

INSTRUCTION BOOK

MD6A

FOREWORD

Before you start using your new Volvo Penta marine engine, we recommend you to read this instruction book carefully. It contains all the instructions you need to run and service your engine in the best possible way.

The dependability and the lifetime of your engine and equipment depend to a great extent on how these units are given service and maintenance. Always closely follow the instructions given in this book.

Volvo Penta has built up a world-service organisation including service workshops with specially-trained personnel at your service.

Always contact your nearest Volvo Penta representative should you need advice and also when you require service or parts.

We are fully convinced that the demands concerning good running economy and outstanding performance you have every right to make on a high-quality product such as this will be more than satisfied and that your Volvo Penta will provide you with a long period of faithful service.

GUARANTEE

Each engine is accompanied by a warranty certificate which entitles the first purchaser to a guarantee concerning both materials and labor. The extent of the guarantee is shown in the warranty card and we recommend you to read this carefully.

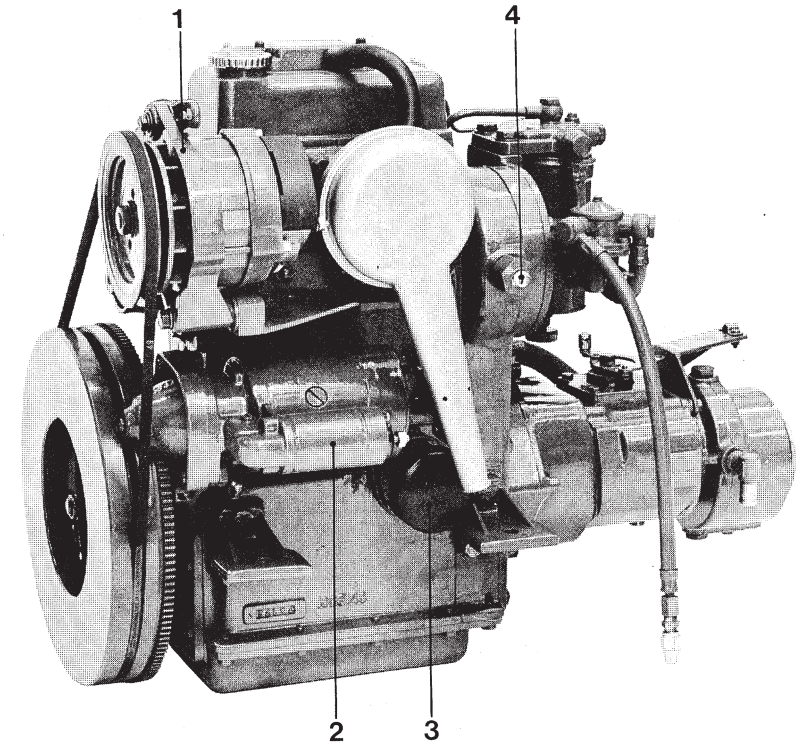
This certificate contains report forms which are filled in by the dealer and/or boatbuilder.

If our guarantee is to be valid, we make one absolute condition and that is that the checking procedures in the maintenance scheme are carried out and that your engine and its equipment are always looked after in accordance with the instructions in this book. When in doubt, please always contact a Volvo Penta authorized dealer.

In all correspondence with your dealer and also when ordering parts, always state the type designation and serial number of the engine and reverse gear (see port side of engine).

Supplement for Instruction Book Publ No 2562.

Marine Diesel engine MD6B



The MD6B is equipped with a 12 volt alternator 1, starter motor 2, full-flow type oil filter 3 and power socket for an electrical rev counter 4 (optional equipment).

IMPORTANT! The oil filter must be changed at the same intervals as for the earlier filter, see instruction book.

Concerning Technical Data, see instruction book.

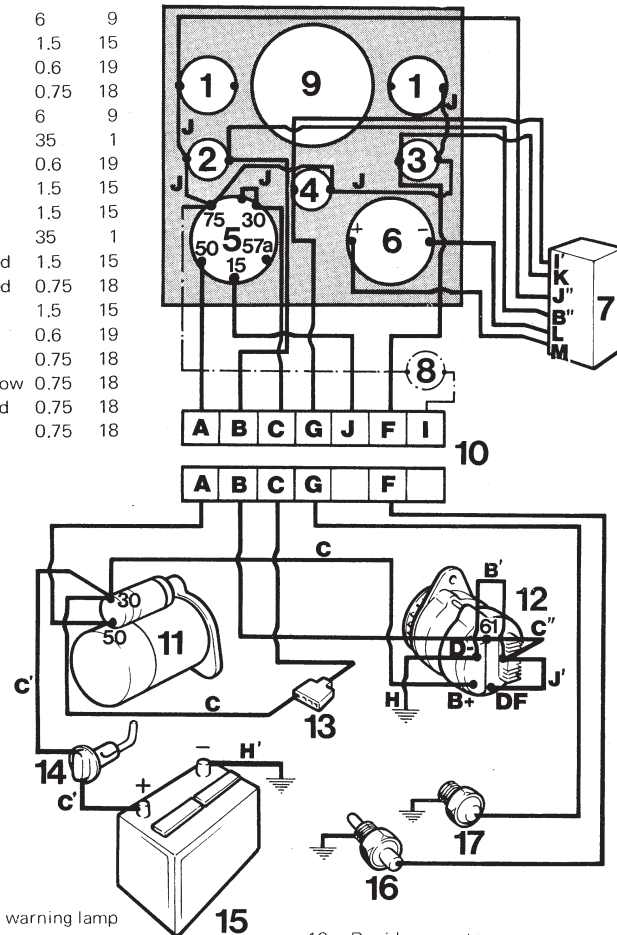
WIRING DIAGRAM

MARINE DIESEL ENGINES TYPE, MD1B, MD2B, MD3B, MD6A

Supplement for Instruction Book, Publ. No. 2492A

Cable colour code

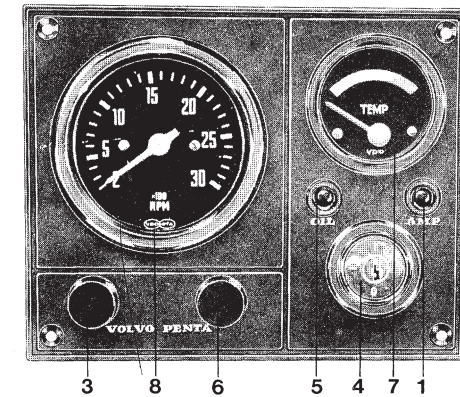
Marking	Colour	mm ²	A.W.G.
A	White	6	9
B	Black	1.5	15
B'	Black	0.6	19
B''	Black	0.75	18
C	Red	6	9
C'	Red	35	1
C''	Red	0.6	19
F	Yellow	1.5	15
G	Brown	1.5	15
H'	Blue	35	1
I	Green/Red	1.5	15
I'	Green/Red	0.75	18
J	Green	1.5	15
J'	Green	0.6	19
J''	Green	0.75	18
K	Blue/Yellow	0.75	18
L	White/Red	0.75	18
M	Blue/Red	0.75	18



List of components

- | | |
|--|-------------------------|
| 1. Extra switch | 10. Rapid connector |
| 2. Battery charging warning lamp | 11. Starter motor |
| 3. Excessive temp. warning lamp | 12. Alternator |
| 4. Low oil pressure warning lamp | 13. Fusebox |
| 5. Key switch | 14. Main switch |
| 6. Siren | 15. Battery |
| 7. Alarm unit | 16. Temperature sender |
| 8. Battery charging warning lamp (for battery circuit, opt. equipm.) | 17. Oil pressure sender |
| 9. Place for instruments, op. equipm. | |

This supplement shows the new instrument panel for MD2B and MD3B. Revolution counter and temperature gauge for the cooling water and instrument-lighting standard equipments. See wiring diagrams on next page. MD1B (with e1. equipment) has still the instrument panel, which is described in Publ. No. 2492A.

