Workshop Manual

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Engine unit

AQ211, AQ231, AQ271, AQ311, BB231, BB261
500, 501, 570, 571, 572

Workshop manual

AQ211, AQ231, AQ271, AQ311, BB231, BB261

500, 501, 570, 571, 572

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.

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

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!

⚠ Avoid skin contact with oil. Long-term or repeated contact with oil can remove the natural oils from your skin. The result can be irritation, dry skin, eczema and other skin problems. Used oil is more dangerous to health than new oil. Use protective gloves and avoid using oil-soaked clothes and rags. Wash regularly, especially before meals. Use the correct barrier cream to prevent dry skin and to make cleaning your skin easier.

⚠ Most chemicals used in products (engine and transmission oils, glycol, petrol and diesel oil) and workshop chemicals (solvents and paints) are hazardous to health Read the instructions on the product packaging carefully! Always follow safety instructions (using breathing apparatus, protective goggles and gloves for example). Ensure that other personnel are not unwittingly exposed to hazardous substances (by breathing them in for example). Ensure that ventilation is good. Handle used and excess chemicals according to instructions.

⚠ Be extremely careful when tracing leaks in the fuel system and testing fuel injection nozzles. Use protective goggles! The jet ejected from a fuel injection nozzle is under very high pressure, it can penetrate body tissue and cause serious injury There is a danger of blood poisoning.

⚠ All fuels and many chemicals are inflammable. Ensure that a naked flame or sparks cannot ignite fuel or chemicals. Combined with air in certain ratios, petrol, some solvents and hydrogen from batteries are easily inflammable and explosive. Smoking is prohibited! Ensure that ventilation is good and that the necessary safety precautions have been taken before carrying out welding or grinding work. Always have a fire extinguisher to hand in the workplace.

⚠ Store oil and fuel-soaked rags and fuel and oil filters safely. In certain conditions oil-soaked rags can spontaneously ignite. Used fuel and oil filters are environmentally dangerous waste and must be deposited at an approved site for destruction together with used lubricating oil, contaminated fuel, paint remnants, solvent, degreasing agents and waste from washing parts.

⚠ Never allow a naked flame or electric sparks near the batteries. Never smoke in proximity to the batteries. The batteries give off hydrogen gas during charging which when mixed with air can form an explosive gas – oxyhydrogen. This gas is easily ignited and highly volatile. Incorrect connection of the battery can cause a spark which is sufficient to cause an explosion with resulting damage. Do not disturb battery connections when starting the engine (spark risk) and do not lean over batteries.

⚠ Never mix up the positive and negative battery terminals when installing. Incorrect installation can result in serious damage to electrical equipment. Refer to wiring diagrams.

⚠ Always use protective goggles when charging and handling batteries. The battery electrolyte contains extremely corrosive sulfuric acid. If this comes into contact with the skin, wash immediately with soap and plenty of water. If battery acid comes into contact with the eyes, immediately flush with copious amounts of water and obtain medical assistance.

⚠ Turn off the engine and turn off power at main switch(es) before carrying out work on the electrical system.

⚠ Clutch adjustments must be carried out with the engine turned off.

⚠ Use the lifting eyes mounted on the engine/reverse gear when lifting the drive unit.
Always check that lifting equipment is in good condition and has sufficient load capacity to lift the engine (engine weight including reverse gear and any extra equipment installed).

To ensure safe handling and to avoid damaging engine components on top of the engine, use a lifting beam to raise the engine. All chains and cables should run parallel to each other and as perpendicular as possible in relation to the top of the engine.

If extra equipment is installed on the engine altering its center of gravity, a special lifting device is required to achieve the correct balance for safe handling.

Never carry out work on an engine suspended on a hoist.

⚠ Never remove heavy components alone, even where secure lifting equipment such as secured blocks are being used. Even where lifting equipment is being used it is best to carry out the work with two people; one to operate the lifting equipment and the other to ensure that components are not trapped and damaged when being lifted.
When working on-board ensure that there is sufficient space to remove components without danger of injury or damage.

⚠ Components in the electrical system, ignition system (gasoline engines) and fuel system on Volvo Penta products are designed and constructed to minimize the risk of fire and explosion. The engine must not be run in areas where there are explosive materials.

⚠ Always use fuels recommended by Volvo Penta. Refer to the Instruction Book. The use of lower quality fuels can damage the engine. On a diesel engine poor quality fuel can cause the control rod to seize and the engine to overrev with the resulting risk of damage to the engine and personal injury. Poor fuel quality can also lead to higher maintenance costs.

⚠ Observe the following rules when cleaning with high-pressure water jets. Never direct the water jet at seals, rubber hoses or electrical components. Never use a high pressure jet when washing the engine.

General Information

About the workshop manual

This workshop manual contains technical specification, descriptions and instructions for the standard versions of 500/SP, 500/DP, 501SP, 501/DP, 501/MS4, 570/SP, 570/MS4, 571/SP, 572/SP and 572/DP. Engines manufactured before March 27, 1989 had the designations AQ 211, AQ 231, BB 231, AQ 271, BB 261 or AQ 311. The product designation and number should be given in all correspondence about the product.

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.

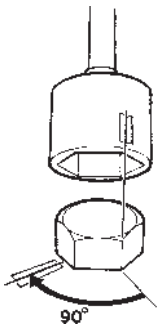
Bear in mind that most chemicals used on boats are harmful to the environment if used incorrectly. Volvo Penta recommends the use of biodegradable degreasing agents for cleaning engine components, unless otherwise stated in a workshop manual. Take special care when working on-board, that oil and waste 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	**lbf.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

Tightening torques-protractor (angle) tightening



Tightening using both a torque setting and a protractor angle requires that first the recommended torque is applied using a torque wrench and then the recommended angle is added according to the protractor scale. Example: a 90° protractor tightening means that the joint is tightened a further 1/4 turn in one operation after the stated tightening torque has been applied.

Locknuts

Do not re-use lock nuts that have been removed during dismantling as they have reduced service life when re-used – use new nuts when assembling or reinstalling. For lock nuts with a plastic insert such as Nylock® the tightening torque stated in the table is reduced if the Nylock® nut has the same head height as a standard hexagonal nut without plastic insert. Reduce the tightening torque by 25% for bolt size 8 mm or larger. Where Nylock® nuts are higher, or of the same height as a standard hexagonal nut, the tightening torques given in the table apply.

Tolerance classes

Screws and nuts are divided into different strength classes, the class is indicated by the number on the bolt head. A high number indicates stronger material, for example a bolt marked 10-9 indicates a higher tolerance than one marked 8-8. It is therefore important that bolts removed during the disassembly of a bolted joint must be reinstalled in their original position when assembling the joint. If a bolt must be replaced check in the replacement parts catalogue to make sure the correct bolt is used.

Sealants

A number of sealants and locking liquids are used on the engines. The agents have varying properties and are used for different types of jointing strengths, operating temperature ranges, resistance to oil and other chemicals and for the different materials and gap sizes in the engines.

To ensure service work is correctly carried out it is important that the correct sealant and locking fluid type is used on the joint where the agents are required.

In this Volvo Penta Service Manual the user will find that each section where these agents are applied in production states which type was used on the engine.

During service operations use the same agent or an alternative from a different manufacturer.

Make sure that mating surfaces are dry and free from oil, grease, paint and anti-corrosion agent before applying sealant or locking fluid. Always follow the manufacturer's instructions for use regarding; temperature range, curing time and any other instructions for the product.

Two different basic types of agent are used on the engine and these are:

RTV agent (Room temperature vulcanizing). Use for gaskets, sealing gasket joints or coating gaskets. RTV agent is clearly visible when a component has been dismantled; old RTV must be removed before the joint is resealed.

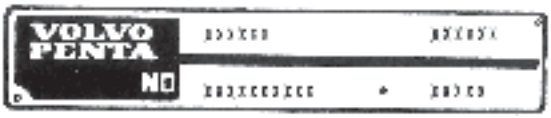
The following RTV agents are mentioned in the Service Manual: Loctite® 574, Volvo Penta 840879-1, Permatex® No. 3, Volvo Penta P/N 1161099-5, Permatex® No. 77. Old sealant can be removed using methylated spirits in all cases.

Anaerobic agents. These agents cure in an absence of air. They are used when two solid parts, for example cast components, are installed face-to-face without a gasket. They are also commonly used to secure plugs, threads in stud bolts, cocks, oil pressure switches and so on. The cured material is glass-like and it is therefore colored to make it visible. Cured anaerobic agents are extremely resistant to solvents and the old agent cannot be removed. When reinstalling the part is carefully degreased and then new sealant is applied.

The following anaerobic agents are mentioned in the Service Manual: Loctite® 572 (white), Loctite® 241 (blue).

NOTE! Loctite® is the registered trademark of Loctite Corporation, Permatex® is the registered trademark of the Permatex Corporation.

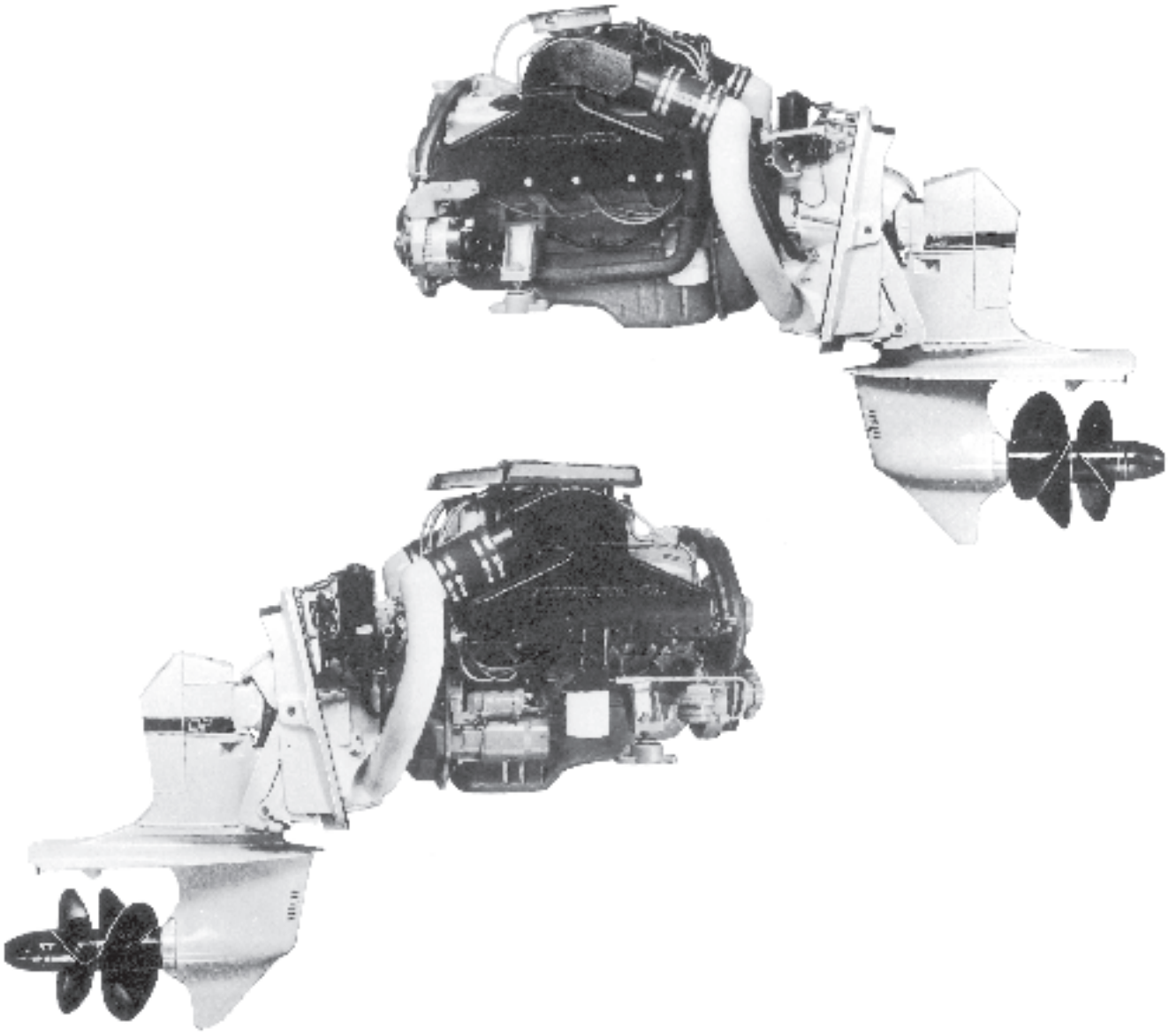
Presentation



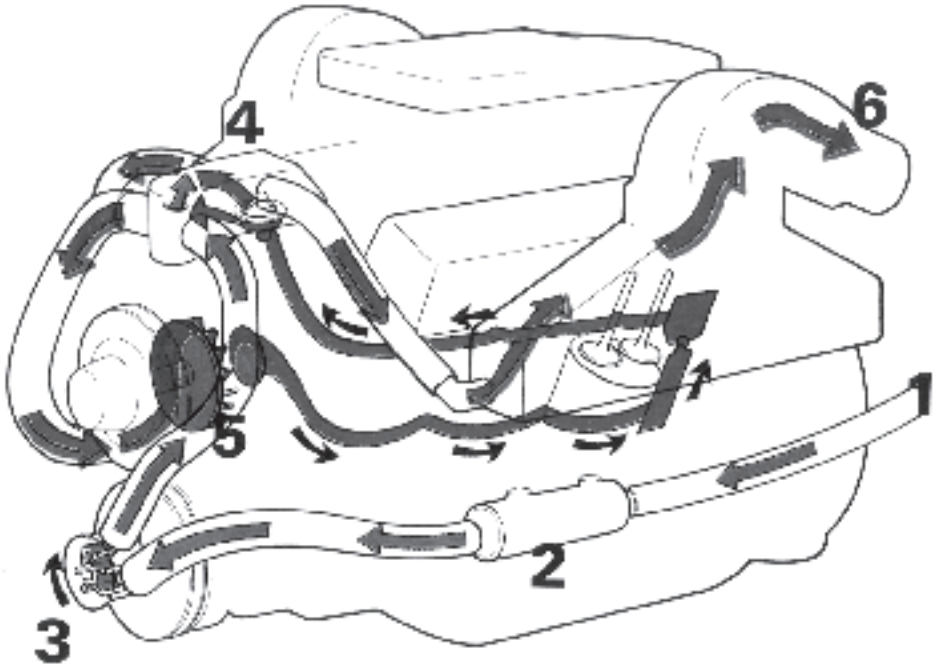
The serial number plate is located at the rear of the engine block on the port side (as seen from the rear). Engines manufactured before March 1988 have the plate located on the starboard side.

The engines are 8-cylinder, sea water cooled gasoline engines. The thermostatically controlled cooling system is supplied with sea water from a crankshaft drive impeller pump. A separate circulation pump forces cooling water through the engine block to maintain an even operating temperature. The cooling water also circulates through the exhaust system to keep it cool.

The 500 and 501 (AQ211, AQ231 and BB231) have a displacement of 4.998 dm^3 (305 cu.in.) and the 570, 571 and 572 (AQ271, AQ311 and BB261) have a displacement of 5.735 dm^3 (350 cu.in.). The 500, 501B and AQ211 is equipped with a two barrel, single-stage, down draught carburetor and the remaining engines have a four barrel, two-stage, down-draught carburetors. AQ211, AQ231, BB231 and BB261 use a conventional marinized breaker point ignition system while the 500, 501, 570, 571 and 572 (AQ271 and AQ311) feature a breakerless electronic ignition system.

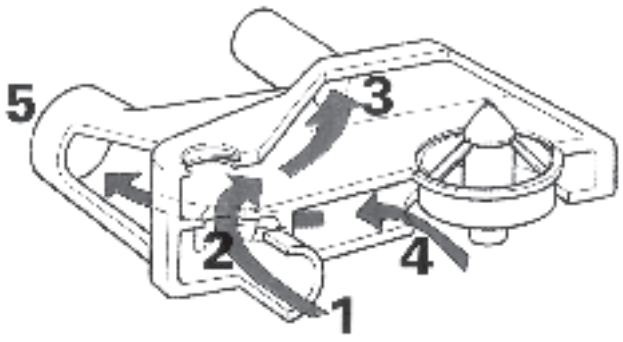


Engine cooling system

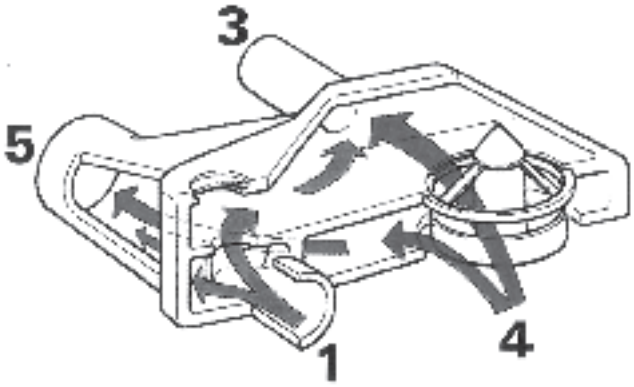


Cooling system

1. Incoming sea water
2. Oil cooler (571/SP, AQ311)
3. Impeller pump
4. Thermostat housing
5. Circulation pump
6. Outlet



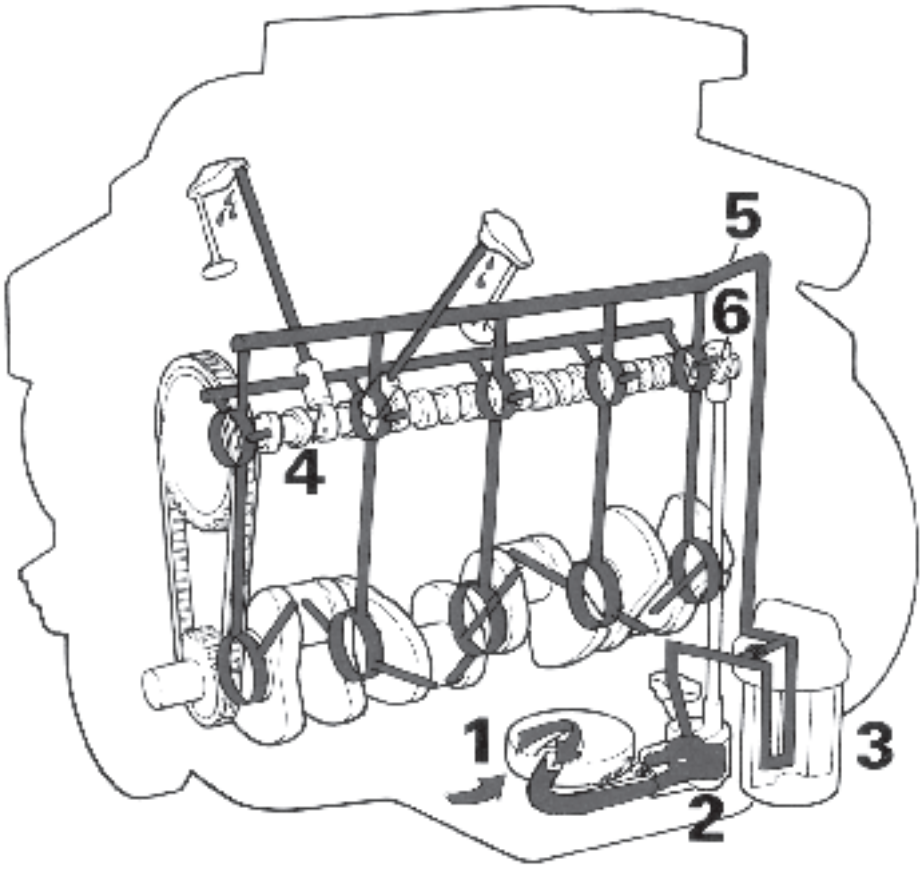
Cooling channels in the thermostat housing, thermostat closed.



Cooling channels in the thermostat housing, thermostat open.

1. Cooling water from the impeller pump
2. “By-pass” to the outlet chamber
3. Outlet to exhaust manifold
4. Cooling water from the engine block
5. Outlet to the circulation pump

Engine lubricating system



Lubricating system, from the strainer to lubrication points

1. Oil strainer
2. Oil pump with relief valve
3. Oil filter
4. Hydraulic valve lifters
5. Oil gallery
6. Drive for oil pump

Fault-tracing procedure, engine

Engine does not start	Engine stops	Engine does not reach correct operating r/min at full throttle, or knocks	Engine runs unevenly or vibrates abnormally	Engine gets abnormally hot	Cause
X					Main switch not switched ON, discharged battery, open circuit in electrical cables, main fuse or 8A fuse in instrument panel blown.
X	X				Empty fuel tank, closed fuel cock, clogged fuel filter.
X	X		X		Water or impurities in the fuel
X	X	X	X		Faulty spark plugs
X					Burnt breaker points, moisture in the distributor or on the ignition cables
X		X			Faulty electronics unit AQ271, AQ311, 500, 501, 570, 571 and 572
	X		X		Idling speed not adjusted correctly
		X			Faulty rev counter
		X			Boat loaded abnormally
		X			Growth on boat hull and on outboard drive
			X		Damaged propeller
				X	Clogged cooling water intake or cooling channels. Clogged oil cooler (571, AQ311). Faulty impeller or thermostat. Incorrect ignition setting (too late)
		X			Wrong fuel grade in relation to ignition setting.

Chapter 1 Overhaul data

Technical Data

General

Type designation	500, 501 (AQ211A, AQ231A, BB231A)	570, 572 (AQ271A,C BB261A)	571 (AQ311A,C)
Output, see sales literature			
Compression ratio		9.3:1	
Compression pressure at starter motor speed		10–11 kp/cm^2 (142–156 lb/in^2)	
Number of cylinders		8	
Cylinder diameter mm (in)	94.87–94.96 (3.735–3.7385)	101.59–101.66 (3.9995–4.0025)	
Cylinder bore, oversize 0.76 mm (0.030 in)	95.7(3.77)	102.4 (4.03)	
Max cylinder ovality		0.05 mm (0.0020)	
Max cylinder conicity		0.025 mm (0.0010)	
Max piston clearance	0.069 mm (0.0027)	0.069 mm (0.0027)	0.155 mm (0.0061)
Stroke		88.4 mm (3.480)	
Swept volume, dm^3 approx (cu.in)	4.998 (305)	5.735 (350)	
Weight with drive 290 without oil and water approx. kg (lbs).		405 (893)	
Idling speed r/s		10.0–10.8 (600–650)	
Direction of rotation (viewed from front)		clockwise	

Piston rings

Piston ring gap in bore,	
compression ring upper	0.25–0.76 mm (0.010–0.030 in)
lower	0.25–0.89 mm (0.010–0.035 in)
Oil control ring	0.38–1.65 mm (0.015–0.065 in)
Oversize piston rings	0.76 mm (0.030in)

Compression rings

Marked “Top”, upper ring chromium plated	
Number on each piston	2
Height	1.98 mm (0.078 in)
Piston ring clearance in groove, upper	0.03–0.11 mm (0.0012–0.0043 in)
Piston ring clearance in groove, 2nd	0.03–0.11 mm (0.0012–0.0043 in)

Oil control rings

Number on each piston	1
Height	4.74 mm (0.187 in)
Piston ring clearance in groove	0.05–0.20 mm (0.002–0.008 in)

Wrist pins

Grip fit	
Fit: in connecting rod, negative clearance	0.02–0.04 mm (0.0008–0.0016 in)
Diameter, standard	23.50 mm (0.925 in)
Wrist pin clearance in piston, max.	0.025 mm (0.0010 in)

Crankshaft

Crankshaft end float	0.05–0.15 mm (0.002–0.006 in)

Main bearings

Main bearing journals, journal No. (from front)	1	2, 3, 4	5
Diameter, standard	62.189–62.21 mm (2.448–2.449 in)	62.18–62.20 mm (2.448–2.449 in)	62.177–62.199 mm (2.4479–2.4488 in)
Bearing clearance	0.025–0.038 mm (0.0010–0.0015 in)	0.025–0.064 mm (0.0010–0.0025 in)	0.064–0.089 mm (0.0025–0.0035 in)
Ovality, max		0.025 mm (0.0010 in)	
Conicity, max		0.025 mm (0.0010 in)	

Main bearing shells

1st undersize	0.25 mm (0.010 in)
2nd undersize	0.50 mm (0.020 in)

Big-end bearing journals

Diameter standard	53.30–53.33 mm (2.0986–2.0998 in)
Big-end bearing clearance	0.033–0.076 mm (0.0013–0.0030 in)
Ovality, max	0.025 mm (0.010 in)
Conicity, max	0.025 mm (0.010 in)

Big-end bearing shells

1st undersize	0.25 mm (0.010 in)
2nd undersize	0.50 mm (0.020 in)

Connecting rods

Axial clearance at crankshaft	0.15–0.36 mm (0.006–0.014 in)

Camshaft

Number of bearings	5	
Bearing journal, diameter	47.45–47.48 mm (1.868–1.869 in)	
Bearing journal ovality max	0.025 mm (0.010 in)	
Camshaft's straightness, max throw	0.038 mm (0.005 in)	
End float	0.1–0.3 mm (0.004–0.012 in)	
Cam lift height	Inlet	Exhaust
500, 501, 570, 572 (AQ211A, AQ231B, BB231A, AQ271A, BB261A)	6.68 mm (0.263 in)	6.83 mm (0.269 in)
571 (AQ311A, B)	7.52 mm (0.296 in)	7.7 mm (0.303 in)
Lift height tolerance	±0.051 mm (0.002 in)	

Cylinder head

Valves

Inlet

Valve disc diameter	
500, 501 (AQ211A, AQ231A, BB231A)	46.74 mm (1.84 in)
570, 571, 572 (AQ271A,C, AQ311A, BB261A)	49.33 mm (1.94 in)
Valve stem diameter	8.64 mm (0.34 in)
Valve seat angle	45°
Seat angle in cylinder head	46°
Seat width in cylinder head	0.80–1.60 mm (0.031–0.063 in)

Exhaust

Valve disc diameter	37.97–38.23 mm (1.495–1.505 in)
Valve stem diameter	9.45 mm (0.372 in)
Valve seat angle	45°
Seat angle in cylinder head	46°
Seat width in cylinder head	1.60–2.40 mm (0.063–0.094 in)

Valve guides

Clearance, valve stem-guide, intake valve	0.025–0.094 mm (.0010–.0037 in)
Clearance, valve stem-guide, exhaust valve	0.025–0.120 mm (.0010–.0047 in)

Valve springs

	Inlet, Exhaust
Length without load	51.6 mm (2.03 in)
Length with load 339–374 N (34.5–38.1 kp/76–84 lb)	43.2 mm (1.7 in)
Length with load 863–916 N (88–93.5 kp/194–206 lb)	31.8 mm (1.252 in)

Lubricating system

Oil quality	Service SG
Viscosity	SAE 20W/50 (15W/50)
Oil capacity excl. oil filter, litre (Imp.gals/US gals)	5.0 (1.1/1.32)
Oil capacity incl. oil filter, litre (Imp.gals/US gals)	5.4 (1.19/1.42)
Oil capacity incl. oil filter and oil cooler	5.6 (1.23/1.48) (571, AQ311)
Oil pressure, hot engine	min. 2.1 kp/cm^3 (30 psi), nom 4.2–4.5 kp/cm^2 (60–65 psi), max 5.6 kp/cm^2 (80 psi)

Fuel system

Oil quality, min	91 octane (RON)

The engine can be run on unleaded fuel

Fuel pump

Fuel pressure	0.32–0.46 kp/cm^3 (4.5–6.5 psi) at 1000 rpm.

Electrical system

Battery

Earth connection	Negative (–)
System voltage	12 V
Capacity	60 Ah
Density of battery electrolyte:	
fully charged battery	1.275–1.285 g/cm^3 (.0460–.0464 lb/cu.in)
battery to be recharged at	1.230 g/cm^3 (.0444 lb/cu.in)

Alternator

Type	AC
Output max	700W (50A)

Starter motor

Starter motor output kW (hp)	0.96 (1.3)

Ignition system

Spark plugs	Volvo Penta 876047-2 or AC MR43T
Spark plug gap	0.9 mm (0.35 in)
Firing order	1-8-4-3-6-5-7-2
Stroboscope setting	
500A, 501A (AQ211A, AQ231A, BB231A) 2500 r/min	14° B.T.D.C.
500B 2200 r/min	19° B. T. D. C.
501B 2000 r/min	20° B.T.D.C.
570 (BB261A, AQ271C) 3000 r/min	23° B.T.D.C.
571 (AQ311B) 3000 r/min	25° B. T. D. C.
572 2500 r/min	24° B.T.D.C.
AQ271A, AQ311A 3000 r/min	28–30° B.T.D.C.
Basic setting (idling) 500A, 501A, 570 (AQ211A, AQ231A, BB231A, AQ271C, BB261A)	6° B.T.D.C.
Basic setting (idling) 500B, 501B, 572, AQ271A, AQ311A, B	8° B.T.D.C.
Distributor, contact gap	
AQ211A, AQ231A, BB231A, BB261A	0.36–0.48 mm (.014–.018 in)
Closing angle	
AQ211A, AQ231A, BB231A, BB261A	28°–34°
Sensor gap 500, 501, 570, 571, 572 (AQ271, 311)	0.20–0.25 mm (.0078–.0098 in)

Cooling system

Thermostat

Starts opening at	62°C (144°F)
Fully open at	72°C (162°F)

Tightening torques

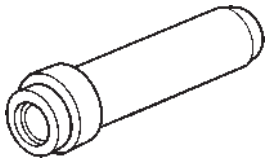
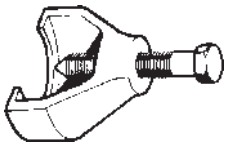
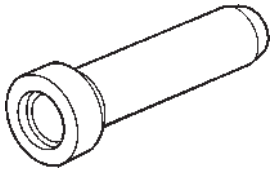
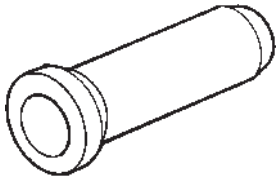
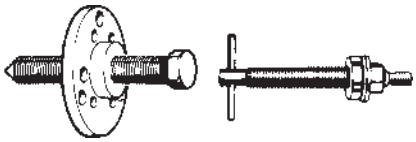
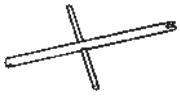
	Nm	Kpm	Lbf.ft	Lubrication
Cylinder head bolts, 1st tightening	50	5	36	Permatex
2nd tightening	90	9	66	
Main bearing bolts	108	11	79	Molycote
Big-end bearing caps	61	6.2	45	oil
Flywheel bolts	82	8.2	60	oil
Flywheel housing bolts	41	4.1	30	oil
Center bolt, crankshaft, front	82	8.2	60	oil
Bolts for camshaft gear	24	2.4	17.5	oil
Intake manifold bolts	41	4.1	30	oil
Exhaust manifold bolts	35	3.5	26	Permatex
Riser, bolts	25	2.5	18.5	Permatex
Spark plugs	20	2	14.5	Dry
Bolts for oil pump	90	9	66	oil
Oil pan bolts	11	1.1	8	oil
Oil pan nuts	22	2.2	16	oil
Timing gear casing bolts	14	1.4	10.3	oil
Valve cover bolts	6	0.6	4.5	oil
Oil drain plug	27	2.7	19.8	oil
Circulation pump bolts (coolant)	41	4.1	30	Permatex
Distributor bracket bolts	46	4.6	34	oil
Carburetor bolts	13	1.3	9.5	oil

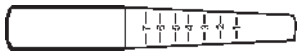
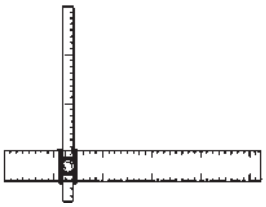
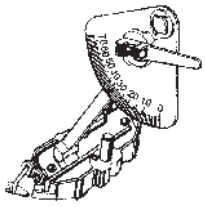
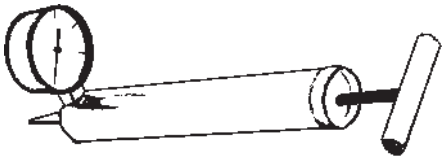
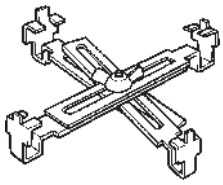
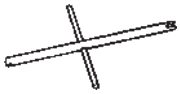
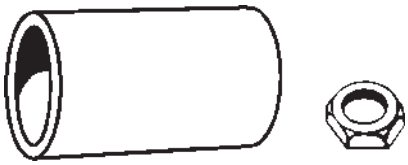
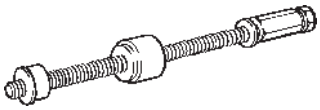
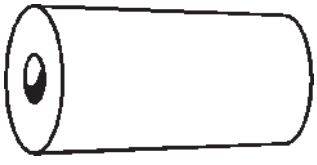
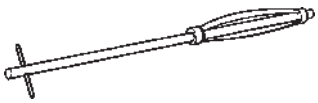
Speed range, maximum speed

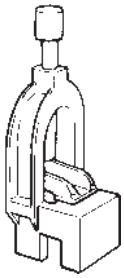
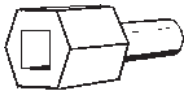
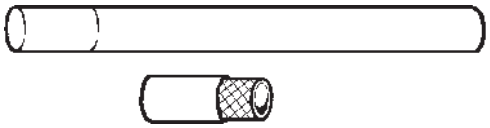
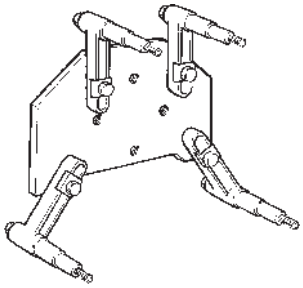
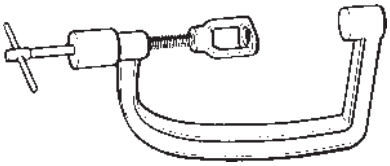
500/SP, 500/DP	(AQ211)	4000–4400 rpm
501/SP, 501/DP	(AQ231)	4200–4600 rpm
570/SP, 570/DP	(AQ271)	4200–4600 rpm
571/SP	(AQ311)	4600–5200 rpm
572/SP, 572/DP		4200–4600 rpm
501/MS4	(BB231)	4200–4600 rpm
570/MS4	(BB261)	4200–4600 rpm

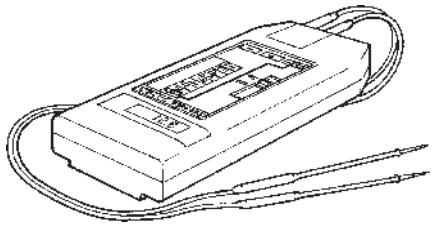
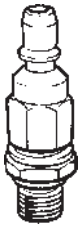
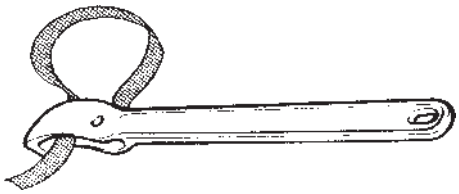
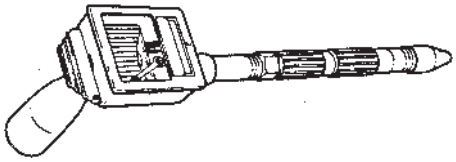
The maximum cruising speed should always be at least 300–500 rpm below the maximum rpm achieved.

Chapter 2 Special tools

856927-9		Gaging plastic (consumable)
884359-1		Drift for fitting seal in flywheel housing
884528-1		Puller for crankshaft gear
884529-9		Drift for fitting timing gear casing seal
884530-7		Drift for fitting crankshaft drive
884596-8		Drift for fitting primary shaft in flywheel housing
884599-2		Drift for fitting sealing ring in flywheel housing
884608-1		Tool for removing and fitting the front vibration damper
884609-9		Locating pin for removing and fitting exhaust manifold
884613-1		Drift for choke lever
884614-9		Break tool for carburetor linkage

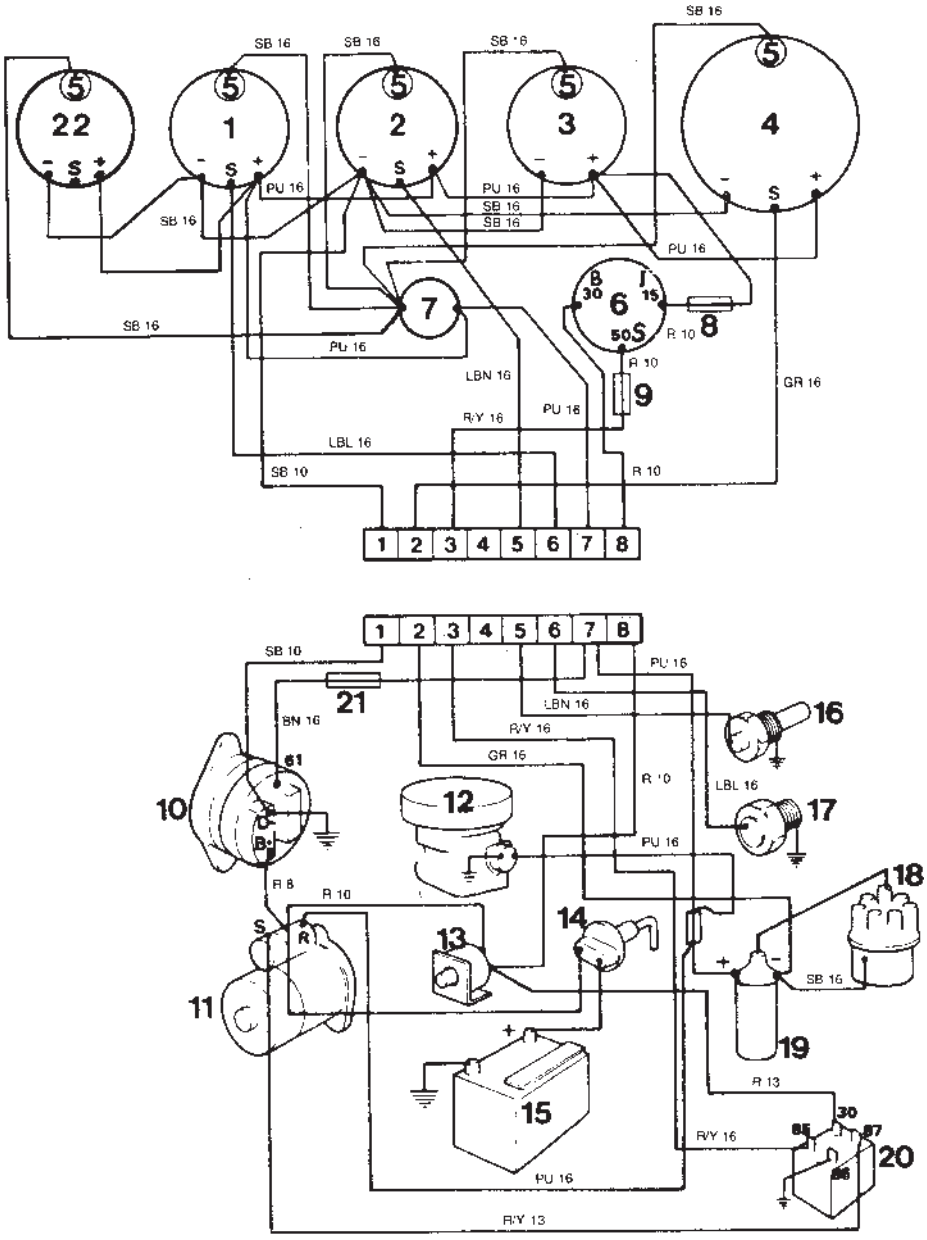
884615-6		Measuring tool for float level
884616-4		T-measure, inch scale
884617-2		Angle scale for choke valve
884618-0		Vacuum pump
884619-8		Holder for choke lever
884620-6		Support for carburetor
884621-4		Adjuster key
884627-1		Puller for rocker arm bolt
884628-9		Tool for removing and fitting camshaft bearings
884629-7		Tool for fitting rocker arm bolt
884630-5		Tool for cleaning valve guide

884632-1		Reamer for rocker arm bolt, 0.013 in oversize
884682-6		Fixture and drift for removing and fitting wrist pin
884691-7		Tool for venting screw (when setting fuel/air mixture)
884838-4		Drift for fitting sealing ring in flywheel housing
884943-2		Tool for fitting oil strainer
884944-0		Tool for guiding the connecting rod and protection for connecting rod bolt
884991-1		Reamer kit for valve guide, inlet and exhaust
885050-5		Fixture for support
9986052		Valve spring compressor
9996398-5		Oil pressure gauge

9996525-3		Multimeter
9996591-5		Nipple for 9996398-5
9999179-6		Demounting tool, for oil and fuel filters.
9999689-4		Compression tester.

Chapter 3 Wiring Diagram

AQ211, AQ231, BB231, BB261



1. Oil pressure gauge
2. Temp gauge
3. Voltmeter
4. Tachometer
5. Instrument lights
6. Key switch
7. Switch, instrument lights
8. Fuse 8 Amp
9. Fuse 8 Amp
10. Alternator
11. Starter motor
12. Automatic choke
13. Automatic fuse 40 Amp
14. Main switch (optional)
15. Battery (optional)
16. Temp sender
17. Oil pressure sender
18. Distributor
19. Ignition coil
20. Relay
21. Resistor
22. Fuel gauge (alternative)

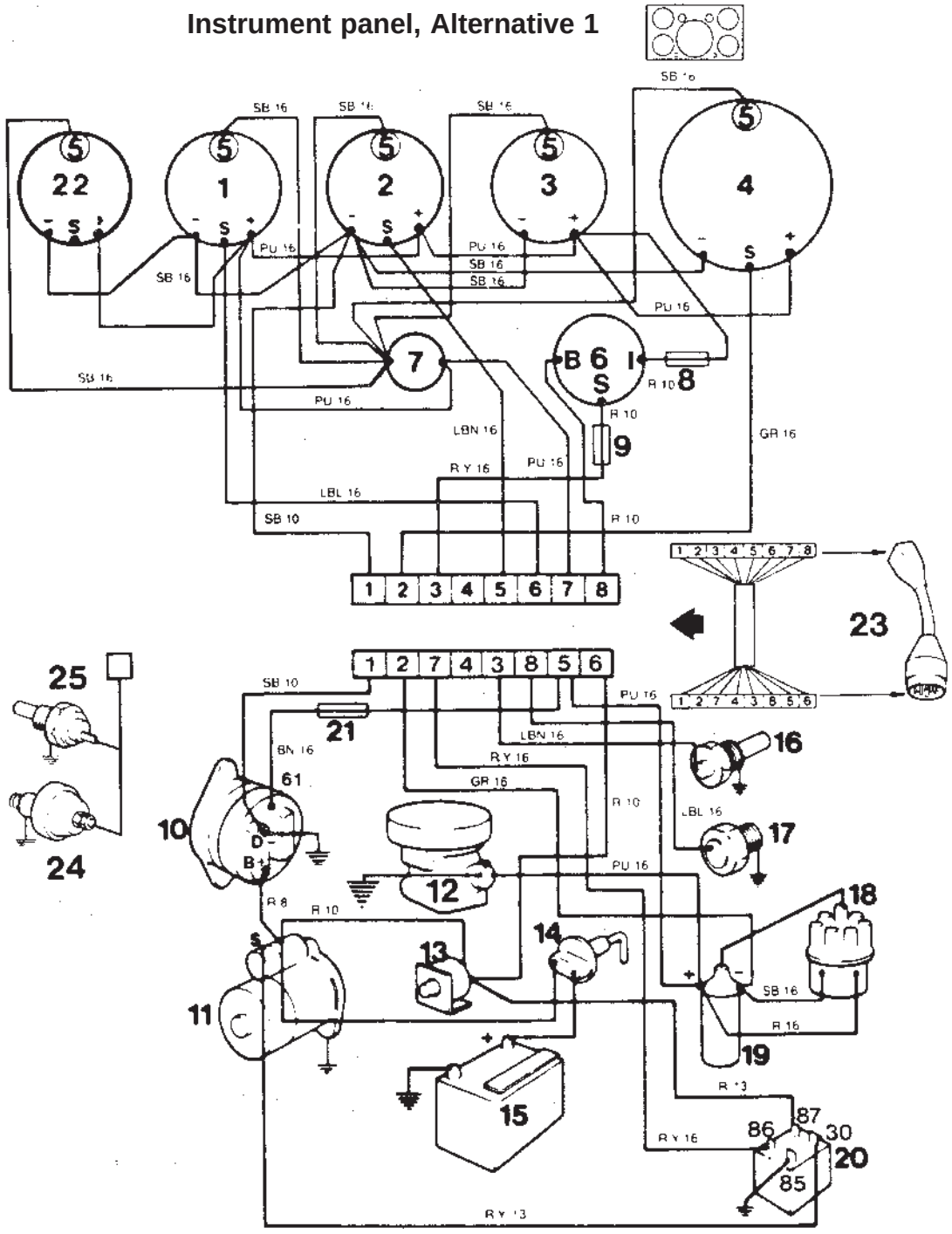
AWG	mm²
16	1.5
13	2.5
10	6.0
8	10.0

Color

SB	= black	LBL	= light blue
PU	= purple	R/Y	= red/yellow
LBN	= light brown	BN	= brown
R	= red	W	= white
GR	= grey		

WIRING DIAGRAM
(500/SP, 500/DP, 501/SP, 501/DP, 501/MS4, 570/MS4)

Instrument panel, Alternative 1



1. Oil pressure gauge
2. Temp gauge
3. Voltmeter
4. Tachometer
5. Instrument lights
6. Key switch
7. Switch, instrument lights
8. Fuse 8 Amp
9. Fuse 8 Amp
10. Alternator
11. Starter motor
12. Automatic choke
13. Automatic fuse 40 Amp
14. Main switch (optional)
15. Battery (optional)
16. Temp sender
17. Oil pressure sender
18. Distributor
19. Ignition coil
20. Relay
21. Resistor
22. Fuel gauge (alternative)
23. Connector adapter
24. Oil pressure monitor (501/MS4, 570/MS4)
25. Temp.monitor (501/MS4, 570/MS4)

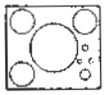
AWG	mm^2
16	1.5
13	2.5
10	6.0
8	10.0

Color

SB	= black	LBL	= light blue
PU	= purple	R/Y	= red/yellow
LBN	= light brown	BN	= brown
R	= red	W	= white
GR	= grey		

WIRING DIAGRAM
(500/SP, 500/DP, 501/SP, 501/DP, 501/MS4, 570/MS4, 572/SP, 572/DP)

