SAAB

900

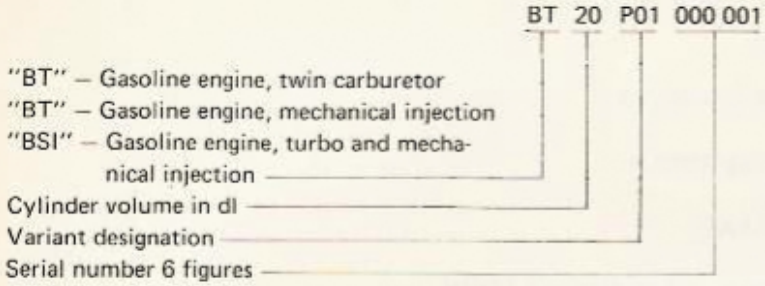
SERVICE MANUAL

2 Engine

M 1979–80

CONTENTS

ENGINE NUMBER



Engine number variants Saab 900 model 1979			Gearbox type	Market (Exhaust emission control degree)
B	20	P04	– Manual transmission	– Europe
BT	20	P04	– Manual transmission	– Europe, Sweden
BT	20	P05	– Automatic transmission	– Europe
BT	20	P06	– Automatic transmission	– Sweden
BI	20	P08	– Manual transmission	– Europe, Sweden, Canada
BI	20	P09	– Automatic transmission	– Europe
BI	20	P10	– Automatic transmission	– USA federal (UF)
BI	20	P11	– Manual transmission	– USA California (UC)
BI	20	P12	– Automatic transmission	– USA California (UC)
BI	20	P13	– Manual transmission	– USA federal (UF) Australia
BI	20	P14	– Automatic transmission	– Sweden, Canada
BSI	20	P01	– Manual transmission	– Europe, Sweden
BSI	20	P02	– Manual transmission	– USA, Canada

Engine number variants Saab 900 model 1980–			Gearbox type	Market (Exhaust emission control degree)
B	20	P04	– Manual transmission	– Europe
BT	20	P04	– Manual transmission	– Europe,
BT	20	P05	– Automatic transmission	– Europe (excl. Sweden)
BT	20	P06	– Automatic transmission	– Sweden
BI	20	P08	– Manual transmission	– Europe, Canada, Australia
BI	20	P09	– Automatic transmission	– Europe,(excl. Sweden)
BI	20	P11	– Manual transmission	– USA
BI	20	P12	– Automatic transmission	– USA
BI	20	P14	– Automatic transmission	– Sweden, Canada, Australia
BSI	20	P01	– Manual transmission	– Europe
BSI	20	P02	– Manual transmission	– USA, Canada

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EXHAUST EMISSION CONTROL INFORMATION

S 6984

Engine number

SPECIFICATIONS

Engine

GENERAL DATA

Type	4-cyl., 4-stroke with overhead camshaft
Power rating, DIN (SAE net) at 5 500 rev/min:	
Catalyst engine (excl. Turbo)	81 kW (110 hp) at 5 500 rev/min
Non catalyst engine (Federal model 1979)	85 kW (115 hp) at 5 500 rev/min
Canada	87 kW (118 hp) at 5 500 rev/min
Turbo	99 kW (135 hp) at 5 000 rev/min

Max. power on driving wheels:	
Automatic transmission, catalyst engine (excl. Turbo)	53 kW (72 hp) at 5 500 rev/min
Automatic transmission, non catalyst engine (Federal model 1979)	56 kW (76.5 hp) at 5 500 rev/min
Automatic transmission, Canada	57 kW (78.5 hp) at 5 500 rev/min
Manual transmission, catalyst engine (excl. Turbo)	60 kW (81 hp) at 5 500 rev/min
Manual transmission, non catalyst engine (Federal model 1979)	57 kW (77.5 hp) at 5 500 rev/min
Manual transmission, Canada	61 kW (83 hp) at 5 500 rev/min
Turbo	70 kW (93 hp) at 5 000 rev/min
Max. torque at 3 500 rev/min:	
Catalyst engine (excl. Turbo)	161 Nm (119 ft.lb.)
Non catalyst engine (Federal model 1979) and Canada	167 Nm (123 ft.lb.)
Turbo	217 Nm (160 ft.lb.)
Compression ratio:	
As from model 1980 (excl. Turbo)	9,25:1
Non Catalyst, model 1979	9,25:1
Catalyst, model 1979 (excl. Turbo)	8,7:1
Turbo	7,2:1
No of cylinders	4
Cylinder bore	3.543" (90.0 mm)
Stroke	3.071" (78.0 mm)
Cylinder volume	121.0 cu.in. (1985 cm^3)
Ordering of firing (No. 1 at rear)	1–3–4–2
Engine idling speed	875 ± 50 rev/min
Weight incl. clutch, throttle valve housing, exhaust manifold, starter and oil filter	appr. 308 lb. (140 kg)
Fuel, octane number	RON 91 (NOTE! Catalyst cars, only lead-free fuel.)

CYLINDER BLOCK

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

CYLINDER HEAD

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

PISTONS

Make	
Make	"MAHLE" or "KARL SCHMIDT" Pistons of different makes must not be fitted in the same engine.
Material	Light metal alloy
No. of rings per piston	2 compression rings 1 oil scraper (3-piece)
Width of ring grooves:	
Top	1.79–1.81 mm
Middle	2.03–2.05 mm
Bottom	4.01–4.03 mm
Piston diameter (measured 0.79"/20 mm from lower edge perpendicular to piston pin):	
Standard (AB)	89.980–89.986 mm
–"– (C)	89.999–90.010 mm
1st oversize	90.472–90.487 mm
2nd oversize	90.972–90.987 mm
Piston clearance	0.014–0.040 mm
Withdrawal of piston	From top of block
Piston orientation	Groove on top should be facing the engine transmission end
Pin diameter	23.996–24.000 mm
Fit of pin	0.005–0.014 mm Sliding fit under gentle pressure with thumb
Piston speed (average speed)	13 m/sec. at 5 000 rev/min

PISTON RINGS

Upper compression ring:	
Thickness	1.73–1.75 mm
Gap, fitted in new cylinder	0.35–0.55 mm
Piston ring play in groove	0.050–0.082 mm
Lower compression ring:	
Thickness	1.98–1.99 mm
Gap, fitted in new cylinder	0.30–0.45 mm
Piston ring play in groove	0.040–0.072 mm
Oil scraper:	
Thickness (segment)	0.58–0.64 mm
Gap fitted in new cylinder (segment)	0.38–1.40 mm
Thickness, middle ring	2.63–2.73 mm

CONNECTING RODS

Material	Forged steel
Big-end bore	56.000–56.019 mm
Small-end bushing, installed	24.005–24.010 mm
Maximum allowed weight difference between connecting rods in same engine	6 g

CRANKSHAFT

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

Crank pin diameter:	
Standard	51.981–52.000 mm
1st undersize	51.731–51.750 mm
2nd undersize	51.481–51.500 mm
3rd undersize	51.237–51.250 mm
4th undersize	50.987–51.000 mm
Main bearing pin diameter:	
Standard	57.981–58.000 mm
1st undersize	57.731–57.750 mm
2nd undersize	57.481–57.500 mm
3rd undersize	57.237–57.250 mm
4th undersize	56.987–57.000 mm
Radius at pin end	2.2–2.5 mm
Max. out-of-round of pins	0.05 mm
Max. conicity of pins	0.05 mm
Bearing material	Lead-bronze
Crankshaft axial play	0.08–0.28 mm
Main bearing play	0.020–0.062 mm
Crank bearing play	0.026–0.062 mm

Colour marks, main and crank bearing halves:	Thin	Thick
Standard	Red	Blue
1st undersize	Yellow	Green
2nd undersize	White	Brown

CAMSHAFT

Number of bearings	5	
Bearing diameter	28.94 mm	
Camshaft axial play	0.08–0.25 mm	
Camlifting height at valve clearance 0:		Turbo
Inlet valve	10.8 mm	9.1 mm
Exhaust valve	11.0 mm	10.5 mm

Valve timing:		Turbo
Inlet (nominal valve clearance 0.014"/ 0.35 mm)	starts 10° BTDC ends 54° ABDC	starts 12° BTDC ends 40° ABDC
Exhaust (nominal valve clearance 0.022"/ 0.55 mm)	starts 46° BBDC ends 18° ATDC	starts 62° BBDC ends 2° ATDC

VALVE MECHANISM

Valve grinding angle, inlet and outlet	44.5°
Valve seat angle in cylinder head, inlet and outlet	45.0°
Valve seat width, inlet and outlet	1–2 mm
Valve spindle diameter:	
Inlet	7.960–7.975 mm
Outlet	7.955–7.980 mm
Max. play valve spindle–valve guide	0.5 mm Measured on valve disc pulled 0.12" (3 mm) from seat

Valve disc diameter:	
Inlet	42.0 mm
Outlet	35.5 mm
Valve guides:	
Length	46.65 mm
Outer diameter	13.040–13.051 mm
Bore for valve guides in cylinder head, diameter	13.000–13.018 mm
Valve springs:	
Installed length	39.5 mm
Free length	43.1 mm
Length at full elevation	29.5 mm
Load at full elevation	755–815 N (170–183 lb., 77–83 kp)
Valve depressors:	
Diameter	37.87–37.98 mm
Height	33 mm
Bore in cylinder head for valve depressors (camshaft bearing assy.) diameter	38.000–38.016 mm
Pallets for valve adjustment:	
Diameter	15.5 mm
Thickness	1.77–2.89 mm There are 23 pallets of different thicknesses at intervals of 0.050 mm
Material:	
Exhaust valve, federal	Stellite steel
Exhaust valve, California and Turbo	Sodium cooled exhaust valves

N.B.
Scrapped sodium-filled valves must never be mixed with ordinary scrap without prior treatment, since there will otherwise be a danger of explosion during melting. See "Disposal of sodium-filled exhaust valves", section 214.

Inlet valve	Steel (Valve spindles are chromium plated)	
Valve guides	Cast iron	
Valve seats	Sintered metal	
Valve clearances, cold engine (30 minutes after driving the engine warm):		
Inspection tolerance zone:		Turbo
Inlet	0.006–0.012" (0.15–0.30 mm	
Exhaust	0.014–0.020" (0.35–0.50 mm)	0.016–0.020" (0.40–0.50 mm)
Adsjutment tolerance zone:		
Inlet	0.008–0.010" (0.20–0.25 mm)	
Exhaust	0.016–0.018" (0.40–0.45 mm)	0.018–0.020" (0.45–0.50 mm)
Idler shaft axial play	0.002–0.005" (0.05–0.13 mm)	

LUBRICATION SYSTEM

Type	Forced-flow circulating oil system Dual-rotor type oil pump
Pressure-lubricated points	Camshaft, crankshaft, idler shaft, connecting rods, transmission chain
Splash-lubricated points	Piston pins, cylinder walls, valve depressors and valve spindles
Oil filter	Full-flow type
Crankcase ventilation, fully enclosed	From crankcase through valve cover via a restriction to inlet manifold. The valve cover is connected to atmospheric pressure via the air cleaner.
Lubricating oil, grade: SAE 10 W 30 or 10 W 40. If no oil meeting these specifications is available, oil with a viscosity of SAE 10 W 50 may be used. (In extremely cold conditions with temperatures constantly below $-4^{\circ}F$ ($-20^{\circ}C$) oil with viscosity rating SAE 5 W 20 or 5 W 30 or 5 W 40 should be used. Note! SAE 5 W 20, 5 W 30 or 5 W 40 must not be used at temperatures above $+32^{\circ}F$ ($0^{\circ}C$).	Service SE in API-system or Ford spec. ESE–M2C–101C
Oil volume incl. filter	3.7 US quarts (3.5 liters)
Oil pump pressure-reducing valve opens at	4.0–5.0 bar (kp/cm^2, 57–71 psi.)
Oil pressure warning light comes on at	0.3–0.5 bar (kp/cm^2, 4.2–7.1 psi.)
Oil pressure at 2 000 rev/min (oil SAE 10 W 40 at $176^{\circ}F/80^{\circ}C$)	Min. 3.0 bar (kp/cm^2, 43 psi.)
Oil pump:	
Axial clearance between rotor and housing	0.002–0.003" (0.05–0.09 mm)

FUEL SYSTEM

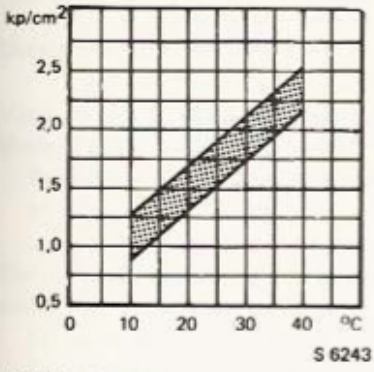
Components

Injection valve	
Model 1979	Bosch 0 437 502 004
As from model 1980	Bosch 0 437 502 012
Cold start valve	Bosch 0 280 170 401
Mixture control unit:	Bosch 0 438 040 007
Non-catalyst cars	Bosch 0 438 040 049
Catalyst cars (and Turbo)	Bosch 0 438 040 051
Air flow sensor:	
Non-catalyst cars	Bosch 0 438 120 071
Catalyst cars (and Turbo)	Bosch 0 438 120 073
Fuel distributor:	
Non-catalyst cars	Bosch 0 438 100 023
Catalyst cars (and Turbo)	Bosch 0 438 100 032
Warm-up regulator:	
Non-catalyst cars	Bosch 0 438 140 020
Catalyst cars	Bosch 0 438 140 051
Turbo	Bosch 0 438 140 051

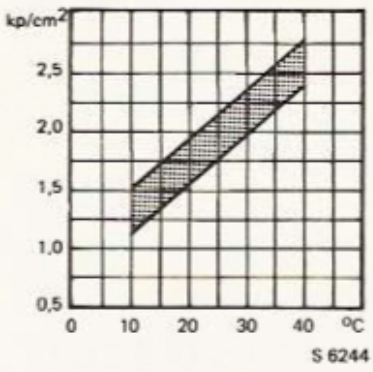
Test values

1. Electric fuel pump, capacity — (900 cm^3/30 s) min., measured in the return fuel line

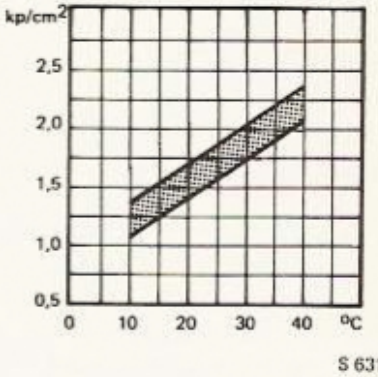
2. Control pressure, cold engine



WARM-UP REGULATOR 0 438 140 020
NON-CATALYST CARS



WARM-UP REGULATOR 0 438 140 032
(CATALYST CARS)



WARM-UP REGULATOR TURB
0 438 140 051

3. Control pressure, warm engine — 3.4–3.8 bar (≈ kp/cm^2, 48.5–54.0 psi.)
4. Line pressure:
   Test value — 4.5–5.1 bar (≈ kp/cm^2, 64.0–72.5 psi.)
   Setting value — 4.7–4.9 bar (≈ kp/cm^2, 66.9–69.7 psi.)
5. Leakage check:
   Minimum pressure after 20 minutes — 1.5 bar (≈ kp/cm^2, 14.2 psi.)
6. Injection valve:
   Opening pressure, 1979 model up to date code 828 — 2.5–3.6 bar (≈ kp/cm^2, 36.0–52.0 psi)
   Opening pressure, 1979 model as from date code 829 — 2.7–3.8 bar (≈ kp/cm^2, 38.0–54.0 psi)
   Opening pressure, 1980 model — 3.0–3.8 bar (≈ kp/cm^2, 43.0–54.0 psi)
   Maximum variation within group — 0.6 bar (≈ kp/cm^2, 8.5 psi.)
7. Leakage test — By a pressure of 2.4 bar (≈ 33.8 psi.) no drop should fall within 15 sec

8. Adjustment of idling speed:
   Idling speed — 875 ± 50 rev/min

CO value

Non-catalyst cars:

0.75 ± 0.25 %

Catalyst cars Model 1979:

$0.75 \pm \frac{0.25}{0.5}$ % (Sensor discon. After cat.)

Catalyst cars Model 1980:

1.0 ± 0.25 % (Sensor discon. Before cat.)

Canada cars (excl. Turbo):

1.5 ± 0.5 %

Tightening torques

Air flow sensor:	
Stop bracket retaining screws	4.7–5.3 Nm (3.4–3.8 ft.lb., 47–53 kpcm)
Counterweight retaining screw	4.7–5.3 Nm (3.4–3.8 ft.lb., 47–53 kpcm)
Air flow sensor plate retaining screw	5.0–5.5 Nm (3.6–4.0 ft.lb., 50–55 kpcm)
Fuel distributor retaining screws	3.2–3.8 Nm (2.3–2.7 ft.lb., 32–38 kpcm)
Line pressure regulator screw plug	13–15 Nm (9.4–10.8 ft.lb., 130–150 kpcm)

M 8 bolt	10–12 Nm (7.2–8.7 ft.lb., 100–120 kpcm)
M 10 bolt	13–15 Nm (9.4–10.8 ft.lb., 130–150 kpcm)
M 12 bolt	20–24 Nm (14.4–17.4 ft.lb., 200–240 kpcm)
M 14 bolt	15–20 Nm (10.8–14.4 ft.lb., 150–200 kpcm)
M 12 cap nut	15–20 Nm (10.8–14.4 ft.lb., 150–200 kpcm)
M 14 cap nut	25–30 Nm (18.1–21.8 ft.lb., 250–300 kpcm)

Others

Fuel tank capacity	14.5 US gal. (55 liters)

Turbo system

Turbo compressor make	Garret AiResearch
Maximum charging pressure (see measuring the charging pressure)	7.1 ± 0.7 psi. (0.50 ± 0.05 bar)
Approximate length of spring in charge pressure regulator (basic setting)	Approx. 0.717 in. (18.2 mm)
Actuating pressure of pressure switch	10.0 ± 1.4 psi. (0.7 ± 0.1 bar)
Clearance, turbo shaft bearings:	
axial clearance	0.025–0.10 mm
radial clearance	0.075–0.18 mm

EXHAUST SYSTEM

Exhaust pipe inner diameter	1.73" (44 mm)

EXHAUST EMISSION CONTROL SYSTEM

EGR, two-port

Speed when the EGR valve starts to open (revved at idle):	
Manual transmission	2600–3200 rev/min
Automatic transmission	2300–2900 rev/min
EGR valve, marking color–part No.–max. flow–restriction in exhaust manifold:	
Manual transmission	Red–83 66 700–10 kg/h–ø 0.20 in (5 mm)
Automatic transmission	Blue–83 57 725–20 kg/h–no restriction

Oxygen-sensor regulated injection system

Pulse relation:	
Opening interval at fixed regulation	60 ± 5 %
Opening interval with grounded oxygen sensor cable	greater than 75 %
Pulse relation:	
Opening interval at fixed regulation	60 ± 5 %
Opening interval with grounded oxygen sensor cable	greater than 75 %
Opening interval with throttle valve fully open:	
Model 1979 Standard	45 % ± 5 %
Model 1979 Turbo	80 % ± 5 %
As from model 1980 Standard	65 % ± 5 %
As from model 1980 Turbo	85 % ± 5 %
Modulating valve frequency	approx. 70 Hz
Oxygen sensor, replacement interval	15.000 miles
Oxygen sensor, tightening torque	40 Nm (29 ft.lb.) (Coat the threads and gaskets of the sensor with anti-seize compound, e.g., Never seize or Molycote 1 000)

CO-value: (Evaporative canister purge pipe disconnected)	
Disconnected sensor, permissible deviation during checking	0.25–1 %
Disconnected sensor, value for checking	0.75 %
Connected sensor, checking value	0.4 % max.

Deceleration device

Vacuum controlled deceleration valve, Model 1979:	
Deceleration time from 3 000 rev/min to idling speed	4–6 sec. (High-altitude districts 3–4 sec.)
Electronically controlled deceleration device (Turbo) Model 1979:	
Speed transmitter, actuating speed	20–22 mph (30–35 km/h)
Deceleration solenoid, setting (increased idling speed obtained when throttle closes with deceleration solenoid connected to battery voltage).	1400 ± 100 r.p.m.
Dashpot as from model 1980:	
Check: Retardation time from 3 000 r.p.m. to idling speed	3–6 secs.
Setting: Idling speed when the dashpot rod strikes the throttle stop (warm engine, distributor vacuum pipe connected)	2 500 ± 100 r.p.m.

Evaprative loss control device (ELCD)

Pressure valve	
Opening pressure, overpressure function (pressure from tank)	0.147–0.235 bar (1,500–2,500 mm VP)
Opening pressure, underpressure function (pressure towards tank)	0–0.029 bar (0–300 mm VP)

Carts for Canada

Cars for the Canadian market are equipped with:
Delay valve (cars with manual transmission)
EGR two-port (cars with automatic transmission)

COOLING SYSTEM

Type	Pressurized
Liquid capacity of cooling system incl. heating system	10.8 US quarts (10 liters)
Thermostat opens at	190°F (88°C)
Expansion tank pressure cap opens at	0.9–1.2 bar (kp/cm^2, 12.9–17.1 psi.)

CO-value: (Evaporative canister purge pipe disconnected)	
Disconnected sensor, permissible deviation during checking	0.25–1 %
Disconnected sensor, value for checking	0.75 %
Connected sensor, checking value	0.4 % max.

Deceleration device

Vacuum controlled deceleration valve, Model 1979:	
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Pressure valve	
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Carts for Canada

Cars for the Canadian market are equipped with:
Delay valve (cars with manual transmission)
EGR two-port (cars with automatic transmission)

COOLING SYSTEM

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Liquid capacity of cooling system incl. heating system	10.8 US quarts (10 liters)
Thermostat opens at	190°F (88°C)
Expansion tank pressure cap opens at	0.9–1.2 bar (kp/cm^2, 12.9–17.1 psi.)

Air oil coolen (Turbo)

Thermostat opening temperature	approx 165°F (approx 75°C)

WATER PUMP

Number of vanes on impeller	8

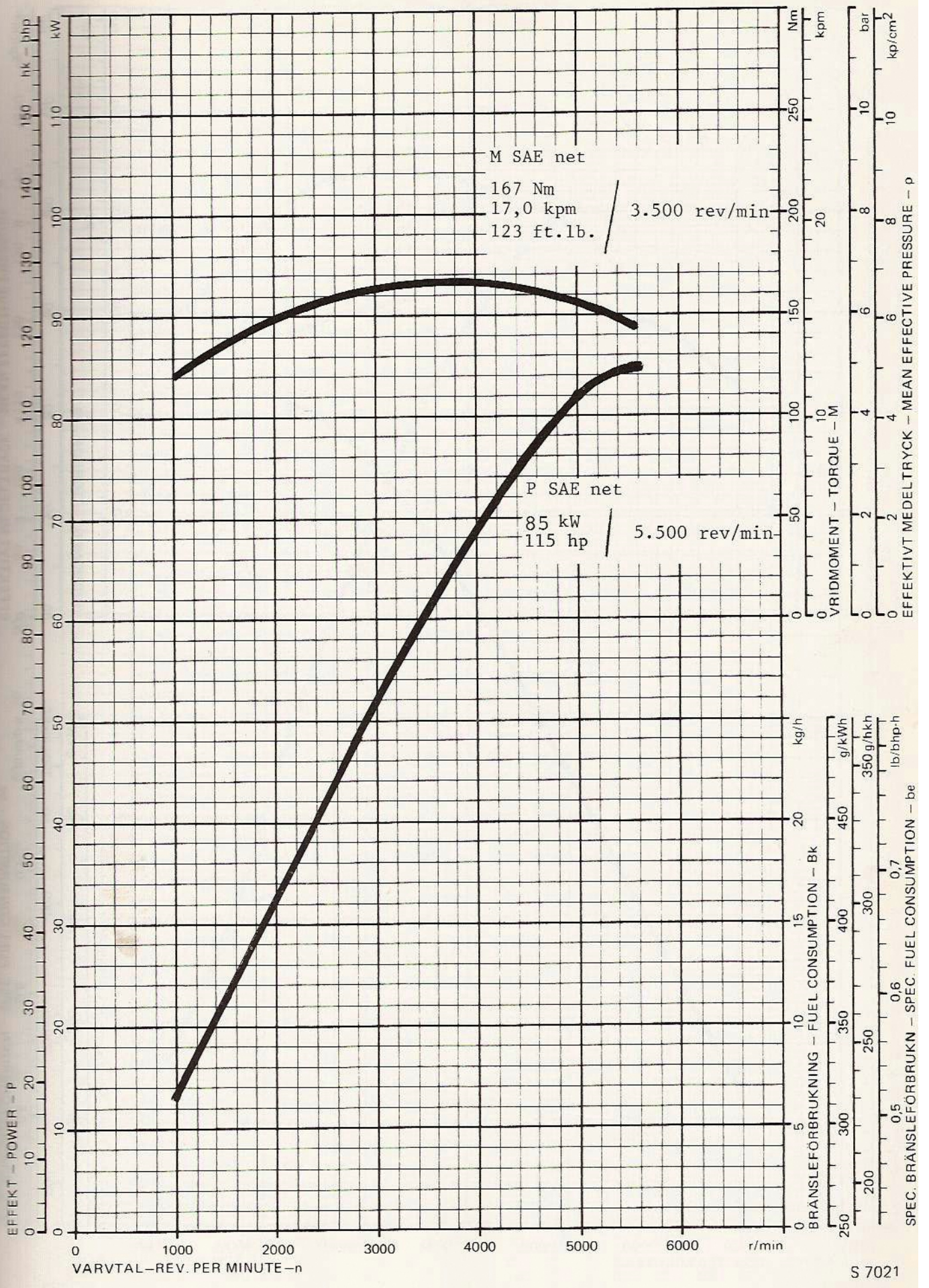
A tapping-out hammer must never be used in the removal or installation of later version water pumps. The thread on the water pump shaft is only used during removal of the pump. See section 262.

TIGHTENING TORQUES

	Dimension	Nm	Torque kpm	ft.lb.
Main bearings	M 12	108	11	79
Crank bearing screws	M 10	54	5.5	40
Camshaft bearing caps	M 8	18	1.8	13
Valve cover	M 6 (M 8)	2.0	0.2	1.4
Crankshaft belt pulley	M 16	190	19	137
Sealing end (flywheel side)	M 8	20	2.0	14
Cylinder head screw	M 12	93	9.5	69
Flywheel	M 10	59	6.0	43
Oil pump	M 8	18	1.8	13
Spark plugs	M 14 x 1.25	28	2.8	20
Idler shaft keeper plate	M 8	20	2.0	14
Chainwheel, idler shaft	M 10	25	2.5	18
Chainwheel, camshaft	M 8	20	2.0	14
Inlet manifold	M 8	18	1.8	13
Thermostat housing	M 8	18	1.8	13
Throttle valve housing	M 8	18	1.8	13
Exhaust manifold	M 8	25	2.5	18

Fot other screws, use general tightening torques:

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



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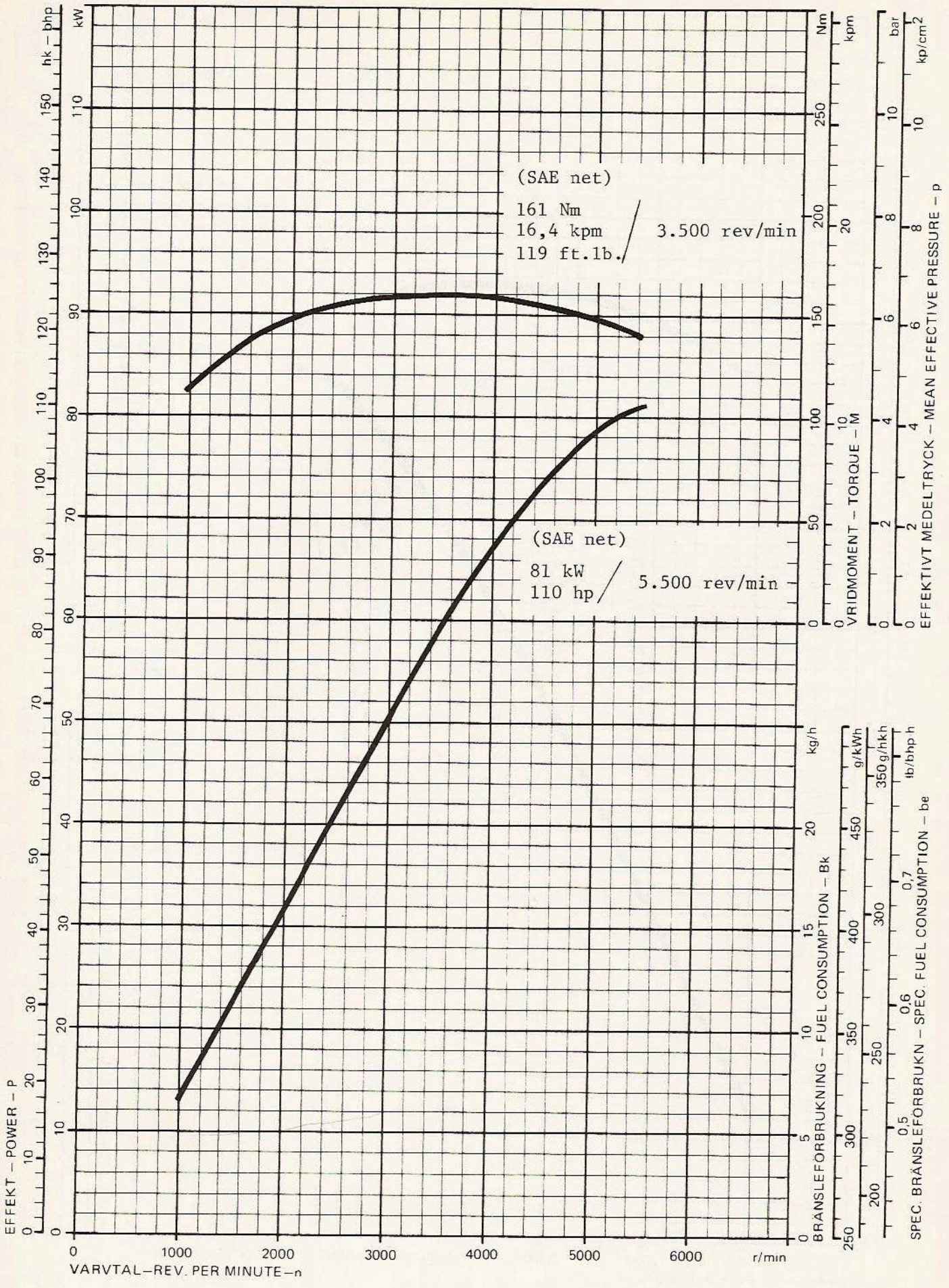
ENGINE PERFORMANCE GRAPHS
NON CATALYST CARS (FEDERAL, MODEL 1979)



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ENGINE PERFORMANCE GRAPHS
CATALYST CARS (EXCL. TURBO)

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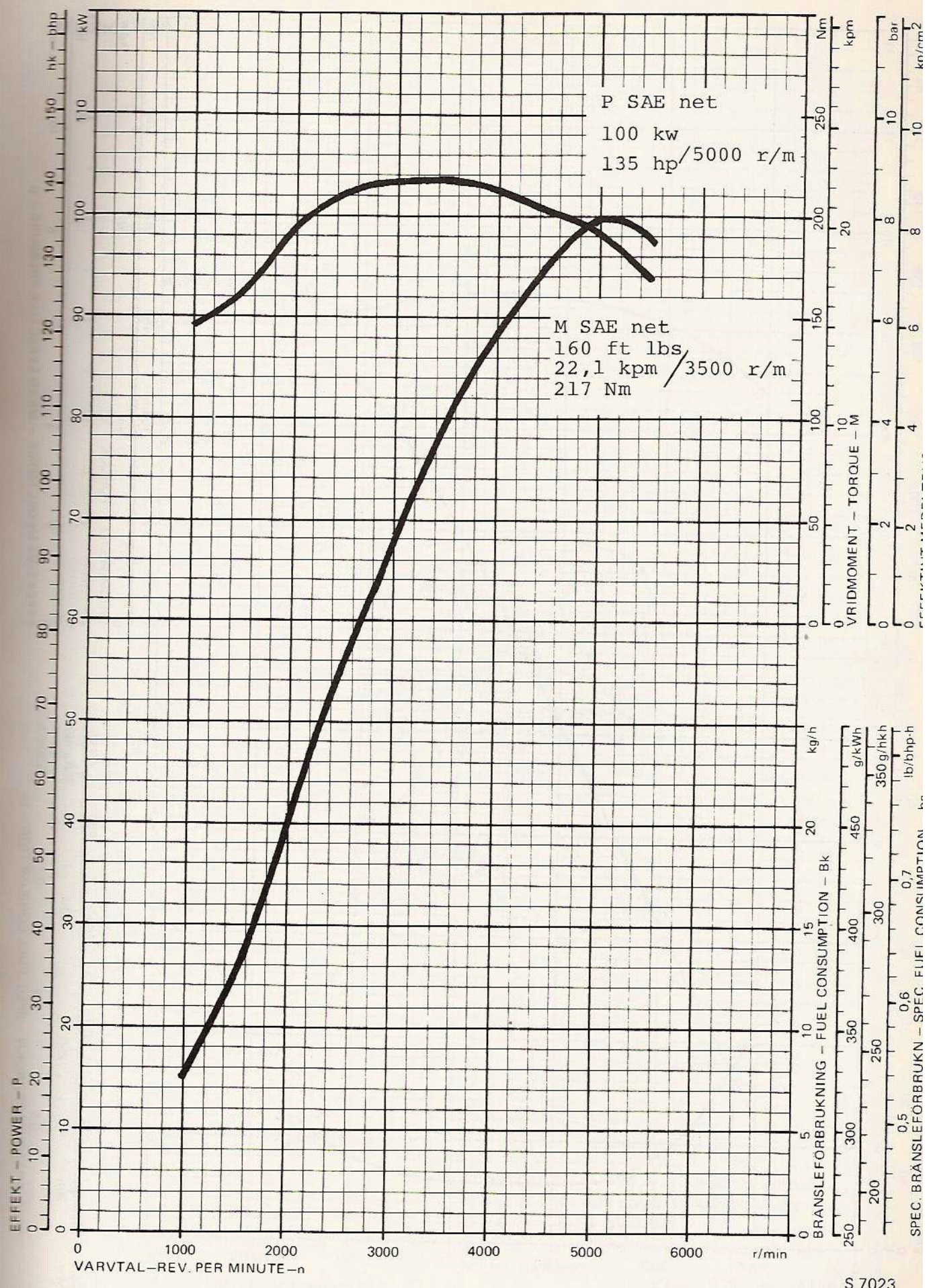

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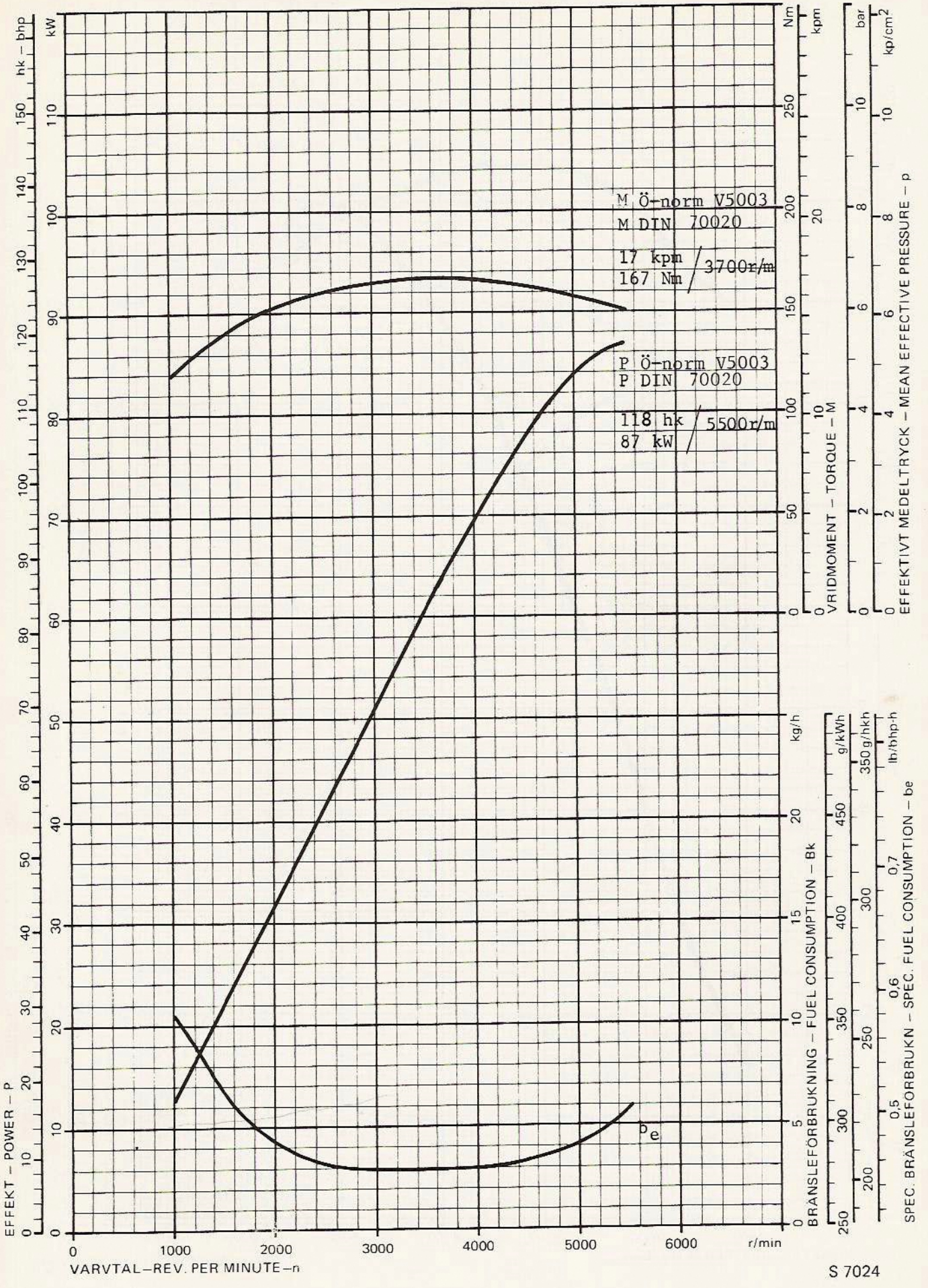
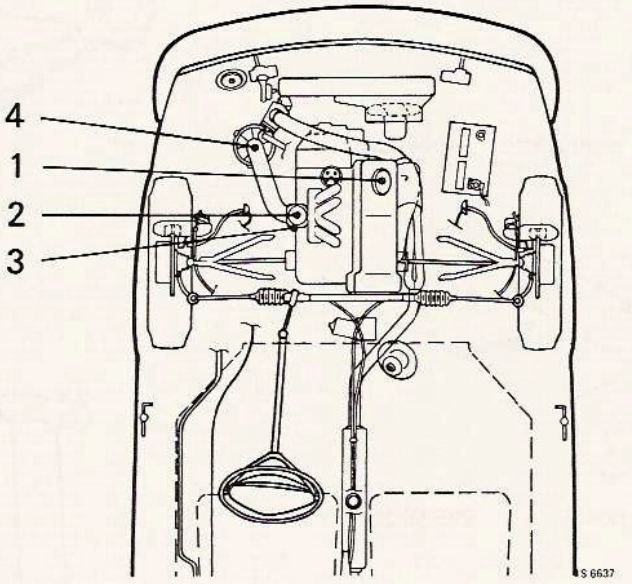
ENGINE PERFORMANCE GRAPHS
CARS WITH TURBO ENGINE



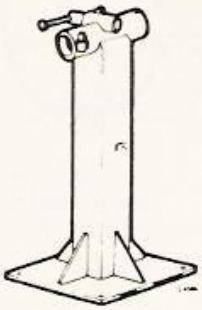
ENGINE PERFORMANCE GRAPHS
CARS FOR CANADA

SAAB

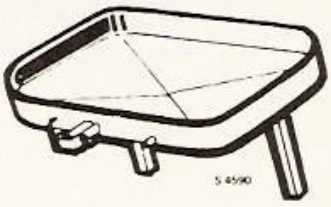


Point	Lubrication point	Lubricant
1	Engine, oil	Engine oil SAE 10 W 30 alt. 10 W 40 according to service SE in the API system or according to Ford specification ESEM2C–101C
3	Throttle controls	Oil SAE 10 W 40 Note! The throttle wire should not be lubricated
4	Fuel mixture control unit, lever bearing	Bosch grease Ft2v2

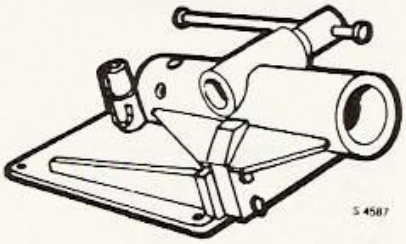
SPECIAL TOOLS



7860794 Floor stand

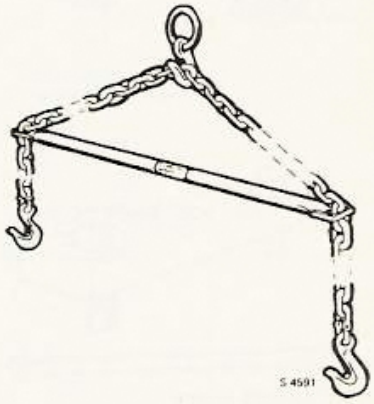


7860802 Oil pan

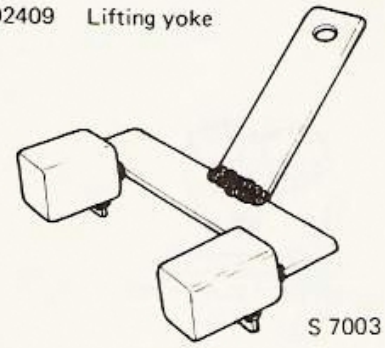


7860877 Bench stand

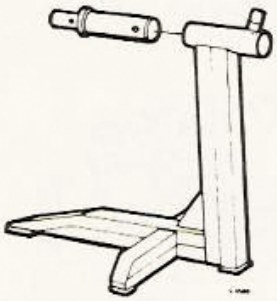
7860885 Vise stand



8392409 Lifting yoke



83 93 209 Spacer tool



7861479 Stand

8390478 Axle for stand

8390270 Tapping-out hammer

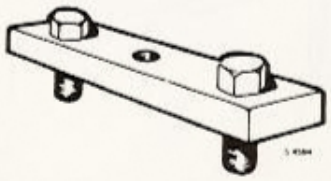
See also 262 water pump

8392169 Holder, engine

8790529 Joint, removing clutch shaft

8392060 Centering tool, clutch disc

7862014 Key, oil filter

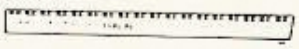


8392151 Puller, belt pulley

8391849 Dolly, removal of chain wheel

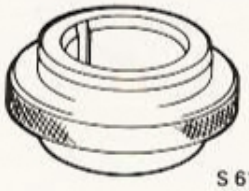
8391260 Crank, transmission end

8392540 Installing tool, crankshaft seal, flywheel end



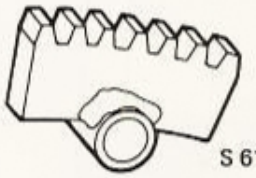
7860505 Plastigage, measuring bearing clearance

8392961 Ring spanner, pulley bolt



S 6182

8392979 Sleeve, installation of seal on transmission side



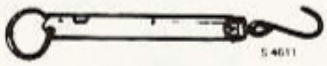
S 6183

8392987 Locking segment for locking of crankshaft

8391997 Drift, flywheel bearing

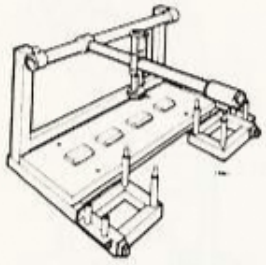
7862287 Piston installing tool

8392128 Guide pin cylinder head



8390130 Dynamometer

8392300 Spring depressor (for use in car or on removed cylinder head)



8393050 Installing and removing tool, valves

8391401 Magnet tool

8392326 Air nipple, spark plug hole

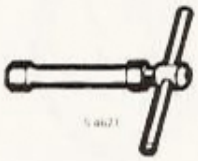
S 4619

8392193 Valve cutter assy.

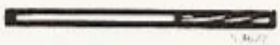
8392201 Cutter 75°

8392219 Cutter 11°–45°

7861057 Guide spindle



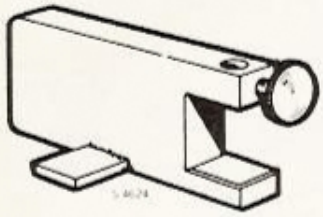
7861065 T-key



8392268 Reamer, valve guide ø 8 H8

8392631 Valve guide tool (for removal and installation in a press)

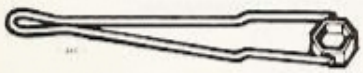
8391450 Measuring tool, valve play



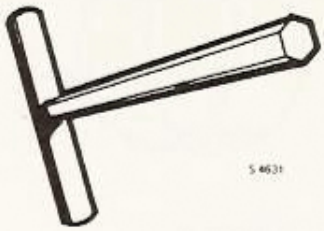
8392250 Measuring point

8391633 Measuring plate, checking of adjusting pallets

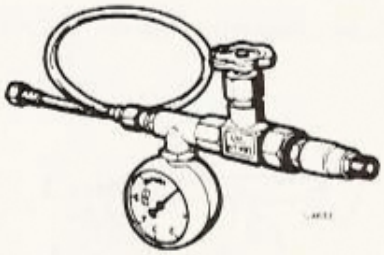
7840622 Dial indicator (0.01)



8392185 Key, crankshaft screw

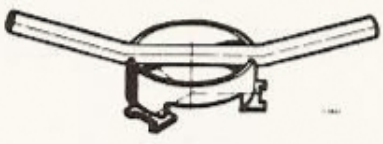


8392482 Key, adjustment CO-value, injection engine

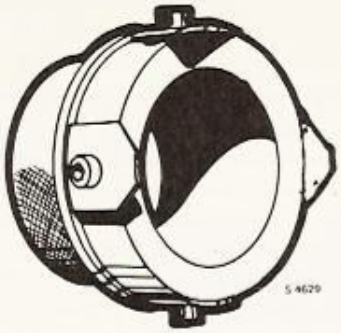


8392516 Pressure testing equipment
8392607 Hose
8392615 Nipple

8393183 Test hose



8392433 Key, fuel pump bracket

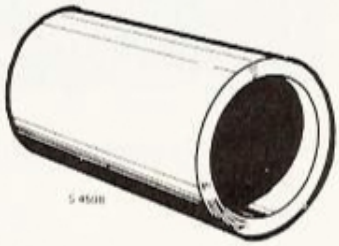


8392474 Centering tool (for non catalyst air flow sensor)
8392623 Shims for same (4)

8390544 Dolly

8390585 Handle

8392490 Installing and removing tool, water pump (earlier design)

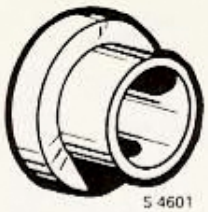


8390536 Sleeve, installation of water pump

8390551 Sleeve, installing ball bearing

8392649 Installing and removing tool, water pump (later design)
8392664 Pressing sleeve water pump (later design)

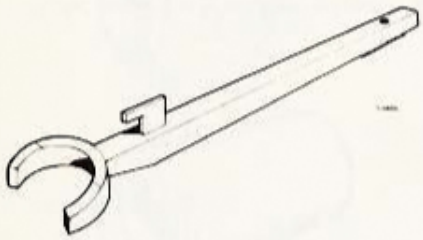
8390569 Installing sleeve, thrower



8392524 Installing sleeve for ball bearing, versions II and III.

8308454 Locquic activator grade T
7860513 Locktite stud lock
8343808 Locktite quickset

8809097 Tikatät, can, 1 pound

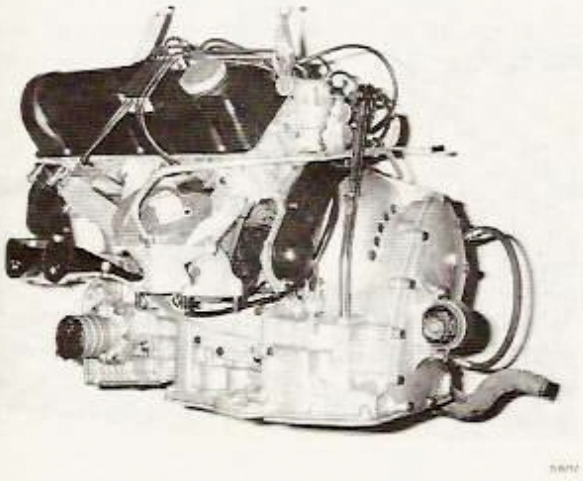


8393175 Tool, removal of clutch shaft

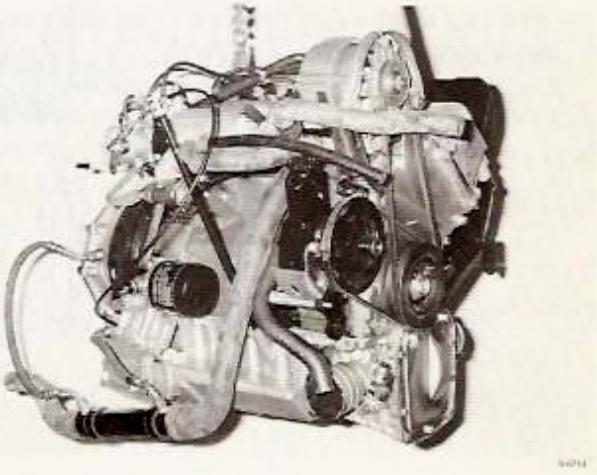
GENERAL

The car has a four-in-line cylinder, water-cooled overhead camshaft engine. The crankcase ventilation is totally enclosed. The cylinder blcok is inclined at an angle of 45° and the cylinder head is of the cross-flow type, i.e. with the inlet passages on one side and the exhaust passages on the other. The engine is mounted with the clutch towards the front of the car and with the transmission and No. 1 cylinder towards the rear. The engine is equipped with fuel injection.

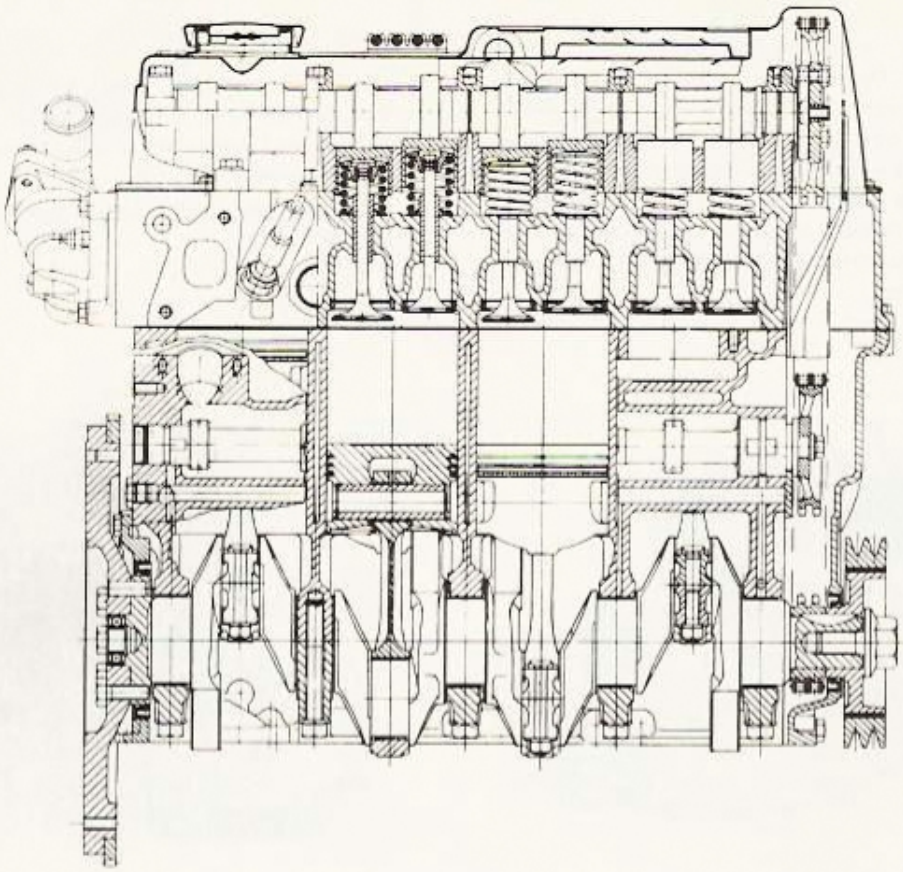
The injection system is manufactured by Bosch and has the designation CI. CI (continuous injection) means that the injection valves remain open when the engine is running. The air flow to the engine is measured continuously and this governs the supply of fuel to the engine. The fuel is injected into the inlet manifold in front of the inlet valve.



POWER PLANT SEEN FROM RIGHT

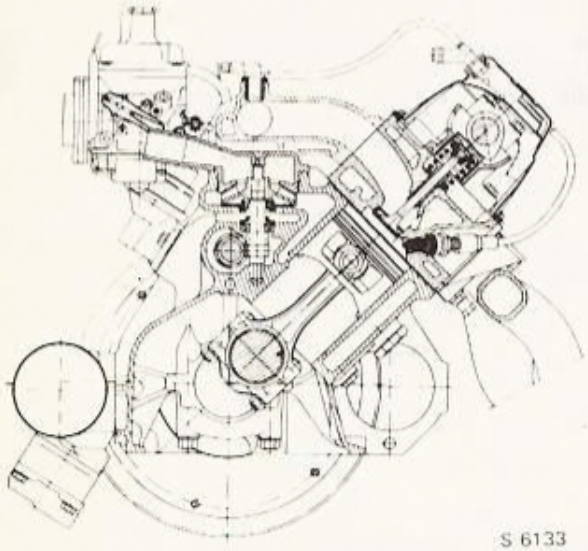


POWER PLANT SEEN FROM LEFT



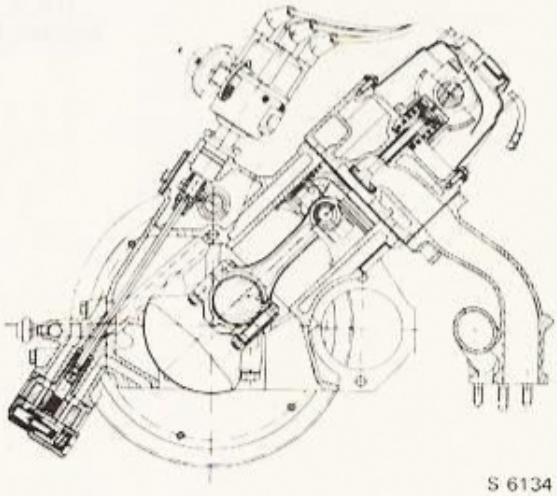
S 6132

CROSS SECTION OF ENGINE, SIDE VIEW



S 6133

CROSS SECTION OF ENGINE AT WATER PUMP



S 6134

CROSS SECTION OF ENGINE AT DISTRIBUTOR

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 oil channels for the lubricating system.

CYLINDER HEAD AND VALVES

The cylinder head is made of aluminium. The cylinder head is bolted to the block. The camshaft is made of special casting and it is seated in bearings in the camshaft bridge which is bolted to the cylinder head.
The valves are of steel with chromium-plated spindles and the valve heads are induction hardened.

CRANKSHAFT AND BEARINGS

The crankshaft is forged with ground journals which have been hardened by tenifer treatment which provides a hard non-metallic surface giving good protection against wear. There are five main bearings. The center bearing also acts as an axial locating bearing. The shaft contains drilled passages for lubricating oil. All main bearing shells can be replaced. The crankshaft also drives a separate idler shaft which powers the oil pump, water pump and distributor through cog gears and the fuel pump by a cam.

CAMSHAFT AND VALVE DEPRESSORS

The camshaft is cast and has hardened and phosphatized cams. It is driven by a chain from the crankshaft. The valves are directly actuated by the camshaft cam via valve depressors and adjusting pallets.

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 upper compression ring is flat with a chromed finish. The lower compression ring has oil-scraping characteristics and is somewhat wider than the upper one. The actual oil scraper is a three-piece ring.

CONNECTING RODS AND PISTON PINS

The connecting rods are forged and fitted with bushings for journaling the piston pins. The piston pin bushing and big-end bearing halves are exchangeable.
The piston pin makes a floating fit in the piston and connecting rod. Its axial movement is restricted by lock rings in the piston pin holes.

IGNITION SYSTEM

The distributor is driven by a gear transmission from the idler shaft. The rotor arm rotates counterclockwise. The order of firing is 1–3–4–2, cylinder No. 1 being farthest to the rear. Ignition advance in relation to engine speed is regulated by a centrifugal governor and in relation to load by a vacuum regulator.
Turbo cars and cars for the USA are equipped with an electronic ignition system without breaker points.

REMOVAL AND FITTING

REMOVING THE POWER UNIT

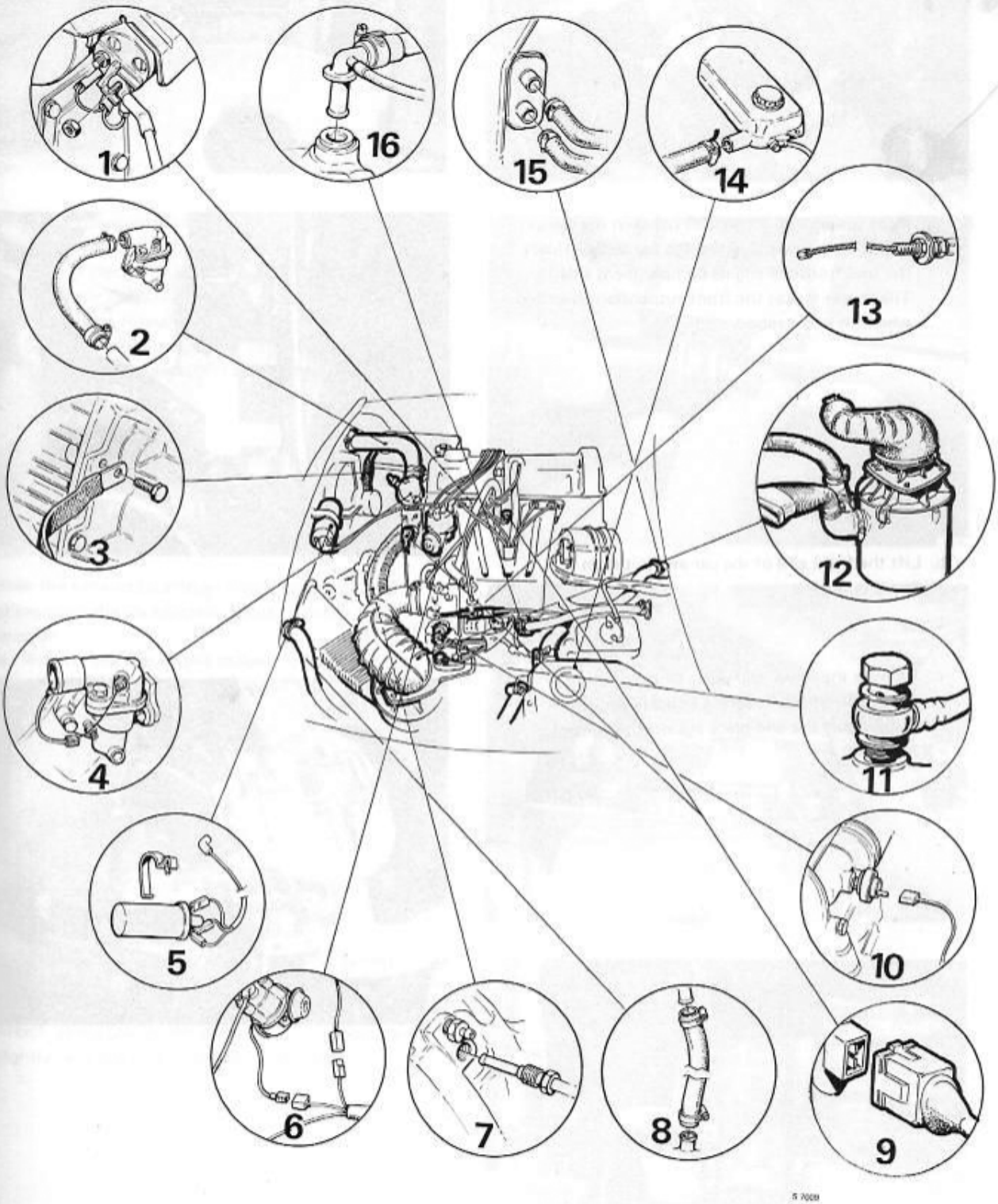
For major work on the engine and transmission, the entire power unit should be lifted out of the car. Removal of the engine by itself is not recommended.