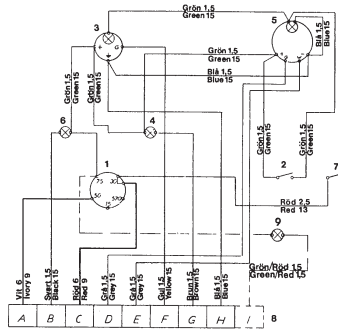


INSTRUMENT PANEL, MD2B, MD3B, MD6A

- | | |
|---|---|
| 1. Warning lamp for battery charging
Red light = no charging | 6. Switch for instrument lighting |
| 3. Switch for extra lighting | 7. Temperature gauge for cooling water.
Green field = normal cooling-water temperature |
| 4. Key switch with built-in starter | 8. Revolution counter |
| 5. Warning lamp for oil pressure.
Red light = Stop engine, insufficient oil pressure | |

WIRING DIAGRAMS

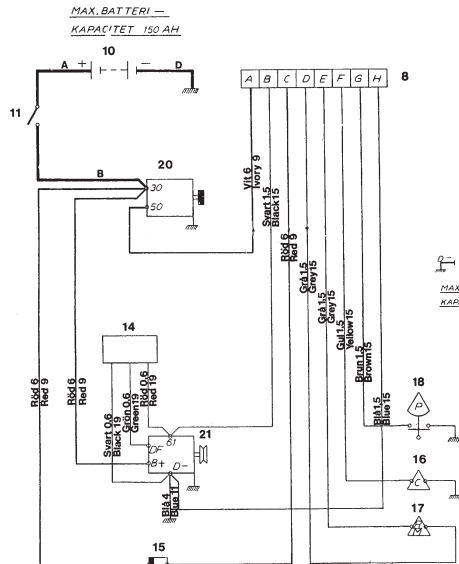
1. Key switch
2. Switch, inst. lighting
3. Temperature gauge
4. Warning lamp for "low pressure"
5. Revolution counter
6. Warning lamp, charging starter generator
7. Switch, extra equipment
8. Connector
9. Warning lamp, charging alternator (extra equipment)
10. Battery
11. Master switch
12. Starter-generator
13. Alternator (extra equipment)
14. Charging regulator
15. Fuse
16. Temperature sender
17. Revolution sender
18. Oil-pressure sender
19. Other el. equipment
20. Starter motor
21. Alternator



INSTRUMENT PANEL, MD3B, MD2B, MD6A

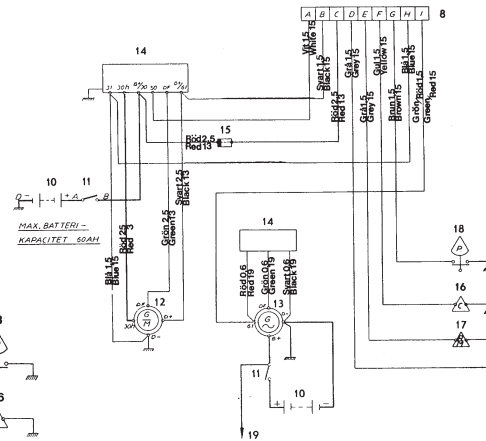
ENGINE

MD3B, MD2B (with starter motor)



ENGINE

MD2B, MD6A (with starter generator)



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MD6A ENGINE

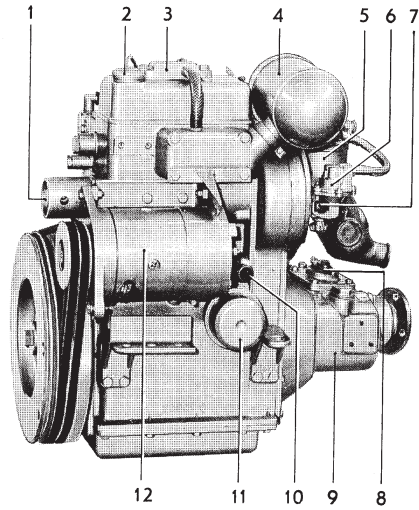


Fig. 1. MD6A, with MS reverse gear, port side

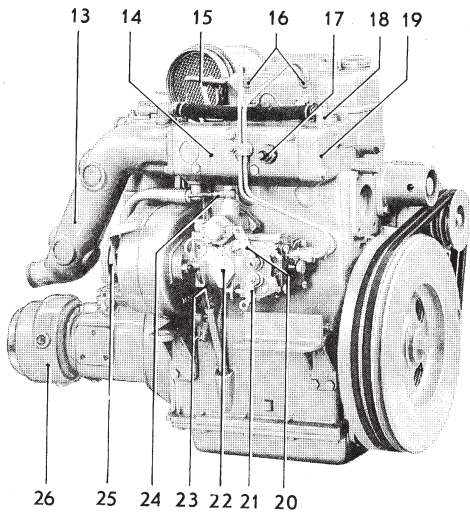


Fig. 2. MD6A, with MS reverse gear and reduction gear, starboard side

1. Shaft for starting crank
2. Oil filler cap
3. Closed crankcase ventilation
4. Intake silencer
5. Fuel filter
6. Feed pump
7. Connection, fuel inlet
8. Control lever, reverse gear
9. Reverse gear MS, ratio 1:1
10. Oil pressure contact
11. Lubricating oil filter
12. Starter-generator
13. Water-cooled exhaust elbow (extra equipment)
14. Water-cooled exhaust manifold
15. Decompression lever
16. Injectors
17. Pressure sensor
18. Cooling water outlet
19. Thermostat housing
20. Lever, throttling
21. Stop lever
22. Fuel injection pump
23. Oil dipstick, engine
24. Connection, fuel return line
25. Sea-water pump
26. Reduction/reverse gear MS, ratio 1.91:1
27. Throttle lever for Combi reversing mechanism
28. Reversing mechanism
29. Lubricating nipple
30. Control lever for Combi adjustable propeller device
31. Combi reduction gear, ratio 1.42:1
32. Alternator 38 amps (extra equipment)
33. Cam disc for throttle lever

PRESENTATION

MD6A COMBI ENGINE

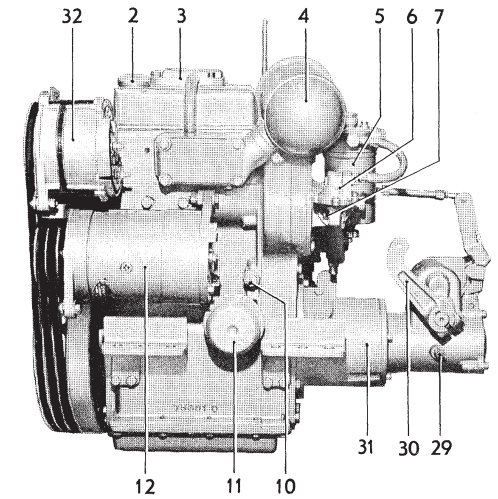


Fig. 3. MD6A Combi, port side (Reference numbers, see page 2)

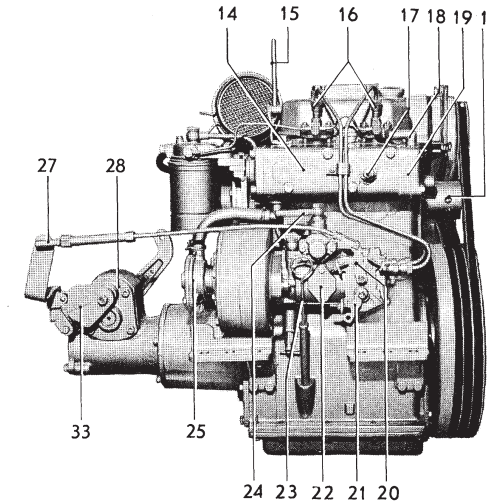


Fig. 4. MD6A Combi, starboard side (Reference numbers, see page 2)

RUNNING THE UNIT

INSTRUMENTATION

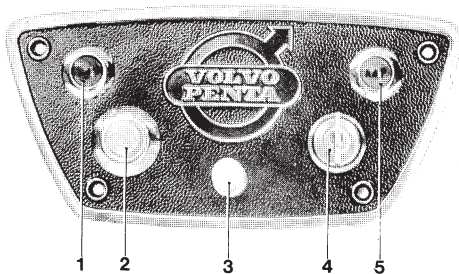


Fig. 5. Instrument panel, MD6A

1. **Warning lamp for battery charging**
Red light — no charging
2. **Starter button**
3. **Switch for extra electrical equipment (max. load 5 amps)**
4. **Key switch**
5. **Warning lamp for oil pressure**
Red light — stop engine, insufficient oil pressure

FART- OCH MANÖVERREGLAGE

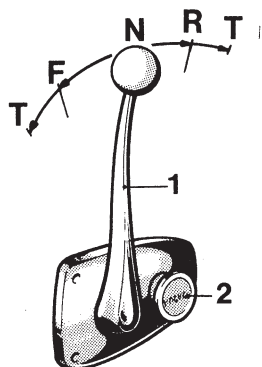


Fig. 6. MV kombinerat varvtals- och manöverreglage för MS-backslag

1. Manöverspak
 2. Frikopplingsanordning för växelmekanism (utdrages axiellt)
- N = neutralläge
F = manöverspaken i läge för körning "fram"
R = manöverspaken i läge för körning "back"
T = varvtalspådrag

RUNNING THE UNIT

FUEL AND LUBRICATING OIL RECOMMENDATIONS

NOTE. Our guarantee only applies on condition that the following fuel and lubricating oil recommendations are followed.

