SAAB

90

SERVICE MANUAL

2 Engine

M 1985–

2 Engine

M 1985-

Cylinder block

Cylinder bore:	Standard (A)	90.000–90.010 mm
	Standard (B)	90.010–90.020 mm
	First oversize	90.500 mm
	Second oversize	91.000 mm

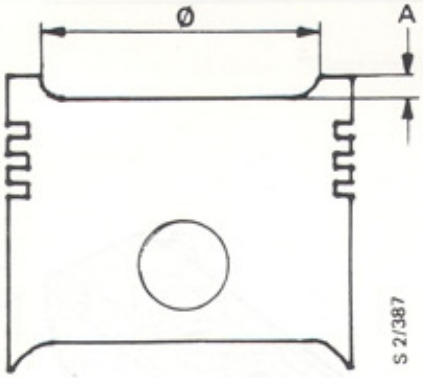
Pistons

Make: MAHLE or KARL SCHMIDT
Pistons of different makes must not be fitted in the same engine.

Piston speed (average) 13 m/s at 5 000 r/min

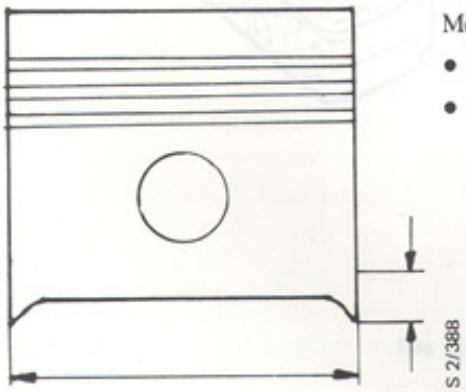
Piston type

The type of piston used varies with the compression ratio of the engine.



Engine	Model year	Piston dia, mm	A, mm	Piston weight, g
Carburetted (CM)	1985–	58	0.4	480–492

Piston diameter

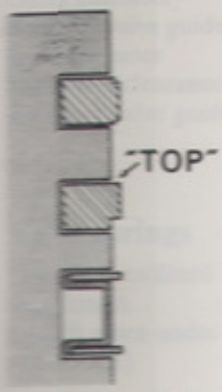


Measure at right angles to the gudgeon pin hole and:

- Mahle: 16 mm above lower edge
- Schmidt: 26 mm above lower edge

Standard A (not spare part)	89.978–89.988
Standard AB	89.988–89.996
Standard B	89.996–90.004
Standard C	90.004–90.020
First oversize (0.5 mm)	90.482–90.497
Second oversize (1.0 mm)	90.982–90.997
Piston clearance	0.014–0.032

Piston rings



	Top compression ring	Second compression ring	Scraper ring
Width (thickness), mm	1.73–1.75	1.98–1.99	2.63–2.73*
Side clearance in groove, mm	0.050–0.082	0.040–0.072	
Working gap in new cylinder, mm	0.35–0.55	0.30–0.45	0.38–1.40**

* Segment width (thickness): 0.58–0.64 mm
** Applies to segment

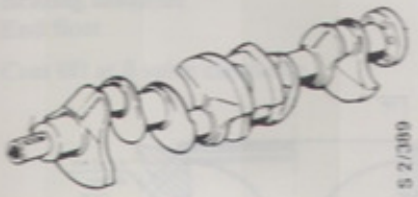
Gudgeon pins

Diameter	23.996–24.000 mm
Clearance	0.005–0.014 mm (sliding fit under gentle thumb pressure)

Connecting rods

Diameter of big-end	56.000–56.019 mm
Diameter of small-end bush (fitted)	24.005–24.010 mm
Maximum permissible weight variation per set	6 g

Crankshaft



Maximum variation in straightness	0.10 mm
End float	0.08–0.28 mm
Maximum ovality of journals	0.05 mm
Maximum conicity of journals	0.05 mm
Radius of main journal fillet	2.2–2.5 mm

Colour markings of main bearing and big-end bearing shells:	Thin	Thick
Standard	Red	Blue
First undersize	Yellow	Green
Second undersize	White	Brown

Crank pin diameter:

Standard	51.981–52.000 mm
First undersize	51.731–51.750 mm
Second undersize	51.481–51.500 mm
Third undersize	51.237–51.250 mm
Fourth undersize	50.987–51.000 mm

Main journal diameter:

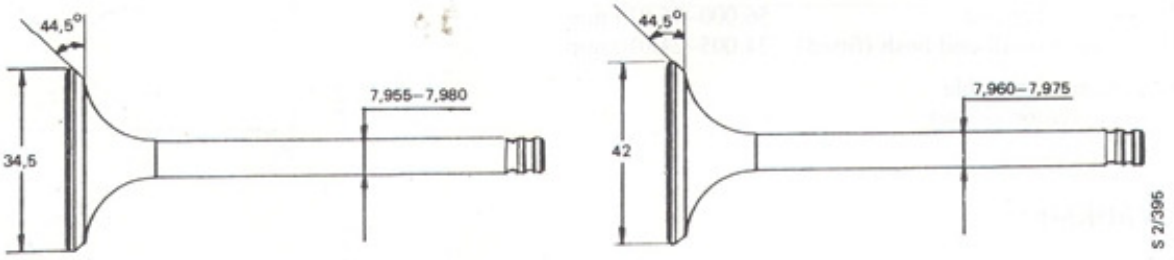
Standard	57.981–58.000 mm
First undersize	57.731–57.750 mm
Second undersize	57.481–57.500 mm
Third undersize	57.237–57.250 mm
Fourth undersize	56.987–57.000 mm

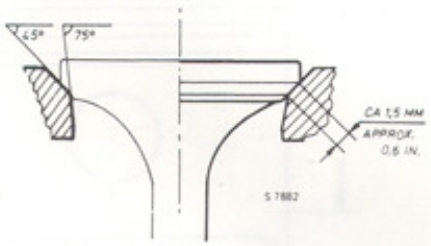
Valve mechanism

Valve clearance, mm, in engine having stood for 30 min after running at normal temperature

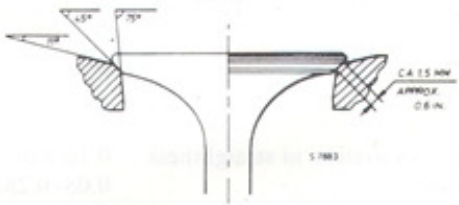
On checking:	inlet exhaust	0.15–0.30 0.35–0.50
On adjusting:	inlet exhaust	0.20–0.25 0.40–0.45

Shims available in intervals of 0.05 mm between 1.77 and 2.89 mm





Exhaust



Inlet valve

N.B.
The exhaust valves have a stellite coating and should therefore not be machined. Grinding using valve grinding paste only is recommended.

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
Maximum clearance between valve stem and valve guide	0.5 mm, measured on valve head when it is raised 3 mm above the seat

Valve springs

Length when fitted	39.5 mm
Free length	43.1 mm
Length when under load of 755–815 N (77–83 kgf)	29.5 mm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Cam followers

Diameter	37.87–37.98 mm
Height	33 mm
Bore for cam followers in cylinder head (camshaft bearing assembly)	38.000–38.016 mm

Shims for valve adjustment

Diameter	15.5 mm
Thickness	1.77–2.89 mm 23 shims available within the range, at intervals of 0.050 mm

Camshaft

Bearing diameter	28.94 mm
End float	0.08–0.25 mm

Cam lift at 0 valve clearance	Inlet valves	Exhaust valves
	10.8 mm	11.0 mm

Valve timing (at design clearance, inlet 0.35, exhaust 0.55 mm)

Inlet valves		Exhaust valves	
Open	Close	Open	Close
10° BTDC	54° ABDC	46° BBDC	18° ATDC

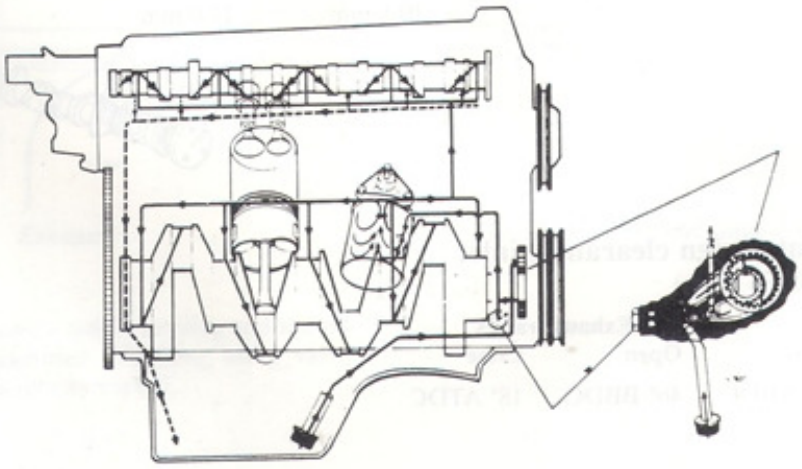
Tightening torques

	Size	Torque
Main bearings	M 12	110 Nm (11 kgf m)
Big-end bearings	M 10	55 Nm (5.5 kgf m)
Camshaft bearing caps	M 8	18 Nm (1.8 kgf m)
Valve cover	M 6	5 Nm (0.5 kgf m)
Crankshaft pulley	M 16	190 Nm (19 kgf m)
Rear engine plate (flywheel end)	M 8	20 Nm (2.0 kgf m)
Flywheel	M 10	60 Nm (6.0 kgf m)
Oil pump	M 6	8 Nm (0.8 kgf m)
Spark plugs	M 14 x 1.25	28 Nm (2.8 kgf m)
Chain tensioner	M 6	12 Nm (1.2 kgf m)
Chain guide	M 6	12 Nm (1.2 kgf m)
Camshaft sprocket	M 8	20 Nm (2.0 kgf m)
Inlet manifold	M 8	18 Nm (1.8 kgf m)
Thermostat housing	M 8	18 Nm (1.8 kgf m)
Throttle housing	M 8	18 Nm (1.8 kgf m)
Exhaust manifold	M 8	20 Nm (2.0 kgf m)
Timing cover	M 8	20 Nm (2.0 kgf m)
Distributor	M 6	5 Nm (0.5 kgf m)
Oil filter	3/4" – 16 UNF	10 Nm (1.0 kgf m)
Oil pressure switch	1/4" – 19 NPTF	10 Nm (1.0 kgf m)
Thermostatic valve (EGR)	M 14 x 1.5	15 Nm (1.5 kgf m)
Engine block heater plug	3/8" BSP	55 Nm (5.5 kgf m)
Drain plug, coolant	M 14 x 1.5	30 Nm (3.0 kgf m)

All other bolts should be tightened as follows:

Size	Tightening torque	
	Nm	kgf m
M 5	5	0.5
M 6	10	1.0
M 8	20	2.0
M 10	40	4.0

Lubricating system



Oil capacity, including oil cleaner	3.8 l
Volume between marks on dipstick	1.0 l
Recommended oil	Oil to API Service SF/CC
Viscosity:	10 W/30, 10 W 40. At constant temperture below 68 °F (−20 °C) 5 W 30 should be used. On markets where these viscosities are not available, 15 W 40 or 15 W 50 oil may be used.

Oil pressures

Oil pump pressure-reducing valve opens at	4.5–5.0 bar (kgf/cm²)
Warning light lights up at	0.3–0.5 bar (kgf/cm²)
Oil pressure at 2000 r/min, engine temperature of 80 °C and 10 W 40 oil	Minimum of 3.0 bar (kgf/cm²)

Oil pump

End float between rotor and housing	0.03–0.08 mm

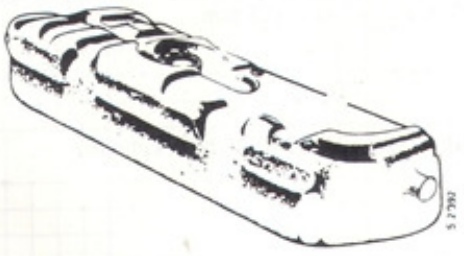
Fuel system

CO on idling (engine warm). Engines at normal running temperature.
On cars with carburetted engines for Sweden and Switzerland, the CO check should be carried out at an engine speed of 2000 r/min with the hoses to the vacuum control unit, the crankcase ventilation and the EGR system (where applicable) disconnected.
On cars with extra CO idling screw, this should be screwed down to the bottom before the setting work.

Engine	Model year	Specification	CO%	Engine speed	Idling speed, r/min, ±50
Single carburetor (CM)	1985–	Sweden	1.5–2.0*	2000	850
		Europe	0.5–2.5	850	850
		Switzerland	1.4–2.0**	2000	850

* Maximum value of 4.5 % at idling
** Maximum value of 0.8 $^{+0.8}_{-0.4}$% at idling speed. Adjust as necessary by means of the extra CO screw.

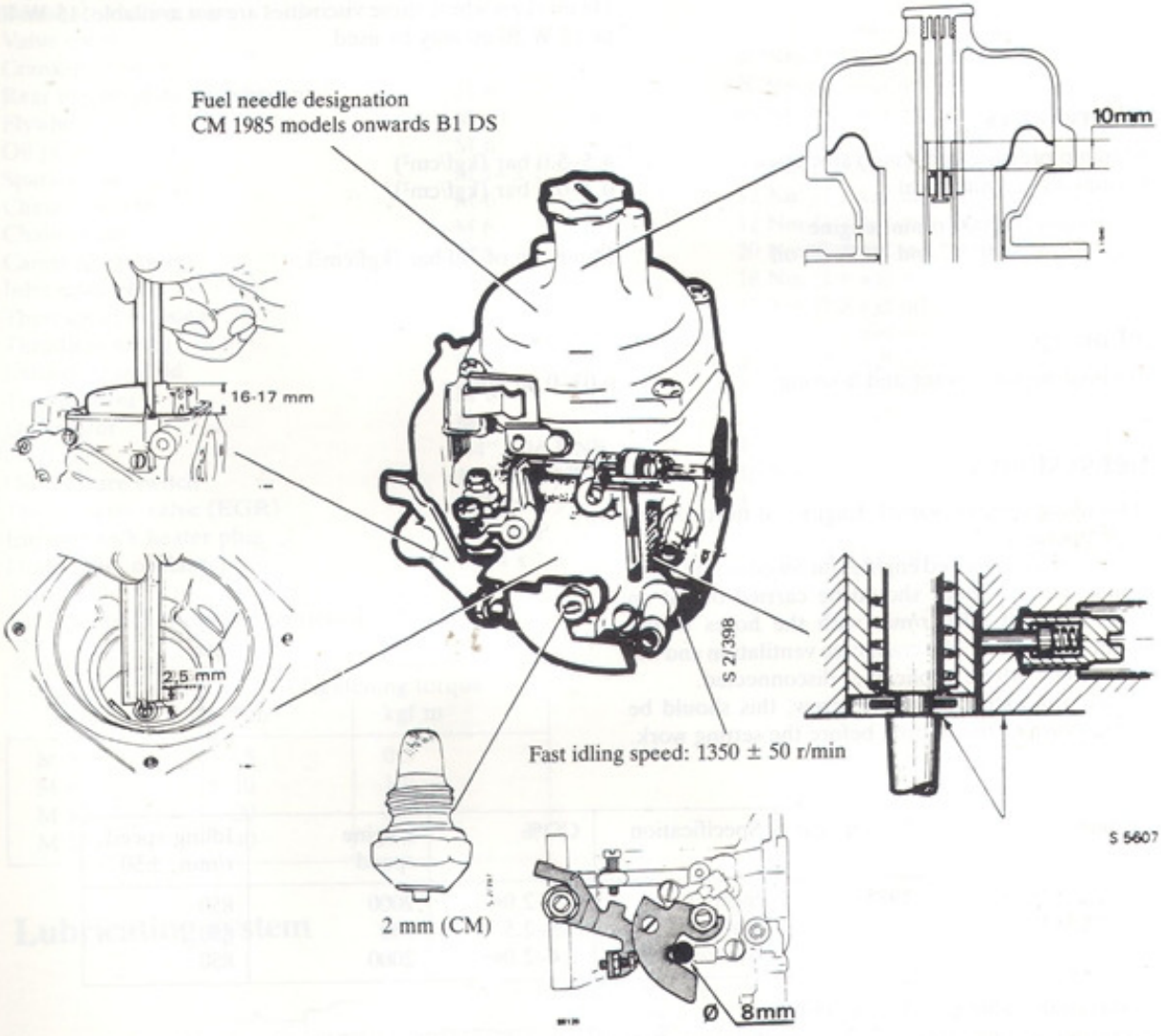
Fuel tank



Capacity, total	63 l
Quantity of fuel remaining when fuel warning light comes on	7 l (approx.)

Fuel system, carburetted engine

Carburetor type (CM) 175 CDSEVX



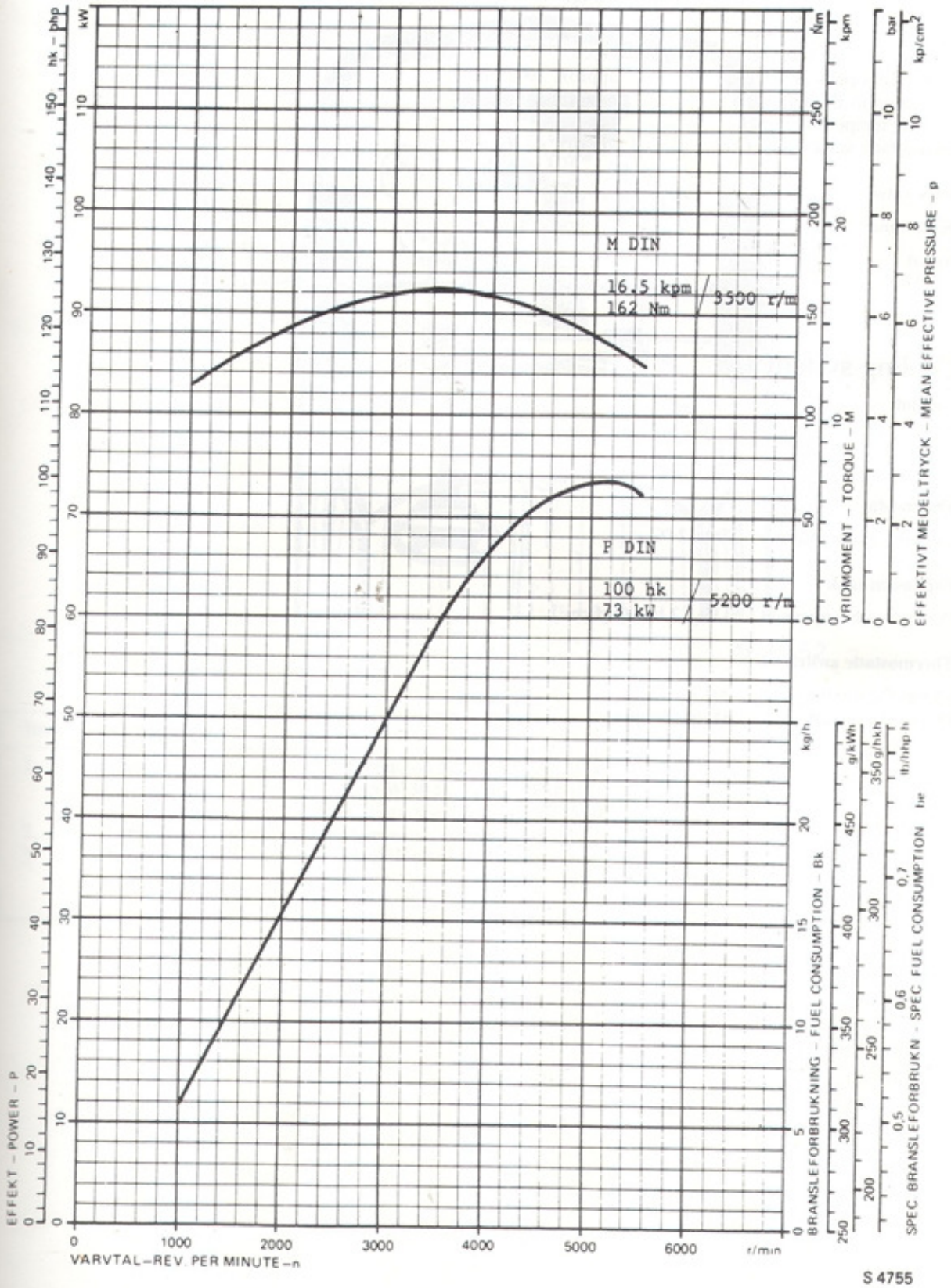
Temperature compensator

Opening at room temperature (+20 °C)	0.1–0.3 mm

Fuel pump

Fuel pressure at starter motor speed	0.17–0.25 bar (kgf/cm²)

Engine performance graphs, single carburetor engine



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Exhaust emission control system

	On-off
EGR valve, maximum flow	6 kg/h
Colour code on EGR valve	green
EGR valve opens at	approx. 1900 r/min
Restriction in EGR pipe	4 mm dia.
Opening temperature of thermostatic valve	approx. 43 °C

Delay valve

Delay time

Brown
2 ± 1 s

Cooling system

Coolant

Type	Saab Original Coolant
Capacity	8 l

Thermostat

Opening temperature	89 ± 2 °C

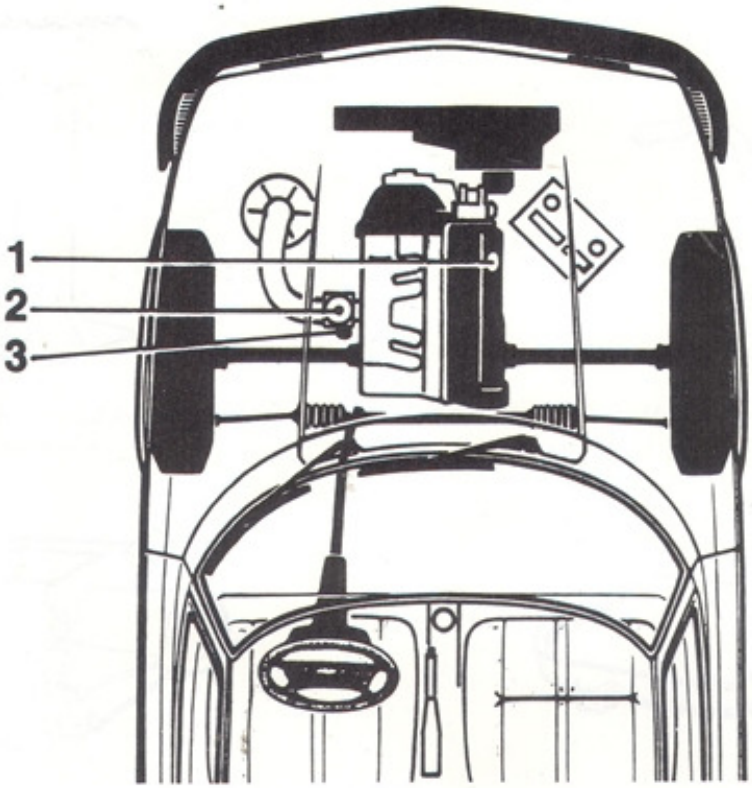
Expansion tank

Pressure valve opens at	0.9–1.2 bar (kgf/cm²)

Thermostatic switch

Closes the circuit at	90–95 °C
Opens the circuit at	85–90 °C

Lubrication, general



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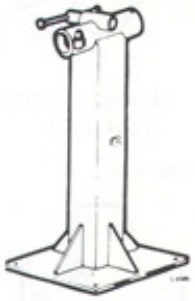
Item	Lubrication point	Lubricant
1.	Engine oil	Engine oil SAE 10 W 30, 10 W 40 alt. 5 W 30 or 5 W 30 to service SF in the API system or to Ford specification ESE M2C-101C
2.	Carburetor damper	Automatic transmission oil
3.	Throttle controls	Engine oil **Note!** The throttle cable itself should not be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

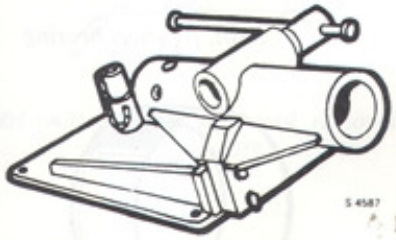
Special tools

Some tools can also be used in other groups.



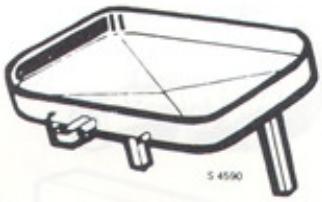
78 60 794 (A2) *Floor stand for stationary installation*

83 92 169 (A2) *Holder for engine floor stand*

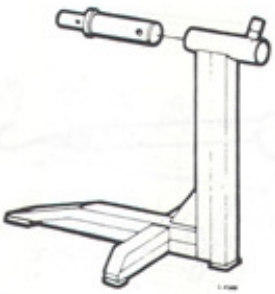


78 60 877 (A2) *Bench stand 78 60 794)*

78 60 885 *Vise stand*

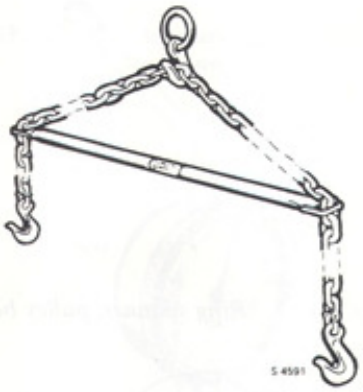


78 60 802 (A2) *Oil pan, for floor stand*



78 61 479 (A2) *Movable stand (alternative for 78 60 794)*

83 90 478 (A2) *Axle for stand*



83 92 409 (A2) *Lifting yoke, power unit*

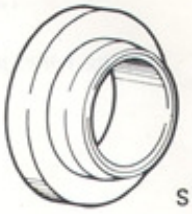
78 62 014 (A0-1) *Strap wrench for standard oil filter*

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

83 91 849 (A2) *Dolly, removal of sprocket*

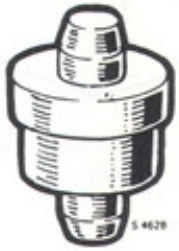
83 92 540 (A1) *Installing tool, crankshaft seal, flywheel end*

83 92 961 (A1) *Ring spanner, pulley bolt*



83 93 340 (A1) *Sleeve, installation of seal on transmission side*

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

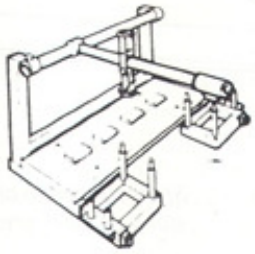


83 91 997 (A3) *Drift, flywheel bearing*

78 62 287 (A3) *Piston installing tool*

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

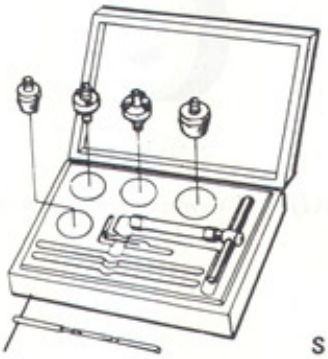
83 92 300 (A2) *Spring depressor (for use in car or on removed cylinder head)*



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*



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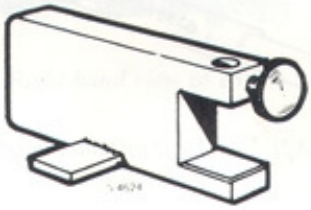
83 92 193 (A2) *Valve cutter assy.*
83 92 201 *Cutter 75°*
83 92 219 *Cutter 11°–45°o*
78 61 057 *Guide spindle*
78 61 065 *T-key*
The remaining tools in the set are for other Saab-models

83 92 268 (A2) *Reamer, valve guide Ø8 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*



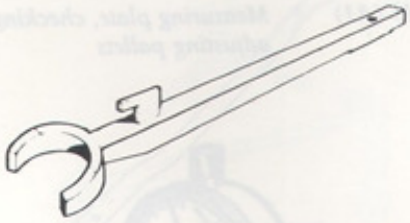
83 91 633 (A1) *Measuring plate, checking of adjusting pallets*

78 40 622 (A1) *Dial indicator*

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

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

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



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

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

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83 93 365 (A1) *Key for fuel gauge transmitter*

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83 93 910 (A01) *Torx E16 1/2-inch drive socket for cylinder head bolts.*

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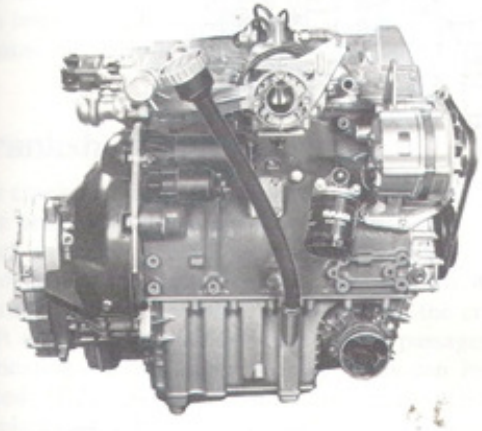
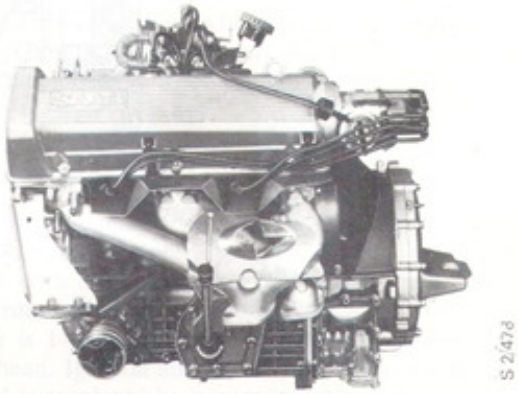
83 93 589 (A1) *Centring collar for oil pump*

General

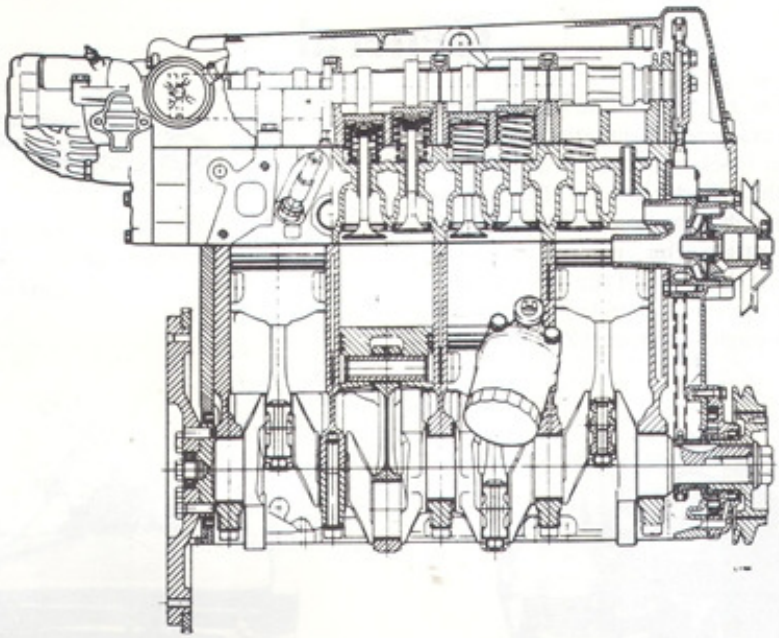
The water cooled engine is a four-in-line with an overhead camshaft. The crankcase ventilation is totally enclosed. The cylinder block is inclined at an angle of 45o to the right and the cylinder head is of the cross-flow type, i.e. with the inlet ports on one side and the exhaust ports on the other. 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.



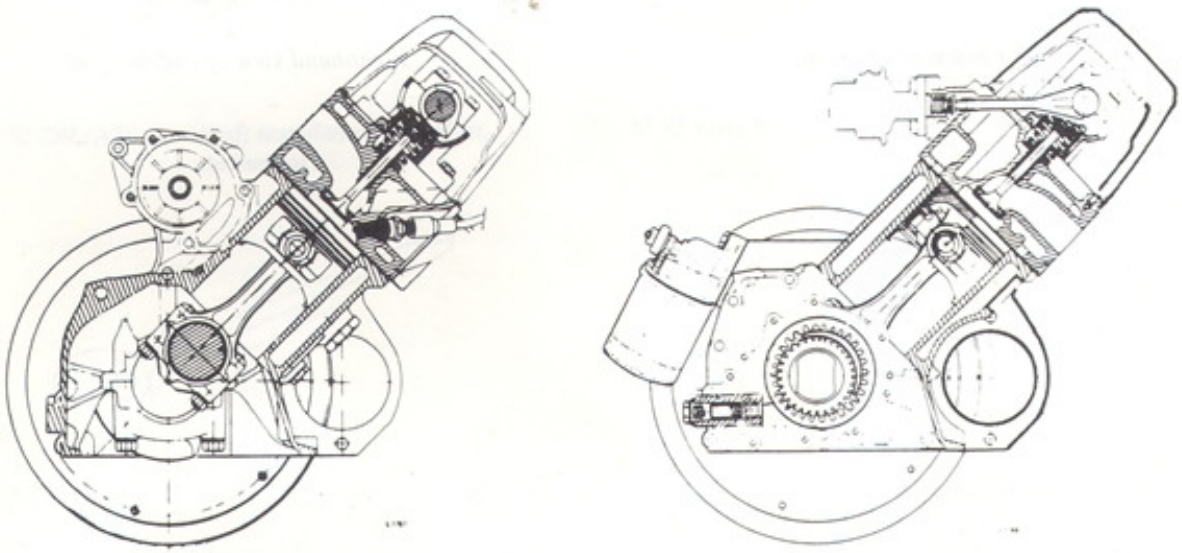
Left-hand view of engine



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 by Torx type bolts. 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 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

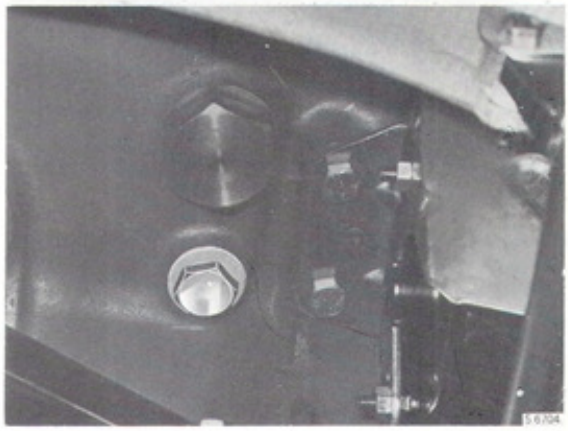
The distributor is driven by the camshaft. Drive is transmitted via a slot in the end of the camshaft which mates with the driving dog on the distributor shaft. The rotor arms turns counter-clockwise. The firing order is 1–3–4–2, No. 1 cylinder being nearest the bulkhead. Ignition advance in relation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

Removal and installation

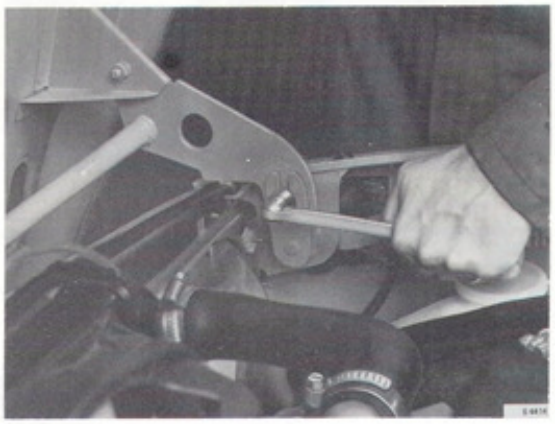
Removing the power unit

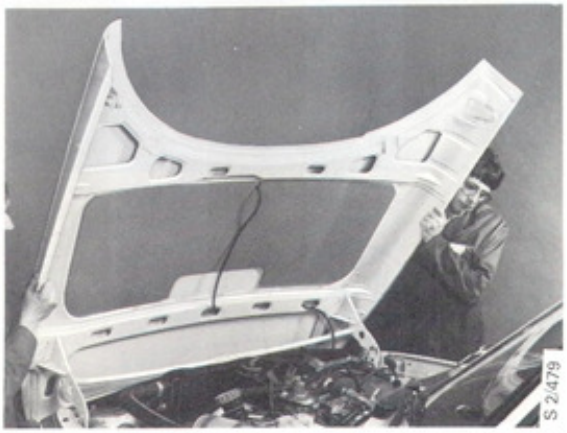
For major work on the engine and transmission, the entire power unit should be lifted out of the car. Removal of the engine by itself is not recommended.

1. Disconnect the positive battery lead.
2. Drain the coolant through the radiator drain cock and drain plug in the engine block.