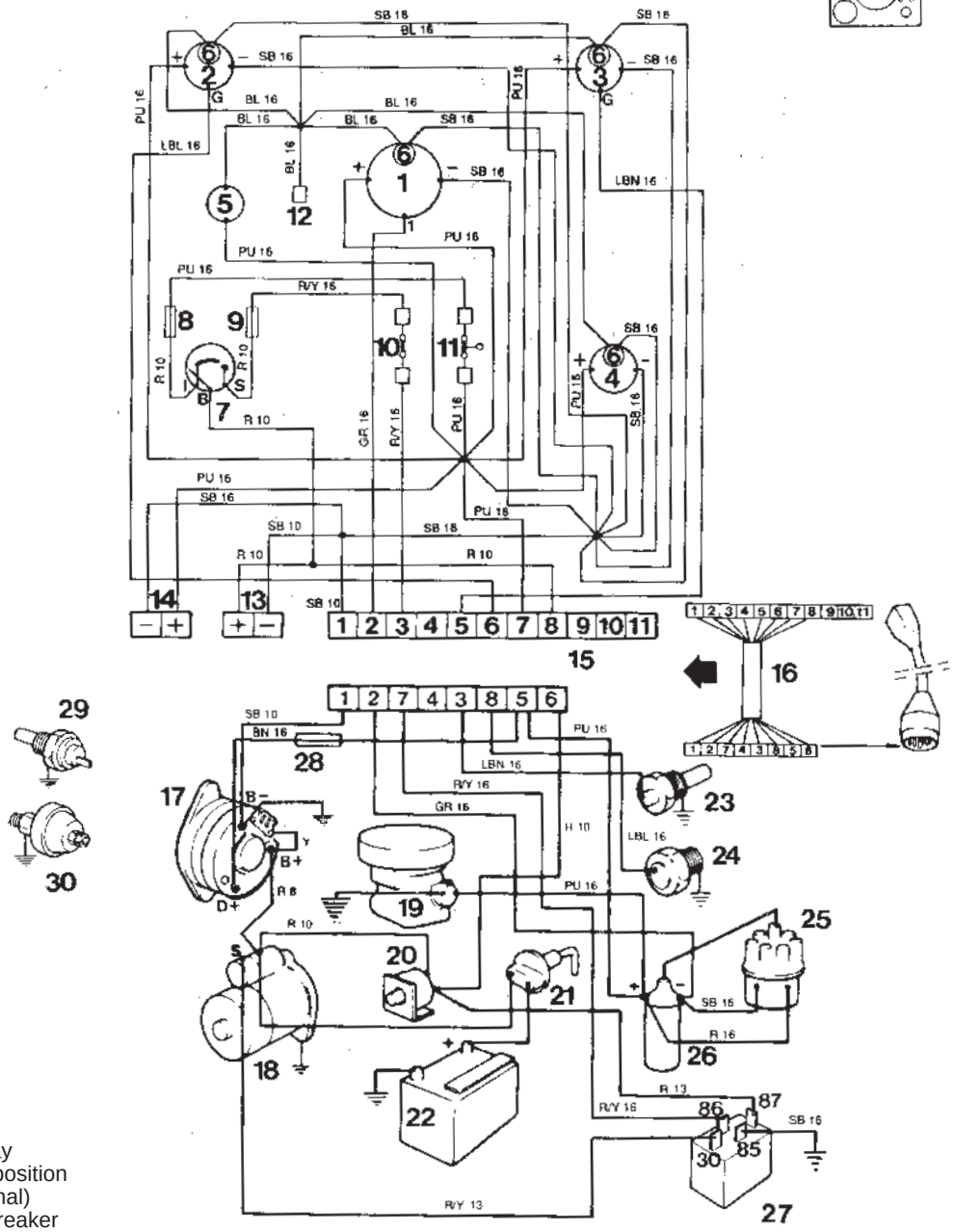
Instrument panel, Alternative 2



Color

SB = black
PU = purple
LBN = light brown
R = red
GR = grey
LBL = light blue
R/Y = red/yellow
BN = brown
W = white
Y = yellow

AWG	mm^2
16	1.5
13	2.5
10	6.0
8	10.0

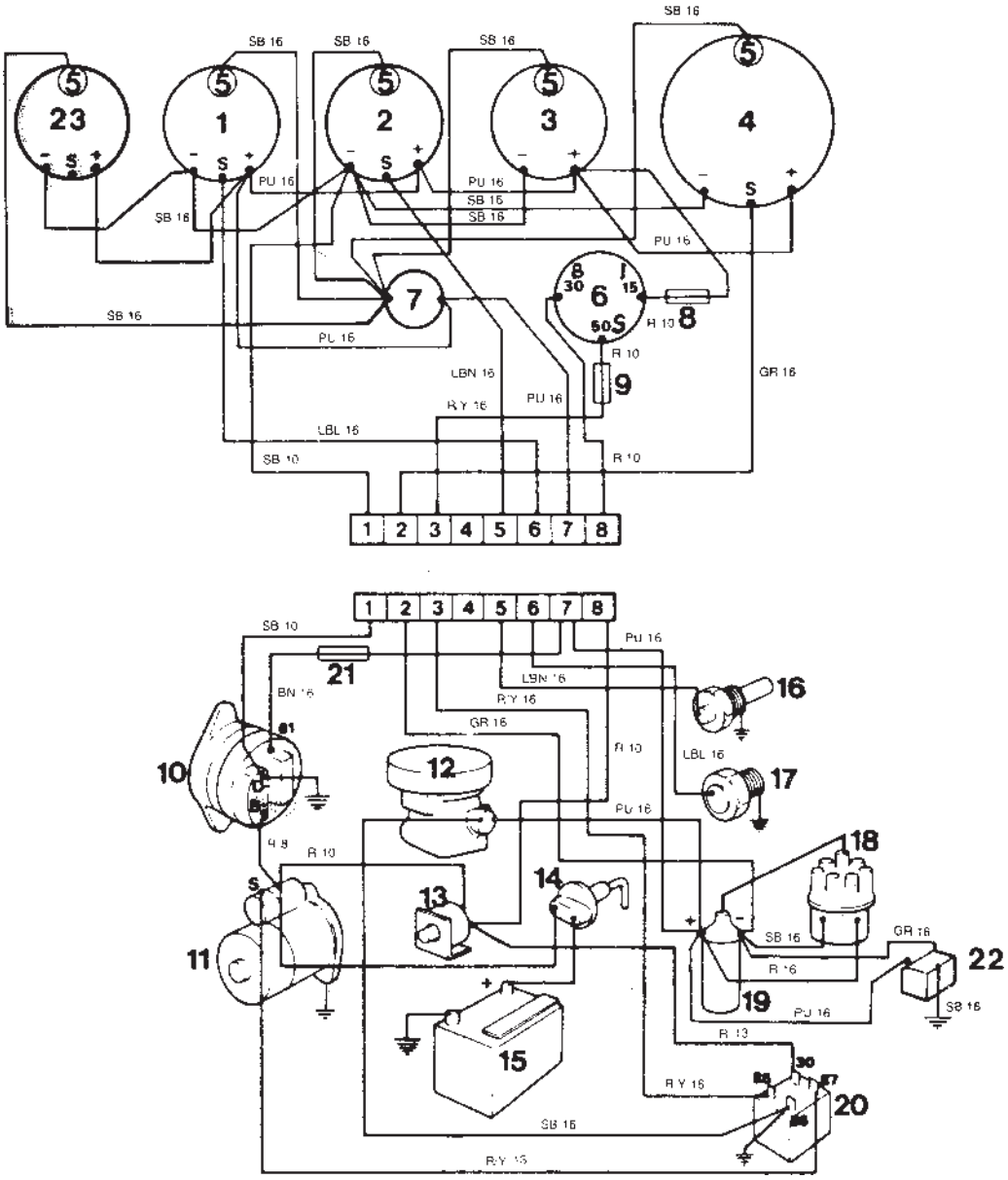


1. Tachometer
2. Oil pressure gauge
3. Temp gauge
4. Voltmeter
5. Switch, instrument lights
6. Instrument lights
7. Key switch
8. Fuse 8 Amp, ignition
9. Fuse 8 Amp, starter relay
10. Cable terminal, neutral position switch (alternative/optional)
11. Cable terminal, safety breaker switch (optional)
12. Cable terminal, instrument lights
13. Current outlet, max 20 Amp
14. Current outlet, max 5 Amp total (Main panel + flybridge panel)
15. Connectors, Engine/instruments*
16. Extension cable harness
17. Alternator
18. Starter motor
19. Automatic choke
20. Automatic fuse 40 Amp
21. Main switch (optional)
22. Battery (optional)
23. Temp sender
24. Oil pressure sender
25. Distributor
26. Ignition coil
27. Relay
28. Resistor
29. Oil pressure monitor (501/MS4, 570/MS4)**
30. Temp. monitor (501/MS4, 570/MS4)**

*** NOTE!** The connector pins in the engine's round connector and the instrument panel's rectangular connector are numbered differently. The numbers in the Wiring Diagram are the pin numbers in the connectors, not the electrical connection between the connectors. Electrically the connectors are connected according to the cable colors, i.e. with the corresponding pin shown in the diagram.

** The engine is delivered from Volvo Penta without connected wiring to the monitors.

WIRING DIAGRAM
(AQ271C, AQ311B)



1. Oil pressure gauge
2. Temp gauge
3. Voltmeter
4. Tachometer
5. Instrument lights
6. Key switch
7. Switch, instrument lights
8. Fuse 8 Amp
9. Fuse 8 Amp
10. Alternator
11. Starter motor
12. Automatic choke
13. Automatic fuse 40 Amp
14. Main switch (optional)
15. Battery (optional)
16. Temp sender
17. Oil pressure sender
18. Distributor
19. Ignition coil
20. Relay
21. Resistor
22. Speed limiter
23. Fuel gauge (alternative)

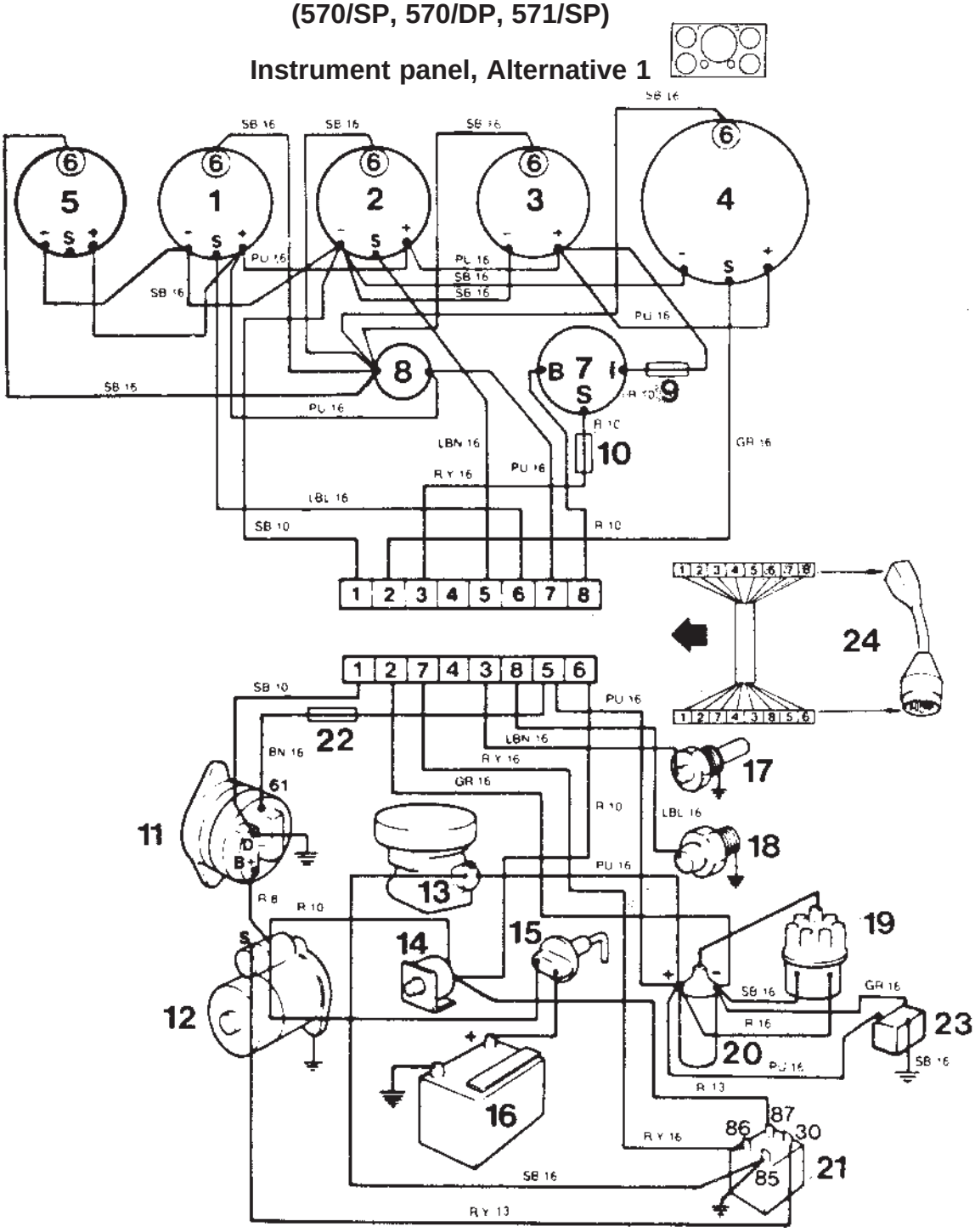
AWG	mm^2
16	1.5
13	2.5
10	6.0
8	10.0

Color

SB	= black
PU	= purple
LBN	= light brown
R	= red
GR	= grey
LBL	= light blue
R/Y	= red/yellow
BN	= brown
W	= white

WIRING DIAGRAM
(570/SP, 570/DP, 571/SP)

Instrument panel, Alternative 1



1. Oil pressure gauge
2. Temp gauge
3. Voltmeter
4. Tachometer
5. Fuel gauge
6. Instrument lights
7. Key switch
8. Switch, instrument lights
9. Fuse 8 Amp
10. Fuse 8 Amp
11. Alternator
12. Starter motor
13. Automatic choke
14. Automatic fuse 40 Amp
15. Main switch (optional)
16. Battery (optional)
17. Temp sender
18. Oil pressure sender
19. Distributor
20. Ignition coil
21. Relay
22. Resistor
23. Speed limiter
24. Connector adapter

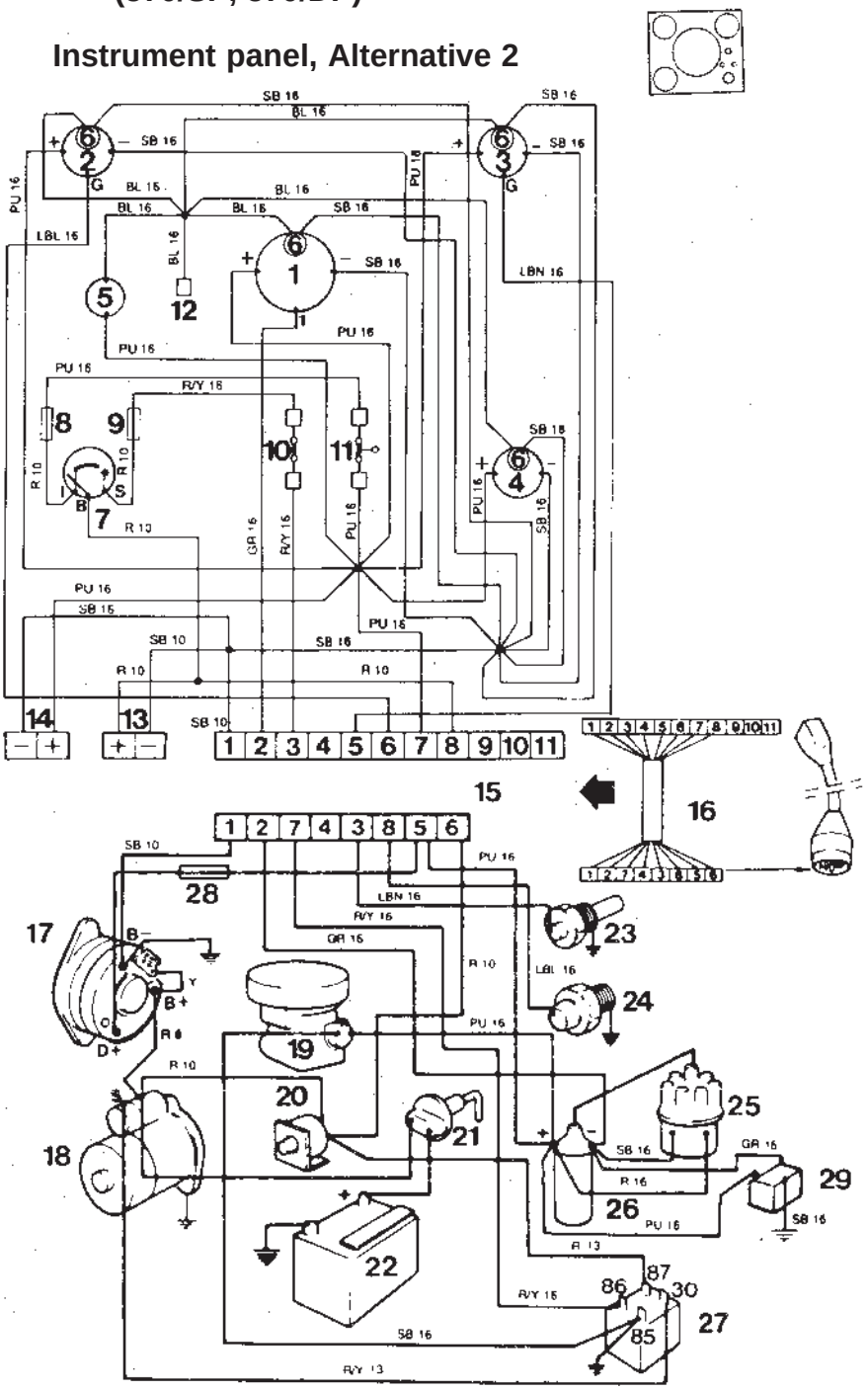
AWG	mm^2
16	1.5
13	2.5
10	6.0
8	10.0

Color

SB	= black	GR	= grey
PU	= purple	LBL	= light blue
LBN	= light brown	R/Y	= red/yellow
R	= red	BN	= brown

WIRING DIAGRAM
(570/SP, 570/DP)

Instrument panel, Alternative 2



Color

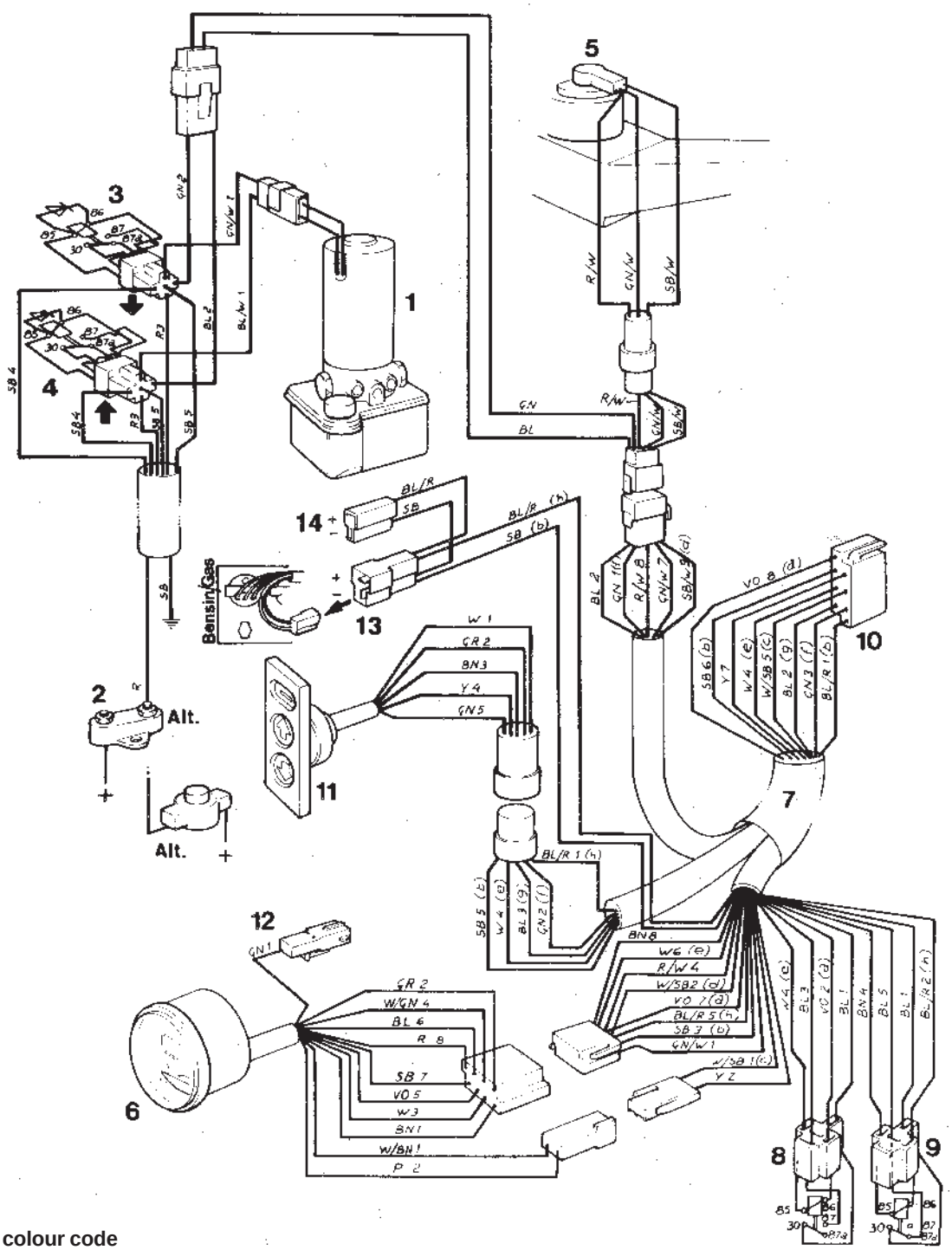
SB = black
PU = purple
LBN = light brown
R = red
GR = grey
LBL = light blue
R/Y = red/yellow
BN = brown
W = white
Y = yellow

AWG	mm²
16	1.5
13	2.5
10	6.0
8	10.0

1. Tachometer
2. Oil pressure gauge
3. Temp gauge
4. Voltmeter
5. Switch, instrument lights
6. Instrument lights
7. Key switch
8. Fuse 8 Amp, ignition
9. Fuse 8 Amp, starter relay
10. Cable terminal, neutral position switch (alternative/optional)
11. Cable terminal, safety breaker switch (optional)
12. Cable terminal, instrument lights optional equipment
13. Current outlet, max 20 Amp
14. Current outlet, max 5 Amp total (Main panel + flybridge panel)
15. Connectors, engine/instruments
16. Extension cable harness
17. Alternator
18. Starter motor
19. Automatic choke
20. Automatic fuse 40 Amp
21. Main switch (optional)
22. Battery (optional)
23. Temp sender
24. Oil pressure sender
25. Distributor
26. Ignition coil
27. Relay
28. Resistor
29. Speed limiter

* **NOTE!** The connector pins in the engine's round connector and the instrument panel's rectangular connector are numbered differently. The numbers in the Wiring Diagram are the pin numbers in the connectors, not the electrical connection between the connectors. Electrically the connectors are connected according to the cable colors, i.e. with the corresponding pin shown in the diagram.

WIRING DIAGRAM, POWER TRIM
Digital trim instrument, round display



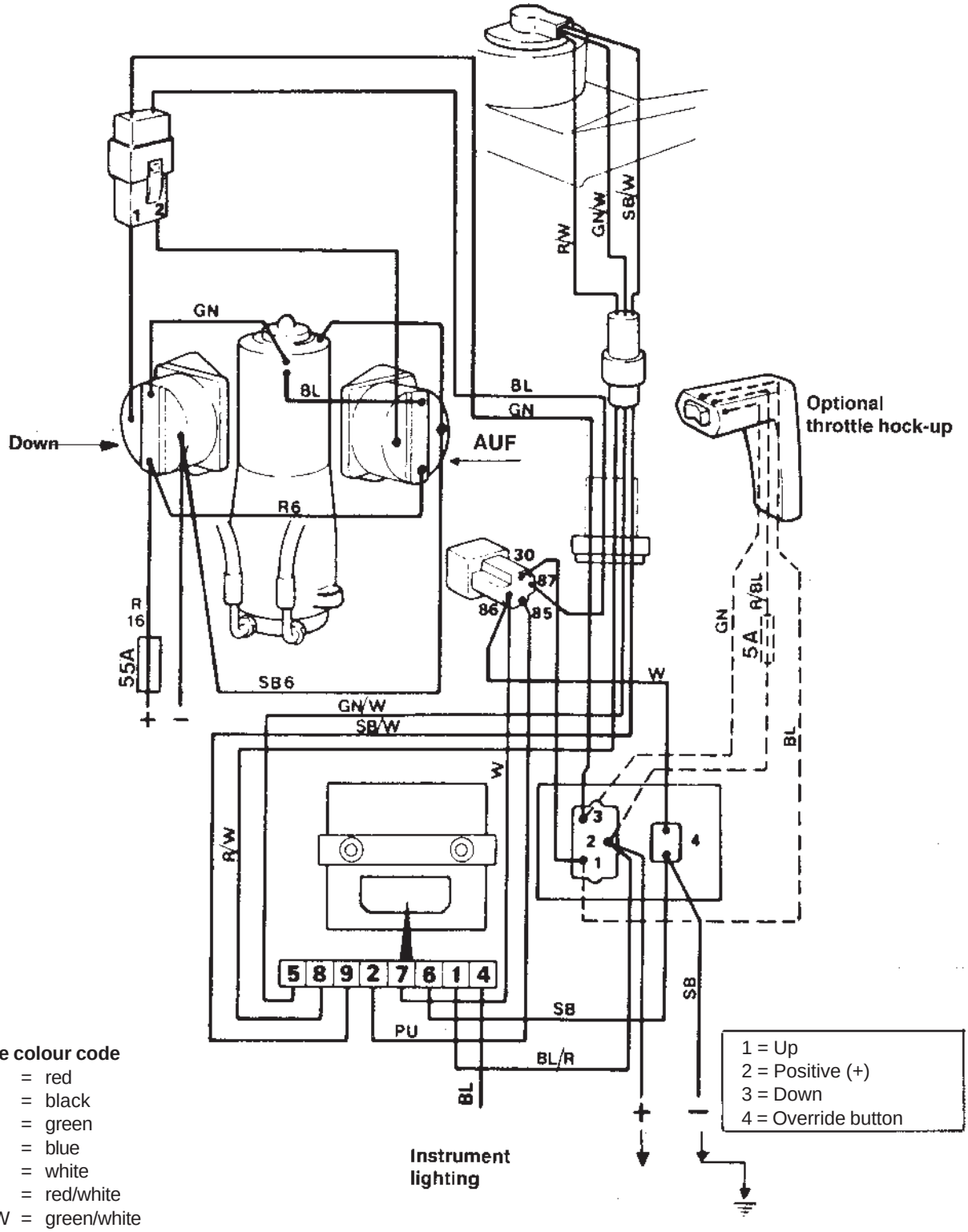
Cable colour code

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

1. Oil pump
2. Fuse (55 A)
3. Engine relay (“DOWN” function)
4. Engine relay (“UP” function)
5. Trim sender
6. Trim instrument
7. Wiring harness. The wires with the same colour are electrically connected in the wiring harness
8. Relay, override for the “BEACH” lock
9. Relay, lift stop
10. Sleeve insulator. Connection to the trim control (see separate wiring diagram)
11. Trim control (accessory)
12. Sleeve insulator (for extra equipment)
13. Connector (connected to the instr. panel)
14. Connector (not used)

Note. The wires with the same letter coding are connected electrically.

WIRING DIAGRAM, POWER TRIM
Oil pump model “Prestolite”
Digital trim instrument, square display

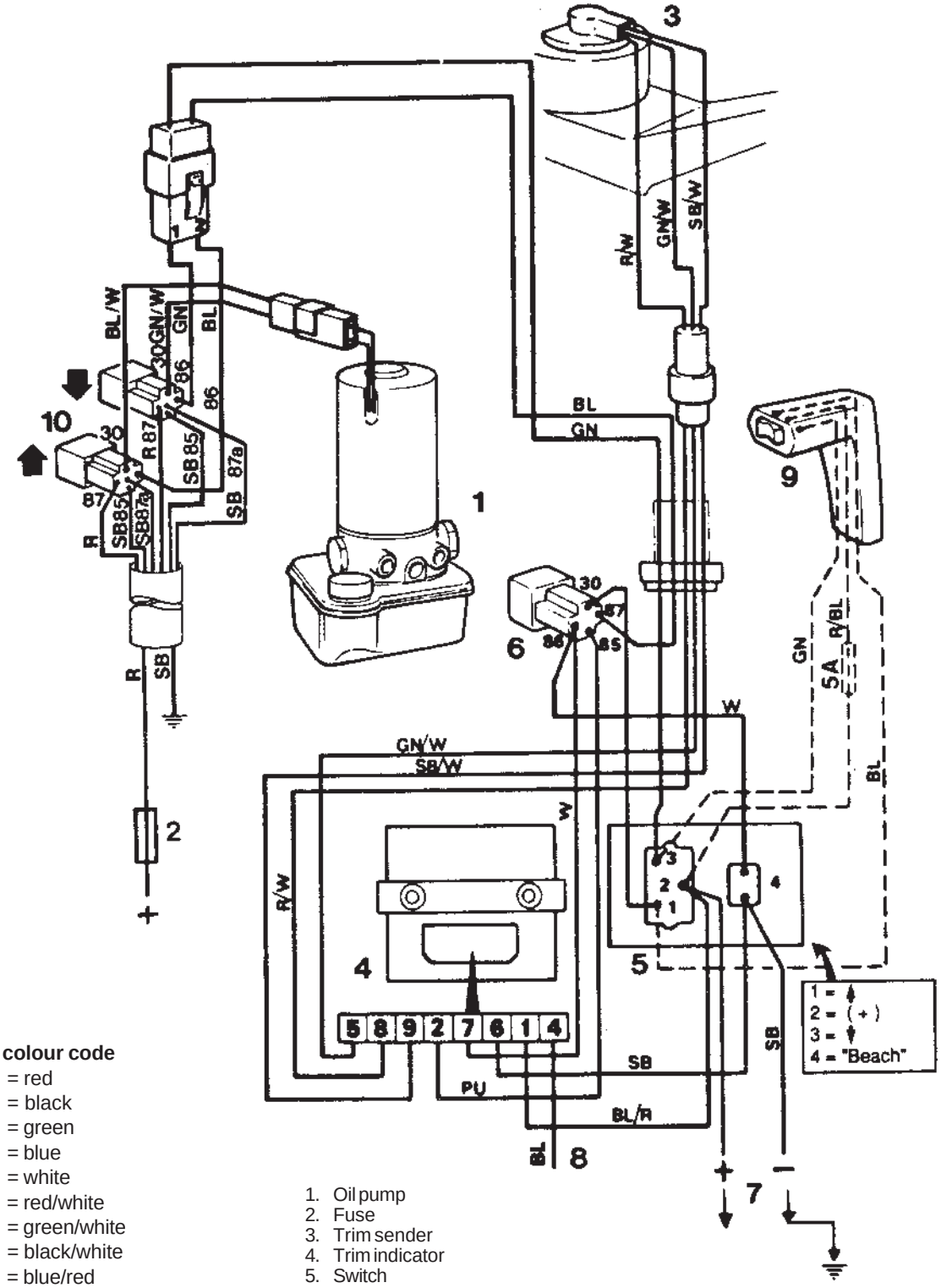


Cable colour code

R	=	red
SB	=	black
GN	=	green
BL	=	blue
W	=	white
R/W	=	red/white
GN/W	=	green/white
SB/W	=	black/white
BL/R	=	blue/red
PU	=	purple

Cable area 1,5 mm^2

WIRING DIAGRAM, POWER TRIM
Oil pump model “Oildyne”
Digital trim instrument, square display



Cable colour code

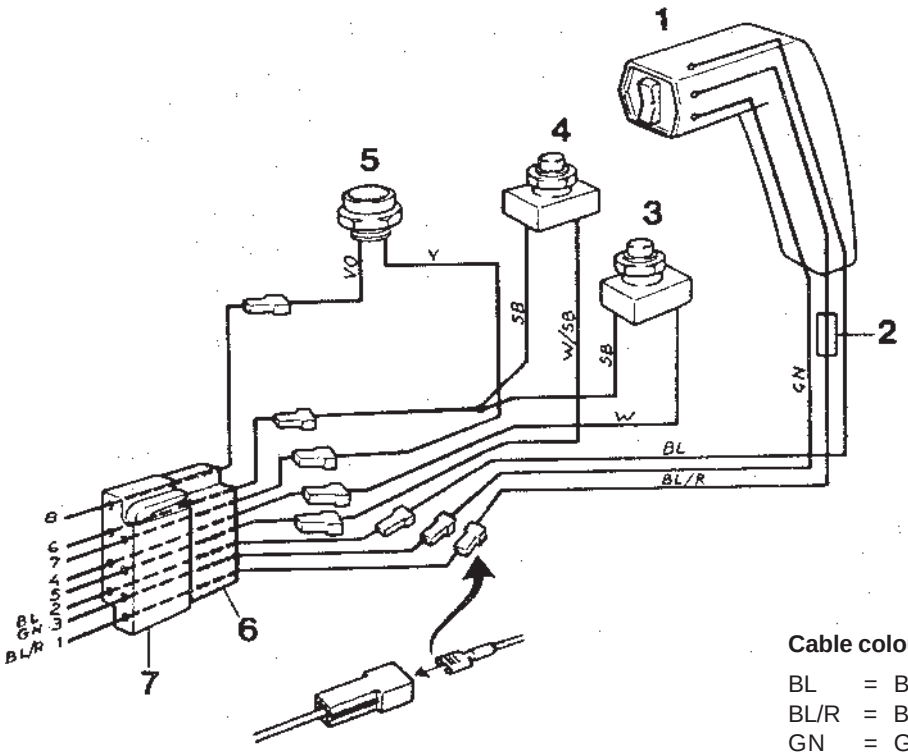
R	= red
SB	= black
GN	= green
BL	= blue
W	= white
R/W	= red/white
GN/W	= green/white
SB/W	= black/white
BL/R	= blue/red
PU	= purple

Cable area 1,5 mm²

1. Oil pump
2. Fuse
3. Trim sender
4. Trim indicator
5. Switch
6. Switch-relay, position “Beach”
7. Connection instrument panel
8. Instrument lighting
9. Throttle hook-up (optional)

The arrows refer to the trimming function up/down.

WIRING DIAGRAM, TRIM CONTROL POWER TRIM
(Digital trim instrument, round display)



1. Control with integral trim function
2. Fuse 5A
3. Push button–by-pass standard
4. Push button–by-pass (self locking) (lamp 5 is on)
5. Indicator lamp (red)
6. Adapter kit (VP p/n 872444-5)
7. Connector (connected to 10 in the wiring diagram for the Power Trim

Cable colour code

BL	=	Blue
BL/R	=	Blue/Red
GN	=	Green
SB	=	Black
VO	=	Violet
W	=	White
W/SB	=	White/Black
Y	=	Yellow

Chapter 4 Cylinder Head

This chapter covers the cylinder head and related parts as follows:

Quick guide:

Replacing the thermostat: Follow points 144–146.

Overhauling the sea water pump: Follow points 149–150.

Chapter 4A Cylinder Head

Fault-tracing and repair procedures, fuel system

The fault-tracing procedure only covers problems in the carburetor and fuel system.

The symptoms described can also be caused by malfunction of the ignition or electrical system, a dirty hull, damaged propeller or drive, incorrect trim angle or a worn engine. Check these possible causes of the fault before any work is started on the carburetor.

WARNING! Remember the danger of fire. Always have a fire extinguisher nearby! Switch off the ignition when working with the fuel system. All checks and repairs must be done with the engine stopped! Run the engine room blower for 2 to 3 minutes before starting work.

IMPORTANT! Be aware of the fire hazard. Always have a fire extinguisher near at hand.

SYMPTOM / CAUSE	Will not start	Starts but stops again	Difficult starting	Poor idling (too fast or slow)	Runs on, post ignition	Hesitates when accelerating	Loss of power during normal acceleration	Loss of power during fast acceleration or at high speed	Suddenly stops	Poor fuel economy	Irregualr running	CORRECTIVE ACTION
Empty fuel tank	X								X			Fill fuel tank
Closed fuel cock	X	X										Open the fuel cock
Clogged fuel filter	X	X				X					X	1)
Faulty fuel pump	X	X							X		X	Replace the pump
Blocked fuel line	X										X	Blow clean all fuel lines
Carburetor flooding			X	X								2)
Not enough fuel in the carburetor		X	X			X		X				3)
Choke not functioning correctly	X	X	X				X	X		X		4)

Corrective Action

1. Replace or clean the fuel filters. The engine has 2 fuel filters: one large main filter fitted at the fuel pump and a filter fitted in the carburetor at the fuel inlet (Holley, both inlets). The main filter must be replaced, the carburetor inlet filter(s) either cleaned or replaced.
NOTE! Certain installations can have additional filters or water separators, for example before the fuel cock. Ensure that all filters are clean.

2. Check by removing the flame arrester and looking down into the carburetor with the engine stopped. If the engine is flooding, there will be fuel flowing in the venturi. To stop the flooding, check the needle and seat, and the float. Replace the needle and seat if there is leakage. Check that the float can move freely. If the carburetor is flooding due to contamination, then the complete carburetor must be removed and cleaned.

3. Check the needle and seat function and float level. Adjust the float level as specified under “Overhauling the Carburetor”.

4. General: Clean the choke mechanism and check that linkage and choke valve is not sticking or seized. When replacing parts or disassembling, adjustment of the choke and the vacuum break must be completed. (Vacuum break only on Rochester).

The engine starts but stops again: Check the choke warm-up function and that the electrical connections are undamaged.
Holley: Check the choke vacuum piston. Correct any sticking. Check that there is no air leakage at the cork gasket.

The engine is difficult to start: The choke valve is not closing, check setting.

CAUSE / SYMPTOM	Will not start	Starts but stops again	Difficult starting	Poor idling (too fast or slow)	Runs on, post ignition	Hesitates when accelerating	Loss of power during normal acceleration	Loss of power during fast acceleration or at high speed	Suddenly stops	Poor fuel economy	Irregualr running	CORRECTIVE ACTION
Vacuum break faulty/incorrectly adj		X	X			X						5)
Loose or leaking vacuum hose					X	X	X					Repl. the hose. Rochester
Carburetor sucking air, vacuum leak				X			X	X				6)
Accelerator pump faulty/incorrectly adj			X			X	X			X		7)
Air valve sticking/incorrectly adjusted				X		X		X				8) Only Rockester 4ME
Contamination in carburetor	X			X		X		X	X		X	Clean the carburetor
Idling speed incorrectly adjusted		X		X	X							9)
Choke incorrectly adjusted	X		X			X				X		Ádjust the choke setting

5. Check operation and make sure it is not sticking. Adjust as per specification in “Overhauling the Carburetor”.

6. Check the gaskets and the mounting hardware. The carburetor should be tightened to a torque of 13 Nm (1.3 kpm/9 ft.lb.). Do not over tighten. Holley: Check that the vacuum housing diaphragm or the cork gasket at the sealing face is not leaking. If leaking the secondary valve will not open fully.

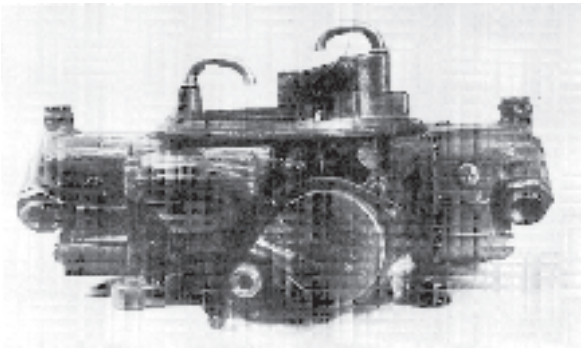
7. Remove the flame arrestor and the cover (Rochester). Check the function and setting of the accelerator pump, and the ball valve. Check that there is no contamination in the accelerator pump fuel passages. For Holley carburetors, check the accelerator pump discharge nozzle. Clean and blow through with compressed air.

8. Check the function and adjust the mechanism as per specification under “Overhauling the Carburetor”.

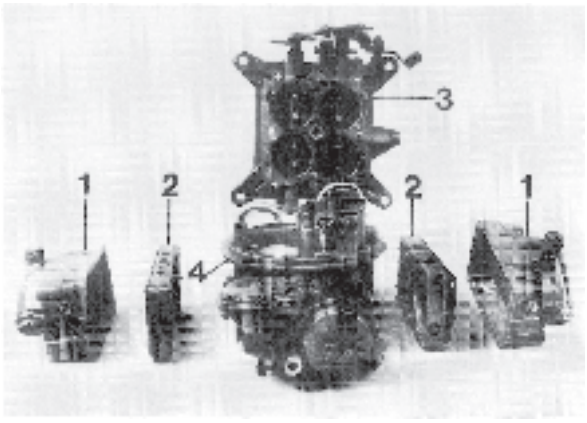
9. Adjust the idle to the correct speed as per Technical Data.

Overhauling and Checking the Carburetor, 570/SP, 570/DP, 571/SP (AQ271, 311)

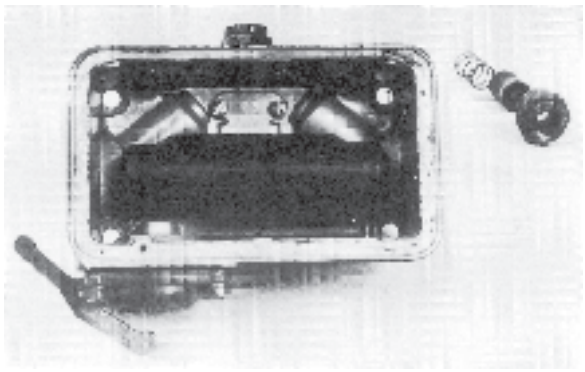
Functional description of the Holley 4150 carburetor.



1. The Holley 4150 is a four-barrel two-stage down-draught carburetor. Its construction is characterized by two different and completely separate fuel systems for the primary and secondary sides of the carburetor.

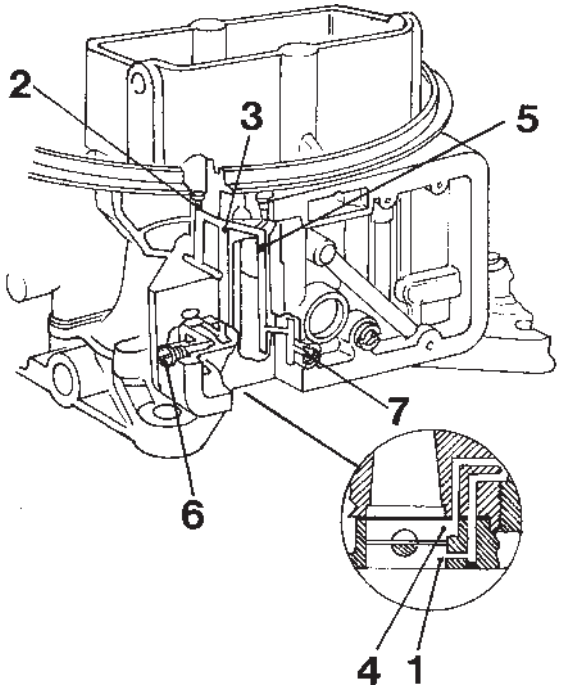


2. The carburetor is built up in modules, consisting of the fuel bowls (1) and the metering blocks (2), the throttle body (3) and the main carburetor body (4) containing four barrels (venturis). Both the primary and secondary barrels have the same diameter, 1 11/16" (42.8 mm).



3. **The fuel bowls** have centrally pivoted plastic floats. The float lever works against a replaceable needle and seat assembly. The inlet is provided with a sintered bronze fuel filter, which is tension against a seat by a spring. If the filter is completely blocked, the fuel pump pressure will overcome the spring pressure, so that the fuel will bypass the filter.

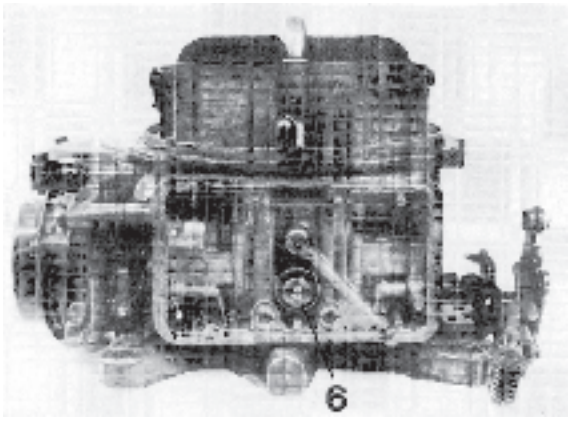
4. **The first stage (primary side)** consists of two barrels which are supplied with fuel from the idle system, main metering system, power system and the accelerator pump.



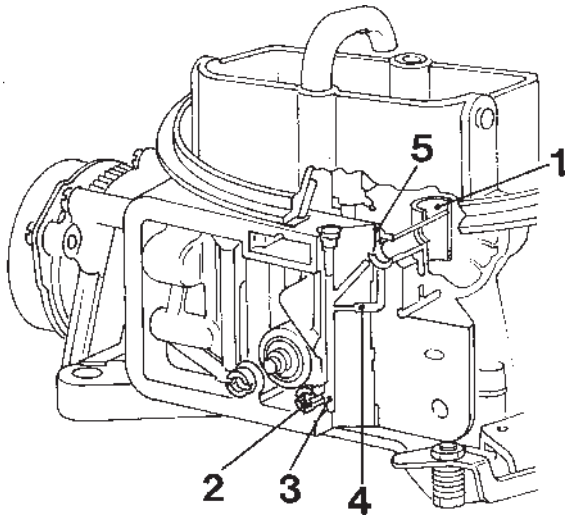
5. **The idle system** supplies the engine with fuel when the throttle plate is partly or completely closed. Fuel flows from the fuel bowl through the main jet (7) to the main well. From the main well, fuel flows through the idle-feed restriction (5) into the idle well. In the idle well it mixes with air from the idle air bleed (2). The fuel/air mixture then flows down another passage (3) where it splits up and part of the flow goes to the transfer port (4) but the majority of the flow goes to the idle discharge port (1).

There is an adjustment screw (6) which controls the fuel mixture discharged through port (1). The plate opens to give a smooth transition from the idle to the main metering system.

Both the primary and secondary sides of the carburetor has an idle system. The only difference being there are no mixture adjustment screws on the secondary side.



6. **The main metering system** works on the venturi principle which states when air flows through a constricted tube, flow is fastest and pressure lowest at the point of maximum constriction.



In the carburetor this is utilized by placing the opening of the discharge nozzle in the venturi itself. To further increase the vacuum signal, the discharge nozzle opening is formed into a booster venturi (1). Fuel flows from the fuel bowl, through the main jet (2) into the bottom of the main well (3). Fuel then flows up the well and mixes with air from the main air-bleed holes in the side of the well (4). These holes connect to the air bleed restrictions (5) which are located in the carburetor air inlet. The mixture of fuel and air moves up the main well to the discharge nozzle located in the booster venturi (1).

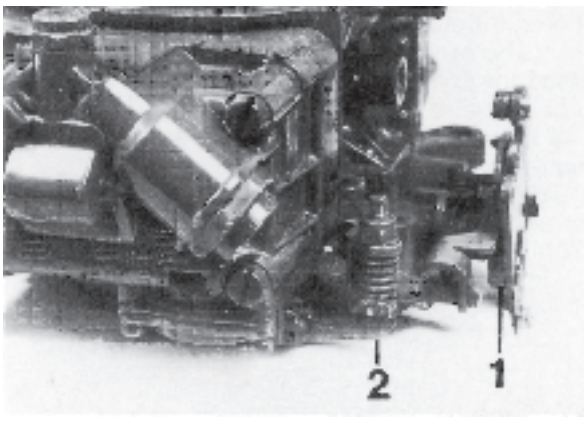
7. **The power system** is part of the main metering system and provides additional metered fuel when high speed or high load conditions exist. Under either condition the throttle is opened fully and manifold vacuum is low. The engine is operating with a surplus of air and to get higher output additional fuel must be provided. A spring loaded power valve (6), which is controlled by manifold vacuum, opens allowing more fuel to flow to the discharge nozzle. This power valve is marked with a number which corresponds to the vacuum reading at which it opens. An 85 power valve will open once manifold vacuum drops below 8.5 inches of mercury.

When the manifold vacuum exceeds 8.5 in. Hg the power valve closes and the additional fuel flow stops. This allows the carburetor to provide optimum fuel efficiency yet still be able to produce higher power levels.

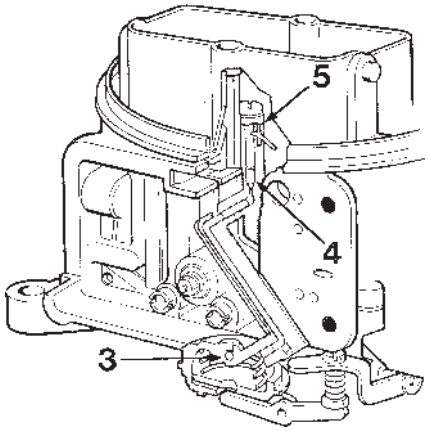
8. **The accelerator pump** is of the diaphragm type and is at the bottom of the primary side fuel bowl. The accelerator pump has two functions:

1) To compensate for the lack of fuel when the throttle opens and air rushes in. The lack of fuel occurs due to the fuel being considerably heavier than air and takes longer to start flowing.