Fuel quality

Only diesel fuel oils of quality "AUTO-DIESEL", specially intended for rapid diesel engines, may be used. Do not use fuel oils of lesser quality since these can easily cause damage to the fuel injection pump and injectors.

Lubricating oil quality

Modern, rapid marine diesel engines require high-class lubricating diesel oils. It is therefore absolutely essential that the right type of lubricating oil quality is used. For the engines, only **lubricating diesel oil of quality "Service DS"** according to the API-system, should be used. This oil contains additives which ensure maximum engine life under various conditions of operation.

RUNNING-IN

When your marine engine is new, we recommend that you run it with a certain amount of care during the first 20 hours of operation. During this period, never subject the engine to full loading for more than brief periods, because it is during this time that the moving parts wear in together.

Oil changes

During the running-in period, the engine lubricating oil should be changed more frequently than usual. Change the engine oil and the oil filter after 20 hours of operation, see also under "Servicing", points 3, 4 and 5.

RECOMMENDED ENGINE SPEED

In order to obtain best running economy, the engine r.p.m. should be at 300 r.p.m. below the maximum speed reached when running for a longer period.

Note. When the boat has been in the water for some considerable time, maximum engine speed can decrease if there is marine growth on the bottom of the boat. Use therefore anti-fouling bottom paint. Check and clean the bottom of the boat at regular intervals.

PRECAUTIONS TO BE TAKEN IN CASE OF FROST

If there is risk of frost, drain off the cooling water to prevent cracks in the engine block and reverse gear caused by the water freezing. Note the risk of water getting into the boat. See also procedure to be followed when laying up a boat, under "Servicing".

RUNNING

Procedure before starting

1. Check the lubricating oil levels in the engine and reverse gear, see under "Servicing", points 1 and 2.
2. Check the fuel level in the tanks and open the cock for fuel supply to the engine. Check at the same time all fuel cocks, pipelines and screw unions for leakage.
3. Check that the drain cock for the engine cooling system is closed (see Fig. 25) and that the drain cock for the cooling water in the reduction gear (1.91:1) is fitted and tightened. Open the bottom cock for the cooling water intake.
4. Switch on the master switch for the electrical system and pump out any bilge water that may have been collected.
5. Make sure that the equipment on board includes a fire extinguisher, life vests,

STARTING

1. Move the control lever to the neutral position so that the shift mechanism disengages, see the directions given in Fig. 6. Push in the stop control for the injection pump, if one is fitted.
2. Turn the key switch to the starting position. Check that the warning lamps for battery charging and low oil pressure light up.
3. Press in the starter button so that the starter-generator cuts in. Release the button as soon as the engine starts.
4. If the battery is so flat that it is difficult to start the engine, the engine can be started with the help of the starting crank as follows:

Set the decompression handle to the vertical position "B, Fig. 7". Turn over the engine as rapidly as possible with the starting crank and move down the decompression handle during continued cranking until the engine starts.

RUNNING THE UNIT

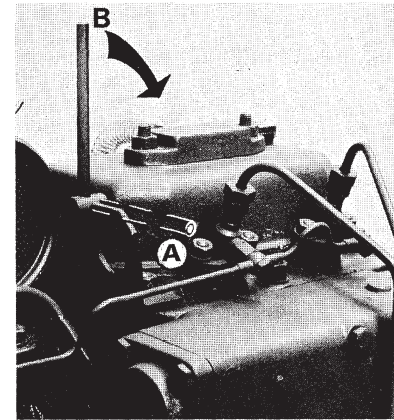


Fig. 7. Decompression handle
A. Operating position
B. Starting position (decompression)

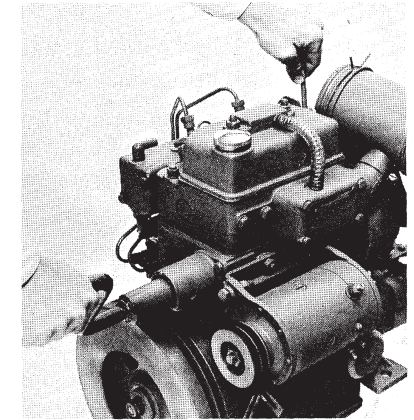


Fig. 8. Starting engine by cranking

5. Check immediately after starting that the warning lamps for oil pressure and battery charging have gone out. **Should the red oil warning lamp remain on – stop the engine immediately.**
6. Check the cooling water circulation by observing that the water is being discharged overboard. Run the engine warm at fast idling RPM.
7. Move the control lever to neutral in order to engage the shift mechanism (see Fig. 6). The boat is now ready for operation.

STARTING IN COLD WEATHER

To facilitate starting in cold weather, the fuel injection pump is provided with an automatic cold starting device. This is always engaged when the engine is stopped, providing that the stop control is pushed in fully.

The cold starting device disengages automatically when the engine has started and reached the operating speed to which the speed control is adjusted. **NEVER RACE A COLD ENGINE.**

If the engine does not start at the first attempt, make a short pause in order to enable the battery and starter-generator to recover.

With manual starting in cold weather, starting the engine is facilitated by cranking over the engine several turns. The decompression handle should then be vertical.

RUNNING THE UNIT

STOPPING

1. Move the control lever to neutral position and let the engine run some minutes at idling speed before stopping it.
2. Pull out the stop control fully (stop lever, 21, Figs. 2 and 4, on the injection pump is turned towards fore). This shuts off the fuel injection and the engine stops. The engine should not be stopped by using the decompression handle.
3. Turn the key switch to neutral position when the engine has stopped. **NOTE. If the engine is fitted with an alternator, the master switch must not be switched off until the engine has stopped. To neglect to do this would otherwise ruin the charging regulator.**
4. Switch off the master switch and close the fuel and cooling water cocks if the unit is to remain idle for some considerable time.
5. If the unit is to remain idle for more than two weeks, special inhibiting measures must be taken with the engine (see under "Procedure if unit is to remain idle").

The engine's electrical equipment should be regularly sprayed with fluid which protects against corrosion and moisture.

SPECIAL INSTRUCTIONS FOR MD6 COMBI

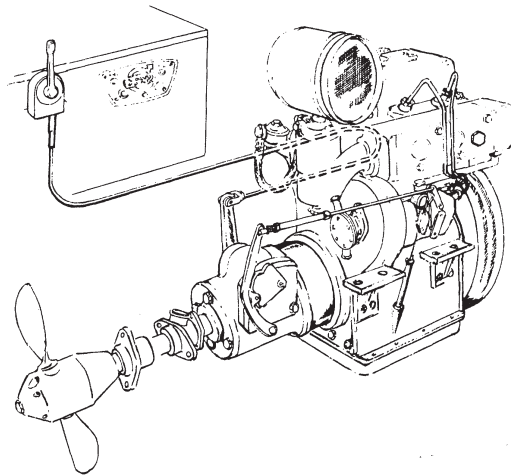


Fig. 9. MD6A Combi

TECHNICAL DESCRIPTION

1. Start the engine. The control lever should be in the neutral position. The engine is then at idle and the propeller is disengaged.
2. When the control lever is moved forwards (for running "Forward"), both engine speed and propeller pitch increase. Because of the synchronisation, the propeller pitch will always be correct in relation to the throttle speed.
3. Reversing takes place as follows: When the control lever is moved backwards, both engine speed and propeller pitch are reduced at the same time. When the neutral position is passed, the propeller blades change direction to reverse and both pitch and engine speed again increase.
4. The propeller can also be adjusted to the fully floating position for minimum resistance when sailing. The control lever should thereby be moved as far as possible in the direction of aft.

