Contents

Safety Precautions

Introduction

This Workshop Manual contains technical data, descriptions and repair instructions for Volvo Penta products or product versions contained in the contents list. Ensure that the correct workshop literature is being used.

Read the safety information and the Workshop Manual "General Information" and "Repair Instructions" carefully before starting work.

Important

In this book and on the engine you will find the following special warning symbols.

WARNING! If these instructions are not followed there is a danger of personal injury, extensive damage to the product or serious mechanical malfunction.

IMPORTANT! Used to draw your attention to something that can cause damage, product malfunction or damage to property.

NOTE! Used to draw your attention to important information that will facilitate work or operations.

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

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

Generally, all servicing should be carried out with the engine switched off. Some work (carrying out certain adjustments for example) requires the engine to be running. Approaching a running engine is dangerous. Loose clothing or long hair can fasten in rotating parts and cause serious personal injury.
If working in proximity to a running engine, careless movements or a dropped tool can result in personal injury. Avoid burns. Take precautions to avoid hot surfaces (exhausts, turbochargers, charge air pipes and starter elements etc.) and liquids in supply lines and hoses when the engine is running or has been turned off immediately prior to starting work on it. Reinstall all protective parts removed during service operations before starting the engine.

Check that the warning or information decals on the product are always clearly visible. Replace decals that have been damaged or painted over.

Never use start spray or similar to start the engine. The starter element may cause an explosion in the inlet manifold. Danger of personal injury.

Avoid opening the filler cap for engine coolant system (freshwater cooled engines) when the engine is still hot. Steam or hot coolant can spray out. Open the coolant filler cap carefully and slowly to release pressure before removing the cap completely. Take great care if a cock, plug or engine coolant line must be removed from a hot engine. It is difficult to anticipate in which direction steam or hot coolant can spray out.

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

Stop the engine and close the sea cock before carrying out operations on the engine cooling system.

Only start the engine in a well-ventilated area. If operating the engine in an enclosed space, ensure that exhaust gases and crankcase ventilation emissions are ventilated out of the working area.

Always use protective goggles where there is a danger of pieces of metal, sparks from grinding, acid or other chemicals being thrown into your eyes. Your eyes are very sensitive, injury can lead to loss of sight!

General information

About the workshop manual

This workshop manual contains technical specification, descriptions and instructions for repairing the standard versions of the following engines MD11C, D, MD17C, D. The workshop manual displays the operations carried out on any of the engines above. As a result the illustrations and pictures in the manual that show certain parts on the engines, do not in some cases apply to all the engines listed above. However the repair and service operations described are the same in all essential details. Where they are not the same this is stated in the manual and where the difference is considerable the operations are described separately. Engine designations and numbers are given on the number plate (See page 9). The engine designation and number should be given in all correspondence about the engine.

This Workshop Manual has been developed primarily for Volvo Penta service workshops and qualified personnel. Persons using this book are assumed to have a grounding in marine drive systems and be able to carry out related mechanical and electrical work.

Volvo Penta is continuously developing their products. We therefore reserve the right to make changes. All the information contained in this book is based on product data available at the time of going to print. Any essential changes or modifications introduced into production or updated or revised service methods introduced after the date of publication will be provided in the form of Service Bulletins.

Replacement parts

Replacement parts for electrical and fuel systems are subject to statutory requirements (US Coast Guard Safety Regulations for example). Volvo Penta Genuine parts meet these requirements. Any type of damage which results from the use of non-original Volvo Penta replacement parts for the product will not be covered under any warranty provided by Volvo Penta.

Repair instructions

The working methods described in the Service Manual apply to work carried out in a workshop. The engine has been removed from the boat and is installed in an engine fixture. Unless otherwise stated reconditioning work which can be carried out with the engine in place follows the same working method.

Warning symbols occurring in the Workshop Manual (for their meaning see *Safety information*)

WARNING!

IMPORTANT!

NOTE!

are not in any way comprehensive since it is impossible to predict every circumstance under which service work or repairs may be carried out. For this reason we can only highlight the risks that can arise when work is carried out incorrectly in a well-equipped workshop using working methods and tools developed by us.

All procedures for which there are Volvo Penta special tools in this Workshop Manual are carried out using these. Special tools are developed to rationalize working methods and make procedures as safe as possible. It is therefore the responsibility of any person using tools or working methods other than the ones recommended by us to ensure that there is no danger of injury, damage or malfunction resulting from these.

In some cases there may be special safety precautions and instructions for the use of tools and chemicals contained in this Workshop Manual. These special instructions should always be followed if there are no separate instructions in the Workshop Manual.

Certain elementary precautions and common sense can prevent most risks arising. A clean workplace and engine eliminates much of the danger of injury and malfunction.

It is of the greatest importance that no dirt or foreign particles get into the fuel system, lubrication system, intake system, turbocharger, bearings and seals when they are being worked on. The result can be malfunction or a shorter operational life.

Our joint responsibility

Each engine consists of many connected systems and components. If a component deviates from its technical specification the environmental impact of an otherwise good engine may be increased significantly. It is therefore vital that wear tolerances are maintained, that systems that can be adjusted are adjusted properly and that Volvo Penta Genuine Parts as used. The engine Maintenance Schedule must be followed.

Some systems, such as the components in the fuel system, require special expertise and special testing equipment for service and maintenance. Some components are sealed at the factory for environmental reasons. No work should be carried out on sealed components except by authorized personnel.

Bear in mind that most chemicals used on boats are harmful to the environment if used incorrectly. Volvo Penta recommends the use of biodegradable degreasing agents for cleaning engine components, unless otherwise stated in a workshop manual. Take special care when working on-board, that oil and waste is taken for destruction and is not accidentally pumped into the environment with bilge water.

Tightening torques

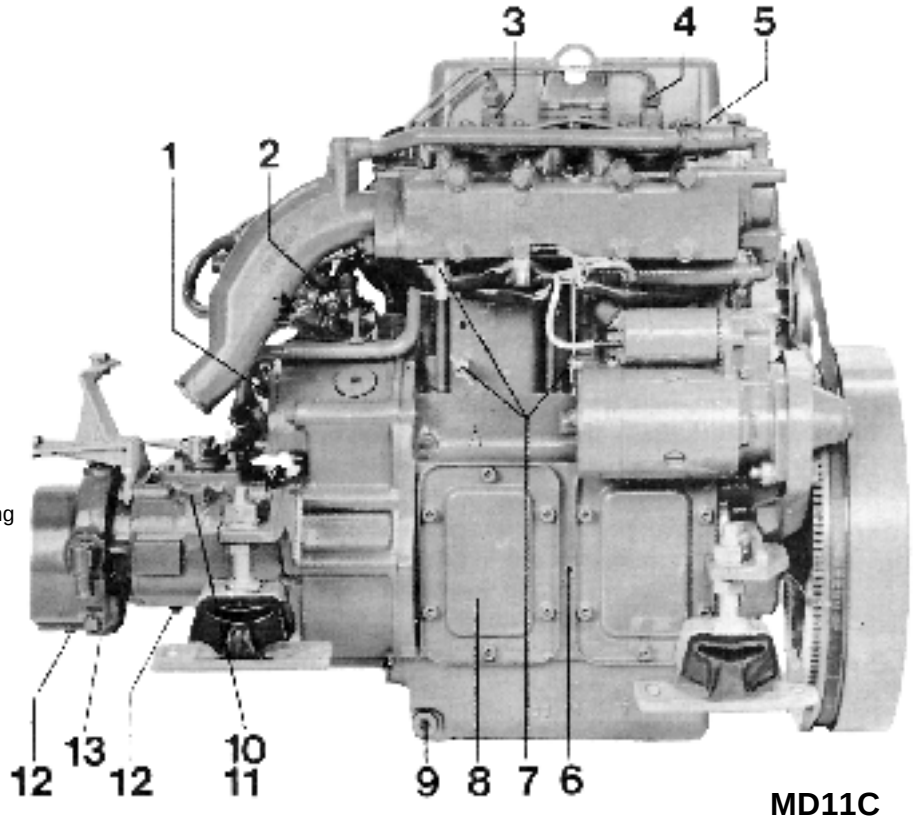
Tightening torques for vital joints that must be tightened with a torque wrench are listed in workshop manual “Technical Data”: “Tightening Torques” and are contained in work descriptions in this Manual. All torques apply for cleaned threads, screw heads and mating surfaces. Torques apply for lightly oiled or dry threads. If lubricants, locking fluid or sealing compound are required for a screwed joint this information will be contained in the work description and in “Tightening Torques” Where no tightening torque is stated for a joint use the general tightening torques according to the tables below. The tightening torques stated are a guide and the joint does not have to be tightened using a torque wrench.