1. Disconnect the positive battery lead.
2. Drain the coolant through the radiator drain cock.
3. Remove the engine hood:
   - Disconnect the windshield washer hose
   - Undo the hood hinge links
   - With the aid of an assistant, lift off the hood.

4. Disconnect and remove the following (see illustration).
   1. Disconnect the positive battery lead at the starter motor.
   2. Remove the top radiator hose.
   3. Remove the earthing braid.
   4. Disconnect the temperature transmitter cable.
   5. Remove the ignition coil.
   6. Disconnect the cable harness from the clutch cover.
   7. Disconnect the hydraulic line to the clutch sleeve cylinder and plug the ends. (Manual transmission)
   8. Remove the lower radiator hose.
   9. Disconnect the CI-system electrical connections from the warm-up regulator, thermo-time switch cold start valve and auxiliary air valve. (On lambda system cars also the oxygen sensor and the throttle valve switch cables.)
   10. Disconnect the oil-pressure transmitter cable.
   11. Loosen the fuel line connections from the fuel distributor

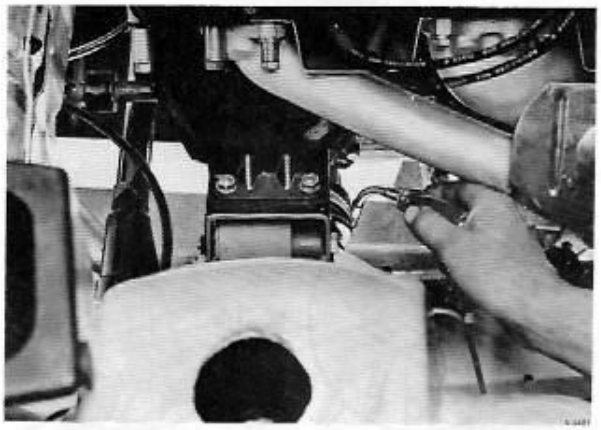
> NOTE
> Clean the area around the connections before disconnecting. Fold in and cover over openings in the fuel system.

12. Remove the air filter together with the mixture control unit.
13. Disconnect the throttle cable.
14. Disconnect the hose to the expansion tank.
15. Disconnect the hoses for heating of the passenger compartment.
16. Disconnect the brake vacuum hose.



DETAILS THAT ARE TO BE REMOVED WHEN THE POWER UNIT IS TAKEN OUT OF THE CAR

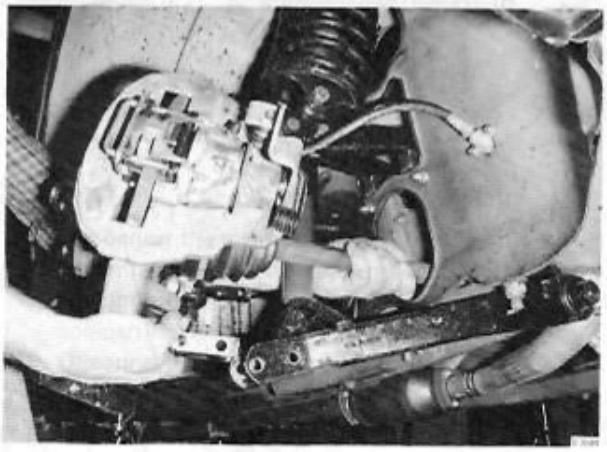
5. Undo the clips and remove the bellows from the inner drivers.



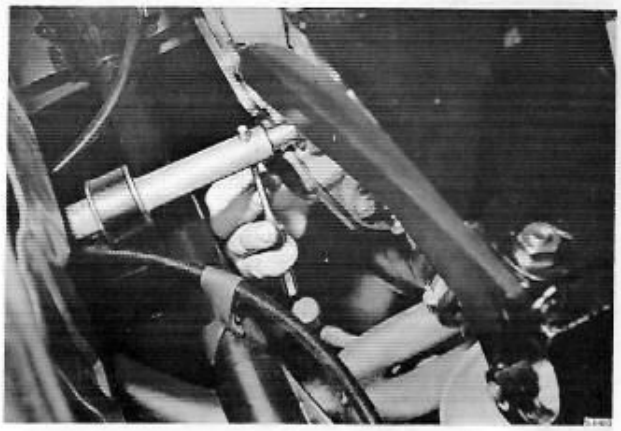
6. a. Place spacer tool 83 93 209 between the upper control arm underside and the car body. (Insert the tool from the engine compartment side.) The spacer makes the front suspension unloaded when the car is raised.

b. Lift the front end of the car and put it on threstles.

c. Remove the lower end piece from the control arm. Pull out the "steering knuckle package" and support the end piece against the control arm outer end.

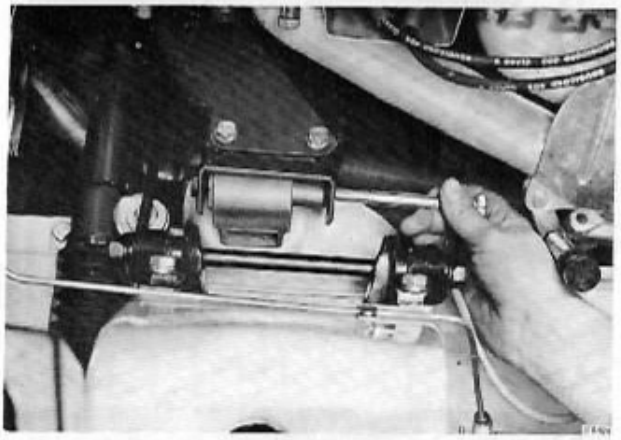


7. Manual transmission:
   Put the gear lever in neutral. Remove the nut and tap out the taper pin in the gear shift rod joint. Separate the joint from the gear shift rod.

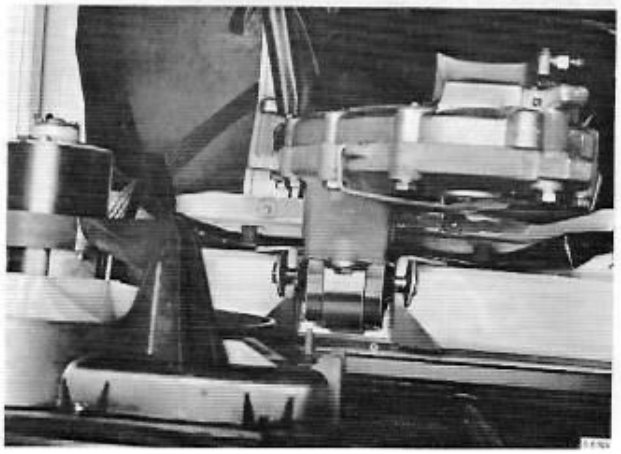


7. Automatic transmission:
   a. Remove the retaining screw for the gear selector cable at the transmission.
   b. Withdraw the cable with the gear selector rod in its extreme forward position (P).
   c. Slide back the spring-loaded sleeve on the gear shift rod and unhook the end of the cable.

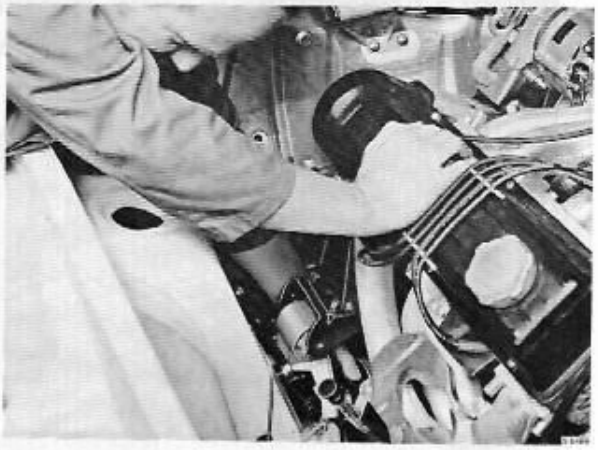
8. Free the exhaust pipe from the exhaust manifold.
9. Disconnect the speedometer cable from the transmission.
10. a. Remove the rear engine mounting bolts.



   b. Slacken the front engine mounting nut so that the mounting can be lifted out of the bracket. There is no need to remove the nut.
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.

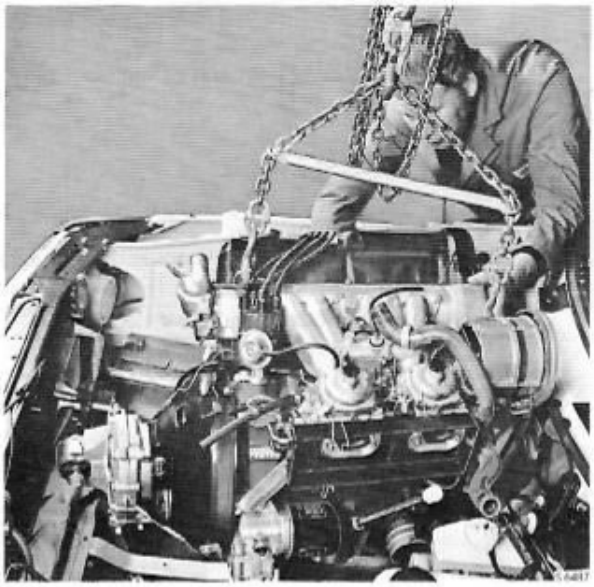


Deviations, cars with power steering

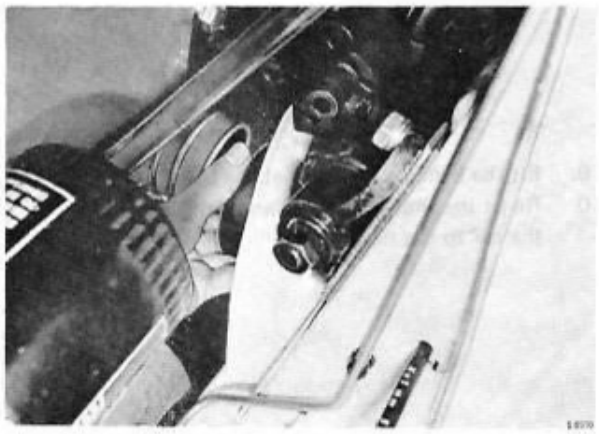
– Disconnect the two hydraulic lines at the servo pump. Plug the exposed openings.

FITTING THE POWER UNIT

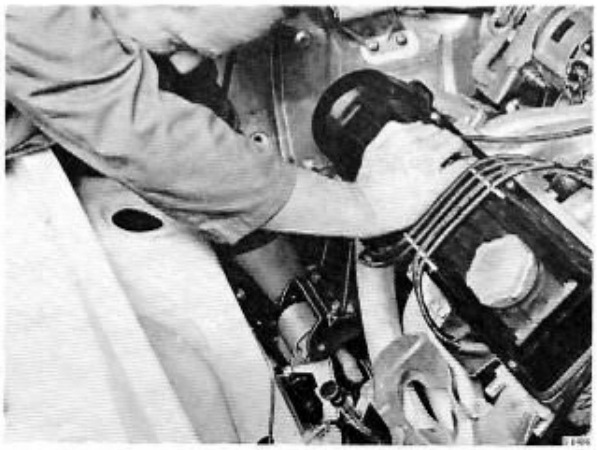
1. a. Check that the inner universal joints are packed with grease.
   b. Fit new gaskets to the exhaust pipe flanges.
   c. Hook the clips onto the inner drivers.
2. Suspend the power unit in the engine compartment and balance it such that the front engine mounting will locate in its bracket before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



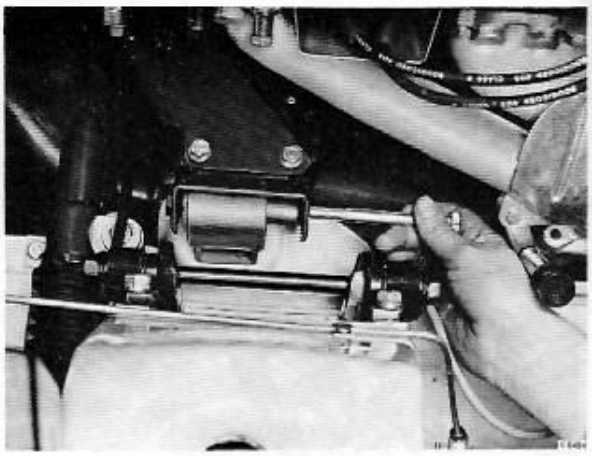
3. a. Lower the power unit, guiding the front mounting into the bracket and continue to lower the power unit until the rear of the engine is approximately 50–60 mm above the mountings.
   b. Move the engine to one side and guide in the left-hand universal joint, and then move the engine to the left.



   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 right end piece to the control arm. Check that the right universal joint locates in the driver cup. Fit the two bolts and lock nuts.

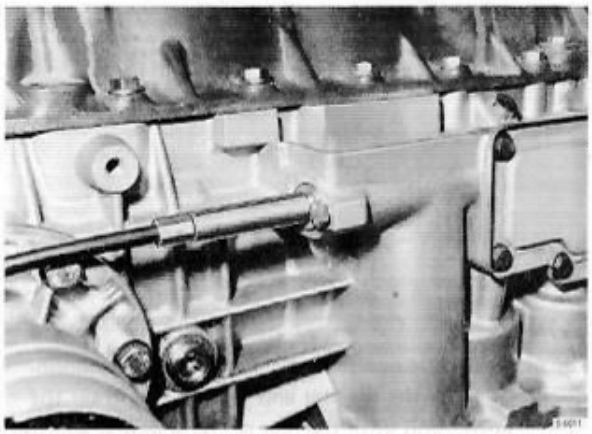


4. Fit the rear engine mounting bolts and tighten all engine mountings.
5. Fit the exhaust pipe flanges.
6. Connect the speedometer cable.



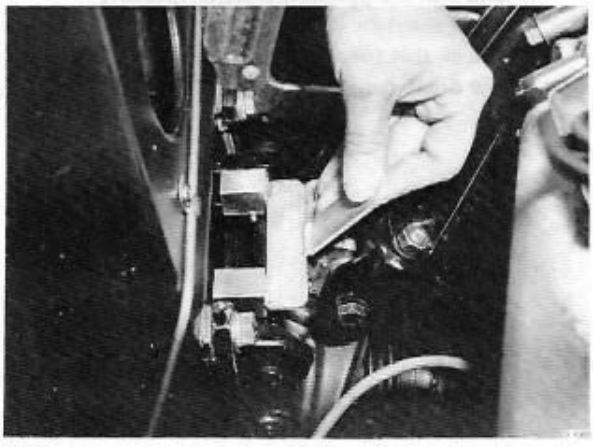
7. Manual transmission:
   Connect the gear shift rod joint and fit the taper pin.

8. Automatic transmission:
   Connect the cable to the gear selector rod and secure the cable sheath to the transmission.
   Check the gear positions and adjust if necessary.



9. Fit the bellows and clips at the inner universal joints.
10. Re-fit the shock absorber and front wheel. Lower the car to the floor.

REMOVE THE SPACER TOOL 8393209.

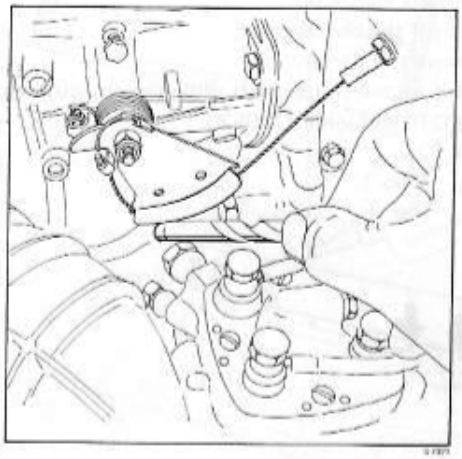


11. Re-fit the hoses as shown in the illustration on page 201–2.

When installing the air cleaner assembly and the mixture control unit ENSURE THAT THERE IS AT LEAST 10 MM CLEARANCE ROUND THE THROTTLE CONTROLS.

12. Replace the engine hood and connect the windshield wiper hose.
13. Fill up with coolant and bleed the cooling system by means of the bleeder nipple on the thermostat housing.
14. Reconnect the battery.
15. Test drive the car. Check the coolant level after driving.

SEE THE PICTURE ON PAGE 201–2



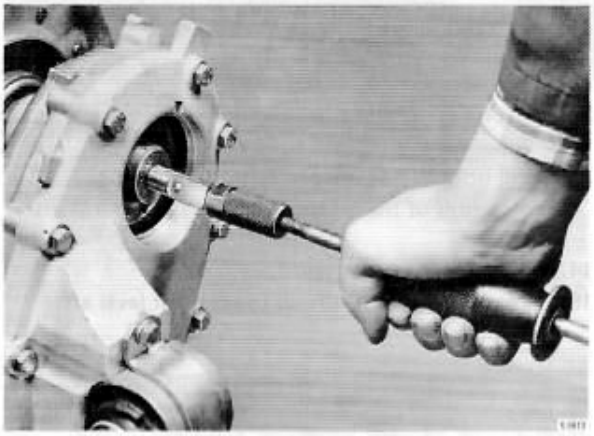
Deviations, cars with power steering

– Connect the two hydraulic lines to the servo pump. Do not over-tighten the couplings as this can damage the seals.

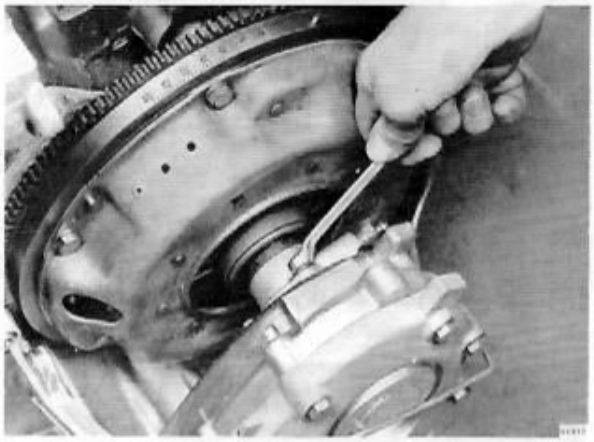
Tightening torque:	
Servo pump coupling	20–34 Nm (15–25 ft.lb., 2.0–3.4 kpm)

SEPARATING ENGINE FROM MANUAL TRANSMISSION

1. Clean the outside of the power unit.
2. Drain the engine oil.
3. Take off the clutch cover.
4. Remove the starter.
5. Withdraw the clutch shaft using tapping-out hammer 8390270 and joint 8790529.

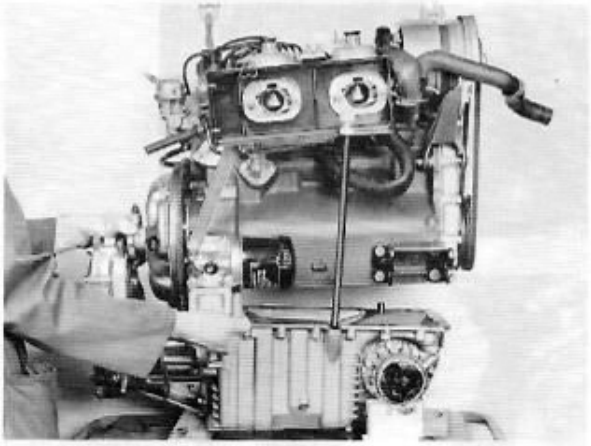


6. Remove the three retaining bolts for the slave cylinder.



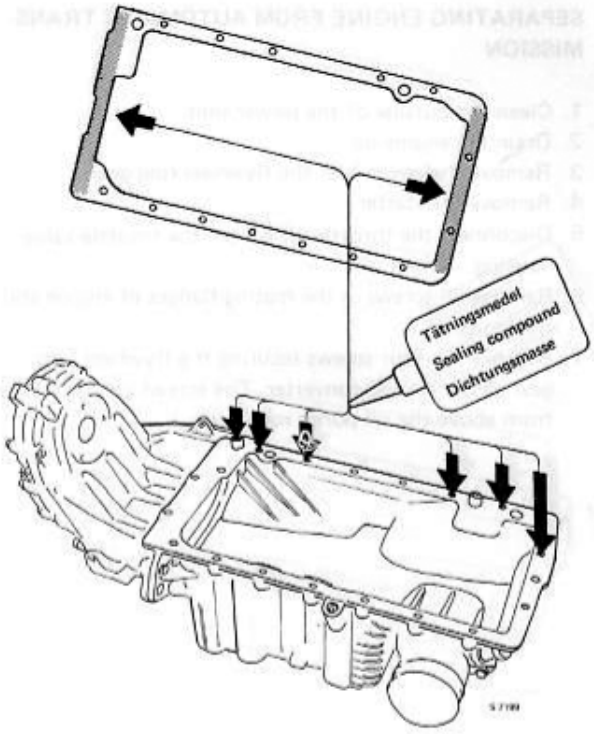
7. Undo all screws in the mating flanges of engine and transmission.
8. Lift the engine carefully off the transmission (see illustration). At the same time remove the release bearing guide sleeve.

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



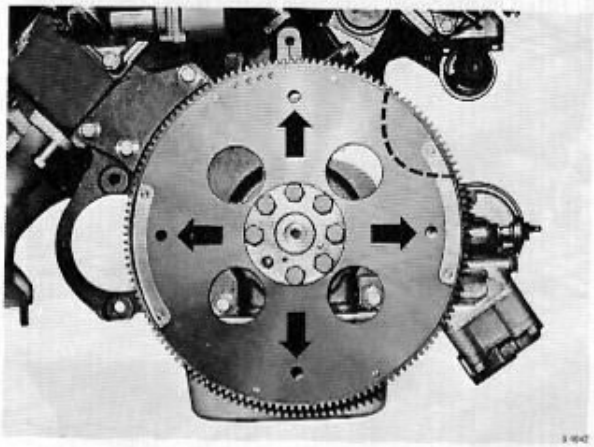
When fitting together the engine and transmission:

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



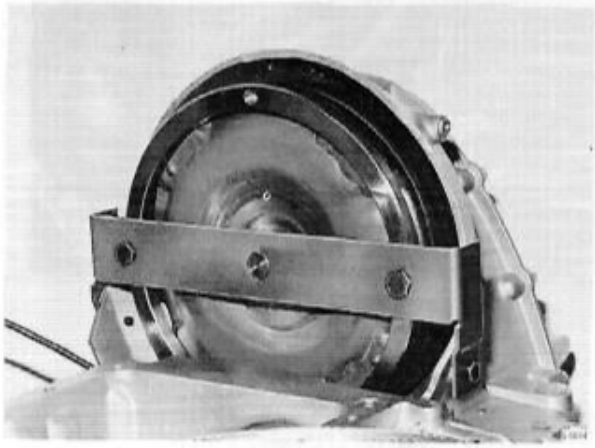
SEPARATING ENGINE FROM AUTOMATIC TRANSMISSION

1. Clean the outside of the power unit.
2. Drain the engine oil.
3. Remove the cover over the flywheel ring gear.
4. Remove the starter.
5. Disconnect the throttle wire from the throttle valve housing.
6. Remove all screws in the mating flanges of engine and transmission.
7. Remove the four screws securing the flywheel ring gear to the torque converter. The screws can be reached from above the oil pump mounting.



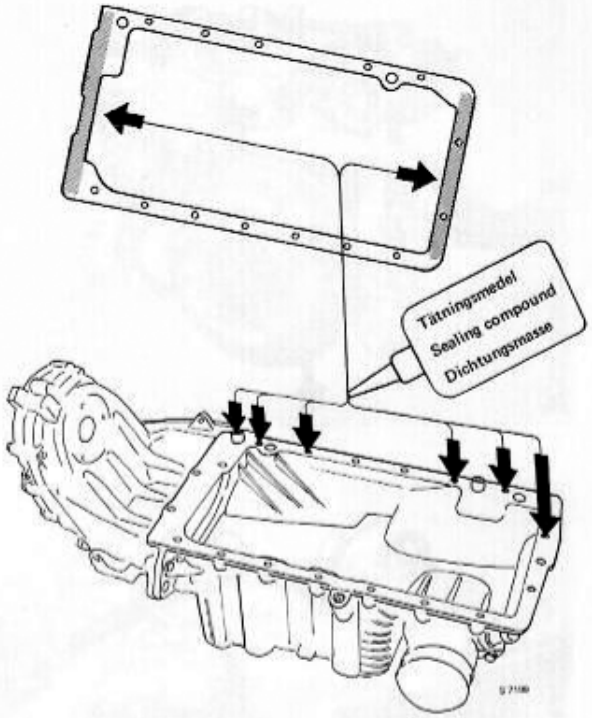
8. Turn the driver disc, so that the plate angles will be horizontal. Lift the engine carefully off the transmission.

9. Fit the torque converter support (special tool 8790255).



When fitting together the engine and transmission:

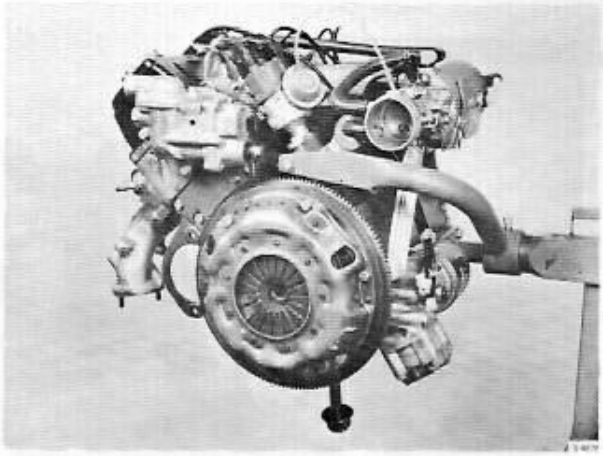
- Ensure that the mating flanges between the engine and transmission are scrupulously clean.
- Check that the two guide sleeves are fitted in the transmission.
- Fit a new gasket on the transmission flange. Apply sealing compound to both sides of the gasket as indicated by the arrows in the illustration.
- Apply thread sealing compound to the six bolts to be fitted in the holes indicated in the lower illustration.
- Be careful not to damage the centre stub of the torque converter when lifting the engine into position over the transmission.



ENGINE BODY

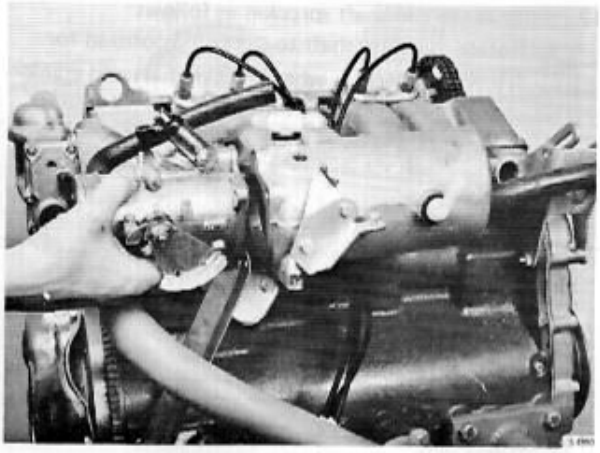
DISASSEMBLING THE ENGINE

1. Mount the engine in a work stand.

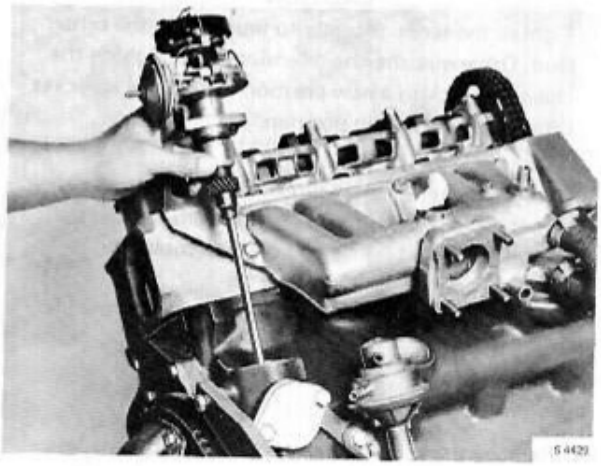


2. Remove the distributor cap and disconnect the ignition cables.

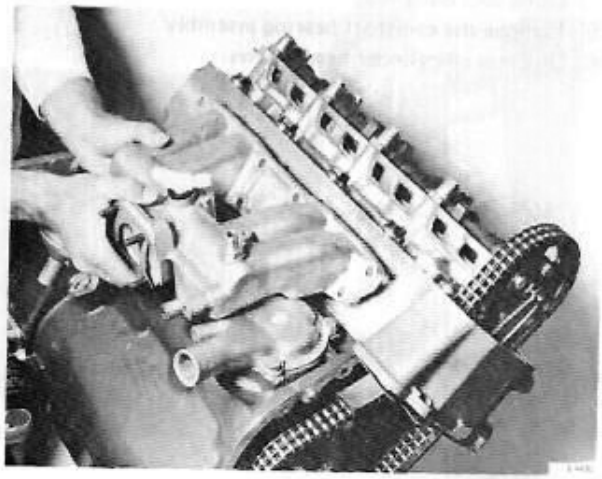
3. Remove the throttle valve housing.



4. Undo the hose connections from the water pump, by-pass system and crankcase ventilation circuit.
5. Remove the valve cover.
6. Remove the distributor.



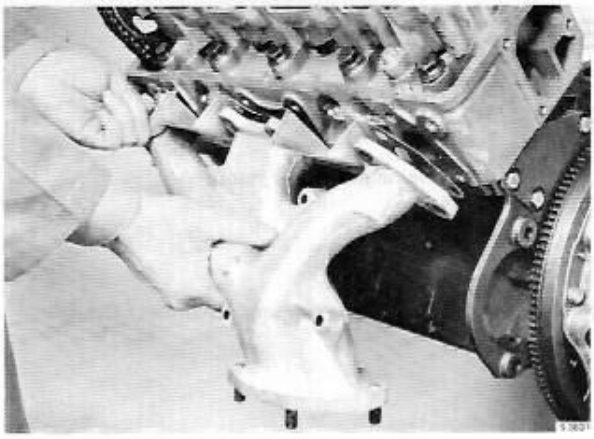
7. a. Remove the inlet manifold together with the front lifting lug.
   b. Remove the alternator bracket.
8. a. Remove the oil filter.
   b. Remove the oil pump.
   c. Remove the oil pump spacing piece.
   d. Remove the suction line to the pump.
9. Remove the water pump (see section 262).



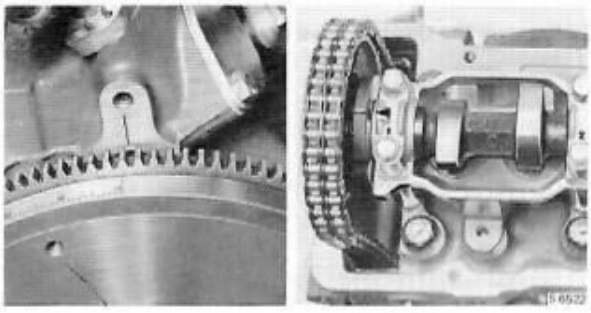
NOTE
Impact tools must never be used in conjunction with the removal or fitting of the water pump.

10. Remove the thermostat housing.

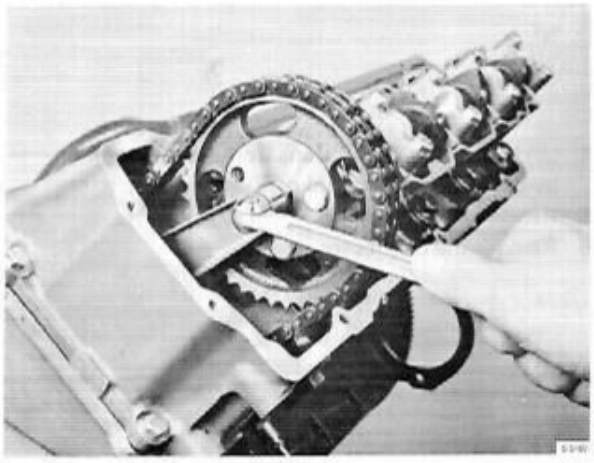
11. Remove the exhaust manifold.



12. Remove the camshaft sprocket as follows:
    a. Rotate the crankshaft to the firing position for No. 1 cylinder, i.e. when the camshaft and crankshaft are both at the "zero" setting.



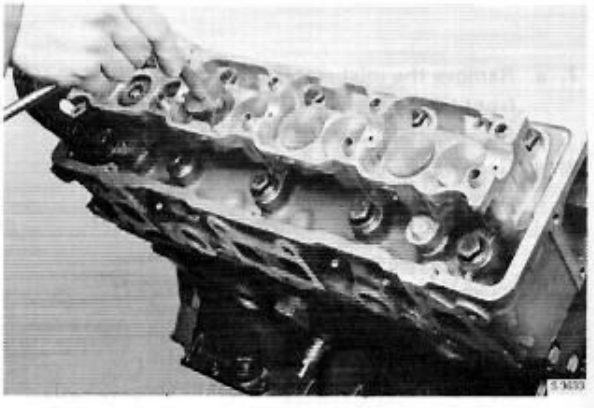
    b. Bolt the mounting plate to the centre of the camshaft sprocket using one of the camshaft sprocket bolts.



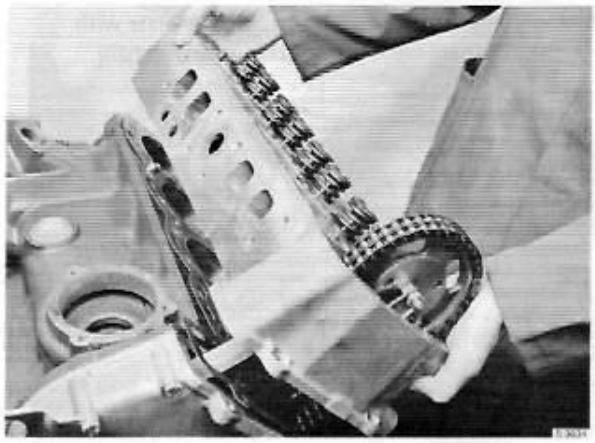
> CAUTION
> Tighten the screw securely to immobilize the center stud. Otherwise the chain tensioner will tighten the chain and lock in a new position so that the sprocket cannot be replaced in position.

    c. Undo the retaining screws from the camshaft sprocket. Separate the wheel from the camshaft plate until it hangs free on the center stud in the mounting plate.
13. Remove the camshaft bearing caps and lift out the camshaft.

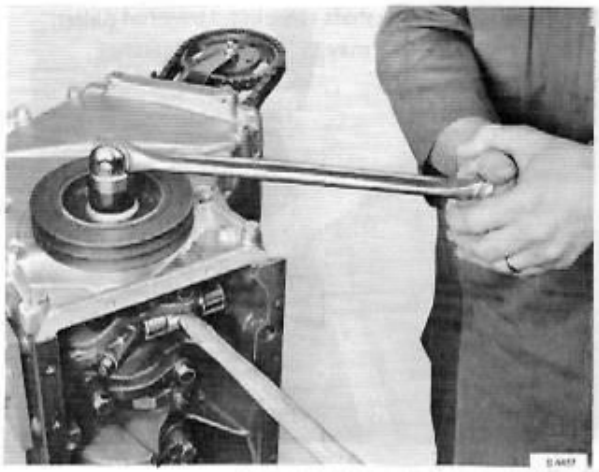
14. Remove the valve depressors and adjusting pallets. Using tool 8391401.
15. Remove the camshaft bearing assembly
16. Unscrew all cylinder head screws.

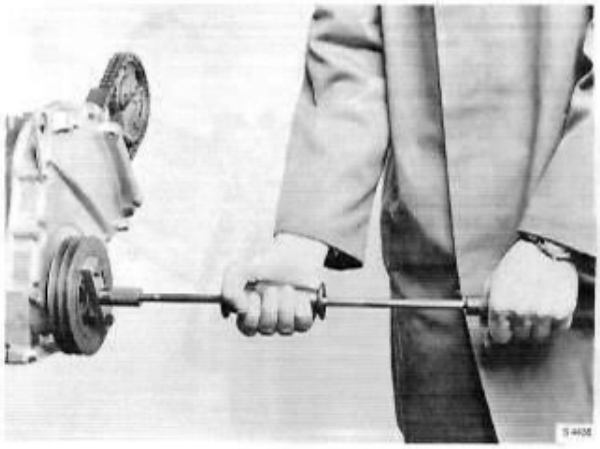


17. Lift off the cylinder head and remove the gasket.



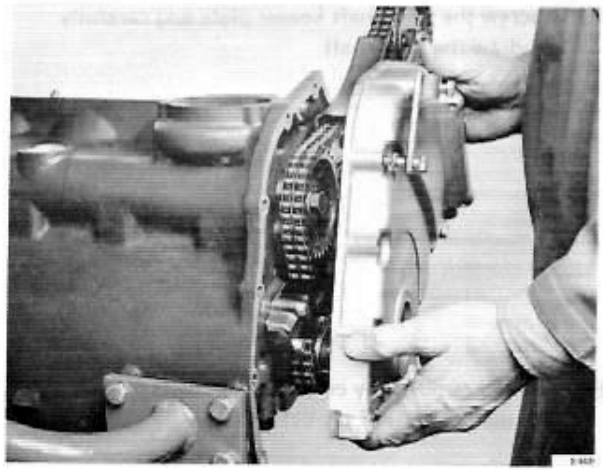
18. Remove the belt pulley screw and the pulley, using when necessary puller 8392151.



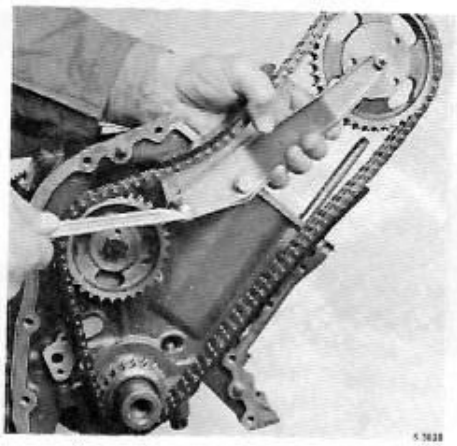


19. Remove the transmission cover.

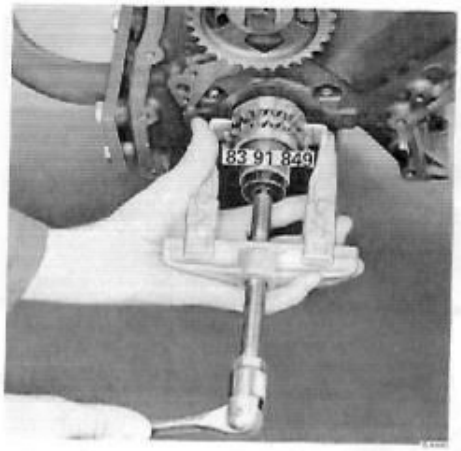
20. Remove the chain tensioner.



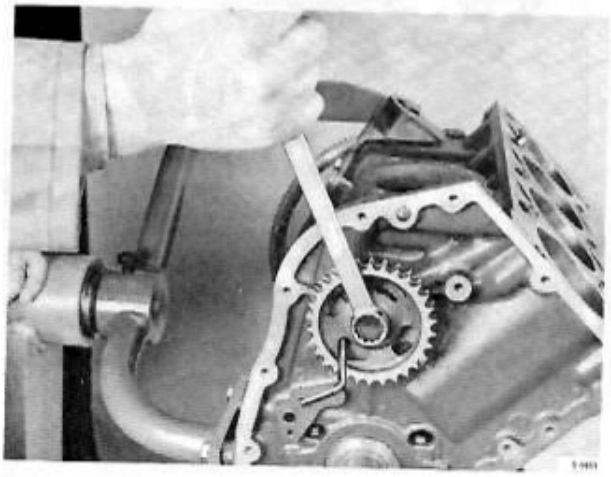
21. Undo the chain guides, the mounting plate with the camshaft sprocket and transmission chain.



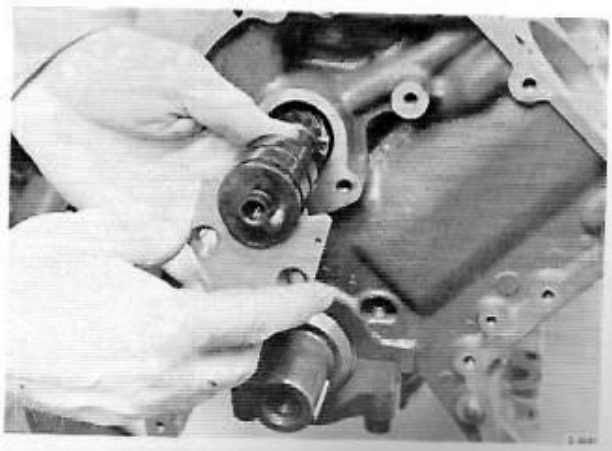
22. Remove the crankshaft sprocket. Universal puller and tool 8391849 may be used, if necessary.



23. Remove the idler shaft sprocket.

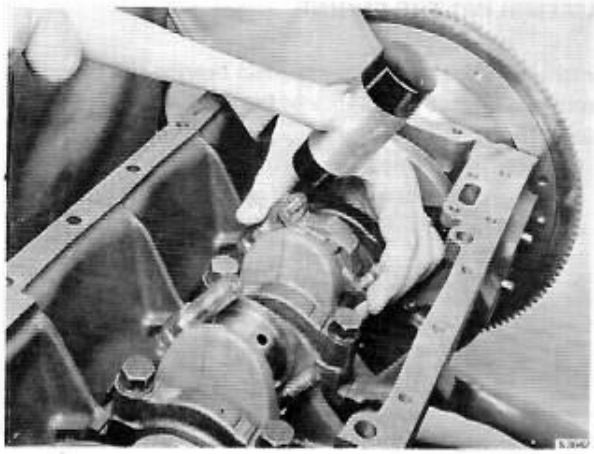


24. Unscrew the idler shaft keeper plate and carefully withdraw the idler shaft.

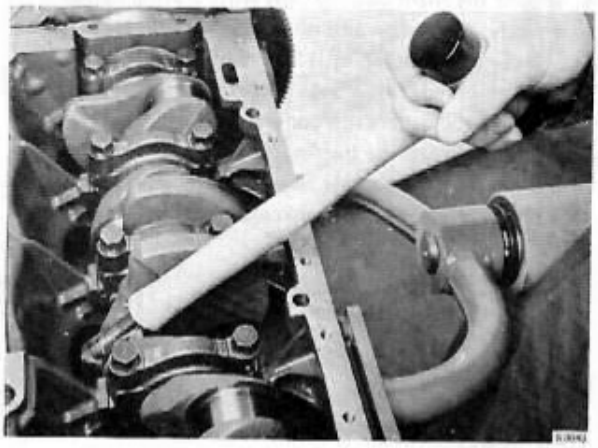


25. Carefully remove any crusts and deposits of soot from the top ends of the cylinders.

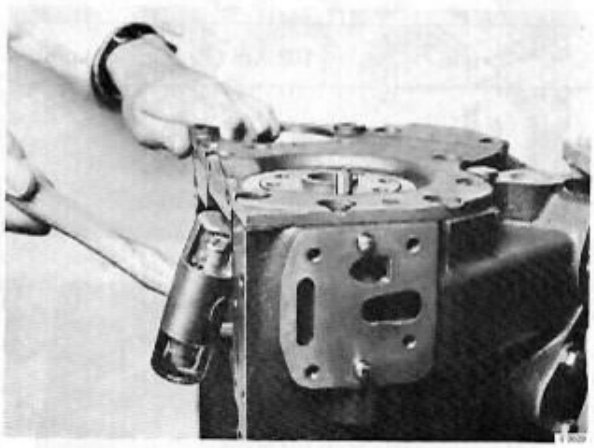
26. Note the markings on the connecting rods and big-end bearing caps so that they can be reassembled later in their original positions. Remove the nuts and bearing caps and push the pistons complete with connecting rods out of the cylinders (see illustration). Protect the stud threads with pieces of plastic hose when dismantling pistons and connecting rods.
    For instructions with regard to exchanging pistons see page 212–1.
27. Replace the big-end bearings and caps loosely on the connecting rods from which they came.



28. Manual transmission:
    Dismantle the clutch and flywheel.
28. Automatic transmission:
    Remove the driver disc.
29. Remove the gable plate and shaft seal.



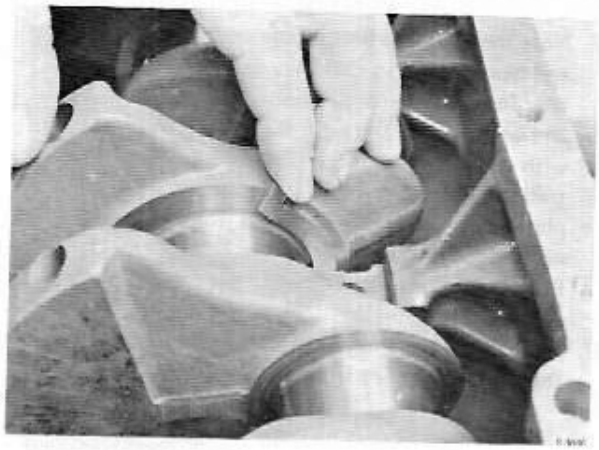
30. Undo the main bearing screws and remove the bearing caps.
31. Lift out the crankshaft.
32. Remove the bearing halves and thrust bearing washers and put them carefully aside so that they can be reassembled in their original positions.



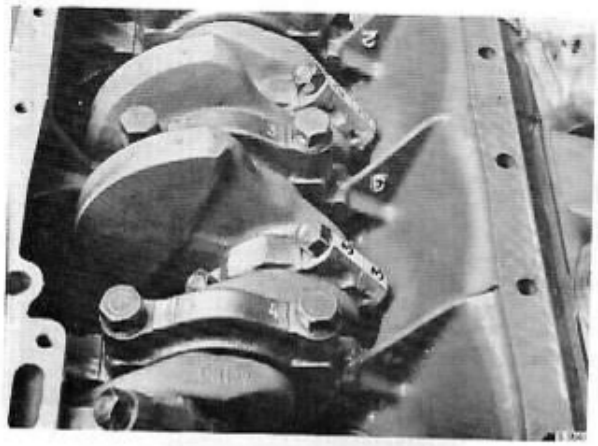
ASSEMBLING THE ENGINE

Instructions for measuring the main bearing and big-end bearing clearance and choice of bearing halves, see section 216.

1. Place the bearing halves in the main bearing journals and lubricate the bearings with engine oil.
2. Locate the crankshaft carefully in the bearing journals.
3. Locate the thrust bearing washers. Check the axial play with a feeler gauge.

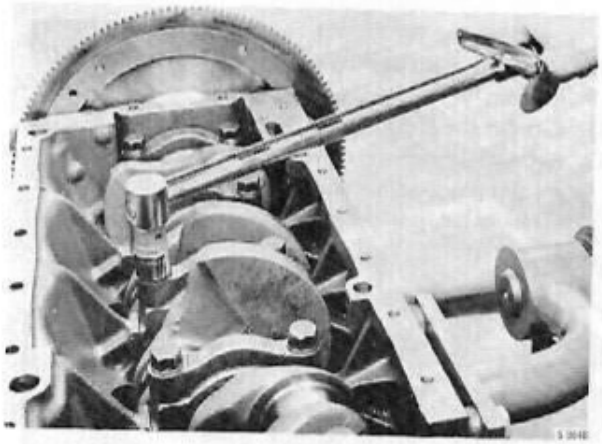


4. Mount the main bearing caps with bearing halves already in position and oiled. (NOTE! Make sure the markings match up!) The main bearing caps are numbered; No. 1 goes at the transmission chain end and the others run consecutively to the flywheel end with the bearing locks facing each other. To each number on the bearing caps, corresponds a cast number on the crankcase.

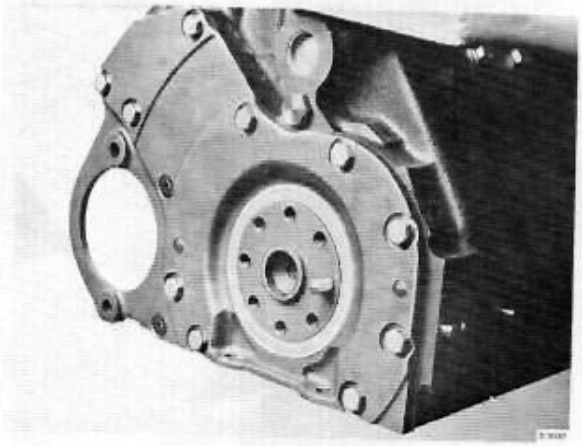


5. Tighten the main bearing bolts to the specified torque.

Torque	108 Nm (79 ft.lb./11 kpm)



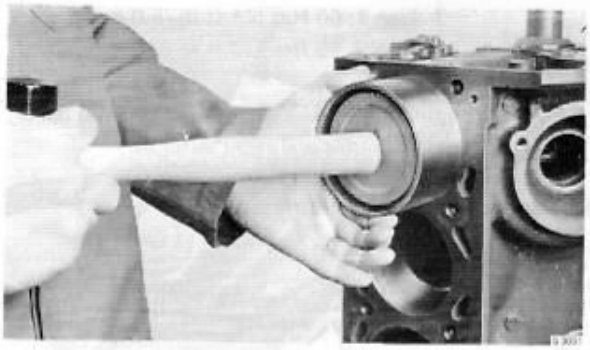
6. Fit the gable plate with the crankshaft seal towards the mating surface of the engine block. Grease the inner circlip of the sealing ring. Fit a new gasket on the gable plate and trim it flush with the mating surface of the transmission.



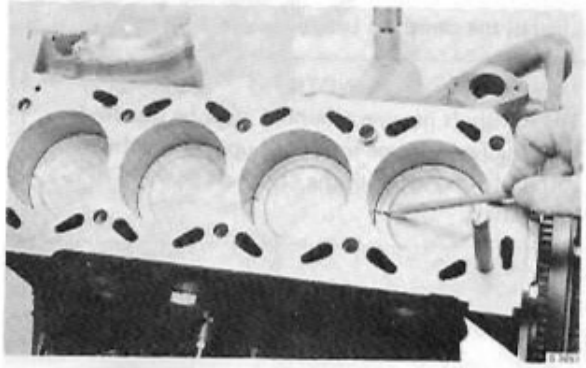
7. Fit the flywheel (driver disc). Apply thread sealant or the equivalent to the screw threads.

Torque	60 Nm (44 ft.lb./6.0 kpm)

8. Install the pistons and connecting rods using tool 7862287. Make sure that the studs are still protected by their plastic sleeves. The connecting rods and big-end bearing caps are numbered to match the corresponding cylinders. Instructions for fitting piston rings are given on page 212–2.

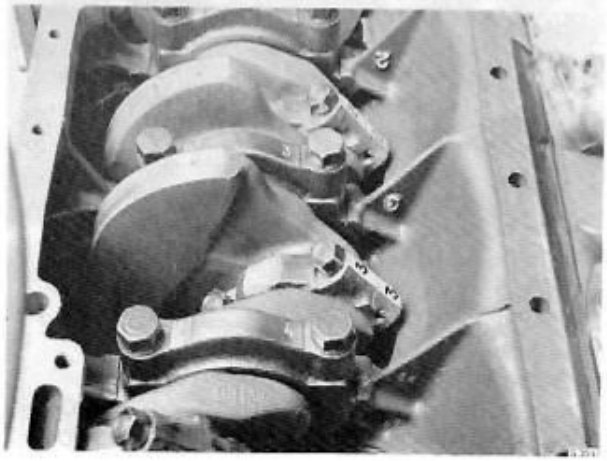


NOTE
The groove on top of the piston should be facing the transmission end.



9. a. Fit the big-end bearing caps so that the figures face the same way as those on the connecting rod, i.e. away from the idler shaft.
   b. Tighten the nuts to the specified torque.

Torque	54 Nm (40 ft.lb./5.5 kpm)



10. a. Install the idler shaft and fit the keeper plate.

CAUTION
The idler shaft is available in two versions which must not be confused.
Idler shafts of the later version are made of cast-iron and the gears for the distributor and water pump have a larger number of cogs.

b. Mount the sprocket on the idler shaft.

11. Fit the water pump (see section 262).

CAUTION
Tapping-out hammers or the like must never be used in the assembly of the water pump.

12. Mount the sprocket on the crankshaft.

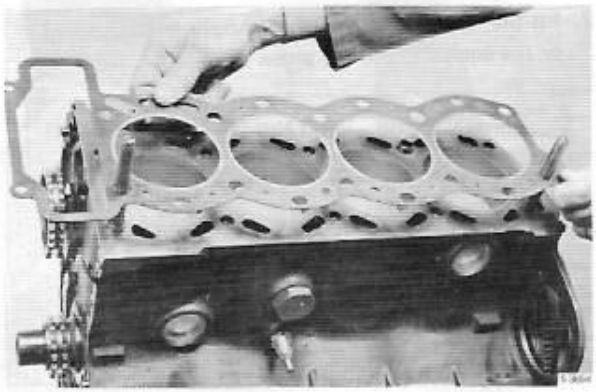
13. Fit the cylinder head gasket. Fit two locating pins, tool 8392128.

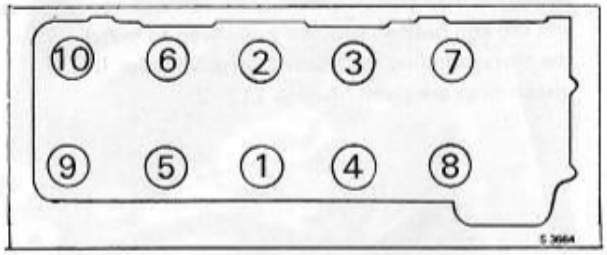
14. a. Mount the cylinder head.
    b. Tighten the screws in two steps.

Torque	Step 1: 60 Nm (44 ft.lb./6.0 kpm) Step 2: 95 Nm (70 ft.lb./9.5 kpm)

    c. Do the final tightening after the engine has been allowed to cool for about 30 minutes.

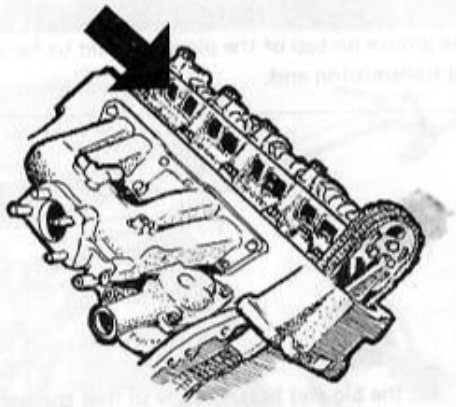
15. Mount the camshaft bearing assembly.





15. Install the camshaft bearing assembly.

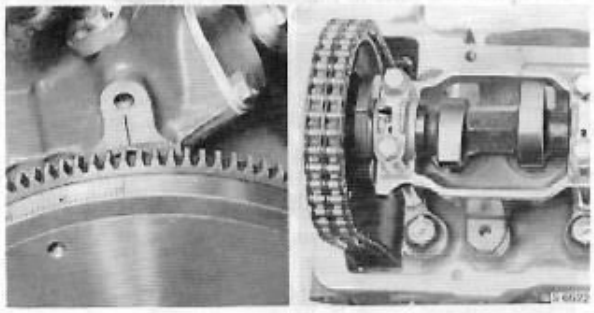
NOTE
The camshaft bearing assembly must be installed with the feeler gauge insertions uppermost. Incorrect fitting deprives the camshaft bearings of lubrication.



S 7203

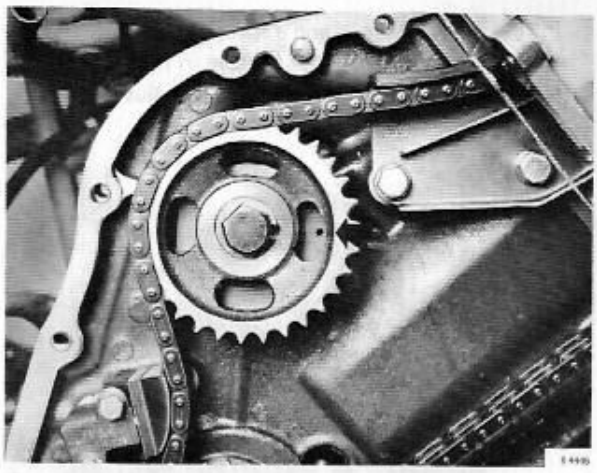
16. Mount the adjusting pallets and valve depressors.
17. Fit the camshaft.

NOTE
When the camshaft is to be fitted, the setting marks on the camshaft and crankshaft must be in the firing position for No. 1 cylinder. Reason: If the transmission is not installed correctly, the exhaust valves can make contact with the piston tops. WHEN WIDE OPEN, THE EXHAUST VALVE WILL COLLIDE WITH THE TOP OF THE PISTON WHEN THE PISTON REACHES THE TOP DEAD CENTRE POSITION.

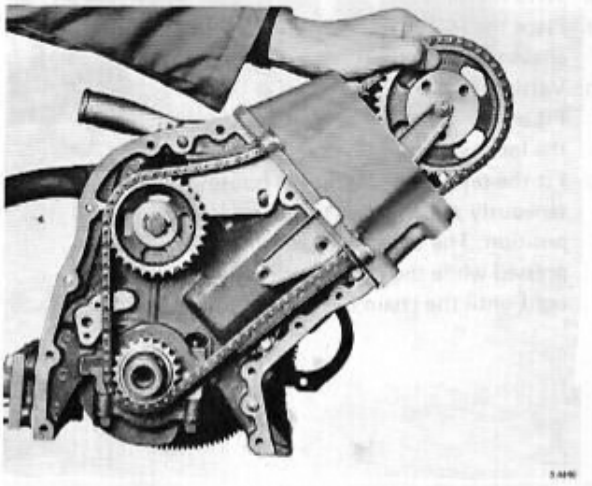


18. Fit the camshaft bearing caps. Note the marks.
19. Mount the straight chain guide plate.
20. Check that the setting marks on the crankshaft, camshaft and idler shaft are in the ignition position for the first cylinder.

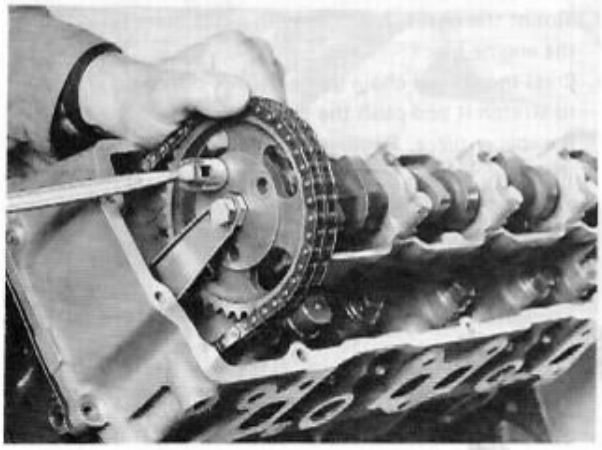
IDLER SHAFT MARKING. THE BULGE IN THE HOLE ON THE IDLER SHAFT CHAINWHEEL SHOULD LINE UP WITH THE SMALL HOLE IN THE KEEPER PLATE.



