

INSTRUCTION BOOK

AQ 140/280

**VOLVO
PENTA**

FOREWORD

Before you start your new Volvo Penta marine engine, you are advised to read through this instruction book carefully. It contains all the information you need to run and service your engine in the best possible way.

Volvo Penta has built up an extensive service organization with service workshops with specially trained personnel at your service.

Always contact your local Volvo Penta representative for advice and when in need of service and parts.

We are convinced that the demands on good running economy and top performance, which you have every right to expect of a quality product, will be met and that your engine will serve you faithfully on many pleasant cruises.

Warranty Certificate

A warranty certificate is supplied with each new engine. It contains the warranty conditions for the engine and should be studied carefully.

Included in the warranty certificate is a report card which is to be completed by the dealer or boat seller and forwarded to Volvo Penta.

However, if our warranty is to apply, it is an absolute condition that the measures given in the "Check and Service Scheme" are carried out and that your engine and equipment are looked after according to the instructions in this book. When in doubt, always get in touch with an authorized Volvo Penta dealer.

In all correspondence with the dealer and when ordering spare parts, state the type designation and serial number of the engine and outboard drive (see page 38,39).

Make certain that the engine's specification coincides with what is described in this instruction book.

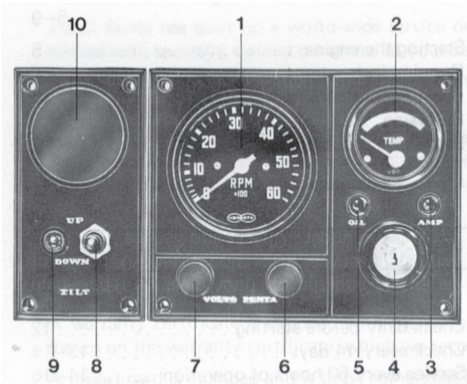
AB VOLVO PENTA
Technical Publications Dept.

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PRESENTATION

INSTRUMENT PANEL



1. **Rev counter** – graduated 0-6000 rev/min
2. **Temperature gauge for cooling water** (fresh water)
Green field – Normal cooling water temperature
3. **Battery charging warning lamp**
Red light – no charging
4. **Key switch with starter contact**
5. **Oil pressure warning lamp**
Red light – stop engine, insufficient oil pressure
6. **Instrument panel light switch**
7. **Switch for extra lighting**
8. **Operating switch** –
Up – drive up
Down – drive down
9. **Drive warning lamp** –
Red light indicates retaining pawl disengaged or drive tilted up. Do not start engine when lamp lights!
10. Place for extra instrument (Ø 52 mm = 2.05")

OPERATING CONTROLS

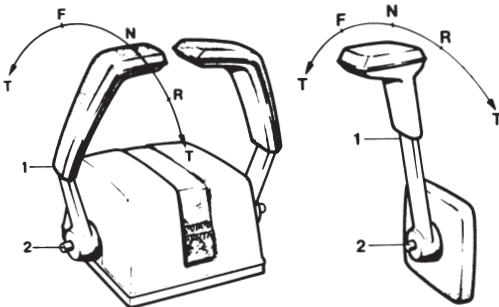


Fig. 9 Volvo Penta Twin Control System Fig. 10. Volvo Penta Single Control System

N = neutral
F = operating lever in position for running "Forward"
R = operating lever in position for "reversing"
T = throttle

1. Operating lever
2. Disengaging device

Push in the red button when the operating lever is in neutral and move the lever forwards slightly. Release the button. The lever now operates only the throttle. Push in the button again and pull back the lever when you wish to use it for operating the speed and for manoeuvring.

GENERAL INFORMATION

Important information concerning the function of your engine:

FUEL

Use petrol with 90–97 octane (Research Number), with or without lead.

LUBRICATING OIL

Use only oil with quality SE (MS) according to the API system. Volvo Penta oil for petrol engines meets the quality demands mentioned and can be used with advantage. If any other type of oil is used, see under "Technical Data" concerning the viscosity.

RUNNING-IN

A new marine engine must be run-in with care during the first 20 hours of operation. Try to avoid, therefore, loading the engine fully during this period.

FREE SERVICE INSPECTION

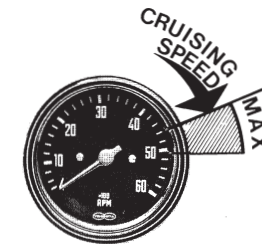
After about 20 hours operation or max. 60 days, after delivery of your engine, you are entitled to a service inspection carried out by a Volvo Penta authorized workshop.

OIL CHANGE

The oil in the engine and the oil filter must be replaced in connection with the service inspection after 20 hours of operation. See moreover under "Checks and Service".

ENGINE SPEED

MAX. SPEED: 85 rev/sec (5100 rev/min).



For light, fast boats, the speed can be permitted to go up to 91.7 rev/sec (5500 rev/min).

The max. permitted operating speed while cruising is 5–8 rev/sec (300–500 rev/min) below the max. speed reached.

If a propeller of the proper size is fitted and the boat has a normal load, the max. speed should lie between 75–85 rev/sec (4500–5100 rev/min). If this speed cannot be attained, there is risk of overloading the engine. NOTE! When the boat has been in the water for some time, the boat and max. engine speed can drop due to marine growth on the bottom of the boat and the outboard drive. Try to prevent this growth on the bottom of the boat and the outboard drive with antifouling paint. See under "Measures before launching".

GENERAL INFORMATION

SAFETY EQUIPMENT

Irrespective of whether the boat is being used for long cruises or short bathing trips, it should be equipped with the safety equipment listed below. It can, of course, be supplemented further according to personal tastes. Investigate 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.

FIRE EXTINGUISHER, approved, at least one and installed where it is 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, etc.

ANCHOR with line.

RADAR REFLECTOR

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

COMPASS which is deviated.

BOAK HOOK and **paddle**.

MOORING ROPES

FOG-HORN and whistle.

FLOATING ANCHOR

TORCH

PROPELLER

PREPARATIONS BEFORE STARTING

Before starting make sure that:

There is no **FUEL LEAKAGE**

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

There is no **OIL LEAKAGE**

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

The **OIL LEVEL** is correct

That the **COOLANT LEVEL IN EXPANSION TANK** of the fresh-water system is correct.

There is enough **FUEL** for the planned voyage

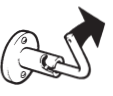

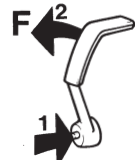


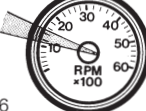

The proper **NAUTICAL CHARTS** are on board for the planned voyage

Make sure when filling with fuel that there is no naked flame on board, e.g., in the galley. Ventilate the boat and run the engine room fan before starting the engine. Do not fill with too much fuel.

If some people are on board for the first time, tell them how to manouvre the boat and where to find the life-jackets and the fire-extinguisher. Also tell them anything more 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.

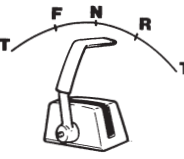
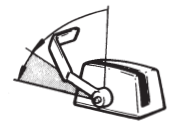
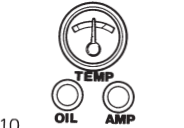


RUNNING INSTRUCTIONS

STARTING THE ENGINE

 <p>1</p>	<p>Switch on the main switch. Start the engine room fan and allow it to run for several minutes before starting the engine.</p>
 <p>2</p>	<p>Run down the drive, if it has been tilted up. Make sure there is no obstacle near the propeller. The warning lamp should be out.</p>
 <p>3</p>	<p>To use the control lever only for throttling, proceed as follows: Move the control lever (2) to neutral, push in the red disengaging button (1), and move the lever slightly forwards. Release the button. The lever now only operates the throttle. In cold weather: Move the control lever to and fro several times. NOTE! Do this only if the engine is cold.</p>
 <p>4</p>	<p>Turn the ignition key one step to the right. The warning lamps for battery charging and oil pressure should now light and the alarm (accessory) should start buzzing. Push in and turn the key further to the right to start the engine. Release the key as soon as the engine has started.</p>
 <p>5</p>	<p>Check immediately after starting that the warning lamps for oil pressure and battery charging are out and that the alarm is off. If any of the lamps remain on and the alarm (accessories) buzzes, the engine must be stopped immediately and the reason investigated.</p>
 <p>6</p>	<p>Run the engine warm at rapid idle, which means at a speed of 20–25 rev/sec (1200–1500 rev/min). When the needle on the temperature gauge starts approaching the green field, then the boat is ready for moving off.</p>
 <p>7</p>	<p>Reduce speed to idle and check that the engine is running smoothly. To use the control lever for both throttling and manoeuvring, proceed as follows: Push in the red disengaging button 1) and pull the lever 2) back to neutral. Release the button. The control lever now operates both the power transmission and the throttle simultaneously.</p>

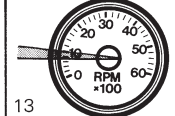

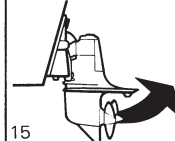

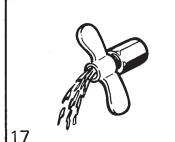
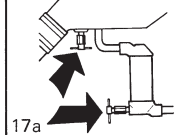
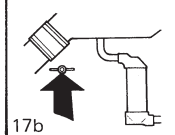
RUNNING INSTRUCTIONS

