

SAAB

Service Manual Saab 99



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2 Engine

M 1982—

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Contents

2 Engine

M 1975-81

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Specifications

Engine

General data

Type

Power rating, DIN (SAE net)
Max. torque, DIN

Compression ratio

Cylinder bore

Stroke

Cylinder volume

Firing order

Engine idling speed (warm engine
and headlamps on low beam)

Weight incl. clutch, throttle
valve housing, exhaust manifold,
starter motor and oil filter

Fuel, minimum octane number,

Single-carbureted engine

4-cyl, 4-stroke with
overhead camshaft
73 kW (100 hp)/5.200 r.p.m.
162 Nm (120 ft.lb., 16.5 kpm)
3.500 r.p.m.

9.5:1

3.543 in (90.0 mm)

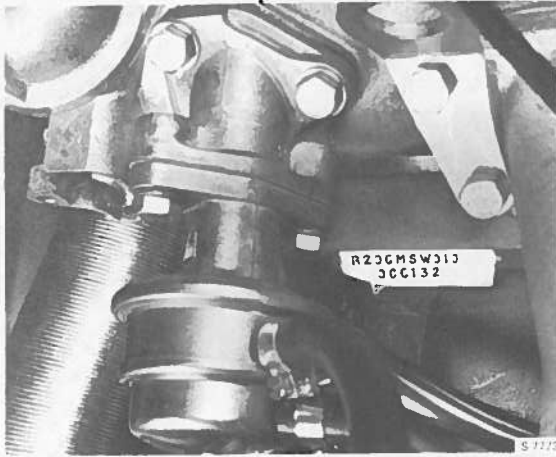
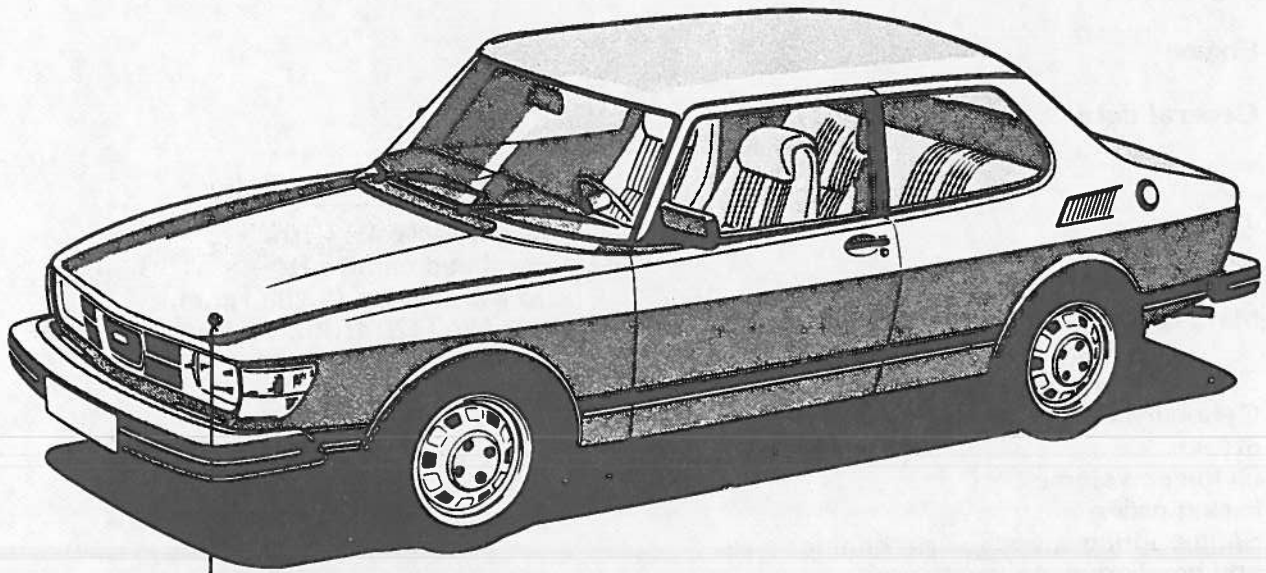
3.071 in (78.0 mm)

121.0 cu.in. (1985 cm³)

1-3-4-2

850 ± 50 r.p.m.

308 lb. (140 kg) approx.
RON 93 (Sweden spec.)
RON 97 (Europe spec.)



Engine Number

"B" - Petrol engine — B
Cylinder volume in dl — 20
Model: — C
"C" = Single carburetor
"T" = Twin-carburetor
"I" = Fuel injection
"S" = Turbo
Transmission type: — M
"M" = Manual
"A" = Automatic
Exhaust emission control level: — UC
"UC" = USA
"SW" = Sweden
"EU" = Europe
Equipment variants — 01
Year designation: — C
"B" = 1981
"C" = 1982 etc.
Manufacturing number — 000001

Cylinder block

Material	Specially alloyed cast iron
No. of main bearings	5
Cylinder bore:	
Standard (A)	90.000-90.010 mm
Standard (B)	90.010-90.020 mm
1st oversize	90.500 mm
2nd oversize	91.000 mm

Cylinder head

Max. grinding or facing of cylinder head surface	0.4 mm
Distance from cylinder head gasket to valve cover gasket surface, new cylinder head	92.75 ± 0.05 mm

Pistons

Make	"MAHLE" or "KARL SCHMIDT" Pistons of different makes must not be fitted in the same engine.
Material	Light metal alloy
No. of rings per piston	2 compression rings
Width of ring grooves:	
Top	1.79-1.81 mm
Second	2.03-2.05 mm
Scraper	4.01-4.03 mm
Piston diameter perpendicular to gudgeon pin ("MAHLE" measured 16 mm from lower edge of piston "KARL SCHMIDT" measured 26 mm from lower edge of piston)	
	std 9.5:1
Standard A (not spare part)	89.972-89.980
Standard AB	89.980-89.986
Standard B (not spare part)	89.986-89.994
Standard (C)	89.994-90.010
1st oversize (0.5 mm)	90.472-90.487
2nd oversize (1.0)	90.972-90.987
Piston clearance	0.014-0.040
Withdrawal of piston	From top of block
Piston orientation	Groove on top should be facing the transmission end of engine
Pin diameter	23.996-24.000 mm
Fit of pin	0.005-0.014 mm Sliding fit under gentle pressure with thumb
Piston speed (average speed)	13 m/s at 5000 r/min

Piston rings

Top compression ring:

Thickness	1.73-1.75 mm
Gap, fitted in new cylinder	0.35-0.55 mm
Piston ring play in groove	0.050-0.082 mm

Second compression ring:

Thickness	1.98-1.99 mm
Gap, fitted in new cylinder	0.30-0.45 mm
Piston ring play in groove	0.040-0.072 mm

Oil scraper:

Thickness (segment)	0.58-0.64 mm
Gap fitted in new cylinder (segment)	0.38-1.40 mm
Thickness, middle ring	2.63-2.73 mm

Connecting rods

Material	Forged steel
Diameter of drilling in big-end	56.000-56.019 mm
Small-end bush installed	24.005-24.010 mm
Max. permissible weight variation per set	0.2 oz. (6 g)

Crankshaft

Material	Forged steel
Surface treatment	Tennifer-coated
Journal hardness	HV 800 approx.
No. of main bearings	5

Crank pin diameter:

Standard	51.981-52.000 mm
1st undersize	51.731-51.750 mm
2nd undersize	51.481-51.500 mm
3rd undersize	51.237-51.250 mm
4th undersize	50.987-51.000 mm

Main journal diameter:

Standard	57.981-58.000 mm
1st undersize	57.731-57.750 mm
2nd undersize	57.481-57.500 mm
3rd undersize	57.237-57.250 mm
4th undersize	56.987-57.000 mm
Radius at journal end	2.2-2.5 mm
Max. ovality of journals (out-of-round)	0.005 mm
Max. conicity of journals (taper)	0.005 mm
Bearing material	Lead-bronze
Crankshaft end float	0.08-0.28 mm
Main bearing clearance	0.020-0.062 mm
Big-end bearing clearance	0.026-0.062 mm

Colour marking, main and connecting rod bearing shells:

	Thin	Thick
Standard	Red	Blue
1st undersize	Yellow	Green
2nd undersize	White	Brown

Camshaft

Number of bearings	5
Bearing diameter	28.94 mm
Camshaft end float	0.08-0.25 mm

Cam lift (at 0 valve clearance):

Inlet	10.8 mm
Exhaust	11.0 mm

Valve timing (at 0 valve clearance):

Inlet	
- opens	10 ⁰ BTDC
- closes	54 ⁰ ABDC
Exhaust	
- opens	46 ⁰ BBDC
- closes	18 ⁰ ATDC

Valve mechanism

Valve face angle, inlet and exhaust	44.5 ⁰
Valve seat angle in cylinder head, inlet and exhaust	45 ⁰
Valve seat width, inlet and exhaust	1-2 mm

Valve stem diameter:

Inlet	7.960-7.975 mm
Exhaust	7.955-7.980 mm
Stem to guide clearance	0.5 mm
	Measured on valve head raised 3 mm above seating

Valve head diameter:

Inlet	42.0 mm
Exhaust	34.5 mm

Valve guides:

Length	46.65 mm
Outer diameter	13.040-13.051 mm
Bore for valve guides in cylinder head, diameter	13.000-13.018 mm

Valve springs:

Installed length	39.5 mm
Free length	43.1 mm
Length at full elevation	29.5 mm
Load at full elevation	755-815 N (170-183 lb, 77-83 kg)

Valve depressors:

Diameter	37.87-37.98 mm
Height	33 mm
Bore in cylinder head for valve depressors (camshaft bearing assy.) diameter	38.000-38.016 mm

Pallets for valve adjustment:

Diameter	15.5 mm
Thickness	1.77-2.89 mm
There are 23 pallets of different thicknesses at intervals of 0.50 mm	

Materials

Exhaust valves	Stellited steel
Inlet valve	Steel (Valve stems are chromium plated)
Valve guides	Cast iron
Valve seats	Sintered metal

Valve clearances, cold engine
(30 minutes after driving the
engine warm:

Inspection tolerance zone:

Inlet

0.006-0.012 in (0.15-0.30 mm)

Exhaust

0.014-0.020 in (0.35-0.50 mm)

Adjustment tolerance
zone:

Inlet

0.008-0.010 in (0.20-0.25 mm)

Exhaust

0.016-0.018 in (0.40-0.45 mm)

Lubrication system

Type

Forced-flow circulating oil system
Gear-type oil pump with eccentric
ring gear

Pressure-lubricated points

Camshaft, crankshaft, idler shaft,
connecting rods

Splash-lubricated points

Gudgeon pins, cylinder walls, valve
depressors, valve stems and timing
chain.

Oil filter

Full-flow type

Crankcase ventilation, fully
enclosed

From crankcase through valve cover -
restriction to inlet manifold. Valve
cover is connected to atmospheric
pressure via the air cleaner.

Lubricating oil, grade:

SAE 10 W 30, 10 W 40, or
5 W 30.

If no oil meeting these speci-
fications is available, oil with
a viscosity of SAE 15 W 40 or
15 W 50 may be used.

The use of additives is not
recommended.

Service SF in API-system or
Ford spec. ESE-M2C-101C
6 Imp. pints (3.5 litres)

Oil volume incl. filter

Oil pump pressure-reducing valve
opens at

3.6-5.2 bar (kg/cm², 51-74 lb/in²)

Oil pressure warning light comes
on at

0.3-0.5 bar (kg/cm², 4.2-7.1 lb/in²)

Oil pressure at 2.000 r/min (oil
SAE 10 W 40 at 1767°C F, 80°C)

Min. 3.0 bar (kg/cm², 43 lb/in²)

Fuel system

Single-carburetor

Make	Zenith
Model	175 CD
Diameter	1 3/4 in
Metering needle	B1 DS
Float adjustment	0.63-0.67 in, (16-17 mm) between the highest point on the float and the mating flanges of the carburetor housing.
Float valve	0.08 in, (2.0 mm)
Damper oil	Automatic transmission oil
Quantity of oil in damper	Lowest level: 0.39 in, (10 mm) below the upper lip of the air valve sleeve.

Fast idling speed:

(Engine at normal running temperature and with an 8 mm drill between the notch in the cam and the stop on the choke housing):

Approx. 1100 r/min

Normal idling speed:

(engine at normal running temperature and, for cars with Sweden spec., daylight driving lights on):

850 ± 50 r/min

CO Content:

Sweden: Engine running at 2 000 r/min; hoses to the vacuum control unit and crankcase ventilation disconnected; engine at normal running temperature (just after cut-in of fan); daylight driving light on:

1.75 ± 0.25 %

Europe: Engine running at 850 r/min and normal temperature; an lights off:

1.5 ± 1.0 %

Fuel jet installation position

Inserted to a distance of one in, (2.5 mm) from the jet seating surface

Basic position of fuel needle in vacuum piston (basic setting for adjustment)

Shoulder of needle in line with lower edge of vacuum piston

Temperature compensator, opening at room temperature (68°F/20°C)
Vacuum piston return spring, colour

0.004-0.012 in, (0.1-0.3 mm)

Red

Miscellaneous

Fuel pump (mechanical) type
Static fuel pressure at starter speed
Fuel tank capacity

Pierburg 7.20739.00

0.17-0.25 bar (2.4-3.6 lb/in²)
12.8 Imp. gal. (58 l)

Deceleration valve, carbureted engine with Europe specification

Setting:

1. Turn the valve screw clockwise until engine speed ceases to increase.
2. Turn the valve screw counter-clockwise until the engine returns to idling speed and then turn the screw a further 1/2-3/4 turn clockwise from this position.

To check:

Rev up the engine and release the throttle. Check that the engine speed - after a slight delay - returns smoothly and surely to the idling speed.

Dashpot, carbureted engines with Sweden spec.

Checking: Retardation time from 3 000 r/min to idling speed should be:

Between 3 and 6 seconds

Setting: Idling speed when the dashpot rod strikes the throttle lever stop (vacuum hose disconnected and plugged; engine warm)

Single-carburetor engines: $2\,600 \pm 100$ r/min

Delay valve: cars with sweden spec.

Vacuum signal delay to vacuum control unit
Colour fo valve

2 ± 1 s
Brown

Exhaust system

Exhaust pipe inner diameter

1.73 in (44 mm)

Cooling system

Type
Liquid capacity of cooling system incl. heating system
Thermostat opens at
Radiator pressure cap opens at

Pressurized

14 Imp. pints (8 l)
 192°F (89°C)
0.9-1.2 bar (12.8-17.0 lb/in²)

Water pump

Number of vanes on impeller

8

Tightening torques

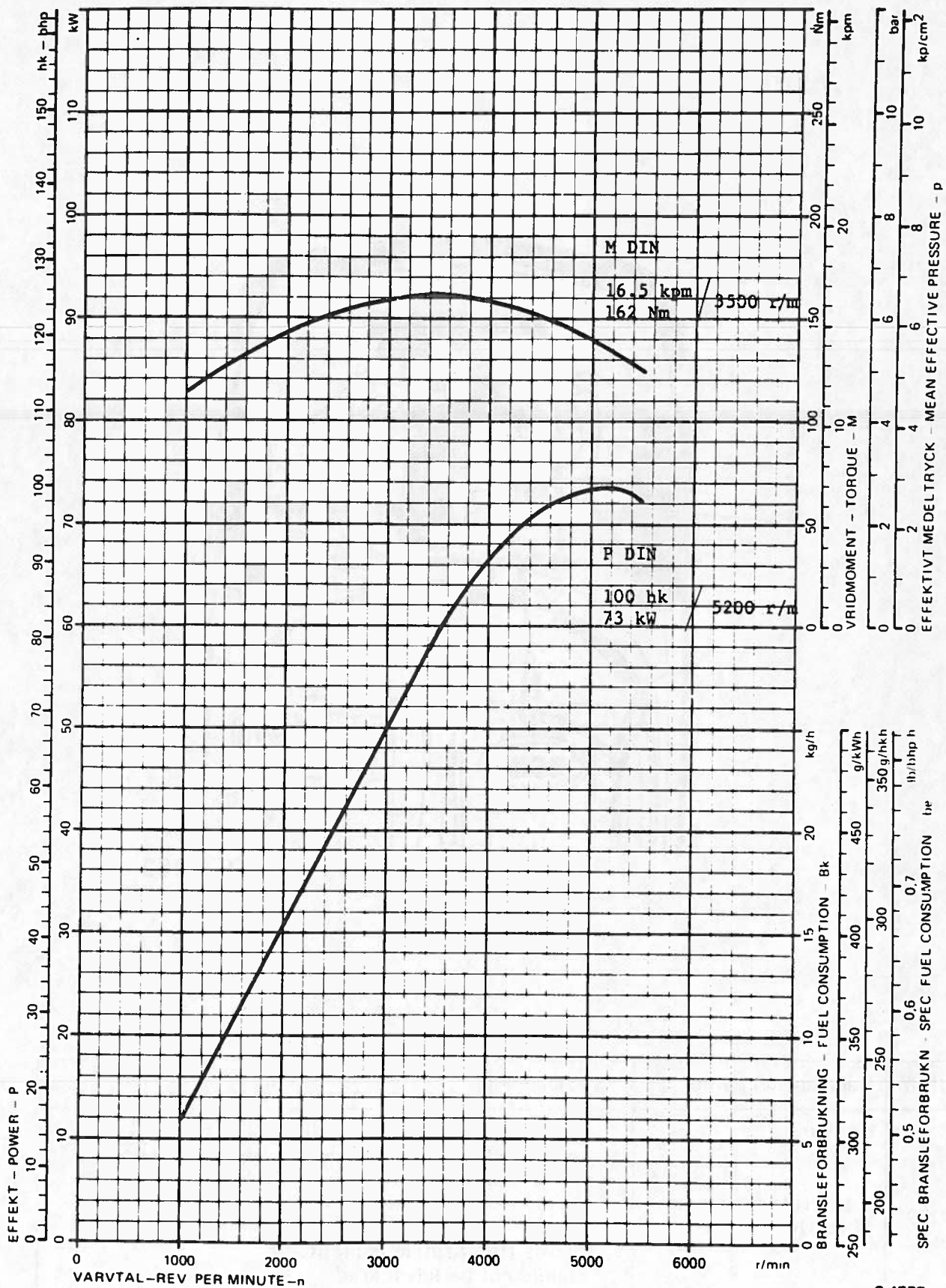
	<u>Dimension</u>	<u>Nm</u>	<u>Torque</u> <u>kpm</u>	<u>lbft</u>
Main bearings	M 12	108	11	79
Big-end bearings	M 10	54	5.5	40
Camshaft bearing caps	M 8	18	1.8	13
Valve cover	M 6	4.9	0.5	3.6
Crankshaft pulley	M 16	190	19	137
Rear engine plate (flywheel side)	M 8	20	2.0	14
Cylinder head bolts				
Stage I:	M 12	60	6.0	44
Stage II:		90	9	65
Run engine until warm				
Allow to cool (30 min)				
Re-tighten to:				
Stage I:		90	9	65
Stage II:		90° (1/4 turn)		

	<u>Dimension</u>	<u>Nm</u>	<u>Torque</u> <u>kgm</u>	<u>lbft</u>
Flywheel	M 10	59	6.0	43
Oil pump	M 8	18	1.8	13
Spark plugs	M 14 x 1.25	28	2.8	20
Chainwheel, camshaft	M 8	20	2.0	14
Inlet manifold	M 8	18	1.8	13
Thermostat housing	M 8	18	1.8	13
Throttle housing	M 8	18	1.8	13
Exhaust manifold	M 8	25	2.5	18
Timing cover	M 8	20	2.0	14
Distributor	M 6	4.9	0.5	3.5
Oil filter	1/4 in 16 UNF	10	1.0	7.2
Oil pressure switch	1/4 in 18 NPTF	10	1.0	7.2
Thermo-valve EGR	M 14 x 1.5	15	1.5	11

For other bolts, use general tightening torques:

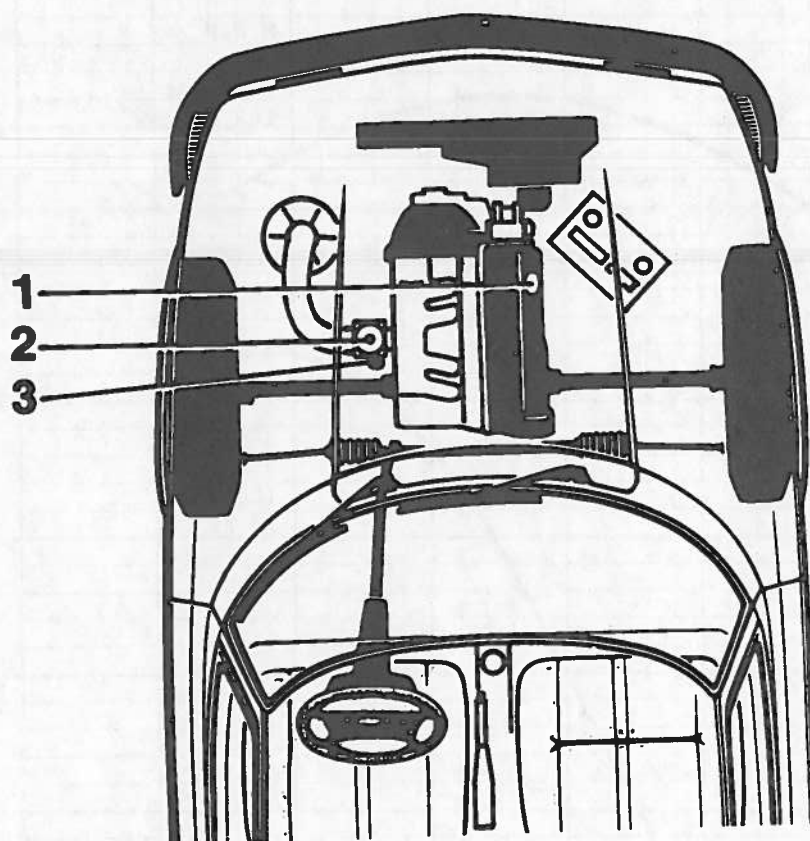
Size	Tightening torque		
	Nm	kgm	lb ft
M 5	4.9	0.5	3.6
M 6	9.8	1.0	7.2
M 8	19.6	2.0	14.4
M 10	39.2	4.0	28.9

Engine performance graphs,
single-carburetor engines



S 4755

Engine performance graphs, single carburetor engine

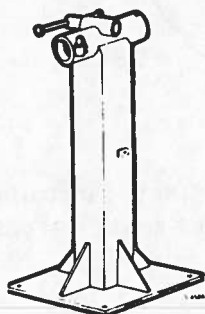


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Item	Lubrication point	Lubricant
1	Engine oil	Engine oil SAE 10 W 30, 10 W 40 alt. 5 W 30 or 5 W 30 to service SF in the API system or to Ford specification ESE M2C-101C
2	Carburetor damper	Automatic transmission oil
3	Throttle controls	Engine oil Note! The throttle cable itself should not be lubricated

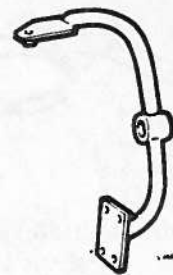
Special tools

Some tools can also be used in other groups.



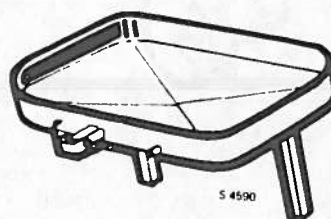
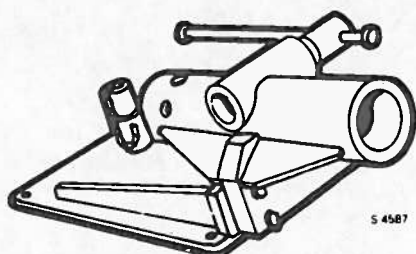
83 92 169 (A2)

Holder for engine floor stand



78 60 794 (A2)

Floor stand for stationary installation



78 60 802 (A2)

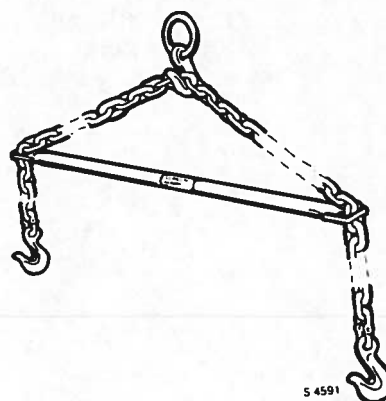
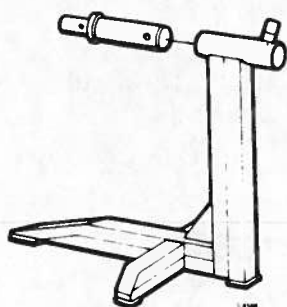
Oil pan, for floor stand

78 60 877

Bench stand

78 60 885

Vise stand



78 61 479 (A2)

Movable stand (alternative for 78 60 794)

83 92 409 (A2)

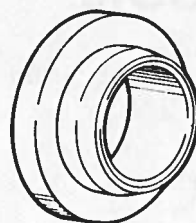
Lifting yoke, power unit

83 90 478 (A2)

Axle for stand



78 62 014 (A0-1) Strap wrench for standard oil filter



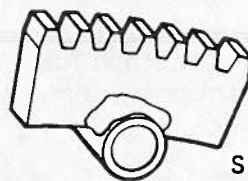
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83 93 332 (A0-1) Strap wrench (for removal of factory installed oil filter at 1200 mile service)

83 93 349 (A1) Sleeve, installation of seal on transmission side

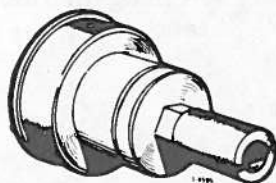


83 91 849 (A2) Dolly, removal of sprocket

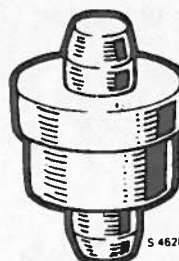


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83 92 987 (A1) Locking segment for locking of crankshaft

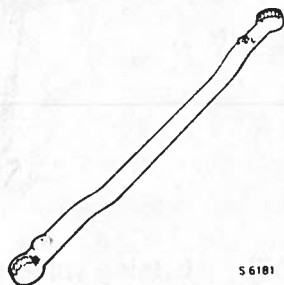


83 92 540 (A1) Installing tool, crankshaft seal, flywheel end



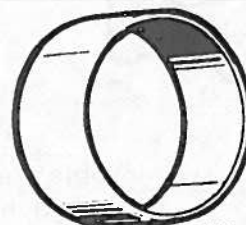
S 4628

83 91 997 (A3) Drift, flywheel bearing



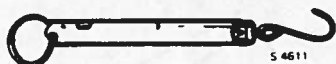
S 6181

83 92 961 (A1) Ring spanner, pulley bolt



S 4 196

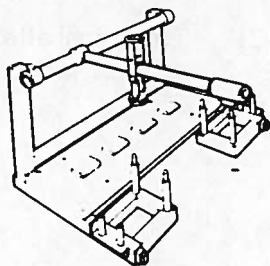
78 62 287 (A3) Piston installing tool



83 90 130 (A3) Spring balance, checking of piston clearance



83 92 300 (A3) Spring depressor (for use in car or on removed cylinder head)



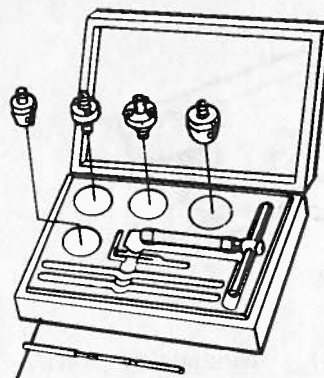
83 93 050 (A2) Installing and removing tool, valves



83 91 401 (A3) Magnetic tool, removal of valve depressors



83 92 326 (A3) Air nipple, spark plug hole



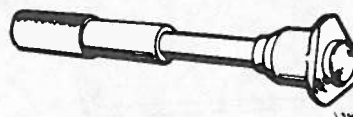
S 2 051

83 92 193 (A2) Valve cutter assy.
 .83 92 201 Cutter 75°
 .83 92 219 Cutter 11°-45°
 .78 61 057 Guide spindle
 .78 61 065 T-key

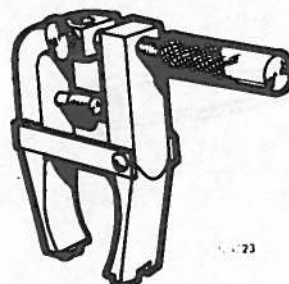
The remaining tools in the set are for other Saab-models



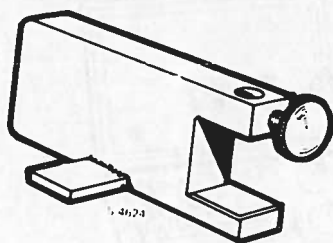
83 92 268 (A2) Reamer, valve guide Ø 8 mm H8



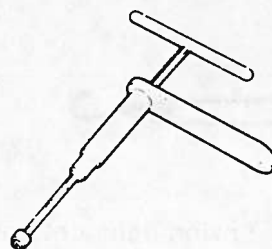
83 92 631 (A2) Valve guide tool (for removal and installation in a press)



83 91 450 (A2) Measuring tool, valve play
 .83 92 250 Measuring point



83 91 633 (A1) Measuring plate,
checking of adjusting
pallets



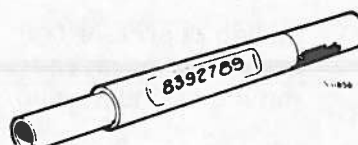
S 6187

83 93 035 (A0-1) Adjusting tool,
fuel needle



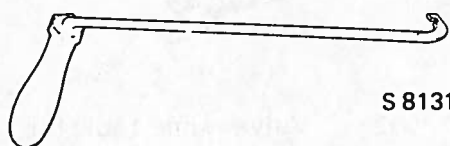
S 4625

78 40 622 (A1) Dial indicator



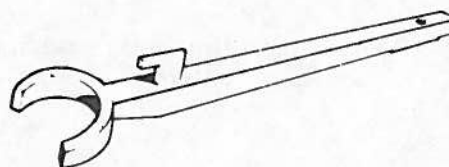
S 8956

83 92 789 (A2) Drift installation
of fuel jet, carburetor

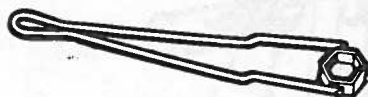


S 8131

83 93 357 (A1) Tool, chain tensioner



83 93 175 (A1) Tool, removal of
clutch shaft

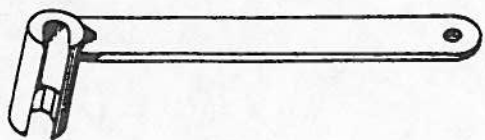


83 92 185 (A1) Spanner, crankshaft
bolt (turning
the crankshaft
to adjust valves)



S 8133

83 93 217 (A0-1) Adaptor, cooling
system tester



83 93 571 (A3) Spanner, removal
and fitting of slave
cylinder pressure
line

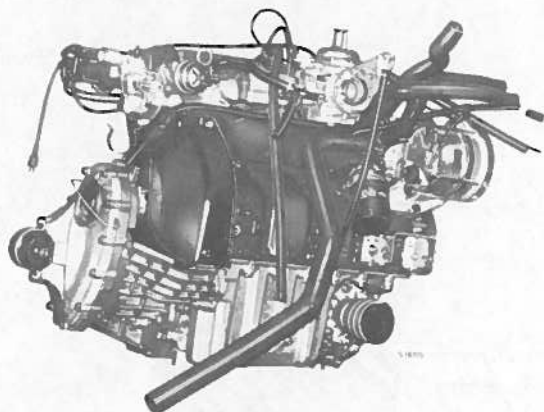


Faint, illegible text, possibly a date or reference number, located in the upper right quadrant of the page.

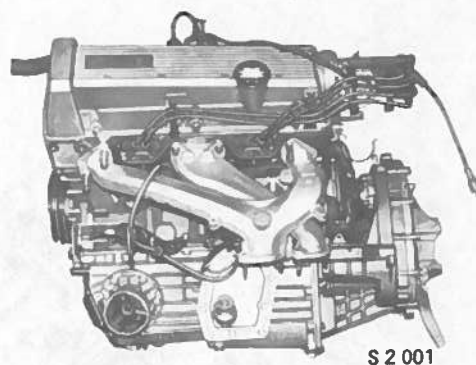


General

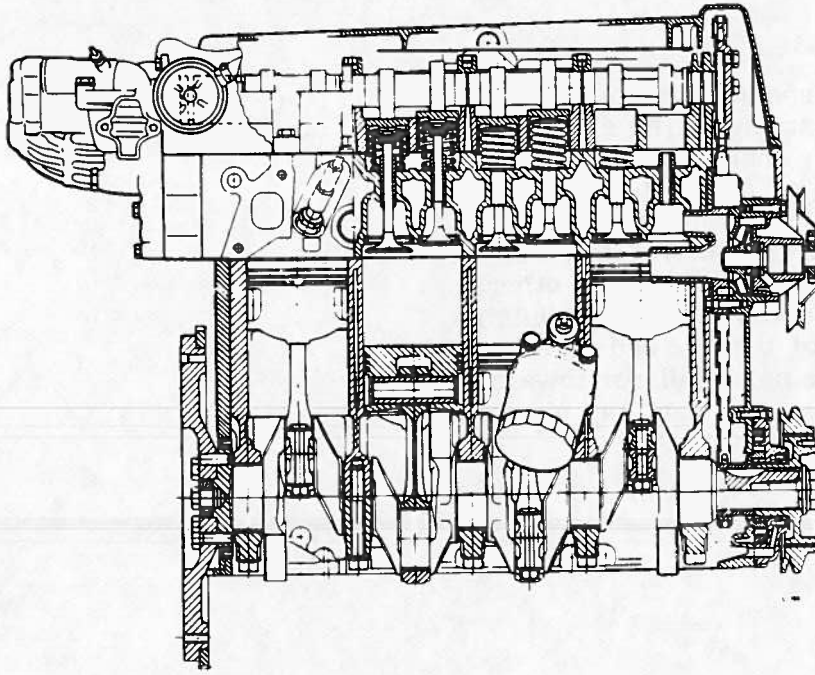
The water cooled engine is a four-in-line with an overhead camshaft. The crankcase ventilation is totally enclosed. The cylinder block is inclined at an angle of 45° to the right and the cylinder head is of the cross-flow type, i.e. with the inlet ports on one side and the exhaust ports on the other. The engine is mounted with the clutch towards the front of the car and with the timing chain and the no. 1 cylinder towards the rear. The engine has a single, horizontal Zenith carburetor.



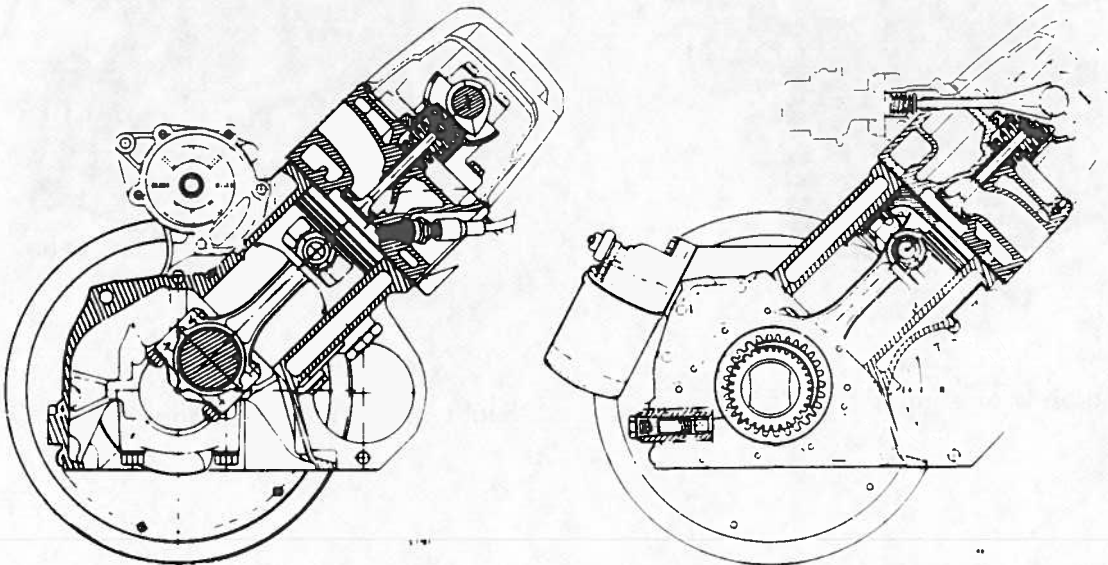
Left-hand view of engine



Right-hand view of engine



Engine, side section



Engine, end section

Cylinder block

The cylinder block is made of special cast iron, cast in one piece. The cylinder bores, surrounded by cooling jackets, are drilled straight out of the block. The block also contains oilways for the lubricating system.

Cylinder head and valves

The cylinder head is of aluminium and is bolted to the block. The camshaft is a special casting and runs in bearings in the camshaft bearing assembly which is bolted to the cylinder head.

The valves are of steel with chromium-plated stems. The inlet valves have induction-hardened heads. The exhaust valve heads are coated with "Stellite".

Crankshaft and bearings

The crankshaft is forged with ground journals which have been surface-hardened by "Tenifer" treatment, which provides a hard non-metallic surface giving good protection against wear. There are five main bearings. The centre bearing also locates the crankshaft axially. The shaft contains drilled passages for lubricating oil. All main bearing shells can be replaced. The crankshaft drives the oil pump via a driving plate on the transmission sprocket, and the water pump and alternator via a belt drive.

Camshaft and valve depressors

The camshaft is cast and has hardened and phosphatized cams. It is chain driven by the crankshaft. The valves are directly actuated by the cams via valve depressors and pallets. The camshaft drives the distributor. The drive is transmitted by a slot in the end of the camshaft in which the driving dog of the distributor shaft engages. The fuel pump of carbureted engines is driven by an eccentric on the camshaft.

Pistons and piston rings

The pistons are made of light alloy and are provided with grooves for two compression rings and one oil scraper ring. The top compression ring is flat with a chromed finish. The second compression ring has oil-scraping characteristics and is somewhat wider than the top ring. The actual oil scraper is a three-piece ring.

Connecting rods and piston pins

The connecting rods are forged and fitted with small-end bushes in which the gudgeon pins run. The small-end bushes and big-end bearing shells can be replaced.

The gudgeon pins have a floating fit in the pistons and connecting rods. The pins are located by a circlip at each end of the gudgeon pin hole.

Ignition system

The distributor is driven by the camshaft. Drive is transmitted via a slot in the end of the camshaft which mates with the driving dog on the distributor shaft. The rotor arms turns counter-clockwise. The firing order is 1-3-4-2, No. 1 cylinder being nearest the bulkhead. Ignition advance in relation to the engine speed is regulated by a centrifugal governor and in relation to load by a vacuum regulator.

The object is a small, rectangular, light-colored box, approximately 10 cm long, 5 cm wide, and 3 cm high. It is made of a material that appears to be wood or a similar composite material. The box is empty and has no visible markings or text on its exterior. It is located in a room with a light-colored floor and walls.

The box is placed on a flat surface. It is oriented horizontally. The lighting is even, and there are no shadows cast by the box. The background is a plain, light-colored wall.

The box is made of a light-colored material, possibly wood or a composite material. It has a smooth finish and no visible grain or texture.

The box is empty and has no visible contents. It is a simple, rectangular object with no decorative elements or markings.

The box is located in a room with a light-colored floor and walls. It is placed on a flat surface. The lighting is even, and there are no shadows cast by the box. The background is a plain, light-colored wall.

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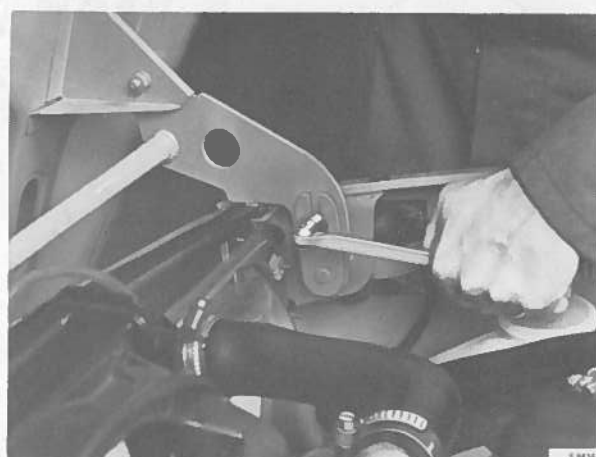
The box is made of a light-colored material, possibly wood or a composite material. It has a smooth finish and no visible grain or texture.

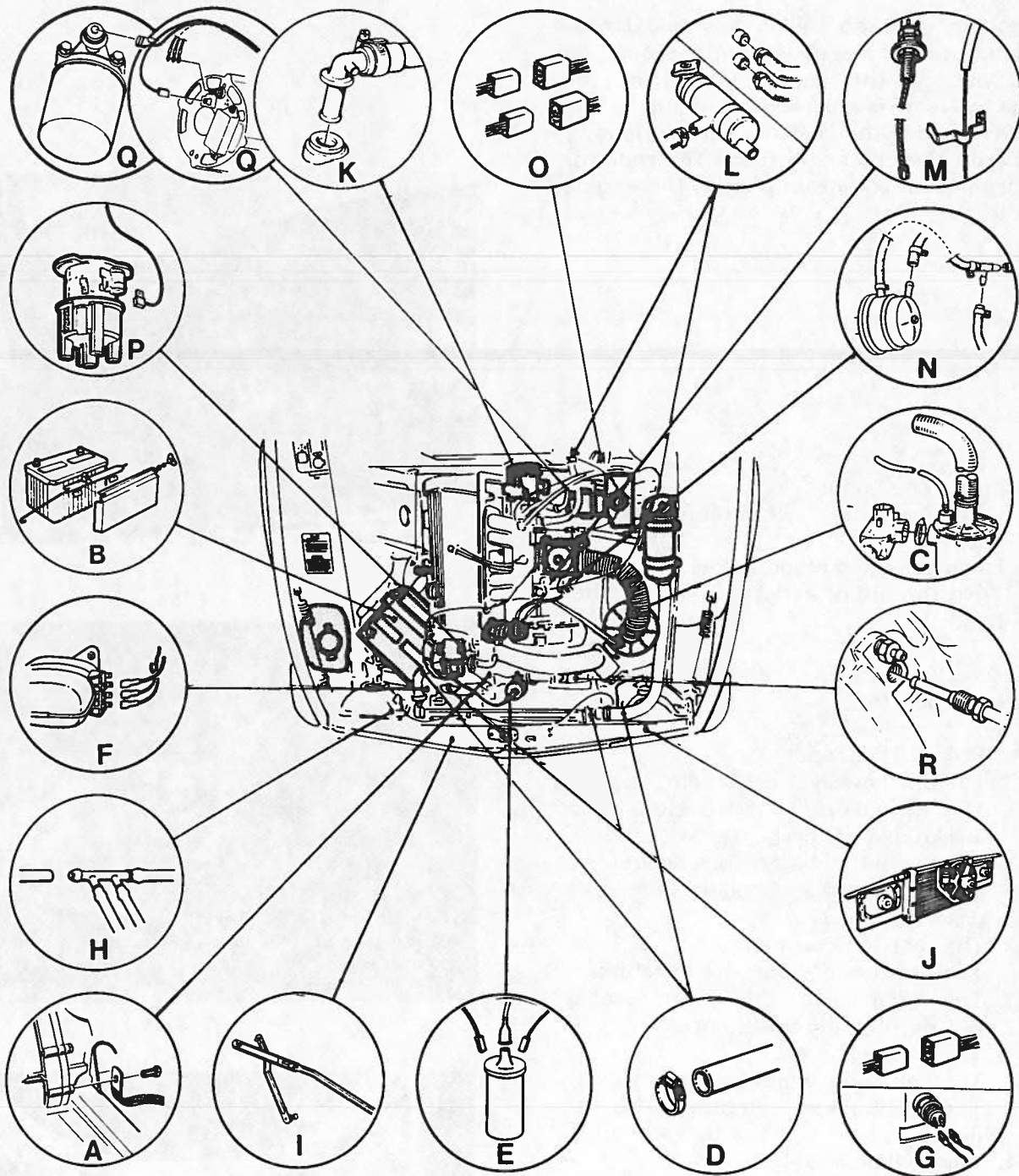
Removal and installation

Removing the power unit

For major work on the engine and transmission, the entire power unit should be lifted out of the car. Removal of the engine by itself is not recommended.