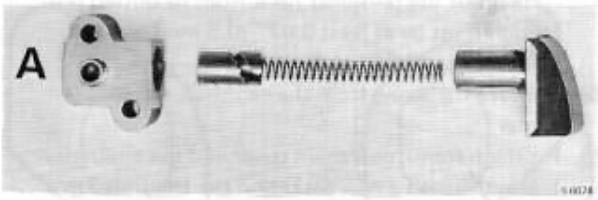
21. Assemble the camshaft sprocket and mounting plate if they have been disassembled, fit the transmission chain over the camshaft sprocket, and lower the transmission chain and mounting plate past the camshaft flange until the center stud of the sprocket is lined up with the camshaft.



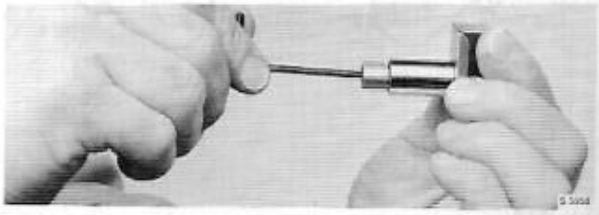
22. Rotate the camshaft sprocket until the screw holes match the threaded holes in the camshaft flange.
23. Fit the transmission chain over the other sprockets so that it hangs straight from the camshaft to the crankshaft.
    NOTE! The shaft settings must not be altered.
24. Guide the center stud of the camshaft sprocket into the camshaft. Fit the screws.



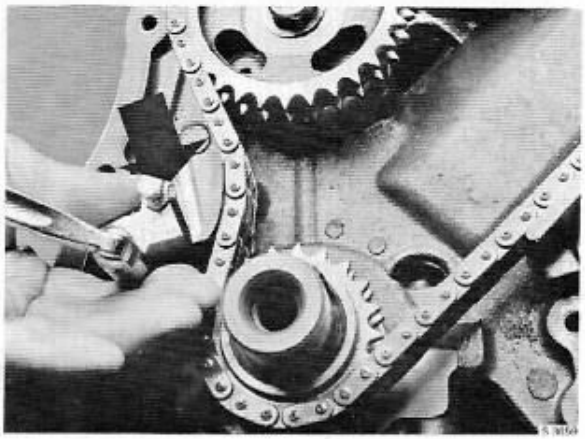
25. Mount the curved chain guide plate together with the mounting plate (the chain guide plate nearest the block) with two screws and stretch the chain somewhat.
26. Check the setting "camshaft-crankshaft-idler shaft".
27. Fit the chain tensioner as follows:
    Different versions of the chain tensioner exist, with the assembly procedure for each being different.
    A REYNHOLDS make
    a. Before installation, remove the tensioner neck.



b. Tension the spring, by turning the ratchet sleeve (actuated by the spring) clockwise and at the same time pushing it until it locks in its innermost position.



c. Fit the tensioner neck and a spacer piece, so that the tensioner neck will not bottom in the chain tensioner housing and release the self-adjuster.

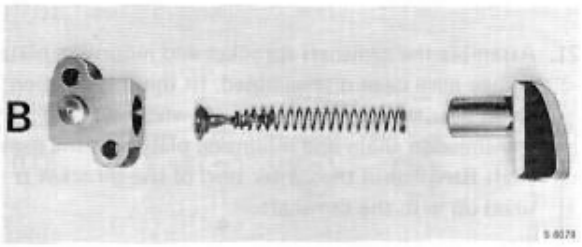


B JWIS make

a. Place the lock washer with the spiral rod in the chain tensioner housing.

b. Version B:
Fit the spring with the smaller diameter against the lock washer.

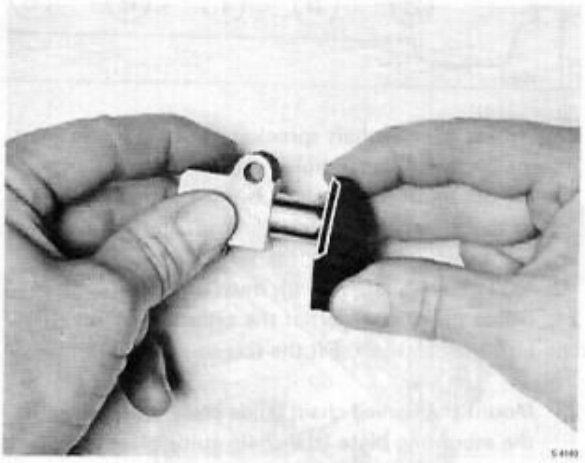
c. Fit the tensioner neck in the housing by simultaneously pressing and turning it into its inner position. The tensioner neck must be held depressed while the chain tensioner is being fitted, right until the chain has been tensioned.



A and B (both versions):

d. Mount the chain tensioner with guide plate on the engine block.

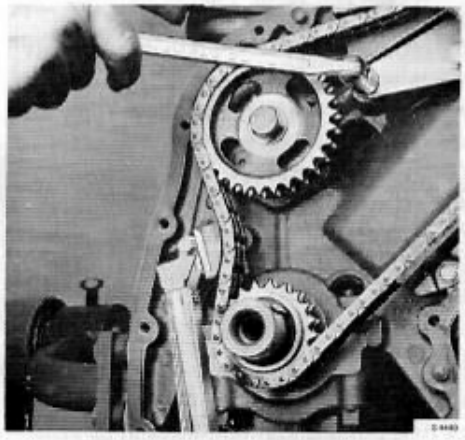
e. Press the curved chain guide against the chain to stretch it and push the tensioner neck against the spacer piece. Remove the spacer piece while the chain is kept tensioned. Then adjust to leave a clearance of 0.02" (0.5 mm) between the housing and the tensioner neck.
Tighten the chain guides.



f. Rotate the crankshaft one full turn in its normal sense and check the chain tension. The movement of the tensioner neck from its butted position must be at least 0.02" (0.5 mm) and not more than 0.06" (1.5 mm).

28. Remove the screw from the camshaft sprocket center.

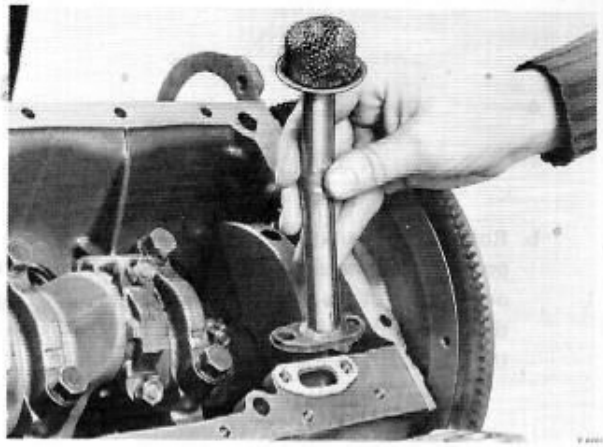
29. Fit the transmission chain cover and the alternator bracket. Install a new gasket on the transmission chain cover and trim the gasket flush with the mating surface of the transmission.



30. Fit the belt pulley and tighten the screw with the prescribed torque.

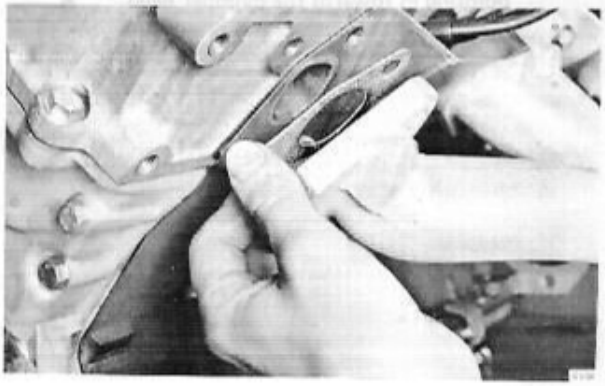
Tightening torque	190 Nm (137 ft.lb., 19 kpm)

31. Mount the oil pump spacing piece with gasket.
32. Fit the oil pump suction line. Make sure that the suction tube gasket is the right way round.



33. Fit the oil filter.
34. Fit the inlet manifold. Connect water hoses and crankcase ventilation hoses. Screw in the engine lifting eye.
35. Injection engine:
    Mount the throttle valve housing.
36. Mount the thermostat housing.

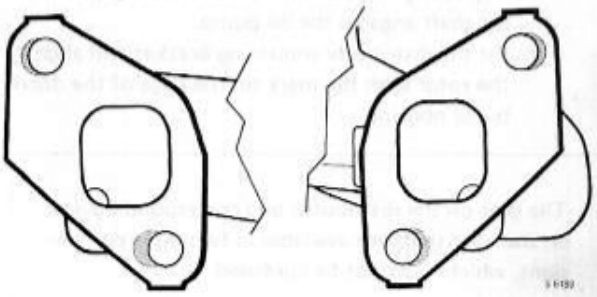
37. Fit the exhaust manifold and radiation shield.
    - Use a face plate to check that the sealing surfaces are flat and parallel.
    - If necessary, grind the sealing surfaces using a face plate.
    - Fit "service-kit" gaskets (two smaller and one large) between the exhaust manifold and the radiation shield.



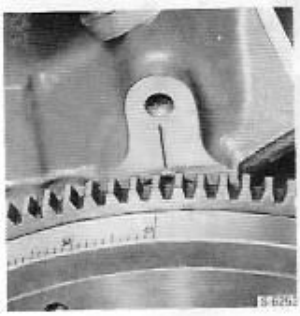
NOTE

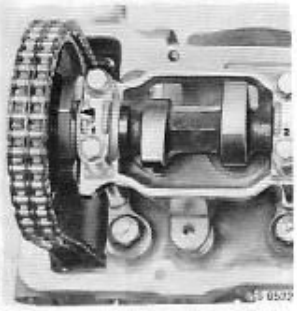
These gaskets are not fitted at the factory but are none the less recommended in conjunction with reassembly following repair or overhaul work. This is because a certain amount of deformation occurs as a result of the extreme temperature fluctuations to which the exhaust manifold is subjected.

In cars with 2-branch exhaust manifolds, difficulty due to contraction may arise when the outer flange is to be secured. In such cases, use a file to make the bolt holes in the flange oval so that the bolts can be installed.

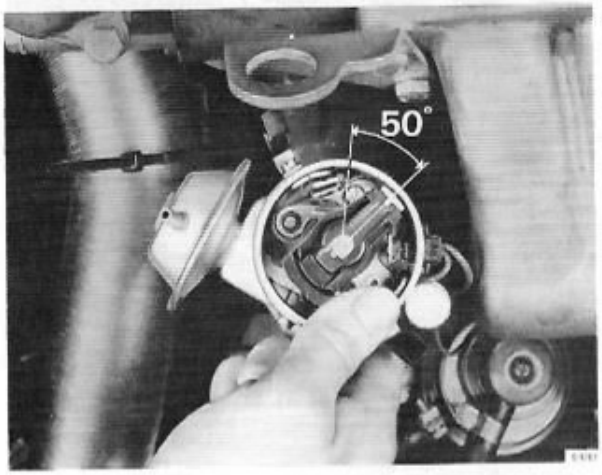


38. Fit the distributor as follows:
    a. Check that the crankshaft and camshaft are set to the firing position for No. 1 cylinder.



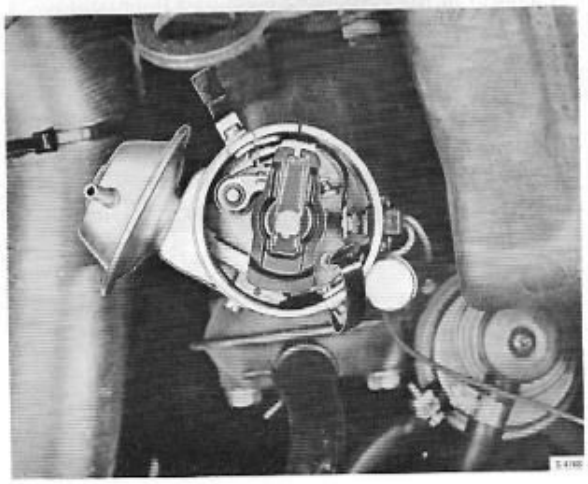


    b. Rotate the distributor shaft so that the rotor will point approximately 50° clockwise from the mark on the edge of the distributor housing. (On fitting, the rotor will move approximately 50°, owing to the helical cut of the teeth.)



    c. Locate the distributor in the engine block with the mark on the edge of the distributor housing pointing in towards the cylinder head.

    d. Engage the gears with each other and rotate the engine slightly back and forth until the distributor shaft engages the oil pump.
    e. Fit the distributor mounting bracket and align the rotor with the mark on the edge of the distributor housing.



> The gear on the distributor and corresponding gear on the idler shaft are available in two different versions, which must not be confused.

39. Fit the oil pump.
40. Fit the valve cover.
41. Mount the clutch. (Manual transmission)

CYLINDER HEAD

DISASSEMBLY

(Engine in car)

1. Disconnect the battery leads.
2. Drain the coolant through the drain cock on the radiator and plug in the engine block.
3. Injection engines:
   Remove the rubber bellows from between the air flow meter and the throttle valve housing and disconnect the throttle cable from the valve housing.
4. Disconnect the cable from the temperature transmitter.
5. a. Detach the vacuum hose of the power assist cylinder from the inlet manifold.
   b. Disconnect the fuel lines from the fuel distributor to the injection valves. Tape the ends of the lines to prevent dirt from entering. Remove the stay from the throttle valve housing mounting.
6. Undo the hose clamps at the connections to the thermostat housing, water pump and inlet manifold.
7. Unbolt the exhaust pipe from the exhaust manifold.
8. Remove the distributor cap and ignition cables.
9. Remove the valve cover.
10. Remove the camshaft sprocket as follows:
    Bolt the mounting plate to the center of the camshaft sprocket using one of the camshaft sprocket retaining screws.

> CAUTION
> Tighten the screw securely to immobilize the center stud. Otherwise the chain tensioner will tighten the chain and lock in a new position so that the sprocket cannot be refitted. The chain tensioner cannot be reset without lifting the engine out of the car.

   b. Undo the retaining screws from the camshaft sprocket. Separate the wheel from the camshaft plate until it hangs free in the mounting plate by the center stud.
11. a. Unscrew and remove all cylinder head screws.

b. Mount two guide pins (tool 8392128), in two of the cylinder head screw holes.
c. Remove the screws at the transmission cover.
d. Lift off the cylinder head.

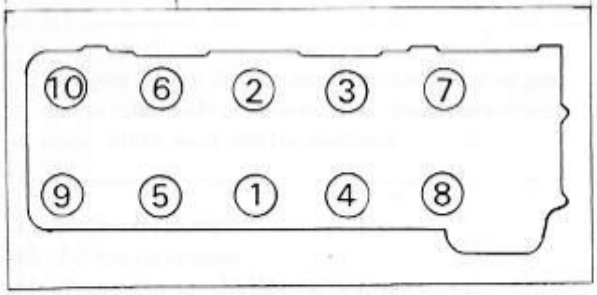
ASSEMBLING

1. Carefully scrape off old gasket material from the contact surfaces (emery cloth must not be used). Check that the contact surfaces are plane.
2. Fit the new cylinder head gasket over the two guide pins.
3. Make sure that the markings on the camshaft and bearing cap are in line with each other.
4. Check that the flywheel mark is in line with the mark on the cylinder block and that the ignition is set on No. 1 cylinder.

> CAUTION
> When the cylinder head is to be fitted, the setting marks on the camshaft and crankshaft must be in the firing position for No. 1 cylinder. Reason: If the transmission is not installed correctly, the exhaust valves can make contact with the piston tops. WHEN WIDE OPEN, THE EXHAUST VALVE WILL COLLIDE WITH THE TOP OF THE PISTON WHEN THE PISTON REACHES THE TOP DEAD CENTRE POSITION.

5. a. Mount the cylinder head. Tighten the cylinder head screws to the specified torque in two stages. The order of tightening is shown in the illustration. Insert and tighten the transmission chain cover screws. Retighten after the engine has been warmed up and then cooled off for about 30 minutes.
   b. Screws are retightened after 2,000 and 10,000 km (1,200 and 6,000 miles).

Torque	Step 1: 60 Nm (44 ft.lb./60 kpm) Step 2: 95 Nm (70 ft.lb./9.5 kpm)

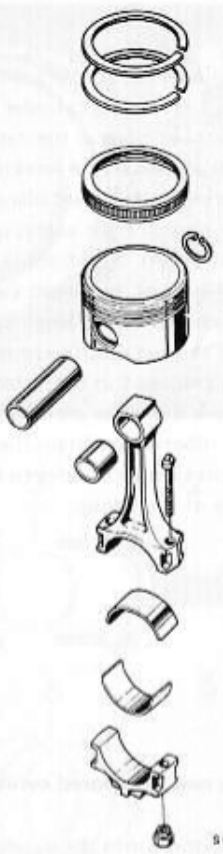


6. Mount the camshaft sprocket on the camshaft. Unscrew the screw from the center of the sprocket.

> CAUTION
> The screw on the camshaft sprocket center must not on any account be unscrewed before the sprocket is tightly screwed to the camshaft.

7. Mount the engine mounting screw in the cylinder head.
8. Fit the valve cover. Undamaged gasket can be remounted.
9. Fit the distributor cap complete with ignition cables.
10. Bolt the exhaust pipe to the exhaust manifold.
11. Connect the throttle control cable.
12. Connect the hoses to the thermostat housing, water pump and inlet manifold and tighten the hose clamps.
13. Connect the vacuum hose from the inlet manifold to the servo cylinder. Connect the fuel hoses. Mount the stay at the throttle valve housing.
14. Connect the cables to the ignition coil and temperature transmitter.
15. Mount the inlet hose (rubber bellows).
16. Close the drain cocks and fill with coolant.
17. Connect the battery cables.

PISTONS, CONNECTING RODS, CYLINDER BORES



CHANGING PISTONS, PISTON RINGS AND BIG-END BEARINGS

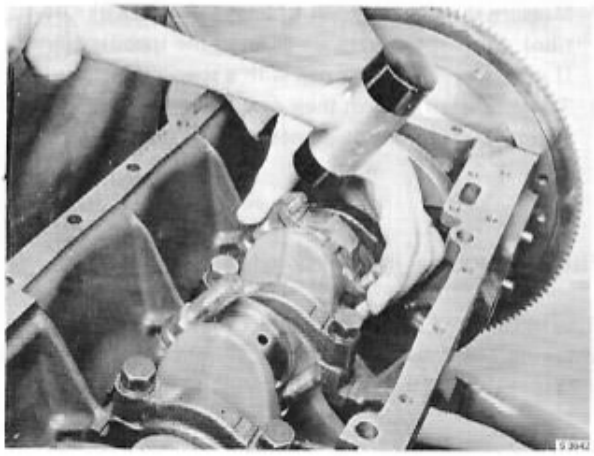
(Engine mounted in work stand)

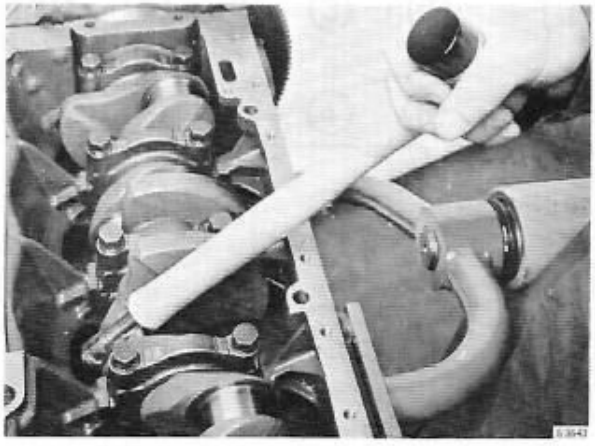
Disassembly

1. Remove the oil filter.
2. Remove the valve cover.
3. Remove the camshaft sprocket as follows:
   a. Turn the crankshaft to ignition position for No. 1 cylinder.
   b. Screw the sprocket against the mounting plate provided for the purpose.

> CAUTION
> Tighten the screw securely to immobilize the center stud. Otherwise the chain tensioner will tighten the chain and lock in a new position so that the sprocket cannot be refitted.

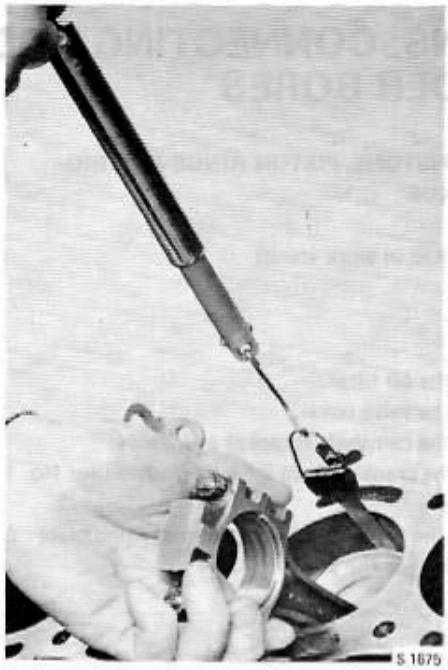
   c. Undo the retaining screws from the camshaft sprocket. Separate the wheel from the camshaft plate until it hangs freely by its center stud in the mounting plate.
4. a. Unscrew all cylinder head screws.
   b. Remove the cylinder head screws and mount two guide pins.
   c. Remove the screws from the transmission chain cover.
5. Disconnect the hoses from the inlet manifold and the carburetor/throttle valve housing. Unscrew the spark plugs.
6. Lift off cylinder head with carburetor/throttle valve housing, inlet manifold, exhaust manifold and valve mechanism.
7. Remove the big-end bearing caps and push the pistons complete with connecting rods out of the cylinders. Protect the studs with pieces of plastic hose.
   NOTE! Remove any crusts and deposits of soot from the top ends of the cylinders.





Fitting pistons

To fit pistons to the cylinder bores, use a feeler gauge 1/2" 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 belance and place it between the piston and cylinder bore at right angles to the axis of the piston pin (see illustration). At a tractive force of 8–12 N (1.8–2.6 lb., 0.8–1.2 kp), the mean value of the clearance equals the thickness of the feeler gauge. Repeat the test with the piston at several different depths on the piston. 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.


S 1675

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.

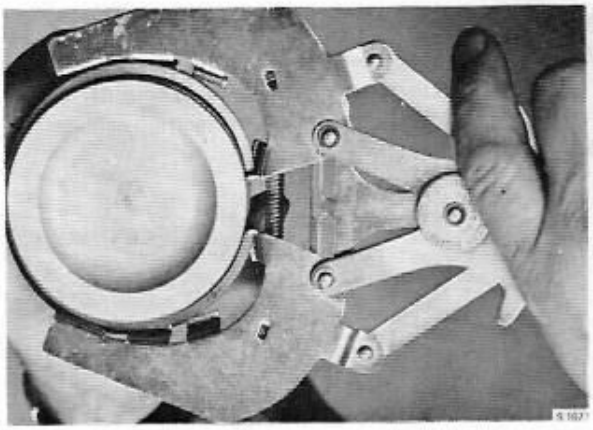

S 1676

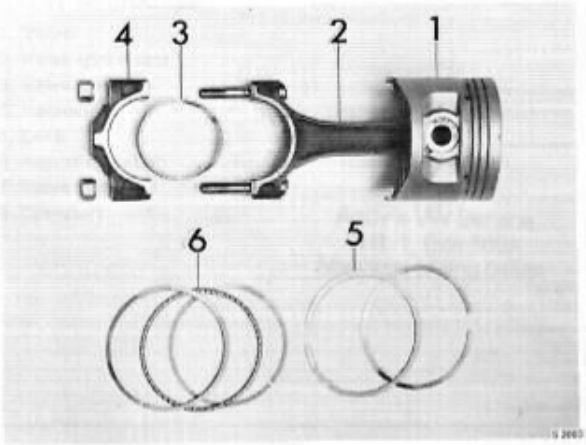
Fitting piston rings in worn cylinders

Ring 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.

Assembly of piston rings

Use a piston ring tool to position the rings as illustrated. Place the lower compression ring with the side marked "top" uppermost. Oil the piston and rings before assembling. Rotate the compression rings so that gaps in alternate rings will be at 180° to each other, positioned alternately over the two ends of the piston pins.
Make sure, too, that the spring gaps of the top and bottom rings in the three-piece scraper ring are staggered.





PISTON AND CONNECTING ROD WITH BEARINGS AND PISTON RINGS

1. Piston
2. Connecting rod
3. Bearing
4. Bearing cap
5. Compression rings
6. Three-piece oil scraper ring

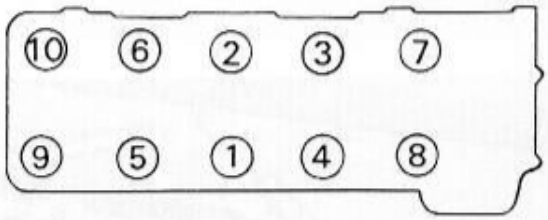
Installation

1. Install pistons and connecting rods using the piston installing tool 7862287.

> NOTE
> The groove on top of the piston should be facing the transmission end.

2. Mount big-end bearing caps with bearing halves.
3. Fit the cylinder head gasket.
4. Mount the cylinder head. Remove the guide pins and refit the screws. Tighten the cylinder head screws to the specified torque in two steps; first to 59 Nm (6 kpm, 43 ft.lb.) and then 93 Nm (9.5 kpm, 69 ft.lb.). The order of tightening is illustrated below. Tighten finally after the engine has been warmed up and then cooled off for about 30 minutes. Insert and tighten the transmission chain cover screws.
   Screws are re-tightened after 2.000 and 10.000 km (1.200 and 6.000 miles).

Tightening torque	Step 1: 60 Nm (44 ft.lb./6.0 kpm) Step 2: 95 Nm (70 ft.lb./9.5 kpm)



5. Fit the camshaft sprocket to the camshaft, making sure that the notches on the camshaft and bearing cap are in line. Tighten and lock the retaining screws. Remove the retaining screw and remount it to the sprocket. Check at the same time that the mark on the flywheel is in line with the mark on the cylinder block.

6. Mount the valve cover.
7. Connect hoses and cables to the valve cover, inlet manifold and carburetor/throttle valve housing. Screw in the spark plugs and connect the ignition cables.
8. Install the oil filter.

VALVE MECHANISM

VALVE COVER

Removing

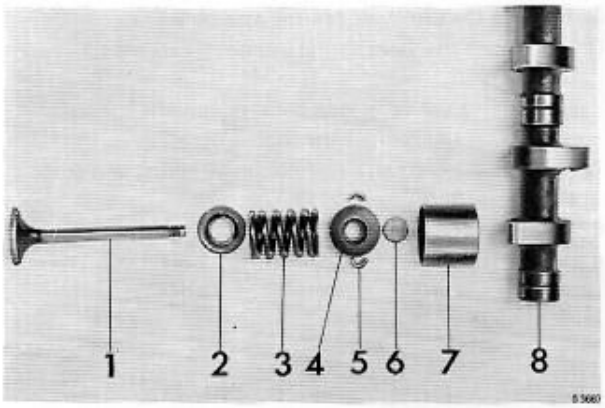
1. Disconnect the crankcase ventilation hose.
2. Detach the ignition cables from the valve cover and spark plugs.
3. Back off the screws and lift off the cover.

Replacing

If the screws have been tightened too hard so that the contact surface around the screw holes has been depressed, the surface should be restored before the cover is fitted. If this is neglected, the contact pressure between the holes will be reduced.

1. Fit the gasket. The original gasket may be reused if undamaged.
2. Fit the cover.
3. Connect the ignition cables.
4. Connect the crankcase ventilation hose.

NOTE Do not tighten the screws so hard that the cover is deformed.	
Tightening torque	2 Nm (1.4 ft.lb., 0.2 kpm)



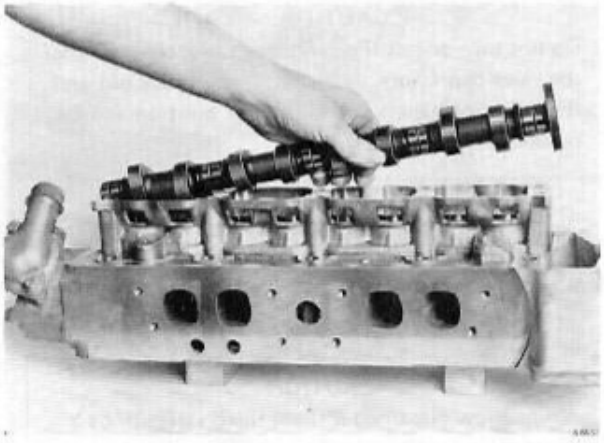
VALVE MECHANISM
1. Valve
2. Valve spring seat
3. Valve spring
4. Retainer
5. Lock
6. Adjusting pallet
7. Valve depressor
8. Camshaft

VALVES

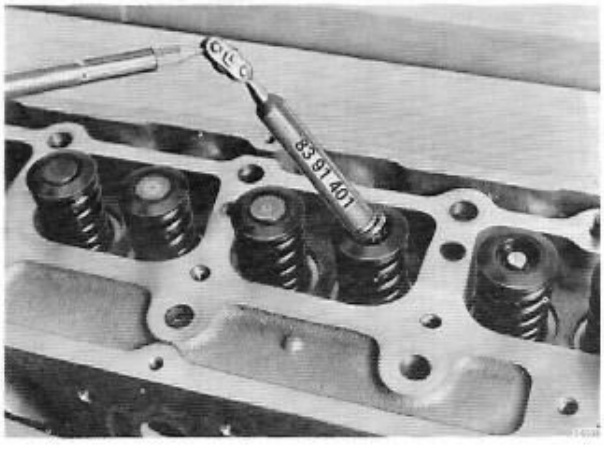
Disassembling

(Cylinder head removed from cylinder block)

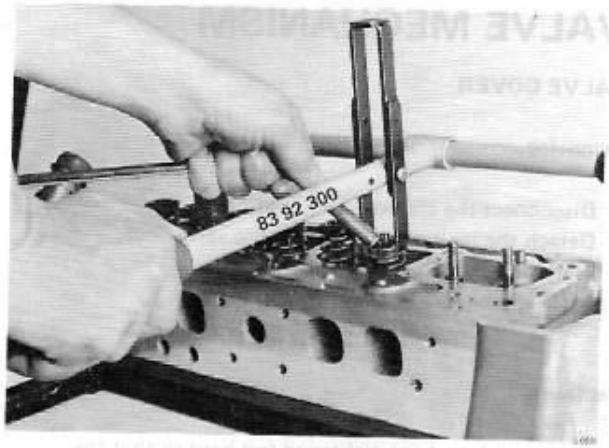
1. Remove the camshaft bearing caps.
2. Lift out the camshaft.



3. Withdraw the valve depressors, using the magnetic tool, and lay them aside in the correct order.
4. Remove the adjusting pallets. Be careful not to mix them up.



5. Remove the camshaft bearing assembly.
6. a. Depress the valve spring using valve spring tool 8393050.
   b. Remove the valve lock clips, release the spring tension and remove the tool.
7. Remove the top valve retainer, valve spring and guide sleeve.
8. Withdraw the valve.



Assembling

1. Insert and oil the valve spindles.
2. Insert the guide sleeve before the spring.
3. Insert the springs and top retainers.
4. Depress the spring, using a valve spring tool, and fit the valve locks (clips). Then release the pressure on the spring and check that the clips are correctly positioned on the spindle. Remove the tool.
5. Mount the camshaft bearing assembly.
6. Insert adjusting pallets, replacing them in their original positions.
7. Insert the valve depressors, lubricating the bearing surfaces with engine oil.
8. Install the camshaft.
9. Install the bearing caps. (NOTE the markings!)

> CAUTION
> Do not turn or tips the cylinder head after inserting the valve depressors, as these will then slide out and the adjusting pallets will fall out of position and be randomized.

Scrapping of sodium-filled exhaust valves

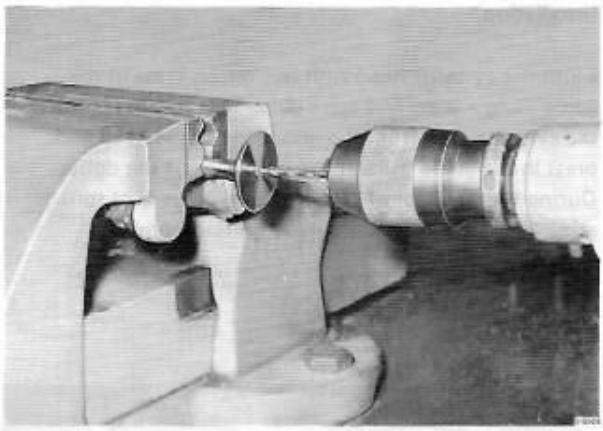
> CAUTION
> Never allow discarded sodium-filled valves to become mixed with normal scrap before they have been properly treated. Failure to observe this will result in a serious risk of explosion when the scrap is melted.

Sodium-filled exhaust valves are fitted in injection engines.

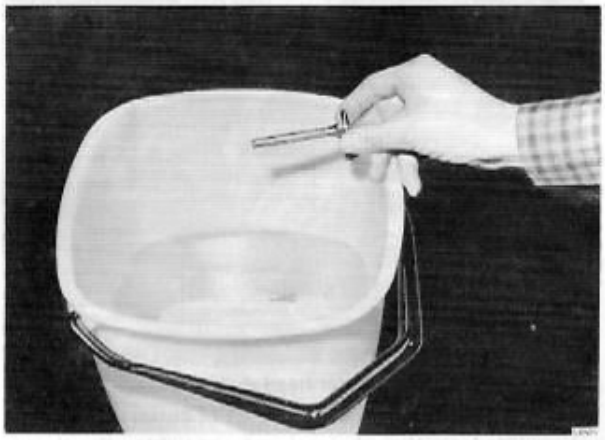
Valves to be scrapped should be treated as follows:

1. Drill a hole through the centre of the valve head down to the sodium compound.
2. Drill an additional hole in the stem or cut off the stem about approx 1.0 in (25 mm) from the bottom.

> CAUTION
> Keep the valve and sodium compound well away from water when drilling or cutting the valves or exposing the sodium compound in any other way, as contact with water is likely to cause an explosion.



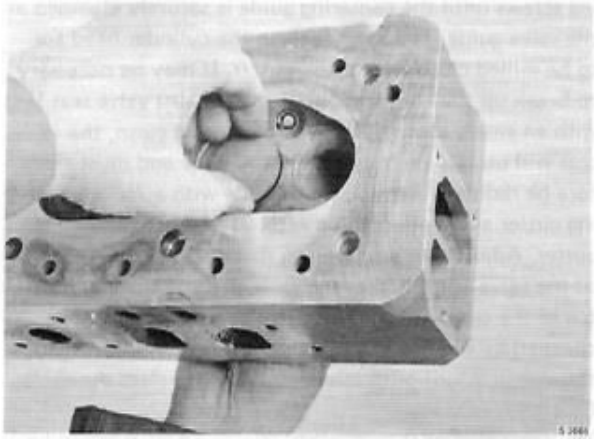
3. Throw the valve into a bucket of water. This will cause an explosive chemical reaction. The manufacturer recommends that you should withdraw to a distance of at least 3 metres from the bucket. After a period of one or two minutes, the reaction will die down and the valve may be scrapped in the normal way.



VALVE GUIDE

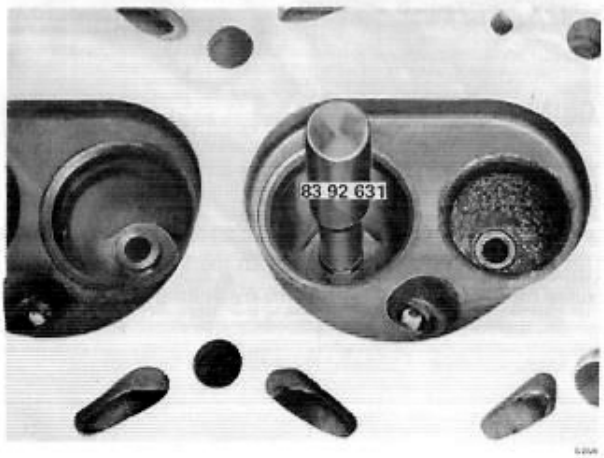
Checking the wear

Pull out the valve about 0.12" (3 mm) from its seat and check the radial play of the valve, by rocking the valve disc. If the play at the disc exceeds 0.02" (0.5 mm), the valve guide is to be exchanged.



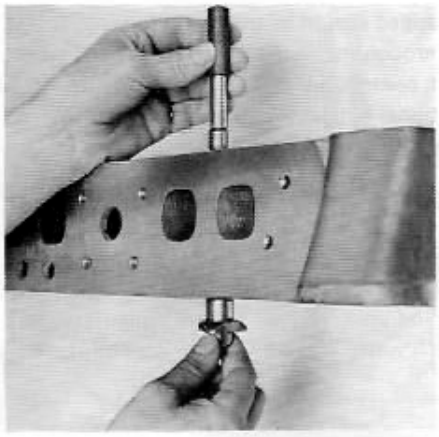
Removing

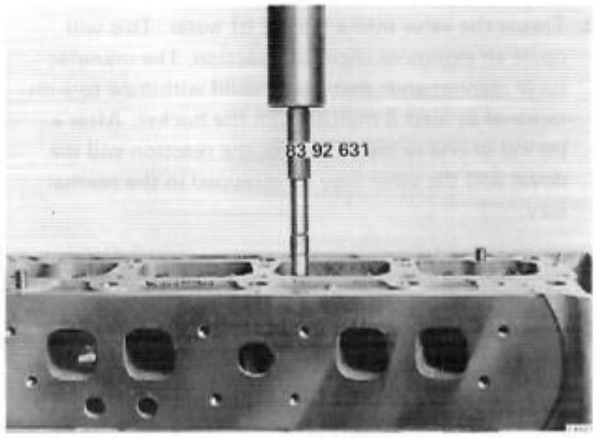
Before removing a valve guide, flush the cylinder head through with hot water. Withdraw the valve guide from the camshaft end using special tool 8392631 with pull rod and nut.



Installation

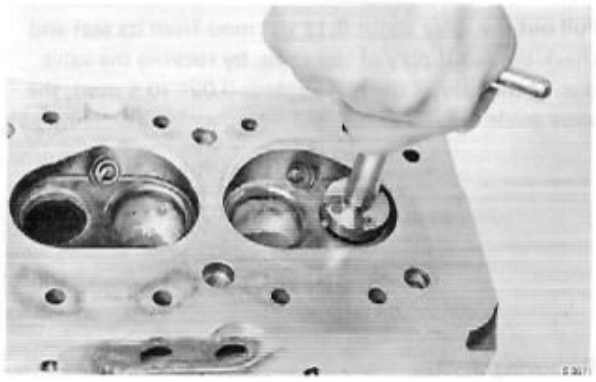
Flush the cylinder head with hot water. Press in the guide using a press and valve guide tool 8392631. Insert the centring stop from the underside of the head and press in the guide from above by means of the dolly. During the last pact of the work, the guide tool springs aside and the valve guide can be pressed home.





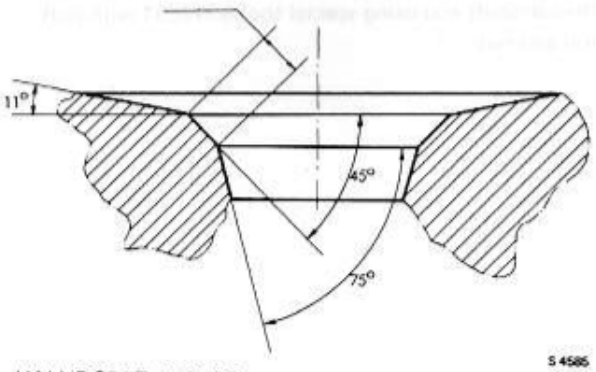
MILLING VALVE SEATS

Clean all parts and remove all traces of soot and dirt from the valve and cylinder head duct.
Insert the centering guide for the set of cutters into the valve guide from the valve seat end end tighten the clamping screws until the centering guide is securely clamped in the valve guide. The valve seats in the cylinder head are to be milled clean with a 45° cutter. It may be necessary to break up the hard surface of the exhaust valve seat first with an emery clotch. After being ground clean, the valve seat will usually be found to be too wide and must therefore be reduced. Reduce from inside with a 75° correcting cutter and from outside with an 11–12° correcting cutter. Adjust the reduction so that the contact surface of the valve seat touches the valve plate as close as possible to the center of the seat. This can conveniently be checked by the use of a marking dye. After adjustment, the seat width of both inlet and exhaust valves should be 0.040–0.080" (1–2 mm).
The condition of the valve will decide whether it can be machine ground or must be exchanged. The valve plate angle must be 44.5°.



GRINDING VALVES

Smear a thin coat of grinding paste on the valve seat and insert the valve in the cylinder head. Make a few grinding movements with the grinding tool, clean all traces of paste off the seat, and check the fit with marking dye. Grind once more if required and finish by milling if necessary.



S 4585

VALVE SEAT ANGLES

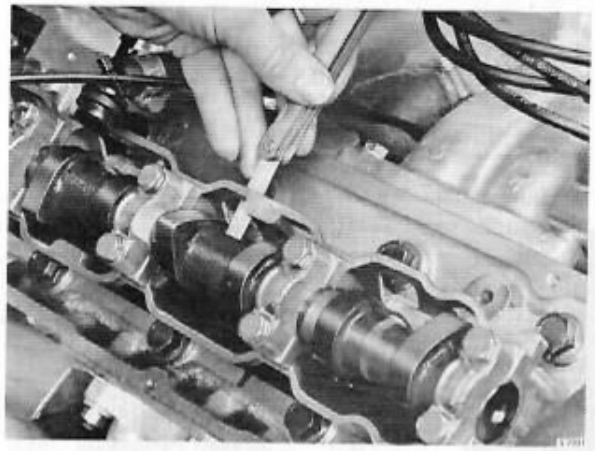
SAAB

VALVE CLEARANCE

General

The valve clearance is stable and adjustment is needed only after a long time or when the valves are renovated. However, the valve clearance is to be checked each 15.000 miles. (24.000 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 0.006"–0.012" (0.15–0.30 mm) for inlet valves and 0.014"–0.020" (0.35–0.50 mm), Turbo 0.016–0.020 in. (0.40–0.50 mm) for exhaust valves.
The procedure is as follows:

1. Remove the valve cover.
2. Cars with manual transmission:
   Engage 3rd gear. Push the car forward or backward to bring the camshaft cams into the correct measuring positions, i.e. with the cam of the valve to be measured pointing 180° away from the valve stem. Two cams will be in the measuring position at the same time.
2. Cars with automatic transmission:
   Rotate the cankshaft using special wrench 8390817 to bring the camshaft into position for measurement. This special wrench fits the center screw of the crankshaft belt pulley at the dash panel and can be used on all models.
3. Try the maximum and minimum clearances with feeler gauge. The minimum feeler should slip in, but the maximum feeler should not. If this result is not obtained, the clearance must be measured for adjustment.
4. Refit the valve cover.

Measuring and adjusting

If the clearance of any valve is found on checking to be outside the permissible limits, the clearance of all valves must be measured.
Adjustment of valve clearance is to be based on actual measurement. Measurement are made with tool 8391450 and a dial indicator.
Adjust the deviation of the valve clearance from the correct value by changing the adjusting pallet.
The procedure for measurement and adjustment is as follows:

1. Turn the cam to the measuring position (180° from the valve stem).
2. Fit measuring tool 8391450, with a dial indicator, and clamp the tool in a position where the three jaw seg-

ments grip the valve depressor and the point of the dial indicator rests on the top of the cam. Set the dial indicator to zero.

3. Lift the valve depressor with the measuring tool and read off the deflection of the instrument pointer, which indicates the valve clearance. Note the reading.
4. Measure and note down the clearances of all valves in the same manner. Proceed to adjust the clearance of any valves in he
   any valves in which it o
   any valves in which it 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)
Turbo	0.018–0.020 in. (0.45–0.50 mm)

5. Remove the camshaft and the valve depressors and adjusting pallets of any valves needing adjustment.

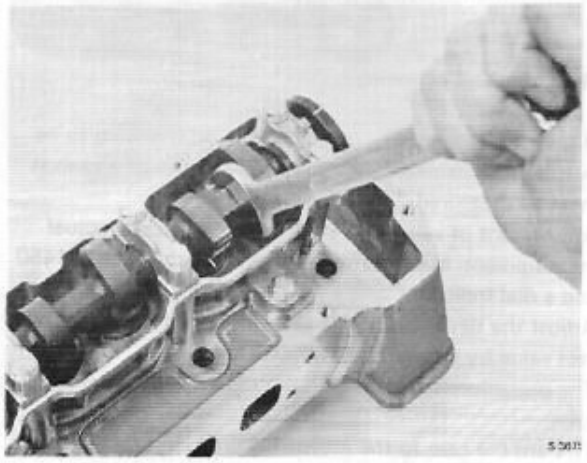
6. Measure and make a note of the thickness of the pallet using tool 8391633 or a micrometer.
   This thickness plus the valve clearance adds up to the total distance between the valve and the cam.
   Example:

Measured valve clearance	0.005" (0.13 mm)
Measured pallet thickness	0.100" (2.54 mm)
Total distance	0.105" (2.67 mm)

   The choice of adjusting pallet is determined by the measured total distance between the valve depressor and the cam less the specified valve clearance for an intake or exhaust valve as the case may be.
   Example:

Total distance	0.105" (2.57 mm)
Less specified inlet valve clearance	0.008"–0.010" (0.20–0.25 mm)
Required pallet thickness	0.097" (2.44 mm)

   Choose a pallet with thickness 0.096" (2.43 mm).
7. Insert the new adjusting pallet and the valve depressor and install the camshaft.
8. Repeat the measurement procedure to check that the clearances are now correct.



MEASURING AND ADJUSTING VALVE CLEARANCE AFTER VALVE RECONDITIONING

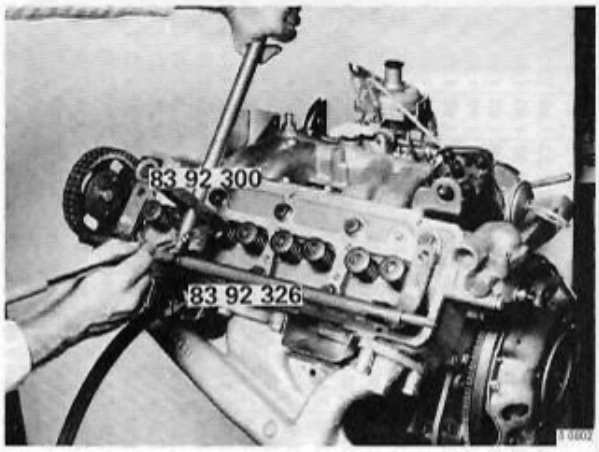
1. Install adjusting pallets with a minimum thickness of 0.070" (1.77 mm).
2. Insert depressors and install the camshaft.
3. Measure the valve clearances, note the reading for each valve and calculate the total distance.
4. Select new pallets to give the correct clearances.
5. Remove the depressors and the camshaft, take out the 0.070" (1.77 mm) pallets and insert new pallets to give the correct clearances.
6. Replace the depressors and reinstall the camshaft.
7. Check clearance measurements once more with the dial indicator. To make your choice of adjusting pallets easier, use the table in this section.

REPLACEMENT OF VALVE SPRINGS WITHOUT REMOVING CYLINDER HEAD

1. Remove the valve cover.
2. Rotate the crankshaft until the No. 1 cylinder is in the ignition position.
3. Fit a screw to the camshaft sprocket center and tighten the camshaft sprocket against the retaining plate.

> WARNING
> Tighten the screw fully, so that the center stud is held securely immobilized. Otherwise the chain tensioner will tighten the chain and lock in a new position so that the sprocket cannot be refitted.

4. Remove the screws holding the camshaft sprocket to the camshaft.
5. Unscrew the camshaft caps and remove the camshaft.
6. Remove the valve depressors and adjusting pallets.
7. Remove the camshaft bridge.
8. Take out the spark plug for the cylinder requiring a new valve spring and fit an air hose connector (tool 8392326) in the spark plug hole. Connect the cylinder to a compressed air supply to prevent the valve dropping into the cylinder.
9. Apply the valve spring tool (tool 8392300) as shown in the illustration. Compress the valve spring and pick up the valve spring retainers using a magnetic tool. Remove the valve spring and the valve spring seat.



Reassemble in the reverse order.

> NOTE
> When the camshaft is to be fitted, the setting marks on the camshaft and crankshaft must be in the firing position for No. 1 cylinder. Reason: If the transmission is not installed correctly, the exhaust valves can make contact with the piston tops.
> WHEN WIDE OPEN, THE EXHAUST VALVE WILL COLLIDE WITH THE TOP OF THE PISTON WHEN THE PISTON REACHES THE TOP DEAD CENTRE POSITION.

Valve clearance measured with dial indicator (mm)	Measured pallet thickness, inlet (mm)	Measured pallet thickness, exhaust (mm)
0,00	2,89	2,64
0,02	2,89	2,64
0,05	2,89	2,64
0,07	2,74	2,69
0,10	2,74	2,69
0,12	2,79	2,74
0,15	2,79	2,74
0,17	2,84	2,79
0,20	2,84	2,79
0,22	2,89	2,84
0,25	2,89	2,84
0,27		2,89
0,30		2,89
0,32		2,89
0,35		2,89
0,37		2,89
0,40		2,89
0,42		2,89
0,45		2,89
0,47		2,89
0,50		2,89
0,52		2,89
0,55		2,89
0,57		2,89
0,60		2,89
0,62		2,89
0,65		2,89
0,68		2,89
0,70		2,89
0,72		2,89

Measured pallet thickness, inlet (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
Measured pallet thickness, exhaust (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)	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
0,00	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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
0,57								2,89	2,84	2,79	2,74	2,69	2,64	2,59	2,54	2,48	2,43	2,38
0,60								2,89	2,84	2,79	2,74	2,69	2,64	2,59	2,54	2,48	2,43	2,38
0,62									2,89	2,84	2,79	2,74	2,69	2,64	2,59	2,54	2,48	2,43
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	2,48
0,72											2,89	2,84	2,79	2,74	2,69	2,64	2,59	2,54

HOW TO USE THE VALVE ADJUSTMENT TABLE

The following example illustrates how the table is used: The inlet valve clearance is 0.13 mm and therefore needs adjustment. The measured thickness of the adjusting pallet for this valve is 2.54 mm.

Starting from 0.12 mm, which is the closest figure in the table to the measured clearance, go horizontally across the table to the column above the inlet pallet thickness of 2.54 mm. The correct pallet thickness, 2.43 mm, can be read from the table at the intersection of the horizontal line from 0.12 mm and the vertical column from inlet 2.54 mm.

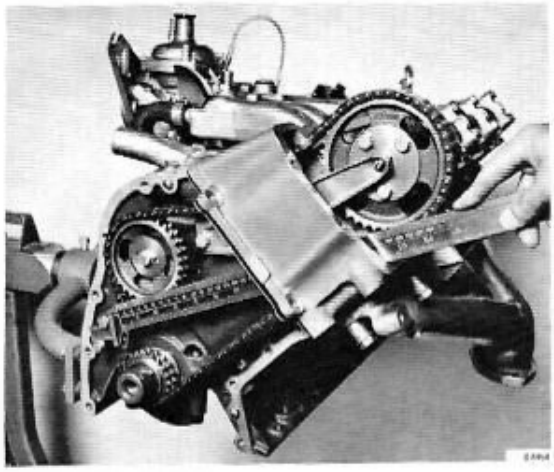
TRANSMISSION

Instructions for transmission chain, camshaft and idler shaft setting will be found in section 210.

CHECKING THE CHAIN TENSIONER

In order to prevent transmission damage caused by the chain tensioner running out to far, the position of the chain tensioner can be checked with the engine mounted in the car.

1. Remove the valve cover.
2. Insert a steel rule down, against the rubber neck on the chain tensioner and measure the distance to the level of the cylinder head cover.
3. The distance should be more than 11.8" (300 mm). If the distance is less than 11.8" (300 mm), the engine should be removed as soon as possible for correction. For completely tight chain tensioners (newly adjusted transmissions) the distance should be about 12.3" (313 mm).



CRANKSHAFT (CRANK MECANISM)

MEASURING THE CRANKSHAFT

Clean the crankshaft and measure its journals with a micrometer. Measurements should be made at several points round the surface. Out-of-round at the main bearing journals and big-end bearing journals should not exceed 0.002" (0,05 mm).
If the measurements are close to or over the started limit of wear, the crankshaft should be ground down to undersizes according to specification.
The journals can be ground down one step below nominal size without re-hardening. If they are ground more than one step, the shaft must be "tenifer-hardened" again.
Check that the crankshaft is straight to within 0.002" (0.05 mm) by indicating it; mount the shaft in two V-blocks, place an indicator against the center journal, and rotate the shaft.

MEASURING THE CLEARANCE

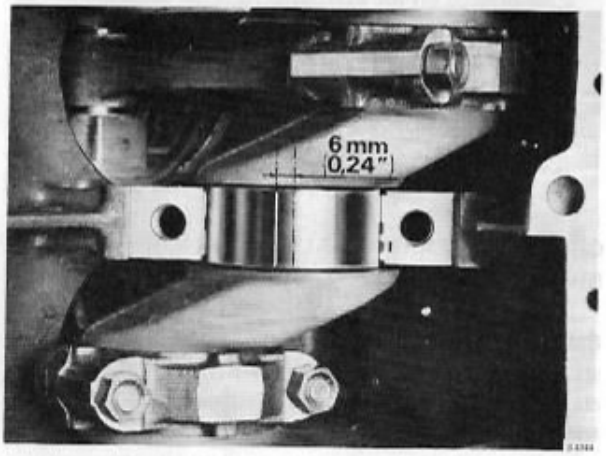
Before the bearing clearance is measured in connection with the fitting of new bearings, the out-of-round and taper of the big-end bearing journals should be checked. This clearance can be measured with a "Plastigage" which can be obtained as spare parts number 7860505. The Plastigage is available in three thicknesses. Type PG–1 (green) should be used.

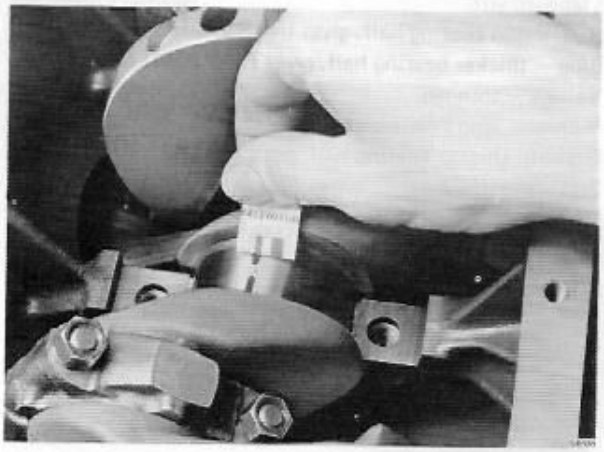
Instructions for use of Plastigage

Main bearings

The Plastigage can be used to measure both out-of-round and clearance.

1. Place the engine with the cylinder head plane downwards to prevent the weight of the crankshaft from affecting the measurement.
2. Ensure that the parts which are to be measured are free from oil and dirt. Put a strip of Plastigage about 0.24" (6 mm) to the side of the centreline.
3. Fit the cap and tighten to a torque of 108 Nm (79 ft.lb., 11 kpm). The crankshaft must not be turned during the measurement.
4. Remove the cap. The strip should by now have been firmly pressed into the bearing cap or onto the big-end bearing journal.
5. Measure the width of the Plastigage strip using the scale printed on the Plastigage package and read off the clearance. One side of the package gives the dimension in mm, the other side in thousandths of inches. Measure the strip at its widest point, but do not touch it with your fingers.



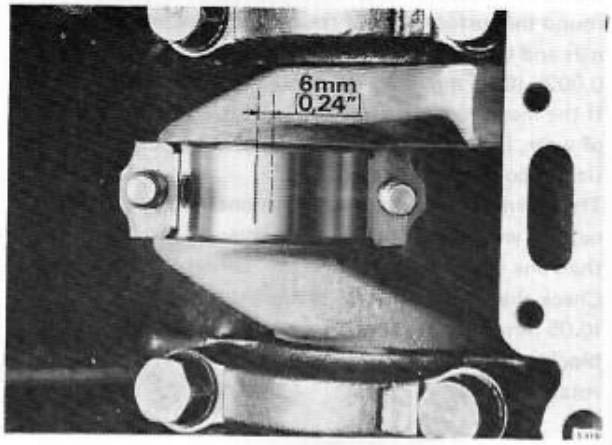


Big-end bearings

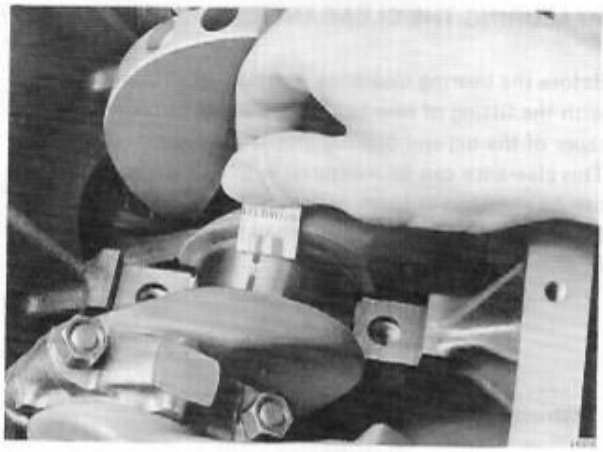
Plastigage strips cannot be used to measure out-of-round with the pistons fitted in the block. A micrometer should be used instead.

Big-end bearing clearance can be measured in connection with the fitting of new bearings as follows.

1. Turn the crank which is to be measured to a position about 60° before the top dead centre.
2. Ensure that those parts which are to be measured are dry and free from oil and dirt. Place a strip of Plastigage 0.24" (6 mm) to the side of the centreline.



3. Fit the cap and tighten to a torque of 54 Nm (39 ft.lb., 5.5 kpm). The crankshaft must not be turned during the measurement.
4. Remove the cap. The strip should by now have been firmly pressed into the bearing cap or onto the big-end bearing journal.
5. Measure the width of the Plastigage strip using the scale printed on the Plastigage package and read off the clearance. One side of the package gives the dimension in mm, the other side in thousandths of inches. Measure the strip at its widest point, but do not touch it with your fingers.



CHOICE OF BEARING HALVES FOR MAIN AND BIG-END BEARINGS

Bearing halves are available in two different classes for standard size, 1st undersize and 2nd undersize. The two classes are of different thickness and can be combined to obtain the proper clearance. For the 3rd and 4th undersizes, bearing halves are only available in one thickness.

The classified bearing halves are colour-coded as follows:

Standard size:
Red – thin bearing half, gives INCREASED clearance
Blue – thicker bearing half, gives REDUCED clearance
Yellow – thin ber
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:
First try to obtain the proper clearance by fitting two thin bearing halves. If the clearance is too large between two thin bearing halves, fit a thin and a thick or two thick halves to reduce the clearance.
If the clearance is too large even after two thick bearing halves have been fitted, the crankshaft must be ground down to the r
of correspor

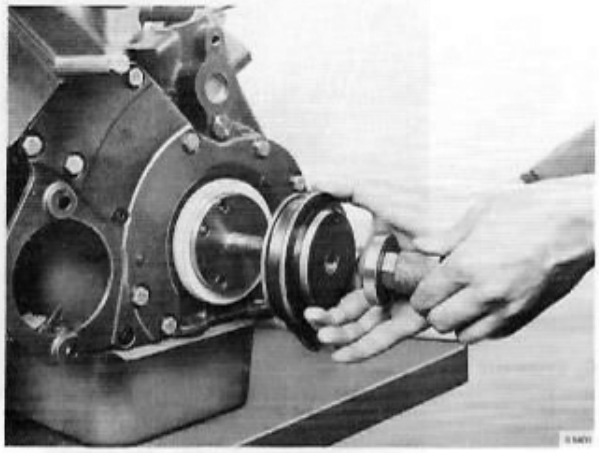
NOTE

The crankshaft journals may be ground down one undersize (0.25 mm) without necessitating hardening of the shaft. If the crankshaft is ground down more than one undersize, the shaft must be tenifer-hardened again.