Dimension	**Tightening Torques**	
	Nm	**lbt.ft**
M5	6	4.4
M6	10	7.4
M8	25	18.4
M10	50	36.9
M12	80	59.0
M14	140	103.3

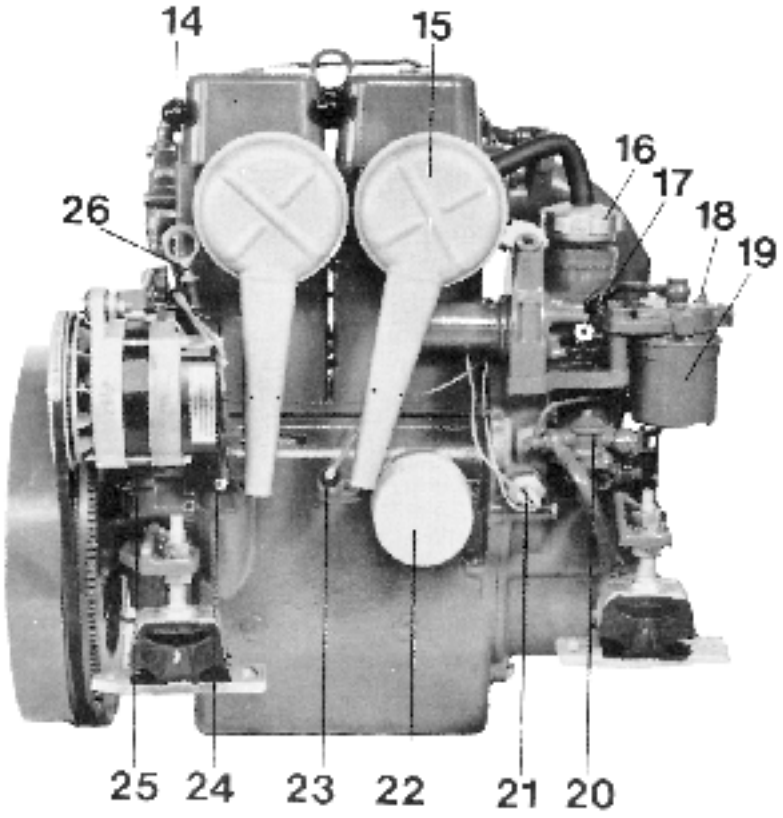
Component guide

MD11C and D

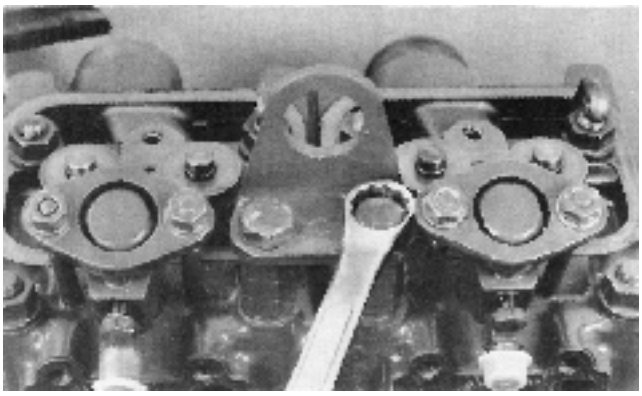
1. Stop device
2. Air bleed screw, injection pump
3. Injector
4. Delivery pipe nut
5. Temperature sender
6. Lock-screw, crankshaft centre bearing
7. Drain cocks, cooling water
8. Inspection cover
9. Oil drain plug, engine
10. Oil dipstick, reverse gear
11. Oil filler, reverse gear
12. Oil drain plug, reverse gear
13. Water drain plug, reverse gear (MD11D, connection hose)
14. Decompression handle (certain models)
15. Air filter
16. Oil filler, engine
17. Pressure equalizing valve (certain models)
18. Air bleed screw
19. Fine filter
20. Feed pump
21. Engine speed sender
22. Oil filter
23. Oil pressure sender
24. Oil strainer and oil dipstick (MD11C)
25. Oil pump
26. Oil dipstick, MD11D



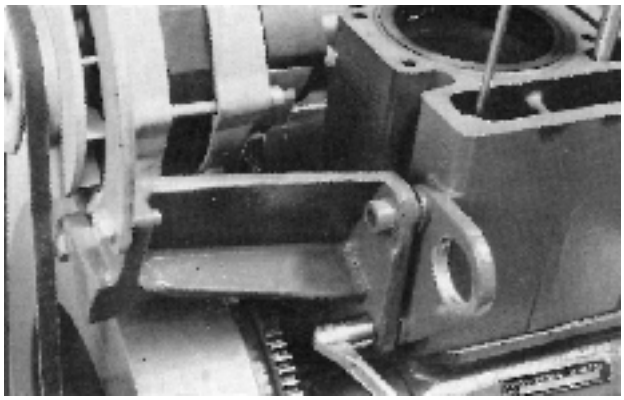
MD11C



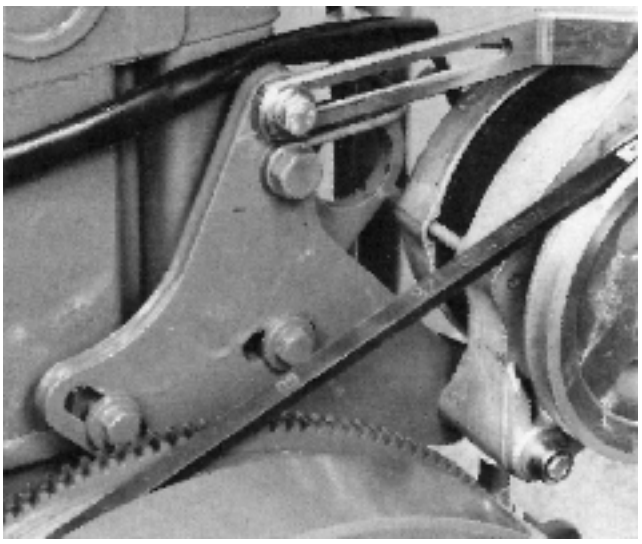
MD11D



5. Remove the eyebolt (or eyebolts) and nuts holding the cylinder heads (wrench width 19 mm). Straighten out the oil pipes slightly and lift the cylinder heads off.