RUNNING INSTRUCTIONS

 <p>8</p>	<p>The single control lever operates both the speed and the power transmission.</p> <p>F = Forwards R = Reverse N = Neutral T = Throttle</p>
 <p>9</p>	<p>In order to attain good running economy, the engine should not be run at max. speed during lengthy periods.</p> <p>Note that the max. permitted operating speed during lengthy periods, what is known as the "cruising speed", is 5–8 rev/sec (300–500 rev/min) below the maximum speed rated for the boat.</p>
 <p>10</p>	<p>Check while the engine is running that the temperature is normal (the needle is within the green field) and that the lamps for the battery charging and oil pressure are out. With excessive temperature, or if any of the lamps is lighted, the engine must be stopped immediately and the reason for the fault investigated.</p>
 <p>11</p>	<p>Running in shallow waters</p> <p>If you are uncertain about the depth of the water, we recommend that you lower the speed and that you switch the drive lift to the "UP" position for several seconds. The drive warning lamp will then light red and the retaining pawl will disengage.</p> <p>CAUTION! It is now not possible to reverse.</p>
 <p>12</p>	<p>Reversing</p> <p>The drive must be fully down and the warning lamp out before carrying out any reversing.</p> <p>IMPORTANT Never shift to reverse when the boat is planing.</p>

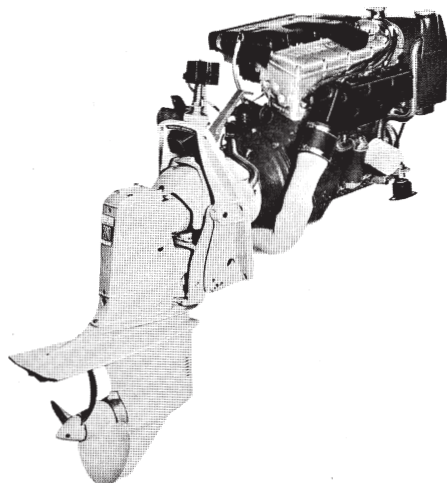
RUNNING INSTRUCTIONS

SHUTDOWN PROCEDURE

 <p>13</p>	<p>When it is not intended to run the engine any more for the day, it should be allowed to idle for a minute or two with the control lever in neutral.</p>
 <p>14</p>	<p>Stop the engine by turning the key back to the switched-off position.</p>
 <p>15</p>	<p>If there is shallow water at the mooring place and if there is risk that the drive can strike the bottom, it should be run up fully. Otherwise it is not necessary to run up the drive.</p>
 <p>16</p>	<p>Switch off the main switch. IMPORTANT! The main switch must never be switched off until the engine has stopped.</p>
 <p>17</p>	<p>Before leaving the boat check to make sure there is no water leakage.</p> <p>With cold weather and risk of icing, drain the cooling water from the engine.</p>
 <p>17a</p>	<p>Drain the sea-water system by opening the cock on the oil cooler and exhaust pipe. Also take off the cover on the sea-water pump and the plug under the heat exchanger. NOTE! Close the cocks and tighten up the cover and plug before leaving the boat.</p>
 <p>17b</p>	<p>Drain the fresh-water system by opening the cock on the side of the block. The expansion tank cap should be removed in order for the water to flow out more rapidly.</p>

Carry out any measures that would make theft on board difficult. Never leave your boat "ready" for sailing. Fit the VOLVO PENTA steering wheel lock.

TECHNICAL DESCRIPTION



ENGINE ASSEMBLY

The AQ140A is an in-line, 4 cylinder marine engine with overhead camshaft and valves. The engine block is made of cast iron and the cylinder head of light-alloy. The cylinder liners are drilled directly in the block. The crankshaft is journalled in five main bearings.

LUBRICATING SYSTEM

The lubricating system includes an oil cooler and a full-flow oil filter. All the oil is filtered and cooled before reaching the lubricating points. A relief valve in the oil pump prevents the oil pressure from becoming excessive.

ELECTRICAL SYSTEM

The electrical system is run on 12 volts.

The engine has an alternator with a built-in rectifier. The voltage is regulated by a transistorized regulator. The alternator makes it possible to charge two battery circuits independent of each other, if a charging distributor (accessory) is fitted on the alternator. The electrical system is otherwise entirely of the marine type.

A main fuse, which is easily switchable, is mounted on the engine. It protects the electrical system from damage in the event of overloading.

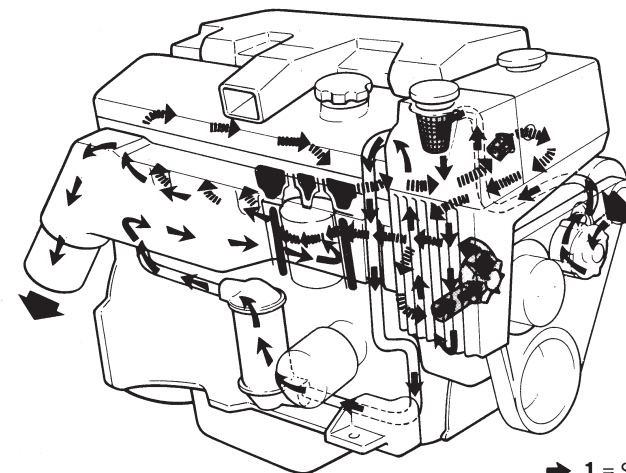
The wiring diagram for the engine and instrument panel is shown on page 36–37 which also contains a suggested diagram on how to connect up any optional equipment.

TECHNICAL DESCRIPTION

FUEL SYSTEM

The fuel system contains a fuel pump, 2 horizontal carburetors with flame arrestor and intake silencer. The fuel pump, which is driven by an intermediate shaft in the block, is of the diaphragm type. The carburetors, which have anti-flooding devices, have fixed nozzles and an acceleration pump.

COOLING SYSTEM



→ 1 = Sea-water system
→ 2 = Fresh-water system

The engine is equipped with a heat exchanger and 2 cooling systems: 1 sea-water system and 1 fresh-water system. The sea-water system includes a water filter, sea-water pump and oil cooler, and the fresh-water system includes a circulation pump and thermostat.

The sea-water pump, which has a neoprene rubber impeller, is driven by an intermediate shaft via a rubber flange.

The circulation pump is driven by the same belt which drives the alternator.

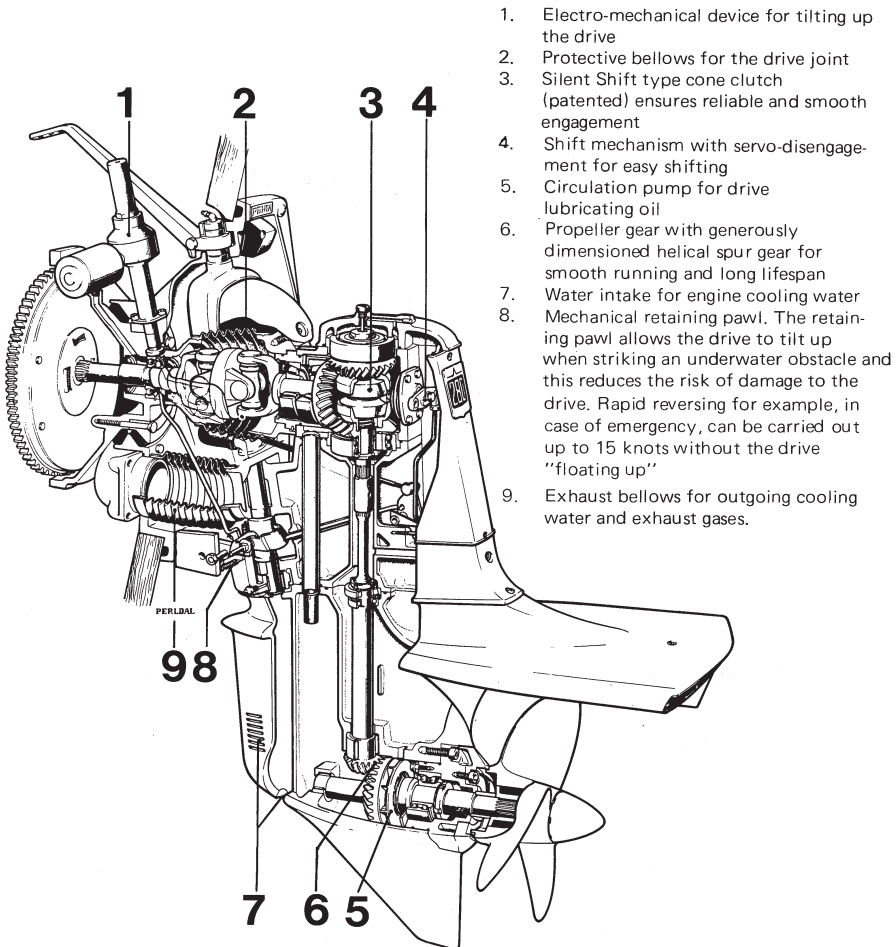
In order to prevent, for example, sea-water from getting into the sea-water system and prevent circulation, a water filter is fitted on the pressure side of the system. It is not difficult to clean the water filter, which is intergrally built with the heat exchanger. The thermostat regulates the water circulation so that the engine temperature will always be the correct one.