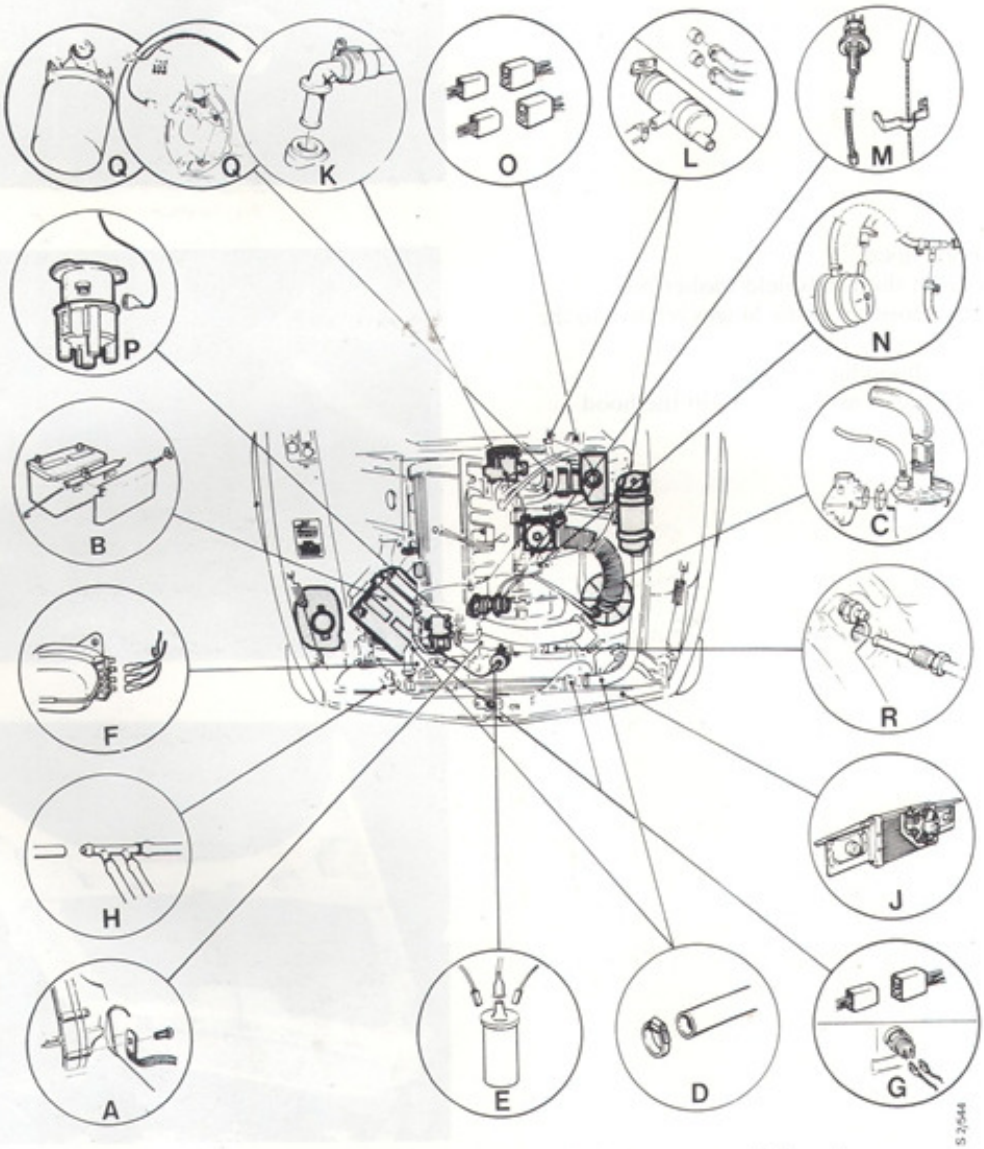


3. Remove the hood:
   - Disconnect the windshield washer hose
   - Mark the position of the hinges relative to the hood
   - Undo the hood hinge links
   - With the aid of assistant, lift off the hood.



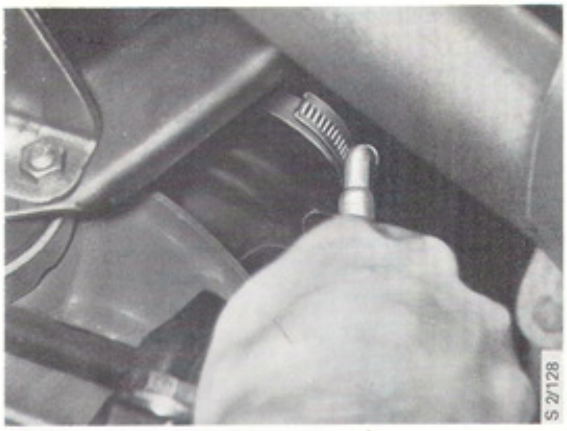


4. Disconnect and/or remove the following (see fig.)
   a. The earth strap.
   b. The battery and heat shield.
   c. The crankcase ventilation, air intake and air preheater hoses.
   d. The radiator hoses (disconnect at the thermostat housing and expansion tank.)
   e. The ignition coil leads.
   f. The headlight wiper motor cables.
   g. The cables to the thermostatic switch, fan and headlights.
   h. The washer hoses.
   i. The front panel complete with radiator.
   j. The brake servo hose.
   k. The hoses to the expansion tank and heater valve.
   l. The throttle and choke cables.
   m. The fuel lines (to fuel pump and carburetor.)
   n. The two plug connectors for the cable harnesses in the engine compartment.
   o. The distributor leads.
   p. The electrical connections at the alternator and oil pressure switch.
   q. The hydraulic line for the clutch.

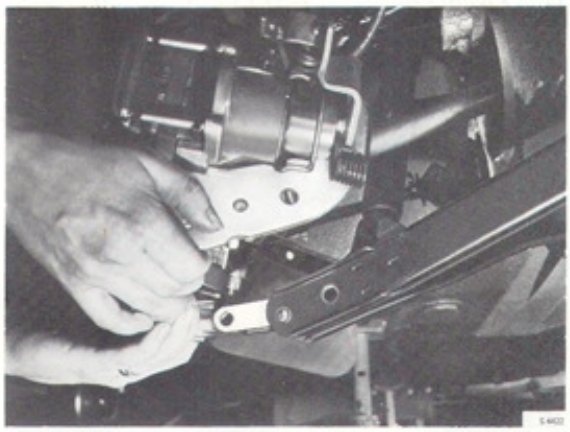


Components to be disconnected/removed prior to removal of engine.

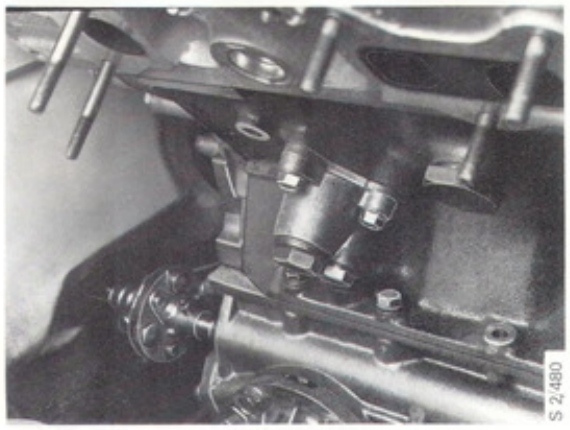
5. Undo the clips and remove the bellows from the inner drivers.



6. Remove the lower end piece from the control arm on the right-hand side of the car. Pull out the steering knuckle assembly and support the end piece against the control arm outer end.

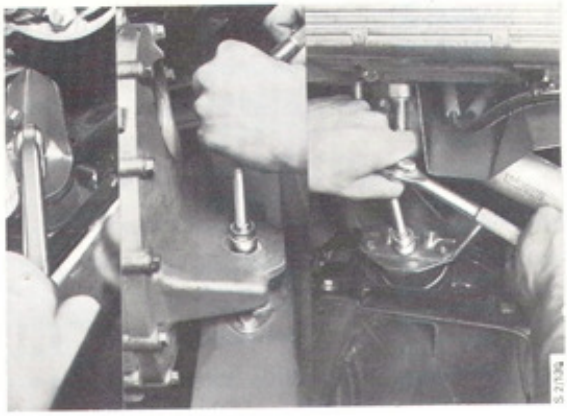


7. Put the gear lever in neutral. Remove the nut and tap out the taper pin in the gear shift rod joint. Separate the joint from the gear shift rod.

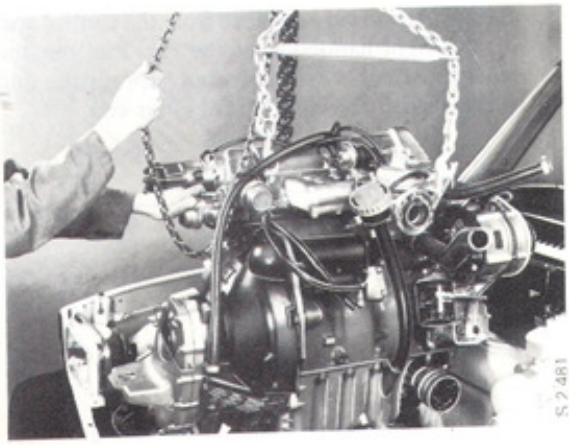


8. Disconnect the speedometer cable from the transmission.
9. Unbolt the exhaust pipe from the exhaust manifold.

10. Remove the nuts from the engine mountings.

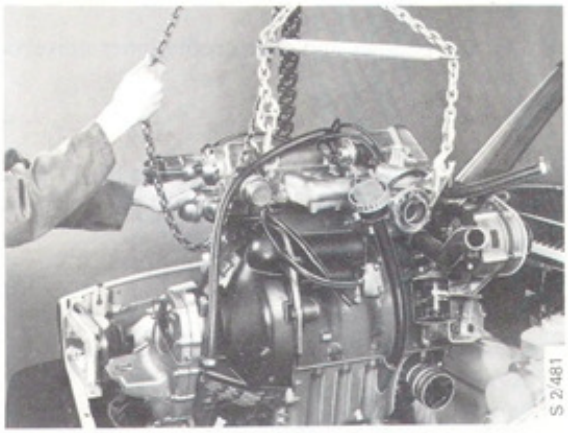


11. Attach lifting gear to the two lugs on the engine and slightly raise the unit. Move the power unit to one side and free the two universal joints. Lift the power unit out of the car.



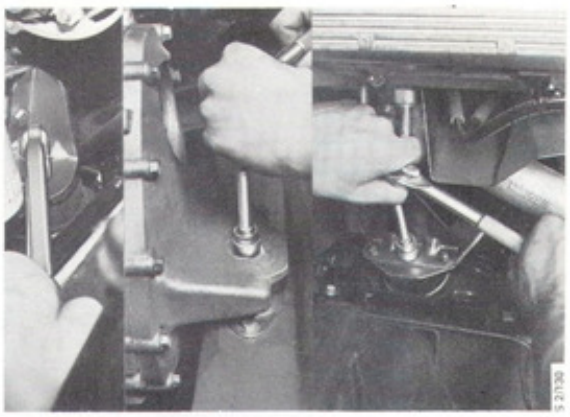
Fitting the power unit

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.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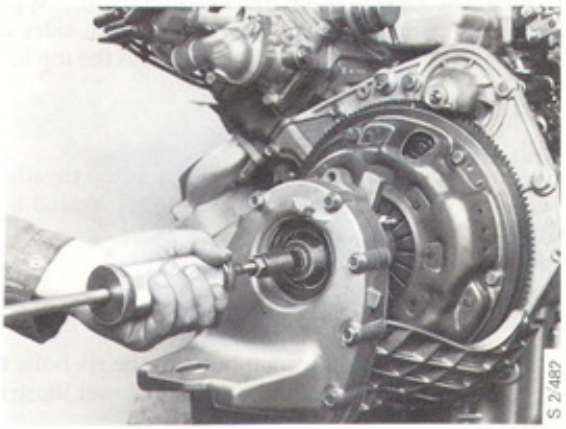
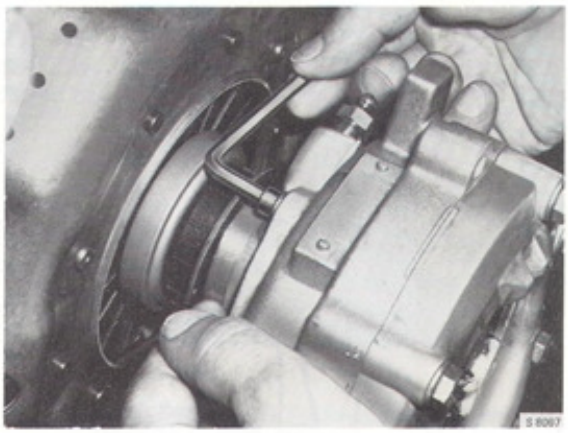
Separating engine from manual transmission

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

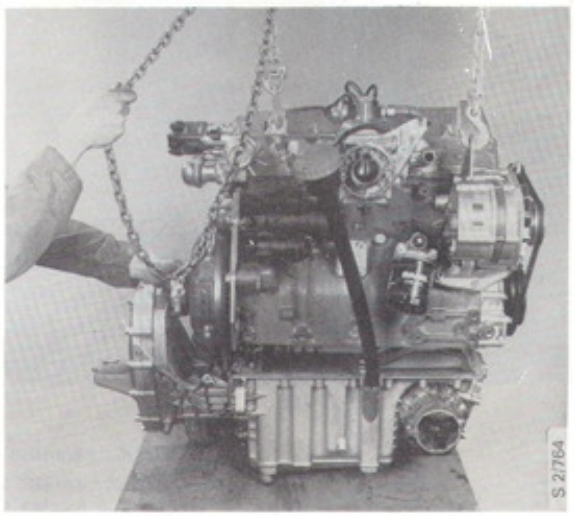

S 2482

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



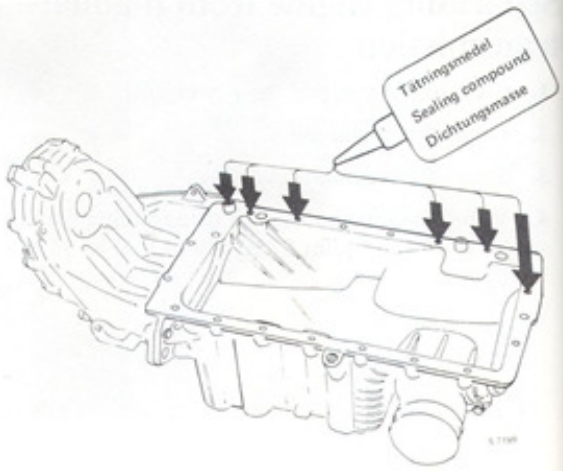
6. Undo all bolts in the mating flanges of engine and transmission.
7. Lift the engine carefully off the transmission (see illustration.) At the same time remove the release bearing guide sleeve.

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.


S 2764

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 (/45/ 3021243) to both sides of the gasket as indicated by the arrows in the top half of the adjacent picture.



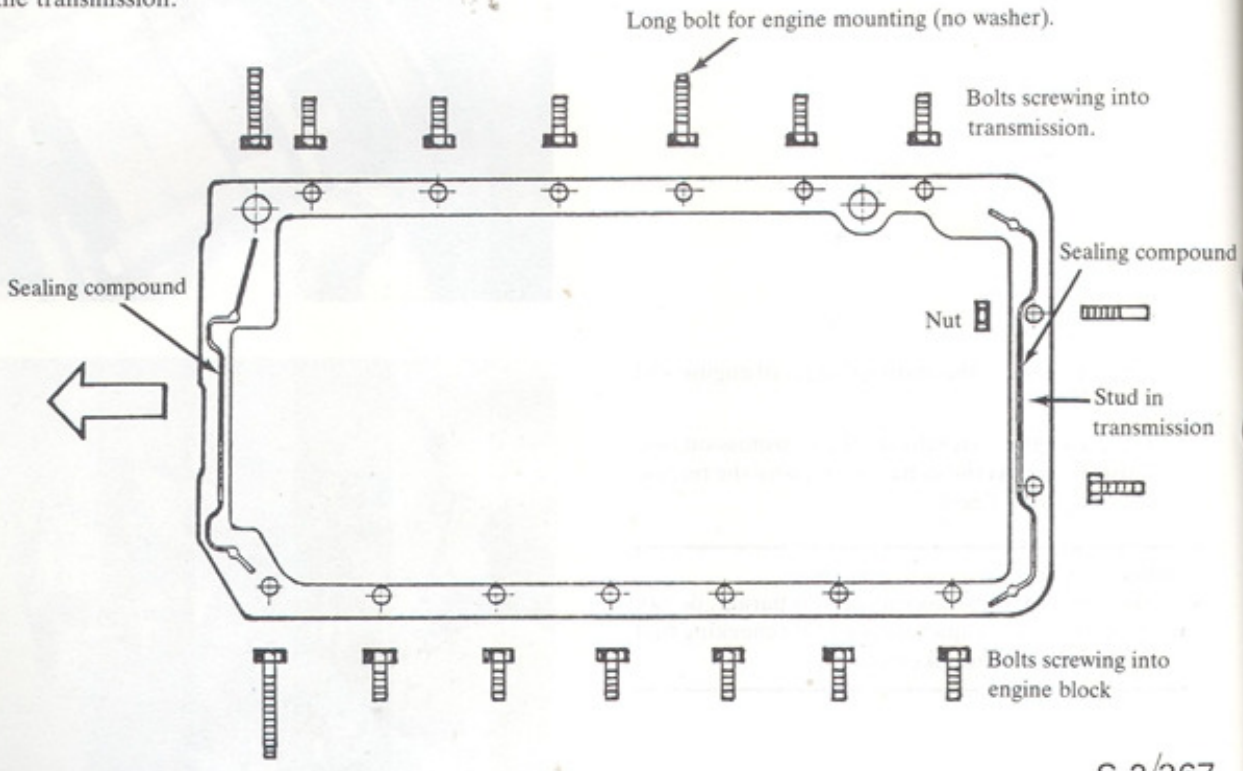
N.B.
The engine and transmission must be fitted together within 15 minutes, before the sealing compound has dried.

N.B.
Metal gaskets cannot be reused.

- Apply thread sealing compound to the six bolts to be fitted in the holes indicated in the lower illustration.

Refit in the reverse order.

N.B.
The guide sleeve and release bearing must be held in place against the clutch as the engine is lowered onto the transmission.



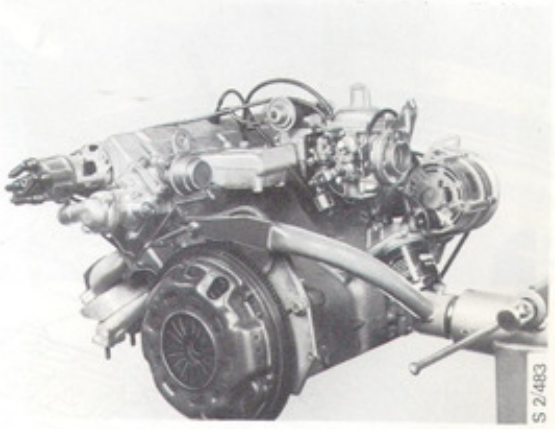
S 2/367

Standard tightening torque for bolts in the flanges between the engine and transmission:
25 Nm ± 3 Nm (2.5 ± 0.3 kgfm)

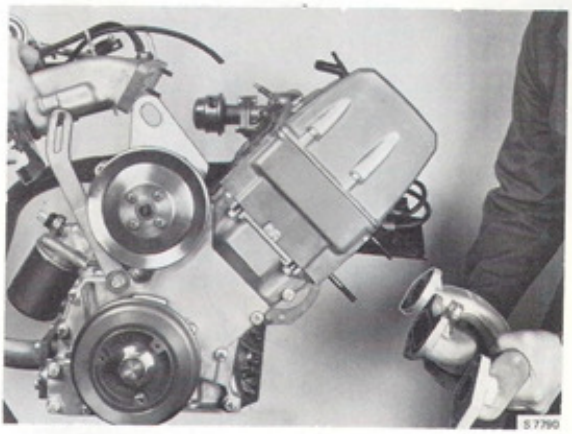
Engine body

To dismantle

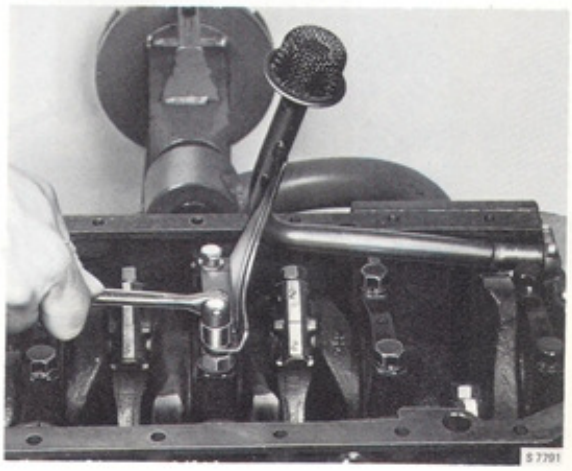
1. Remove the engine mountings and the oil filter and mount the engine in a work stand.
   Holder 83 92 169
   4 M8 x 30 mm bolts
   1 M8 x 40 mm bolt

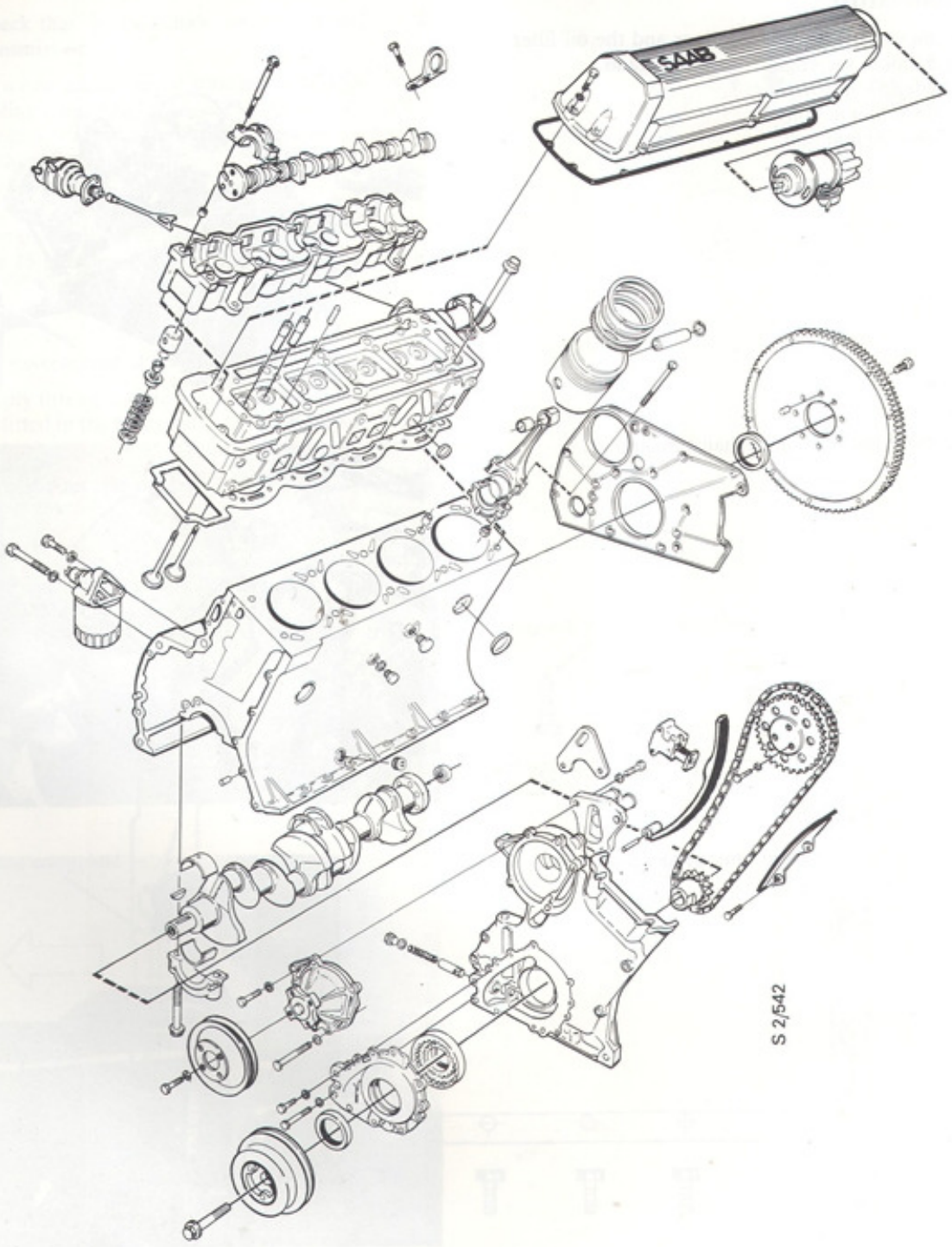


2. Remove the inlet and exhaust manifolds.



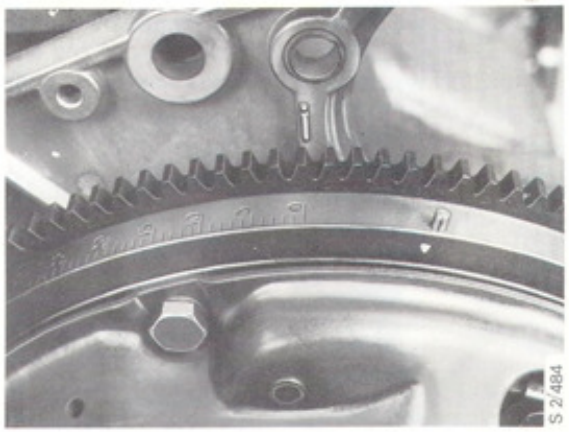
3. Remove the oil pump filter intake pipe.



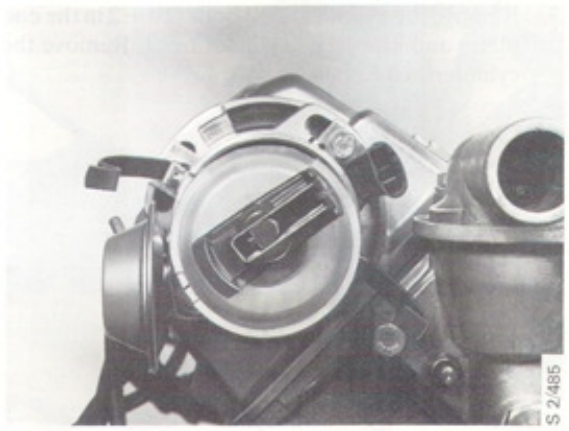


Engine, explosed view

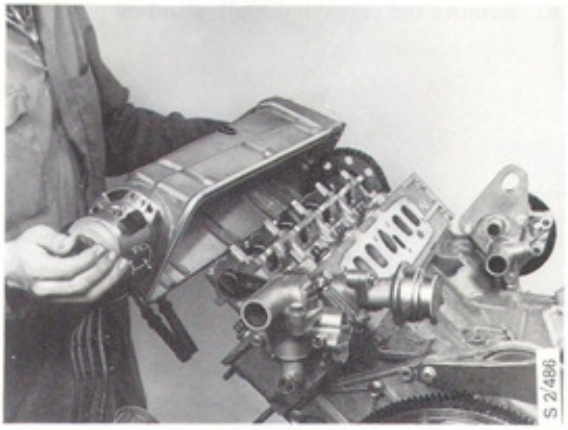
4. Rotate the crankshaft to the firing position for No. 1 cylinder.
   - The "O" mark on the flywheel should line up with the line on the rear engine plate.


S 2484

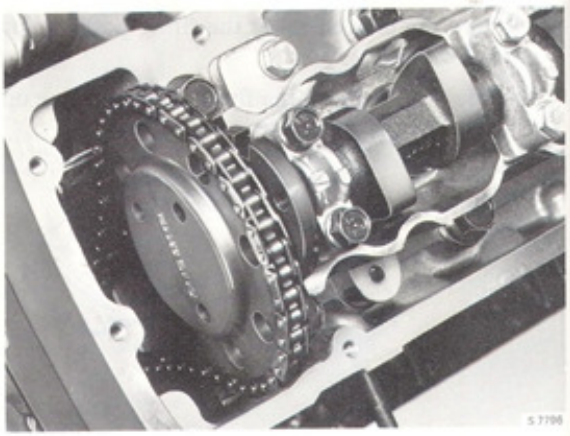
   - The mark on the rotor should line up with the slot in the distributor housing.


S 2485

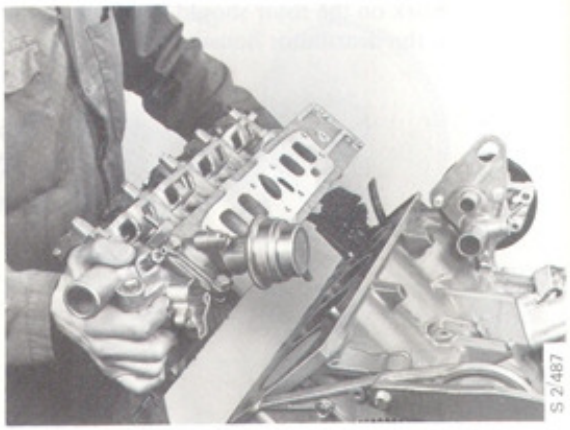
5. Remove the valve cover.


S 2486

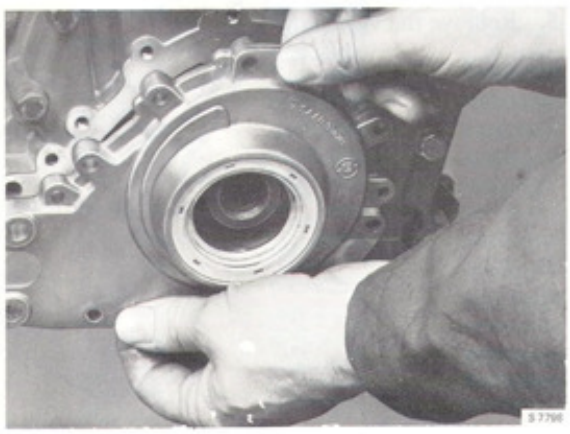
6. Remove the sprocket from the camshaft. Stretch the chain by moving the sprocket one cog and then off rest the sprocket between the pivoting guide and the chain guide.



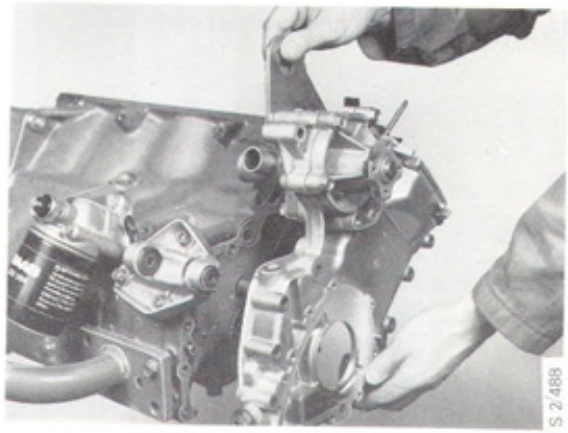
7. Remove the cylinder head bolts (10 + 2 in the end plate) and lift off the cylinder head. Remove the cylinder head gasket.



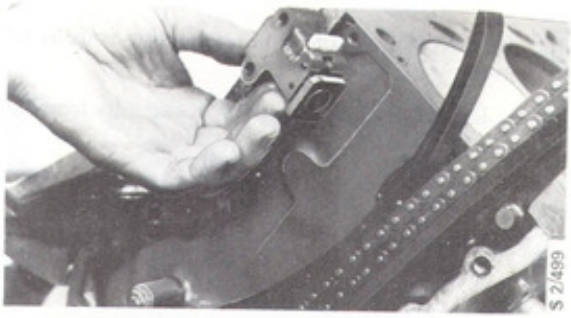
8. Remove the crankshaft pulley and oil pump.



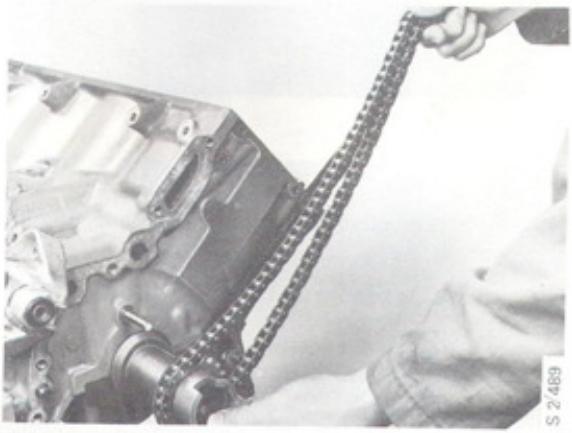
9. Remove the pulley and the water pump.
10. Remove the timing cover.


S 2488

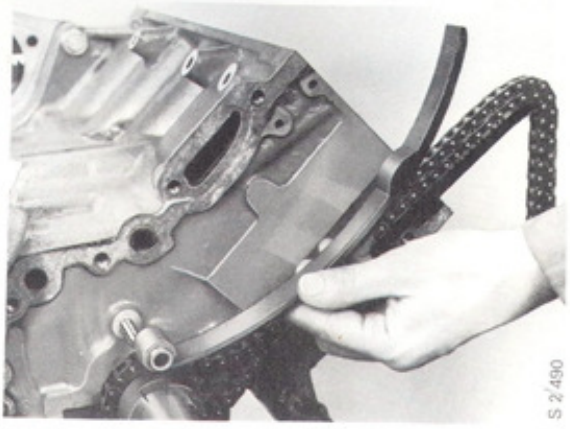
11. Remove the chain tensioner.


S 2499

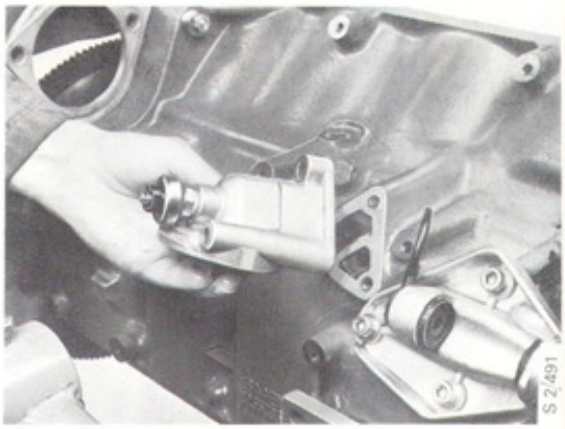
12. Remove the pivoting guide.


S 2489

13. Remove the timing chain and sprocket.

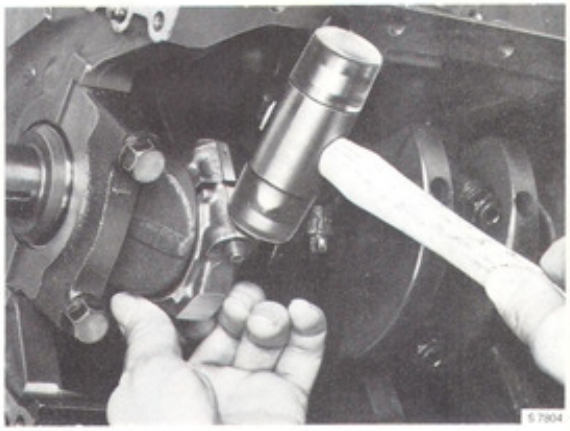

S 2490

14. Remove the oil filter adapter casting.

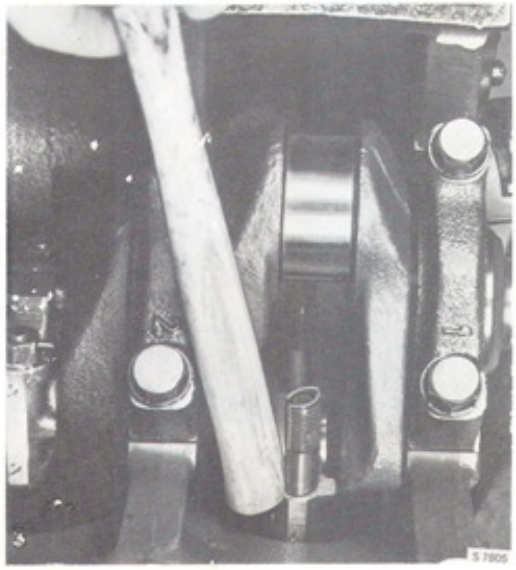


15. Remove the pistons and connecting rods as follows:

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



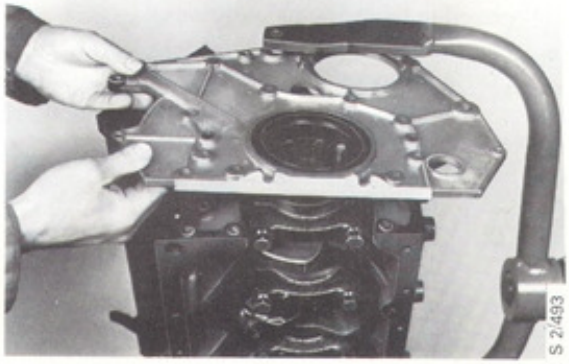
- Fit protective sleeves to the connecting rod studs.
- Push the pistons and connecting rods out of the cylinders.



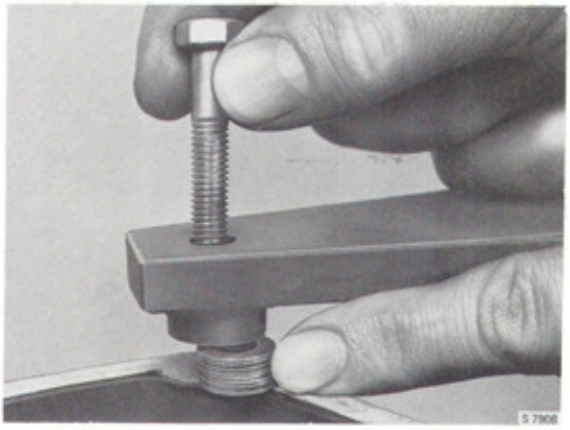
Note
The marks on the pistons and connecting rods. Keep the bearing shells so that they can be refitted in their original positions.