1. Disconnect the positive battery lead.
2. Drain the coolant through the radiator drain cock and drain plug in the engine block.
3. Remove the hood:
 - Disconnect the windshield washer hose
 - Undo the hood hinge links
 - With the aid of assistant, lift off the hood.
4. Disconnect and/or remove the following (see fig.)
 - A. The earth strap.
 - B. The battery and heat shield.
 - C. The crankcase ventilation, air intake and air preheater hoses.
 - D. The radiator hoses (disconnect at the thermostat housing and expansion tank.)
 - E. The ignition coil leads.
 - F. The headlight wiper motor cables.
 - G. The cables to the thermostatic switch, fan and headlights.
 - H. The washer hoses.
 - I. The headlight wiper linkage.
 - J. The front panel complete with radiator.
 - K. The brake servo hose.
 - L. The hoses to the expansion tank and heater valve.
 - M. The throttle and choke cables.
 - N. The fuel lines (to fuel pump and carburetor.)
 - O. The two plug connectors for the cable harnesses in the engine compartment.
 - P. The distributor leads.
 - Q. The electrical connections at the alternator and oil pressure switch.
 - R. The hydraulic line for the clutch.

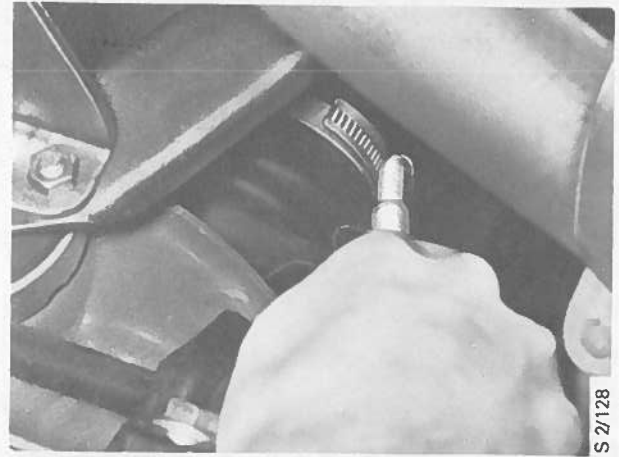




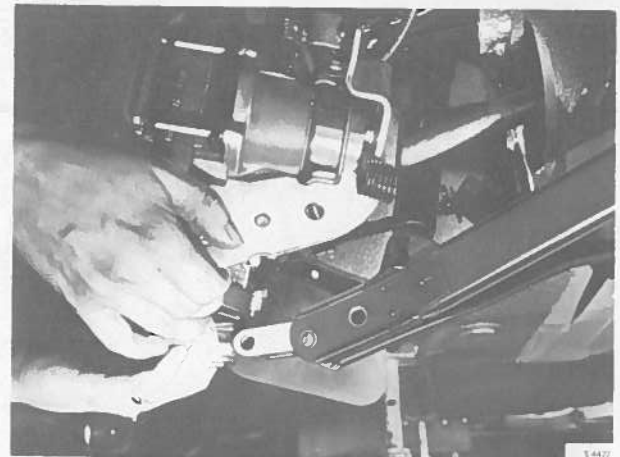
S 2/149

Components to be disconnected/removed
prior to removal of engine.

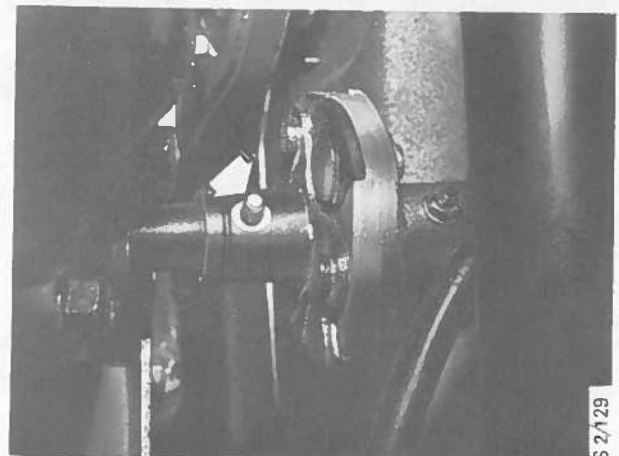
5. Undo the clips and remove the bellows from the inner drivers.



6. Remove the lower end piece from the control arm. Pull out the steering knuckle assembly and support the end piece against the control arm outer end.

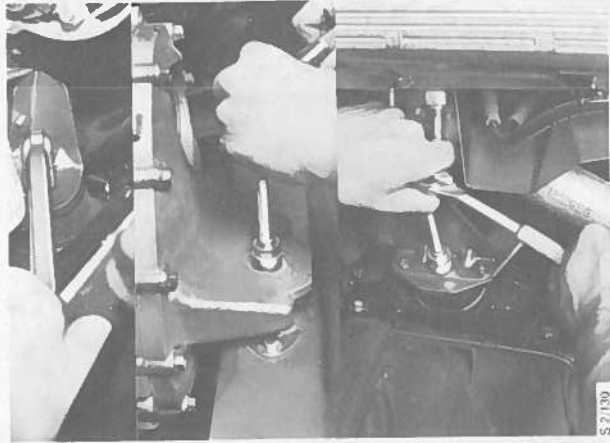


7. Put the gear lever in neutral. Remove the nut and tap out the taper pin in the gear shift rod joint. Separate the joint from the gear shift rod.

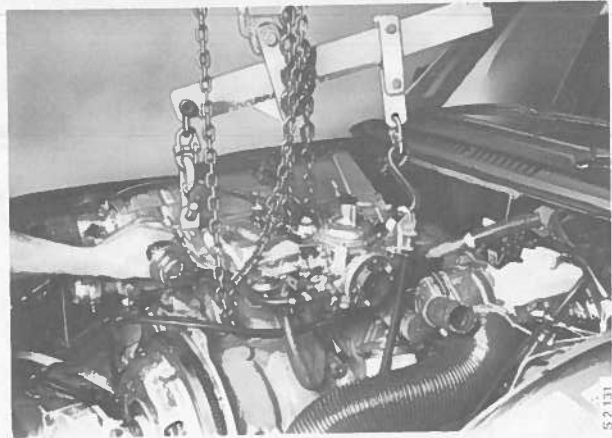


8. Disconnect the speedometer cable from the transmission.
9. Unbolt the exhaust pipe from the exhaust manifold.

10. Remove the nuts from the engine mountings.



11. Attach lifting gear to the two lugs on the engine and slightly raise the unit. Move the power unit to one side and free the two universal joints. Lift the power unit out of the car.

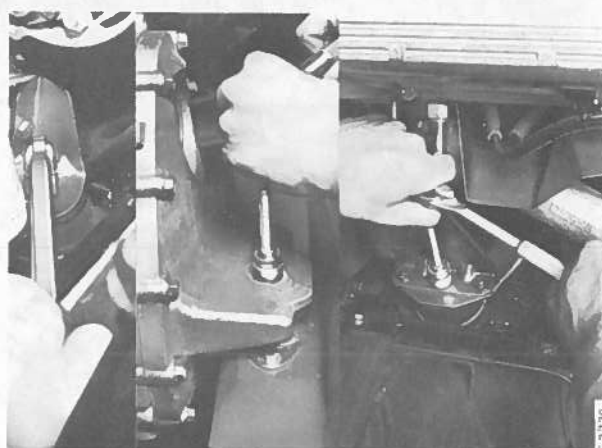


Fitting the power unit

1. a. Check that the inner universal joints are packed with grease.
b. Fit new gaskets to the exhaust pipe flanges.
c. Hook the clips onto the inner drivers.
2. Suspend the power unit and balance it such that the front engine mounting will locate in before the rear mountings.



3. a. Lower the power unit, guiding the front mounting into the bracket and then lowering the rear of the engine until it is approximately 50-60 mm above the mountings.
b. Move the engine to the right, guide in the left-hand universal joint, and then move the engine to the left.
c. Lower the engine carefully, guiding it into the mountings, and, at the same time, aligning the right universal joint with the driver cup. Also make sure that the exhaust pipe flanges line up and that the gaskets are seated properly.
d. Refit the lower end piece to the control arm. Check that the right universal joint locates in the driver cup. Fit the two bolts and locknuts.
4. Fit the rear engine mounting bolts and tighten all engine mountings.



5. Bolt the exhaust pipe to the manifold.
6. Connect the speedometer cable.
7. Connect the gear shift rod joint and fit the taper pin.

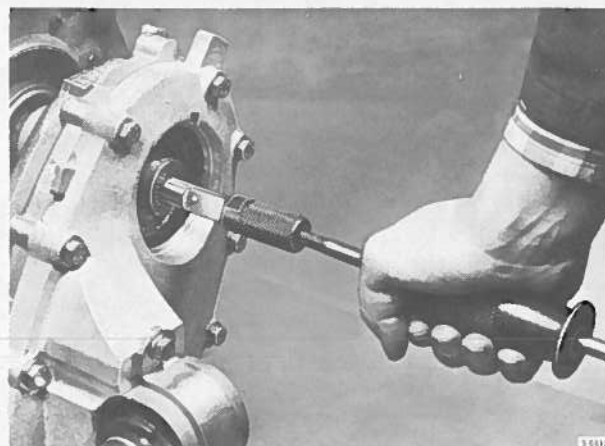
8. Fit the bellows and clips on the inner universal joints.



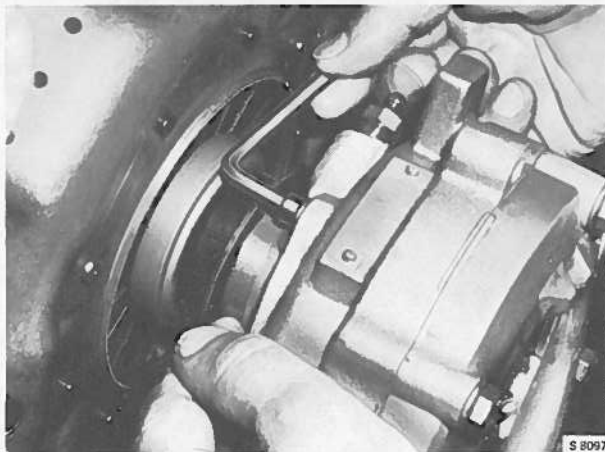
9. Refit/reconnect the components shown in the illustration on page 201-2.
10. Replace the hood and connect the windshield washer hose.
11. Fill up with coolant and bleed the cooling system by means of the bleeder nipple on the thermostat housing.
12. Reconnect the battery.
13. Test drive the car. Check the coolant level after driving.

Separating engine from manual transmission

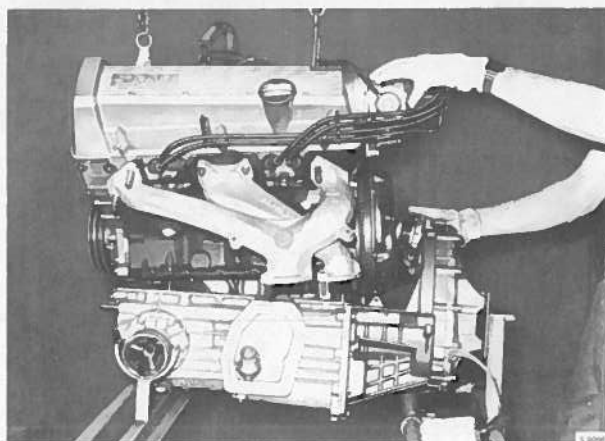
1. Clean the outside of the power unit.
2. Drain the engine oil.
3. Take off the clutch cover.
4. Remove the starter.
5. Withdraw the clutch shaft using sliding hammer 83 90 270 and joint 87 90 529 or tool 83 93 175.



6. Remove the three socket screws for the slave cylinder.



7. Undo all bolts in the mating flanges of engine and transmission.
8. Lift the engine carefully off the transmission (see illustration.) At the same time remove the release bearing guide sleeve.



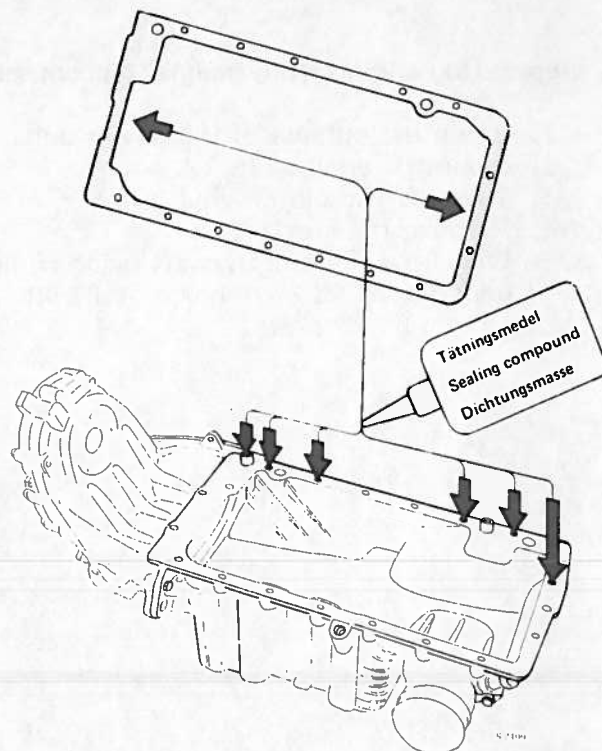
Caution

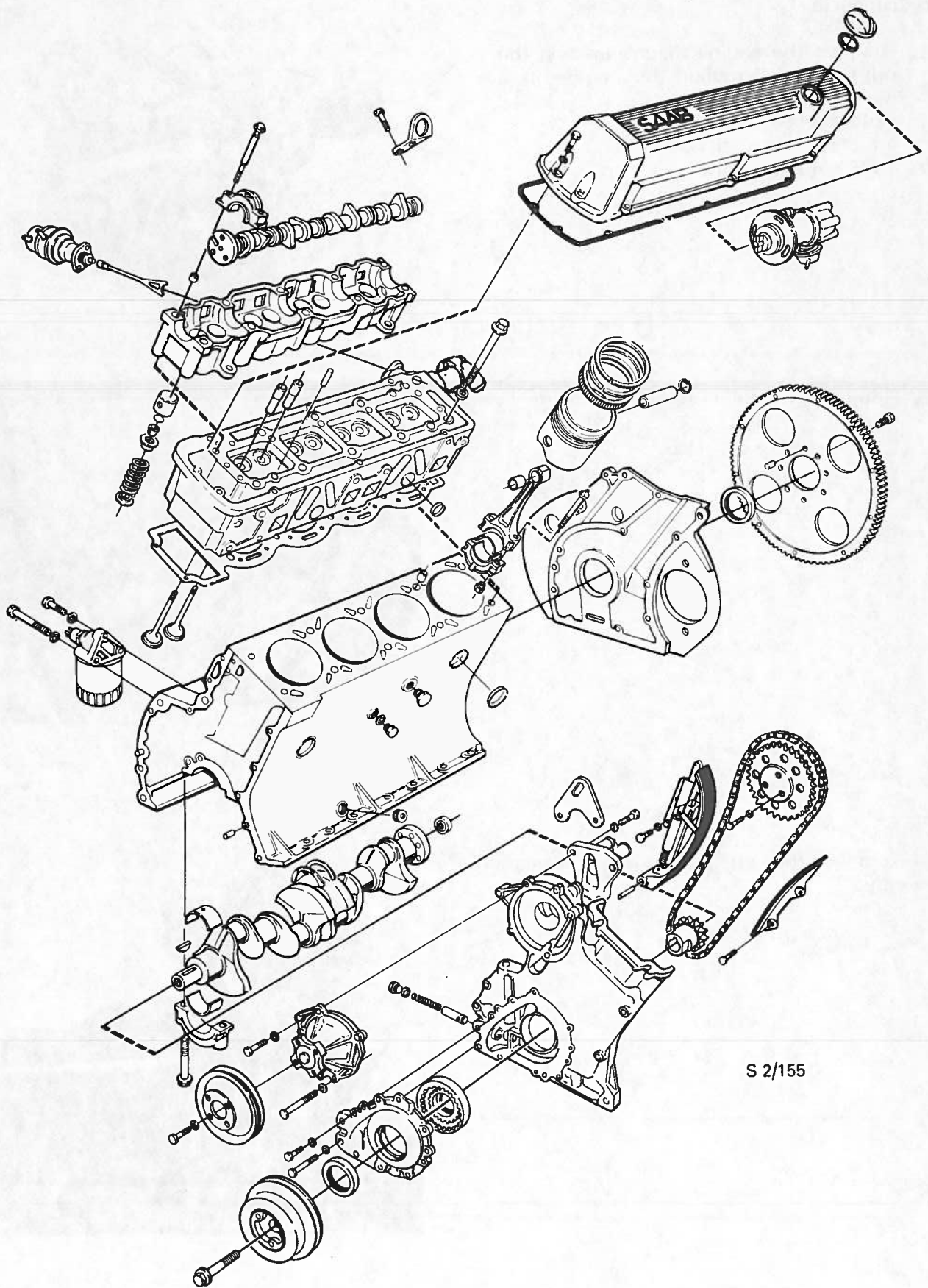
If the engine and transmission fail to separate, do not attempt to force them apart without first checking that all the bolts have been taken out.

Before fitting together the engine and transmission:

- Ensure that the mating flanges between the engine and transmission are scrupulously clean.
- Check that the two guide sleeves are fitted in the transmission.
- Fit a new gasket on the transmission flange. Apply sealing compound to both sides of the gasket as indicated by the arrows in the illustration.
- Apply thread sealing compound to the six bolts to be fitted in the holes indicated in the lower illustration.

Refit in the reverse order.





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Engine, exploded view

Engine body

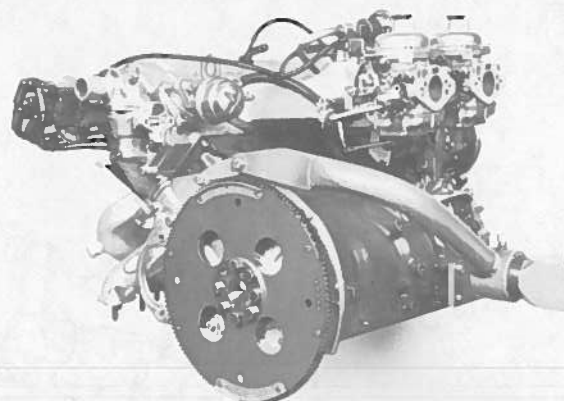
To dismantle

1. Remove the engine mountings and the oil filter and mount the engine in a work stand.

Holder 83 92 169

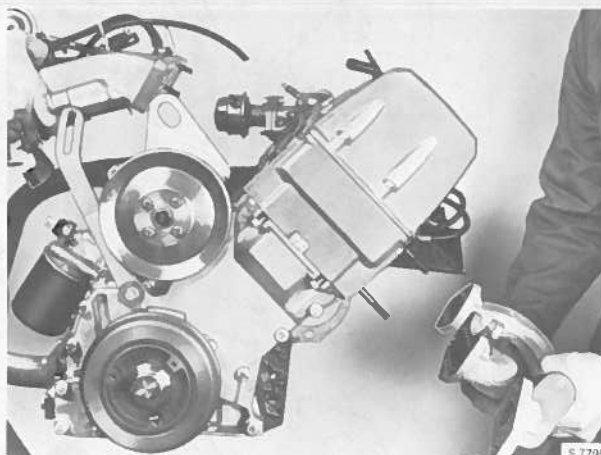
4 M8 x 30 mm bolts

1 M8 x 40 mm bolts



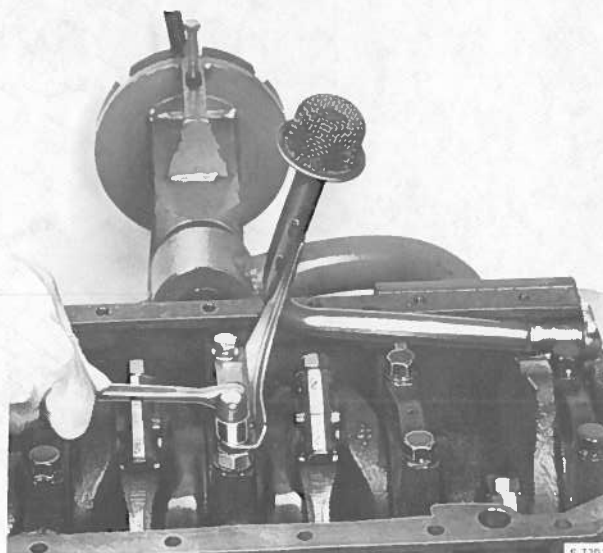
S 7790

2. Remove the inlet and exhaust manifolds.



S 7790

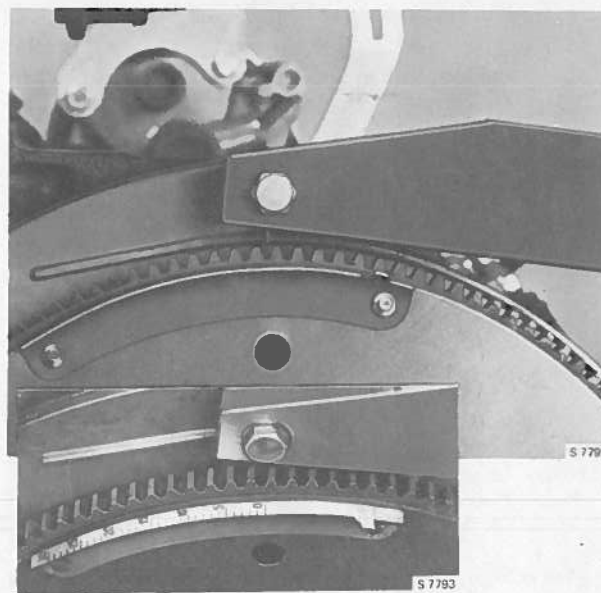
3. Remove the oil pump filter intake pipe.



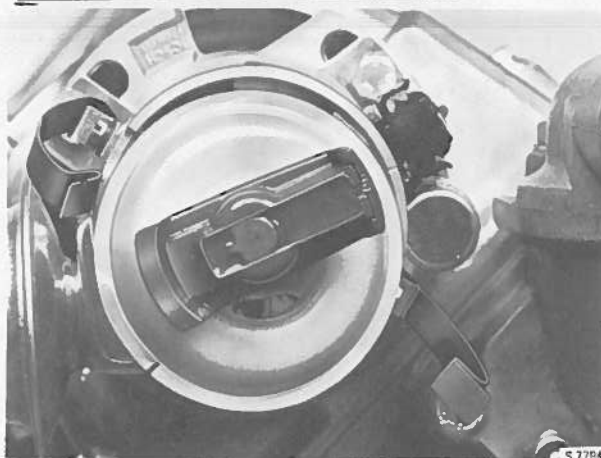
S 7791

4. Rotate the crankshaft to the firing position for No. 1 cylinder.

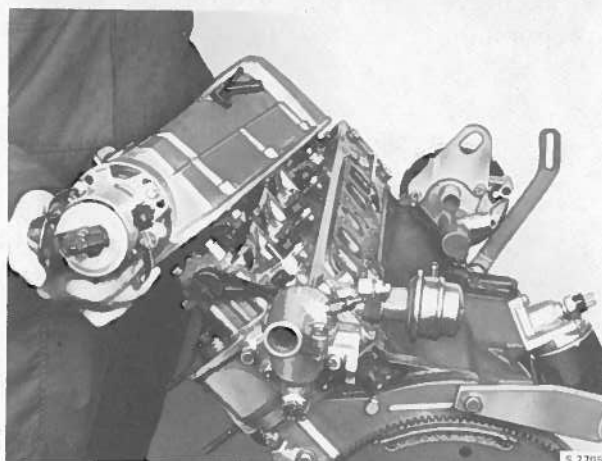
- The "O" mark on the flywheel should line up with the line on the rear engine plate.



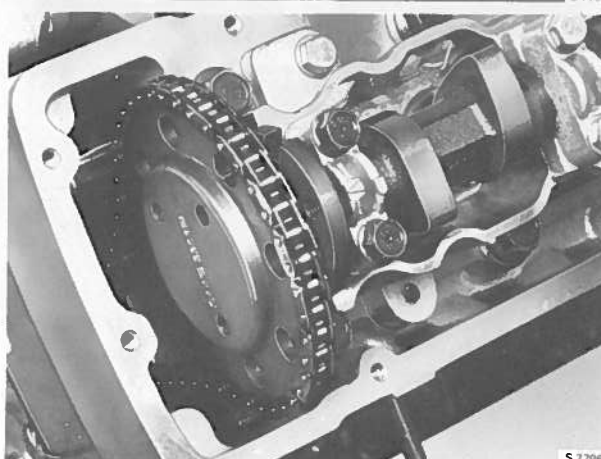
- The mark on the rotor should line up with the slot in the distributor housing.



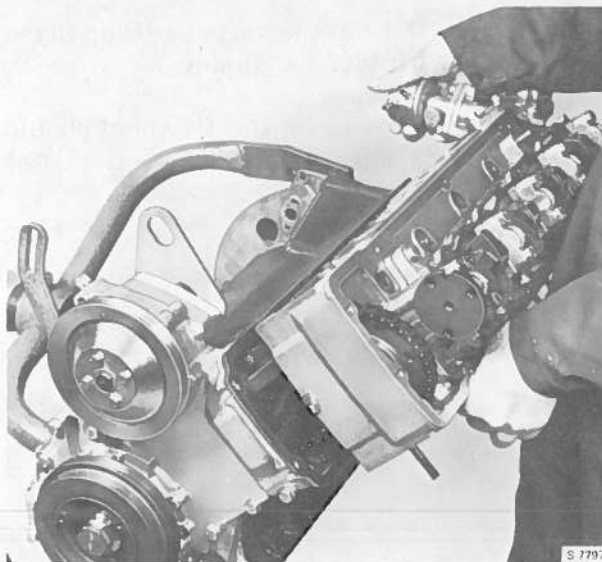
5. Remove the valve cover.



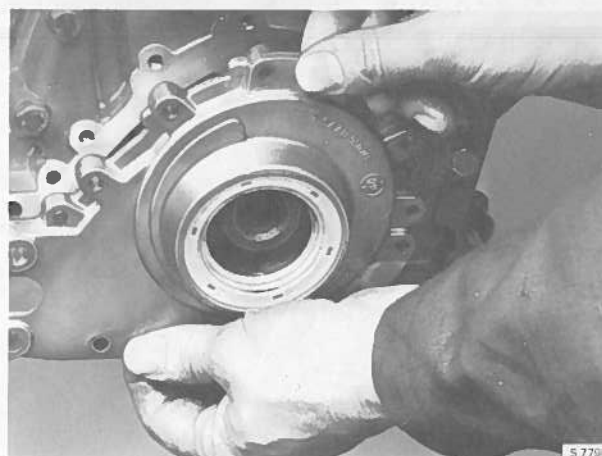
6. Remove the sprocket from the camshaft and rest it on the chain tensioner and the chain guide.



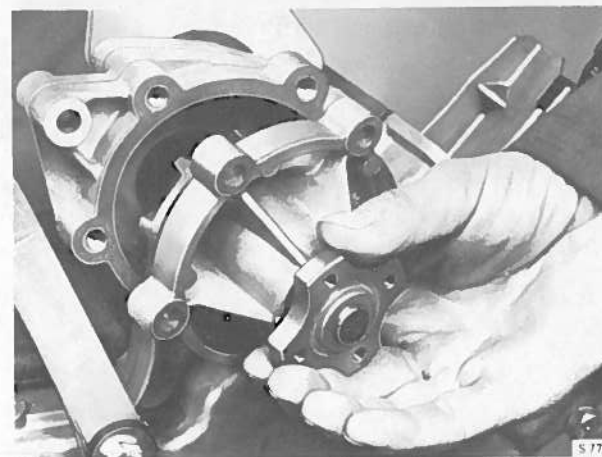
7. Remove the cylinder head bolts (10 + 2 in the end plate) and lift off the cylinder head. Remove the cylinder head gasket.



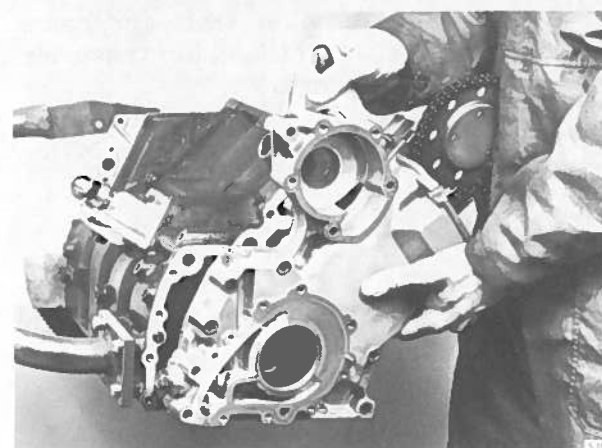
8. Remove the crankshaft pulley and oil pump.



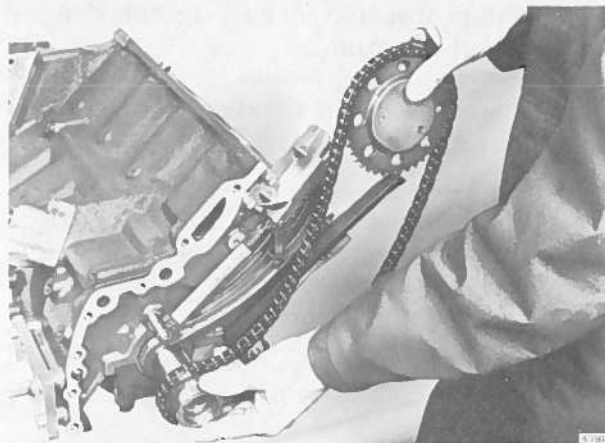
9. Remove the pulley and the water pump.



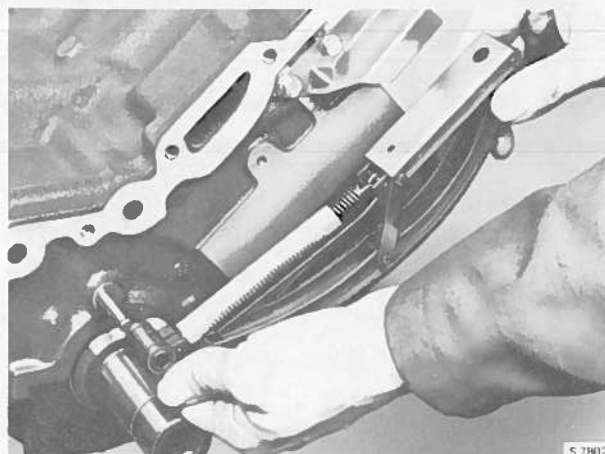
10. Remove the timing cover.



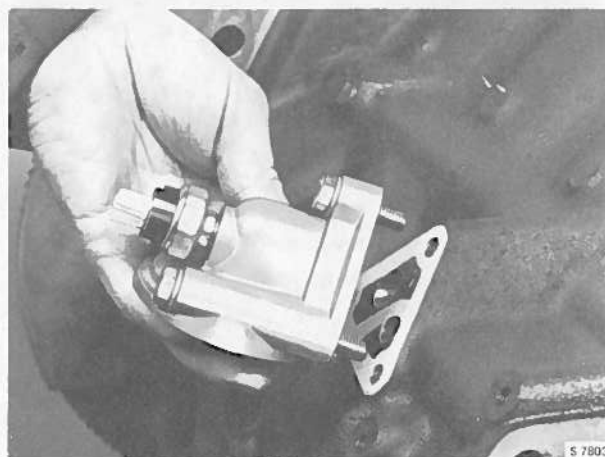
11. Remove the timing chain and sprocket.



12. Remove the chain tensioner assembly.

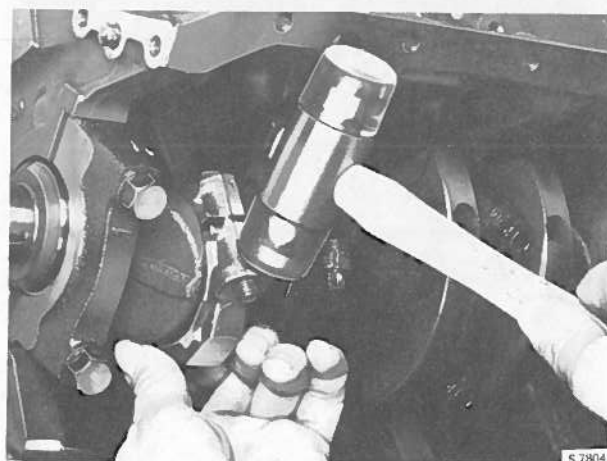


13. Remove the oil filter adapter casting.



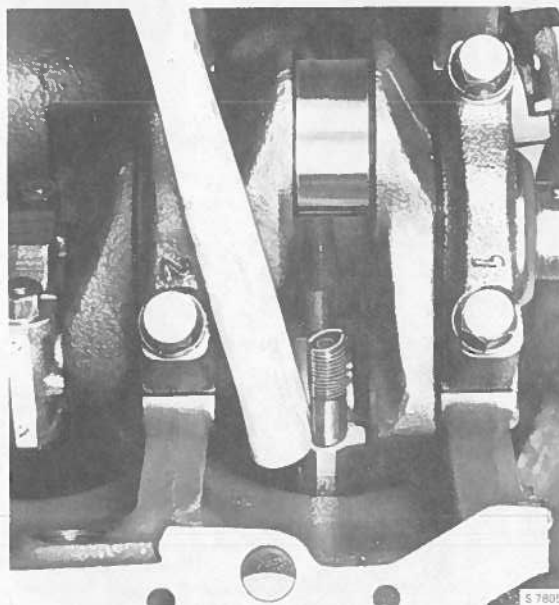
14. Remove the pistons and connecting rods as follows:

- Remove any dirt or carbon deposits from the cylinders.
- Remove the big-end bearing caps.

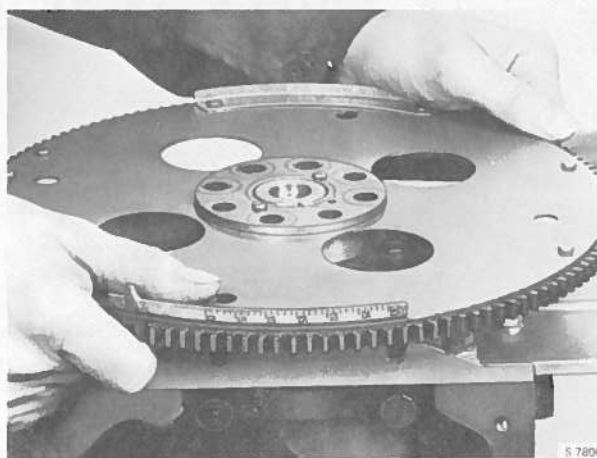


- Fit protective sleeves to the connecting rod studs.
- Push the pistons and connecting rods out of the cylinders.

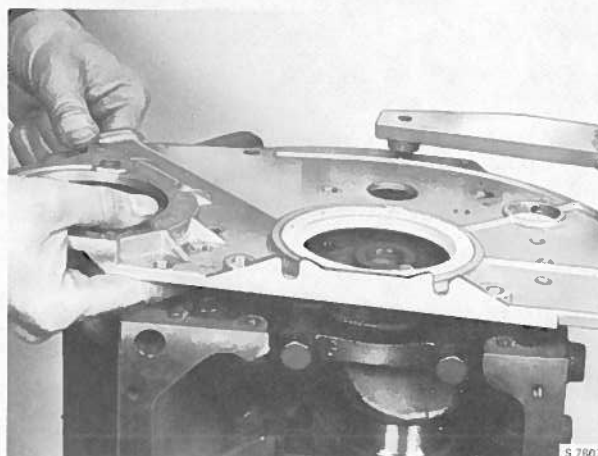
Note the marks on the pistons and connecting rods. Keep the bearing shells so that they can be refitted in their original positions.



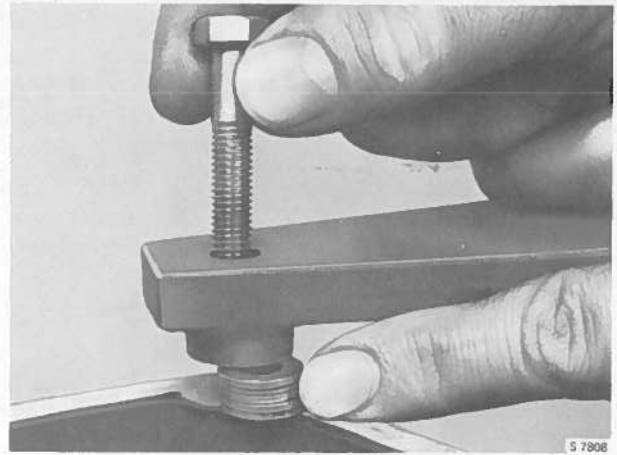
15. Rotate the engine block so that the flywheel end is uppermost and remove the flywheel.



16. Remove the rear engine plate.
Remove the engine holder bolt.

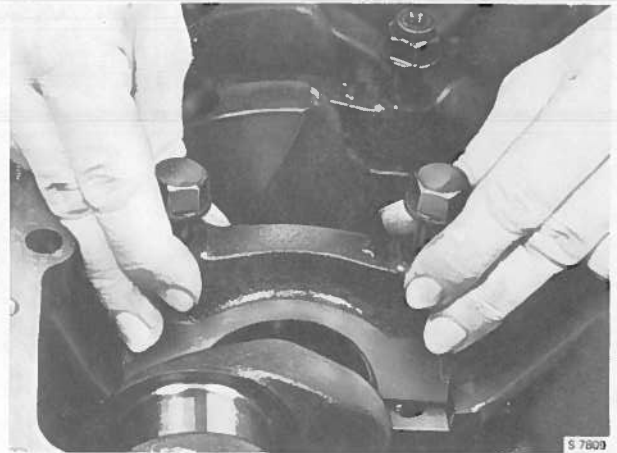


Fill the space between the engine block and engine holder with washers and refit the bolt.



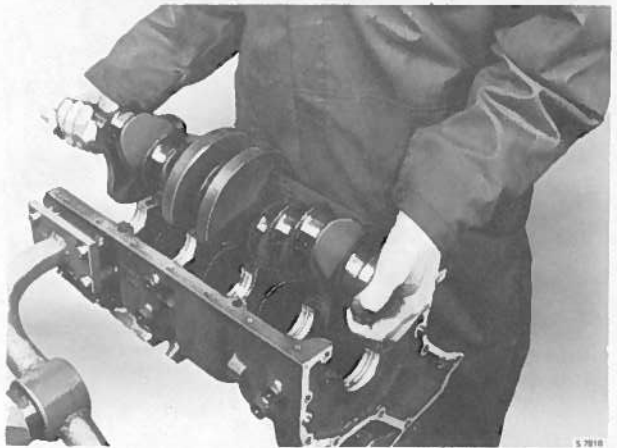
17. Remove the main bearing retaining bolts and the main bearing caps.

Note the markings



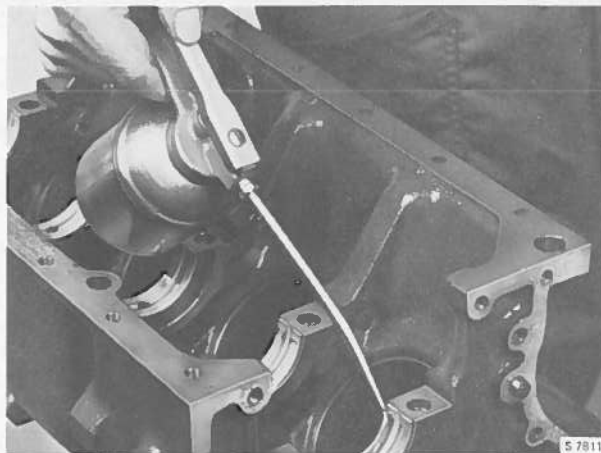
18. Lift out the crankshaft. Keep the bearing shells and the thrust washers so that they can be replaced in their original positions.

Clean and inspect all parts. Remove all traces of old sealing compound from mating surfaces. For measuring and fitting pistons and piston rings see section 212. For measuring and selecting main bearings and big-end bearings see section 216.

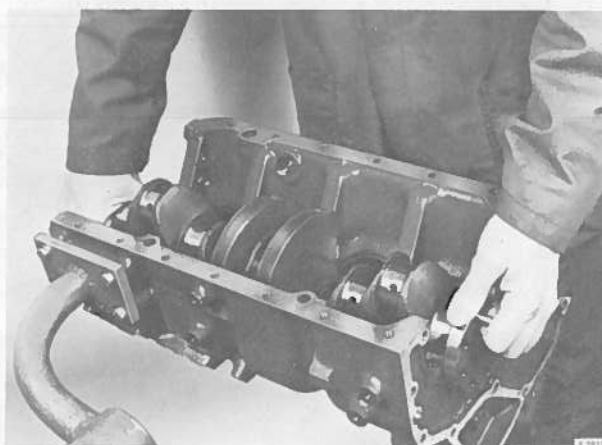


To assemble

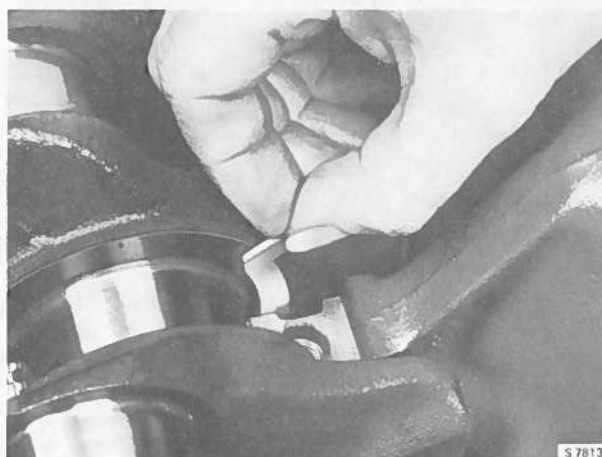
1. Place the shells in the top half of the bearings and coat them with engine oil.