2) To compensate for the fuel which condenses on the inlet manifold surfaces when the throttle is opened quickly at low engine speeds. This is caused by a large decrease in manifold vacuum allowing the fuel to drop out of suspension and condense on the walls of the manifold.



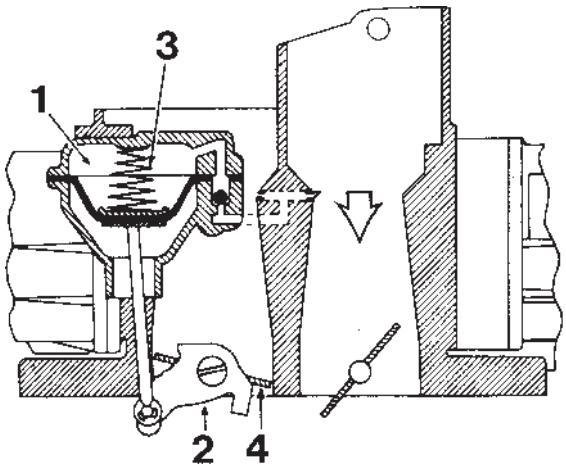
9. The pump is mechanically operated by a plastic cam (1) mounted on the throttle shaft which operates the accelerator pump arm (2) through an intermediate lever. The capacity and duration of the accelerator pump shot is determined by the profile of the cam (1).



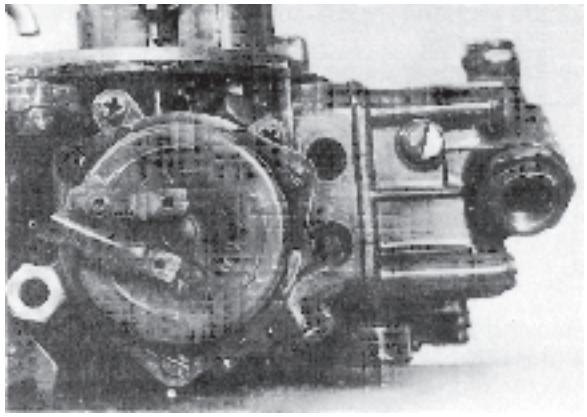
10. The fuel runs down into the pump from the fuel bowl via the open check valve (3). When the pump lever presses up against the spring loaded diaphragm it closes the check valve and thereby forces the fuel into a passage in the metering block. It is then fed via a long diagonal passage to the discharge check valve (4) which opens, allowing the fuel to flow out the discharge nozzle in the carburetor venturi. When the pressure drops in the fuel passage the check valve (4) closes, which prevents air from coming into the pump housing or the passage from being sucked dry by the vacuum in the venturi.

As the throttle closes the pump lever returns to its original position allowing the return spring to push the diaphragm down. Fuel flows through the open check valve (3) and re-fills the pump.

11. **The second stage (secondary side)** consists of two barrels (venturis), which is equipped with a vacuum controlled throttle plate. Fuel is supplied through separate idle and main metering circuits. The function and construction is equivalent to the primary side. The throttle plate is connected directly to a vacuum housing (1) via a lever (2). The upper side of the diaphragm contains a pressure spring (3), which tries to keep the plate closed. A passage connects the vacuum housing with the primary side venturi.



When the air flow through the primary barrels is sufficient, the effect of the vacuum on the diaphragm will overcome the spring pressure and the secondary throttle plate (4) starts to open. If the vacuum in the primaries is reduced, the spring will press down the diaphragm and thereby close the secondaries. There is also linkage connected to the primaries which closes the secondaries. The linkage is there for safety reasons, so that a broken diaphragm spring does not prevent the secondary throttle plate from closing.



12. The carburetor is equipped with an **electric choke.** The choke cover contains a bimetallic spring which closes the choke valve when cold. When the engine is started manifold vacuum partially opens the choke valve to the “qualified” position by means of a vacuum-qualifier piston. The remainder of the opening of the choke valve is done by electrically heating of the bimetallic spring. When the engine is stopped and cools down, the spring also cools and pulls together and closes the valve.

Overhauling and Adjusting the Carburetor

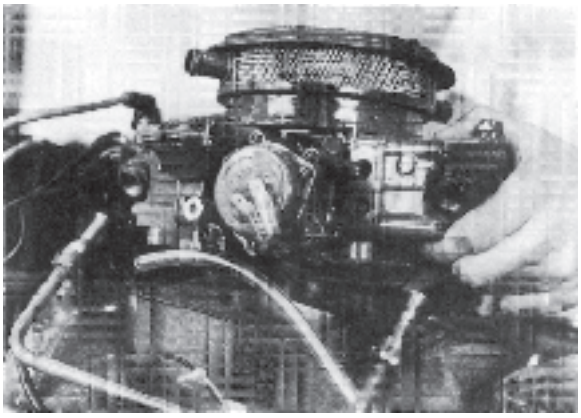
Overhauling the Holley 4150 carburetor.

Technical data, VP No. 855750-6
571 (AQ311, AQ271 up to engine No. 4 100 106052)

Carburetor size	CFM 715
Primary Jet	74
Secondary Jet	85
Accelerator pump setting	position 2
Choke setting	4 marks right

Technical data, VP No. 856690-3
570/SP, 570DP (AQ271 from engine No. 4 100 106053)

Carburetor size	CFM 715
Primary Jet	72
Secondary Jet	80, 90
Accelerator pump setting	position 2
Choke setting	4 marks right



13. Removing the carburetor from the engine: Remove the carburetor protective cover, wrench size 10 mm. Remove the flame arrestor, wrench size 11 mm.

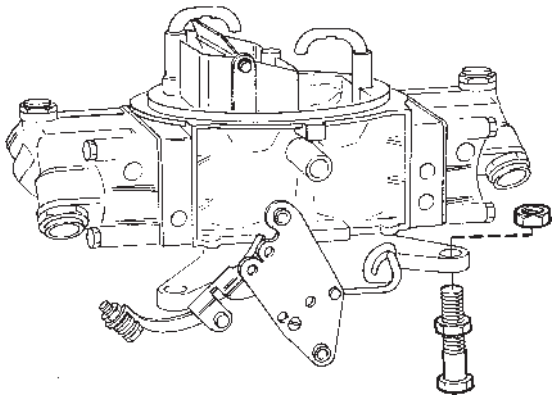
Disconnect the throttle cable from the control mechanism. Remove the fuel line from the connections to the fuel bowl. Remove the carburetor from the intake manifold.
NOTE! Do not forget to remove the choke electrical connections.

14. Removing the carburetor:
NOTE! Before the carburetor is disassembled, it must be cleaned externally if it is dirty. Clean carefully using a brush and carburetor cleaner, thinners or denatured alcohol.

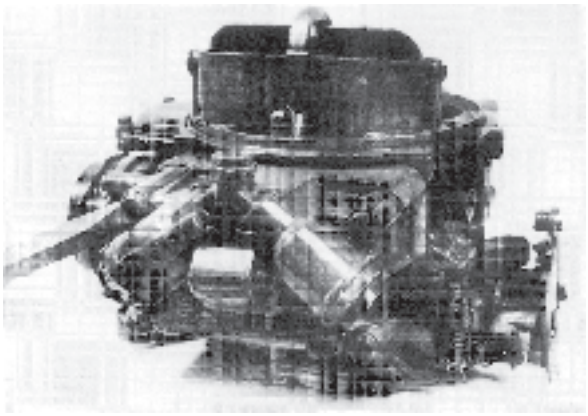
WARNING! Always work in well ventilated areas: Open flames are extremely dangerous.

IMPORTANT! Do not use more cleaner than absolutely necessary and minimize your exposure to these solvents as they can be harmful. The carburetor must **never** be immersed in cleaning fluid to loosen up dirt. Rubber and plastic components can be damaged by certain types of cleaning solvents.

Hold the carburetor in the horizontal position with the flame arrestor installed. If compressed air is used for drying and blowing clean, a plastic bag must be pulled over the flame arrestor as protection. Blow from above and downward, do not direct the air flow in from underneath the carburetor. Remove the flame arrestor and wipe clean the upper edges and lower side with a clean, lint-free rag.



15. Place the carburetor in fixture 884620-6. Alternatively, fit four M8 or 5/16" bolts with a minimum length of 45 mm (1 3/4") in the carburetor mounting holes to provide a raised working position.

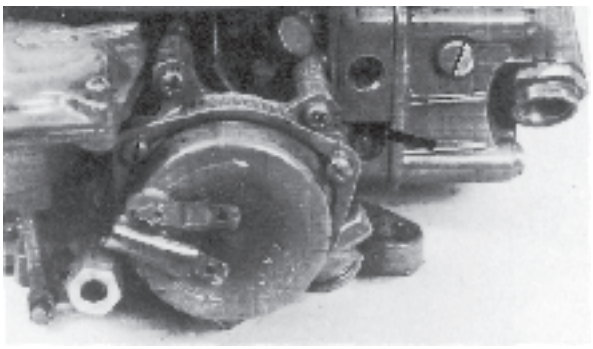


16. Remove the fuel bowl screws on the primary side. Remove the fuel bowl and metering block together with the gasket.

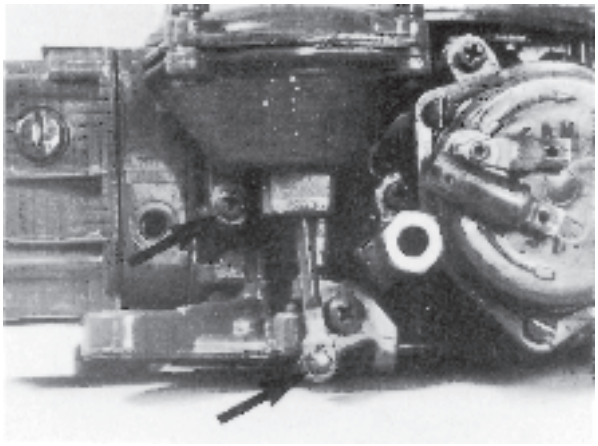
NOTE! The gasket may be glued, in which case light knocking with a screwdriver handle or a plastic hammer may be necessary to separate the parts.

17. Carry out the same procedure on the secondary side.

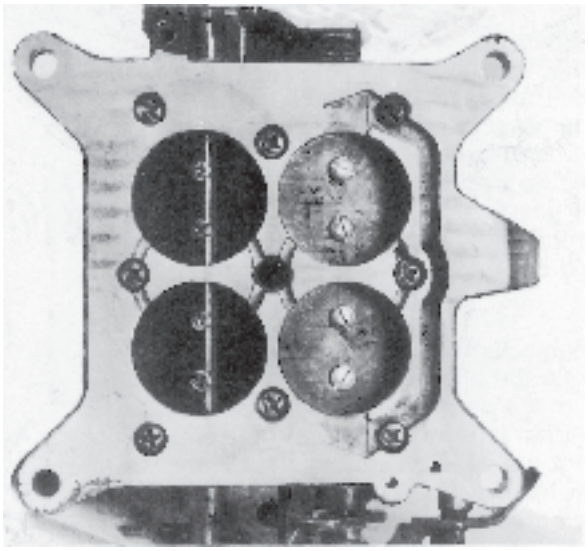
18. Disassemble the choke. First remove the wire clip that secures the linkage to the choke valve shaft lever. Use circlip pliers or needlenose pliers. Before any other disassembly is done, note the choke setting, so that it will be reassembled in the same position.



19. Remove the choke thermostat housing and retainer by unscrewing the three Phillips-head screws.

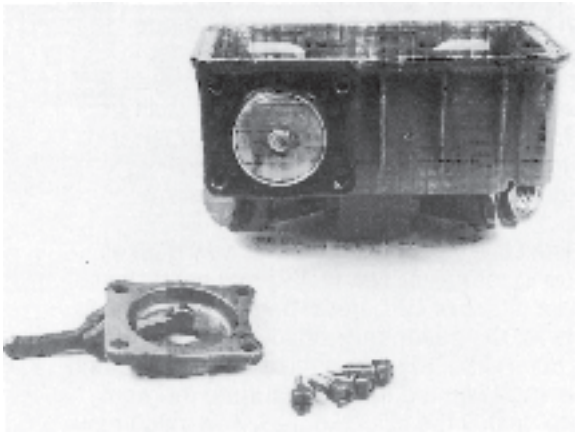


20. Remove the vacuum housing linkage from the secondary throttle shaft lever by using a screw driver to remove the circlip. Remove the vacuum housing from the carburetor body.

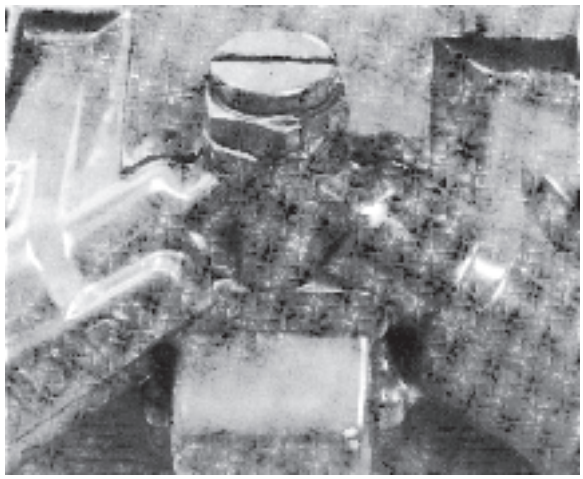


21. Remove the throttle body by loosening the eight screws. Knock the valve housing loose using a plastic hammer so that the gasket releases.

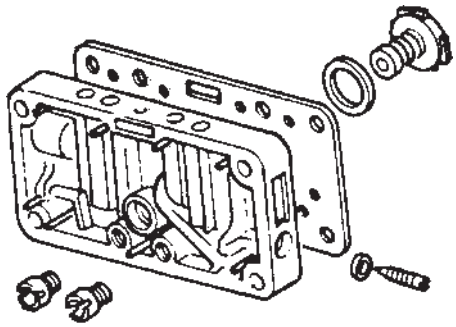
22. Any additional disassembly of the valve housing should not be done. The inside of the throttle body can be cleaned with a brush and a mild cleaner. Any remains of gaskets should be removed by using solvents. Do not use a knife or scraper as the metal can scratch the surfaces causing sealing problems. Blow the idle system passages clean using compressed air.
NOTE! Steel wire or equivalent must not be used when cleaning the fuel passages.



23. Remove the accelerator pump from the primary fuel bowl. Clean using the same methods and cleaners as in point 22.
NOTE! Use extra care so that strong cleaning agents do not come in contact with the float or the accelerator pump diaphragm.

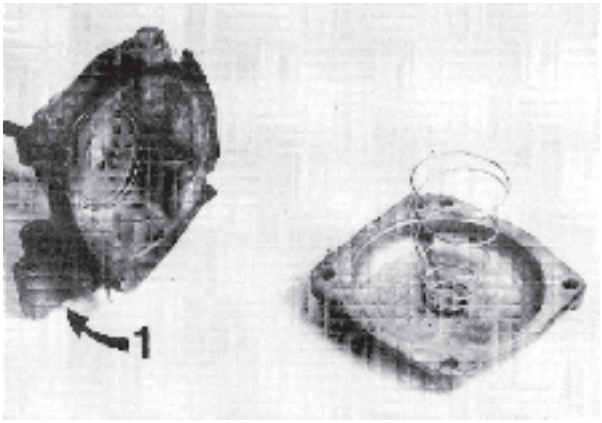


24. Replacing the float.
To remove the needle and seat assembly, loosen the locking screw and unscrew the adjuster nut counter-clockwise, wrench size 5/8". Remove the float by loosening the two screws in the fuel bowl. Assemble in the reverse order.



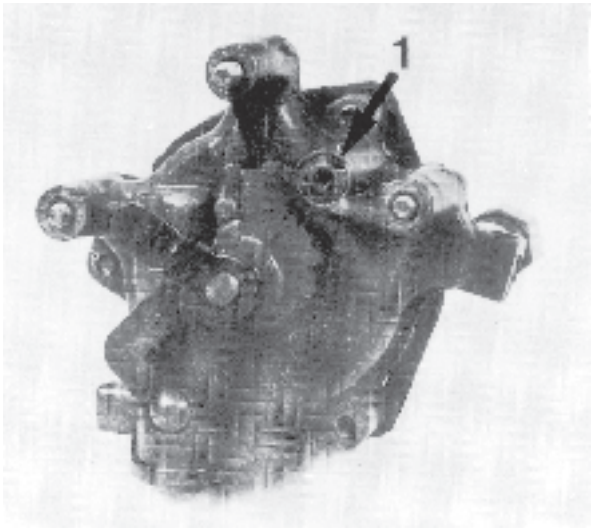
25. Replacing the jets:
Remove the main jets using a wide-blade screwdriver, at least 8 mm (5/16") wide. Unscrew the idle mixture screws with their cork seals. Remove the power valve (primary side) using a 1" socket or wrench. Brush the metering block clean and blow all the passages clean using compressed air.

26. Install the Power valve with a new gasket. Tightening torque 11 Nm (1.1 kpm/8 ft.lbf). Install the main jets. For carburetor part No. 856690-3, the jets for the secondary side have different sizes, 80 and 90. Size 80 is fitted in the right hand jet opening (with the fuel plate turned the right way up). Install the idle mixture screws with new cork seals.

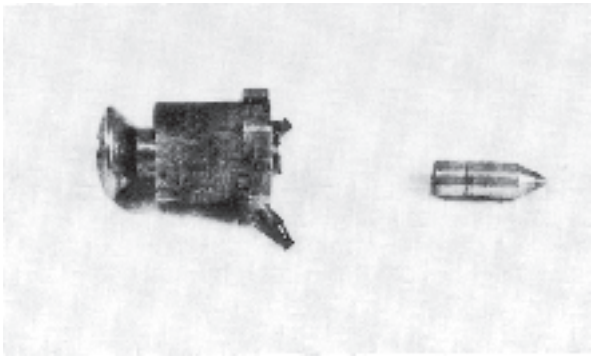


27. Replacing the secondary diaphragm: Unscrew the four screws; tap lightly with a screwdriver handle to separate the lower and upper diaphragm housings. The spring and diaphragm can now be replaced. The cork gaskets (1) must be replaced when reassembling.

NOTE! Be careful and prevent the steel ball from the secondary housing check valve from failing out when the upper and lower housings are disassembled.



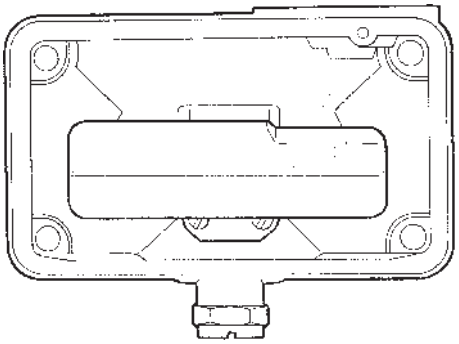
28. Checking the choke housing:
Remove the choke shaft. Remove the choke qualifier piston, check that the piston does not stick. Clean and polish with a very fine-grained emery cloth. Clean and refit the parts. Replace the vacuum connection cork gasket (1).



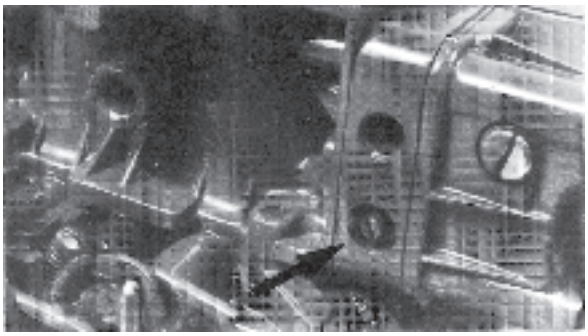
29. Clean the carburetor body using a mild cleaner. Blow clean all passages using compressed air. Remove the accelerator pump discharge nozzle and the seat assembly. Additional disassembly of the carburetor body should be avoided. If the choke linkage nylon guide needs replacing, refer to point 30. When assembling the discharge nozzle, new gaskets should be used.

30. Replacing the choke linkage guide:
Remove the choke valve. First file down the ends of the screws that are staked to prevent them from loosening. Loosen the screws and pull out the valve plate and shaft. Replace the guide.
NOTE! When reassembling the new screws must be staked. Use a support under the valve shaft so it does not bend when staking. Do not bend the ends too much so that the thread in the shaft is damaged.

Carburetor Adjustment



31. Adjusting the Float Level:
Turn the removed fuel bowl upside down. On the primary side, set the float level so the bottom edge of the float is even with the bottom edge of the float screws. The screws should not be visible. On the secondary side, set the float level so that approximately half the float screw heads are visible as shown in the diagram.

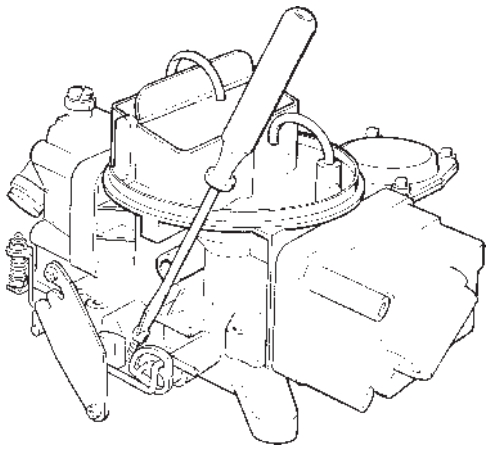


32. Idle Setting:
The screws for the idle mixture are located one on each side of the primary side metering block. If the screws have been removed then a basic setting must be done first.
NOTE! The secondary throttle valve stop position should be correctly set before idle adjustment is carried out, see point 39.

a) Lightly bottom the screws, and then screw them out one and a half turns. On carburetor 856690-3 the basic setting is 1/4–3/8 turns out. Fine adjustment is done according to method (b) with a vacuum gauge or according to (c) without a gauge.

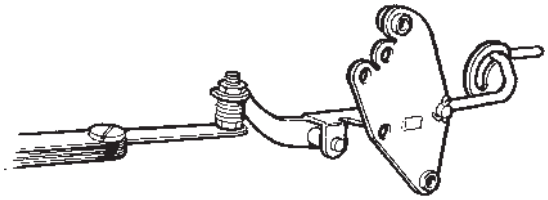
b) Connect a vacuum gauge to the pipe plug on the engine intake manifold. Then adjust both screws equally to the highest possible value on the vacuum gauge.

c) Screw in one of the idle mixture screws until the engine starts to run rough. Then screw out the mixture screw until the engine runs smoothly again. Repeat this setting on the other screw. The same procedure is then done once more for both screws.



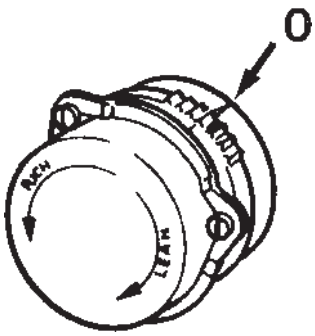
33. Set the required idle speed with the idle screw by the throttle valve lever. Use a shop tachometer, do not rely on the instruments in the boat.

34. Setting the Accelerator Pump:
Check that the plastic cam is fitted in position 2. Set the adjuster screw on the pump lever so that it just makes contact with the pump arm at idle.

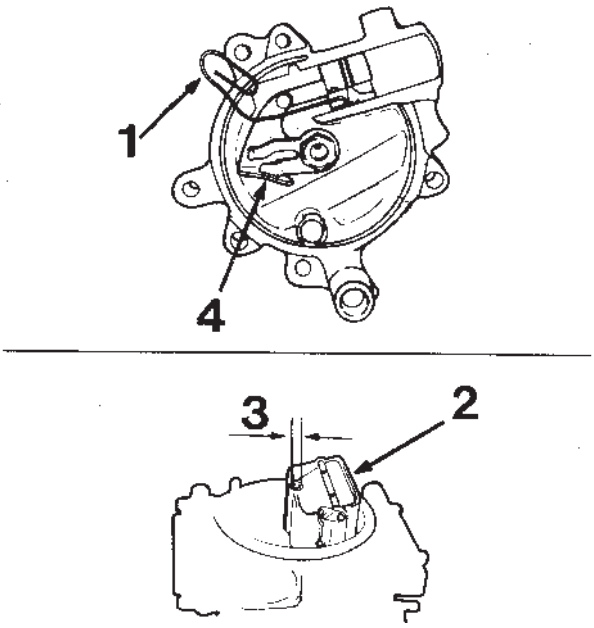


35. Check the adjustment. When properly set, the pump arm starts to move as soon as the throttle moves. The correct adjustment must also allow a slight clearance between the pump arm and the adjuster screw with the throttle fully opened. This clearance should be 0.40–0.50 mm (0.016–0.020") at wide open throttle.

36. Choke Setting:
The setting is split up into two parts, the choke index and the choke qualification. Adjust the choke index first, if this is not previously known.



37. Check that the bimetallic spring eyelet is against the choke arm in the choke housing (if the choke has been removed). Turn the choke cover so that the setting mark lines up with the correct setting mark on the housing. The setting should be at the fourth mark to the left (from 0-index). Tighten the choke cover.



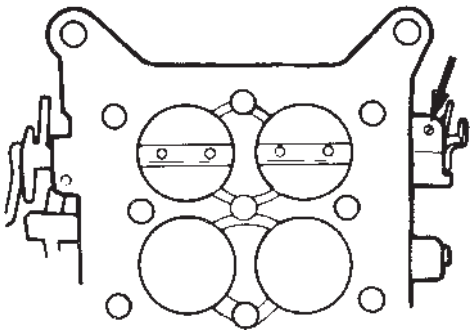
38. Bend a wire or a paper clip with a maximum diameter 0.7 mm (0.028") into an “L”. The length of the bent end of the wire: maximum 3 mm (0.120").

1) Insert the wire into the piston slot until it bottoms, pull out together with the piston until the wire hooks on.

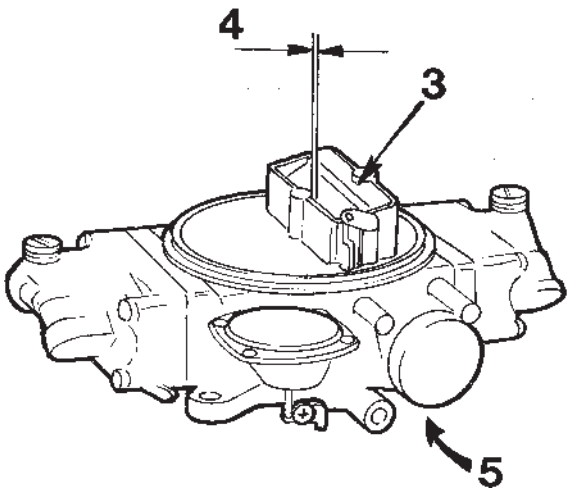
2) Press lightly using finger pressure on the choke valve in the closed position.

3) The clearance between the choke valve lower edge and the carburetor body wall is maximum 3.55 mm (9/64"). Measure using a drill.

4) When adjusting, bend the tang (4) using pliers.



39. Setting the secondary throttle plate position (carburetor removed). Unscrew the adjuster screw until the secondary valve is closed. Screw in the screw (clockwise) until contact with the lever stop is obtained. Screw in another 1/4 turn.



40. Setting the choke unloader.

1) The choke must be correctly adjusted.

2) The primary valve must be in the fully open position.

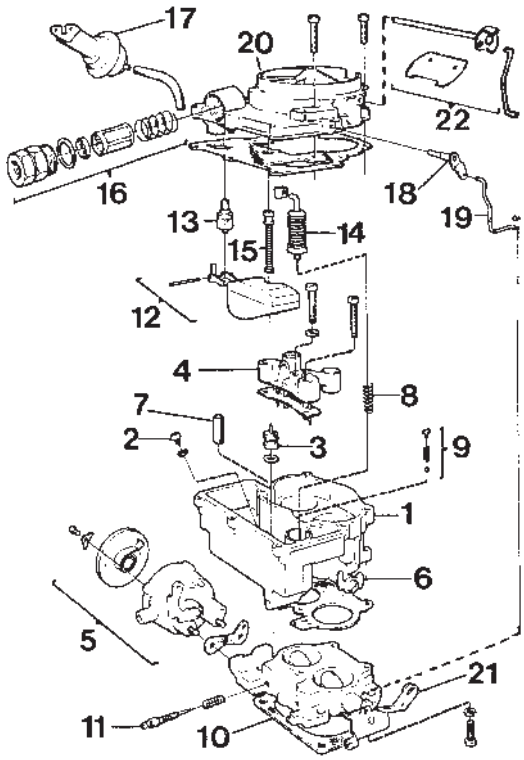
3) Press lightly on the choke valve in the closed position.

4) Measure the distance between the choke valve lower edge and the back wall of the primary air horn. The distance shall be maximum 7.6 mm (19/64").

5) To adjust, bend the tang on the throttle shaft lever (below the choke housing).

Overhauling and Checking the Carburetor 500A/SP, 500A/DP (AQ211), Rochester 2GE

41. The construction of the Rochester 2GE carburetor.



The carburetor is a two-barrel, single-stage down-draught carburetor.

The venturi diameter is 43 mm (1 11/16").

1. Carburetor body
2. Main jet (2 pcs)
3. Power Valve
4. Venturi
5. Choke
6. Fast Idle Cam
7. Screen
8. Return Spring
9. Check valve, accelerator pump
10. Throttle Body
11. Idle Mixture Screw (2 pcs)
12. Float
13. Needle and Seat Assembly
14. Accelerator Pump
15. Power Piston
16. Fuel Inlet with Filter
17. Vacuum Break
18. Pump Shaft
19. Pump Linkage
20. Carburetor Cover
21. Throttle Lever
22. Choke Valve

42. Removing the Carburetor
Remove the carburetor flame arrestor, wrench size 11 mm. Remove the throttle cable from the control mechanism. Remove the fuel line, wrench size 17 mm. Remove the carburetor, wrench size 13 mm.
NOTE! Do not forget to disconnect the electrical connections to the choke.

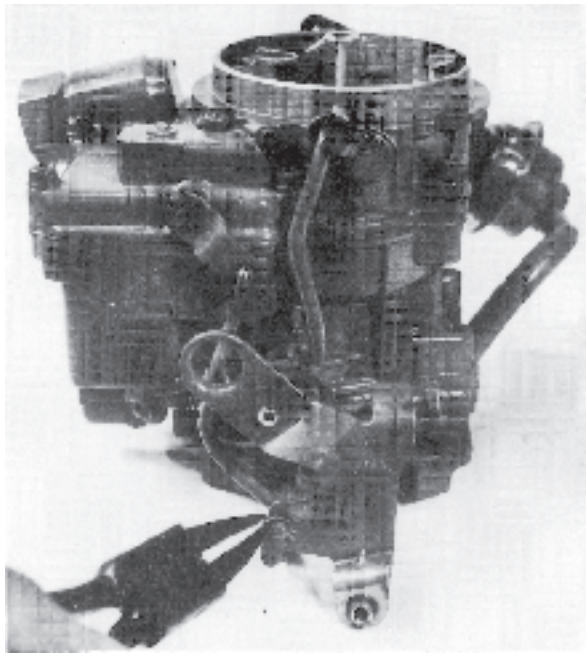
43. Dismantling the Carburetor Cover.
NOTE! Before disassembling the carburetor, it must be cleaned if it is dirty externally. Clean carefully using a brush and carburetor cleaner, thinners or other solvents.

⚠ **WARNING!** Always work in well ventilated areas: Open flames are extremely dangerous.

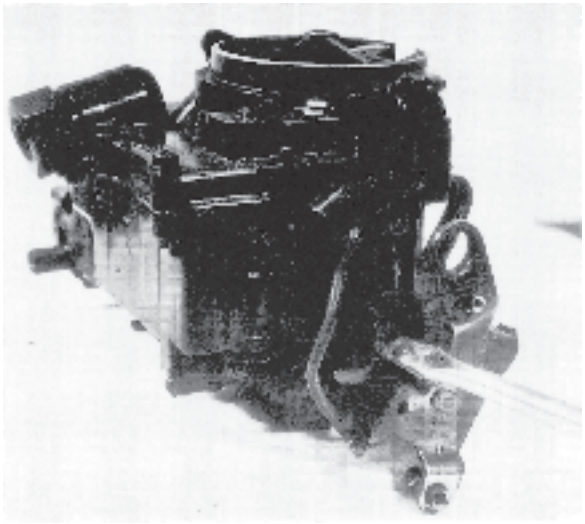
IMPORTANT! Do not use more cleaner than absolutely necessary and minimize your exposure to these solvents as they can be harmful.

The carburetor must **never** be immersed in cleaning fluid to loosen up dirt. Rubber and plastic components can be damaged by certain types of cleaning solvents.

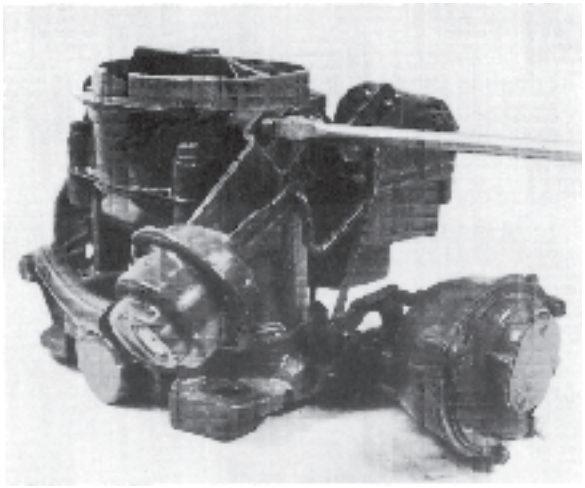
Hold the carburetor in the horizontal position with the flame arrestor installed. If compressed air is used for drying and blowing clean, pull a plastic bag over the flame arrestor. Blow from above and downward. Do not direct the air in from underneath the carburetor. Remove the flame arrestor and wipe both the upper and edge underside clean with a clean lint-free rag.



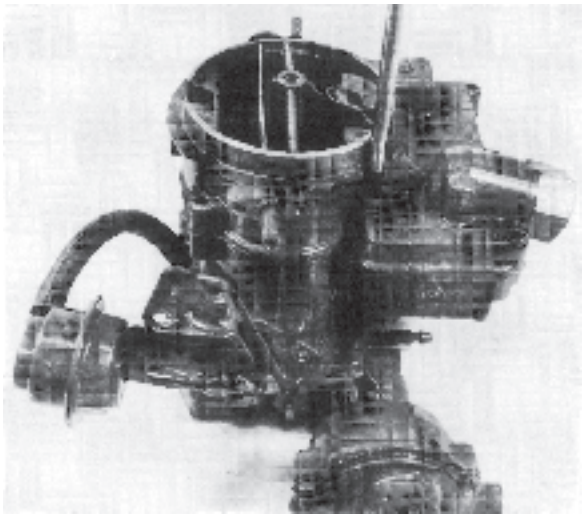
44. Remove the clip for the accelerator pump linkage.



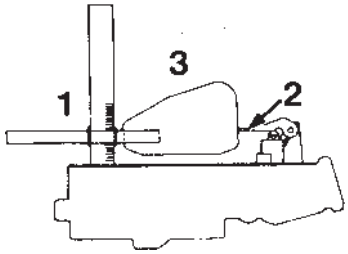
45. Remove the idle cam.



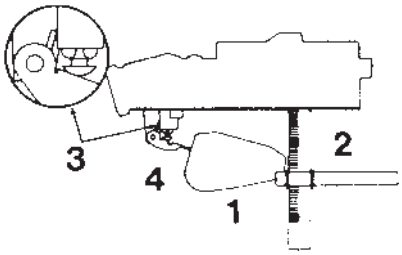
46. Remove the linkage level for the choke and vacuum break. The screw head – TORX 10. Remove the vacuum break.



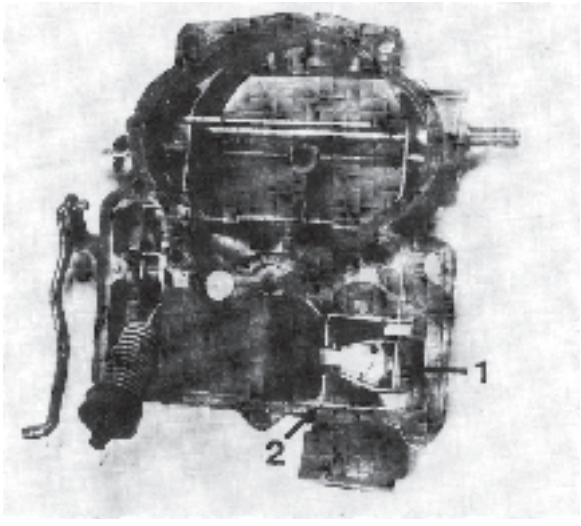
47. Remove the eight screws for the carburetor cover. If the cover is stuck, gently knock it with a screwdriver handle so that it loosens.



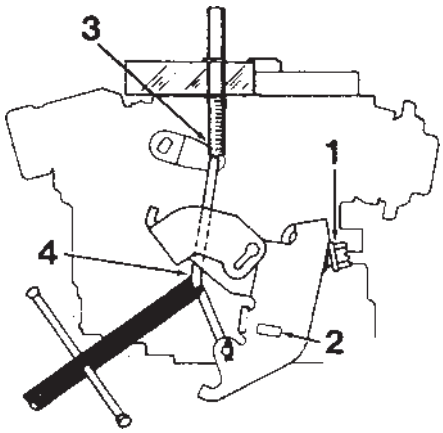
48. Checking and adjusting the float level, upper position. With the cover upside down measure from the seam on the tapered end of the float to the carburetor gasket. Use T-gauge 884616-4 (1). The float level should be 12,9 mm (0,51"). Adjusting: Bend the float arm (2) at the point shown by the arrow. After adjusting, check that the float hangs straight.



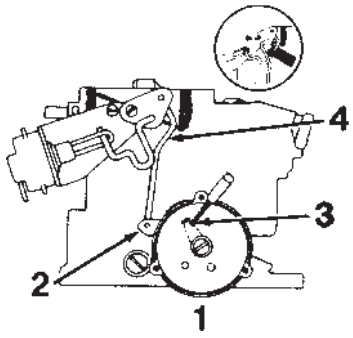
49. Checking and adjusting the float level, lower position. Turn the carburetor right side up and let the float (1) hang free. Measure from the gasket to the seam at the tapered end of the float. The level (2) should be 44.4 mm (1.75"). Adjusting: Bend the tang (3) at the point shown by the arrow. Cheek that the float needle (4) does not stick at the maximum position.



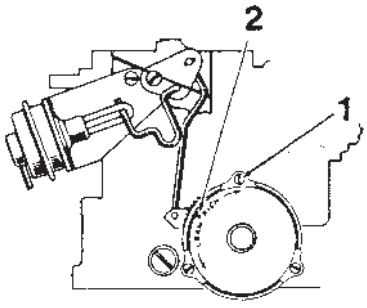
50. Replacing the Float Needle and Seat
Remove the float by pressing out the float shaft (1). The float needle can now be unhooked from the float arm, Unscrew the seat with a 10 mm (3/8") wide bladed screwdriver. Screw in the new seat using a new seal. Do not forget to fit the baffle (2) around the float needle.



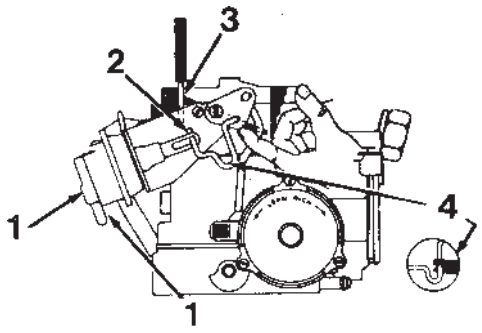
51. Checking and adjusting the accelerator pump movement. Unscrew the idle screw (1). Hold the throttle valve (2) completely closed. Measure from the upper surface of the carburetor cover to the top of the pump rod (3). The distance should be 31.2 mm (1.23"). Adjusting: Bend the linkage rod (4) at point shown by the arrow.



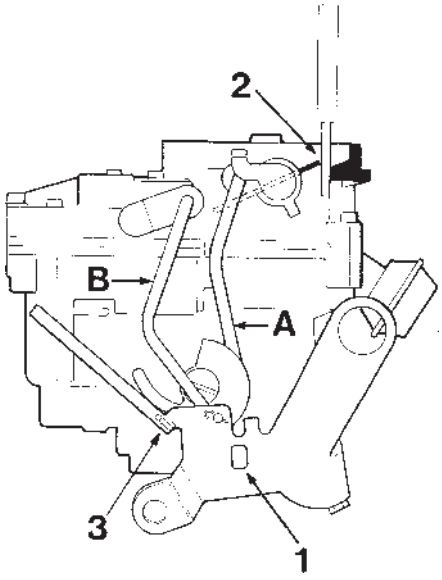
52. Checking and adjusting the choke lever. Remove the cover for the choke (1). Close the choke valve by pressing up on the lever (2). Turn the choke arm so that a 3 mm (0.012") drift can be inserted into the hole in the choke housing (3). The edge of the choke arm should make light contact with the drift inside the choke housing. Adjusting: Bend the linkage arm (4).



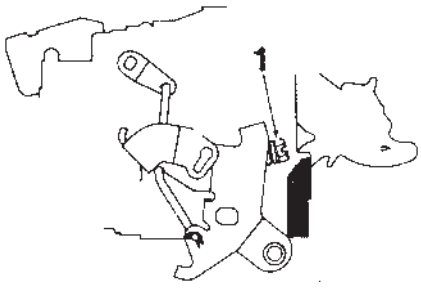
53. The Choke Coil Setting. Loosen the locking screws (1). With the choke valve fully open (cold choke), turn the choke cover against the tension of the bimetallic spring until the choke closes. Then turn to the 0-mark (2) on the choke housing. Tighten the locking screws (1).



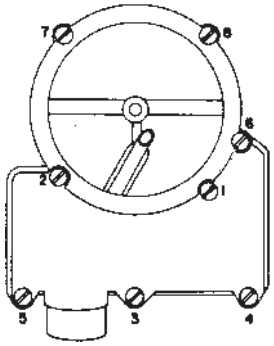
54. The Vacuum Break Setting. Place tape across the hole in the vacuum chamber (1). Suck the rod to the bottom using the vacuum pump 884618-0. Press up the choke valve shaft lever until the link bottoms in the slot (2). The clearance between the valve upper edge and the carburetor bore should be 4.8 mm (3/16"). Measure using a 4.8 mm (3/16") drill. Adjusting: Bend the link at



55. Checking the Choke Unloader. Hold the throttle valve (1) completely open. Measure between the valve upper edge and the carburetor bore. The clearance (2) should be 7.6 mm (19/64"). Adjusting: Bend the tang (3). A and B refer to the linkage order of assembly if the carburetor has been removed. Linkage A is fitted before linkage B.



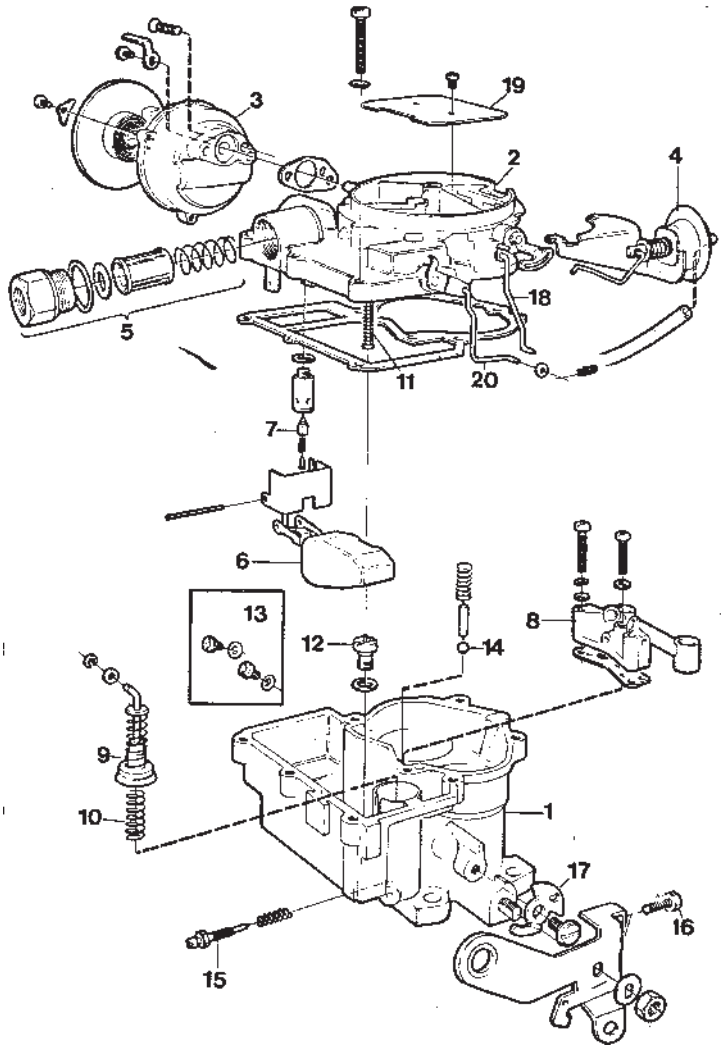
56. Setting the Idle Speed. Connect a shop tachometer to the engine. Using the adjustment screw (1) set the idle speed as per Technical Data.



57. Installing the Carburetor Cover.
Before installing a new gasket, check that the float needle baffle is correctly installed. Lower the cover. Check that the accelerator pump locates correctly in the return spring. Fit the screws and tighten them evenly in the sequence shown in the illustration. Install all linkage and the vacuum break. See also Fig. 55.

Overhauling and Checking Carburettor Nikki, 500B

58. Functional description of the Nikki Carburettor

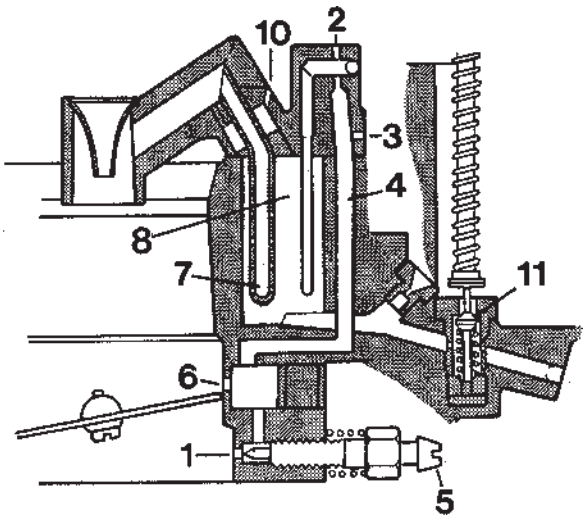


1. Carburettor body with Float Chamber
2. Air horn
3. Choke body
4. Vacuum Break
5. Fuel Intake with Filter
6. Float with mounting
7. Carburettor Float Needle
8. Venturi cluster
9. Accelerator Pump
10. Return Spring, Accelerator Pump
11. Power Piston
12. “Power Valve”
13. Main Jet
14. Pump Discharge Valve
15. Idling Mixture Screw
16. Idle Screw
17. Fast Idle Cam
18. Choke Linkage
19. Choke Valve
20. Pump Linkage

The Nikki carburettor is a two-barrel, one-stage carburettor. The diameter of each barrel (venturi) is 43 mm (11/16").

The carburettor has two barrels and two different and completely separate systems for measuring fuel and air. At idling speed and partial-load driving, fuel is fed to the carburettor by the main jets. The fuel runs into the main wells, one for each opening. The wells have fuel tubes for idling/partial-load systems and emulsion tubes for the main metering/full load system.

The idling system supplies the engine with fuel when the throttle plate is partly or completely closed. It is helped by negative pressure from the air inlet.



When the valve is closed, the negative pressure at the opening (1) under the valve is high. There is atmospheric pressure at the opening (2). The large difference in pressure causes air to rush into the mixing channel taking fuel with ft.

More air is taken in through the other opening (3). Fuel/air is mixed in the mixing channel (4) which opens out at the idling outlet (5). The amount of fuel/air is regulated by the Mixture Screw (6).

The idling system has an extra opening (4) which starts to function when the negative pressure reaches the opening at the petrol valve. This gives a smooth transition from idling to partial-load driving.