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

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

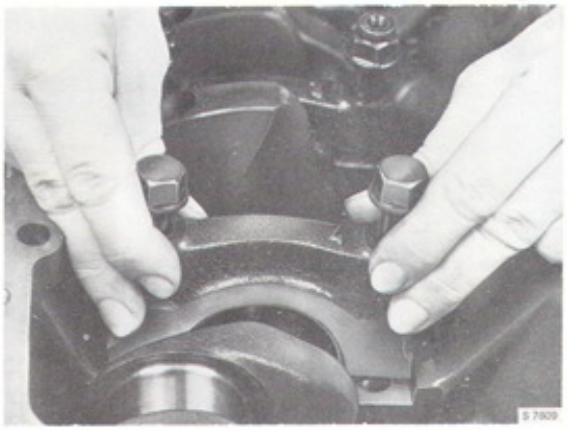


Fill the space between the engine block and engine holder with washers and refit the bolt.



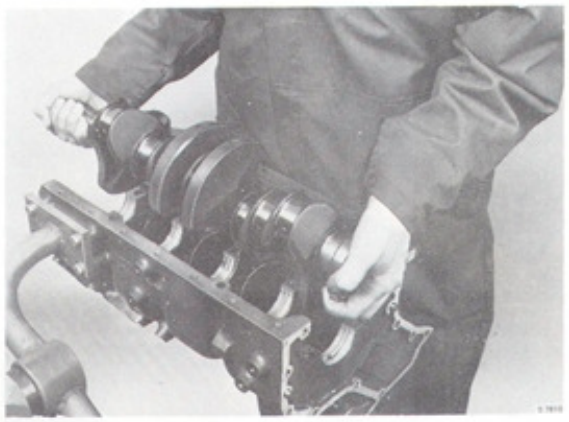
18. Remove the main bearing retaining bolts and the main bearing caps.

Note the markings



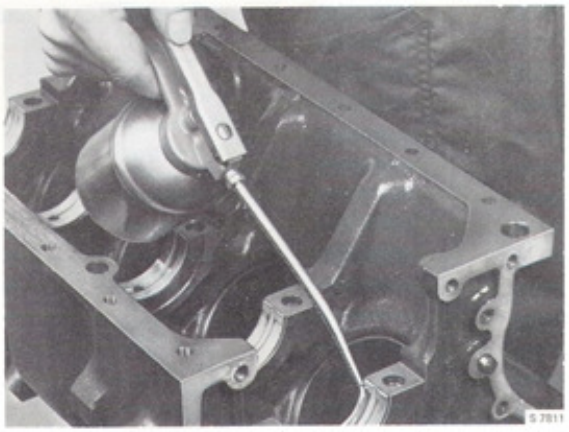
19. Lift out the crankshaft. Keep the bearing shells and the thrust washers so that they can be replaced in their original positions.

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.

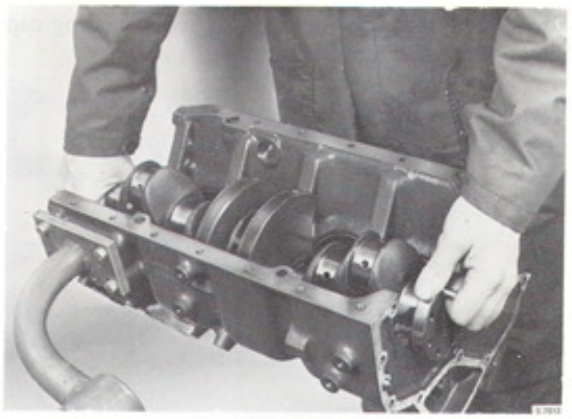


To assemble

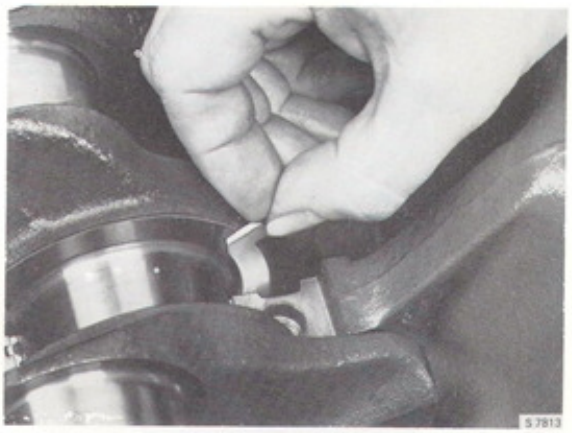
1. Place the shells in the top half of the bearings and coat them with engine oil.

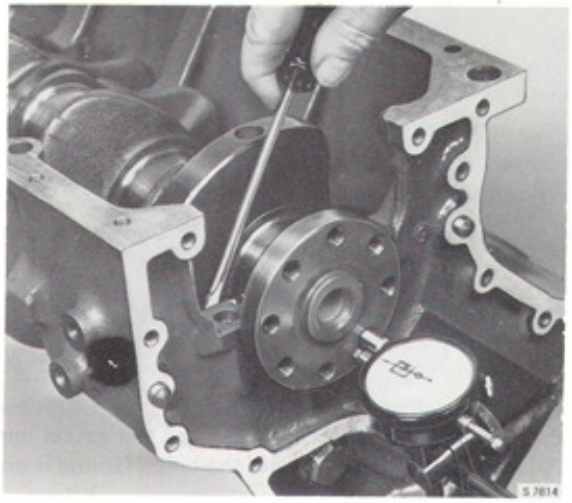


2. Carefully place the place the crankshaft in position.



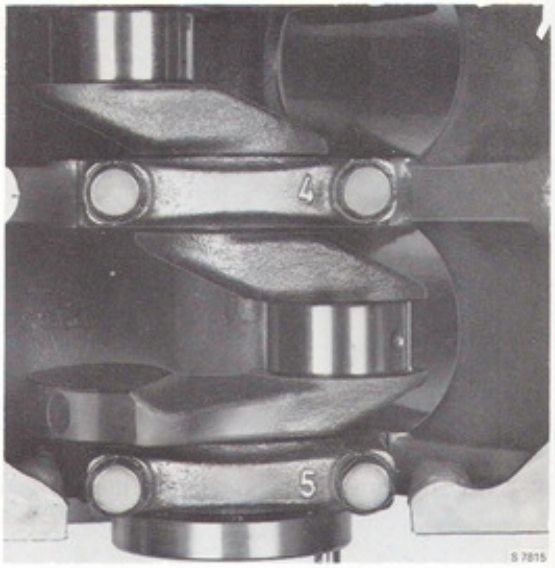
3. Install the thrust washers and check the end float.

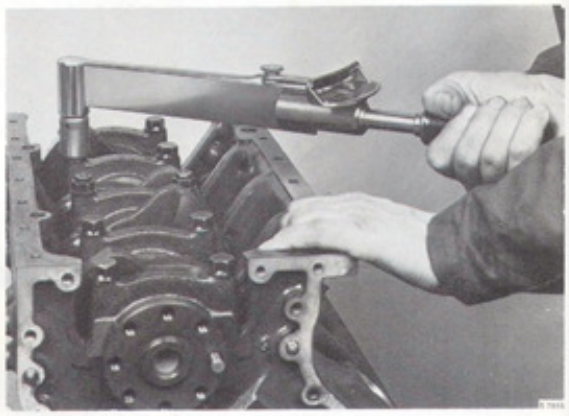




4. Oil the bearing shells in the main bearing caps and refit. (Note the markings.)

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

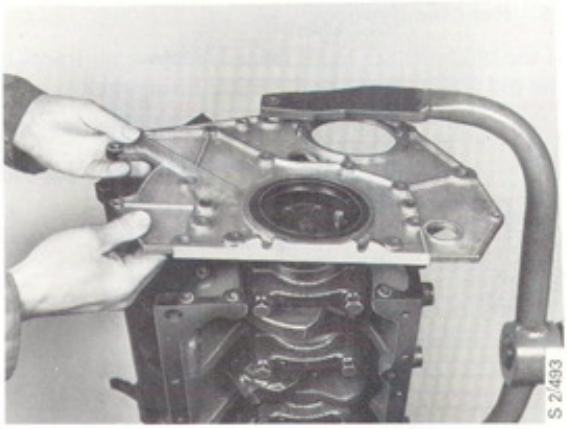




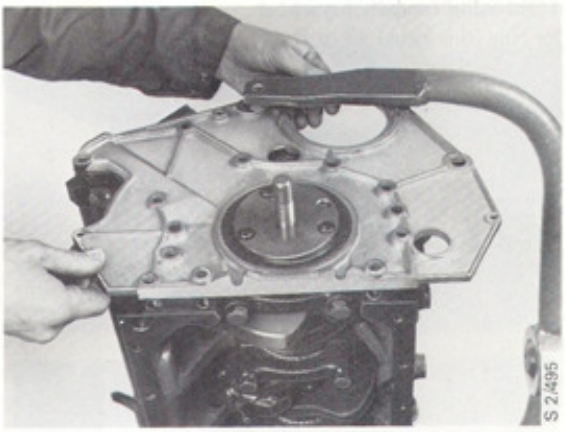
5. Refit the rear engine plate as follows:
   - Rotate the engine so that the flywheel end is uppermost and remove the engine holder bolt.
   - Apply dabs of grease to the mating surfaces on the engine block (to keep the gasket in place during assembly) and fit a new gasket.

N.B.
Do not use adhesives, as these are likely to melt when the engine is hot, thereby disturbing the gasket and reducing the torque setting of the bolts. Grease is not affected in this way.

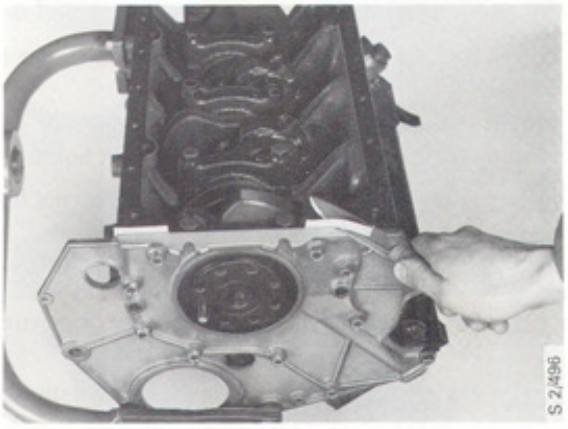
- Place the guide ring for tool 83 92 540 on the flywheel flange and refit the rear engine plate and bolts.



- Replace the engine holder bolt.



- Trim off excess gasket material from the mating surface with the transmission casing.

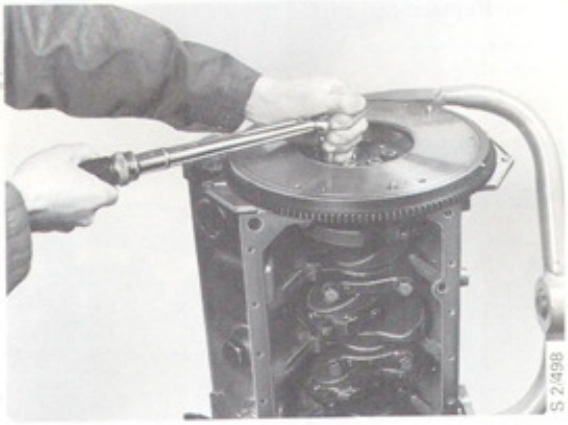


6. Refit the flywheel

If the old bolts are to be reused, remove all traces of the old sealing compound before fitting them.

- Apply sealing compound to the bolt threads.
- Alternatively, fit new bolts precoated with sealing compound.

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

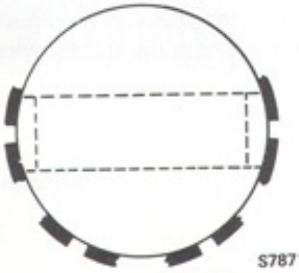


7. Refit the pistons and connecting rods as follows:

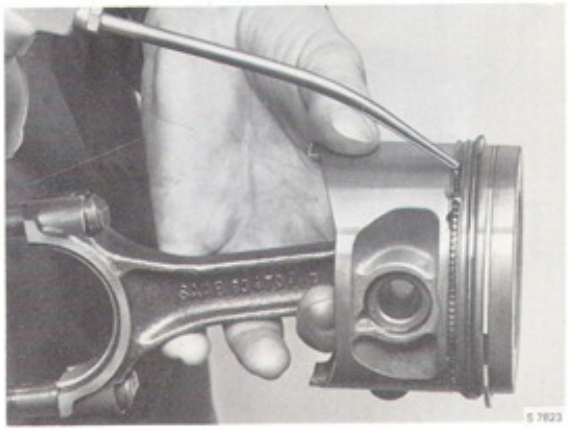
- Position the piston ring openings as shown in the illustration.

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

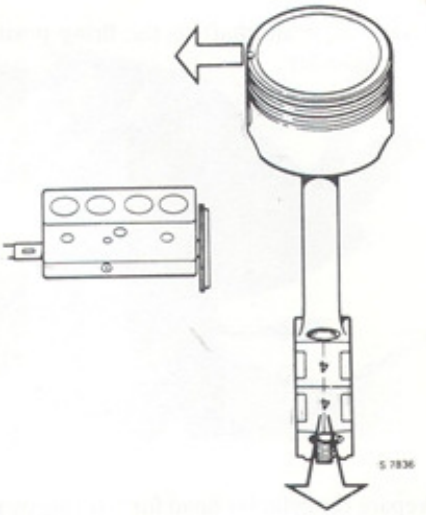
Rotate the oil scraper ring so that the gaps do not line up.



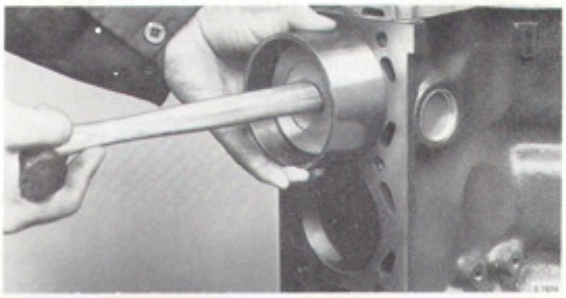
- Put the bearing shells in place in the connecting rod and cap.
- Place protective sleeves on the big-end studs to protect them during installation.
- Lubricate the piston rings and bearings.



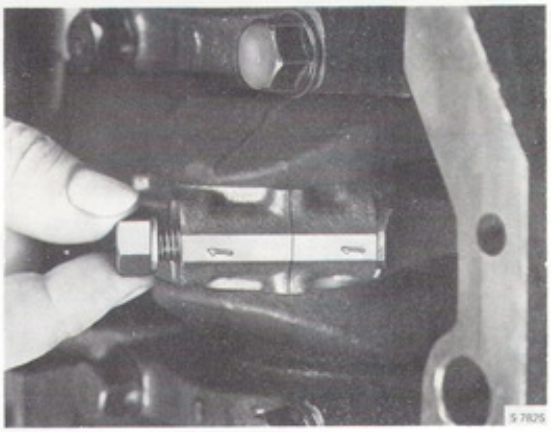
– Refit the big-end bearing caps.
The identification number the top of the piston should face the timing chain end of the engine.
The marks on the connecting rods should face the cap.



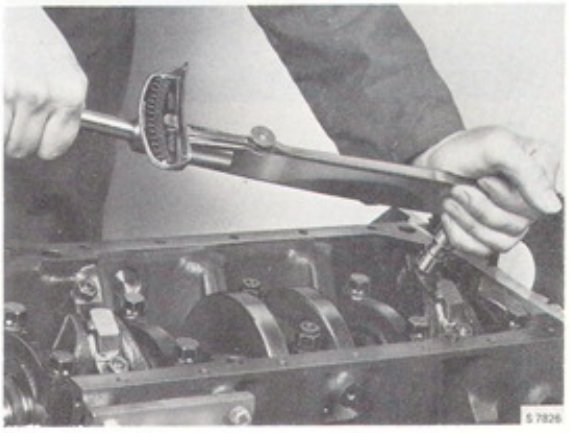
– Fit the piston with the aid of tool 78 62 287



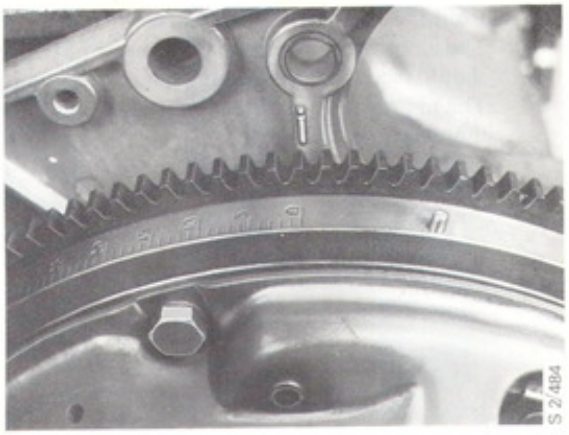
– Refit the big-end bearing caps.
The identification number the top of the piston should face the timing chain end of the engine.
The marks on the connecting rods should face the cap.



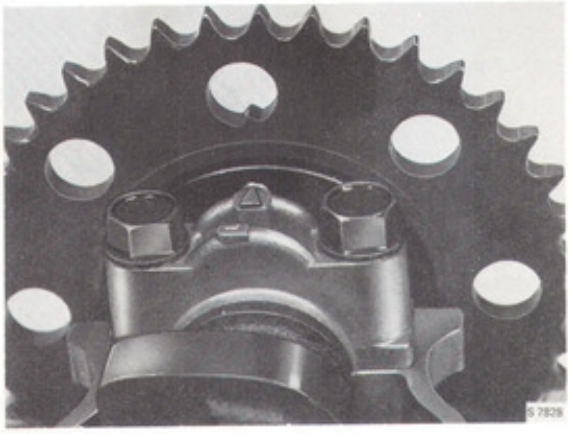
Tightening torque, Big-end bearings
54 Nm (5.5 kgm) 40 lb ft



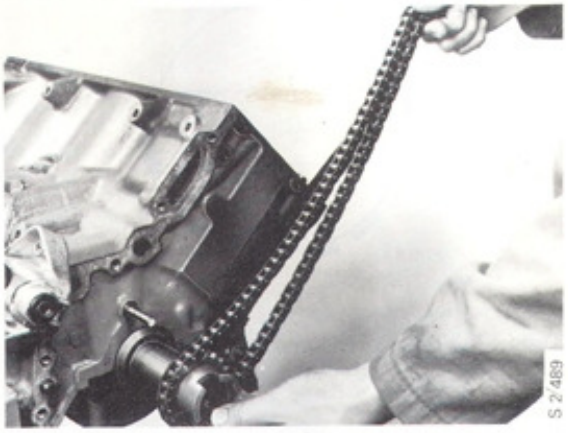
8. Rotate the crankshaft to the firing position for No. 1 cylinder.



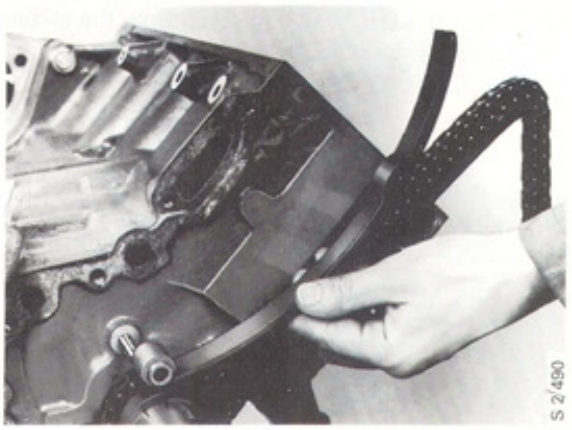
9. Prepare the cylinder head for refitting by rotating the camshaft to the firing position for No. 1 cylinder i.e. the mark on the camshaft sprocket should line up with the arrow on the bearing ap. (Camshaft sprocket temporarily installed.)



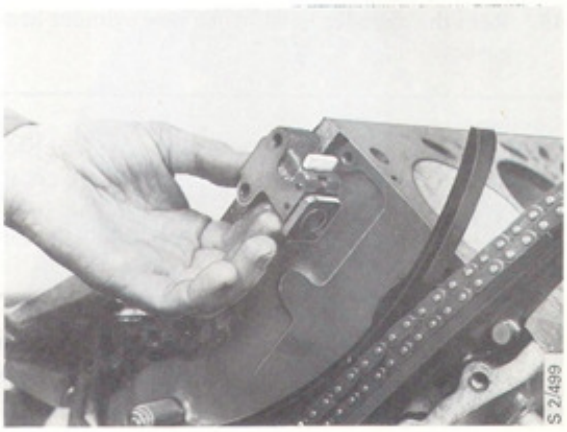
10. Fit the transmission chain and the sprocket.



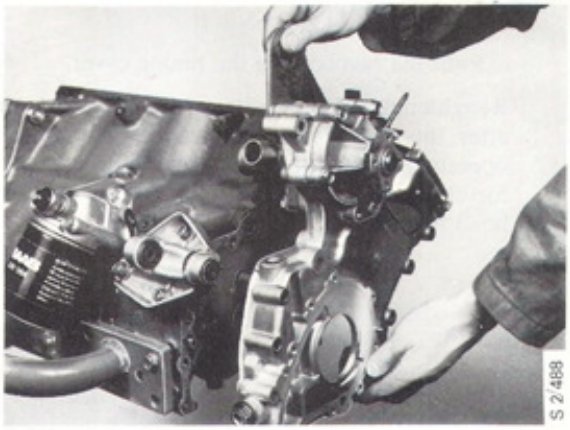
11. Fit the chain guide.



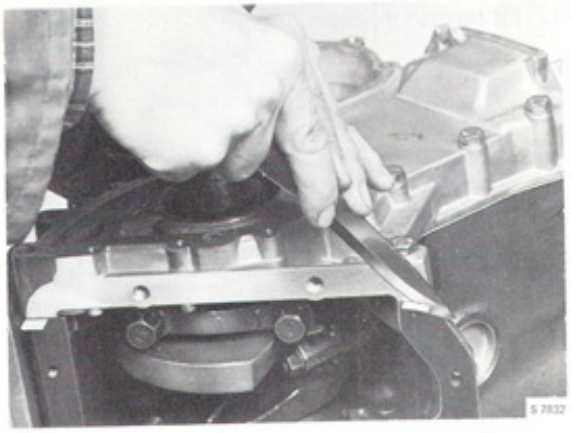
12. Refit the chain tensioner.



13. Refit the timing lover. Stretch the chain when the cover is fitted to prevent it being trapped. Apply sealing compound and place the gasket on the flange.

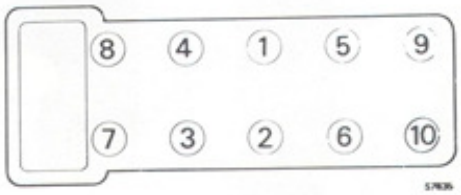


14. Trim off excess gasket material from the mating surface with the timing cover.



15. 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.

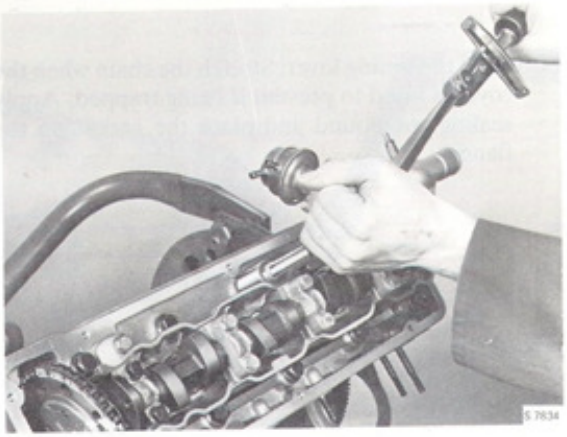


– Tighten the bolts to the correct torque in two stages. For tightening order see the illustration.

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

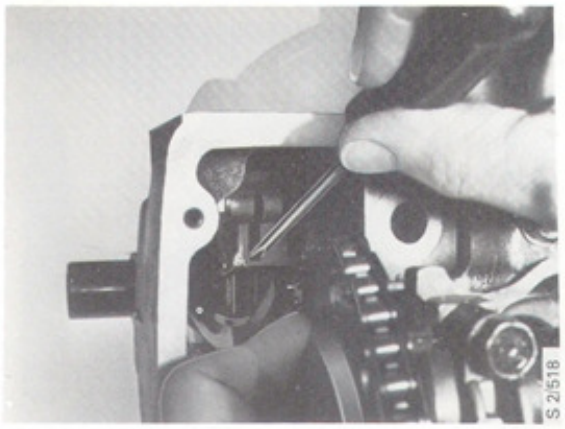
– Refit the two bolts in the timing cover.

Retightening of the bolts must be carried out after the engine has been run up to normal operating temperature and then allowed to cool for about 30 min. See "Retaining the cylinder head bolts".



16. Press down the outside of the ratchet tooth on the chain tensioner to render it inoperative. Depress the tensioning device by pressing on the pivoting guide.

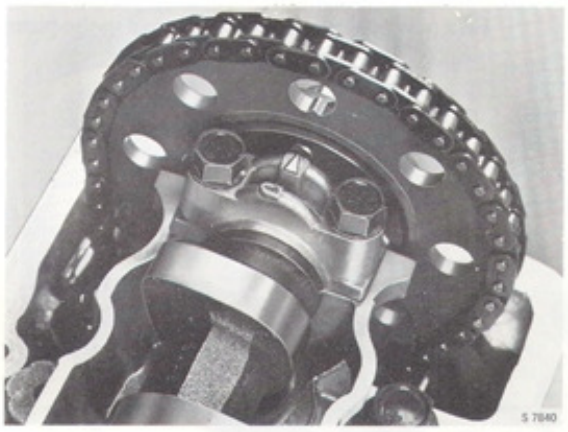
Hold the pivoting guide in this position and fit the sprocket onto the camshaft.



Change the position of the chain on the sprocket as necessary until the mark on the bearing cap, the bolt holes and the mark on the sprocket coincide.

(**N.B.** The crankshaft must be in the '0°' position.)

See "Adjustment of the chain tensioner".

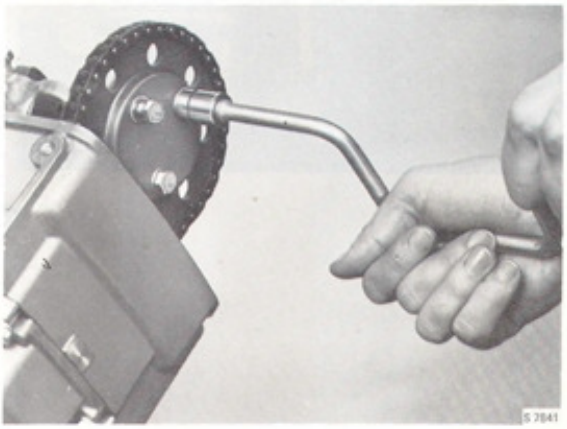


Adjusting the chain tensioner

If the position of the tensioning device prevents the sprocket from being fitted, proceed as follows:

Press down on the outside of the ratchet tooth on the chain tensioner to render it inoperative. Depress the tensioning device by pressing on the pivoting guide.

Caution
On no account attempt to release the ratchet by means of a screwdriver, as this is liable to damage the ratchet, causing it to malfunktion.

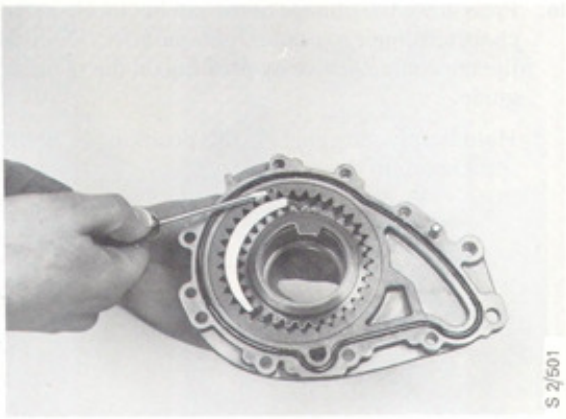


17. Refit the sprocket bolts with plain washers.

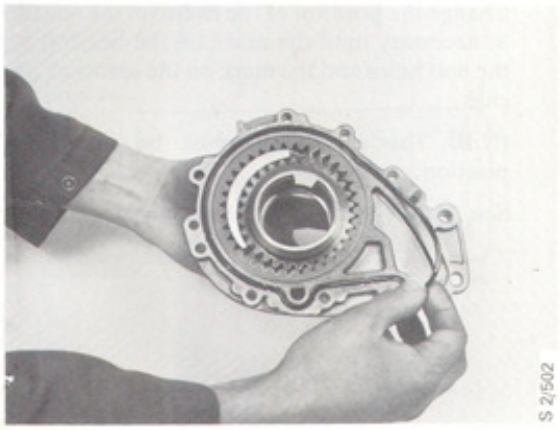
Caution
Washers must be fitted to prevent the bolts from butting against the camshaft bearing assembly.

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

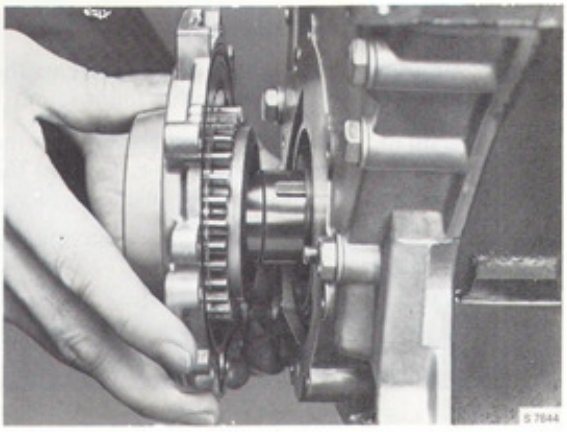
18. Refit the oil pump as follows:
- Refit the ring gear so that the mark is visible.



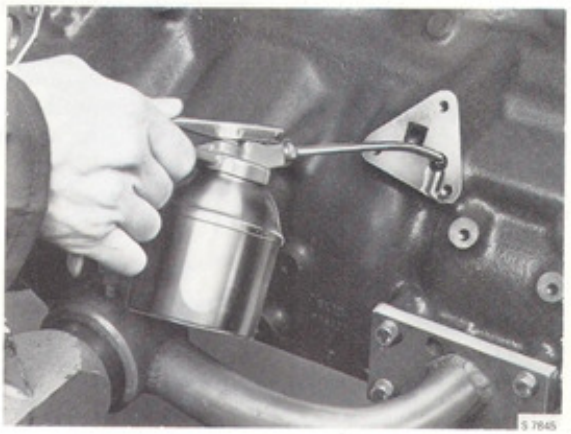
- Fit a new sealing ring in the groove in the pump body.



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



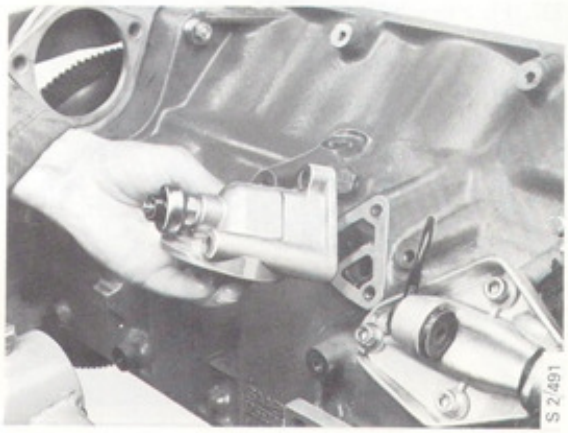
– Fill the oilway between the oil pump and the oil filter adapter with engine oil.



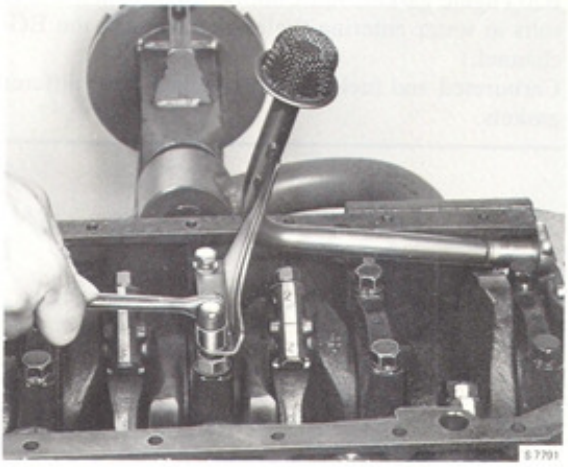
19. Refit the adapter casting for the oil filter with a new gasket.

20. Refit the pulley on the crankshaft.

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



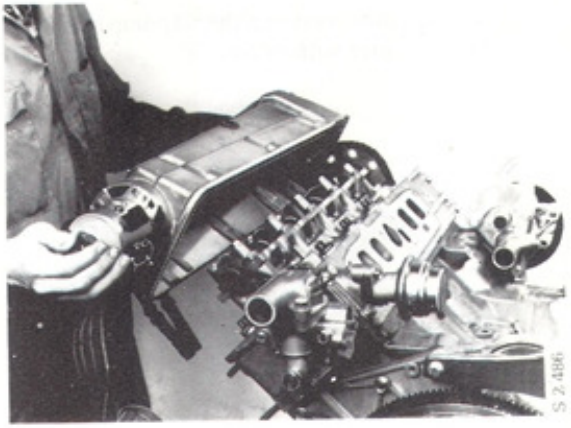
21. Refit the oil pump filter intake pipe with 0 ring.



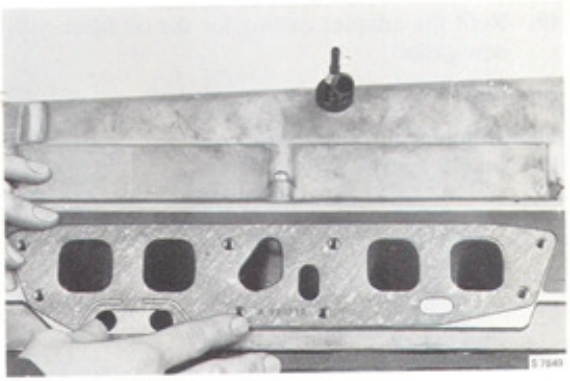
22. Fit the rubber sealing ring in the valve cover groove.

- 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.

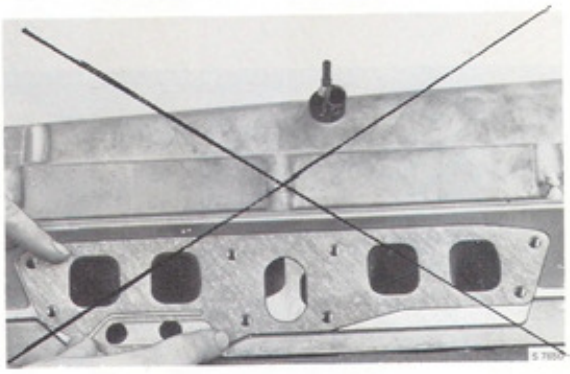
Tightening torque, Valve cover
4.9 Nm (0.5 kgm) 3.5 lb ft



23. Fit a new inlet manifold gasket.

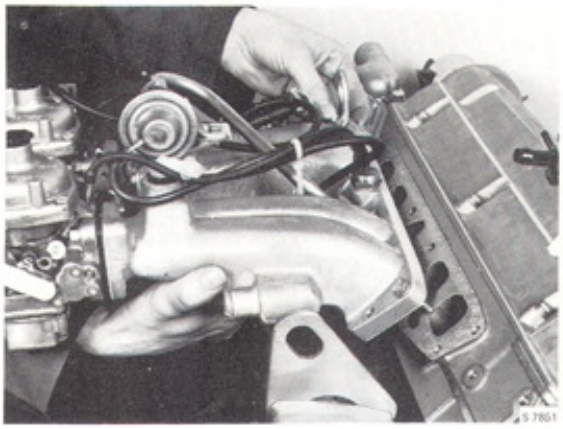


Caution
B20 engine gaskets must not be used. (Their use results in water entering the engine through the EGR channel.)
Carbureted and fuel injection engines have different gaskets.

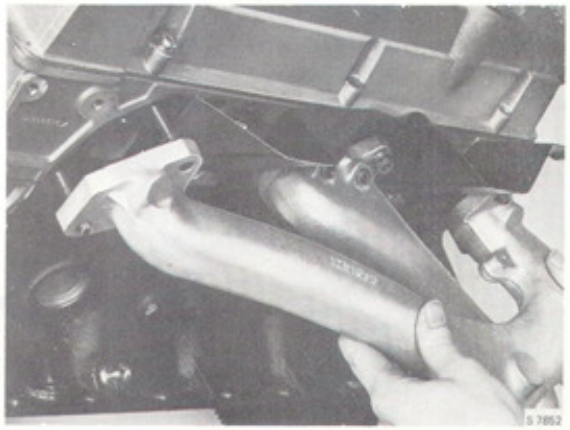


– Refit the inlet manifold and lifting lugs. (Fit plain washers between the inlet manifold and the lugs.)