CHANGING THE CRANKSHAFT SEAL (SEAL RING) AT THE FLYWHEEL END

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

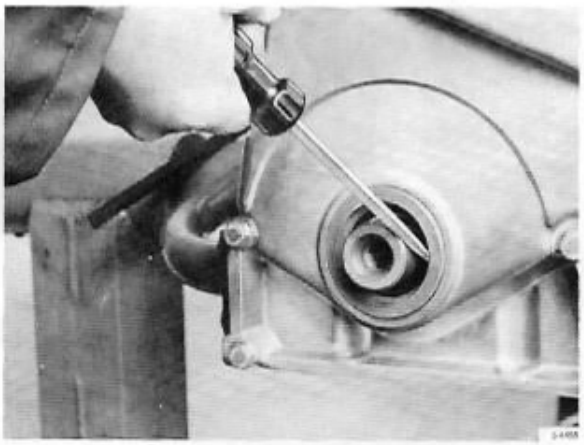
1. Remove the old seal ring, using a screwdriver.
2. Fit a new seal with the spring ring turned inwards towards the crankshaft. Grease the sealing surfaces of the seal prior to fitting. Use installing tool 8392540 or earlier tools 8391971, 8391963 and 8391922.



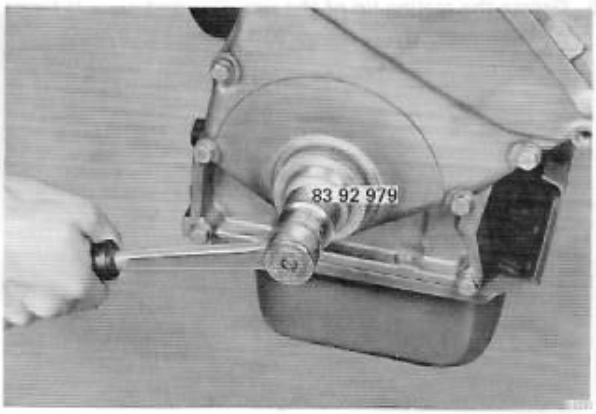
CHANGING THE CRANKSHAFT SEAL (SEAL RING) AT THE TRANSMISSION END

Power unit removed.

1. Remove the sealing ring by means of a screwdriver.
2. Apply a generous coating of grease to the sealing lips of the sealing ring.



3. Press the sealing ring into place using sleeve 8392979, which is drawn in by means of the pulley retaining bolt.

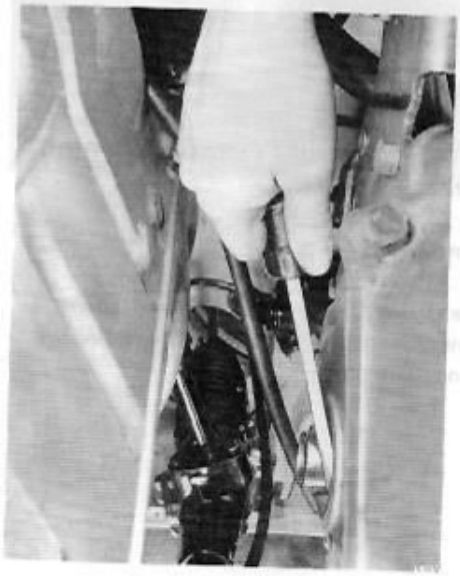


Power unit mounted

1. Remove the fan belt (and the V-belt for the pump in cars with power assisted steering and the V-belt for the compressor in cars with air conditioning).
2. Remove the clutch cover (torque converter cover) and lock the crankshaft by fitting locking segment 83 92 987 to the ring gear.

3. From beneath the car, remove the pulley retaining screw using special wrench 83 92 961 and remove the pulley.

4. Prize off the old seal ring by means of a screwdriver.



5. Grease the sealing lip of the new ring and press it into position using sleeve 83 92 979 and the pulley retaining bolt.

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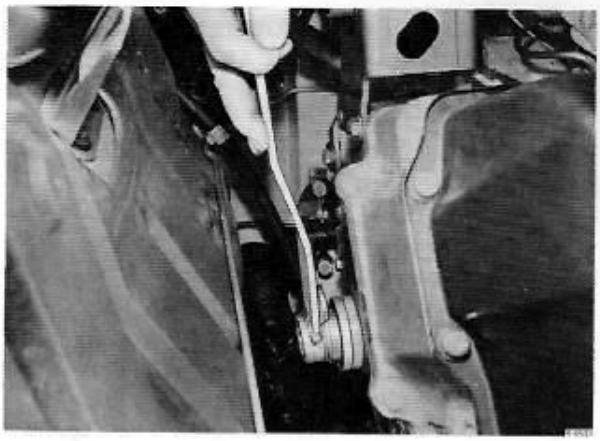
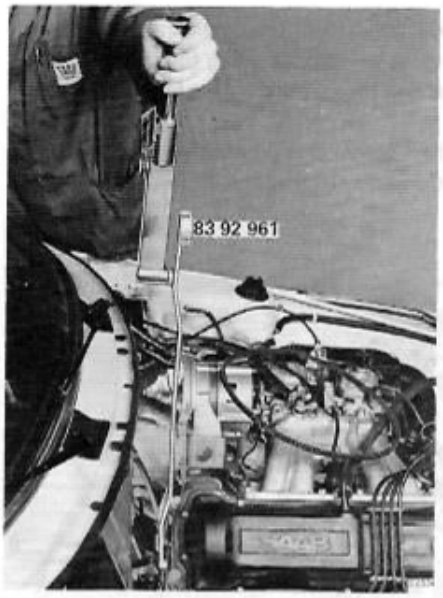


6. Fit the pulley and tighten the retaining bolt to the specified torque using special wrench 83 92 961 and a torque wrench.



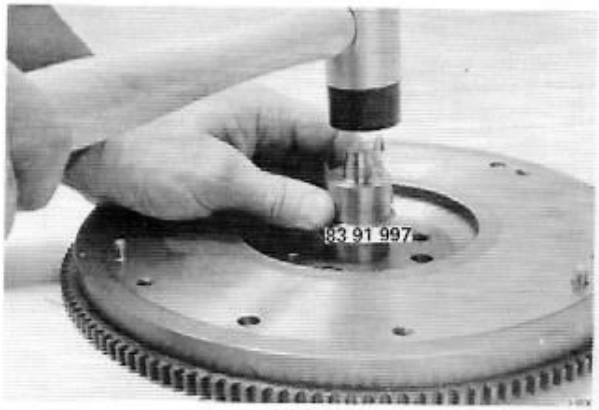
Tightening torque To obtain the correct torque at the bolt, the tightening torque must be adapted to the length of the torque wrench.	
Torque wrench length	Tightening torque
300 mm	55 Nm (41 ft.lb., 5.5 kpm)
400 mm	70 Nm (52 ft.lb., 7.0 kpm)
500 mm	80 Nm (58 ft.lb., 8.0 kpm)
Accordingly, a torque of 190 Nm (137 ft.lb., 19 kpm) will be obtained at the bolt.	

Remove the locking segment and fit the fan belt (and other V belts, where applicable).

CHANGING THE CLUTCH SHAFT BEARING

1. Remove the flywheel.
2. Remove the clutch shaft bearing from the flywheel, using drift 8391997.

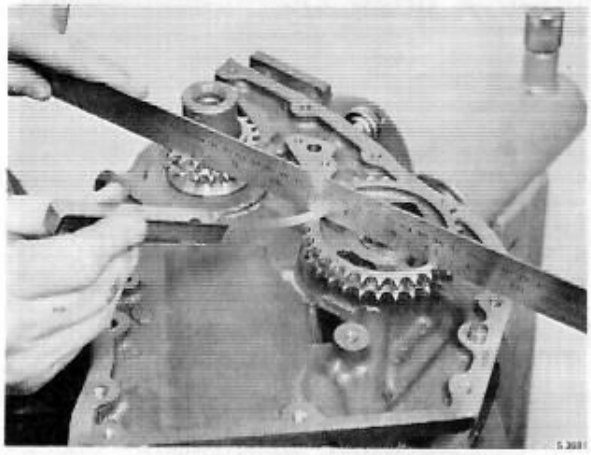
3. Fit a new clutch shaft bearing in the flywheel, using drift 8391997.



MEASURING AND SHIMMING THE CRANKSHAFT SPROCKET ON CRANKSHAFT AFTER INSTALLATION OF NEW PARTS

When a new crankshaft, idler shaft or sprocket has been installed, the crankshaft sprocket must be shimmed to align it with the idler shaft sprocket, as there will otherwise be excessive wear on the chain transmission.
Measure the sprocket alignment as follows:

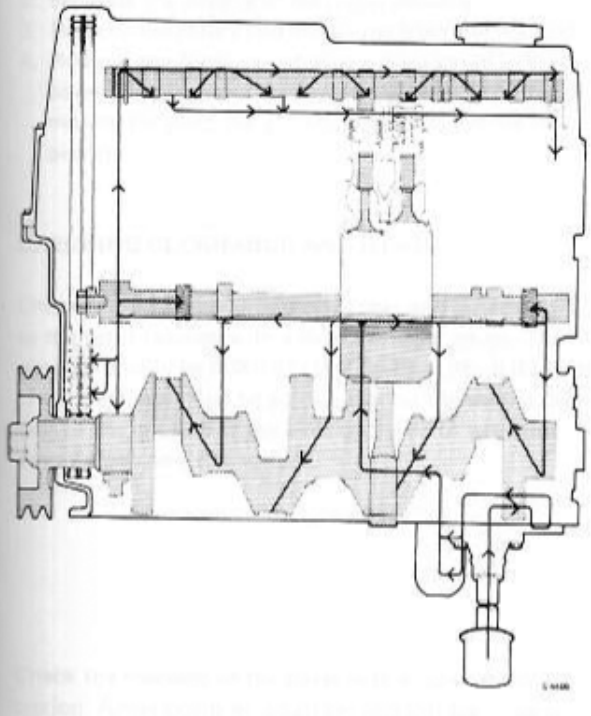
1. Lay the edge of a rule against the idler shaft sprocket as close as possible to the center of the sprocket and lying across the crankshaft sprocket. Make sure that the edge of the rule butts flat against the idler shaft sprocket across its full width and press it hard against the sprocket.
2. Adjust the axial position of the crankshaft sprocket if necessary, using shims or grinding to align the idler shaft sprocket and the camshaft sprocket in the same plane.
   If the crankshaft sprocket is grinded, great care must be taken, so that no axial throw will occur.



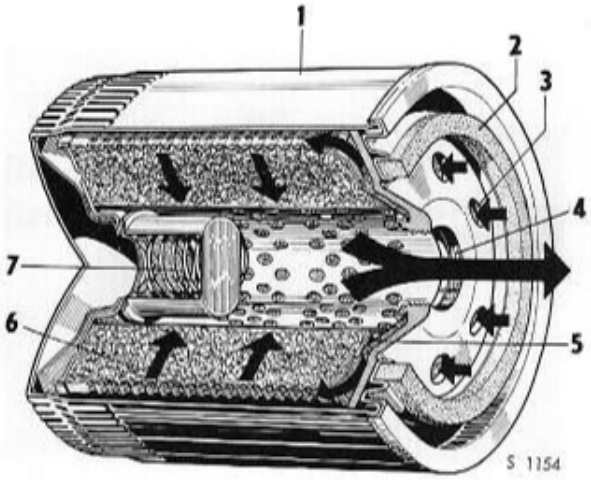
LUBRICATING SYSTEM, OIL FILTER

The engine has a forced lubrication system (see fig. below). Oil pressure is generated by a birotary pump driven from the idler shaft. The pump and oil filter are mounted on a special mounting. Its rotors force the oil through a reducing valve in the pump itself and on through the oil filter and oil channels to the various lubrication points. Each connecting rod bearing has a separate oil channel from the main bearings. The oil filter is of full-flow type, i.e. all oil force-fed to the lubrication points goes through the filter.

OIL PUMP



LUBRICATION SYSTEM



OIL FILTER

1. Filter housing
2. Rubber seal
3. Oil inlet
4. Oil outlet
5. Non return valve
6. Filter part
7. Over flow valve

OIL PUMP

REMOVAL

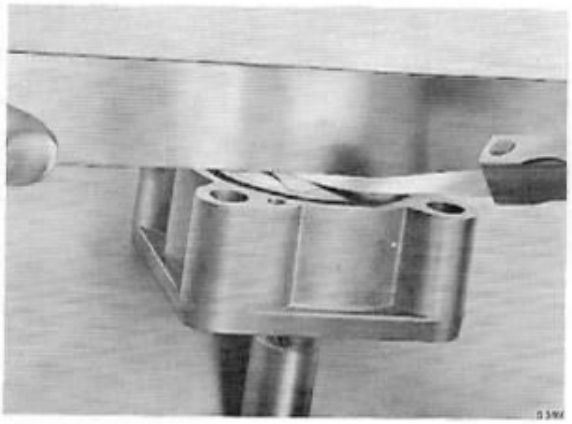
1. Undo the four retaining screws that pass through the corners of the pump.
2. Remove the pump and the sealing ring between the pump and the intermediate plate.

DISMANTLING

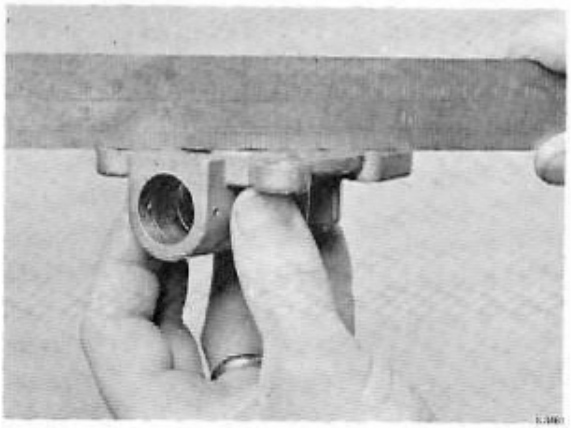
1. Remove the two screws holding the cover and the pump housing together.
2. Separate the cover and the pump housing.
3. Remove the rotors and the O-ring from the housing.
4. Remove the pressure reducing valve located in the cover by pulling out the locking pin first and then removing the plug, the O-ring, the spring and the valve piston.

CHECKING CLEARANCE AND WEAR

Check the axial clearance of the inner and outer rotors to the rotor housing with a rule and feeler gauge. The clarance should be 0.00197–0.00354" (0.05–0.09 mm). If the clearance must be adjusted, grind the sealing surface of the housing or the sides of the rotor with fine emery cloth on a flat surface.



Check the evenness of the cover with a rule, see illustration. All deformities, scratches and pits are to be removed by grinding.

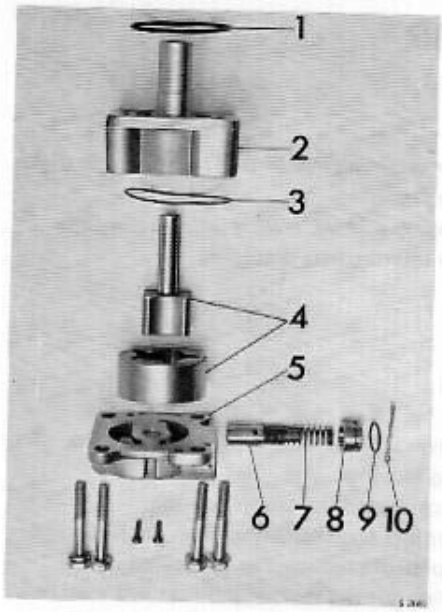


REASSEMBLY

1. Lubricate the rotors with engine oil and refit. NOTE! The camfered edge of the outer rotor faces inwards in the pump housing (towards the drive shaft).
2. Fit the pressure reducing valve in the pump cover:
   a. Fit the valve piston, the spring and the plug with the O-ring.
   b. Fit the locking pin.
3. Fit the pump housing O-ring and the cover.

INSTALLATION

1. Fit the O-ring between the pump and the intermediate plate, push in the pump and turn it so that the pump drive engages in the rotor.
2. Fit and tighten the four retaining screws.



OIL PUMP

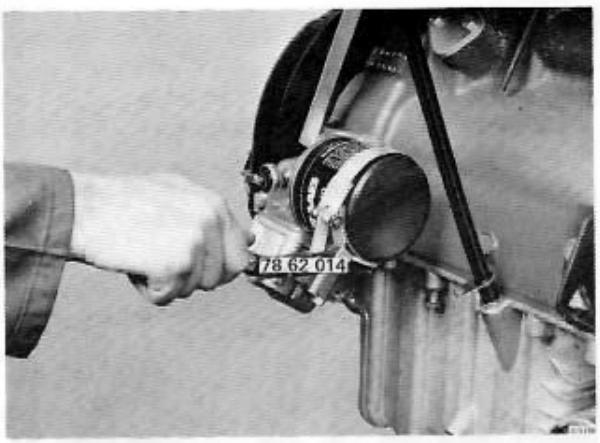
1. O-ring
2. Pump housing
3. O-ring
4. Rotors
5. Cover
6. Valve piston
7. Spring
8. Plug
9. O-ring
10. Locking pin

OIL FILTER

REPLACEMENT OF FILTER CARTRIDGE

1. Free the oil filter cartridge with a special wrench (tool 7862014).
2. Lubricate the rubber seal of the new cartridge and screw in the cartridge until the seal is in place up against the intermediate piece. Then tighten an additional half turn.

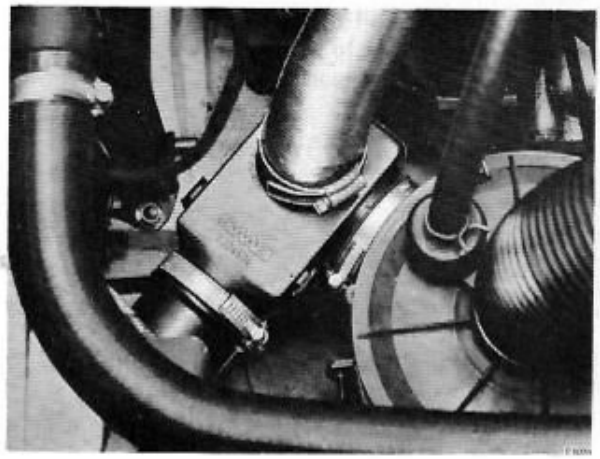
NOTE
If the filter cartridge is tightened too hard there is a risk that oil will leak out, as the rubber seal may be twisted in its rack.



INLET SYSTEM

THERMOSTATICALLY CONTROLLED AIR PRE-HEATING

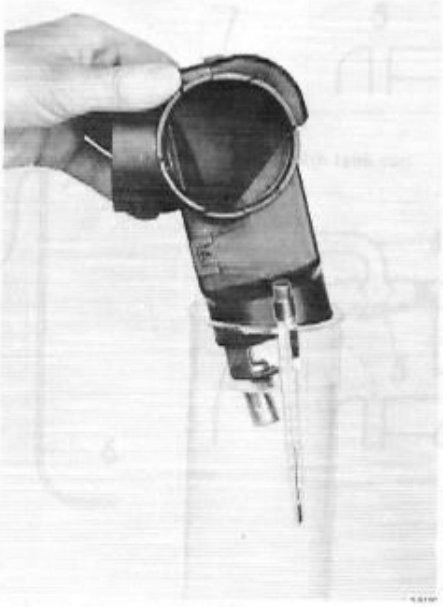
A thermostatically controlled valve which governs the air preheating according to the ambient air temperature is located in the air cleaner intake.
The valve housing has two air intakes, one for cold air and one for heated air which is drawn in through a hose running from a cover on the exhaust manifold.
The valve is actuated by a thermostat in the cold-air intake which senses the temperature of the ambient air.



Checking

A rough check of the operation of the valve is possible by comparison with the ambient air temperature:
- at temperatures below +43°F (8°C) (Turbo 23°F (−5°C), heated air only is inducted into the engine.
- at temperatures between 43°F (+8°C) and 64°F (+18°C) (Turbo 23°F (−5°C) and 40°F (+5°C), the valve admits varying proportions of heated air and cold air.
- at temperatures above 64°F (+18°C) (Turbo 40°F, +5°C), cold air only is indicted.

A more accurate check involves submerging the thermostat body in warm water (+43°F/+8°C and +64°F/18°C, respectively), and checking the position of the valve.



FUEL TANK AND FUEL LINES

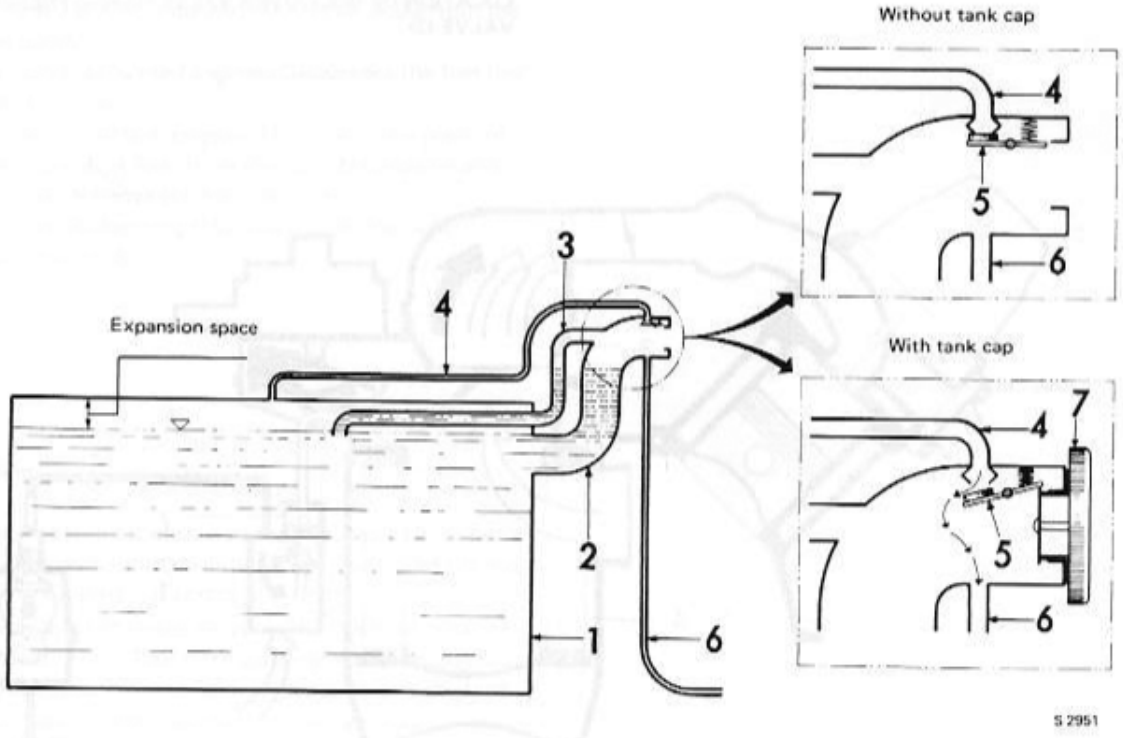
Fuel tank

The fuel tank is designed so as to allow internal expansion of the fuel. The expansion space is opened by a valve which is actuated by the filler cap.

Fuel tank ventilation

When fuel is poured in, the tank (1) will not be completely filled, and instead the level rises only slightly above the lower opening on the venting tube (3). The reason for this is that an air cushion is formed above this level and prevents further filling of the tank.
The formation of this air cushion is due in its turn to the fact that a spring-loaded valve (5) located in the filler pipe (2) blocks the upper opening on the venting tube (4) from the upper side of the tank.

When the tank cap (7) is screwed on, a lever is actuated which opens the valve, thus providing a communication from the upper part of the tank to the surrounding air via the ventilation hose (6). The hose runs inside the roof channel, through the left windshield pillar and out into the engine compartment behind the left wheel housing. The fuel, which increases in volume when the temperature rises, is now able to expand inside the tank instead of being pressed up through the filler pipe (2). As the fuel level becomes lower in course of driving, air is drawn into the tank via the ventilation hose (6).



FUEL TANK VENTILATION, ARRANGEMENT DIAGRAM

1. Fuel tank
2. Filter pipe
3. Venting tube
4. Venting tube
5. Spring-loaded valve
6. Ventilation hose
7. Tank cap

Evaporative loss control device (ELCD)

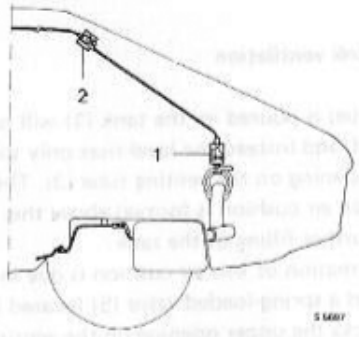
Cars for the USA-market are fitted with a charcoal filter, which absorbs the vapor from the fuel tank. The charcoal canister is placed in the engine compartment. It is connected to the vent hose of the fuel tank and with a hose to the air cleaner. When the engine is running, fresh air is sucked through the charcoal filter and further to the engine inlet system. The filter will then be cleaned from petrol.

The cars are equipped with a so called roll-over valve. The valve is connected to the ventilation hose between the filler tube and the charcoal canister. In the event of the car rolling over or ending up on its side, a pendulum will,actuate the valve, which will shut off the ventilation hose thereby preventing the escape of fuel.

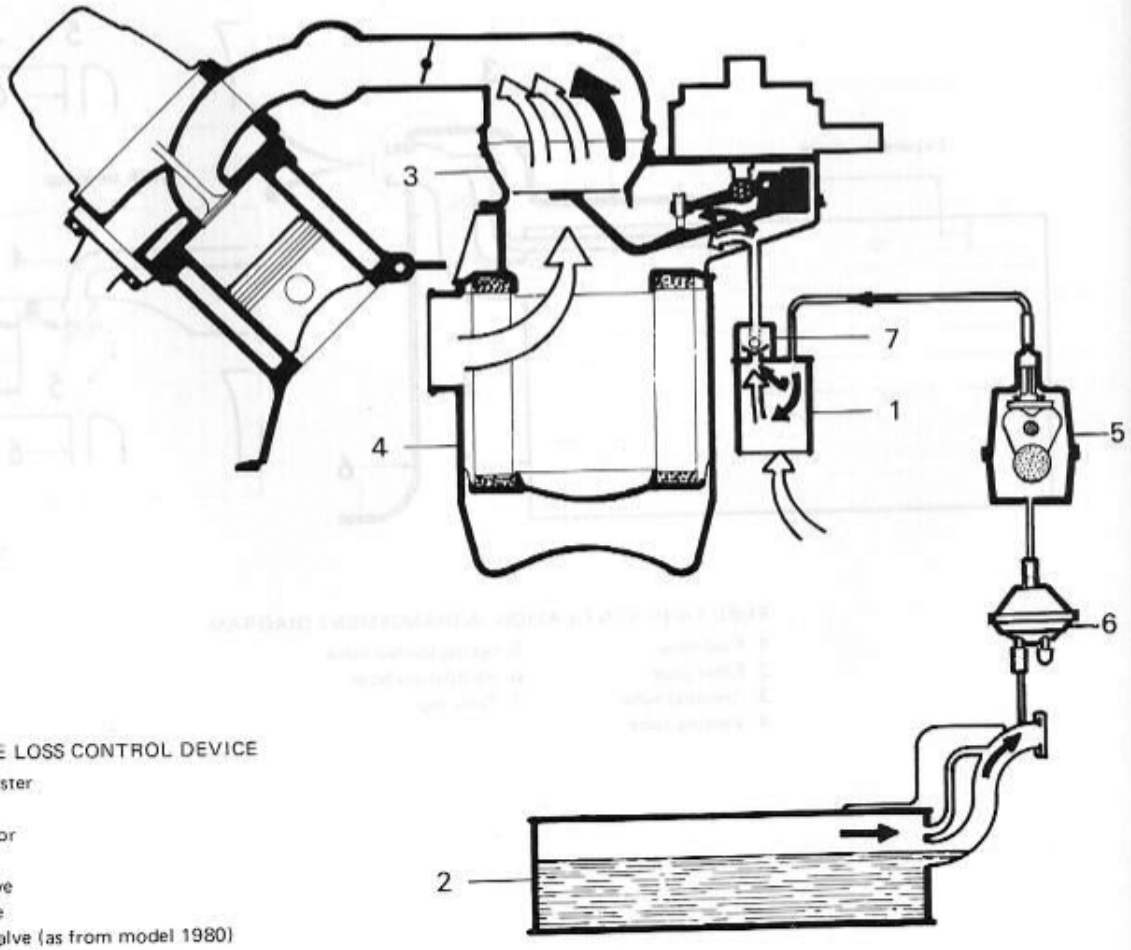
A valve (6) is located in the ventilation hose.

As the fuel in the tank expands, the valve causes an increase in pressure which reduces tne amount of vapour (hydrocarbons) evacuated from the tank.

The valve can be located in the pictures.



LOCATION OF ROLL-OVER VALVE (1) AND PRESSURE VALVE (2)



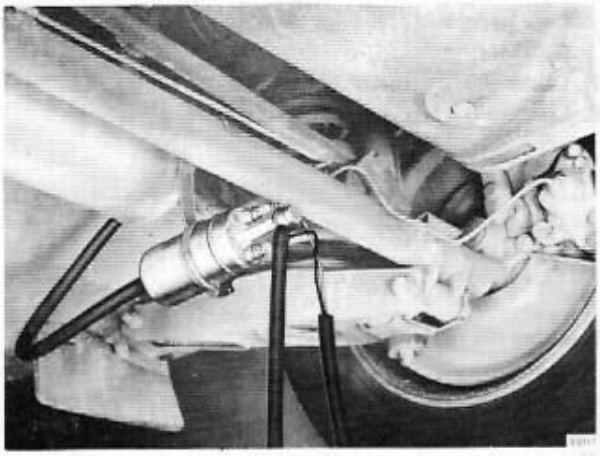
EVAPORATIVE LOSS CONTROL DEVICE

1. Charcoal canister
2. Fuel tank
3. Air flow sensor
4. Air cleaner
5. Roll over valve
6. Pressure valve
7. Non-return valve (as from model 1980)

SAAB

FUEL TANK

Removing



1. Disconnect the earth cable from the battery.
2. Jack up the rear end 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.
   Cars with carburetor engines: Connect an electric fuel pump (designed for injection engines) to the inlet line of the fuel tank and pump the fuel through a hose into a container. The work should be done with the car jacked up.
   Cars with injection engines: Disconnect the fuel line from the fuel pump and connect a special line with a banjo connection, with the other end connected to a container.
   The container should be enclosed and equipped with a vent hose which should be run back into the fuel filler pipe.
4. Remove the rear floor panel in the luggage compartment.
5. Remove the fuel level transmitter cover plate.
6. Remove all electrical connections from the tank.
7. Remove the filler pipe and ventilation hoses from the fuel pump.
   Cars with carbureted engines: Disconnect the fuel line from the tank.
   Cars with injection engines: Disconnect the pressure and return fuel lines from the fuel accumulator and the tank. Remove the fuel line clips.
8. Remove the securing strap nuts under the tank.
9. Lower the tank.

Installing

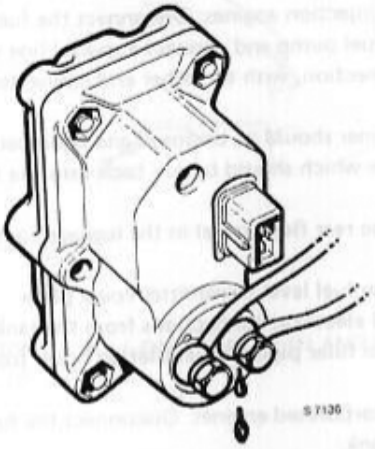
1. Check that the rubber seals are undamaged and that they are correctly fitted round the opening of the fuel level transmitter (fuel pump).
2. Check that the straps are properly mounted, and cover the filler and vent hose openings with masking tape.
3. Clamp the wires to the top of the tank. Lift the tank into position and suspend it in the two straps.
4. Center the tank and tighten the nuts. Remove the masking tape from the filler pipe and vent hose.
5. Connect the fuel line(s) 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 to the top of the tank. Connect the wires to the fuel level transmitter (fuel pump) and replace the access panel. Relay the floor covering in the trunk. Replace the floor panel and rear floor cover in the luggage compartment.
7. Lower the rear end of the car.
8. Connect the battery earth cable.

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 dip stick sleeve, throttle cable, the lower section of the mixture control unit, 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.

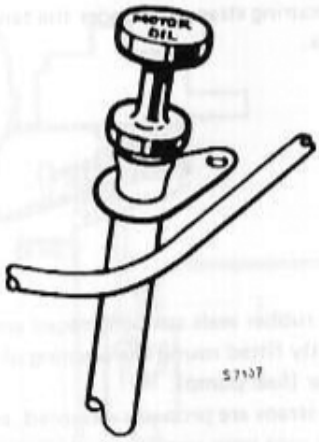


Check fuel pipes (every 15 000 miles (24.000 km))

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:	
Pipes to injection valves	– 2 mm
Other 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.



Checking pipe connections (every 15 000 miles (24 000 km))

Check if banjo connections are leaking.
The seals should be replaced every time the connections are loosened.

REPLACING FUEL LINES IN THE PASSENGER COMPARTMENT

The fuel line (fuel lines in cars with injection engines) 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 dash panel.
4. Disconnect the fuel line in the engine compartment, remove the rubber grommet and pull the line into the passenger compartment.
   Cars with carbureted engines: Disconnect the connection at the fuel pump.
   Cars with injection engines:
   Remove the return fuel line from the fuel distributor. Remove the pressure line from the fuel filter.
5. Undo the clip and disconnect the fuel line from the fuel tank. In cars with injection engines, disconnect the fuel line from the fuel accumulator and from the fuel tank.

Installation

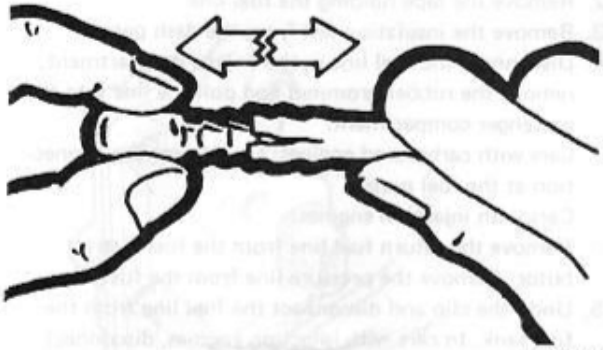
1. Clean the fuel line by blowing through with compressed air. Close the ends with masking tape.
2. Push the fuel line through the hole in the dash panel and the spring link bracket and connect the line in the engine compartment.
3. Insert the rubber grommets in the hole in the dash panel and in the 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 theline 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 dash panel. Replace the carpet and kick plate.

REMOVAL AND INSTALLATION OF NIPPLE ON FUEL LINE

1. Remove the old nipple as follows:
   a. Burn a notch in the fuel line by means of a soldering iron.

S 5192

b. Withdraw the fuel line from the banjo coupling. (Do not cut the fuel line by means of a nkife as this may damage the banjo coupling and cause leakage.)



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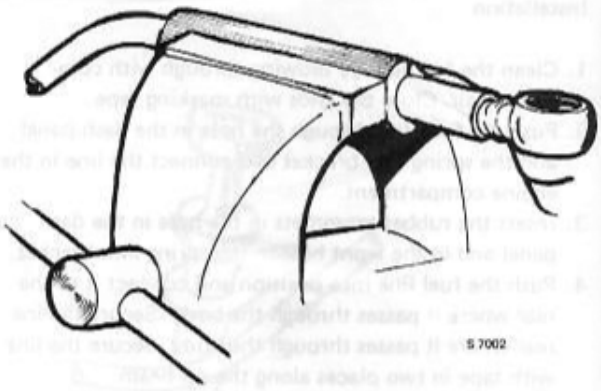
2. Mount the nipple to the fuel line as follows:
   a. Slide a thick slitted rubber hose on the fuel line and brace it in a vise so that the free end protrudes approx. 0.08 in. (2 mm) longer than the nipple length.
   b. Knock down the nipple with the aid of a hammer. Guide the nipple all the time preventing it from upsetting.

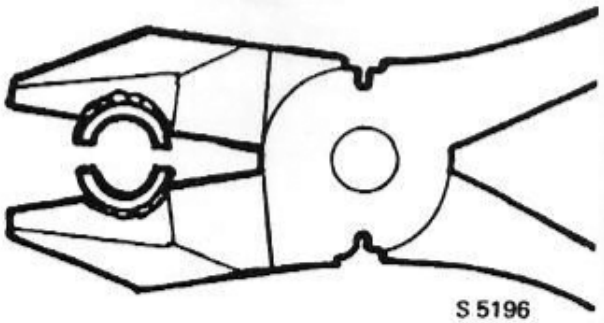


S 7002

MAKING A FUEL LINE FITTING TOOL

Material: One pair of pliers
One valve guide (2.0 l engines)

1. Using a hacksaw, saw off the guide to a length of 1.0 in (25 mm).
2. Split the valve guide by means of a hacksaw so that two cup-shaped halves are obtained.
3. Carefully deburr all edges.
4. Solder the two halves to the pliers with the parting line running along the centre line of the pliers. Guide the halves during soldering by inserting an old valve between them.



S 5196

FUEL INJECTION – THE CI SYSTEM

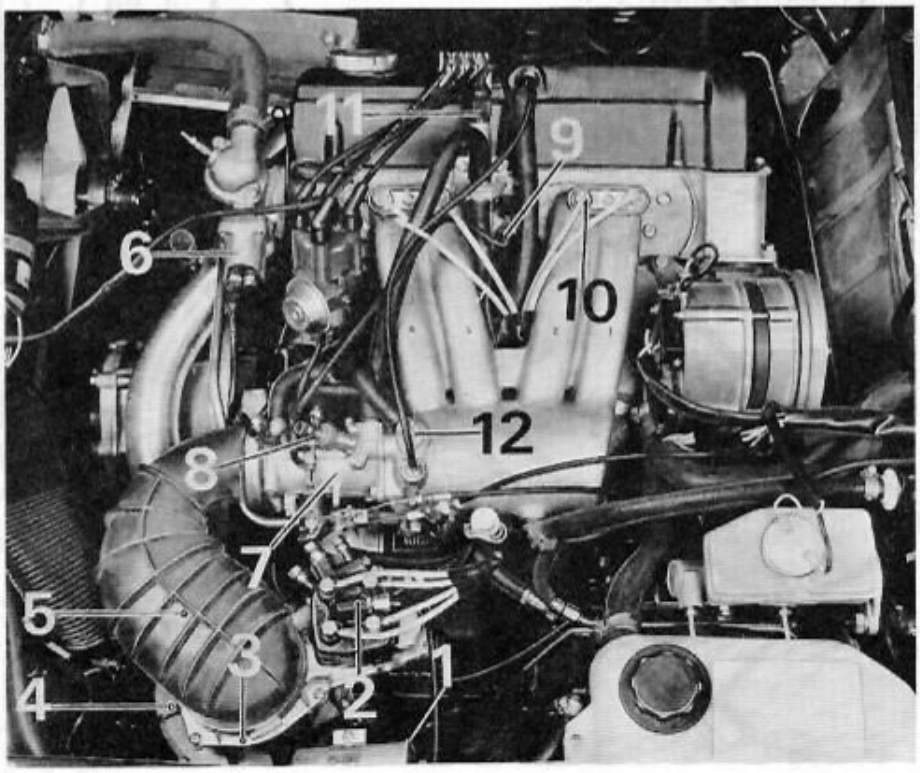
GENERAL

INJECTION SYSTEM

The engine is fitted with a Bosch, CI (continuous injection) injection system.
An electric fuel pump mounted inside the tank provides fuel at a constant pressure to the mixture control unit. The latter consists of an air flow sensor which measures the flow of air to the engine and which acts mechanically on the fuel distributor. The fuel distributor provides the injection valves with the correct amount of fuel. The fuel is injected continuously into the inlet manifold immediately upstream of the inlet valve.

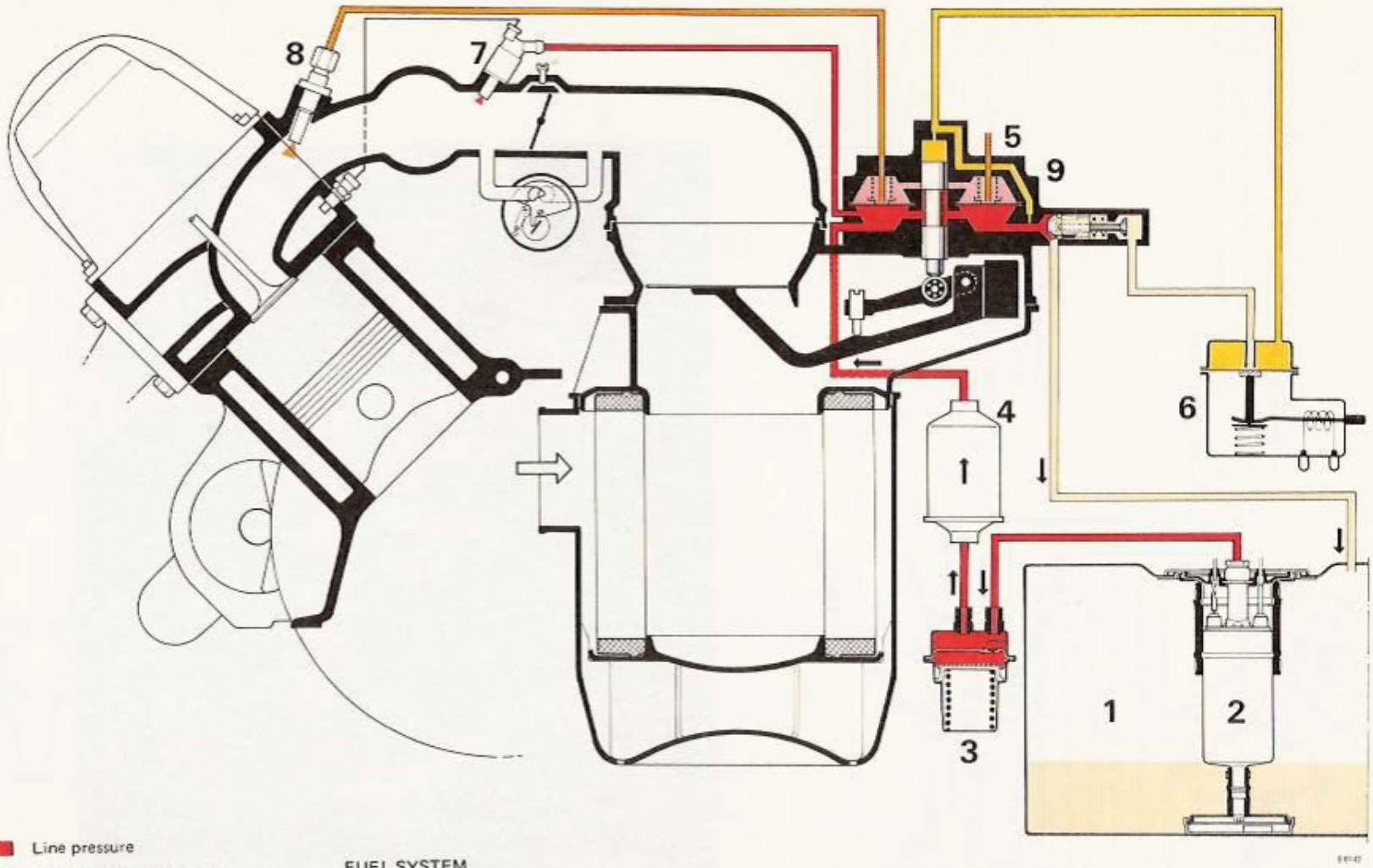
Cars for the Californian market and other U.S. cars for marketing in districts at high altitudes are equipped with a special CI-system comprising en electronic control unit which is regulated by an oxygen sensor in the exhaust manifold.

Description



FUEL INJECTION ENGINE

1. Fuel filter
2. Fuel distributor
3. Air flow sensor
4. Air cleaner
5. Rubber bellows
6. Warm-up regulator
7. Throttle valve housing
8. Cold start valve
9. Thermo-time switch
10. Injection valve
11. Auxiliary air valve
12. Deceleration valve



Line pressure
Line pressure –0.1 bar (1
Injection pressure
Control pressure
Return, no pressure

FUEL SYSTEM

1. Fuel tank
2. Fuel pump
3. Fuel accumulator
4. Fuel filter
5. Fuel distributor
6. Warm-up regulator
7. Cold start valve
8. Injection valves
9. Line pressure regulator

FUEL TANK, FUEL PUMP

The fuel pump is an electric rotary pump and is mounted inside the tank. The pump and motor are totally enclosed and cannot be dismantled for repair. A relief valve is fitted to the fuel pump and is actuated when the pressure is too high. A check valve in the fuel pump outlet ensures that the supply pressure in the fuel circuit will not fall to zero immediately after the pump has stopped.

FUEL ACCUMULATOR

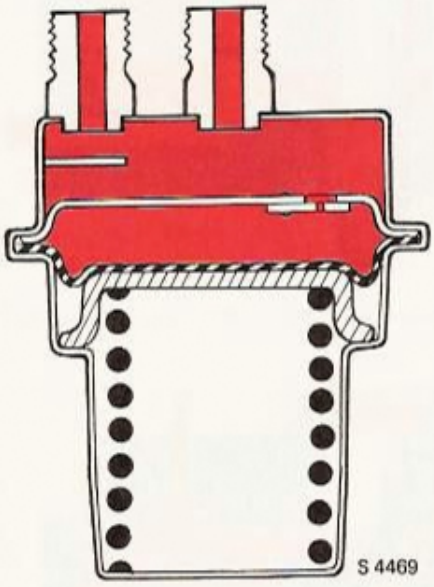
The fuel accumulator is connected to the pressure pipe from the fuel pump.

Position: 1979 model – on the left-hand end of the tank

1980– model – under the floor in front of the tank

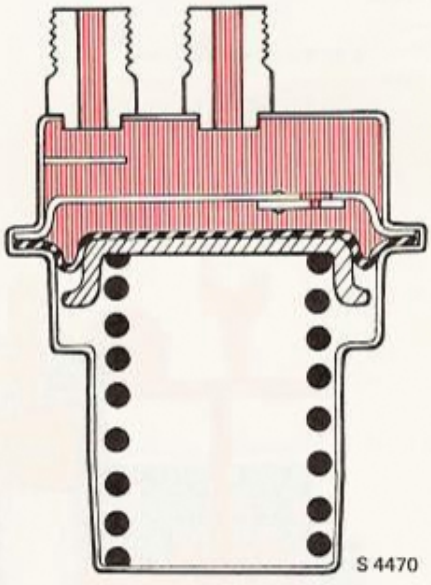
The fuel accumulator has three functions:

1. When the engine stops, the fuel pressure in the system will drop to approximately 2 bar (kp/cm^2, 28 psi). This pressure will be maintained as a result of the fuel accumulated in the fuel accumulator. This means that the system will remain prssurized at the "rest pressure" while the engine is cooling, and this prevents the fuel from vaporizing, thus facilitating starting when the engine is warm.
2. The accumulator absorbs pressure fluctuations or surges occurring in the system.
3. When the engine is being started, the fuel accumulator delays the pressure rise in the fuel system so that the control plunger in the fuel distributor will have time to reach its lower position before the injection valve opens. This prevents too much fuel being injected into the cylinders.



THE FUEL ACCUMULATOR WHEN THE FUEL PUMP IS WORKING

Line pressure

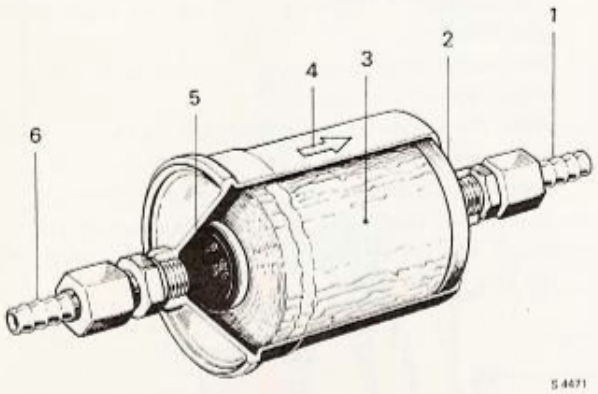


THE FUEL ACCUMULATOR WHEN THE ENGINE HAS BEEN STOPPED

Rest pressure

FUEL FILTER

The fuel filter is fitted to the circuit between the fuel accumulator and the fuel distributor. The filter has a paper element and a nylon strainer.

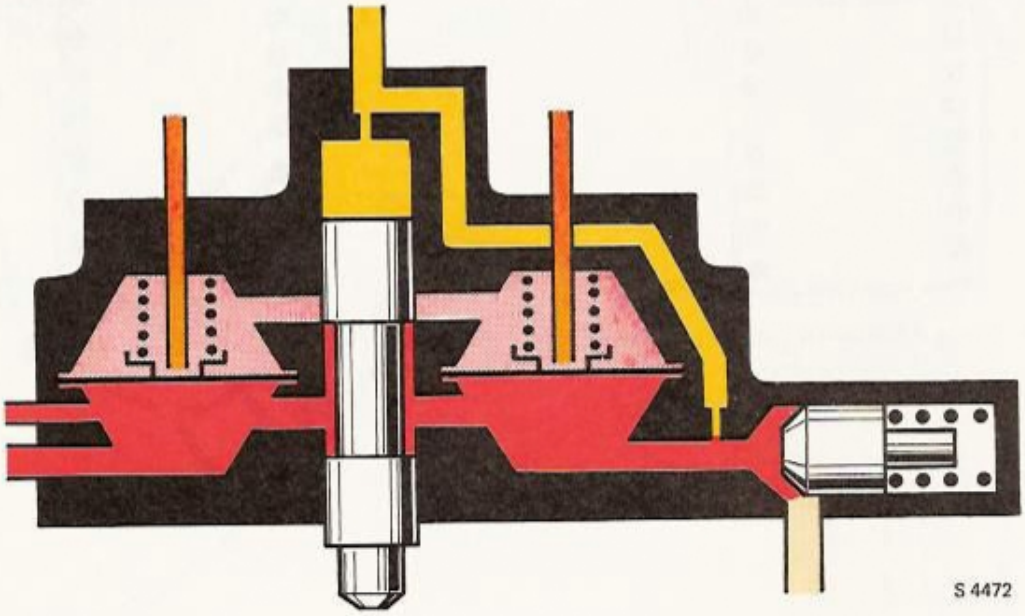


FUEL FILTER

1. Outlet
2. Nylon strainer
3. Paper element
4. Arrow, marking the cross flow direction
5. Rubber cone
6. Inlet

FUEL DISTRIBUTOR

The fuel distributor distributes the fuel to the injection valves. The fuel distributor consists of a fuel control unit and four pressure regulating valves, one for each cylinder.

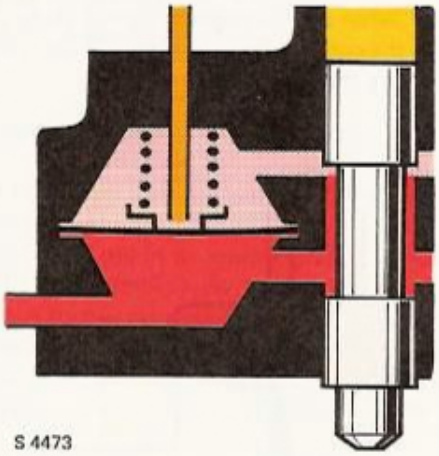


FUEL DISTRIBUTOR

- Line pressure
- Line pressure —0.1 bar (1.4 psi)
- Injection pressure
- Control pressure
- Return, no pressure

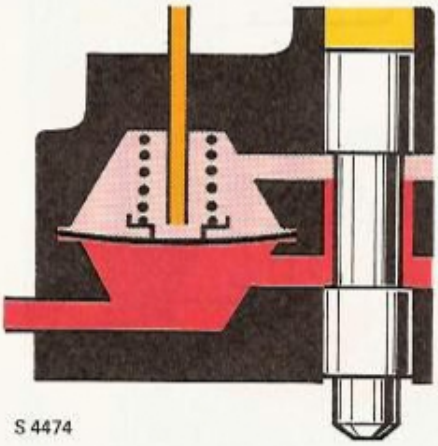
SAAB

The skirt of the control plunger is in continuous contact with the line pressure which also acts on the bottom of the pressure regulating valve. When the control plunger is raised by the lever from the air flow sensor plate, four metering slots (one for each cylinder), which feed the fuel to the top of the pressure regulating valve, will be opened. The pressure above the spring-loaded diaphragm acts on the latter, deflecting it downwards and opening the outlet to the injection valve. A pressure differential of 0.1 bar (kp/cm^2, 1.4 psi) is maintained between the line pressure and the pressure above the diaphragm. This constant pressure differential is required to ensure that the injected quantity of fuel always remains proportional to the open area of the metering slots and that this is the same for all four cylinders.



S 4473

PRESSURE REGULATING VALVE, PARTIAL LOAD



S 4474

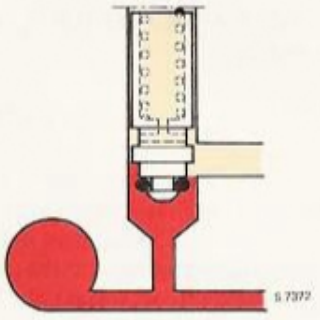
PRESSURE REGULATING VALVE, FULL LOAD

- Line pressure
- Line pressure –0.1 bar (1.4 psi)
- Injection pressure
- Control pressure

The fuel distributor also contains a line pressure regulator, passages for the control pressure, and fuel inlets and outlets.

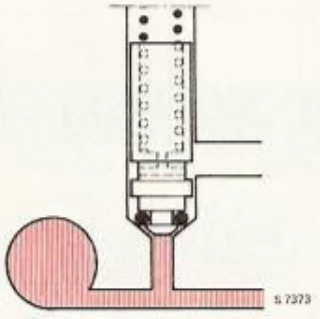
LINE PRESSURE REGULATOR

The line pressure regulator ensures that the pressure in the circuit remains constant when the fuel pump is in operation and also controls the recirculation of fuel to the tank. When the fuel pump is switched off, the regulator will cause a rapid pressure drop to approximately 2.5 bar (kp/cm^2, 35 psi), i.e. the rest pressure, which is maintained by means of the O-ring seal and the quantity of fuel contained in the fuel accumulator. The purpose of the rest pressure is to prevent the fuel from vaporizing in the circuit when the engine is warm, which would otherwise make restarting difficult.



S 7372

LINE PRESSURE REGULATOR WHEN THE FUEL PUMP IS WORKING,

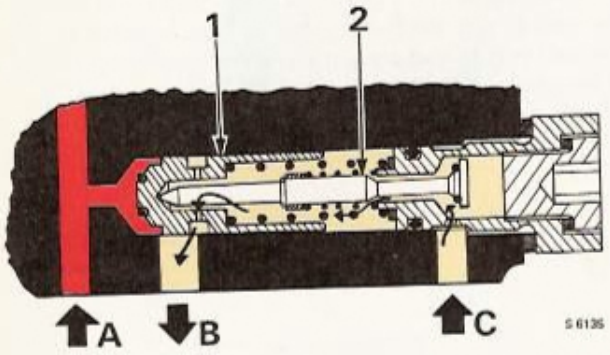


S 7373

LINE PRESSURE REGULATOR WHEN THE ENGINE IS SWITCHED OFF

- Line pressure
- Return, no pressure
- Rest pressure

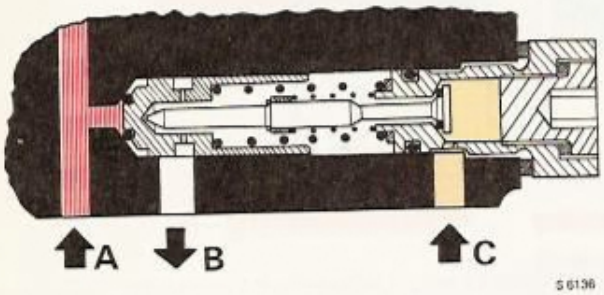
The line pressure regulator forms an integral unit with a shut-off valve to which the return fuel line from the control pressure regulator is connected. When the fuel pump is operating, the shut-off valve is actuated mechanically by the control pressure regulator, whereupon the return fuel from the control pressure regulator by-passes the shut-off valve to the return line.



LINE PRESSURE REGULATOR, FUEL PUMP OPERATING

1. Line pressure regulator
2. Shut-off valve
A. Line pressure
B. Return line
C. Control pressure return

When the fuel pump stops running and the line pressure regulator valve is pressed into its seating, the shut-off valve is also pressed into its seating, preventing the fuel system from emptying through the control pressure return.

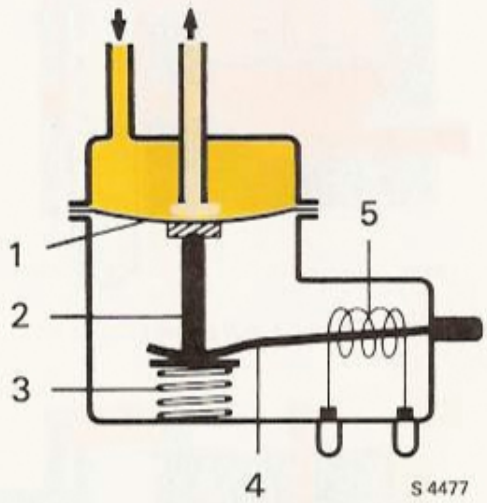


LINE PRESSURE REGULATOR, FUEL PUMP IDLE

A. Line pressure
B. Return line
C. Control pressure return

WARM-UP REGULATOR

When the engine is warm, the warm-up regulator maintains a constant control pressure above the control plunger. When the engine is cold and requires a richer fuel/air mixture, the control pressure is decreased, allowing the control plunger in the fuel distributor to rise, and more fuel to flow to the injection valve.
The warm-up regulator consists of a spring-loaded diaphragm valve.
When the engine is cold, a bi-metal strip reduces the spring load of the diaphragm. This causes the diaphragm to open and more fuel to flow through the recirculation line to the fuel tank, thus lowering the control pressure.
When the engine is running, current flows through the coil which surrounds the bi-metal strip. As the bi-metal strip heats up, it will bend away from the spring, and the pressure on the diaphragm, and thus the control pressure, will increase. When a warm engine is started, there is no reduction in the control pressure, as the bi-metal strip is then affected by the engine temperature.

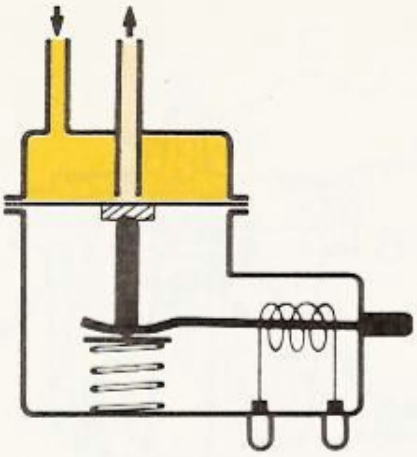


WARM-UP REGULATOR, COLD ENGINE

Control pressure

Return, no pressure

1. Diaphragm
2. Push rod
3. Pressure spring
4. Bi-metal strip
5. Heating coil



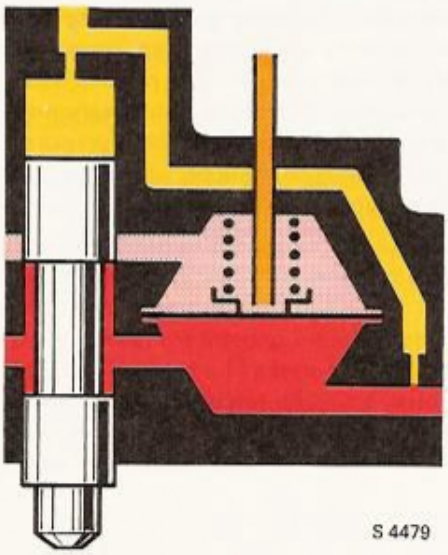
S 4478

WARM-UP REGULATOR, WARM ENGINE

- Control pressure
- Return, no pressure

CONTROL PRESSURE REGULATION

Some of the fuel from the fuel distributor is diverted via a restriction. The control pressure is reduced to 3.7 bar (kp/cm^2, 52.5 psi) in the control pressure regulator or to 0.5–3.7 bar (kp/cm^2, 7–52.5 psi) during the warm-up period. A further restriction is located between the control pressure passage and the top of the control plunger, and this is designed to eliminate any fluctuations which may occur in the air flow sensor lever.