Outgoing water from sea-water system always flows through the exhaust pipe and elbow.

TECHNICAL DESCRIPTION

DRIVE 280

The Aquamatic Outboard Drive model 280 is designed in such a way that it provides very low resistance to flow at high speeds. The drive is steerable, is mounted on a collar on the boat transom and can be tilted up with the help of an electro-mechanical tilting device.



1. Electro-mechanical device for tilting up the drive
2. Protective bellows for the drive joint
3. Silent Shift type cone clutch (patented) ensures reliable and smooth engagement
4. Shift mechanism with servo-disengagement for easy shifting
5. Circulation pump for drive lubricating oil
6. Propeller gear with generously dimensioned helical spur gear for smooth running and long lifespan
7. Water intake for engine cooling water
8. Mechanical retaining pawl. The retaining pawl allows the drive to tilt up when striking an underwater obstacle and this reduces the risk of damage to the drive. Rapid reversing for example, in case of emergency, can be carried out up to 15 knots without the drive "floating up"
9. Exhaust bellows for outgoing cooling water and exhaust gases.

CHECKS AND SERVICE SCHEME

Checks and servicing should be carried out regularly according to the intervals given below. Let an authorized Volvo Penta Service Workshop maintain your engine.

CHECK DAILY BEFORE STARTING that

	Page
The engine oil level is between the marks on the dipstick	12
The coolant level in the expansion tank is between the marks on the pipe	12

CHECK every 14 days that

The oil level in the drive is between the marks on the dipstick.	13
The electrolyte level in the battery is correct.	13
The belt tension is sufficient to prevent the alternator from slipping.	13
The protection against corrosion has not been reduced more than 50%.	14

SERVICE EVERY 50 HOURS OF OPERATION

Change the oil in the engine.	14
Lubricate the drive and the steering shaft journals.	15
Valve clearance. Check and adjust.	15
Spark plugs. Check and if necessary replace.	16
Sea-water filter. Check and clean.	16

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

Change the oil filter.	17
Change the oil in the drive.	17
Check the drive belt for the alternator and circulation pump.	18
Check-tightening the toothed belt.	18
Check the ignition system.	19
Check and adjust the carburetors.	19
Check-tighten the cylinder head bolts.	20
Check the cooling system.	21
Check/replace the impeller.	21
Electrical system. Check. Fusing. Battery.	22
Fuel system.	23

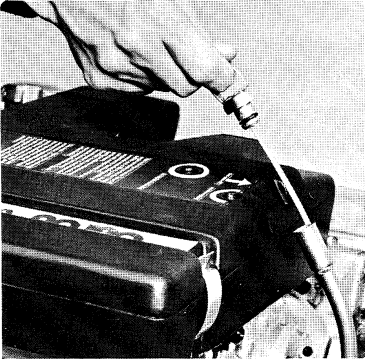
MEASURES IN CONNECTION WITH LAYING-UP AND LAUNCHING THE BOAT

Inhibiting scheme (I) Measures carried out with boat in water.	25
Inhibiting scheme (II) Measures carried out with boat on land.	26
Measures when launching	28

CHECKS AND SERVICE

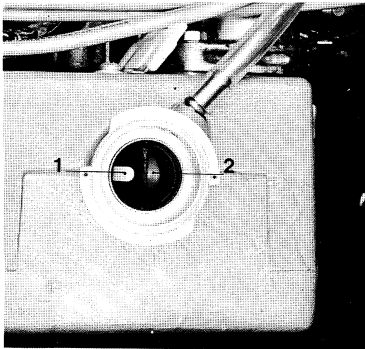
CHECK DAILY BEFORE STARTING

OIL LEVEL IN ENGINE



Check daily before starting for the first time that the oil level is between the marks on the dipstick. Top up if necessary through the oil filler hole. NOTE. Do not go above the MAX. mark. Concerning the selection of oil, see under "Technical Data".

COOLANT LEVEL IN EXPANSION TANK



Check daily before starting for the first time that the coolant level is between the marks (2= upper mark, 1= lower mark) on the filler pipe. If necessary, add fresh water or an anti-freeze mixture to the correct level.

With danger of frost, it is important that the fresh-water system is filled with an anti-freeze mixture. Or the cooling system can be drained. Concerning the sea-water system, see under "Shutdown procedure".

The anti-freeze mixture should be according to the table below. (use genuine Volvo ethylene glycol),

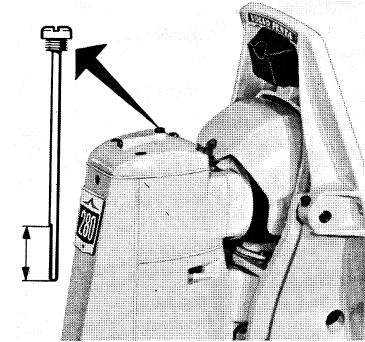
Freezing point for mixtures of ethylene glycol and water:

Volume per cent	Freezing point °C (°F)
glycol	
35	-20 (-4)
45	-30 (-22)
50	-35 (-31)

CHECKS AND SERVICE

CHECK every 14 days

OIL LEVEL IN DRIVE



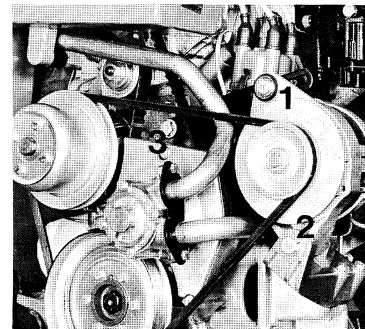
Check the oil level with the drive fully down. The oil level should be between the marks on the dipstick, which must not be screwed down to measure the level. Make sure that water cannot get into the drive when carrying out the oil-level check. If necessary, top-up with oil through the hole for the dipstick. Concerning the type of oil, see under "Technical Data".

Note the O-ring which lies in the groove under the dipstick tightening screw.

ELECTROLYTE LEVEL IN BATTERY

The level should be 5–10 mm (3/8") above the cell plates in the battery. If necessary, top-up with distilled water. CAUTION! Observe great care since the gas formed in the battery is explosive.

BELT TENSION



The belt must be properly tensioned in order to get full alternator output and correct cooling water temperature. The belt is properly tensioned when it is possible to depress it 5 mm (3/16") midway between the pulleys.

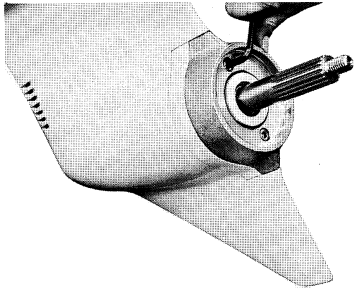
To tension the belt, slacken the alternator retaining points, 1, 2 and 3, tension the belt and retighten the retaining points.

A badly worn or cracked belt must be replaced.

Warning: Keep clear of moving parts.

CHECKS AND SERVICE

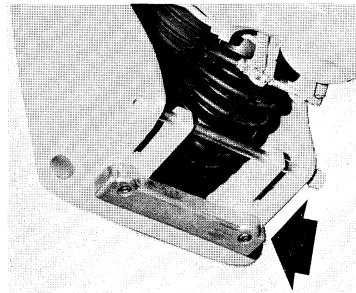
PROTECTION AGAINST CORROSION



Replace the zinc ring on the inside of the propeller when half of the ring has been worn off.

Scrape clean the contact surface before fitting a new zinc ring.

Concerning removing and installing the propeller, see under "Removing and Installing the propeller".

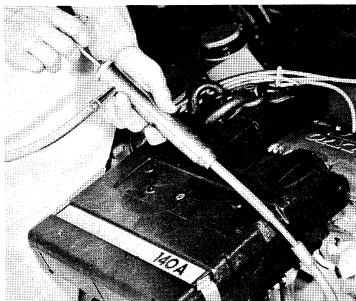


Replace the zinc plate under the collar when half of the plate has been worn off.

Scrape clean the contact surface before fitting a new zinc plate.

SERVICE EVERY 50 HOURS OF OPERATION

CHANGE OIL IN ENGINE



With a new or newly reconditioned engine, the oil must be changed for the first time after 20 hours of operation and subsequently after every 50 hours of operation.

Run the engine warm. Suck up the oil through the hole for the dipstick.

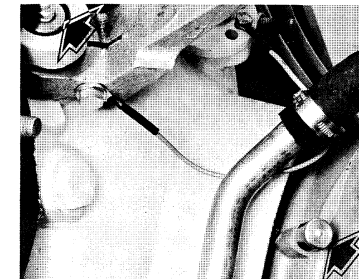
Fill with oil to the correct level. See under "Technical Data" concerning the type of oil to be used.

NOTE! The oil filter must also be replaced at every other oil change.