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



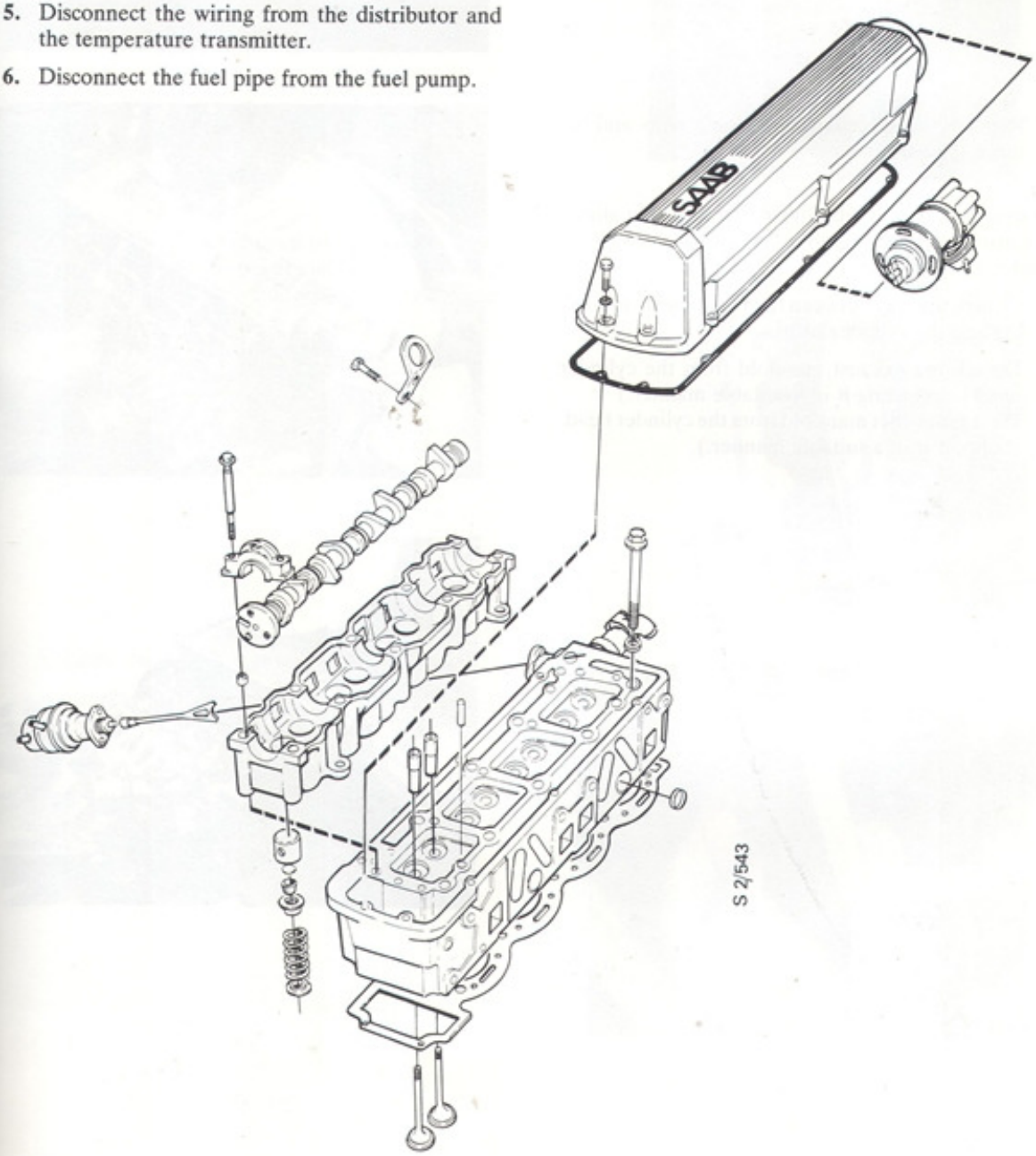
24. Refit the exhaust manifold and heat shield.
25. Suspend the engine by the lifting yoke and fit the engine mountings and a new oil filter.



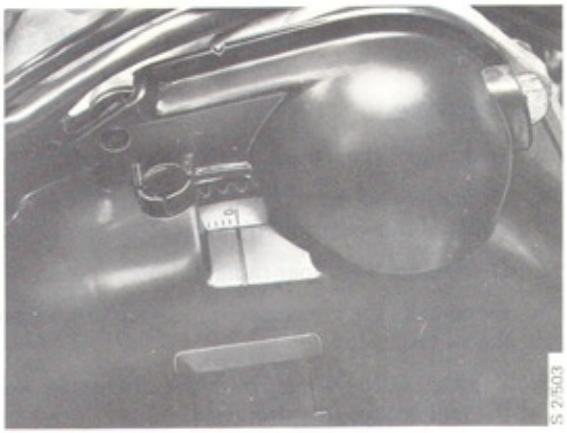
Cylinder head

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.

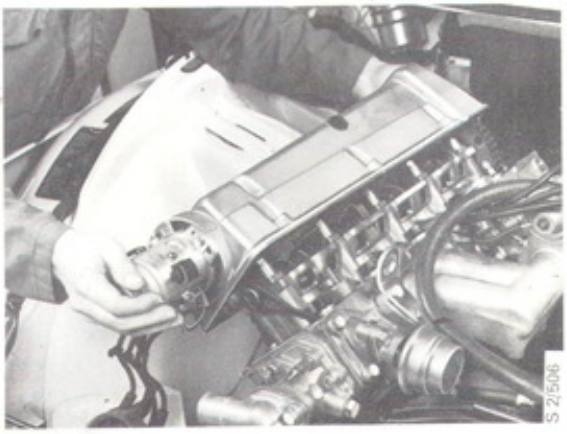


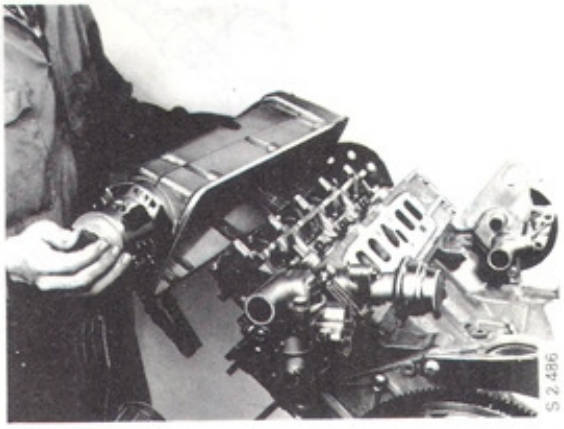
8. Remove the valve cover retaining bolts and remove the valve cover.

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. Wedge the handle of a suitable screwdriver between the pivoting guide and fixed guide for the timing chain.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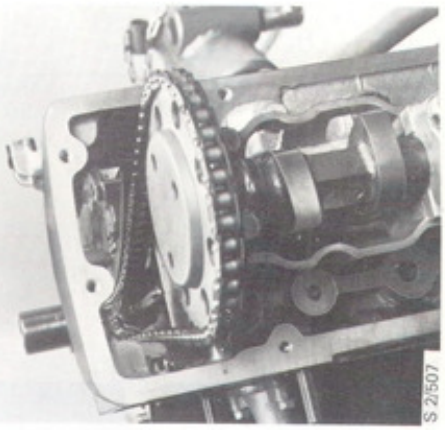
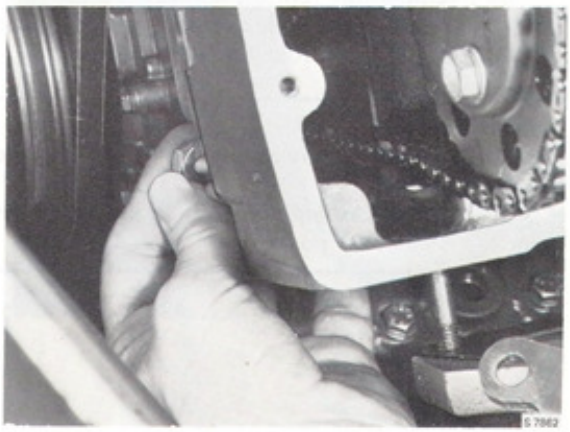
12. Remove the sprocket from the camshaft. Leave the chain on the sprocket and rest the sprocket between the pivoting guide and the fixed guide.


S 2/507

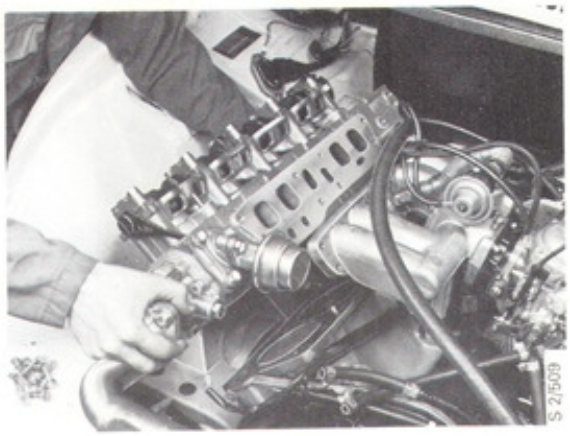
13. Remove the two bolts from the timing cover.


S 7962

14. 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.

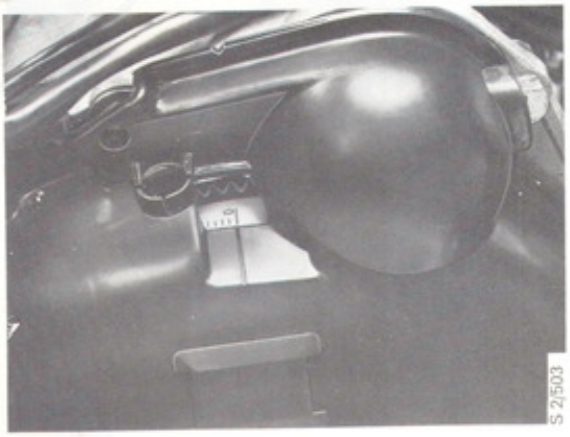
Check that the mating surfaces are flat.



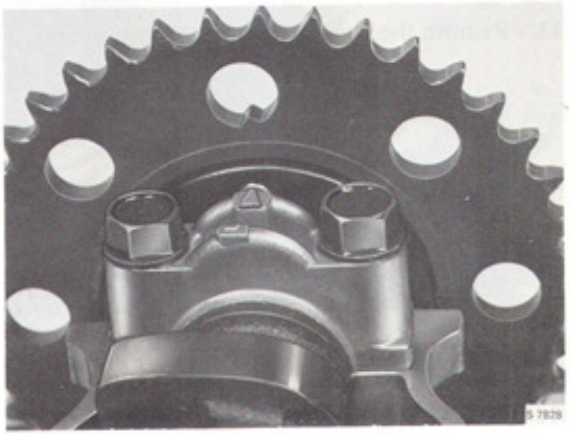
To refit

1. Place a new cylinder head gasket on the engine block.

2 a. Rotate the crankshaft to the "0" position.

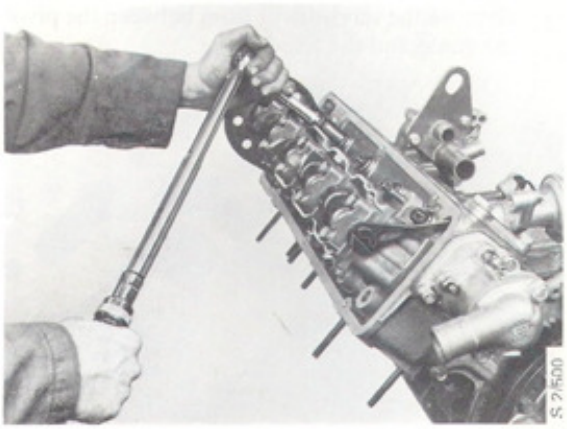


b. Temporarily refit the sprocket on the camshaft and rotate the camshaft to TDC on the combustion stroke for No. 1 cylinder.



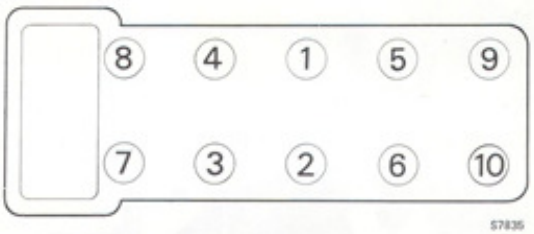
Caution
Do not move any of the shafts before refitting the timing chain.
A fully open valve can come into contact with the piston in the top dead centre position.

3. Position the chain on the camshaft sprocket and place the chain between the pivoting guide and the rigid guide.
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".



Caution
The Torx screws need normally no lubrication at the first refit. They can be used five times. At further use the screws must be coated with Molycote 1000.

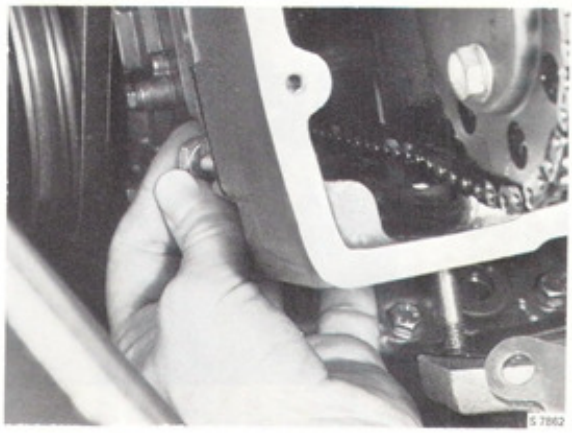
Refit the two bolts in the timing cover.

5. Fit the sprocket and the cam shaft. Change the position of the chain on the sprocket as necessary until the mark on the bearing cap, the bolt holes and the mark on the sprocket coincide.

(**N.B.** The crankshaft must be in the '0°' position.)

If the position of the tensioning device prevents the sprocket from being fitted, proceed as follows:

Press down on the outside of the ratchet tooth on the chain tensioner to render it inoperative. Depress the tensioning device by pressing on the pivoting guide.

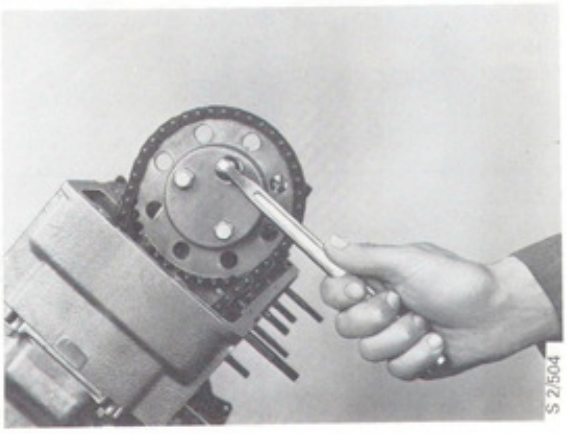


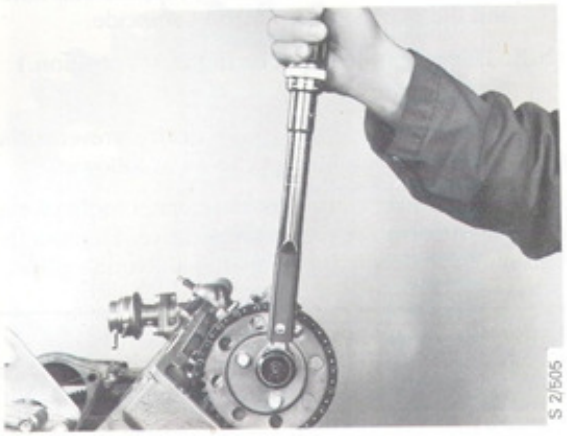
Caution
On no account attempt to release the ratchet by means of a screwdriver, as this is liable to damage the ratchet, causing it to malfunktion.

6. Remove the screwdriver from between the pivoting guide and the fixed guide.

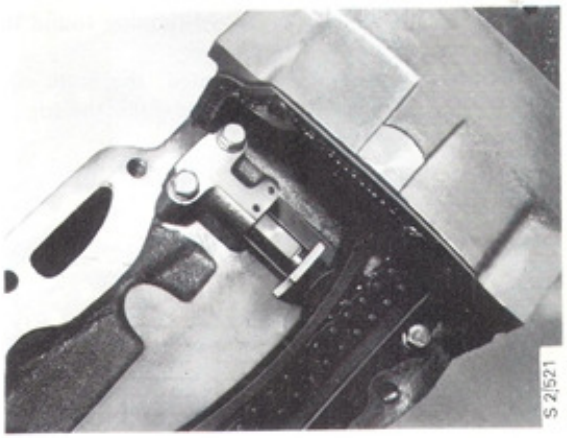

S 2/519

7. Fit the three sprocket bolts with plain washers.


S 2/504

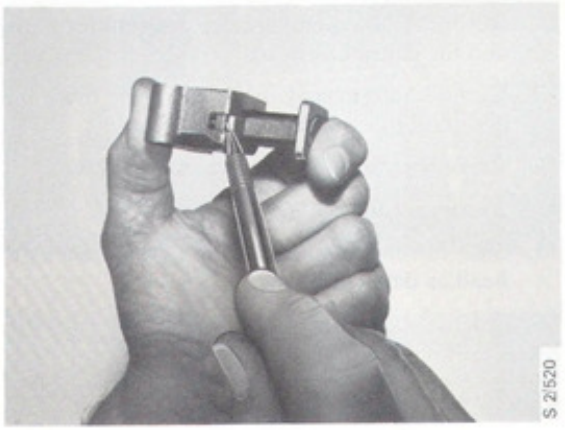

S 2/505

If the position of the tensioning device prevents the sprocket from being fitted, proceed as follows:



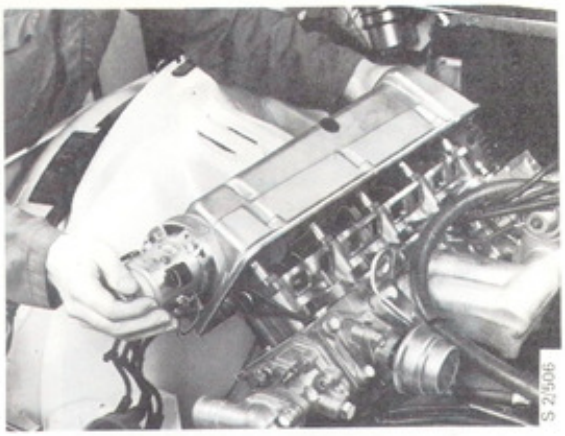
Press down on the outside of the ratchet tooth on the chain tensioner to render it inoperative. Depress the tensioning device by pressing on the pivoting guide.

Caution
On no account attempt to release the ratchet by means of a screwdriver, as this is liable to damage the ratchet, causing it to malfunktion.



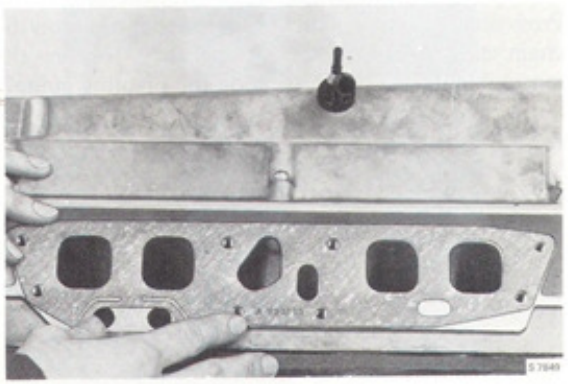
8. Insert the seal in the groove running round the valve cover and refit the cover.
(If the distributor is mounted, the rotor arm should be positioned to face the slot in the edge of the distributor housing.)

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

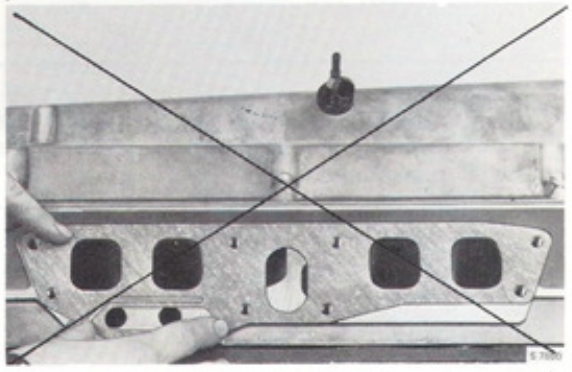


9. Refit the inlet manifold using a new gasket.

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.



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



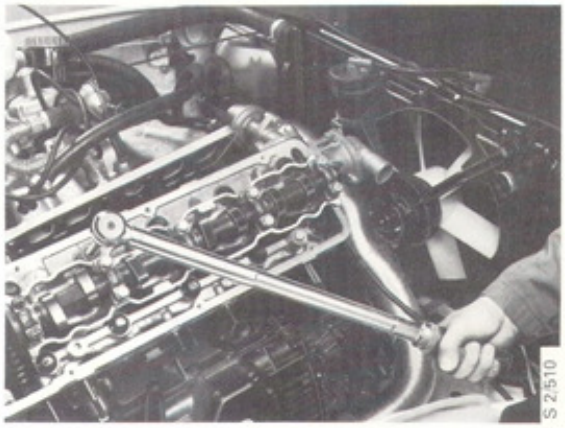
Retightening the cylinder head bolts

General

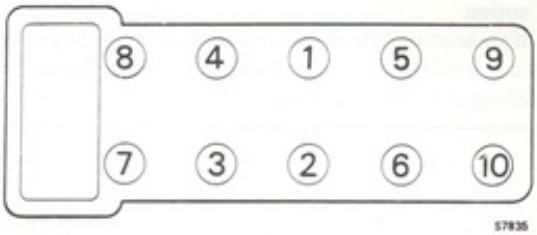
The cylinder head bolts should be retightened on the following occasions:

a. At the 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.



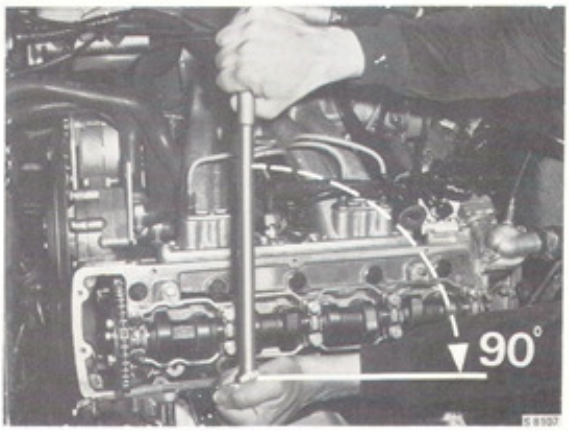
1. Slacken off each bolt slightly and then retighten to 90 Nm (9 kgm; 65 lb ft.) The tightening sequence is shown in the adjacent figure.



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

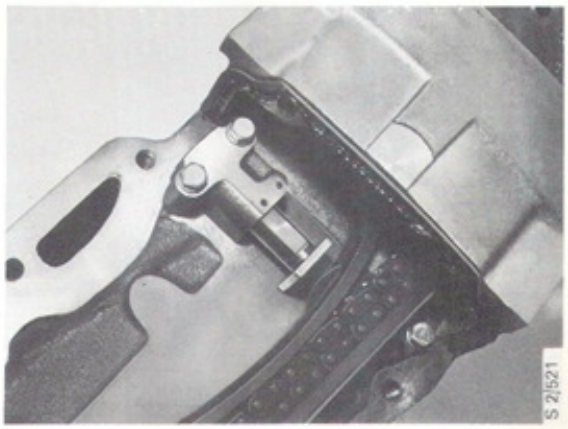
   Stage I: Tightening torque
   90 Nm (9 kgm) 65 lb ft.

   Stage II: Further tightening by
   a 90° (1/4) turn.

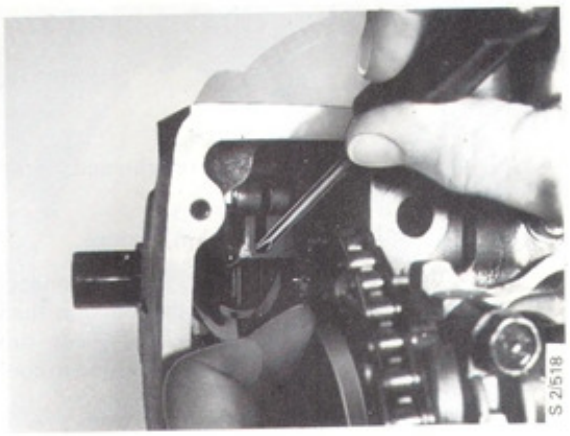


Adjusting the chain tensioner

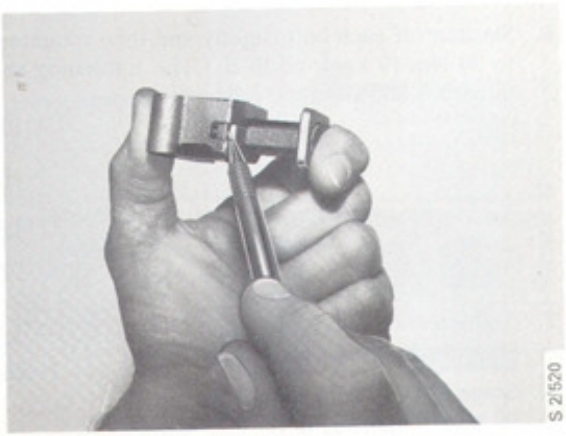
If the position of the tensioning device prevents the sprocket from being fitted, proceed as follows:



Press down on the outside of the ratchet tooth on the chain tensioner to render it inoperative. Depress the tensioning device by pressing on the pivoting guide.



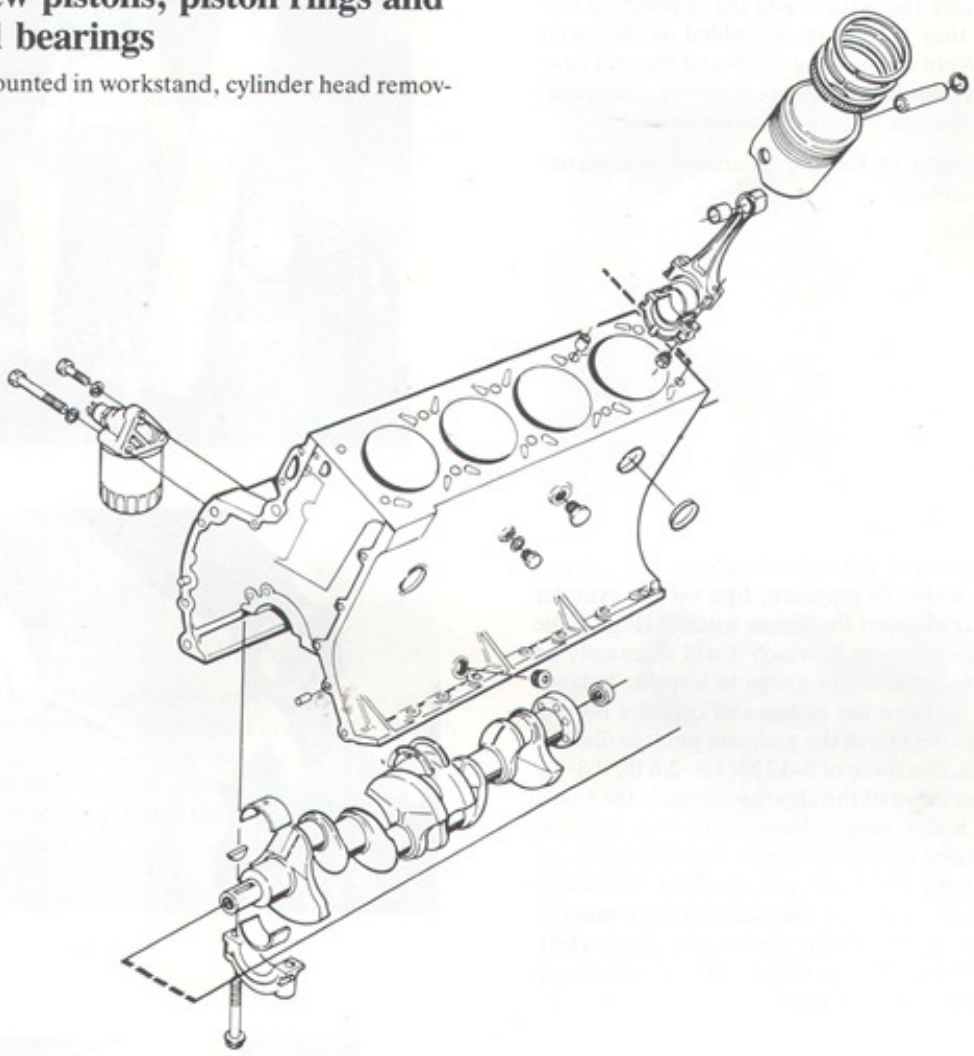
Caution
On no account attempt to release the ratchet by means of a screwdriver, as this is liable to damage the ratchet, causing it to malfunktion.



Pistons, connecting rods, and cylinder bores

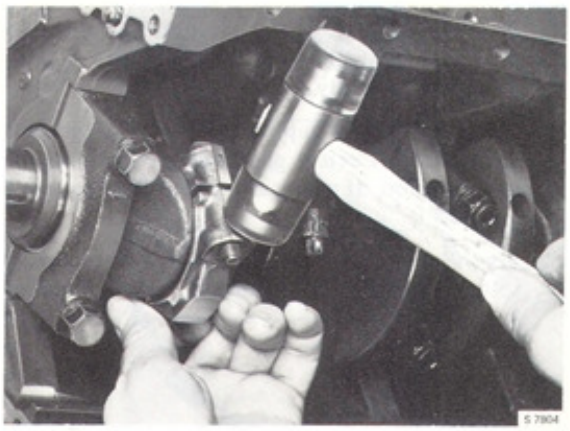
To renew pistons, piston rings and big-end bearings

(Engine mounted in workstand, cylinder head removed)



To remove

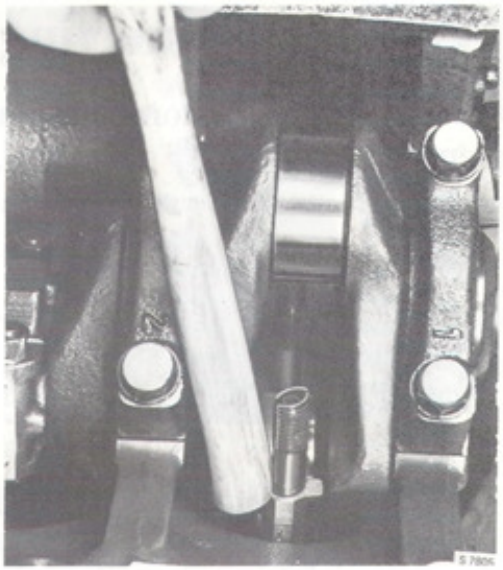
1. Remove any crusts and deposits of carbon from the top ends of the cylinders.
2. Remove the big-end bearing caps.



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

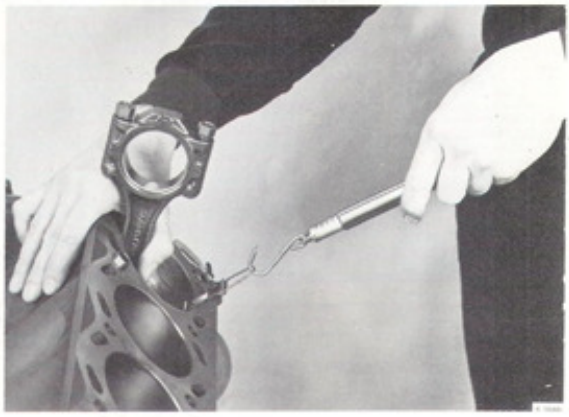
   Note. Mark the pistons and the connecting rods so that they can be re-assembled as they were found. Refit the bearing shells and big-end bearing caps loosely onto their respective connecting rods so that the parts are not confused.

For measurement of bearing clearance, see section Crank mechanism.



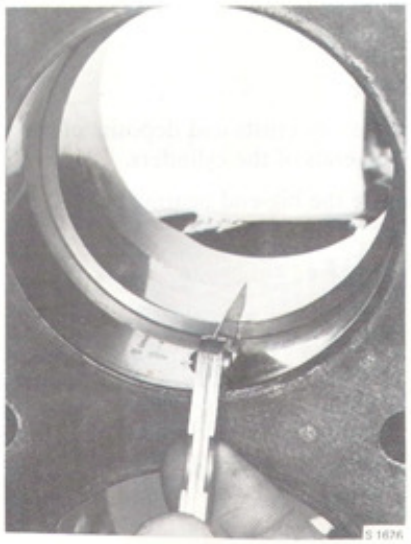
Fitting the pistons

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.

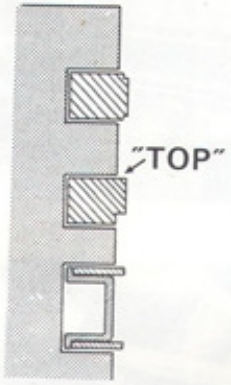


Fitting piston rings in worn cylinder

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

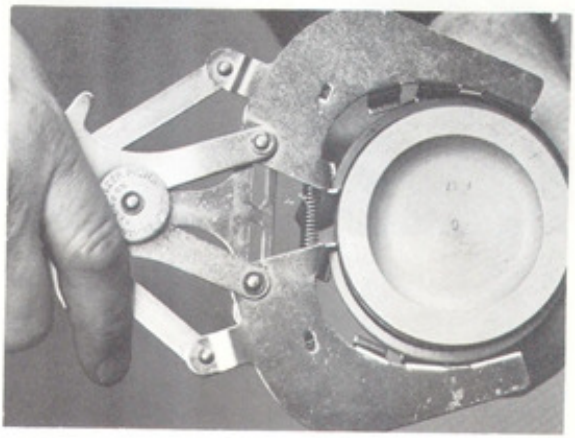
Use the piston ring tool to fit the rings as illustrated. The lower compression ring should be fitted with the side marked "top" uppermost.

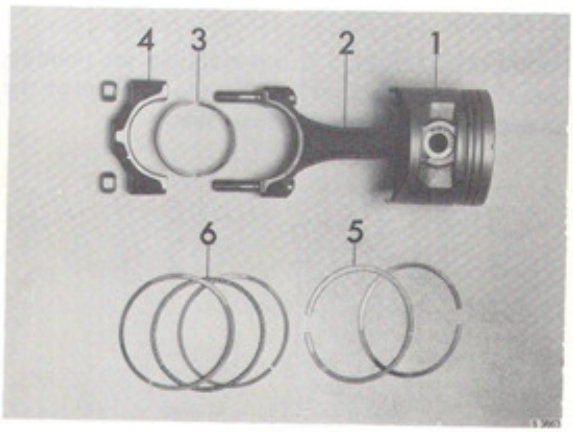


Oil the piston and rings before assembly. Position the compression rings so that the gaps are at 180° to each other, each positioned above one of the gudgeon pin holes. Make sure that the gaps in the oil scraper ring are equally spaced out round the piston, and not in line with one another.

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

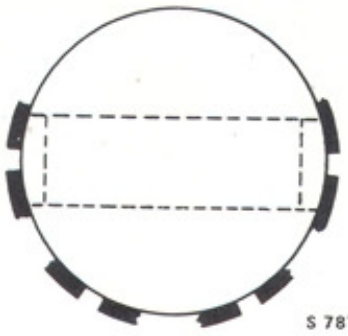
Position the oil scraper ring gaps equally round the piston, and not in line with one another.





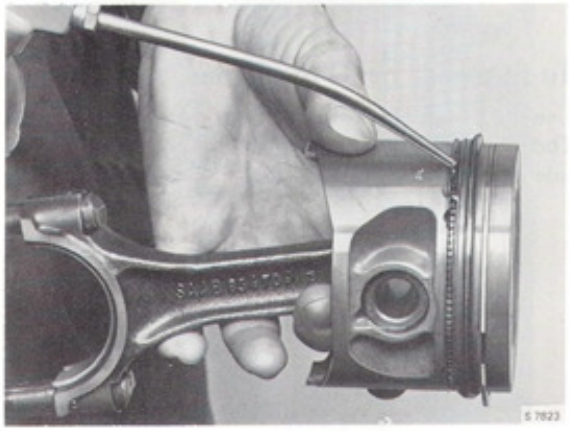
Piston and connecting rod with bearings and piston rings

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



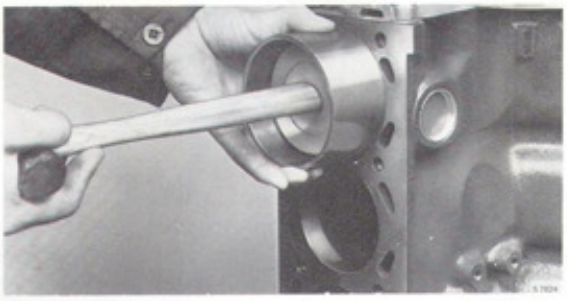
To fit the pistons in the cylinders

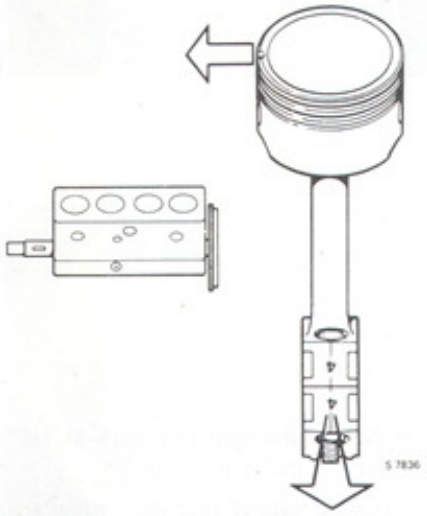
1. Place the bearing shells in position in the connecting rods and fit the protective sleeves to the connecting rod studs.
2. Oil the piston rings and bearings.