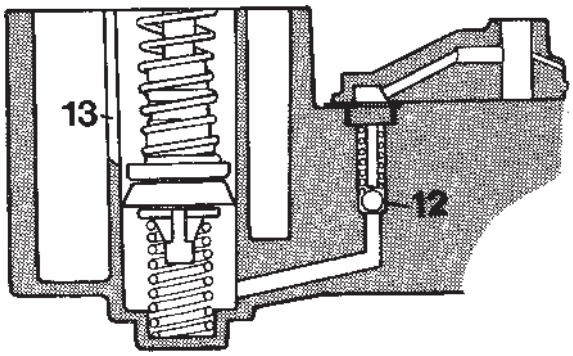
The main metering system consists of emulsion tubes (7) which are embedded in the main fuel channels. The full-load system starts working gradually when the petrol valve begins to open and air enters into the venturi tubes (openings) in accordance with the venturi principle which states that when air flows through a constricted tube, flow is fastest and pressure lowest at the point of maximum constriction.

In the carburettor, this is utilized by placing the opening of the discharge nozzle inside the venturi itself. To further increase the vacuum signal, the discharge nozzle opening is formed into a booster venturi.

The main fuel well (8) receives air through the air bleed (10); in this way, the movement of fuel/air is accomplished with the help of negative pressure. The fuel/air mixture is created in the emulsion tube (7) when air flows in through the holes in the side of the well.

The power system is a part of the main metering system and provides additional metered fuel when high speed or high load conditions exist. Under either condition, the vacuum in the air inlet is at its lowest (close to atmospheric pressure) due to the large air flow when the valve is fully open. The engine is operating with a surplus of air and to get higher output additional fuel must be provided; negative pressure is allowed to control a plunger which has a spring on it (11) which opens an extra passage for fuel in addition to the main one. The “Power Valve”, as it is called, is equipped with a loaded spring which opens when the Power Valve vacuum plunger is reached. When the vacuum in the engine increases, the vacuum plunger will move upwards and the Power Valve will be closed by its loaded spring.

The accelerator pump is of the diaphragm type equipped with a loaded spring. The pump is operated mechanically from the throttle arm. When acceleration occurs, the diaphragm is pushed downwards and fuel is forced from the cylinder of the pump.



The pressure of the fuel then opens the seat valve (12), and fuel reaches the two jets which direct the fuel booster venturi at each of the openings. When the downward movement of the plunger has ceased, the pressure is lowered in the fuel well and the seat valve is closed; thereby preventing air from entering the pump housing or that the channel is sucked dry by the air stream in the venturi tube.

The pump plunger is pushed upwards by the loaded spring and the cylinder can once again be filled from the float chamber using the slots (13).

The carburettor is equipped with an electric choke. The choke cover has a bimetallic spring strong enough to keep the choke valve in a closed position. In the case of cold starts, the bimetallic spring is electrically heated.

When the engine has been turned off and it has cooled down, the spring contracts and closes the valve.

59. Removing the carburettor

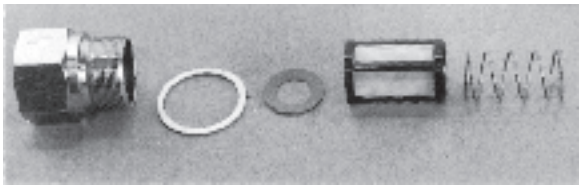
Remove the carburettor flame arrestor, wrench size 11 mm. Remove the throttle cable from the control mechanism. Remove the fuel line, wrench size 17 mm. Remove the carburettor, wrench size 13 mm.
IMPORTANT NOTE! Do not forget to disconnect the electrical connections to the choke.

60. Dismantling the carburettor cover
IMPORTANT NOTE! Before disassembling the carburettor, it must be cleaned if it is dirty externally. Clean carefully using a brush and carburettor cleaner, thinners or other solvents.

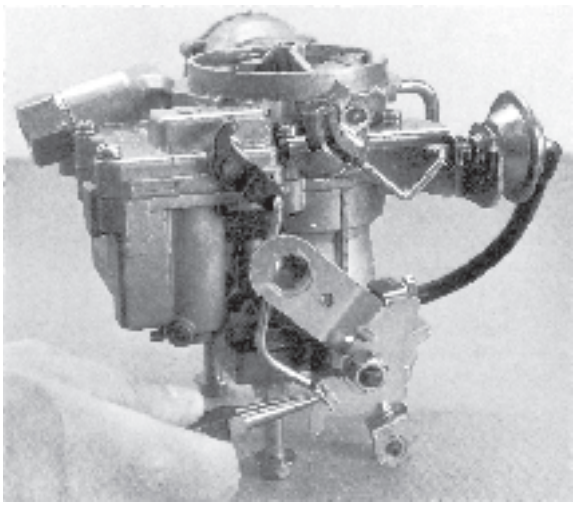
WARNING! Always work in well ventilated areas. Open flames are very dangerous.

IMPORTANT! Do not use more cleaner than absolutely necessary and minimize your exposure to these solvents as they can be harmful. The carburettor must never be immersed in cleaning fluid to loosen up dirt. Rubber and plastic components can be damaged by certain types of cleaning solvents.

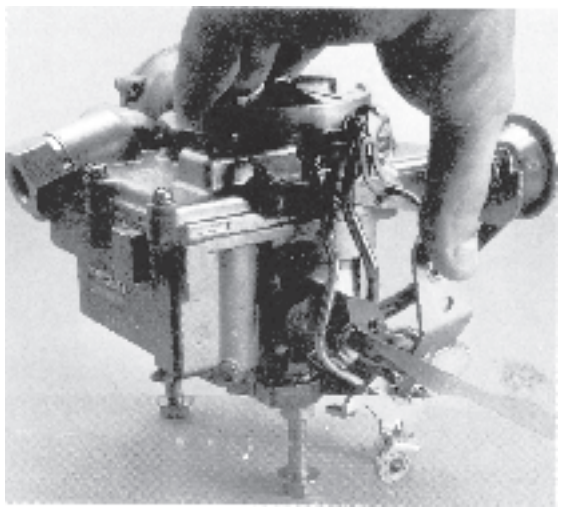
Hold the carburettor in a horizontal position with the flame arrestor installed. If compressed air is used for drying and blowing clean, pull a plastic bag over the flame arrestor. Blow from above and downward. Do not direct the air in from underneath the carburettor. Remove the flame arrestor and wipe both the upper edge and the underside clean with a clean lint-free rag.



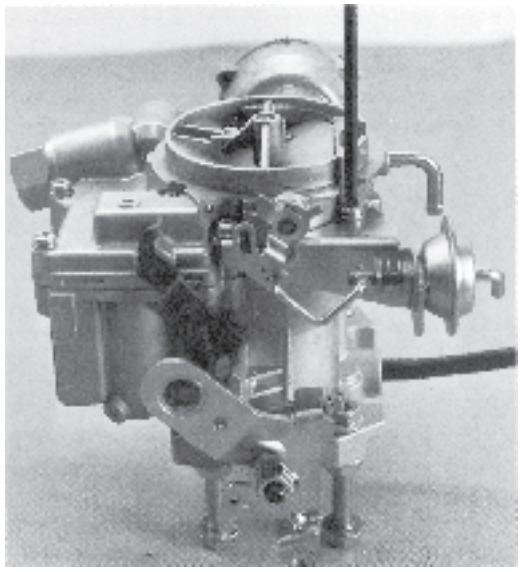
61. Dismantling and cleaning the fuel filter. If the filter is very clogged up, unfiltered fuel may reach the carburettor if the fuel pressure is greater than the pressure of the filter spring. Should this happen, the whole carburettor will need to be carefully cleaned.



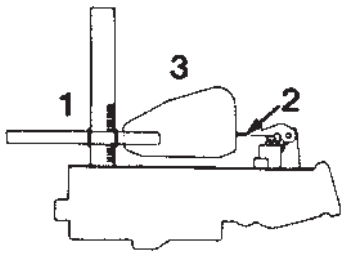
62. Remove the pin for the linkage of the accelerator pump.



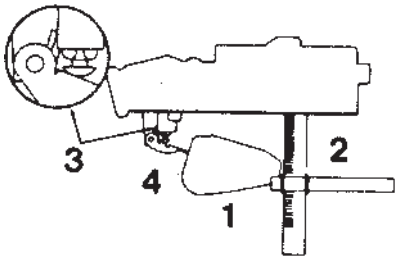
63. Remove the idle cam.



64. Remove the eight screws for the carburettor cover. If the cover is stuck, gently knock it with a screwdriver handle until it loosens. Disconnect the vacuum tubing and remove the vacuum break and linkage as a unit.

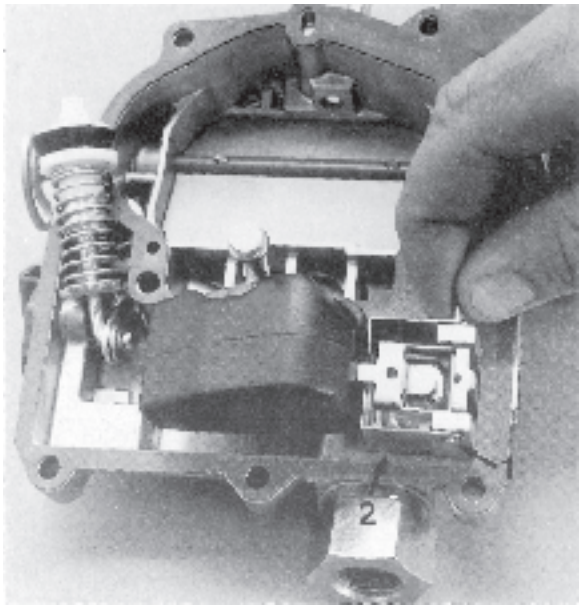


65. Checking and adjusting the float level, upper position
Measure from the lower dot on the float to the carburettor gasket which should be in place. Use T-gauge 884616-4 (1). The level of the float should be 12.5 mm (0.49") ±1.5 mm (0.06"). To adjust: Bend float arm (2) at the point by the arrow. After adjustment, check that the float (3) is hanging straight.



66. Checking and adjusting the float level, lower position

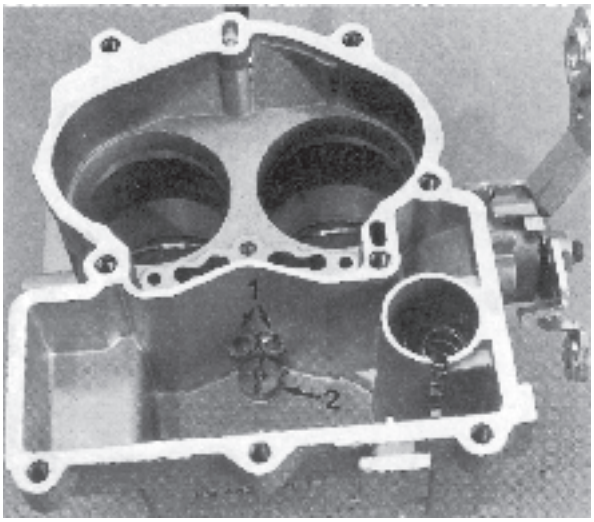
Turn the carburettor right side up and let the float (1) hang free. Measure from the gasket to the seam at the tapered end of the float. The level (2) should be 36.5 mm (1 7/16"). To adjust: Bend tang (3) at the point indicated by arrow. Check that the float needle (4) does not stick at the maximum position.



67. Replacing the float needle

Remove the float by applying pressure to the float shaft (1). The float needle can now be unhooked from the float arm.

NOTE! The float needle consists of 3 separate and loose pieces. Unscrew the seat using a 10 mm (3/8") wide-blade screwdriver. Screw the new seat in place using a new seal. Do not forget to fit the baffle (2) around the float needle.

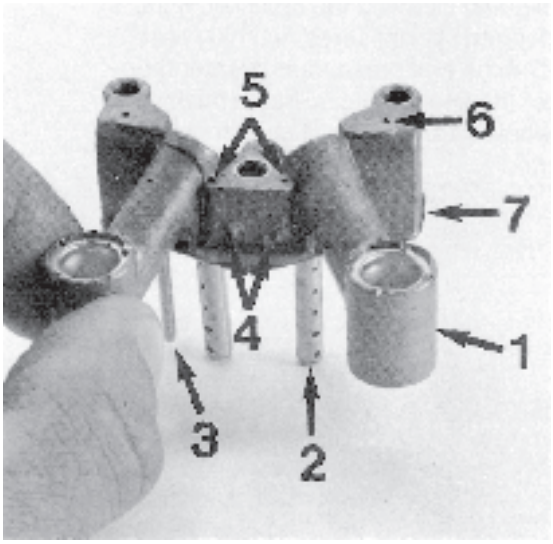


68. Changing the main jets

Loosen the main jets with a wide-blade screwdriver. The carburettor is equipped with two main jets (1) size 185 and a Power Valve.

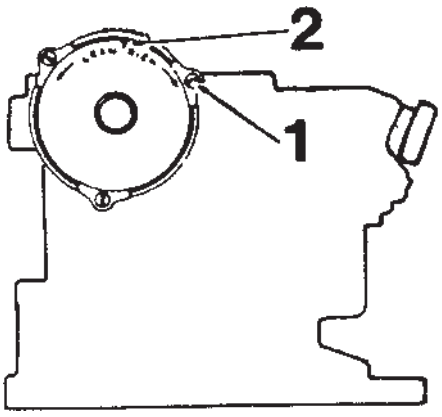
69. Fuel channels

Blow-clean the air bleeds and fuel wells with compressed air. Remove the booster venturi and blow-clean it separately.

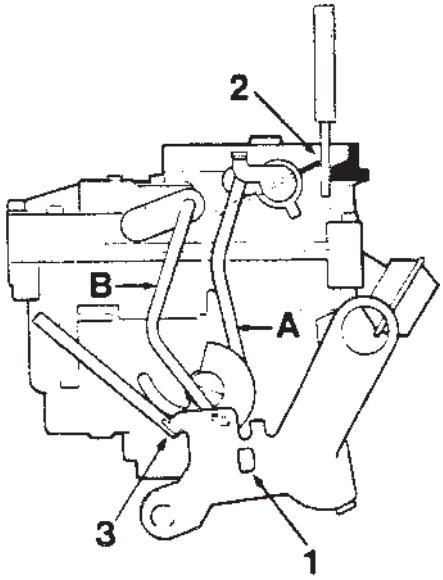


Booster venturi construction:

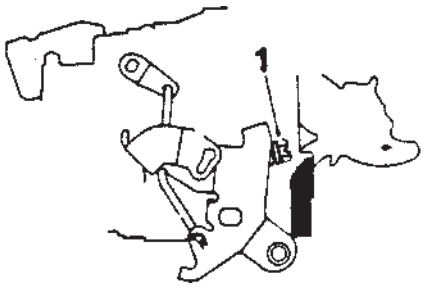
1. Venturi cluster for the main metering system
2. Emulsion tubes
3. Fuel tube system
4. Acceleration pump nozzle
5. Main air bleed
6. Idle air bleed
7. Idle air bleed



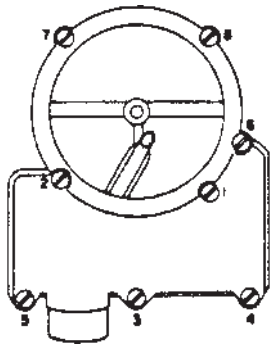
70. The choke coil setting
Loosen the locking screws (1). With the choke valve fully open (cold choke), turn the choke cover against the tension of the bimetallic spring until the choke closes. Then turn to the 0-mark (2) on the choke housing. Tighten the locking screws (1).



71. Checking the choke unloader
Hold the throttle valve (1) completely open. Measure between the upper edge of the valve and the carburettor bore. The clearance (2) should be 6 mm. To adjust: Bend the tang (3). A and B refer to the mounting order of the linkage 9 the carburettor cover has been removed. Link A should be mounted before link B.



72. Setting the idle speed
Connect a shop tachometer to the engine. Using the adjustment screw (1), set the idle speed in accordance with Technical Data.



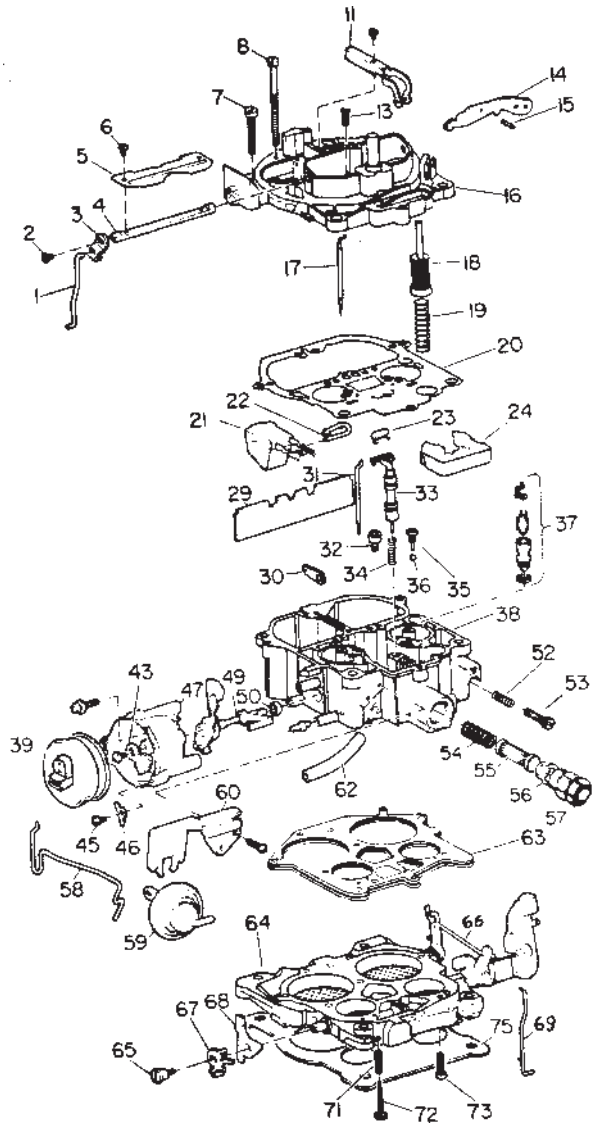
73. Installing the carburettor cover
Before installing a new packing, check that the float needle baffle is correctly installed. Lower the cover. Check that the accelerator pump positions itself correctly in the return spring. Mount the screws and tighten them evenly in the sequence indicated in the illustration. Install all linkage and the vacuum break. See also Fig. 71.

Overhauling and Checking the Carburetor 501A, 570/MS4 (AQ231, BB231, BB261)

Functional Description – Carburettor: Rochester 4ME

The carburetor is a four barrel, two-stage, down-draught carburetor.

74. Carburetor Construction, Rochester 4ME.



1. Linkage for choke valve
2. Screw for the choke valve shaft
3. Choke valve lever
4. Choke valve shaft
5. Choke valve
6. Choke valve screw (2)
7. Screw for carburetor air horn (short)
8. Screw for carburetor air horn (long)
11. Secondary fuel needle hanger
13. Screw for carburetor air horn (countersunk – 2)
14. Control lever for pump
15. Shaft for pump lever
16. Carburetor air horn, complete
17. Fuel needle, secondary
18. Pump, complete
19. Spring, pump return
20. Gasket, carburetor air horn – fuel bowl
21. Float, complete
22. Float shaft, complete
23. Spring, holder for primary fuel needles
24. Intermediate piece, fuel bowl
29. Protection plate, secondary venturi
30. Lever, choke rod (lower part)
31. Fuel needle, primary (2)
32. Main jet, primary (2)
33. Power piston for fuel needles, primary
34. Spring
35. Holder, ball pump discharge
36. Ball, check valve accelerator pump
37. Float needle and seat, complete (standard)
38. Fuel bowl, complete
39. Choke cover with spring
43. Arm
45. Locking screw
46. Locking washer
47. Chock housing
49. Shaft with lever
50. Seal
52. Spring, adjuster screw idle
53. Screw, idle speed adjustment
54. Spring, filter discharge
55. Filter, fuel intake
56. Gasket, fuel filter
57. Filter nut, fuel intake
58. Rod for vacuum break
59. Vacuum break, complete
60. Bracket for vacuum break
62. Hose for vacuum break
63. Gasket, throttle body – fuel bowl
64. Throttle Body, complete
65. Fastening screw, throttle lever
66. Linkage, secondary valve
68. Lever
69. Linkage, accelerator pump
71. Spring, fuel needle idle mixture
72. Fuel needle, idle mixture
73. Fastening screw, throttle body to fuel bowl
75. Gasket, throttle body – inlet manifold

75. **The first stage** (primary side) consist of two 13/8" (35 mm) barrels where the fuel is metered through a combination of fixed main jets and tapered fuel needles (32). The up and down movement of the fuel needles (31) in the main jets is controlled by a spring loaded power piston (33). The power piston is regulated by manifold vacuum.

The primary side is also equipped with an accelerator pump consisting of a spring loaded piston (18) that moves in a fuel filled well. Movement of the piston is controlled by a lever (14) that is connected by linkage (69) to the throttle mechanism. When the throttle is opened it pushes the piston down into the well forcing fuel through the accelerator pump check valve (36) to a passage and into the primary venturi.

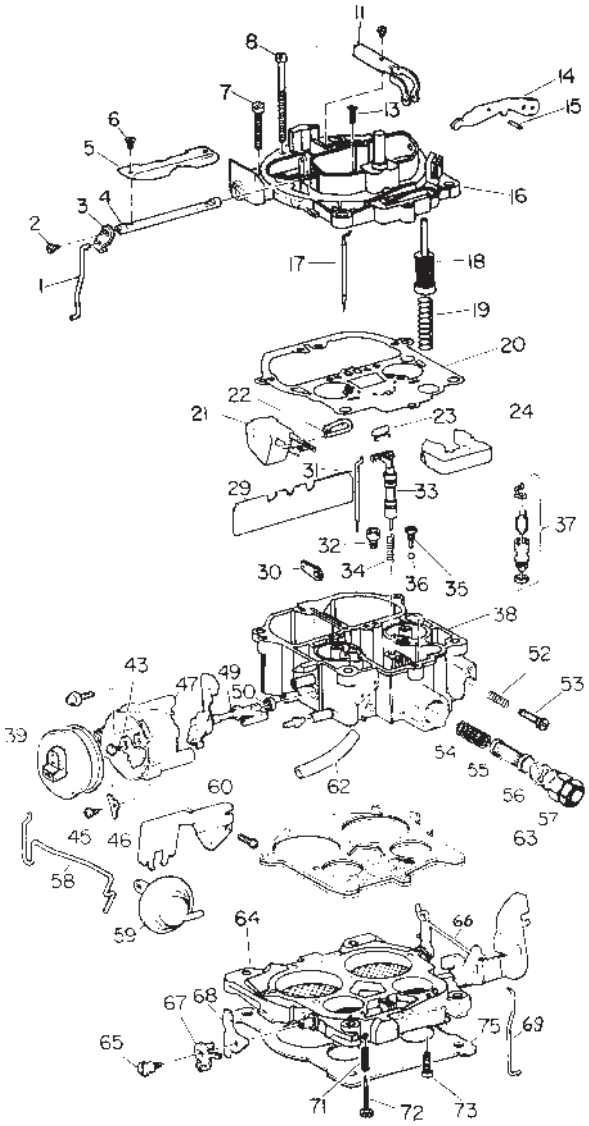
The accelerator pump piston contains a check valve on the piston plunger itself. When the piston moves downward into the fuel well the valve is closed. When the piston moves upwards, the valve opens allowing the fuel well to fill and any gas to escape. The accelerator pump check valve closes when the pump piston moves upward preventing air from being sucked into the pump well.

76. **The second stage (secondary side)** consists of two 2 1/4" (57 mm) venturis controlled by a mechanical set of throttle plates as well as a vacuum operated air valve. When the primary side throttle is completely opened, linkage (66) opens the mechanically operated secondary throttle plates located at the bottom of the carburetor bore (16). This exposes the vacuum operated secondary air valve, mounted at the top of the carburetor bore (16), to manifold vacuum. As the air valve opens an eccentric cam mounted on the air valve shaft lifts the hanger (11) and in turn the secondary needles (17). The tapered needles lift out of a fixed orifice which meters the fuel proportionate to the air flow through the venturi. The higher the needle is lifted the more fuel is delivered to the secondary venturi.

77. **The fuel bowl** is centrally located between the two primary venturis, which makes for a short fuel transfer distances to both the primary and secondary fuel circuits. The float (21) is made of a closed cell plastic material hung on a lever, which pivots on a shaft (22). The other end of the lever operates the float needle which works in a brass seat (34).

The incoming fuel must first pass through a spring loaded filter (55). Should the filter become blocked so that fuel cannot flow through, the fuel pump pressure will overpower the spring pressure (54) and bypass the clogged filter element.

78. **Idle System.** The primary side of the carburetor incorporates an idle system to supply the correct air/fuel mixture during idle and off-idle operation. The idle circuit is necessary since airflow through the venturi at these slow engine speeds is insufficient to obtain efficient metering through the main metering system. Fuel flows from the main jets to the main well. It then passes through the idle passage where it is picked up by the idle tube. At the top of the idle tube it mixes with air from the idle air bleeds and flows down another passage, through an idle channel restriction, and exits through the idle discharge hole below the slightly opened throttle plate. The idle discharge hole has an adjustment screw (53) to provide the correct mixture setting. Turning the screw in (clockwise) leans the mixture out and turning it out (counter-clockwise) richens the mixture up.



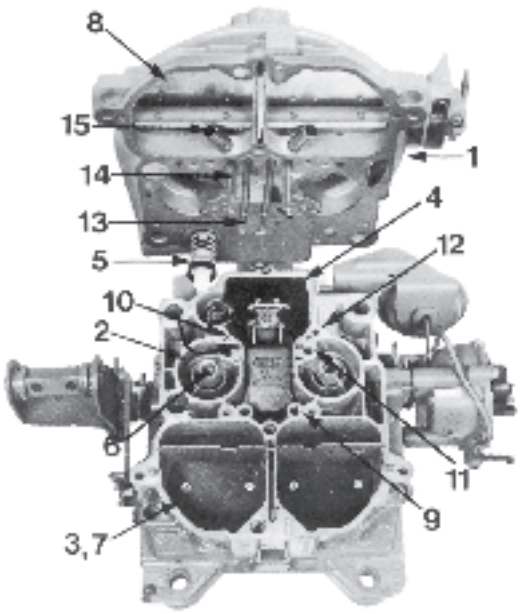
79. **Vacuum break.** The secondary air valve is controlled by a vacuum break (59). It consists of a spring loaded diaphragm which is connected to the air valve by a piece of linkage (58). When manifold vacuum exceeds 127–152 mm Hg (5–6" Hg) the diaphragm fully retracts by overcoming the spring tension. In this position the linkage (58) is in the rearmost of the slot of the air valve lever and the air valve is consequently closed.

During acceleration or when the engine under load manifold vacuum drops and the diaphragm spring overcomes the effect of the vacuum on the diaphragm and presses it outward. The linkage (58) extends and moves forward in the lever groove and allows the air valve to open.

The vacuum connection to the diaphragm has a restriction to provide gradual opening of the air valve. This is done so that the heavier fuel gets a chance to start to flow to the secondary discharge nozzles to prevent a lean mixture.

80. The carburetor has an **electric choke.** There is a bimetallic spring which keeps the choke valve in the closed position when the engine is cold. Upon starting the bimetallic spring is electrically heated and the spring begins to unwind. As it unwinds it begins to open the choke valve by means of the choke arm (43) and linkage (1). When the choke shaft (49) turns as the choke opens it releases the lock for the secondary air valve and allows the secondaries to operate if required.

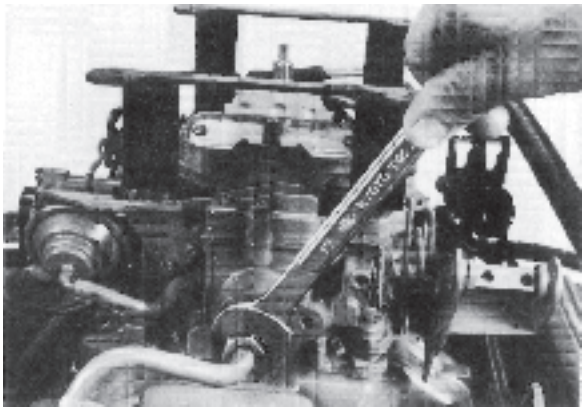
As the spring pressure holding the choke closed decreases the vacuum underneath will gradually take over so that the valve will continually open until the spring is completely unwound. The electric heating of the choke is done in two stages with a built-in thermostat monitoring the temperature of the choke housing. If it is sufficiently hot, due to the rising heat from the engine, the spring will be heated rapidly. In this condition the bimetallic spring is already partially unwound due to the engine heat, the choke valve will open much faster. Therefore little or no choke is used when starting a warm engine.



81. Carburetor Air and Fuel System.

1. Carburetor cover
2. Primary barrel (first stage)
3. Secondary barrel (second stage)
4. Fuel bowl
5. Accelerator pump (primary barrel)
6. Primary venturi with discharge nozzle
7. Secondary valve
8. Air valve (secondary)
9. Fuel channel secondary barrel
10. Channels, idle system
11. Fuel channel primary barrel
12. Accelerator fuel channel (primary)
13. Fuel needle (secondary)
14. Fuel pipe (secondary)
15. Main jet (secondary)

Overhauling and checking the Rochester 4 ME Carburetor, VP No. 841047-4



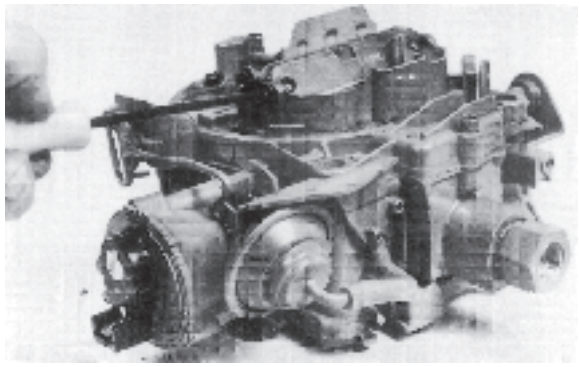
82. Removing the carburetor.
Remove the carburetor protective cover, wrench size 10 mm. Remove the flame arrestor, wrench size 11 mm. Remove the throttle cable from the throttle mechanism. Remove the fuel line, wrench size 17 mm. Remove the carburetor, together with the brackets for the protective cover, wrench size 1/2".
NOTE! Do not forget to disconnect the electrical connections to the choke.

83. Dismantling the carburetor cover.
NOTE! Before opening the carburetor, it must be cleaned if it is dirty externally. Clean carefully using a brush and carburetor cleaner, thinners or other denatured alcohol.

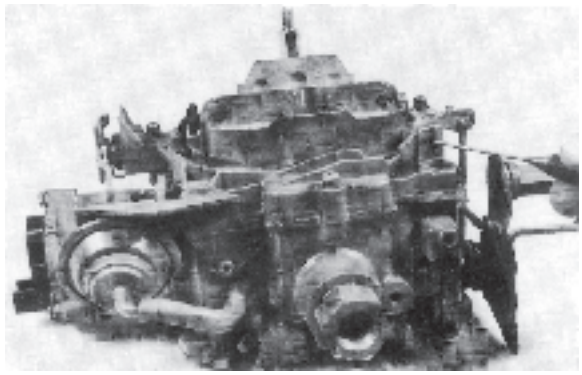
WARNING! Always work in well ventilated areas. No open flames!

IMPORTANT! Never use more cleaner than absolutely necessary and minimize your exposure to these solvents as they may be harmful. The carburetor must **never** be immersed in cleaning fluid to remove dirt. Rubber or plastic components can be damaged by certain types of cleaning agents.

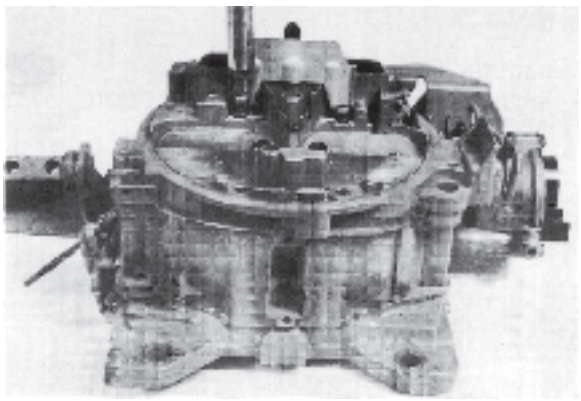
Hold the carburetor in the horizontal position with the flame arrestor installed. If compressed air is used for drying and blowing clean, pull a plastic bag over the flame arrestor. Blow from above and downward. Do not direct the air in from underneath the carburetor. Remove the flame arrestor and wipe both the upper edge and underside clean with a clean lint-free rag.



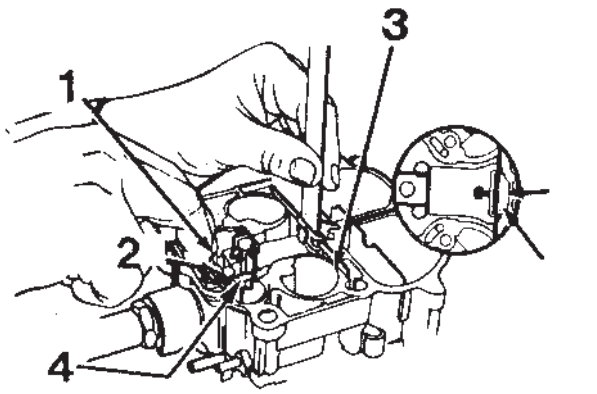
84. Place the carburetor in the fixture 884620-6. Remove the arm for the choke intermediate linkage at the choke valve. Remove the small TRX screw for the secondary hanger (in the middle of the secondary air valve) and pull out the hanger together with the needles.

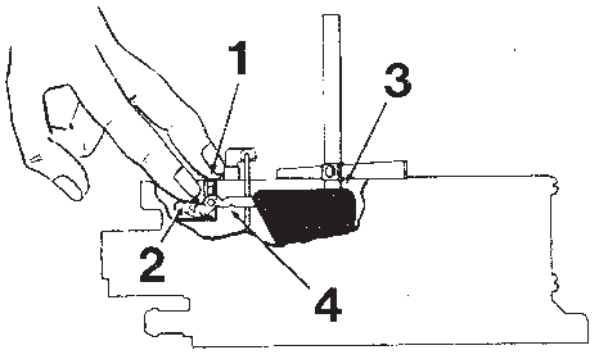


85. Push in the pin for the accelerator pump lever, using drift 884613-1, only far enough to release the lever. When reassembling, the pin is pressed in with a screwdriver.

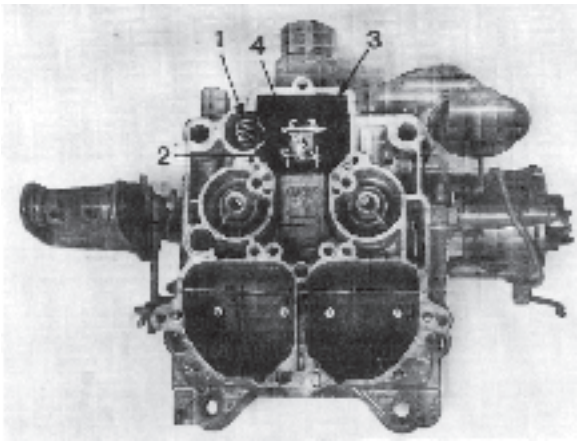


86. Remove the center stud. Remove the two countersunk screws in the carburetor bore, remove the two baffle screws and the three short and two long screws. All the screw heads are TRX 20. Pry loose the carburetor cover carefully so that it releases from the gasket. Lift the cover and remove the vacuum break linkage.
NOTE! Be careful not to let the accelerator pump fall from the cover.

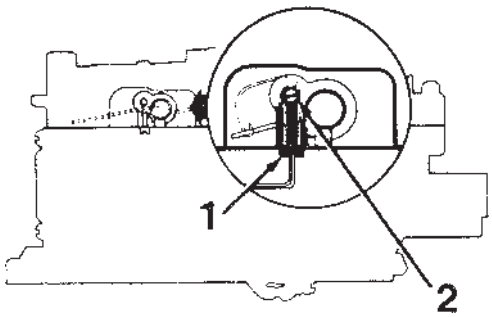




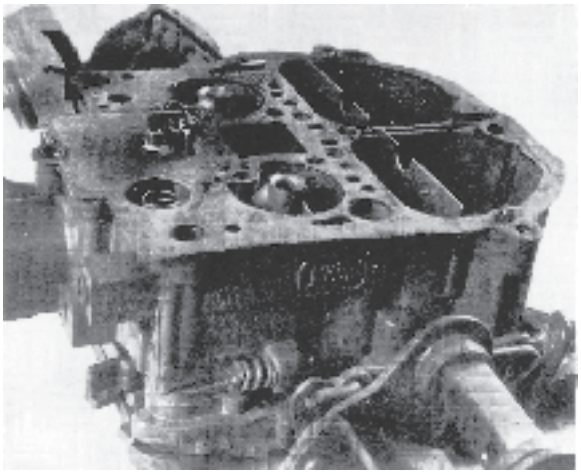
87. Checking and adjusting the float level.
Remove the fuel bowl spacer to allow better accessibility. Hold the float shaft (1) in position while measuring, see diagram. Lightly press the float arm (2) against the float valve.
Measure from the upper edge of the fuel bowl to the top of the float (3), 4.8 mm (3/16") from the tip of the float. Use T-gauge 884616-4. The float level should be 6.1 mm (0.24") Adjusting: Remove the float and bend the float arm (4) up or down. Check after adjusting that the float hangs straight.



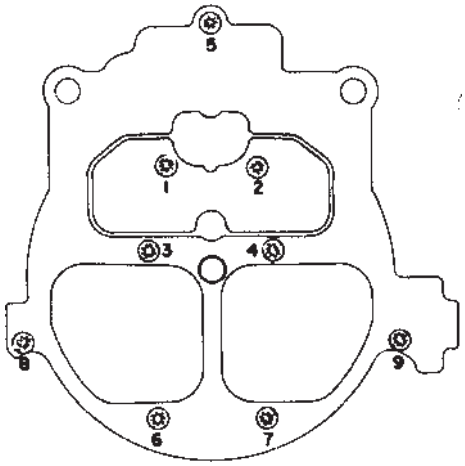
88a. Replacing the needle and seat.
Remove the carburetor cover gasket, being careful where the primary needles pass through the gasket. Remove the return spring for the accelerator pump (1). Remove the power piston together with the primary needles as one unit (2). This is done by repeatedly pressing down and quickly releasing the piston. Remove the fuel bowl plastic spacer (3). Remove the power piston return spring. Remove the float and float needle together by pulling them out by the float hinge pin (4). The float needle and float hinge pin can now be removed from the float. Remove the seat and remove the seal.



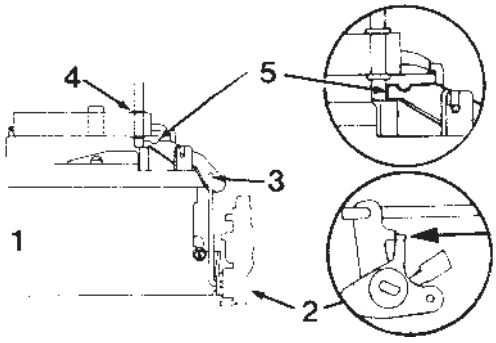
88b. Adjusting the air valve spring.
Loosen the locking screw (1) approximately 1/4 turn using a Torx driver, TRX10. Turn the adjuster screw (2) counter-clockwise until the air valve is partly opened. Turn the adjuster screw clockwise until the air valve just closes, and then turn it another 1/2 turn. Lock with the locking screw (1).



89. Installing the carburetor cover.
Fit a gasket carefully over the primary needles and guide pins. Check that the gasket holes for the fuel passages are correctly centered. Install the vacuum break linkage to the air valve lever. Carefully lower the cover. Check that the accelerator pump locates correctly into the return spring. Install the secondary needles and hanger.

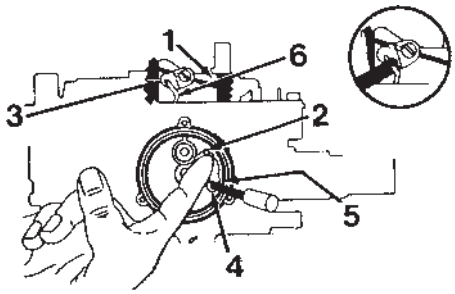


90. Install the two long screws, 6 and 7 and the two countersunk, 1 and 2. Install the baffle with screws 3 and 4. Install the remaining screws and tighten in the sequence shown in the diagram. Install the accelerator pump lever.



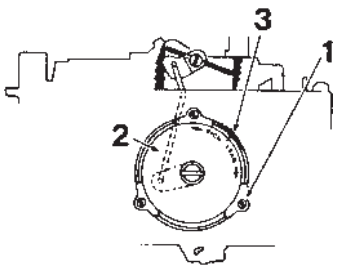
91. Checking and adjusting the accelerator pump stroke.

- Throttle valve (1) must be completely closed.
- If necessary, bend away the stop tang (2) so that the primary throttle valve can be closed completely. (Diagram is with throttle arm removed.)
- The linkage must be in the innermost hole on the accelerator pump lever (3).
- Measure from the top of the carburetor (4) (by the bowl vent) to the pump rod at its upper position. The distance should be 9.1 mm (0.36"). Bend the accelerator pump lever (5) when adjusting.



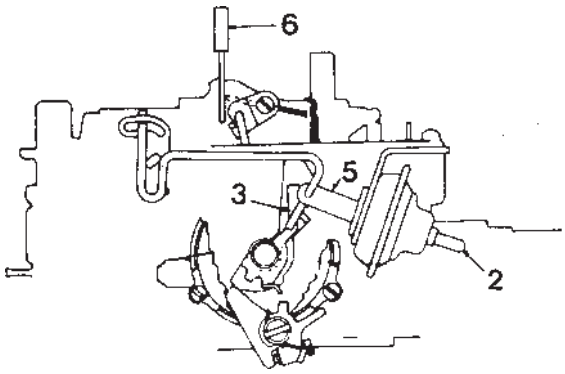
92. Checking and adjusting the choke lever.

- Remove the cover for the choke.
- Close the choke valve (1) by pressing up the choke arm (2) – insert a 3 mm (3/16") drift into the hole in the choke housing.
- The lower edge of the choke arm (4) should make light contact with the drift.
- Adjusting: bend the linkage arm at (5), see diagram insert.



93. The choke coil setting.

- Loosen the locking screws (1).
- With the choke valve fully open (cold choke and engine), turn the choke cover (2) until the choke valve just closes.
- Turn to the 0-mark on the choke housing (3).
- Tighten the locking screws.

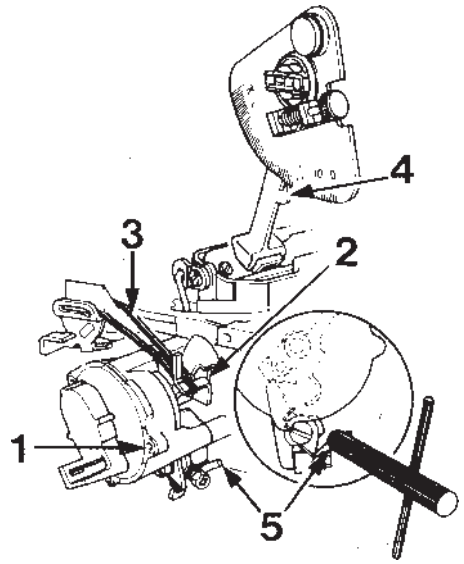


94. The vacuum break setting.

- Place an angle gauge 884617-2 on the choke valve as per points 98–100.
- Apply vacuum (2) with the pump 884618-0 to 18" Hg (60.9 kPa).
- Press the throttle arm tang lightly against the vacuum break rod (3).
- The choke valve should open to the set number of degrees: 26°. Check on the bubble level. If necessary, adjust by bending the throttle arm tang (3).

95. Simplified setting (less accurate)

- Press in the vacuum rod (5)
- Press the valve arm tang lightly against the vacuum break rod (3).
- Measure the valve opening (6) using a 3 mm (3/16") drill bit.
- Where necessary, adjust by bending the throttle arm tang (3)



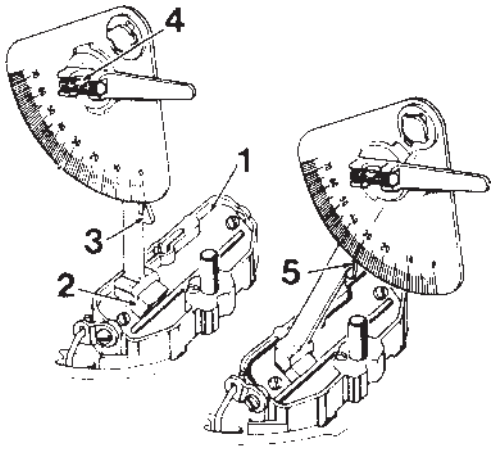
96. Checking and adjusting the choke unloader

- Place an angle gauge 884617-2 on the choke valve as per points 98–100. The choke coil must be at the 0-mark.
- Hold the throttle valve wide open.
- Close the choke valve by pressing up the intermediate lever tang (2). Hold it in place using a rubber band (3).
- The choke valve shall open (incl. linkage play) at 33° (4).
- When adjusting, bend the tang (5).

97. Simplified setting (less accurate).

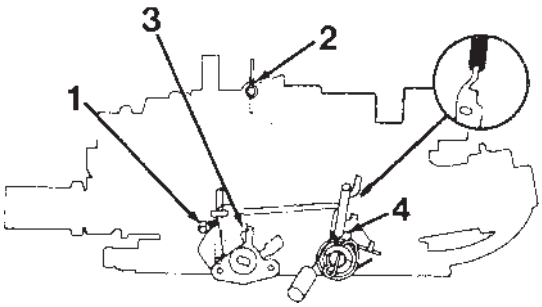
- Follow point 96, except, measure the choke valve opening with a 4 mm (5/32") drill, instead of the angle gauge. Place the drill on the underside of the valve (by the float bowl vent).

98. Measuring with the angle gauge 884617-2.
The angle gauge can be used for measuring the choke valve opening angle. If the carburetor has been removed, it must be placed so that the throttle plates and linkage function in the same way as if the carburetor was installed on the engine.



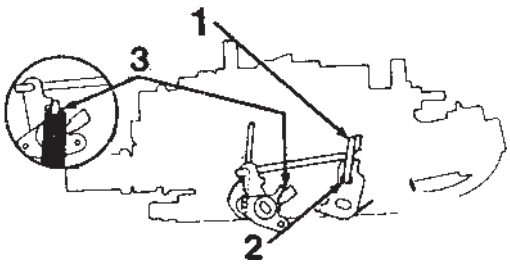
99. Close the choke valve (1) and place the magnetic foot of the tool on the valve (2). Zero the degree plate and center the bubble level (4).

100. Adjust the degree plate to the angle given (33) (5). Adjust carburetor if necessary (as per 94 and 96) until the bubble level is centered.