2. Carefully place the crankshaft in position.

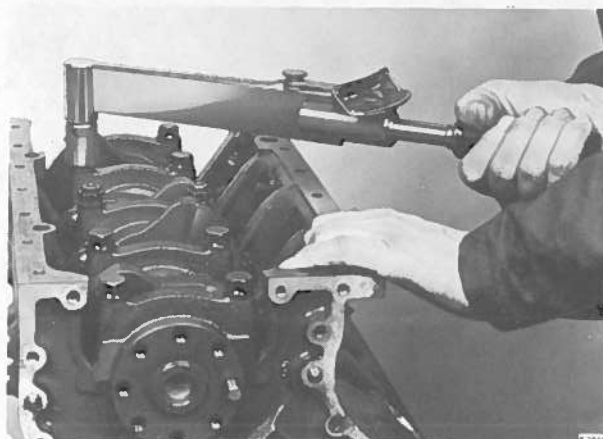
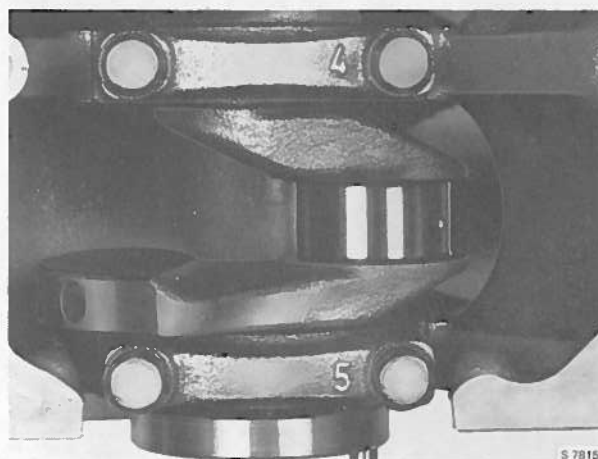
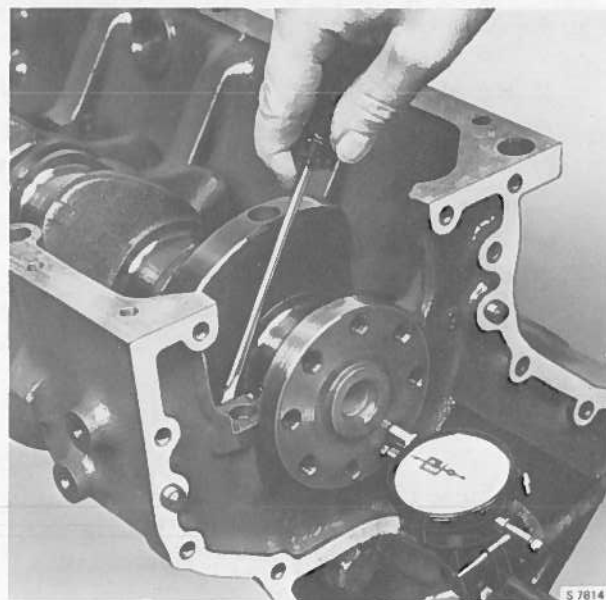


3. Install the thrust washers and check the end float.



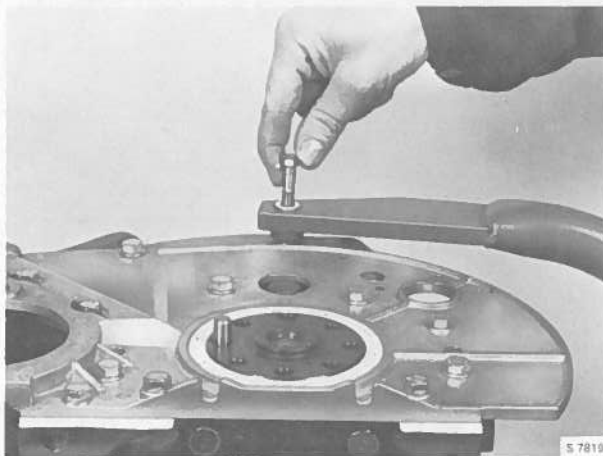
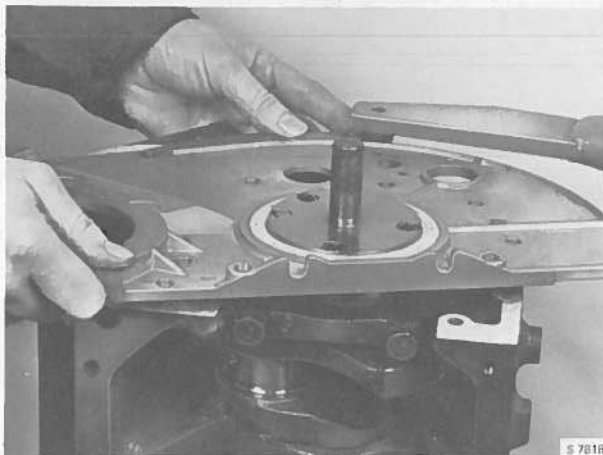
4. Oil the bearing shells in the main bearing caps and refit. (Note the markings.)

Tightening torque Main bearings
108 Nm (11 kgm) 79 lb ft



5. Refit the rear engine plate as follows:

- Rotate the engine so that the flywheel end is uppermost and remove the engine holder bolt.
- Apply sealing compound to the mating surfaces on the engine block and fit a new gasket.
- Place the guide ring for tool 83 92 540 on the flywheel flange and refit the rear engine plate and bolts.
- Replace the engine holder bolt.
- Trim off excess gasket material from the mating surface with the transmission casing.

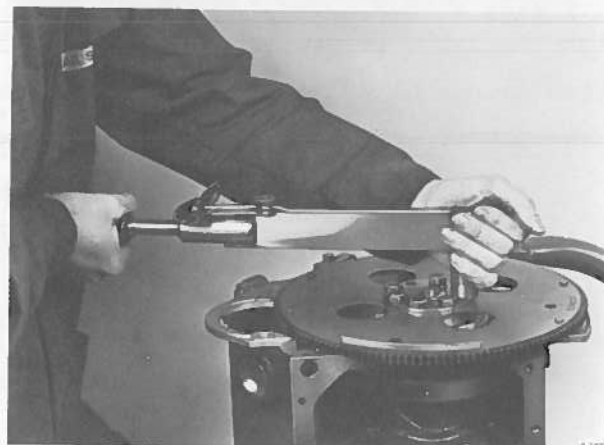


6. Refit the flywheel

- Apply sealing compound to the bolt threads.



Tightening torque, Flywheel
59 Nm (6.0 kgm) 43 lb ft



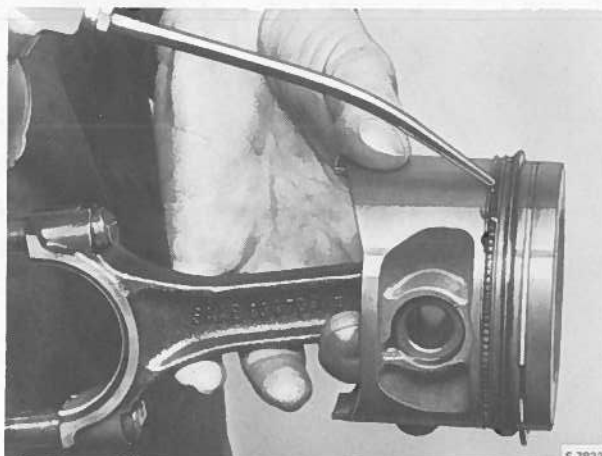
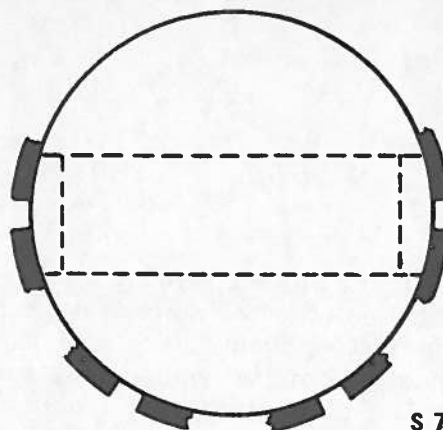
7. Refit the pistons and connecting rods as follows:

- Position the piston ring openings as shown in the illustration.

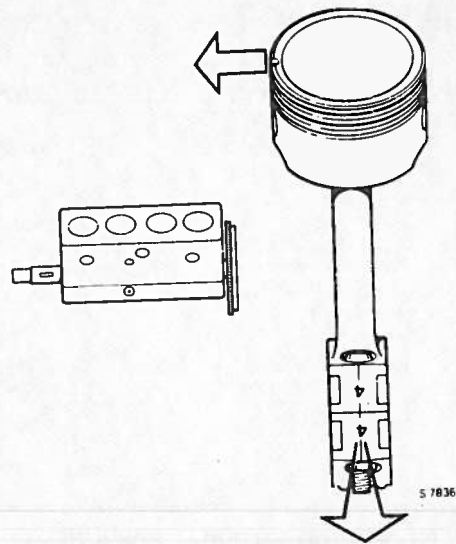
Rotate the gaps of the compression rings 180° and position them in line with the gudgeon pin holes.

Rotate the oil scraper ring so that the gaps do not line up.

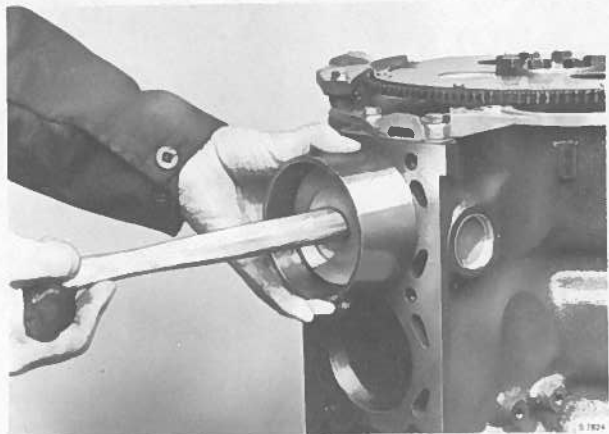
- Put the bearing shells in place in the connecting rod and cap.
- Place protective sleeves on the big-end studs to protect them during installation.
- Lubricate the piston rings and bearings.



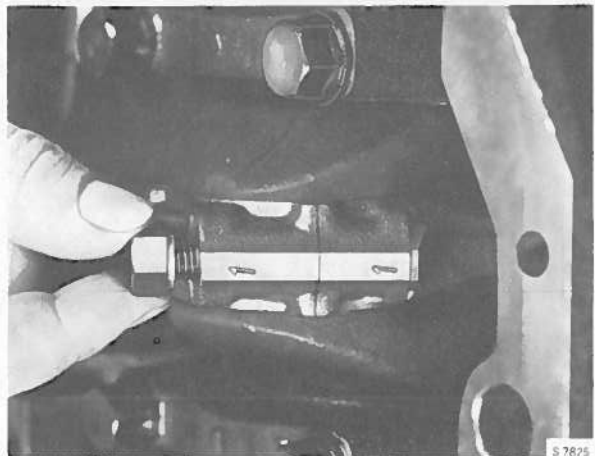
- Refit the big-end bearing caps.
The identification number the top of the piston should face the timing chain end of the engine. The marks on the connecting rods should face the cap.



- Fit the piston with the aid of tool 78 62 287

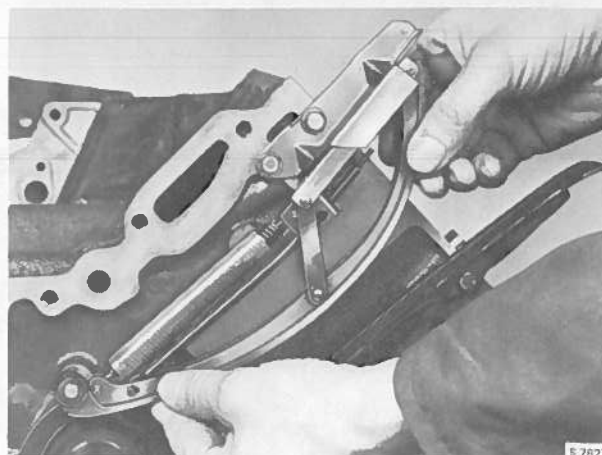
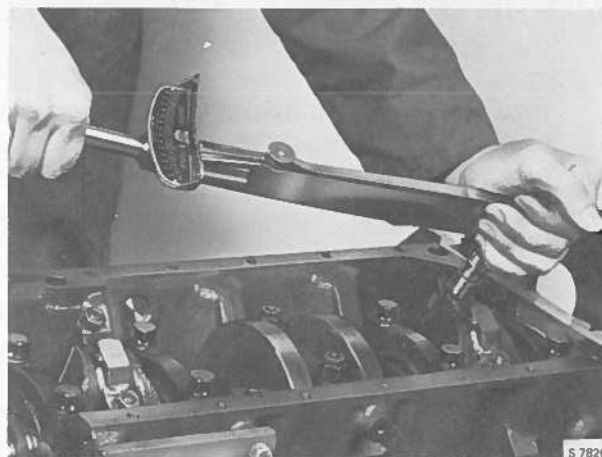


- Refit the big-end bearing caps.
The identification number the top of the piston should face the timing chain end of the engine. The marks on the connecting rods should face the cap.

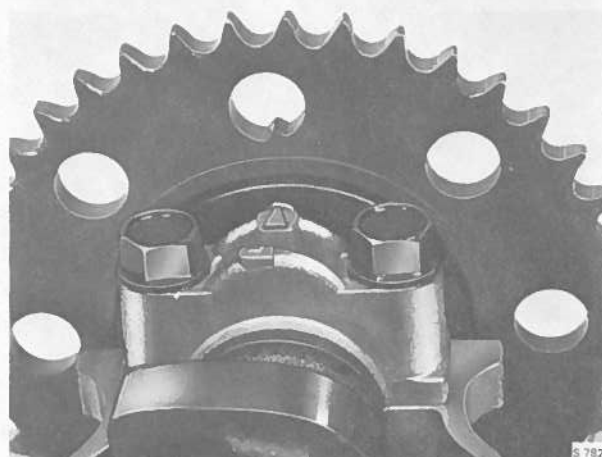


Tightening torque, Big-end bearings
54 Nm (5.5 kgm) 40 lb ft

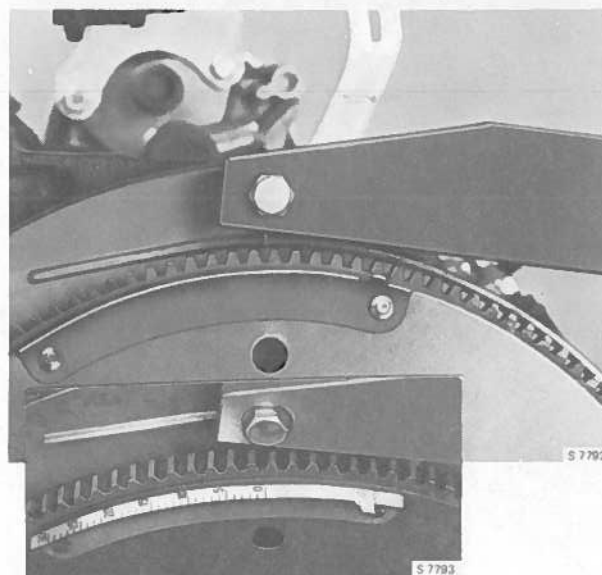
8. Refit the chain tensioner and guide.



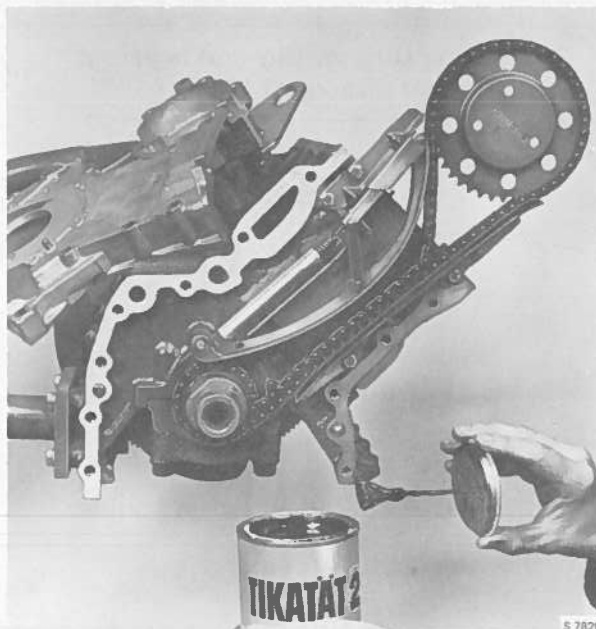
9. Prepare the cylinder head for refitting by rotating the camshaft to the firing position for No. 1 cylinder i.e. the mark on the camshaft sprocket should line up with the arrow on the bearing ap. (Camshaft sprocket temporarily installed.)



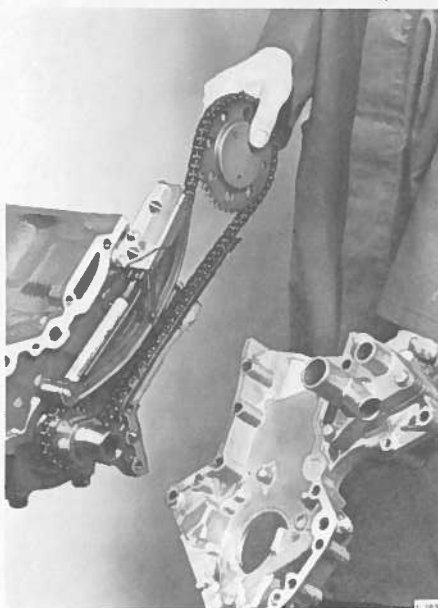
10. Rotate the crankshaft to the firing position for No. 1 cylinder.



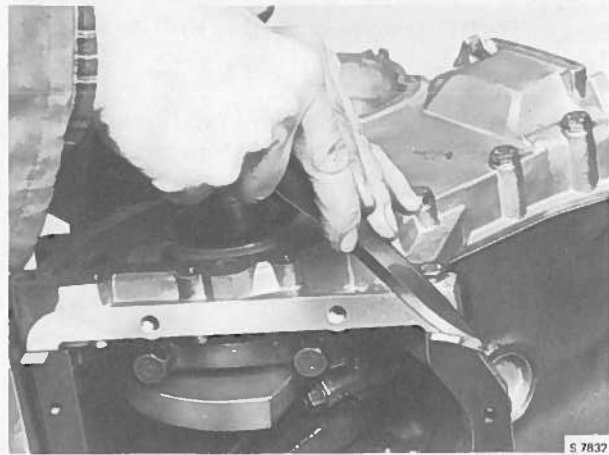
11. Refit the sprocket and the chain to the crankshaft and temporarily suspend the chain and the camshaft sprocket between the chain guide and tensioner. Apply sealing compound and place the gasket the flange.



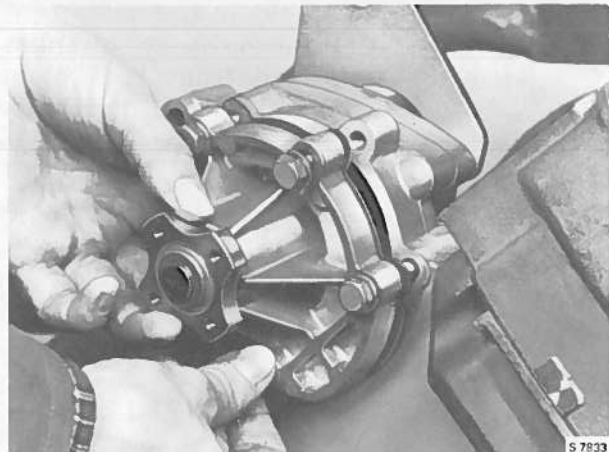
12. Refit the timing cover. Pull up the chain when the cover is being fitted to prevent it being trapped.



- Trim off excess gasket material from the mating surface with the timing cover.



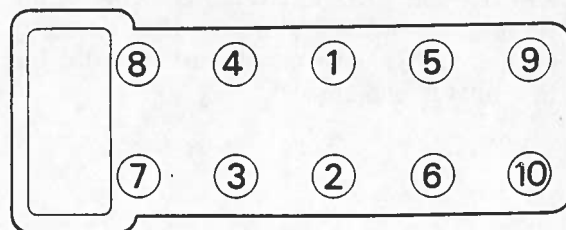
13. Refit the water pump with a new gasket.



14. Refit the cylinder head with a new cylinder head gasket.

Caution

A fully open valve can come into contact with a piston at top dead centre. Position the camshaft and crankshaft in the firing position for No. 1 cylinder when refitting engine parts. Do not rotate the shafts before installing the timing gear.



- Tighten the bolts to the correct torque in two stages. For tightening order see the illustration.

Tightening torques, Cylinder head bolts

Stage I: 69 Nm (6.0 kgm) 43 lb ft
 Stage II: 90 Nm (9.0 kgm) 65 lb ft



- Refit the two bolts in the timing cover.

The engine should be run until warm and allowed to cool for 30 min. approx. Before retightening the bolts. See "tightening cylinder head bolts.

15. Insert hook 83 93 357 in the chain tensioner and pull upwards so disengaging the tensioner from the chain. Refit the sprocket on the camshaft.

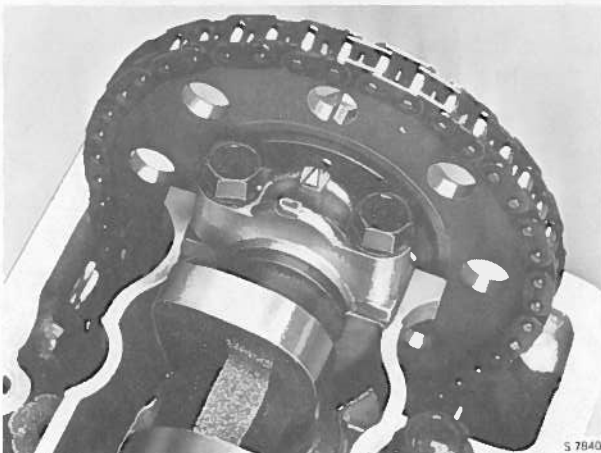
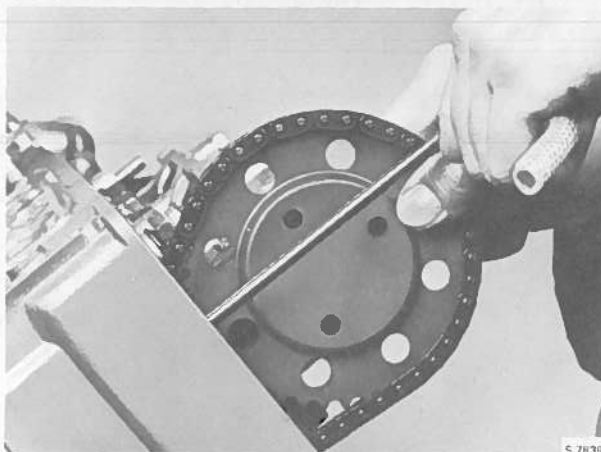
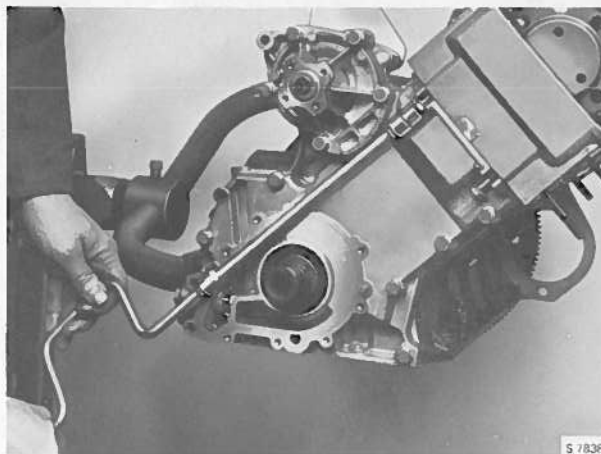
Rotate the sprocket until the marks on it line up with those on the bearing cap. (NOTE. The crankshaft should be in the "O" position.)

16. Refit the sprocket bolts with plain washers.

Caution

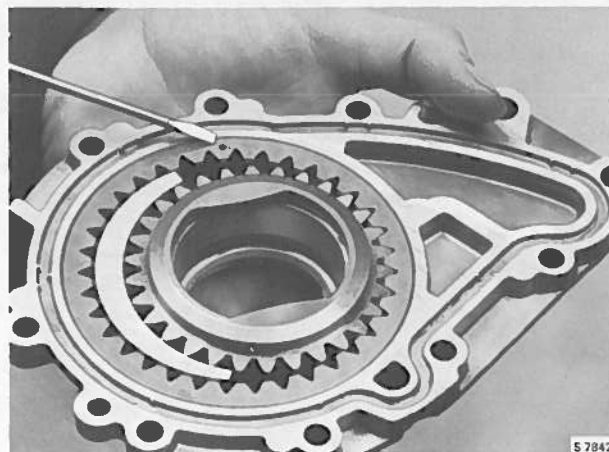
Washers must be fitted to prevent the bolts from butting against the camshaft bearing assembly.

Tightening torque, Camshaft chainwheel
20 Nm (2.0 kgm) 14 ft lb.

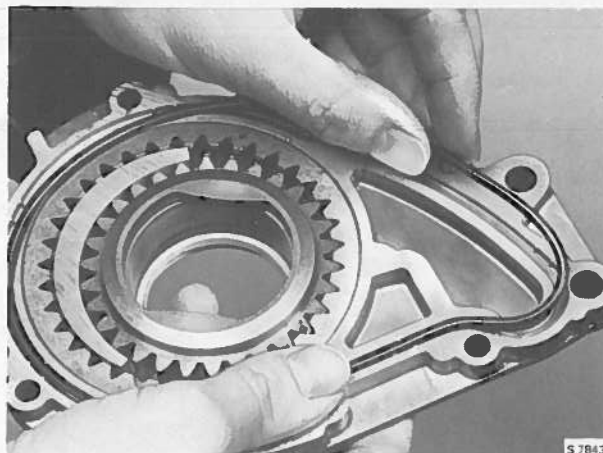


17. Refit the oil pump as follows:

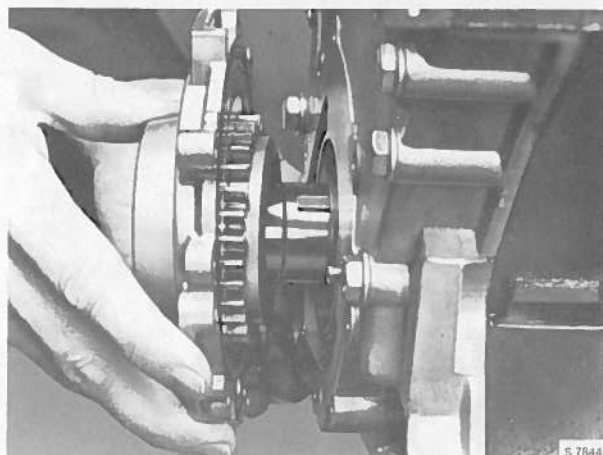
- Refit the ring gear so that the mark is visible.



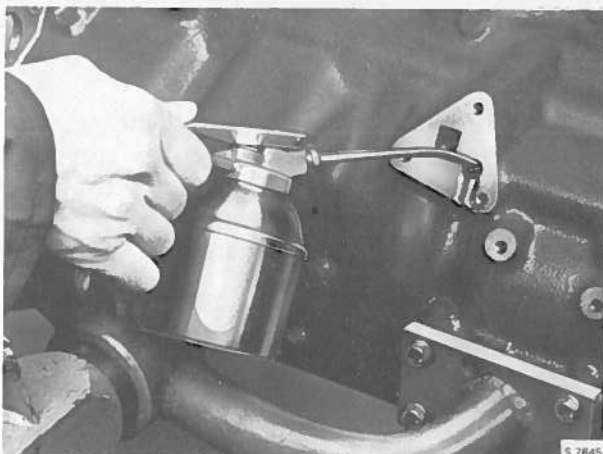
- Fit a new sealing ring in the groove in the pump body.



- Oil the pump wheels and push out the pump wheel a bit to make installation easier.



- Fill the oilway between the oil pump and the oil filter adapter with engine oil.



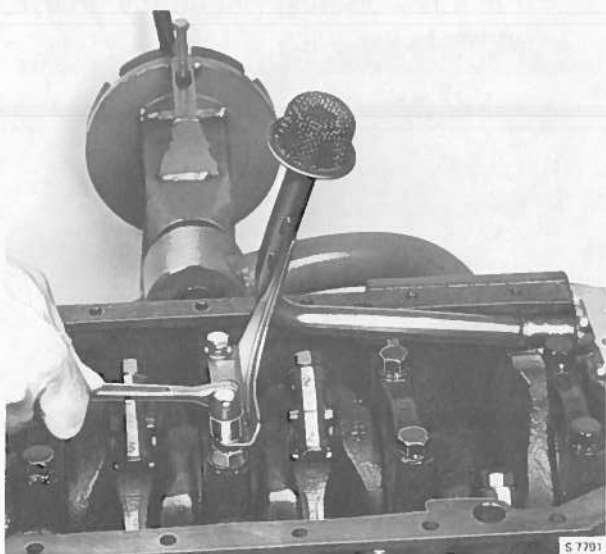
18. Refit the adapter casting for the oil filter with a new gasket.

19. Refit the pulley on the crankshaft.

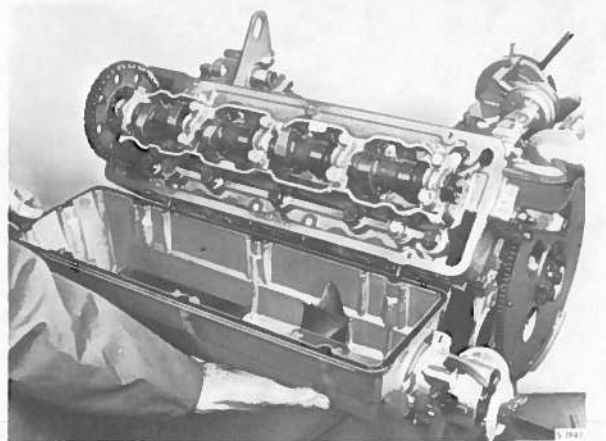
Tightening torque, Pulley
190 Nm (19 kgm) 137 lb ft



20. Refit the oil pump filter intake pipe with O ring.

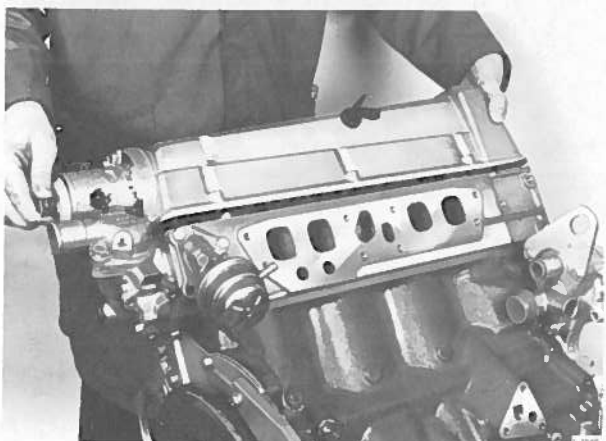


21. Fit the rubber sealing ring in the valve cover groove.



- Refit the valve cover. Line up the distributor rotor arm with the slot in the distributor housing so that the distributor driving dog locates in the slot in the end of the camshaft.

Tightening torque, Valve cover
4.9 Nm (0.5 kgm) 3.5 lb ft



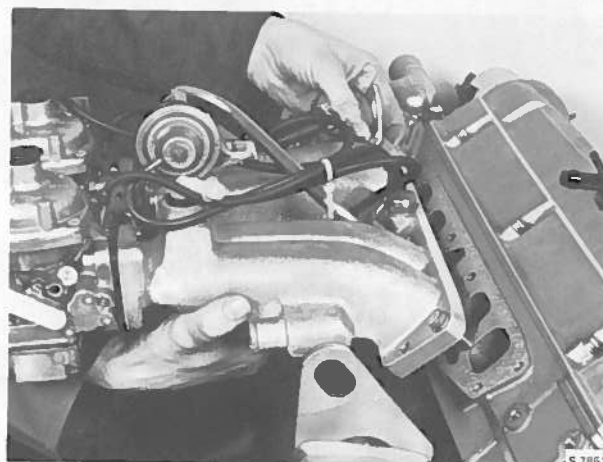
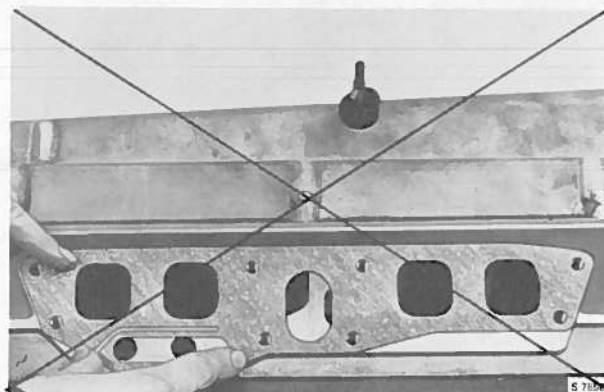
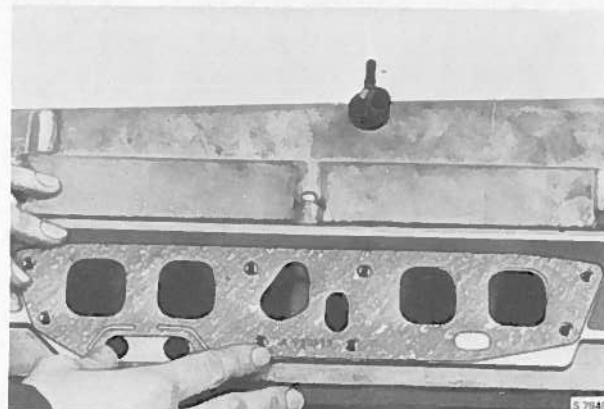
22. Fit a new inlet manifold gasket.

Caution

B20 engine gaskets must not be used. (Their use results in water entering the engine through the EGR channel.) Carbureted and fuel injection engines have different gaskets.

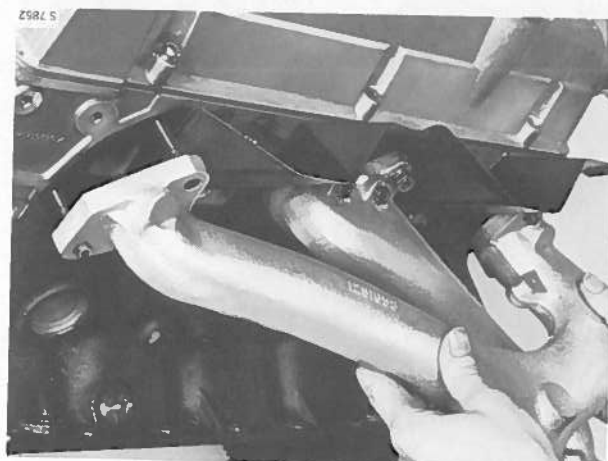
- Refit the inlet manifold and lifting lugs. (Fit plain washers between the inlet manifold and the lugs.)

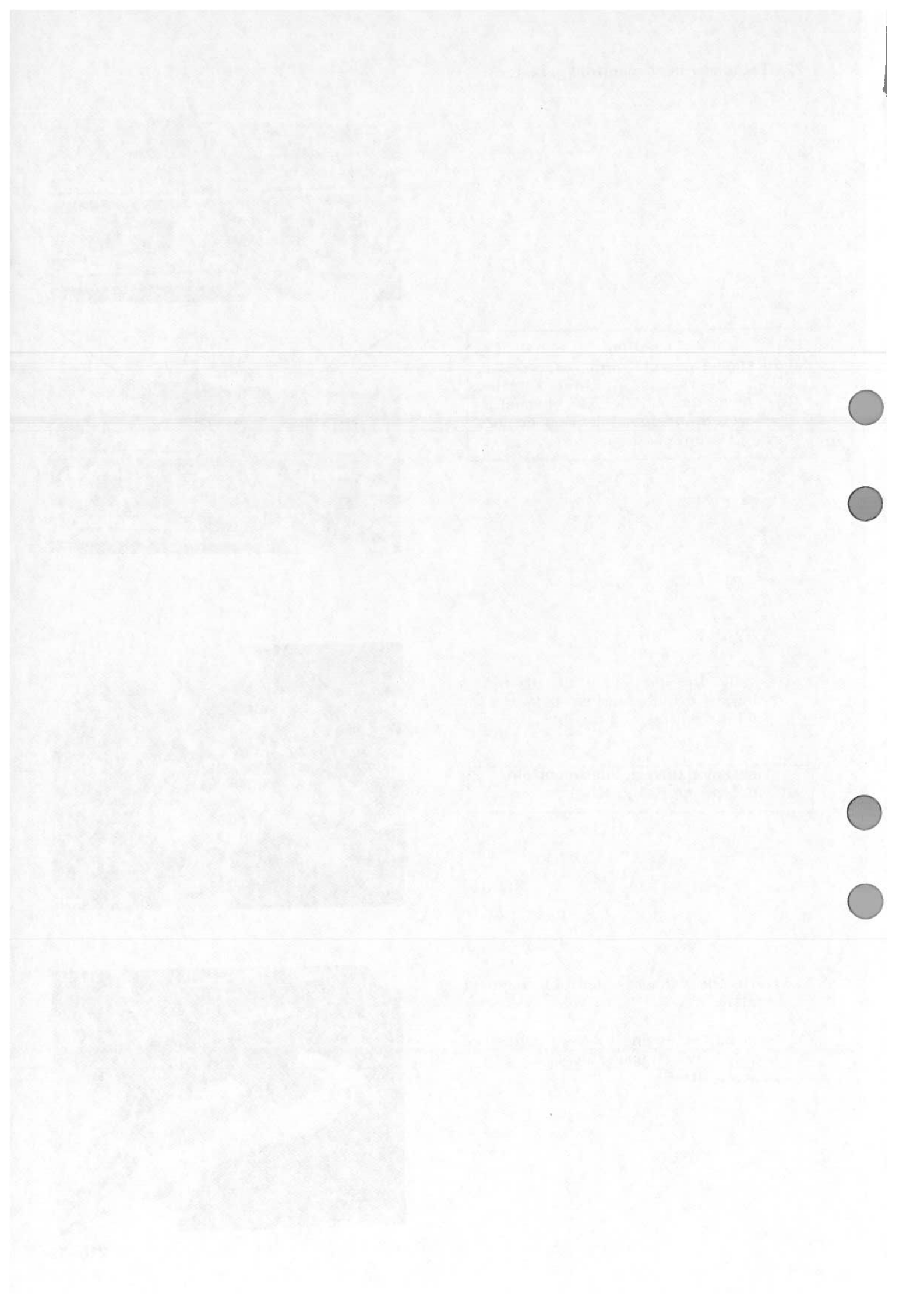
Tightening torque, Inlet manifold
18 Nm (1.8 kgm) 13 lb ft



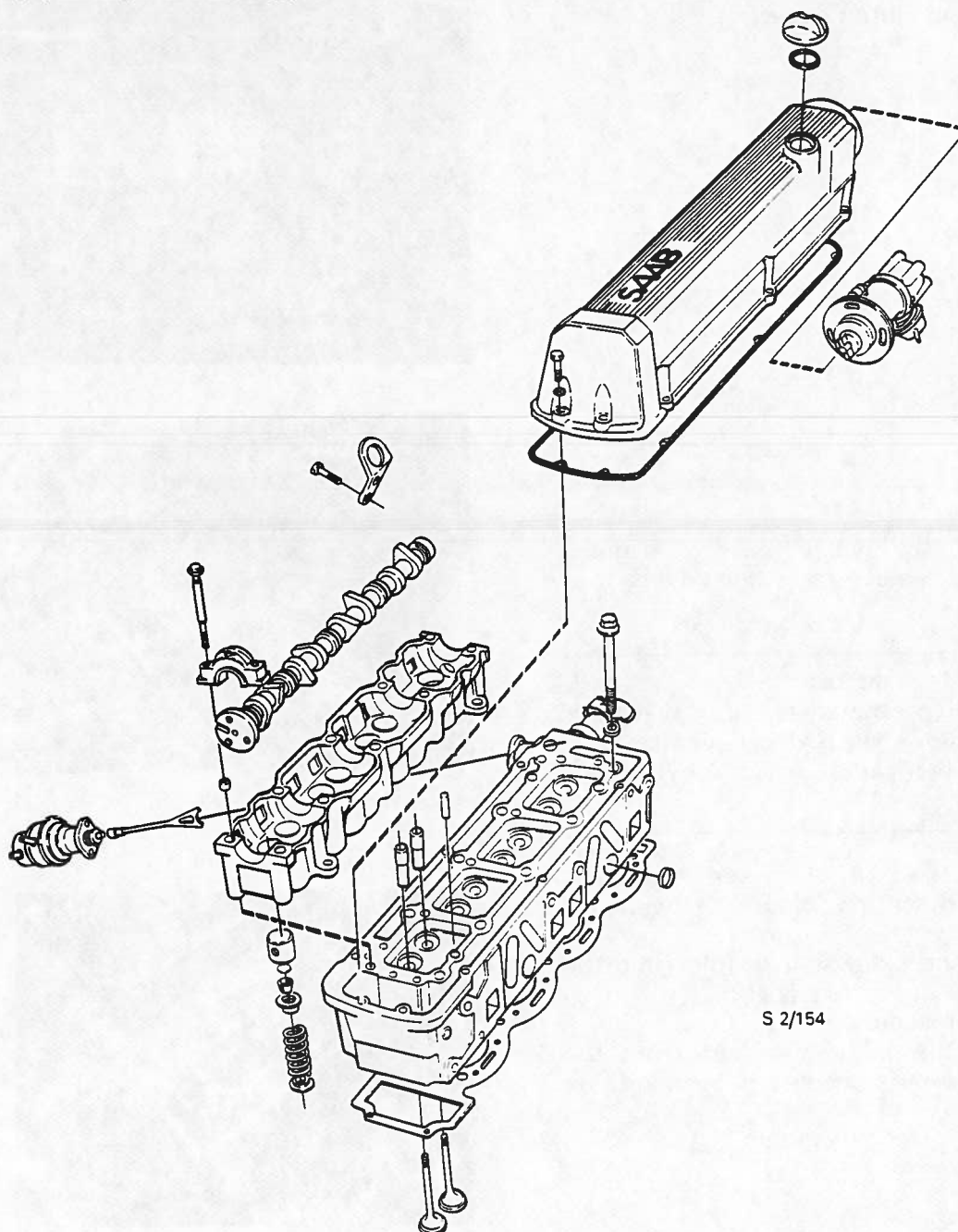
23. Refit the exhaust manifold and heat shield.

24. Suspend the engine by the lifting yoke and fit the engine mountings and a new oil filter.





Cylinder head

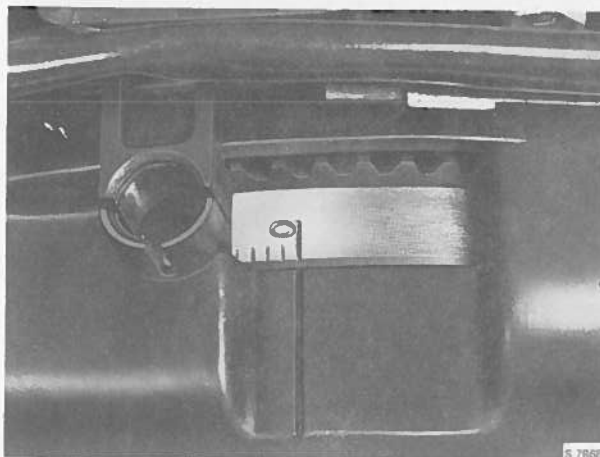


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To remove

1. Disconnect the battery leads.
2. Drain the coolant through the drain cock on the radiator and the drain plug in the engine block.
3. Disconnect the upper radiator hose.
4. Disconnect the crankcase ventilation hoses from the valve cover.
5. Disconnect the wiring from the distributor and the temperature transmitter.
6. Disconnect the fuel pipe from the fuel pump.

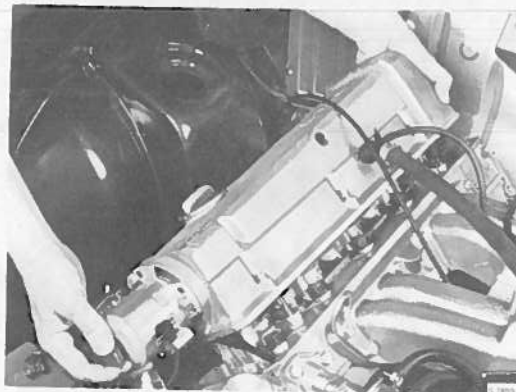
7. Rotate the crankshaft so that the flywheel's (0) mark lines up with the line on the clutch cover.