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

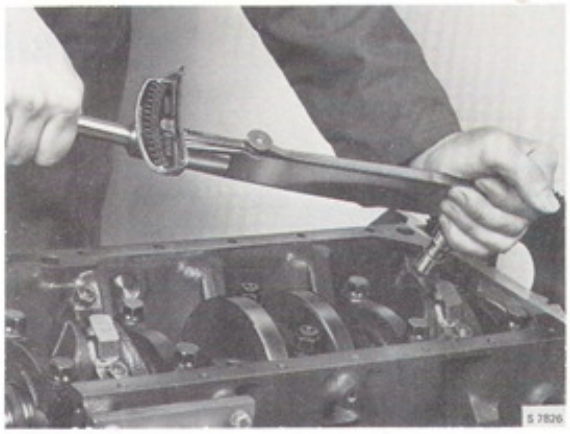
Ensure that the piston crown markings are pointing towards the timing cover and that the numbers on the connecting rods face the exhaust side.





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

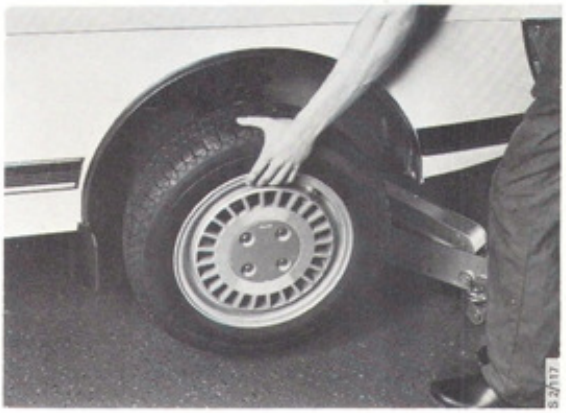


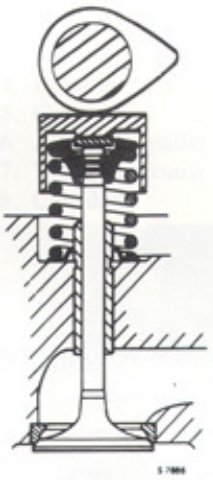
Valve mechanism

Valve cover

To remove

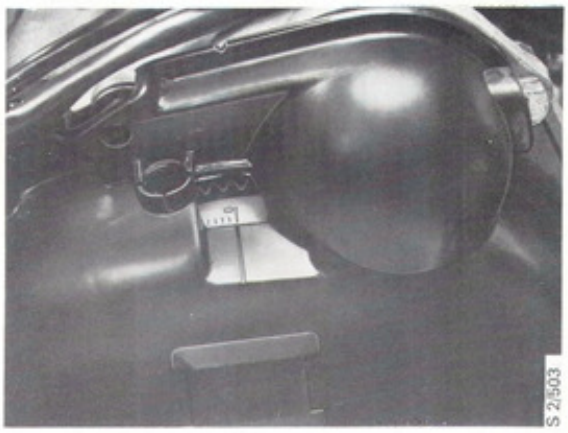
1. Rotate the crankshaft to the "O" mark (top dead centre for No. 1 and No. 4 cylinders) as follows:
   a. Put the car in gear.
   b. Lift the front of the car. Rotate one of the front wheels until the "O" on the flywheel coincides with the line in the flywheel cover.
2. Disconnect the crankcase ventilation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

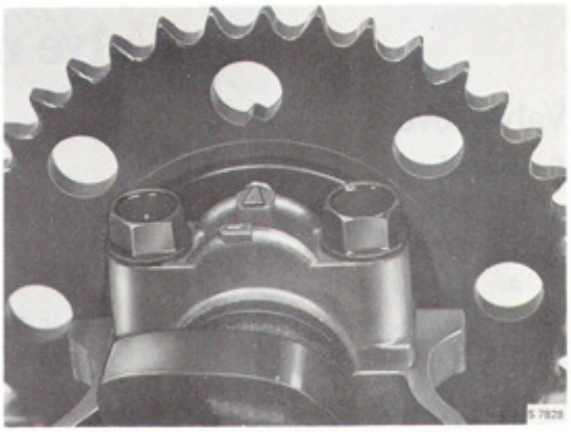




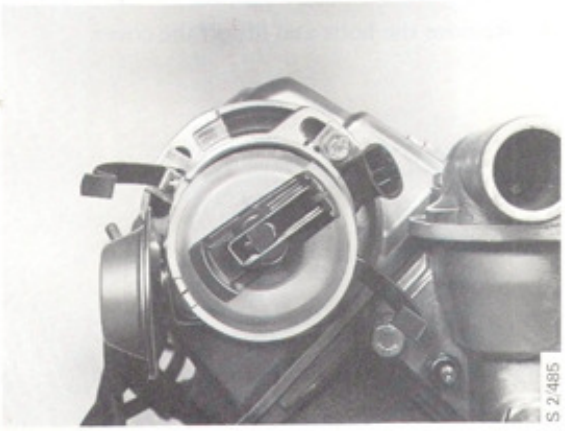
To refit

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





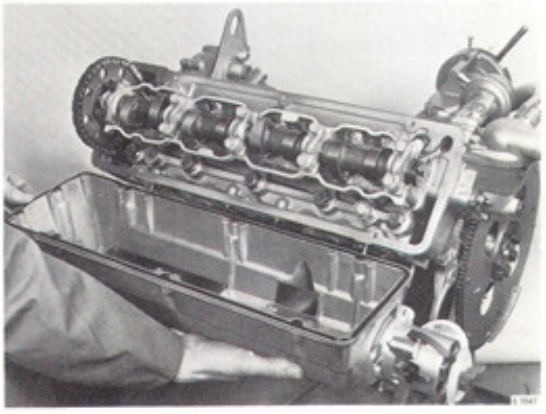
b. Remove the distributor cap and line up the rotor with the mark on the distributor housing.



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.

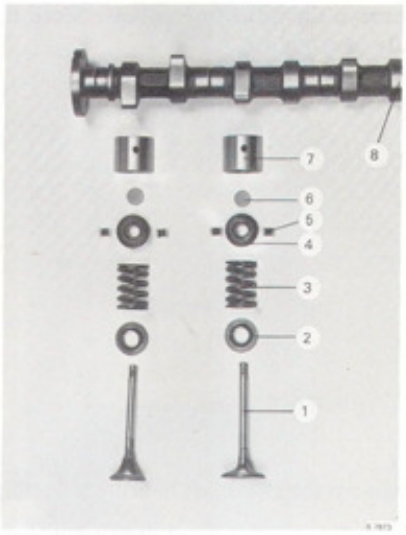


Valves

To remove

(Cylinder head removed from cylinder block)

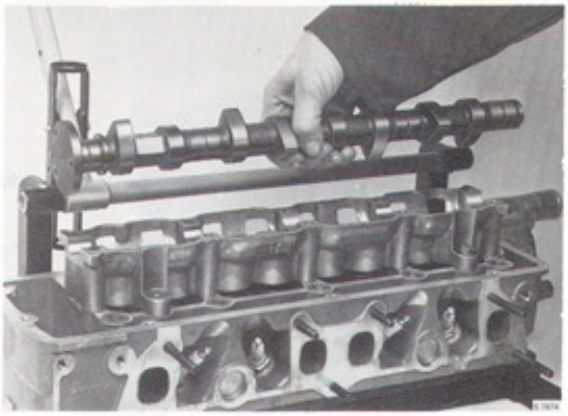
1. Remove the camshaft bearing caps.



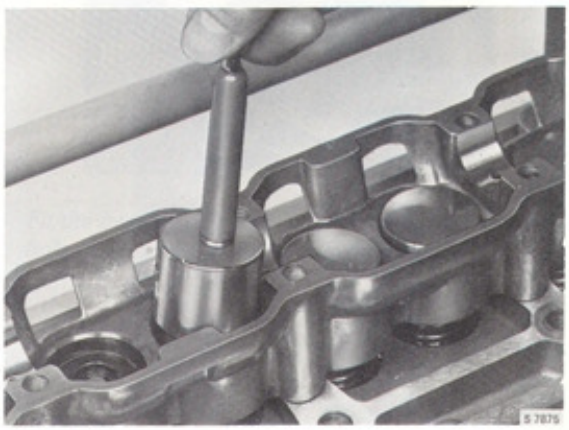
Valve mechanism

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

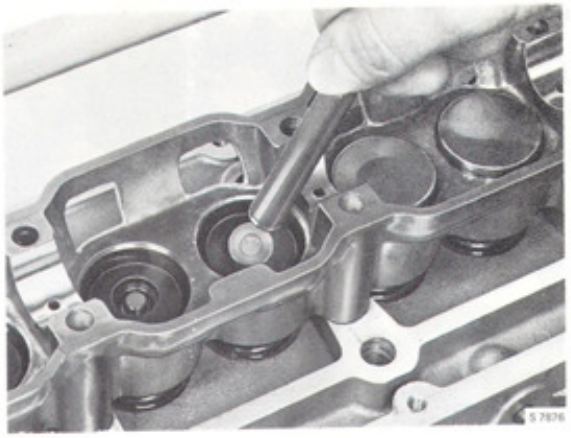
2. Lift off the camshaft.



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

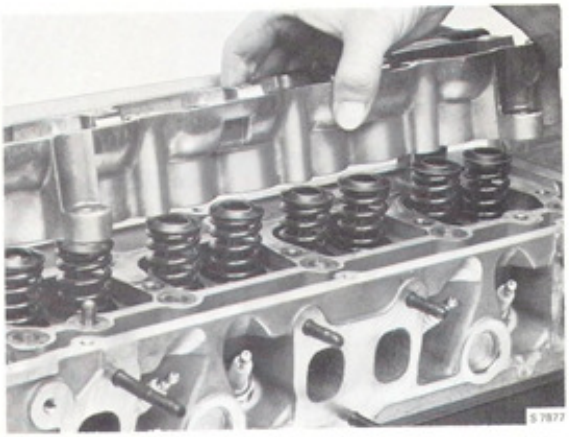


4. Remove the adjusting pallets. Store them carefully in sequence.



5. Remove the camshaft bearing assembly.

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

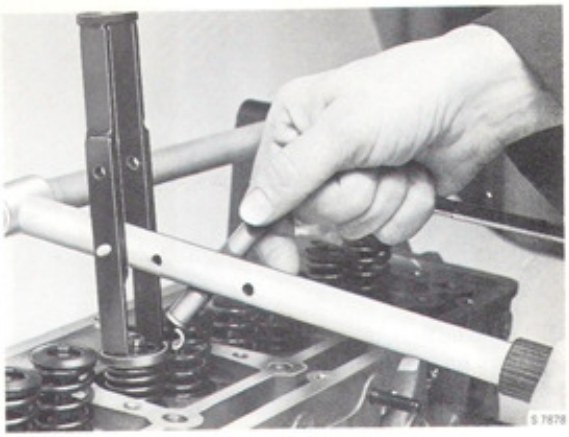


6 a. Compress the valve springs.

   b. Remove the collets release the spring and remove the tool.

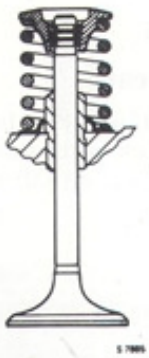
7. Remove the valve spring retainer, valve spring and valve spring seat.

8. Withdraw the valve.

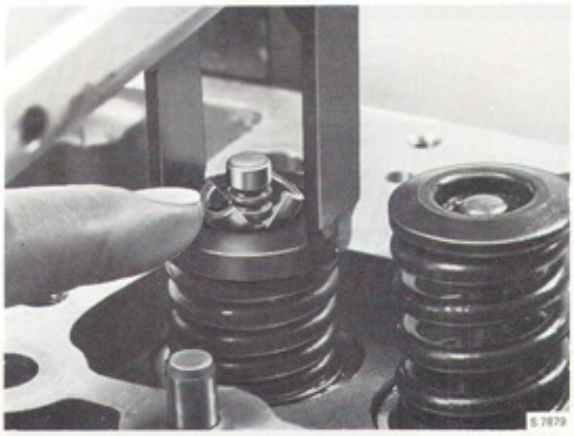


To refit

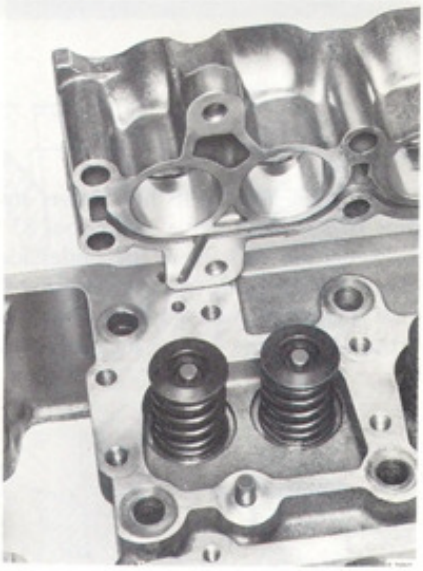
1. Oil the valve stems and refit the valves.
2. Refit the valve spring seats.



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.



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

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.

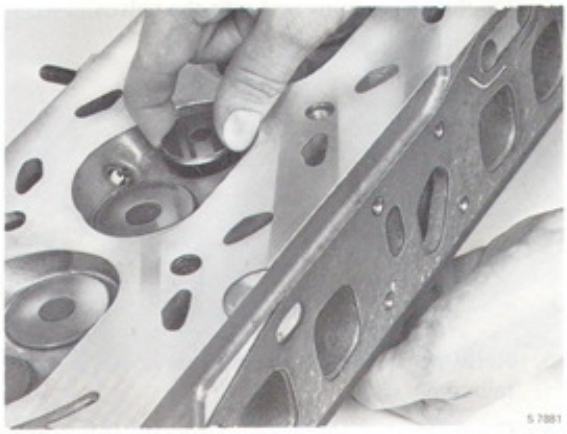
8. Refit the camshaft.
9. Refit the bearing caps.
   (**Note.** Line up the marks.)

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

Valve guides

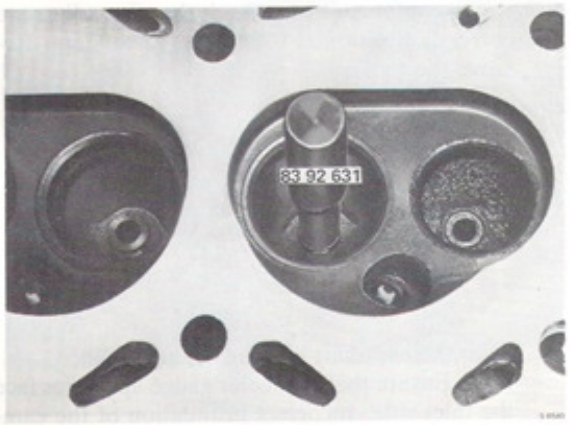
To check for wear

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.



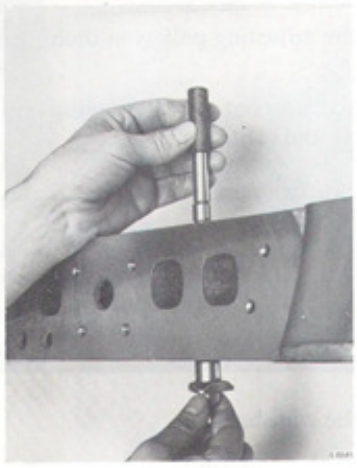
To remove

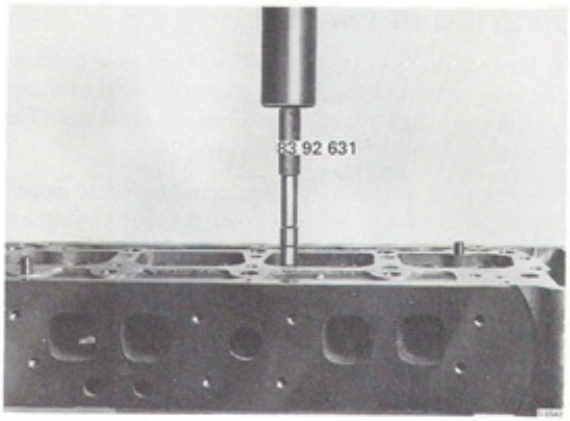
Before removing the valve guide, flush the cylinder head with hot water. Press out the guide using a drift and tool 83 92 631.



To replace

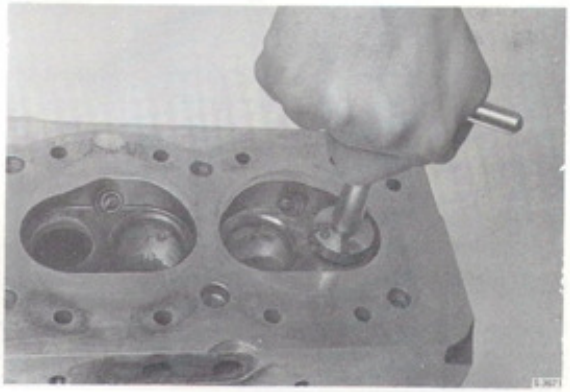
Flush the cylinder head with hot water. Insert the guide using a press and valve guide tool 83 92 631. Insert the centering drift from the underside of the head and press in the guide from above using the drift. In the final stages the valve guide tool moves to one side and the valve guide can be located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



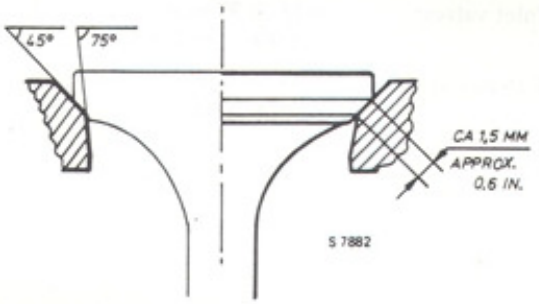


Milling the valve seats

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.

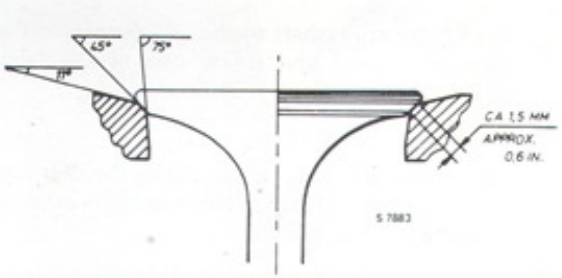


The *exhaust valve seats* should only be reduced from the bottom by means of a 75° cutter. The contact surface should extend to the periphery of the valve head.



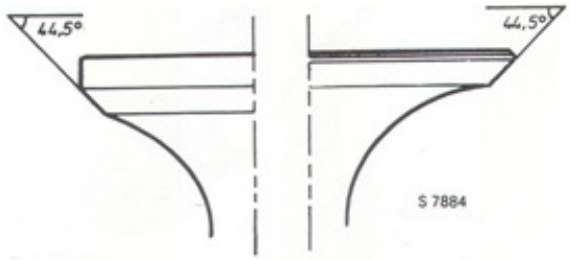
The width of *the inlet valve seats* should be reduced so that the contact surface lies in the middele of the ground surface of the valve head. Reduce from the bottom by means of a 75° cutter and from the top using an 11° – 12° cutter.

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

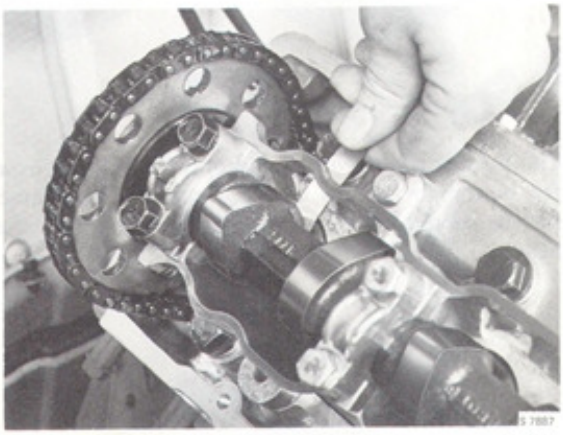
General

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

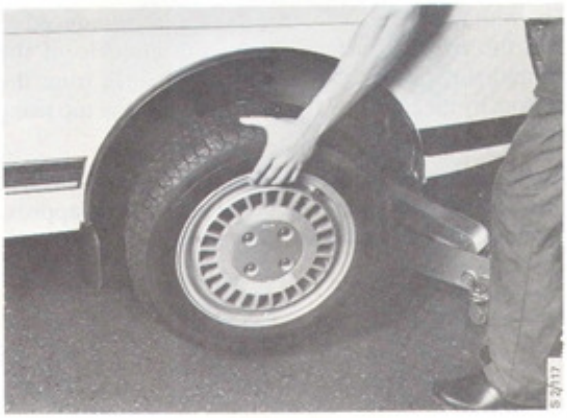
Check the valve clearance with a feeler gauge, comparing with the maximum and minimum tolerances. The tolerance limits for purposes of valve clearance checking are:

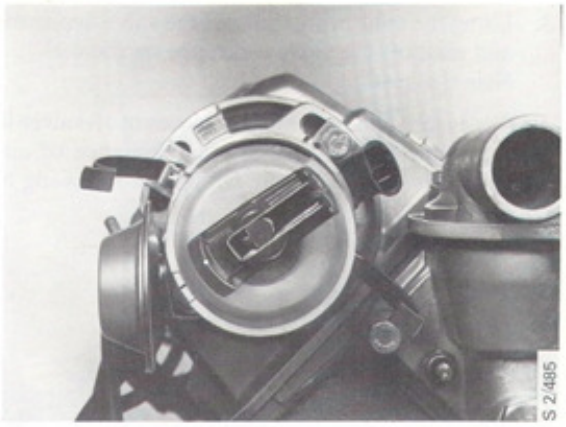
Inlet valves:	0.15–0.30 mm ((0.006–0.012 in)
Exhaust valves:	0.35–0.50 mm (0.014–0.020 in)



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.

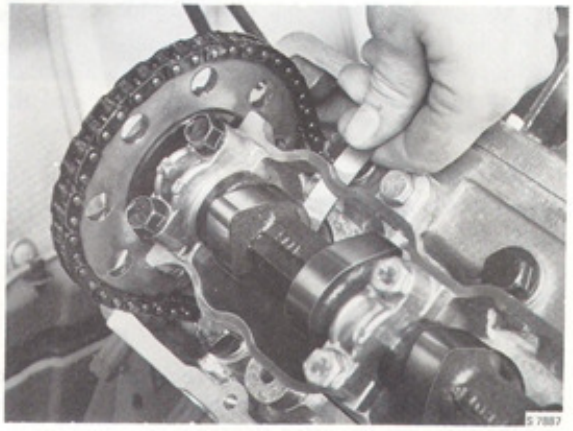
   The distributor drive design allows the camshaft to be removed only when No. 1 or No. 4 cylinder is at top dead centre.
3. **a.** Rotate the crankshaft until the cam lobe of the valve to be measured is opposite the valve depressor.





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.)



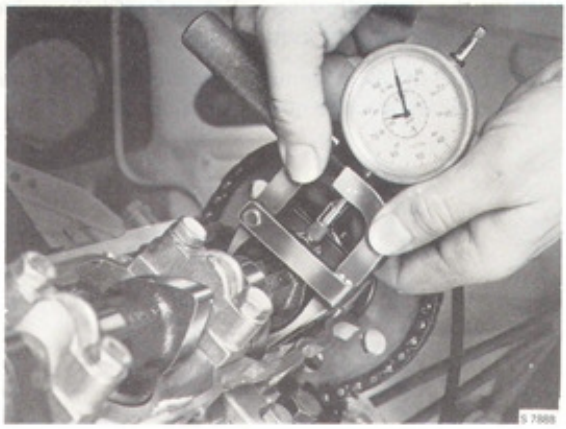
To measure and adjust

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 two 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	0.100 (2.54 mm)
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	0.008–0.010 in. (0.20–0.25 mm)
Pallet thickness required	0.097 (2.44 mm)

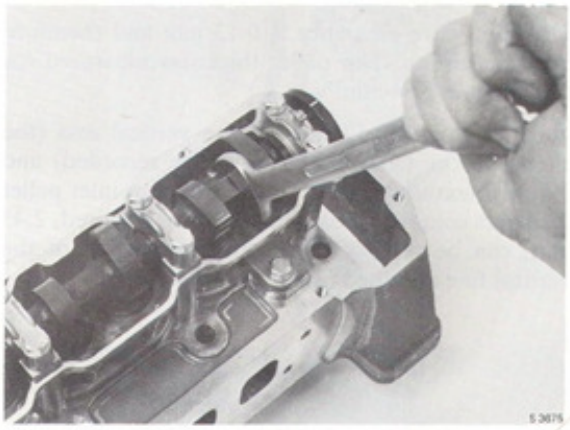
Select an adjusting pallet 0.096 in (2.43 mm) thick.

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.



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.

Pallet thickness measured		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
	Inlet, mm								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 (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 clearance measured with dial indicator (mm)																								
0,00		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					
0,02		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				
0,05		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				
0,07		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			
0,10		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			
0,12		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		
0,15		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		
0,17		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	
0,20		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	
0,22		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
0,25		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
0,27			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
0,30			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
0,32				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
0,35				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
0,37					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
0,40					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
0,42						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
0,45							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
0,47								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
0,50									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
0,52										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
0,55											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
0,57												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
0,60													2,89	2,84	2,79	2,74	2,69	2,64	2,59	2,54	2,48	2,43	2,38	2,33
0,62														2,89	2,84	2,79	2,74	2,69	2,64	2,59	2,54	2,48	2,43	2,38
0,65															2,89	2,84	2,79	2,74	2,69	2,64	2,59	2,54	2,48	2,43
0,68																2,89	2,84	2,79	2,74	2,69	2,64	2,59	2,54	2,48
0,70																	2,89	2,84	2,79	2,74	2,69	2,64	2,59	2,54
0,72																		2,89	2,84	2,79	2,74	2,69	2,64	2,59

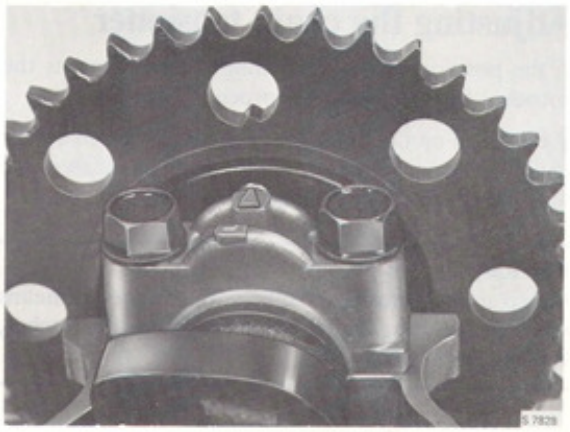
Transmission

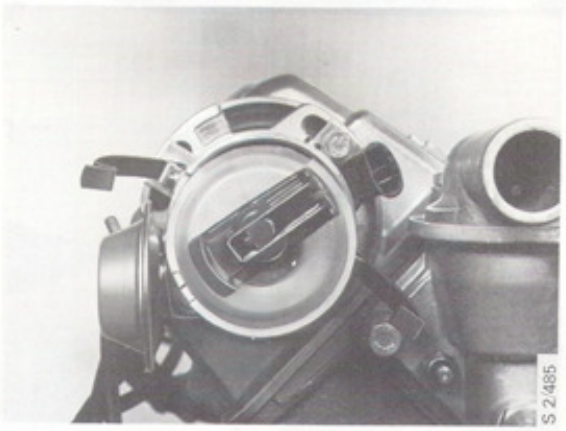
Timing chain

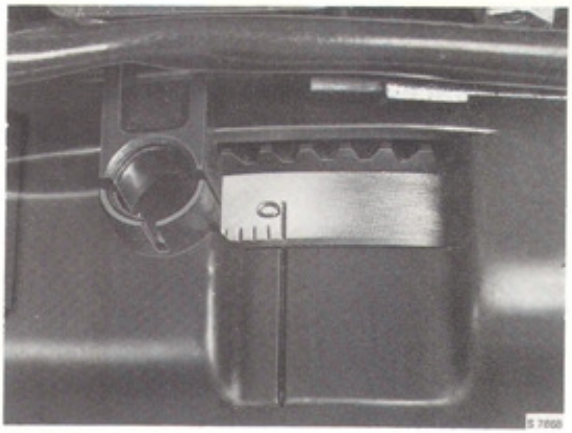
The camshaft is driven by a single chain with a mechanical chain tensioner, a pivoting guide and a fixed guide.

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.

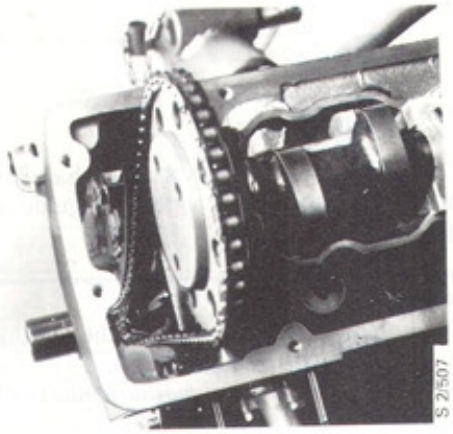
Remove and refit the timing chain with the camshaft and crankshaft at TDC on the compression stroke for No. 1 cylinder.







On both fitting and removal of the camshaft sprocket, lock the chain tensioner by wedging the handle of a suitable screwdriver between the pivoting and fixed chain guides.

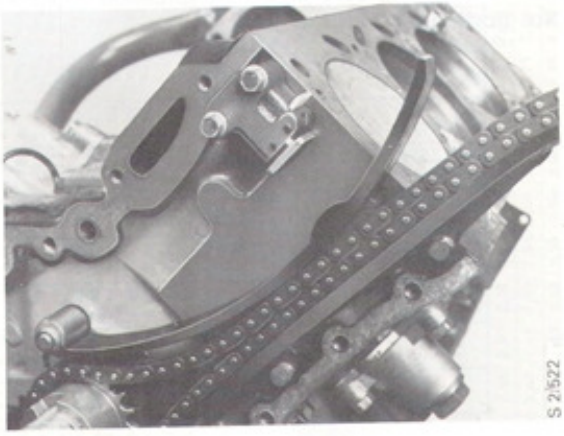


Adjusting the chain tensioner

If the position of the tensioning device prevents the sprocket from being fitted, proceed as follows:

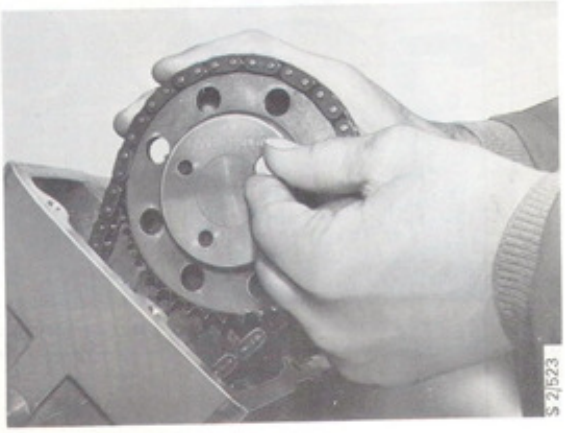
Press down on the outside of the ratchet tooth on the chain tensioner to render it inoperative. Depress the tensioning device by pressing on the pivoting guide.

Caution
On no account attempt to release the ratchet by means of a screwdriver, as this is liable to damage the ratchet, causing it to malfunction.

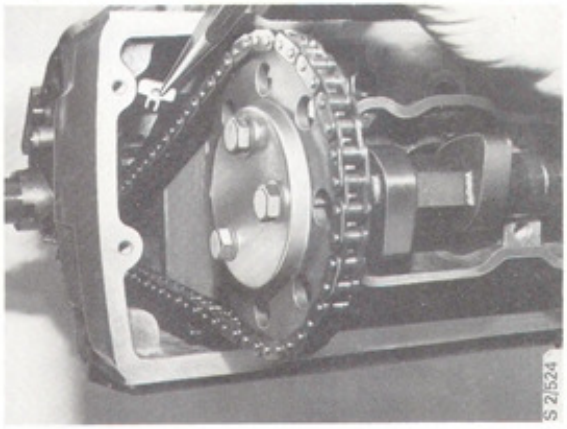


To replace the chain tensioner

1. Fit the new chain tensioner without removing the transit lock.



2. Fit the camshaft sprocket and the timing chain.
3. Remove the transit lock from the tensioner, whereupon the tensioning device will be triggered.



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 part No. (45) 30 06 558.

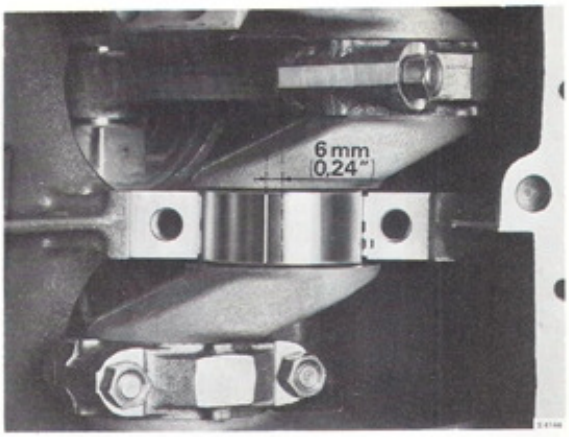
"Plastigage" – Instructions for use

Main bearings

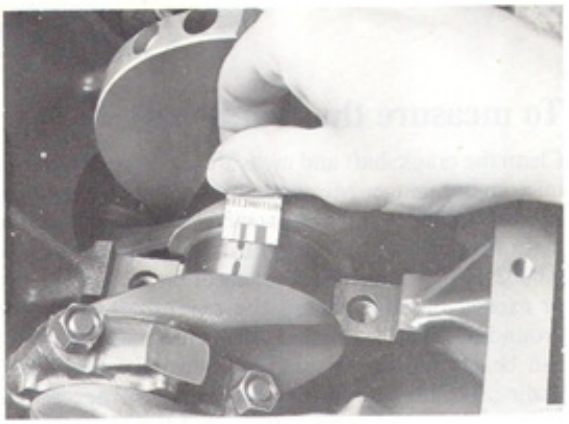
Main bearing clearance:
0.020 – 0.050 mm

"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.



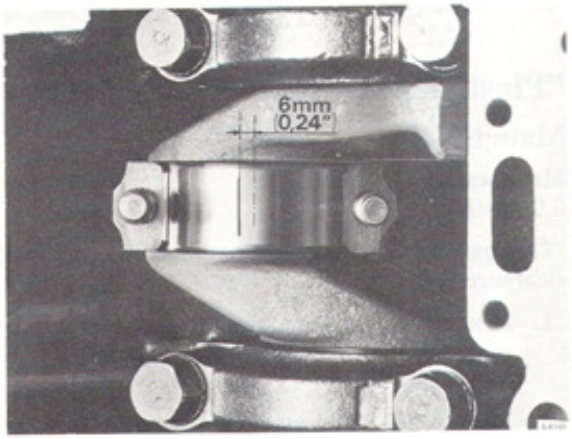
Big-end bearings

Big-end bearing clearance:
0.026 – 0.052

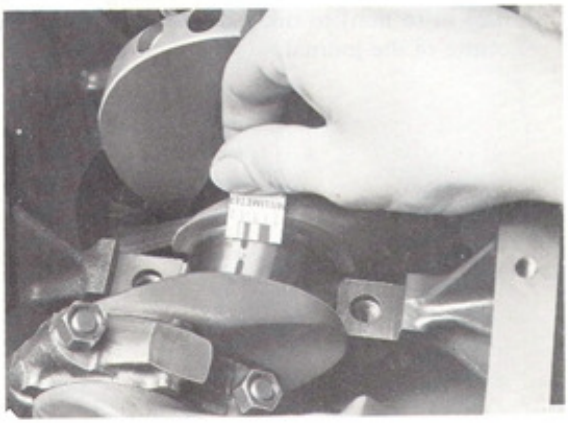
Plastigage strips cannot be used to measure the ovality of big-end bearings with the pistons fitted in the block. A micrometer should be used instead.

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.

1 st 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.

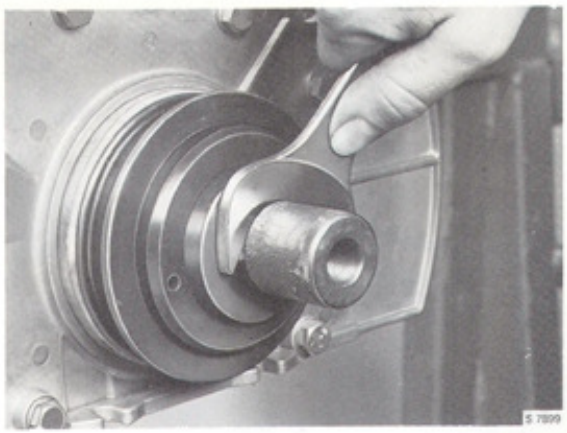
If the clearance is excessive even after two thick bearing halves have been fitted, the crankshaft must be ground down to the next undersize and the appropriate undersized bearing shells fitted. See Section 0.