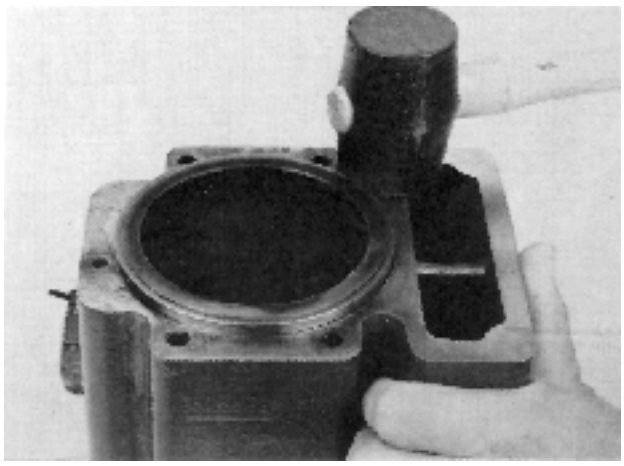


6A. Disconnect the cables from the engine speed sender, the oil pressure switch and the alternator. MD11: Remove the alternator bracket together with the alternator. The picture shows the earlier model MD11C up to and including engine no. 52480 and MD11D from production start. MD17: Remove the cover (earlier models) over the V-belt and remove the alternator.



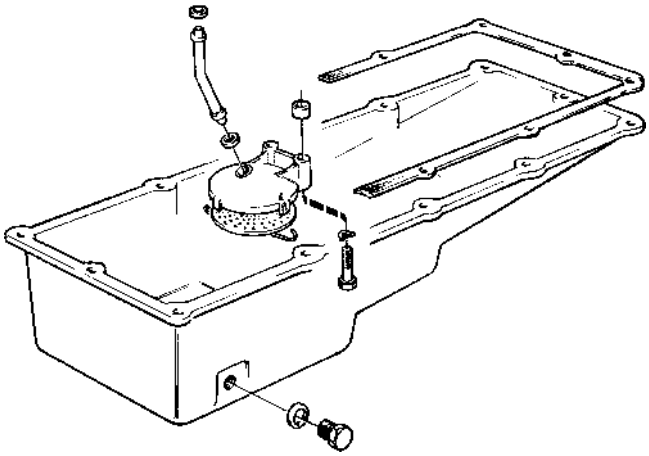
6B. MD11C: The picture shows the later models from and including engine no. 52481.

CYLINDERS, CYLINDER LINERS

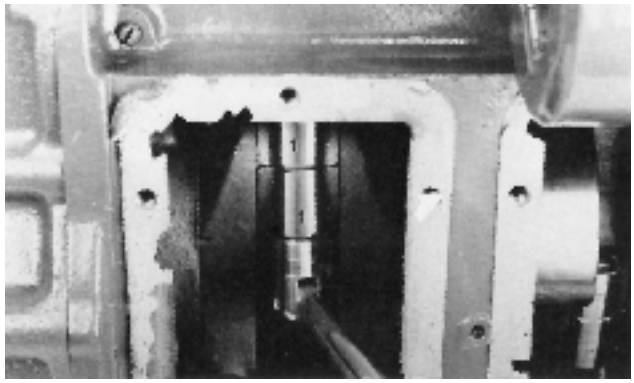


7. Lift the cylinders out. Remove the cylinder liners by placing the cylinder with the bottom of the liner on a flat support and strike the top face of the cylinder with a rubber mallet.

PISTONS AND CONNECTING RODS

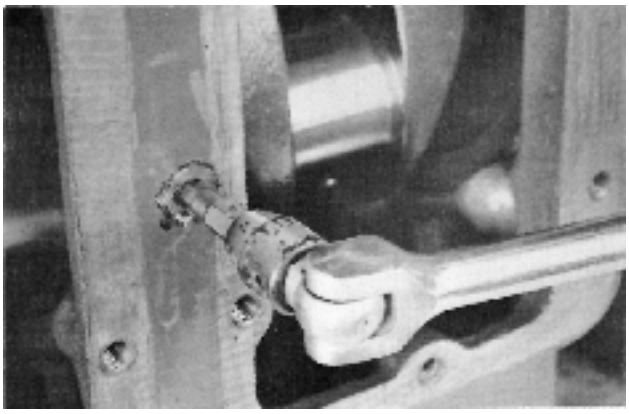


8. MD11: Remove the inspection covers on the crankcase (6 mm socket head). MD17: Remove the oil sump and strainer. NOTE! Remove the sealing rings in the ends of the oil pump suction pipe.

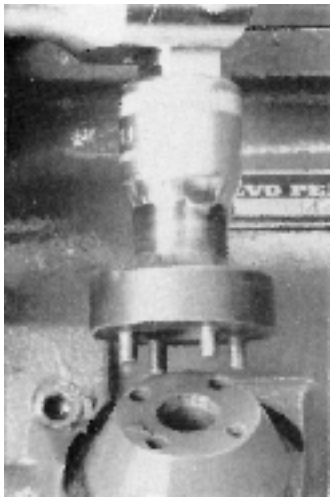


9. Remove the big-end bearing caps and take out the connecting rods (and pistons). Mark the connecting rods (if this has not already been done). Remove the valve tappets.

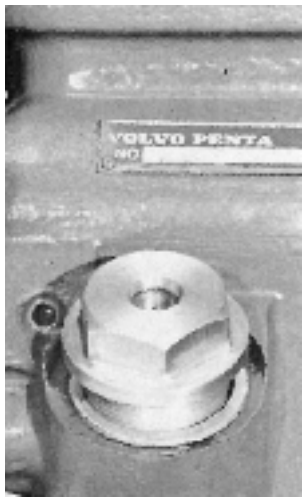
CRANKSHAFT



21. Remove the locating screw for the crankshaft centre bearing (two in the case of MD17). Pull the crankshaft out.

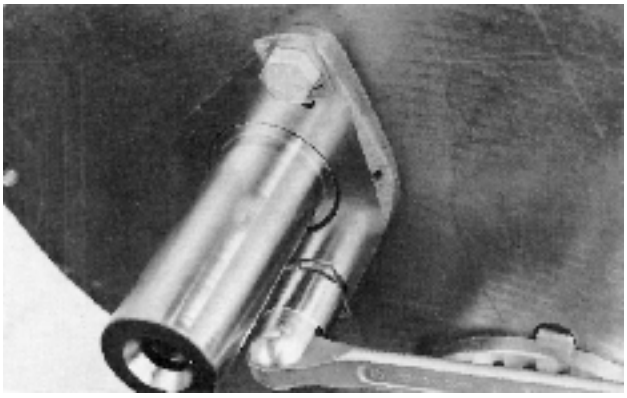


23B. MD11C. Tool 884714.

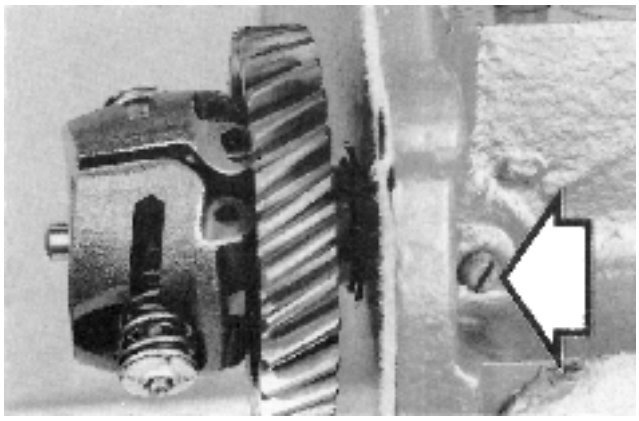


23C. MD11D. Hexagon, 30 mm.