CHECKS AND SERVICE

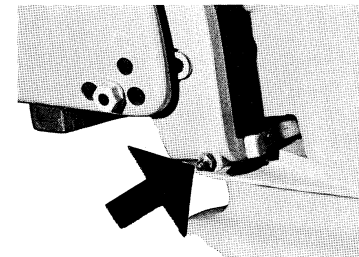
LUBRICATING THE DRIVE AND STEERING SHAFT JOURNALLING

DRIVE SHAFT JOURNALLING



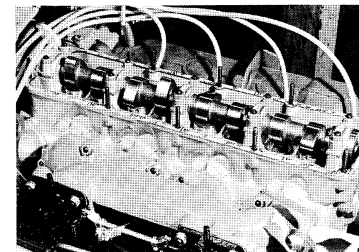
Fill the lubricator for the drive shaft journalling with water-resistant grease and screw it down to the bottom.

STEERING SHAFT JOURNALLING



Lubricate the steering shaft journalling with a grease gun and water-resistant grease until the grease squeezes out at the journalling.

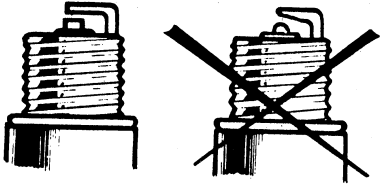
VALVE CLEARANCE



The valve clearance should be checked and adjusted by an authorized workshop. See under "Valves, Technical Data".

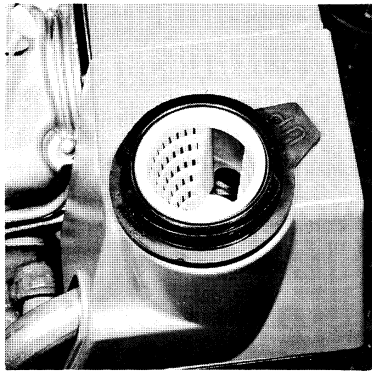
CHECKS AND SERVICE

SPARK PLUGS



Check the electrode gap and adjust if necessary. If the spark plugs are damaged or worn, or the edges of the electrodes rounded, the spark plugs must be replaced with those with similar data. See under "Technical Data".

SEA-WATER FILTER

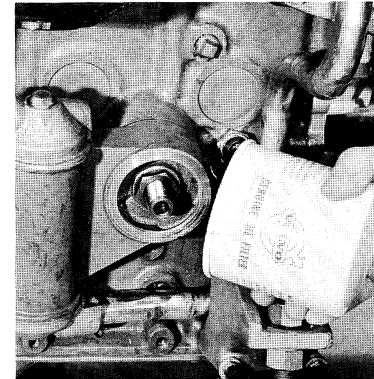


To check and clean the water filter, unscrew the cover and lift out the insert. Shake the insert and then rinse it. It can only be fitted in one particular way.
NOTE! Make sure no water gets in.

CHECKS AND SERVICE

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

OIL FILTER



The oil filter must be replaced for the first time after 20 hours of operation and thereafter at every other oil change. Unscrew and scrap the oil filter. Look out for oil splash.

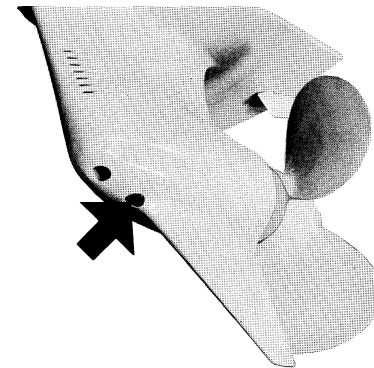
Coat the rubber gasket for the new filter with oil. Check the filter contact surface on the engine and screw on the filter **by hand** until it just touches the contact surface. Screw the filter a further **half turn, but not more.**

NOTE! Use only a genuine oil filter with 92 mm (3 5/8") diameter.

Start the engine, allow it to idle and check that the oil pressure warning lamp goes out immediately.

Check the oil level and make sure there is no leakage round the oil filter.

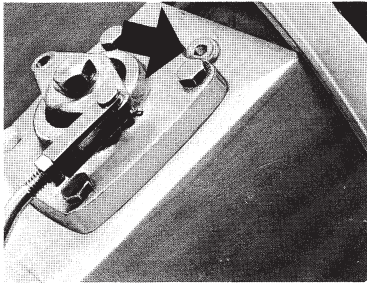
OIL CHANGE IN DRIVE



Draining

Take out the oil dipstick. Run up the drive. Remove the plug under the propeller shaft housing and allow the oil to run out. Re-fit the plug together with its O-ring.

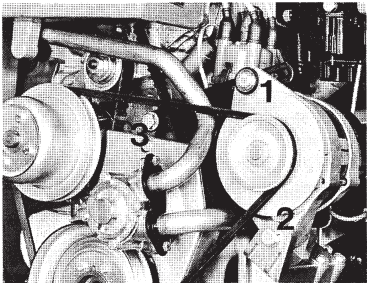
CHECKS AND SERVICE



Filling

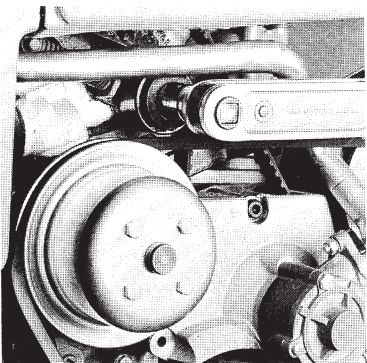
Remove the oil filler plug. Fill with oil. Concerning the quality and capacity of the oil, see under "Technical Data". Re-fit the plug together with its O-ring. Run down the drive. Check the oil with the dipstick, which must not be screwed down when measuring the level. Fill to the correct level through 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.

CHECK THE ALTERNATOR DRIVE BELT



Check the belt thoroughly for wear and cracks. If there is any indication of these, the belt must be replaced. To do so, slacken the alternator retaining points 1, 2 and 3 to enable the belt to be slipped off. Clean the belt groove on the pulleys before fitting a new belt. Tension the belt. It is properly tensioned when it can be depressed 5 mm (3/16") midway between the pulleys. After running the engine for several hours, re-check the belt tension and adjust if necessary.

CHECK-TIGHTENING THE TOOTHED DRIVE BELT

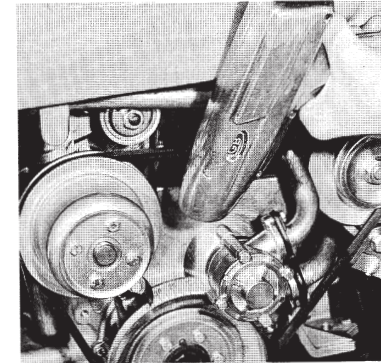


The toothed belt which drives the camshaft and the intermediate shaft must be stretched once a season (before launching) or after every 100 hours of operation. The belt is held stretched by a belt stretcher. Slacken the belt stretcher nut so that the spring can stretch the belt. Lightly press the roller to the one side in order to check that it is loose. Release the roller and tighten up the nut. Concerning the tightening torque, see under "Technical Data".

IMPORTANT! Make sure that no oil or grease gets onto the belt.

CHECKS AND SERVICE

IGNITION SYSTEM



All adjustments to the engine's ignition system should be done by an authorized workshop, which has the proper equipment for this. Since the ignition system is sensitive, any faulty work on it could have serious consequences.

The ignition distributor must be checked on a test bench. Use a stroboscope to check the ignition setting. Concerning the adjustment values, see under "Technical Data".

The check should be carried out once per season.

Lubricate the distributor with several drops of engine oil on the drive shaft lubricating felt under the rotor.

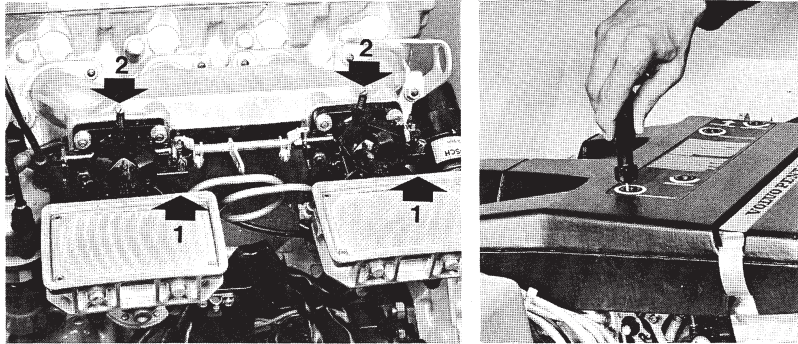
CARBURETTORS

Properly adjusted carburetors are necessary for smooth running and good fuel economy. For this reason, you should let an authorized workshop check the adjustment some time during the season.

SYNCHRONIZING AND ADJUSTING THE IDLING

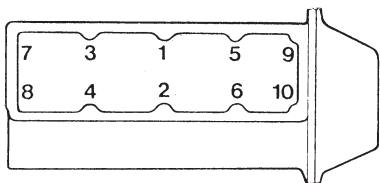
1. Disconnect the control cable cube from the control lever. If accessibility is difficult from the side, the intake silencer should be removed.
2. Slacken the clamp nut for the lever so that it can be moved on the intermediate shaft.
3. Screw back the idle-adjustment screws (1) – can be carried out with the intake silencer fitted, see decal – so far that they just ease off from the levers and then screw them in exactly 1 1/4 turns.
4. Adjust and lock the lever on the intermediate shaft in such a position that both the levers actuate the shutter levers for the carburetors simultaneously.
5. Adjust the position of the cube on the control cable so that the pins on the levers are opposite the gap on the shutter levers, when the cube has been connected to the control lever. Connect the cube to the control lever and lock it.