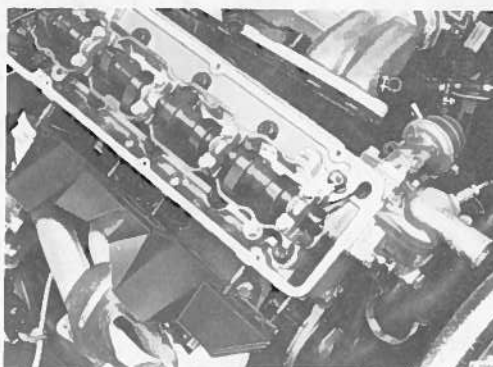
8. Remove the valve cover retaining bolts and remove the valve cover.

Note

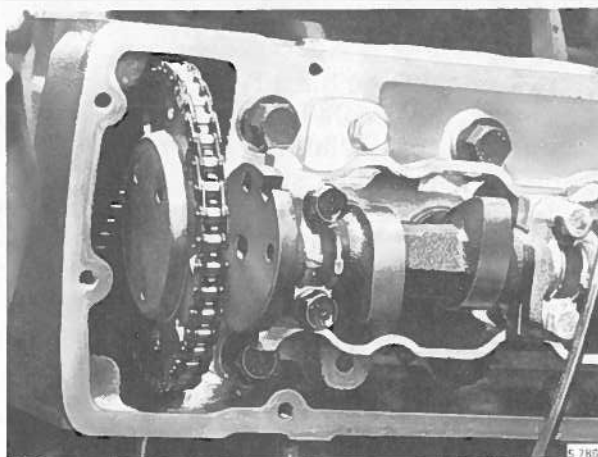
The design of the distributor driving dog only allows the valve cover to be removed when No. 1 or No. 4 cylinder is at TDC.



9. Detach the stay between the right engine mounting and the cylinder head.
10. Detach the exhaust manifold from the cylinder head (supporting it in a suitable manner.)
Detach the inlet manifold from the cylinder head. (Support it in a suitable manner.)



11. Remove the camshaft sprocket bolts. Remove the sprocket from the camshaft but keep the chain hanging on the sprocket. Place the sprocket between the chain guide and tensioner.



12. Remove the two bolts from the timing cover.



13. Remove the cylinder head bolts and lift off the cylinder head.

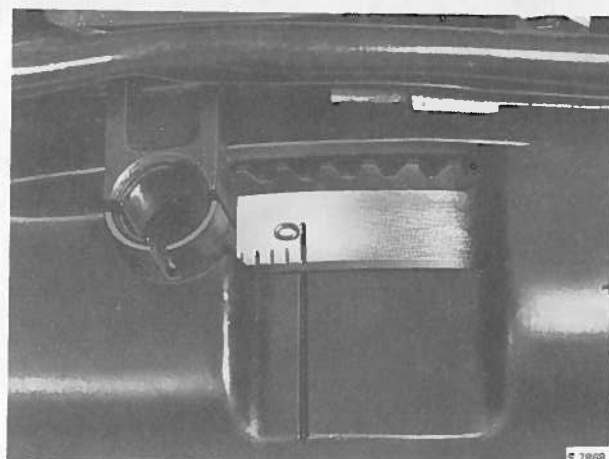
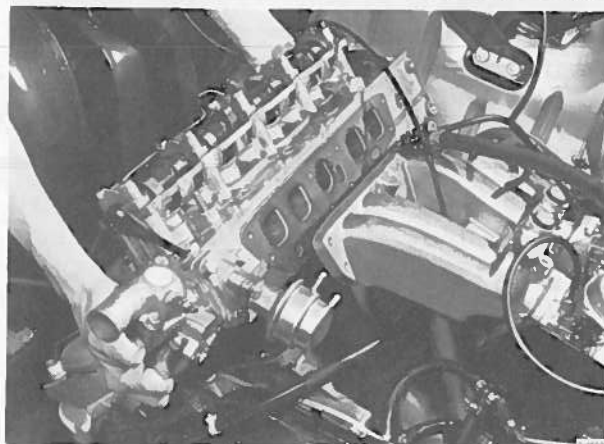
Clean all mating surfaces on the cylinder head, engine block, inlet and exhaust manifolds.

Carefully scrape away remains of the gaskets and sealing compound. Do not use emery cloth.

Check that the mating surfaces are flat.

To refit

1. Place a new cylinder head gasket on the engine block.
- 2 a. Rotate the crankshaft to the "0" position.

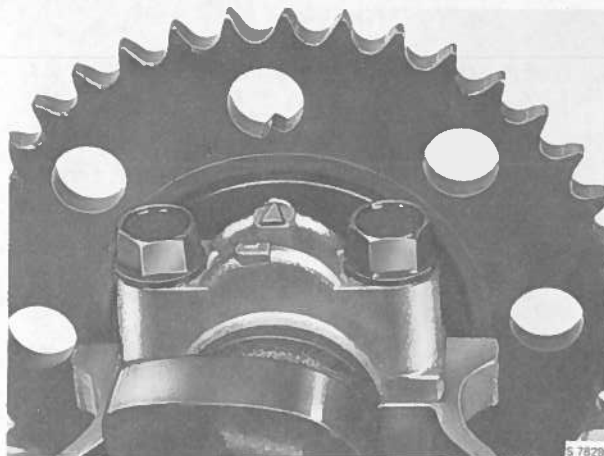


- b. Temporarily refit the sprocket on the camshaft and rotate the camshaft to TDC on the combustion stroke for No. 1 cylinder.

Caution

Do not move any of the shafts before refitting the timing chain.

A fully open valve can come into contact with the piston in the top dead centre position.



3. Position the chain on the camshaft sprocket and place the chain between the chain guide and tensioner.
4. Refit the cylinder head. Tighten the bolts to the correct torque in two stages in the tightening sequence shown in the illustration.



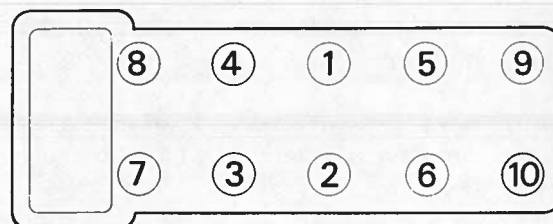
Tightening torque, Cylinder head bolts

Stage I: 60 Nm (6 kgm) 43 lb ft

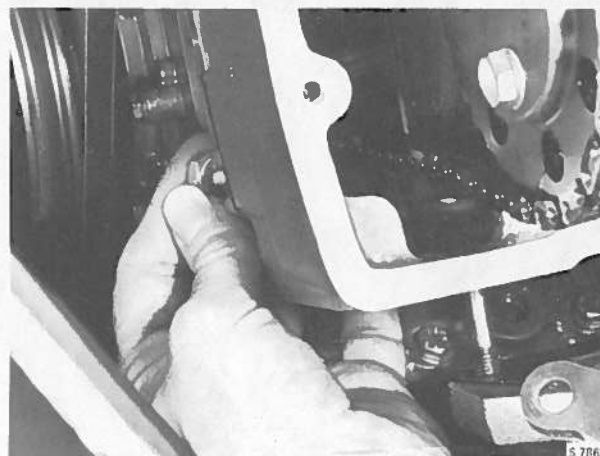
Stage II: 90 Nm (9 kgm) 65 lb ft

Retightening should be performed once the engine has been run until warm and then allowed to cool for 30 min approx.
See "retightening the cylinder head bolts".

Refit the two bolts in the timing cover.

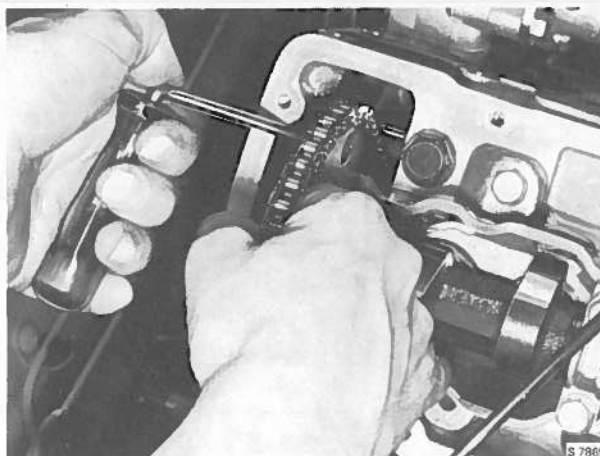


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S 7862

5. Refit the timing chain and sprocket as follows:
 - a. Take the tension off the chain tensioner using tool 83 93 357. Hook the tool into the catch and pull upwards.



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- b. Then place the sprocket on the camshaft so that the mark on the bearing cap, the mark in the sprocket and the bolt holes coincide. If necessary alter the position of the chains. Refit the three camshaft retaining bolts with flat washers.

6. Insert the seal in the groove running round the valve cover and refit the cover.

(If the distributor is mounted, the rotor arm should be positioned to face the slot in the edge of the distributor housing.)

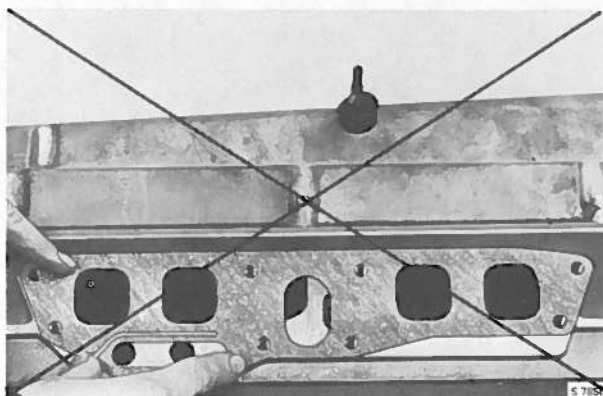
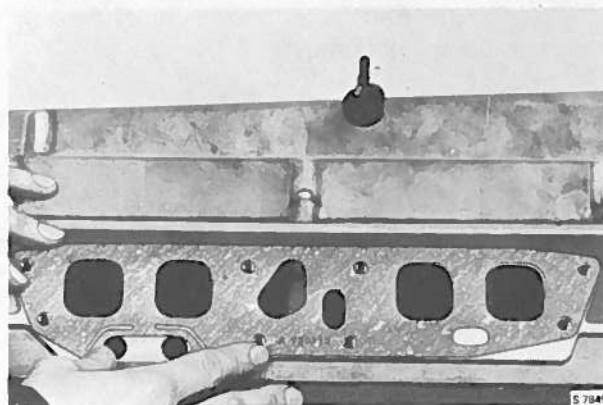
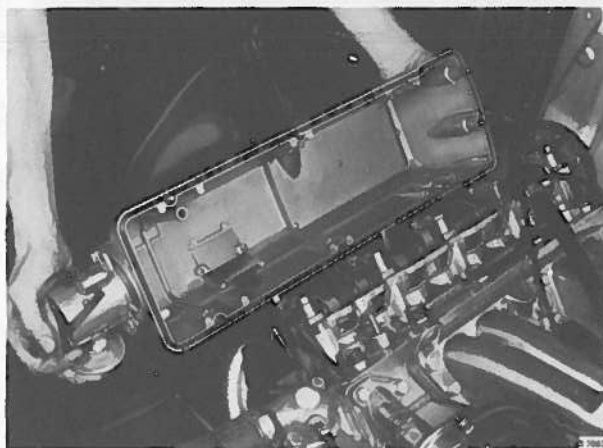
Tightening torque, valve cover
4,9 Nm (5 kgm) 36 ft lb.

7. Refit the inlet manifold using a new gasket.

Caution

Do not confuse the "H" engine inlet manifold gasket with the "B 20" engine gasket.

If the incorrect gasket is used then water will enter the cylinder head through the EGR channel.



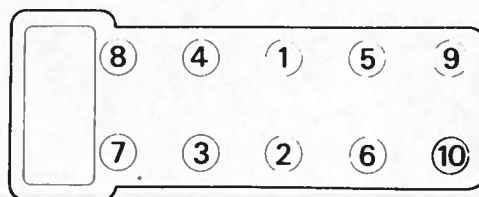
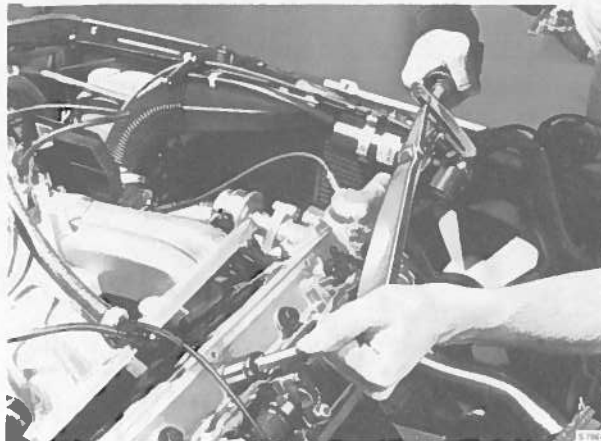
8. Refit the fuel lines to the fuel pump.
9. Refit the exhaust manifold and heat shield/gasket.
10. Refit the stay between the right engine mounting and the cylinder head.
11. Refit the radiator hose.
12. Reconnect the temperature transmitter cables and the distributor leads.
13. Close the drain cock and tighten the drain plug and refill the system with coolant.
14. Reconnect the crankcase ventilation hoses.
15. Reconnect the battery.
16. Start the engine, preparatory to retightening the head as detailed below.

Retightening the cylinder head bolts

General

The cylinder bolts should be retightened on the following occasions:

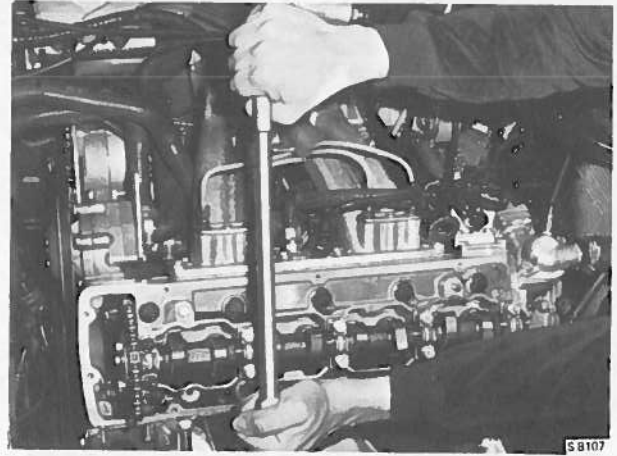
- a. At 1200 mile (2000 km) service
 - b. After refitting the cylinder head in connection with repair work. Retightening is then performed once the engine has been run until warm and subsequently allowed to cool for 30 min.
1. Slacken off each bolt slightly and then retighten to 90 Nm (9 kgm; 65 lb ft.) The tightening sequence is shown in the adjacent figure.

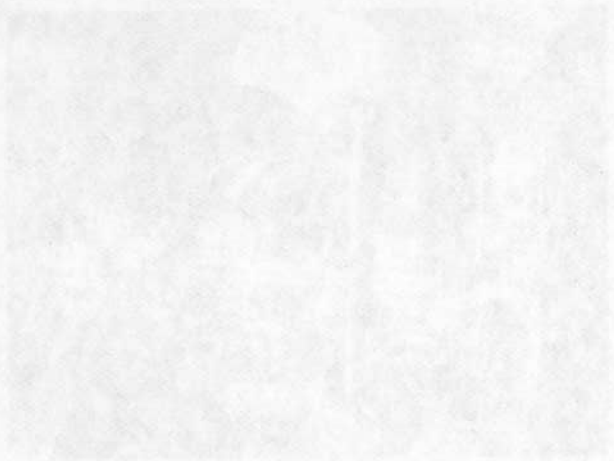


57036

2. Tighten each bolt a further 90° ($1/4$ turn) in the same sequence.

Stage I: Tightening torque 90 Nm (9 kgm) 65 lb ft.
Stage II: Further tightening by a 90° ($1/4$) turn.

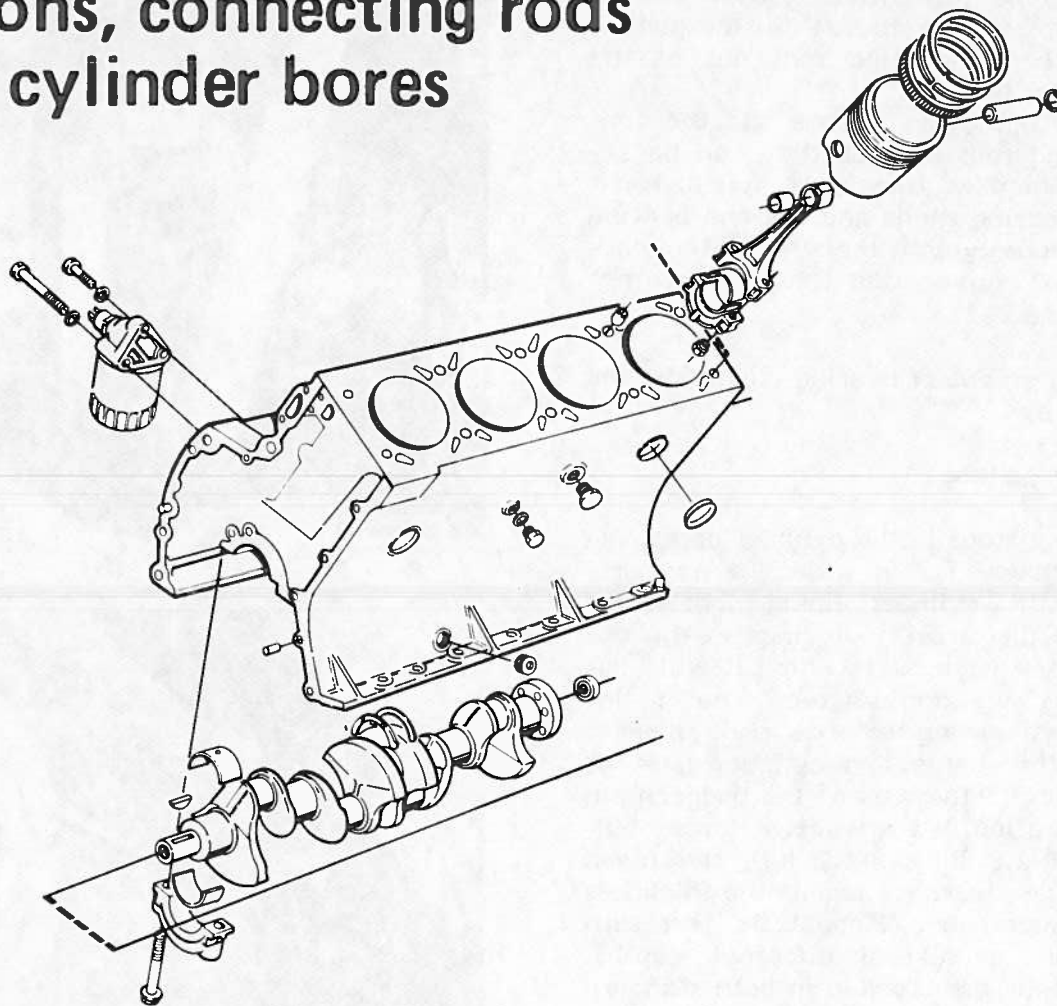




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Pistons, connecting rods and cylinder bores

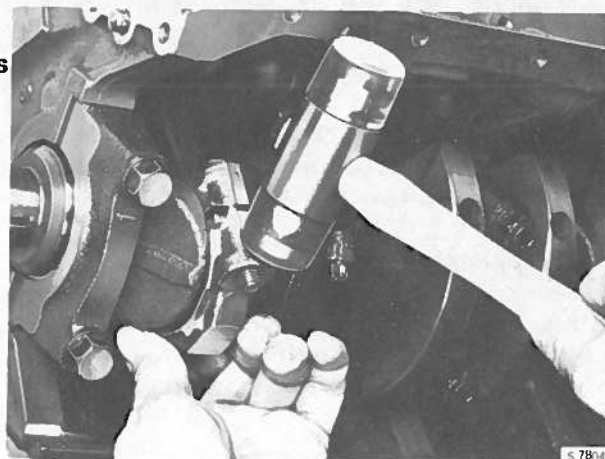


To renew pistons, piston rings and big-end bearings

(Engine mounted in workstand, cylinder head removed)

To remove

1. Remove any crusts and deposits of carbon from the top ends of the cylinders.
2. Remove the big-end bearing caps.



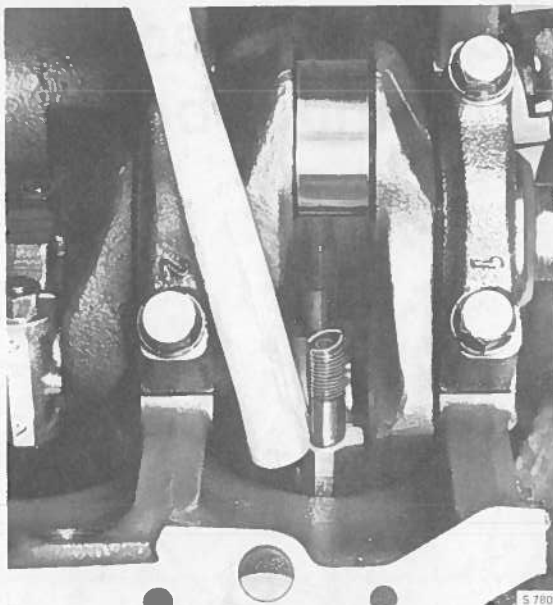
3. Place the protective sleeves on the connecting rod studs. Push the pistons and the connecting rods out of the cylinder bores.

Note. Mark the pistons and the connecting rods so that they can be re-assembled as they were found. Refit the bearing shells and big-end bearing caps loosely onto their respective connecting rods so that the parts are not confused.

For measurement of bearing clearance, see section 216.

Fitting the pistons

To fit the pistons in the cylinder bores, use a feeler gauge 1/2 in wide. To measure, first oil the cylinder lining lightly and insert the piston without rings in the cylinder in the position in which it will ultimately be working. Attach the feeler gauge to a spring balance and place it between the piston and cylinder bore at right angles to the axis of the gudgeon pin (see illustration.) At a tractive force of 8-12 N (1.8-2.6 lb, 0.8-1.2 kg), the mean value of the clearance equals the thickness of the feeler gauge. Repeat the test with the piston at several different depths. Spare pistons are stocked in both standard and oversize diameters. Where the latter are used, the cylinder bore must be honed or rebored to obtain the correct piston clearance. For piston clearance, refer to the specifications at the beginning of the Group.

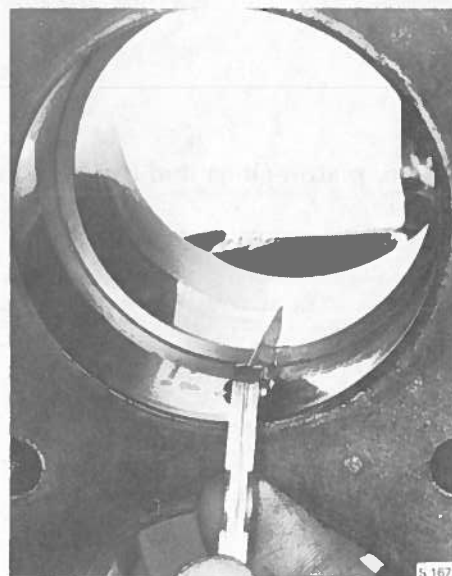


Fitting piston rings in a new or rebored cylinder

1. Push the piston rings down into the cylinder one at a time, using an inverted piston head to position them correctly.
2. Measure the ring gap with a feeler gauge (see illustration.) Correct gap sizes are given in the specifications. If necessary, widen the gap with a special file.
3. Try the piston rings in their respective grooves by rolling. Measure the clearance at a few points too.

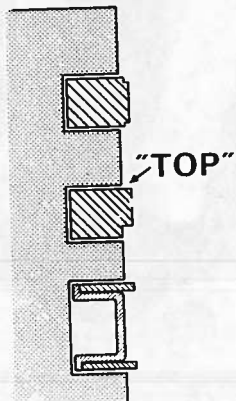
Fitting piston rings in worn cylinder

Rings to be fitted in a worn cylinder must be tried at the lower limit of travel of the piston, as the bore will be narrowest at this point.



To fit piston rings to pistons

Use the piston ring tool to fit the rings as illustrated. The lower compression ring should be fitted with the side marked "top" uppermost.

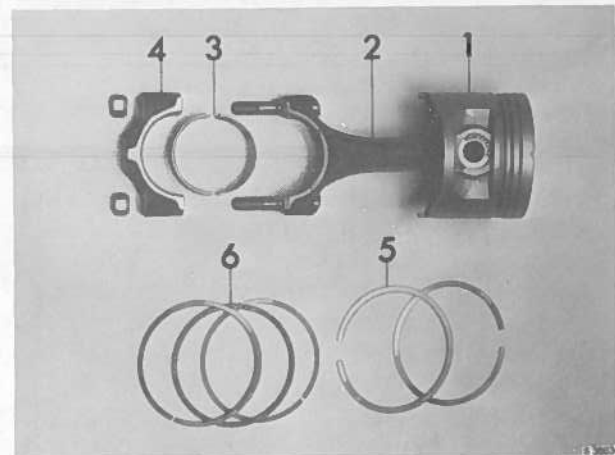
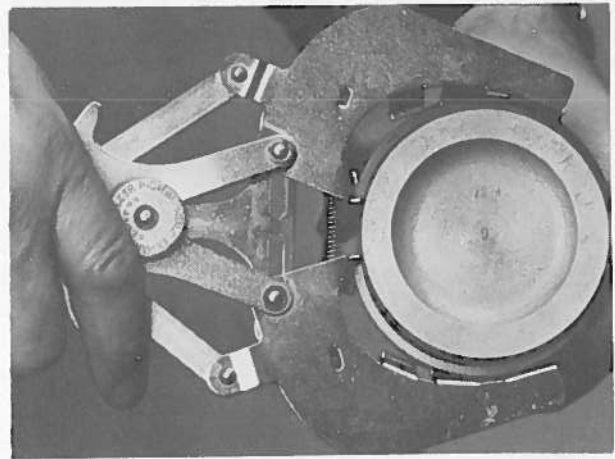


5-75/70

Oil the piston and rings before assembly. Position the compression rings so that the gaps are at 180° to each other, each positioned above one of the gudgeon pin holes. Make sure that the gaps in the oil scraper ring are equally spaced out round the piston, and not in line with one another.

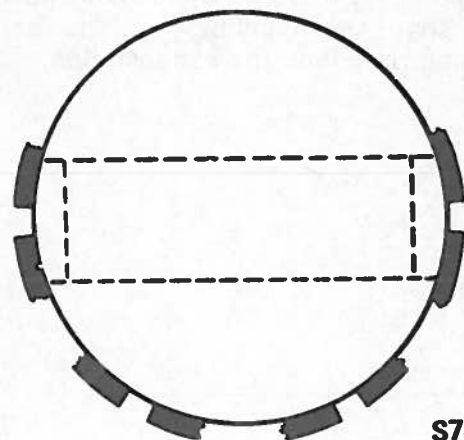
Position the compression ring gaps at 180° to each other, above the gudgeon pin holes.

Position the oil scraper ring gaps equally round the piston, and not in line with one another.



Piston and connecting rod with bearings and piston rings

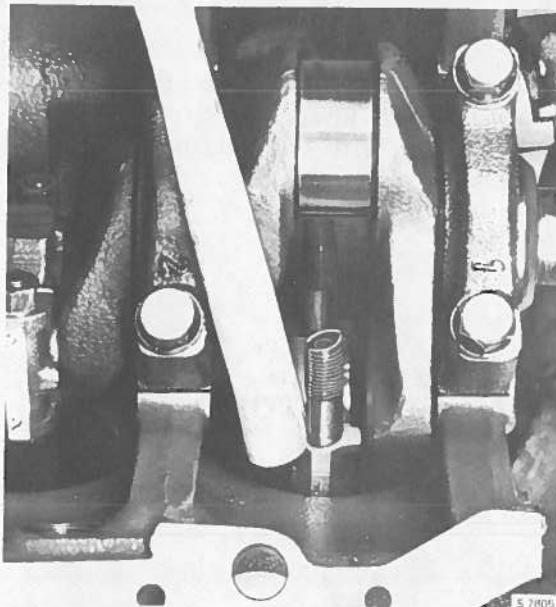
1. Piston
2. Connecting rod
3. Bearing
4. Bearing cap
5. Compression rings
6. Oil scraper ring



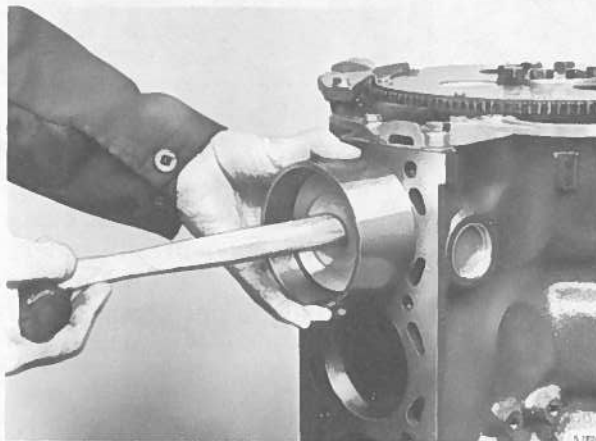
S7871

To fit the pistons in the cylinders

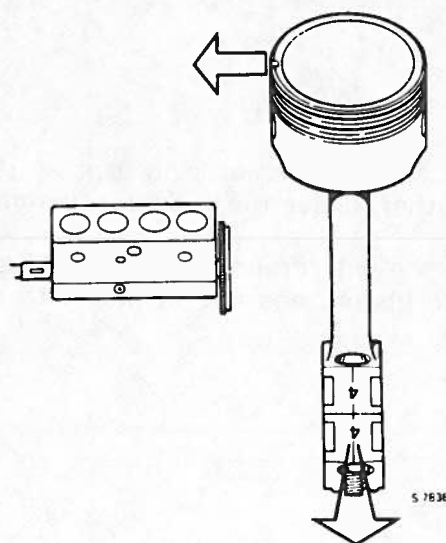
1. Place the bearing shells in position in the connecting rods and fit the protective sleeves to the connecting rod studs.
2. Oil the piston rings and bearings.



3. Refit the pistons using piston ring compressor 78 62 287

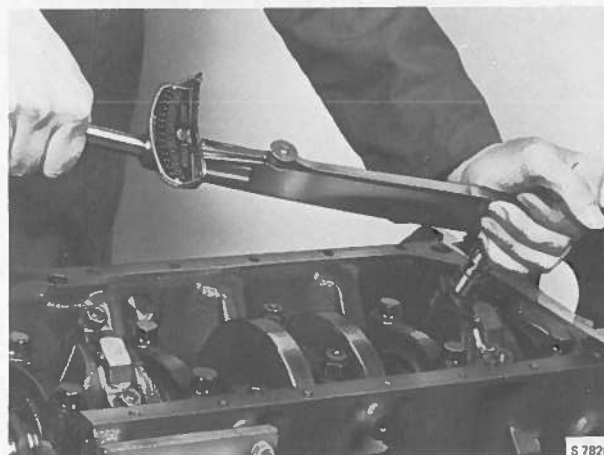


Ensure that the piston crown markings are pointing towards the timing cover and that the numbers on the connecting rods face the exhaust side.



4. Refit the big-end bearing caps with bearing shells (the connecting rod and big-end bearing cap identifying numbers should line up.) The big-end bearing nuts should be fitted with the flanges towards the connecting rods.

Tightening torque, Big-end bearings
54 Nm (5.5 kgm) 40 lb ft



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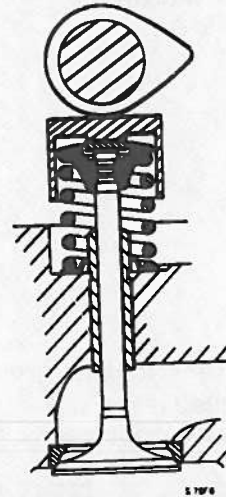
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Valve mechanism

Valve cover



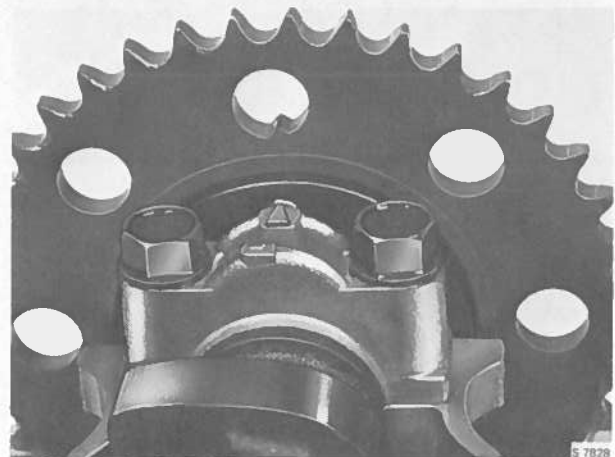
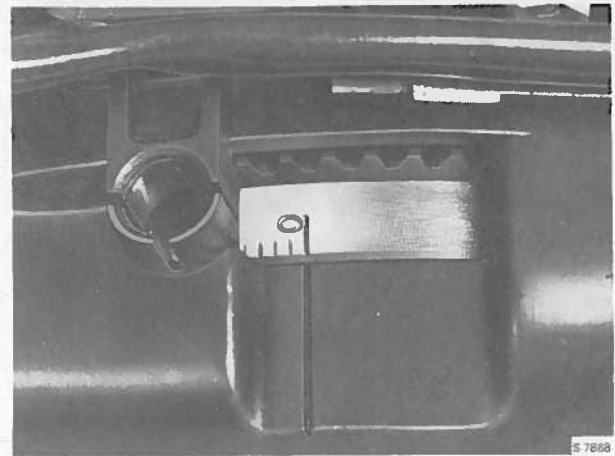
To remove

1. Rotate the crankshaft to the "O" mark (top dead centre for No. 1 and No. 4 cylinders) as follows:
 - a. Put the car in gear.
 - b. Rotate one of the front wheels until the "O" on the flywheel coincides with the line in the flywheel cover.
2. Disconnect the crankcase ventilation hose.
3. Disconnect the HT leads from the spark plugs.
4. Remove the bolts and lift off the cover.

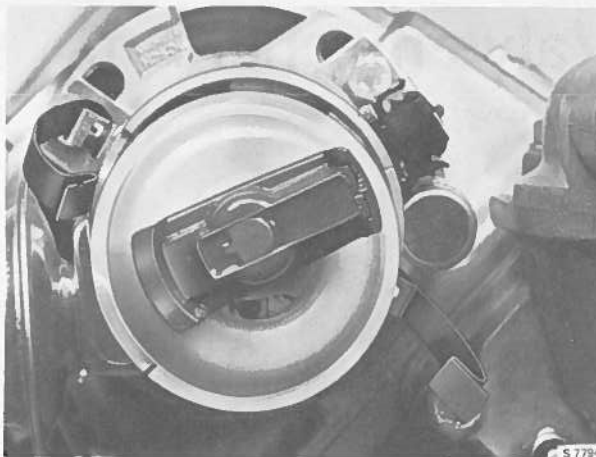


To refit

- 1 a. Ensure that the camshaft and the crankshaft are at top dead centre for No. 1 cylinder.



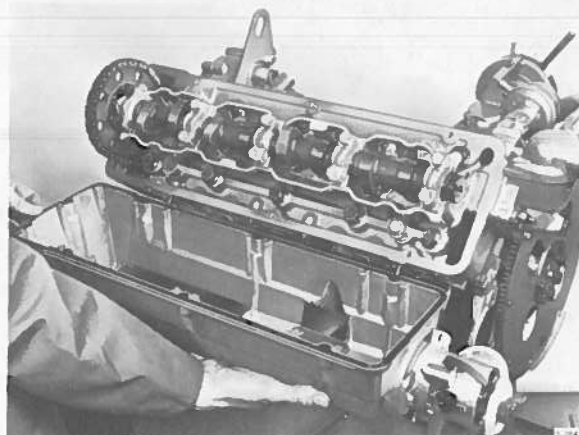
- b. Remove the distributor cap and line up the rotor with the mark on the distributor housing.



2. Insert the seal in the groove running round the cover.
3. Refit the valve cover.

Tightening torque, Valve cover
4.9 Nm (0.5 kgm) 3.6 lb ft)

4. Refit the distributor cap and HT leads.
5. Refit the crankcase ventilation hose.

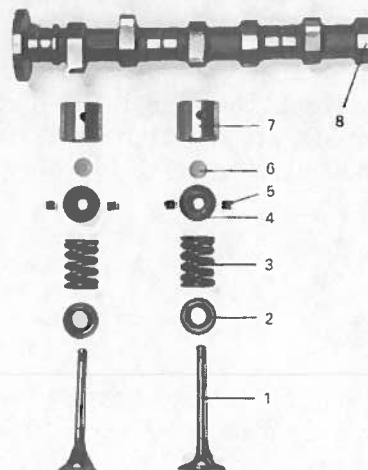


Valves

To remove

(Cylinder head removed from cylinder block)

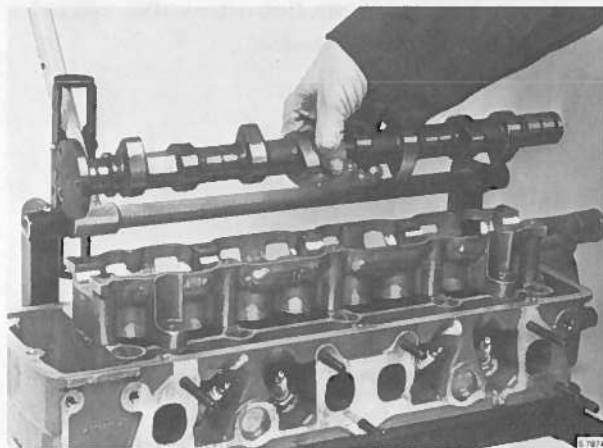
1. Remove the camshaft bearing caps.



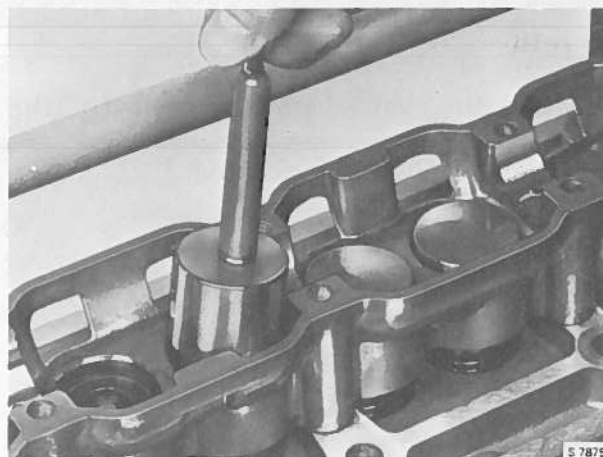
Valve mechanism

1. Valve
2. Valve spring seat
3. Valve spring
4. Retainer
5. Collet
6. Adjusting pallet.
7. Valve depressor.
8. Camshaft

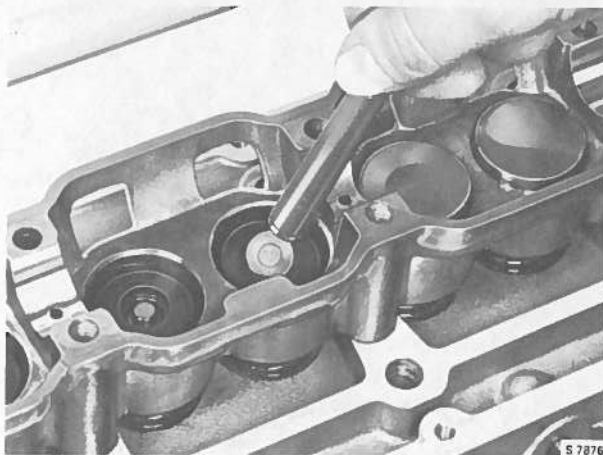
2. Lift off the camshaft.



3. Use the magnetic tool to extract the valve depressors and store them in the correct sequence.



4. Remove the adjusting pallets. Store them carefully in sequence.

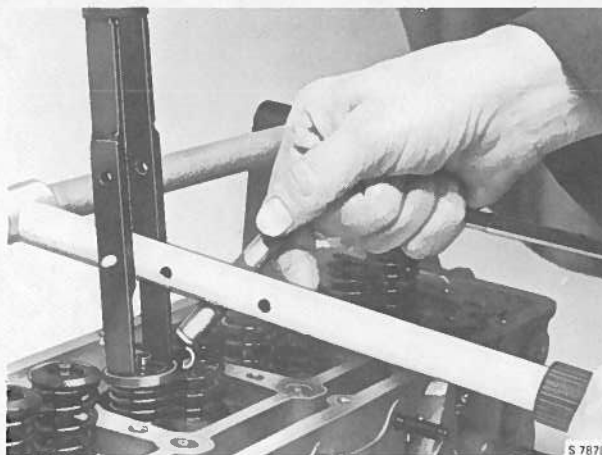


5. Remove the camshaft bearing assembly.



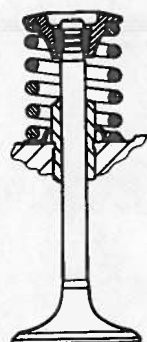
Place the cylinder head in valve spring compressor 83 93 050.

- 6 a. Compress the valve springs.
b. Remove the collets release the spring and remove the tool.
7. Remove the valve spring retainer, valve spring and valve spring seat.
8. Withdraw the valve.

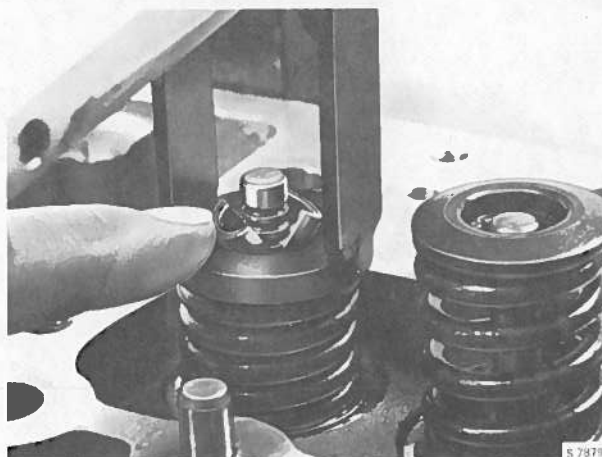


To refit

1. Oil the valve stems and refit the valves.
2. Refit the valve spring seats.



3. Refit the valve springs and the valve spring retainers.
4. Compress the valve springs using the valve spring compressor and refit the collets release the valve spring compressor and check that the collets are correctly positioned round the valve stem. Remove the tool.



5. Refit the camshaft bearing assembly.
Note. Ensure that the feeler gauge apertures face the inlet side. Incorrect installation of the camshaft bearing assembly cuts off lubrication to the valve gear.
6. Refit the adjusting pallets in their original positions.
7. Apply a thin coat of engine oil to the valve depressors and refit them.

Caution

Do not move the cylinder head from its vertical position once the valve depressors are refitted. Moving the head can cause the valve depressors and adjusting pallets to fall out.

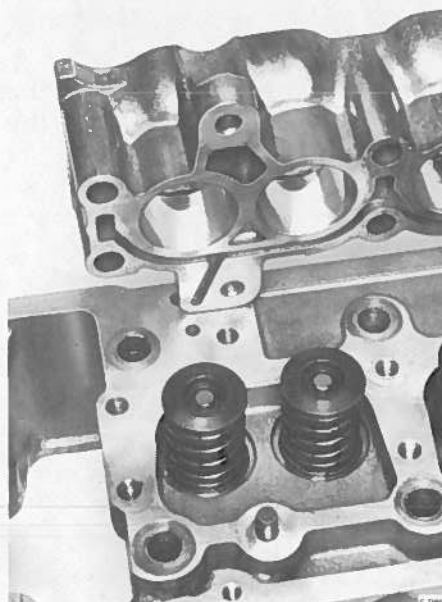
8. Refit the camshaft.
9. Refit the bearing caps.
(**Note.** Line up the marks.)