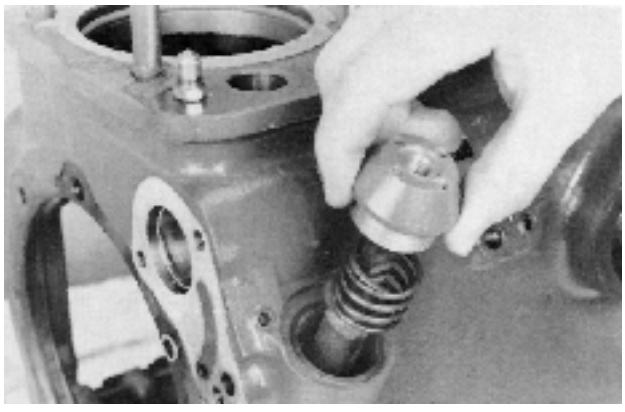
CAMSHAFT



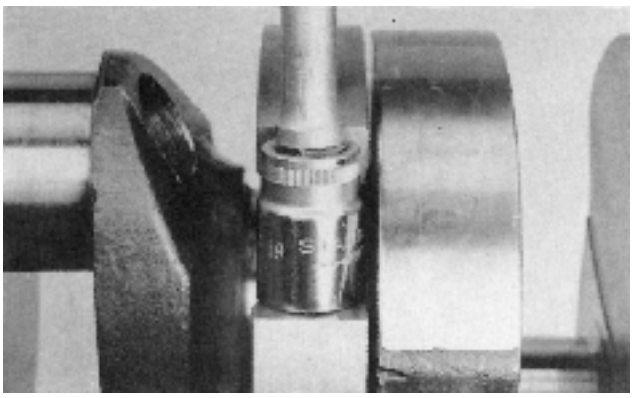
22. Remove the thrust washer and lift the camshaft out. MD17: Check that the oil hole is correctly located when re-assembling.



24. Loosen the lock screw and remove the centrifugal governor.



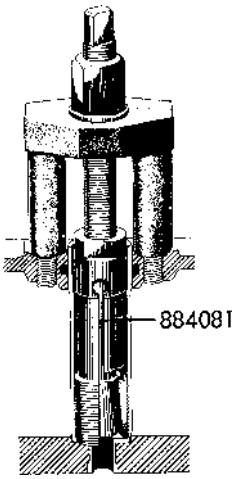
23A. Remove the oil filter, the oil pressure switch and the oil pipes for the rocker arm mechanism. MD11: Remove the oil strainer. MD11C: Use tool 884714 (see 23B). MD11D: 30 mm hexagon (see 23C).



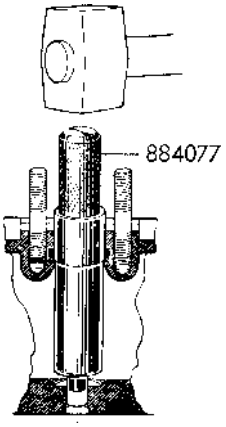
25. Unscrew the centre bearing (MD17, two bearings). NOTE! Mark them so that they can be re-fitted in the same positions.

INJECTOR SLEEVE

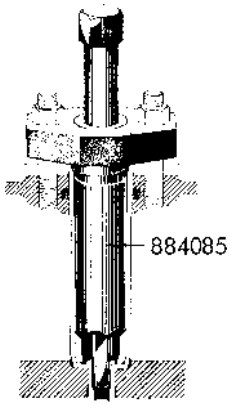
Drain the engine cooling water, if this has not already been done.



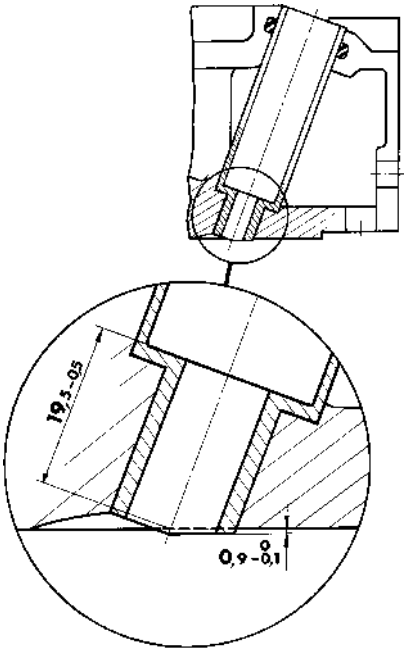
35. Remove the sleeve using the tool 884081. Push the expanding screw down into the sleeve and screw anti-clockwise so that the screw expands and grips the sleeve. Tighten until the threads bite into the copper material. Fit the yoke onto the stud bolts which hold the injector. Screw on the nut and rotate until the sleeve is removed.



36. Remove the O-ring and carefully clean the hole in which the sleeve is to fit. Grease and fit the new O-ring. Oil the new sleeve and fit it using tool 884077. Knock the sleeve in until it bottoms.

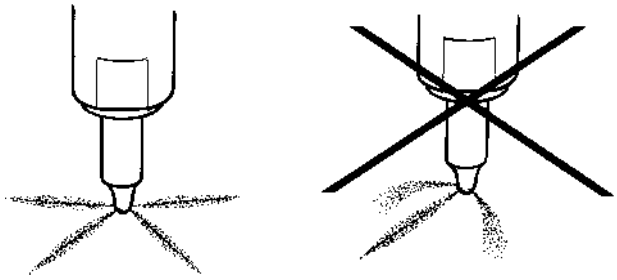


37. Oil-in the flaring tool 884085 and push it into the sleeve (make sure that the pin is screwed back correctly). Place nuts or washers on the stud bolts so that the yoke can be clamped tightly with the nuts. Screw the tool down as far as the shoulder in the sleeve permits, thus flaring the sleeve. Remove the tool.



38. Adjust the length of the sleeve outside the plane of the cylinder head (dimension 0.9 mm, 0.035"). Also check that the sleeve is correctly fitted (dimension 19.5 mm, 0.768").

INJECTORS



39. Check the spray pattern at the correct opening pressure. Up to and including engine no. 50988 (MD11), 16621 (MD17):

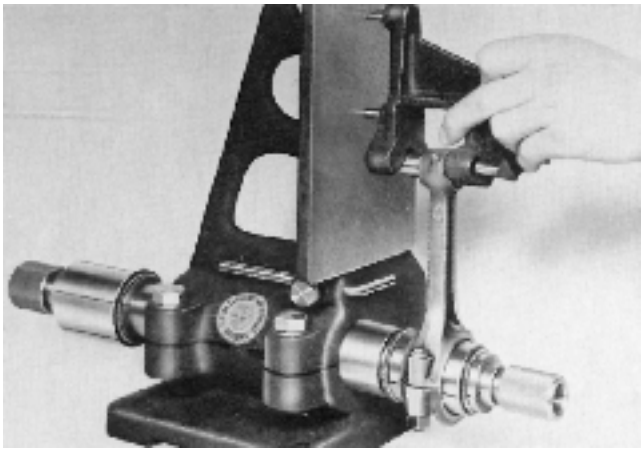
$17.0\ ^{+\ 0.8}_{-\ 0}$ MPa ($170\ ^{+\ 0.8}_{-\ 0}$ kp/cm^2 = $2418\ ^{+\ 114}_{-\ 0}$ p.s.i.)