101. Checking and adjusting the secondary valve opening ratio.

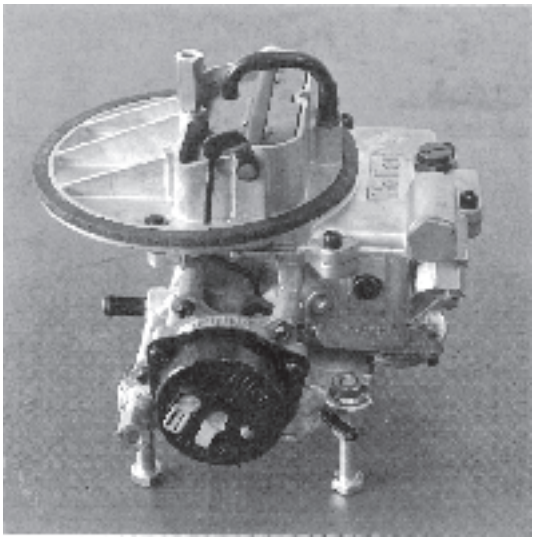
- The screw is set to the correct idle speed (1)
- The choke valve is completely open (2)
- The lever is against the tang (3)
- Measure the clearance in the oval hole (4) 3 mm (1/8"). Do not touch the linkage rod during the measuring
- When adjusting, bend the tang (at the arrow)



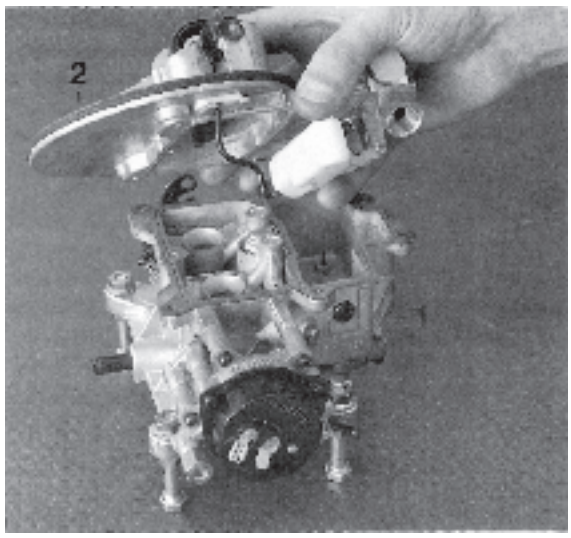
102. Adjusting the arm for the secondary valve (second stage) opening function.

- Open the primary valve until the arm touches the tang (1)
- The arm must be in the middle of the oval hole (2).
- When adjusting, bend the tang (at the arrow) (3)

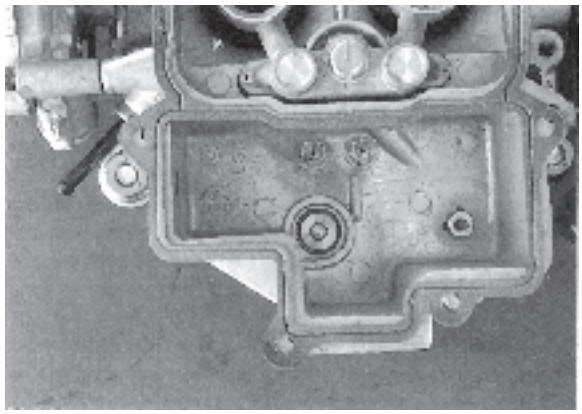
Overhauling and checking the carburetor. Holley 2010, 572



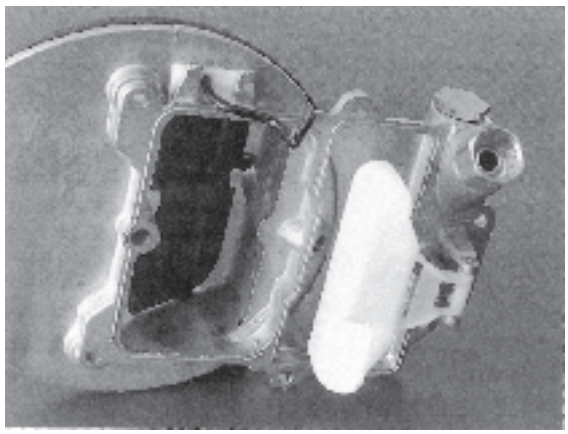
103. The Holley 2010 is a two-barrel one-stage down-draft carburetor. Its construction makes for easy servicing with few main components, which facilitates i.e. cleaning.



104. The carburetor housing (1) is cast in one piece with its two barrels (venturis). The fuel bowl and the choke valve are fitted on the air horn cover (2).

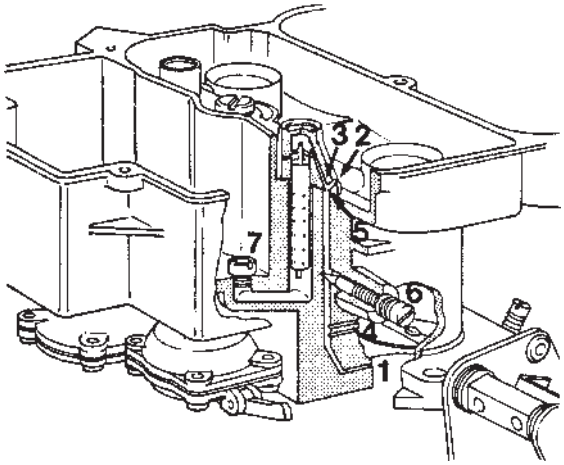


105. The fuel bowl has bottom mounted main jets and a vacuum controlled power valve. The fuel bowl has also a outlet direct to the acceleration pump. The bowl is ventilated with ventilation pipe opening out above the barrels.



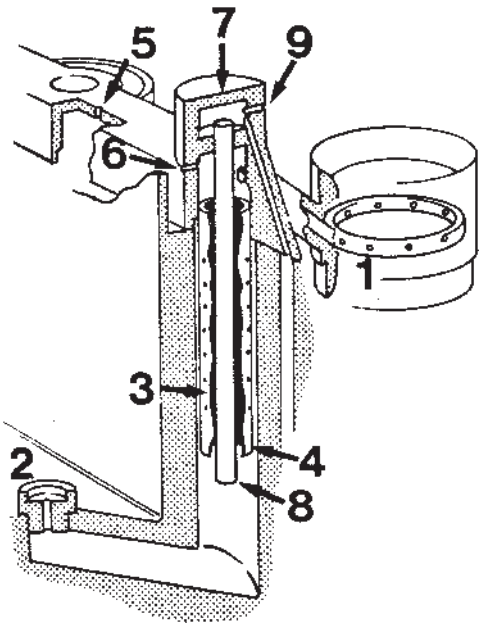
106. The float is made of a plastic material and mounted with a centre pivoted. The float's lever affects the seat valve, which is replaceable. The inlet has fuel filter consisting of a brass mesh.

107. The two barrels are supplied with fuel from the idle system, main metering system, power system and the accelerator pump.



108. The idle system supplies the engine with fuel when the throttle plate is partly or completely closed. It works by using the underpressure from the inlet pipe. When the valve is closed the underpressure at the opening (1) below the valve is high. When opening (2) there is atmospheric pressure. This great pressure difference makes air rush in to the channel, taking with it fuel to the fuel channel's opening (3). This fuel has been mixed with air in the idle well at the top of the booster cluster, see pos 7–9 point 109. The orifice has an adjuster screw (6) which controls the fuel mixture.

The idle system has extra orifices (4), which also start to work when the throttle valve starts opening and the orifice is reached by the underpressure. This gives a smooth transfer from running with help from the idle system to the main system. The fuel supply is done via the main jet (7) into the idle system's fuel channel. When the fuel bowl has atmospheric pressure, the pressure difference helps to suck the fuel (3). The fuel channel has a limiter (5), which controls the amount of fuel for the idle system.



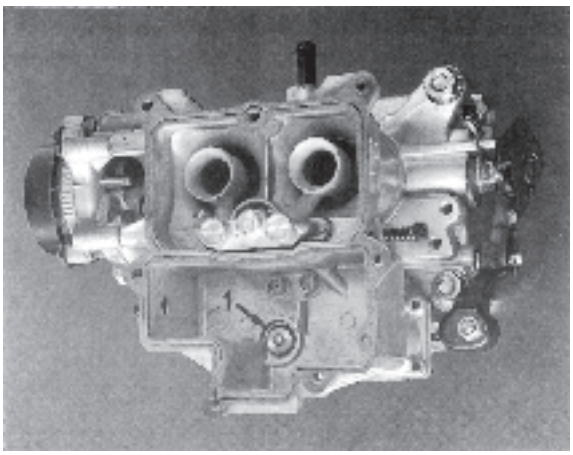
109. Main metering system works on the venturi principle. This means that when air flows through a constricted tube, the flow is fastest and the pressure lowest at the point of maximum constriction.

In a carburetor this is utilized by placing the orifice of the discharge jet in the venturi itself. To further increase the vacuum, the discharge jet's orifice has been formed into a booster venturi (1). The emulsion is led from the fuel bowl through the main jet (2) into the main well (3).

The fuel/air mixture is obtained there by the air flowing from the booster venturi (4) tubes. The tubes have drilled side holes and are recessed in the main fuel channels. Air flows into the inlet port (5), where there is atmospheric pressure, down and into the tubes' side holes. The pressure difference between the booster venturi (1) where the fuel/air mixture flows out (vacuum) and (5) and the fuel bowl (atmospheric pressure) create, in this way, the driving force for the fuel transfer. Extra air, which helps with the fuel transfer is taken in via (6). The idle system's fuel mixing chamber, which is supplied with fuel via the pipe (8) and air through the hole (9), is located at (7).

The amount of air flowing through the venturi decides the amount of fuel to be pressed out from the fuel bowl.

When the valves are fully open the air speed in the venturi is greatest, the pressure in the venturi is at it's lowest, and the fuel transport is the highest. The replaceable main jets limit the fuel flow. The main jets are marked with the flow capacity in cm^3/min.



110. The power system is part of the main metering system and complements it at high speed operation or if high load conditions exists. In these cases the vacuum in the intake manifold is at its lowest (near atmospheric pressure) due to the great air flow with fully open valve.

At full load one requires as high power output as possible and this is achieved by adding more fuel to the air surplus. Therefore, one allows the underpressure to control a spring loaded vacuum valve (1), which opens an extra channel for fuel above the main jet. This so-called “Power valve” is marked with a number corresponding to the vacuum at which it opens. An 65 power valve will open when the vacuum drops below 6.5 inches of mercury.

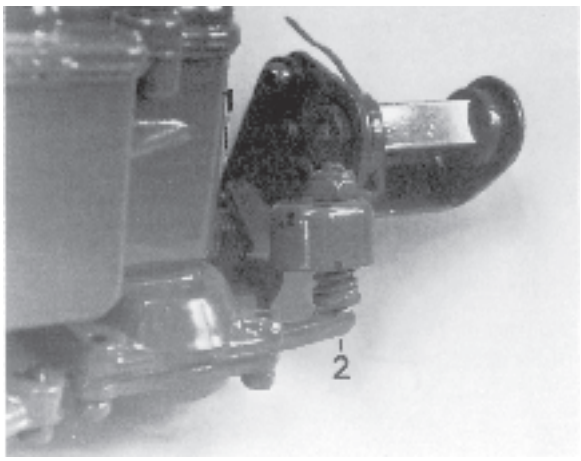
When the valves starts to close and the underpressure increases, and the spring force will be overpowered closing the extra fuel channel. This allows the carburetor to provide optimum efficiency with low fuel consumption in the intermediate range and yet still provide the possibility of high power outputs.

111. The accelerator pump is of the diaphragm type and is at the bottom of the fuel bowl.

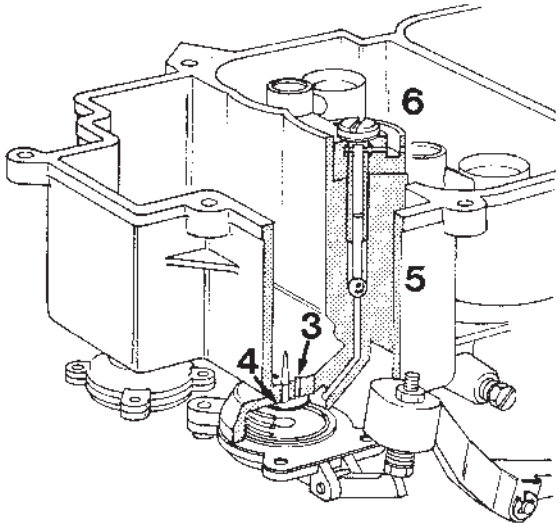
The accelerator pump has two functions:

1) To compensate for the lack of fuel when the throttle opens and air rushes in. The lack of fuel occurs due to the fuel being considerably heavier, i.e. has a higher density than air. This leads to inertia in the fuel supply at rapid throttle changes resulting in a too lean fuel/air mixture.

2) To compensate for the fuel which condenses on the intake manifold surfaces when the throttle is opened rapidly at low engine speeds. A sudden drop of the vacuum tends to condensate the fuel.



112. The pump is driven mechanically from the valve shaft. The throttle shaft is equipped with a plastic cam (1) which operates the acceleration pump lever (2) through an intermediate lever. The construction of the cam decides the pump’s capacity, and its profile how this fuel amount is distributed during the throttle’s opening.



113. The fuel runs down into the pump from the fuel bowl via the channel (3). When the pumper lever presses up the spring loaded diaphragm, the supply diaphragm (4). The fuel is then pressed further in a channel to a seat valve (5) which opens allowing the fuel to reach the jets. These squirt a jet aimed at the booster venturi in the barrels.

When the pressure drops in the fuel channel the seat valve (5) closes, preventing air from entering into the pump housing or the channel is sucked dry by the air flow in the venturi. The seat valve consists of a ball with a pin as counterweight. When the pressure drops in the pump housing, the weight of the fuel bowl fuel opens the return diaphragm allowing the fuel to run down into the pump housing. At the same time, the return spring in the pump presses back the pump diaphragm, thus creating the pump’s capacity.

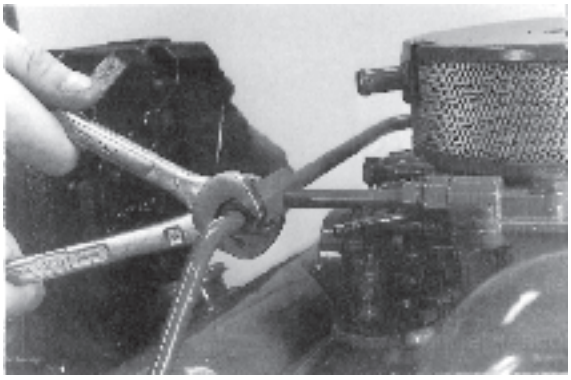
114. **The choke** is of the electric type. The choke cover contains a bimetallic spring which by means of its spring pressure keeps the choke valve in the closed position. When starting from cold, the bimetallic spring is heated electrically. Once the engine has started, a vacuum controlled piston in the choke housing pulls the choke valve to a preset position, the so-called “qualified” position. The remainder of the choke valve’s opening is done by the bimetallic spring.

When the engine is stopped and cools down, the spring pulls together and closes the valve.

Overhauling and adjusting the carburetor

Carburetor overhauling Holley 2010

Technical data	VP nr 857147-3
Choke setting	7 marks from left



115. Removing the carburetor from the engine: Remove the carburetor’s protective cover, socket size 10 mm. Disconnect the electrical connection to the choke and the vacuum tube to the fuel pump. Remove the throttle cable and return spring. Remove the fuel pipe connections. Wrench sizes 17 and 19 mm.

WARNING!
Be careful to avoid fuel spillage.

Remove the carburetor from the intake manifold. Wrench size 1/4" allen.

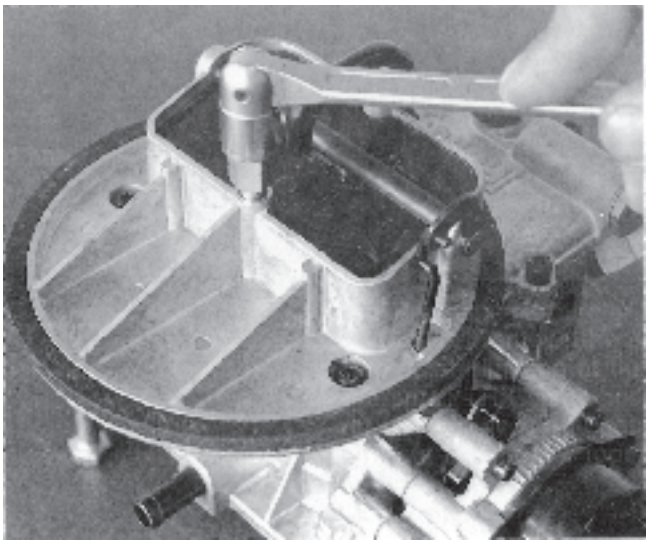
116. Removing the carburetor cover:
NOTE! Before opening the carburetor it must be cleaned externally if dirty. Clean carefully using a brush and carburetor cleaner, thinners or denatured alcohol, i.e methylated spirits.

WARNING! Always work in well ventilated areas: Open flames are not allowed nearby.

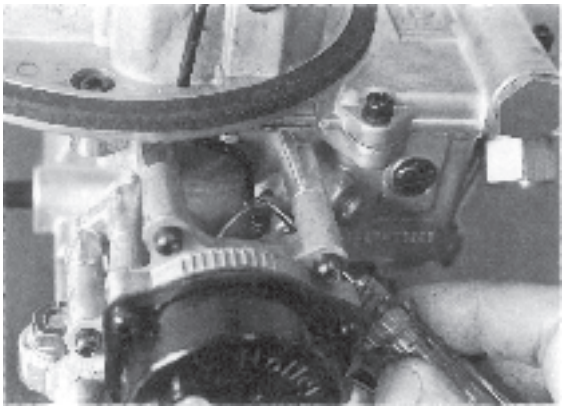
Important! Do **not use** more cleaner than absolutely necessary and only for shortest possible time. The carburetor must **never** be immersed in cleaning fluid to loosen up dirt. Rubber and plastic components can be damaged by certain types of cleaning solvents.

Hold the carburetor in the normal horizontal position with the flame arrestor fitted. If compressed air is used for drying and blowing clean, a plastic bag must be pulled over the flame arrestor as protection. Blow from above and downwards, do not direct the air flow in from underneath the carburetor. Remove the flame arrestor and wipe the upper and lower sides clean using a clean lint-free rag.

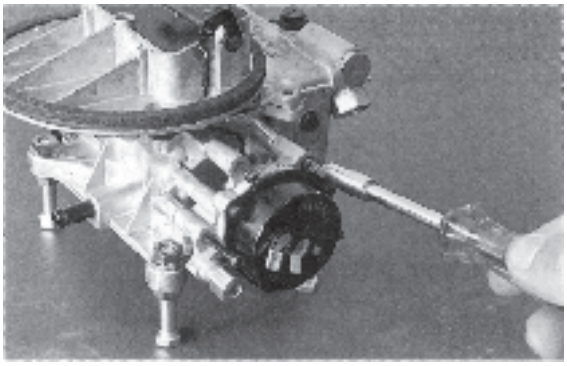
117. Place the carburetor in fixture 884620-6. Alternatively, fit four M8 or 5/16" bolts with a minimum length of 45 mm (1 3/4") in the carburetor mounting holes to provide a raised working position.



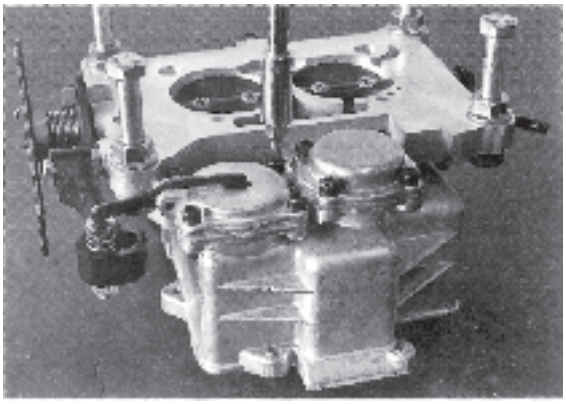
118. Unscrew the carburetor’s centre bolt. Wrench size 11 mm.



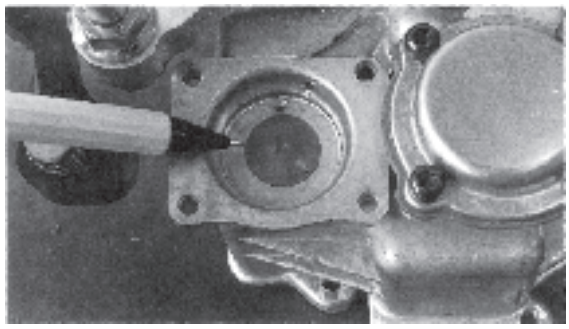
119. Remove the wire clip that secures the choke linkage.



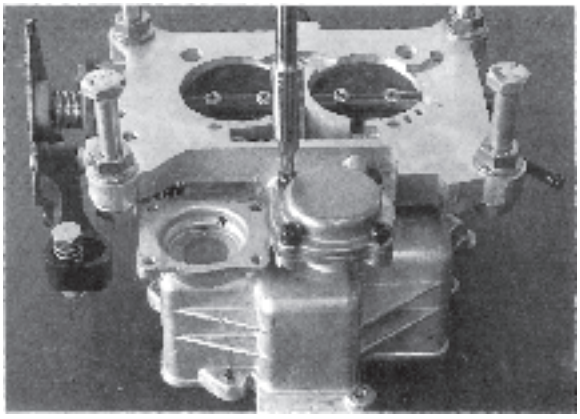
120. Unscrew the 3 TORX-20 bolts and remove the choke housing. Unscrew the 6 TORX-25 bolts and carefully lift off the air horn cover. It might be necessary to knock lightly using a screwdriver handle or a plastic mallet to separate the units.



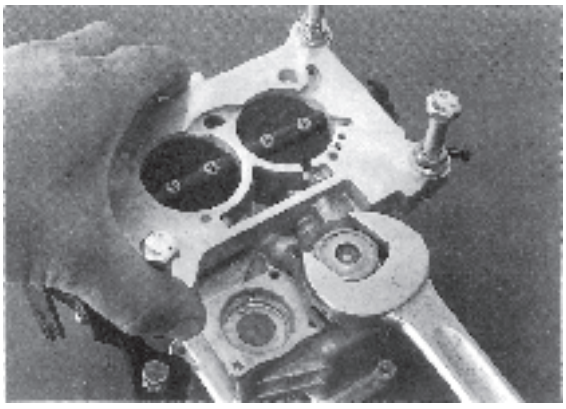
121. Remove the accelerator pump from the fuel bowl. Bolt head TORX 20.



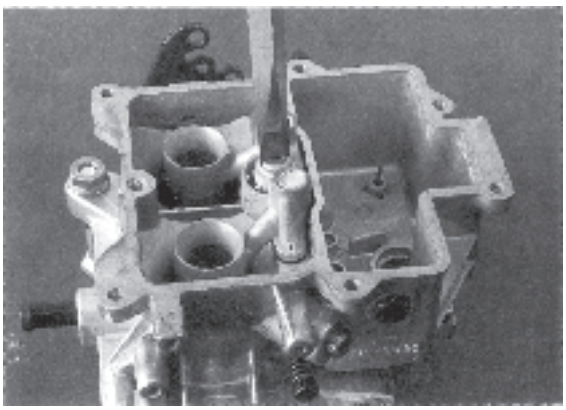
122. Remove the pump diaphragm and the return spring. Leave the check valve diaphragm in place, as per figure. Check that the diaphragms are undamaged.



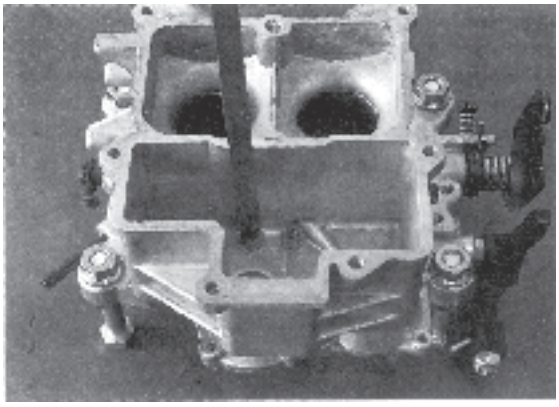
123. Remove the power valve covers. Bolt TORX 20.



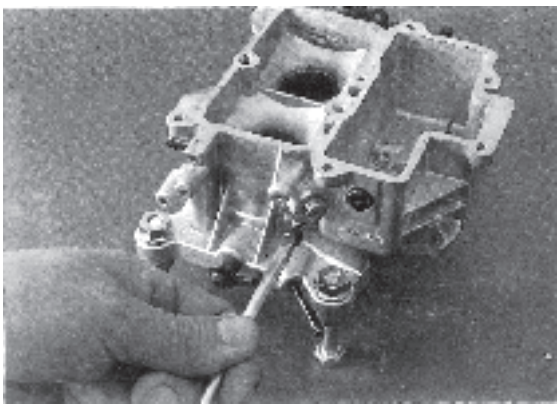
124. Remove the power valve using a 1" ring wrench or socket. When reassembling, tighten the valve to a torque of 11 Nm (1.1 kpm/8 ft/lb).



125. Remove the booster venturis.
NOTE! The seat valve for the accelerator pump's fuel channel is located under the hollow bolt that holds the booster venturi.



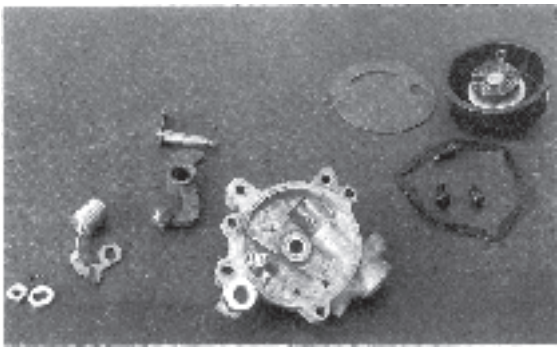
126. Unscrew the main jets from the fuel bowl using a wide-bladed screwdriver, at least 8 mm (5/16") wide.



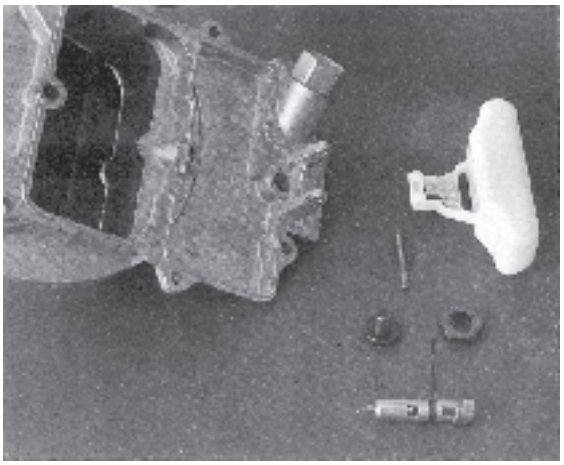
127. Unscrew the idle mixture screws for both barrels.

128. Clean the carburetor housing internally using a mild cleaner such as kerosene. Blow all the passages clean using compressed air.

129. Clean all the removed carburetor parts. Blow clean all passages in the booster venturi and the hollow bolt. Ensure that the accelerator pump and power valve diaphragms are undamaged.



130. Checking the choke housing:
Remove the choke housing. Check that the choke vacuum piston does not stick. Blow the vacuum channel clean using compressed air. Remove the piston, if necessary, by unscrewing the choke spindle. Press in the stop rivet in the piston rod and pull out the piston. The piston can be polished using a very fine-grained emery cloth. Blow the vacuum channel clean using compressed air. Lightly oil the shaft and accelerator cam's hub. Reassemble the parts; do not forget to press back the rivet.

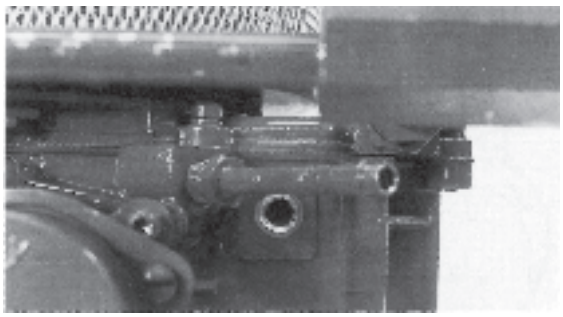


131. Replacing the float and the seat valve:
Press out the float shaft and remove the float. The seat valve is replaced by unscrewing the locking screw; the valve can now be unscrewed with the adjustment nut.
NOTE! Take care of the nut which is loose on the valve. Before fitting, lubricate the O-ring (1) and place new gaskets above and below the adjustment nut.

Carburetor Adjustment

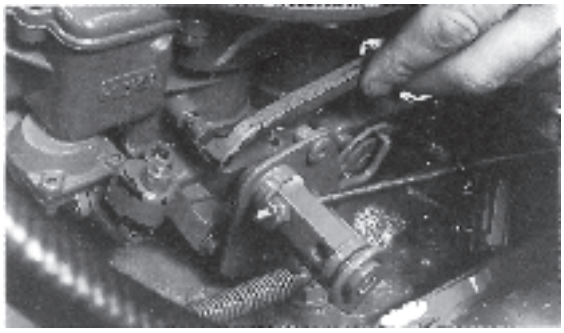
Adjusting the float level

WARNING! Be very careful when adjusting the float level. Smoking, open fire or sparks are not allowed nearby. Be aware of the engine's moving parts such as belts and pulleys, so that clothes, tools or parts of the body do not come into contact.

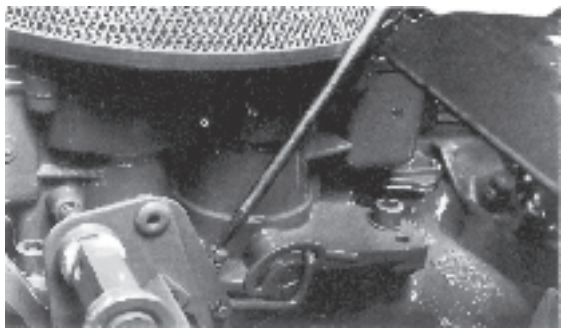


132. With the engine at idling and the throttle control in Neutral, unscrew the level plug. Loosen the locking screw and turn the adjustment nut until the fuel is level with the bottom of the level hole. Check the setting by accelerating the engine a few times with the gear in Neutral. Tighten the lock screw while holding the lock nut with a 16 mm (5/8") wrench. Fit the level plug.

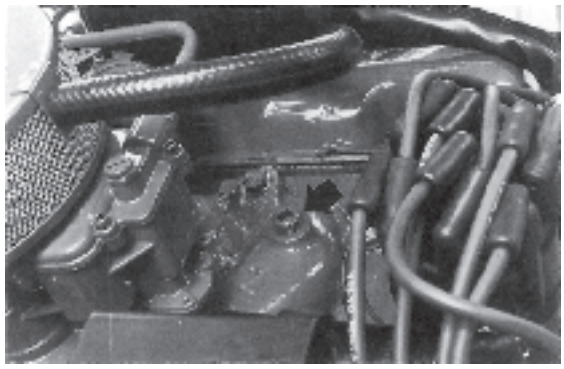
Idle setting



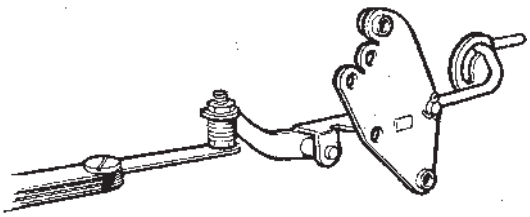
133. The screws for the idle mixture are located one on each side of the carburetor housing. If the screws have been removed, then a basic setting must be done first. With the engine stopped, the mixing screws should be screwed in until they bottom. Do not screw them in hard, as this can damage the seat! Then screw out both screws 3/4 turns (counterclockwise).



134. Run the engine until it reaches normal operating temperature. Set the idle speed to 750 rpm using the stop screw on the throttle valve lever. Use a workshop tachometer.



135. Connect a vacuum gauge to the tapping (1) on the intake manifold. Make note of the mixing screws' original position (the screwdriver slot). Adjust both screws equally; adjust by 1/8–1/4 turn at the time to the highest possible value on the vacuum gauge is obtained. Set the idle speed to 750 rpm again with the stop screw. The same procedure is then repeated once more.

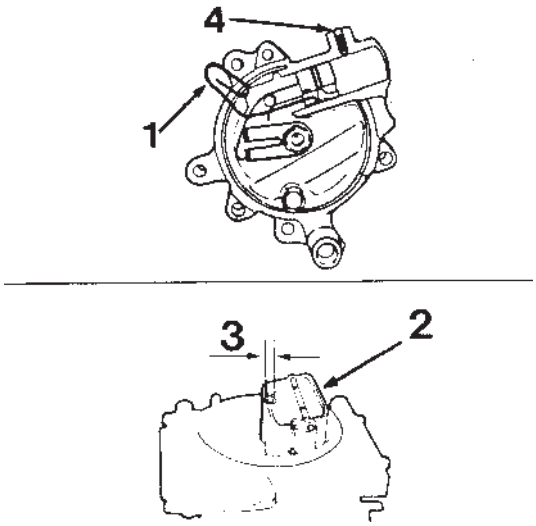


136. Setting the accelerator pump.

- Check that the plastic cam is fitted in position 2. Set the adjuster screw on the pump lever so that it makes contact with the pump arm at idle.
- Check the setting. When properly set, the pump arm starts to move as soon as the plastic cam moves. The correct adjustment must also allow a slight clearance between the pump arm and the adjuster screw with the throttle fully open. This clearance should be 0.40–0.50 mm (0.016–0.020 in) at wide open throttle.

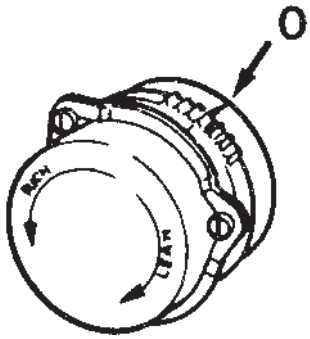
137. Check the function with the throttle cable connected. Let someone manoeuver the throttle control at the helm with the engine stopped. Remove the flame arrester and watch the booster venturi. The slightest acceleration by the throttle control should cause fuel to be sprayed out from the jets into the venturi. Adjust any clearance of the throttle control mechanism.

138. Choke setting:
The setting is split up into two parts, the choke index at the choke qualification.

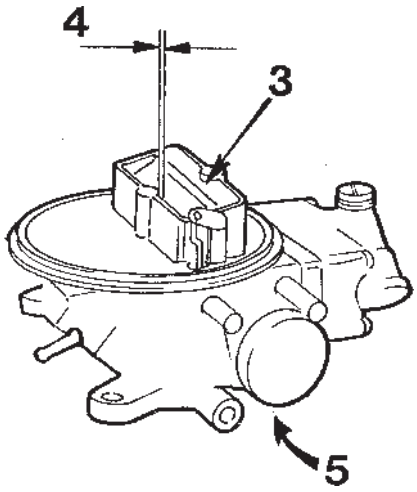


Bend a wire or paper clip with a max. diameter of 0.7 mm (0.027 in) so that the bent end is max. 3 mm (0.012 in).

1. Insert the wire into the piston groove until it bottoms. Pull it out together with the piston until the wire catches.
2. Press lightly with a finger on the choke valve in the closed position.
3. The distance between the choke valve's lower edge and the carburetor wall should be 6.35–7.60 mm (0.25–0.30 in). Measure using a drill bit.
4. When adjusting, turn adjustment screw in (clockwise) to decrease dimension or out (counterclockwise) to increase dimension.



Check that the bimetallic spring eyelet is against the choke arm in the choke housing (if the choke has been removed). Turn the choke cover so that the setting mark lines up with the correct setting mark on the housing. The setting should be at the 7th mark from left. Tighten the choke cover.

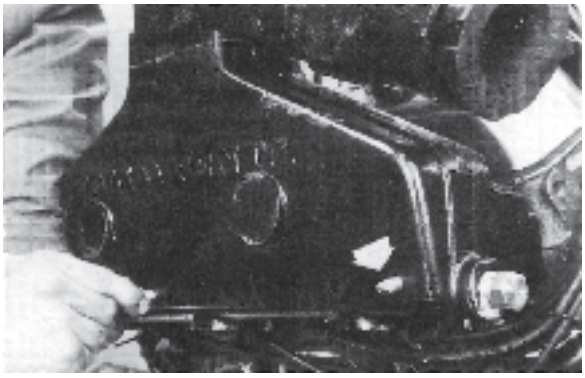


139. Setting the choke unloader

1. The choke must be correctly set.
2. The primary valve is fully open.
3. Press lightly on the choke valve in the closed position.
4. Measure the distance between the choke valve's lower edge and the carburetor wall. The distance may be min. 7.1 mm (0.28 in).
5. When adjusting, bend the tang on the valve spindle's lever (under the choke housing).

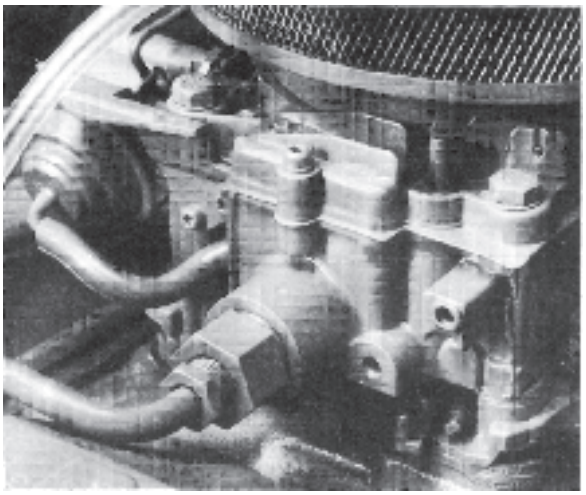
Chapter 4B Cylinder heads

Removal of related parts



140. Exhaust manifold

Remove the fuel filter connections and the fuel filter. If the left hand cylinder head is to be removed, the alternator and v-belt should be removed. Replace the two outer bolts in the exhaust manifold with two guide pins (884609-9). Then loosen the other bolts, wrench size 9/16".

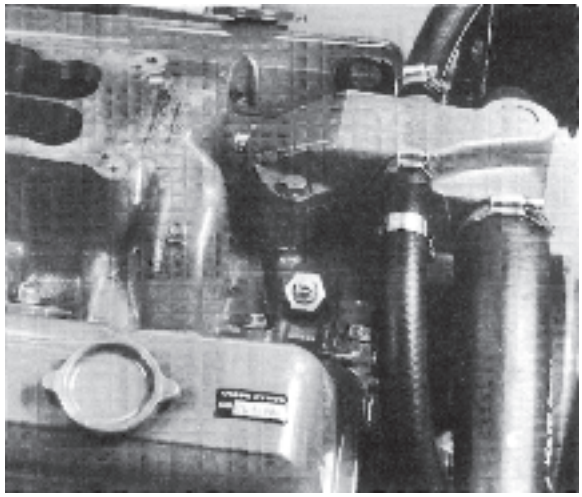


141. Carburetor

Remove the protective cover above the carburetor (if applicable). Remove the fuel line and electrical connection for the choke. Remove the carburetor.

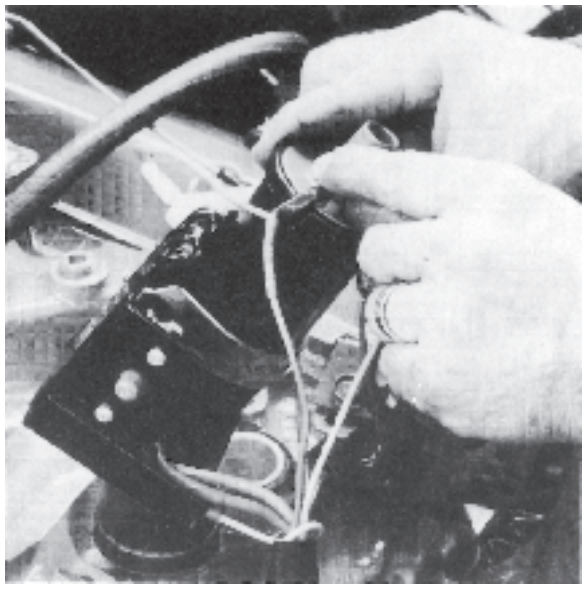
⚠ Be careful to avoid fuel spillage.

Thermostat, thermostat housing



142. Thermostat, thermostat housing

Loosen the thermostat housing hose connections. Loosen the temperature sender connection, wrench size 3/8".

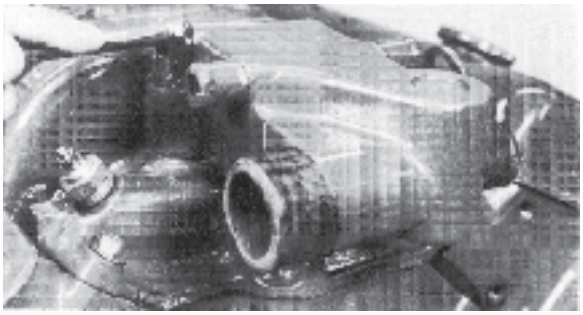


143. Intake manifold

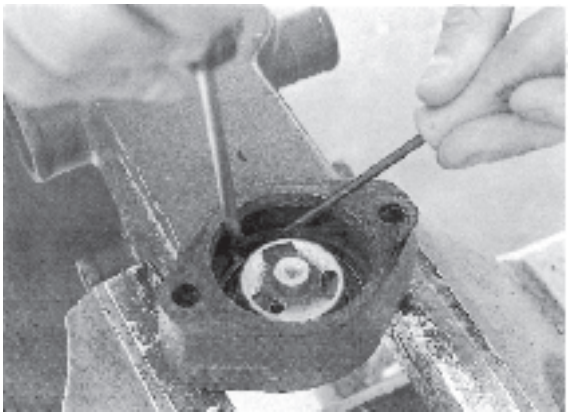
Remove the cable harness and the bracket with ignition coil and circuit breaker. Mark the spark plug leads and remove the distributor, wrench size 9/16". Remove the intake manifold, socket size 9/16".

Chapter 4C Cylinder heads

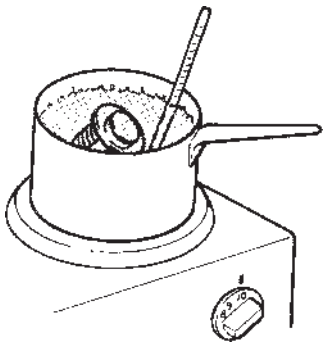
Overhauling the cooling system



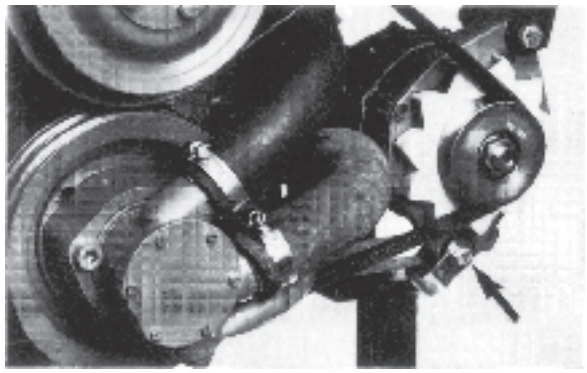
144. Remove the coolant hoses from the thermostat housing. Check the condition of the hoses. Remove the thermostat housing from the intake manifold, socket size 9/16".



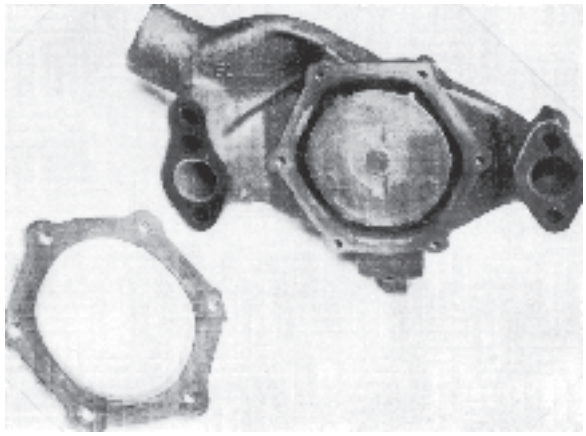
145. Remove the circlip and take out the thermostat. Use two screwdrivers. Early style of thermostat housing has a circlip with eyelets for circlip pliers.



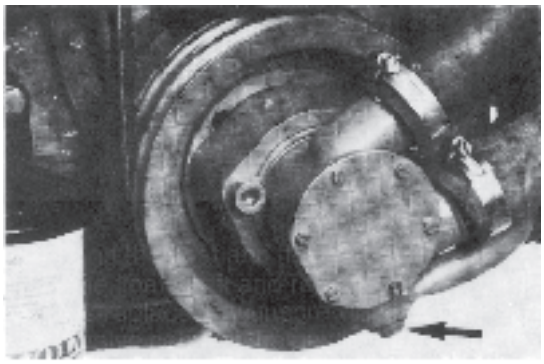
146. Where necessary, check the thermostat opening temperature by immersing the thermostat in hot water. The thermostat should start opening at 62°C (154°F) and should be fully open at 72°C (162°F).



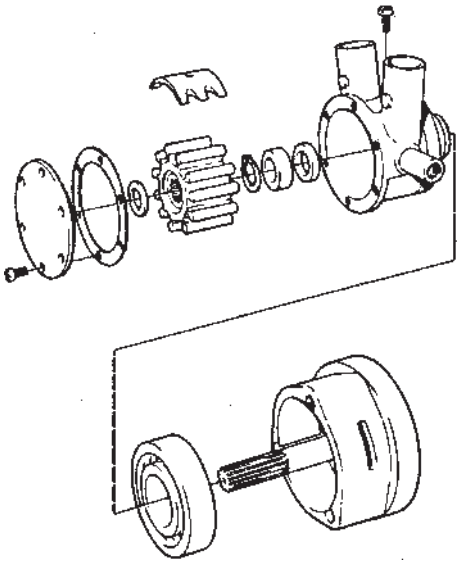
147. Loosen the belt tensioner and remove the V-belt. Wrench size 13 mm.



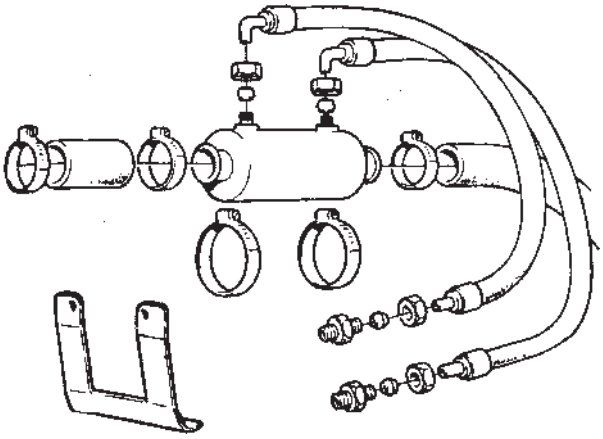
148. Remove and inspect the circulation pump. Wrench size 9/16". Any evidence of damage or wear requires the replacement of the pump as an assembly. Remove the pulley and install it on the new pump. Wrench size 5/8".



149. Remove the coolant hoses from the sea water pump. Remove the pump bracket from the pump. Wrench size 1/2". Remove the pump bracket from the engine block. Wrench size 14 mm. Remove the pump from the harmonic balancer, 5/16" (Allen wrench).



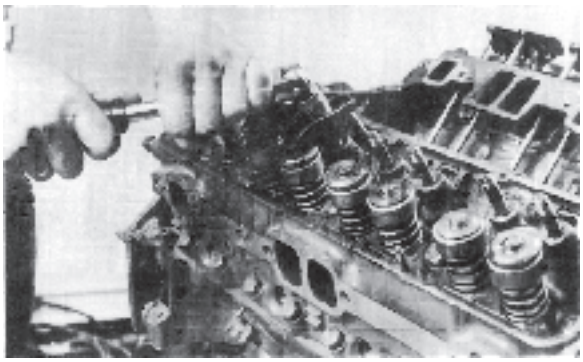
150. Remove the pump cover and pull out the pump housing using slip joint pliers. Remove the circlip and separate the pump and bearing housing. Take care of the seal ring and washer. Check the ball bearing and replace if necessary. Lubricate the ball bearing thoroughly with grease and assemble the pump in the reverse order. Install the cover using a new gasket.



151. 571 (AQ311): Remove the oil and water hoses from the oil cooler. Remove the cooler from the bracket. Flush the oil cooler water passages clean. Any dirt or contamination that is stuck can be carefully removed using steel wire. If damaged, replace the cooler. Check the oil and water hoses for cracks. Replace if necessary.