TECHNICAL DESCRIPTION

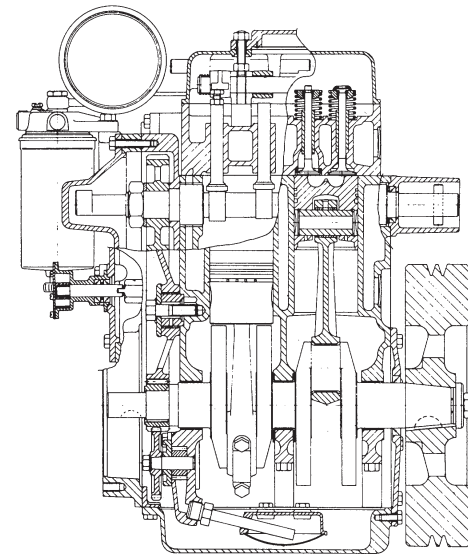


Fig. 10. Longitudinal section

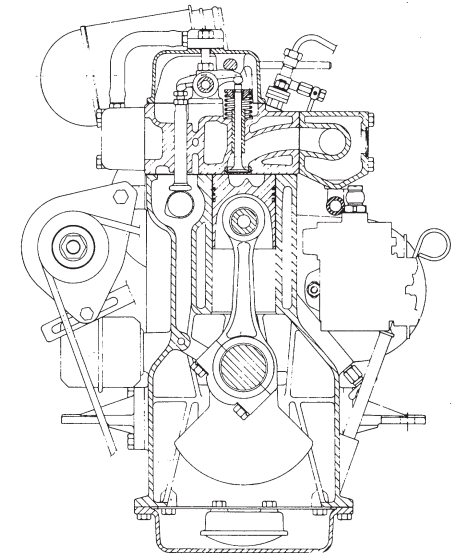


Fig. 11. Cross-section

ENGINE UNIT

The MD6A is a 2-cylinder, 4-stroke diesel engine with direct injection. It is specially constructed for marine use.

The crankcase, cylinders and cylinder head are made of special cast iron. The cylinder bores, which are surrounded by cooling jackets, are drilled directly in the cylinders.

The crankshaft is carried in 3 main bearings. The bearing shells are replaceable and have bearing metal of indium-plated lead-bronze.

Fuel system

The engine fuel system consists of a feed pump with pre-filter, fine filter, fuel injection pump with speed regulator, injectors and fuel lines. The fuel feed pump is of the diaphragm type and is actuated by a cam on the engine camshaft.

A hand priming device on the feed pump makes it possible to pump forward the fuel even when the engine is stopped. The fuel injection pump is a flange-mounted, distributor pump of the single piston type and is gear-driven from the crankshaft. The speed regulator, which is built into the housing of the fuel injection pump, regulates the amount of fuel supplied to the fuel injection pump during operation. To facilitate starting during cold weather, there is an automatic cold starting device.

Lubricating system

The engine is fitted with a complete pressure lubricating system. The oil filter is of the Spin-on type and is replaceable as a unit. The lubricating system has a relief valve which prevents the oil pressure from reaching excessive values.

Cooling system

The engine is sea-water cooled and fitted with a thermostat which controls the temperature of the engine. Cooling water circulation is taken care of by means of a sea-water pump mounted on the timing gear housing.

When the cooling water has passed through the engine, it is led either overboard or through a water-cooled exhaust elbow to the exhaust line.

Electrical system

The MD6A is equipped with a starter-generator, in other words, a combined generator and starter motor, which are driven by vee-belts from the engine flywheel.

The voltage for the system is 12 V. As extra equipment, an alternator with particularly high charging capacity can be installed for charging a separate battery circuit.

TECHNICAL DESCRIPTION

Warning

The following applies to an engine equipped with an alternator and master switch:

Never break the circuit between the alternator and battery while the engine is running. To do this would be to ruin the charging regulator immediately.

Do not switch off the master switch until the engine has stopped. See also under "Servicing", point 16.

Wiring diagrams:

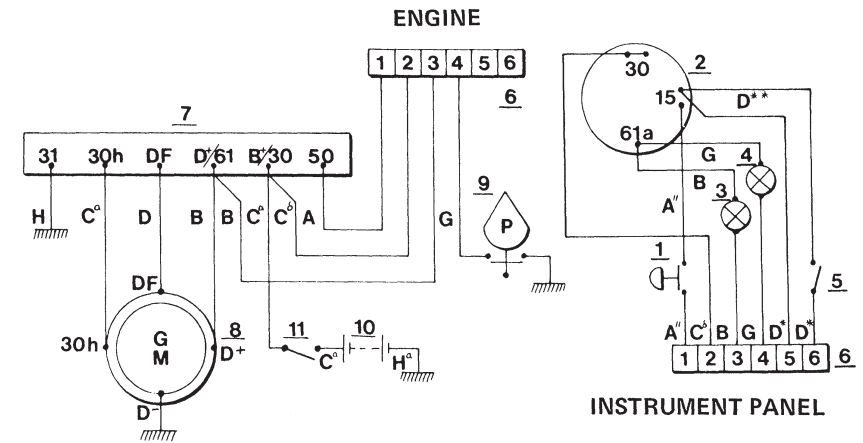


Fig. 12. Wiring diagrams for MD6A with starter-generator

Cable marking

Mark	Colour	sq. mm	AWG
A''	Ivory	2.5	13
B	Black	1.5	15
C	Red	25	3
C	Red	2.5	13
D	Green	1.5	15
D**	Green	2.5	13
G	Brown	1.5	15
H	Blue	1.5	15
H	Blue	25	3

1. Starter button
2. Key switch
3. Battery charging warning lamp
4. Oil pressure warning lamp
5. Switch
6. Connection terminal, instrument panel and engine
7. Charging regulator
8. Starter-generator
9. Oil pressure sensor
10. Battery 12 V, max. 60 Ah
11. Master switch

TECHNICAL DESCRIPTION

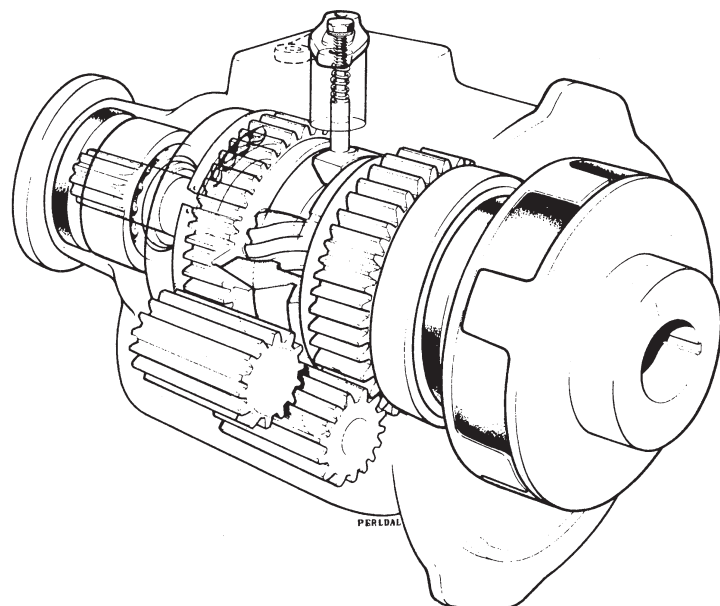


Fig. 13. Cross-section through MS reverse gear, ratio 1:1

Reverse gear, type Mono Shift (MS)

The Volvo Penta reverse gear, type Mono Shift, has a ratio of 1:1 and, as alternative, a reduction gear with reduction ratio 1.91:1. The reduction gear is integrally built with the reverse gear.

Power is transmitted from the engine to the reverse gear through a rubber flange.

For manoeuvring "Forward" and "Reverse", the Volvo Penta patented cone clutch is used. With this type of clutch, engagement is both smooth and quiet. Very little force is required to operate the reverse gear.

The engaging power of the cone clutch is influenced by the size of the power transmission torque. The greater the torque, the stiffer will be the clutch engagement with increased throttling.