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.

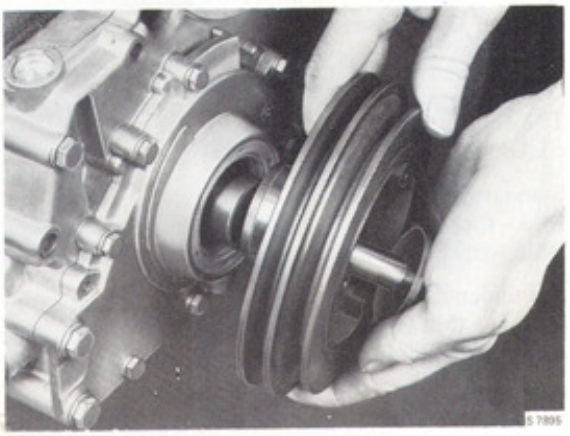
1. Use a screwdriver to remove the old seal.
2. Fit the new seal with the spring ring towards the crankshaft. Oil the mating surfaces before fitting. Use tool 83 92 540 to fit the seal.



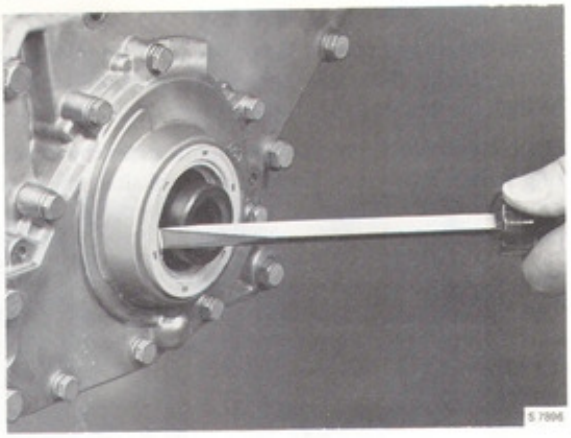
To replace the crankshaft seal at the timing chain end

(Possible only with engine removed from car)

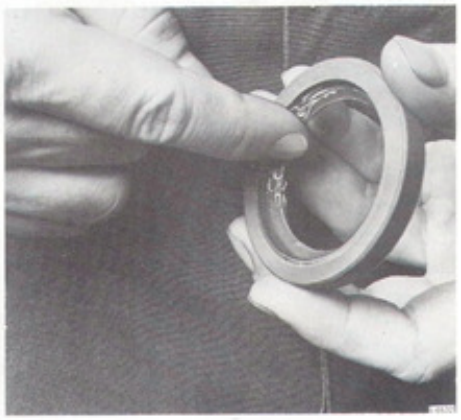
1. Remove the belt (belts), unscrew the pulley bolt, lock the crankshaft with tool 83 92 787 and remove the pulley.



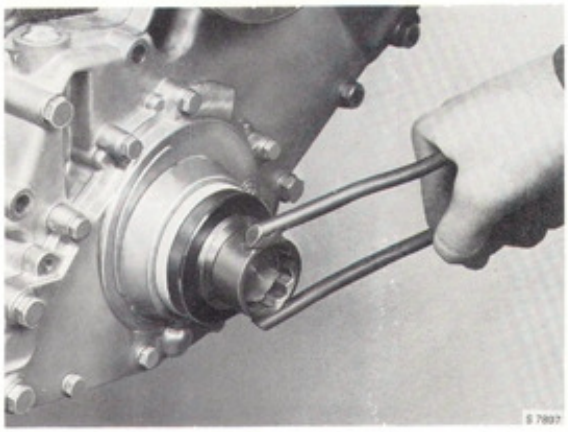
2. Remove the sealing ring by means of a screwdriver.



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 93 340, which is drawn in by means of the pulley retaining bolt.



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

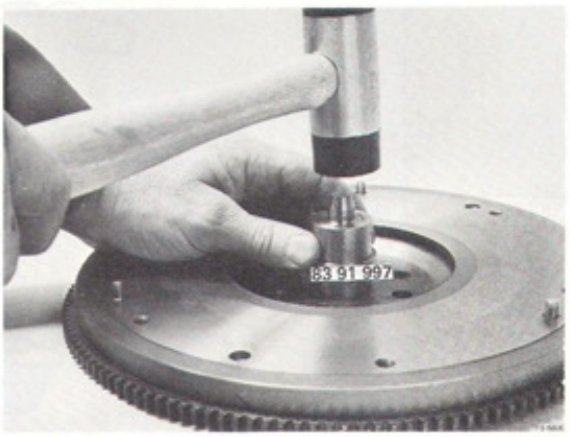
Tightening torque, for pulley
190 Nm (19 kgm; 137 lb ft)

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.



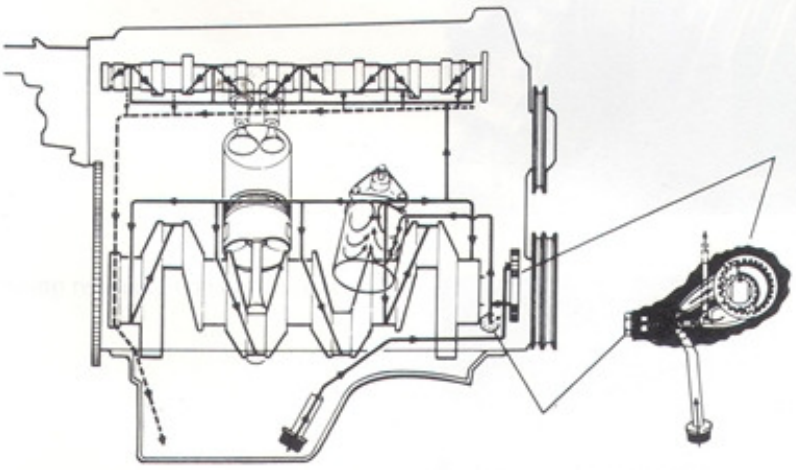
Lubricating system

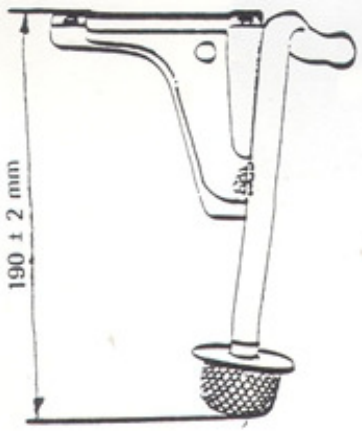
The engine has a forced lubrication system (see fig. below). Oil pressure is raised by a gear-type pump consisting of a gear wheel and an eccentric ring gear. The pump is driven by the crankshaft and is positioned between the timing cover and crankshaft pulley. A reduction valve in the timing cover limits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

Engine oil is filled through the dipstick pipe.





Oil pump

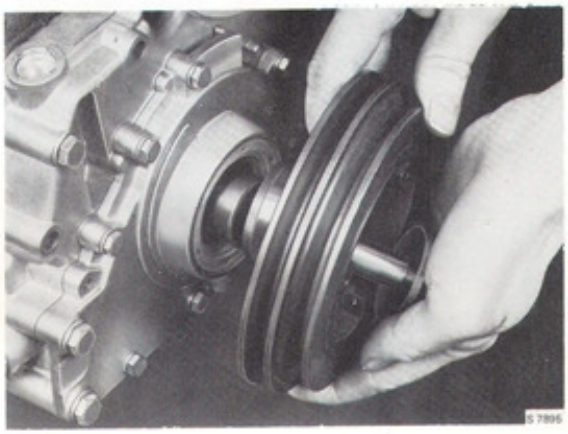
The oil pump is a gear type with one gear wheel and an eccentric ring gear. The pump is mounted on the timing cover and is driven by a driving plate mounted on the crankshaft.

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

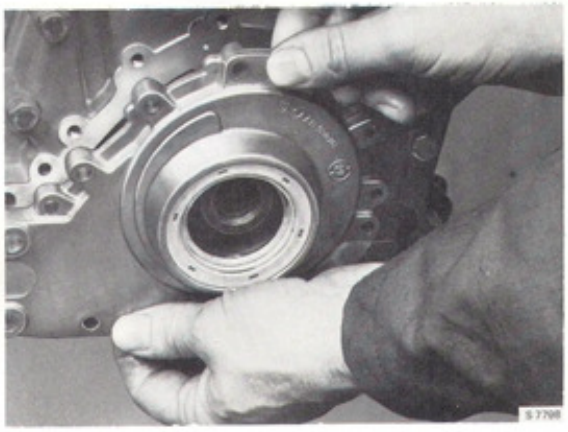
To remove

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.



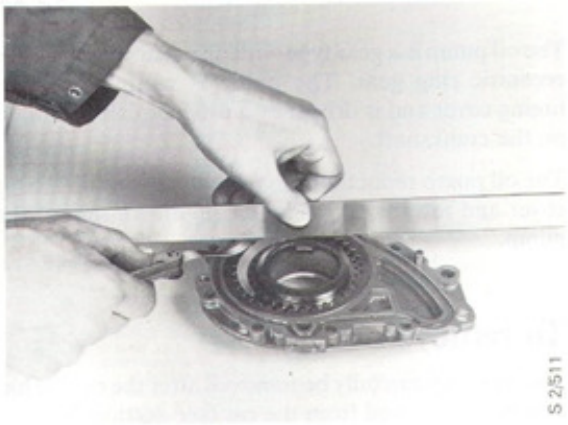
3. Remove the oil pump retaining bolts and extract the pump.



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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To refit

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


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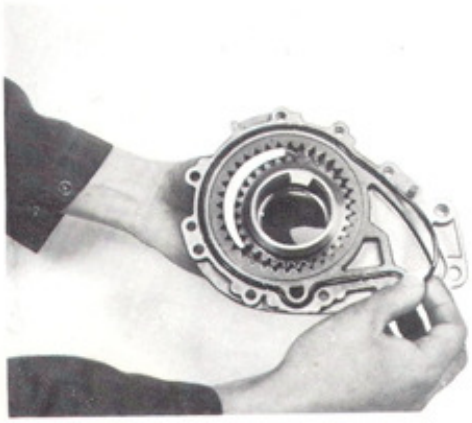
3. Fit a new sealing ring in the groove in the pump body and check that the dowel is fitted.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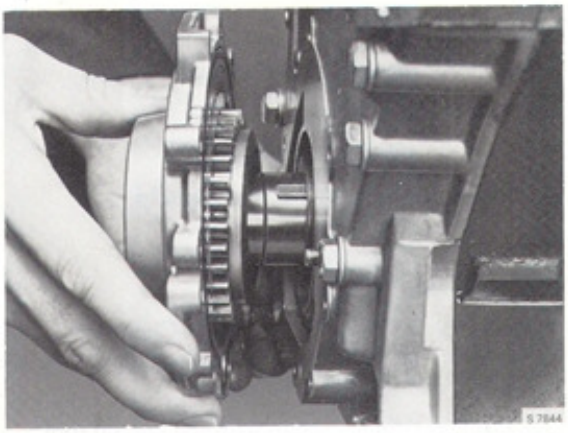
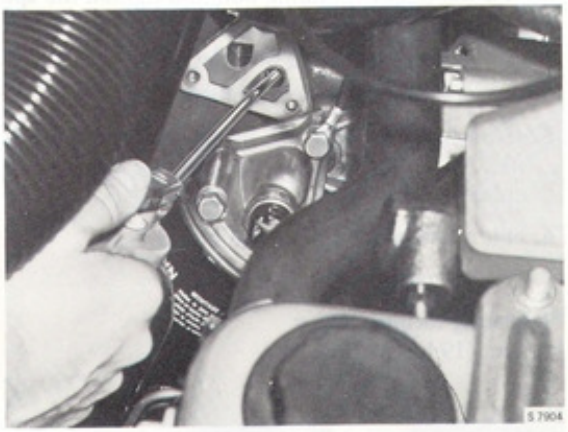
4. Refit the pump. Extract the pump gear slightly to facilitate locating it on the driving plate.

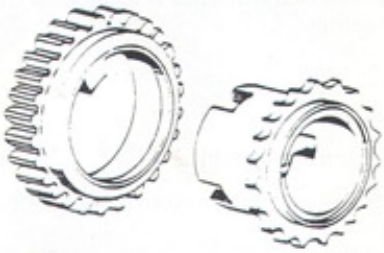


5. Remove the oil filter adaptor casting and fill the oilway to the oil pump pressure side with engine oil.



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

6. Refit the oil filter adaptor casting.



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Centring of the oil pump

Should noise emanate from an otherwise serviceable oil pump, or if a pump not equipped with locating pins is to be fitted, tool 83 93 589 should be used to fit the pump. This obviates the need to use locating pins.

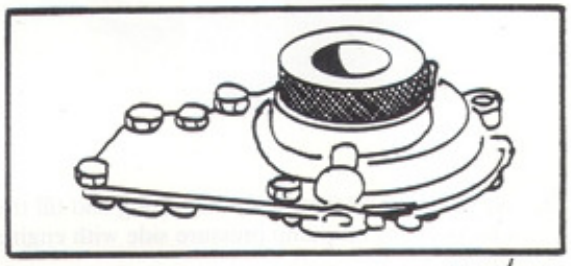
Removal

1. Remove the pulley from the crankshaft.
2. Remove the pump.
3. Remove existing locating pins.
4. Remove the shaft seal in the pump.

Fitting and centring

1. Fit tool 83 93 589 to the pump. Check the condition of the O ring at the mating flange of the pump and replace if defective.
2. Fit the pump complete with the special tool.
3. Fit the pulley retaining bolt and tighten the special tool to a torque of 27 Nm (2.7 kgm; 20 lb ft) using a 400 mm long torque wrench.
4. Secure the pump (8 + 2 bolts).
5. Remove tool 83 93 589, using strap wrench 83 93 332 or a large pair of polygrip or water-pump pliers.
6. Fit a new shaft seal on the pump.
7. Fit the pulley.

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



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Oil pressure transmitter

The oil pressure transmitter is located on the oil filter adaptor casing.

To remove

1. Disconnect the cable.
2. Unscrew the oil pressure transmitter (7/16 in spanner).

To refit

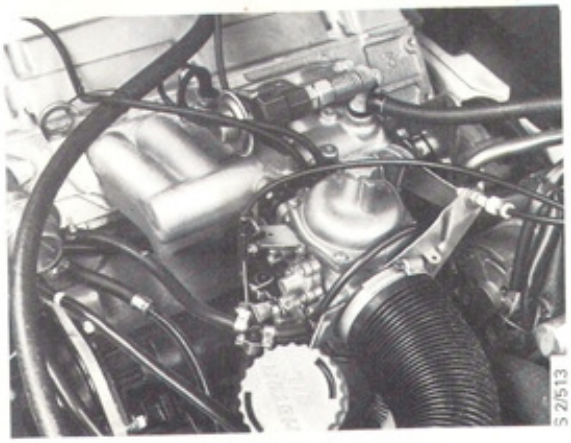
Note
Apply sealing compound to the thread before refitting.

1. Screw in the oil pressure transmitter and tighten to a torque of 9–11 lb ft (12–15 Nm; 1.2–1.5 kgm).
2. Reconnect the cable.

Carburetor

General

The engine is equipped with a Stromberg 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.



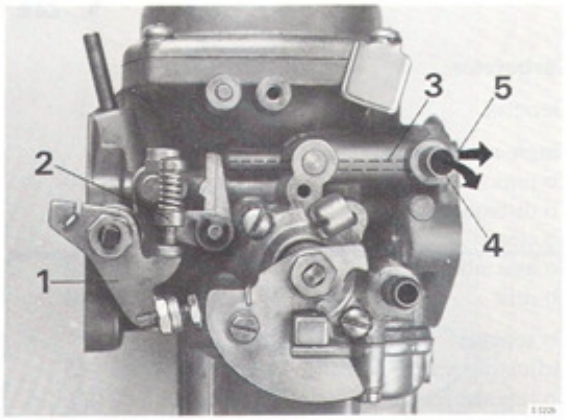
The carburetor is made of light alloy. It consists of three main sections, the central one being the carburetor housing. The bottom section is the float chamber. The jet is press-fitted in the carburetor housing. The height of the fuel needle is adjustable, and this can be regulated from above by means 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

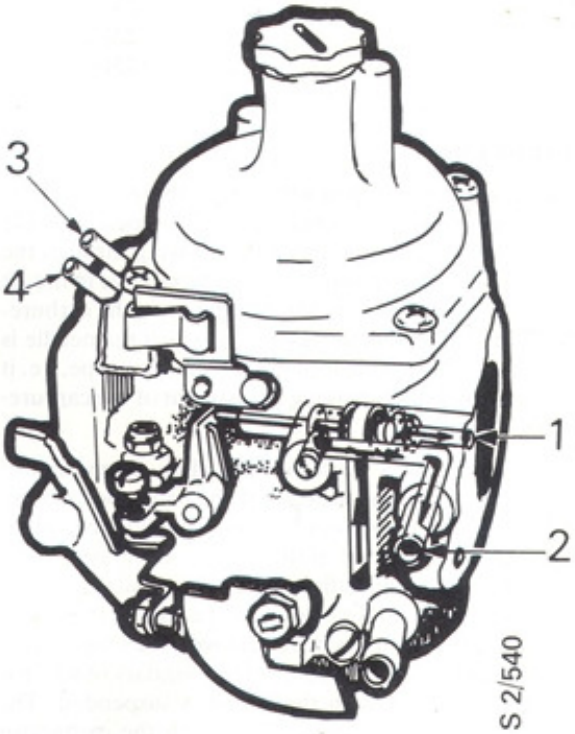
Fuel enters the float chamber through the float valve. The float, which is double, is mounted on the float chamber by an arm and spindle, which fits into two retaining clips. As the fuel level rises, the float rises with it, and when the correct level is reached, the float valve is closed by a tongue 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 to atmosphere. 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



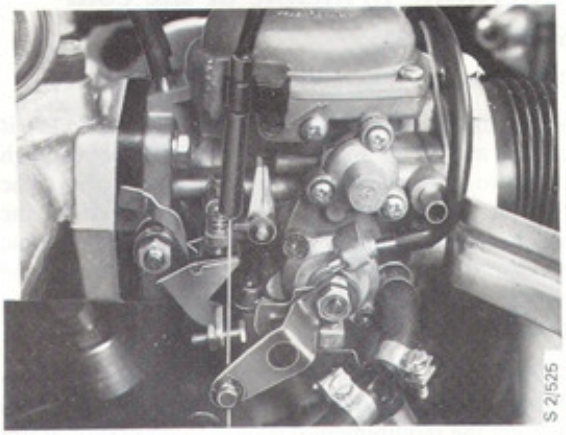
Float chamber ventilation

1. Ventilation through air cleaner
2. Direct atmospheric ventilation
3. EGR outlet
4. Vaccum advance mechanism outlet

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

The text below refer to figure on page 231-5.

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.)

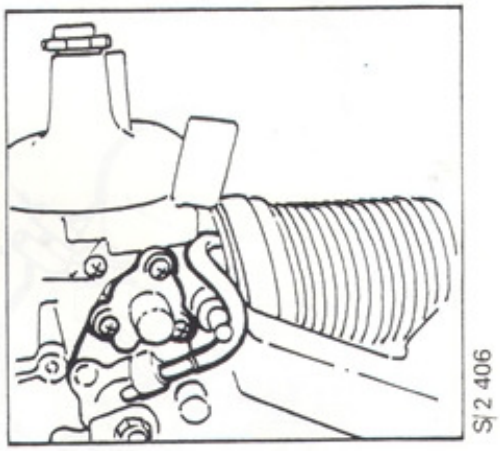
To enable the engine to run smoothly under any driving conditions, the quantity of choke fuel is optimized to meet the requirement during acceleration or at full throttle (fig A). This quantity of fuel is much greater than that needed when the car is being driven at a constant speed.
A leaner mixture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

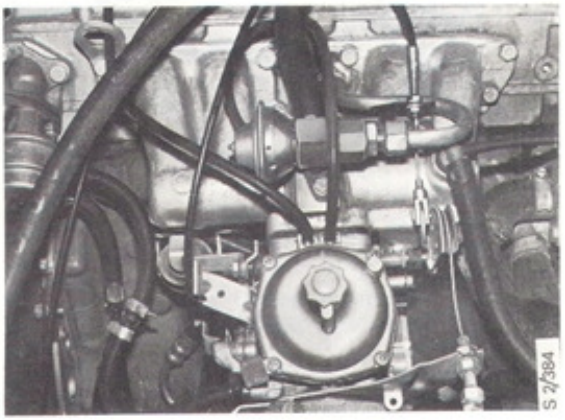
At constant speed (constant throttle opening), a depression is present in the inlet manifold. Via connecting passage (8) the depression acts on the diaphragm (1), once the force of the spring (2) has been overcome, allowing air to be drawn through passage (9) into the fuel inlet passage (5). The air/fuel mixture flows through the diesc (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.

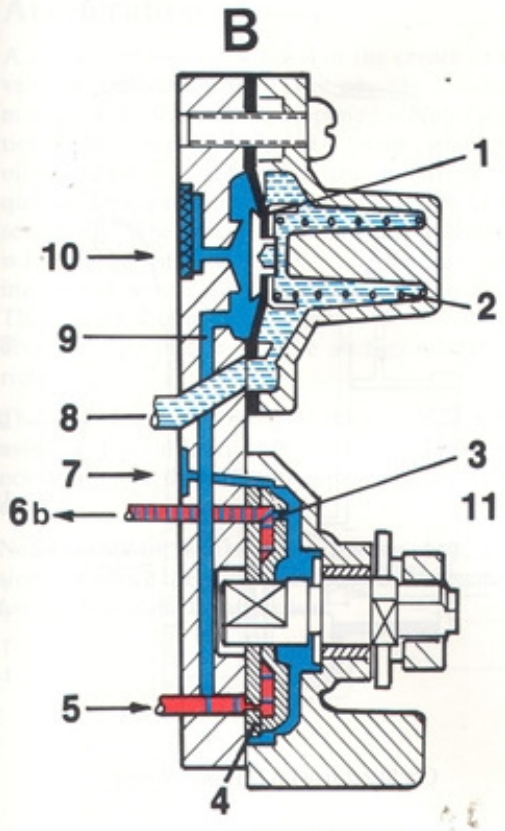
On renewed acceleration (opening of the throttle), the mixture is automatically enriched (load-sensing choke), since there is a reduction in the depression in the inlet manifold, which allows the spring loading on the diaphragm to close the air-bleed port.

Operating principle of fast-idling function

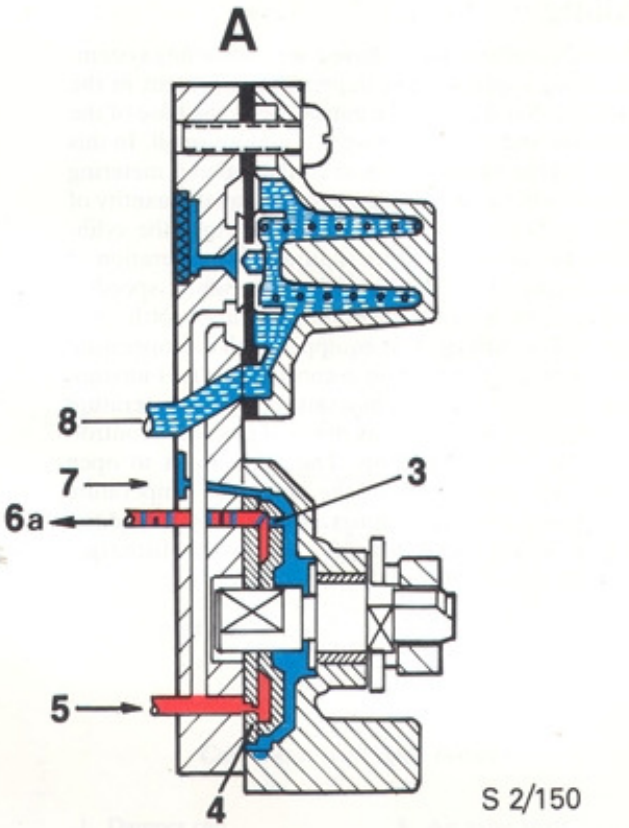
When the choke control is pulled out, a cam (11), which acts on the throttle valve, is rotated. The further the choke control is withdrawn, the faster will be the fast-idling speed.







At constant speed



On starting, driving acceleration and at full throttle

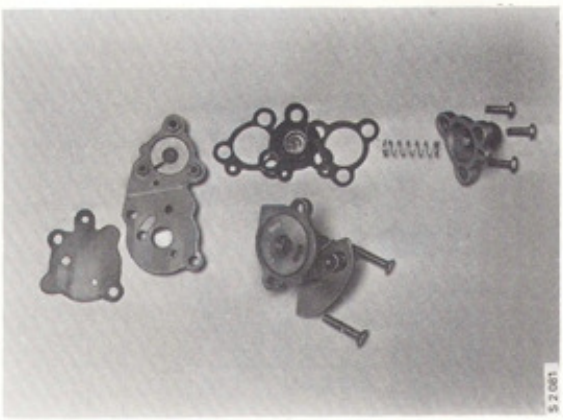
= Fuel

= Air (at atmospheric pressure)

= Strong depression

= Weak depression

= Air/fuel mixture

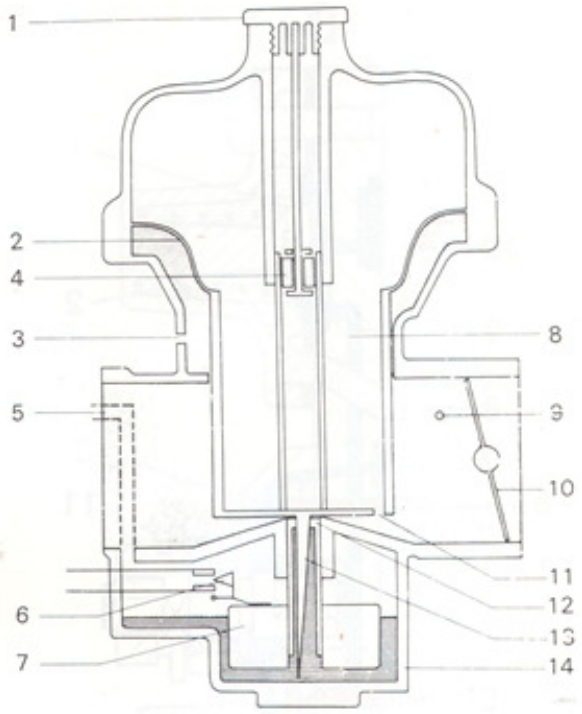


Diaphragm housing and choke disc

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 inelt 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 a weak depression is present in the vacuum chamber and the gap between the base of the air valve and the jet seating is therefore 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-metallic strip. The valve starts to open when the temperature of the air at the temperature compensator reaches approx. 68 oF (20 oC.) 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

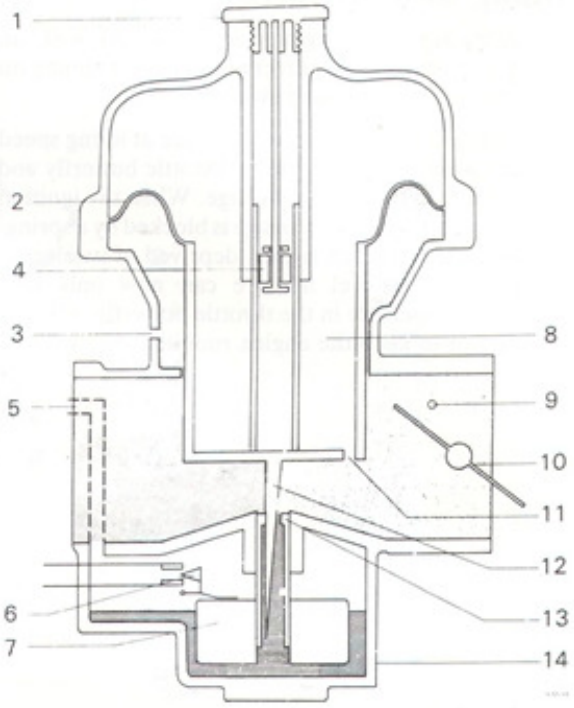
When the throttle is opened, the pressure in the vacuum chamber, which is in communication with the top of the diaphragm, falls, causing the piston to rise to a new position, stabilising the depression in the vacuum chamber. As the fuel needle rises with the piston, the flow of fuel is adjusted to the flow of air.

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.

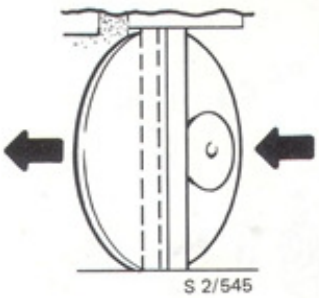


Carburetor with open throttle

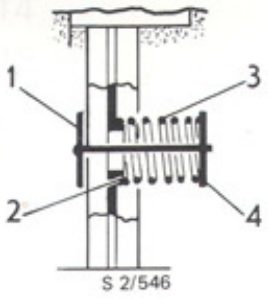
1. Damper cap
2. Diaphragm
3. Compensating aperture
4. Damper piston
5. Float chamber vent.
6. Needle valve
7. Float
8. Air valve shaft
9. Start-up fuel aperture
10. Throttle (butterfly)
11. Vacuum aperture
12. Jet orifice
13. Fuel needle
14. Float chamber

Deceleration

A disc valve has been fitted to the throttle butterfly. On engine overrun, the disc valve opens, allowing air to flow through the butterfly and the engine to receive the required fuel/air mixture.



Deceleration valve, normal running



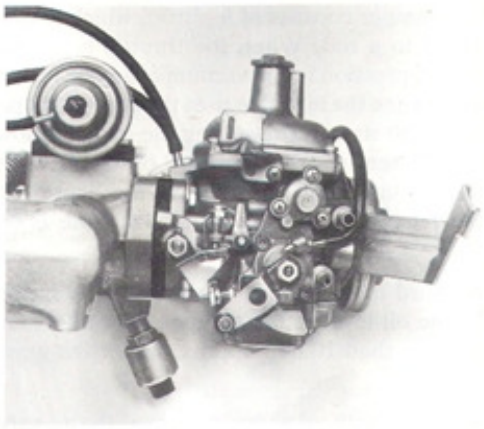
1. Disc valve
2. Spring seat
3. Spring
4. Spring seat

Deceleration valve, engine overrun

Idling shut-off valve

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.



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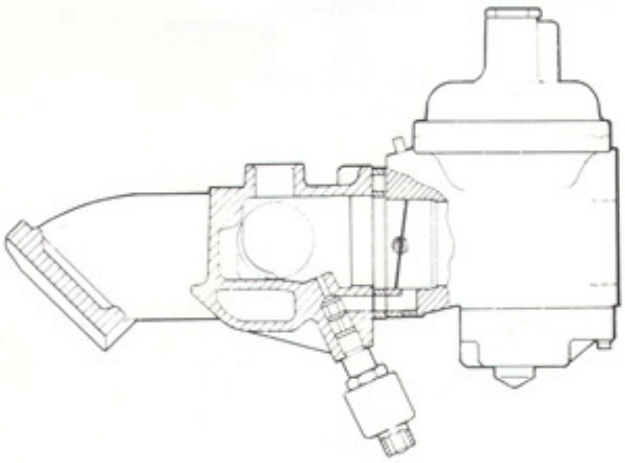
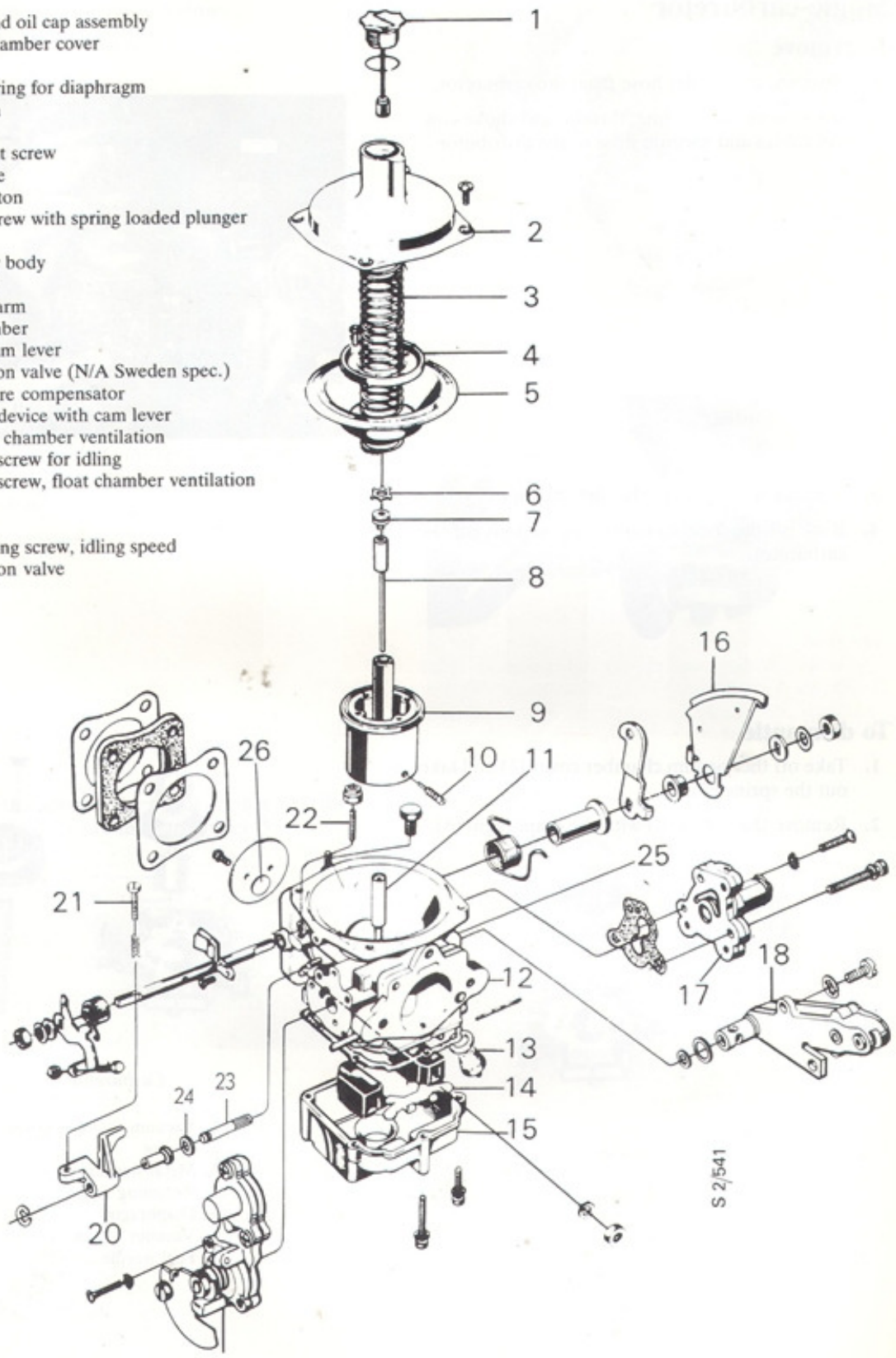


Idling shut-off valve

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

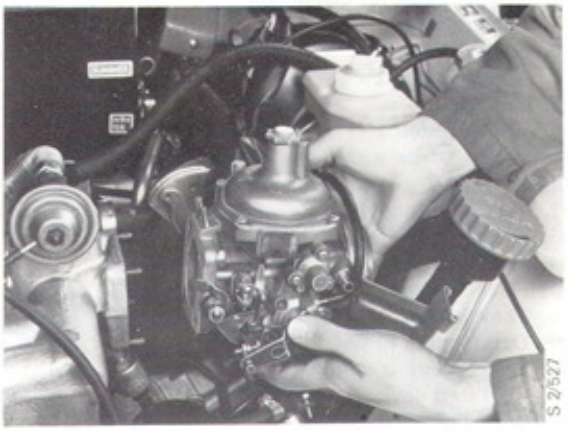


Carburetor

Single-carburetor

To remove

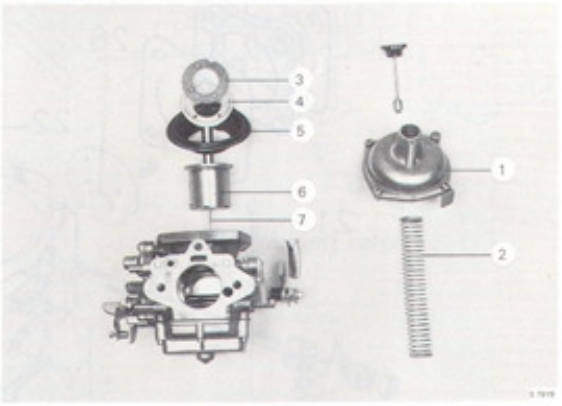
1. Disconnect the inlet hose from the carburetor.
2. Disconnect the fuel line, throttle and choke control cables and vacuum hose to the distributor.



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).