S 4479

CONTROL PRESSURE REGULATION

- Line pressure
- Line pressure –0.1 bar (1.4 psi)
- Injection pressure
- Control pressure

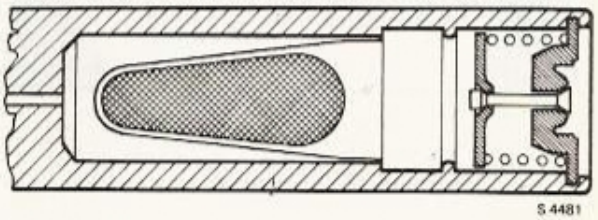
COLD START VALVE

The cold start valve is mounted in the throttle valve housing and is connected to the line pressure. The valve, which is operated by a solenoid coil, is actuated by a thermo-time switch which is controlled by the engine temperature.
The cold start valve can only cut in when the starter motor is running. At temperatures lower than –2°F (–20°C) the valve inject fuel for a maximum of about 9.5 seconds. At temperatures above –2°F (–20°F), the injection time gradually decreases, and ceases entirely at around 122°F (45°C).

COLD START VALVE

INJECTION VALVES

The injection valves are mounted in the inlet manifold at the cylinder head, and continuously inject atomised fuel upstream of the inlet valves.
A spring-loaded valve is contained in each injector and these open at a fuel pressure of 3.3 bar (kp/cm^2, 47 psi). The valves also contain a small fuel filter.

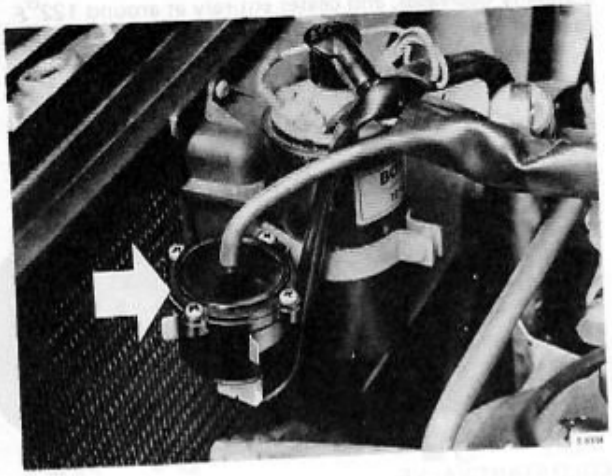


S 4481

INJECTION VALVE

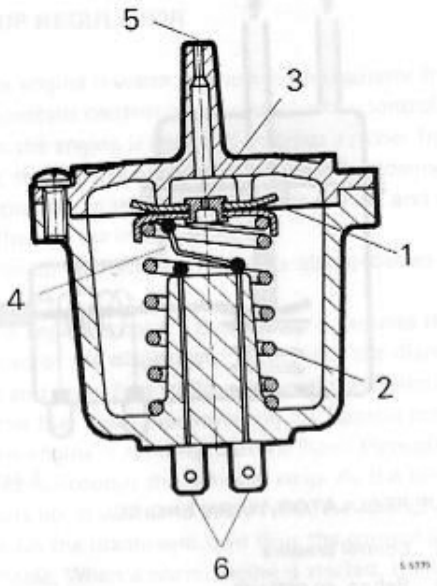
PRESSURE IMPULSE CONTACT

The pressure impulse contact gives acceleration fuel enrichment when the engine is cold. The contact is mounted beside the ignition coil and is connected to the inlet system via a vacuum hose and is electrically connected to the ignition coil and the cold start valve.



PRESSURE IMPULSE CONTACT

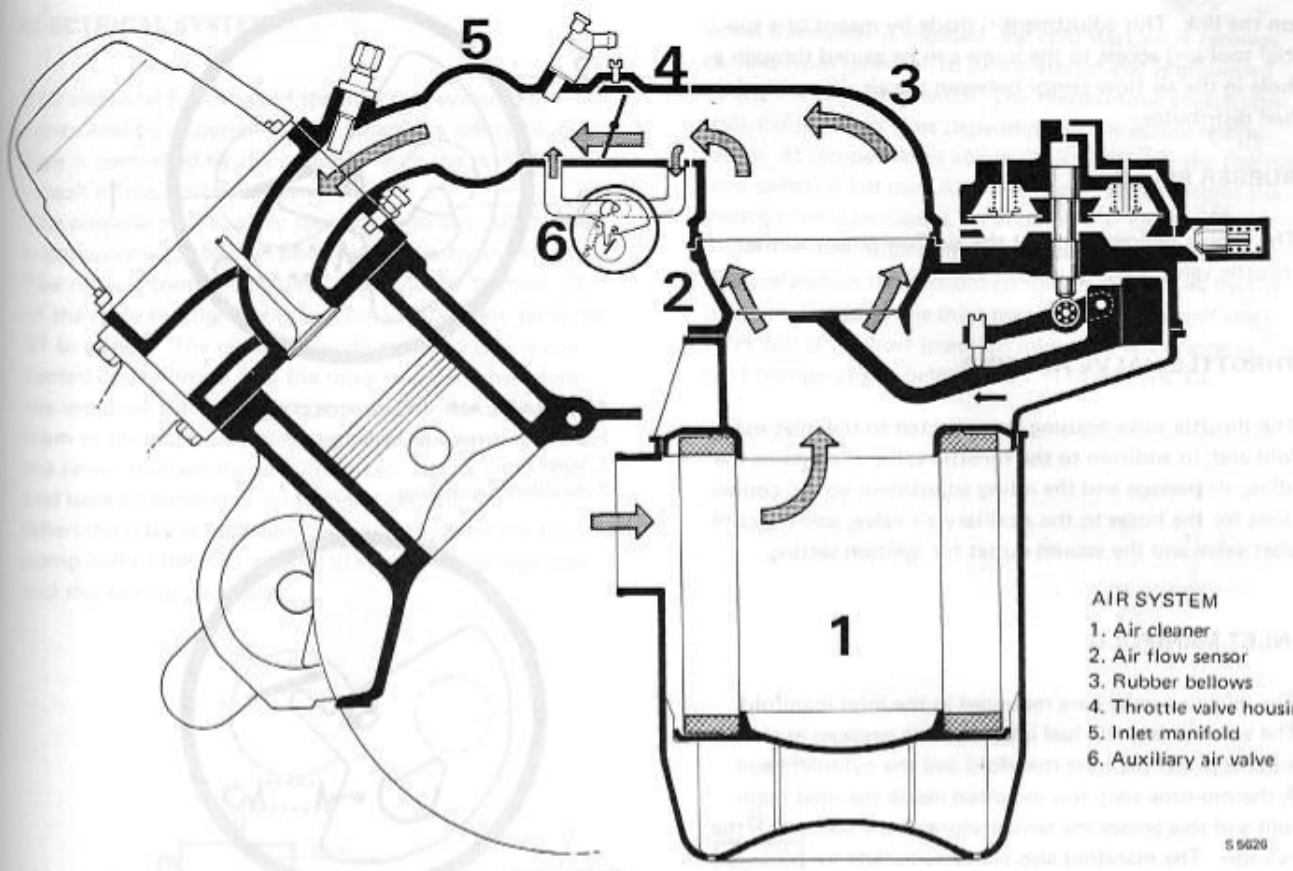
The contact is actuated by the change of pressure in the inlet pipe at accelerations when the cold start valve has current for a short moment. Provided that the thermotime switch at this point is closed (cold engine) is the engine momentarily supplied with an additional amount of fuel via the cold start valve.



PRESSURE IMPULSE CONTACT

1. Diaphragm
2. Spring
3. Restriction
4. Spring contact arm
5. Vacuum connection
6. Electrical connections

Valve function: At constant vacuum the pressure is equal on both sides of the diaphragm depending on the restriction in the center of the diaphragm. When the vacuum is quickly decreased, the change in pressure is delayed on the underside of the diaphragm due to the restriction. This gives the result that the absolute pressure for a moment is increasing on the upper side of the diaphragm, causing the diaphragm going down, actuating the contact.



AIR SYSTEM
1. Air cleaner
2. Air flow sensor
3. Rubber bellows
4. Throttle valve housing
5. Inlet manifold
6. Auxiliary air valve

S 5026

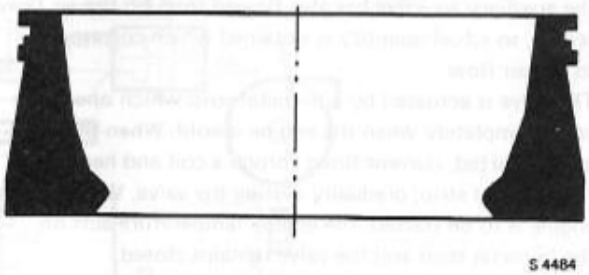
AIR CLEANER

The air cleaner is fitted to a bracket mounted on the front part of the left-hand wheel housing. The air cleaner contains a paper cartridge. The air flows through the inlet pipe into the air cleaner, through the air filter and upwards to the air flow sensor which is bolted to the top of the air cleaner.

AIR FLOW SENSOR

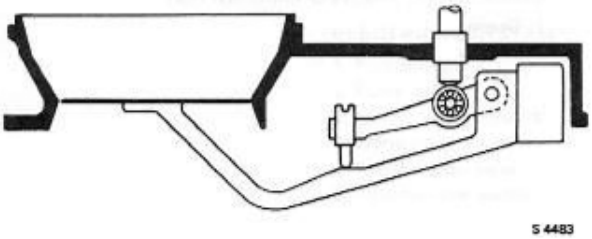
The air flow sensor consists of an air venturi tube in which an air flow sensor plate moves. The air flowing into the venturi from the air cleaner lifts the air flow sensor plate, allowing the air to flow through. The greater the amount of air, the higher the sensor plate will be raised.
The air flow sensor plate is fitted to a lever which is compensated by a counterweight. The lever acts on the control plunger in the fuel distributor which is pressed down by the control pressure, thus counteracting the lifting force of the air flow sensor plate.

The height to which the air flow sensor plate is raised is governed by the magnitude of the air flow.
The air/fuel mixture varies with the load. The inclination of the venturi walls therefore varies in stages in order to provide a correct fuel/air mixture at all loads. Thus, the mixture is enriched at full load.



S 4484

THE AIR VENTURI OF THE AIR FLOW SENSOR



S 4483

AIR FLOW SENSOR

The lever acts on the control plunger in the fuel distributor by means of an adjustable link with a needle bearing at the contact point. The basic fuel setting, and thus the CO setting, is adjusted by means of the adjustment screw

on the link. This adjustment is made by means of a special tool and access to the screw can be gained through a hole in the air flow sensor between the air venturi and the fuel distributor.

RUBBER BELLOWS

The rubber bellows connect the air flow sensor to the throttle valve housing.

THROTTLE VALVE HOUSING

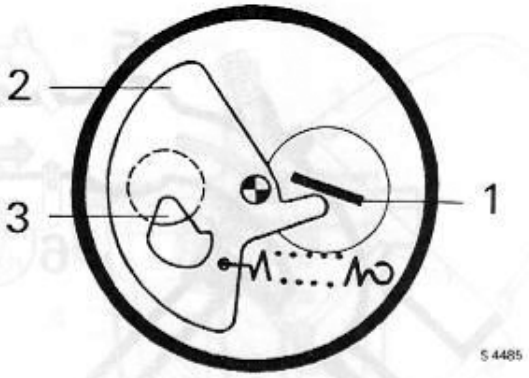
The throttle valve housing is connected to the inlet manifold and, in addition to the throttle valve, it contains the idling air passage and the idling adjustment screw, connections for the hoses to the auxiliary air valve, and the cold start valve and the vauum outlet for ignition setting.

INLET MANIFOLD

The injection valves are mounted in the inlet manifold. The valves inject the fuel into the inlet passages at the joint between the inlet manifold and the cylinder head. A thermo-time switch is mounted inside the inlet manifold and this senses the temperature of the coolant in the cylinder. The manifold also contains outlets for pipes to the brake servo unit and outlets for crankcase ventilation.

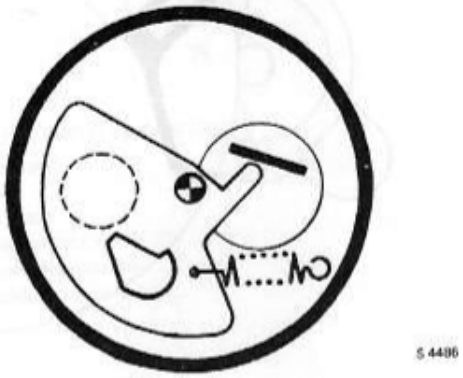
AUXILIARY AIR VALVE

The function of the auxiliary air valve, together with the warm-up regulator, is to compensate for losses due to friction and condensation in the inlet manifold and combustion chamber on cold starting, so that the required idling speed will be obtained. The valve is located in a passage which by-passes the throttle valve. The air flowing through the auxiliary air valve has also flowed through the air flow sensor, so a fuel quantity is obtained which corresponds to the air flow.
The valve is actuated by a bi-metal strip which opens the valve completely when the engine is cold. When the engine is started, current flows throgh a coil and heats up the bi-metal strip, gradually closing the valve. When a hot engine is to be started, the engine temperature acts on the bi-metal strip and the valve remains closed.

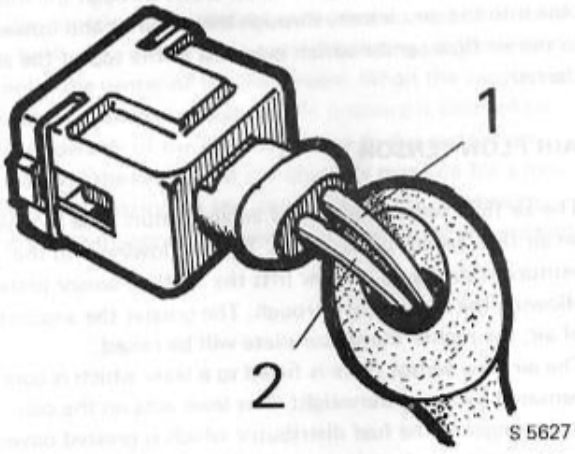


AUXILIARY AIR VALVE, COLD ENGINE

1. Bi-metal strip with heating coil
2. Valve
3. Auxiliary air opening



AUXILIARY AIR VALVE, WARM ENGINE



CONNECTOR, THERMO-TIME SWITCH

1. Green
2. Yellow

ELECTRICAL SYSTEM

The electrical functions of the injection system are controlled by a special relay in which the safety function is controlled by the impulses from the primary circuit of the ignition system.

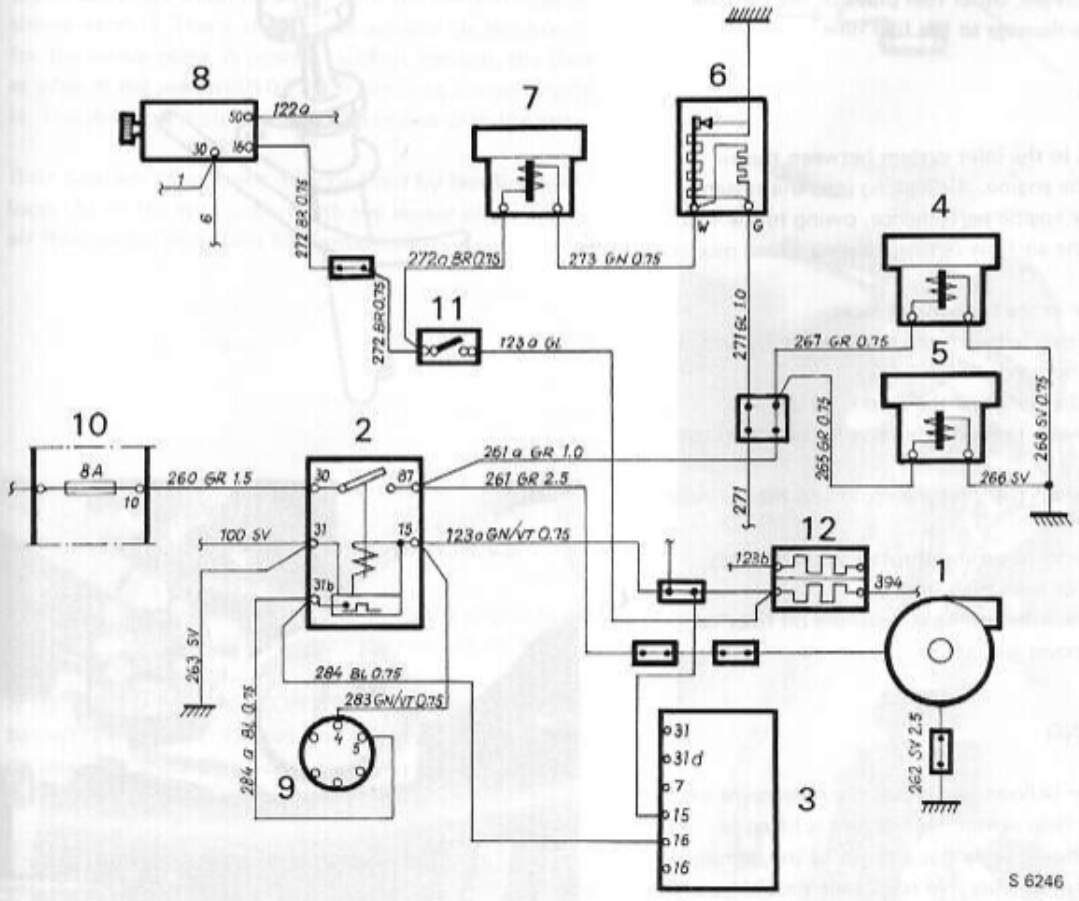
The purpose of the safety function is to cut out the electrical current to the fuel pump when the engine stops.

The relay is controlled from "+15", via the terminal 15 of the relay through the relay coil, via the relay terminal 31 to ground. The circuit through the relay coil is connected on condition that the relay impulse sensor fells the impulses from the ignition coil. The impulses are led from terminal 15 on the ignition coil, via terminal 15 on the relay, through the impulse sensor, via terminal 31b and back to terminal 1 on the ignition coil.

When the relay is actuated, there is current to the fuel pump and to the heat wirings of the warm-up regulator and the auxiliary air valve.

When the starter is engaged, the cold start valve receives current from terminal 16 of the starter and is grounded by the thermo-time switch. The thermo-time switch controls the injection time depending on the actual temperature. At temperatures above +113°F (45°C) the thermo-time switch is cut out. At lower engine temperatures the closing time is increased. At about −4°F (20°C) and colder the max. injection time (about 8 sec.) is achieved.

At acceleration the vacuum contact is influenced by the pressure change in the inlet manifold and the cold start valve will get a short injection impulse if the engine is cold (temperatures below about +113°F (+45°C).



ELECTRICAL SYSTEM

1. Fuel pump
2. Pump relay
3. Ignition control unit
4. Warm-up regulator
5. Auxiliary air valve
6. Thermo-time switch
7. Cold start valve
8. Starter
9. Ignition service outlet
10. Fuse
11. Pressure impulse contact (acceleration enrichment, cold)
12. Compensating resistor

Checking

GENERAL

Before testing and fault tracing of the CI system is started, it must first be established that there are no mechanical faults in the engine and that the ignition system is functioning properly.
Scrupulous cleanliness must be observed during work on the fuel system. The surrounding area should be thoroughly cleaned before any lines are disconnected.

FUEL LEAKAGES

Check that there are not leakages at the connections and in the fuel lines. Check around the fuel tank, in the passenger compartment and in the engine compartment. New seals should be fitted to any leaking connections. Damaged fuel lines should be replaced.

Check that fuel pipes do not chafe against other objects (particularly of plastic). CONTINUOUS CHAFING against e.g. the dip stick sleeve, other fuel pipes or the throttle cable can result in damage to the fuel pipe

AIR LEAKAGES

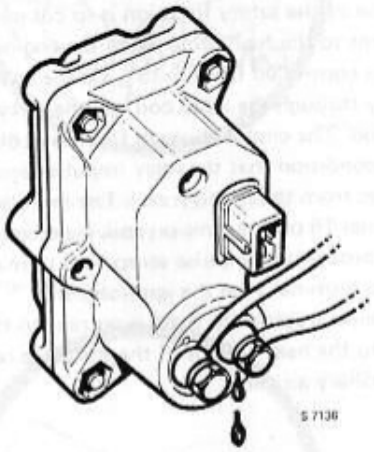
Check for leakage in the inlet system between the air flow sensor and the engine. Air leaking into the system may result in poor engine perfomance, owing to the fact that it by-passes the air flow sensor, causing a lean mixture.
Leakage can occur in the following places:
At the rubber bellows between the air flow sensor and the throttle valve housing.
At the gasket on the flange of the cold start valve.
At the gasket between the throttle valve housing and the inlet manifold.
At the gasket between the inlet manifold and the cylinder head.
At the hose connections on the throttle valve housing, auxiliary air valve or inlet manifold.
Via the crankcase ventilation hose from the oil filler cap, dip stick or valve cover gasket.

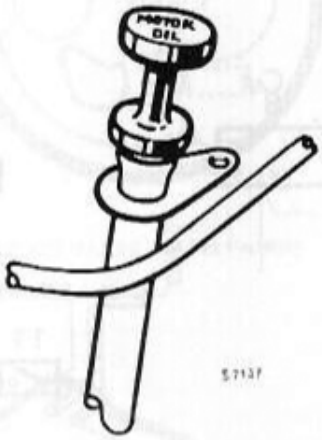
LEVER MOUNTING

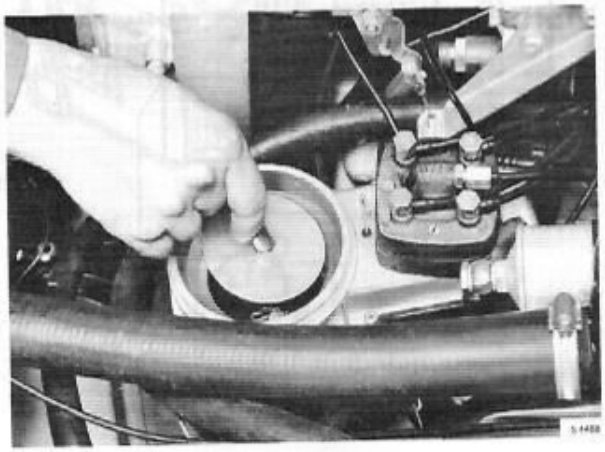
Remove the rubber bellows and check the movement of the lever in the air flow sensor. As the arm is lifted, a steady resistance should be felt as a result of the damping action of the control plunger. No resistance should be felt when the arm is suddenly pushed down and is not acting on the plunger. If the air flow sensor has not been dismantled, a pair of pliers or a magnet should be used to lift the lever. If any binding is felt, the air flow sensor must be repaired.

CAUTION

Due to the atomization of the fuel, there is a serious fire risk when the injection valves and cold start valve are being tested.

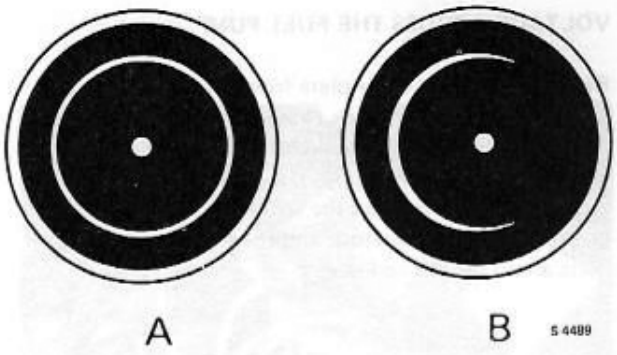






AIR FLOW SENSOR PLATE CLEARANCE

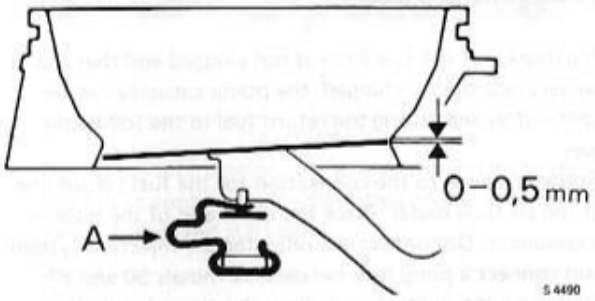
Check that there is uniform clearance between the edge of the air flow sensor plate and the air venturi. The correct clearance will be obtained automatically when tool 8392474 is used to mount the plate on the lever.



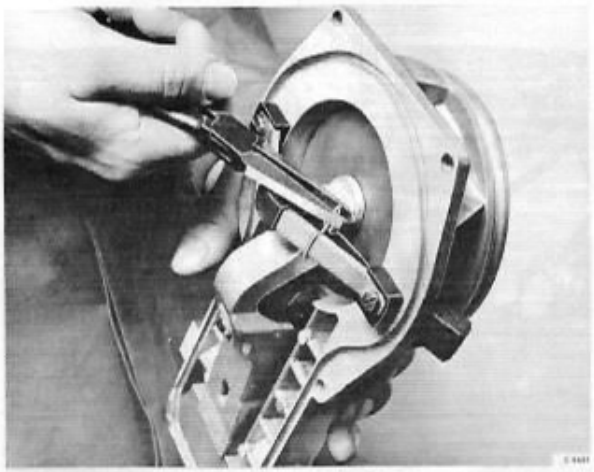
SENSOR PLATE CLEARANCE
A. Correct
B. Faulty

REST POSITION OF AIR FLOW SENSOR PLATE

To check the rest position of the air flow sensor plate, switch off the ignition (to switch off the fuel pump). This prevents fuel being injected into the cylinders if the sensor plate is lifted from its rests position. The top of the sensor plate should be level with the bottom edge of the air venturi. This is the highest permissible position for the sensor plate. A position slightly beneath the lower edge of the venturi (0.02"/0.5 mm max.) is permissible. The position should be checked in line with the lever.



Rest position adjustment is carried out by bending the loop (A) on the wire underneath the sensor plate. The air flow sensor must first be dismantled.

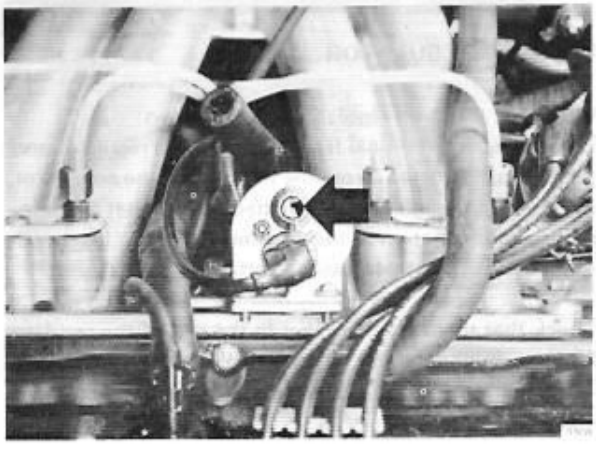


PERFORMANCE OF AUXILIARY AIR VALVE

(Checking can only be carried out when the engine is cold.) Isolate the safety circuit by disconnecting the terminal on the air flow sensor.
If the "COLD ENGINE CONTROL PRESSURE" (see below) is also to be checked, the terminals on the warm-up regulator should be disconnected to prevent the bi-metal strip from warming up.

Check by means of a torch and a mirror that there is a elliptical opening in the auxiliary air valve.

Switch on the ignition. The opening should close completely after about 5 minutes.
If the auxiliary air valve does not close, check the power supply. If no fault is found, the auxiliary air valve should be replaced.

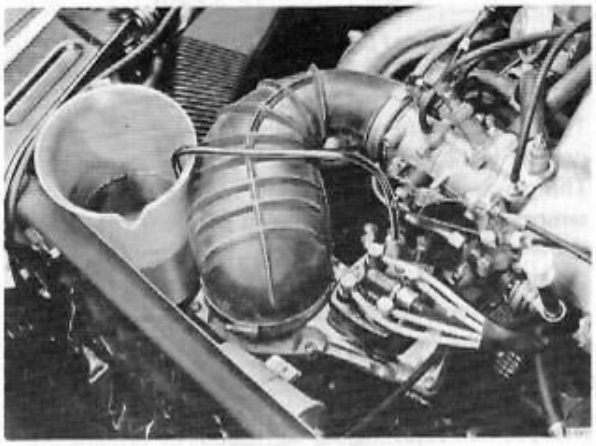


VOLTAGE ACROSS THE FUEL PUMP

Remove the round cover plate from the top of the fuel pump (located in the trunk compartment) and measure the voltage between the positive and negative terminals when the pump is operating. The lowest permissible voltage is 11.5 V. Disconnect the terminals connecting the pump to the air flow sensor and the warm-up regulator if these are to be checked later.

FUEL PUMP CAPACITY

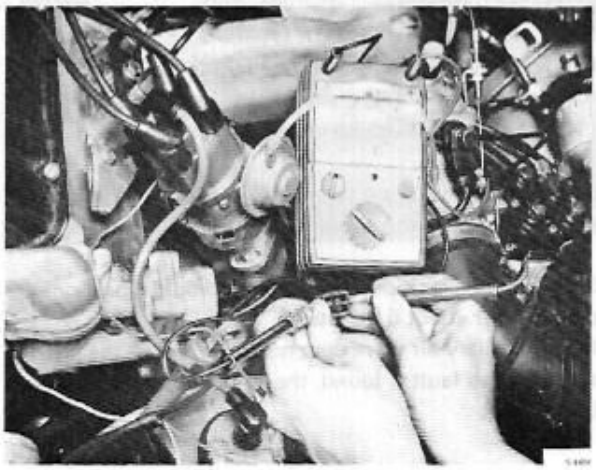
Provided that the fuel filter is not clogged and that the battery is properly charged, the pump capacity can be checked by measuring the return fuel in the following way.
Connect a hose to the connection for the fuel return line at the air flow meter. Place the other end of the hose in a container. Disconnect the relay for the injection system and connect a jump lead between terminals 30 and 87, Switch on the ignition and allow the pump to run for about 30 seconds. Measure the quantity of fuel (refer to the specifications in Group section 022).



WARM-UP REGULATOR

Check the warm-up regulator line as follows:
Disconnect the terminal from the warm-up regulator and connect a voltmeter across the contacts in the connector. Ensure that the ignition is switched on and that the safety circuit connection at the air flow sensor has been withdrawn. The lowest permissible voltage is 11.5 V.

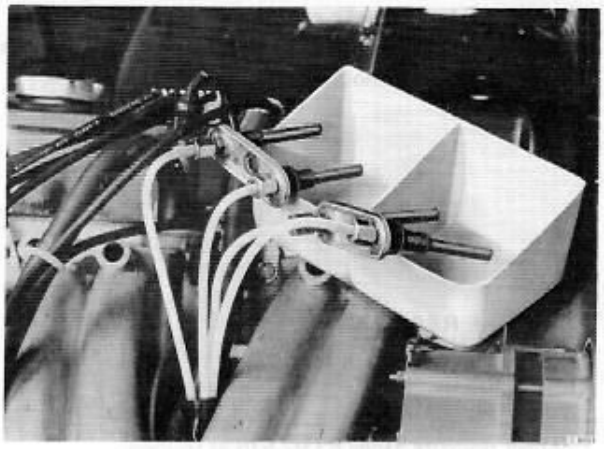
Check that there are no brakes in the coil of the regulator by connecting a buzzer or test lamp in series with the coil. If the coil is found to be damaged, the warm-up regulator should be replaced.



PERFORMANCE AND TIGHTNESS OF INJECTION VALVES

The injection valves can be checked as follows:

1. Remove the rubber bellows from the air flow sensor.
2. Unscrew the injection valves from the inlet manifold and place them in a suitable container. The fuel lines should be left connected.
3. Switch on the ignition and withdraw the safety circuit plug from the air flow sensor. This enables the fuel pump to operate.
4. Fuel atomization: Lift the lever in the air flow sensor and check the spray form emitted at the injection valves. If the atomization is poor, see under "Cleaning of injection valves" for further details.
5. Valve tightness: Switch off the ignition to obtain the rest pressure. Wipe dry the area around the injection valve nozzles. Lift the lever and check for leakage. It should not take less than 15 seconds for a drop to form. In the case of excessive leakage, see under "Cleaning of injection valves".



CAUTION

Due to the atomization of the fuel, there is an acute fire risk in conjunction with testing of the injection valves or the cold start valve.

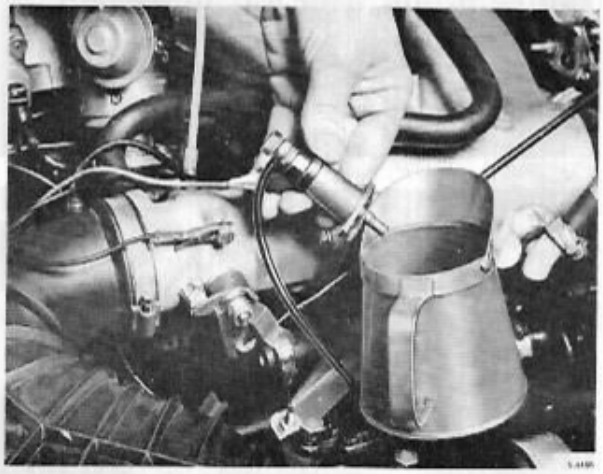
PERFORMANCE AND TIGHTNESS OF COLD START VALVE

Withdraw the plug of the cold start valve and unscrew the latter from the throttle valve housing, allowing the fuel line to remain connected.

Connect a wired plug to the cold start valve and connect the wires to the main beam terminal and body of one of the headlights.

Switch on the ignition and disconnect the electrical connection to the air flow sensor. The fuel pump is now running. Place the cold start valve in a container and have an assistant switch the headlights to main beam for a short period (30 seconds max.). Fuel should spray out of the valve during this period.

Dry the valve nozzle and let the fuel pump run for a further minute. No fuel should pass through the valve during this time.



THERMO-TIME SWITCH

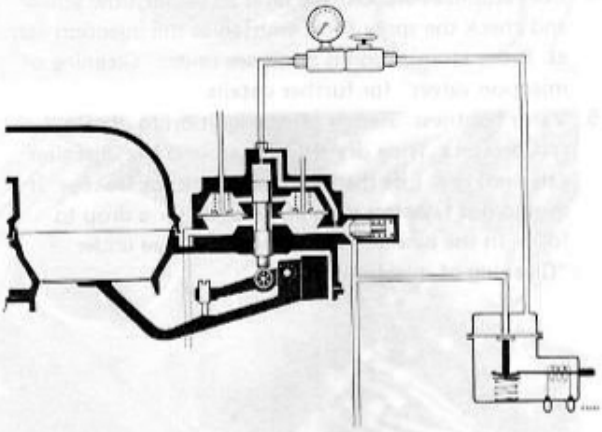
When the engine temperature is below approximately $113^{o}F$ ($+45^{o}C$), current is allowed to flow for a certain period (depending on the temperature) while the starter motor is running.

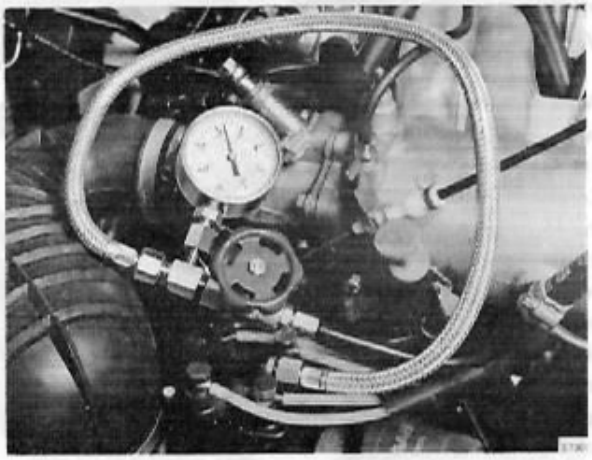
Check that the switch closes when the engine is started by means of connecting a test lamp in series across the contacts of the cold start valve plug.
It is not possible to make a more accurate check of the cut-in time or temperature. If the condition of the switch is at all in doubt, it should be replaced.

PRESSURE READING

General

Connect pressure gauge 83 92 516 as follows:
Disconnect the control pressure line from the fuel distributor and connect the pressure gauge between the fuel distributor and the line to the control pressure regulator.

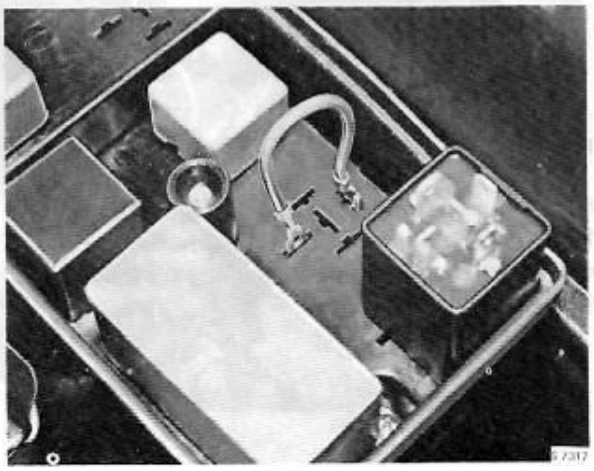




CAUTION

The safety function is governed by a pulse sensor in the pump relay which is actuated by the ignition pulses.

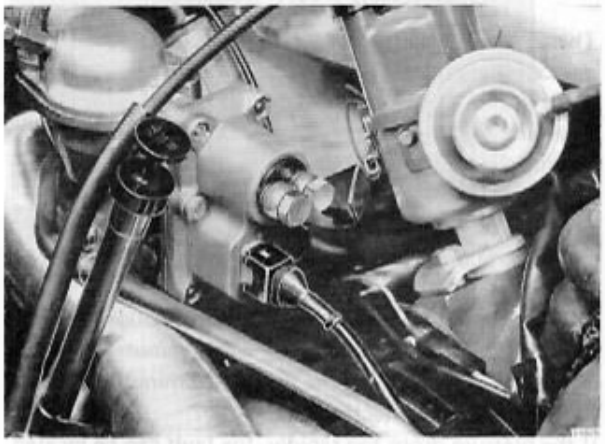
Disconnect the fuel pump relay and connect a jump lead across terminals 30 and 87 in the relay holder. Thus, the fuel pump will cut in as soon as the ignition is switched on.

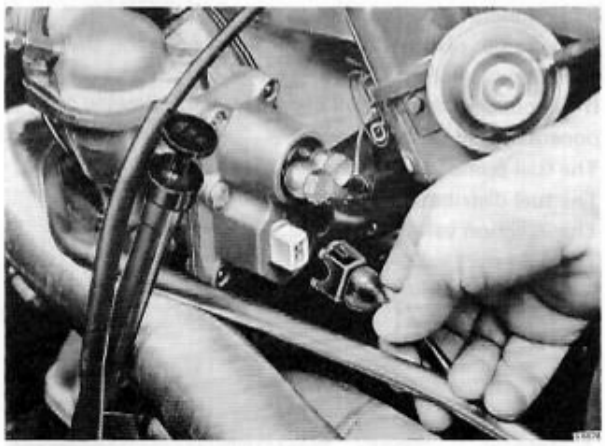


Bleed the pressure gauge by repeated opening and closing of the valve with the pressure gauge directed downwards and the fuel pump connected.

Cold engine control pressure

Carry out this test if poor engine performance has been experienced during cold starting and the warming up period.
The test can only be carried out when the engine is cold. The engine should not be run for a longer period of time (e.g. overnight) before the test can be carried out, to ensure that the engine is at ambient temperature. The engine must not be run before this test.
Open the valve, disconnect the plug at the warm-up regulator and switch on the ignition.
Compare the pressure gauge reading with the recommended pressure given in the temperature/pressure graph. Refer to the test values in section 022.
If the values should differ, replace the warm-up regulator.





Warm engine control pressure

Carry out this test when poor performance has been experienced when the engine is warm.
Open the valve.
Connect the warm-up regulator plug.
Leave the ignition switched on until rest pressure is present.
Refer to the test values in section 022.
If the value should differ, replace the warm-up regulator.

Line pressure

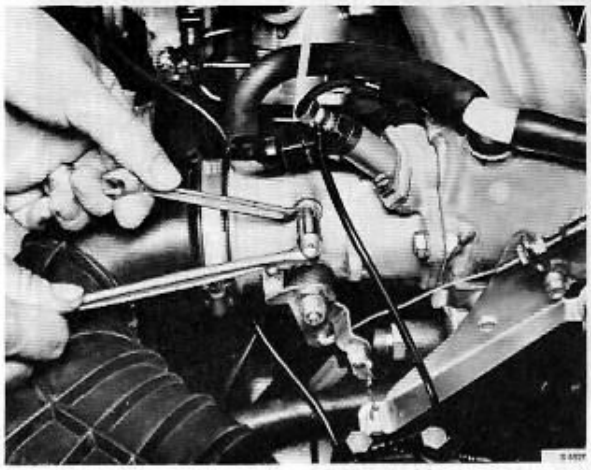
Close the valve.
Switch on the ignition.
Refer to the test values in section 022.
If the line pressure should differ from the recommended values, this may be due to:
In the case of insufficient line pressure:
Insufficient pressure from the fuel pump
Blockage of the strainer in the tank
Leakage in the fuel line
Line pressure regulator being faulty
In the case of ec
In the case of excessive line pressure:
Blockage of the return line
Line pressure regulator being faulty.
For adjustment of the line pressure see under "Mixture control unit, line pressure regulator".

Leakage tests on the whole system

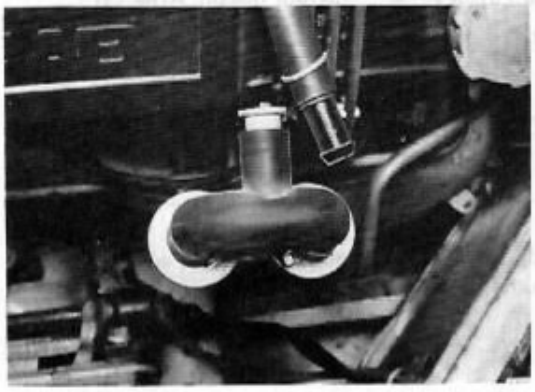
The test should be carried out after unsatisfactory performance arising from warm-engine starting.
If the engine is cold, the bi-metal strip in the warm-up regulator must be heated and kept warm during the test.
Unplug the connector on the warm-up regulator and replace it with a plug connected directly to the battery.
Open the valve. Switch on the ignition until "warm engine control pressure" is reached, and then switch off the ignition.
Observe the pressure drop on the pressure gauge. Leakage can generally be established after 3 or 4 minutes. In cases of uncertainty, carry out the test for 20 minutes. Refer to the test values in section 022.
If the pressure drops too rapidly, the fault can be located by conducting the test with the valve closed.
If the values obtained from this test are correct, then the warm-up regulator is faulty.
If the pressure drop is still excessive, the following components could be faulty:
The fuel pump
The fuel distributor
The injection valves
The cold start valve
If the O-ring of the line pressure regulator is damaged, leakage may occur. For replacement of the O-ring, see under "Mixture control unit, line pressure regulator".

SETTING THE IDLING SPEED AND THE CO VALUE

1. Run the engine until it reaches a temperature sufficient to open the thermostat.
2. Set the idling speed at 875 ± 50 r.p.m.

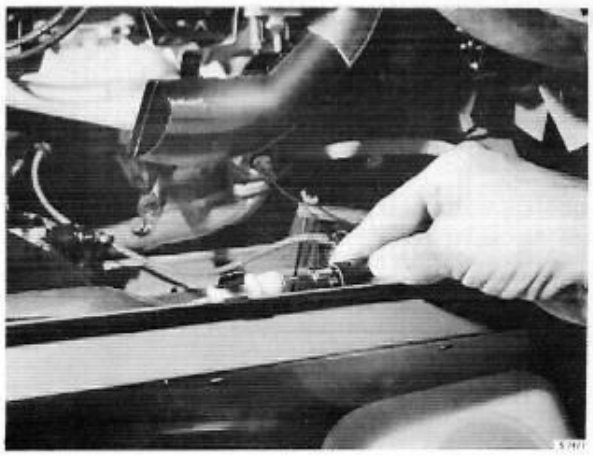


3. Non-catalyst cars
   - Remove the "pulse-air" hose and block the air inlet to the return valves.

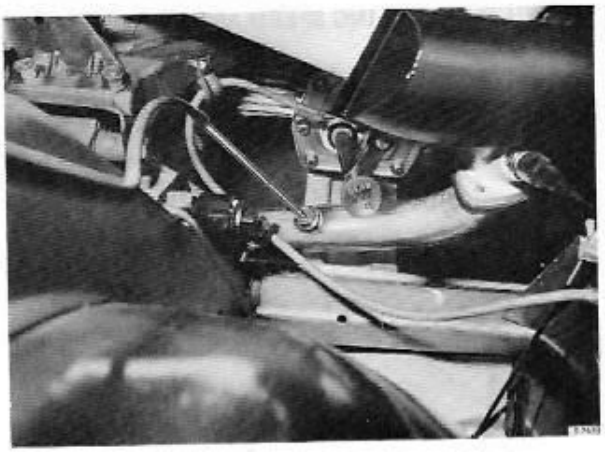


   - USA Model 1979 and Canada: Remove the large-bore hose from the charcoal canister.
   - Connect the CO-meter's sond to the exhaust pipe.

3. Catalyst cars Model 1979
   - Remove the large-bore hose from the charcoal cannister.
   - Connect the CO-meter's sond to the exhaust pipe.
   - Remove the oxygen sond's wire (do not let the sond's wire come into contact with earth.)



3. Catalyst cars Model 1980
   - Remove the plug from the front exhaust pipe and attach the CO-meter with connector(s). . .
   - Remove the oxygen sond's wire (do not let the sond's wire come into contact with earth).
4. Read off and adjust the idling speed and CO value. Before each reading, rev up the engine and then allow it to return to a steady idling speed. Wait approx. 30 seconds before reading off the CO value.



CO value

Non-catalyst cars:

0.75 ± 0.25 %

Catalyst cars Model 1979:

$0.75 \pm \frac{0.25}{0.5}$ % (Sensor discon. After cat.)

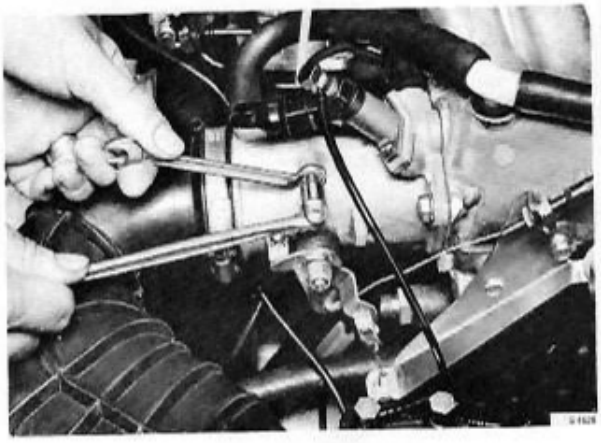
Catalyst cars Model 1980:

1.0 ± 0.25 % (Sensor discon. Before cat.)

Canada cars (excl. Turbo):

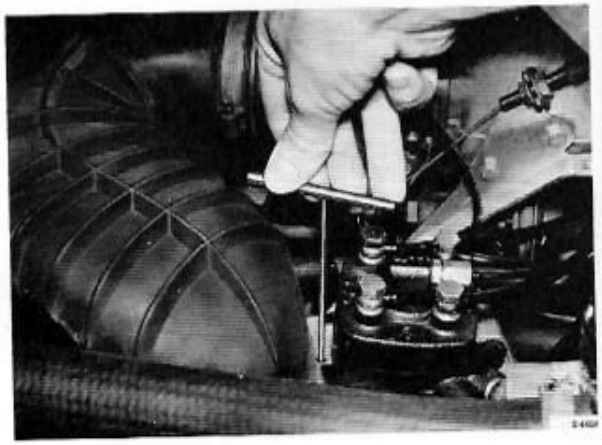
1.5 ± 0.5 %

a. Adjust the idling speed using the idle adjusting screw on the throttle valve housing.



b. Adjust the CO-setting using the adjusting screw on the fuel distributor. Use key 83 92 482.
   Clockwise – richer mixture
   Anti-clockwise – leaner mixture

These adjustments affect each other and should therefore be performed in the order shown.

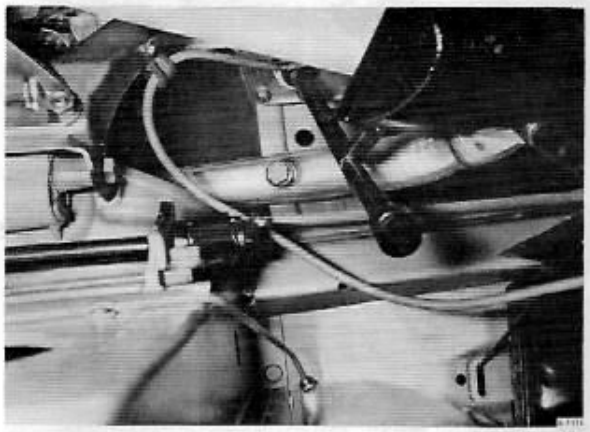


5. Catalyst cars: Connect the oxygen sond's wire and check the CO value after the catalyser (as from Model 1980, move the CO-meter's sond to the rear end of the exhaust pipe and install the plug in the front exhaust pipe). The CO value should be less than 0.4 % CO there (with the catalyser warmed up).

APPLY "NEVER SEIZE", "MOLYCOTE 1000" OR SIMILAR TO THE PLUG IN THE EXHAUST PIPE TO PREVENT IT "WELDING" FAST.

CAUTION

Remove the Allen key from the adjustment screw after each adjustment. If the key is left in the screw damage could result to the lever when the engine is revved up.



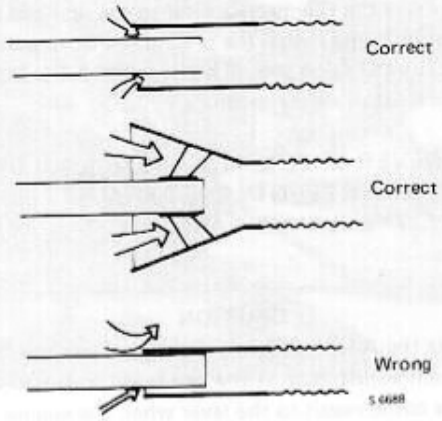
Connection to exhaust extraction equipment

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.

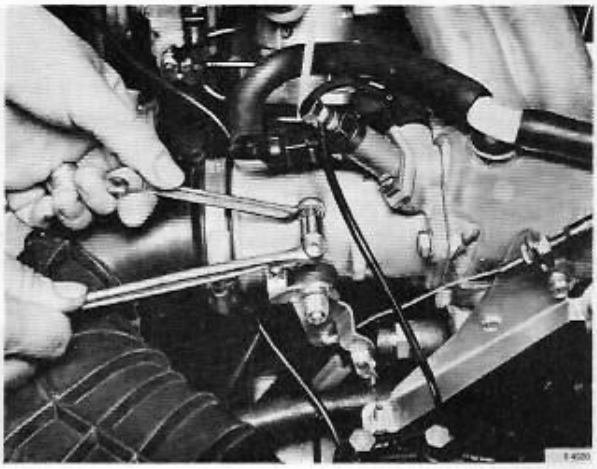
IF EXCESSIVELY POWERFUL EXHAUST EXTRACTION EQUIPMENT IS CONNECTED TO TURBO CARS, OIL MAY ESCAPE THROUGH THE SEALS IN THE TURBO UNIT.

This will result in the wool becoming saturated with oil, and blue smoke will be emitted in the exhaust for some considerable time afterwards.

TO AVOID EXCESSIVELY POWERFUL EXHAUST EXTRACTION, CONNECT A HOSE WITH AN OPEN COUPLING.

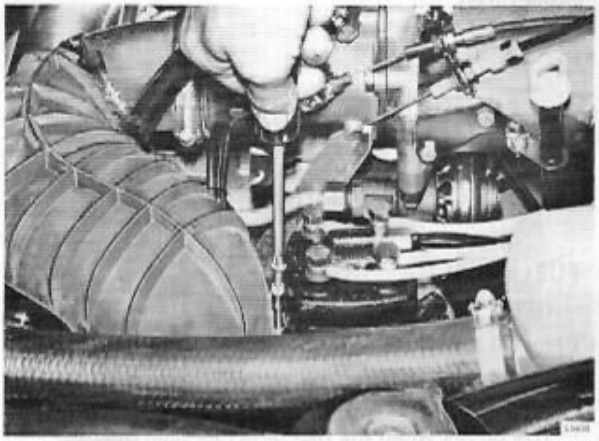


IDLING ADJUSTMENT (ENGINE SPEED AND CO VALUE)



Revolution setting

Run the engine until it is warm and then connect the CO gauge and the tachometer.
Adjust the idling speed by means of the adjustment screw located on the by-pass passage at the throttle valve housing.



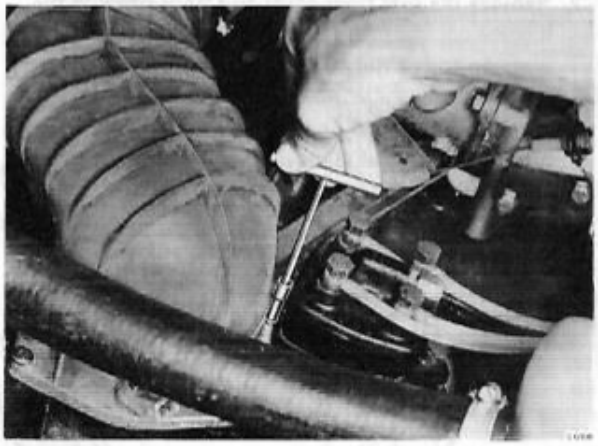
Adjusting the CO value

The hose in the fuel distributor is sealed by means of a plastic plug which must be removed (and thereby destroyed) before adjustment can be carried out.

A suitable tool can be made by brazing a 0.20 in. (5 mm) self-tapping screw onto a screwdriver. Grind a fine point on the screw and use the tool as an extractor.

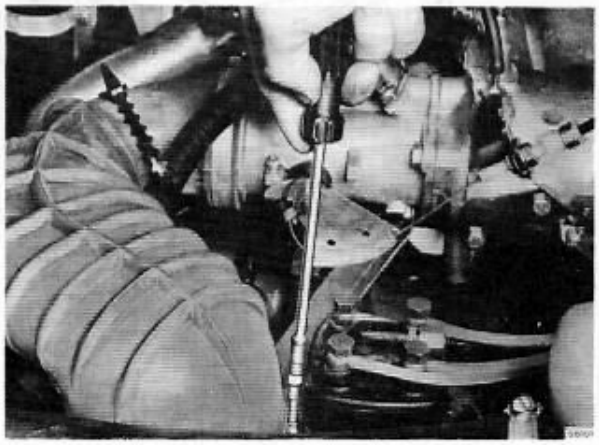
CAUTION

Remove the Allen key from the adjustment screw after each adjustment. If the key is left in the screw and the engine revved up, the lever could be damaged.



Turning in a clockwise direction – richer mixture.
Turning in an anticlockwise direction – leaner mixture.

After adjustment, seal the hole by means of a new plastic plug.

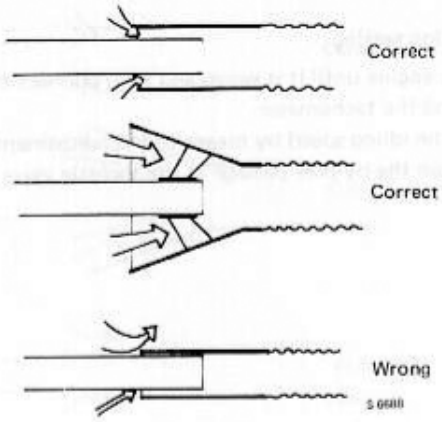


NOTE

If the idling speed is erratic or if difficulty is encountered in reducing the idling speed, check the setting of the overrun valve.
See section 254.

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.
IF EXCESSIVELY POWERFUL EXHAUST EXTRACTION EQUIPMENT IS CONNECTED TO TURBO CARS, OIL MAY ESCAPE THROUGH THE SEALS IN THE TURBO UNIT.
This will result in the wool becoming saturated with oil, and blue smoke will be emitted in the exhaust for some considerable time afterwards.
TO AVOID EXCESSIVELY POWERFUL EXHAUST EXTRACTION, CONNECT A HOSE WITH AN OPEN COUPLING.

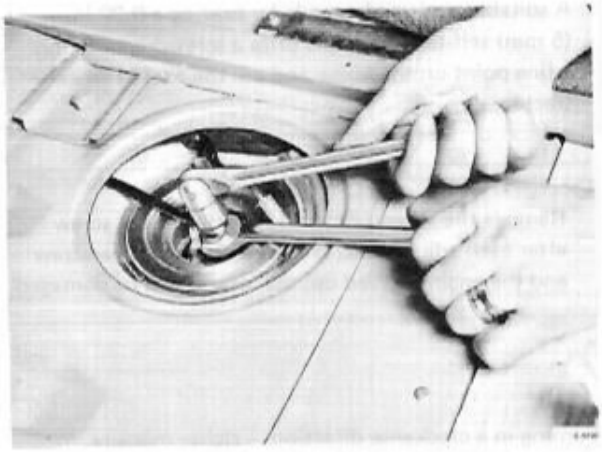


Dismantling and assembly, repairs and adjustments

FUEL PUMP

Removal (Sheet metal tank, 1979 model)

1. Disconnect the battery to prevent flashover and the risk of fire when the fuel tank has been opened.
2. Remove the rear floor cover and floor panel in the luggage compartment, and remove the circular cover plate on top of the pump mounting.
3. Disconnect the electric terminals at the pump.
4. Disconnect the fuel line from the pump. Hold the pump by means of an open-ended spanner when loosing the connection.



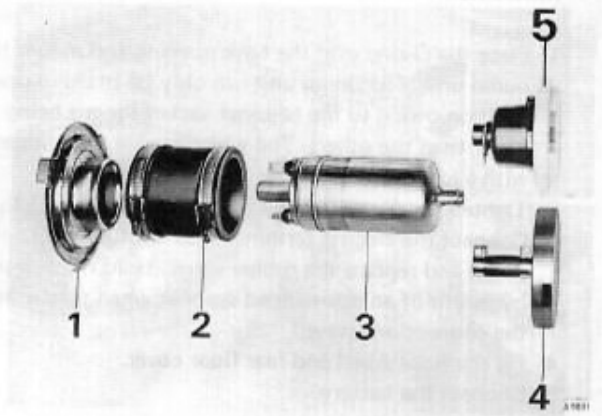
5. Using tool 8392433, turn the pump mounting anticlockwise to the nearest groove, to unlock the bayonet socket. Lift out the pump unit and save the O-ring.

NOTE
The pump can only be removed in one position, as one of the bayonet tongues are wider than the others.

6. Suitably cover the tank opening.

Dismantling (Sheet metal tank)

Release the clips and remove the splash guard and pump mounting from the pump.