PERIODICAL SERVICING

MAINTENANCE SCHEME

The numbers of the servicing procedures below refer to the detailed descriptions on the following pages. Some of these operations require specialized mechanical knowledge and the use of special tools. For this reason, these operations should be carried out by an authorized service workshop.

See point	Operation	Daily before first start	After ¹⁾ 50 hours running	After ¹⁾ 100 hours running
PERIODICAL SERVICING				
1.	Check oil level in engine	•		
2.	Check oil level in reverse gear and red. gear	•		
3.	Change oil in engine		•	
4.	Change oil filter			•
5.	Change oil in reverse gear		•	
6.	Lubricate reversing mechanism in Combi reduction gear		•	
7.	Clean air cleaner and crankcase ventilation			•
8.	Check vee-belt		•	
9.	Replace fine filter and clean pre-filter			•
10.	Vent fuel system	2)		
11.	Check valve clearances			•
12.	Check battery electrolyte level	3)		
GENERAL SERVICING INSTRUCTIONS				
13.	Check-tighten cylinder head nuts	To be carried out according to the intervals given under respective points or when necessary		
14.	Check injectors			
15.	Cooling system			
16.	Electrical system			
17.	Check reverse gear and reduction gear			
18.	Procedure if unit is to remain idle and inhibiting			

1) Or once each season should this occur first

2) When necessary

3) Every fortnight

PERIODICAL SERVICING

1. Checking oil level in engine

Check the oil level in the engine daily before starting for the first time. The dipstick is located on the starboard side of the engine and has upper and lower markings. The oil level must never be allowed to go down below the lower mark and it should not be above the upper mark either since this can result in abnormally high oil consumption. To fill with oil unscrew the rocker arm casing (see Fig. 14). Concerning the oil quality and viscosity, see point 3.

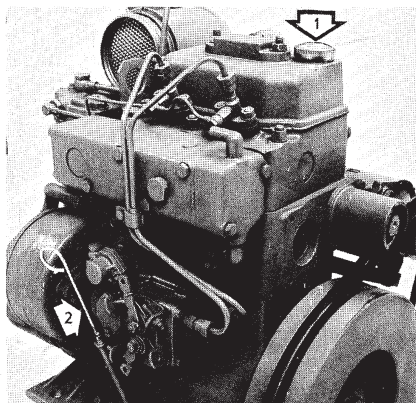


Fig. 14. Checking engine oil level

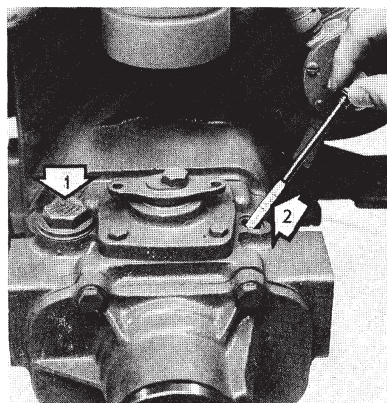


Fig. 15. Checking reverse gear oil level

- 1. Oil filling
- 2. Dipstick

2. Checking oil level in reverse gear and Combi reduction gear

The MS reverse gear has a separate oil compartment. Check the oil level daily before starting for the first time with the help of the dipstick which is located on the starboard side of the reverse gear. The oil level should be between the max.-min. marks on the dipstick, which does not need to be screwed down when measuring the oil level. When necessary, top up with new oil (see Fig. 15). Concerning the oil quality and viscosity, see point 5.

The reduction gear on the MD6A Combi has the same oil compartment as the engine, so that no separate oil level check is necessary.

PERIODICAL SERVICING

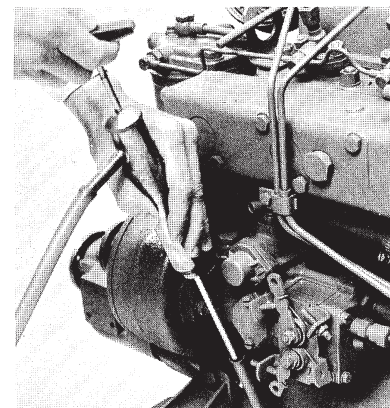


Fig. 16. Sucking up oil

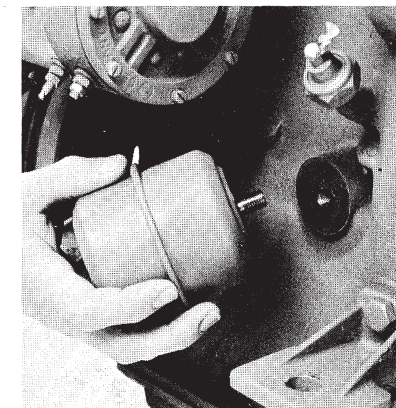


Fig. 17. Changing oil filter

3. Changing the engine oil

Change the lubricating oil after every 50 hours running or at least once each season. During the running-in period the oil should be changed after 20 hours of operation.

Run the engine warm before changing the oil. The oil is sucked up from the crankcase with the help of a crankcase pump, the tube of which is inserted through the dipstick hole, see Fig. 16. The crankcase pump is included in the tool kit. Concerning the oil quality and viscosity, see table below.

Use only diesel lubricating oil, quality Service DS.

QUALITY	VISCOSITY		OIL CAPACITY, LITRES (IMP. QTS. = US QTS.)		incl. oil filter
	below +10°C (50°F)	above +10°C (50°F)	engine	engine incl. Combi red. gear	
Service DS	SAE 20W	SAE 30	2.8 (2,5 = 2,9)	3,0 (2,6 – 3,2)	+0,2 (0,25)

4. Changing the oil filter

Change the oil filter after every 100 hours running at the same time as the oil is changed. In the case of a new or reconditioned engine, the oil filter should also be changed for the first time after 20 hours running (see "Running-in the engine").

PERIODICAL SERVICING

The oil filter is changed as follows:

Unscrew the old filter (see Fig. 17). If it remains firmly in position and cannot be loosened, use a special tensioning tool or pierce the outer part of the filter with a screwdriver that can then be used as a lever. Remember that oil can spill out.

Make sure that the contact surface against the engine block is clean. Smear the new filter rubber gasket with oil and screw on the filter by hand until it just comes into contact with the contact surface of the engine block.

Tighten the filter a further half turn but no more. Start the engine and run it at idling speed while checking to make sure there is no leakage at the filter.

Always check the oil level after changing the oil filter or changing the engine oil.

5. Changing oil in reverse gear

Change the lubricating oil in the reverse gear after every 50 hours running or at least once each season. The oil is drained through the reverse gear drain hole or is sucked up with the help of an oil scavenging pump through the hole for the oil dipstick. When adding oil to the reverse gear, fill up to the upper mark on the oil dipstick, see Fig. 15.

REVERSE GEAR TYPE	OIL QUALITY	VISCOSITY		OIL CAPACITY, LITRES (IMP QTS. = US QTS.)			
		below +10°C (50°F)	above +10°C (50°F)	excl. red. gear min.	excl. red. gear max.	incl. red. gear min.	incl. red. gear max.
MS	Service DS	SAE 20W	SAE 30	0,35 (0,31 = 0,37)	0,45 (0,40 = 0,48)	0,50 (0,44 = 0,53)	0,60 (0,53 = 0,64)

6. Lubricating reversing mechanism in Combi reduction gear

Lubricate the reversing mechanism after every 50 hours running or at least once each season. Set the control lever to neutral position and pump in grease – about 20 strokes of the pump – through the pressure lubricating nipple on the port side of the reduction gear (see 29, Fig. 3).

Use Shell Alvania EP2 grease or similar. The so-called “cam disc” on the reversing mechanism can be greased with the same grease. Ball joints and fork ends for the control cables are lubricated with engine oil.

Check once each season when launching that the propeller hub is completely filled with grease. To add grease, remove the plug in the hub and fit the lubricating nipple supplied. Use Shell Alvania EP2 grease or similar.