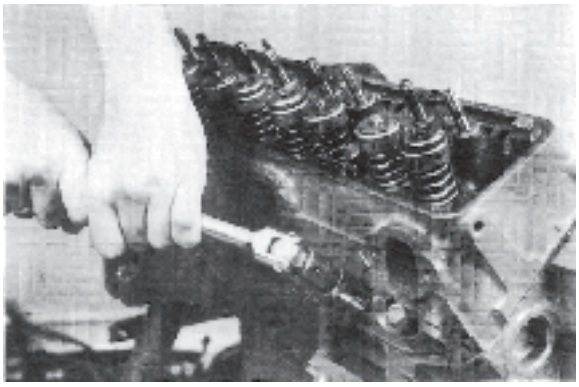
Chapter 4D Cylinder heads

Overhauling the valve system

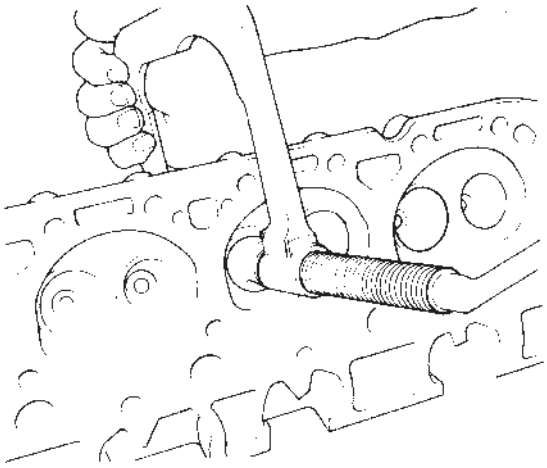


152. Remove the valve cover(s) and remove the gasket. Use a Torx 27 driver on later production engines. Remove the rocker arms and push rods, socket size 5/8". (Remove the valve lifters if the engine block is to be overhauled. Keep them in order if they are to be reused).

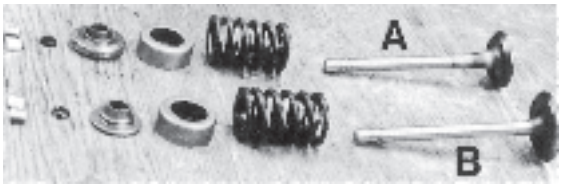
153. Place the rocker arms, rocker arm balls, push rods and valve lifters in the same order as were in the cylinder heads. Mark their position so they can be installed in their original position when reassembling.



154. Remove the cylinder head(s) and remove gasket. Socket size 5/8".

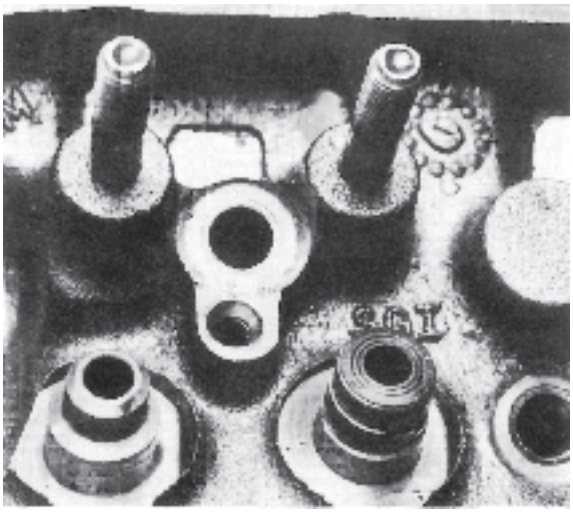


155. Remove the valves and springs. Use tool 9986052-0.

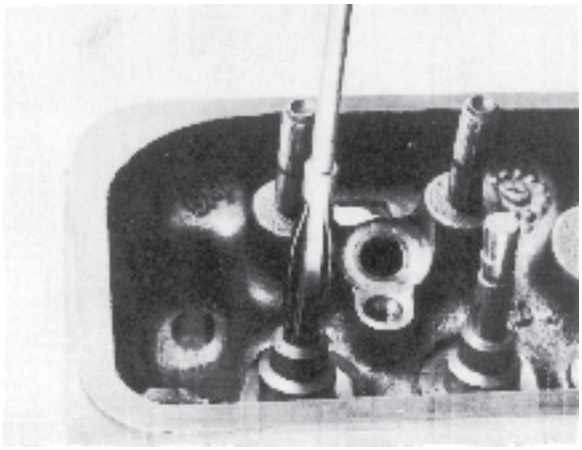


156. Remove valve lock, seal (rubber ring), retainer, spring, damper, and valve.

A = Exhaust valve
B = Inlet valve



157. Remove the valve stem seals from the inlet valve guides.

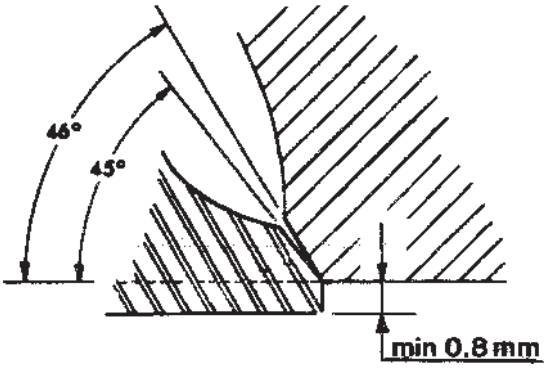


158. Remove any carbon from combustion chambers and valves. Clean the valve guides using tool 884630-5.

159. If necessary, machine the valves in a valve grinding machine. The angle should be:

Exhaust valve: 45°
Inlet valve: 45°

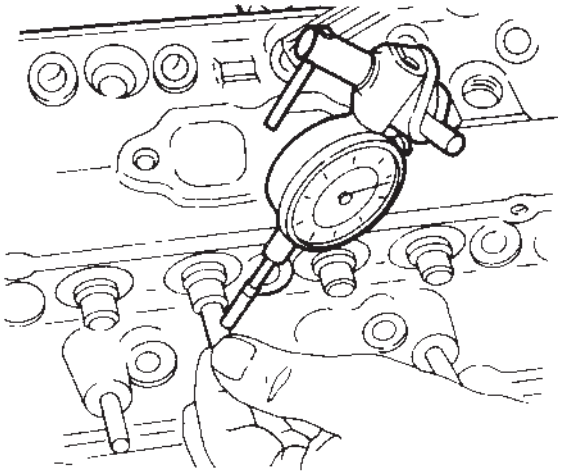
Minimum valve edge height after machining: 0.8 mm (0.0315")



160. If necessary grind the valve seats. The angle should be:

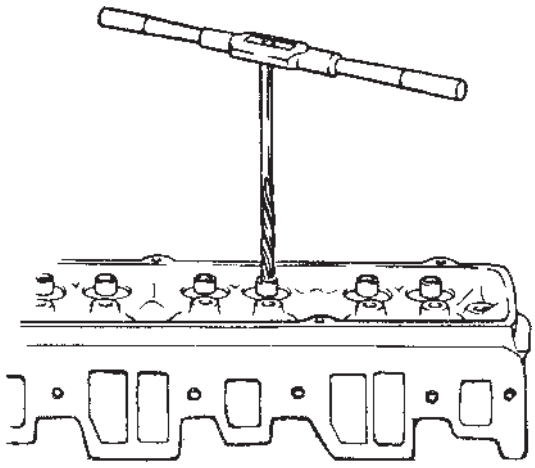
Exhaust valve: 46°
Inlet valve: 46°

161. Ensure that valves and valve seats are seating properly. Apply marking dye to the valve seating surface and rotate it with light pressure against the seat. If the dye is not evenly distributed over the entire valve seat surface (the valve is not sealing correctly), the valve should be re-machined or the seat should be re-ground , and a new check carried out until the desired result is obtained.

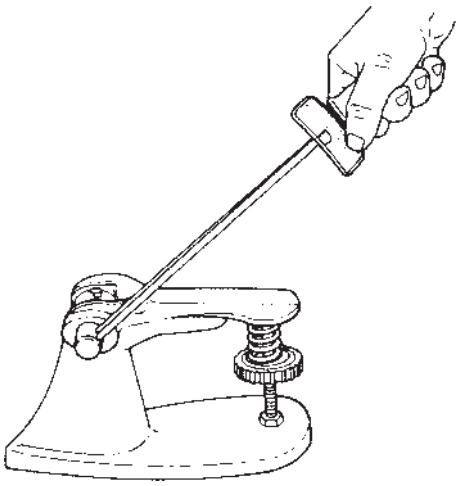


162. Check the valves and valve guides for wear. (Lower the valve approx. 1.5 mm (1/16") when checking.

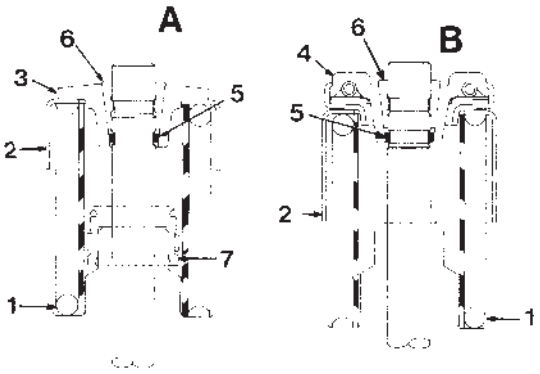
Permitted clearance:
Exhaust: 0.025–0.120 mm (0.001–0.0047")
Inlet: 0.025–0.094 mm (0.001–0.0037")



163. Where the clearance is excessive, the valve guides should be reamed to the next oversize. Use reamer kit 884991-1 which contains reamers for 0.015" OS and 0.030" OS. The appropriate oversize valve should then be used.



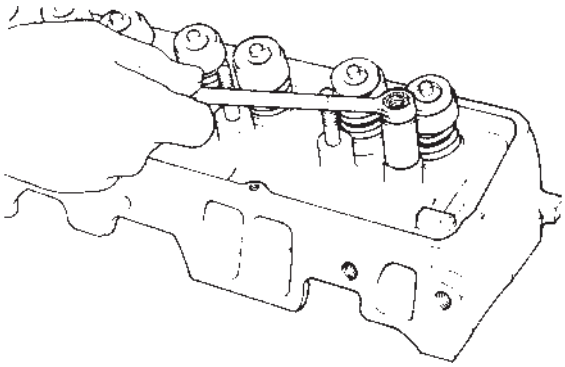
164. Check the valve springs (without damper):
Length without load: 51.5 mm (2.03")
Length with 334–370 N: 44.0 mm (1.70")
Length with 853–905 N: 31.7 mm (1.25")



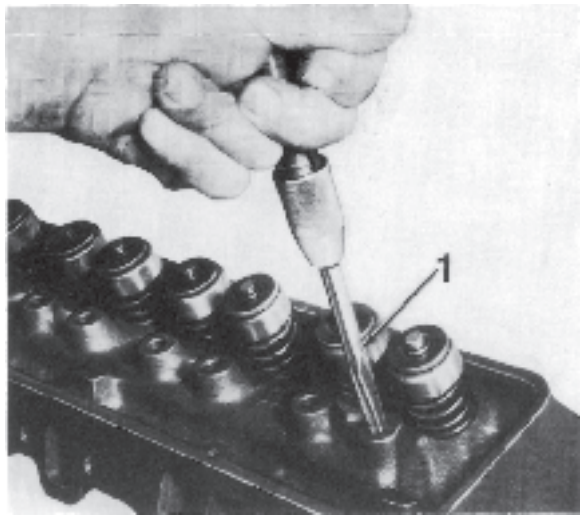
165. Install the valves. Oil the valve stem and fit the valve in its original seat. Fit the seal (7) on the inlet valve guide. Assemble the valve spring (with damper) (1), spring protector (2), valve spring retainer (3) (inlet) and rotator (4) (exhaust).

Compress the spring with the valve spring compressor, and install the seal ring (5) in the valve stem bottom groove. Fit the valve keepers (6) in the upper groove by using grease to keep them in place. Remove the valve spring compressor and install the remaining valves.

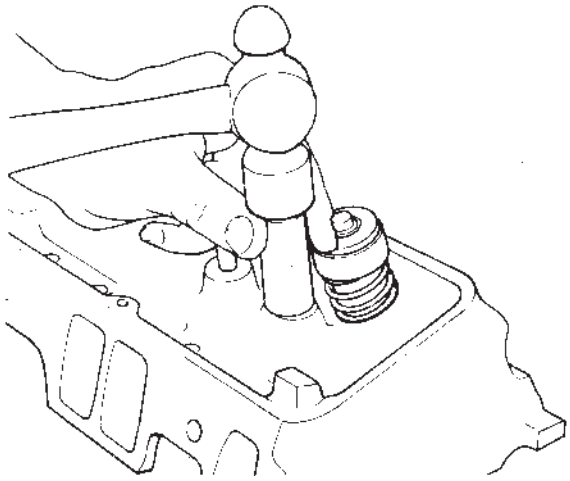
A = Inlet valve
B = Exhaust valve



166. Rocker arm studs that have damaged threads or are loose in the cylinder head should be replaced. Remove the rocker arm stud using tool 884627-1.



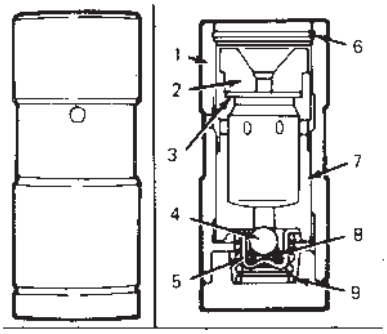
167. Ream to oversize: Tool (1) 884632-1 for 0.3 mm (0.013") OS.



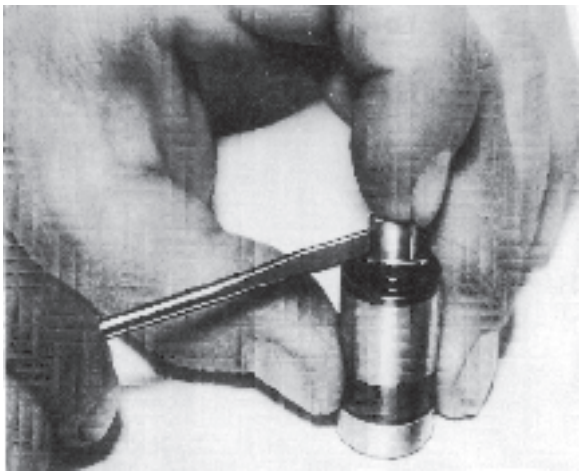
168. Apply hypoid oil to the stud and install using tool 884629-7.
NOTE! The tool should bottom against the cylinder head.

Valve lifters

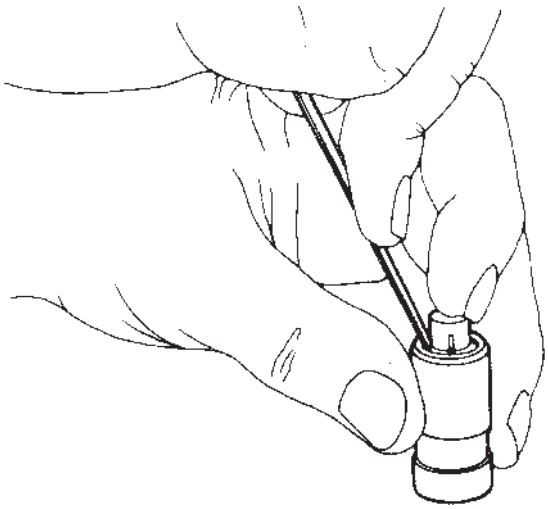
169. If there is noise in one or more of the lifters, all lifters should be disassembled and cleaned. Press down the piston using a push rod and remove the circlip using a screwdriver. Release the push rod and remove the internal parts.



1. Valve lifter
2. Seat for push rod
3. Valve
4. Valve ball
5. Ball holder
6. Circlip
7. Piston
8. Spring for the ball
9. Spring for the piston

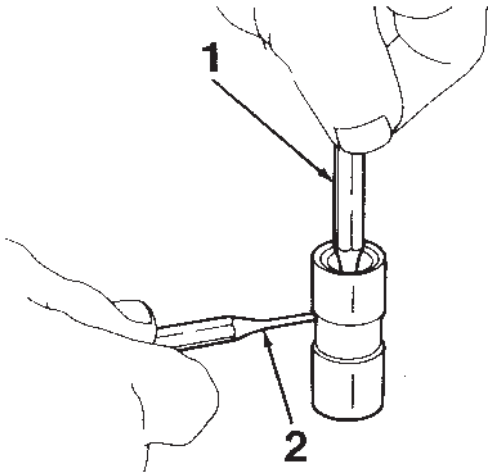


170. Loosen the ball holder using a screwdriver.



171. Clean all parts and inspect them carefully. If any of the internal parts are found to be worn the complete valve lifter should be replaced. Place the ball and spring in the piston and fit the ball holder using a screwdriver.

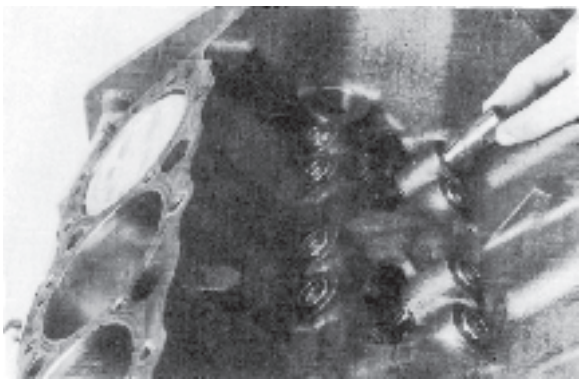
172. Place the piston spring on the piston and insert into the valve lifter.
NOTE! The oil holes in lifter body and piston must line up.



173. Fill the lifter with SAE 20 oil and press down the piston using a 3 mm (1/8") drift (1) so that the oil holes align.
NOTE! Do not pump the piston.

Insert a 1.5 mm (1/16") drift (2) through the oil hole so that the piston is locked in its bottom position. Remove the 3 mm (1/8") drift and fill the lifter with SAE 20 oil again.

Fit the valve, push rod seat and circlip. Press down the seat and remove the 1.5 mm (1/16") drift.

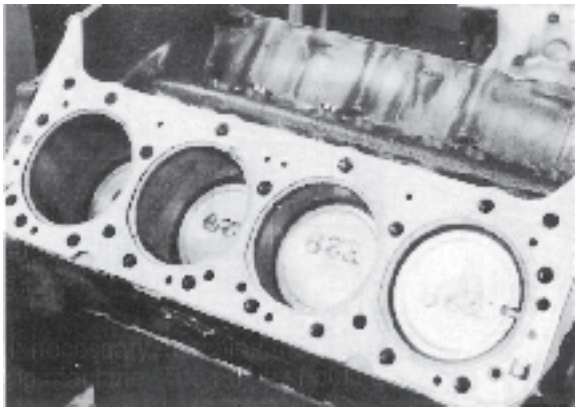


174. Coat the bottom of the lifter with “Molycote” or equivalent and install the lifters in their original lifter bores.

NOTE! New valve lifters should always be used when a new camshaft has been installed. Fill the lifters with oil and coat the bottom with “Molycote” or equivalent.

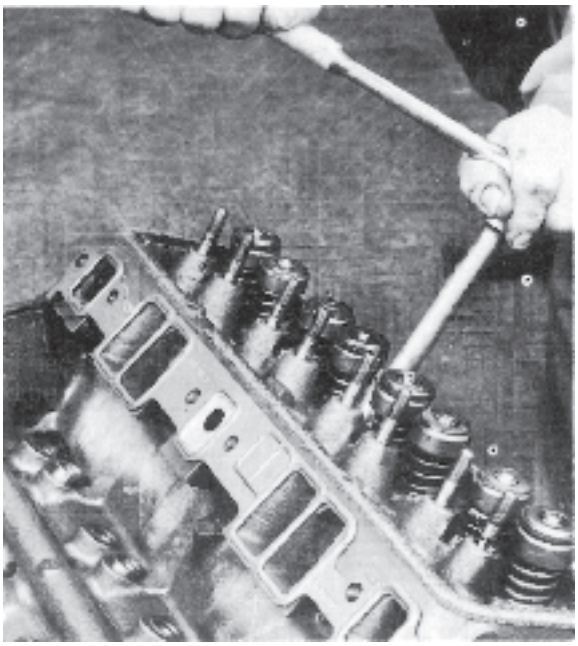
Chapter 4E Cylinder heads

Assembling the cylinder head

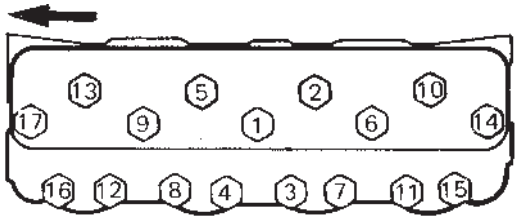


175. Check to make sure that the mating surfaces are clean. Apply a thin coating of sealing compound Permatex, or similar, to both sides of the cylinder head gaskets.

NOTE! Use a short-fiber roller or brush.
Locate the gaskets with the raised ribbing of the gasket facing upward.



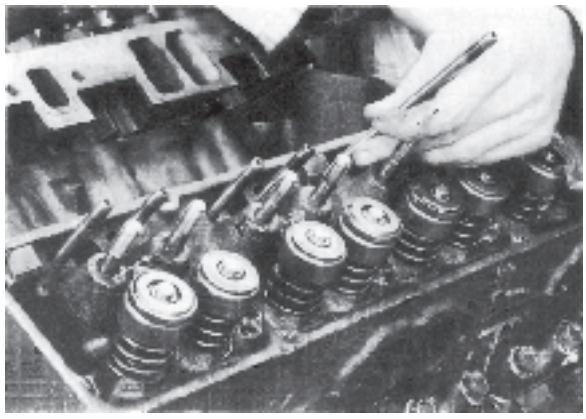
176. Install the cylinder heads by guiding them onto the two locating dowels. Clean all the cylinder head bolts and apply sealer to the threads before installing.



177. Head bolt tightening should be carried out in two steps and in the order shown in the diagram. The arrow indicates the front of the engine.

1. 50 Nm (5.0 kpm/36 ft. lb.s.)
2. 90 Nm (9.0 kpm/65 ft. lb.s.)

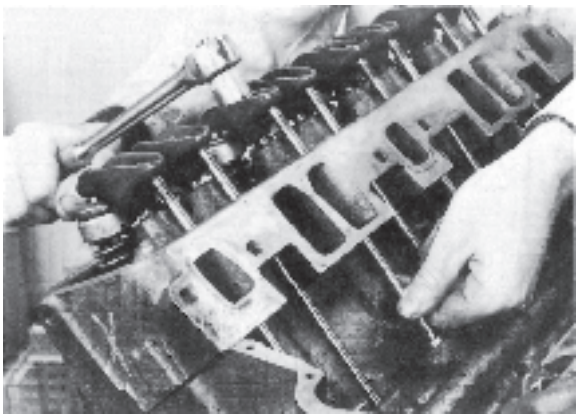
Valve Mechanism



178. Install the push rods in the same location they had when removed.

179. Fit the rocker arms, rocker balls and rocker arm nuts in the same order they were removed. When rocker arms or rocker balls are installed, they should be lubricated with “Molycote” or equivalent.

Adjusting the valve clearance



180. The engine has hydraulic valve lifters, and can be adjusted during re-assembly. Tighten the adjustment nut until the rocker arm touches the valve and push rod and a slight resistance can be felt when turning the push rod. Tighten the adjustment nut an additional 1 turn.

A. Turn the engine until the no. 1 piston is in the firing position. Check the marking on the vibration damper. Valves for no. 6 should be rocking.
NOTE! With the engine in this position, the following valves can be adjusted:

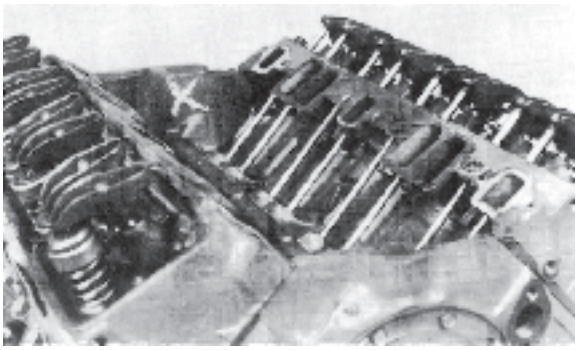
Exhaust: 1-3-4-8
Inlet: 1-2-5-7

B. Turn the engine one revolution (360 degrees) until the No. 6 piston is in firing position, no. 1 valves should be rocking. Check the marking on the vibration damper. With the engine in this position, the following valves can be adjusted:

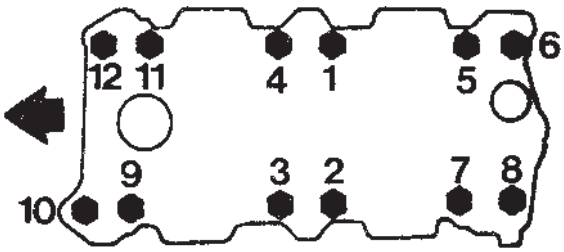
Exhaust: 2-5-6-7
Inlet: 3-4-6-8

Chapter 4F Cylinder heads

Installing the intake manifold



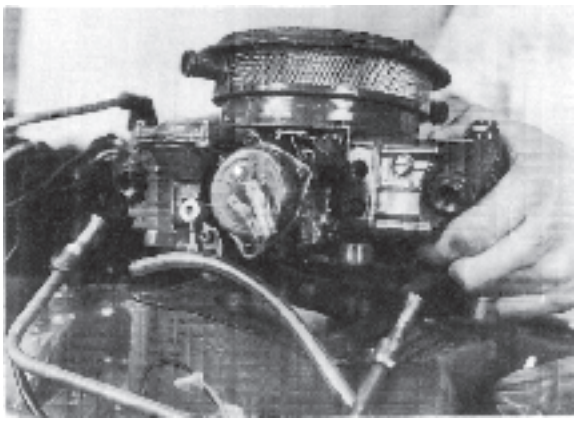
181. Thoroughly clean the intake manifold contact surfaces and then place the gaskets for the intake manifold. Apply sealer around the water ports.



182. Install the intake manifold. Do not forget the lifting eyes. Tighten the intake manifold in the order shown in the diagram. The arrow indicates the direction towards the front.

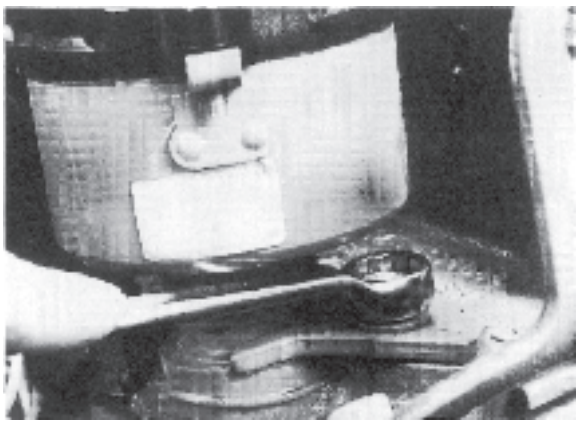
Tightening torque 41 Nm (4.2 kpm/30 ft. lb.).

Installing intake manifold related parts.



183. Install the carburetor together with a new gasket. Install fuel line, throttle cable and electrical connection for the choke. For checking and adjusting, see Chapter 4A.

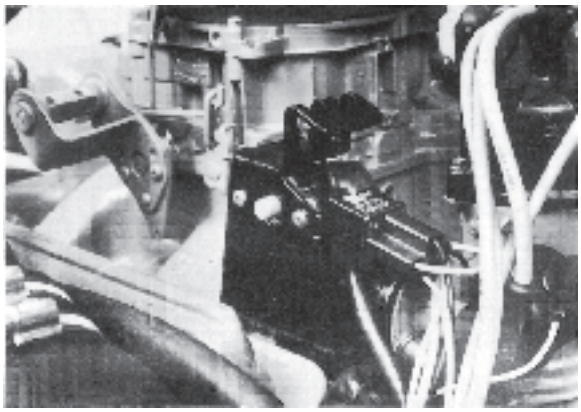
⚠ Carefully check the fuel connections for any leakage.



184. Install the distributor. Rotate the engine until the No. 1 piston is in the firing position. See the marking on the vibration damper.
NOTE! Cylinder No. 6 valves should rock in this position. Install the distributor.
NOTE! Do not forget the gasket. The distributor rotor should point towards no. 1 cylinder spark plug wire.

185. Install the exhaust manifold and risers. Use new gaskets and wave washers. Install the gaskets with the metal side facing manifold. First, screw in two guide pins (884609-9) and hang the exhaust manifold on the cylinder head. Tighten the manifold and remove the guide pins and install the remaining bolts. Apply “Moly-cote” or equivalent on the threads. Install the valve covers.

Tightening Torque:
Exhaust manifold 35 Nm (3.5 kpm/26 ft.lb.)
Risers 25 Nm (2.5 kpm/18 ft.lb.)
Valve covers 13 Nm (1.3 kpm)



186. Install the bracket with ignition coil and main fuse.

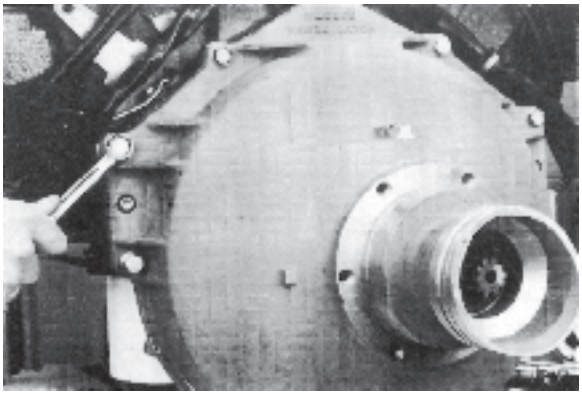
187. Install the fuel filter and alternator. The alternator V-belt should be tension that it can be depressed approximately 8–10 mm (5/16–3/8") midway between the pulleys using thumb pressure.

Chapter 5 Engine block

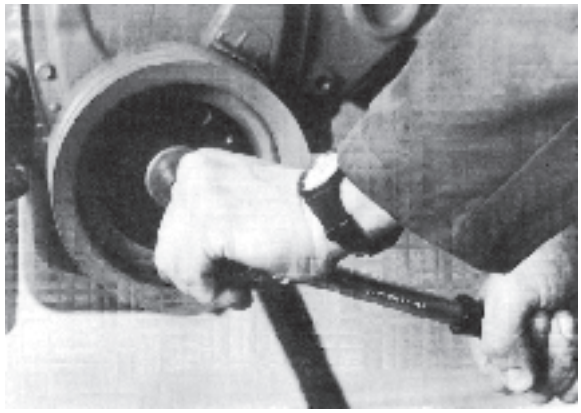
This chapter covers the engine block and related parts as follows:

Chapter 5A Engine block

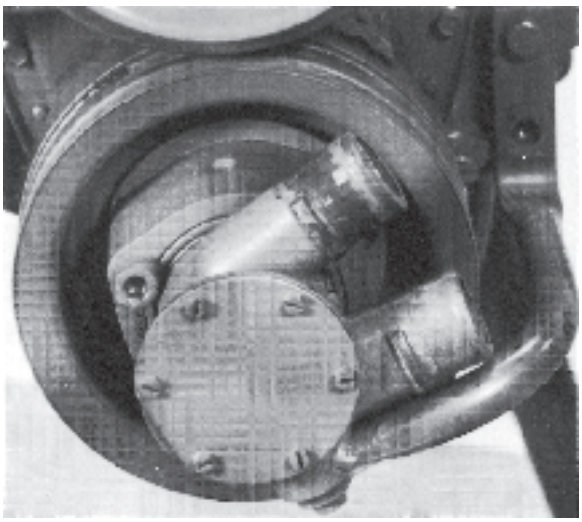
Removal of related parts.



188. Remove the starter motor and flywheel housing. Wrench size 9/16".



190. Remove the belt pulley, socket size 5/8". Remove the circulation pump, socket size 9/16".

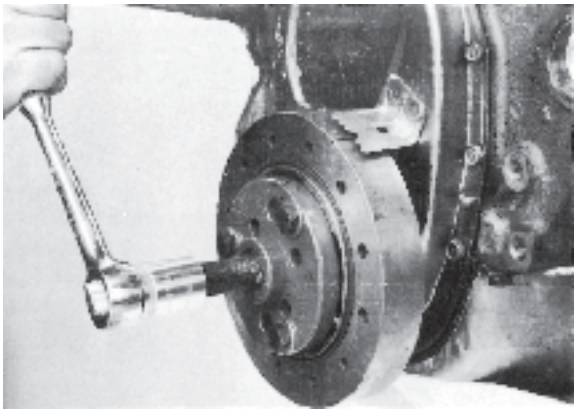


189. Remove the fuel pump and sea water pump. Wrench sizes 3/8" and 17 mm for the fuel pump, 5/16" Allen wrench and 14 mm for the sea water pump.

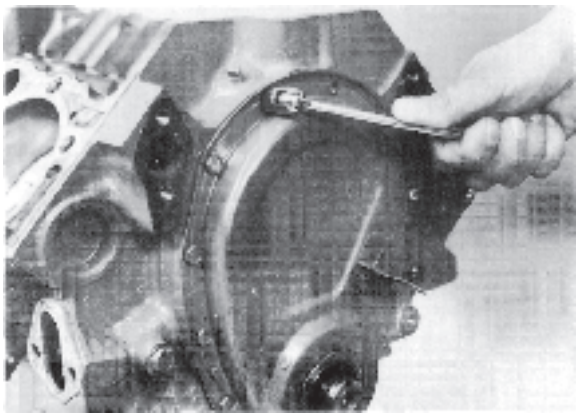
Chapter 5B Engine block

Overhauling the crankshaft assembly

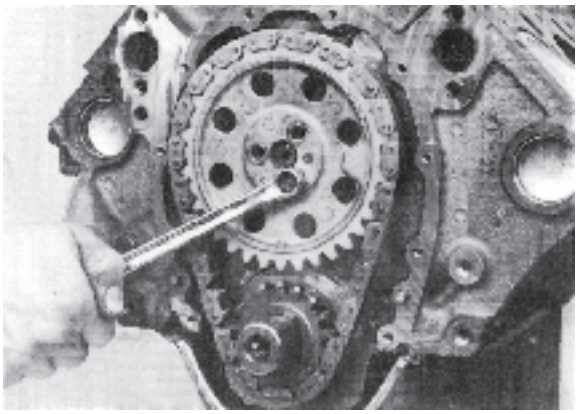
Removal



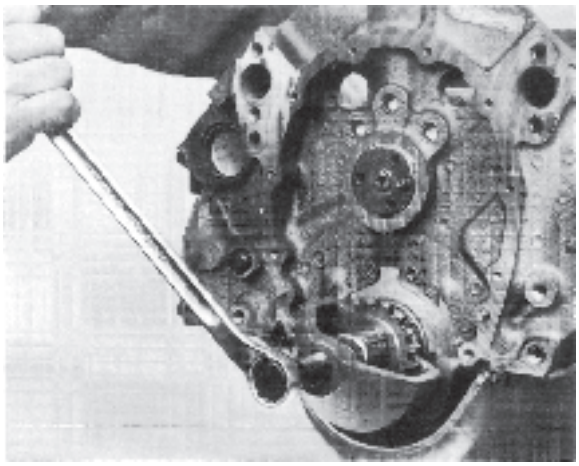
191. Remove the front vibration damper. Use puller 884608-1.



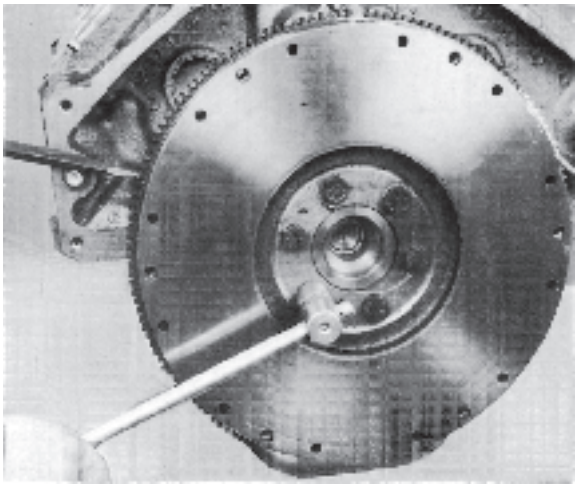
192. Remove the timing gear cover, wrench size 3/8".



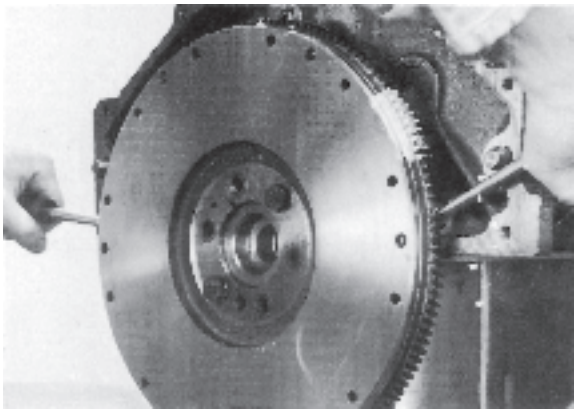
193. Loosen the three bolts for the camshaft gear and remove the gear and chain. Wrench size 1/2".



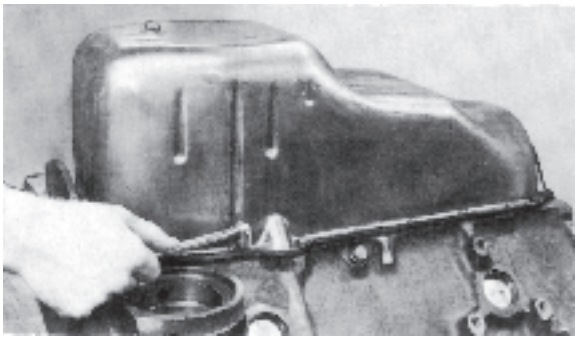
194. Remove the crankshaft gear. Use puller 884528-1.



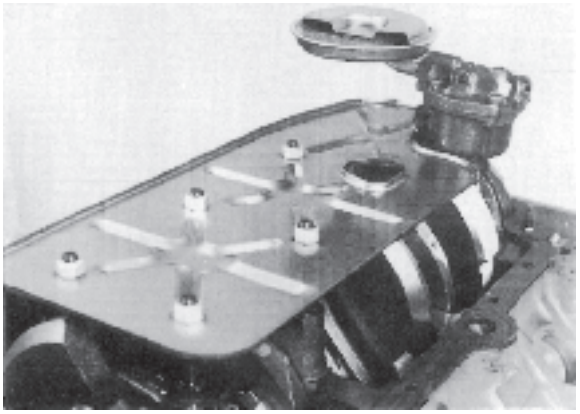
195. Remove the rear vibration damper. Remove the flywheel. Loosen four bolts completely and two bolts part way.



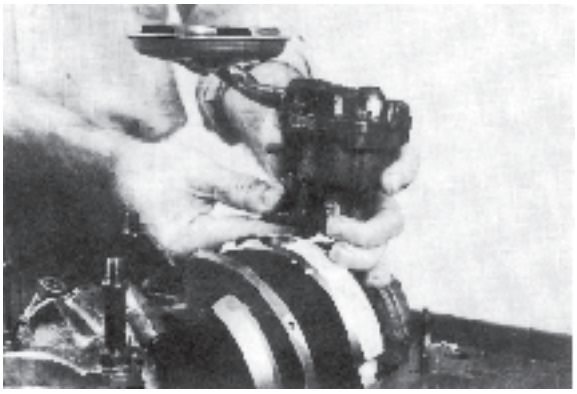
196. Pry off the flywheel, the partially loosened bolts will act as stops. Remove the bolts and remove the flywheel.



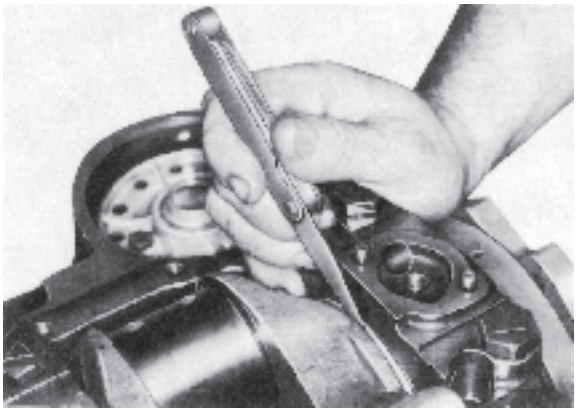
197. Turn the engine over and remove the oil pan. Wrench sizes 3/8" and 1/2".



198. Remove the windage tray. The rear bolt also holds the oil pump. Wrench size 5/8".

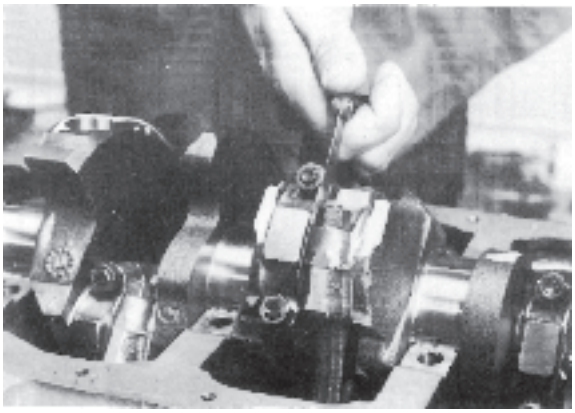


199. Remove the oil pump.



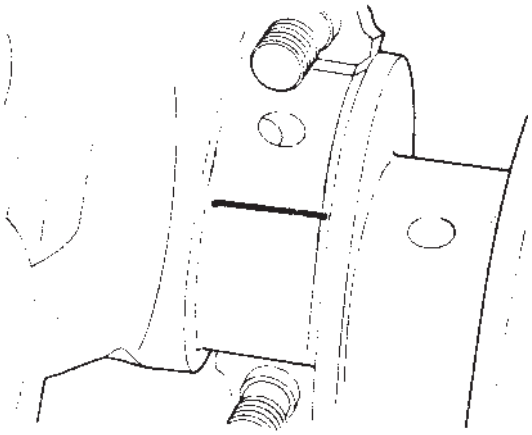
200. Measure the crankshaft axial clearance (end play)

Min. 0.05 mm (0.0020")
Max. 0.15 mm (0.0059")

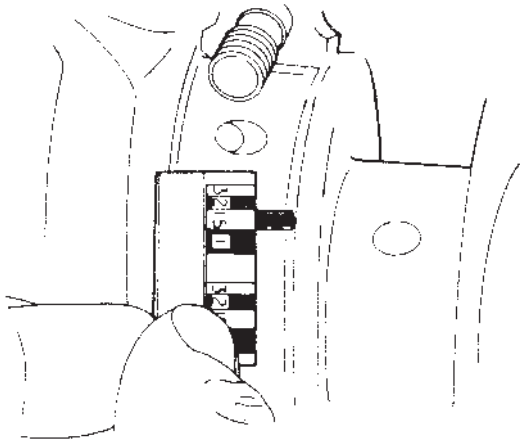


201. Measure the connecting rods axial clearance (side play) on the crankshaft journal.

Min: 0.15 mm (0.0059")
Max: 0.36 mm (0.0142")



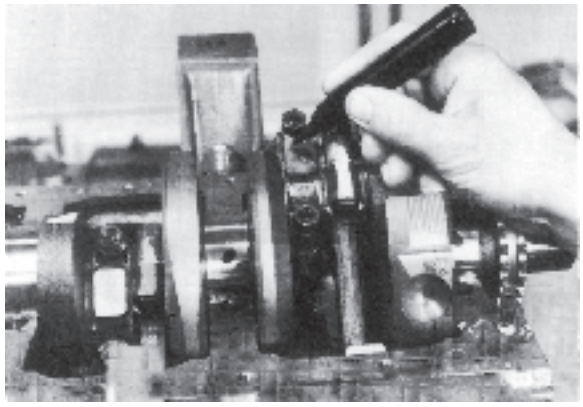
202. Checking the connecting rod clearance
The connecting rods' axial clearance on the crankshaft journal can be done using gaging plastic, part No 856927-9. Remove the rod end bearing cap, wipe away oil from the bearing and connecting rod journal. Place a piece of gaging strip along the connecting rod bearing journal; it should be as long as the bearing width. Fit the connecting rod and cap; tighten to a torque of 61 Nm (6.2 kpm/45 ft/lb).
NOTE! The crankshaft must not be turned, as this will damage the gaging strip.



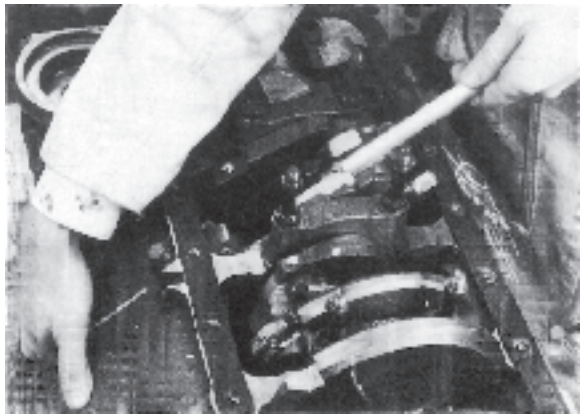
203. Remove the bearing cap and measure the compressed gaging strip at its widest point using the scale. Make a note of the result and measure the remaining connecting rod bearing caps. Connecting rod bearings can wear unevenly, i.e. become oval. The out-of-round of the connecting rod bearing journal should therefore be checked afterwards using a micrometer, see point 228. Should any of the journals be out-of-round but within the permitted value (max 0.025 mm/0.0010 in), the area with the largest diameter should be marked. Then carry out a new check with the gaging strip placed on the largest diameter (the marking).

204. The connecting rod bearing clearance should be 0.033–0.076 mm (0.0013–0.0030 in). Existing bearing caps can be reused if the bearing clearance is not near the max permissible value and they are otherwise free from faults.

Pistons



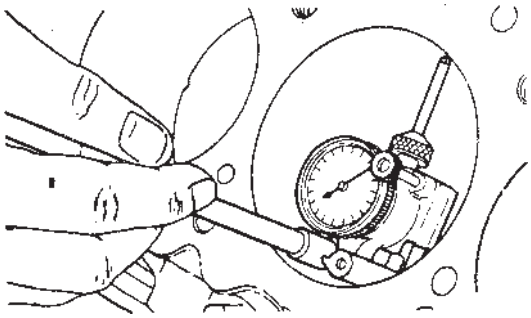
205. If the connecting rods and bearing caps are not marked, then mark them now! Each connecting rod and cap shall be marked starting from the engine timing gear end (front). Cylinder Nos. 1, 3, 5 and 7 are in the left hand side of the engine block and 2, 4, 6 and 8 in the right side of the engine block. (Engine turned right side up).



206. Remove the pistons and connecting rods
Loosen the rod end bearing caps, wrench size 9/16". Push out the piston and connecting rod through the cylinder. Use tool 884944-0 for the connecting rod bolts as protection and guide when pressing out.
After the connecting rods and rod end bearing caps have been marked, place the pistons with connecting rods in order, in a rack.

Engine block

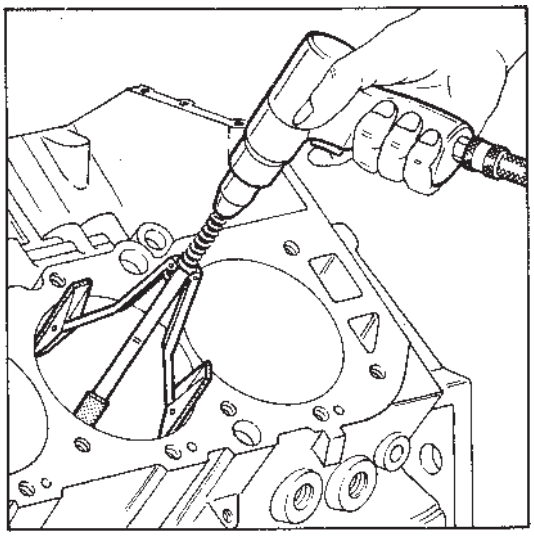
207. Wipe the cylinder bores clean. Carry out a visual check for damage such as scratches, wear and cracks.



208. Measure the cylinder bores using a cylinder indicator. Measuring for greatest wear should be done directly below the upper turning point and diagonally across the engine. Measuring for the least wear should be done at the lower turning point. The difference between measurings is the conicity. Measure the cylinder out-of-round; the difference in cylinder diameter, both diagonally and longitudinally, is the out-of round.