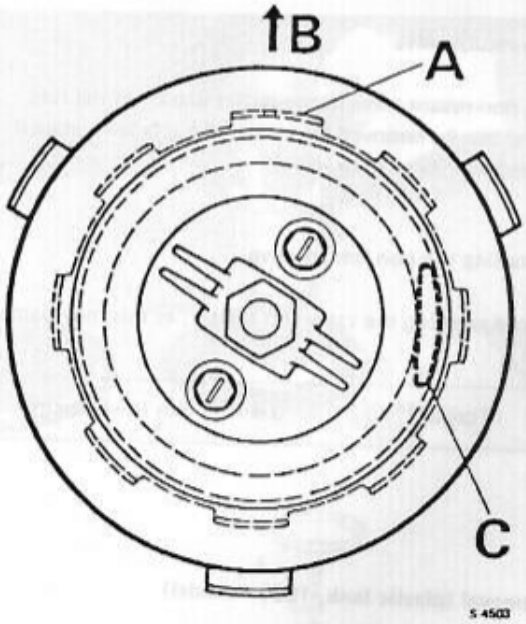


FUEL PUMP, DISMANTLED
1. Bayonet socket
2. Adapter
3. Fuel pump
4. Splash guard with suction strainer

Assembly (Sheet metal tank)

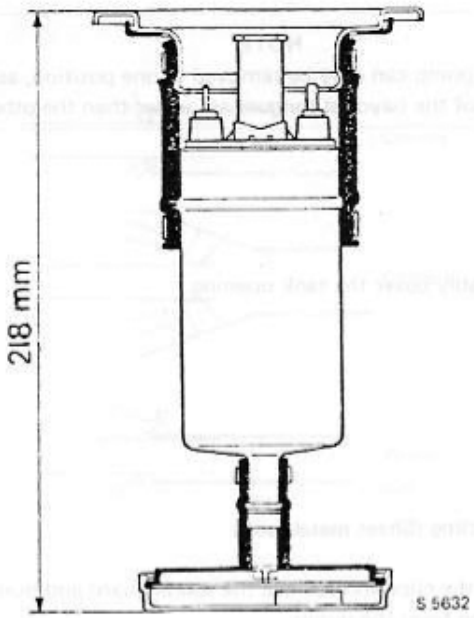
Assemble the pump unit as shown in the figure.
Note the following:

1. Rotate the pump in the mounting so that none of the electric connections are in line with the wide tonque of the bayonet socket which is equipped with a locking groove. If this is neglected, the electric connection will be in the way of the fuel line.
2. Rotate the splash guard so that the indent in it is to the right, looking towards the front of the car. The wide tonque of the bayonet socket equipped with a locking groove must point towards the front of the car.



MOUNTING POSITION OF THE SPLASH GUARD
A. Wide bayonet tongue, equipped with a locking groove
B. Driving direction of the car
C. Splash guard indent

3. The distance from the bottom of the splash guard to the top of the pump mounting should be 8.82" (218 mm).



Installation

1. Place the O-ring over the tank opening and mount the pump unit. The pump unit can only be fitted in one position owing to the bayonet socket tongue being wider than the others. The wider tongue is equipped with a locking groove.
2. Tighten the pump unit by means of tool 8392433.
3. Connect the electric terminals and the fuel line to the pump and replace the rubber cover. Hold the pump by means of an open-ended spanner when tightening the connection screw.
4. Fit the floor panel and rear floor cover.
5. Connect the battery.

Non-return valve

The non-return valve in the outlet line from the fuel pump can be removed by means of a specially shaped screwdriver (see illustration).

Installing the non-return valve

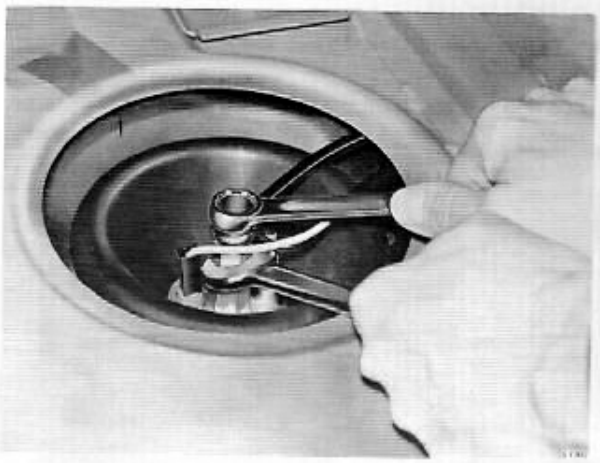
Avoid gripping the valve too tightly, as this may damage it.

Torque	0.4–0.6 Nm (4–6 kpcm)

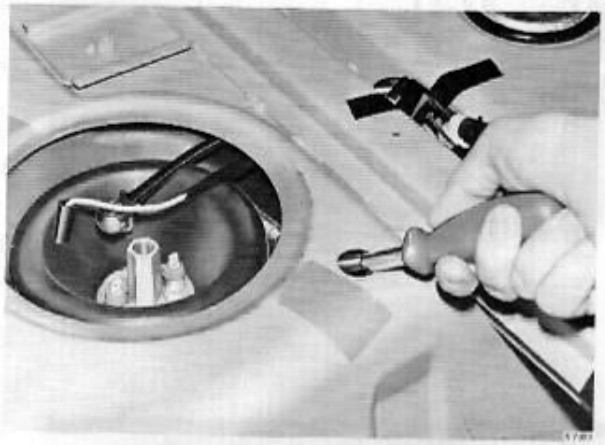
Removal (plastic tank, 1980– model)

1. Disconnect the battery.
2. Remove the rear floor panel in the luggage compartment and remove the round cover from above the fuel pump.
3. Detach the fuel pump's electrical connections.

4. Detach the fuel pipes from the pump. Use an open-ended spanner to hold the pump steadily while loosening the banjo connections.



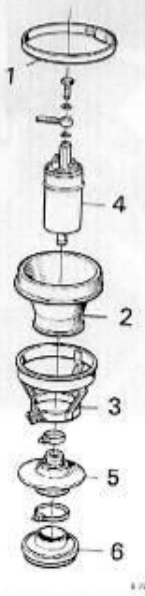
5. Use a jointed screwdriver (supplied by SAAB) to undo the pump mounting clamp.



6. Lift out the pump.

FUEL PUMP

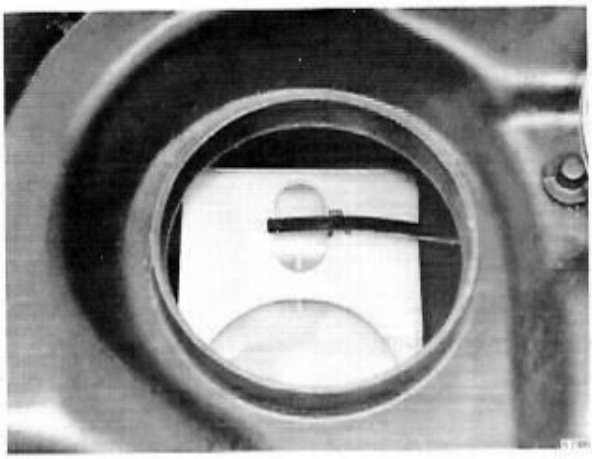
1. Clamp
2. Fitting collar
3. Pump support
4. Pump
5. Connecting bellows
6. Suction strainer



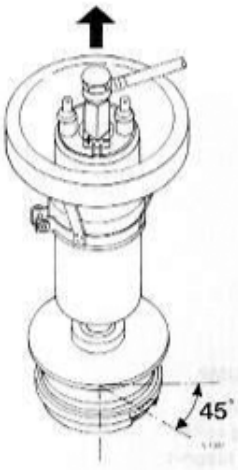
Installation (plastic tank, 1980– model)

1. Position the pump on the mounting so that the distance between the base of the suction strainer and the upper edge of the rubber mounting is 236 mm (9.2 in).

2. Check that the fuel return pipe is connected to the splash guard holder in the bottom of the fuel tank.



3. Install the pump unit in the tank as follows:
   - Tilt the + electrical connection to the left (as seen from the direction of movement of the car).
   - Tilt the suction strainer inlet 45° backwards to the right (as seen from the direction of movement of the car).



Removal is in the reverse order.

FUEL ACCUMULATOR

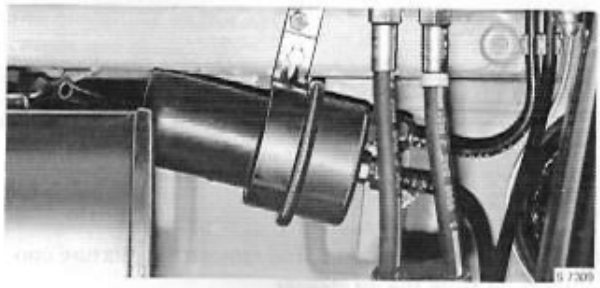
Removal

1. Clean the area around the fuel connections.
2. Disconnect the connections and remove the fuel accumulator.

Installation

1. Mount the accumulator on the bracket on the fuel tank.
2. Connect the fuel lines. The line from the fuel pump should be fitted to the connection nearest to the edge of the fuel accumulator.

Make sure that the fuel line from the pump is not in contact with the body.

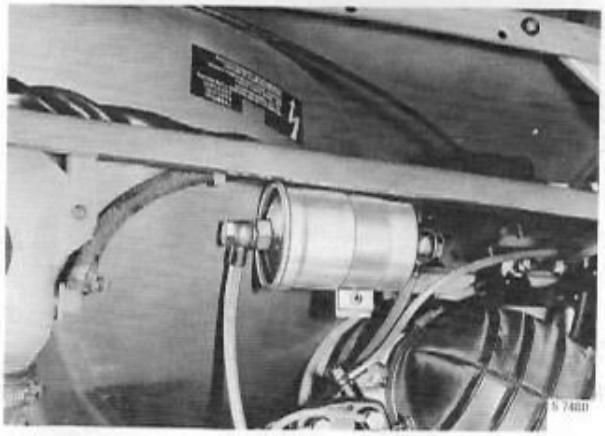


REPLACING THE FUEL FILTER

1. Clean the area around the two connections.
2. Hold the filter by means of the hexagons on the filter and nipple and disconnect the fuel lines. Remove the filter.

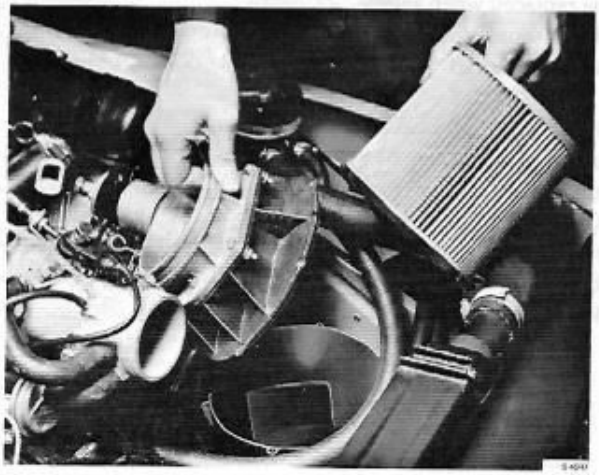
> CAUTION
> Avoid loosening the nipple on the outlet side to prevent aluminium swarf from the threads entering the system.

3. Mount the new filter with the arrow pointing in the direction of flow and connect the fuel line.



REPLACING THE AIR CLEANER ELEMENT

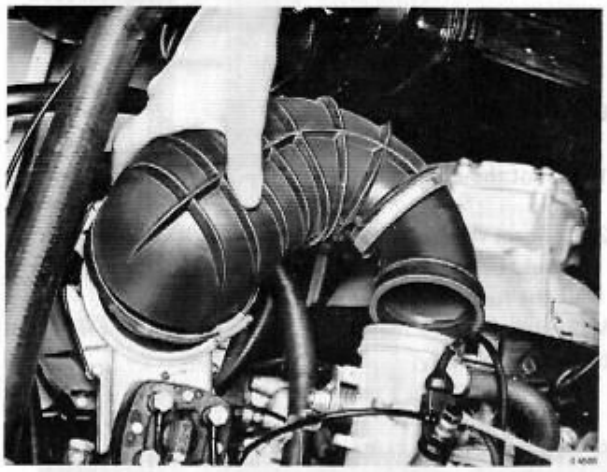
1. Remove the rubber bellows from between the air flow sensor and the throttle valve housing.
2. Remove the bolts securing the lower section of the air flow meter to the air cleaner.
3. Raise the mixture control unit slightly and remove the cleaner element. Take care not to damage the fuel line.
4. Remove the cleaner element holder from the bottom of the air cleaner and clean the air cleaner casing.
5. Fit the cleaner element holder and the new element.
6. Bolt the air flow meter to the air cleaner.
7. Fit the rubber bellows between the air flow meter and the throttle housing.



MIXTURE CONTROL UNIT

Removal

1. Thoroughly clean the area around the fuel connections on the fuel distributor.
2. Disconnect the fuel lines from the fuel distributor. Disconnect the lines to the injection valves before disconnecting the control pressure line, to avoid damaging the adjacent lines.
3. Remove the rubber bellows from between the air flow sensor and the throttle valve housing.



4. Undo the retaining bolts, and remove the mixture control unit from the air cleaner.

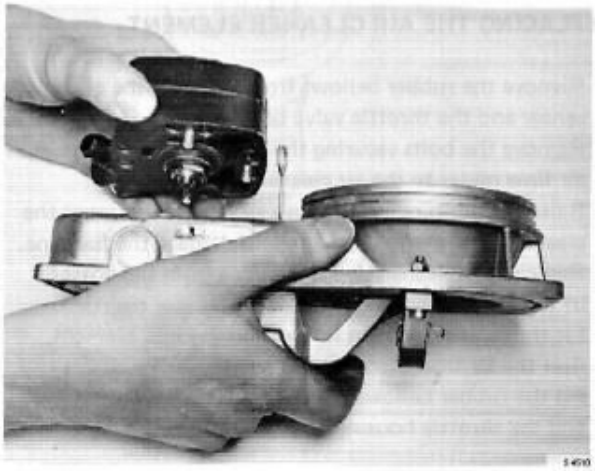
Assembly

1. Make sure that the air cleaner element is in the correct position and then bolt the mixture control unit to the air cleaner.
2. Connect the fuel line to the fuel distributor.
3. Fit the rubber bellows between the air flow sensor and the throttle valve housing.

Fuel distributor

The fuel distributor must not be dismantled but should be replaced when faulty.
When separating the fuel distributor from the air flow sensor, ensure that the control plunger does not fall out.

If the control plunger has been removed, it must be thoroughly cleaned in petrol and reassembled. Avoid touching the plunger with the fingers.
On assembly of the fuel distributor, ensure that the O-ring is located in its groove. Tighten the three retaining bolts to a torque of 3.2–3.8 Nm (2.3–2.7 ft.lb., 32–38 kpcm).



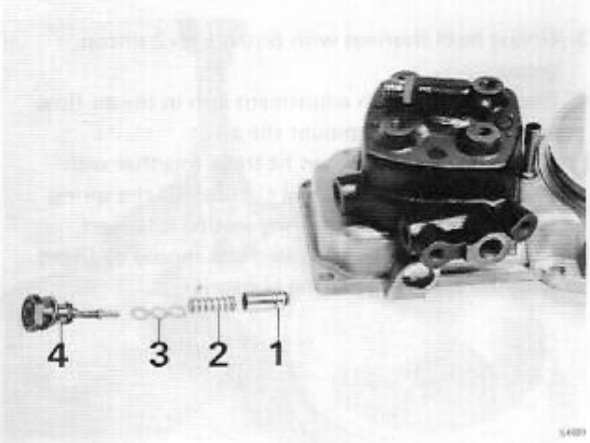
Line pressure regulator

The line pressure regulator is located inside the screw plug at the return line and return connection from the control pressure regulator.
The regulator comprises the following:

1. Piston with O-ring
2. Spring
3. Shims
4. Screw plug with O-ring and washer.
   (The screw plug contains a shut-off valve which closes the return line from the control pressure regulator when the fuel pump is not operating. The socket head screw in the plug should not normally be removed.)
   An 0.1 mm shim produces a change in pressure of 0.15 bar (kp/cm^2).

Adjusting the line pressure

After replacement of the O-ring, the line pressure must be checked and adjusted if necessary.
The pressure can be increased by fitting additional shims and decreased by removing shims.
The shims are available in thicknesses of 0.004" and 0.020" (0.1 and 0.5 mm). An 0.004" (0.1 mm) shim produces a change in pressure of 0.15 bar (kp/cm^2).
A prerequisite for measuring and adjusting the line presure is that the fuel pump capacity is correct.
The screw plug should be tightened with a torque of 13–15 Nm (9.4–10.8 ft.lb., 130–150 kpm).



LINE PRESSURE REGULATOR
1. Piston with O-ring
2. Coil spring
3. Washers
4. Screw plug with O-ring and sealing washer (contains a stop valve for the fuel return from the warm-up regulator/boost control circuit)

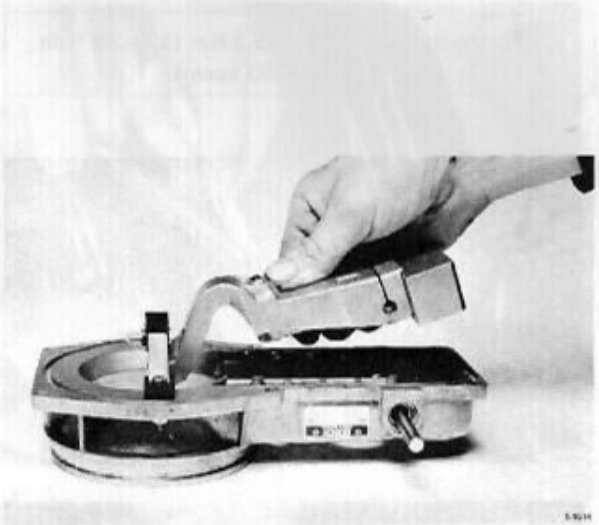
Lever, adjustment arm and sensor plate

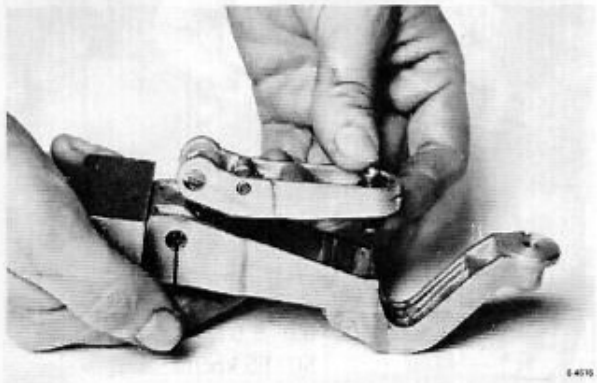
Removal

1. Remove the mixture control unit and remove the lower plastic section and the fuel distributor.
2. Remove the retaining screws and the sensor plate.
3. Remove the circlips from the lever seating and remove, the shims, rubber seals, spring (on one side) and balls.
4. Remove the counterweight retaining screw and press out the pivot.
5. Remove the lever with counter weight and adjustment arm.

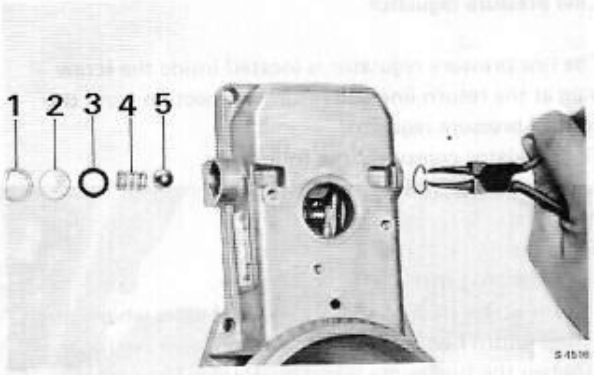
Assembly

1. Fit the counterweight to the lever but do not completely tighten the screw.
2. Place the adjustment arm in the lever in such a way that the socket head screw on the adjustment arm is visible.





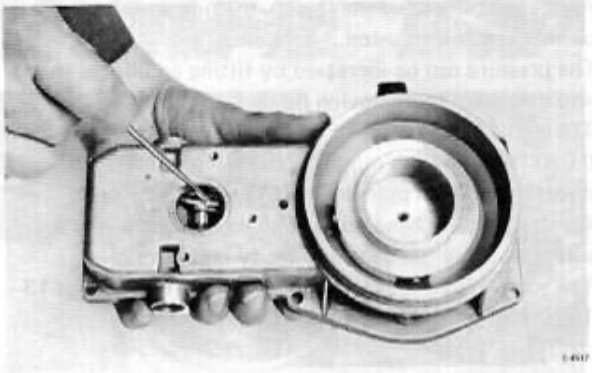
3. Grease both bearings with Bosch Ft2v2 silicon grease.
4. Place the lever with adjustment arm in the air flow sensor housing and mount the pivot.
5. Grease the balls and then fit them together with the spring, seals, shims and circlips. Fit the spring to the side where the bearing seating is longest. Note! The circlips are pressed and should be fitted with the sharp edge facing outwards.



1. Circlip
2. Covering washer
3. Seal
4. Spring
5. Ball

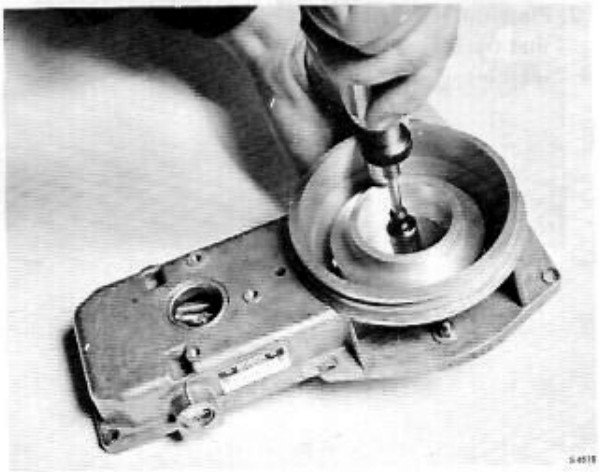
6. Mount the sensor plate in the centring tool and place the tool and plate in the air venturi. Centre the lever so that the threaded hole is aligned with the hole in the sensor plate.

Tightening torque	4.7–5.3 Nm (3.4–3.8 ft.lb., 47–53 kpcm)



7. Fit the sensor plate retaining screw and tighten it. Check that the lever can be moved without any resistance being felt.

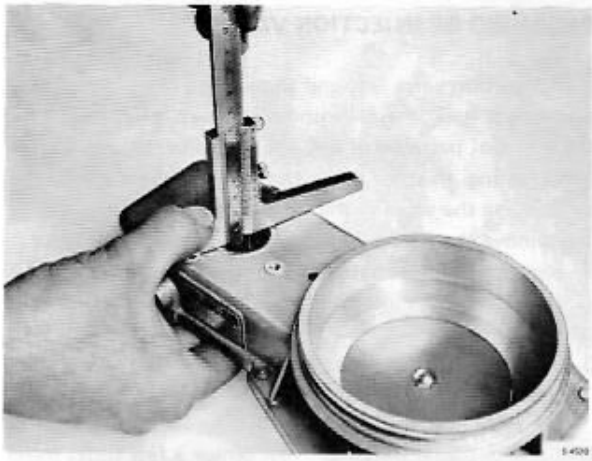
Tightening torque	5.0–5.5 Nm (3.6–4.0 ft.lb., 50–55 kpcm)



8. Adjust the rest position setting of the sensor plate by bending the wire loop on the stop bracket underneath the air flow sensor.
9. Preset the position of the adjustment arm. Using a depth gauge, measure the distance bwtween the joint surface of the fuel distributor (across the screw holes) and the needle bearing roller. The dimension should be 0.71"–0.75" (18–19 mm). To adjust the dimension, turn the mixture adjustment screw by means of an Allen key.
10. Fit the O-ring and the fuel distributor. The fixing screws should be tightened according to the table. Fit the lower plastic section of the air flow sensor together with the gasket.

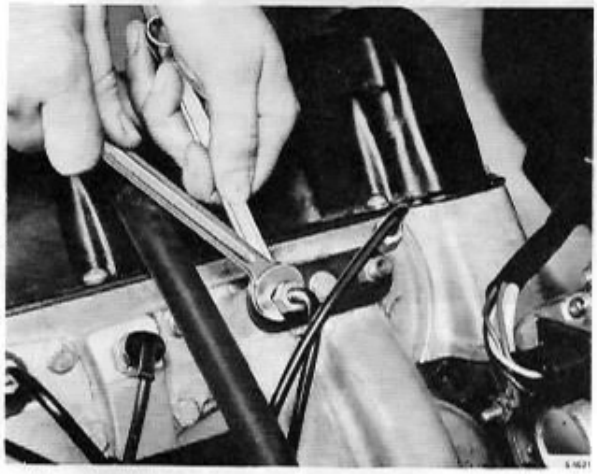
Fuel mixture control unit	3.2–3.8 Nm (2.3–2.7 ft.lb., 32–38 kpcm)

11. Mount the mixture control unit to the car. Fine adjustment of the basic fuel flow is made by means of a CO gauge after the engine has been warmed up.



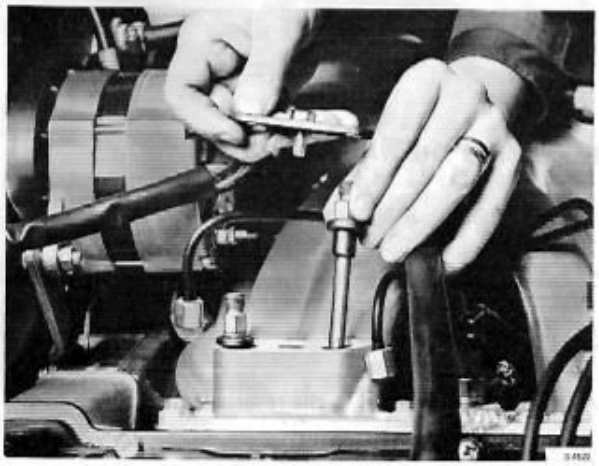
REPLACING INJECTION VALVES

1. Clean the area around the injection valve and its connection.
2. Disconnect the fuel line from the valve. To prevent the valve turning, hold the hexagon with a spanner.



3. Remove the retaining plate.
4. Withdraw the injection valve and pull off the rubber seal.

Assembly is carried out in the reverse order.



CLEANING OF INJECTION VALVE

If an injection valve is found to produce poor atomization of the fuel or to leak under pressure, this may be the result of particles of dirt having collected around the valve seating. In some cases, the dirt can be washed away by flushing the valve in the following manner:

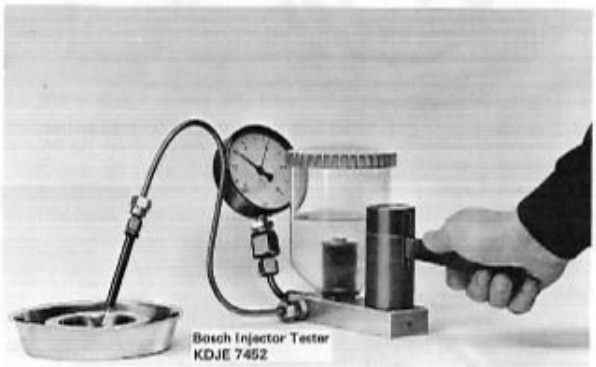
1. Remove the rubber bellows from the air flow sensor.
2. Remove the injection valves from the inlet manifold and place them in a container. Do not disconnect the fuel lines.
3. Switch on the ignition, remove the pump relay and connect a jump lead between terminals 30 and 87 in the relay holder. This will allow the fuel pump to run.
4. Raise the lever in the air flow sensor a few times to its highest position so that the injection valves will be flushed by a powerful jet of petrol.

PERFECT ATOMIZATION

ACCEPTABLE ATOMIZATION

EXAMPLE SHOWING BAD ATOMIZATION

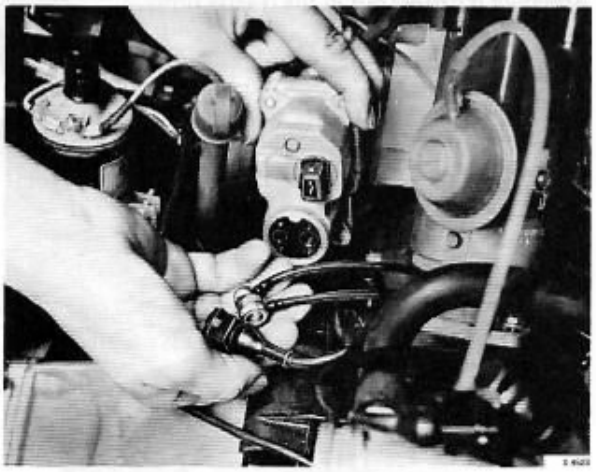
Injection valves which have been removed from the car can also be cleaned by means of an injector tester. Cleaning with compressed air is not recommended. If the fault should still remain, replace the injection valve.



REPLACING THE WARM-UP REGULATOR

1. Clean the area around the warm-up regultor and its connections.
2. Disconnect the electric terminals and both fuel lines from the regulator.
3. Dismantle the regulator.

Assembly is carried out in the reverse order.

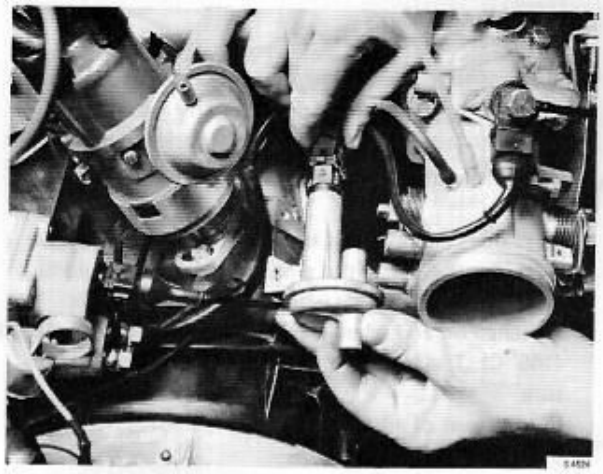


SAAB

REPLACING THE AUXILIARY AIR VALVE

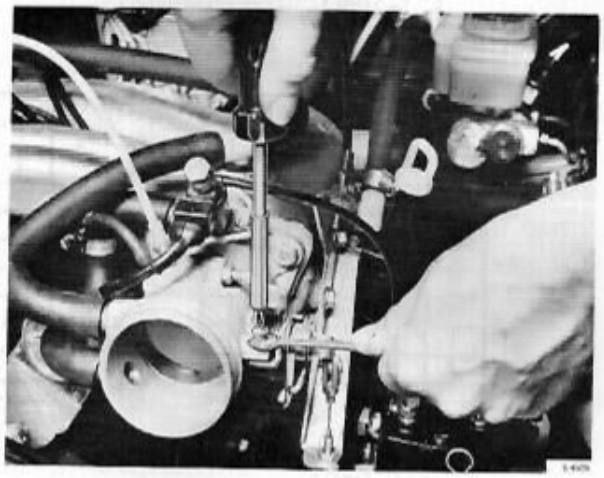
1. Pull off the hoses and disconnect the electric terminals.
2. Unscrew the auxiliary air valve.

Assembly is carried out in the reverse order.



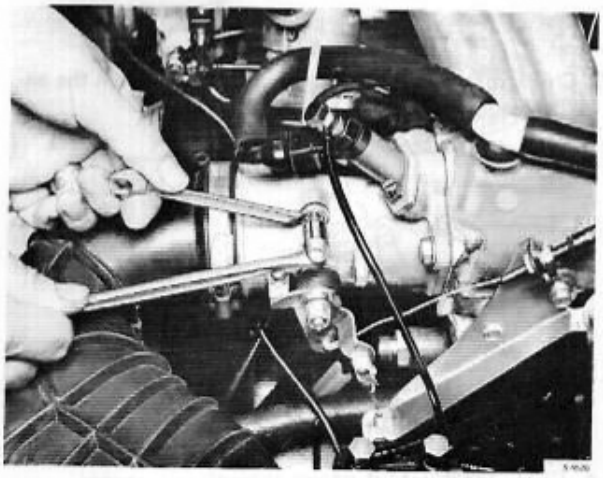
ADJUSTING THE THROTTLE VALVE STOP

1. Check that the throttle valve is central in he housing.
2. Turn the adjustment screw until it just makes contact with the stop tongue (throttle valve completely closed).
3. Turn the adjustment screw another one-third of a turn and lock the screw. A clearance of approx. 0.002" (0.05 mm) will thus be obtained between the throttle valve and the housing.



ADJUSTMENT OF IDLING SPEED

To adjust the idling speed, turn the adjustment screw on the throttle valve housing by-pass passage.
Adjustment should be made in connection with setting of CO-value. See adjustment of idling speed.



FAULT-TRACING

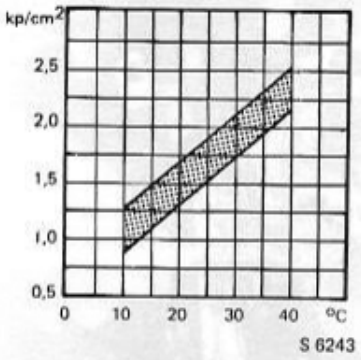
In the fault-tracing procedure described below it is assumed that the engine does not have any mechanical faults and that the ignition system is working properly.

Starting difficulties, cold engine

1. Check the operation of the cold start valve. Remove the valve and place it in a container. Fuel should be ejected from the valve when the starter motor is switched on and when the engine is colder than +113°F (+45°C). The injection time depends on the temperature.
   In the event of ailure, check:
   The cold start valve
   The termal time switch
   The electrical system

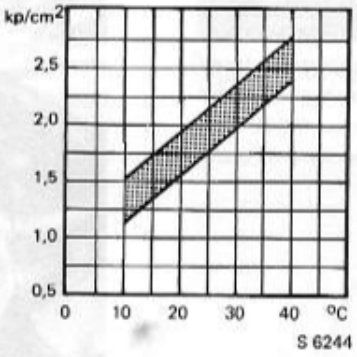

S 5199

2. Measure the control pressure with the engine cold.



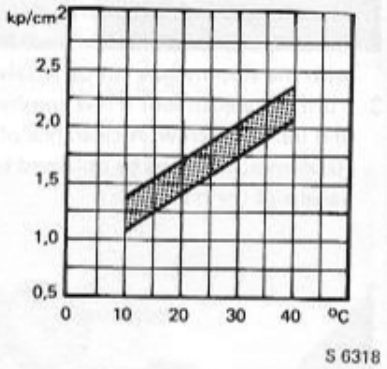
S 6243

WARM-UP REGULATOR 0 438 140 020
NON-CATALYST CARS



S 6244

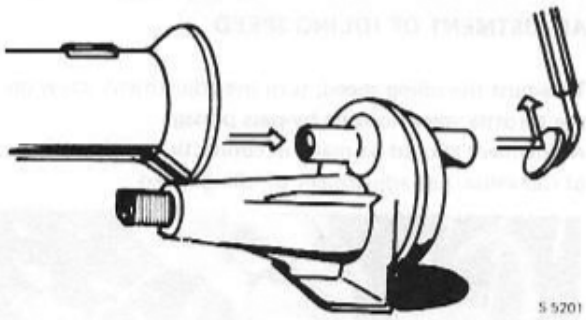
WARM-UP REGULATOR 0 438 140 032
(CATALYST CARS)



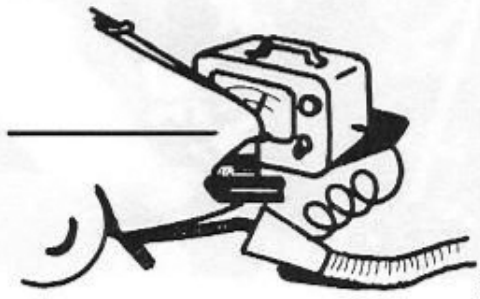
S 6318

WARM-UP REGULATOR TURBO
0 438 140 051

3. Check that the auxiliary air valve is open when the engine is cold.

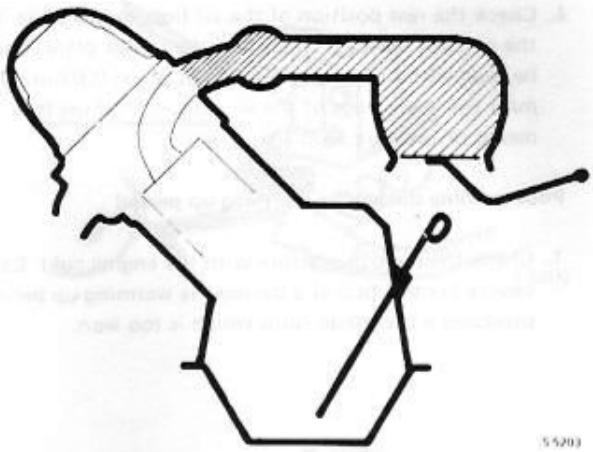

S 5201

4. Check the CO-value (warm engine).


S 5202

SAAB

5. Check for air leakage between the air flow sensor and the engine.

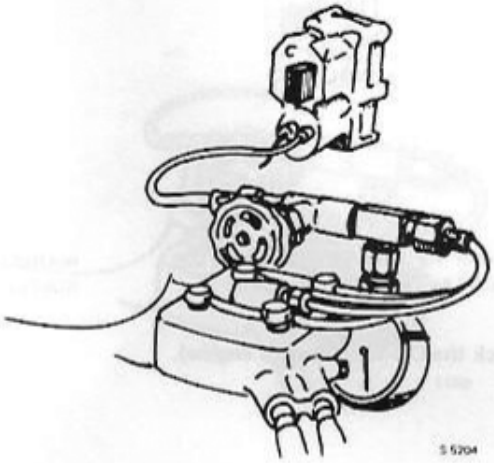


S 5203

Starting difficulties, warm engine

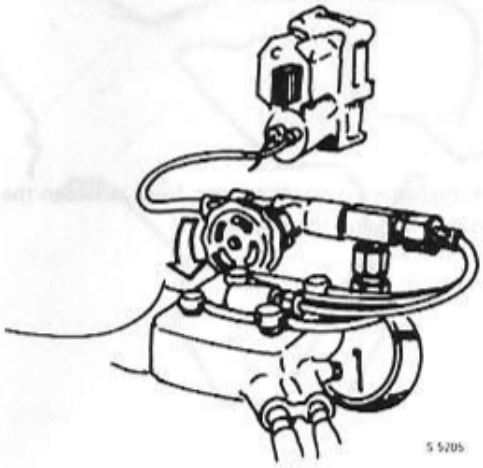
1. Check the residual pressure in the fuel system after the engine has been switched off. Excessively low pressure when the engine is still warm can cause vaporization in the fuel lines.
   Check the tightness of the system.
   Check first with the valve open. In the event of leakage, repeat the test with the valve closed (control pressure regulator disconnected).

Possible leakage places:
- Control pressure regulator
- Non-return valve at fuel pump
- Cold start valve
- Line pressure regulator
- Injection valves
- External leakage



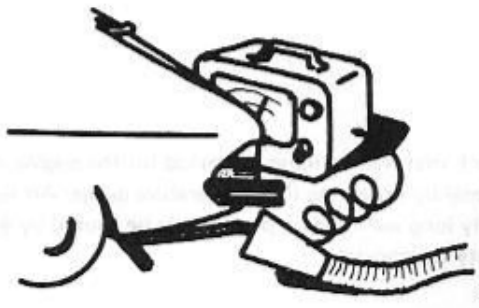
S 5204

2. Check the control pressure with the engine warm.



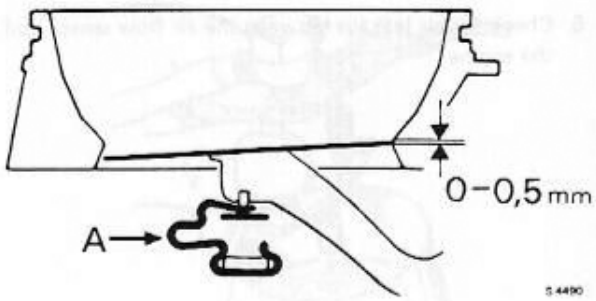
S 5205

3. Check the CO-value (warm engine).



S 5202

4. Check the rest position of the air flow sensor plate in the air flow sensor. (The top of the sensor plate should be level with or slightly lower than (max. 0.02 in., 0.5 mm) the lower edge of the air venturi.) Adjust by means of the wire loop (A).



S 4490

Poor running during the warming-up period

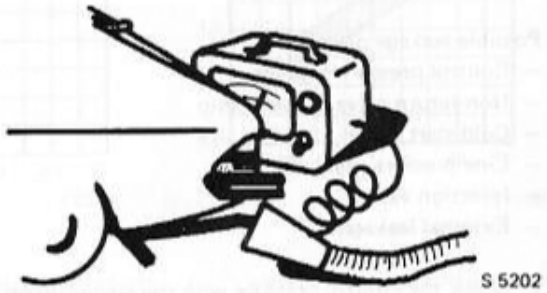
1. Check the control pressure with the engine cold. Excessive control pressure during the warming-up period produces a fuel-to-air ratio which is too lean.

WARM-UP REGULATOR 0 438 140 020
NON-CATALYST CARS

WARM-UP REGULATOR 0 438 140 032
(CATALYST CARS)

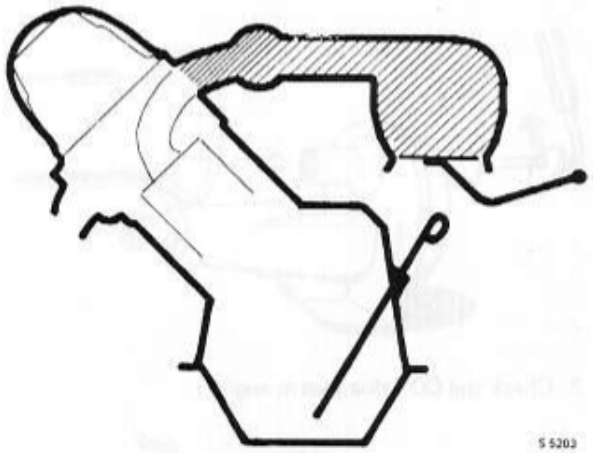
WARM-UP REGULATOR TURBO
0 438 140 051

2. Check the CO-value (warm engine).



S 5202

3. Check that there is no air leaking from between the air flow sensor and the engine.



S 5203

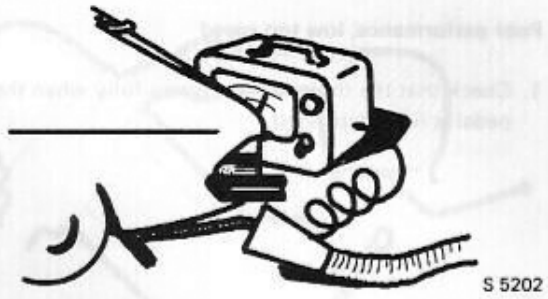
4. Check that the warming-up period for the engine is normal by observing the temperature gauge. An abnormally long warming-up period may be caused by a faulty thermostat.

S 5207

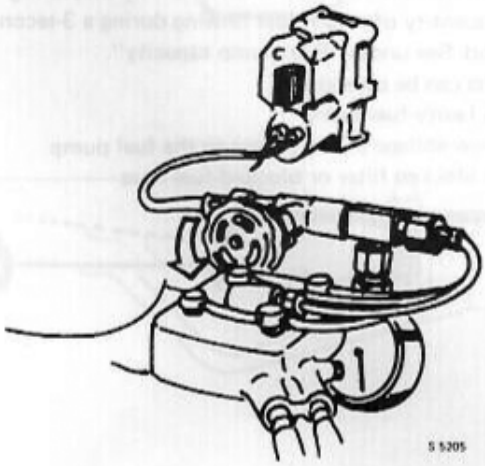
SAAB

Poor running, warm engine

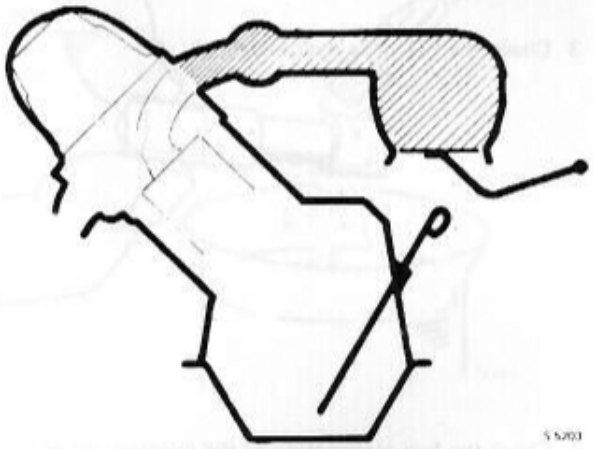
1. Check the CO-value (warm engine).


S 5202

2. Check the control pressure with the engine warm.

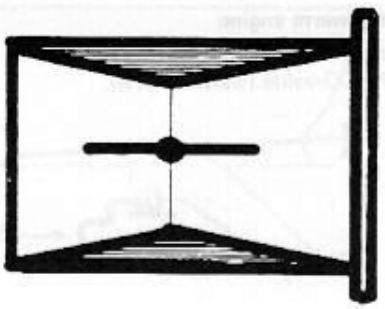

S 5205

3. Check that there is no air leaking from between the air flow sensor and the engine.



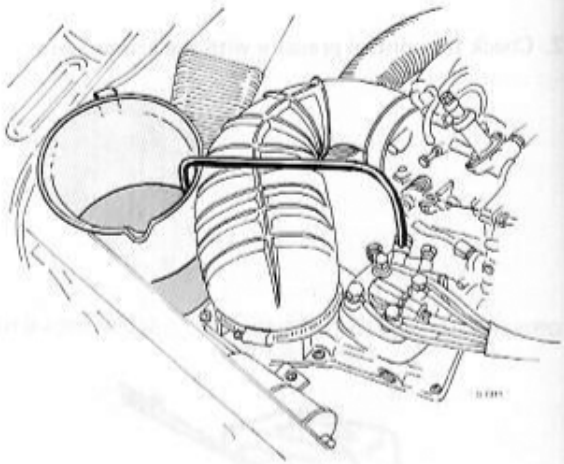
Poor performance, low top speed

1. Check that the throttle valve opens fully when the pedal is fully depressed.

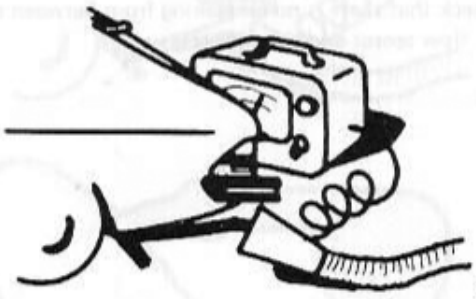


S 5206

2. Check that the fuel flow is sufficient by measuring the quantity of return fuel flowing during a 3-second period. See under "Fuel pump capacity".
   Faults can be caused by:
   - A faulty fuel pump
   - Low voltage of the supply to the fuel pump
   - A blocked filter or blocked fuel lines

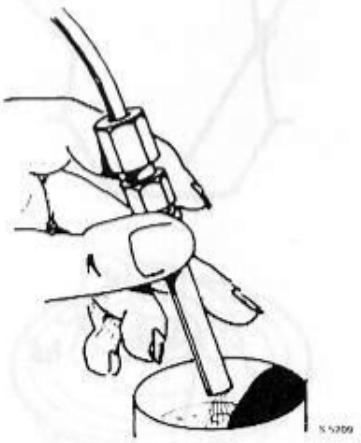


3. Check the CO-value (warm engine).



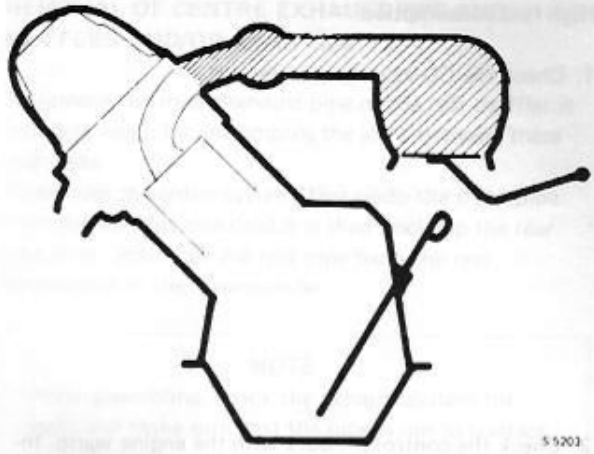
S 5202

4. Check the fuel atomization of the injection valves. Deposits on the spark plugs can give an indication of poor atomization.



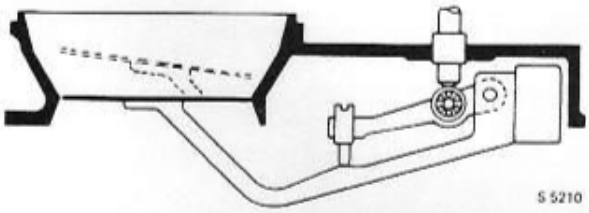
Irregular CO-value and idling speed, difficulty in adjusting

1. Check that no air is leaking from between the air flow sensor and the engine.

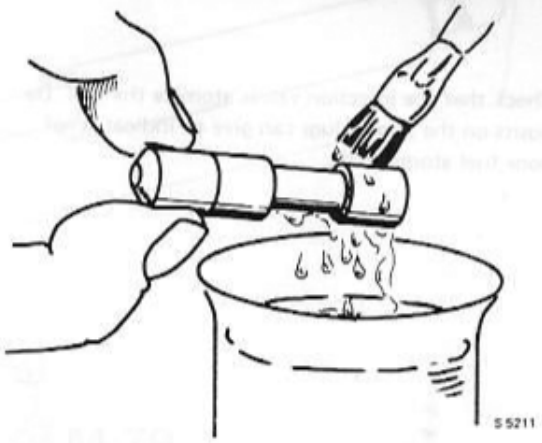

S 5203

2. Check whether any parts of the air flow sensor are sticking as follows:
   - Run the engine until it is warm and then connect a CO-meter.
   - Switch off the engine and then restart it without touching the accelerator. Read off the CO-value.
   - Rev the engine to around 3.000 rev/min and then allow it to return to idling speed. If the CO-value is different now to the earlier reading, then either the control plunger or the lever is sticking.

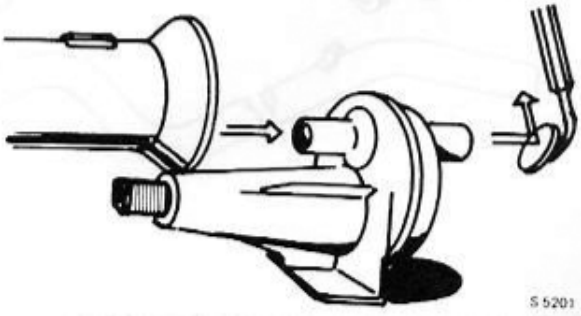
Check that the lever moves freely.


S 5210

Disconnect the fuel distributor from the air flow sensor, ensuring that the control plunger does not fall out. Extract and inspect the control plunger (avoid handling the sealing surfaces). Clean the plunger in petrol, install it and mount the fuel distributor. Never dismantle the fuel distributor any further.

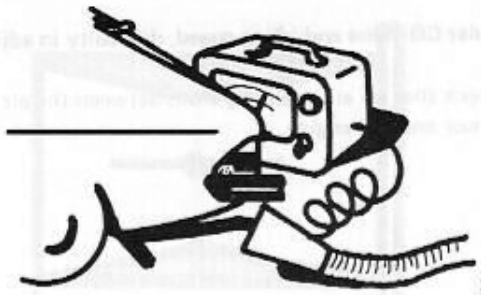

S 5211

3. Check that the disc in the auxiliary air valve is not sticking.

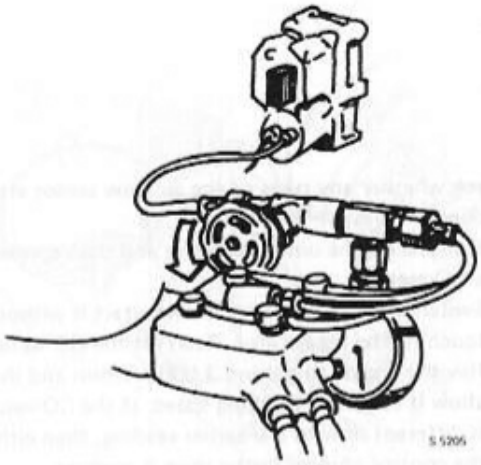

S 5201

High fuel consumption

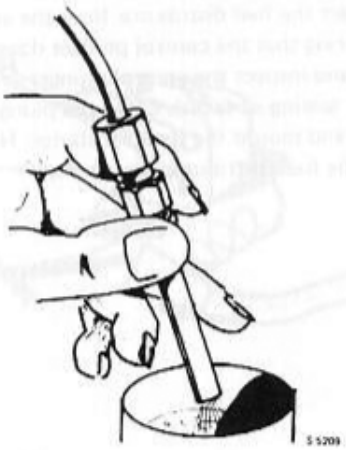
1. Check the CO-value (warm engine).


S 5202

2. Check the control pressure with the engine warm. Insufficient control pressure implies a fuel-to-air ratio which is too rich.


S 5205

3. Check that the injection valves atomize the fuel. Deposits on the spark plugs can give an indication of poor fuel atomization.


S 5209

4. Check that the cold start valve is not leaking.


S 5212

5. Check that there is no external leakage of fuel.

EXHAUST SYSTEM

GENERAL

The exhaust system comprise 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

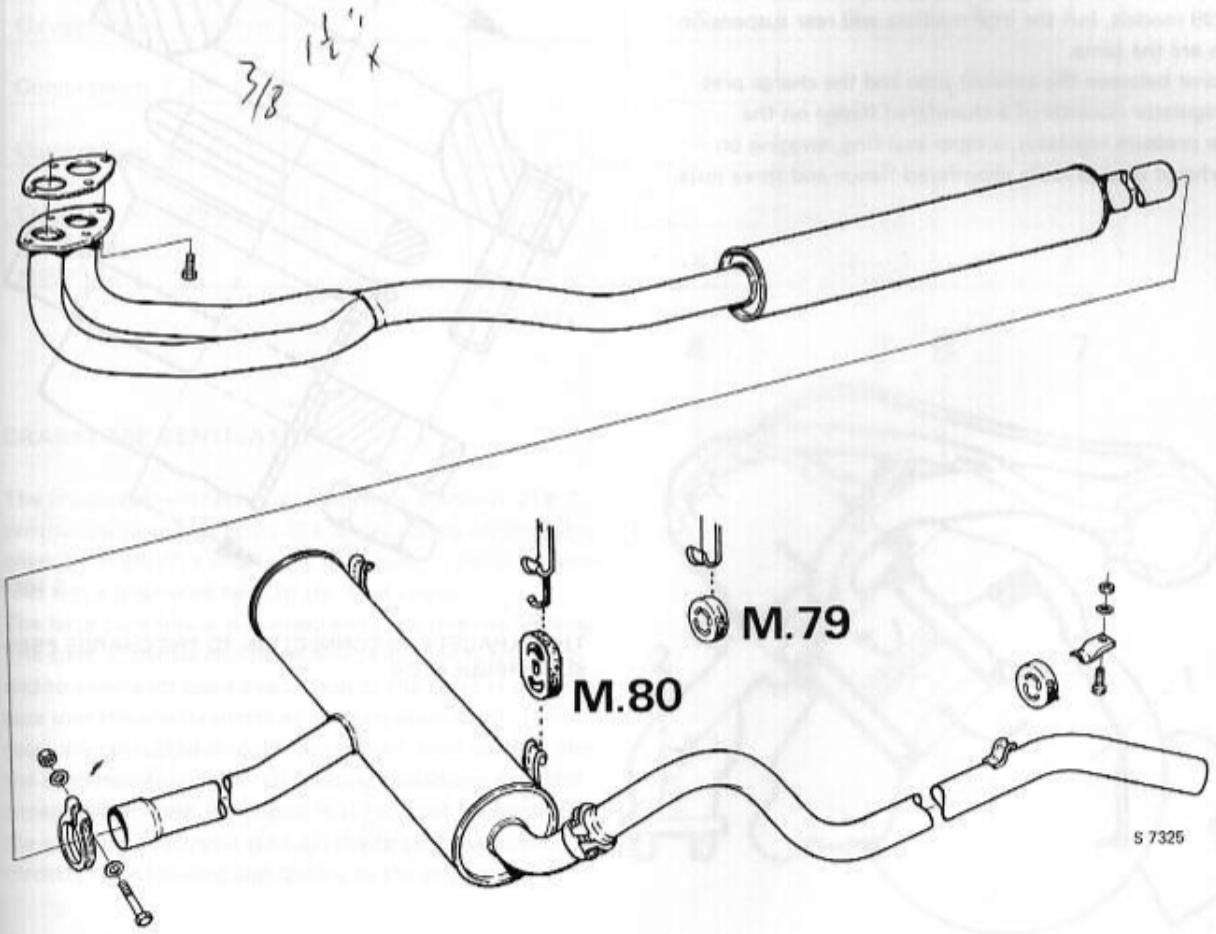
1. Jack up the car.
2. Unscrew the screws securing the front exhaust pipe to the exhaust manifold.
3. Undo the clamp holding the connecting ring at the joint with the middle exhaust pipe and separate the pipes.

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

REMOVAL OF CENTRE EXHAUST PIPE AND MUFFLER AND/OR REAR PIPE

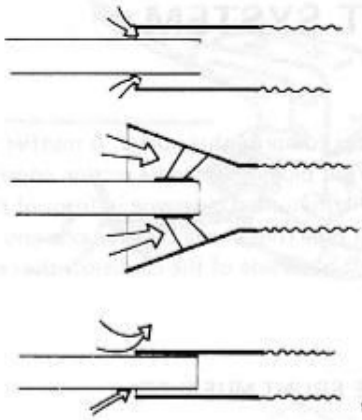
To remove the midle exhaust pipe or the rear muffler it is best to begin by unclamping the joint between these two units.
To remove the entire system, first undo the front pipe from the exhaust manifold and then unclamp the rear pipe joint. Withdraw the rear pipe from the rear. Reassemble in the reverse order.

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



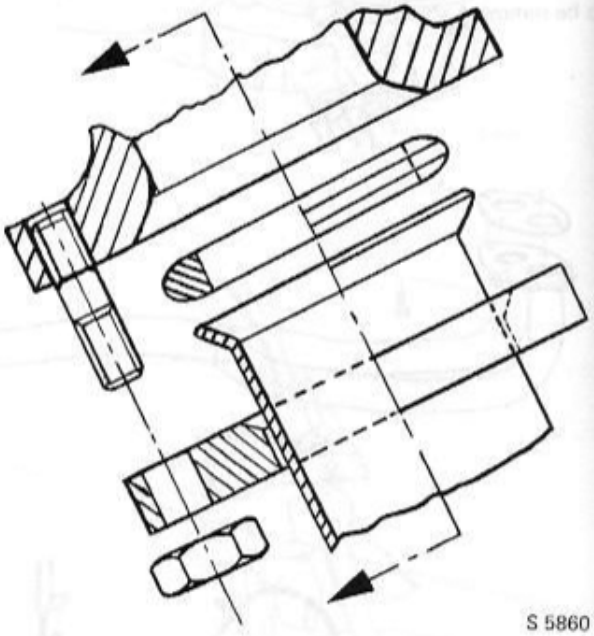
Connection to exhaust extraction equipment

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.
IF EXCESSIVELY POWERFUL EXHAUST EXTRACTION EQUIPMENT IS CONNECTED TO TURBO CARS, OIL MAY ESCAPE THROUGH THE SEALS IN THE TURBO UNIT.
This will result in the wool becoming saturated with oil, and blue smoke will be emitted in the exhaust for some considerable time afterwards.
TO AVOID EXCESSIVELY POWERFUL EXHAUST EXTRACTION, CONNECT A HOSE WITH AN OPEN COUPLING.



EXHAUST SYSTEM, TURBO ENGINE

The exhaust system on cars with turbocharged engines comprises pipes of a larger diameter than those on other Saab 99 models, but the intermediate and rear suspension points are the same.
The joint between the exhaust pipe and the charge pressure regulator consists of a chamfered flange on the charge pressure regulator, a taper seal ring, swaging on the exhaust pipe, a loose chamfered flange and three nuts.