Tightening torque
Camshaft bearing caps
18 Nm (1.8 kgm) 13 lb ft

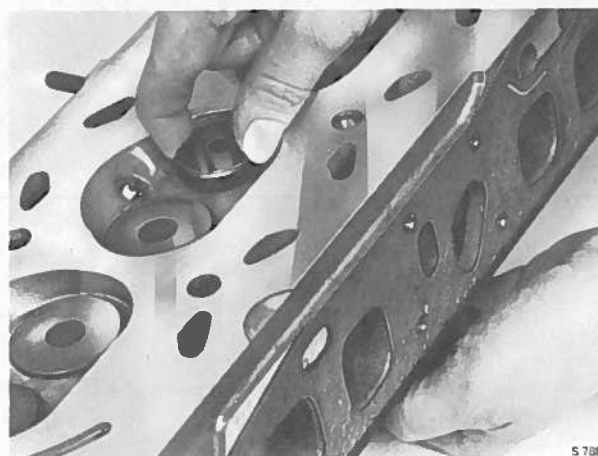
Valve guides

To check for wear

Pull up the valve 0.12 in (3 mm) from its seat and check the radial play by rocking the valve head. If the play at the head exceeds 0.02 in (0.05 mm) the valve guide should be exchanged.

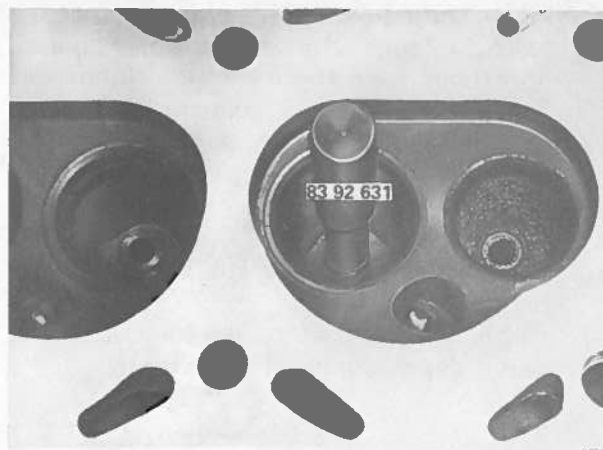


Fit the bearing assembly so that the oilway and the hole in the cylinder head are connected.



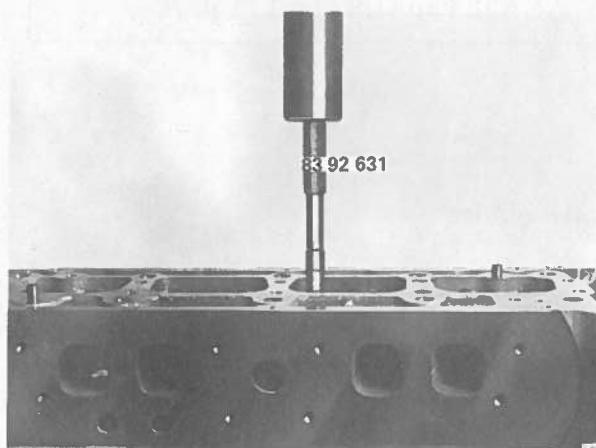
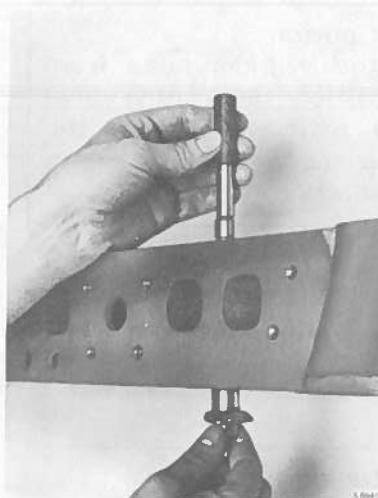
To remove

Before removing the valve guide, flush the cylinder head with hot water. Press out the guide using a drift and tool 83 92 631.



To replace

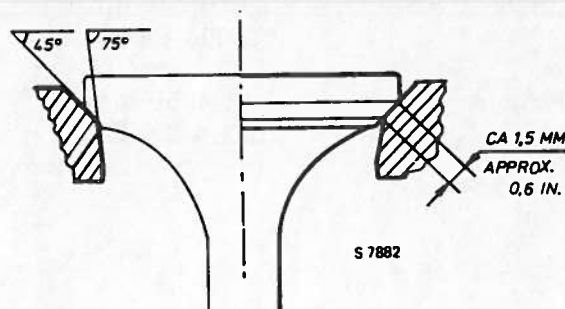
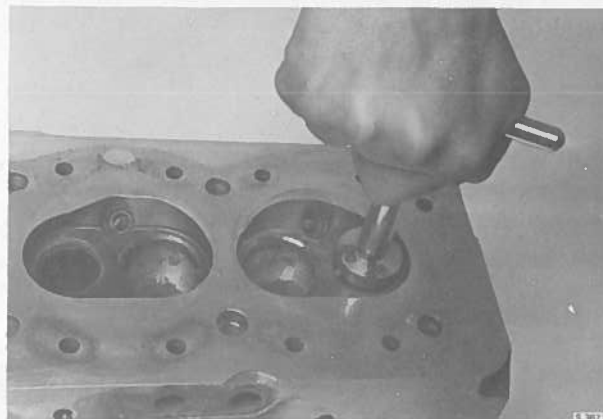
Flush the cylinder head with hot water. Insert the guide using a press and valve guide tool 83 92 631. Insert the centering drift from the underside of the head and press in the guide from above using the drift. In the final stages the valve guide tool moves to one side and the valve guide can be located in its proper position.



Milling the valve seats

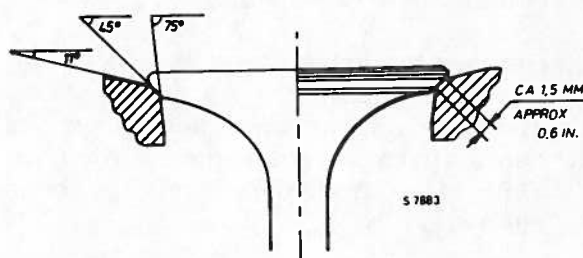
Clean all parts and remove all traces of carbon and dirt from the valves and ports. Insert the cutter pilot in the valve guide and tighten the bolt until the pilot is secured in the guide. The valve seats in the cylinder head should be recut with a 45° cutter. It may be necessary to use an emery cloth first to remove the hard deposits on the surface of the exhaust valve seats. After recutting, the width of the valve seat is often excessive and must be reduced.

The exhaust valve seats should only be reduced from the bottom by means of a 75° cutter. The contact surface should extend to the periphery of the valve head.



The width of the inlet valve seats should be reduced so that the contact surface lies in the middle of the ground surface of the valve head. Reduce from the bottom by means of a 75° cutter and from the top using an 11° - 12° cutter.

Engineers' marking can be used to check the finished seat width which should be 0.060 in (1.5 mm) approx. for both inlet and exhaust valve seats.

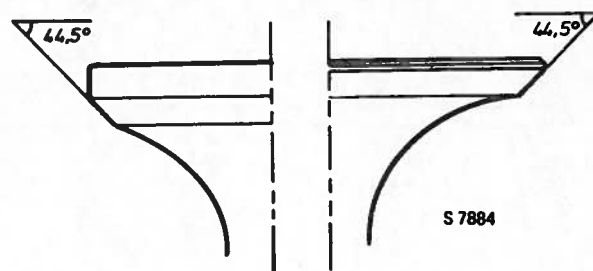


To grind in valves

If, on examination of the valves it appears unlikely that they would clean up satisfactorily with ordinary grinding in, they must be refaced or replaced. The valve faces should be at an angle of 44.5° .

Place a small amount of valve grinding paste evenly round the valve seat and place on its seating by means of the grinding tool. Rotate the valve from side to side through a few degrees only, using light pressure. Remove the valve, clean the seat and check for a good seal with engineers' marking.

Continue grinding in if necessary and recut the valve seats if required.



Valve clearance

General

The valve clearances do not vary and adjustment under normal conditions is only required after long periods or when work has been performed on the valves. However, the valve clearance should be checked every 28,000 miles (45,000 km).

Checking

Check the valve clearance with a feeler gauge, comparing with the maximum and minimum tolerances. The tolerance limits for purposes of valve clearance checking are:

Inlet valves: 0.15-0.30 mm
((0.006-0.012 in)

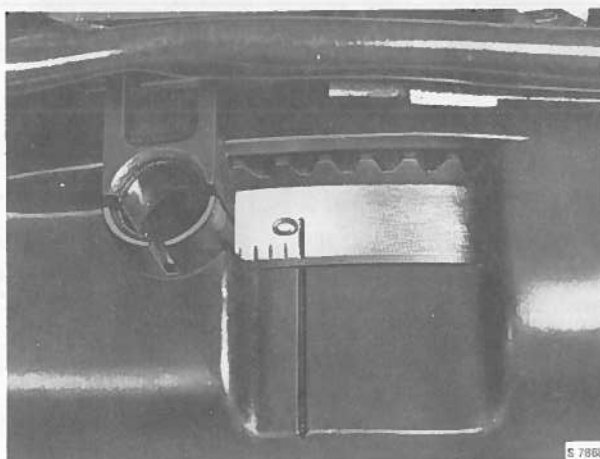
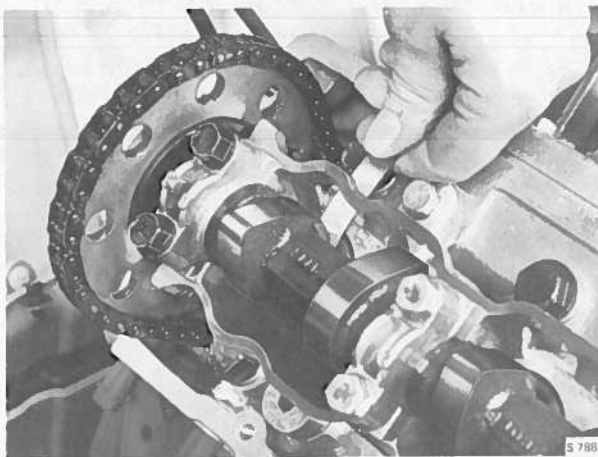
Exhaust valves: 0.35-0.50 mm
(0.014-0.020 in)

1. Rotate the crankshaft to the "0" position. (Put the car in gear and rotate one of the front wheels.)

2. Remove the valve cover.

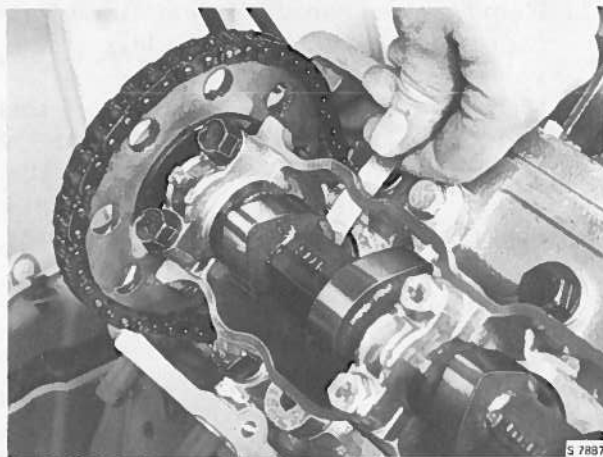
The distributor drive design allows the camshaft to be removed only when No. 1 or No. 4 cylinder is at top dead centre.

3. a Rotate the crankshaft until the cam lobe of the valve to be measured is opposite the valve depressor.



b. Check the valve clearance with the feeler gauge. If it does not fall within the limits then the clearance should be measured and adjusted.

4. Rotate the crankshaft to TDC on the compression stroke for No. 1 cylinder and fit the valve cover. (See Section 214.)



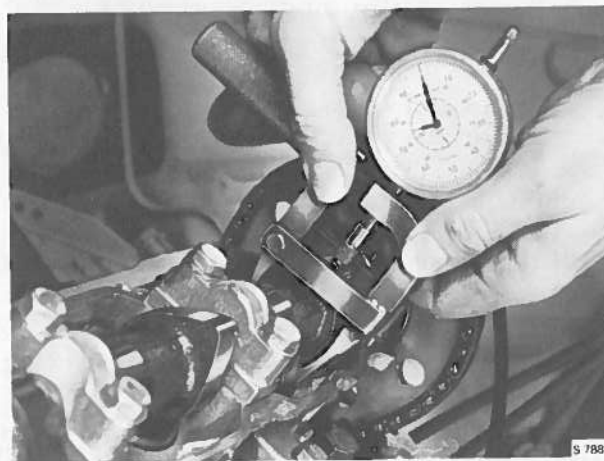
To measure and adjust

The clearance of all valves should be checked if one is found to fall outside the prescribed limits.

Adjustment of valve clearance is to be based on actual measurement. Measurements are made using tool 83 91 450 and a dial indicator.

Adjustments in valve clearances are made by fitting adjusting pallets of different thicknesses. Measurement and adjustment are performed as follows:

1. Position the cam lobe opposite the valve depressor.
2. Assemble measuring tool 83 91 450 and the dial indicator and clamp the three jaws onto the valve depressor. Position the point of the plunger on the top of the cam lobe. Set the dial to zero.
3. Using the measuring tool, lift the valve depressor and read off the valve clearance on the dial. Note the reading.
4. Measure and note the clearances of all valves in the same manner. Adjust the clearance of any valve which does not lie within the following limits:
Inlet valves: 0.008-0.010 (0.20-0.25 mm)
Exhaust valves: 0.016-0.018 (0.40-0.45 mm)



5. Remove the camshaft and the valve depressors and adjusting pallets of the valves requiring adjustment.
6. Measure and note the thickness of the pallets using tool 83 91 633 or a micrometer. This thickness plus the valve clearance equals the total distance between the valve depressor and the cam.

Example:

Valve clearance measured	0.005 (0.13 mm)
Pallet thickness measured	<u>0.100 (2.54 mm)</u>
Total distance	0.105 (2.67 mm)

The thickness of adjusting pallet required equals the total distance measured between the valve depressor and the cam, less the valve clearance specified for the inlet or exhaust valve.

Example:

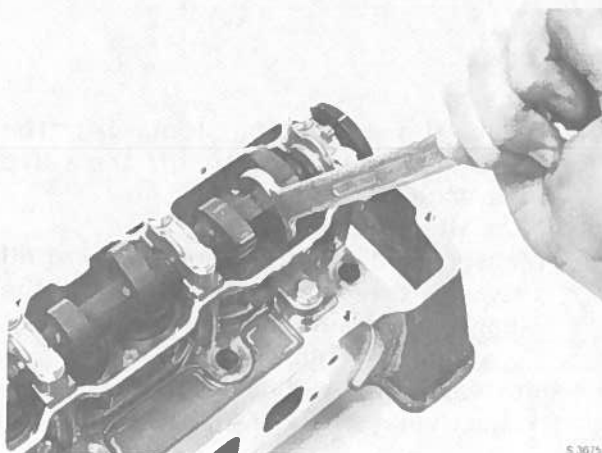
Total distance	0.105 (2.57 mm)
Less specified inlet valve clearance	<u>0.008 - 0.010 in.</u> <u>(0.20-0.25 mm)</u>
Pallet thickness required	0.097 (2.44 mm)

Select an adjusting pallet 0.096 in (2.43 mm) thick.

7. Fit the new adjusting pallet and refit the valve depressor and the camshaft.
8. Repeat the measurement procedure to check that the clearances are now correct.

To measure and adjust valve clearance after work on valves

1. Fit the thinnest adjusting pallets (0.070 in: 1.77 mm.)
2. Refit the valve depressors and camshaft.
3. Measure the clearances for each valve and calculate the total distance between the cam and the valve depressor.
4. Calculate the thickness of the adjusting pallets required to give the correct clearances.
5. Remove the camshaft and valve depressors, extract the adjusting pallets and install the new pallets.
6. Refit the valve depressors and camshaft.
7. Use the dial indicator to check the valve clearance. Use the table elsewhere in this section to simplify calculating the thickness of the adjusting pallets.



S 3075

Pallet thickness measured	Inlet, mm
Exhaust (standard) mm	2,89 2,84 2,79 2,74 2,69 2,64 2,59 2,54 2,48 2,43 2,38 2,33 2,28 2,23 2,18 2,13 2,08 2,03 1,98 1,93 1,88 1,82 1,77
Exhaust (Turbo) mm	2,89 2,84 2,79 2,74 2,69 2,64 2,59 2,54 2,48 2,43 2,38 2,33 2,28 2,23 2,18 2,13 2,08 2,03 1,98 1,93 1,88 1,82 1,77

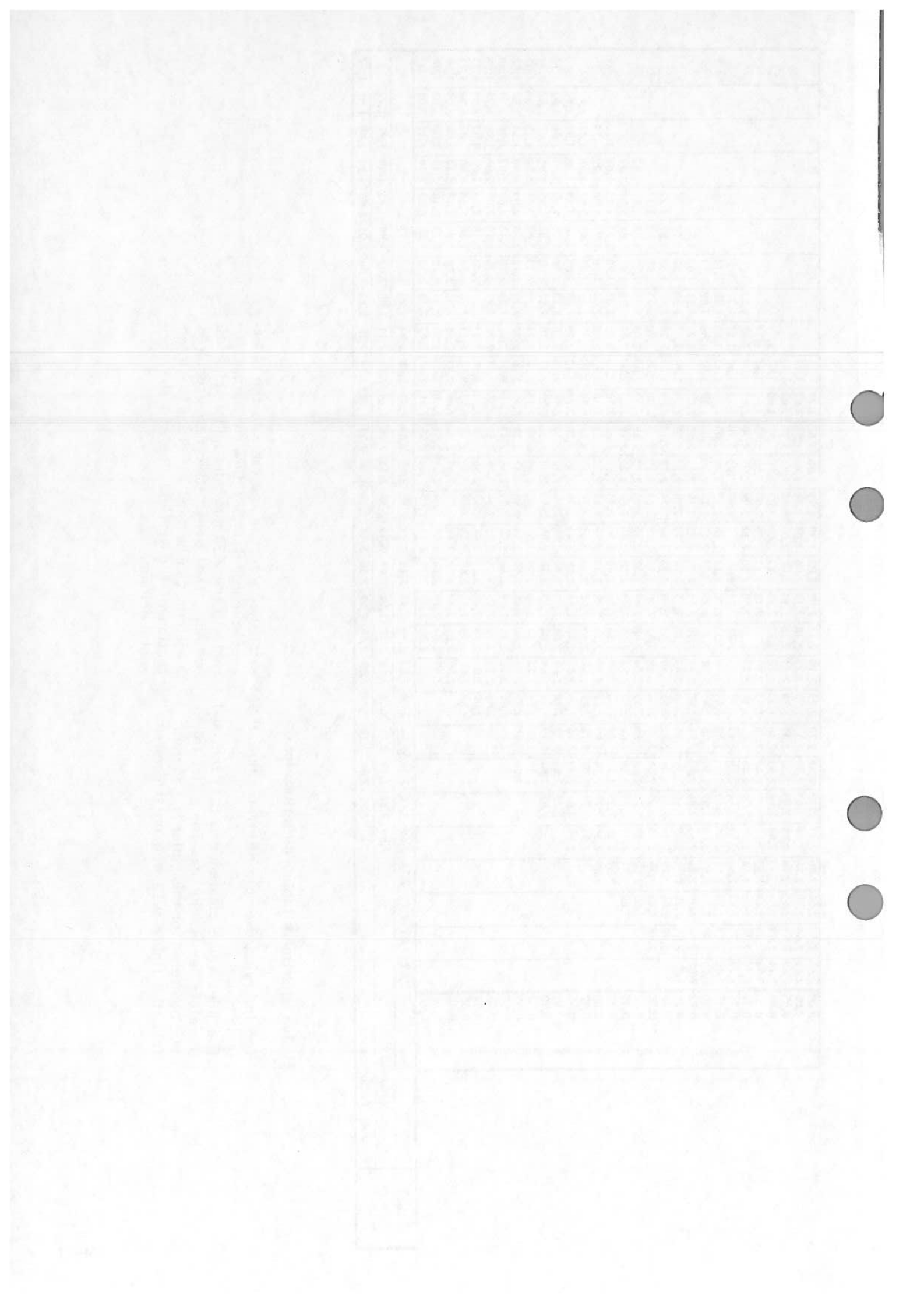
Valve adjustment table - directions for use

The following example illustrates how the table is used:

The inlet valve clearance is 0.13 mm and therefore needs adjusting. The pallet thickness measured for this pallet is 2.54 mm.

Take the figure 0.12 mm on the vertical

axis (the closest in the table to the clearance recorded) and follow it across the table to the 2.54 mm inlet pallet thickness column. The pallet thickness required, 2.43 mm, can be read off from the intersection of the vertical line and the horizontal column.



Transmission

Timing chain

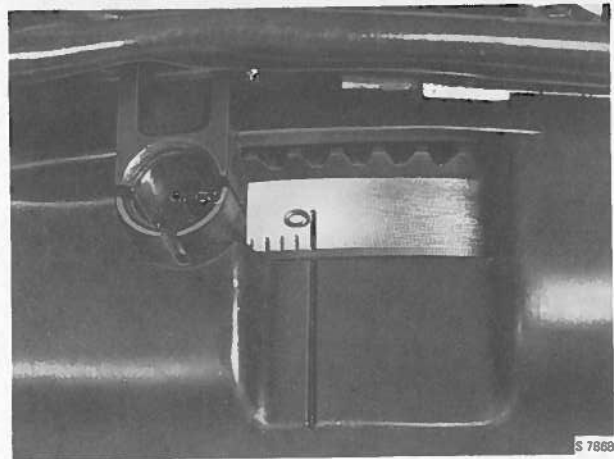
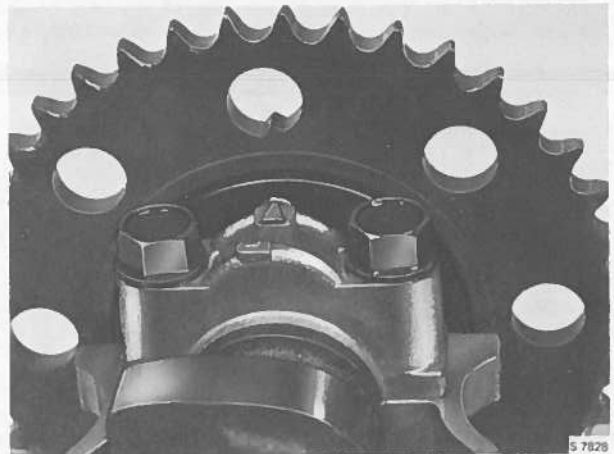
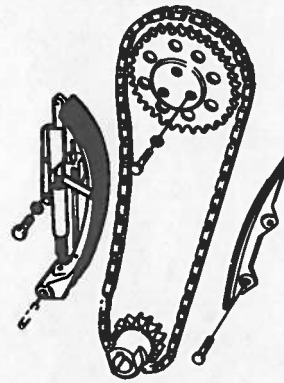
The camshaft is driven by a single chain with a mechanical chain tensioner and a straight chain guide.

Caution

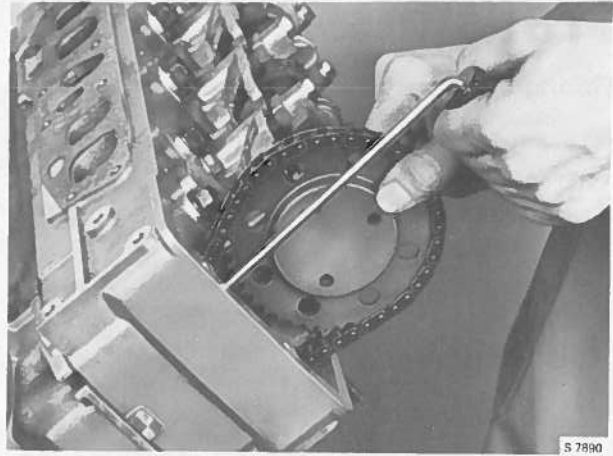
Do not rotate the crankshaft or the camshaft once the timing chain has been detached.

A fully open valve can come into contact with a piston at top dead centre.

Remove and refit the timing chain with the camshaft and crankshaft at TDC on the compression stroke for No. 1 cylinder.



Tool 83 93 357 should be used to take the tension off the chain tensioner when removing and refitting the sprocket.



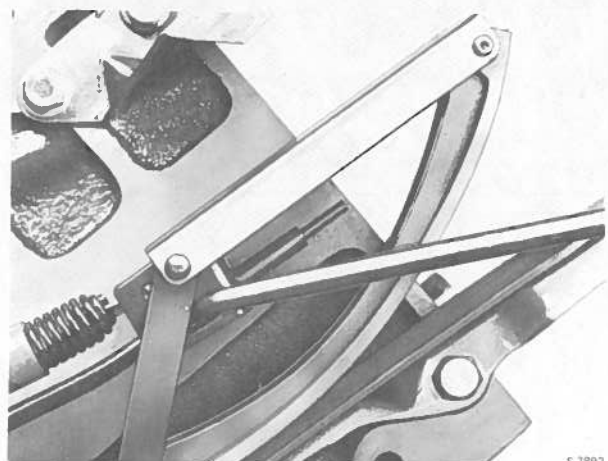
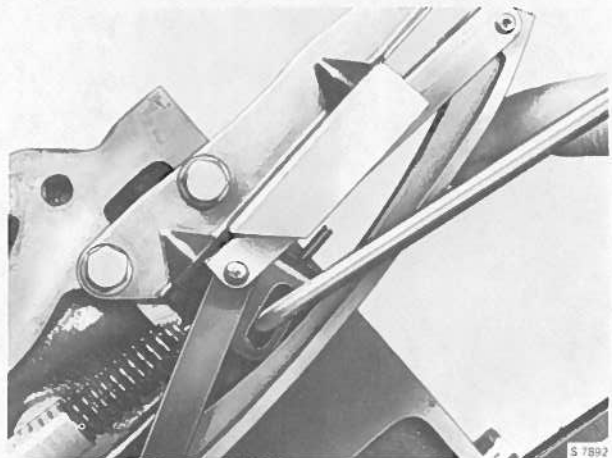
Insert the hook as shown. Pull upwards to slacken the chain.



To replace the chain tensioner

When fitting the tensioner, release it by introducing the tool into the catch as shown.

Turn the catch so that it slides in over the latch arm.



Crank mechanism

To measure the crankshaft

Clean the crankshaft and measure the journals using a micrometer gauge. Measurements should be taken at several points round the journal. The ovality of the main bearing and big-end journals should not exceed 0.0002 in (0.005 mm.) If the measurements are close to or exceed the stated limit the crankshaft should be ground down to undersize as specified. The journals can be ground down one undersize without re-hardening. Grinding to further undersizes will necessitate "Tenifer" re-hardening. Check that the crankshaft is true to within 0.0002 in (0.005 mm) using a dial indicator. Mount the crankshaft in two V-blocks, place the indicator plunger against the centre journal and rotate the shaft.

To measure clearance

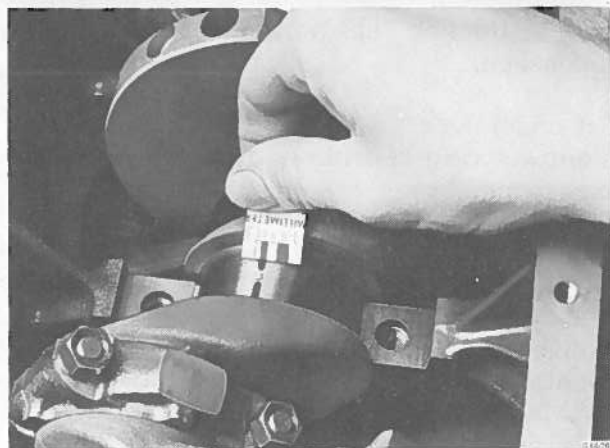
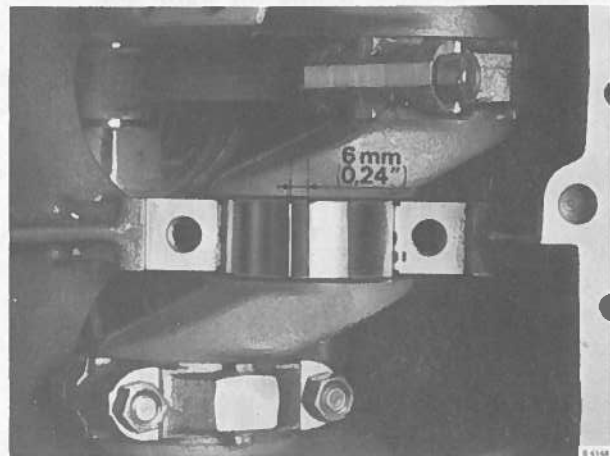
Before measuring the bearing clearance when fitting new bearings, check the ovality and conicity of the journals. Measurements are made using a "Plastigage", which is obtainable under spare parts no. (45) 30 06 558 and is available in three thicknesses. Type PG-1 (green) should be used.

"Plastigage" - Instructions for use

Main bearings

"Plastigage" can be used to measure both ovality and clearance.

1. Position the engine upside-down so that the weight of the crankshaft will not affect the measurements.
2. Ensure that the parts to be measured are free from oil and dirt. Put a strip of "Plastigage" about 0.24 in (6 mm) to one side of the longitudinal centre of the journal.
3. Refit the bearing cap and tighten to a torque of 108 Nm (11 kgm; 79 lb ft). The crankshaft must remain stationary while the measurement is made.
4. Remove the bearing cap. The strip of "Plastigage" should now adhere to the bearing shell or crankshaft journal.
5. Measure the width of the "Plastigage" strip using the scale printed on the package and read off the clearance. One side of the package is calibrated in mm, the other side in thousandths of an inch. Measure the strip at its widest point but do not touch it with your fingers.



Big-end bearings

Plastigage strips cannot be used to measure the ovality of big-end bearings with the pistons fitted in the block. A micrometer should be used instead.

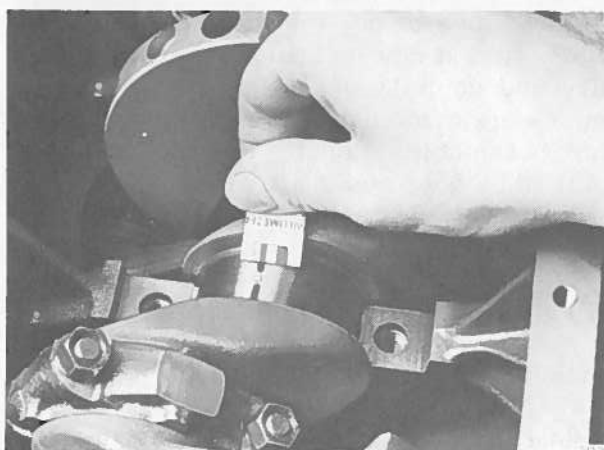
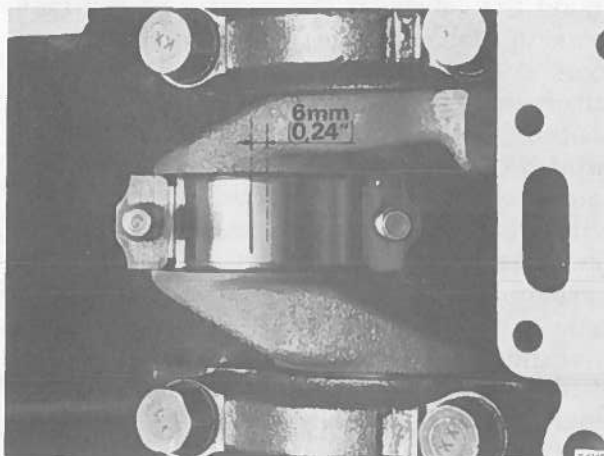
When fitting new bearings the big-end bearing clearance should be checked as follows.

1. Rotate the crank to be measured to about 60° BTDC.
2. Ensure that the parts to be measured are dry and free from oil and dirt. Place a strip of 0.24 in (6 mm) "Plastigage" to one side of the journal.

3. Refit the bearing cap and tighten to a torque of 54 Nm (5.5 kgm; 39 lb ft). The crankshaft must remain stationary while measurement is made.

4. Remove the bearing cap. The strip of "Plastigage" should now adhere to the bearing shell or crankshaft journal.

5. Measure the width of the "Plastigage" strip using the scale printed on the package and read off the clearance. One side of the package is calibrated in mm, the other side in thousandths of an inch. Measure the strip at its widest point but do not touch it with your fingers.



To choose bearing shells for main and big-end bearings

Bearing shells are available in two different thicknesses for standard size, 1st undersize and 2nd undersize. The two thicknesses can be combined to obtain the correct clearance. Bearing shells for 3rd and 4th undersizes are only available in one thickness.

The different thicknesses of bearing shells are colour-coded as follows:

Standard size:

Red - thin bearing half, gives increased clearance

Blue - thicker bearing half, gives reduced clearance.

1st undersize:

Yellow - thin bearing half, gives increased clearance.

Green - thicker bearing half, gives reduced clearance.

2nd undersize:

White - thin bearing half, gives increased clearance.

Brown - thicker bearing half, gives reduced clearance.

Example:

Try to obtain the correct clearance by fitting two thin bearing shells. If the clearance is excessive reduce it by fitting one thin and one thick or two thick shells.

If the clearance is excessive even after two thick bearing halves have been fitted, the crankshaft must be ground down to the next undersize and the appropriate undersized bearing shells fitted. See Section 0.

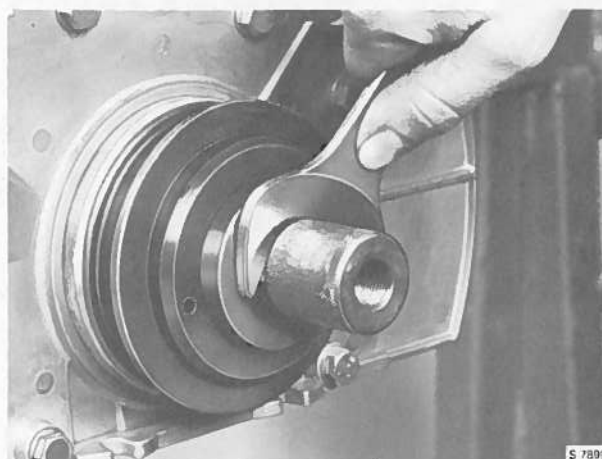
Note

The journals can be ground down one undersize 0.098 in (0.25 mm) without requiring re-hardening. Grinding to further undersize will necessitate "Tenifer" re-hardening.

To replace the crankshaft seal at the flywheel end

The seal can be replaced with the engine in the car. The clutch and flywheel must be removed first.

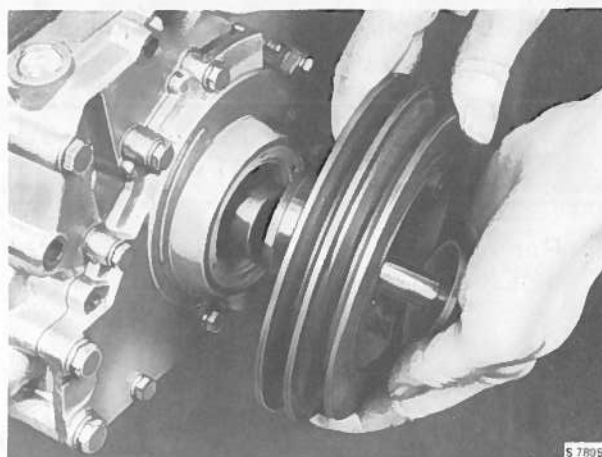
1. Use a screwdriver to remove the old seal.
2. Fit the new seal with the spring ring towards the crankshaft. Oil the mating surfaces before fitting. Use tool 83 92 540 to fit the seal.



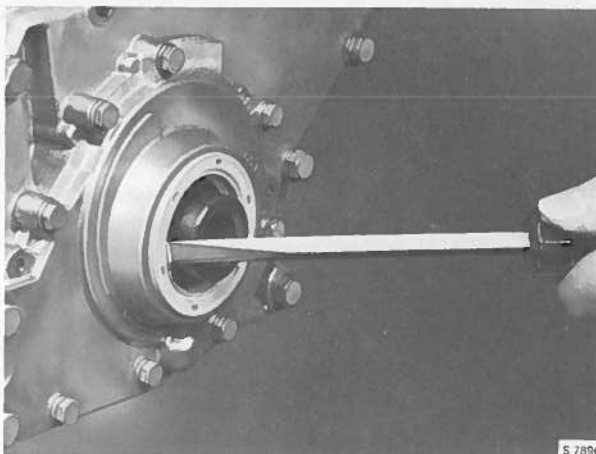
To replace the crankshaft seal at the timing chain end

(Possible only with engine removed from car)

1. Remove the belt (belts), unscrew the pulley bolt, lock the crankshaft with tool 83 92 787 and remove the pulley.



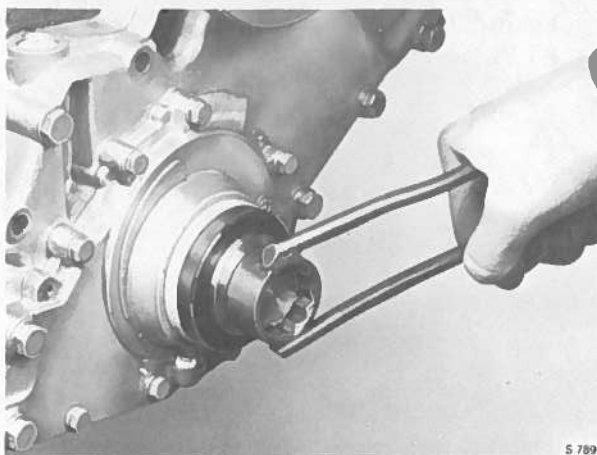
2. Remove the sealing ring by means of a screwdriver.



3. Apply a generous coating of grease to the sealing lips of the sealing ring.



4. Press the sealing ring into place using sleeve 83 92 979, which is drawn in by means of the pulley retaining bolt.



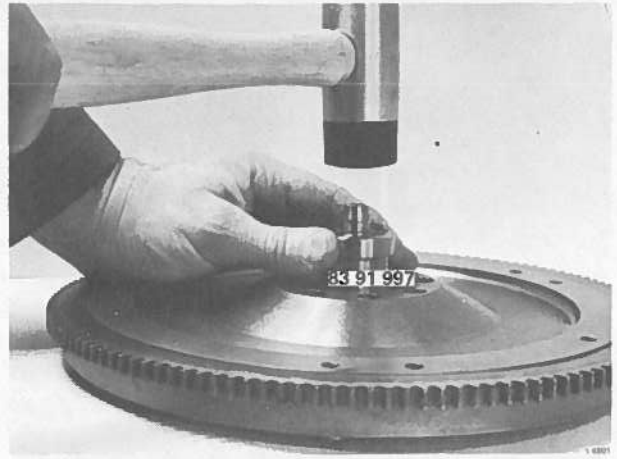
5. Install the pulley and tighten the bolt to the specified torque.

Tightening torque, for pulley
190 Nm (19 kgm; 137 lb ft)

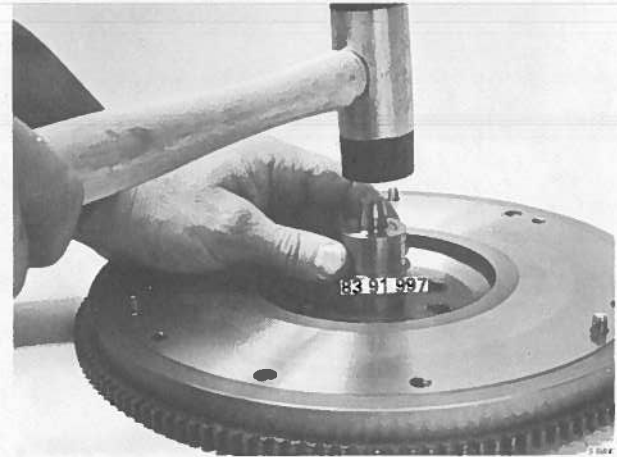
6. Remove the locking segment and fit the belt (belts).

Changing the clutch shaft bearing

1. Remove the flywheel.
2. Remove the clutch shaft bearing from the flywheel, using drift 83 91 997.



3. Fit a new clutch shaft bearing in the flywheel, using the same drift.



1. The first part of the report is the title page.

2. The second part is the abstract.

3. The third part is the introduction.

4. The fourth part is the literature review.

5. The fifth part is the methodology.

6. The sixth part is the results.

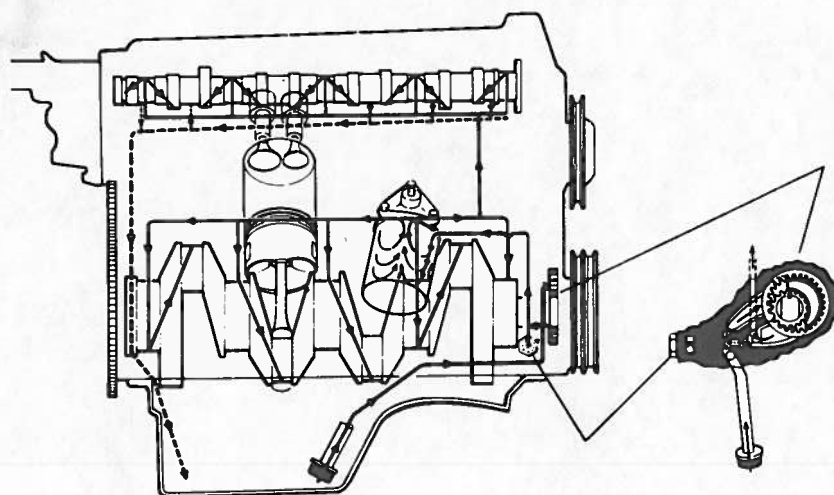


Lubricating system

The engine has a forced lubrication system (see fig. below). Oil pressure is generated by a gear-type pump consisting of a gear wheel and an eccentric ring gear. The pump is driven by the crankshaft and is positioned between the timing cover and crankshaft pulley. A reduction valve in the timing cover limits the oil pressure and leads excess oil to the intake side of the pump.

The oil pan is part of the transmission housing and is totally separate from the transmission lubrication system. The oil filter is of the full-flow type, i.e. all the oil force-fed to the lubrication points passes through the filter.

The oil pressure switch is in the oil filter adaptor casting. The oil passes through the oil pump intake filter in the oil pan, through the oil pump and out into the main oil gallery in the engine block via the oil filter. From the gallery, oilways lead to the cylinder head for camshaft and valve gear lubrication.



Oil pump

The oil pump is a gear type with one gear wheel and an eccentric ring gear. The pump is mounted on the timing cover and is driven by a driving plate mounted on the crankshaft.