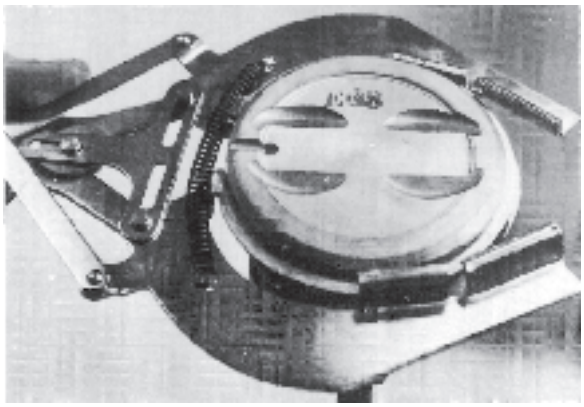
Max. cylinder out-of-round ..... 0.050 mm (0.0020 in)
Max. cylinder conicity ..... 0.025 mm (0.0010 in)

209. Measure and note the measured result for all cylinders. The cylinder with the largest wear decides if the cylinders shall be bored or honed. Boring always means replacing the pistons to the OS dimension of the bore. When honing, the pistons can be re-used if free from faults. See also steps 213–214, piston clearance, which affects the decision whether to bore or hone.



210. If the cylinders do not need to be bored, they must always be honed. The honing creates a matt, checkered surface, that holds the lube oil film and hastens the running-in of pistons and piston rings.
NOTE! The honing stones must not be used so much that the cylinder dimensions are exceeded.

Piston rings and wrist pin



211. Remove the piston rings using piston ring pliers (if existing pistons are to be re-used). Remove all carbon deposit and clean the piston ring grooves. Use a groove cleaner or an old broken piston ring that is ground.
NOTE! Steel wire brushes must never be used for de-carbonizing.

212. Check for any damage. Cracks, knocking and overheating damage and damage caused by damaged piston rings must always lead to replacement of the piston.

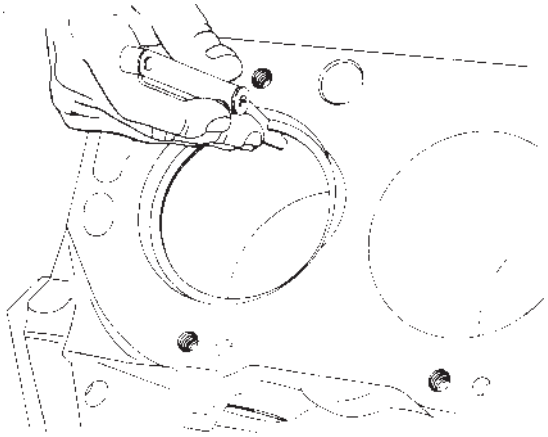
213. Measure the pistons using a micrometer perpendicular to the piston pin hole and approx. 6 mm (0.236 in) from the lower turning point. Note the measured values for each piston.

Measure the cylinder bore diameter (for each piston), diagonally approx. 50 mm (1.969 in) down into the bores. Cylinder bore – piston diameter is the piston clearance.

Alternatively, the piston (without piston rings) can be inserted into its bore and the clearance can be measured using a feeler gauge perpendicular to the piston pin at the piston's lower edge. Measure in several places along the bore.

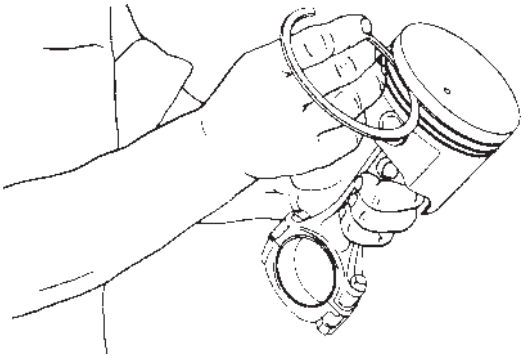
For max. piston clearance see: Overhaul Data.

214. If the piston clearance is greater, the pistons must be replaced with new ones. If the cylinder wear according to step 208 was near the maximum wear, the bores should be bored and the pistons replaced with the corresponding OS pistons to obtain good economy and service life from the overhaul. See also step 218 piston pin clearance.



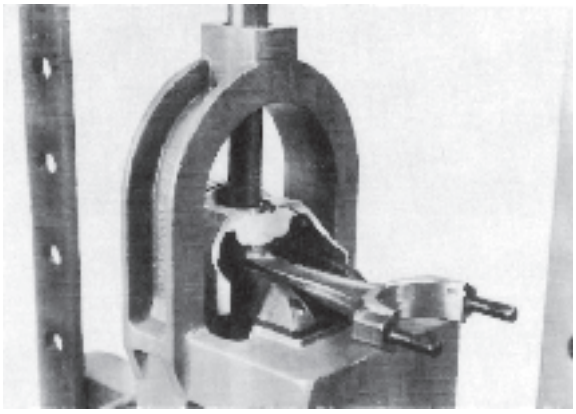
215. Measure the new piston ring gaps using a feeler gauge. Insert the ring approximately 6 mm (1/4") into the cylinder bore, (The cylinder bores must be finished, honed or bored.) If necessary, increase the gap using a special file. The gap should be:

Upper compression ring 0.25–0.76 mm (0.010–0.030")
Lower compression ring 0.25–0.89 mm (0.010–0.035")
Oil ring 0.38–1.65 mm (0,015–0.065")



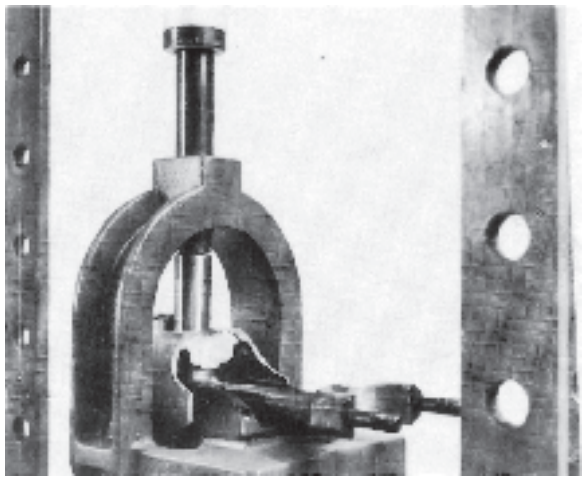
216. Check the piston ring clearance by first rolling the piston rings in the groove. Measure the clearance in several places using a feeler gauge.

The clearance should be:
Compression rings: 0.03–0.11 mm (0.0012–0.0042")
Oil ring: 0.05–0.20 mm (0.002–0.008")

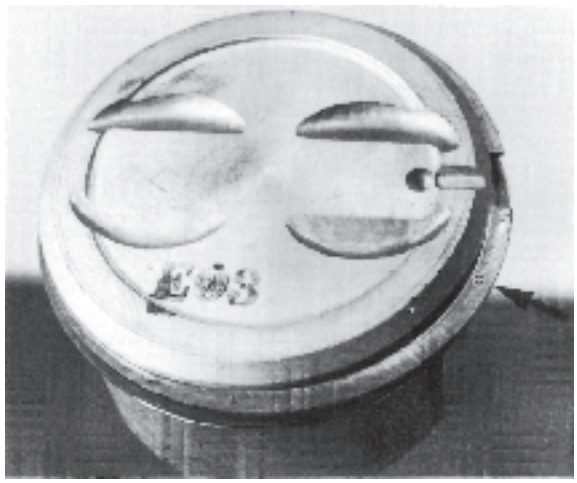


217. Press out the wrist pin using tool 884682-6.

218. Clean the parts thoroughly and measure the wrist pin using a micrometer and the wrist pin hole of the piston with an inside micrometer. If the combined clearance is more than 0.025 mm (0.010"), the piston and wrist pin should be replaced.

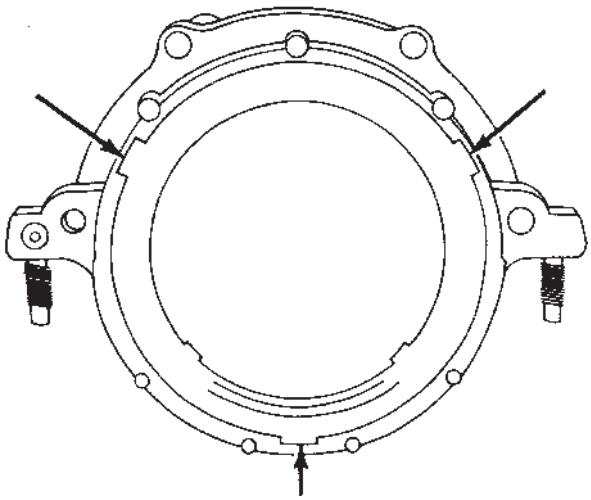


219. Press in the wrist in using tool 884682-6. The wrist pin is an interference fit in the connecting rod by 0.02–0.04 mm (0.0008–0.0016").



220. Install the piston rings. Use piston ring pliers. Start with the oil ring. The compression ring marking should face towards the top of the piston. Turn the piston rings so that the gaps are spaced 120° apart from each other.

Crankshaft seal



221. The rear crankshaft seal can be replaced after the flywheel housing and flywheel have been removed. Pry out the seal using a screwdriver at the tabs shown in the diagram.

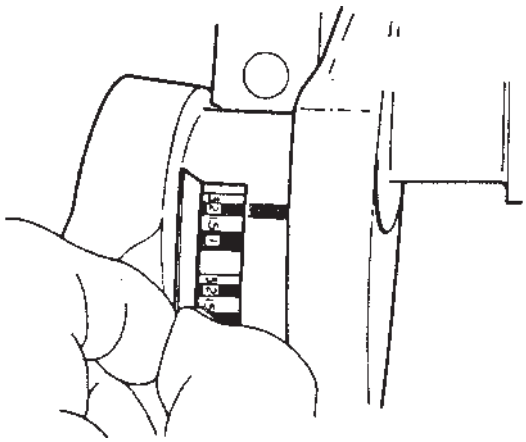
222. Before installing the new crankshaft seal, it should be lubricated with engine oil. Press in the crankshaft seal until it bottoms.

Gasket for crankshaft seal housing

223. The crankshaft seal housing gasket can be replaced after the flywheel housing, flywheel, oil pan and crankshaft seal have been removed. When refitting the seal holder tighten the bolts to 13–16 Nm (1.3–1.6 kpm/9.5–11.7 lbf ft).

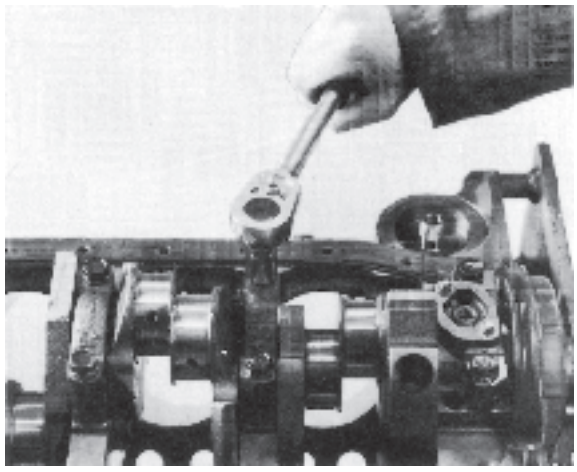
Crankshaft

224. Check the crankshaft's bearing play
The main bearing clearance (radial clearance) can be done using gaging plastic, part No 856927-9. Remove the main bearing half for the bearing to be measured. Wipe away oil from the bearing and shaft. Place a piece of gaging strip along the shaft; it should be as wide as the bearing width. Fit the bearing half and tighten to a torque of 108 Nm (79 ft/lb).
NOTE! The shaft must not be turned, as this will damage the gaging strip.

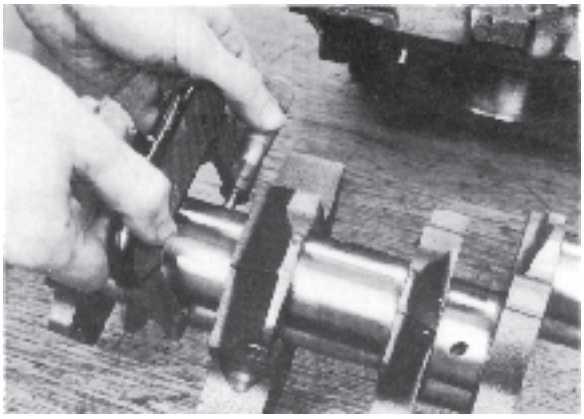


225. Remove the bearing cap and measure the width of the depressed gaging strip using the scale.
NOTE! The gaging strip must note removed before measuring. Make a note of the measured value for each bearing. Normally the main bearings wear evenly; if there is an out-of-round, the measured values are probably misleading. Therefore the crankshaft's out-of-round must be checked using micrometer according to step 228. Should any of the crankshaft's bearings be oval but within the permitted value (max 0.025 mm/0.0010 in), the area for the largest diameter should be marked. Then carry out a new check with the gaging strip placed on the area with the largest diameter (the marking).

226. Main bearing clearance should be 0.025–0.038 mm (0.010–0.0015 in) for bearing No 1 and 0.025–0.064 mm (0.010–0.0025 in) for the bearings No 2, 3, 4. The No 5 bearing clearance should be 0.064–0.089 mm (0.0025–0.0035 in). Existing bearing caps can be reused if the bearing clearance is not near the max permissible value and they are otherwise free from faults.



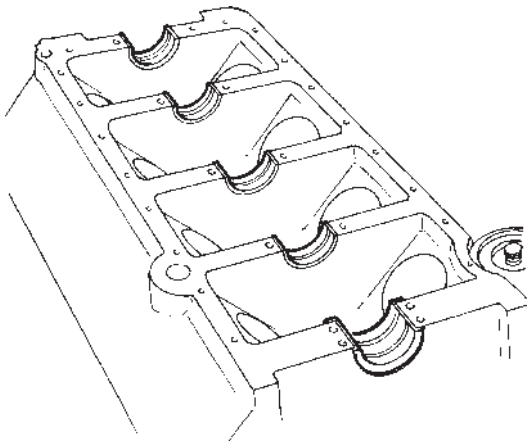
227. Remove the crankshaft. Place the marked main bearing caps and bearing insert in the same order as they were in the block.



228. Check the connecting rod and main bearing journals. Use a micrometer. Measure in several places around the circumference and lengthwise. The out of round for both big end and main bearing journals must not exceed 0.025 mm (0.0010"). The taper must not exceed 0.025 mm (0.0010") on any of the journals. If the measured values are near or exceed the above, the crankshaft should be machined to the nearest undersize. See “Overhaul Data”.

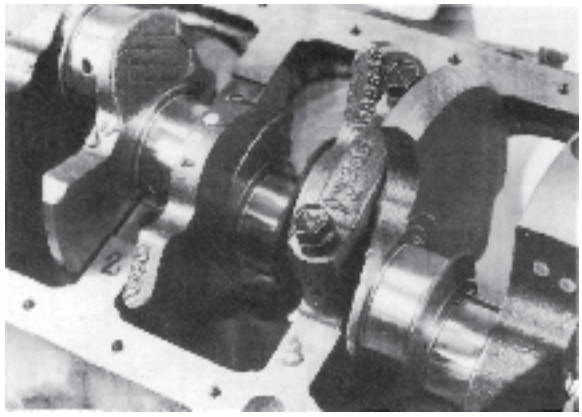
If the engine is to be completely overhauled, refer to point 254, page 97, Camshaft overhaul.

Assembly

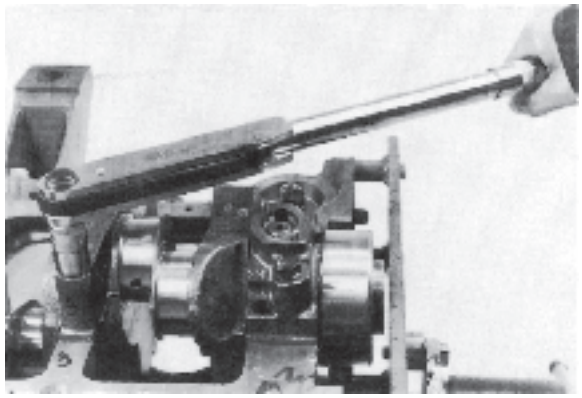


229. Locate the main bearing inserts in the block and main caps.
NOTE! The main bearing closest to the flywheel also functions as a thrust bearing.

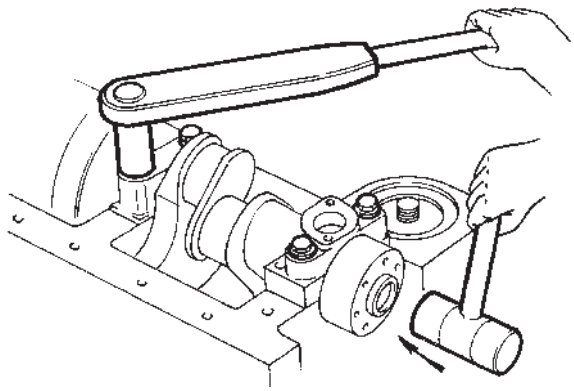
230. Lubricate the bearing inserts and install the crankshaft.
NOTE! Do not lubricate the backside of the bearing. If the crankshaft has been machined, it must have been thoroughly washed and cleaned.



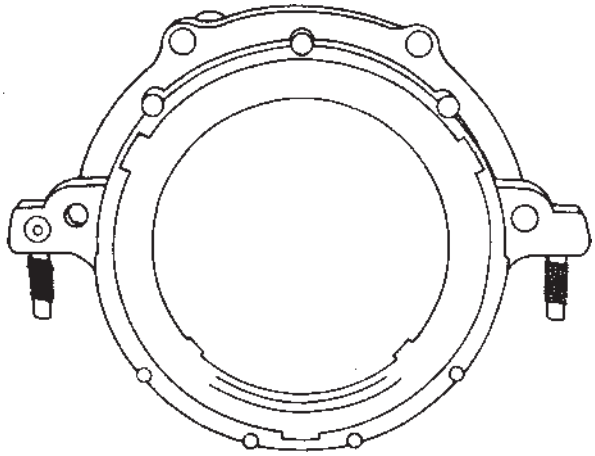
231. Lubricate the main bearing insert in the caps and install them according to the previous marking.
NOTE! The arrow marking points towards the front of the engine.



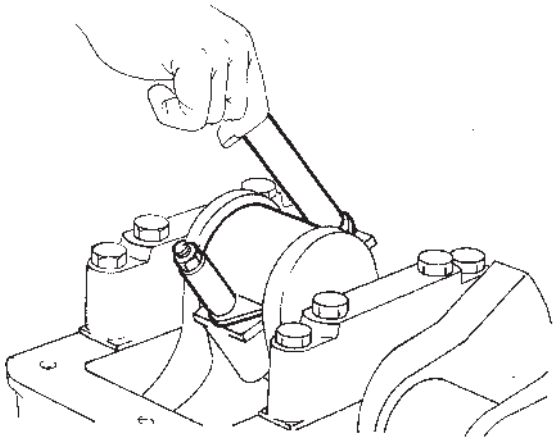
232. Coat the bolt threads using “Molycote” or equivalent. Torque all the main bearing caps to 108 Nm (11 kpm/80 ft.lb.) except the rear one. 571 (AQ311): the inner bolts of the three middle bearing caps to be torqued to 108 Nm (11 kpm/80 ft.lb), the outer bolts to 95 Nm (9.6 kpm/ 70 ft.lb.). The rear bearing cap bolts shall be torqued to 14–16 Nm (1.4–1.6 kpm/10–12 ft.lb.).



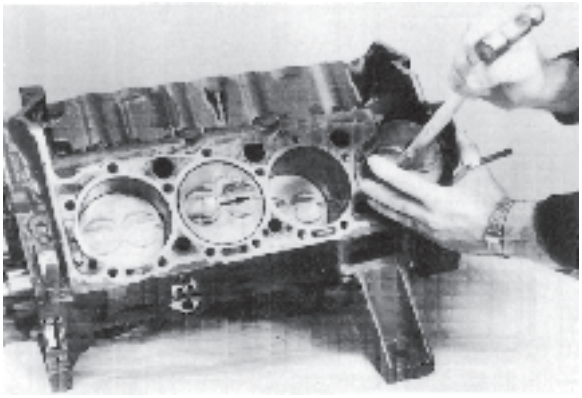
233. Using a lead mallet, carefully strike each end of the crankshaft so that the crankshaft settles in place. First move it backwards, and then forwards. Retorque **all** the main bearing caps to 108 Nm (11 kpm/80 ft.lb.).
571 (AQ311): Torque all the inner bolts to 108 Nm (11 kpm/80 ft.lb.), the outer bolts of the three middle bearing caps to 95 Nm (9.6 kpm/70 ft.lb.).



234. Install the crankshaft seal housing with a new gasket, tighten the bolts to 13–16 Nm (10–12 ft.lb.). Press in the crankshaft seal until it bottoms. The seal should be lubricated with engine oil.



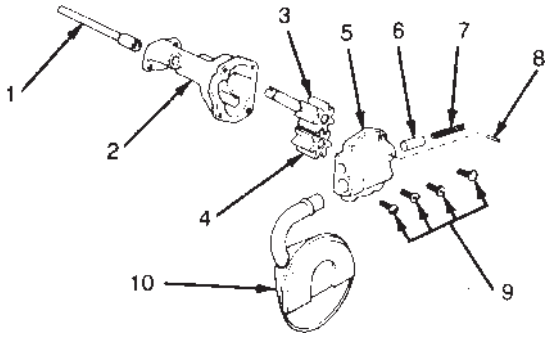
236. Pull the connecting rod in place and remove the tool 884944-0. Fit the connecting rod caps according to the markings. Oil the threads and tighten using a torque wrench. Tightening torque; 61 Nm (6.2 kpm/45 ft.lb.). Check that the crankshaft can be turned.



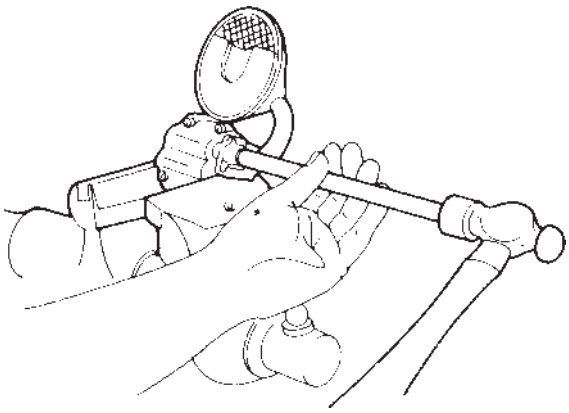
235. Fit the bearing shells in the connecting rod and caps. Lubricate the cylinder bores, pistons and connecting rod bearings with engine oil. Turn the crankshaft so that the rod journal is the bottom position for the cylinder where the pistons will be installed. Fit the pistons in their original cylinders according to the marking done earlier. Screw tool 884944-0 onto the connecting rod bolts. Check that the marking on the piston is facing the front of the engine and that the piston ring gaps are 120° displaced from each other. Use a piston ring compressor and push the piston down into the bore using a hammer handle.

Lubricating oil pump

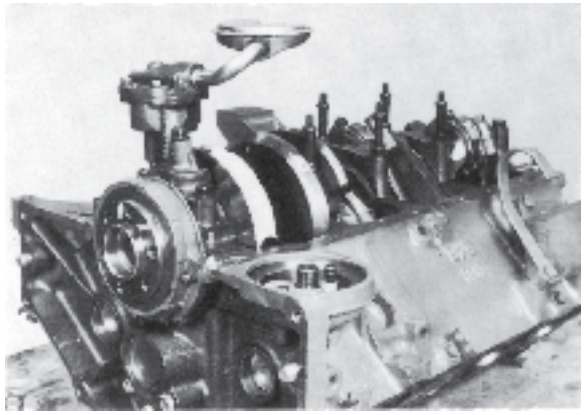
Overhauling



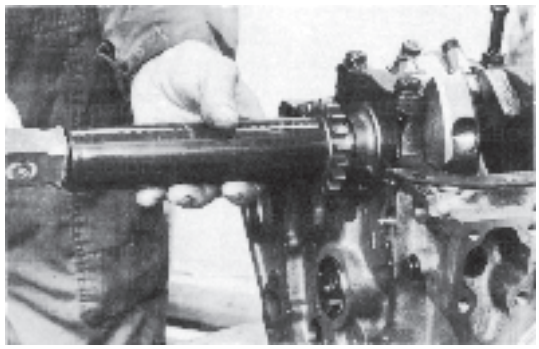
237. Remove the oil pump cover (5). Mark the gear wheels (3, 4), so that reassembly can be done with the same tooth engagement. Remove the gears. Remove the pressure relief valve. Knock out the lock pin (8) and remove the spring (7) and piston (6). Do not remove the oil strainer (19) unless it will be replaced. Clean all parts and dry with compressed air. Check that the pump housing is not worn or that the drive shaft has no play due to wear. If the pump housing or the gear wheels are worn, the entire pump should be replaced. Reassemble in the reverse order. The cover (5) should be torqued to 9 Nm (0.9 kpm/6.6 ft.lb.).



238. Replacing the oil strainer: Hold the pump in a vice, using protective jaws. Reference or mark the angle of the strainer. Remove the old strainer. Install the new strainer using tool 884943-2.

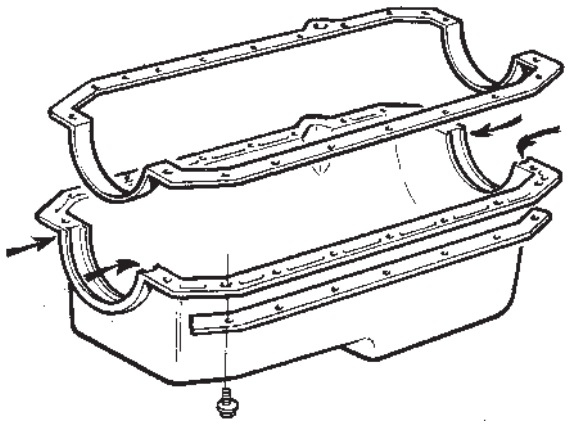


239. Install the oil pump and splash plate. Torque to 90 Nm (9 kpm/69 ft.lb.). Wrench size 5/8".

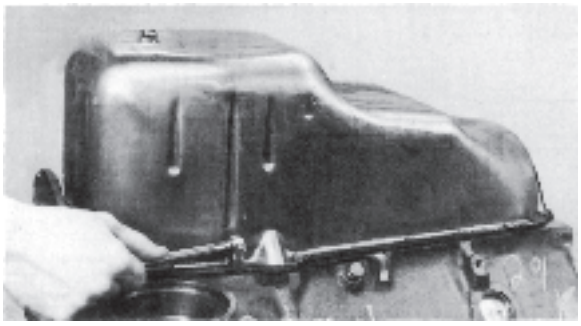


240. Install the crankshaft gear. Use tool 884530-7.

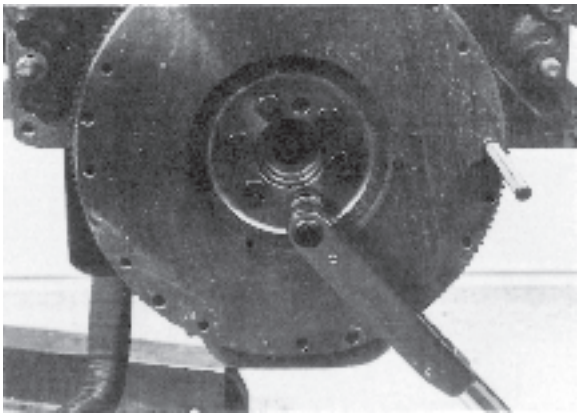
241. Install the camshaft gear according to points 264–269, on page 99.



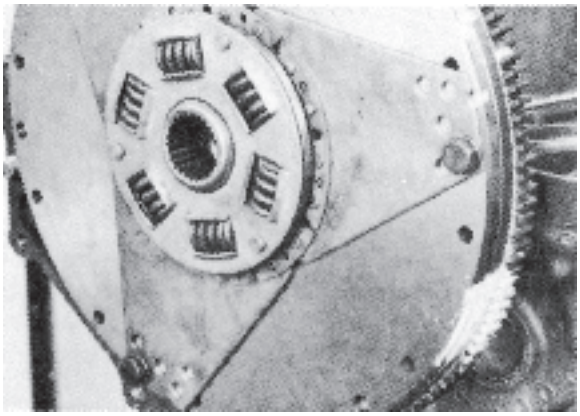
242. Clean the oil pan gasket surfaces. Place the new gasket on the block. Put a small bead of sealing agent (part no. 841261-1) on the corners of the oil pan, see arrows.



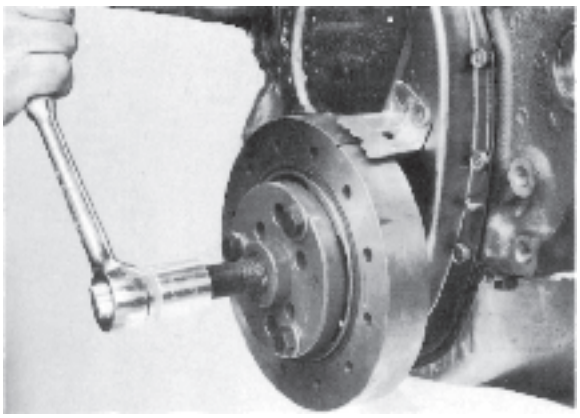
243. Install the oil pan. Torque the bolts to 11 Nm (1.1 kpm/ 8 ft.lb.) and the nuts to 22 Nm (2.2 kpm/16 ft.lb.).



244. Install the flywheel. Coat the inside with an anti-rust agent, “Tectyl” or equivalent. Oil the threads and torque diagonally to 82 Nm (8.2 kpm/59 ft.lb.).
NOTE! Use a drift as a counterhold as shown in the picture.



245. Install the rear vibration damper.

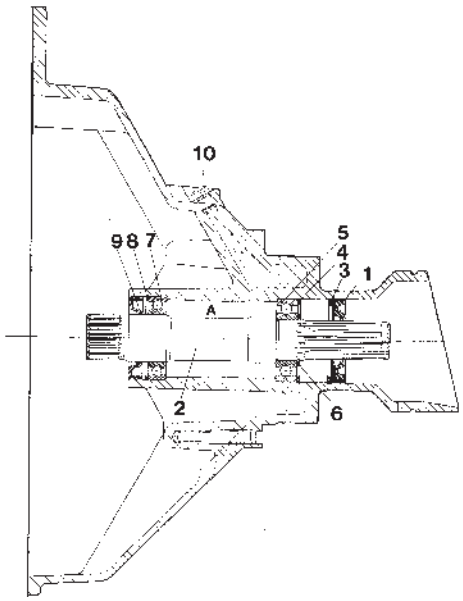


246. Install the front vibration damper. Apply a thin coat of oil to the journal and the vibration damper’s contact surface against the sealing ring. Use tool 884608-1. Hold still by inserting a screwdriver in the flywheel ring gear.

Overhauling the flywheel housing

There are two different flywheel housings installed on the engines. An earlier execution intended for 13" flywheels. Here the primary shaft is journalled in two ball bearings. Description and repair instructions, see step 247.

The later execution of flywheel housing is intended for 14" flywheels. In this flywheel housing the primary shaft is journalled in one ball bearing. The front end of the primary shaft is journalled in a friction bearing in the crank shaft. Description and repair instructions, see step 248.



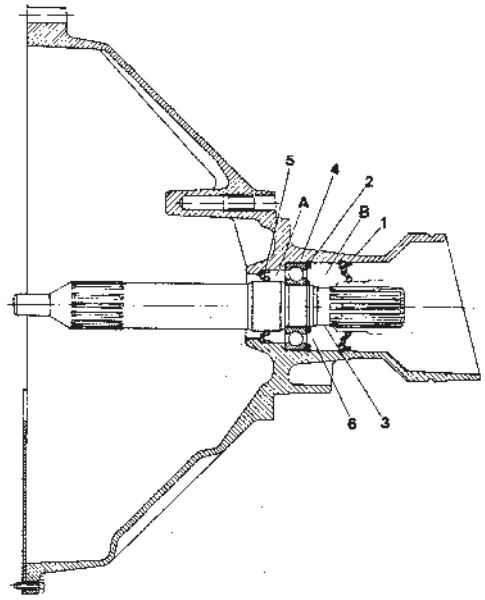
247. Inspect the flywheel housing and replace defective parts. Press in and out bearings and seals using tools 884359-1, 884596-8 and 884599-2. Note how the seals are fitted (what way they are facing) before removal.

Remove in the following order:
Remove seal (1) and the retainer rings (3) and (4). Press the primary shaft (2) together with the bearing (5). Remove the retaining ring (6) before pressing the bearing off the primary shaft. Thereafter, remove the seal (9) and retainer ring (8). Bearing (7) can then be pressed out.

Assemble in the following order:
Press on front bearing (7) and fit the retainer ring (8). Press the rear bearing (5) onto the primary shaft and secure with retainer ring (6). Press in the primary shaft into the flywheel housing and install retainer rings (4) and (3). Install a new seal ring (9).

NOTE! Carefully grease the seals before they are installed. Turn the seals the correct way when installing.

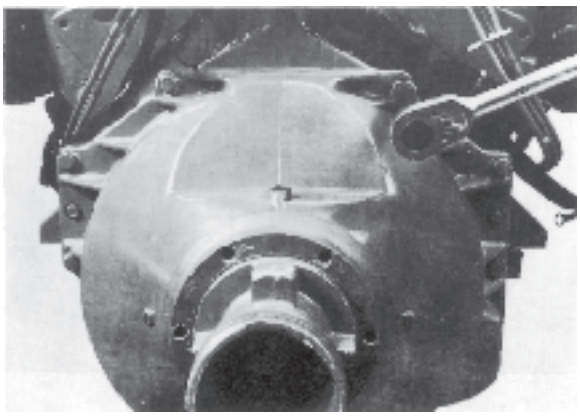
Fill the space marked “A” with water resistant bearing grease. Replace the plug (10) with a grease nipple. Use a grease gun and force grease out through the rear bearing (4). Install a new seal ring (1).
NOTE! Install it with the “opening” facing outwards.



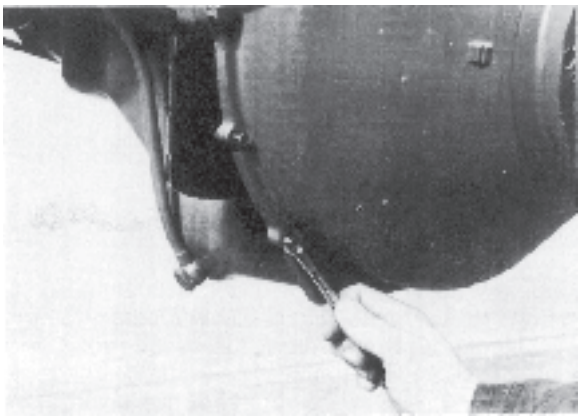
248. Inspect the flywheel housing and replace defective parts. Use special tools part nos 884838-4, 884596-8 and 884359-1 to replace bearing and sealings. Stuff the bearing with water resistant grease, part no 1141509-8.

Disassemble, observing the following sequence:
Remove the sealing (1) and the locking rings (2). “Knock out” the shaft (3) along with the bearing (4) using a rubber mallet. Then remove the sealing (5) and then the locking ring (6). Then remove the bearing from the shaft by pressing it off.

Assemble, observing the following sequence:
Install the new, inner sealing (5) using special tool part no 884838-4. The sealing is installed with its “opening” facing outwards. Install the new bearing on the shaft. Use special tool part no 884596-8 and press the bearing onto the shaft. Install the locking ring (6). Fill up the space “A” between the sealing and the bearing shoulder with water resistant grease. Install the primary shaft in the flywheel housing. Use special tool part no 884596-8 and press the shaft into its location. Make sure that the locking ring (6) ends up in the machined “groove” of the tool. Install the locking rings (2). Fill up the space “B” with water resistant grease. Use special tool part no 884359-1 and install the new, outer sealing (1).
NOTE! The “opening” of the sealing should face outwards.



249. Coat the exposed portions of the primary shaft with rust inhibitor before installing the flywheel housing. Oil the bolts and install the flywheel housing. Torque to 41 Nm (4.1 kpm/30 ft.lb.). Wrench size 9/16".



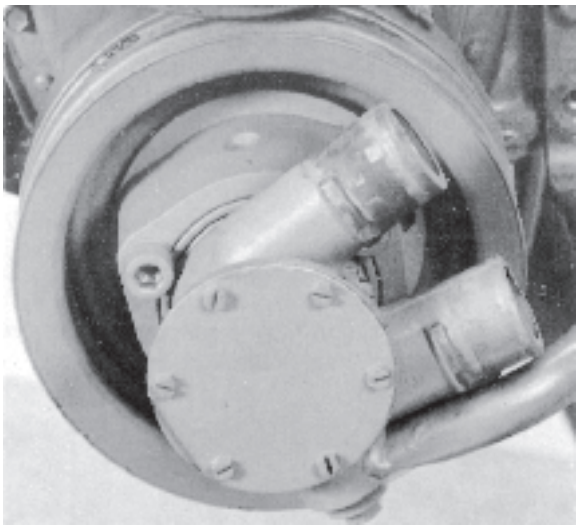
250. Install the protection plate to the flywheel housing. Wrench size 5/16".

Chapter 5C Engine block

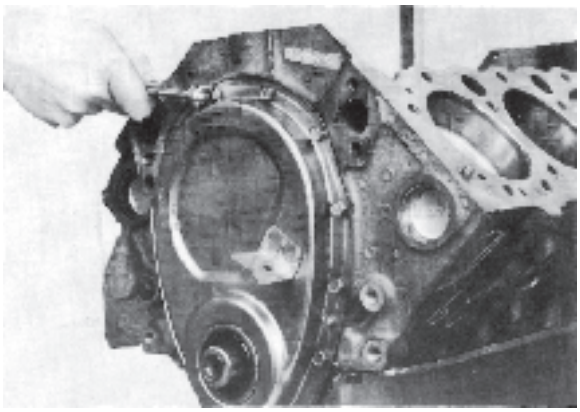
Overhauling the camshaft

Removal

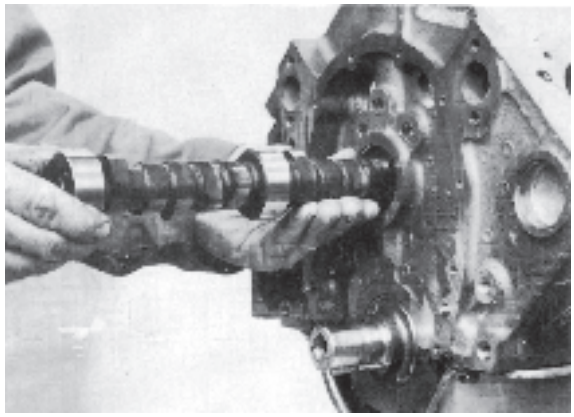
251. Remove both cylinder heads as described in Chapter 4B.



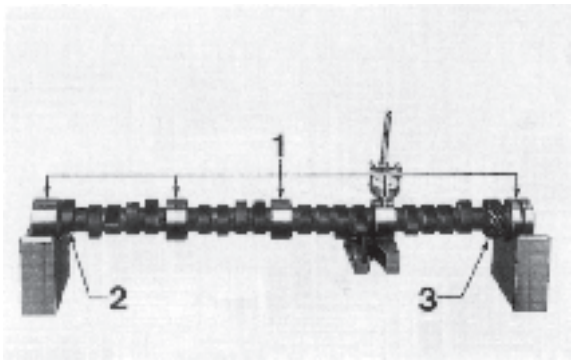
252. Remove the circulation pump and sea water pump bracket. Wrench size 9/16". Remove the sea water pump, Allen key 5/16" Remove the belt pulley, socket size 5/8".



253. Remove the vibration damper, use puller 884608-1. Remove the oil pan, socket size 3/8" and 1/2".
Remove the timing gear casing, wrench size 3/8".
Inspect the chain and gear for wear.
Remove the cam gear and chain, wrench size 1/2".
Remove the fuel pump. Wrench size 17 mm for the fuel line, 1/2" for the pump bolt.
Remove the mounting plate and pull out the push rod. Wrench size 3/8".



254. Carefully pull out the camshaft. Be careful not to damage the camshaft bearing surfaces in the block. Removal is made easier if two long 5/16" bolts are screwed into the cam shaft and used as a handle.



255. Check the camshaft bearing journals using a micro meter. If they are out of round by more than 0.025 mm (0.0010"), the camshaft must be replaced. Also check the camshaft for straightness. If the run out is more than 0.038 mm (0.0015"), the camshaft must be replaced.

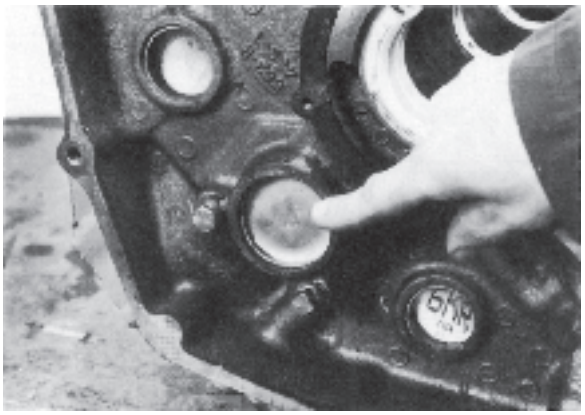
1. Camshaft bearing journals
2. Drive cam for fuel pump
3. Drive gear for the distributor

256. Check the cam lift height according to the specifications below. Tolerance of the lift height +/–0.05 mm (0.0020").

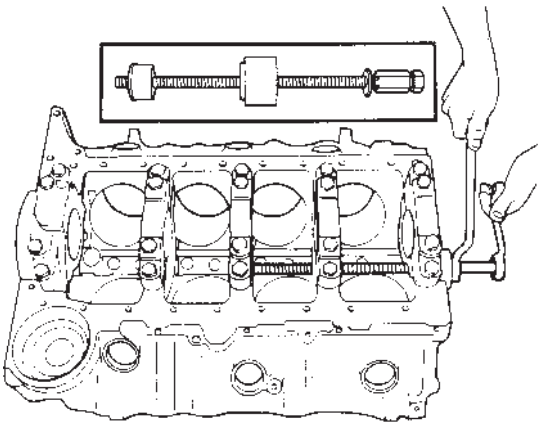
	Inlet	Exhaust
500, 501, 570, 572 (AQ211, AQ231, AQ271, BB231, BB261)	6.68 mm (0.263")	6.83 mm (0.269")
571 (AQ311)	7.52 mm (0.296")	7.70 mm (0.303")

257. Inspect the camshaft bearings in the block for wear. Replace it necessary.

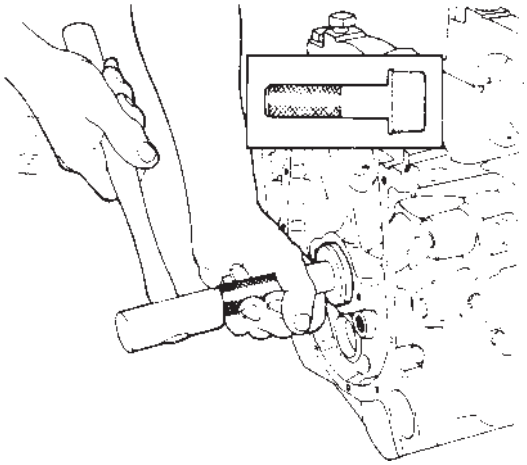
Replacing the camshaft bearings



258. Knock out the camshaft plug. Use a wooden handle or similar with approx. 45 mm (1 3/4") diam.



259. Install tool 884628-9. Press out the three middle bearings first.

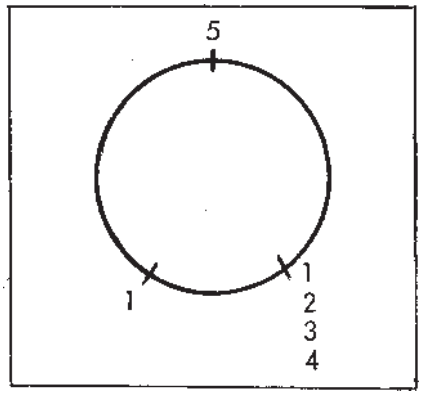


260. When removing the front and rear camshaft bearings, the puller and drift should be used that included in 884628-9.

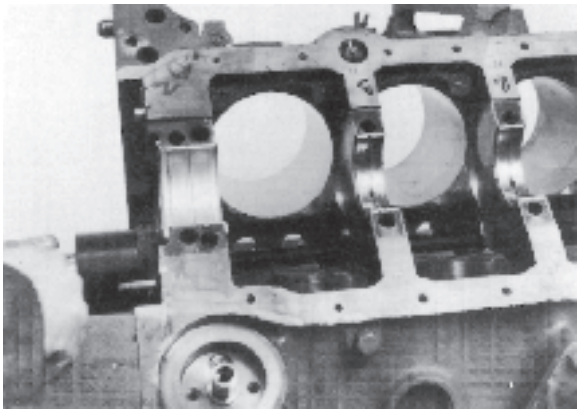
Installing camshaft bearings

261a. Install the front and rear bearings using the puller and drift included in tool 884628-9.

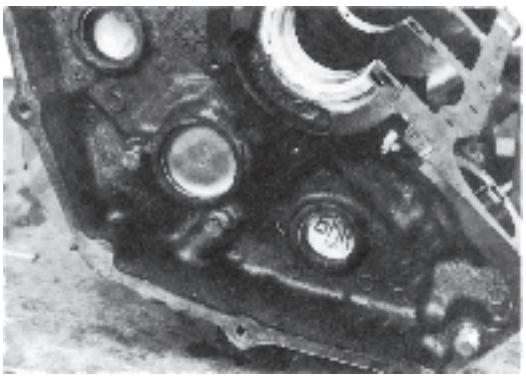
NOTE! The camshaft bearings should be installed with the oil holes located as per Fig. 261 b.



261b. Installation positions for camshaft bearing oil holes. The diagram shows the engine turned the right side up seen from the front, (camshaft timing gear side). The front bearing has two oil holes, other bearings, one.

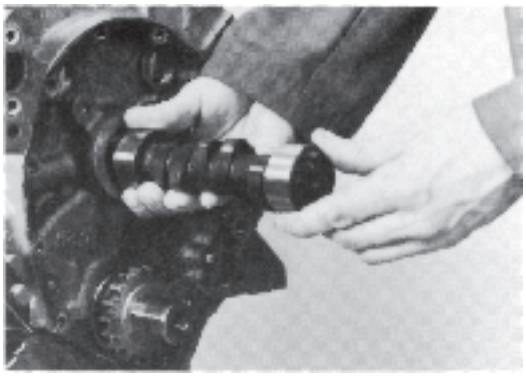


262. Install the three middle bearings using tool 884628-9 with the oil hole position as per Fig. 261b. Remove the tool and check that all oil holes are aligned correctly.

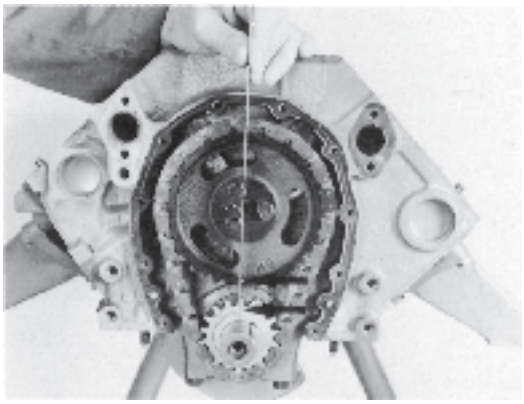


263. Install a new camshaft plug, seal with “Permatex” or equivalent. Fit the plug flush or max. 0.80 mm (0.030") deeper than the end surface.

Installing the camshaft

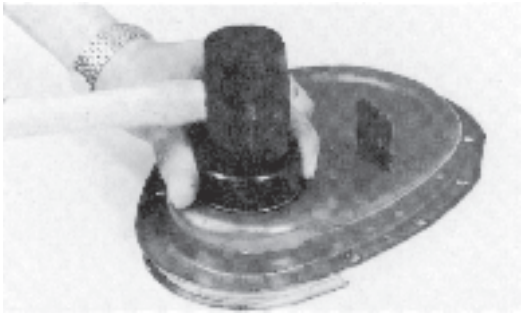


264. Oil the camshaft bearing surfaces with engine oil and install the camshaft. Be careful not to damage the camshaft bearings.
NOTE! If a new camshaft is installed, all the cam lobes should be coated with “Molycote” or equivalent. When installing a new camshaft, all new valve lifters should also be installed, see Chapter 4D.