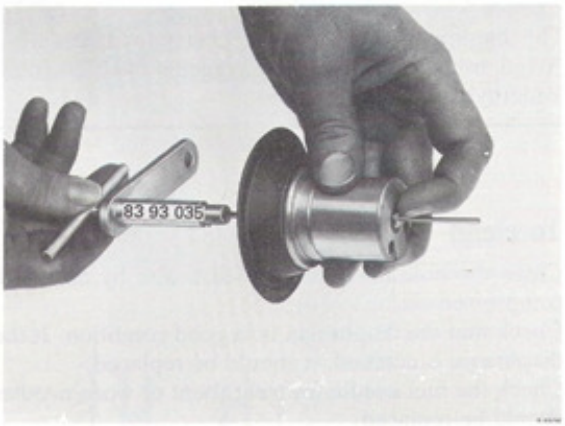


Carburetor

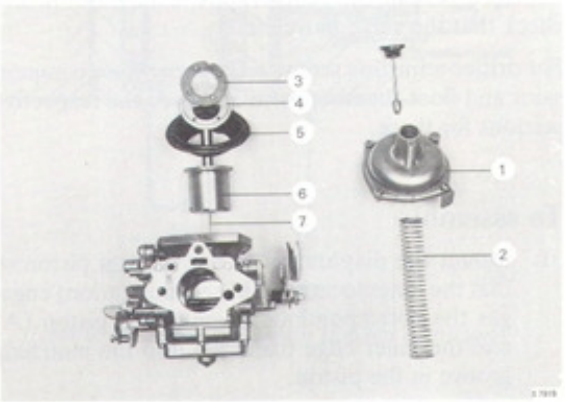
1. Vacuum chamber cover
2. Spring
3. Metal washer
4. Retaining ring
5. Diaphragm
6. Vacuum piston
7. Fuel needle

3. Remove the fuel needle as follows:
   a. Back off the setscrew.

   b. Turn the adjusting screw counterclockwise, using tool 83 93 035, until the needle is almost out. Undo the setscren until the shoulder of the needle can pass freely, and then withdraw the needle.



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

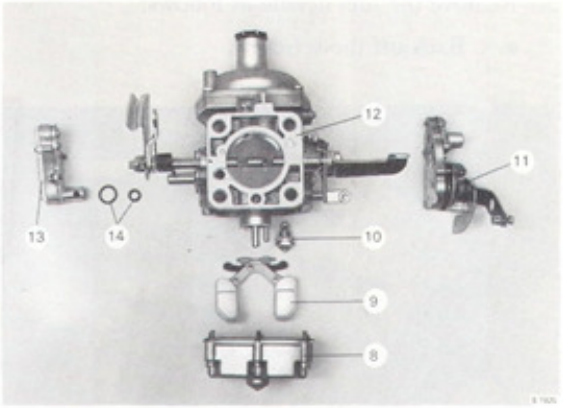


Carburetor

1. Vacuum chamber cover
2. Spring
3. Metal washer
4. Retaining ring
5. Diaphragm
6. Vacuum piston
7. 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 cracked, it should be replaced.
Check the fuel needle for wear; bent or worn needles should be replaced.
Check that the contact and sealing sur faces are not damaged. Clean the temperature compensator and check that the valve moves freely.

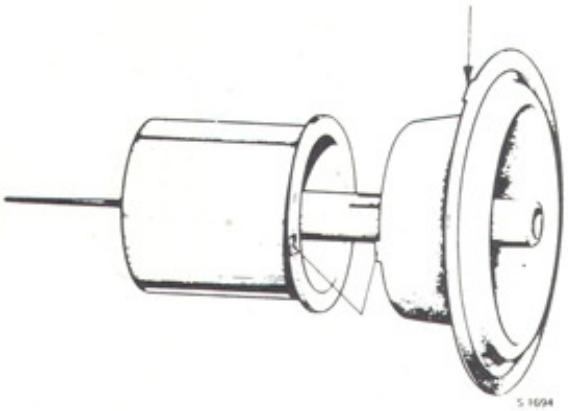
For orifice adjusting screw, jet, temperature compensator and float chamber ventilation see the respective sections for these.

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.

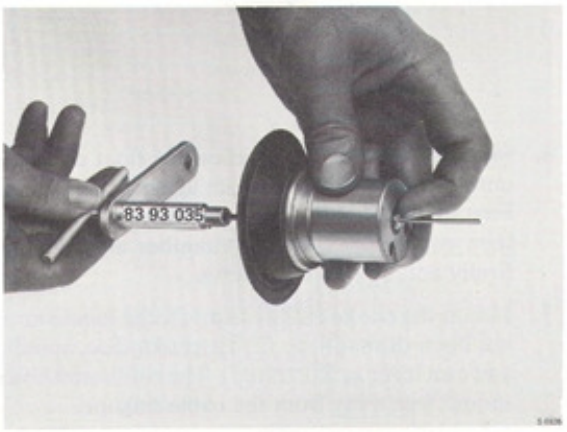
N.B. A distended diaphragm will usually revent to its normal shape after being allowed to dry for a short wile.

Note
If, after having been allowed to dry for a short while, the diaphragm is still so distended that it will not fit into the piston, exchange it for a new one.



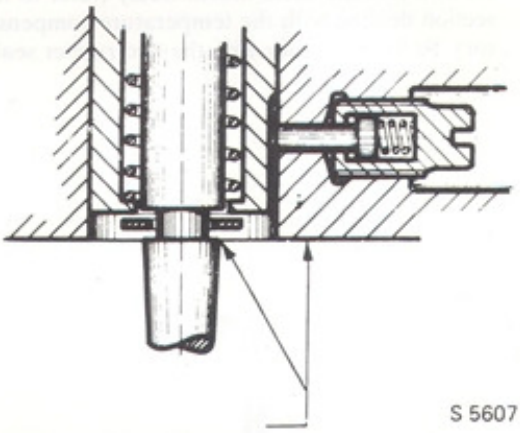
Place the retaining ring (4) and the metal washer (3) carefully in position, lining up the screw holes with those in the piston and diaphragm without twisting the washer and matching the notches in the washer with the screws.

2. Fit the fuel needle as follows:
   a. Insert the spring housing of the needle into the vaccum piston. Screw in the setscrew until the spring-loaded pin drops into the groove in the side of the spring hoousing.
   b. Screw the spring housing onto the adjuster by turning the adjuster with Allen-key tool 83 93 035.
   c. Adjust the position of the needle, which is correct when the needle shoulder is flush with the bottom of the piston.
   d. Tighten the setscrew.



   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.

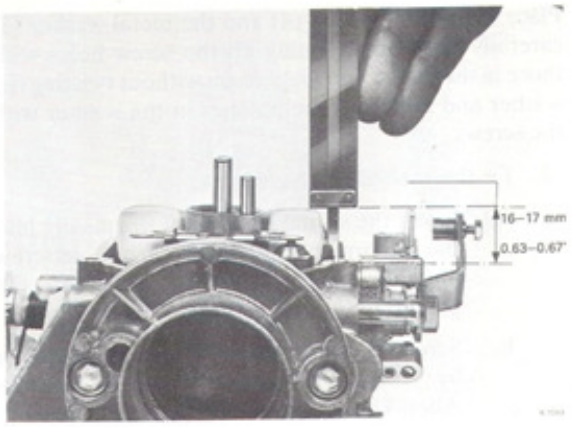
This position is the initial setting for subsequent CO--adjustment.



Needle shoulder flush with bottom of piston

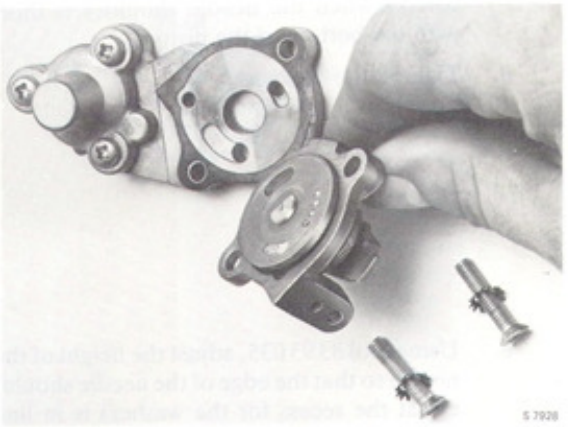
3. Install the piston complete with diaphragm and spring in the carburetor body. Make sure that the outer tab on the diaphragm engages the matching recess in the carburetor body. Place the vacuum chamber cover carefully in position, aligning the marks. The groove and locating rim should be a good fit; 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 and seal off.

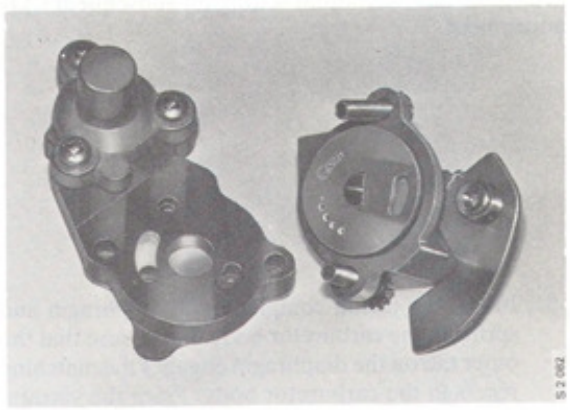
b. For the level to be correct the highest point of the float should be 0.63–0.67 in (16–17 mm) above the edge of the carburetor body (gasket removed) when the float valve is closed. If the level is not correct, adjust by bending the end tab at the float valve.



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.





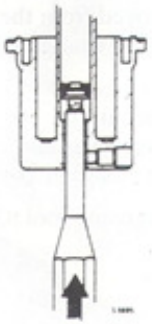
To refit

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.

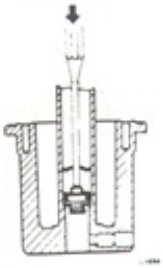
Changing the adjusting screw in the vacuum piston

Removal (vacuum piston with fuel needle removed)

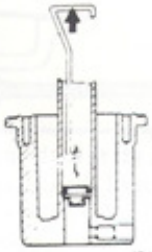
1. Using a drift, press out the adjusting screw until it protrudes a few centimetres beyond thebottom of the piston.



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.

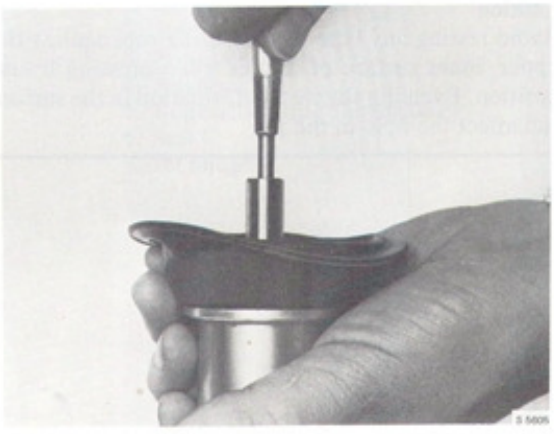


Refitting

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.

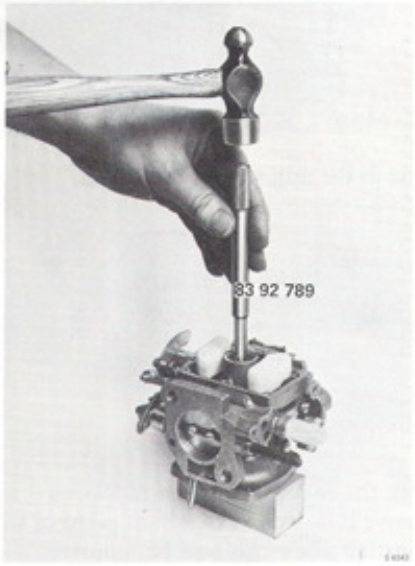
2. Press a new retaining washer into in the damper cylinder using a drift.



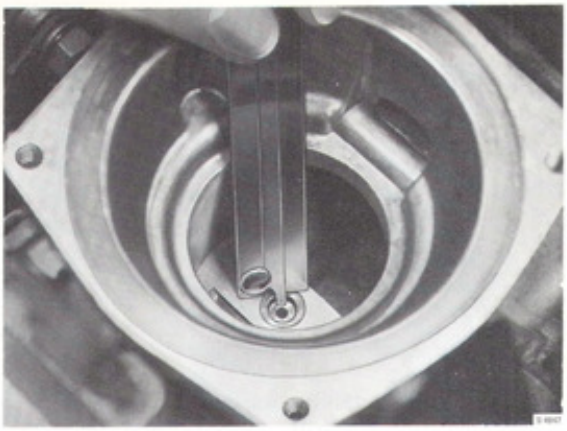
Changing the fuel jet

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.



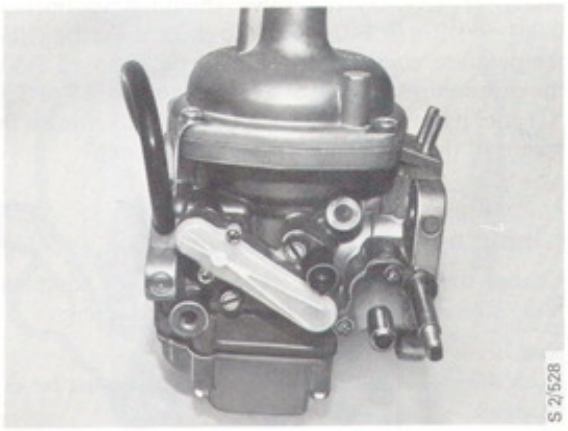
Caution
Avoid resting any type of measuring tool against the upper, inner surface of the jet when pressing it into position. Even the slightest deformation in the surface can affect the hole in the jet.

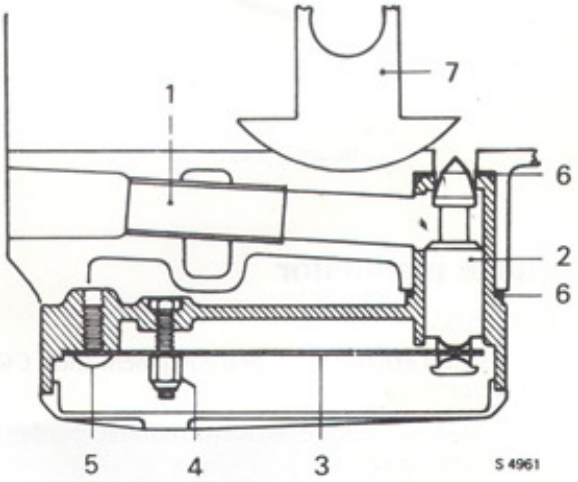
Temperature compensator

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.

The temperature compensator is adjusted at the factory and should therefore not be tampered with unless absolutely necessary.





Temperature compensator

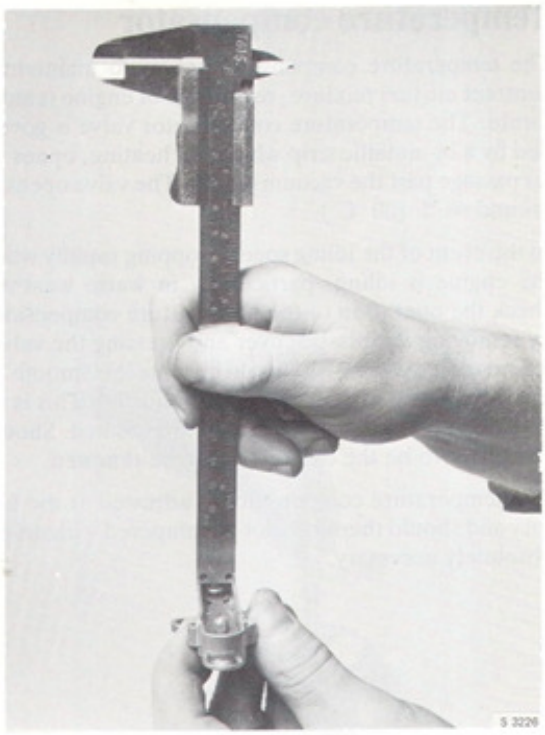
1. Air passage
2. Valve
3. Bi-metallic strip
4. Adjusting nut
5. Bi-metallic strip retaining screw
6. Seal
7. Jet bridge

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 oF (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.

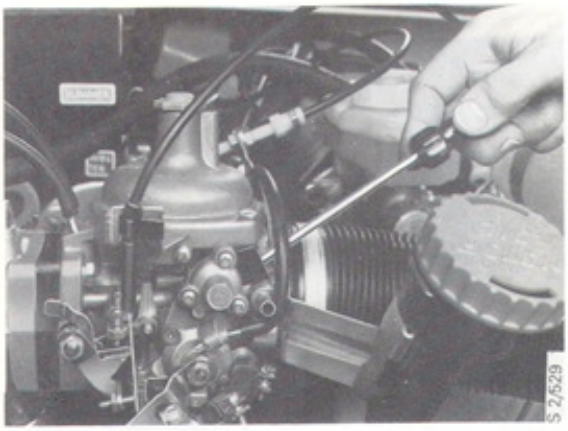
Choke modulator

To check

1. Connect exhaust extraction equipment and a CO meter.
2. Start the engine and run it up to normal operating temperature.
3. Use a finger or a piece of fabric tape to seal off the filter orifice in the choke modulator.

N.B. The filter orifice must be tightly sealed.

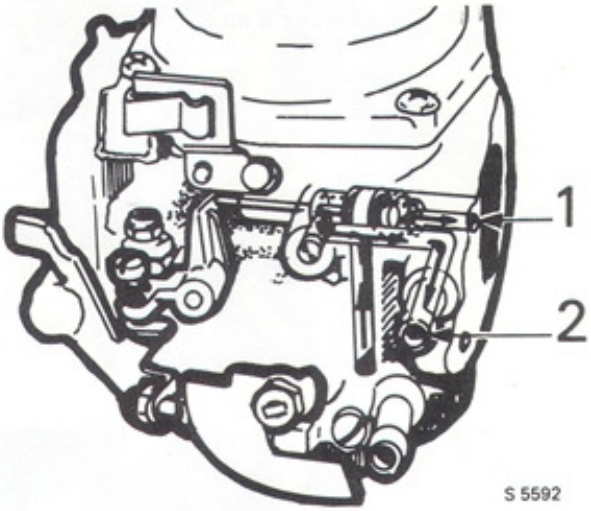
4. If the choke mudulator is working properly, the CO value will increase markedly.



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.



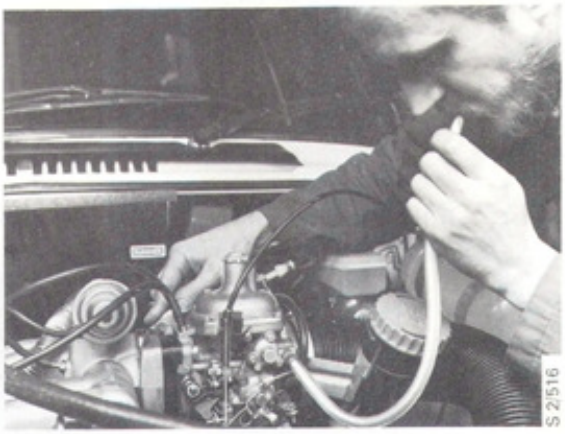
Float chamber vent valve

1. Air from air cleaner
2. Atmospheric air

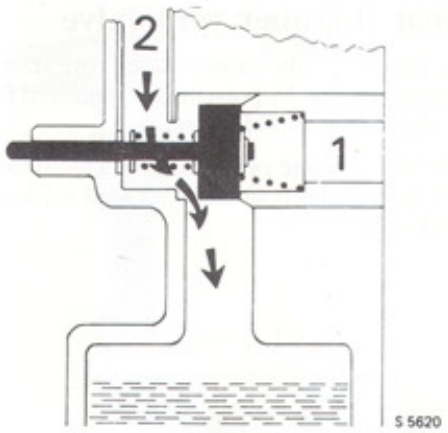
Checking and setting

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.



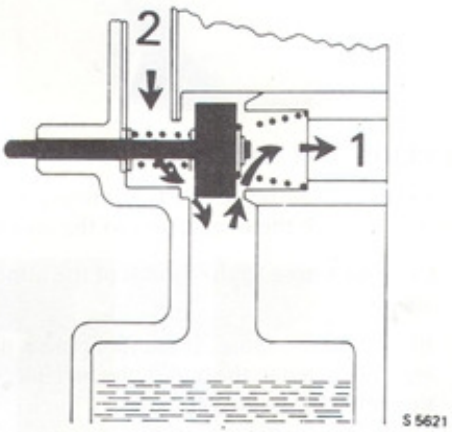
a. With the throttle fully closed it should not be possible to blow through the connection (as the float chamber is an enclosed space.)



Throttle valve fully closed

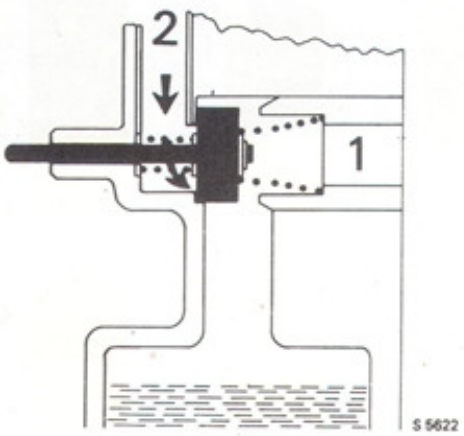
1. Air from air cleaner
2. Atmospheric air

b. If the throttle is opened 2–3 mm (at the throttle stop) a passage will be opened for internal air flow, making it possible to blow through the connection.



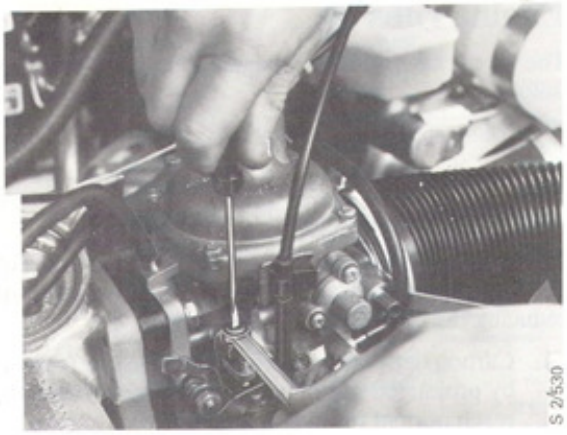
Throttle valve open 2–3 mm

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

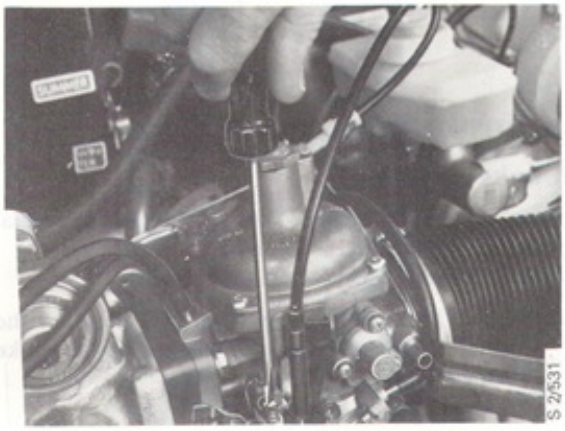


Throttle valve open a few more millimetres

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.

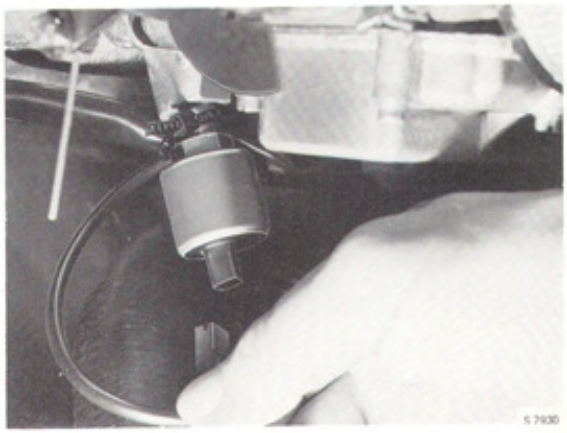


Adjusting the idling speed

Idling shut-off

To check

1. Connect a tachometer and let the enigne 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.



Engine runs on

The likely causes of the engine running on are as follows:

1. Idling speed set too high.
2. The ignition timing is too far advanced.
3. Mixture in carburetor too weak (idling).

These three factors tend to produce a wider opening of the throttle butterfly, which has the adverse effect of reducing the combustion temperature.

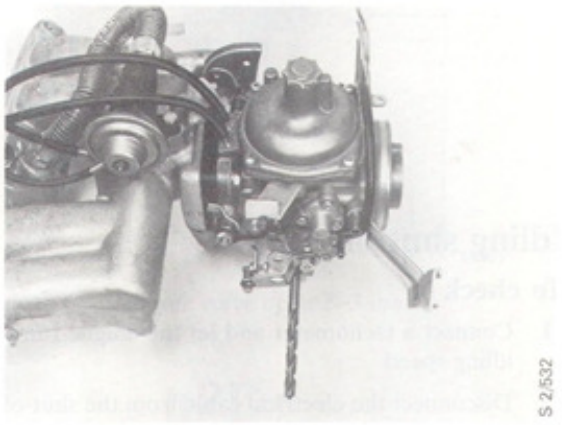
4. Carbon deposits in combustion chamber (caused by prolonged use of choke and engine failing to reach normal running temperature).
5. Grade of fuel too low – higher octane rating needed.

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.

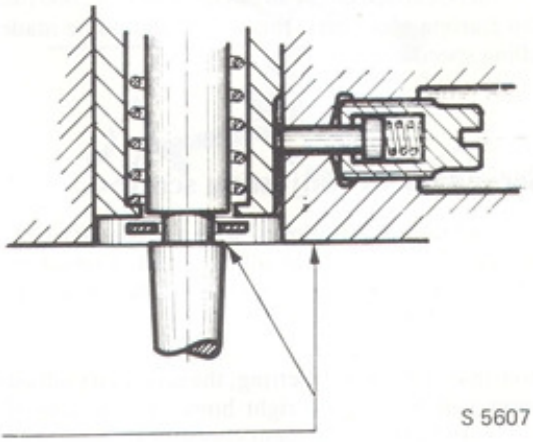
Adjust the stop screw on the throttle lever if required.

Basic setting of the jet

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.
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.



Needle shoulder flush with bottom of piston

CO-setting

Before adjusting the CO setting:

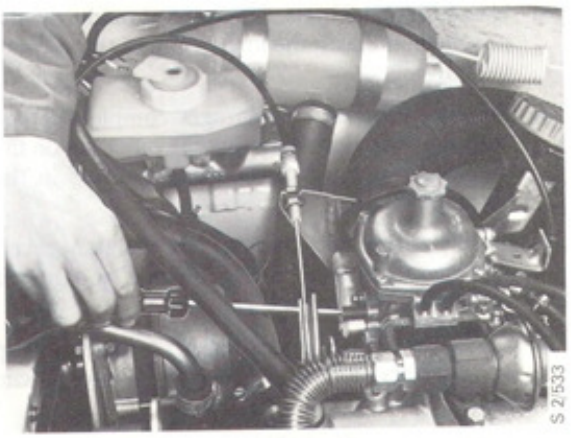
1. Change the engine oil.
2. Check the condition of the spark plugs.
3. Check the HT leads.
4. Check the valve clearance.
5. Check the position of the camshaft (timing).
6. Check the ignition timing.
7. Check the idling speed.
8. Check the float chamber ventilation.
9. Check the oil level in the carburetor dashpot damper.
10. Check the air preheater/air cleaner.
11. Check the delay valve.
12. Check the radiator fan.
13. Check the fuel shut-off valve.
14. Check the fast-idling speed (engine at normal running temperature).
15. Check the operation of the choke modulator by blanking off the filter aperature.
16. Check that the secondary CO adjusting screw is screwed fully home.

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 Europa spec. cars, the setting should be made at idling speed.

Secondary CO adjusting screw

The carburetor is equipped with a secondary CO adjusting screw for use at idling speed. Conventional adjustment of the CO content should be carried out as before at 2,000 r/min.

Note that in its normal setting, the secondary adjusting screw will be screwed right home, to the end of its travel. If during subsequent checking of the CO value at idling speed the value exceeds the specified maximum (4.5 %), the CO content can be reduced using the secondary adjusting screw.

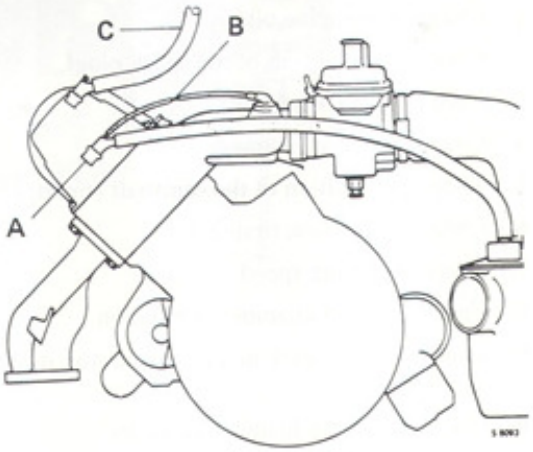


Secondary adjusting screw

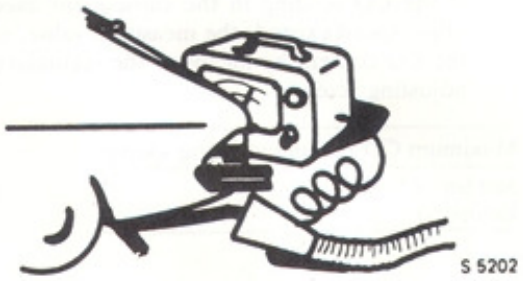
CO-setting at 2000 r/min

1. Plug or clamp shut the vacuum hose to the vacuum control unit on the distributor.
2. Disconnect the crankcase ventilation as follows:
   a. Disconnect the hose from the valve cover.
   b. Plug the end of the small-bore hose.
   c. Connect the evacuation hose to the valve cover.

Evacuate the crankcase gases from the outlet in the valve cover by connecting the other end of the hose to the evacuation hose of the building's extraction system, at a point downstream of the CO-meter probe, to ensure that the readings will not be affected.

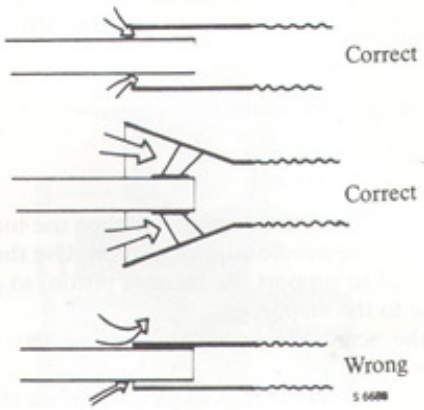


3. Plug the end of the vacuum hose to the EGR valve.
4. Connect the CO meter and tachometer.



5. Switch on the daylight driving lights.
6. Run the engine to its normal operating temperature. Set the idling speed to 2000 r/min. Read the CO value immediately after the radiator fan cuts in.

Note
When connecting exhaust extraction equipment in conjunction with running the engine inside the workshope, avoid excessive depressurization of the exhust system, as this may affect readings, e.g. of the CO content.
To prevent excessive extraction pressure, use an extraction hose with an open coupling.



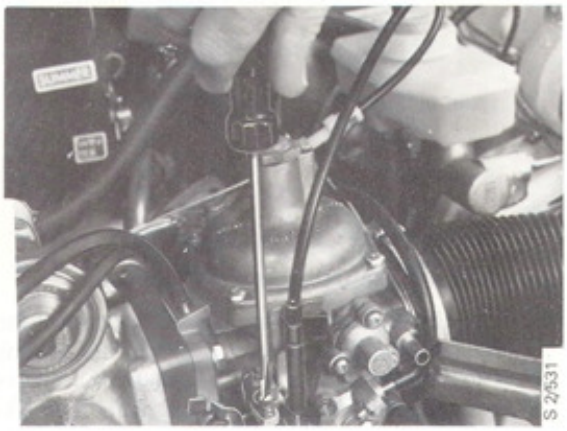
7. If the reading is within the specified limits, reset the idling speed to 850 r/min.

CO-setting (hoses to vacuum control unit, crankcase ventilation and EGR valve disconnected).

Single carburetor: 1.75 ± 0.25 % at 2,000 r/min.

For adjustment, remove the dashpot 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).

8. Remove the plugs and connect the crankcase ventilation, the EGR hose and the vacuum hose to the distributor.
9. Set the idling speed to 850 ± 50 r/min.



Idling adjustment

10. Check the CO-value at idling speed.

    If the CO reading in the subsequent check at idling speed exceeds the measured value, adjust the CO content by means of the secondary CO adjusting screw.

Maximum CO reading at idling speed
Sweden: 4.5 %
Europe: 3.5 %

CO setting at 850 r/min (idling speed)

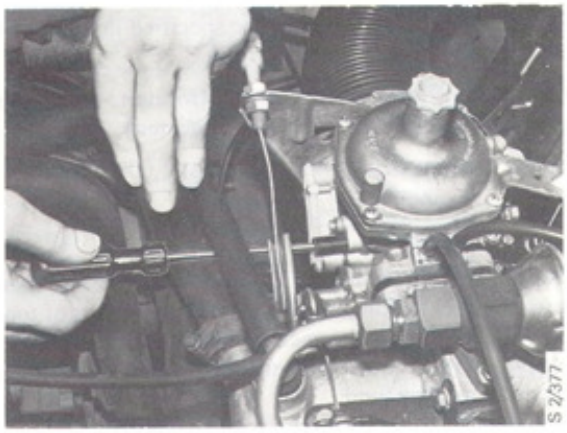
1. Run the engine until it reaches its normal running temperature, so that the CO reading can be made just after the fan has cut in. The reading must be made with the headlights switched off.
2. Take the CO reading.

CO reading at 850 r/min

Single carburetor:
1.5 ± 1 % at 850 r/min

To adjust remove the damper and then use tool 83 93 035 to turn the needle adjusting screw. Use the sleeve of the tool to support the vacuum piston, to prevent damage to the diaphragm.
Turn the screw clockwise to increase the reading (needle raised).
Turn the screw counter-clockwise to reduce the reading (needle lowered).

3. Disconnect the CO meter and tachometer.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Fault tracing when CO reading too high

1. Check the calibration of the CO meter.
2. With the engine at idling speed, disconnect the crankcase ventilation hose. If a lower CO reading is now obtained, this will be because of petrol in the engine oil. Change the oil and read off the CO content again.

3. Check the basic setting by removing the vacuum piston (or pistons) and making sure that the needle shoulder is in line with the bottom of the vacuum piston.
   Before refitting the componnents, clean the piston and carburetor. Read off the CO content again.
4. Check the setting of the air preheater valve.
5. Check that items 2 to 6 inclusive under "CO setting" have been carried out correctly; if not, run through the procedure again.

Note
Do not take CO readings when the engine temperature is above normal, as this will result in faulty readings.

Adjustment screws

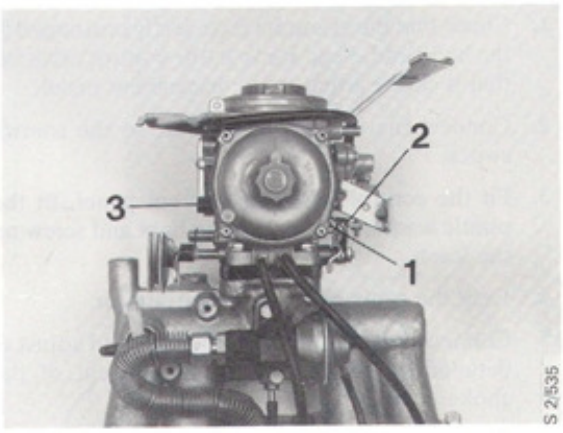
1. **Vent valve, float chamber**

   The setting is fixed and adjustment is not normally necessary. In the event of any adjustment being made, this will affect the settings of adjusting screws 2, 3 and 4. These must therefore be readjusted in the given order.

2. **Idling setting**

   If any adjustment is made it will affect the setting of adjusting screw 4, which should also be checked.

3. **Secondary adjustment screw. CO at idling.**



Adjustment screws

1. Vent valve, float chamber
2. Idling setting
3. Secondary adjustment screw. CO at idling

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.

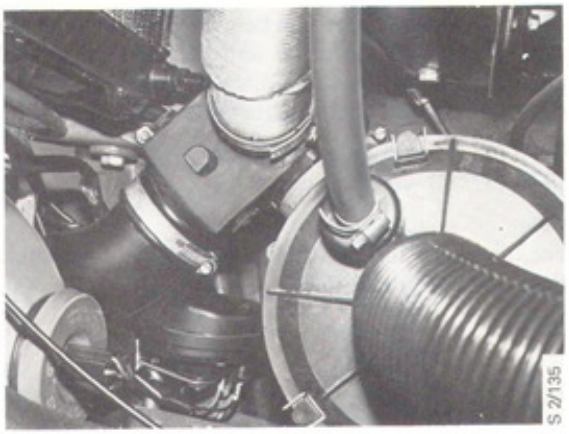
To fit

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.

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. A hose connects the air cleaner and the carburetor.