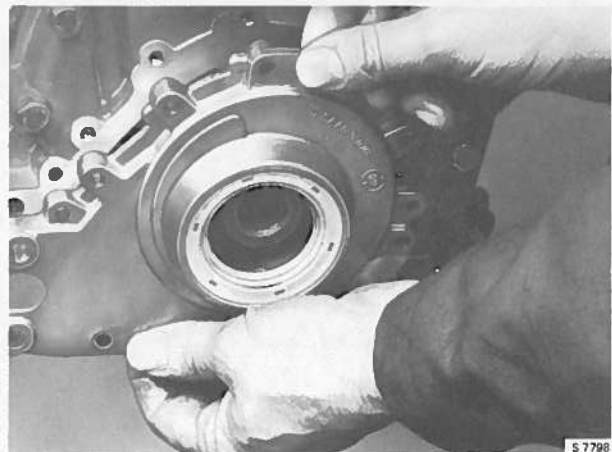
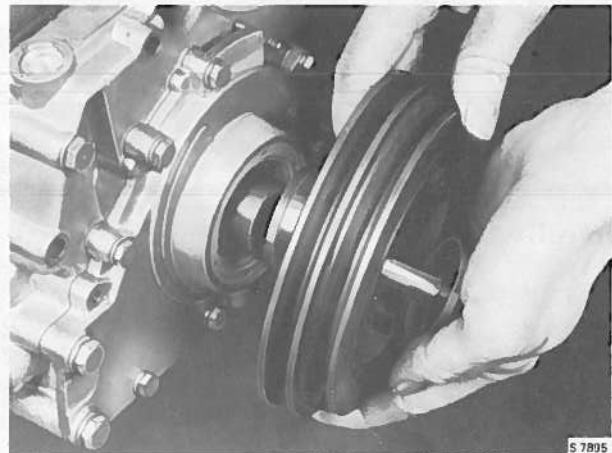
The oil pump reduction valve is situated in the timing cover and returns excess oil to the intake side of the pump.

To remove

The oil pump can only be removed after the engine has first been removed from the car (see section 201).

1. Clean the area round the oil pump.
2. Remove the crankshaft pulley retaining bolt and detach the pulley from the crankshaft. Immobilize the crankshaft by attaching locking device 83 92 987 to the flywheel ring gear.

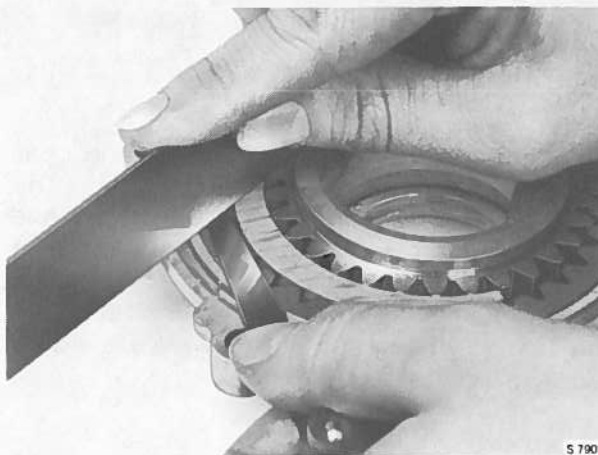
3. Remove the oil pump retaining bolts and extract the pump.



To check

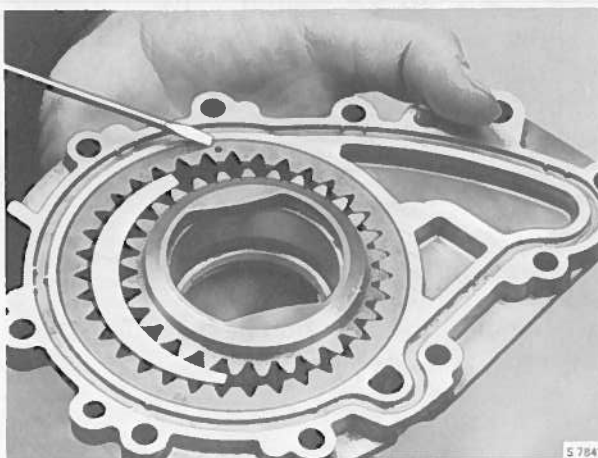
Use a straightedge and feeler gauge to check the end float between the pump body and the gear wheel.

Permissible end float: 0.03-0.08 mm

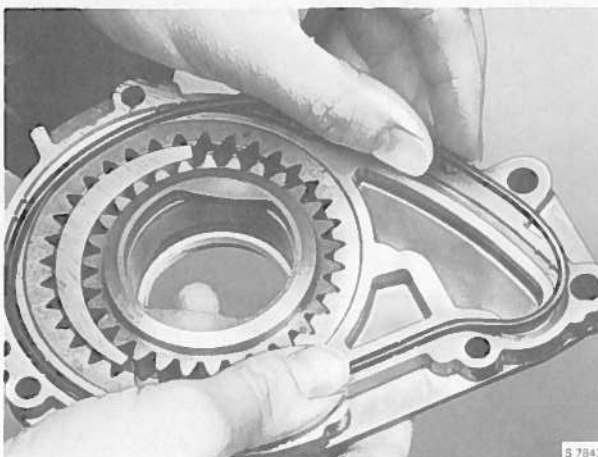


To refit

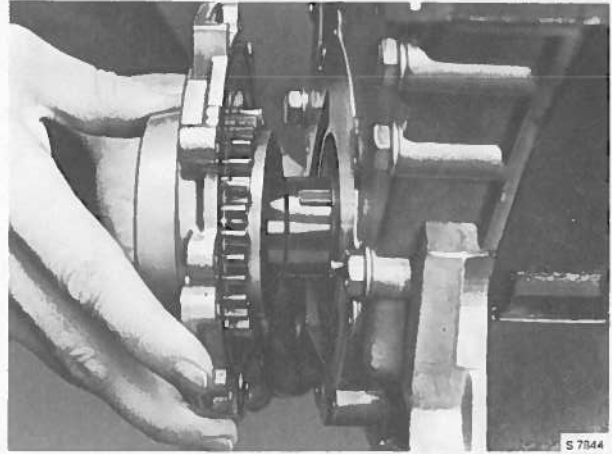
1. Oil the gear wheels.
2. Refit the ring gear so that the mark on its face is visible.



3. Fit a new sealing ring in the groove in the pump body and check that the dowel is fitted.



4. Refit the pump. Extract the pump gear slightly to facilitate locating it on the driving plate.



5. Remove the oil filter adaptor casting and fill the oilway to the oil pump pressure side with engine oil.

Caution

The oil pump must be primed with oil prior to fitting.

6. Refit the oil filter adaptor casting.



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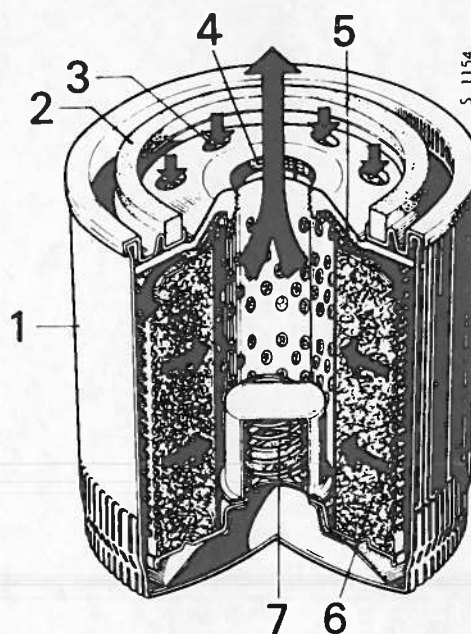


Oil filter

The oil filter is of the full-flow type, i.e. all the oil from the oil pump passes through the filter.

In production a smaller filter (75 mm dia.) is fitted which should be replaced with a larger model at the 1200 mile (2000 km) service.

Note. Only the larger diameter filter should subsequently be used (90 mm dia.)



Oil filter

1. Filter housing
2. Rubber seal
3. Oil inlet
4. Oil outlet
5. Check valve
6. Filter
7. Overflow valve

Changing the filter cartridge

1. Use the strap wrench to unscrew the filter cartridge.
 - Wrench for removing factory-fitted filter (at 1200 mile (2000 km) service): 83 93 332
 - Wrench for removing ordinary filter: 78 62 014.
2. Smear the rubber seal on the bottom of the new filter with engine oil and screw it into position until it just touches the adaptor casting. Then tighten the filter a further half-a-turn.

Overtightening of the filter cartridge is liable to deform the seal, with oil leakage as the result.





Carburetor

Carburetor

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Single-carburetor

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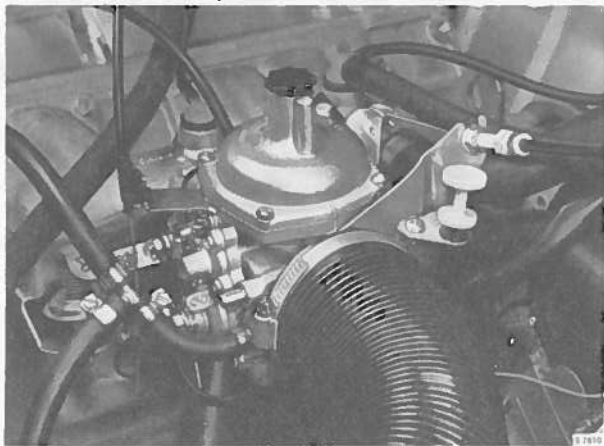
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General

The engine is equipped with a Zenith horizontal carburetor. The carburetor has a single jet with a tapered needle which meters the amount of fuel flowing through the jet orifice. The position of the needle relative to the jet orifice is determined by the depression in the carburetor body acting on the dashpot in which the needle is mounted. The needle is of the self-centring type, i.e. it is spring mounted, making adjustment of the carburetor jet unnecessary.

The carburetor is made of light alloy. It consists of three main sections, the central one being the carburetor housing. The bottom section is the float chamber. The jet is press-fitted in the carburetor housing. The height of the fuel needle is adjustable, and this can be regulated from above by means of a special tool, once the vacuum piston has been removed. The top section is the vacuum chamber, the lower boundary of which is a diaphragm in which the piston is suspended. The vacuum chamber communicates with the carburetor inlet duct via two channels in the piston.

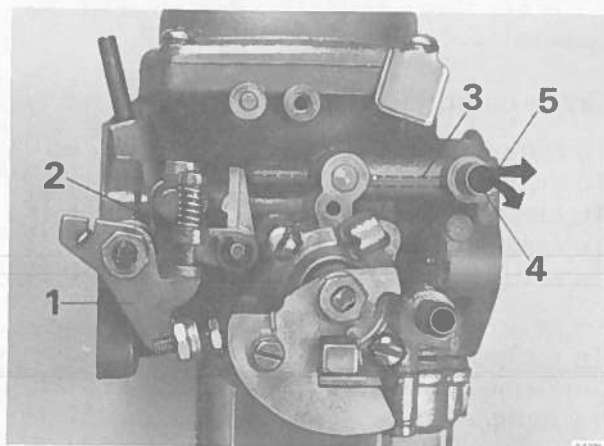
The depression in the carburetor housing determines the rate of fuel flow, which is controlled by the needle, as well as the rate of air flow, which is regulated by the position of the piston in the air duct. In this way the engine always receives a correct mixture of fuel and air under all load conditions.



Float system

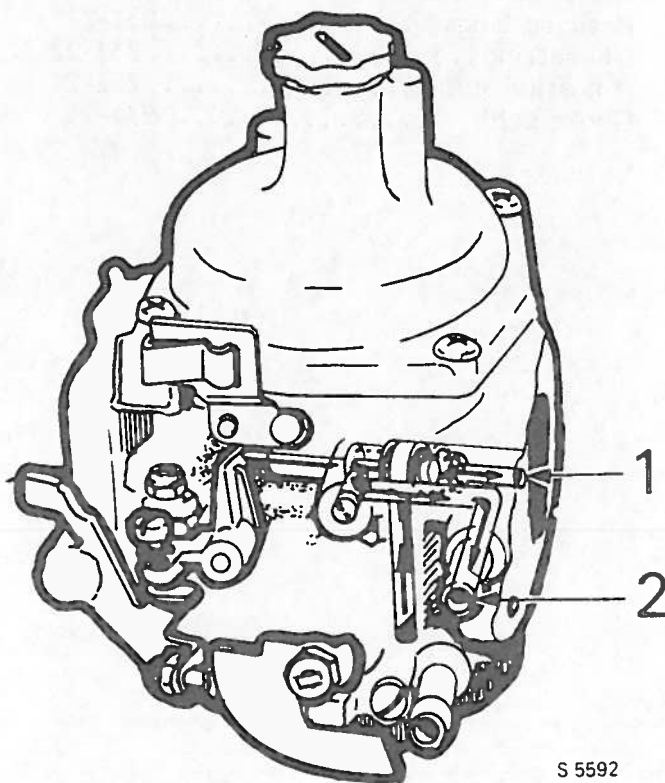
Fuel enters the float chamber through the float valve. The float, which is double, is mounted on the float chamber by an arm and spindle, which fits into two retaining clips. As the fuel level rises, the float rises with it, and when the correct level is reached, the float valve is closed by a tongue on the float arm. Fuel is also drawn into the jet, where the level will be the same as in the float chamber (engine at standstill.)

The carburetor is fitted with a special float chamber vent valve. When the throttle valve is closed, air is expelled directly through a venthole in the carburetor. When the throttle valve is opened, ventilation of the float chamber will be by means of the air cleaner connection.



Float chamber ventilation

1. Throttle stop and fast idle lever
2. Throttle relay lever and idle adjust screw.
3. Ventilation valve
4. Ventilation outlet, throttle shut
5. Ventilation outlet, throttle open



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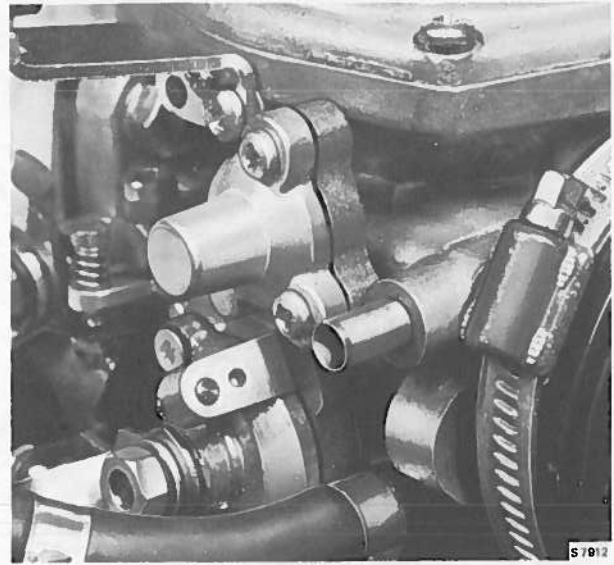
Float chamber ventilation

1. Ventilation through air cleaner
2. Direct atmospheric ventilation

Cold-start device

The carburetor is equipped with a cold-start device to assist starting and running the engine from cold.

As the temperature of the engine increases, the choke control is pushed in to maintain the correct air/fuel mixture as the fast-idling speed decreases.



Cold start device

Operating principle of the cold-start device

When the choke control is pulled out, a disc (4) is rotated and fuel flows from the float chamber through one, two, three or four of the holes in the disc. The flow of fuel through the disc is determined by the number of holes that are not blanked off. Additional air to the disc is drawn in through air jet (3), to form an emulsion with the fuel. The additional air/fuel passage (6a.) (Refer to Fig. A.)

To enable the engine to run smoothly under any driving conditions, the quantity of choke fuel is optimized to meet the requirement during acceleration or at full throttle (fig A). This quantity of fuel is much greater than that needed when the car is being driven at a constant speed.

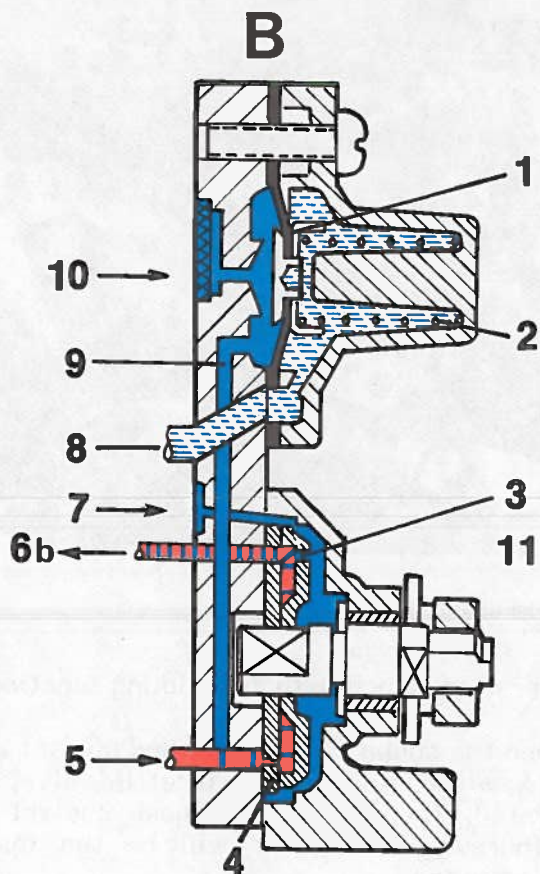
A leaner mixture is obtained as follows (Fig. B.)

At constant speed (constant throttle opening), a depression is present in the inlet manifold. Via connecting passage (8) the depression acts on the diaphragm (1), once the force of the spring (2) has been overcome, allowing air to be drawn through passage (9) into the fuel inlet passage (5). The air/fuel mixture flows through the disc (4), where additional air is drawn in through air jet (3). This lean mixture (6b) then flows into the mixing chamber, providing additional fuel/air.

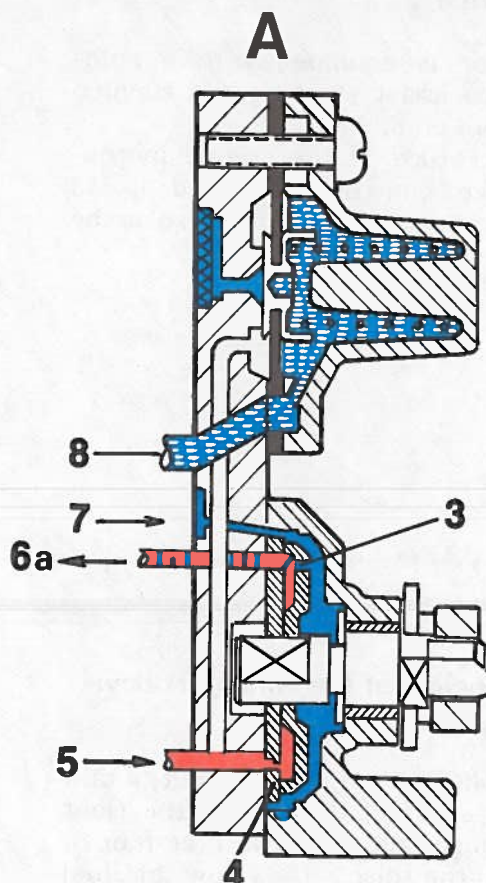
On renewed acceleration (opening of the throttle), the mixture is automatically enriched (load-sensing choke), since there is a reduction in the depression in the inlet manifold, which allows the spring loading on the diaphragm to close the air-bleed port.

Operating principle of fast-idling function

When the choke control is pulled out, a cam (11), which acts on the throttle valve, is rotated. The further the choke control is withdrawn, the faster will be the fast-idling speed.



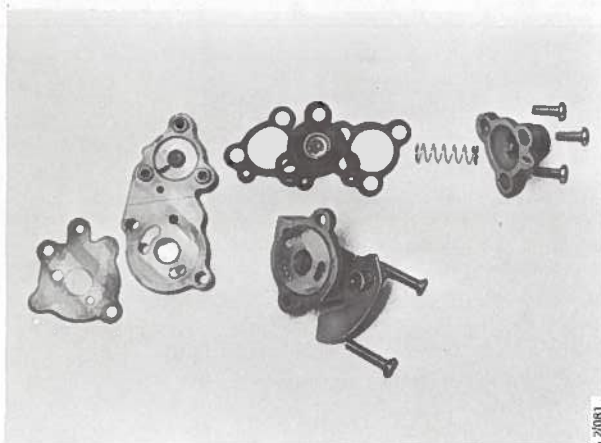
At constant speed



On starting, driving acceleration and at full throttle

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- = Fuel
- = Air (at atmospheric pressure)
- = Strong depression
- = Weak depression
- = Air/fuel mixture

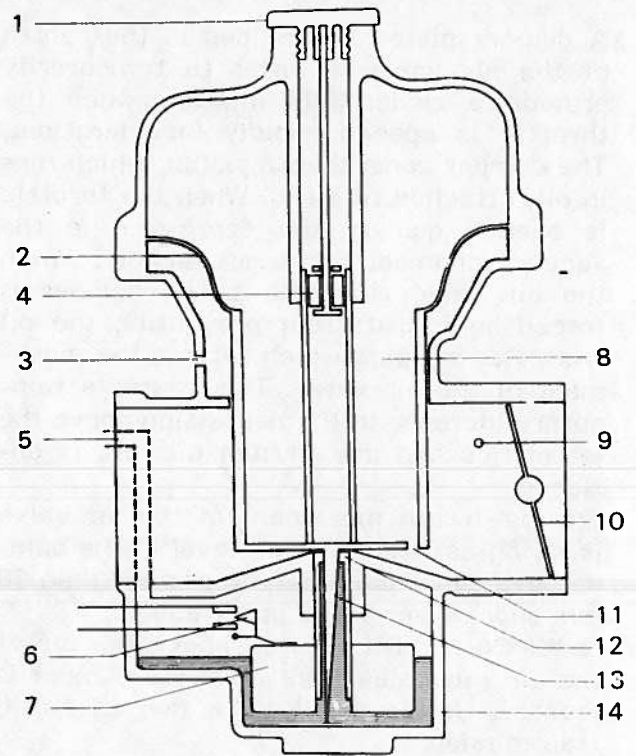


Diaphragm housing and choke disc

1. Diaphragm
2. Diaphragm spring
3. Air jet
4. Disc
5. Fuel inlet passage (from float chamber)
- 6.a. Air/fuel passage (rich mixture to mixing chamber)
- b. Air/fuel passage (lean mixture to mixing chamber.)
7. Air inlet from atmosphere
8. Passage to inlet manifold
9. Air-bleed passage
10. Air-bleed passage inlet from atmosphere
11. Fast-idling cam

Idling

The carburetor does not have a separate idling system. At idling speed there is only a weak depression in the vacuum chamber and the gap between the base of the air valve and the jet seating is small. In this position the thickest section of the tapered metering needle is in the jet orifice and only a small quantity of fuel, sufficient for idling, is inducted into the cylinders. The air/fuel mixture is adjusted by alteration of the height of the fuel needle. The idling speed is adjusted by altering the setting of the throttle stop screw. The carburetor is equipped with a temperature compensator to maintain a constant air/fuel mixture regardless of engine temperature. The temperature compensator consists of an atmospheric valve controlled by a bi-metal spring. The valve starts to open when the carburetor temperature reaches approx. 68°F (20°C.) Additional air is introduced through a vent which discharges behind the air valve shaft.



Carburetor with throttle closed

1. Damper cap
2. Diaphragm
3. Compensating aperture
4. Damper piston
5. Float chamber vent.
6. Needle valve
7. Float
8. Air valve shaft
9. Starting-up fuel aperture
10. Throttle
11. Vacuum aperture
12. Jet orifice
13. Fuel needle
14. Float chamber

Normal driving

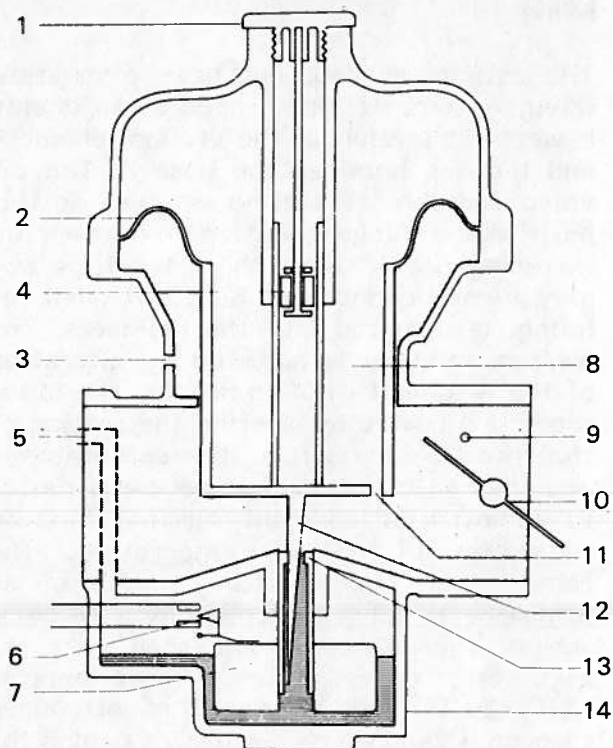
When the throttle is opened the vacuum chamber is subjected to the same depression as that in the manifold through the holes in the air valve. As the underside of the diaphragm is subjected to atmospheric pressure the air valve shaft lifts so increasing the flow of air through the carburetor. At the same time the fuel flow is also increased as the metering needle, which is attached to the air valve is extracted from the jet aperture.

Acceleration

A damper piston is provided in the centre of the air valve in order to temporarily provide a richer fuel mixture when the throttle is opened rapidly (acceleration.) The damper consists of a piston, which runs in oil, attached to a rod. When the throttle is opened quickly the depression in the vacuum chamber increases rapidly. When the air valve rises the piston damper is forced against its seat preventing the oil from flowing past which retards the movement of the air valve. This causes a temporary increase in the depression above the jet orifice and the air/fuel mixture is enriched.

The downward movement of the air valve is spring-assisted. The oil level in the damper cylinder should not drop more than 10 mm approx. below the upper edge.

Note! Do not fill with oil above the top of the air valve sleeve in which the damper is located. Use same oil as for the automatic transmission.



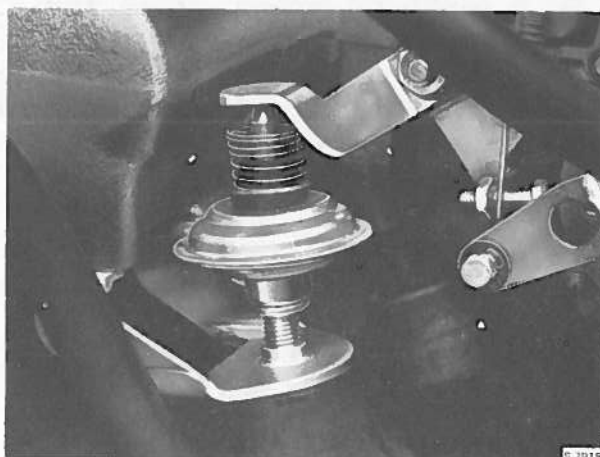
Carburetor with open throttle

1. Damper cap
2. Diaphragm
3. Compensating aperture
4. Damper piston
5. Float chamber vent.
6. Needle valve
7. Float
8. Air valve shaft
9. Start-up fuel aperture
10. Throttle (butterfly)
11. Vacuum aperture
12. Jet orifice
13. Fuel needle
14. Float chamber

Engine overrun

Cars with Sweden specification

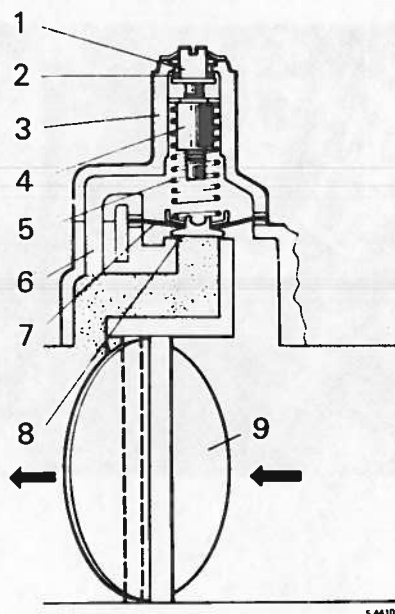
A mechanical dash-pot delays the closure of the throttle when the accelerator pedal is released.



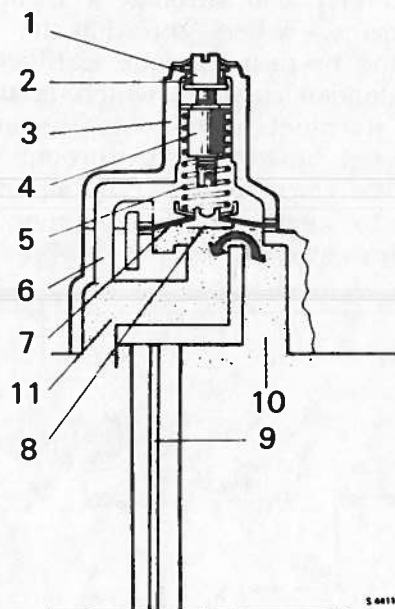
Cars with Europe specification

The carburetor is equipped with a diaphragm valve which is affected by the manifold depression during engine overrun.

This opens the throttle by-pass so permitting the correct air/fuel quantity to reach the engine.



Deceleration valve, normal driving



Deceleration valve, engine overrun

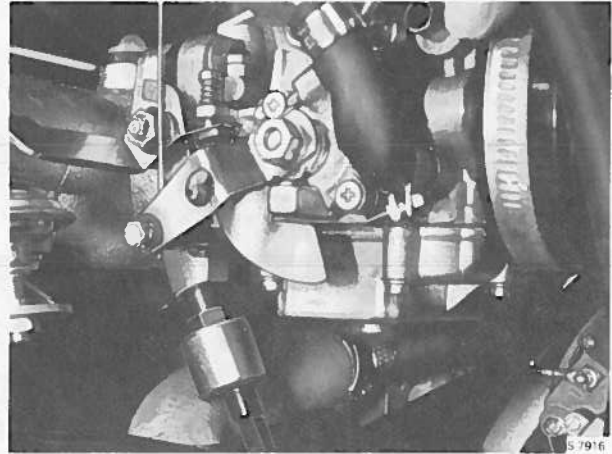
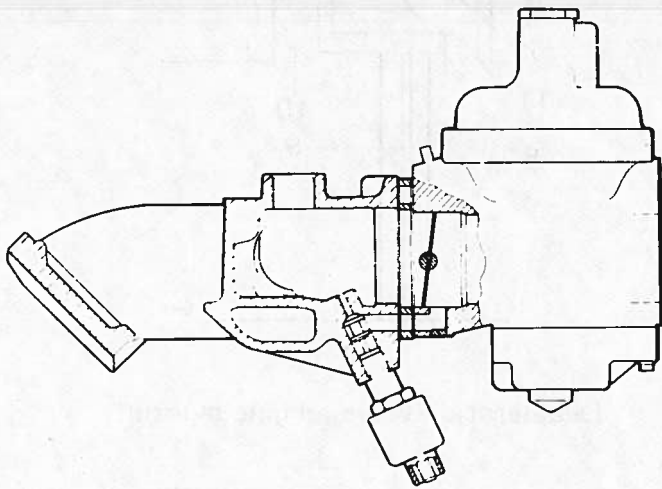
1. Adjusting screw
2. Rubber ring
3. Cover
4. Nut
5. Spring
6. Passage to diaphragm upper side
7. Diaphragm
8. Valve
9. Throttle
10. Air/fuel mixture inlet passage
11. Air/fuel mixture outlet passage

Idling shut-off valve

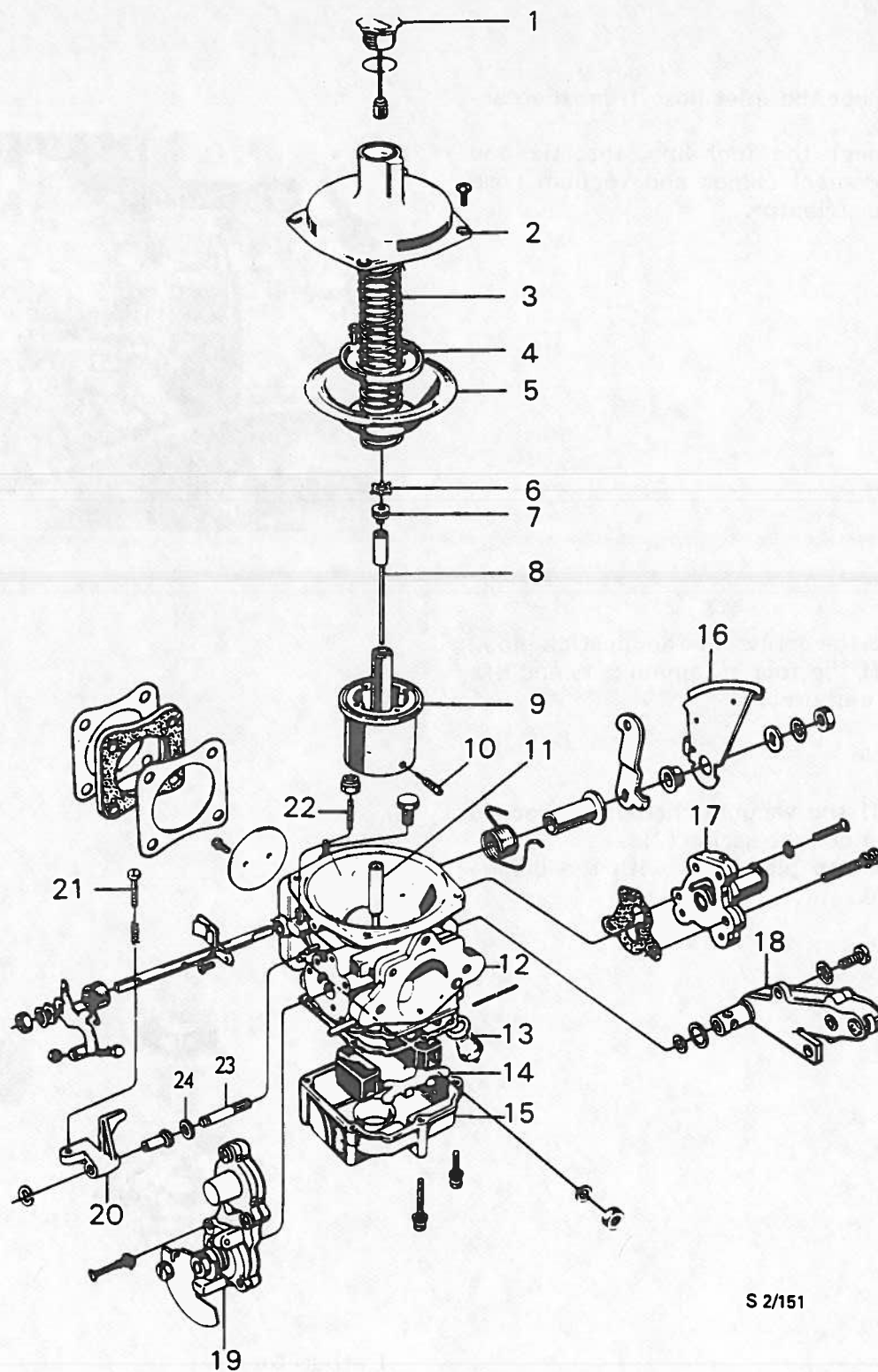
(Cars with Sweden specification)

Normally aspirated engines are equipped with an idling shut-off valve to prevent the engine running on after the ignition has been switched off.

The engine obtains its air/fuel mixture at idling speed through a small aperture in the throttle butterfly and through a throttle by-pass passage. When the ignition is turned off the by-pass passage is blocked by a spring-loaded solenoid which is then deprived of its electric current. The air/fuel mixture can now only pass through the aperture in the throttle butterfly, which is insufficient to keep the engine running, which therefore stops.



Idling shut-off valve



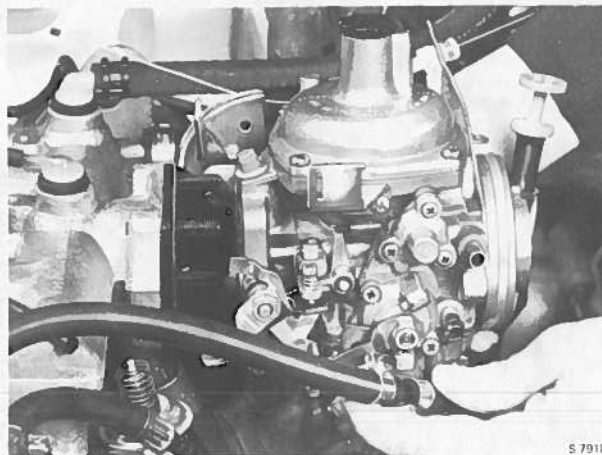
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Carburetor

- | | |
|--|--|
| 1. Damper and oil cap assembly | 13. Float valve |
| 2. Vacuum chamber cover | 14. Float and arm |
| 3. Spring | 15. Float chamber |
| 4. Retaining ring for diaphragm | 16. Throttle cam lever |
| 5. Diaphragm | 17. Deceleration valve (N/A Sweden spec.) |
| 6. Circlip | 18. Temperature compensator |
| 7. Adjustment screw | 19. Cold start device with cam lever |
| 8. Fuel needle | 20. Arm, float chamber ventilation |
| 9. Vacuum piston | 21. Adjusting screw for idling |
| 10. Locking screw with spring loaded plunger | 22. Adjusting screw, float chamber ventilation |
| 11. Jet | 23. Spindle |
| 12. Carburetor body | 24. Spacer |

To remove

1. Disconnect the inlet hose from the carburetor.
2. Disconnect the fuel line, throttle and choke control cables and vacuum hose to the distributor.

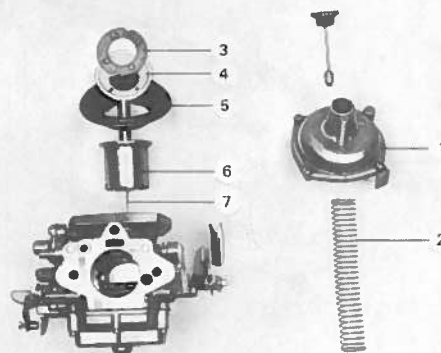


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3. Remove the screw for the dipstick pipe.
4. Back off the four retaining nuts and lift off the carburetor.

To dismantle

1. Take off the vacuum chamber cover (1) and take out the spring (2).
2. Remove the piston (6) with the diaphragm (5).

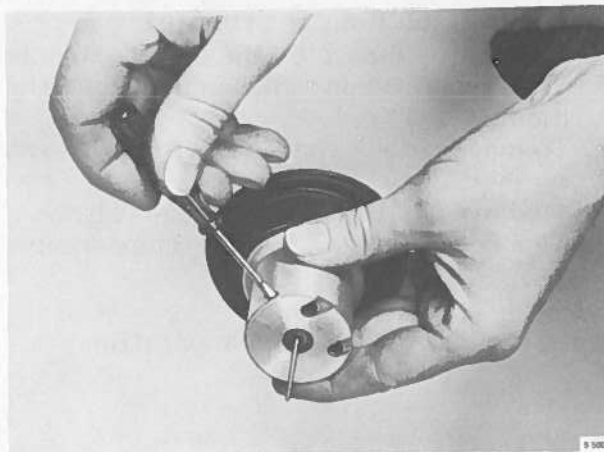


S 7919

Carburetor

1. Vacuum chamber cover
2. Spring
3. Metal washer
4. Retaining ring
5. Diaphragm
6. Vacuum piston
7. Fuel needle

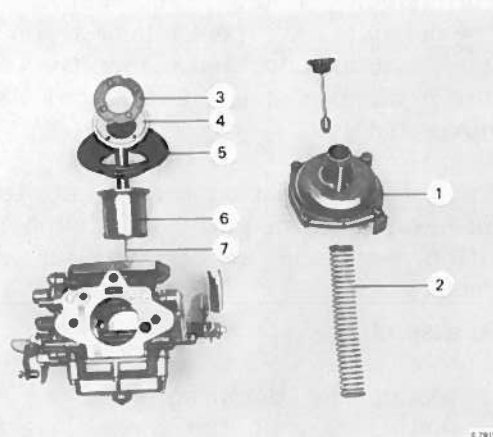
3. Remove the fuel needle as follows:
- Remove the locking screw.



- Turn the adjusting screw counter-clockwise, using tool 83 93 035. Hold the needle sleeve to stop it turning. Remove the needle.



4. Remove the screws, the metal washer (3), the retaining ring (4) and the diaphragm (5).

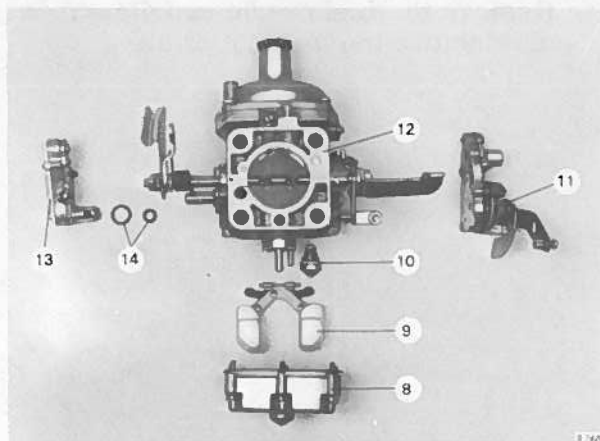


Carburetor

- Vacuum chamber cover
- Spring
- Metal washer
- Retaining ring
- Diaphragm
- Vacuum piston
- Fuel needle

5. Remove the float chamber (8).
6. Carefully separate the float spindle from the retaining clips and remove the float (9).
7. Remove the float valve (10) and washer.
8. Remove the choke mechanism (11).
9. Remove the temperature compensator (13).

Wash the carburetor parts in paraffin.



- 8. Float chamber
- 9. Float
- 10. Float valve
- 11. Cold start assembly
- 12. Carburetor body
- 13. Temperature compensator
- 14. Washers

Caution

The diaphragm should only be cleaned with paraffin. Avoid using volatile cleaning agents such as trichloroethylene.

To clean

Clean the hole in the choke valve disc by means of compressed air.

Check that the diaphragm is in good condition. If the diaphragm is distorted or has cracked, it should be replaced.

Check the fuel needle for wear; bent or worn needles should be replaced.

Check that the contact and sealing surfaces are not damaged. Clean the temperature compensator and check that the valve moves freely.

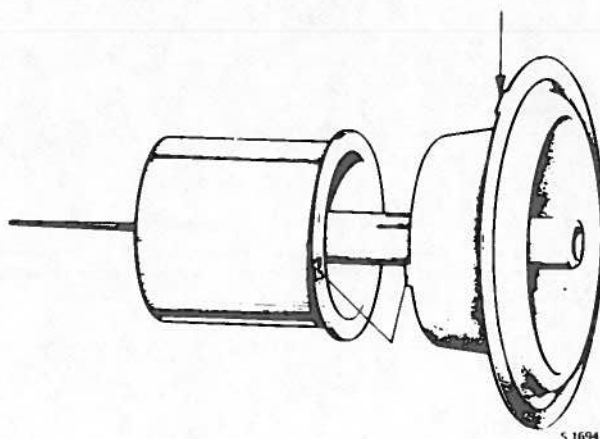
For orifice adjusting screw, jet, temperature compensator and float chamber ventilation see the respective sections for these.

To assemble

1. Mount the diaphragm on the vacuum piston so that the inner locating tab (see illustration) engages the corresponding recess in the piston (A) and the inner edge fits easily into the matching groove in the piston.

Note

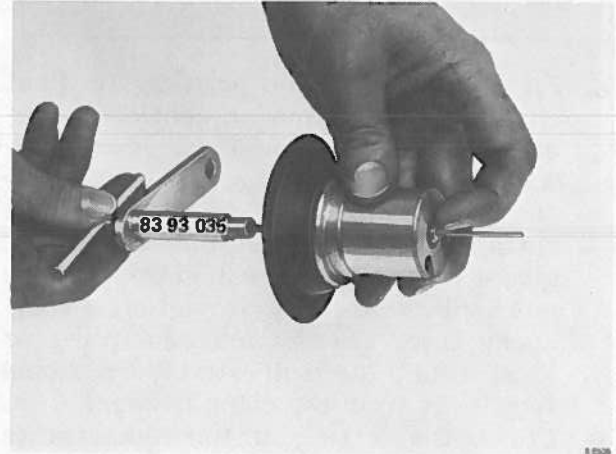
If the diaphragm is so distended that it will not fit into the piston, exchange it for a new one.