CHECKS AND SERVICE



6. Screw in the mixing screw fully and then back it 4 1/2 turns (see the decal on top of the intake silencer). This adjustment can be carried out with the intake silencer fitted.
7. Start the engine and run it warm to normal operating temperature.
Check the engine idling speed, see under "Technical Data". NOTE! The intake silencer must be fitted when checking the idling. If necessary, adjust by screwing in or out the idling screw exactly the same amount on each carburettor. (See the decal on top of the intake silencer.)

CHECK-TIGHTENING THE CYLINDER HEAD BOLTS



Check-tighten the bolts **with a torque wrench** before starting a new or newly reconditioned engine for the first time and once after the engine has been run for 20 hours.

Since the bolts have been removed, they should be tightened in 2 stages.

The adjacent Fig. shows the tightening sequence for the bolts.

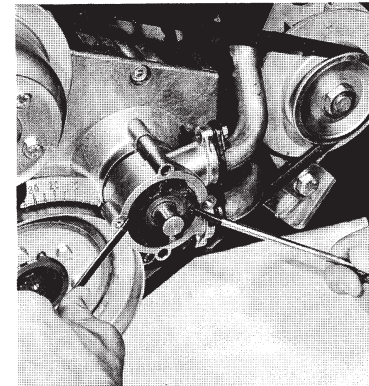
Concerning the tightening torque, see under "Technical Data".

CHECKS AND SERVICE

CHECKING THE COOLING SYSTEM

The cooling system is functioning normally when the needle on the temperature gauge is within the green field. Excessive temperature may be due to the following: clogged water filter, defective impeller or flange in sea-water pump, leakage, clogged oil cooler, slipping or broken circulation pump belt, clogged heat exchanger, faulty thermostat or temperature gauge and temperature gauge sender. **Make sure that no water gets into the boat** when working on the cooling system. Concerning a "clogged water filter", see page 16

CHECKING AND REPLACING THE IMPELLER



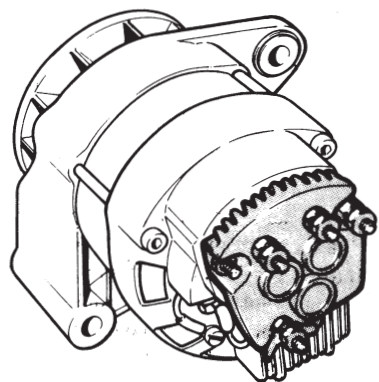
The impeller can be damaged due to, for example, shortage of sea-water. If the impeller is damaged, a new one must be fitted. To remove the impeller, proceed as follows: Remove the water pump cover. Hold against the shaft and pull off the impeller with the help of two screwdrivers. Be careful not to damage the housing. NOTE! If the shaft has slipped out or has been pulled out fully from the impeller, re-fit by rotating while pushing it in again.

If it is difficult to get at the pump, first remove the screws holding the pipes. The pump can then be removed entirely.

The flange is defective if the impeller and shaft can be rotated. To replace the flange, first remove the pump.

CHECKS AND SERVICE

ELECTRICAL SYSTEM



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:

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

Otherwise the charging regulator can be ruined.

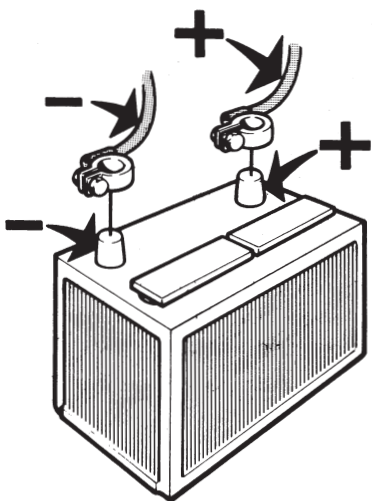
2. **The battery cables must be connected to the correct polarity.** The battery terminals have a plus and a minus sign respectively. The cable from the minus terminal is connected to the engine block. The cable shoes must be greased and well-tightened.

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

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

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 up. Connect the spare battery to the ordinary 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 be broken.

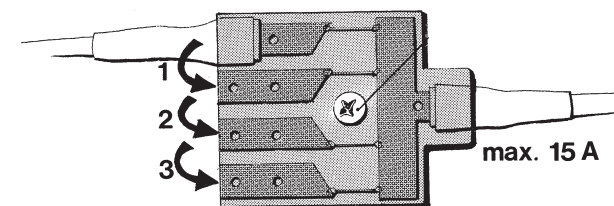


5. Do not use a rapid charger when the alternator is connected to the battery.
6. Disconnect both battery cables before doing any work on the alternator equipment.
7. Before carrying out any electrical welding on the engine or installation parts, disconnect the charging regulator cable at the alternator and insulate the cable ends.
8. Check the belt tension and the cable connections regularly.

CHECKS AND SERVICE

Changing the fuse

A fusebox is fitted next to the starter motor. Its function is to cut out the electric current in the event the electrical system is overloaded. Re-connect the electrical system by moving the cable to the next contact.



Overhauling the starter motor and alternator

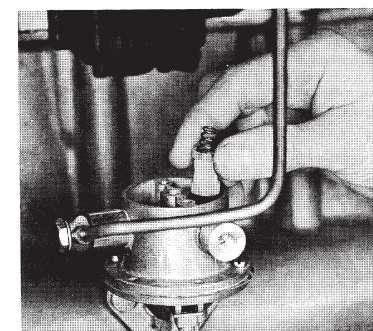
Any work to be done on the starter motor and alternator should be carried out by an authorized service workshop. They should be checked and tested when making a general inspection of the engine.

BATTERY

Checking the state of charge

The state of charge of the battery should be checked at least once per season. This is done with the help of a hydrometer which indicates the specific gravity of the battery acid. This will vary with the state of charge (see under "Technical Data").

FUEL SYSTEM

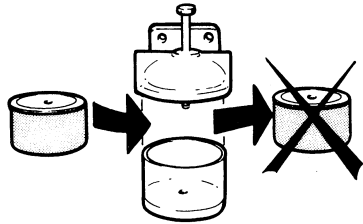


FUEL FILTER

The fuel pump on the engine has a built-in strainer which is accessible after removing the pump cover. Check when refitting the cleaned strainer that the gasket under the cover is in good condition. **Check immediately after starting the engine that there is no leakage.**

If an extra fuel filter is mounted at the water separator, any water in the filter is drained by removing the bottom plug.

CHECKS AND SERVICE



The fine-filter in the fuel filter must be replaced at least once per season.

NOTE! Take care to avoid fuel splash when working on the fuel system. Always wipe up spilled fuel and ventilate well before starting the engine.

Pump up the fuel by running the starter motor.

LAYING-UP AND LAUNCHING

MEASURES IN CONNECTION WITH LAYING-UP AND LAUNCHING THE BOAT

INHIBITING THE ENGINE AND DRIVE

BRIEF INTERRUPTION IN OPERATION WITH BOAT IN WATER




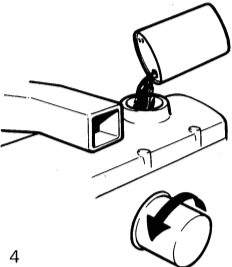
In order to prevent the engine from being attacked by corrosion, it must be run warm at least once every 14 days as long as the boat is in the water. If it is not intended to use the boat longer than a month, long-term inhibiting must be carried out.

LONG-TERM INHIBITING

Before the engine is inhibited for a long period according to inhibiting schemes ① and ② an authorized workshop should be allowed to test the engine and equipment. This would be a suitable occasion to take a compression test in order to find out the condition of the engine.

Inhibiting Scheme ①

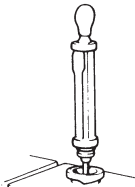

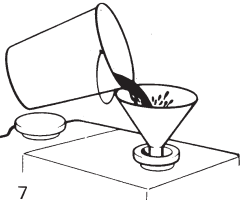

Carried out with boat in water

1	 <p>Run the engine warm. Make sure that all the instruments are functioning properly. Check the function of the control lever.</p>
2	 <p>Test the engine compression. Concerning the compression pressure, see under "Technical Data".</p>
3	 <p>Pump all the oil out of the engine. Use an oil scavenging pump.</p>
4	 <p>Replace the oil filter. Fill the engine to the correct level with Volvo Penta oil, which also contains rustproofing properties. The lubricating system is thereafter ready for operation for the next season. After changing the oil and the filter, start the engine, and check the oil pressure as well as for leakage.</p> <p>If rustproofing oil is used, it should be of type Esso Rustban 623, Shell Ensis Oil or corresponding. Whichever of these is used, the oil filter must be replaced first when about to launch.</p>



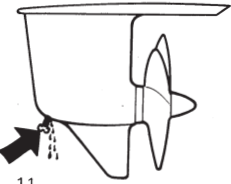
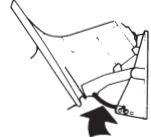
LAYING-UP AND LAUNCHING