PERIODICAL SERVICING

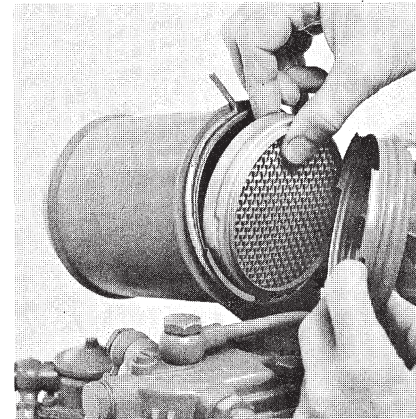


Fig. 18. Air cleaner

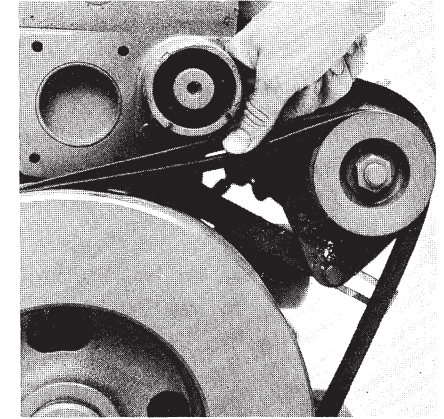


Fig. 19. Checking belt tension

7. Cleaning the air cleaner and crankcase ventilation

The air cleaner and strainer for the crankcase ventilation (located on the rocker arm casing) should be removed and cleaned after every 100 hours running, or once each season. Use white spirit or fuel oil for cleaning. See Fig. 18 and pos. 3, Figs. 1 and 3.

8. Checking the vee-belts

Check the vee-belt tension after every 50 hours running. The belts can start slipping due to wear or grease.

Test the belt tensioning by pressing in the belts midway between the starter-generator and flywheel. It should be possible to depress them about 3–4 mm (1/8”) under normal thumb pressure, see Fig. 19.

If an alternator is fitted, the vee-belt tension should be so hard that it is just possible to get the pulley to slip by turning with one finger a wing on the alternator fan.

If the belt is insufficiently tensioned, loosen the tensioner arm as well as the bolts at the alternator attaching points. Tension the belt by moving the alternator outwards and re-tighten the bolts.

PERIODICAL SERVICING

9. Changing the fine filter and cleaning pre-filter

Change the fine filter after every 100 hours running, or at least once each season. Thoroughly clean the whole of the outside of the filter body (see 2, Fig. 20). Screw loose the filter container by turning the hex head at the bottom of the container. The fine filter with container is of the throw-away type and for this reason the old filter should be scrapped and a new one fitted.

Check that the body contact surface is absolutely clean and that the filter gasket is not damaged. Screw on the new filter by hand until the gasket is against the body. Then tighten the filter a further half turn. Vent the fuel system (see point 10) and check for leakage.

At the bottom of the filter container there is a drain plug for draining water and impurities in the fuel. Vent the fuel system (see point 10) after draining.

The pre-filter in the feed pump should be cleaned after every 100 hours running, or at least once each season.

Wash the outside of the feed pump and remove the cover to get at the gauze filter, see Fig. 21. Clean the gauze filter in fuel oil and re-fit it with the pins pointing upwards. Check the gasket and screw tight the cover. Vent the fuel system (see point 10).

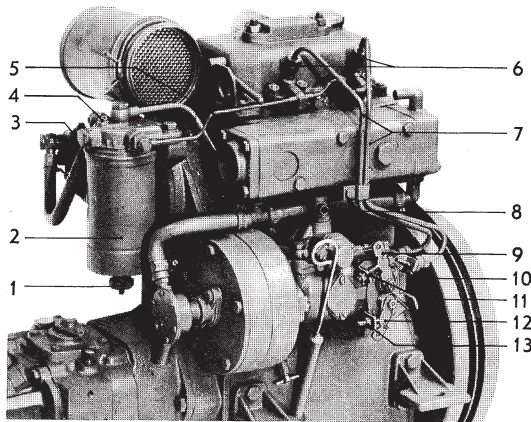


Fig. 20. Fuel system

1. Drain plug
2. Fine filter
3. Feed pump
4. Venting screw, fine filter
5. Leak-off oil line
6. Injectors
7. Delivery pipes
8. Return fuel connection
9. Throttle lever
10. Adjusting screw, max. speed (sealed)
11. Adjusting screw, idling speed
12. Stop lever
13. Adjusting screw, injection quantity (sealed)

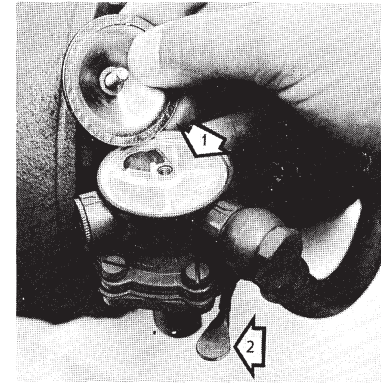


Fig. 21. Feed pump

1. Pre-filter
2. Hand primer

PERIODICAL SERVICING

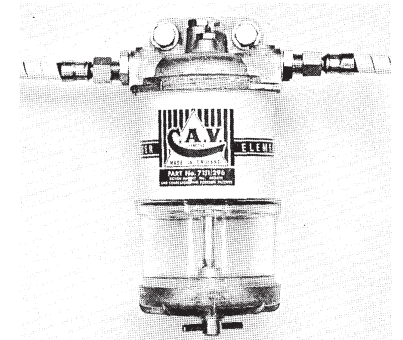


Fig. 22. Extra fuel filter with water separator

If an extra fuel filter with water separator is fitted (Fig. 22), check the transparent container to see if any water has mixed with the fuel. If necessary, drain through the drain cock in the bottom of the filter container. Remember that fuel can spill out. The fine-filter element should be replaced at least once each season.

10. Venting the fuel system

In order for the engine to start, the fuel system must be vented when the following takes place:

- | | |
|---------------------------------------|--|
| After changing the fine filter. | Running fuel tank empty. |
| When draining through the drain plug. | When fitting fuel injection pump. |
| When cleaning the pre-filter. | Leakage and work on fuel lines. |
| | If engine has not been used for some time. |

Venting is as follows:

1. Open the vent screw on the fine filter, 4, Fig. 20.
2. Pump forward fuel with the help of the hand primer (2, Fig. 21) until about 0.2 litre (0.4 pint) has run out. Close the vent screw. If the pumping effect is poor, turn over the engine a bit so that the pump driving cam alters position.
3. If the injection pump has been removed, or when starting a completely new engine for the first time, the fuel injection pump must be vented. Pump with the hand primer about 1/2 minute so that the injection pump automatically vents. Unscrew the nuts for the injector's delivery pipes and turn over the engine with the starter-generator until fuel comes from the delivery pipes. Tighten the delivery pipe nuts and start the engine.

SERVICING INSTRUCTIONS

11.

Checking valve clearances

Check the engine valve clearance after every 100 hours running or at least once each season. This check should be carried out by an authorized service workshop. **Adjustment must be made with the engine stopped.**

Remove the crankcase ventilation and rocker arm cover. Observe the valves while cranking the crankshaft with the help of the starting handle. When both the valves in a cylinder "rock", which means that both valves are partly open, crank the crankshaft one turn further. Then check and if necessary adjust the valve clearance for this cylinder. Repeat this procedure for the other cylinder.

With the engine warm, the clearance should be 0.30 mm (0.012") for both the inlet and exhaust valves.

12.

Checking electrolyte level in battery

Check the battery electrolyte level at least every 14 days.

The level should be between 5 and 10 mm (1/4 and 1/2") over the cell plates. Add distilled water whenever necessary. Never add too much since the electrolyte can then splash out and cause corrosion damage. Never check the electrolyte level by using a lighted match since the gas formed in the battery cells is highly explosive.

GENERAL SERVICING INSTRUCTIONS

13.

Check-tightening cylinder head nuts

With a new engine or when the cylinder head has been removed, the cylinder head nuts must be re-tightened after about 20 hours running. Check-tightening should also be carried out once each season and always with a torque wrench. Concerning tightening torque, see under "Technical Data". Check the valve clearances according to point 11.

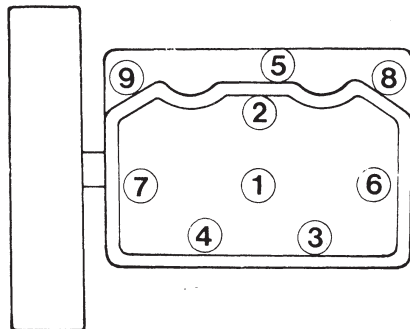


Fig. 23. Tightening sequence for cylinder head nuts

SERVICING INSTRUCTIONS

14.