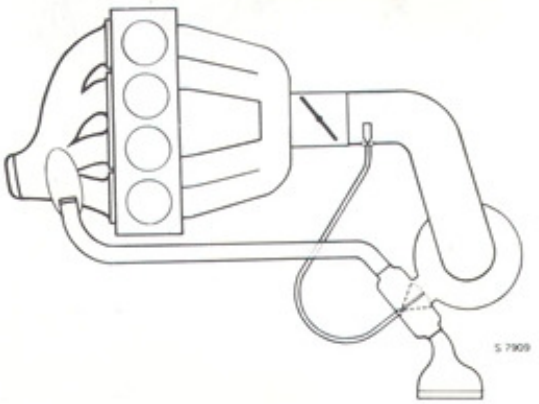


Preheating

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 a hose from a cover on the exhaust manifold.

The valve is activated by a thermostat in front of 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 oF (23 and 37 oC). In operation the valve therefore alternates between the non-preheated and preheated positions.



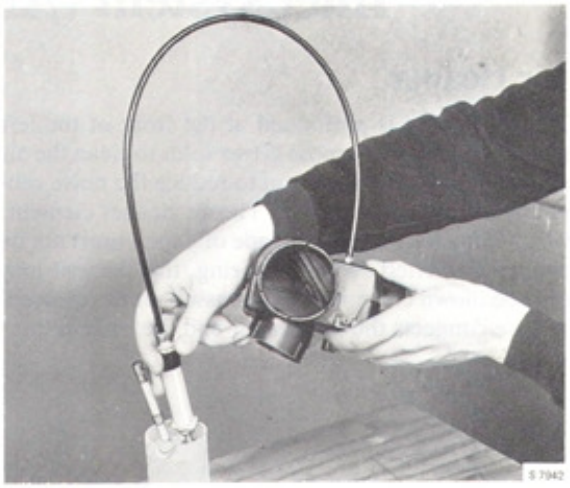
To check

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

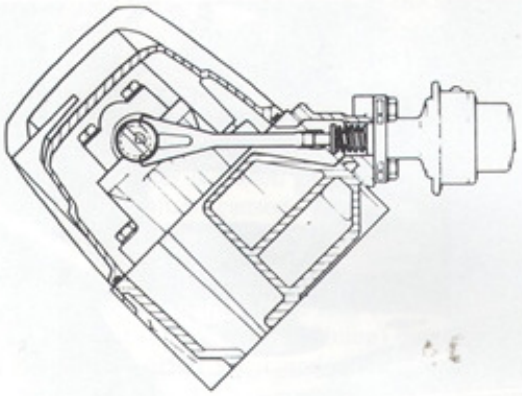
Note
For this check the cable should adopt approximately the same position as it has in the car.

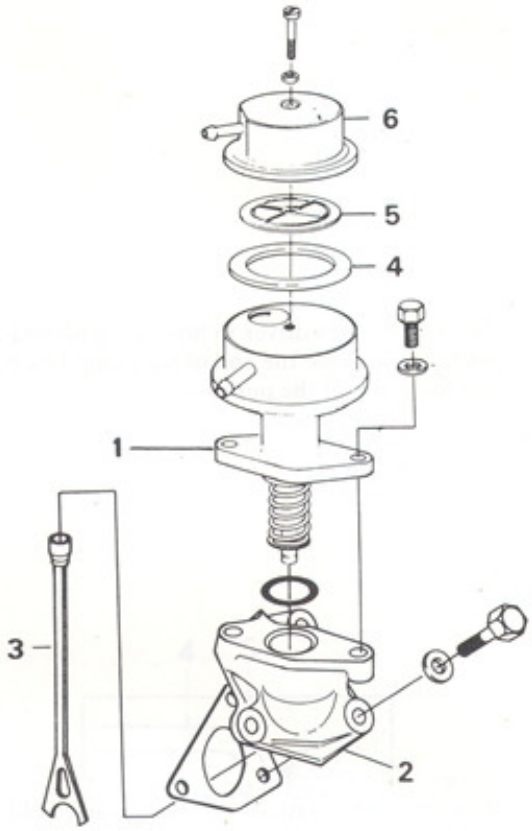


Fuel pump

General

The fuel pump is a diaphragm pump, driven by a push-rod from an eccentric on the camshaft.





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.

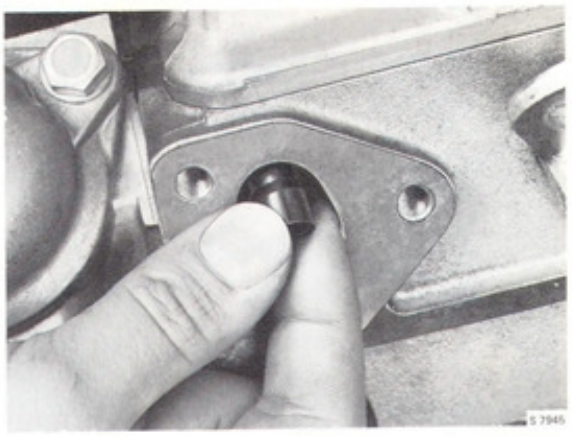
The pump cannot be dismautled and consequently cannot be overhauled in the event of damage to the diaphragm or valves; the entire unit must then be replaced.

To refit

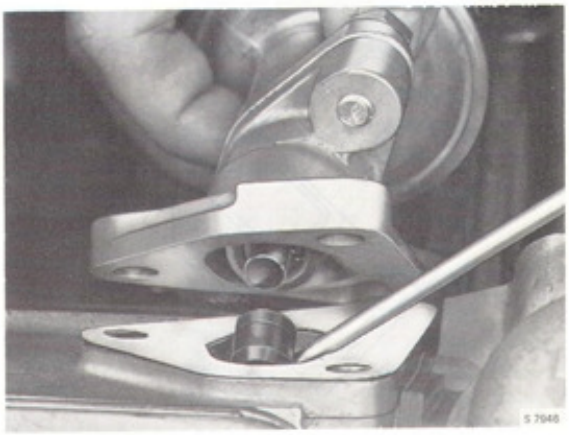
Always fit a new gasket. If the fuel pump has been removed with the valve cover in situ, refit as follows.

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

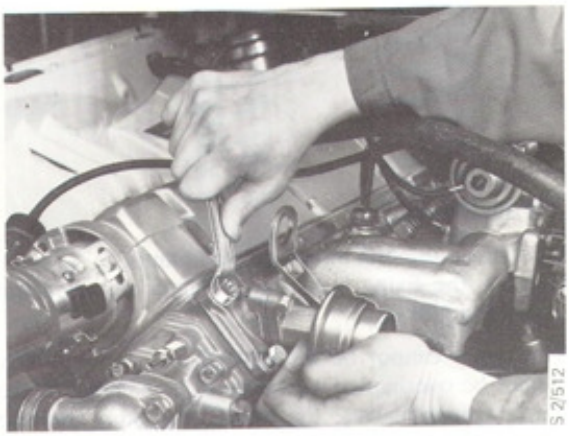
3. Guide the push-rod into the groove in the camshaft.
Rotate the push-rod to ensure that it has engager in the groove.



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 these while fitting and tightening the three fixing bolts.



Fuel tank and fuel lines

Fuel tank

The fuel tank is manufactured of extruded plastic and houses the fuel level transmitter, suction pipe and, in fuel-injection cars, the electric fuel pump.

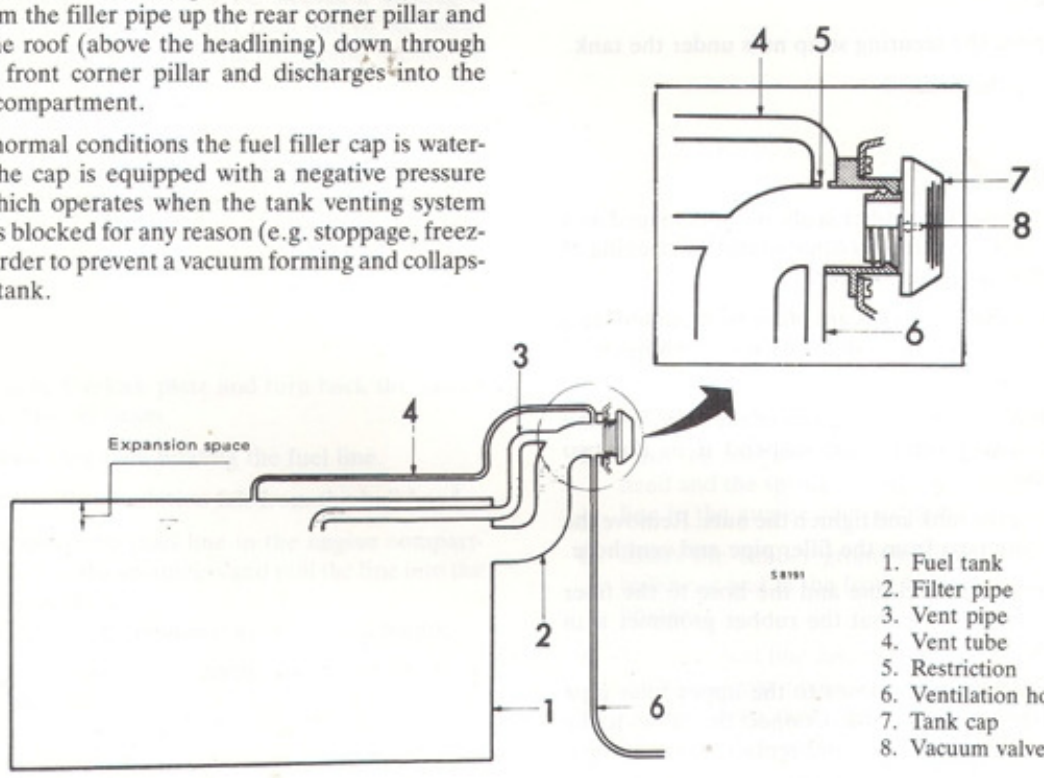
Fuel tank venting and overfill protection

When fuel is added to the tank air is evacuated partially through vent pipe 3.

An air cushion is formed at the top of the tank when the level of fuel reaches the lower opening of the vent pipe (3) due to the action of a valve (5) positioned in the vent pipe for the upper section of the tank (4). The valve seals the pipe thereby limiting the space available for expansion resulting from rapid changes in the volume when fuel is added but is not affected by changes in the volume caused by temperature fluctuations or driving factors.

The tank is vented through the vent hose (6) which runs from the filler pipe up the rear corner pillar and along the roof (above the headlining) down through the left front corner pillar and discharges into the engine compartment.

Under normal conditions the fuel filler cap is watertight. The cap is equipped with a negative pressure valve which operates when the tank venting system becomes blocked for any reason (e.g. stoppage, freezing) in order to prevent a vacuum forming and collapsing the tank.

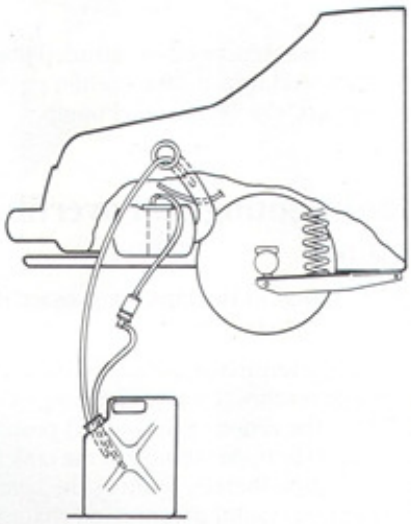


1. Fuel tank
2. Filter pipe
3. Vent pipe
4. Vent tube
5. Restriction
6. Ventilation hose
7. Tank cap
8. Vacuum valve

Fuel tank ventilation, arrangement diagram

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.

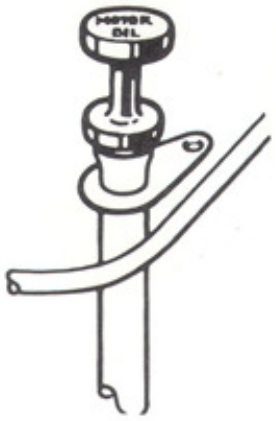
Fuel pipes

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

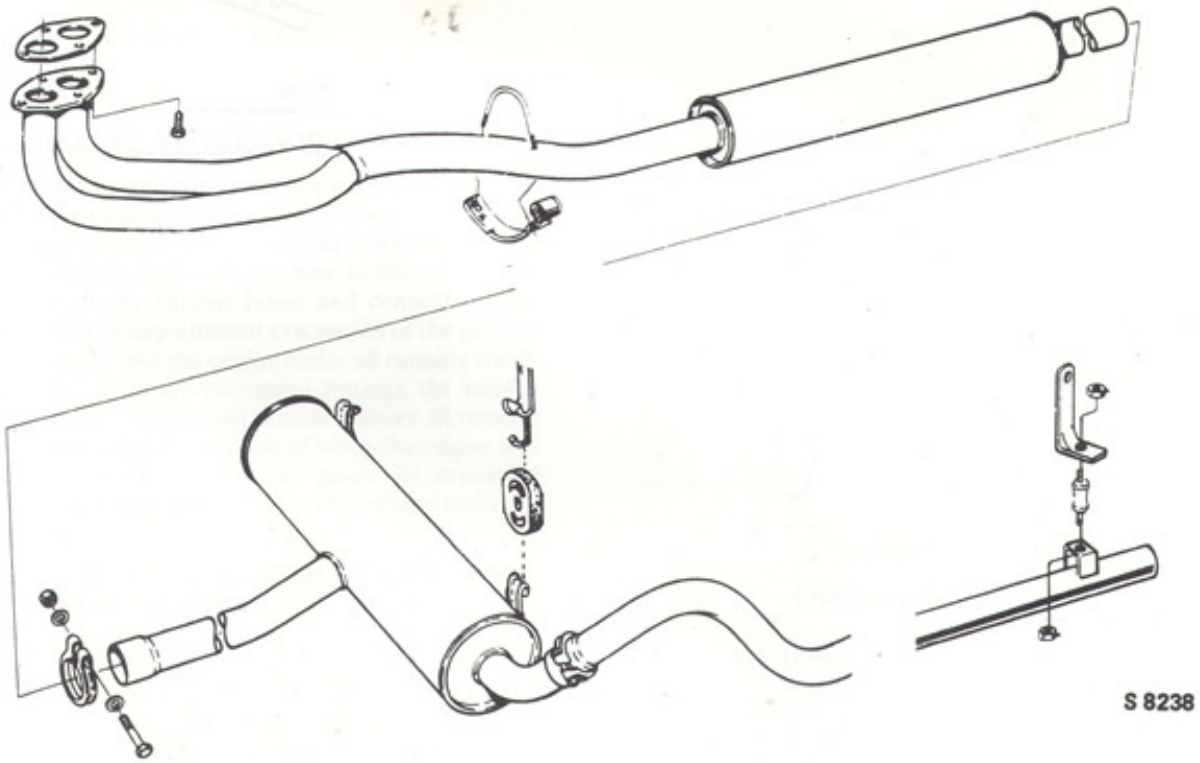
General

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.



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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.

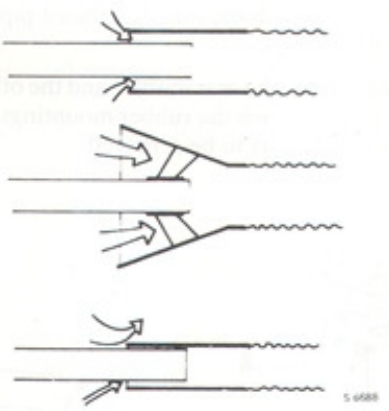
Refit in the reverse order.

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.

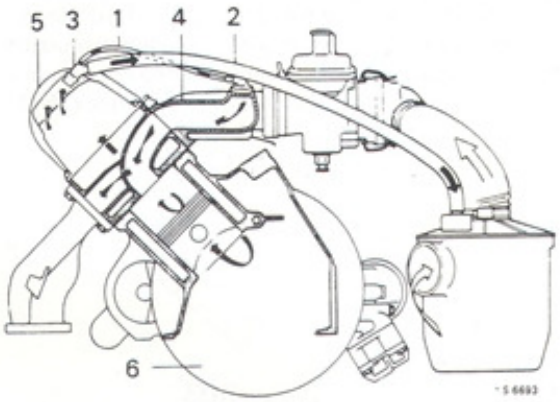
System	Europe	Sweden o Switzerland
Deceleration		
Vacuum-controlled deceleration valve	X	X
Delay valve, vacuum advance		X[1]
EGR valve (green, on/off		X

[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.

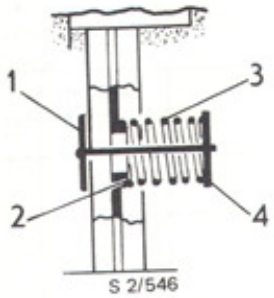
The type of deceleration device used is the vacuum-controlled type.

Vacuum-controlled deceleration valve

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.

The throttle butterfly now incorporates a disc valve, which opens under the action of the depression.



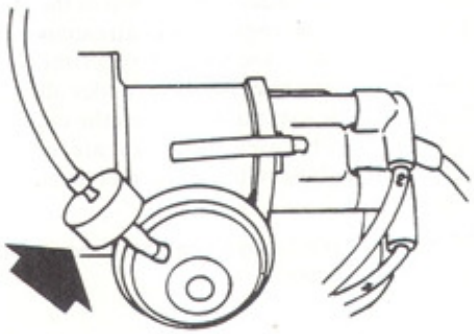
Deceleration valve

1. Disc valve
2. Spring seat
3. Spring
4. Spring seat

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 ± 1 s.

A faulty delay valve should be renewed.

Exhaust gas recirculation system (EGR)

(Cars with Sweden and Switzerland specs. only).

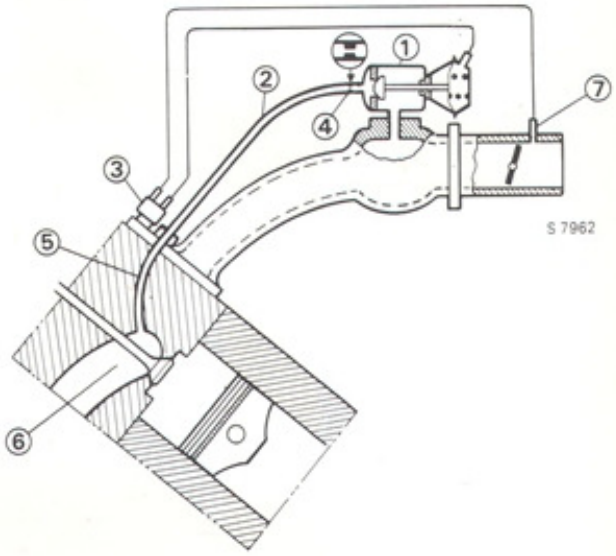
General

Recirculating a small amount of the exhaust gases to the intake side of the engine reduces the combustion temperature, which helps to reduce the emission of nitric oxides (NOx).

EGR gases are led from the exhaust port in No. 2 cylinder through a special passage in the cylinder head and thence a steel pipe on the intake side to a valve in the inlet manifold.

EGR on-off system

When the EGR valve opens a small quantity of exhaust gas flows through the passage and pipe into the inlet manifold. The EGR valve is controlled by the depression from the carburetor (throttle housing). The relative position of the vacuum outleet to the throttle is such that the EGR valve will open at an engine speed of 1900 r/min approx. (fast idling) or at a slightly higher speed. The valve is fully open at low loads. At full throttle and slightly below the depression is so slight that the valve is closed. The quantity of exhaust gas is governed the orifice (4). The thermostatic valve is activated by coolant temperature and disconnects the depression at temperatures below 110 °F (43 °C) approx. which improves engine operation immediately after starting from cold.



EGR on-off system

1. EGR valve
2. EGR pipe
3. Thermostat valve
4. Orifice (4 mm dia.)
5. EGR passage
6. Exhaust port (no. 2 cylinder)
7. Vacuum outlet

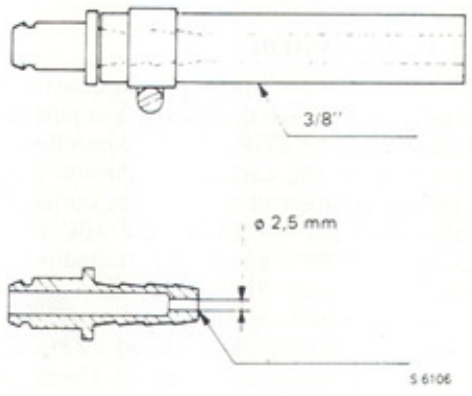
Cleaning

1. Remove the EGR pipe and the EGR valve.

2. Clean the aperture in the inlet as follows:
   a. Remove the brake servo pipe from the connection on the inlet manifold.
   b. Use a specially-made adaptor to connect compressed air to the inlet manifold brake servo outlet.
   See box below:

Compressed air should be connected to the inlet manifold through the brake servo connection when cleaning the EGR aperture in order to prevent particles of carbon entering the manifold. A specially-made compressed air adaptor with an internal orifice (2.5 mm dia.) and a length of 3/8 in compressed air hose is used to limit the pressure of the air.

The compressed air adaptor is made as shown in the figure, e.g. by soldering up the end of the connector and then drilling out a 2.5 mm dia. hole.

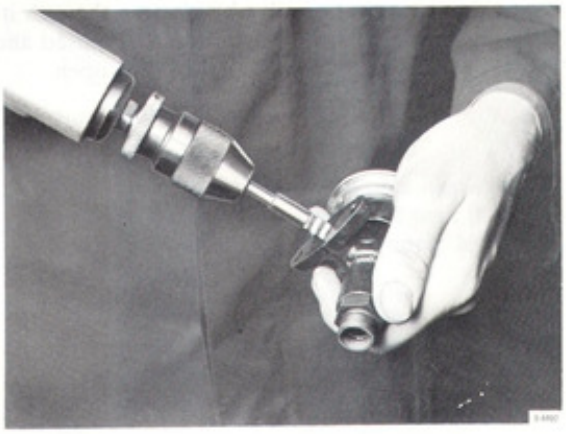


c. Clean the EGR aperture in the inlet manifold with a 10 mm drill bit which allows the carbon deposits to be blown out.

d. Remove the compressed air hose and refit the brake servo hose.

4. Wash the EGR pipe and clean with compressed air. Use a piece of wire to clear the pipe if carbon deposits are extensive.
The orifice in the EGR on-off system should be cleaned with a 4 mm drill bit.

5. Clean the inlet and outlet of the EGR valve using a rotary wire brush. Take care not to damage the valve spindle when cleaning the outlet side.
Rinse the valve in trichloroethylene and blow the valve clean with compressed air, keeping it open by means of a vacuum. To create a vacuum in the EGR valve, use a vacuum pump or suck through a hose connected to the valve.



6. Install the EGR valve using a new gasket and mount the EGR pipe. Connect the vacuum hose.

Checking the EGR system

1. Run the engine until warm and connect a tachometer.

2. Rev up the engine and check when the EGR valve opens. The valve should open at fast-idling speed (see below). The valve spindle is visible between the valve casing and the vacuum bellows.

Type	Engine speed (fast idling) at which the valve should open
On-off	approx. 1 900 r/min

Checking the EGR valve

1. Run the engine at idling speed.
2. Disconnect the vacuum hose from between the PVS valve and the EGR valve. Create a vacuum in the EGR valve using a vacuum pump or by sucking on the hose. The idling should become rough and the engine should eventually stop.

Checking the thermostatic valve

Check the thermostatic valve by blowing through it. With the engine cold the valve should be closed and with the engine warm the valve should be open.

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

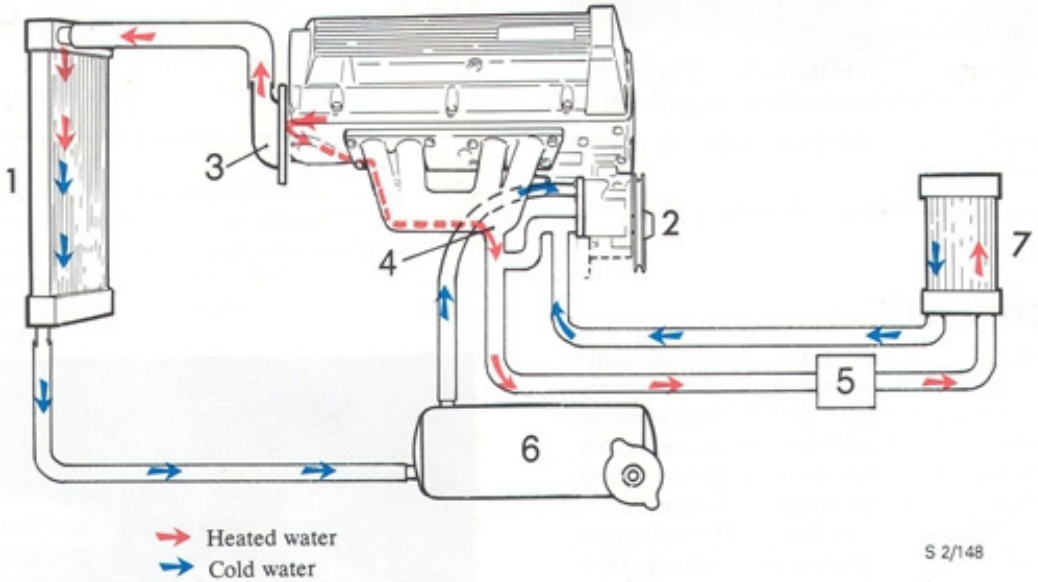
A. Thermostat shut:
From the water pump – via a passage in the engine block through the cylinder head – through the lower outlet of the thermostat housing and through a by-pass passage back to the pump. When the heater valve is open, the coolant will also flow through the heat exchanger.

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.

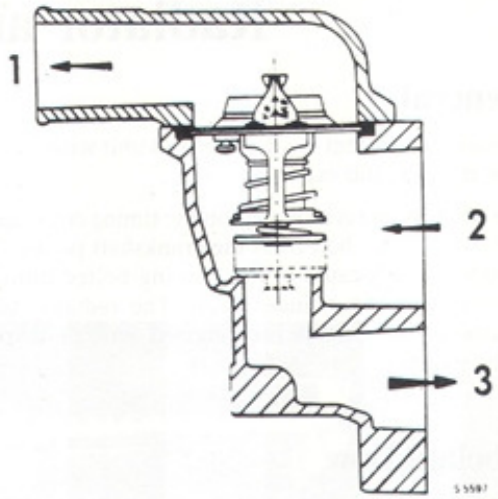
Expansion tank
The liquid in the expansion tank also circulates through the cooling system. The tank is connected to the water pump and the upper left section of the radiator.

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.



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 and engine block

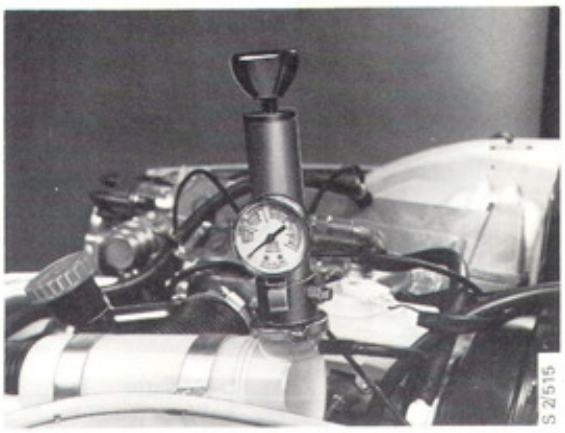
Removal and installation of the radiator

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 1b/in2). A pressure tester can also be used to check the opening pressure of the radiator filler cap. Opening pressure, section 022.



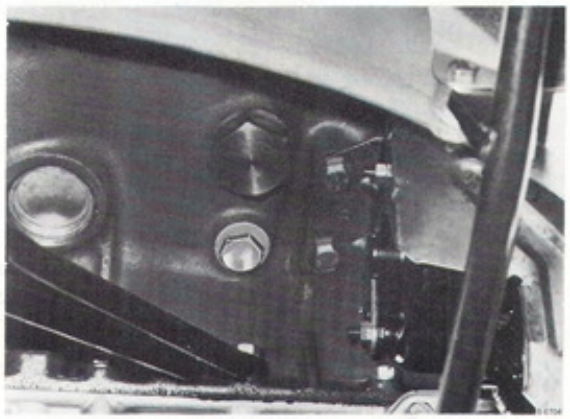
Checking the radiator

If the radiator has been removed from the car, it can be tested for leakage by being immersed in water with the tube openings plugged and supplied with compressed air. The maximum test pressure is 1.2 bar (17 1b/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 clean 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.



Drain plug

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.

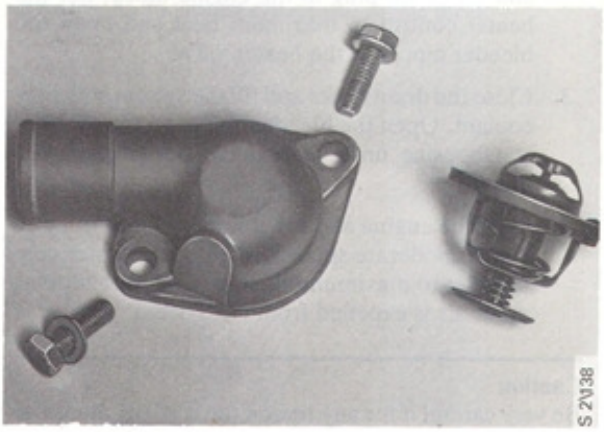
Anti-freeze coolant mixture

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

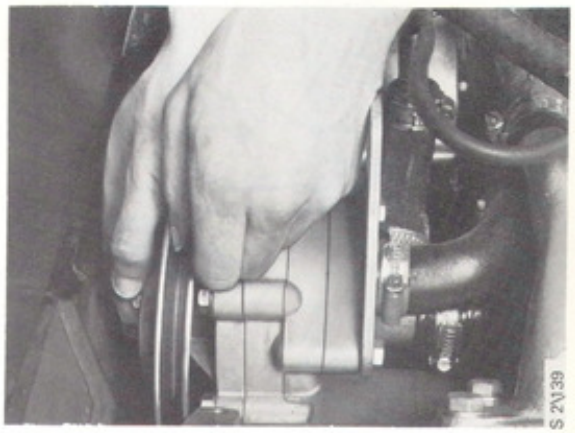
Winter thermostat

A winter thermostat with an opening temperature of 92 °C (198 °,) is available as a spare part.
This thermostat is only intended for winter use in markets with severe climates. It should be replaced by the standard 89 °C (192 °F) thermostat at the end of the winter.

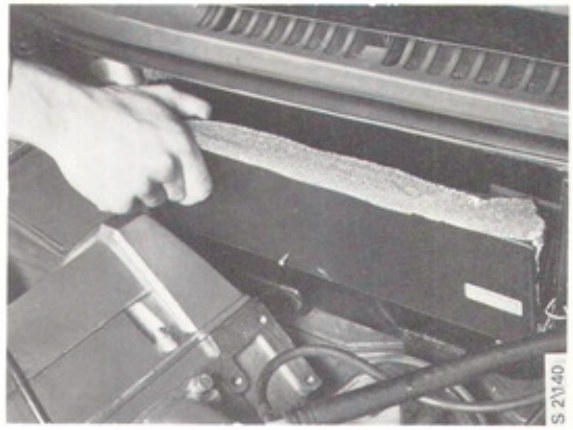
Water pump

To remove

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

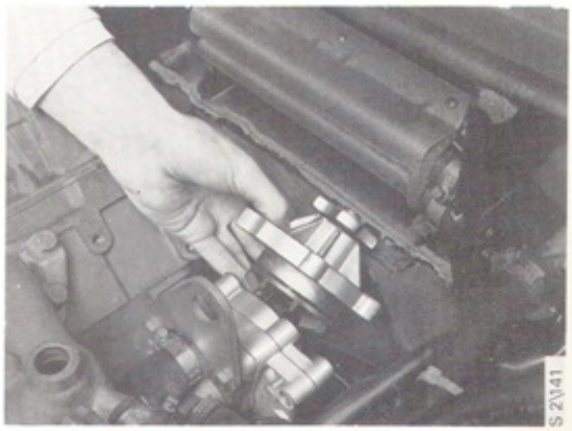


3. Remove the cover from the heater unit.
4. Remove the bolts and lift off the pump

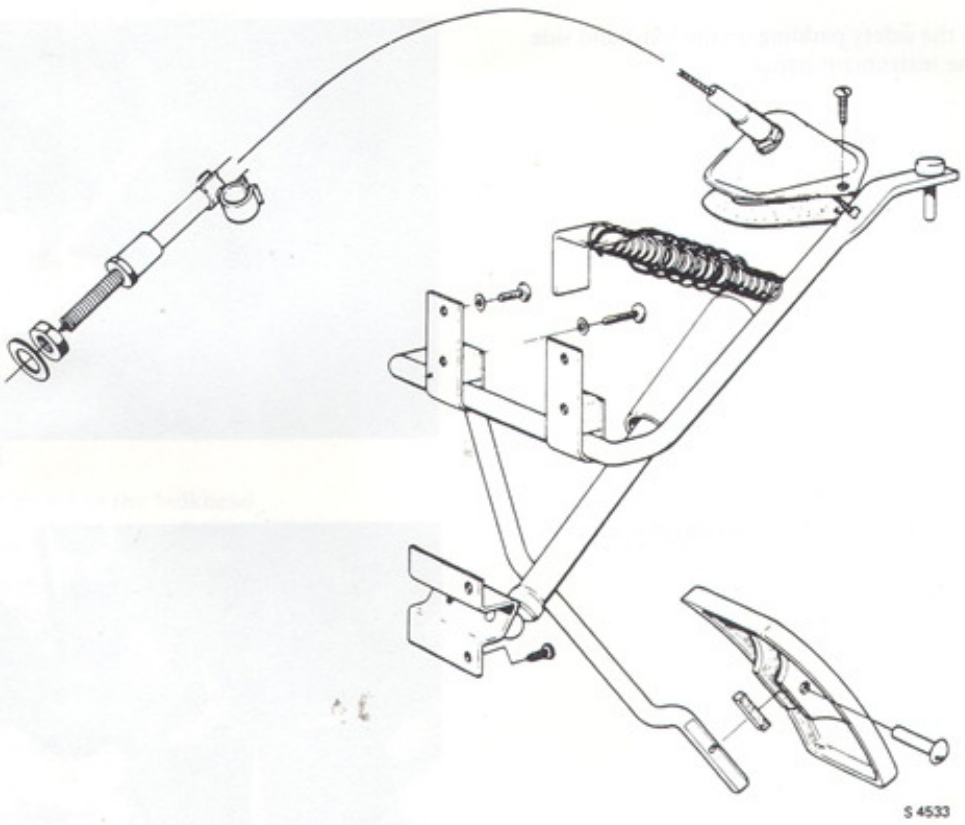


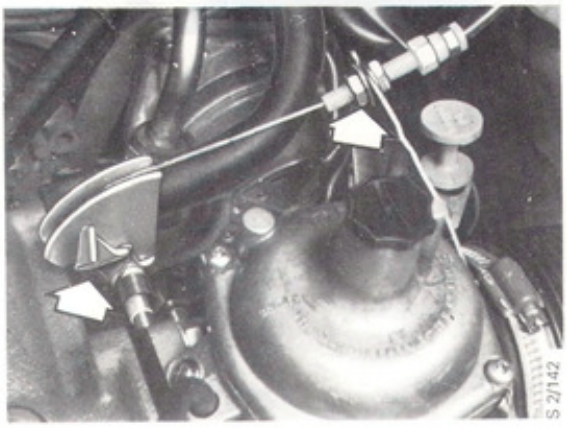
To refit

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.



Throttle controls

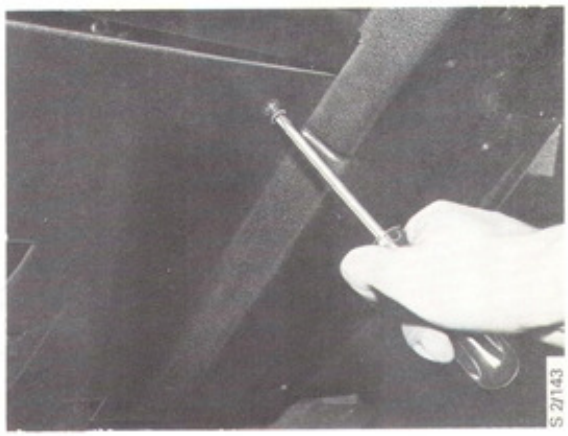




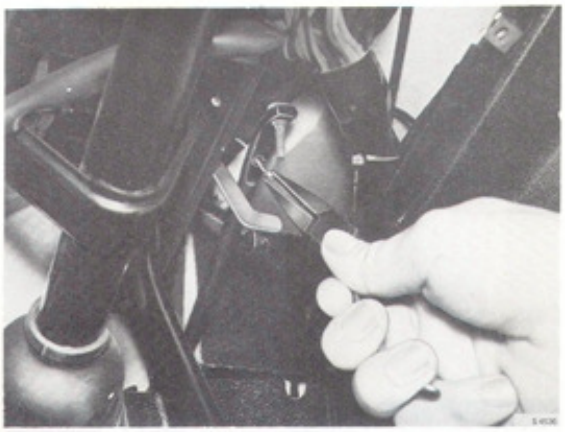
Throttle cable

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)
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)
6. Fit the safety padding under the instrument panel.
7. Adjust the throttle as necessary.

Saab-Scania AB
Saab Car Division
Nyköping, Sweden

GB English edition. Ordering No **327510**. Printed in Sweden by Graphic Systems AB, Göteborg 1984.