Inhibiting Scheme ②

Carried out with boat on land

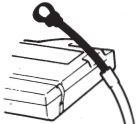



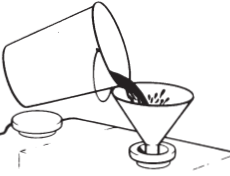

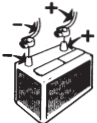
 <p>5</p>	<p>The fresh-water system can be inhibited against rusting according to 3 Methods below (points 5, 6 and 7).</p> <p>Method I. In those cases where the fresh-water system is already filled with an anti-freeze mixture of rust-proofing type, check the freezing point.</p>
 <p>6</p>	<p>Method II. If the system is filled with fresh water only, drain the water and fill with an anti-freeze mixture of rust-proofing type (use genuine Volvo ethylene glycol). See the mixture table on page 12.</p>
 <p>7</p>	<p>Method III. If the system is filled with fresh water only, it also can be inhibited with a rustproofing mixture of emulsifying type. In this case drain the system. Fill with a mixture of 5 litres (10 pints) of water and 1 litre (2 pints) of rustproofing oil. Important! Water first and then the oil.</p> <p>Use, e.g., Esso Cutwell 40, Shell Donax C or corresponding</p>
 <p>8</p>	<p>Drain the cooling water from the engine sea-water system by opening the cocks. Check to make sure the water runs out, since impurities can block the cocks. Then close all the cocks.</p>

LAYING-UP AND LAUNCHING


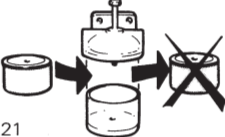
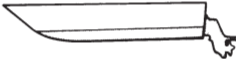
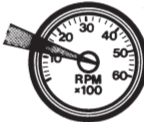

 <p>9</p>	<p>Inhibiting the sea-water system</p> <p>Disconnect the sea-water suction line from the collar. Connect up a hose with 7/8" inner diameter and insert the free end of the hose in a container with fresh water. Arrange for filling the container and idle the engine for several minutes so that it is flushed through by the fresh water. Make sure that nothing next to the exhaust outlet is splashed with the water. Note! Do not let the propeller rotate. Drain all the water from the sea-water system. then close all the drain points.</p> <p>Make a mixture of rust-proofing, consisting of 10 litres (2 1/4 Impgal, 2 5/8 USgal) of fresh water and 1 litre (1 1/2 Impgal, 1/2 USgal) of rust-proofing oil of the emulsifying type. N.B. Mix the oil into the water. Immerse the hose in the rust-proofing mixture. Start the engine and let it idle until the mixture is used up. N.B. The water pump must not be allowed to work without water. Use for example Esso Cutwell 40, Shell Donax C or equivalent. As an alternative an anti-freeze mixture containing 30% glycol of rust-proofing type can be used.</p>
 <p>10</p>	<p>IMPORTANT! After the engine has been run and the inhibiting has been completed, drain the rustproofing mixture from the fresh-water and the sea-water systems, if not anti-freeze type mixture is used. IT WILL NOT PROVIDE ANY PROTECTION AGAINST FREEZING!</p>
 <p>11</p>	<p>Remove the oil drain plug at the bottom of the drive and allow several drops of oil to run out. Make sure the oil is clean and is not discoloured. Fit the plug and fill the drive fully with oil. NOTE! The oil should drop to the correct level when launching.</p> <p>No other inhibiting of the drive's lubricating system is required.</p>
 <p>12</p>	<p>When the boat is about to be transported by land, e.g., on a trailer, the drive must be tilted up fully and locked in the tilted-up position with the lock bracket supplied. The bracket is fitted as shown in the illustration.</p>

LAYING-UP AND LAUNCHING

MEASURES IN CONNECTION WITH LAUNCHING

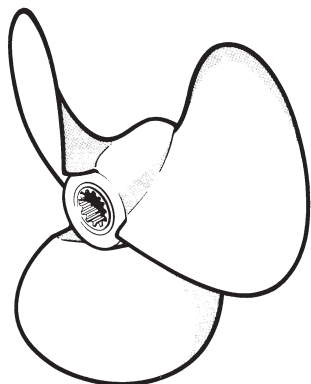
 <p>13</p>	<p>If Volvo-Penta oil has been used in the engine, only the level needs to be checked.</p> <p>If another type of inhibiting oil has been used, both the oil and the filter must be changed. See under "Service every 50 hours of operation".</p>
 <p>14</p>	<p>Check the drive oil level. If it is 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.</p>
 <p>15</p>	<p>Screw tight the cover together with its original gasket on the cooling water pump. Connect up the cooling water hose to the pipe on the collar.</p>
 <p>16</p>	<p>Check to make sure that all hose clamps are tight. Check to make sure that all drain cocks are closed. Clean the outside of the engine and the drive.</p>
 <p>17</p>	<p>Check and fill the fresh-water system to the correct level. Add fresh-water only or a mixture of fresh-water and glycol. See the mixture table on page 12.</p>
 <p>18</p>	<p>Check carefully the bellows for damage. Also check-tighten the hose clamps. If the drive has been removed, observe due care when installing it that the bellows and hose camps are put back in their original position. Adjust the retaining, pawl. see page 30.</p>
 <p>19</p>	<p>Install the battery or batteries, which must be fully charged. Grease the cable shoes. Connect up the battery cables. Important! Do not mix up the polarity. Tighten up the cable shoes well.</p>

LAYING-UP AND LAUNCHING

 <p>20</p>	<p>Remove the spark plugs. Make sure nothing gets splashed with oil and turn over the engine several revs in order to blow out any oil on top of the pistons. Note! The drive must be fully down.</p> <p>If necessary, fit new spark plugs. See under "Technical Data".</p>
 <p>21</p>	<p>If an extra fuel filter is fitted, the filter cartridge must be replaced. Pump forwards the fuel by turning the engine over with the starter motor until fuel flows into the filter. Check for leakage.</p>
 <p>22</p>	<p>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. Important! Anti-fouling paint containing copper must not be used, since this can corrode the drive. Paint the bottom of the boat with anti-fouling paint which does not contain copper. Launch the boat once the paint has dried.</p>
 <p>23</p>	<p>Start the engine. See the instructions on page 5. Run the engine warm with a gear engaged, if this is possible. Check to make sure there is no leakage of fuel, water or exhaust gases in the boat. Also check to make sure that the throttling and manoeuvring with the control lever are correct.</p>
 <p>24</p>	<p>When necessary, contact an authorized Volvo-Penta service workshop. Let them service your engine and drive according to the instructions given in the servicing scheme.</p>

PROPELLERS

SELECTING THE RIGHT PROPELLER



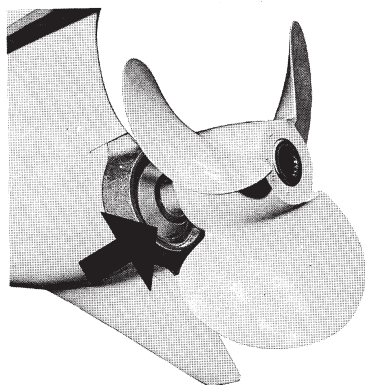
The right propeller has been selected when the engine maximum speed is reached with a normal load in the boat.

A left-hand rotating propeller should be selected for single installation, since with this direction of rotation there is less tendency for the boat to list or turn.

With a twin installation, the port drive should be adjusted for a left-hand rotating propeller and the starboard drive for a right-hand rotating propeller.

When replacing a propeller, make sure that you get a genuine Volvo Penta propeller of the same size as the old propeller. The size is punched on the propeller hub. Sizes are given in inches, e.g., 15 x 17, where 15 stands for the diameter and 17 for the pitch.

REMOVING AND INSTALLING A PROPELLER



The propeller is locked with a toothed lock washer and the propeller cone. Bend up the teeth and unscrew the cone. Pull off the propeller. **NOTE!** There is a spacer sleeve and deflector ring on the inside of the propeller.

With effect from PZ no 2845162 the lock washer has been replaced by a lock screw. This screw is placed in the propeller cone and locks the cone against the propeller shaft.

Replace the propeller if damaged.

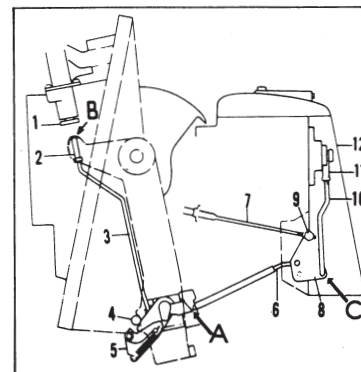
Before fitting the propeller coat it with graphite grease or corresponding to prevent the propeller from sticking on the shaft.

Fit the propeller as follows: Fit the deflector ring and spacer sleeve. Then the propeller. Fit the lock washer and tighten up the propeller cone. If the lock washer teeth do not coincide with corresponding openings in the cone, slacken the cone slightly and adjust the lock washer until teeth and holes coincide. Bend down the teeth.