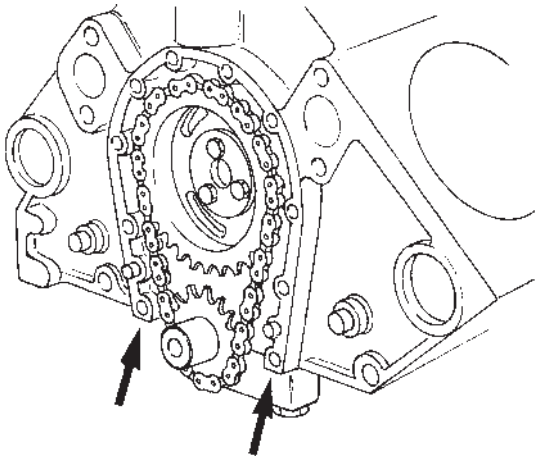
265. Turn the cam and crankshaft so that their timing marks are in line with each other. Camshaft gear marking should be at 6 o’clock and crankshaft gear marking at 12 o’clock.

266. Slip the cam chain around the crankshaft gear and install the cam gear on the end of the camshaft. Torque to 24 Nm (2.5 kpm/17.3 ft.lb.). Wrench size 1/2". Lubricate the cam chain with engine oil.

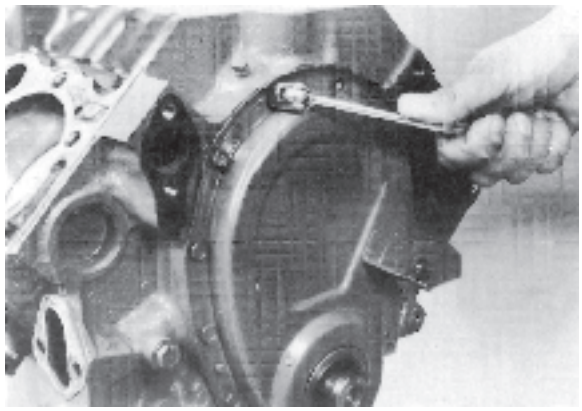


267. Replace the timing gear cover seal. The seal is removed from the front using a large screwdriver.
NOTE! Be careful not to damage the cover.

Install a new seal using tool 884529-9; support with a wooden block when installing.
NOTE! The seal should be installed with the lip facing inward.

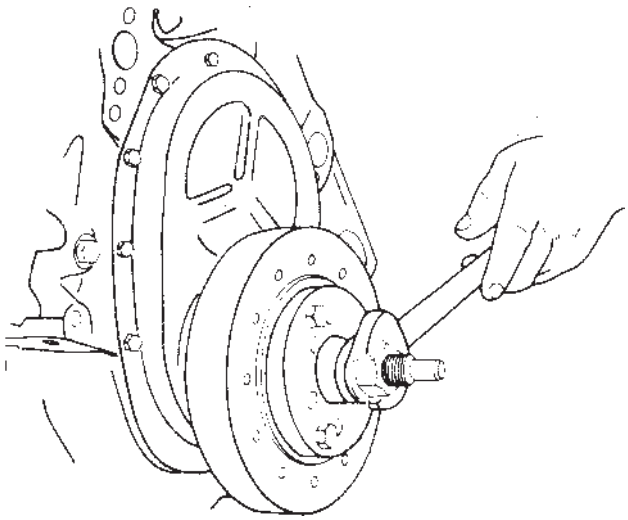


268. Clean the gasket surfaces on the engine block and timing cover. Place a 3 mm (1/8") bead of silicone sealer on the joints, see arrows.

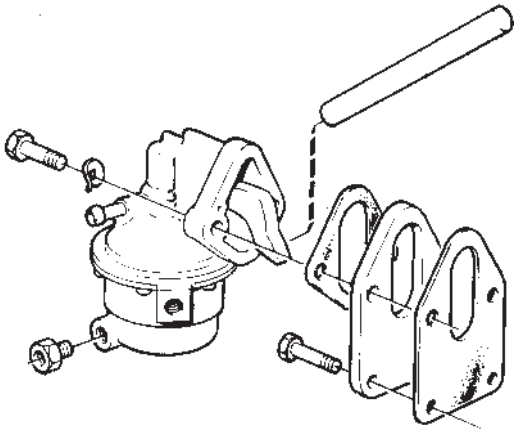


269. Brush the gasket with a sealer and place it on the cover. Install the timing cover. Tightening toque 14 Nm (1.4 kpm/10 ft.lb.), socket size 3/8".

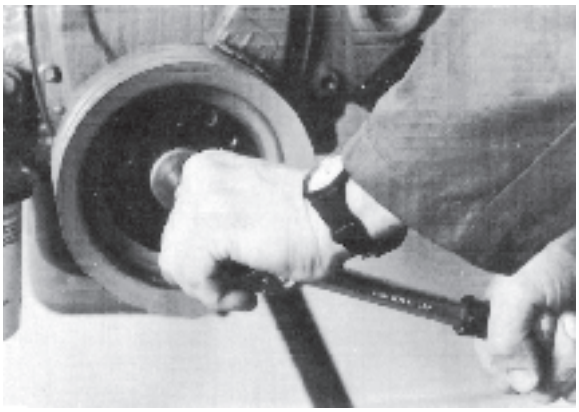
270. Install the oil pan using a new gasket. Oil in the oil pan gasket’s upper side with a little engine oil (sealing surface towards the timing gear casing). Torque the bolts to 11 Nm (1,1 kpm/7.8 ft.lb.) and the nuts to 22 Nm (2.2 kpm/15.6 ft.lb.) Refer to point 242 for installation of the oil pan.



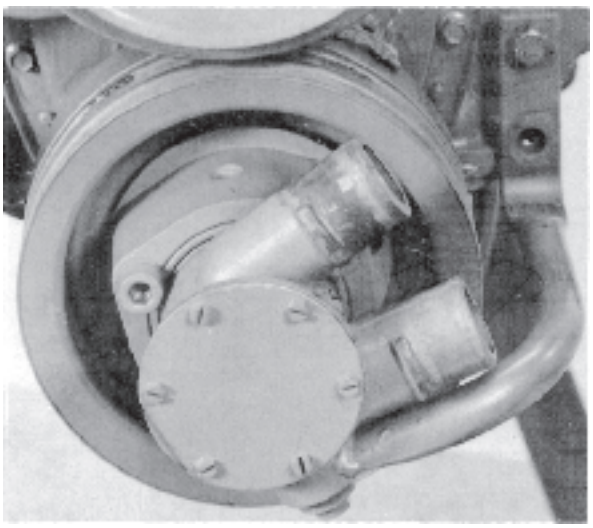
271. Install the vibration damper using tool 884608-1. Lightly lubricate the bearing journal of the vibration damper.



272. Oil the fuel pump push rod and install it together with the mounting plate and gasket, wrench size 3/8". Install the fuel pump, wrench size 3/8". Fit the fuel line, wrench size 17 mm.



273. Install the belt pulley bolt. Tighten to 82 Nm (8.2 kpm/ 59 ft.lb.). Wrench size 5/8".



274. Install the cylinder heads according to Chapter 4E, page 77. Install the sea water pump, Allen key 5/16", and the pump bracket, wrench size 14 mm.

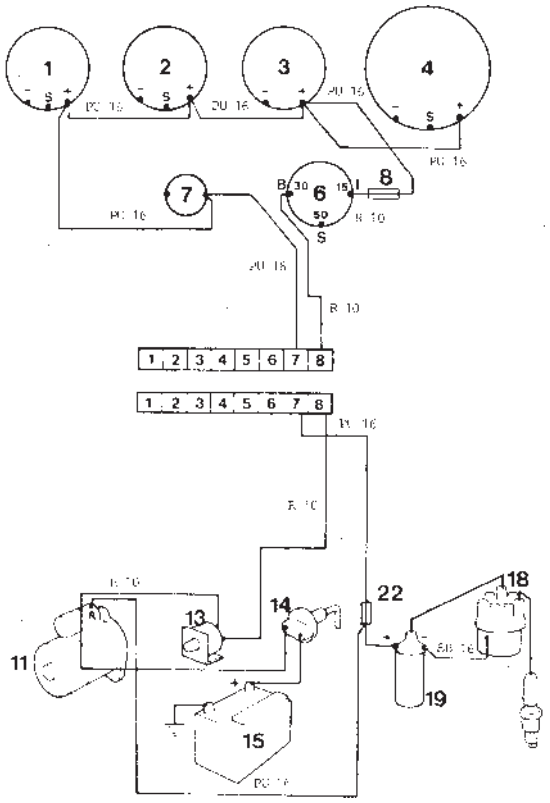
Install the circulation pump, wrench size 14 mm.

Chapter 5D Engine block

Fault-tracing and repair, ignition system

Fault-tracing the ignition system AQ211, AQ231, BB231, BB261 (breaker point system)

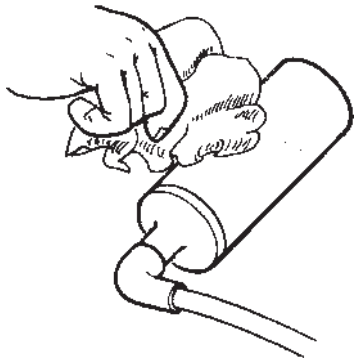
275. Ignition system AQ211, AQ231, BB231, BB261



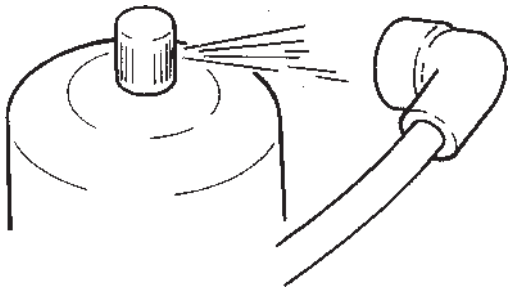
1. Oil pressure gauge
2. Temperature gauge
3. Voltmeter
4. Tachometer
6. Key switch
7. Switch, instrument fighting
8. Fuse, 8 Amp slow-action
11. Starter motor
13. Circuit breaker 40 Amp
14. Main battery switch
15. Battery
18. Distributor
19. Ignition coil
22. Ballast resistor

Wire sizes		Cable colors
AWG	mm^2	SB = Black
16	1.5	PU = Purple
10	6.0	R = Red

Cleaning



276. Before starting any fault-tracing, all components in the ignition system must be thoroughly cleaned. Use a mild de-greasing agent or special purpose cleaner. Dry the ignition coil, ignition wires and distributor. The distributor cap should also be dried on the inside.



277. Inspect the ignition wires, one at a time, and inspect the contact points for pitting, etc. Use a moisture-repelling spray such as Volvo Universal oil part No. 1161398-1 or equivalent. Clean the spark plug insulators. Clean the primary wiring in the same way.

Fault-tracing

278. Fault-tracing should be carried out in two steps:
Fault-tracing in the secondary circuit (high voltage)
Fault-tracing in the primary circuit (low voltage)
Always start fault-tracing in the secondary wiring.

Malfunction of the ignition system often occurs due to several different reasons. Do not stop fault-tracing when one cause of the problem has been found! The entire fault-tracing procedure must be followed.

WARNING! In case of malfunction in the high voltage secondary circuit, arcing and sparks can occur. Before starting to work, ensure that there is no fuel or gas leakage. Ventilate the boat and run the engine room blower (if fitted) 2–3 minutes before starting to work.

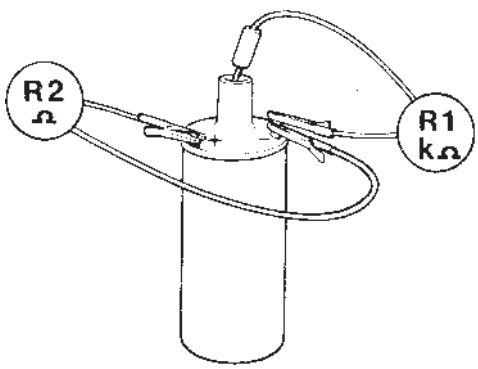
WARNING! The secondary circuit produces voltage of more than 10,000 V. It can be very dangerous to get in contact with any of these high voltage components. The ignition must be switched off when working with the high voltage secondary circuit, and only be switched on when performing function tests.

Fault-tracing the secondary circuit (high voltage)

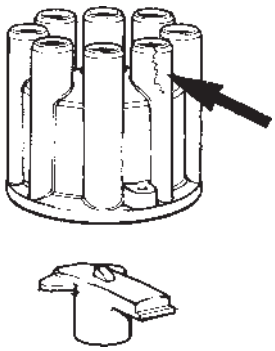
279. The secondary circuit fault-tracing includes

- ignition coil
- distributor cap
- rotor
- ignition wires
- spark plugs

280. Ignition coil
Check that the coil is dry and clean. Make sure that there are no cracks in the top insulation of the ignition coil. Check the ignition wire connections and insulation. Check that the primary wiring is connected correctly and making good contact.



281. Test the ignition coil using an ohm meter. The ignition coil resistance (R1) on the secondary coil should be between 9.4 and 11.7 kΩ at 20 °C (68 °F). The resistance of the ignition coil primary side (R2) should be between 1.6 and 1.8 ohms at 20 °C (68 °F).
NOTE! Disconnect the ignition coil when measuring.

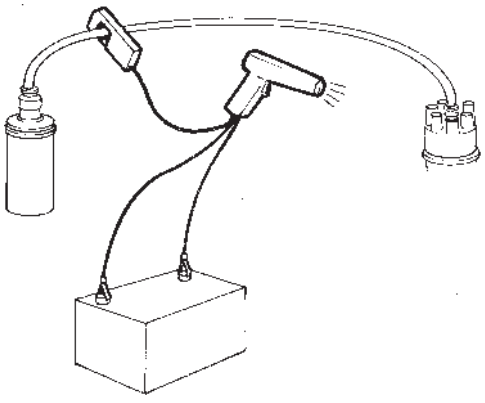


282. Distributor cap and rotor
Make sure that the parts are clean and dry, and that there are no cracks. Replace if there is the smallest crack or if the breaker points are heavily corroded or burnt.

283. Ignition wires
Check that there is good electrical contact and that the insulation is not damaged. Be extra careful when inspecting the coil wire. Remember that an engine very well can function during normal conditions but refuse to start if arcing takes place here e.g. in damp weather. The ignition wire resistance should be 0 Ω, test using an ohm meter.

284. Spark plugs
Check the spark plugs for wear and deposit buildup. Make sure that the insulators are not cracked.

285. Start the engine
Start the engine. If it runs smoothly, there is no need to continue fault-tracing.



286. Engine does not start
Connect an inductive sender for timing light to the ignition wire between ignition coil and distributor. Connect the timing lights power supply wires. Crank the engine with the starter motor and check if the timing light starts to flash.

If the light flashes, the primary circuit (low voltage) is functioning correctly.
NOTE! Ignition timing and the condition of the breaker points should be checked.

287. Timing light does not flash.
Carry out points 280–285 again.
NOTE! Make sure that the difficulty to start is not due to malfunctions in the fuel system or that the timing and dwell setting has been changed e.g. after an engine overhaul. See “Technical Data” for ignition setting data.

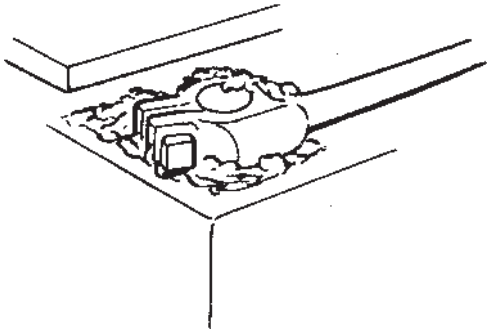
288. If the timing light still does not flash, fault-tracing should be carried out on the primary side.

Fault-tracing in the primary circuit (low voltage)

289. Fault-tracing of the primary circuit includes:

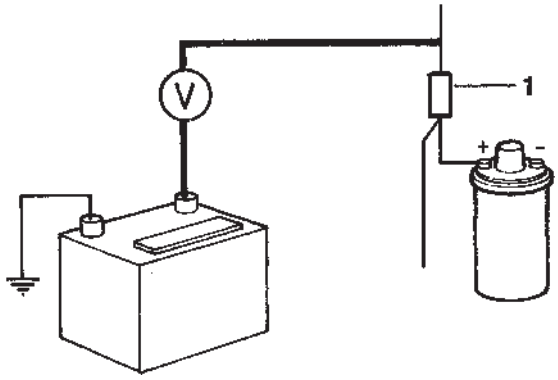
- battery
- supply circuit battery-ignition coil
- ballast resistor
- breaker points and condenser
- checking ignition timing and dwell (contact gap)

290. Cheek the battery voltage. It should be between 12 and 13 V. If lower, the battery should be charged.



291. Make sure that the battery connections are clean and making good contact. Clean and grease with an electrically conductive grease, e.g. CRC copper paste or equivalent. If the battery seems to be in poor condition, carry out a thorough battery test and replace the battery if necessary.

292. Voltage drop supply circuit, battery – ignition coil
A poor connection on this circuit results in voltage drop up to the ignition coil. This voltage drop often results in intermittent loss of ignition, irregular ignition, back-firing, etc.

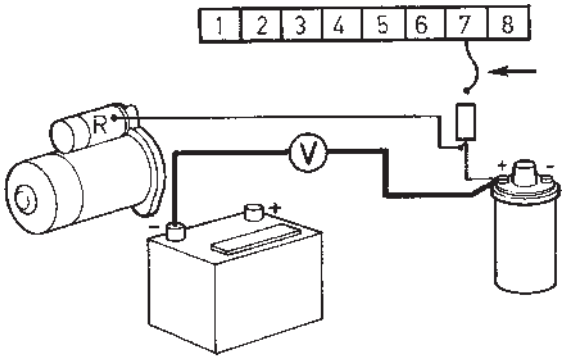


293. Connect the + side of a voltmeter to the battery and connection and the – side to the connection before the ballast resistor (1), see diagram. With the ignition switch on, the voltage should be less than 1 V, typically 0.5 V. Do not stop the test, if the value is correct.

294. Look for poor contact by moving wire connections at the battery, starter motor, solenoid, cable harness connections, starter key, ballast resistor and ignition coil. If any of these contact points change the voltmeter reading when moved, the connection should be removed and the bad connection corrected.

WARNING! Sparking might occur. Make sure that the boat is completely ventilated!

295. If there is no current flowing to the ignition system, although the switch is on, fuse 8 and 13, Figure 275, should be checked.



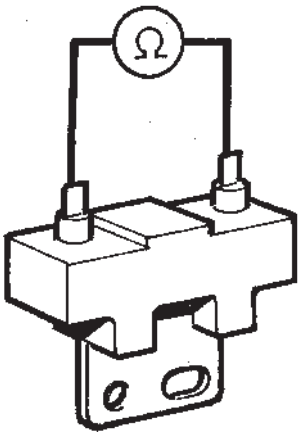
296. Make sure that there is power from the starter motor to the ignition coil. Loosen one of the ballast resistor connections and connect a voltmeter as per diagram. Run the starter motor; the voltmeter should now read 9–10 V. If the voltmeter reading is below 9 V or there is no voltage, check the wiring and connections to the solenoid.

297. Ballast resistor.

The ignition coil is designed to work with a ballast resistor. This is done so that the ignition voltage from the ignition coil should not drop due to the system voltage dropping to 9–10 V during starting.

During starting, the ignition coil is fed from the starter motor R-connection by-passing the ballast resistor. After starting, the starter motor solenoid breaks this circuit and the ignition coil is supplied voltage via the ballast resistor. A faulty ballast resistor will cause the ignition coil to work at the incorrect voltage on the primary side. Too high a voltage will cause the coil to overheat and breaker points to become pitted or burnt. Too low a voltage will cause the distributor not to get sufficiently high ignition voltage.

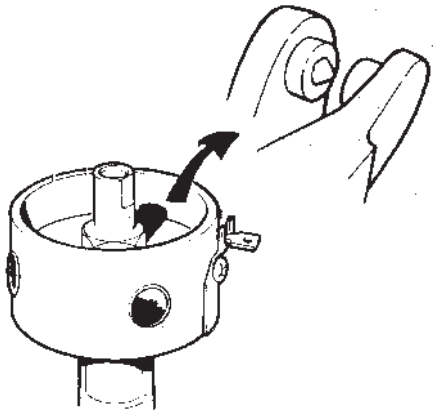
NOTE! Too low voltage will also cause pitting of the breaker points, because the condenser is not matched to the lower voltage.



298. Measure the resistance of the ballast resistor using an ohm meter. At 23 °C (75 °F) the resistance should be 0.5–0.6 Ω. If the ballast resistor has a temperature of 100 °C (212 °F), the resistance should be between 0.7 and 0.8 Ω.

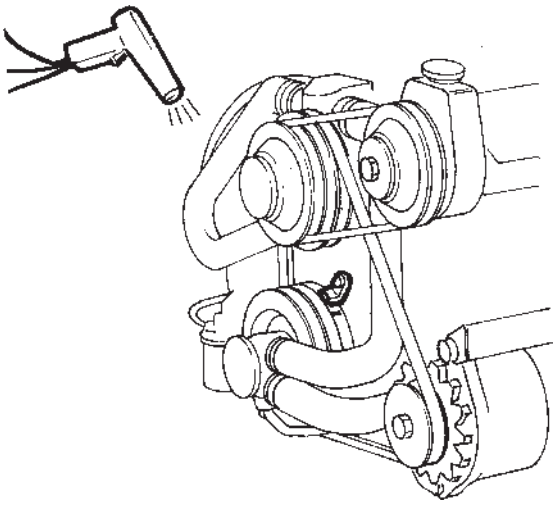
NOTE! Remove the ballast resistor connections when measuring.

Breaker points and capacitor



299. Make sure that the breaker points are not burnt or pitted. If the points burn or become pitted in a short period of time, the condenser should be replaced. See also under “Ballast Resistor”. Check the breaker point gap, see “Technical Data”.

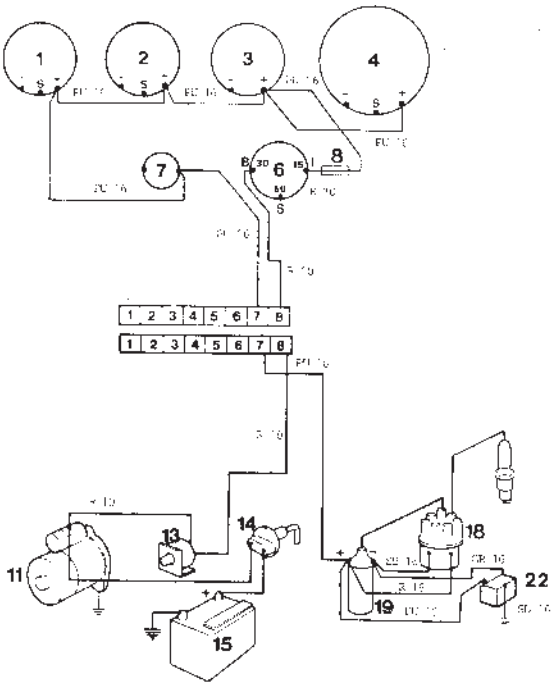
Ignition Timing



300. Check the ignition timing using a stroboscopic timing light on the timing marks on the vibration damper.
NOTE! A workshop tachometer should be used for ignition timing, not the boat instruments. For setting values, see “Technical Data”. Check the breaker point cam angle, correctly set it should be 28°–34°.

Electronic ignition system
500, 501, 570, 571, 572 (AQ271, AQ311)

301. Ignition system



1. Oil pressure gauge
2. Temperature gauge
3. Voltmeter
4. Rev counter
6. Key switch
7. Switch, instrument lighting
8. Fuse, 8 Amp slow-action
11. Starter motor
13. Circuit Breaker
14. Main Battery Switch (accessory)
15. Battery
18. Distributor
19. Ignition coil
22. Speed limiter (AQ271, AQ311, 570/SP, 570/DP, 571)

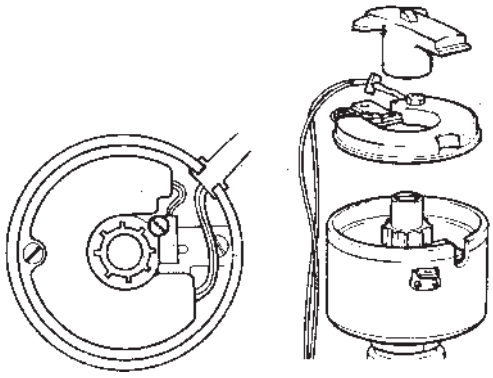
Wire sizes		Cable colors
AWG	mm^2	SB = Black
16	1.5	PU = Purple
10	6.0	GR = Grey
		R = Red

Description

302. The system is a breakerless transistorised ignition system that provides very stable and accurate ignition timing. The electronic module is not affected by moisture, extreme temperatures or vibration. It is also protected from excessive voltage and reversed polarity. The system is independent of engine speed and functions at all speeds above 0 rpm. Few components and a simple fault-tracing makes it very easy to service.

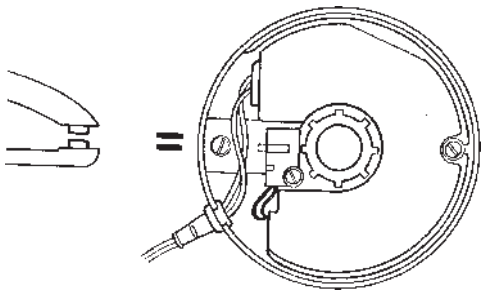
Function

303. The system construction and external appearance is that of a “traditional” ignition system with an ignition coil and distributor. The distributor has been changed so that the breaker points and the condenser have been replaced by an electronic module.

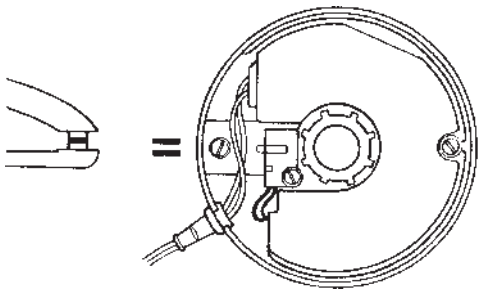


304. The ignition coil has a high voltage output and is matched to the electronic module. A ballast resistor is not used. The impulse sender is in the form of a toothed wheel with 8 teeth that corresponds to the cam on the distributor shaft for breaker point systems.

305. A sensor is mounted next to the impulse sender, which records the presence or absence of teeth. The sensor functions as a metal detector. The electronic module sends a current to a fine wire coil in the sensor. The coil functions as an oscillator that creates a magnetic field. The field is affected by the presence of the teeth of the impulse sender. Each pulse, or “interference”, that the impulse sender creates in the magnetic field causes a transistor to electrically close or open the primary voltage to the ignition coil, performing the same function as breaker points.



306. When a tooth is right opposite the sensor and the magnetic field is disturbed a low frequency current is sent to the electronic module. The transistor is in the “off” position and no current flows to the ignition coil. This corresponds to breaker points being open.



307. When there is a gap right opposite the sensor, the magnetic field is not disturbed by the presence of metal and a high frequency current is sent to the electronic module. The transistor is in “on” position, providing primary voltage to the ignition coil. This position corresponds to breaker points being closed. The ignition advance is controlled by centrifugal weights and the dwell angle is determined by the air gap between the sensor and the impulse sender.

Fault-tracing

308. Fault-tracing is carried out in two steps:
Fault-tracing the secondary circuit (high voltage)
Fault-tracing in the primary circuit (low voltage)
Always start the fault-tracing in the secondary circuit.

Trouble in the ignition system often occurs due to several different reasons. Do not stop the fault-tracing when one cause of the trouble has been found! The entire fault-tracing procedure must be followed.

WARNING! In case of trouble in the high voltage secondary circuit arcing and sparks can occur. Before starting to work, make sure that there is no fuel or gas leakage. Ventilate the boat and run the engine room blower (if fitted) 2–3 minutes before commencing work.

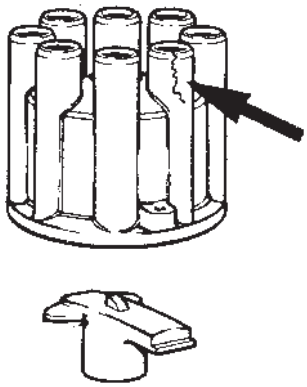
WARNING! The high voltage secondary circuit produces a voltage of more than 10000 V. It can be very dangerous to come in contact with any of these high voltage components. The ignition must be switched off when working with the high voltage circuit, and should only be switched on when performing function tests.

Fault-tracing the secondary circuit (high voltage circuit)

309. The secondary circuit fault-tracing includes:

- ignition coil
- distributor cap
- rotor
- ignition cables
- spark plugs

310. Ignition coil
Check that the coil is dry and clean. Make sure that there are no cracks in the top of the ignition coil. Inspect the condition of the ignition wire connections and insulation. Check that the primary wires are connected correctly and are making good contact.

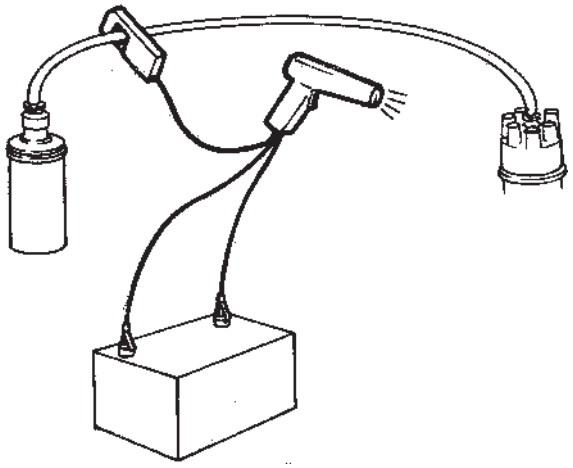


311. Distributor cap and rotor
Make sure that the parts are clean and dry, and that there are no cracks. Replace even if there is the smallest crack or if the contact points are heavily corroded or burnt.

312. Ignition wires
Make sure that the ignition wires are clean and dry. Check that there is good electrical contact and that the insulation is not damaged. Be extra careful when inspecting the coil wire. The resistance of the ignition wires should be 0 Ω, test using an ohmmeter.

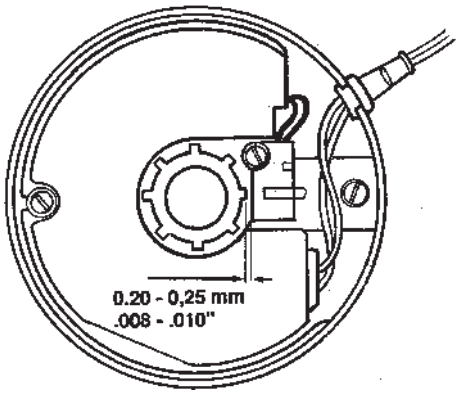
313. Spark plugs
Check the spark plugs for wear and deposit build up. Make sure that the insulator is not cracked.

314. Start the engine
If the engine starts and runs smoothly, there is no need to continue the fault-tracing.



315. Engine does not start
Connect the inductive sender for a timing light around the ignition wire between the ignition coil and distributor. Connect the light to the power source. Have someone crank the engine with starter motor. Cheek if the light starts to flash. If so, the primary circuit (low voltage) is working correctly.

316. Carry out points 310–314 again. Also make sure that the starting difficulty is not due to a problem in the fuel system or that the ignition timing has been altered.

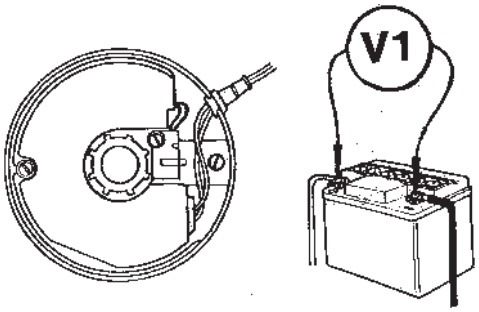


317. If the timing light still does not flash, remove the distributor cap and rotor. Rotate the engine so that one of the impulse sender teeth stop right opposite the sensor. Check that the distributor shaft is not bent. Check the air gap between the impulse sender and sensor. The distance should be 0.20–0.25 mm (.008"–.010"). Adjust if necessary.

318. Repeat point 315. If the timing light still does not flash, the primary circuit voltage should be measured with voltmeter.

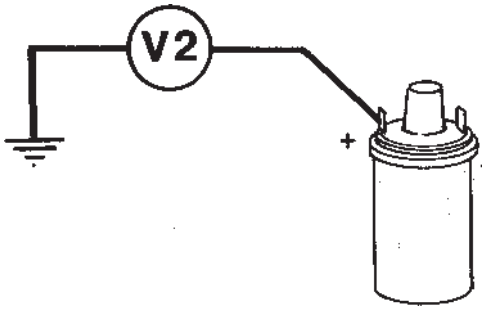
Fault-tracing in the primary circuit (low voltage)

Measuring the voltage in the primary circuit



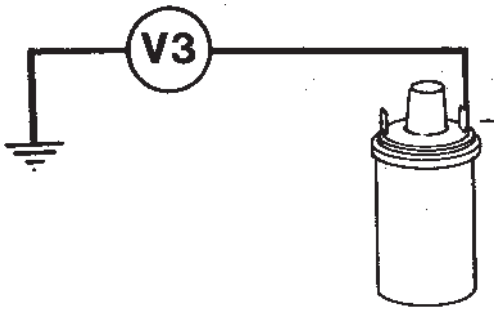
319. Rotate the engine so that the sensor lines up between two teeth on the impulse sender, corresponding to the breaker points being closed. Turn the starter key to the ignition position. The primary circuit is now engaged. The value V-1 should be between 12 and 13 V. If lower, charge the battery. Should the battery seem to be in poor condition, a more thorough battery test should be carried out and the battery replaced if necessary.

NOTE! Always carry out a voltage drop test according to points 327–330, even if the problem has been found.

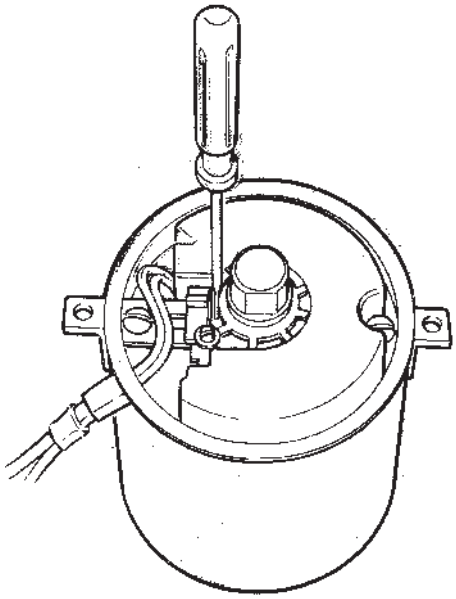


320. Connect the voltmeter between the ignition coil connection and ground. This voltage (V-2) should be max. 2V lower than V-1. Normally 0.5V–1 V lower value.

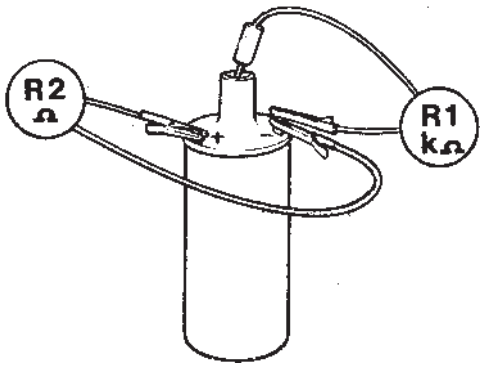
321. If V-2 has a lower value, the reason for the voltage drop must be found, refer to points 327–330.



322. Connect the voltmeter between the ignition coil + connection and ground. This voltage V-3 should be between 4 and 8 V. If less than 4 V – see point 325. If more than 8 V, carry on according to point 326.

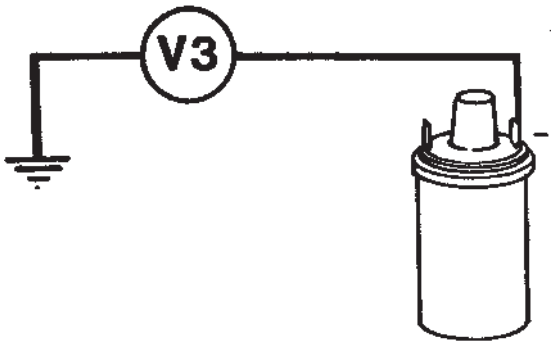


323. Now place a screwdriver in the opening in front of the sensor. V-3 should now read between 12 and 13 V. Should the voltmeter show correct values, although the ignition is not functioning, this indicates a fault in the ignition coil.



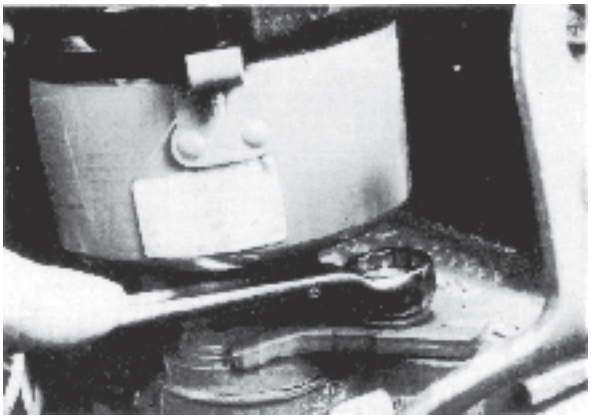
324. Test the coil by measuring the resistance between + and – connections (R2) in the primary circuit. The resistance should be 1.25–1.4 Ω at 20 °C (68 °F). Then measure the resistance of the secondary circuit (R1). It should be 9.4–11.7 kΩ at 20 °C (68 °F). If necessary, replace the ignition coil.
NOTE! Disconnect the ignition coil when measuring.

Connect the timing light according to point 315. Install the distributor cap and rotor. Turn the engine. If the timing light does not light, there is also a fault in the electronic module. Replace the electronic module.



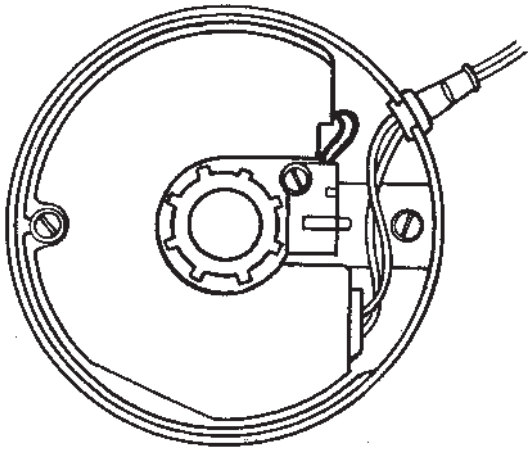
325. V-3 shows less than 4V. Remove the connection from the coil – connection and connect only the voltmeter to the – connection.

If the voltmeter now shows 12–13 V, it indicates that the ignition coil is not at fault and that there is a short circuit in the electronic module. If the same value is obtained, it indicates a faulty coil. There is an open circuit in the primary winding. Replace the coil.

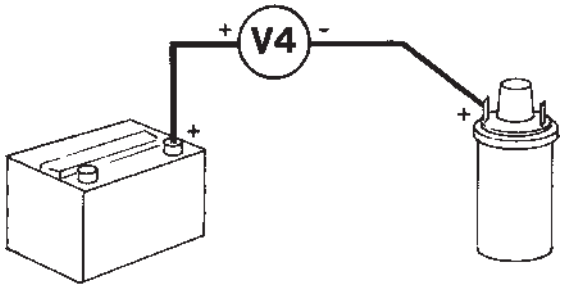


326. V-3 is more than 8 V, typically 12–13 V, the same as for the coil + connection. This indicates poor or no connection to ground between the distributor and engine block. Such a fault is unusual, however. Check the distributor ground connection. If there is not fault there, replace the electronic module.

327. Voltage drop-supply circuit battery to ignition coil
A poor connection in this circuit leads to voltage drop to the ignition coil. This voltage drop often results in intermittent ignition failure, irregular ignition, backfiring, etc.



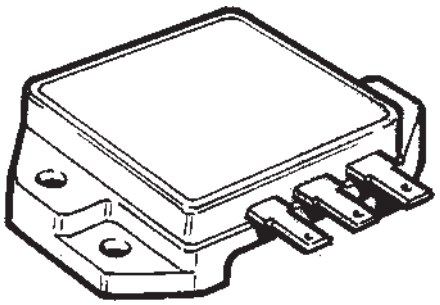
328. Rotate the engine so that the sensor stops right between two teeth on the impulse sender.



329. Connect the + side of a voltmeter to the battery connection and the voltmeter – side to the ignition coil + connection. With the ignition switch on, the voltage V-4 should be less than 2 V, typically 0.5V–1 V. Do not stop the test if the value is correct.

330. Look for poor contact by moving the wire, connections at the battery, starter motor, solenoid, harness connections, starter key and ignition coil. Should a contact point change the voltmeter reading when this is carried out, the connection must be removed and the faulty connection corrected.

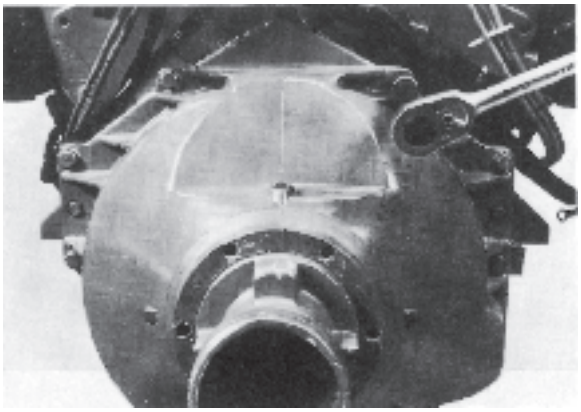
⚠ **WARNING!** Sparking might occur, so make sure that the boat is properly ventilated.



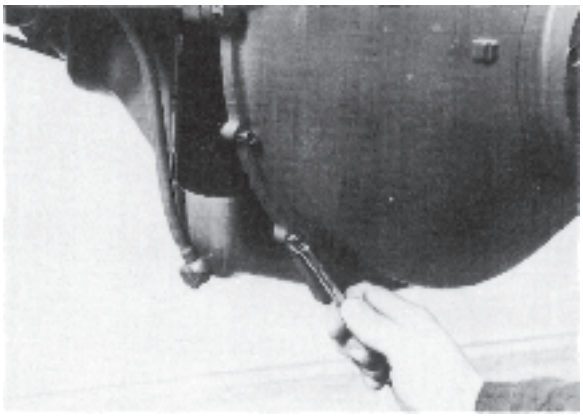
331. Engine speed limiter
The ignition system for 570/SP, 570/DP, 571 (AQ271, AQ311) includes an engine speed limiter. The limiter function is to interrupt the ignition voltage should the preset maximum rpm be exceeded, such as when the propeller leaves the water for a few of seconds. For the 571 (AQ311), it is set at 5700 r/m and for the 570/SP, 570/DP (AQ271) at 5100 r/m. The tolerance is + /– 100 r/m. If the speed limiter operates at lower rpms, replace the limiter. Check that the speed limiter is at fault by removing all three connections.

Chapter 5E Engine block

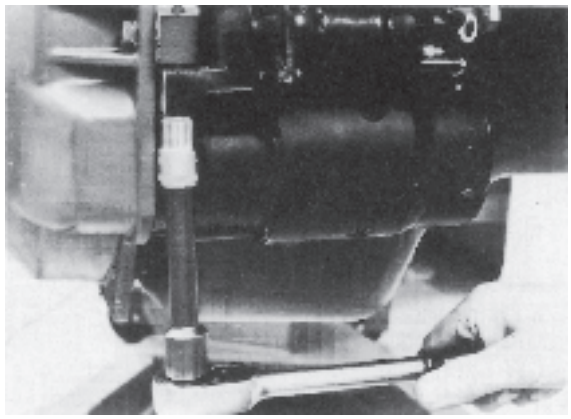
Installation of related parts



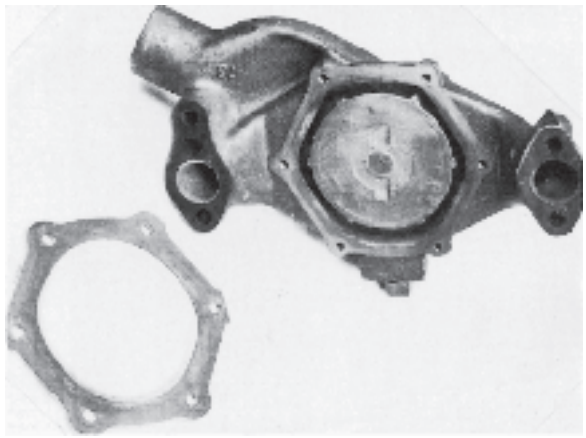
332. Install the flywheel housing. Oil the bolts and torque to 41 Nm (4.2 kpm/30 ft.lb.), Wrench size 9/16".



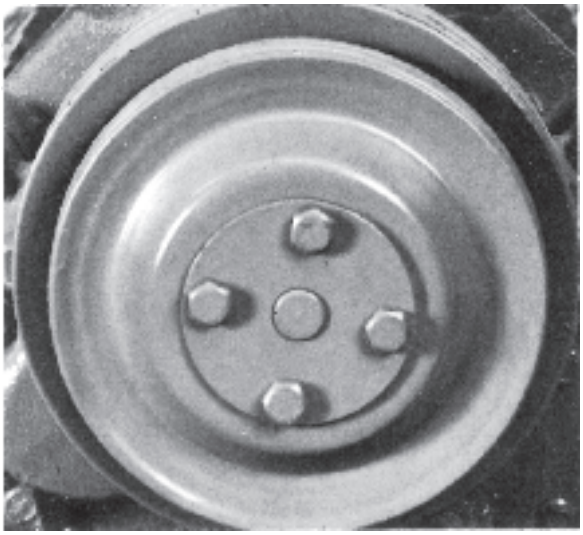
333. Install the protection plate to the flywheel housing. Wrench size 5/16".



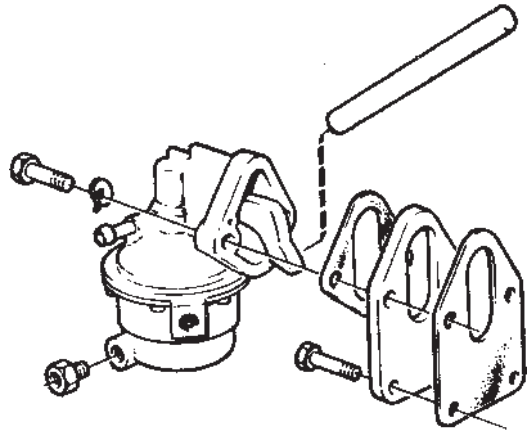
334. Install the starter motor. Wrench size 14 mm.



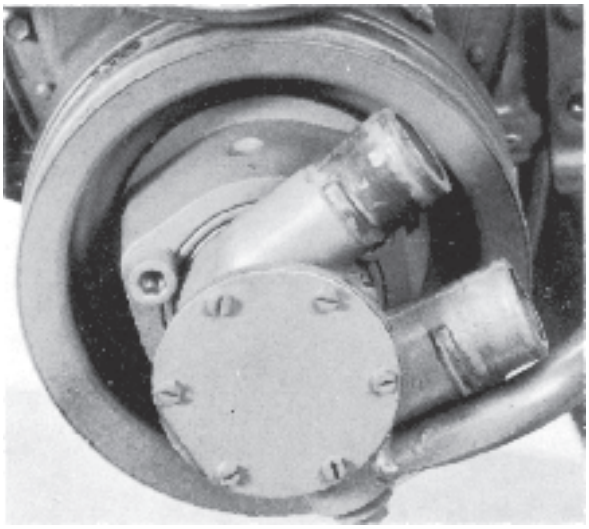
335. Install the circulation pump using new gaskets. Wrench size 9/16".



336. Install the belt pulley, socket size 5/8".



337. Install the fuel pump using new gaskets on both sides of the metal mounting plate. Grease the push rod to hold it in place while installing. Wrench size, 1/2" for the pump and 3/8" for the metal mounting plate.



338. Install the sea water pump, 5/16" Allen wrench. Install with rubber dampers, large washer, spring washer and bolts.

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