From and including engine no. 50989 (MD11), 16622 (MD17):

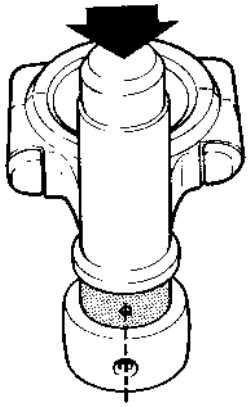
$24.5\ ^{+\ 0.8}_{-\ 0}$ MPa ($245\ ^{+\ 0.8}_{-\ 0}$ kp/cm^2 = $3485\ ^{+\ 114}_{-\ 0}$ p.s.i.)

Also check that the fuel jets cease simultaneously at all four holes and that there is no “dribble” afterwards.

CONNECTING RODS



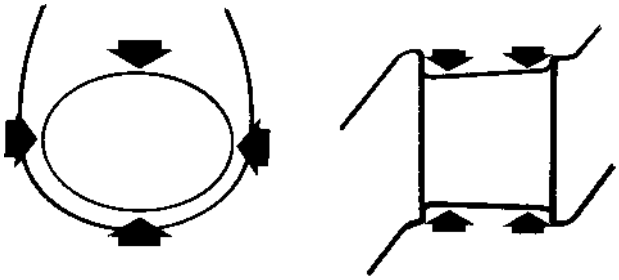
49. Check the connecting rods for straightness and twist.



50. Check the connecting rod bushings, using the gudgeon pins as gauges. There should be no noticeable play. If it is necessary to replace the bushings a suitable drift should be used for pressing in and out. Ensure that the oil hole in bushings coincides with that in the connecting rod.

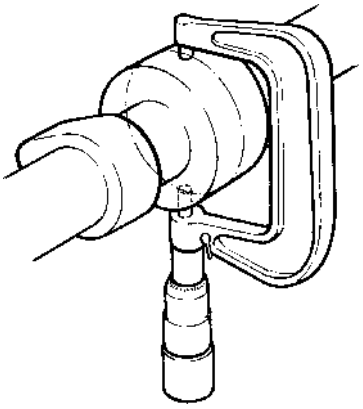
Ream the new bushings. The correct fit is achieved when an oiled gudgeon pin slides slowly through the bushing under its own weight.

CRANKSHAFT



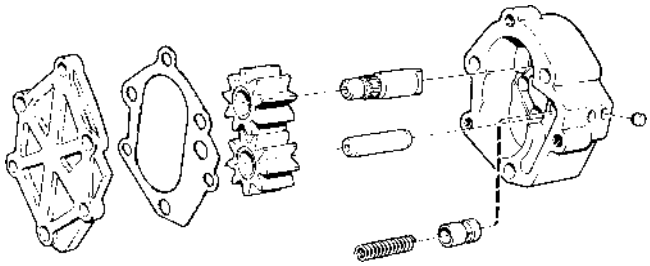
51. Measure the big end journals and the main bearing journals. The out-of-round should not exceed 0.06 mm (0.0024") and the taper should not exceed 0.05 mm (0.002"). If these values are exceeded, the crankshaft should be ground to a suitable undersize (see “Technical Data”).

CAMSHAFT

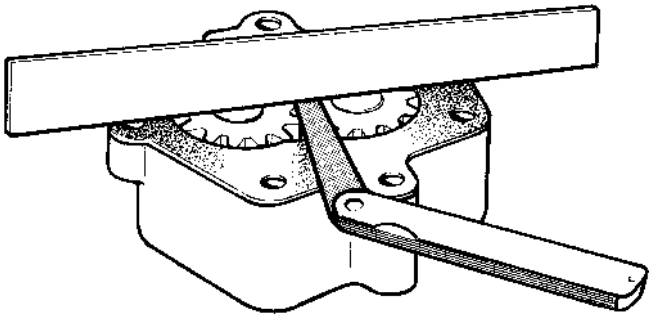


52. Check the camshaft for wear on the cams and bearing journals. Also check the wear on the bearings. The bearings are pressed into their recesses and must be line milled after pressing in. The maximum allowable wear on journals or bearings is 0.05 mm (0.002").

OIL PUMP



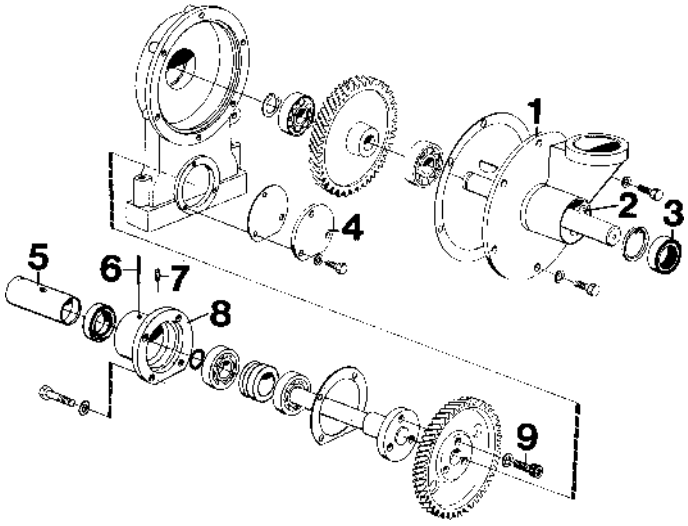
53. Remove the cover, retaining the old gasket. Remove the gearwheels, the spring and the piston. Clean all parts. Check the reducing valve spring, see “Technical Data”. Replace any worn or damaged parts.



54A. Check the axial play of the gearwheels. NOTE! The old gasket should be included in the measurement. If necessary, the number of gaskets may be increased or reduced so as to obtain a clearance of 0.03-0.15 mm (0.001"-0.006"). The thickness of a new gasket is 0.10 mm (0.004"). Also inspect the cover, repair or replace as necessary if badly worn. Coat the gasket(s) with sealant and refit the parts. Pour a little oil into the pump before mounting onto the engine.

B. Check the gear backlash, which should be 0.15-0.35 mm (0.006-0.014"), using a feeler gauge. Worn gears must be replaced.

HAND STARTER, MD17

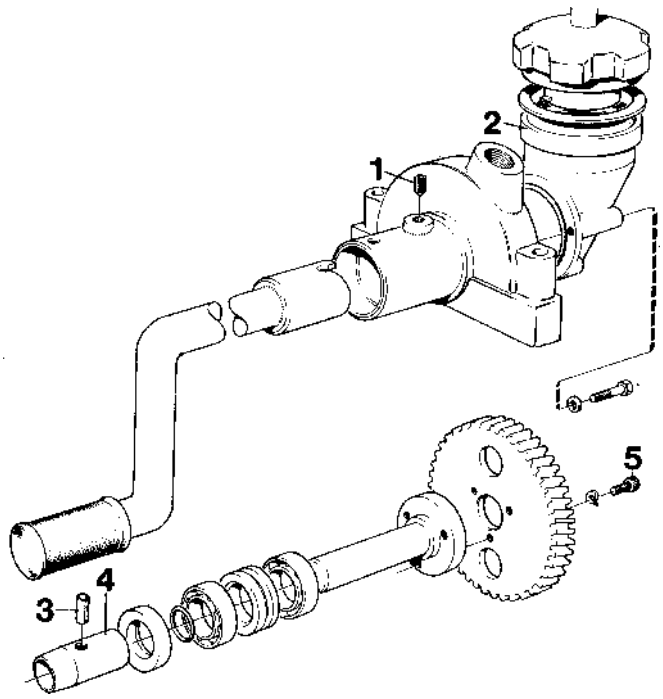


64. Remove the cover (1) together with the drive and shaft. Knock out the pin (2) and press the shaft out. Remove the sealing ring (3).