TRIMMING THE DRIVE

ADJUSTING THE RETAINING PAWL

Check once per season and if necessary adjust the location of the reverse inhibitor rod in relation to the retaining pawl (A) and the position of the thrust rod (see B) for the lift's disengagement of the retaining pawl. Adjust as follows:

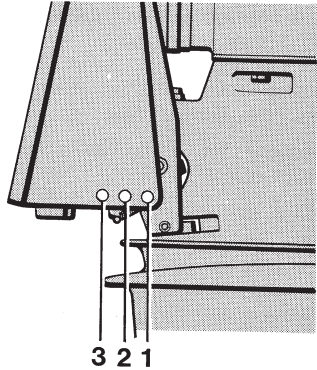


1. Remove the protective cover (12). Move the control lever to neutral.
2. Disengage the shift cable dice (9) and the fork (11).
3. Release the lock nut for the fork (11). Adjust the fork so that, when connected to the lever, it causes the reverse inhibitor rod (6) to take up such a position that it reaches the retaining pawl bracket at "A" without pressing against it. Lock the fork (11) with the lock nut.
4. Adjust the dice (9) so that it easily enters the hole in the shift yoke. Move the control lever to the "Forward" position. Check to make sure that the corner "C" does not catch against the housing. Fit the cover (12).
5. **Push the drive forwards towards the adjusting pin.** Check the position of the rod (3). The upper part should be flush with the fork, at "B" so that the lift (1) can disengage the retaining pawl (5) when tilting up the drive. Adjust the upper part of the rod after having locked the lock nuts.

TRIMMING THE DRIVE

THE TRIM OF THE BOAT

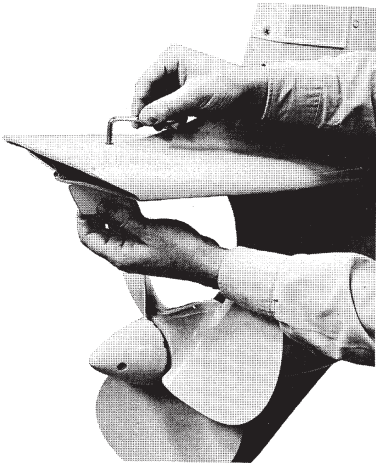
DRIVE 280



The mounting collar adjusting pin determines the adjustment of the drive trimming angle. Place the adjusting pin in either of the three holes as follows:

- Hole 1: When the boat has a tendency to over-planing (the nose dips)
- Hole 2: Normal position
- Hole 3: When the boat has a tendency to heavy planing (heavy stern)

ADJUSTING COARSE DEVIATION



Check for deviation in coarse by releasing the wheel when the boat is planing and observing its coarse. If, e.g., the boat veers to port, the trim tab under the cavitation plate on the drive must be released. Then turn the rear edge of the trim tab slightly to port and lock the trim tab in this position. Test-run the boat. Adjust the trim tab further if the boat still tends to veer.

FAULT TRACING SCHEME

TRACING FAULTS WITH INTERRUPTIONS IN OPERATION

The fault-tracing scheme given below lists only the most usual reasons for faults that cause interruptions in operation. With the help of the instructions given in this handbook, the owner can generally remedy most of the faults listed below. When in doubt, always contact the nearest Volvo Penta service workshop.

Follow the instructions in the Service Scheme – to ensure optimal reliability in operation.

Engine does not start	Engine stops	Engine does not reach correct operating speed at full throttle	Engine runs unevenly or vibrates abnormally	Engine becomes abnormally hot	REASON	See
x					Main switch off, flat battery, breakage in electric cables or fuse blown	page 5, 23
x	x				Empty fuel tank, closed fuel cock, blocked fuel filter	page 23, 24
x	x		x		Water, air or impurities in fuel	page 23, 24
x	x	x	x		Defective spark plugs	page 16
x			x		Burnt ignition breaker points, moisture in distributor and on spark plug cables	
	x		x		Idling speed not properly adjusted	page 19
		x			Defective rev counter	
		x			Boat overloaded	
		x			Marine growth on boat bottom and outboard drive	page 29
			x		Damaged propeller	page 30
				x	Blockage in cooling water intake, oil cooler, cooling jackets, defective impeller or thermostat, too low fluid level in expansion tank	page 21

TECHNICAL DATA

Technical Data

General

Engine designation	AQ 140A
Operation	4-stroke fresh-water cooled carburettor engine with overhead camshaft and valves
Outboard drive, model	280D
Reduction ratio	2.15:1
Number of cylinders	4
Max. output ¹⁾ kW at 91.7 rev/sec (5500 rev/min)	92
Max. operating speed, rev/sec (rev/min)	91.7 (5500)
Max. cruising speed rev/sec (rev/min)	5–8 (300–500) below max. speed reached
Bore, mm (in.)	92 (3.622)
Stroke, mm (in.)	80 (3.150)
Displacement, dm ³ (in ³)	2.13 (130)
Compr. pressure, kp/cm ² (lbf/in ²) (starter motor speed)	10–12 (142–170)
Idling speed rev/sec (rev/min), approx.	15 (900)
Direction of rotation looking at crankshaft pulley	Clockwise
Engine weight, incl. drive approx. kg (lb.)	245 (540)

Valves

Valve clearance adjustment, hot engine	
Inlet, mm (in.)	0.40–0.45 (0.016–0.018)
Exhaust, mm (in.)	0.40–0.45 (0.016–0.018)
Valve clearance adjustment, cold engine	
Inlet, mm (in.)	0.35–0.40 (0.014–0.016)
Exhaust, mm (in.)	0.35–0.40 (0.014–0.016)
Valve clearance check, hot engine	
Inlet, mm (in.)	0.30–0.50 (0.012–0.020)
Exhaust, mm (in.)	0.30–0.50 (0.012–0.020)
Valve clearance check, cold engine	
Inlet, mm (in.)	0.25–0.45 (0.010–0.018)
Exhaust, mm (in.)	0.25–0.45 (0.010–0.018)

Lubricating system

Engine	
Oil capacity, engine, dm ³ = litres (Imp. qts. = US qts.), excl. filter	5.0 (4.4=5.3)
incl. filter	5.7 (5.0=6.0)
Oil quality	Multigrade oil Service SE
Viscosity	SAE 10W/40 ²⁾
Oil pressure hot engine, at full speed, kp/cm ² (lbf/in ²)	2.5–6 (35–85)

Outboard drive

Oil quality/Viscosity	Same as in engine
Oil capacity, dm ³ = litres (Imp. qts = US qts.)	2.6 (2.3=2.7)
Oil capacity between Max. and Min. marks on dipstick, dm ³ = litres (Imp. qts. = US qts.), approx.	0.15 (0.13–0.16)

1) Flywheel output according to DIN 6270 Leistung B

2) Volvo-Penta Multigrade oil

TECHNICAL DATA

Cooling system

Thermostats, start opening at °C (°F)	82 (180)
fully open at °C (°F)	92 (197)
Fresh-water quantity in dm ³ = litres (Imp. qts. = US qts.) approx.	6.75 (6.0=7.0)

Fuel system

Fuel quality	Min 90 octane (RON) engine can be run on lead-free fuel PHN
Carburettors, Solex	
Number	2
Float height from housing face, mm (in.)	4 (0.16)
Idle-trimming screw, screwed out no. of times	1 1/4
Mixing screw, screwed out no. of turns	4 1/2

Ignition system

Firing sequence	1-3-4-2
Ignition distributor:	
Early prod. yellow marked	
Bosch type JF4	0231 178 010
Basic setting 0–12.5 r/s (0–750 r/m)	6° B.T.D.C.
Late prod.	
Bosch type JF4	0231 178 010
Basic setting 0–12.5 r/s (0–750 r/m)	10° B.T.D.C.
Stroboscope setting 46,6–83,3 r/s (2800–5000 rpm)	36–38° B.T.D.C.
Ignition distributor, contact gap, mm (in.)	0.40–0.50 (0.016–0.018)
Dwell angle	62±3°
Spark plug, Bosch type	W 200 T30 (or corresponding type of another make)
Electrode gap, spark plug, mm (in.)	0.7–0.8 (0.028–0.032)

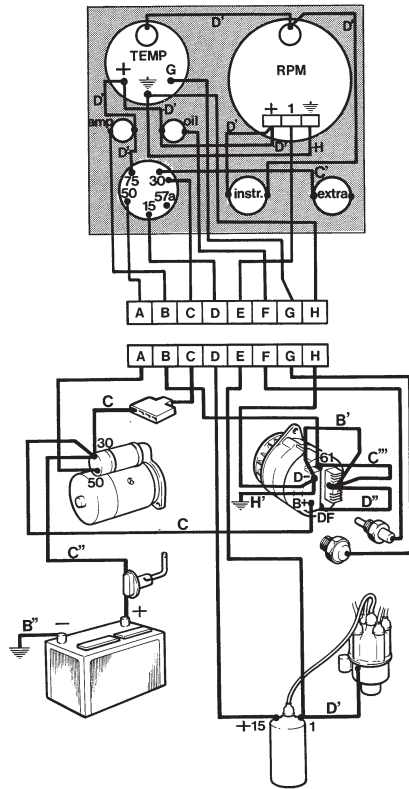
Electrical system

Voltage	12
Battery capacity, standard Ah	60
Battery electrolyte specific gravity:	
Fully charged battery	1.275–1.285
When battery is to be re-charged	1.230
Alternator	
Output, max.	450 W (38 A)
Starter motor output, h.p.	1

Tightening torques

Cylinder head bolts	
1st tightening	60 Nm (6 kpm=43 lbf)
2nd tightening	110 Nm (11 kpm=79 lb.ft)
Spark plug	25 Nm (2.5 kpm=18 lbf)
Tension ring, flywheel casing	40 Nm (4 kpm=30 lbf)