Checking the injectors

At regular intervals all the injectors should be removed and handed in to a diesel workshop for cleaning and a check on opening pressure, leakage and spray pattern. We recommend an interval of max. 100 hours of operation between these inspections.

REMOVING

1. Clean the injector, delivery pipe and cylinder head round the injector.
2. Unscrew the clamp, delivery pipe and leak-off oil line from the injector. The delivery pipe nut at the injection pump should also be slightly slackened. Fit masking caps.
3. Unscrew both the nuts over the yoke holding the injector to the cylinder head and lift up the injector. If carbonising has stuck the injector, turn the injector forwards and backwards carefully with, for example, general purpose pliers and at the same time lever upwards (e.g., with a screwdriver under the yoke).

FITTING

1. Check that the contact surface on the injector and copper sleeve is clean.
2. Push the injector down into position and fit the yoke but do not tighten the nuts.
3. Connect the delivery pipe and return line. Make sure that the cones are in correct position. Do not forget to fit the clamp in position, otherwise the life of the pipes will be shortened.
4. Tighten the nuts on the yoke. Concerning tightening torque, see under "Technical Data".

15.

Cooling system

The cooling system should be checked after 100 hours running, or at least once each season, for leakage, deposits, etc.

The thermostat can be taken out after the water distributor housing on the front end of the exhaust manifold has been removed. When re-fitting the water distributor housing, check that the O-ring for the water hole at the bottom edge of the housing is in position. Concerning operating temperature, see under "Technical Data".

REPLACING THE SEA-WATER PUMP IMPELLER

The pump impeller is made of neoprene rubber and this can be damaged in the case of water deficiency, for example, if the sea-water intake should be blocked. The pump impeller is changed as follows:

SERVICING INSTRUCTIONS

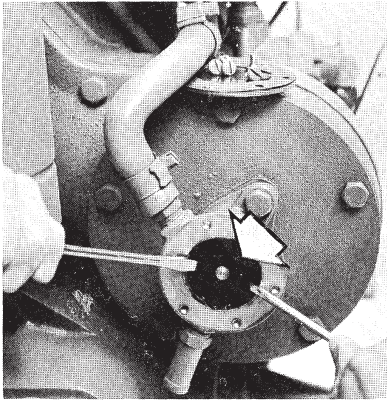


Fig. 24. Removing impeller. Arrow points to impeller lock bolt

1. Close the bottom cock. Remove the cover from the sea-water pump. **Note the risk of water getting into the boat.** With the help of two screwdrivers pull the shaft with the pump impeller out of the housing as far as necessary in order to reach the bolt retaining the impeller. See Fig. 24. NOTE. Place some kind of protection under the screwdrivers in order not to damage the impeller housing.
2. Pull the impeller off the shaft. Clean the inside of the pump housing and fit the new impeller.
3. Fit the cover with its original gasket which has the right thickness. Always have a spare impeller on board. Open the bottom cock.

16. Electrical system

CHECKING THE STATE OF CHARGE OF THE BATTERY

The state of charge of the battery should be checked at least once each season. This is done by using a hydrometer which shows the specific gravity of the electrolyte, this varying with the state of charge. (See under "Technical Data".)

CABLES AND CABLE TERMINALS

At regular intervals check that all cable terminals are properly tightened and that none of the cables are damaged.

NOTE. This is particularly important when the engine is fitted with an alternator.

The battery poles and cable clamps should be well tightened and smeared with grease or vaseline.

SERVICING INSTRUCTIONS

STARTER-GENERATOR

All work on the starter-generator (and alternator if fitted) should be carried out by an authorized service workshop. Inspection and control should be done when the engine is given a general overhaul.

WARNING CONCERNING ALTERNATOR

If the alternator and its regulator are to function perfectly, it is extremely important that the following instructions are followed:

1. Never break the circuit between the alternator and battery while the engine is running. This would otherwise result in a short-circuit in the regulator which is immediately ruined.
The master switch must never be switched off before the engine has completely stopped.
2. Never confuse the battery poles with one another. The poles are generally stamped with a plus and a minus sign respectively. The minus pole must always be earthed to the engine block.
3. Use only a Volvo Penta double diode kit when charging two batteries from one generator.
4. In the case of starting by using a spare battery, this should be done as follows:
Let the ordinary battery remain connected in circuit. Connect the spare battery to the ordinary battery, plus to plus and minus to minus. When the engine starts disconnect the spare battery but never break the circuit to the ordinary battery.
5. Never use a rapid charger while the alternator is connected to the battery.
6. Always disconnect both battery cables before carrying out any work on the alternator equipment.
7. If electric welding work is to be carried out on the engine or installation units, disconnect the charging regulator cables at the alternator and insulate.
8. Check vee-belt tension and cable connections at regular intervals.

Checking the reverse gear and reduction gear

The reverse gear and reduction gear should be checked regularly for oil leakage, abnormal noise or excessive operating temperature.

Check also at regular intervals that the control lever shift cable is properly adjusted to the reverse gear control lever. In the neutral position, it should be possible to move the cube easily into the hole on the reverse gear control lever.

SERVICING INSTRUCTIONS

18.

Procedure if unit is to remain idle

IDLE PERIOD WITH BOAT AFLOAT

In the case of an idle period of **less than one month** with the boat afloat, the engine should be started and run warm **after at least every 14 days**, to prevent corrosion damage to the interval parts of the engine.

If the engine is to remain idle for a **longer period than one month**, then the engine should be inhibited, see under "Procedure before laying up"

Protect the engine and equipment from external corrosion damage by regularly spraying unpainted surfaces and electrical components with corrosion and moisture protection spray.

We also recommend that the cylinders are sprayed through the injector holes in the case of long intervals of idleness.

PROCEDURE BEFORE LAYING UP

Before the boat is taken up on land for laying up, it is advisable to let an authorized service workshop test the engine and reverse gear. It is also advisable to carry out a compression test on the engine.

PREPARE THE ENGINE FOR LAYING UP BEFORE THE BOAT IS LIFTED OUT OF THE WATER AS FOLLOWS:

1. Run the engine warm, stop it and pump all the lubricating oil out of the engine and reverse gear with the help of the scavenging pump. NOTE. The oil must be pumped or drained separately from the MS reverse gear.
2. Fill up the engine and reverse gear with inhibiting oil to the lowest mark on the dipstick. Suitable inhibiting oils are Esso Rust Ban 623, Shell Ensis Oil 20 or corresponding oils of another make. NOTE. The MS reverse gear must be filled separately.
3. Drain off the fuel oil in the fuel filter and disconnect the flexible fuel line from the feed pump at the lower end. Insert the hose into a can with inhibiting oil containing about 1/3rd Esso Rust Ban 623 and 2/3rds diesel oil.
4. Vent the fuel system and start the engine. Allow it to run at rapid idle until about 1/4 litre (1/2 pint) of the fuel in the can is used up.
5. Stop the engine.

SERVICING INSTRUCTIONS

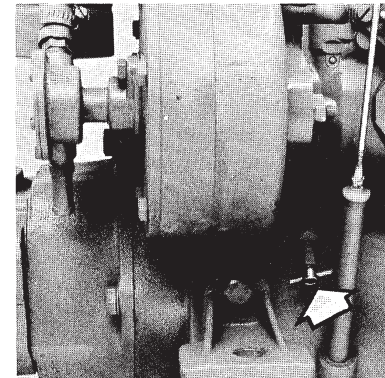


Fig. 25. Drain cock for cooling water

AFTER THE BOAT HAS BEEN LIFTED ASHORE, CARRY OUT THE FOLLOWING PROCEDURE:

1. Inhibit the cooling system as follows:
 - a. Drain off all cooling water from the engine and exhaust manifold by opening drain cock on the starboard side, see Fig. 25. Then close the cock. Remove the drain plug under the reduction gear (ratio 1.91:1) and drain off the cooling water. Screw back the plug.
 - b. Mix rustproofing agent in a container filled with at least 20 litres (3 1/2 Imp. galls. = 4 1/2 US galls.) of fresh water. The rustproofing agent used should be of the emulsifying type, for example, Esso Cutwell 40, Shell Donax C or similar. Add 20% rustproofing oil to the water and stir well. NOTE. Always add the oil to the water and never the other way around.
 - c. Disconnect the suction line between the cooling water pump and bottom intake from the pump. When reduction gear (ratio 1.91:1) is fitted, disconnect the hose between the bottom intake and the reduction gear.
 - d. Instead connect a 1/2" rubber hose, the length of which should be sufficient to reach down to the bottom of the container with rustproofing mixture.
 - e. Insert the connected suction hose into the container. Let the fuel line remain in the can with the mixture of inhibiting oil and fuel and start the engine. Let it run at idling until the water has been sucked out of the container, this forming a protective oil film in all the cooling channels. **NOTE. Never let the engine run dry since this can damage the cooling water impeller.** Then connect the cooling water hose to the bottom intake and the fuel hose to the feed pump.
 - f. Drain all cooling water from the engine and reduction gear by opening the drain cocks. **NOTE. The rustproofing mixture does not protect the engine from frost.** If the engine is fitted with a wet exhaust line, this should also be drained of water.