Remove the cover (4) and the screws (9), take off the gearwheel. Remove the bearing housing (8), knock out the pin (6) and pull out the sleeve (5). Take out the locking screw (7) and press out the shaft, the bearings, the spacer sleeve and the sealing rings.

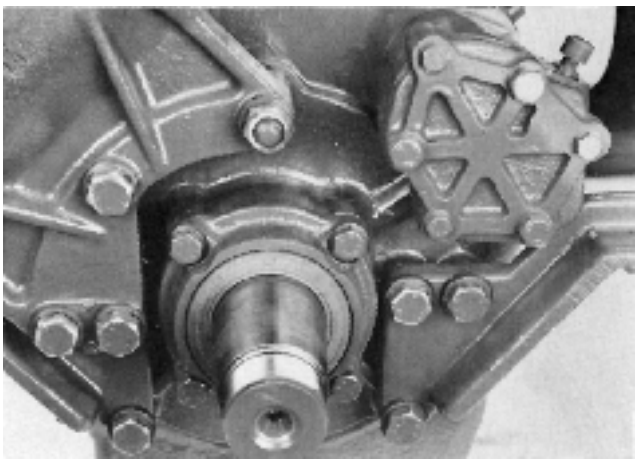
Fit new sealing rings and replace any parts that are worn or damaged. Pack the bearings in with grease and refit the parts.

HAND STARTER, MD11



65. Remove the oil filler pipe (2). Undo the screws and take the gearwheel off. Knock out the locking pin (3) and take off the sleeve (4). Take out the locking screw (1) and press out the shaft, the bearings, the spacer sleeve and the sealing rings.

Fit the new sealing rings and replace any parts that are worn or damaged. Pack the bearings in with grease and refit the parts.

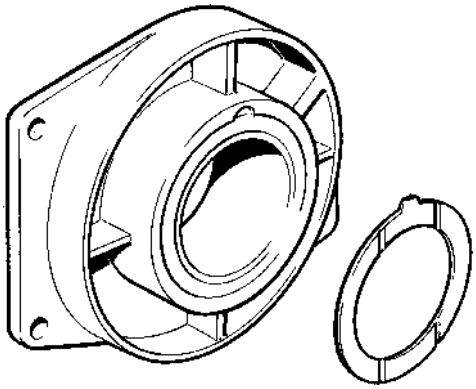


71. Fit the starter motor and the oil pump. NOTE! Put a little oil into the pump before fitting.
MD11: Fit the front engine brackets.

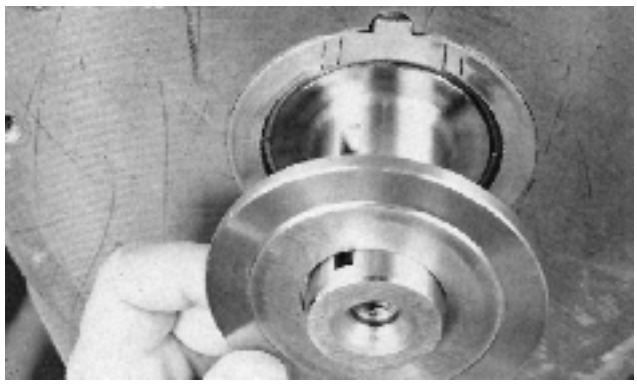
FLYWHEEL

72. Fit the key and the flywheel (the taper must be perfectly clean). Tightening torque 500 Nm (50 kpm = 369 lbf.ft). Lock the nut by bending up the washer.

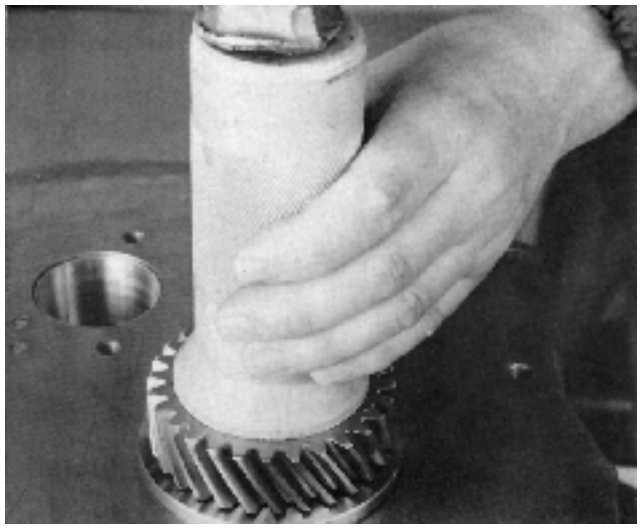
TIMING GEAR



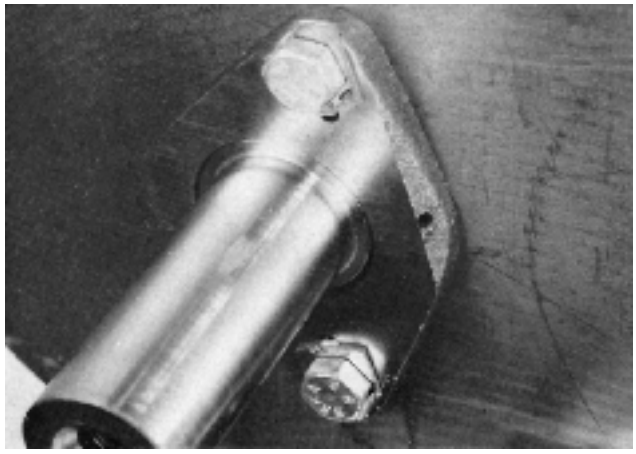
73. MD17: Smear both thrust washers with grease and place one of them on the inner side of the bearing shield, turning the flat side towards the main bearing. Ensure that the lug on the washer fits into the recess in the shield. Fit the bearing shield onto the engine and tighten the screws.



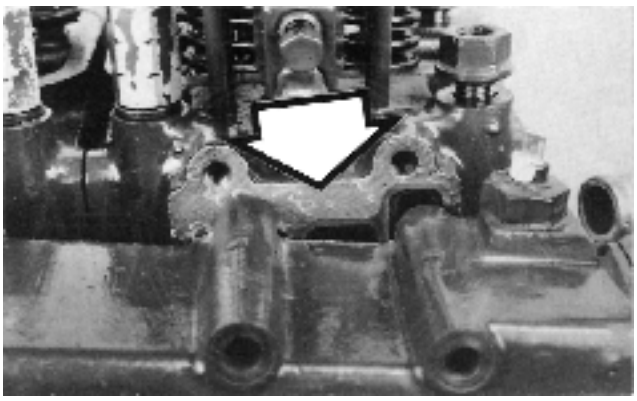
74. Place the engine so that it is resting on the flywheel. Make sure that the inner thrust washer is correctly located. Place the outer thrust washer on the crankshaft with the flat surface towards the main bearing. Fit the distance washer with the flat surface toward the thrust washer.



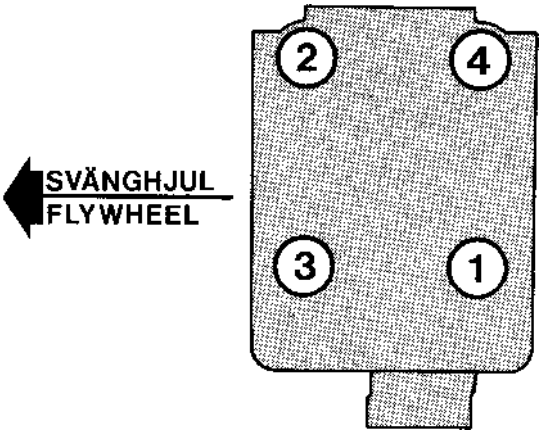
75. Fit the key for the crankshaft drive. Heat the gearwheel to about 100°C (212°F) and fit it onto the crankshaft. Check to make sure that the inner thrust washer does not move from its correct position.