Place the retaining ring (4) and the metal washer (3) carefully in position, lining up the screw holes with those in the piston and diaphragm without twisting the washer and matching the notches in the washer with the screws.

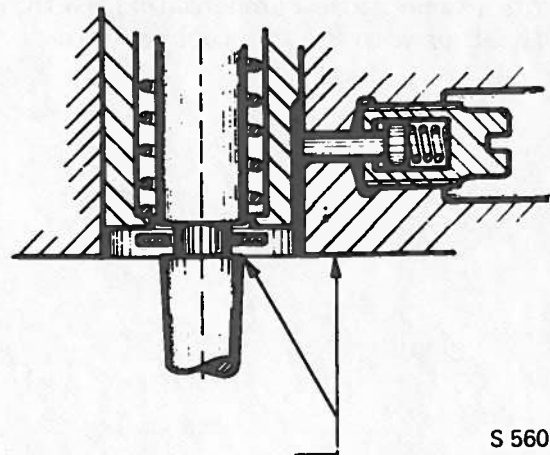
2. Fit the fuel needle as follows:

- a. Insert the spring housing of the needle into the vacuum piston. Screw the spring housing into the adjuster by turning the latter using tool 83 93 035.
- b. Screw in the locking screw so that the spring-loaded locking pin presses against the spring housing.
- c. Using tool 83 93 035, turn the spring housing so that the locking pin engages the milled groove.
- d. Tighten the locking screw.



- e. Using tool 83 93 035, adjust the height of the needle so that the edge of the needle shoulder (at the recess for the washer) is in line with the bottom of the piston.

This position is the initial setting for subsequent CO-adjustment.



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Needle sleeve flush with bottom of piston

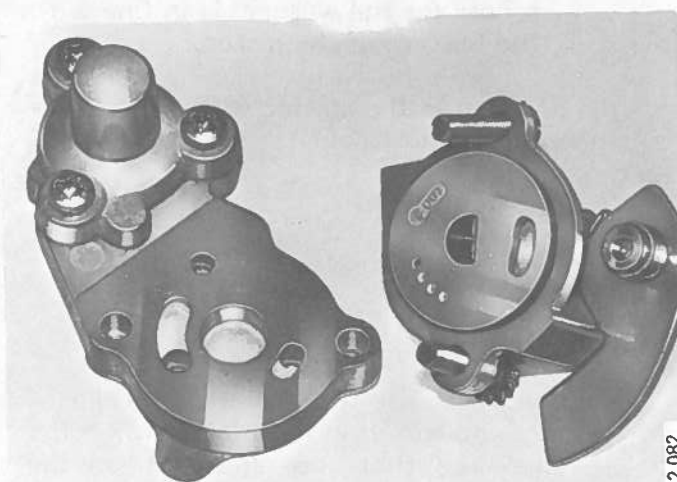
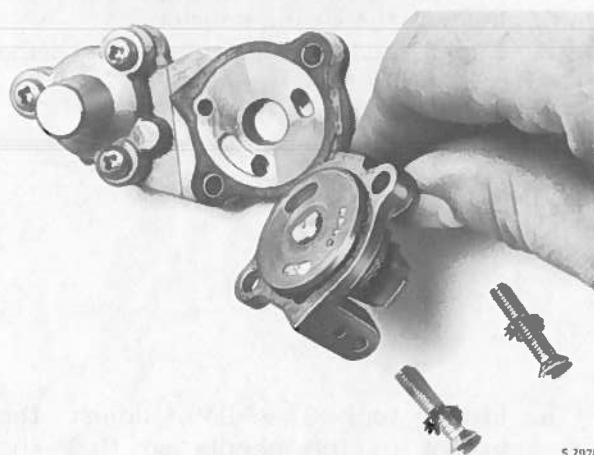
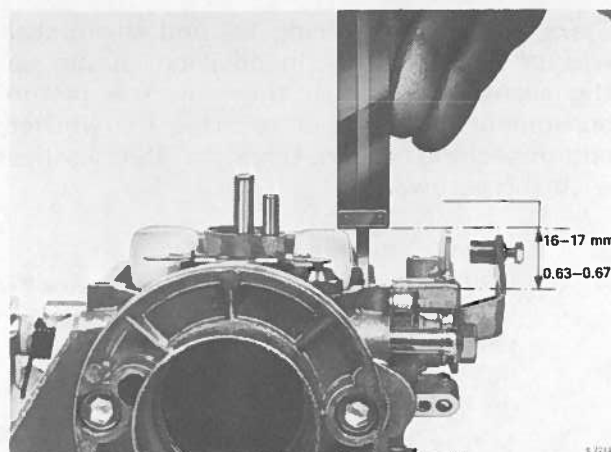
3. Install the piston complete with diaphragm and spring in the carburetor body. Make sure that the outer tab on the diaphragm engages the matching recess in the carburetor body. Place the vacuum chamber cover carefully in position, aligning the marks. The groove and locating rim should be a good fit; if not exchange the diaphragm. Tighten the screws.
4. Mount the float with spindle. The flat side of the float faces away from the carburetor body.
5. Check the float level as follows:
 - a. To check the float level the carburetor must be removed from the engine, and inverted with the float chamber off.

- b. For the level to be correct the highest point of the float should be 0.63-0.67 in (16-17 mm) above the edge of the carburetor body (gasket removed) when the float valve is closed. If the level is not correct, adjust by bending the end tab at the float valve.

Note

Do not bend the arm between the float and the spindle.

6. Fit a new gasket and position the float chamber until it makes gentle contact against the O-ring. First insert all screws and give them a few turns, then push down the float chamber until it butts firmly and tighten the screws.
7. Mount the choke mechanism. (If the mechanism has been dismantled, fit the choke disc, spindle and cam lever as illustrated). The calibrated holes should face away from the cable linkage.
8. Check the setting of the temperature compensator and that the valve moves freely (refer to the section dealing with the temperature compensator). Refit it together with the two rubber seals.



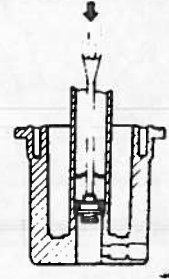
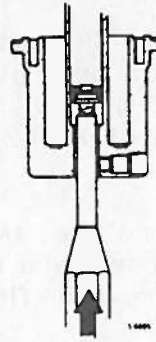
To refit

1. Fit the inlet manifold gasket.
2. Fit the carburetor onto inlet manifold.
3. Connect the fuel line, throttle cable and choke cable, and the vacuum hose to the distributor.
4. Fit the dipstick pipe mounting bolts.
5. Connect the inlet hose to the carburetor.
6. Fill the damper with oil. The oil should come up to a level no lower than 10 mm from the top of the damper cylinder.
7. Set the idling speed and CO content.

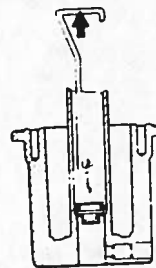
Changing the adjusting screw in the vacuum piston

Removal (vacuum piston with fuel needle removed)

1. Using a drift, press out the adjusting screw until it protrudes a few centimetres beyond the bottom of the piston.
2. Press in the adjusting screw again.



3. Rock the retaining washer to loosen it and then remove it by means of a bent piece of wire. The adjusting screw can now be removed.

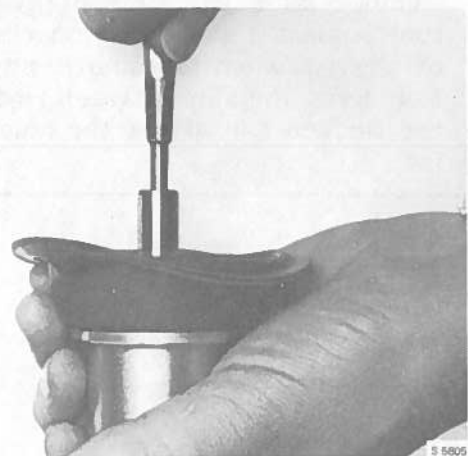


Refitting

1. Using a drift, press the adjusting screw with O-ring into the piston.

Grease the O-ring with Vaseline or the equivalent to prevent the ring from being damaged on fitting by any scoring on the cylinder bore.

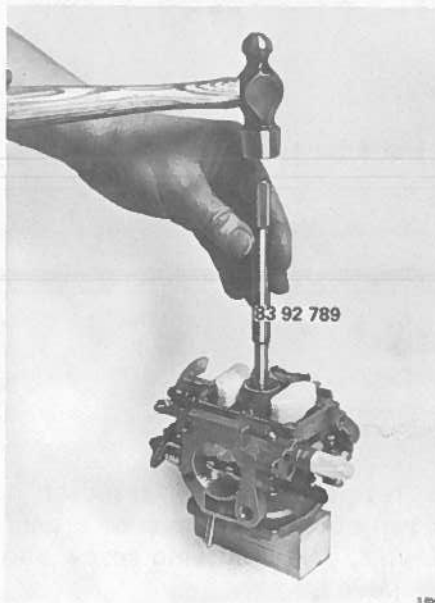
2. Press a new retaining washer into the damper cylinder using a drift.



Changing the fuel jet

The fuel jet is press-fitted in the carburetor housing and should not be moved from the specified position. However, the jet can be changed using tool 83 92 789 as follows.

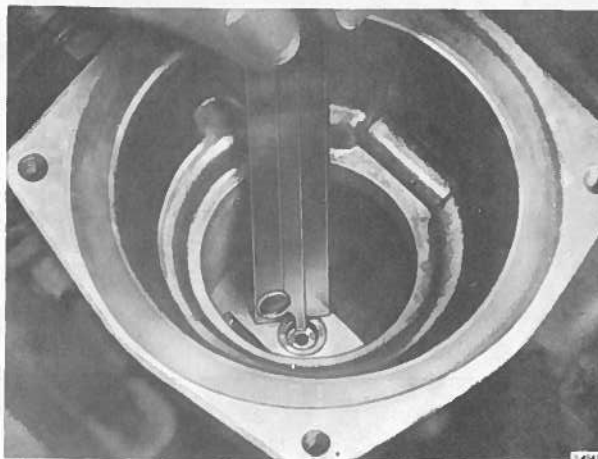
1. Remove the carburetor and then take off the vacuum chamber cover and remove the vacuum piston and float chamber cover.
2. Press out the jet using tool 83 92 789.



3. Using the tool, press in the new jet from the float chamber side until the distance of the jet below the level of the bridge in the carburetor housing is 2.5 ± 0.1 mm. If you happen to press the jet in too far, it can be pushed back from above using the same tool.

Caution

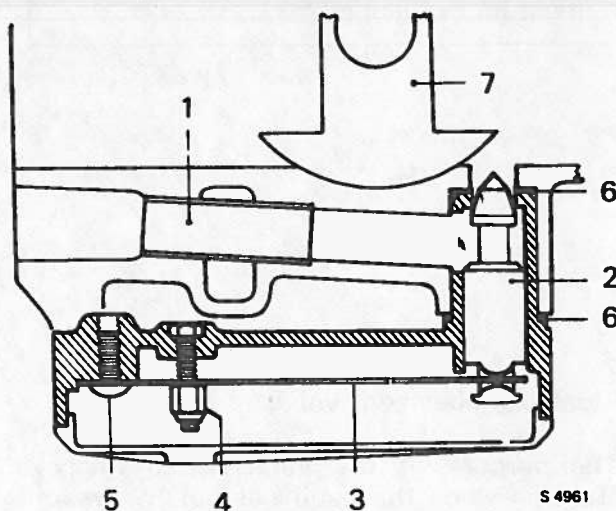
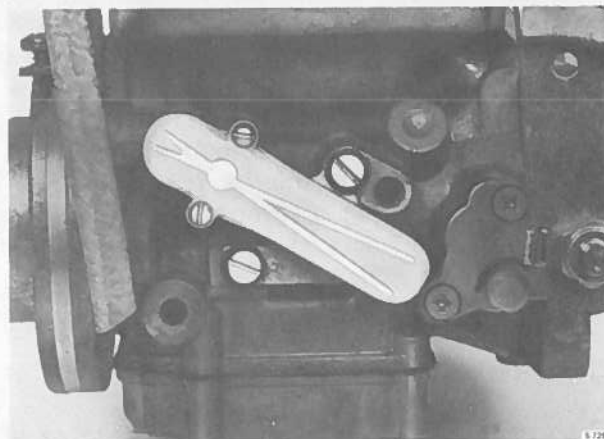
Avoid resting any type of measuring tool against the upper, inner surface of the jet when pressing it into position. Even the slightest deformation in the surface can affect the hole in the jet.



Temperature compensator

The temperature compensator serves to maintain a constant air/fuel mixture, regardless of engine temperature. The temperature compensator valve is governed by a bi-metallic strip which, on heating, opens an air passage past the vacuum piston. The valve opens at around 68°F (20°C.)

In the event of the idling speed dropping rapidly when the engine is idling, particularly in warm weather, check the operation of the temperature compensator by removing the plastic cover and pressing the valve, whereupon the tickover should become less smooth. If the valve is stiff or sticks it can be adjusted. This is on the condition that it is not scratched or coated. Should this prove to be the case, it should be renewed.



Temperature compensator

1. Air passage
2. Valve
3. Bi-metallic strip
4. Adjusting nut
5. Bi-metallic strip retaining screw
6. Seal
7. Jet bridge

Adjustment

Back off the bi-metallic strip retaining screw slightly and centre the valve by pressing it towards its seating and then tighten the screw.

Setting

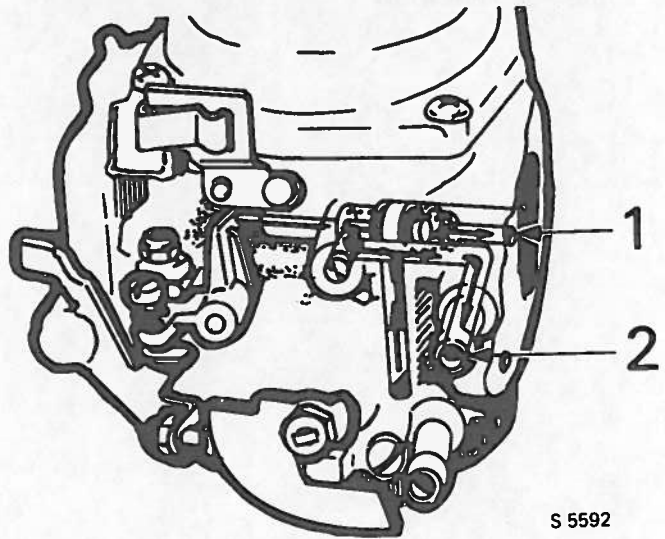
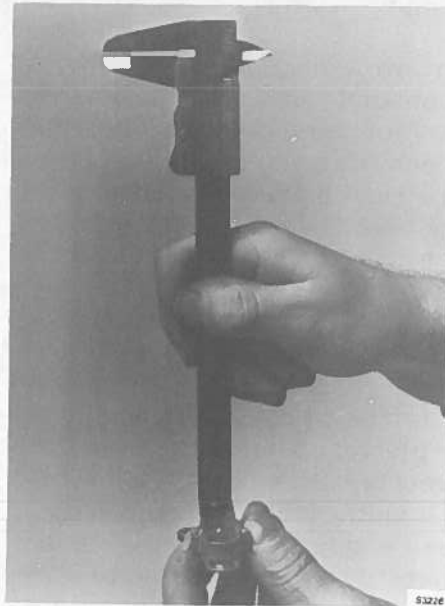
At 68°F (20°C) the valve should have opened 0.004-0.012 in (0.1-0.3 mm). To check the setting, the temperature compensator should be removed from the carburetor and kept at a temperature of 68°F (20°C) until it has acquired this temperature. Setting is by means of the bi-metallic strip adjusting nut.

Changing

Change the temperature compensator as a complete unit. To remove it, undo the two slotted screws.

Note

Both the outer and inner rubber gasket must be exchanged.



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Float chamber vent valve

The purpose of the valve is to improve starting when the engine is hot by preventing vapourized fuel entering the inlet manifold system.

Should the engine run on after the ignition has been switched off the float chamber vent valve should be checked first.

Float chamber vent valve

1. Air from air cleaner
2. Atmospheric air

Checking and setting

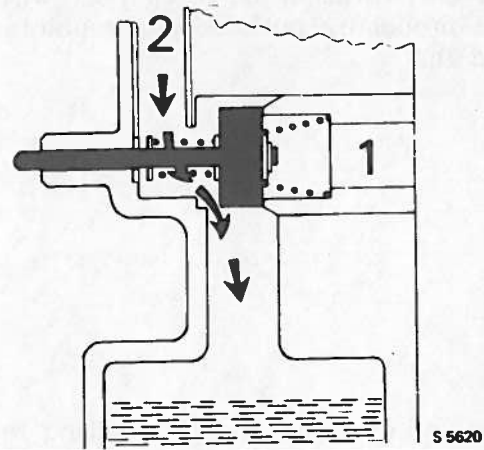
The valves should be set so that atmospheric air is drawn in through the connection to the air cleaner.

1. Connect a hose to the mouth of the atmospheric air pipe.
2. Blow down the hose. If the fuel pipe is not fitted and connected to the pump, the fuel inlet connection must be sealed off.



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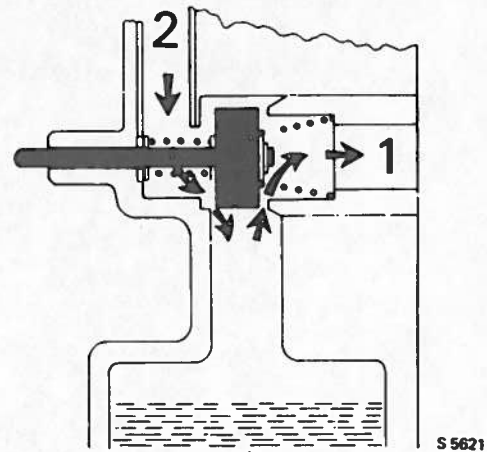
- a. With the throttle fully closed it should not be possible to blow through the connection (as the float chamber is an enclosed space.)



Throttle valve fully closed

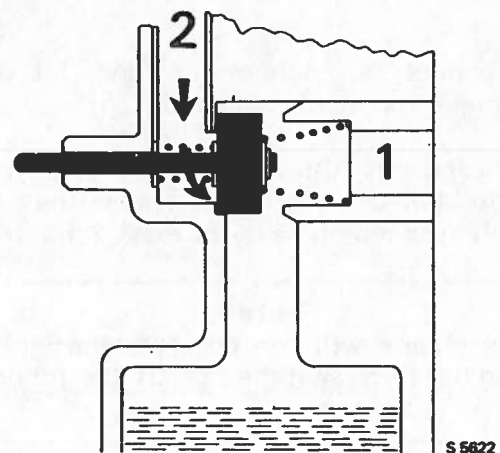
1. Air from air cleaner
2. Atmospheric air

- b. If the throttle is opened 0.5 -1.0 mm (at the throttle stop) a passage will be opened for internal air flow, making it possible to blow through the connection.



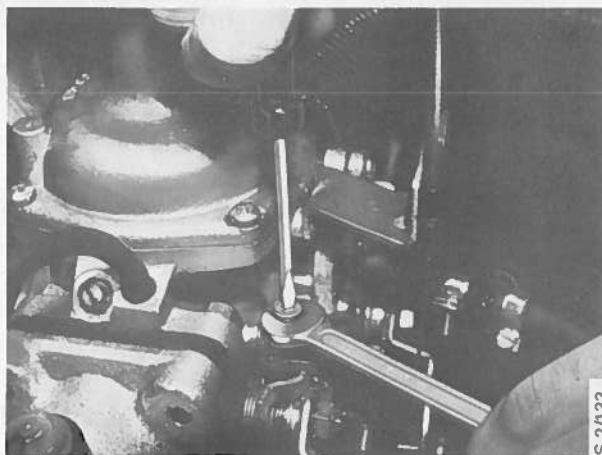
Throttle valve open 0.5 - 1.0 mm

- c. If the throttle is opened a few more millimetres, the passage should close again.

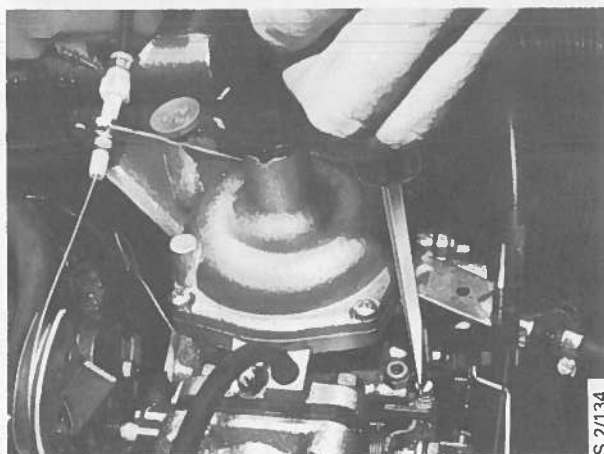


Throttle valve open a few more millimetres

3. Release the locknut and adjust the valve by rotating the setting screw. Use the procedure outlined under points 2a and 2b.



4. The idling speed and CO setting must be checked following the above adjustments and reset if necessary.



Adjusting the idling speed

Idling shut-off

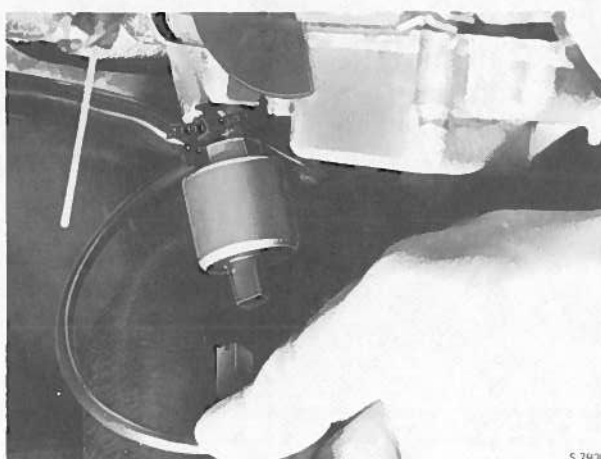
(cars with Sweden specification)

To check

1. Connect a tachometer and let the engine run at idling speed.
2. Disconnect the electrical cable from the shut-off valve and check that the idling speed drops by at least 200 r/min.

Note

The engine will run on after the ignition has been switched off if the idling speed is too high.



Adjustment

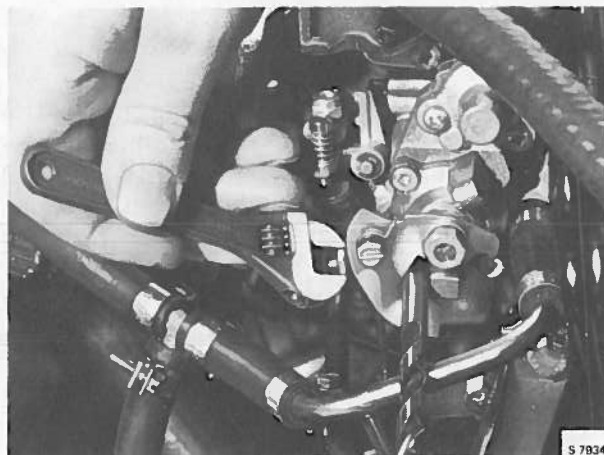
Choke control

Check the fast idling speed with the engine at normal running temperature as follows:
(Vacuum hose to distributor plugged.)

- a. Place an 8 mm spacer (drill bit) between the notch in the cam lever and the stop on the choke housing.

- b. Check that the fast idling speed is now approx. 1100 r/min.

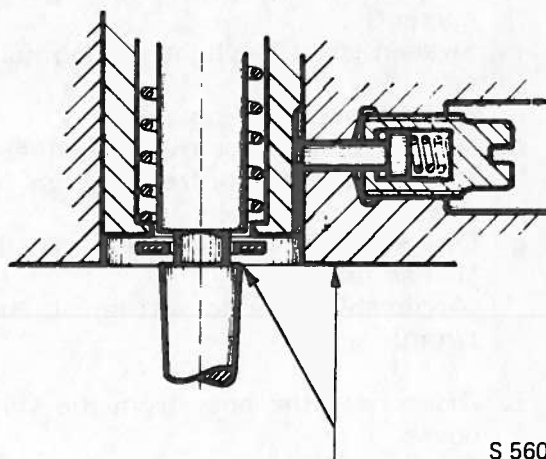
Adjust the stop screw on the throttle lever if required.



Basic setting of carburetor

The jet is fitted immovably in the carburetor, and the height of the needle must therefore be adjusted to effect the basic setting. Proceed as follows:

1. Remove the damper and oil cap assembly.
2. Remove the vacuum chamber cover and the return spring.
3. Withdraw the piston and diaphragm together.
4. Using tool 83 93 035, bring the shoulder of the needle in line with the lower edge of the vacuum piston.



Needle sleeve flush with bottom of piston

5. Fit the piston and diaphragm complete in the carburetor, making sure that the outer tab on the diaphragm engages the matching recess in the carburetor body.
6. Fit the spring and the vacuum chamber cover, making sure that the marks coincide, and then fit and tighten the screws.

7. Check the oil level in the damper cylinder, top up as necessary, and refit the damper and oil cap assembly.

Fine tuning will be effected in the subsequent CO test.

CO-setting

To minimize the possible effect on the readings, caused by various engine and exhaust emission control components, the CO setting on cars with Sweden specifications (and Switzerland, as from 1983 models) should be carried out at an engine speed of 2000 r/min. On Europe spec. cars, the setting should be performed at idling speed. To obviate the possible influence of other factors, when the setting is being performed at 2000 r/min:

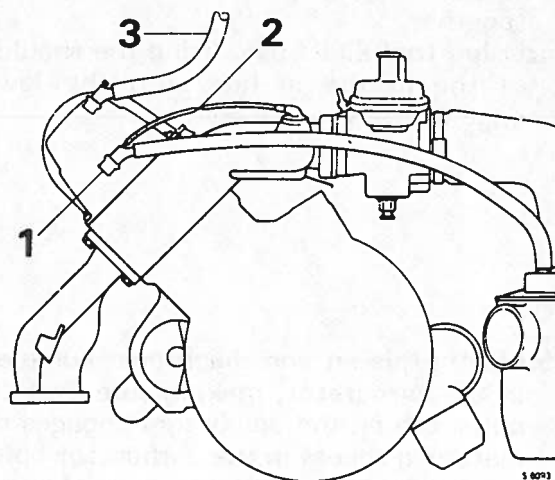
- A. Disconnect the crankcase ventilation
- B. Blank off the hose to the vacuum control unit on the distributor.

1. Preparing to measure the CO-setting.

- a. Run the engine until it is warm so that the CO-reading (item 4) may be carried out immediately after the radiator fan has cut in.
- b. Check that the choke control is pressed home.
- c. Check the float chamber ventilation.
- d. Check that the ignition timing is set correctly.
- e. Sweden spec: Daylight driving lights on.
Europe spec: All lights off.
- f. Plug or clamp shut the vacuum hose to the vacuum control unit on the distributor.
- g. Disconnect the crankcase ventilation as follows:
(Applicable only to setting at 2000 r/min)

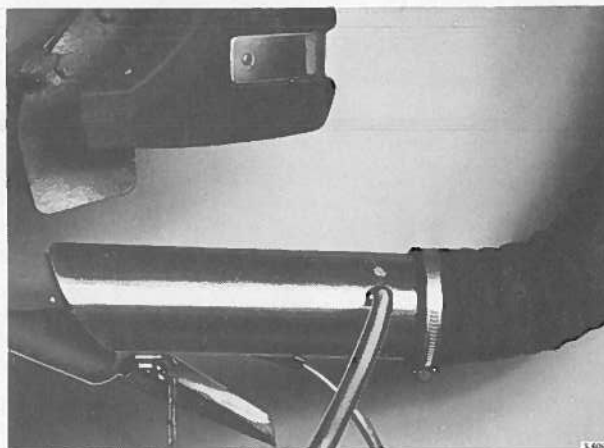
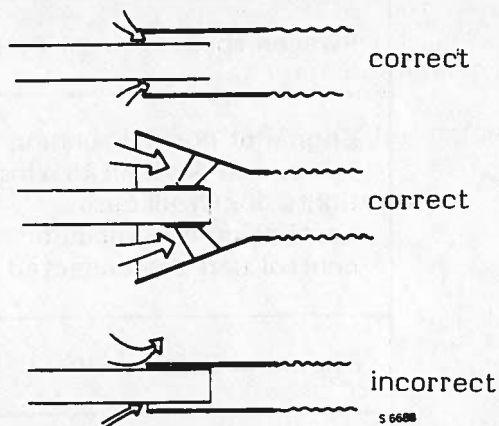
1. Disconnect the hose from the valve cover.
2. Blank off or clamp shut the smallbore hose.
3. Connect the evacuation hose to the valve cover.

Evacuate the crankcase gases from the opening in the valve cover by connecting a hose to the workshop's evacuation hose, downstream of the CO-meter probe, to ensure that the readings will not be affected.

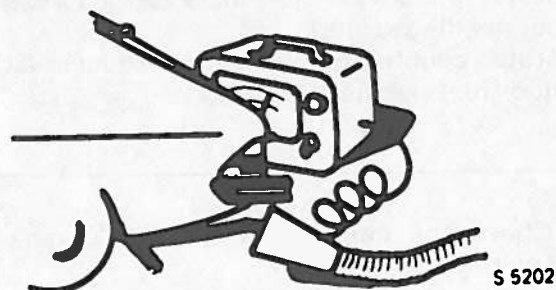


When connecting exhaust extraction in conjunction with running the engine inside the workshop, avoid excessive depressurization of the exhaust system, as this may affect readings of the CO content.

To prevent excessive extraction pressure, use an extraction hose with an open coupling.



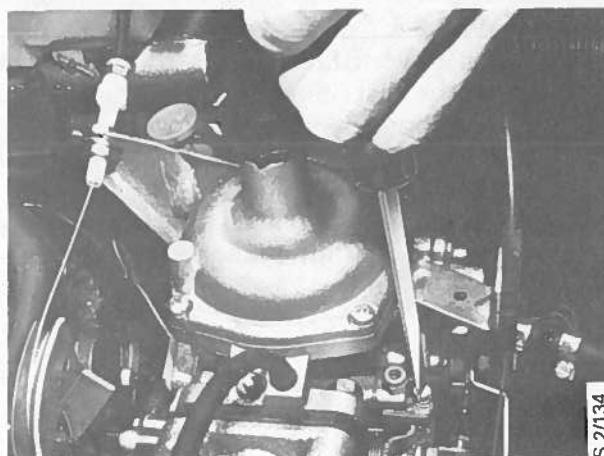
2. Connect the CO-meter and tachometer.



3. Set the idling speed to:

Sweden spec: 2000 r/min
Europe spec: 850 r/min

4. Read off the CO-value.



Sweden spec:	Europe spec:
Engine at normal running temp. and daylight driving lights on. Crankcase ventilation and vacuum control unit disconnected	Engine at normal running temp. and all lights off.
Engine at 2000 r/min	Engine at 850 r/min
$1,75 \pm 0,25 \%$	$2,5 \pm 0,5 \%$

For adjustment, remove the damper and then turn the fuel needle adjusting screw by means of tool 83 93 035. Support the vacuum piston by means of the sleeve of the tool to prevent the rubber diaphragm from being damaged.

Rotate clockwise to increase CO-value (fuel needle raised.)

Rotate counter-clockwise to reduce CO-value (fuel needle lowered.)



Caution

Check the calibration of the CO-meter regularly.

The following items (5-7) apply to cars with Sweden specs. only.

5. Remove the plugs and connect the crankcase ventilation and the vacuum hose to the distributor.
6. Set the idling speed to 850 ± 50 r/min.
7. Check the CO-value at idling speed. If the value exceeds 4.5 %, it is likely that fuel has penetrated the engine oil, necessitating an oil change.

Choke control

To remove

1. Undo the control cable and sheath from the carburetor. Note the cable run. Free the cable in the engine compartment.
2. Remove the trim panel below the instrument panel.
3. Remove the control knob and the transparent plastic washer on the warning light.
4. Unscrew the ring nut which holds the control onto the instrument panel and disconnect the warning light cable from the control switch.
5. Pull the control cable out of the grommet in the bulkhead.

To fit

1. Check that the grommet is correctly positioned in the bulkhead. Feed through the control cable, so that it can be fitted to the instrument panel.
2. Connect the warning-light cable to the control switch.
3. Fit the control to the instrument panel, fit the plastic washer on the warning light and screw on the knob.
4. Refit the cable as far as the carburetor.
5. Connect the cable to the carburetor and adjust as detailed in the section on adjustment of the choke control.
6. Replace the panel under the instrument panel.

The first part of the report is a general description of the project. It includes a brief history of the project, a statement of the problem, and a description of the objectives of the project. The second part of the report is a detailed description of the methodology used in the project. This includes a description of the data collection methods, the data analysis methods, and the results of the analysis. The third part of the report is a discussion of the results of the project. This includes a discussion of the findings of the project, a discussion of the implications of the findings, and a discussion of the limitations of the project.

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Inlet system (Air induction system)

Air cleaner

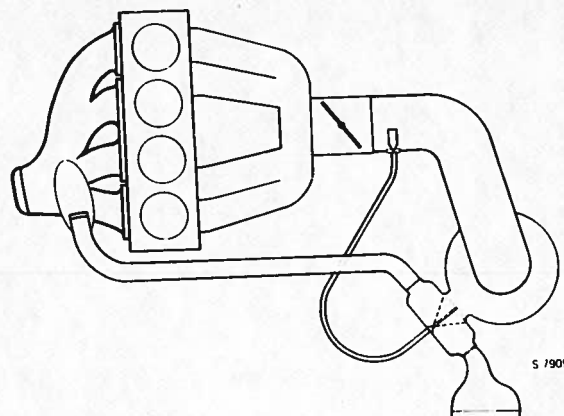
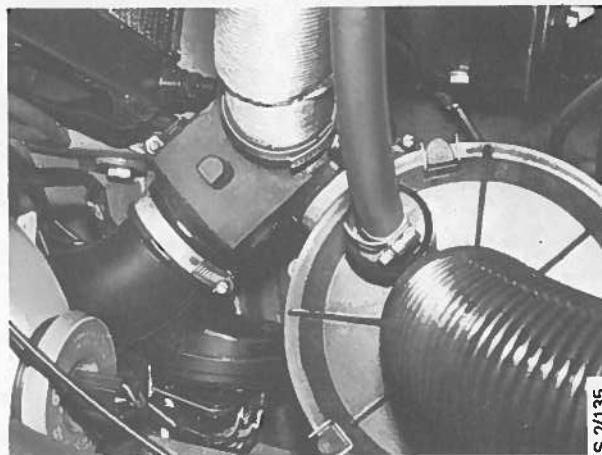
The air cleaner is positioned at the front of the left wheel housing. Its purpose is two-fold: to clean the air inducted into the engine and to reduce the noise caused by the induction system. The air cleaner element, which is made of a special grade of paper, must not be washed or wetted. When servicing, the element may only be blown clean with compressed air or replaced. The engine has a hose connecting the air cleaner and the carburetor.

Preheating

There is a thermostatically-controlled valve situated in the air cleaner intake which governs the temperature of the induction air.

There are two air intakes in the throttle housing: one for cold air and one for heated air. The heated air is drawn in through an insulated hose from a cover on the exhaust manifold.

The valve is activated by a thermostat in front of the throttle housing on the carburetor. The movement of the thermostat is transmitted through a cable. The thermostat senses the temperature of the pre-mixed induction air and maintains it between 73 and 99° F (23 and 37° C). In operation the valve therefore alternates between the non-preheated and preheated positions.



To check

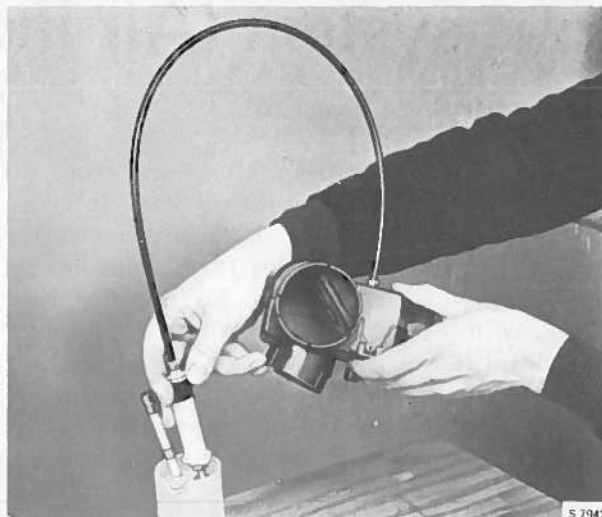
A rough check of the valve operation can be made by noting its movement when the cold air intake is removed.

A more accurate check can be made by removing the valve body with the cable and the thermostat and immersing it in hot or cold water using the figures shown below and checking the position of the valve.

73°F (23°C) - preheated air only
99°F (37°C) - cold air only

Note

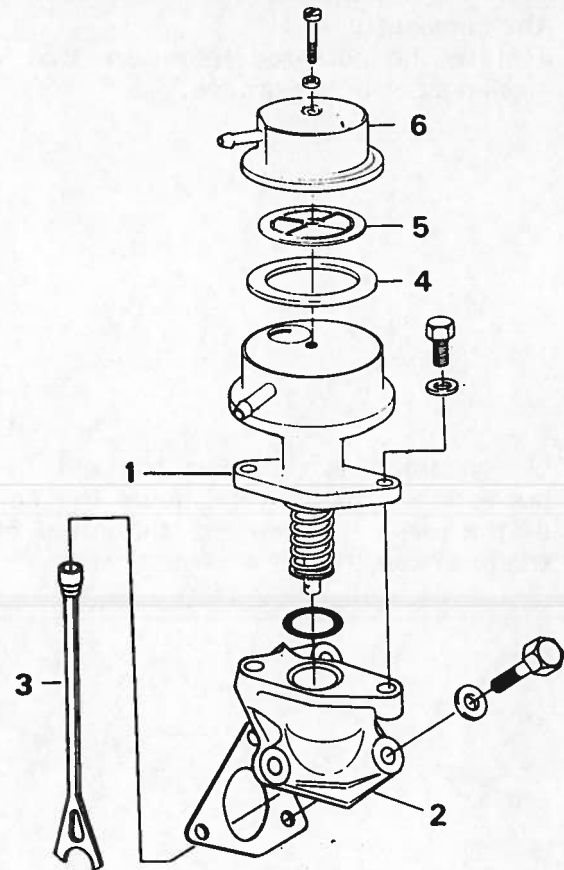
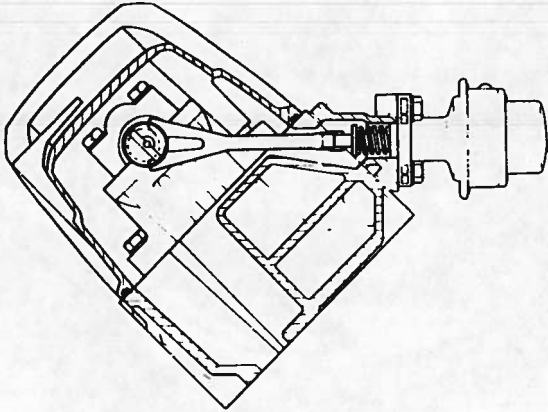
For this check the cable should adopt approximately the same position as it has in the car.



Fuel pump

General

The fuel pump is a diaphragm pump, driven by a push-rod from an eccentric on the camshaft. Apart from the filter, which can be removed for cleaning, the pump cannot be dismantled for overhaul or repair.



- 1. Fuel pump body
- 2. Adaptor
- 3. Push rod
- 4. Seal
- 5. Filter
- 6. Cover

To remove

Disconnect the fuel lines from the pump. Remove the fixing bolts and washers and then the pump and gasket.

The pump cannot be dismantled and consequently cannot be overhauled in the event of damage to the diaphragm or valves; the entire unit must then be replaced.

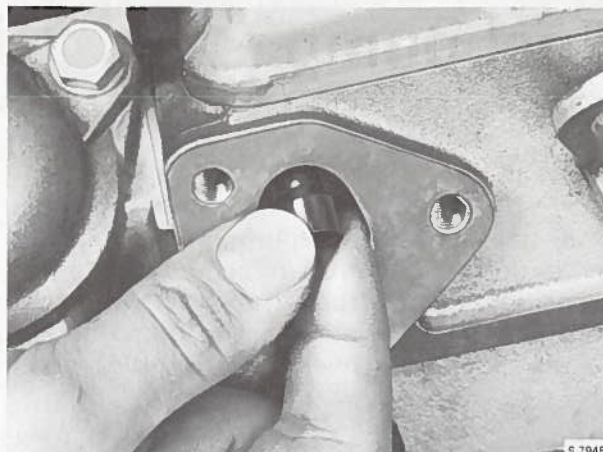
The filter can be removed for cleaning or replacement with the pump in situ. Remove the cover retaining screw and lift off the cover.

To refit

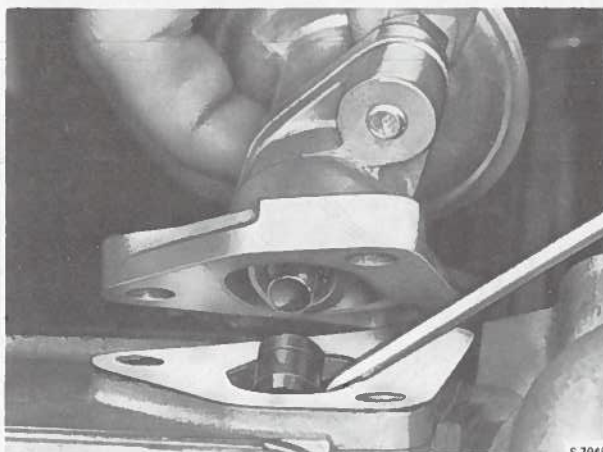
Always fit a new gasket. If the fuel pump has been removed with the valve cover in situ, refit as follows.

1. Fit together the pump body and adaptor.
2. Apply sealant to the cylinder head, flange and then fit the new gasket

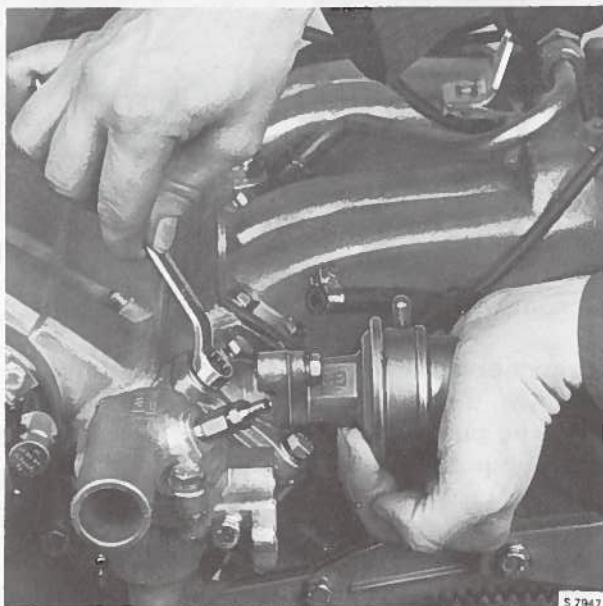
3. Guide the push-rod into the groove in the camshaft.
Rotate the push-rod to ensure that it has engaged in the groove.



4. Use a small screwdriver to hold the push-rod in position and guide the end of the pump link rod into the collar of the push-rod.