THE EXHAUST PIPE CONNECTION TO THE CHARGE PRESSURE REGULATOR

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:

Exhaust emission system	Canada		USA			USA and Canada	
	Model 1979	Model 1980	Non catalyst Model 1979	Catalyst Model 1979–	Catalyst (excl. Turbo) M-80–	Turbo M-79	Turbo M-80
Deceleration device, electric						X	
Deceleration device, vacuum	X		X	X			
Deceleration device, dashpot		X			X		X
Delay valve	X	X	X				
EGR two-port	X[1]	X[1]	X				
Pulse air			X				
Oxygen sensor + catalyst				X	X	X	X
Compression 7,2:1						X	X
Compression 8,7:1				X			
Compression 9,25:1	X	X	X		X		
ELCD-system (see section 234)			X	X	X	X	X

[1] Automatic gearbox only

CRANKCASE VENTILATION

The crankcase ventilation is completely enclosed. The ventilation system consists of a 3-way nipple on the valve cover from which a small-bore hose runs to the inlet manifold and a large-bore hose to the inlet system.
The large bore house is connected to the throttle housing. The sizes 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 case the gases are evacuated through the larger hose to the throttle valve housing and thence to the engine.

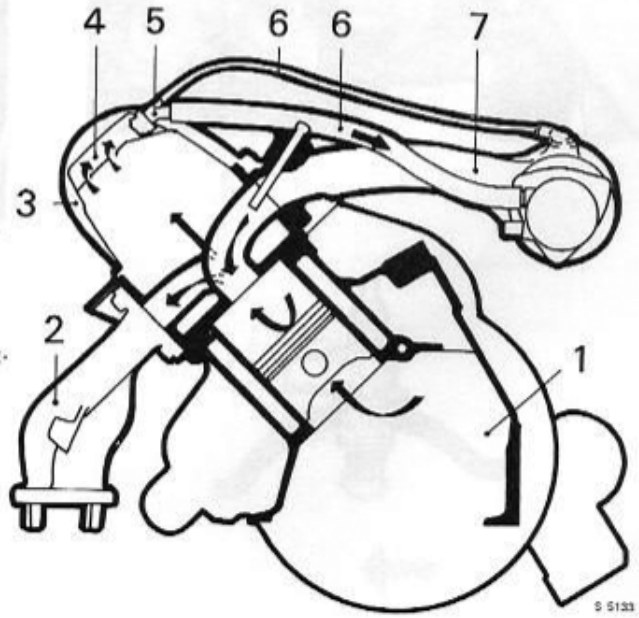


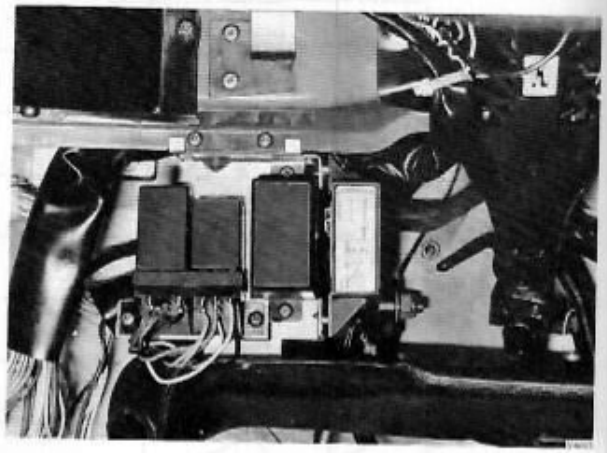
DIAGRAM OF CRANKCASE VENTILATION

1. Crankcase
2. Exhaust manifold
3. Valve cover
4. Oil trap and flame guard
5. Nipple with restriction
6. Hose
7. Inlet manifold

Deceleration device

The deceleration device is designed to maintain combustion during engine overrun to prevent the emission of unburned hydrocarbons.
The following types of deceleration device are used:
- Electric, speed-controlled devices (Turbo)
- Vacuum-controlled devices for injection engines

The electric deceleration device consists of an electronic speed transmitter, located below the instrument panel, which is actuated by electric pulses from the speedometer, and the solenoid at the throttle housing.



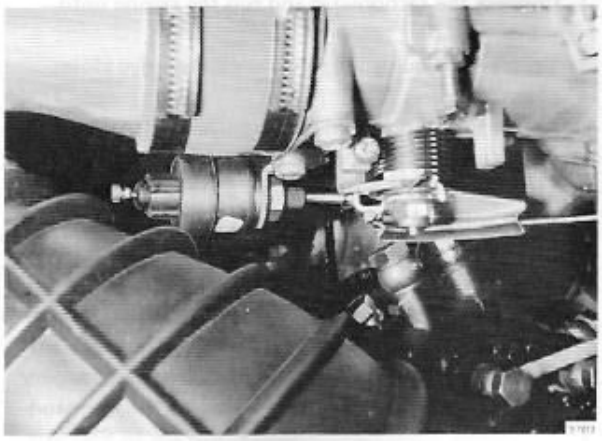
The solenoid serves as a variable idling stop. During engine overrun, the idling speed is increased (approx. 1 550 rev/min) if the speed of the car exceeds 10 mph (30 km/h).

Checking

Checking should include the setting of the deceleration valve (increased idling speed) and the functioning of the speed transmitter (cut-out speed).

A. Engine speed (solenoid setting):

1. Run the engine until it is warm and connect a tachometer.
2. Disconnect the +cable from the solenoid and connect battery voltage to the solenoid.
3. Rev up the engine and then release the throttle. Check that an increased idling speed of 1 500 rev/min is obtained.
   Make any adjustments by means of the solenoid adjusting screw and then recheck the setting by revving the engine again.



> CAUTION
> The solenoid does not open the throttle valve. Its function is merely to prevent the throttle closing completely during engine overrun at speeds in excess of about 18.6 mph (30 km/h).

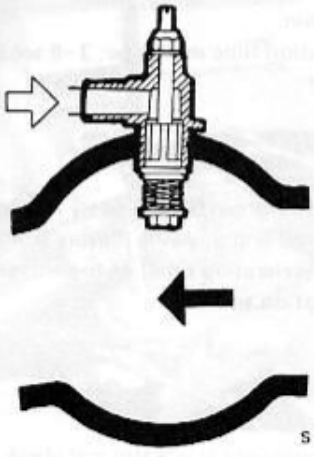
B. Speed (functioning of speed transmitter):

1. Connect a test lamp (0.1 W max.) between the +cable of the solenoid and earth. Place the lamp so that it is visible from the driver's seat.
2. Test drive the car, declutch and let the car cruise at about 25.0 mph (40 km/h). Brake lightly and check that the test lamp goes out at about 18.6 ± 3.1 mph (30 ± 5 km/h). (The functioning of the speed transmitter can also be checked by listening for the time at which the engine speed drops or by means of a tachometer.)

The vacuum-controlled deceleration valve consists of a spring-loaded valve cone, actuated by the vacuum in the inlet manifold.

Checking

1. Run the engine until it has been thoroughly warmed up.
2. Connect a tachometer and adjust the idling speed to 875 rev/min.
3. Rev up the engine to 3.000 rev/min and measure the time (with stop watch) between the release of the throttle and the moment at which the engine returns to 875 rev/min.
   The deceleration time should be: 4–6 sec.



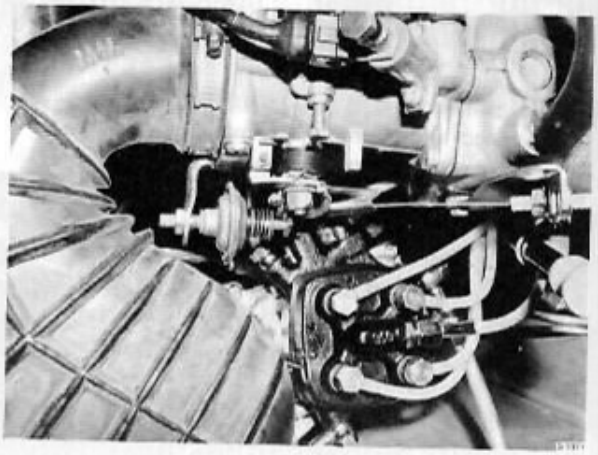
S 5634

Adjustment

1. Connect the tachometer and run the engine until warm.
2. Unscrew the adjusting screw until the valve closes completely.
3. Adjust the idling speed to the correct setting by means of the screw on the throttle housing.
4. Turn down the adjusting screw so that the engine speed will be 1.600 rev/min.
5. Back off the adjusting screw two turns from this position.
6. Make the fine adjustment of the idling speed by means of the adjusting screw on the throttle housing.
7. Check the deceleration time and make any necessary fine adjustments.

CAUTION

If the radiator fan cuts in while the deceleration time is being measured, the readings will be faulty. This can be avoided by disconnecting the cable to the thermal switch for the fan for a few moments while the time is being recorded.



Dashpot

The dashpot is installed on the throttle housing and acts to mechanically dampen the throttle valve when it shuts.

Check

1. Run the engine until it has been thoroughly warmed up.
2. Connect a tachometer and adjust the idling speed to 875 rev/min.
3. Rev up the engine to 3.000 rev/min and measure the time (with stop watch) between the release of the throttle and the moment at which the engine returns to 875 rev/min.
   The deceleration time should be: 3–6 sec.

Setting

The retardation time can be altered by loosening the dashpot's lock nut and screwing it away from the throttle stop (shorter deceleration time) or towards the stop (longer deceleration time).

Basic setting

1. Run the engine until it is warm and check the CO reading and the ignition setting.
2. Rotate the throttle lever and check that the dashpot's

rod strikes the stop at 2 500 ± 100 r.p.m. (use a tachometer).

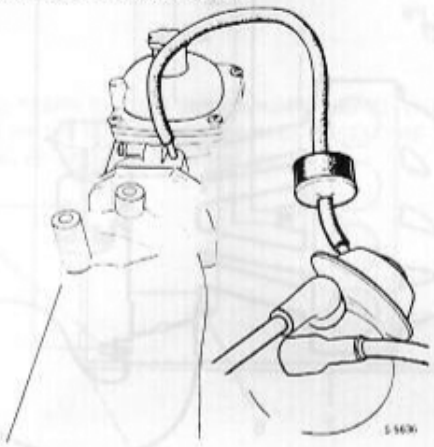
3. Rev up the engine and check that the engine speed drops to idling speed with the prescribed delay (see "Check").

Delay valve

A delay valve is mounted in the vacuum passage between the carburetor (throttle valve housing) and the vacuum control unit of the distributor. The valve delays the formation of a vacuum by around 6 seconds. The ignition advance is therefore also delayed during acceleration and the emission of nitric oxide (NO_x) is reduced.

CAUTION

The white end of the delay valve should be towards the vacuum control unit of the distributor. It is also important that the valve is fitted with the shorter hose running between the valve and the vacuum control unit of the distributor.



NOTE

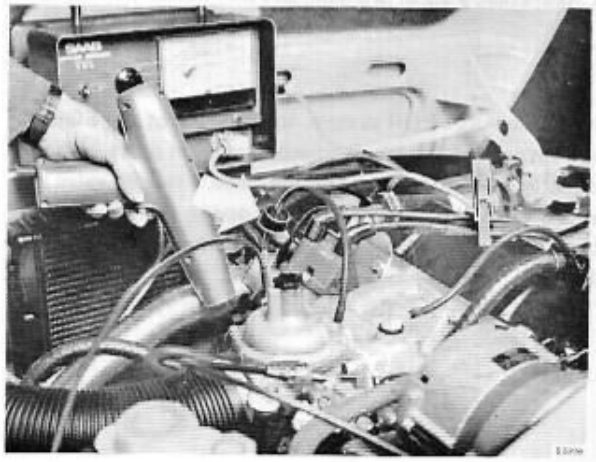
When the suction line is to be disconnected (e.g. in conjunction with checking of ignition timing), always disconnect the hose at the carburetor (throttle housing). There will otherwise be a risk of dirt entering and clogging the delay valve.

Checking

Checking is carried out by means of a stop watch, a tachometer and a stroboscope.

1. Connect the tachometer and stroboscope.
2. Let the engine run at normal idling speed.
3. a. Have an assistant open the throttle valve suddenly and let the engine run at around 3.000 rev/min. Take the time from the moment the throttle valve was opened.
   b. Check the firing point using the stroboscope light. The vacuum regulator should cut in after 6 seconds (± 2 seconds) and the ignition advance should be increased.

Faulty delay valves should be replaced.



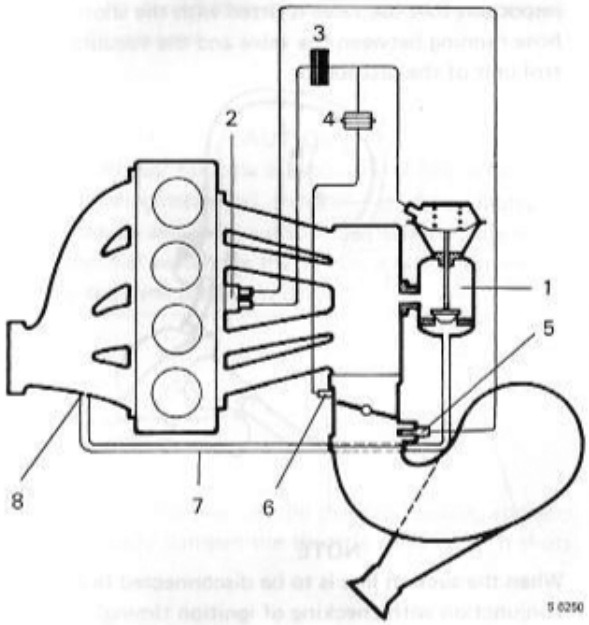
EGR-SYSTEM (EXHAUST GAS RECIRCULATION)

In order to reduce the amount of nitrous oxide (NO_x) in the exhaust gases, a certain portion of the gases must be recirculated to the inlet side.

When the EGR valve opens, a small quantity of the exhaust gases flows from the exhaust manifold via the EGR crosspipe and the EGR valve to the inlet manifold. The EGR valve is controlled by means of vacuum from the throttle valve housing.

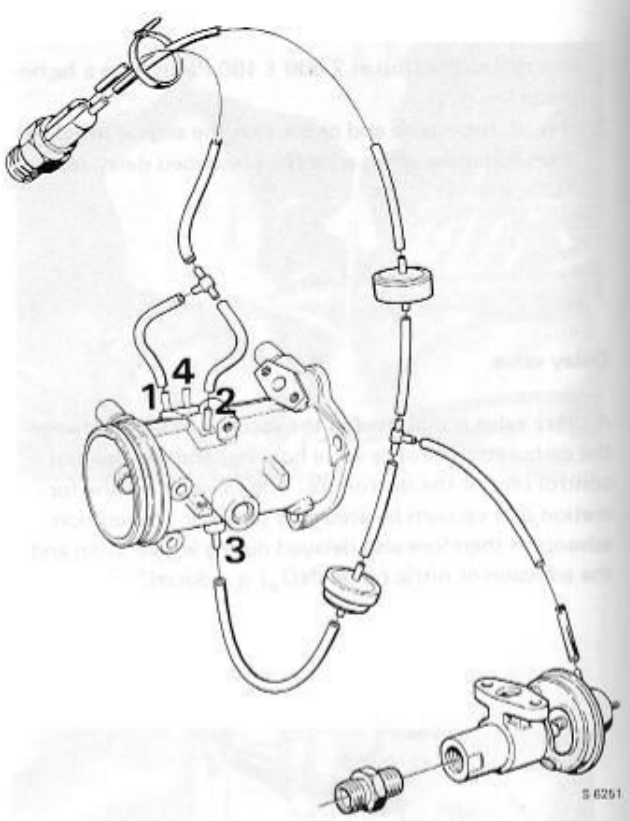
EGR two-port

The system includes the following components:
EGR-valve
PVS-valve
Vacuum holding valve
Vacuum release valve
EGR crosspipe
Throttle valve housing with two-port EGR connections and connection for release valve.



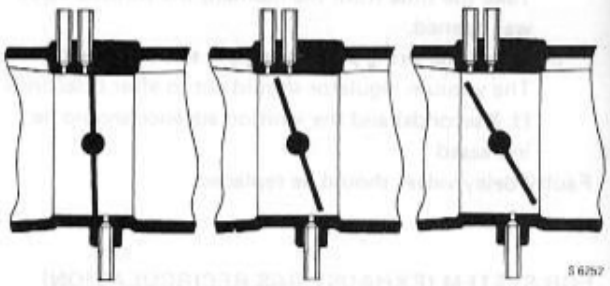
EGR, TWO-PORT SYSTEM
1. EGR valve
2. PVS valve
3. Holding valve (white end towards PVS valve)
4. Release valve
5. Two-port vacuum connection
6. Release vacuum connection
7. EGR crosspipe
8. Restriction, ø 0.2 in (ø 5 mm), cars with manual transmission

In the two-port EGR system, the opening of the EGR valve is regulated by two adjacent vacuum ports in the throttle valve housing, a holding valve, a release valve and a PVS valve. When the EGR valve opens, a small proportion of the exhaust gases are recirculated to the inlet manifold.



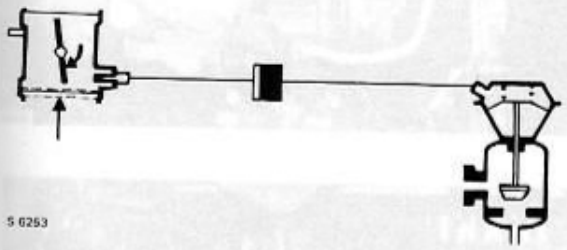
VACUUM PORTS IN THE THROTTLE VALVE HOUSING
1, 2. EGR ports, PVS valve
3. EGR port, release valve
4. Vacuum outlet, distributor

As the throttle valve is opened slightly and the valve passes the two vacuum ports, a gradual increase in the vacuum is obtained and, consequently, a gradual opening of the EGR valve.



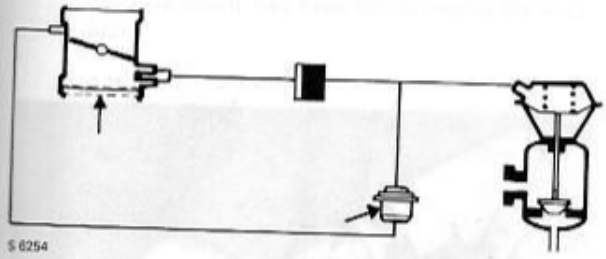
THE THROTTLE VALVE IS SLIGHTLY OPENED

When the throttle valve is opened wide, whereupon the vacuum in the ports diminishes, the earlier vacuum at the EGR valve is maintained for about six seconds by means of the holding valve.



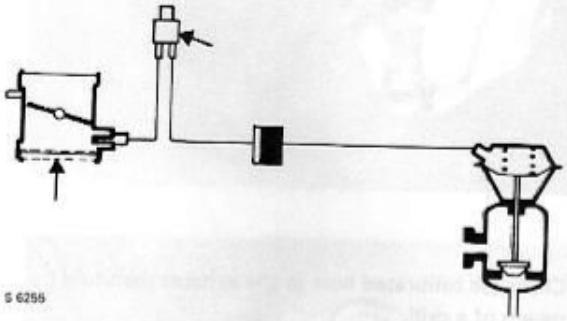
ACCELERATION: THE HOLDING VALVE MAINTAINS THE VACUUM AT THE EGR VALVE FOR ABOUT SIX SECONDS

When the throttle valve is closed, the EGR valve must also be closed to prevent rough idling of the engine. A release valve is fitted for this purpose and the valve is regulated by an additional port located inside the throttle valve housing. Thus, the vacuum maintained by the holding valve is released.



THROTTLE VALVE CLOSED: THE RELEASE VALVE ADMITS ATMOSPHERIC PRESSURE TO THE EGR VALVE

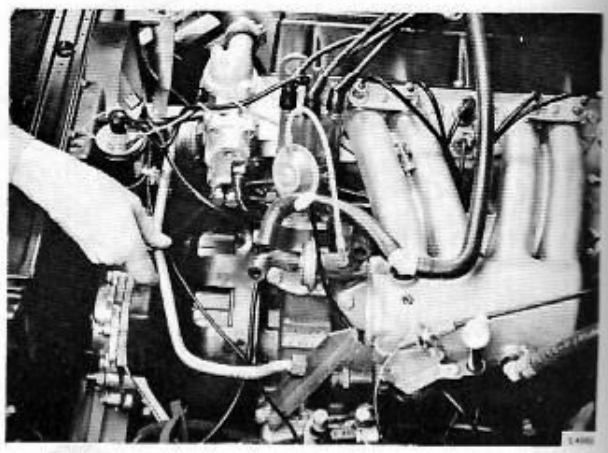
When the temperature of the engine is below approx. 104°F (40°C), the PVS valve shuts off the vacuum between the throttle valve and the EGR valve to improve the running of the engine during the warming-up period.



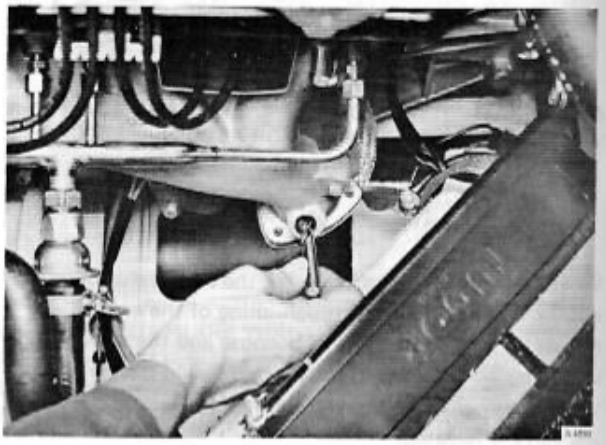
ENGINE TEMPERATURE BELOW 104°F (40°C): THE PVS VALVE SHUTS OFF THE VACUUM BETWEEN THE THROTTLE VALVE AND THE EGR VALVE

EGR service

1. Remove the throttle valve housing, EGR crosspipe and EGR valve.



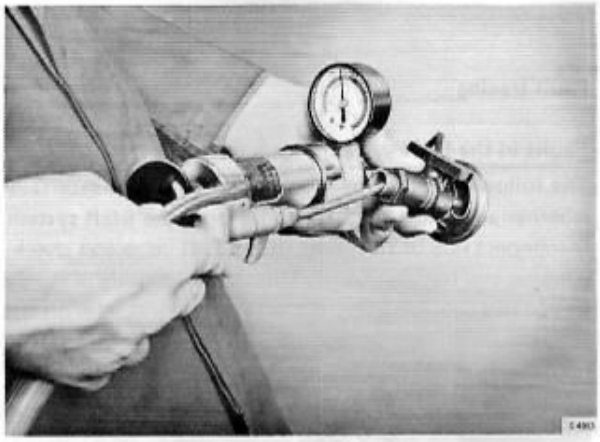
2. Clean the calibrated hole in the exhaust manifold by means of a drill.
EGR two port, manual transmission: ø 0.20 in. (ø 5 mm)
EGR two port, automatic transmission: ø 0.39 in. (ø 10 mm).



3. Clean the EGR crosspipe by flushing with a suitable solvent (e.g. trichloroethylene). Pipes with thicker deposits of soot should be cleaned by means of a wire and then blown clean.

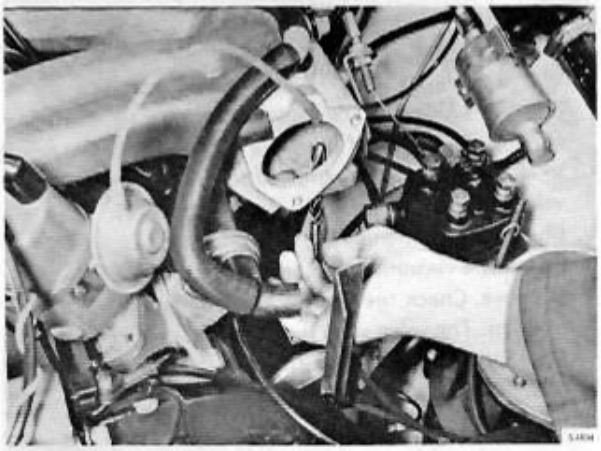
4. Clean the inlet and outlet of the EGR valve by means of a rotary wire brush. Take care not to damage the valve stem during cleaning of the outlet.

Flush out the valve with trichlorethylene. By means of a vacuum tester, create a vacuum in the vacuum connection to open the valve. At the same time, blow compressed air through the valve.



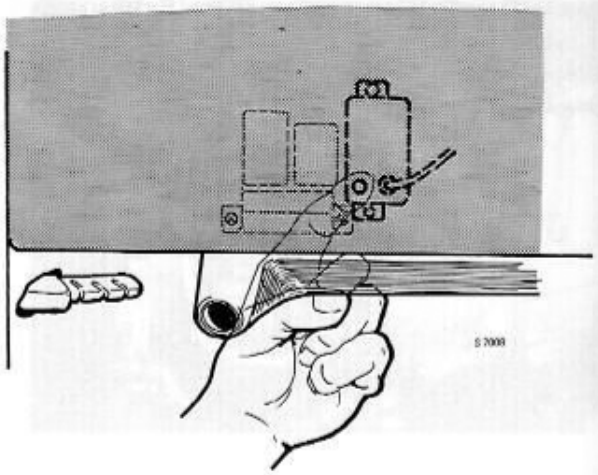
Check the opening and closing of the valve by means of the vacuum tester.

5. Clean the hole in the inlet manifold wall by means of a 0.39" (10 mm) dia. drill and remove any soot deposite which may have formed inside the manifold.



6. Fit the EGR valve with a new gasket. Connect the hose from the PVS valve.
7. Fit the EGR crosspipe to the exhaust manifold and the EGR valve. Clamp the pipe at the throttle valve housing.
   Ensure that no electric cables or hoses can come into contact with the EGR crosspipe.
8. Mount the throttle valve housing together with a new gasket and connect the rubber bellows, the vacuum hoses and throttle cable.
9. Start the engine and check that there are no leaks in the system.

10. Reset the counter unit for the EGR-service warning lamp by pressing the push button on the counter unit.
    The counter unit is located at the flasher relay bracket under the instrument panel.
    THE PUSH BUTTON IS ACCESSIBLE by inserting the hand under the guard panel.
    The push button is located close to the wire connection to the counter unit.
11. Replace the cover.
12. Fit the screen below the instrument panel.



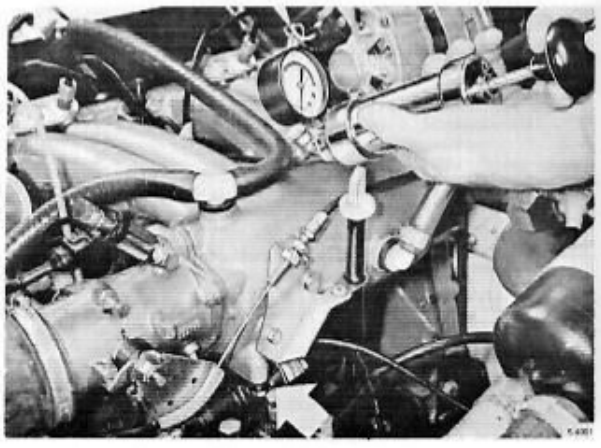
Fault tracing

Faults in the EGR system – general

The following simple test can be carried out to ascertain whether any faults occurring arise from the EGR system: Disconnect one of the hoses to the PVS valve and check whether the fault remains. (This does not apply if the EGR valve should stick.) If the fault remains, it is probably not connected with the EGR system.

EGR valve

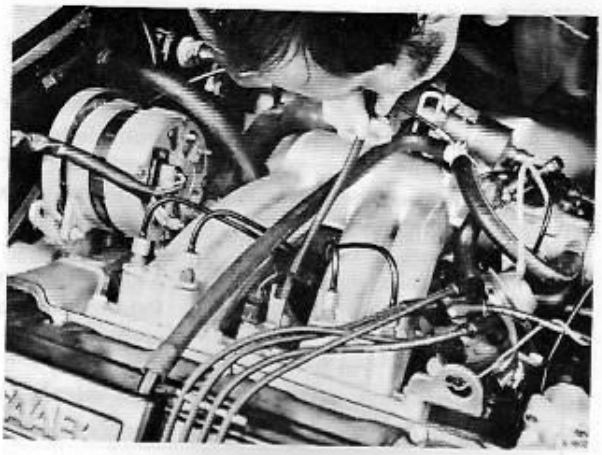
a. Checking valve movement:
   Remove the hose between the PVS valve and the EGR valve at the connection of the former. Suck the end of the hose to create a vacuum of at least 100 mm Hg (4 inches Hg) at the EGR valve and then release the pressure suddenly. The valve should now be heard to close quite clearly. If the valve cannot be readily heard to close, it should be removed for inspection. Faulty valves should be replaced.
b. Checking the opening pressure:
   Connect a vacuum pump and gauge to the EGR valve as above. Check the reading at which the valve starts to open. The valve stem is visible in the opening between the diaphragm housing and the valve body. The opening pressure should be 60 ± 5 mm Hg (2.4 ± 0.2 inches Hg).



CHECKING THE OPENING PRESSURE
(The valve stem is visible at the arrow)

Checking the PVS valve

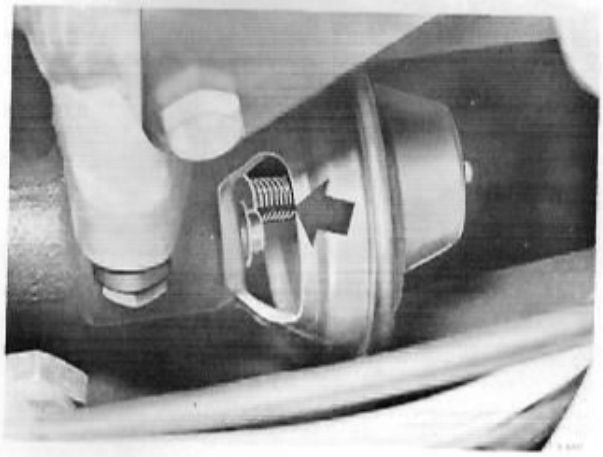
Check the valve by first disconnecting it and then blowing through it. When the engine is cold the valve should remain closed. When the engine is warm, the valve should open. Faulty valves should be replaced.



Checking the cut-in speed (two port system)

1. Warm-up the engine and connect a revolution counter.
2. Rev the engine and check the opening of the EGR valve. The valve should open at fast-idling speed (see below). The valve stem is visible between the valve body and the vacuum control unit.

Type	Engine speed (fast idling) at which the valve should open
EGR two port, manual transmission	2 600–3 200 rev/min
EGR two port, automatic transmission	2 300–2 900 rev/min

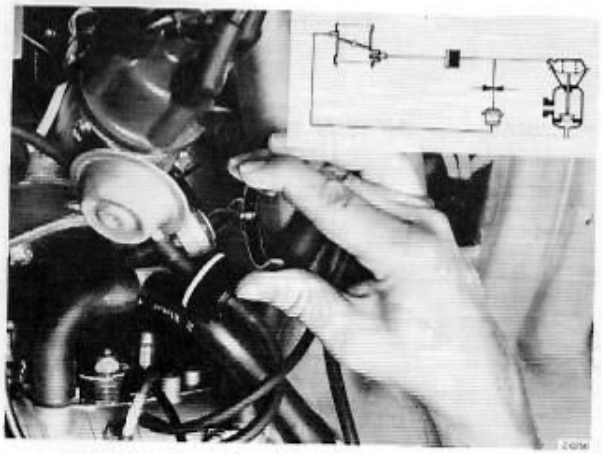


Checking the holding valve (two-port system)

1. Rev the engine to open the EGR valve completely (approx. 3 000–3 500 rev/min).
2. Clamp together the hose between the release valve and the three-way nipple in the line to the EGR valve.
3. Let the engine drop to idling speed and check that the EGR valve remains open for an additional 6 seconds.

Checking the release valve (two-port system)

1. Rev the engine to open the EGR valve completely.
2. Let the eingine drop to idling speed and check that the EGR valve closes immediately.

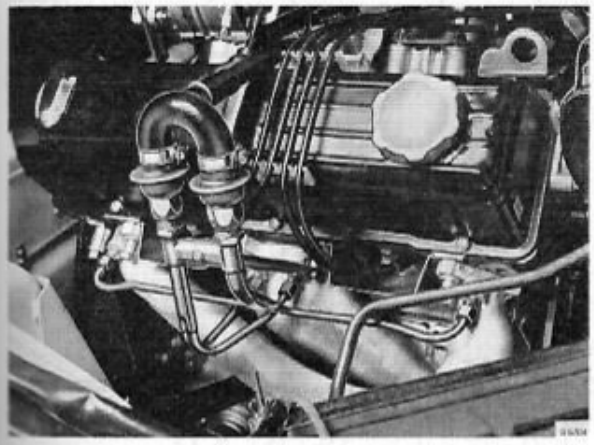


Fault tracing chart for EGR-system

Sympton	Probable fault	Fault tracing, remedy
1. Engine runs poorly or not at all at idling speed	EGR valve stuck in open position	See EGR valve (a) page 254–10
2. Engine stalls when dropping from high speed to idling speed	Two-port system: Release valve not working	See release valve page 254–11
3. High emissions HC	EGR valve has stuck	See EGR valve (a) page 254–10
4. Poor driveability with cold engine	PVS valve constantly actuated	See PVS valve page 254–10

PULSE AIR SYSTEM

Federal cars are equipped with a pulse air system.
In common with the air injection system, the purpose of the pulse air system is to supply air to the exhaust gases from the engine to bring about continued oxidation of the hydrocarbons and carbon monoxide in the exhaust system.
The system comprises two check valves which are connected to the exhaust manifold by means of dual inlet pipes. The pipes open into the exhaust valves where the exhaust gases are hot, which is important to achieving efficient oxidation in the exhaust system.
The check valves are grouped so that one goes to No. 1 and No. 4 cylinders and the other to No. 2 and No. 3 cylinders.

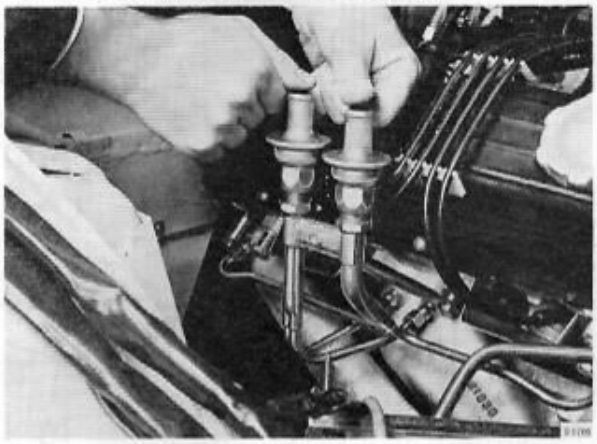


PULSE AIR SYSTEM

Air is supplied to the valves by means of a hose from the air cleaner.
The function of the pulse air system is based on the vacuums occurring in the exhaust system during the pulses.
For a brief moment immediately prior to the closing of the exhaust valve (at the start of the suction stroke), a vacuum is produced in the exhaust manifold whereupon the check valve opens and a small amount of air is sucked into the exhaust manifold.

Inspection service

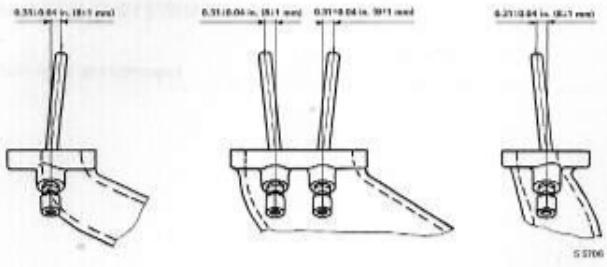
Remove the hose between the air cleaner and the check valve and check that it is free from dents or cracks.
Run the engine at idling speed and check that air is sucked through the check valves. Suction should be felt with the thumbs placed over the openings.



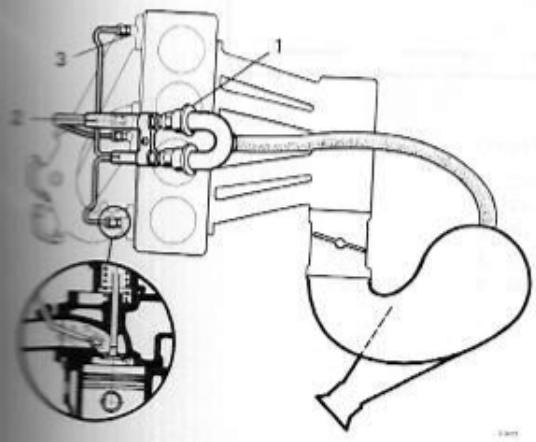
CHECKING THE PULSE AIR SYSTEM

Exhaust manifold

In the event of the exhaust manifold or pulse air inlet pipe being replaced, align the latter before mounting the exhaust manifold.



ALIGNING THE PULSE AIR INLET PIPES

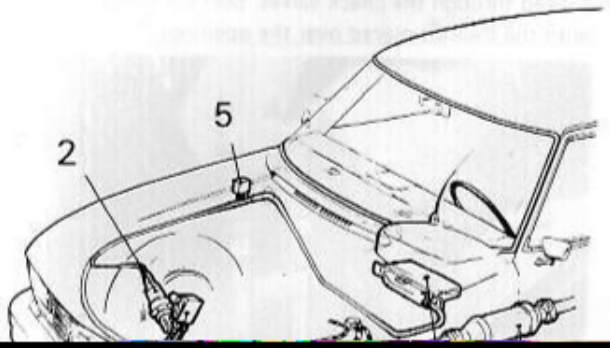


PULSE AIR SYSTEM
1. Check valves
2. Distribution pipes
3. Inlet pipes

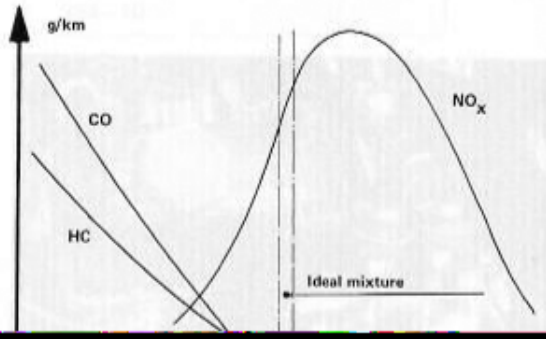
OXYGEN-SENSOR REGULATED CI-SYSTEM (LAMBDA,)

General

Cars for California and high-altitude districts are equipped with a special continuous injection system combined with an electronic control system which is regulated by an oxygen sensor (also known as Lambda sensor) located in the exhaust manifold.
The cars are also fitted with a three-component catalytic converter which is located between the exhaust manifold and muffler in the exhaust pipe.



The three-component catalytic converter is capable of reducing the content of CO, HC and NO_x in the exhaust gases down to the prescribed limits, on the condition that accurate regulation of the air-to-fuel ratio can be maintained under all driving conditions. The chart below shows the extremely narrow range within which the converter can work. Should the air-to-fuel ratio move outside this field, then the limit governing one or more of the relevant gases will be exceeded.
The sensor-regulated injection system ensures that the air/fuel mixture is continually kept within the limits shown.

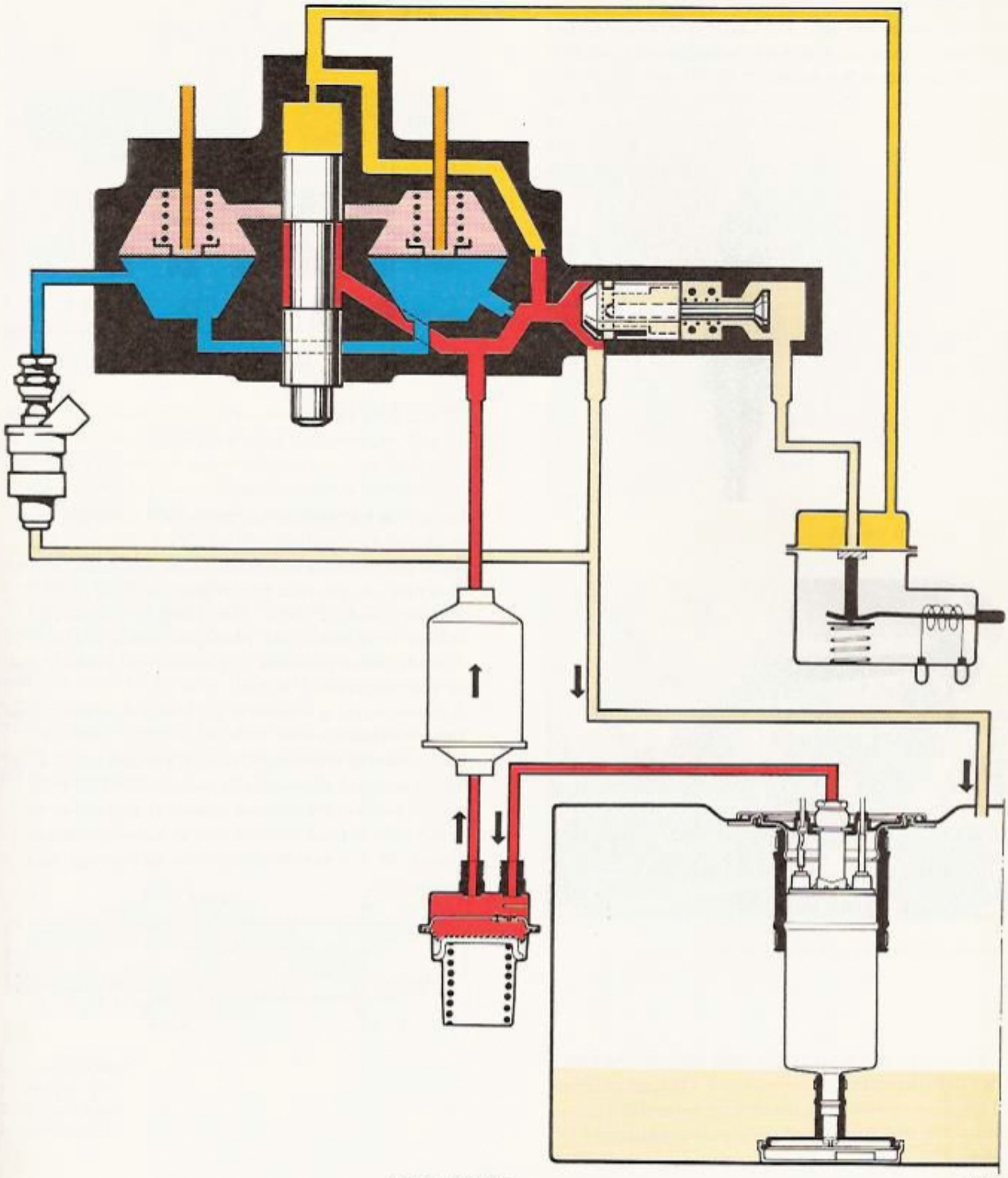


Oxygen-sensor regulated fuel system

In contrast to the earlier CI-system, the oxygen-sensor regulated CI system has an additional control function:

to a modulating valve which regulates the return flow to the fuel tank and thereby the pressure upstream of the valve.

Since the pressure difference between the upper and



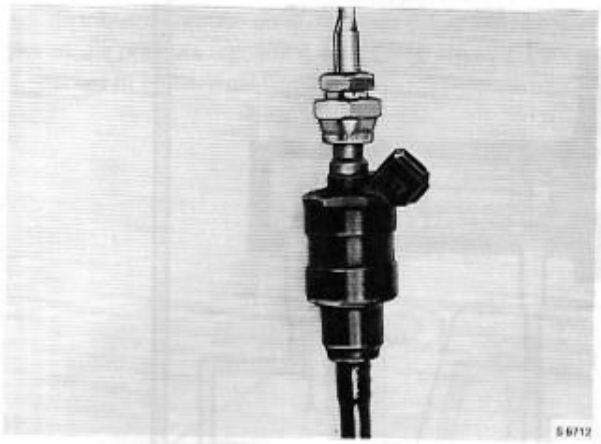
FUEL SYSTEM

S 6297

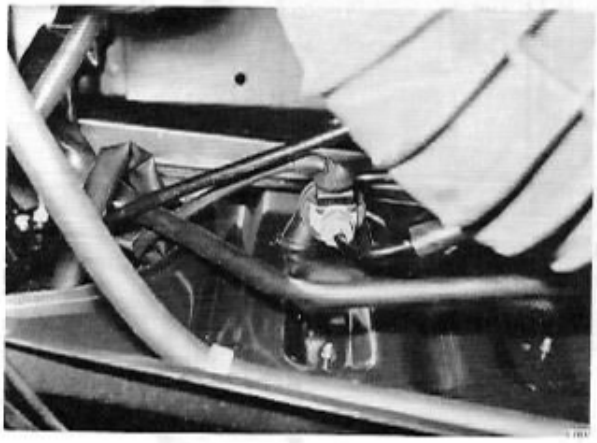
- Line pressure
- Upper chamber pressure
- Lower chamber pressure
- Injection pressure
- Control pressure
- Return, no pressure

Modulating valve

The modulating valve comprises an injection valve of modified design from the EBI system. The valve operates (opens and closes) at a constant frequency of 70 Hz as soon as the engine is running.

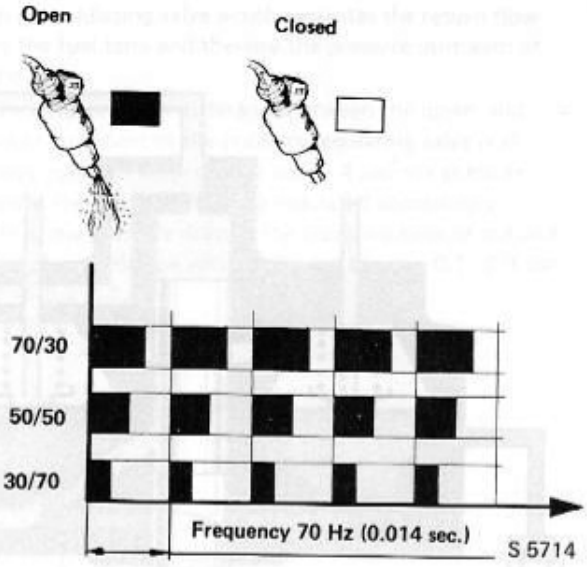


MODULATING VALVE



LOCATION OF MODULATING VALVE

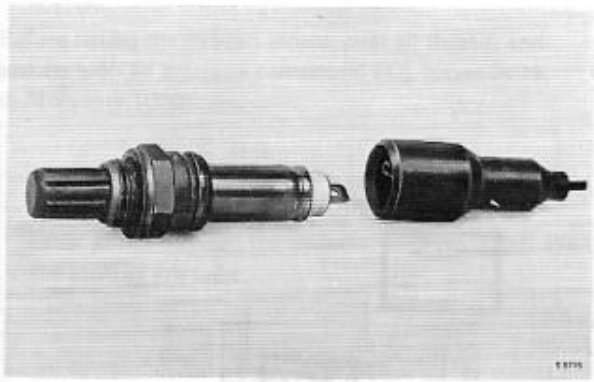
The pulse relation is the relationship between the time the valve is open to when it is closed. Through variation of the pulse relation, it is possible to regulate the pressure in the chambers of the pressure regulating valves.



PULSE RELATION

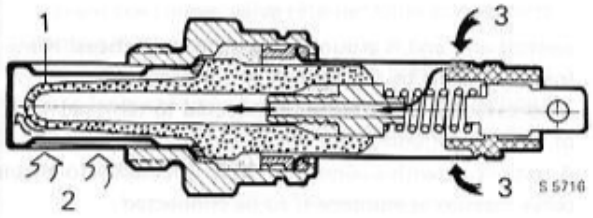
During the warm-up period (before the catalytic converter has started to work), or in the event of a fault arising in the system, a fixed pulse relation of 60/40 will be obtained, i.e., the valve will be open for 60 % of the time and closed for 40 %. This is roughly the average relation when the enigne is idling or parially loaded.
A longer opening interval (e.g. 80 %) will create a richer air/fuel mixture.
A shorter opening interval (e.g. 40 %) will create a leaner air/fuel mixture.
Enrichment of the mixture when the engine is under full load is achieved by means of a switch on the throttle valve. This fixes the opening interval at approx. 45 %, which gives a richer mixture than an opening interval of approx. 30 %, which would oterwise be the case under full load.

Oxygen sensor



OXYGEN SENSOR

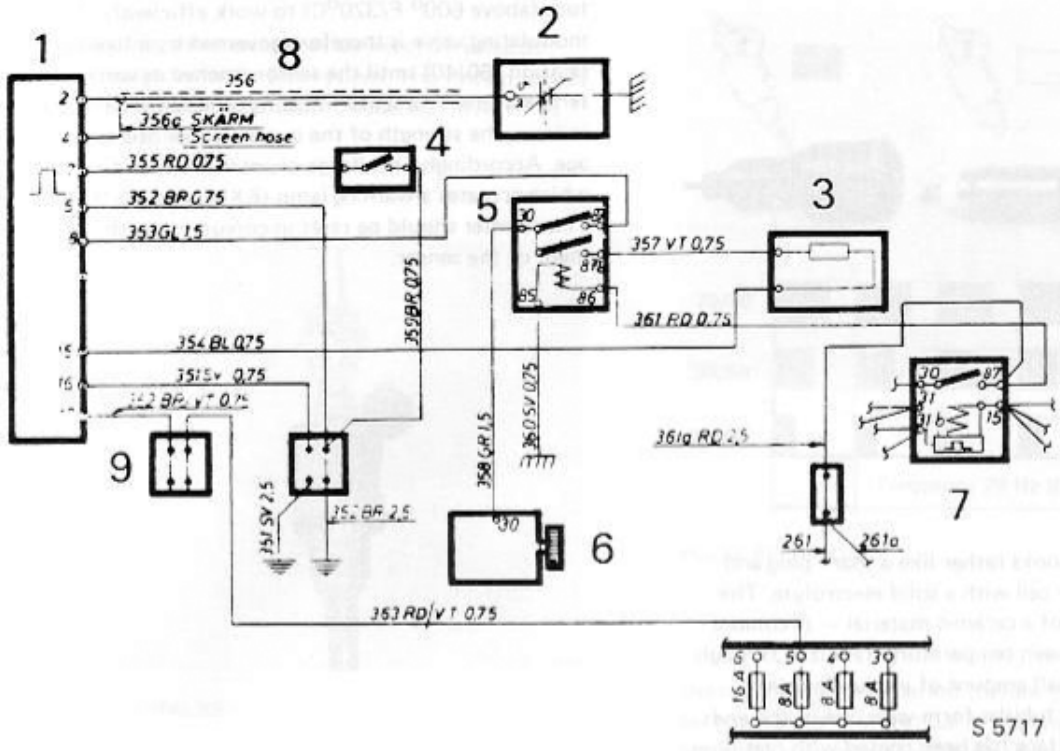
The oxygen sensor looks rather like a spark plug and comprises a primary cell with a solid electrolyte. The electrolyte consists of a ceramic material – zirconium oxide – which has been temperature stabilized through the addition of a small amount of yttrium oxide.
The electrolyte is in tubular form with one of the ends blanked off. The surface has been coated with platinum to make it electrically conductive.
The outside of the electrolyte is exposed to the exhaust gases and the inside to ambient air. When there is a difference in the partial oxygen pressure between the outside and inside of the tube, there is an increase in voltage which raises the ideal air-to-fuel ratio.
This voltage increase is then amplified in the control unit and used to regulate the impulses transmitted to the modulating valve.



OXYGEN SENSOR
1. Primary cell
2. Exhaust gases
3. Ambient air

The oxygen sensor must be kept at a specified temperature (above 600° F/320°C) to work efficiently. The modulating valve is therefore governed by a fixed pulse relation (60/40) until the sensor reaches its working temperature. The sensor must be replaced after 15,000 miles as the strength of the output signal decreases with age. Accordingly, a mileage counter has been fitted which actuates a warning lamp (EXH) after 15,000 miles. The counter should be reset in conjuction with replacement of the sensor.

Electrical system, oxygen-sensor regulation



ELECTRICAL SYSTEM

1. Control unit
2. Oxygen sensor
3. Modulating valve
4. Throttle valve switch
5. Sensor regulating relay
6. Starter
7. Pump relay (CI-system)
8. Suppression for sensor circuit
9. Connecting piece for connection of pulse measuring equipment.

Current to the oxygen sensor regulating relay is supplied from the pump relay (CI-system) when the fuel pump is operating and from terminal 30 (battery +) via the starter motor. Thus, power goes to terminal 8 of the control unit and to terminal 15 via the modulating valve.
The throttle valve switch actuates the control unit across terminals 5 and 7 which are grounded when the throttle valve is fully open. A pulse relation with longer opening intervals is thereby achieved, providing a richer fuel/air mixture.
The oxygen sensor is connected to terminal 2 of the control unit and is grounded through the exhaust manifold. The cable to the oxygen sensor is provided with a suppressor harness which is connected to terminal 4 of the control unit.
A test circuit with a connector piece is included to enable pulse measuring equipment to be connected.
The connector piece is located at the relay holder and cables run to terminal 17 (–) on the control unit and terminal 15 (+) in the primary circuit of the ignition system.

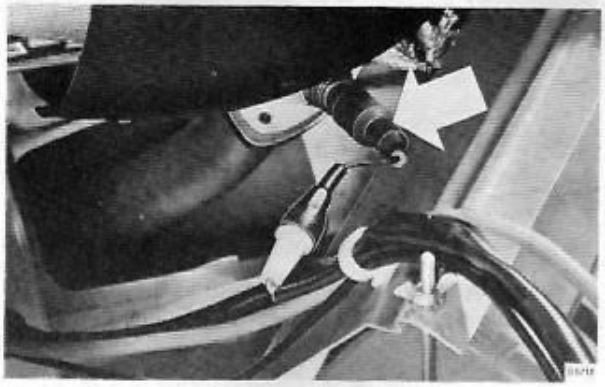
Removal and fitting of oxygen sensor

Before fitting the oxygen sensor, coat all threads and gaskets with an antiseize compound (e.g. Never Seize or Molycote 1000)

N.B.
The joint between the oxygen sensor and the exhaust manifold must be gas-tight. Check that the other joints between the cylinder head cover and the muffler are tight.

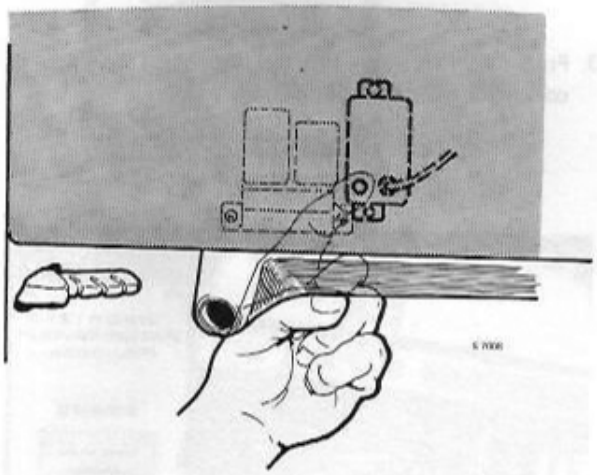
CAUTION
The oxygen sensor is highly sensitive to knocks and must be handled carefully.

Tightening torque	40 Nm (29 ft.lb.)



OXYGEN SENSOR

Reset the counter unit for the EGR-service warning lamp by pressing the push button on the counter unit. The counter unit is located at the flasher relay bracket under the instrument panel.
THE PUSH BUTTON IS ACCESSIBLE by inserting the hand under the guard panel.
The push botton is located close to the wire connection to the counter unit.

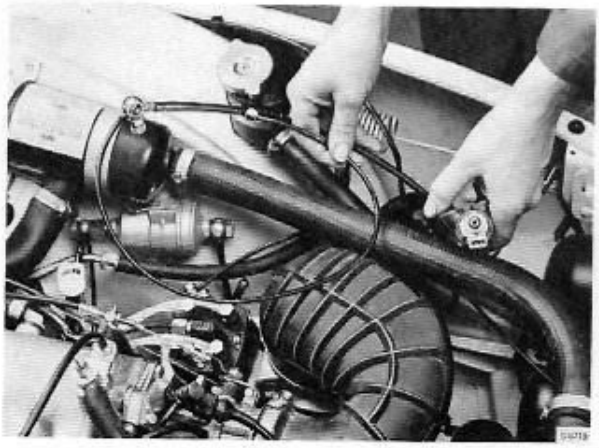


Removal and fitting of modulating valve

N.B.
During removal and fitting of the modulating valve, prevent the rubber valve retainer from coming into contact with gasoline.
The rubber is of a special grade to prevent vibrations from the valve being transmitted to the body. The rubber swells considerably if allowed to come into contact with gasoline.

Removal

1. Disconnect the electric cable.
2. Disconnect the small-bore line to the modulating valve. Grip the hexagonal nut closest to the hose (14 mm across flats) and undo the valve nut (17 mm across flats).
3. Disconnect the modulating valve return line from the warm-up regulator, from the fuel distributor and the joint in the return line on the latter.
4. Remove and disconnect the valve and return lines.

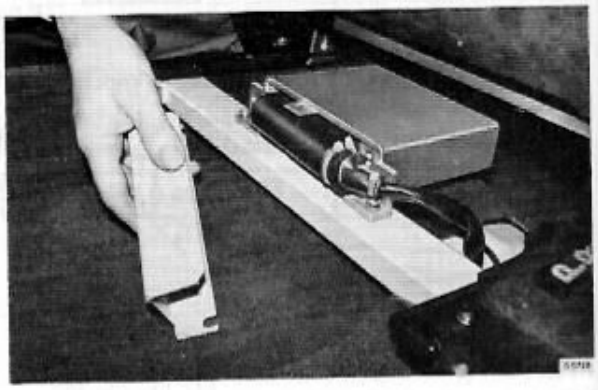


Fitting

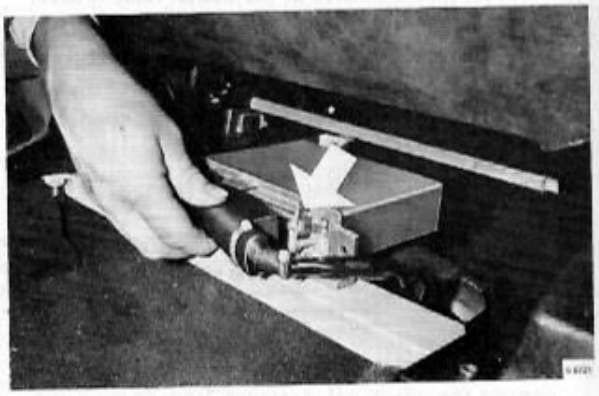
1. Fit the valve and return lines.
2. Connect the return line from the modulating valve to the fuel distributor, to the fuel distributor return line and to the warm-up regulator.
   Fit new seals.
3. Connect the small-bore hose to the valve.
4. Connect the electric cable to the valve.

Removal and fitting of control unit

1. Slide the passenger seat as far back as it will go.
2. Remove the cover plate from in front of the control unit.



3. Press the catch to the side and disconnect the cable connector from the control unit.

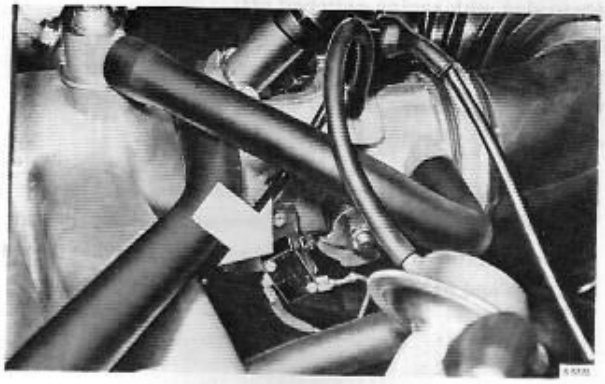


4. Remove the three control unit retaining screws and remove the control unit.

Fit in the reverse order.