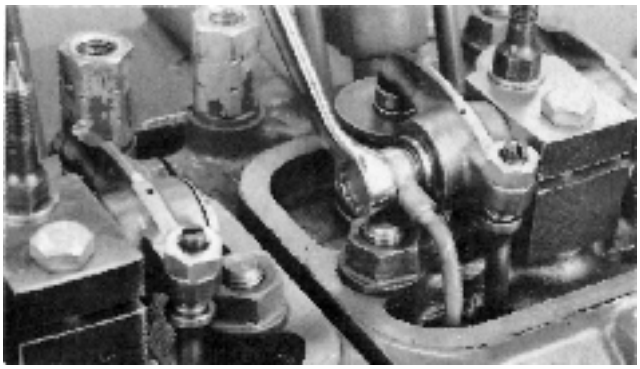
76. Fit the camshaft and ensure that the oil pump shaft fits into the slot in the camshaft. Lock the screws with the lock washers. MD17: Note the location of the oil passage.



97. Fit the exhaust manifold but only tighten it up enough to align the cylinder heads. **NOTE! Make sure that the gaskets are the right way round.**



98. Tighten the cylinder head nuts in stages of 30, 80 and 110 Nm (3, 8, 11 kpm = 22, 58, 80 lbf.ft.). Tighten the exhaust manifold.

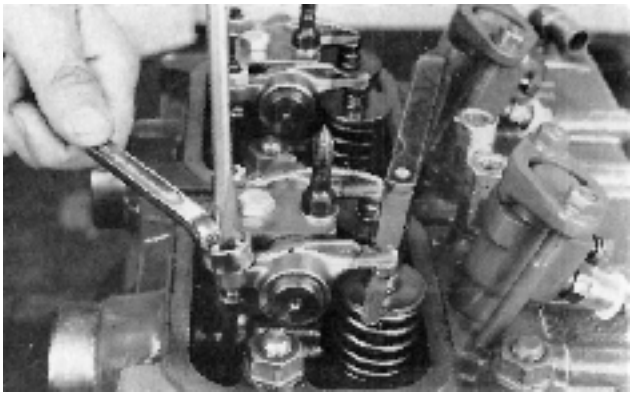


99. Check the straightness of the push rods.

Roll the rods on a flat surface. Bent push rods must be replaced.

Fit the push rods and the rocker arm bearing brackets. Connect the oil pipes to the rocker arm shafts.

ADJUSTING THE VALVE CLEARANCE

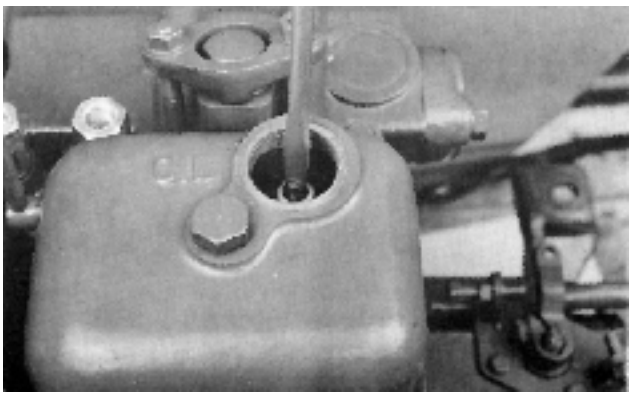


Valve clearance with the engine hot:

Inlet 0.30 mm, (0.0118")

Exhaust 0.35 mm, (0.0138")

100. Turn the engine over in the correct direction of rotation until the valves for one cylinder “rock”. Then turn through a further revolution and adjust the valves for this cylinder. Do the same for the other cylinders. After a trial run, the valves should be readjusted whilst the engine is still hot.



101. Fit the rocker arm covers and check the decompression device as follows:

A. Remove the oil filler plugs.

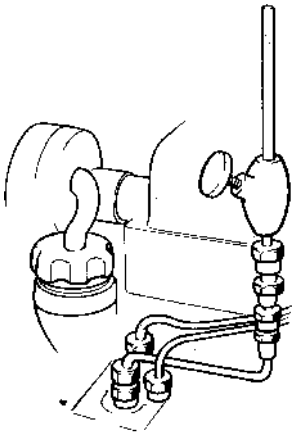
B. Turn the engine over so that the exhaust valve is closed.

C. Place the handle so that it points upwards.

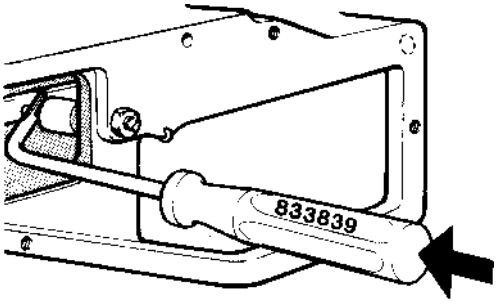
D. Loosen the lock nut and screw the adjusting screw upwards. Screw the adjusting screw down again so that it touches the rocker arm. Screw down a further half turn and tighten the lock nut. Replace the oil filler plugs.

NOTE! The decompression device is not adjustable on the D-engines.

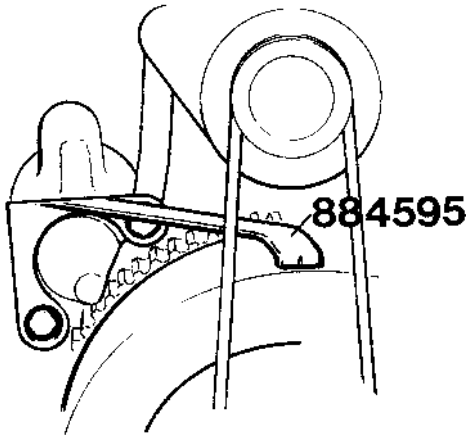
CHECKING THE INJECTION ANGLE



117. Unscrew the rear delivery pipe on the injection pump (nearest the reverse gear) and fit a Wilbär pipe or the level pipe 9993197.

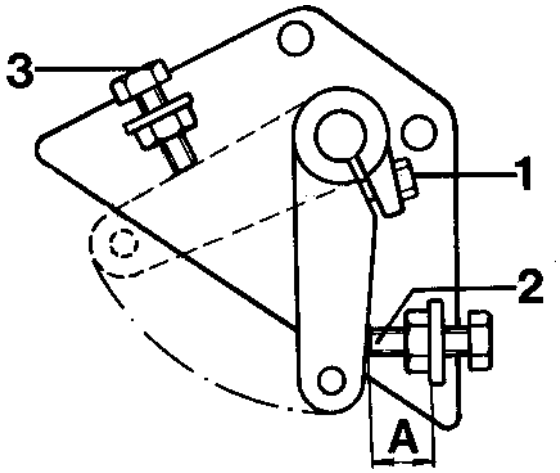


118. MD11: Set the speed control to max. NOTE! The cold start device must not be engaged.
MD17: Remove the inspection cover on the timing gear cover. Push the cold start pin forward using the tool 833839 at the same time as the speed control is set to max.