5. Press the pump against the flange and hold it there while fitting and tightening the three fixing bolts.

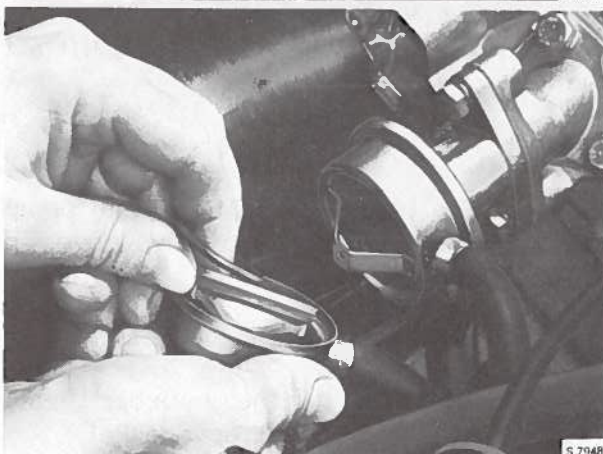


Cleaning the filter

(To be carried out in conjunction with regular servicing.)

Remove the screw in the centre of the pump cover, lift off the cover and remove the filter and seal. Clean the filter and cover.

Reassemble the parts.



Fuel tank and fuel lines

Fuel tank

The fuel tank is made of injection-moulded plastic and houses the fuel level transmitter and suction pipe.

The tank has a venting system and overfill protection, which allow for expansion of the fuel inside the tank.

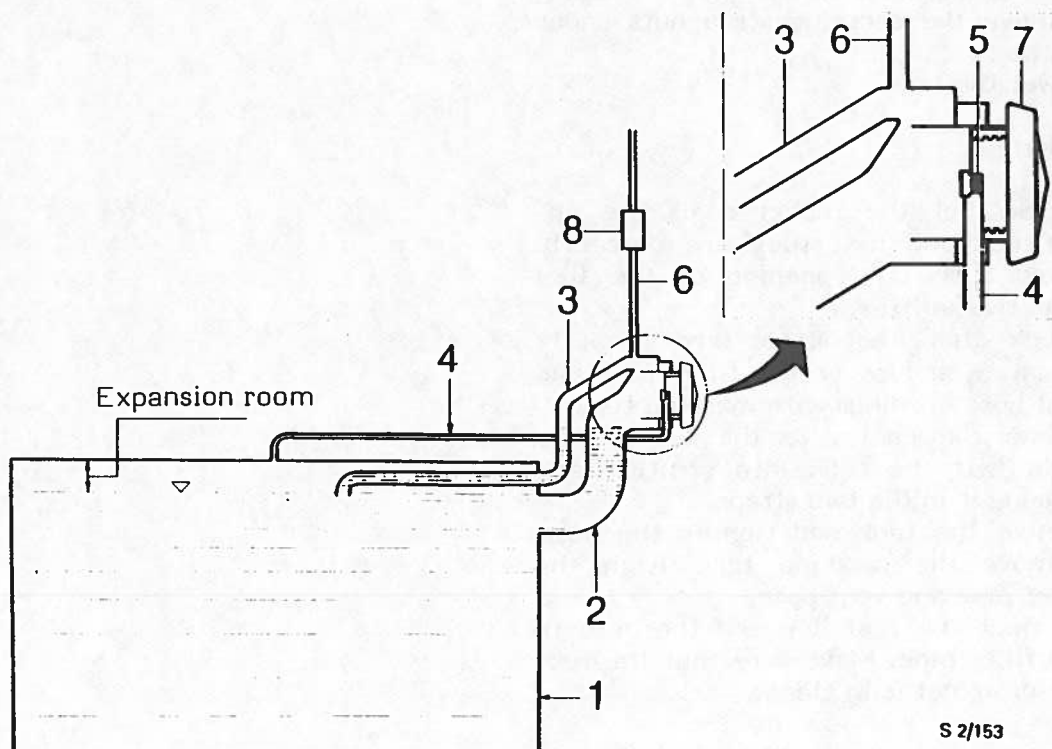
Fuel tank venting and overfill protection

When being refuelled, the tank (1) will not fill up completely; the level in the tank will rise only slightly above the lower end of the vent pipe (3). This is because of the presence of a pocket of air which prevents further filling. The formation of the air pocket is due to a spring-loaded valve (5) in

the filler pipe (2), which closes the outlet of the vent tube (4) from the top of the tank.

The action of screwing on the filler cap (7) operates a lever which opens the valve, thereby connecting the upper section of the tank to atmospheric pressure via the ventilation hose (6). This hose runs along the inside of the guttering, down through the left windshield pillar and into the engine compartment, where it opens behind the left wheel housing. A roll-over valve is fitted in the hose at the rear corner pillar.

Thus there is now room for the fuel to expand inside the tank, instead of being forced up the filler pipe (2). As the level of the fuel inside the tank drops, air will be drawn in through the ventilation hose (6).



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Fuel tank ventilation, arrangement diagram

1. Fuel tank
2. Filler pipe
3. Vent pipe
4. Vent tube
5. Spring-loaded valve
6. Ventilation hose
7. Filler cap
8. Roll-over valve

Fuel tank

Removing

1. Disconnect the earth lead from the battery.
2. Jack up the rear of the car.
3. Drain the fuel tank. To prevent unnecessary emission of hydrocarbons into the workshop, drain the tank by means of a closed system.

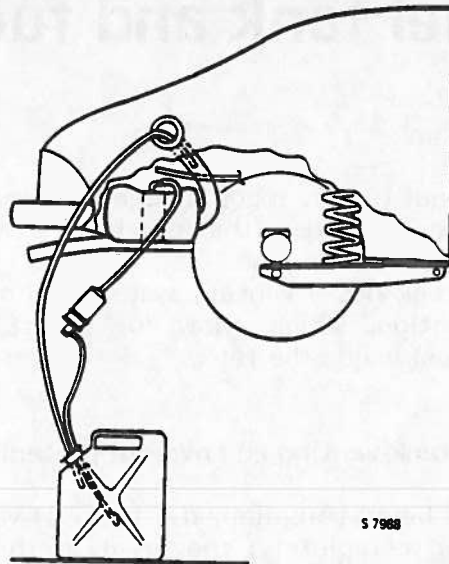
Connect an electric fuel pump (designed for injection engines) to the supply line from the fuel tank and pump the fuel through a hose into a container. The work should be done with the car jacked up.

The container should be enclosed and equipped with a vent hose which should be run back into the fuel filler pipe.

4. Remove the mat and the rear floor cover in the luggage compartment.
5. Remove the fuel level transmitter cover plate.
6. Disconnect all electrical connections from the tank.
7. Disconnect the inlet pipe and ventilation hoses from the fuel pump and the fuel line from the tank.
8. Remove the securing strap nuts under the tank.
9. Lower the tank.

Installing

1. Check that the rubber seals are undamaged and that they are correctly fitted round the opening of the fuel level transmitter.
2. Check that the straps are properly mounted, and cover the filler pipe and vent hose openings with masking tape.
3. Clamp the cables to the top of the tank. Lift the tank into position and suspend it in the two straps.
4. Centre the tank and tighten the nuts. Remove the masking tape from the filler pipe and vent hose.
5. Connect the fuel line and the hose to the filler pipe. Make sure that the rubber grommet is in place.



6. Connect the vent hoses to the upper filler pipe and the top of the tank. Connect the cables to the fuel level transmitter and replace the access panel.
7. Lower the rear of the car.
8. Connect the battery earth lead.

Fuel pipes

Running the fuel pipes

Fuel pipes should not come into contact with any object that could result in wear through chafing.

The risk of wear from chafing is particularly great from contact with plastic components subjected to engine vibrations (e.g. other fuel pipes, the dipstick pipe, the throttle cable, etc.).

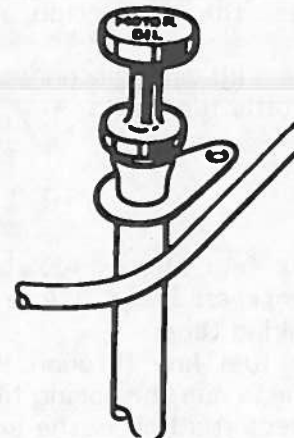
It is therefore of special importance when working in the engine compartment that all fuel pipes are run clear of such equipment. Sheath the pipes with PVC sleeves if contact is unavoidable.

Checking the fuel pipes (every 15 000 km/10 000 miles)

Follow the pipes and check to see if there is any evidence of wear through chafing. Special care should be taken when checking pipes that intersect or are run near plastic components.

Pipe wall thickness, fuel pipes: 1 mm
--

Re-route the pipes and fit PVC sleeves if chafing is detected. If the wear is greater than half of the thickness of the pipe wall then the fuel pipe should be replaced.



Replacing fuel lines in the passenger compartment

The fuel line from the tank to the engine compartment runs through the passenger compartment along the left-hand sill beam.

Removal

1. Remove the kick plate and turn back the carpet from the sill beam.
2. Remove the tape holding the fuel line.
3. Remove the insulation felt from the bulkhead.
4. Disconnect the fuel line in the engine compartment, free the grommets and pull the line into the inside of the car. Disconnect the connection at the fuel pump.
5. Undo the clip and disconnect the fuel line from the fuel tank.

Installation

1. Clean the fuel line by blowing through with compressed air. Close the ends with masking tape.
2. Push the fuel line through the hole in the bulkhead and the spring link bracket and connect the line in the engine compartment.
3. Insert the rubber grommets in the hole in the bulkhead and in the front hole in the spring link bracket.
4. Push the fuel line into position and connect it at the rear where it passes through the body. Secure the line with tape in two places along the sill beam.
5. Fit the insulation felt on the bulkhead. Replace the carpet and kick plate.

Exhaust system

General

The exhaust system comprises three parts. A muffler is mounted in the front pipe. The middle section consists of a pipe and a muffler mounted crosswise in front of the rear axle. The rear pipe runs above the rear axle and emerges on the left-hand side of the car below the rear bumper.

Removing the front muffler.

1. Jack up the car.
2. Unscrew the bolts securing the front exhaust pipe to the exhaust manifold.
3. Undo the clamp holding the connecting ring at the joint with the middle exhaust pipe and separate the pipes.

To remove the rear muffler and the other sections of pipe, detach the rubber mountings and clamps from the part to be removed.

Removal of middle exhaust pipe and muffler and/or rear pipe

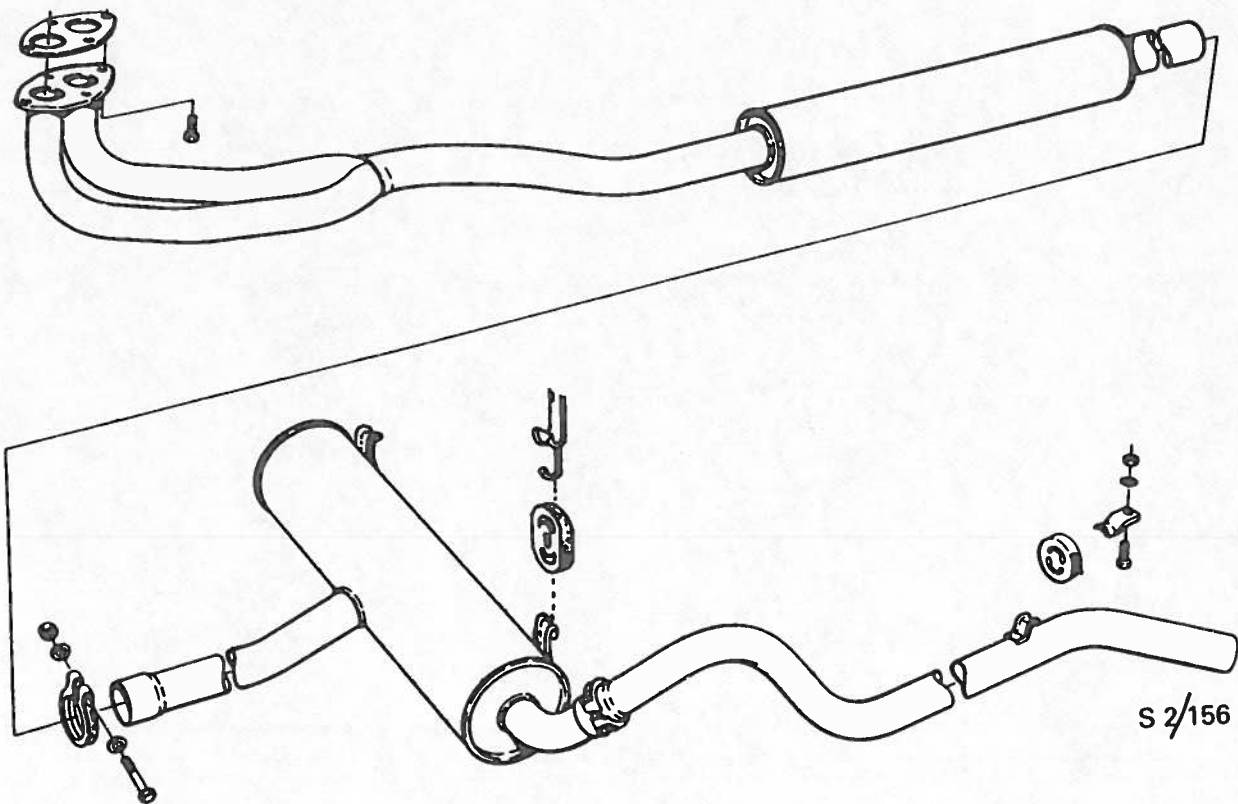
To remove the middle exhaust pipe or the rear muffler it is best to begin by unclamping the joint between these two units.

To remove the entire system, first undo the front pipe from the exhaust manifold and then unclamp the rear pipe joint. Withdraw the rear pipe from the rear.

Refit in the reverse order.

Note

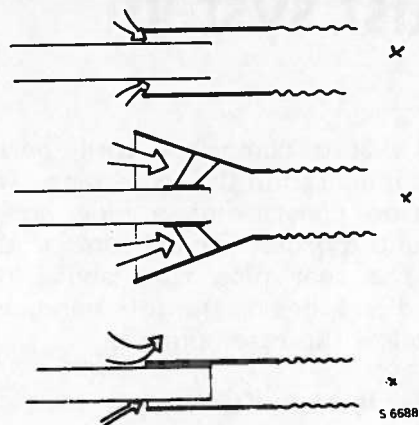
After refitting, check the exhaust system for leaks and make sure that the pipe is not in contact with the body.



Connection to exhaust extraction equipment

When using exhaust extraction equipment when running the engine in the workshop, avoid excessive depressurization of the exhaust system which may affect readings, e.g. of the CO content.

To avoid excessively powerful exhaust extraction, connect a hose with an open coupling.



Exhaust emission control system

Description

To meet with the requirements governing exhaust gas emission which exist on certain markets, cars for these markets are equipped with special exhaust emission control systems. The following systems exist for exhaust emission control.

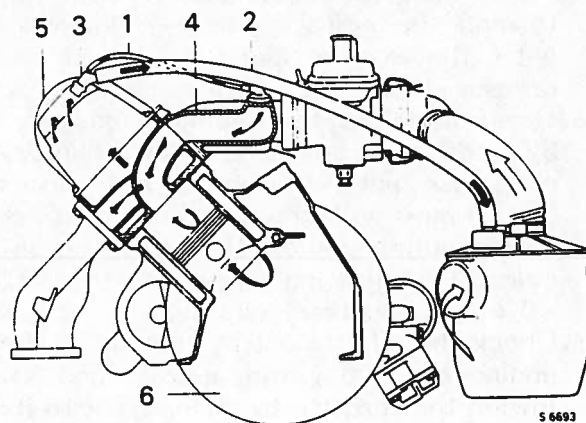
	Europe	Sweden
Deceleration Service: Dash-pot (throttle damper)		X
Vacuum-controlled deceleration valve	X	
Delay valve, vacuum advance		X ¹⁾

1) Brown: 2 ± 1 second delay

Crankcase ventilation

The crankcase ventilation is completely enclosed. The ventilation system comprises a three-way nipple in the valve cover, from which a small-bore hose runs to the inlet manifold, and a thicker hose to the air cleaner. The size of the various hoses and connections are designed to ensure efficient evacuation of the gases in the crankcase into the engine under all running conditions. The gases are evacuated through the smaller hose directly into the inlet manifold under all running conditions with the exception of when the engine is at full load, in which cases the gases are evacuated through the larger hose to the air cleaner and thence to the engine.

A flash guard is fitted at the ventilation hose connection to the air cleaner.



Crankcase ventilation

1. Hose from three-way nipple to inlet manifold
2. Hose to air cleaner
3. Three-way nipple
4. Inlet manifold
5. Valve cover
6. Crankcase

Deceleration device

The deceleration device is designed to maintain combustion during engine overrun to prevent the emission of unburned hydrocarbons.

The following types of deceleration device are used:

- Vacuum-controlled devices
- Mechanical throttle damper (dash-pot)

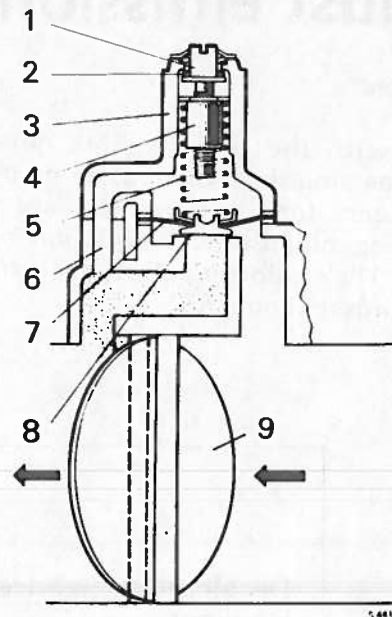
Vacuum-controlled deceleration valve (Cars with Europe spec.)

This diaphragm valve is activated by depression on the engine side of the throttle and provides the correct air/fuel mixture for proper combustion during engine overrun.

Excessive idling speed may be caused by a faulty or an incorrectly adjusted deceleration valve.

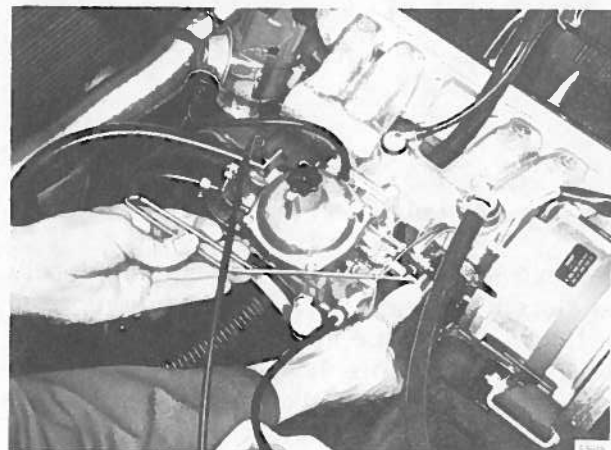
To adjust

1. Run the engine until it and the carburetor are at working temperature.
2. Run the engine at idling speed and check that the deceleration valve is closed. If in doubt, turn the deceleration valve adjusting screw a few turns counter-clockwise.
3. Adjust the quantity of fuel and engine speed to obtain the specified idling speed. (If in doubt, the ignition timing should also be checked).
4. Fully open the deceleration valve by turning the adjusting screw clockwise until the engine speed no longer increases (1500 - 1800 r/min approx).
5. Carefully close the deceleration valve by turning the adjusting screw counter-clockwise until the valve just closes (the engine will now be running at its normal idling speed). Then turn the deceleration adjusting screw a further 1/2 - 3/4 turn counterclockwise.
6. Check the adjustment by revving up the engine to 3000 r/min approx. and allowing the throttle to spring back to its stop position. Despite a slight delay, the engine should unfailingly return to the normal idling speed. If not, the deceleration valve adjusting screw should be turned counter-clockwise slightly more.



Deceleration valve

1. Adjusting screw
2. Rubber ring
3. Cover
4. Nut
5. Spring
6. Connecting passage to area above diaphragm
7. Diaphragm
8. Valve
9. Throttle



Deceleration valve adjustment
Tool 83 92 748 or 83 92 953

Dashpot

(Fitted to cars with Sweden spec.)

The dashpot mechanically delays the closing of the throttle.

To check

1. Run the engine until it reaches normal temperature.
2. Connect a tachometer and set the idling to the correct speed.
3. Increase the engine speed to 3000 r/min, release the throttle and use a stop watch to record the time taken for the engine to return to the idling speed set under point 2. The delay time should be 3-6.



To adjust

To adjust the delay time, loosen the lock-nut on the dashpot and screw it away from the stop on the throttle lever (shorter delay) or towards the stop (longer delay).

Basic setting:

1. Run the engine until warm and check that the CO setting and ignition are correct.
2. Remove the suction advance pipe.
3. Rotate the throttle lever and check that the dashpot rod strikes the stop at the specified engine speed (check using tachometer).

Engine speed at which dashpot strikes throttle lever stop	
Sweden	2,600 \pm 100 r/min

4. Rev up the engine and check that the delay time is correct.

5. Refit the suction advance pipe.

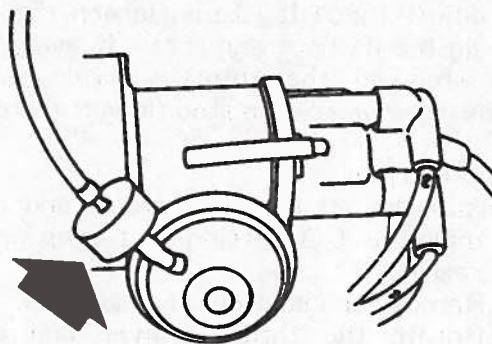
Delay valve,

(Cars with Sweden spec.)

A delay valve is fitted in the suction advance pipe between the carburetor and the vacuum advance control unit on the distributor. The valve retards depression formation by 2 s in cars with manual transmission. This also delays ignition advance during acceleration, thereby reducing the emission of nitric oxides (NO_x).

Note

The brown end of the delay valve should always face towards the vacuum advance control unit on the distributor. It is also important that the valve is fitted with the shorter hose running between the valve and the vacuum advance control unit.



Note

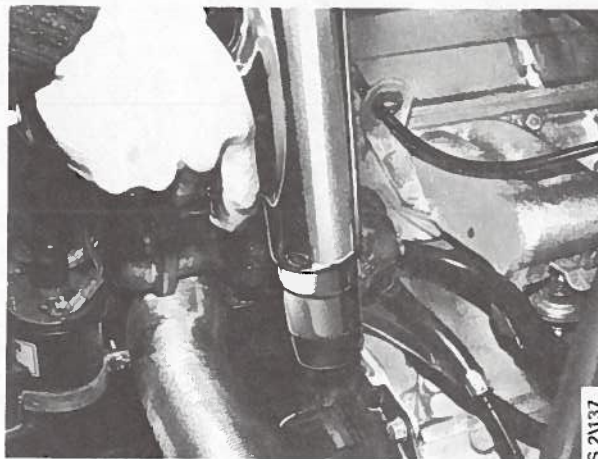
If it is necessary to remove the suction pipe, e.g. when checking the ignition timing, the hose should always be detached at the carburetor end to prevent dirt entering the hose and blocking the delay valve.

To check

A stroboscopic timing light, tachometer and stop watch are required to carry out this test.

1. Connect the tachometer and the stroboscopic timing light.
2. Run the engine at normal idling speed.
3. a. Have an assistant rapidly open the throttle and run the engine at 3000 r/min approx. Start the stop watch when the throttle opens.
b. Observe the ignition timing in the light given by the stroboscopic timing light. Vacuum advance should occur after 2 \pm 1 s.

A faulty delay valve should be renewed.



Radiator and cooling system

General

The cooling system is a pressurized unit with a cross-flow radiator and expansion tank.

The water pump is mounted on the timing cover and is driven by a "V" belt from the crankshaft pulley. The thermostat is located in the housing bolted onto the front end of the cylinder head. The radiator fan is electrically driven and is connected across a thermostatic switch.

Coolant flow

A. Thermostat shut:

From the water pump - via a passage in the engine block through the cylinder head - through the lower outlet of the thermostat housing and through a by-pass passage back to the pump. When the heater valve is open, the coolant will also flow through the heat exchanger.

B. Thermostat normally open:

From the water pump - via a passage in the engine block - through the cylinder head - through the upper outlet of the thermostat housing (by-passing the thermostat) - through the radiator - through the expansion tank return to the pump.

Coolant also flows through the lower outlet of the thermostat housing and through a by-pass passage back to the pump.

C. Thermostat fully open:

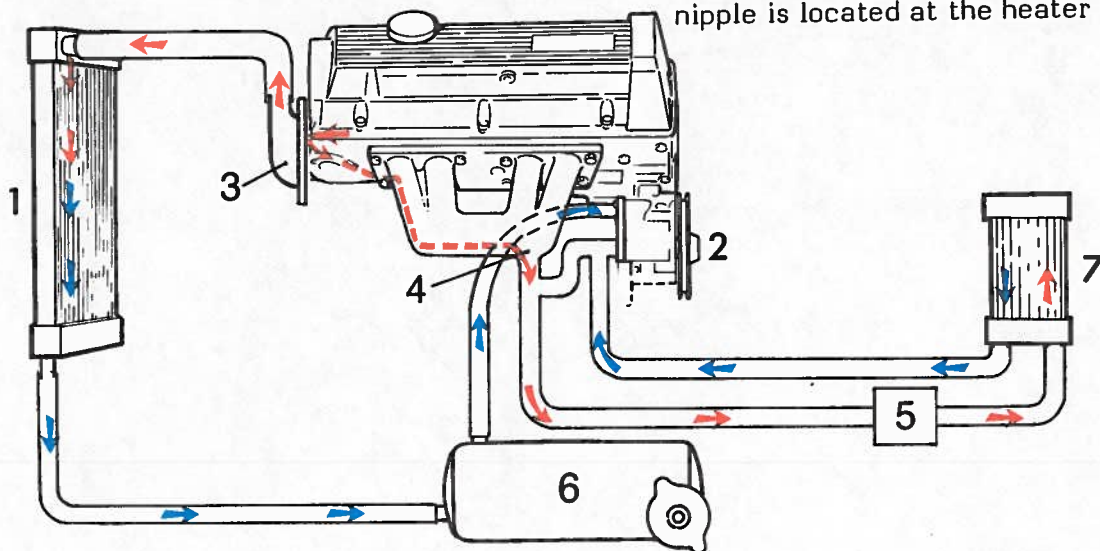
The thermostat closes the lower outlet of the thermostat housing thereby forcing all coolant through the radiator.

Expansion tank

The liquid in the expansion tank also circulates through the cooling system. The tank is connected to the water pump and the upper left section of the radiator.

Bleeder nipple

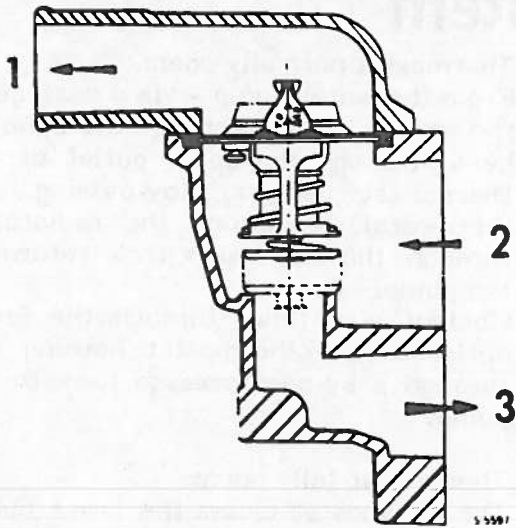
The bleeder nipple located in the thermostat housing cover should be opened when adding coolant to the system. The nipple should not be opened when the engine is running. An additional bleeder nipple is located at the heater valve.



→ Heated water
→ Cold water

Cooling system

1. Radiator
2. Water pump
3. Thermostat housing
4. Outlet, inlet manifold
5. Heater valve
6. Expansion tank
7. Heat exchanger



Three-way thermostat

1. To radiator
2. From engine block
3. To heating system

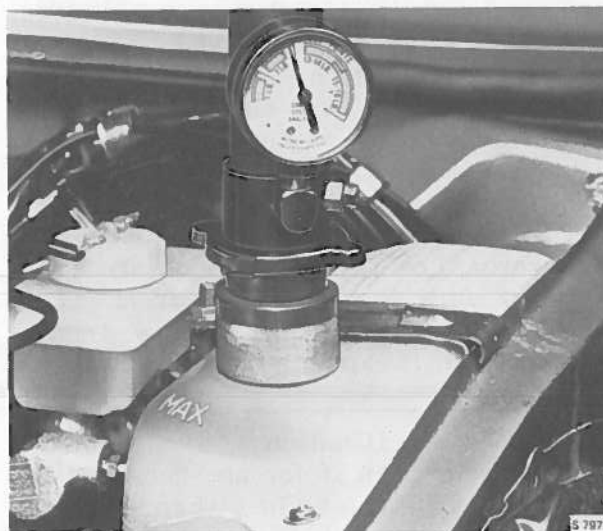
Removal and installation of the radiator

1. Drain the coolant.
2. Undo the clips on the radiator hoses and disconnect the hoses from the radiator.
3. Disconnect the leads to the radiator fan and thermostatic switch and remove the ignition coil.
4. Remove the front panel complete with radiator (see section 201).

Refit in the reverse order.

Pressure testing

Leakage in the cooling system can often be difficult to detect because the system only develops full pressure when the car is actually being driven. A good method is to pressurize the system with a pressure tester, whereupon the radiator, hoses and seals can be checked out. The maximum permitted gauge pressure is 1.2 bar (17 lb/in²). A pressure tester can also be used to check the opening pressure of the radiator filler cap. Opening pressure, section 022.



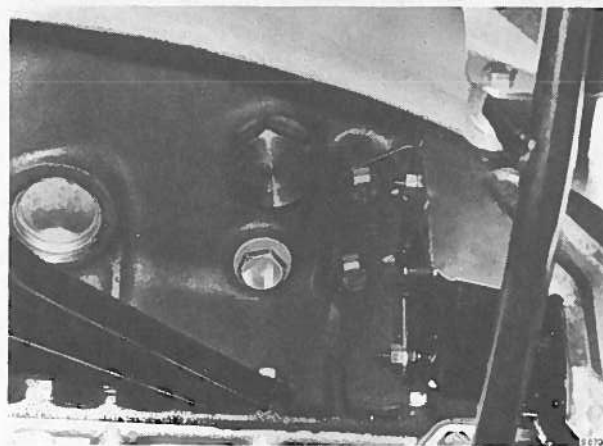
Checking the radiator

If the radiator has been removed from the car, it can be tested for leakage by being immersed in water with the tube opening plugged and supplied with compressed air. The maximum test pressure is 1.2 bar (17 lb/in²).

Leaks, if any, can be repaired by soldering. The use of proprietary sealing agents added to the coolant should only be resorted to in emergencies, as these agents are apt to clog the jacket and tubes and interfere with free circulation. The cells of the radiator may sometimes become blocked with dust, insects, etc., with reduced air flow as a result. If so, wash the radiator and blow it clear with compressed air.

Changing the coolant

1. Remove the pressure cap from the expansion tank.
2. Drain the coolant through the radiator drain cock and the drain plug in the engine block. Set the heater control to maximum heat and open the bleeder nipple at the heater valve.
3. Close the drain cocks and fill the system with new coolant. Open the bleeder nipple on the thermostat housing until coolant escapes through the nipple.
4. Start the engine and run it until it is warm. Let it run at moderate speed and with the heater controls set to maximum heating. Continue topping up as air is expelled from the system).



Caution

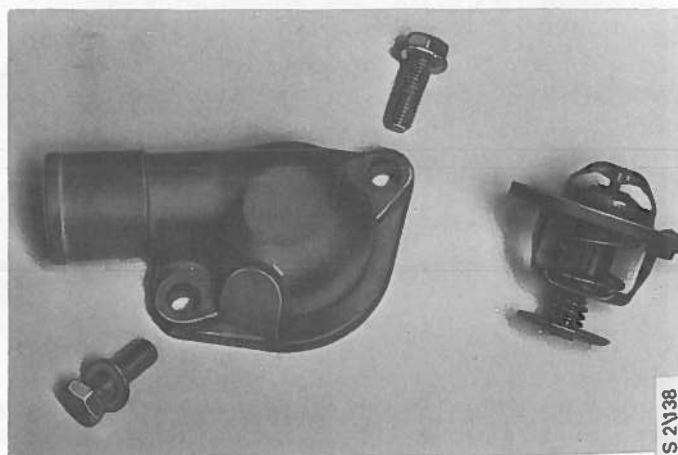
Be very careful if for any reason the coolant should be boiling when you are about to remove the radiator cap. Loosen the cap gently and allow steam to escape before taking the cap off. Never add large quantities of coolant when the engine is warm, as this may crack the cylinder block

Anti-freeze coolant mixture

During the cold season the coolant must be mixed with anti-freeze, as pure water is liable to freeze and burst the cylinder block. Ethylene glycol is recommended as an anti-freeze fluid. For maximum protection against freezing and corrosion the glycol dosage should be 40-50 per cent i.e. 3-4 l (5-7 Imp. pints) of glycol. Use only the glycol grade recommended (see section 022 for details). Saab glycol can be used with good result all the year round for two years at a time. Other recommended glycol grades should be changed every year. If ordinary water is used in the summer season, an anti-corrosion agent should be added. N.B. When anti-freeze is added, it must be premixed with a suitable quantity of water since full circulation of the coolant is not achieved before the thermostat has opened.

Cleaning the cooling system

1. Drain off coolant.
2. Flush the system with clean water.
3. Fill the system with clean water containing a commercial solvent, following the manufacturer's directions for use.
4. Run the engine warm to start all the coolant circulating.
5. Stop the engine and wait a few minutes before draining off the coolant.
6. Flush the system again with clean water; this time, flush the engine and radiator separately and in the reverse direction to the normal coolant circulation. The engine jacket should thus be flushed from the cylinder head down, and the radiator from the left connecting pipe. Remove the thermostat first.
7. Flush out the heater core, likewise in the reverse direction to the normal flow.
8. Check the operation of the cock in the line to the heater core.
9. Fit the thermostat, water outlet pipe and hoses and check the system for leakage. When cleaning the cooling system, check also that the radiator overflow pipe is not blocked by dirt. If the method of cleaning described here fails to clear the radiator of deposits, it should be removed from the car and sent to a radiator specialist.



Water outlet and thermostat

Winter thermostat

A winter thermostat with an opening temperature of 92°C (198°F) is available as a spare part.

This thermostat is only intended for winter use in markets with very severe climates, i.e. Nordic countries, Canada and the northern states of USA. It should be replaced by the standard 89°C (192°F) thermostat at the end of the winter.

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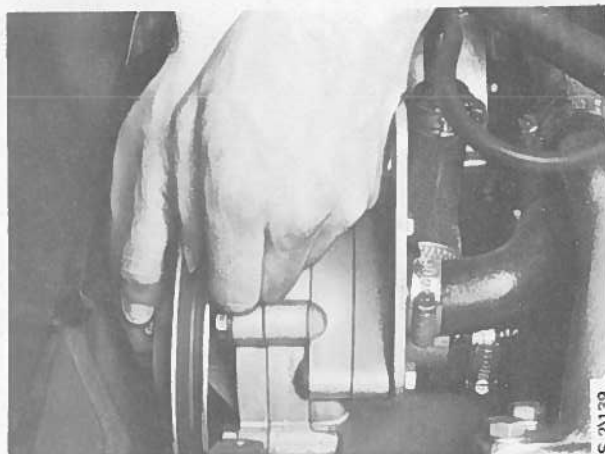
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Water pump

To remove

1. Remove the "V" belt.
2. Remove the pulley.

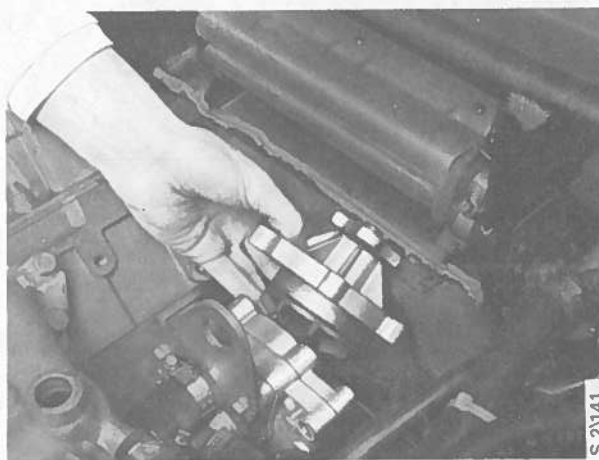


3. Remove the cover from the heater unit.
4. Remove the bolts and lift off the pump



To refit

1. Clean the mating surfaces and fit a new gasket.
2. Refit the pump.
3. Refit the pulley.
4. Refit the "V" belt.
5. Fit the cover on the heater unit.



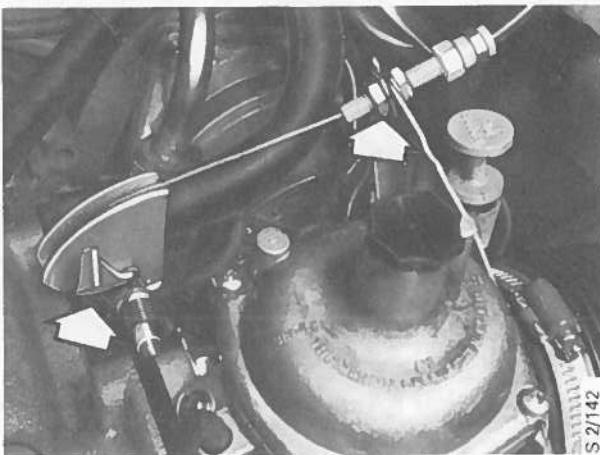
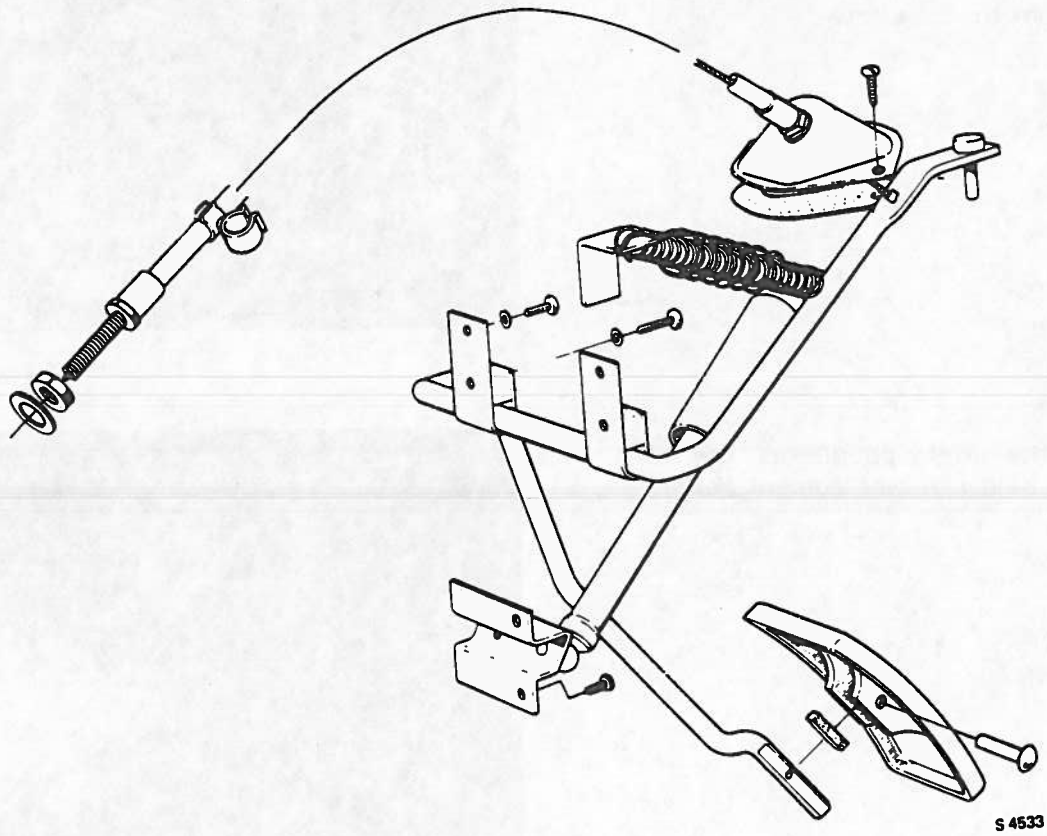
Introduction

The purpose of this document is to provide a comprehensive overview of the project's objectives, scope, and deliverables.

This document is intended for the project team and stakeholders, and will serve as a reference throughout the project lifecycle.



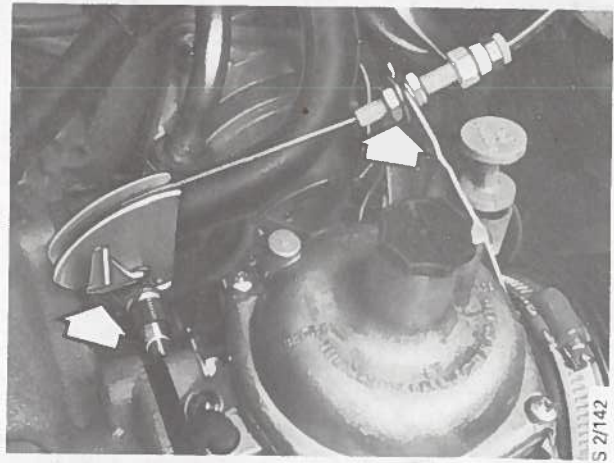
Throttle controls



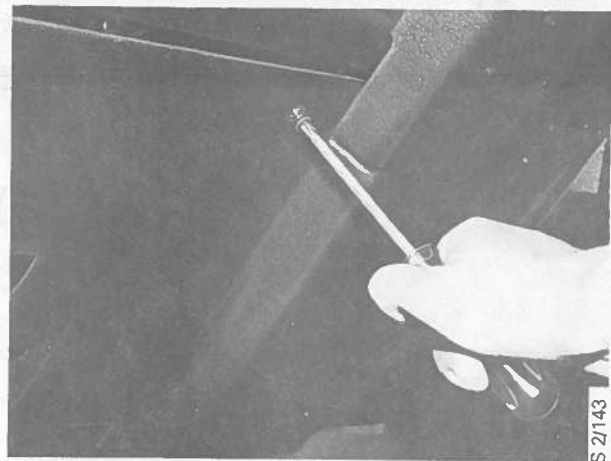
Throttle cable

Removal

1. Disconnect the throttle cable at the carburetor (throttle housing) and the sheath from the bracket.



2. Remove the safety padding on the left-hand side below the instrument panel.



3. Unhook the cable from the accelerator arm.



4. Unscrew the grommet in the bulkhead and remove the cable.

Fitting

1. Fit the grommet in the bulkhead.
2. Connect the cable to the accelerator arm.
3. Fit below the instrument-panel.
4. Fit the throttle cable to the driver.
5. Fit the cable sheath to the bracket and adjust the tension of the cable to eliminate play in the accelerator.
6. Press the accelerator down to the floor and check that the throttle valve is wide open.

Accelerator pedal

Removal

1. Remove the safety padding on the left-hand side below the instrument panel.
2. Remove the throttle damper (dashpot) (N/A to automatic-transmission models).
3. Remove the return spring.
4. Remove the locking pin from the throttle cable attachment to the accelerator.
5. Pull the cable off the pedal attachment.
6. Loosen the upper section of the bulkhead trim and fold it to one side.
7. Detach the pedal from the bulkhead.

To refit

1. Fit the pedal to the bulkhead.
2. Fold back the bulkhead trim.
3. Attach the throttle cable to the pedal and insert the locking pin.
4. Fit the return spring.
5. Refit the throttle damper (dashpot) (N/A to automatic-transmission models).
6. Fit the safety padding under the instrument panel.
7. Adjust the throttle as necessary.

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