WIRING DIAGRAM



INSTRUMENT PANEL

List of components

1. Key switch with starter contact
2. Instrument panel light switch
3. Temperature gauge
4. "Low oil pressure" warning lamp
5. Rev counter
6. Battery charging warning lamp
7. Extra switch
8. Connector

Cable colour code

Marking	Colour	mm ²	AWG
A	Ivory	6	9
B	Black	1.5	15
B'	Black	0.6	19
C	Red	6	9
C'	Red	2.5	13
C''	Red	35	1
D	Green	2.5	13
D'	Green	1.5	15
D''	Green	0.6	19
E	Grey	1.5	15
F	Yellow	1.5	15
G	Brown	1.5	15
H	Blue	1.5	15
H'	Blue	4	11

ENGINE

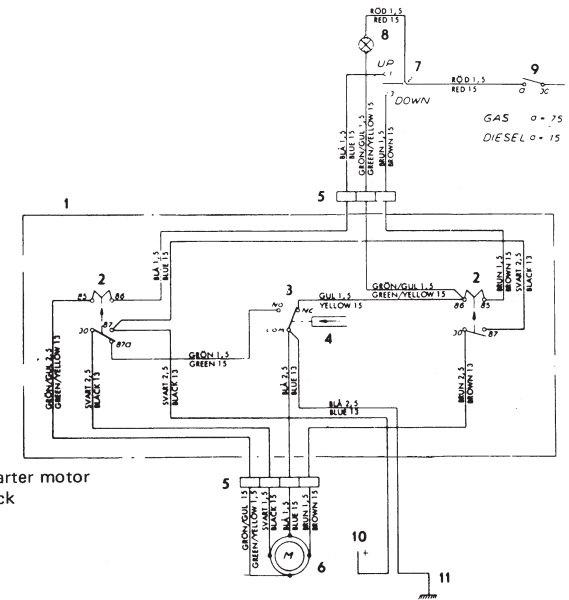
List of components

9. Battery
10. Main switch
11. Starter motor
12. Charging regulator
13. Alternator
14. Fuse
15. Oil pressure sender
16. Temperature gauge sender
17. Ignition coil
18. Ignition distributor

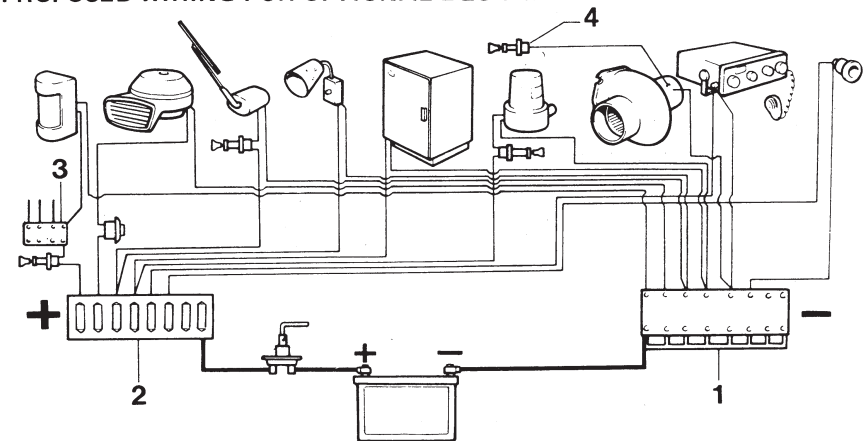
WIRING DIAGRAM

LIFT

1. Relay box
2. Relay
3. End position switch
4. Push rod, retaining pawl
5. Connector
6. Electric motor
7. Manoeuvre switch
8. Warning lamp
9. Key switch
10. Connected to 30 (+) on starter motor
11. Connected to cylinder block



PROPOSED WIRING FOR OPTIONAL EQUIPMENT

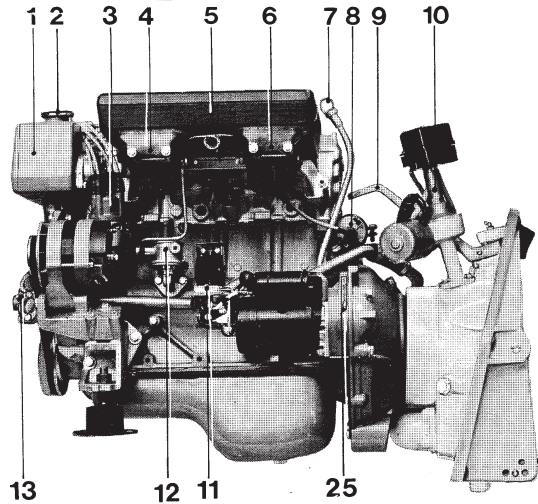


1. Central electric wiring panel, negative
2. Central electric wiring panel, positive and fuses
3. Connection for running lights
4. To be connected to 30 on the key-switch

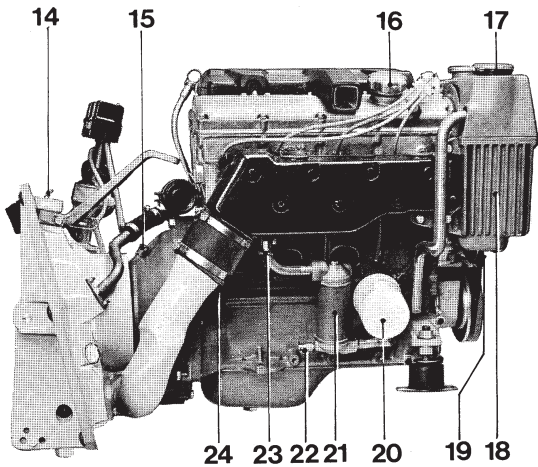
ENGINE COMPONENT GUIDE

DRIVE COMPONENT GUIDE

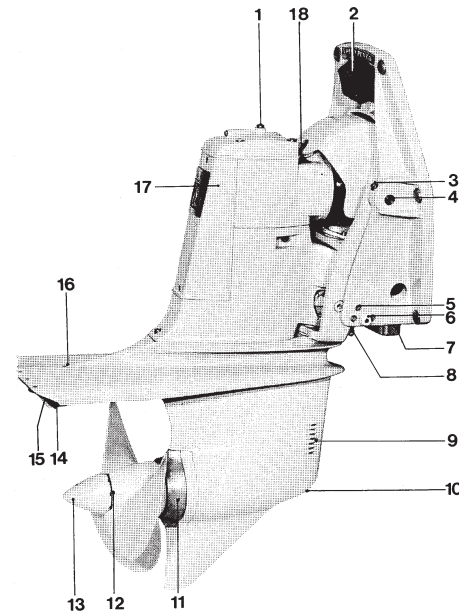
ENGINE



1. Fresh-water tank
2. Filler cap, filling and checking fresh-water system
3. Ignition distributor
4. Front carburettor
5. Intake silencer
6. Rear carburettor
7. Oil dipstick
8. Ignition coil
9. Steering arm
10. Electrical lift for drive
11. Fusebox
12. Fuel pump
13. Sea-water pump
14. Lubricating nipple, upper, steering shaft journalling
15. Lubricator, drive shaft journalling
16. Engine oil filler cap
17. Water filter
18. Heat exchanger
19. Sea-water drain plug
20. Lubricating oil filter
21. Oil cooler
22. Sea-water drain plug
23. Sea-water drain plug
24. Fresh-water drain tap
25. Disignation and serial number



DRIVE



1. Oil dipstick
2. Damping block
3. Lock bolt for suspension pin
4. Suspension pin
5. Holes for support bracket
6. Adjusting pin in middle position
7. Zinc plate
8. Retaining pawl
9. Upper water intake
10. Lower water intake
11. Zinc ring
12. Lock washer
13. Propeller cone
14. Exhaust and cooling water outlet
15. Trim tab
16. Lock bolt for trim tab
17. Shift mechanism under casing
18. Serial number

ON-BOARD DATA

LOA= metres (ft.), beam= metres (ft.), draught= metres (ft.), height above waterline= metres (ft.), displacement= metres (ft.). Fuel tank capacity= litres (Imp. gals.= US gals.) Water tank capacity= litres (Imp.gals. = US gals.). Battery capacity, stdn. circuit= Ah. Battery capacity, opt. equipment circuit= Ah.

The lighting bulbs have the following wattage:

Instrument= W. Cabin= W. Galley= W. Toilet= W. Compass= W. Port/starboard lights= W. Stern lights= W. Masthead lights= W: Search light= W. Cockpit= W.

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Personal Information

Name

Address

Phone

Nearest Volvo Penta Dealer

Name

Address

Phone

Technical Information

Engine type

Serial number, engine

Drive Ratio

Drive serial number, PZ

Propeller size

.

CHECKS AND SERVICE HAVE BEEN CARRIED OUT ACCORDING TO BELOW:

50 hour intervals		100 hour intervals	
date	____/____/____ -by	date	____/____/____ -by
date	____/____/____ -by	date	____/____/____ -by
date	____/____/____ -by	date	____/____/____ -by
date	____/____/____ -by	date	____/____/____ -by
date	____/____/____ -by	date	____/____/____ -by

Notes

Notes

VOLVO PENTA

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