119. Turn the engine over in the direction of rotation until the level pipe is filled with air-free fuel. Open the level screw on the Wilbär pipe so that the level lies at 25-30 mm (1-1.2") measured upwards. Turn the engine over slowly until the fuel just begins to rise in the pipe. The angle markings on the flywheel should now be at 24-26° B.T.D.C. Adjust the injection angle if necessary by increasing or reducing the number of gaskets under the injection pump.
MD11, use tool 884595. MD17, mark on the belt guard or use tool 884741.

ADJUSTING ENGINE SPEED



120A. Allow the engine to warm up and then set the low idling speed adjusting screw (2) so that dimension A in the diagram is 14 mm (0.551").
B. Start the engine and loosen the lock screw (1) on the lever.
C. Turn the lever against the stop (2). Then, using a screwdriver, turn the governor shaft so as to obtain a speed of 12.5-13.5 r/s (750-810 r/min). Tighten the levers' lock screw in this position.
D. Turn the lever up to the adjusting screw (3) and check the high idling speed, which should be MD11C, 17C: 44 r/s (2640 r/min) MD11D, 17D: 46 r/s (2760 r/min) for pleasure use and 42 r/s (2520 r/min) for HD variant. Adjust the speed if necessary.

Fault finding table

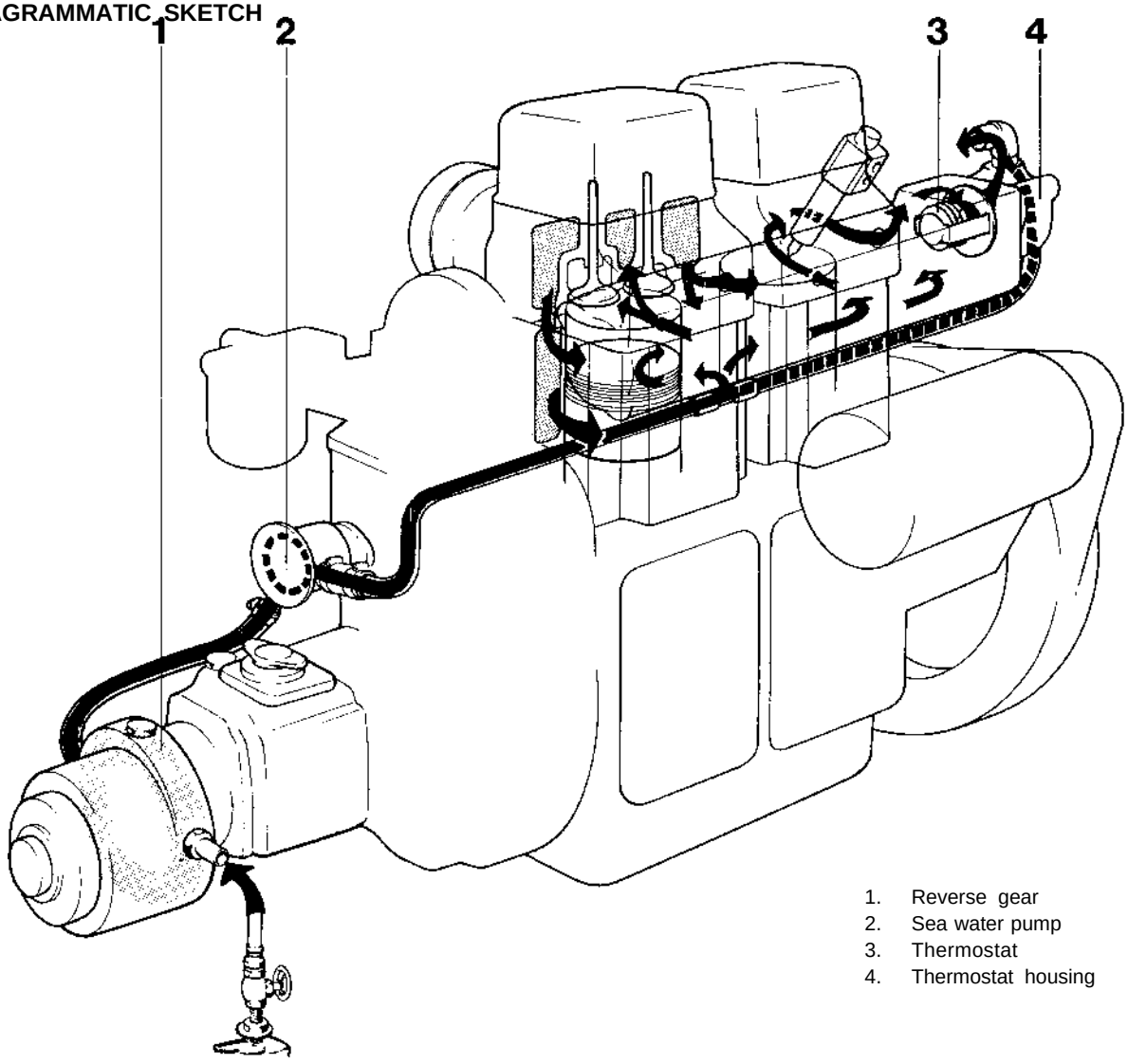
Engine does not start	Engine stops	Engine does not reach correct working speed on full throttle	Engine runs irregularly or vibrates abnormally	Engine becomes abnormally hot	CAUSE OF TROUBLE
X					Stop control not pressed in. Main switch not closed. Battery discharged. Break in cable or main fuse block.
X	X				Fuel tank empty. Fuel cock closed. Fuel filter blocked.
X	X		X		Water or impurities in fuel. Faulty injectors. Air in fuel system.
		X			Faulty rev. counter. Boat loaded abnormally. Air cleaner blocked. Fouling on boat bottom.
		X	X		Incorrect engine aligning. Propeller damaged.
				X	Obstruction in cooling water intake or cooling jackets. Sea-water pump impeller fault. Thermostat faulty.

TIGHTENING TORQUES

	MD11C and D	MD17C and D
Cylinder head nuts*	110 Nm (11 kpm) (80 lbf.ft.)	
Centre bearing	70 Nm (7.0 kpm) (50 lbf.ft.)	
Big-end bearings	65 Nm (6.5 kpm) (47 lbf.ft.)	
Shield for main bearings	40 Nm (4.0 kpm) (29 lbf.ft.)	
Screw for carrier and carrier drive on crankshaft (for reverse gear)	70 Nm (7.0 kpm) (50 lbf.ft.)	120 Nm (12.0 kpm) C-eng. (87 lbf.ft.) 110 Nm (11.0 kpm) D-eng. (80 lbf.ft.)
	500 Nm (50 kpm) (369 lbf.ft.)	
Flywheel nut	20 Nm (2.0 kpm) (14.5 lbf.ft.)	
Injectors	70 Nm (7.0 kpm) (50 lbf.ft.)	320 Nm (32.0 kpm) (231 lbf.ft.)
Carrier for water pump	15 Nm (1.5 kpm) (11 lbf.ft.)	
Cap nuts for valve cover	40 Nm (4.0 kpm) (29 lbf.ft.)	
Nipple for oil filter	70 Nm (7.0 kpm) (50 lbf.ft.)	
Cover for oil strainer MD11 C	120 Nm (12.0 kpm) (87 lbf.ft.)	
MD11 D		

* NOTE! Tightening shall be carried out in 3 stages.
1st stage: 30 Nm (3 kpm) (22 lbf.ft.)
2nd stage: 80 Nm (8 kpm) (58 lbf.ft.)
Final stage: 110 Nm (11 kpm) (80 lbf.ft.)

COOLING SYSTEM, DIAGRAMMATIC SKETCH



1. Reverse gear
2. Sea water pump
3. Thermostat
4. Thermostat housing