SERVICING INSTRUCTIONS

- g. Drain the cooling water pump by releasing the pump cover. Take out the impeller (see under "Servicing", point 15) for winter storage. Let the drive shaft remain in position and re-fit the cover.
2. Remove the injectors (see under "Servicing", point 14) and spray each cylinder with inhibiting oil. Turn over the engine several turns before re-fitting the injectors. Concerning tightening torque for the injectors, see under "Technical Data".
3. Clean the outside of the engine and reverse gear with white spirit or similar and touch up damaged paintwork. Protect all unpainted parts and the electrical system by spraying them with corrosion and moisture protective spray.
4. Remove the battery and put it into storage. It must be re-charged at regular intervals if it is to be kept in good condition.

PROCEDURE WHEN LAUNCHING

1. Pump out all the rustproofing oil from the engine and reverse gear and replace the oil filter, see under "Servicing", points 3, 4 and 5. NOTE. The MS reverse gear has a separate oil compartment.
2. Fill the engine and reverse gear with lubricating oil, see under "Servicing" points 3 and 5. Also lubricate the Combi reversing mechanism and propeller hub, see point 6.
3. Fit the pump impeller in the cooling water pump, see under "Servicing", point 15, and connect all hoses and check-tighten the hose clamps.
4. Clean the outside of the engine and reverse gear of rustproofing oil.
5. Take a fully charged battery on board and connect up the battery cables
NOTE. Be careful not to confuse the cables (see under "Servicing, point 16) The negative battery pole should be earthed to the engine.
Grease the battery cable clamps with grease or vaseline after tightening.
6. Remove the injectors and turn over the engine several times with the starter motor in order to blow out any rustproofing oil which may be on the pistons. NOTE. Prevent oil splash. Re-fit the injectors, see under "Technical Data" for their tightening torque.
7. Close all drain cocks for the cooling system. Check with reduction gear (ratio 1.91:1) that the drain plug is fitted and tightened. Open the bottom cock for the cooling water intake.
8. Launch the boat and fill the fuel tank. Change the fine filter (see point 9) pump forward fuel and vent the system (see point 10). Check thoroughly the tank, lines, connections and cocks to be absolutely sure that there is no leakage.

SERVICING INSTRUCTIONS

9. Start the engine and follow carefully the running instructions given on pages 6–9. Run the engine warm with the reverse gear engaged. Check to make sure there is no leakage of fuel, water, oil, air or exhaust gases. If there is, attend to it immediately. Check the bolts and nuts for tightness.

10. Contact an authorized Volvo Penta service workshop and have servicing of the engine and reverse gear carried out as specified in the maintenance scheme.

TRACING FAULTS IN CASE OF RUNNING INTERRUPTIONS

The fault-tracing scheme below includes only the more usual reasons for faulty operation. With the help of the instructions given in this book, it is usually possible to trace most of the causes mentioned below. In case of doubt always contact the nearest Volvo Penta service workshop.

Follow the instructions in the maintenance scheme – this ensure the best running reliability.

Fault-tracing scheme

Engine will not start	Engine stops	Engine does not reach top speed at full throttle	Engine runs roughly or vibrates abnormally	Engine overheats	FAULT TRACING	Remarks
x					Master switch not on; battery discharged, broken electric cables	see point 16
x	x				Fuel tank empty, fuel cock closed, fuel filter blocked	see points 9, 10
x	x		x		Water, air or impurities in fuel	see points 9, 10
x	x	x	x		Faulty injectors	see point 14
		x			Boat abnormally loaded, Marine growth on boat bottom	see page 5
		x	x		Propeller damaged	
				x	Blocked cooling water intake or cooling jackets, defective pump impeller or thermostat	see point 15

TECHNICAL DATA

General

Engine designation	MD6A
Operation	4-stroke diesel w injection and ov valves
Number of cylinders	2
Output, h.p. (DIN) at 2400 r/m	10
Max. operating speed, r/m	2400 ¹⁾
Bore, mm (in.)	70 (2.75)
Stroke, mm (in.)	82 (3.23)
Displacement, litres (cu.in.)	0.631 (38.5)
Compression pressure, kp/cm ² (psi), starter-generator rpm	20–24 (285–34
Idling speed, r/m	550–650
Direction of rotation, when facing flywheel	Clockwise
Max. inclination of engine in boat underway	15°
Engine weight, incl. MS reverse gear, approx. kg (lb.)	160 (355)
Engine weight, incl. Combi reduction gear, approx. kg (lb.)	165 (365)

Valves

Valve clearances, warm engine	
Valve inlet, mm (in.)	0.30 (0.012")
exhaust, mm (in.)	0.30 (0.012")

Reverse gear

Type designation	Volvo Penta MS
Ratio, "Forward" and "Reverse"	1:1
Ratio with auxiliary gear	1.91:1

Reduction gear for adjustable propeller

Type designation	Combi
Ratio	1.42:1

Lubricating system

Engine

Oil capacity, engine, litres (Imp. qts. — US qts.), excl. filter	2.8 (2.5–2.9)
incl. filter	3.0 (2.6–3.2)
Oil quality	Diesel lubricatir Service DS
Viscosity	
above +10°C (50°F)	SAE 30
below +10°C (50°F)	SAE 20 W
Oil pressure, warm engine, idling speed, kp/cm ² (psi)	0.8–1.5 (14–2'
full speed, kp/cm ² (psi)	3.5–4.0 (50–5'

1) During long running periods, the max. speed reached should be reduced by at lea:
300 r/m.

TECHNICAL DATA

Reverse gear

Oil quality/Viscosity	Same as engine
Oil capacity, litre (Imp. qt. — US qt.)	0.4 (0.35–0.42)
Oil capacity with auxiliary gear, litre (Imp. qt. = US qt.)	0.55 (0.48–0.58)

Combi reduction gear

Reduction gear	Same oil compartment a engine
Reversing mechanism and propeller hub	Lubricating grease Shell Alvania EP2 or similar

Cooling system

Thermostat, starts opening at °C (°F)	75 (167)
is fully open at °C (°F)	85 (185)

Fuel system

Fuel injection pump, make Bosch	Distributor pump with speed regulator
type	0 460 302 006
Feed pressure, kp/cm ² (psi)	0.75 (10)
Injectors, make Bosch, holder	0 431 112 001
spray nozzle	0 433 171 001
opening pressure, kp/cm ² (psi)	180 (2560)
Pre-injection angle, crankshaft degrees B.T.D.C.	10°
Fuel quality	"Autodiesel" rating minimum 45

Electrical system

Battery voltage, volts	12
Battery capacity, max. Ah	60
Starter-generator	
Generator output, max. W	135
continuous W	90
Starter motor output, h.p.	1
Battery electrolyte, specific gravity:	
Battery to be re-charged at g/cm ³	1.230
Fully charged battery, g/cm ³	1.275–1.285

Tightening torques

Cylinder head nuts, kpm (lb.ft.)	7.0 (51)
Connecting rod bolts, kpm (lb.ft.)	5.0 (36)
Crankshaft main bearings, kpm (lb.ft.)	5.0 (36)
Flywheel nut, kpm (lb.ft.)	18.0 (130)
Injection nuts, kpm (lb.ft.)	2.0 (14)