Throttle valve switch, fitting position

Fit the throttle valve switch in such a way that when the throttle valve is fully open there will be clearance of between 0.008 and 0.20 in. (0.2 and 0.5 mm) at the switch lever.



> CAUTION
> The switch will be damaged if the lever is pushed in too far.

Fault-tracing

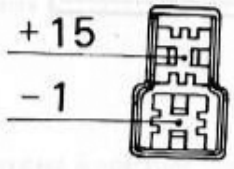
Before tracing possible faults in the oxygen-sensor regulating system itself, make sure that the symptoms are not caused by mechanical faults in the engine, ignition system or other components in the injection system. For example, an incorrectly adjusted exhaust valve may have a considerable effect on regulation of the system.

Measuring the pulse relation

A special testing instrument—designated Bosch KDJE 7453—is available for measuring the pulse relation.

The equipment is connected to a special 2-pole test socket, located by the relay holder.

It is also possible to use certain types of dwell angle testers. The scale values must be corrected accordingly and possibly also marked on the scale itself.
Connect the tester to battery voltage.
Connect the primary connections of the dwell angle tester as follows:



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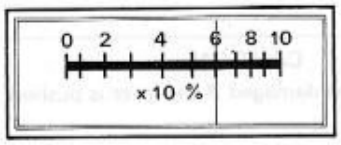
The reading on the instrument indicates the proportion of the pulse that the valve is open.

Example With a pulse relation of 60/40, the instrument will indicate 60±10%.

Measuring with engine switched off:

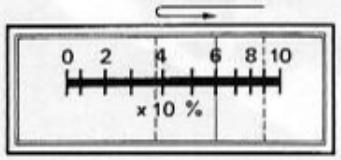
With the engine switched off, connect a jump lead across terminals 30 and 87 in the relay holder) and switch on the ignition. The modulating valve should then operate audibly and evidently.

1. With the sensor connected, the reading should be 60 ± 10 %. This is a fixed pulse relation which is maintained before the sensor has reached its working temperature and in the event of the sensor being defective.

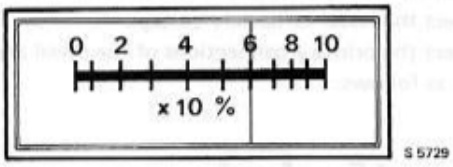


2. By disconnecting the cable from the oxygen sensor and grounding it, it is possible to obtain a reading in excess of 75 %. Greatest scope exists here for the regulating system to enrich the fuel/air mixture.

3. When the sensor cable is disconnected from ground, the mixture will first become leaner and the reading will gradually drop to below 50%. It will then increase



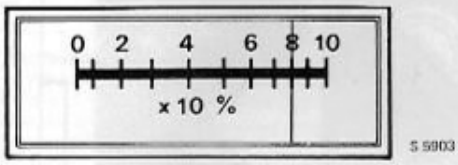
again and steady at 60±10%. Reconnect the sensor cable.



4. Depress the throttle valve switch operating lever so obtaining a fixed stroke ratio for wide-open throttle. The following stroke ratio figures have been issued:

   - Model 1979, excl. Turbo
   - Model 1979, Turbo
   - Model 1980–, excl. Turbo
   - Model 1980–, Turbo

PULSE RELATION 45/55 (Not valid for Turbo cars)



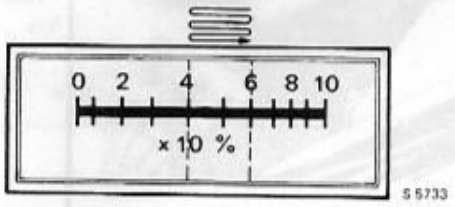
PULSE RELATION 80/20
(TURBO)

Measuring with the engine running:

With the engine running, it is possible to observe variations due to the regulation of the pulse relation.

1. When the oxygen sensor is cold (up to about 1 minute after cold starts) a fixed pulse relation will be obtained. Reading: 60±10%.

2. When the engine is warm and the CO-value set correctly, at ilding speed, the reading should oscillate around the centre of the scale.



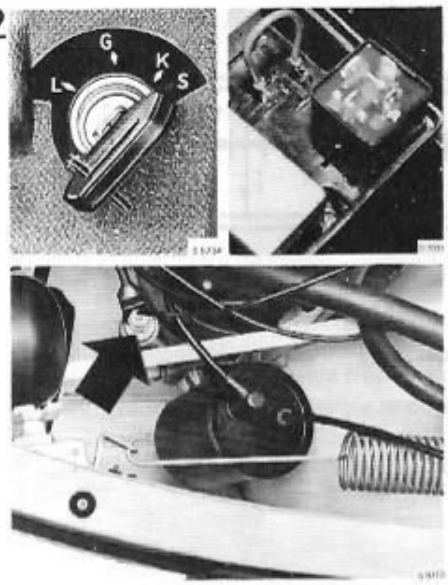
If the system is operating close to one of the ends of the scale, there is a danger that there will not be sufficient scope for satisfactory regulation in a given direction. In such a case, an automatic monitoring system will cut in (after a certain delay), whereupon the system will be regulated at a fixed pulse relation (60 % – open).

Fault tracing scheme (oxygen sensor regulated CI-system)

1

If the engine is warm, let it cool for about 3 minutes. Connect the pulse relation measuring instrument.

2



Switch on the ignition. Disconnect the fuel pump relay and connect a jump lead across terminals 30 and 87 in the relay holder. Audible and apparent operation of modulating valve. Pulse relation 60 ± 10%. (It will take a few seconds before the control unit regulates the pulse relation regularly.)

Yes

No

Modulating valve operating but incorrect pulse relation.

Check that the measuring equipment is properly connected. Check the pulse relation. Is the pulse relation as specified?

Yes

No

Disconnect the oxygen sensor line. Pulse relation should approach 60 %.

Yes

Oxygen sensor defective.

No

Control unit defective.

Modulating valve not operating. Reading other than 60 % or 0.

Check the modulating valve: Coil resistance, 2 to 3 ohm.

OK

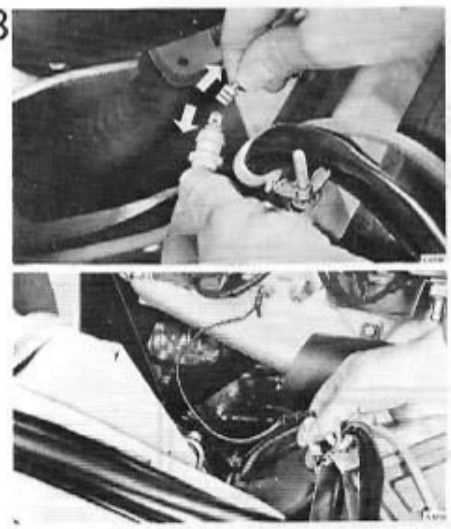
Check the wiring.

OK

Modulating valve operating, no reading.

Check that the measuring equipment is properly connected.

3

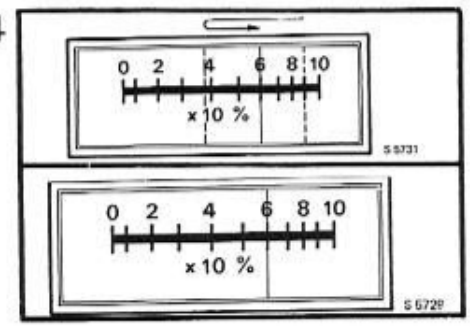


Disconnect the line from the oxygen sensor. No change in pulse relation. Ground the oxygen sensor cable. Pulse relation exceeds 75 %. (Greater than 60 % = too rich).

No

Yes

4



Disconnect the cable from ground. Pulse ratio less than 50% (under 60% = too lean) and then slowly increases towards 60 ± 10%.

Yes

No

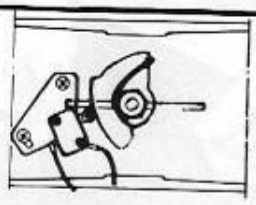
Test the circuit between terminal 2 on the control unit and the oxygen sensor.

OK

Control unit defective.

Continued on next page.

5



S 5738

Model 1979 Std 45 %
Model 1979 Turbo 80 %
Model 1980– Std 65 %
Model 1980– Turbo 85 %

5

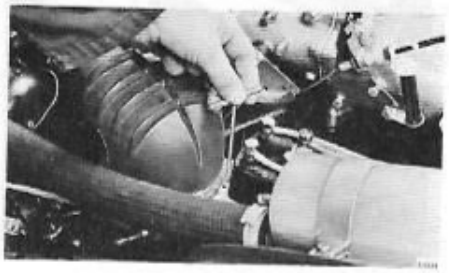
Open the throttle valve wide and read off the pulse relation (full-load condition). A The following stroke ratio figures apply to the various models:

- Model 1979, Standard 45 % ± 5 %
- Model 1979, Turbo 80 % ± 5 %
- Model 1980–, Standard 65 % ± 5 %
- Model 1980–, Turbo 85 % ± 5 %

No → Check the throttle valve switch and connections.

yes

6



6

Run the engine until it is warm and then connect CO-meter. (The oxygen sensor cable should be disconnected and not grounded anywhere.) Adjust the CO-reading at idling speed to around 0.75% CO.

Not possible → Check the CI-system.

Yes

7

7

Connect the oxygen sensor cable: CO-reading set to less than 0.4 % CO.

Yes

No

Increase engine speed to 1,500 rev/min: CO-reading now less than 0.4 %.

No

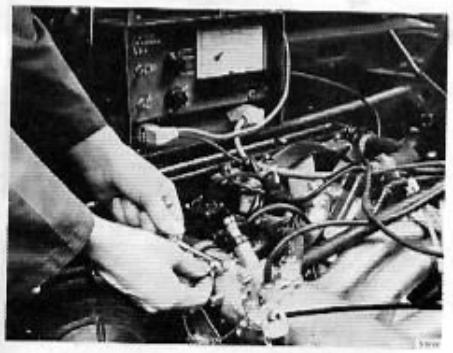
Disconnect the oxygen sensor cable: Idling becomes uneven and then steady. Ground the oxygen sensor cable: CO-reading increases rapidly.

No → Modulating valve defective.

Yes → Oxygen sensor defective.

Yes → Leakage at branch pipe or oxygen sensor, or incorrect valve clearance.

8

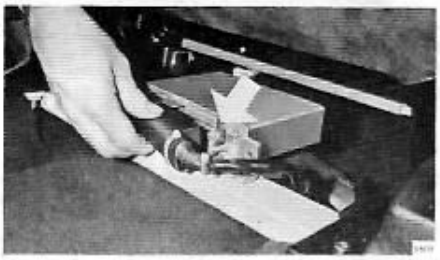


8

Make final fine adjustment of idling speed.

Fault tracing scheme (electrical system)

1



1

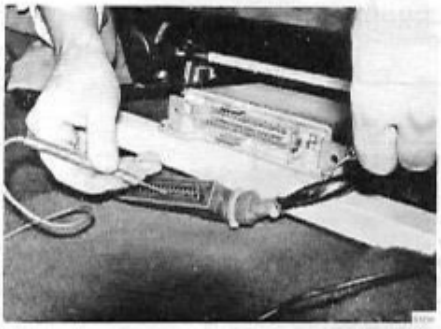
Disconnect the connector from the control unit.

2

2

Switch on the ignition. Disconnect the fuel pump relay and connect a jump lead across terminals 30 and 87 in the relay holder.

3



3

Check the voltage at the control unit connection: Connect a voltmeter across terminal 8 (+) and ground. The meter will indicate the battery voltage.

No

Disconnect the oxygen sensor relay and read off the voltage in the relay holder across:
1. 30 (+) and 87 (-)
2. 86 (+) and 85 (-)
Readings indicate battery voltage.

Yes

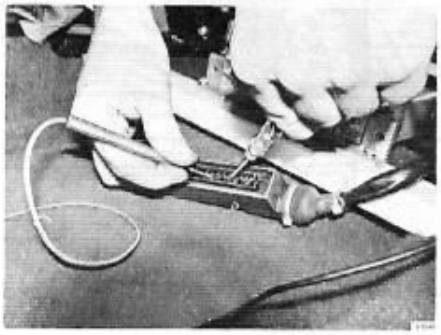
Fit new relay.

No

1. Check the voltage at 30 in the relay holder and the circuit between 87 in the relay holder and 8 on the control unit.
2. Check the voltage at 86 in the relay holder and the circuit between 85 in the relay holder and ground.

Yes

4



4

Measure the voltage across 8 (+) and 5 (-) at the control unit:
Meter indicates battery voltage.

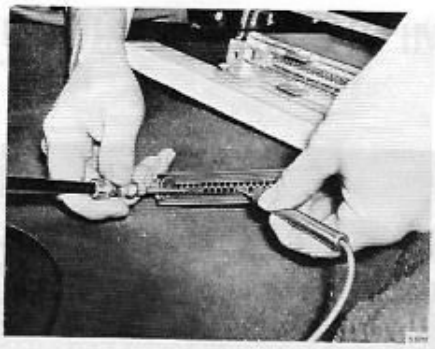
No

Check the circuit between 5 on control unit and ground.

Yes

Continued on next page.

5



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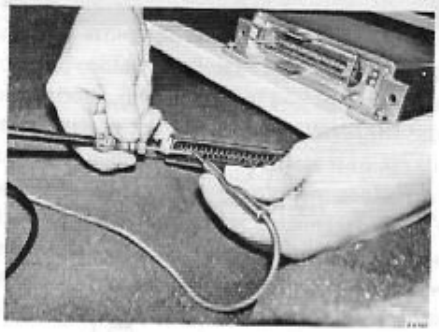

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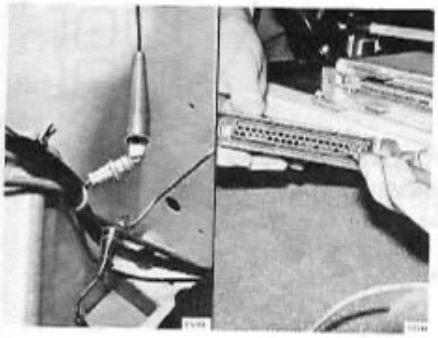

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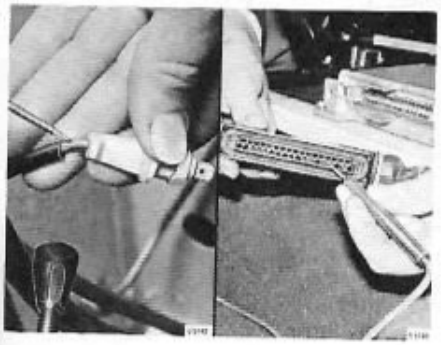

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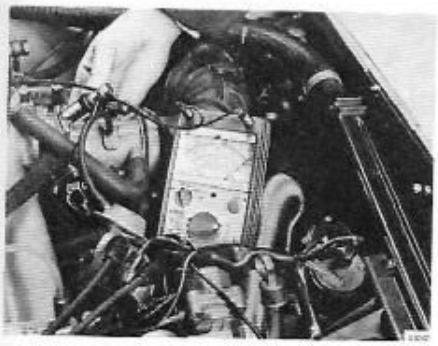


5

Measure the voltage across 8 (+) and 16 (-) on the control unit:
Meter indicates battery voltage.

No → Check the circuit between 16 on control unit and ground.

Yes

6

Measure the voltage across 15 (+) and 16 (-) on the control unit:
Meter indicates battery voltage.

No

Yes

Disconnect the connector from the modulating valve and measure voltage at connector:
Battery voltage obtained across one terminal and ground.
0 reading obtained across other terminal and ground.

No → Check the circuit between the modulating valve and terminal 87 b on the oxygen sensor relay.

OK → Fit new relay.

Yes

Using and ohmmeter, measure the resistance across the modulating valve:
2–3 ohm.

No → Fit new modulating valve.

Yes

Check the circuit between terminal 15 on the control unit and the modulating valve.

7

Disconnect the cable at the oxygen sensor and check the circuit between the oxygen sensor and terminal 2 on the control unit (ohmmeter).

Yes

8

Check the circuit between the suppressor harness on the oxygen sensor and terminal 4 on the control unit (use an ohmmeter).

9

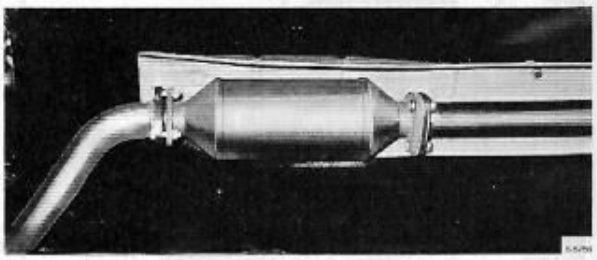
By means of an ohmmeter, check the acceleration enrichment circuit between terminal 7 on the control unit and ground:
Throttle valve closed: ∞
Throttle valve open: 0

No → Check throttle valve switch.

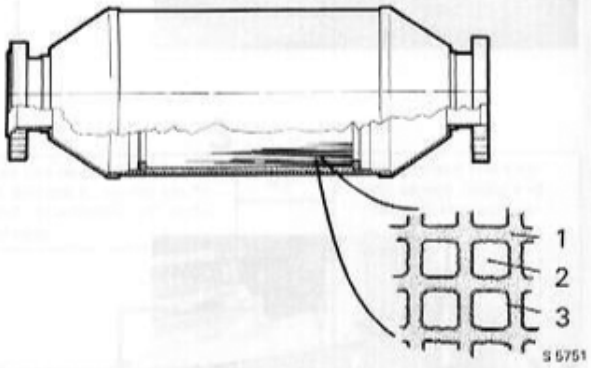
OK → Check the circuit between the throttle valve switch and terminal 7 on the control unit, and between the throttle valve switch and ground.

CATALYTIC CONVERTER

Final cleaning of the exhaust gases is by means of a three-component catalytic converter located in the exhaust system between the engine and the muffler.
On the condition that the oxygen-sensor regulated CI system ensures an ideal air-to-fuel ratio in addition to oxidizing the CO and HC content, the catalytic converter can also reduce the NO_x content. The end products are then CO_2, H_2) and N_2.
The catalytic converter comprises a ceramic material insert of honeycomb design. The walls are coated with catalytic material, viz. platinum and rodium.
Cars with catalytic converters must never be taken with anyting other than lead-free gasoline. This is because lead destroys the reactive properties of the converter.



CATALYTIC CONVERTER



CATALYTIC CONVERTER
1. Ceramic insert
2. Channels
3. Catalytic coating

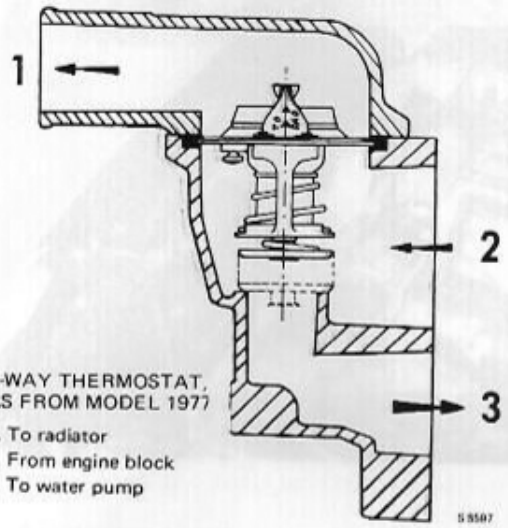
Mounting

The converter is connected to the exhaust pipe by means of flanges, with a conical flange seal at the front and a flat seal at the rear.

RADIATOR, COOLING SYSTEM

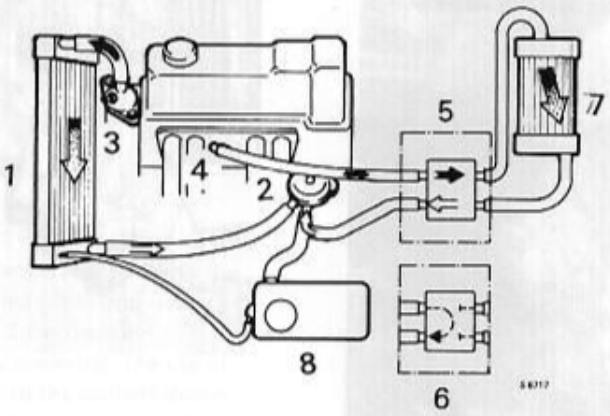
General

The cooling system is of pressurized type with a cross-flow radiator and expansion tank. The water pump is located in the engine block and is powered by a bevel gear from the idler shaft. The thermostat is located in a housing bolted to the front end of the cylinder head. The radiator fan is electrically driven and controlled by a thermostat. When the pump is working and the thermostat is closed, coolant circulates through the cylinder block, cylinder head, inlet manifold and then through a by-pass passage back to the water pump. When the heater valve is open, coolant will also circulate through the heat exchanger. When the thermostat is open, coolant will also circulate from the thermostat housing, through the radiator, expansion tank and back to the water pump.
When the engine is running at a very high temperature (i.e. when the thermostat is practically wide open), the by-pass passage to the water pump will be closed. This forces all coolant to circulate through the radiator. Coolant does not circulate through the expansion tank, since this serves merely as an expansion area, and as a container for bleeding and topping-up fo the cooling system.
A bleeder nipple is located in the thermostat housing cover. A hose runs from the top left corner of the radiator to the expansion tank for bleeding of the radiator.



3-WAY THERMOSTAT, AS FROM MODEL 1977

1. To radiator
2. From engine block
3. To water pump



COOLING SYSTEM

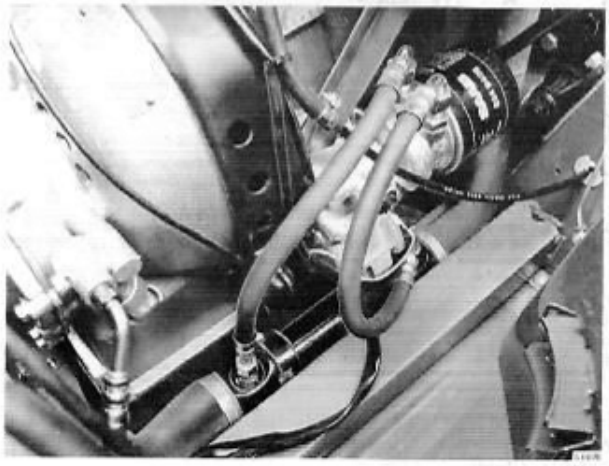
1. Radiator
2. Water pump
3. Thermostat housing
4. Water outlet line (inlet manifold)
5. Heater valve, open
6. Heater valve, shut
7. Heat exchanger
8. Expansion tank

AUXILIARY COOLING SYSTEM

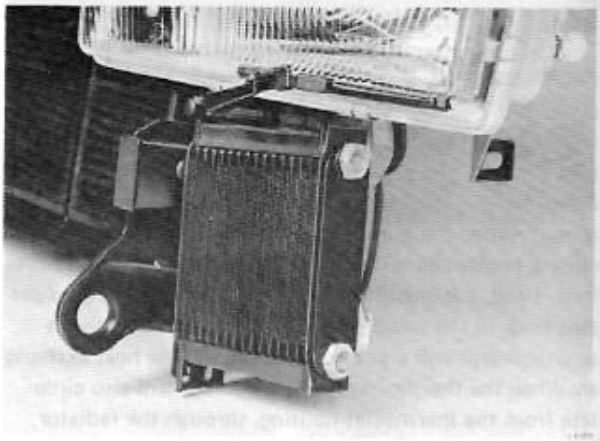
For the cooling system to be able to cope with more demanding conditions, a number of additional auxiliary cooling systems are available for certain car models, and for certain markets with extreme temperature conditions.

- Twin-cell-row radiators.
- Auxiliary radiator fan located to the left of the standard fan

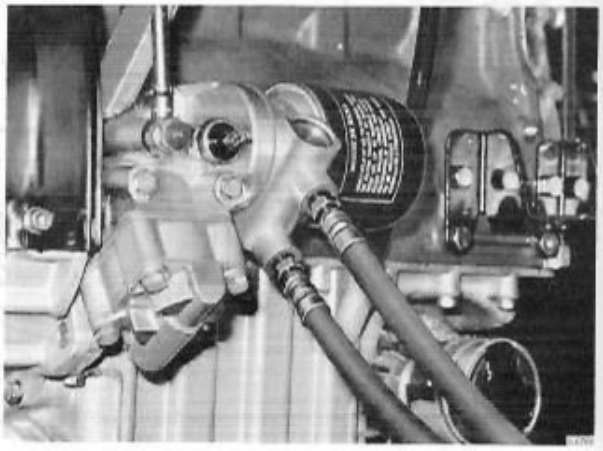
- Water-cooled oil cooler for cooling of the engine oil or automatic transmission oil. The cooler is located in the hose between the radiator and the water pump.



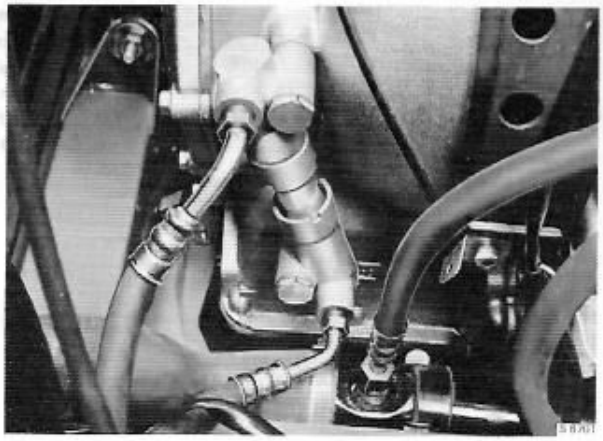
- Air cooled oil cooler for cooling of the engine oil or automatic transmission oil. The cooler is located below the left headlamp.



In versions with an engine oil cooler, the radiator hoses are connected to an adaptor between the oil filter and the cooler housing end-piece. The adaptor contains a thermostat that opens circulation through the oil cooler when the temperature exceeds 164°F (75°C).



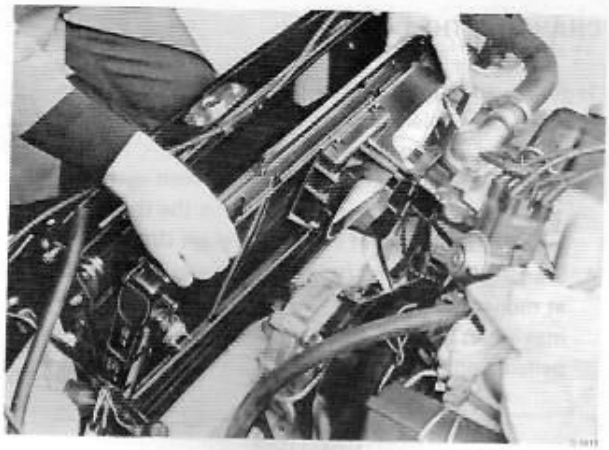
In versions with transmission-oil coolers, a thermostat connected to the transmission is included in addition to the oil cooler and hoses.



REMOVAL AND INSTALLATION

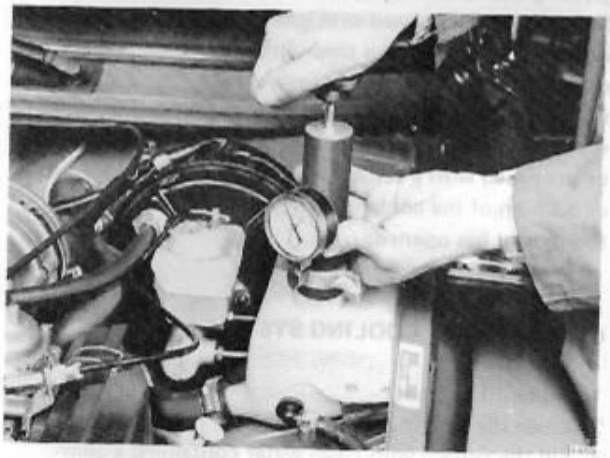
1. Drain the coolant.
2. Undo the clips on the radiator hoses and disconnect the hoses from the radiator.
3. Disconnect the leads to the radiator fan and thermal switch and remove the ignition coil.
4. Remove the two bolts in the upper radiator member, and lift the radiator out of the car, pulling the top of the radiator slightly backwards.

Installation is carried out in the reverse order. Make sure that the guide pins in the bottom of the radiator locate in the corresponding holes in the lower radiator member. Make sure that the rubber buffers are in position.



TEST PRESSURIZATION

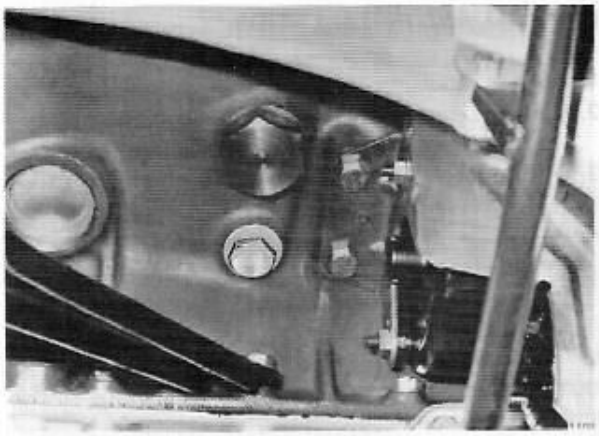
Leakage in the cooling system can often be difficult to detect because the system only develops full pressure when the car is actually being driven. A good method is to pressurize the system with a pressure tester, whereupon the radiator, hoses and seals can be checked out. The maximum permitted gauge pressure is 1.0 bar (kp/cm^2, 14 psi). A pressure tester can also be used to check the opening pressure of the radiator filler. Opening pressure, section 022.



INSPECTING THE RADIATOR

If the radiator has been removed from the car, it can be tested for leakage by being immersed in water with the tube opening plugged and supplied with compressed air. The maximum test pressure is 1.2 bar (kp/cm^2,). 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 battery may sometimes become blocked with dust, insects, etc. with reduced air flow as a result. If so, wash the radiator and blow it clear with compressed air.

CHANGING THE COOLANT



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

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

NON-FREEZING COOLANT MIXTURES

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 rusting the glycol dosage should be 40–50 per cent i.e. 5 imp. quarts (5 liters) 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 antirust agent should be addes. 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.

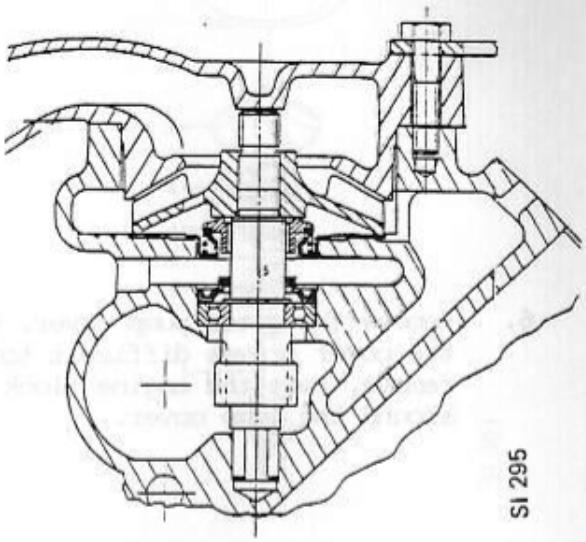
7. Flush out the heater core, likewise in the reverse direction to the normal flow.
8. Check the operation of the cock in the line to the heater core.
9. Fit the thermostat, water outlet pipe and hoses and check the system for leakage. When cleaning the cooling system, check also that the radiator overflow 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.

WINTER THERMOSTAT

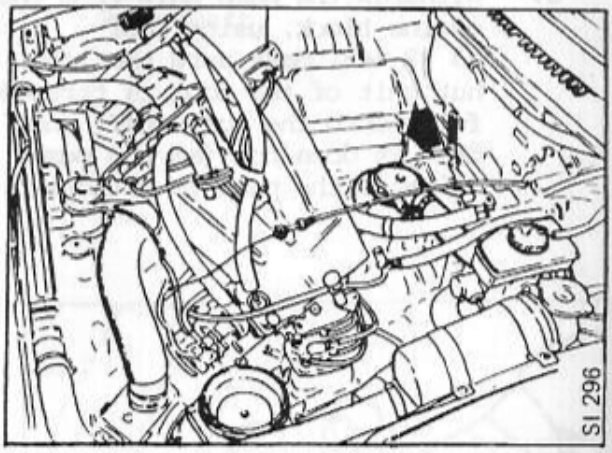
A winter thermostat with an opening temperature of 92°C (198°F) is available as a spare part.
This thermostat is only intended for winter use in markets with very severe climates, i.e. Nordic countries, Canada and the northern states of USA. It should be replaced by the standard 88°C (190°F) thermostat at the end of the winter.
Winter thermostats MUST NOT BE FITTED TO TURBO CARS.

WATER PUMP

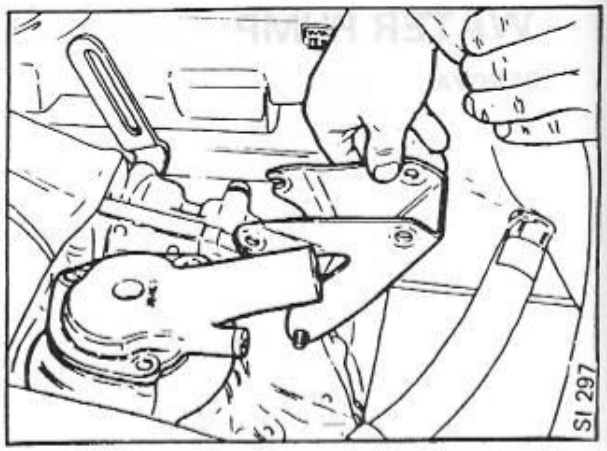
REMOVAL



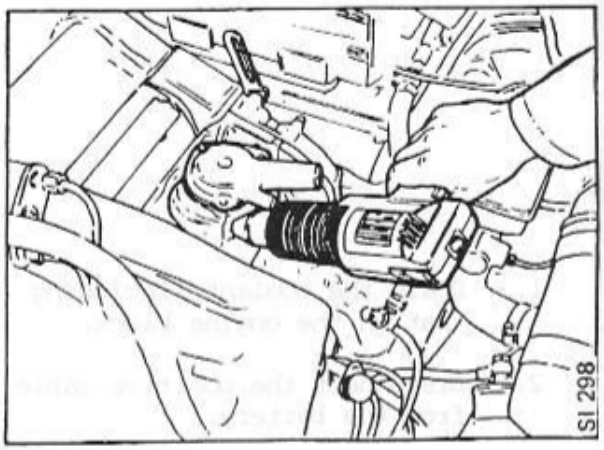
1. Drain the coolant, including that in the engine block.
2. Disconnect the positive cable from the battery.
3. Remove the alternator.
4. Remove the intake manifold. Stick a strip of tape across the intake ports in the cylinder head.



5. Disconnect the water hose from the water pump cover, release the alternator mounting and fold it down to the side.

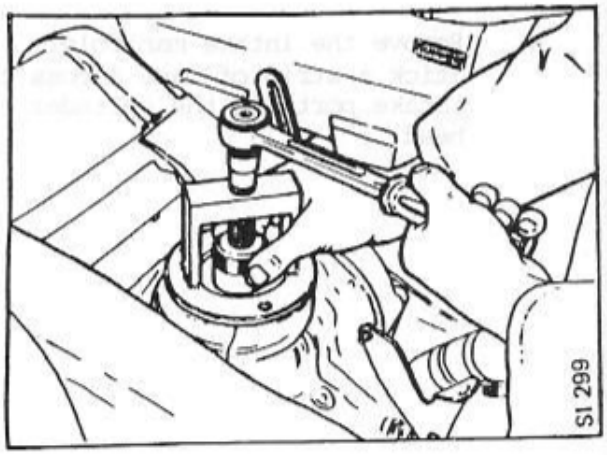


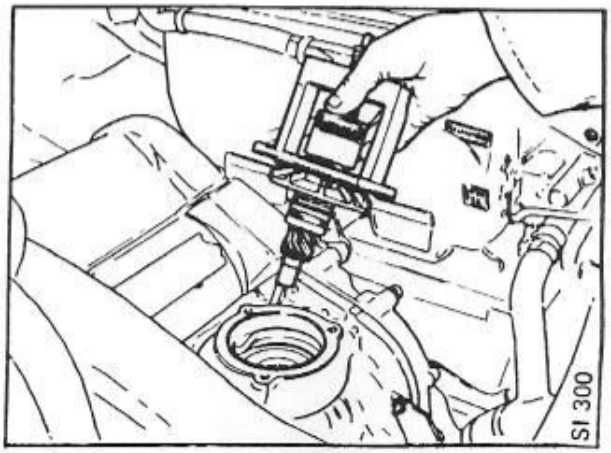
6. Remove the water pump cover. If the cover proves difficult to remove, heat the engine block around the pump cover.



7. Remove all gasket remnants from the engine block joint face.

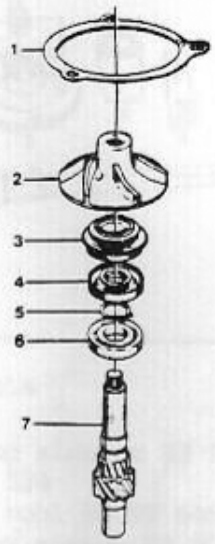
8. Withdraw the pump unit from the engine block, using tool 83 92 649. Make sure that the nut unit of the tool is threaded fully onto the pump shaft and that it does not jam the pump drive as the pump is withdrawn.





9. Clean the bearing sleeve and the recess in the engine block in which the impeller runs.

To dismantle the water pump after it has been removed (see the corresponding section in the Service Manual).



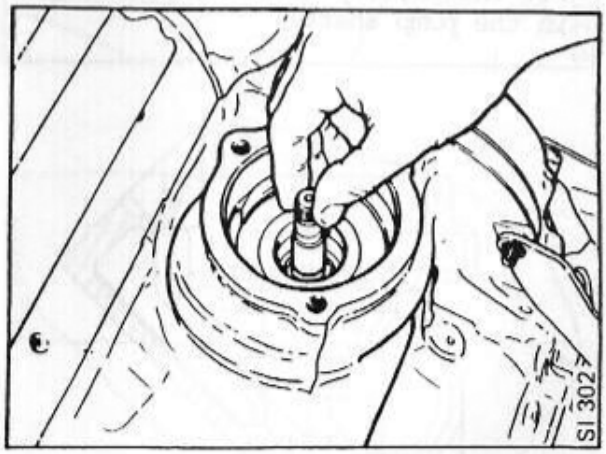
SI 301

Water pump

1. Gasket
2. Impeller
3. Water pump seal
4. Seal
5. Ball bearing circlip
6. Ball bearing
7. Pump shaft

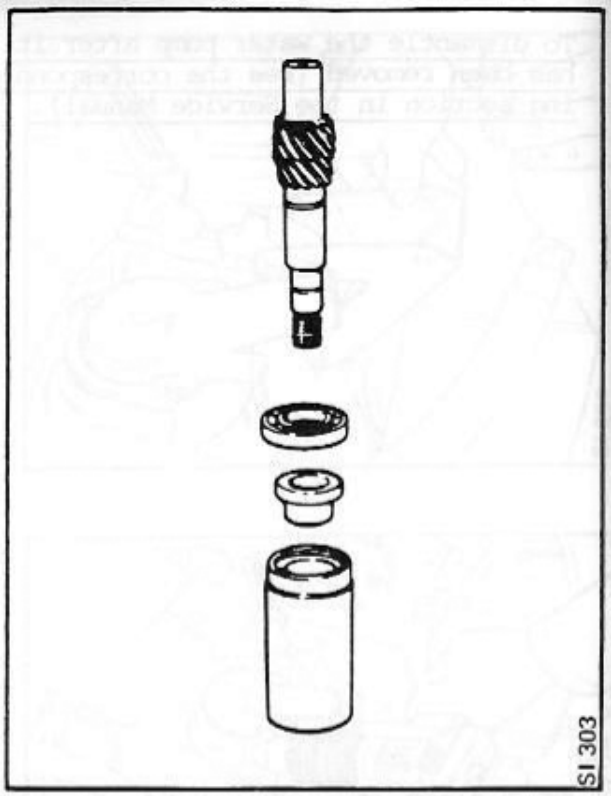
To assemble pump kit No. 83 67 674

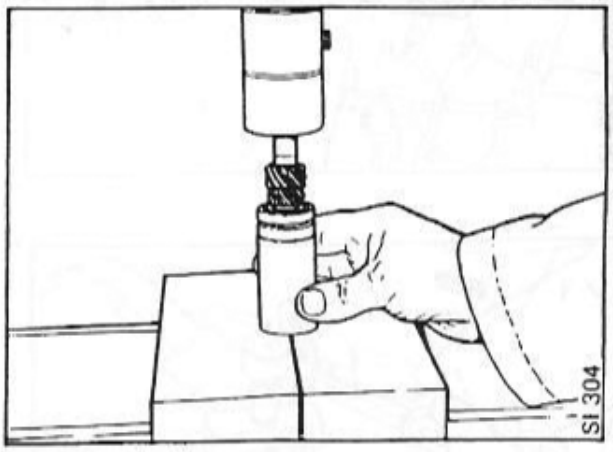
1. Check the gear pump drive and the tail-end pump shaft bearing in the engine block. The pump shaft must not bind as it is fitted into place.



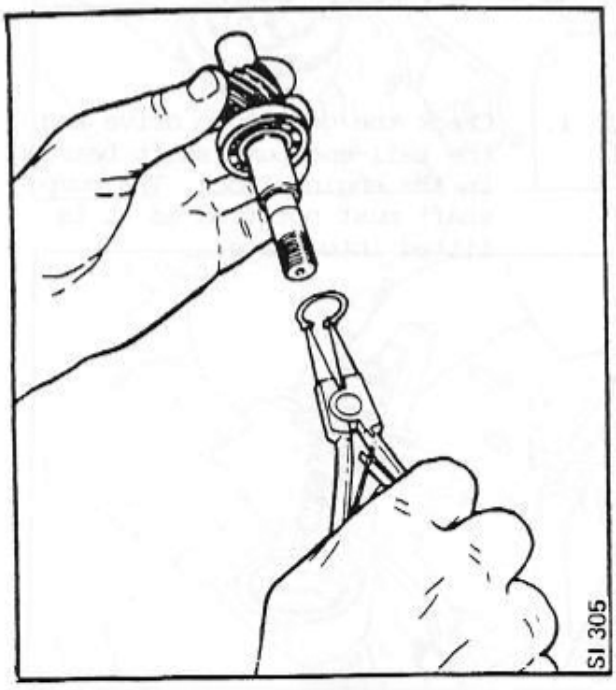
SI 302

2. Press the ball bearing onto the pump shaft. Use fitting sleeves 83 90 551 and 83 92 524.

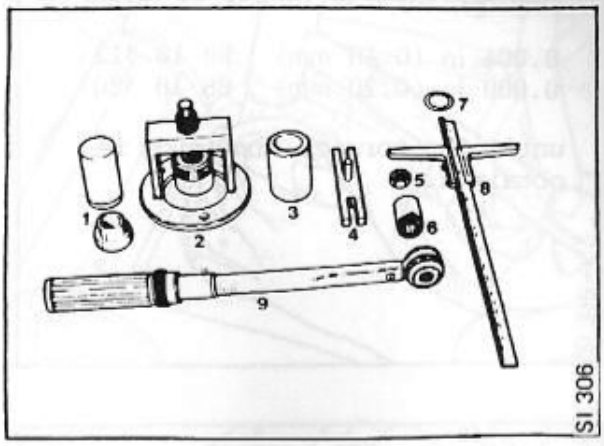




Fit the circlip into its groove in the pump shaft.



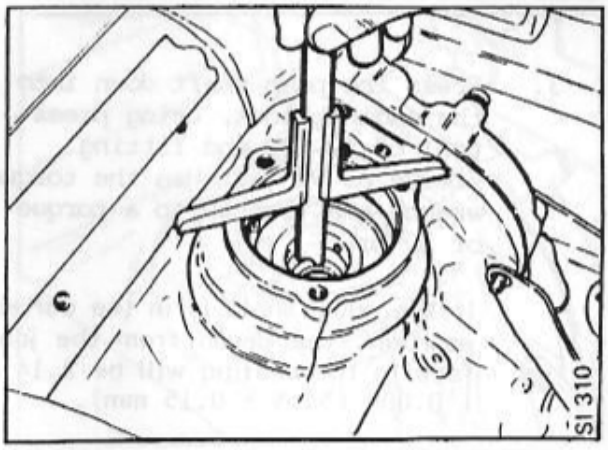
To fit the water pump

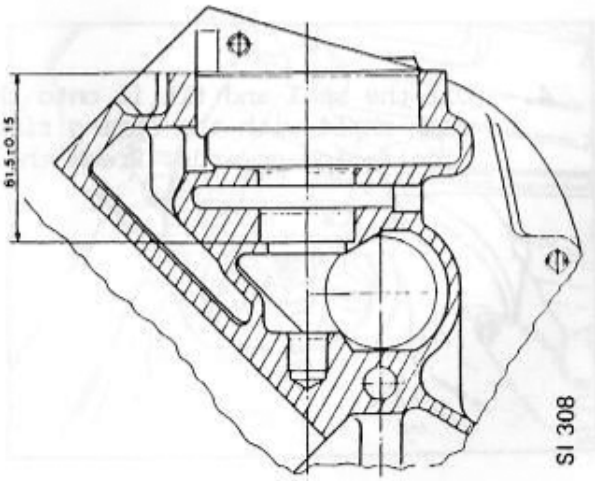


Fitting tools

1. Fitting sleeves 83 90 551 and 83 92 524
2. Press tool 83 92 649
3. Fitting sleeve 83 90 536
4. Restrainer 83 92 672
5. Nut 83 56 305
6. Sleeve
7. Shims
8. Depth vernier gauge
9. Torque wrench

1. Clean thoroughly the joint face for the pump cover, and measure the distance from the joint face down to the bearing shoulder. The dimension should be 2.42 in ± 0.006 (61.5 ± 0.15 mm).

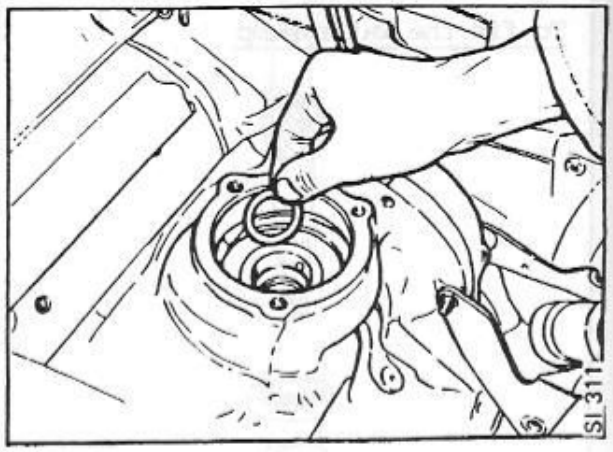




If the dimension is larger, fit the appropriate number of shims

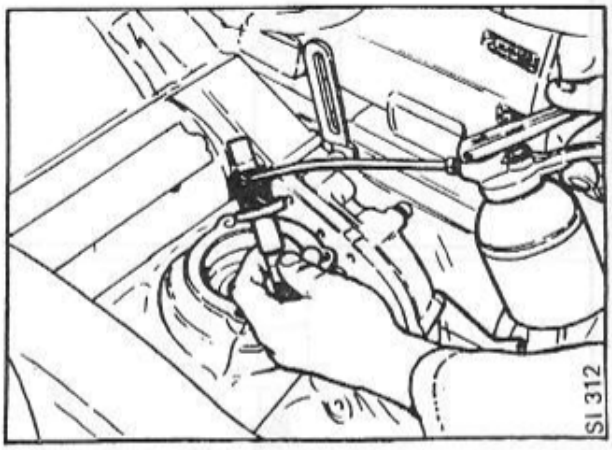
0.004 in (0.10 mm)	88 18 312
0.008 in (0.20 mm)	88 18 320

until the correct dimension is obtained.



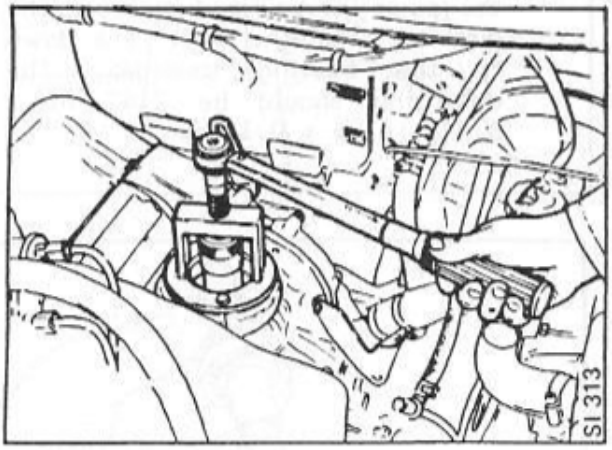
2. Oil the pump shaft teeth and journal with engine oil. Fit the pump shaft, together with the bearing and circlip, into the engine block.

   Ensure that the teeth engage smoothly and that the shaft enters freely into the tail-end bearing.

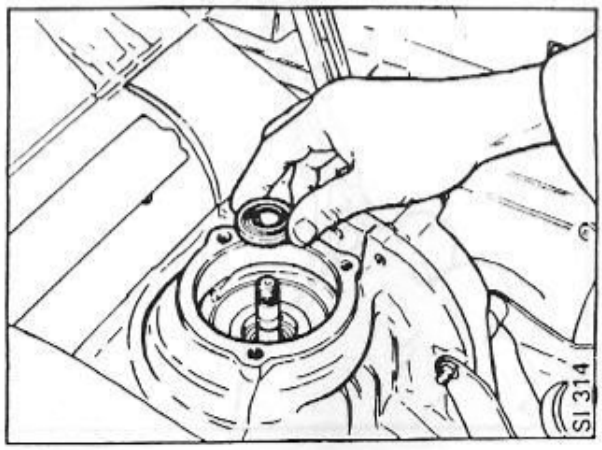


3. Press the pump shaft down into the engine block, using press tool 83 92 649 and fitting sleeve 83 90 551. Use the torque wrench and tighten to a torque of 10 Nm.

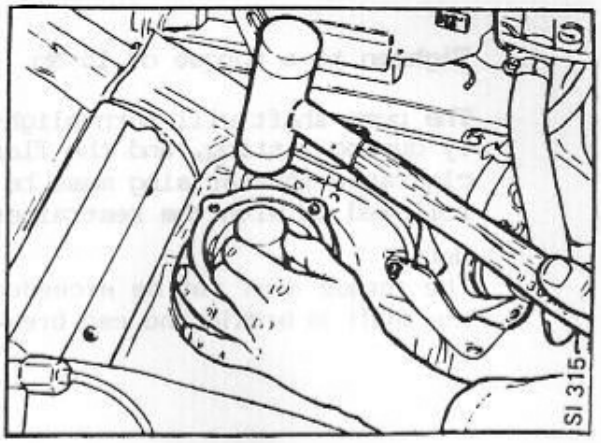
   If the pump shaft is in the correct position, the depth from the joint face to the bearing will be 2.14 in ± 0.006 (54.5 ± 0.15 mm).



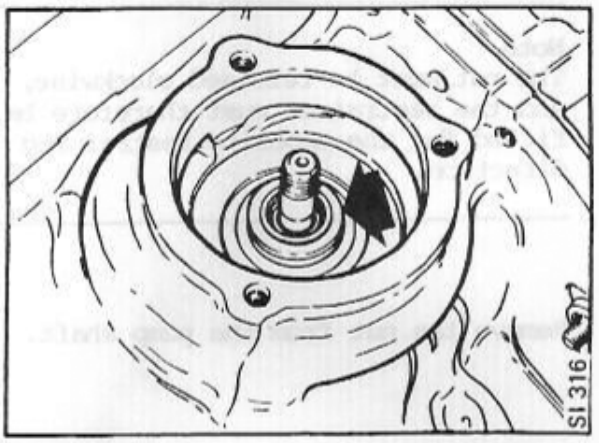
4. Oil the seal and fit it onto the pump shaft with the spring ring side facing upwards. Press the



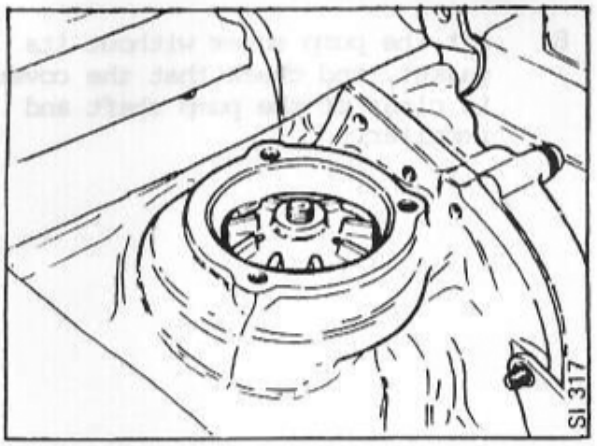
seal down onto the bearing, using fitting sleeve 83 90 551 and a plastic mallet.



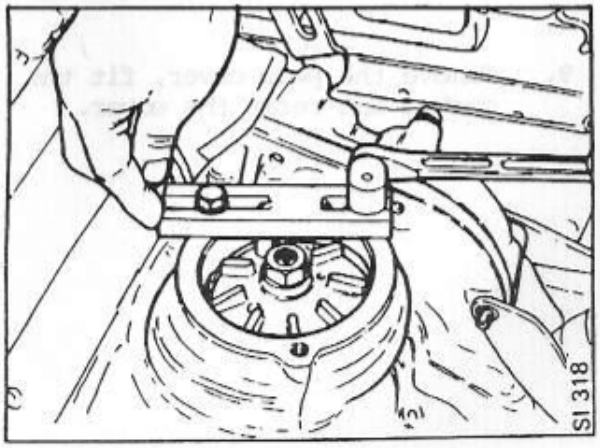
5. Fit the upper seal, using fitting sleeve 83 90 536 and a plastic mallet.



6. Fit the impeller onto the shaft



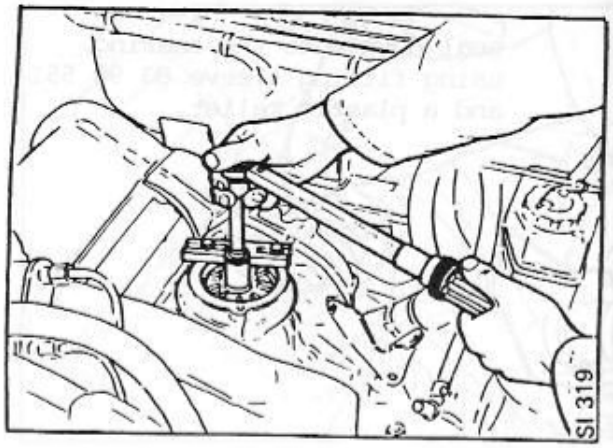
and secure it in position using restrainer 83 92 672 and nut 83 56 305. Use the restrainer to prevent the impeller from rotating, so that no loads will be applied to the teeth when the nut is tightened. N.B. The shaft end and nut have left-hand threads.



Tighten to a torque of 15 Nm.

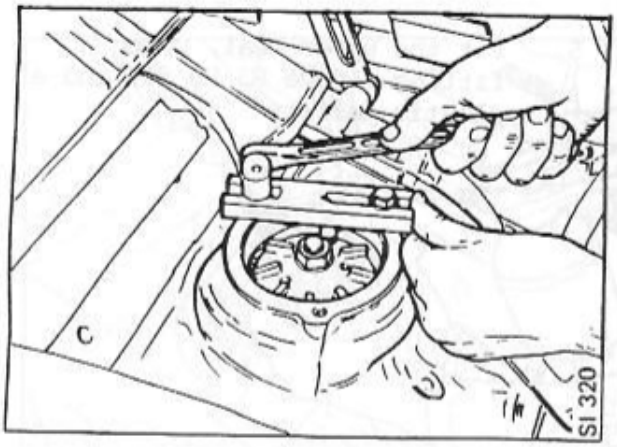
The pump shaft will turn slightly during fitting, and the flank clearance then arising must be followed up with the restrainer.

Note:
The torque must not be exceeded, the shaft is brittle and can break.



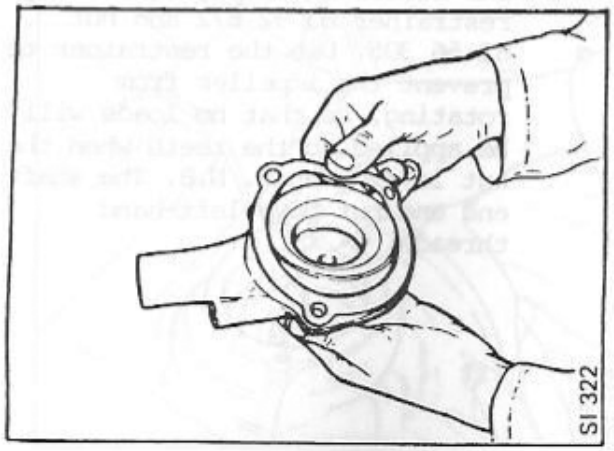
Note:
The nut must be released clockwise, and the restrainer must therefore be fitted for the opposite restraining direction.

Remove the nut from the pump shaft.



8. Fit the pump cover without its gasket, and check that the cover is clear of the pump shaft and impeller.

9. Remove the pump cover, fit the gasket and refit the cover.



10. Connect the hose to the pump cover.

11. Fit the alternator mounting.

12. Fit the intake manifold.

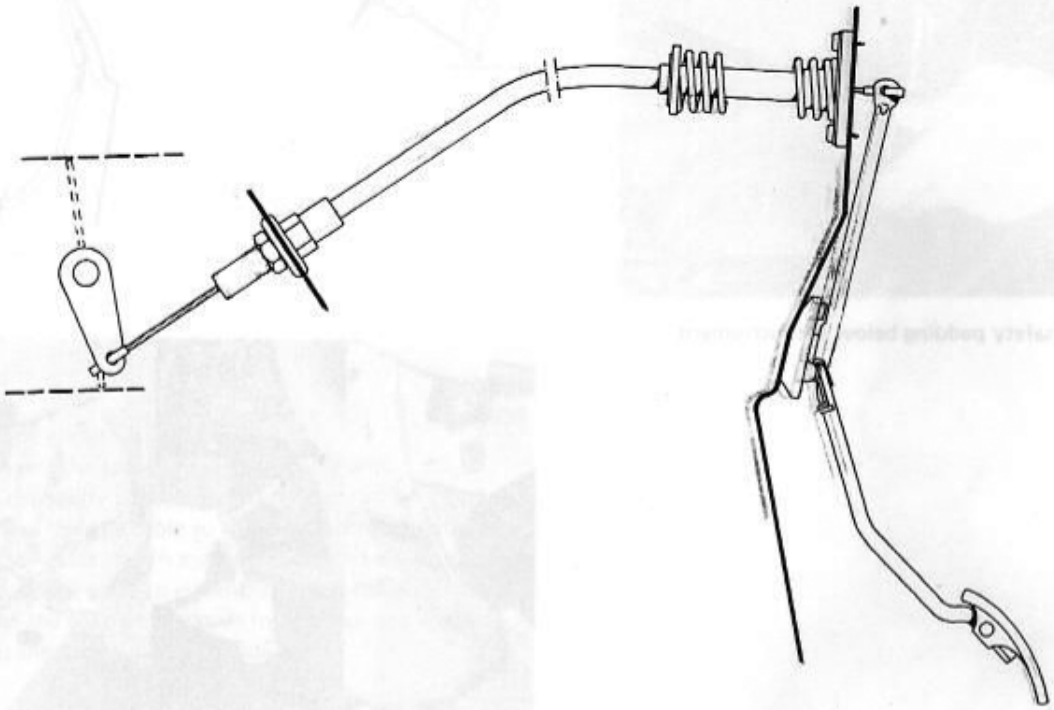
13. Fit the alternator.

14. Connect the battery cable.

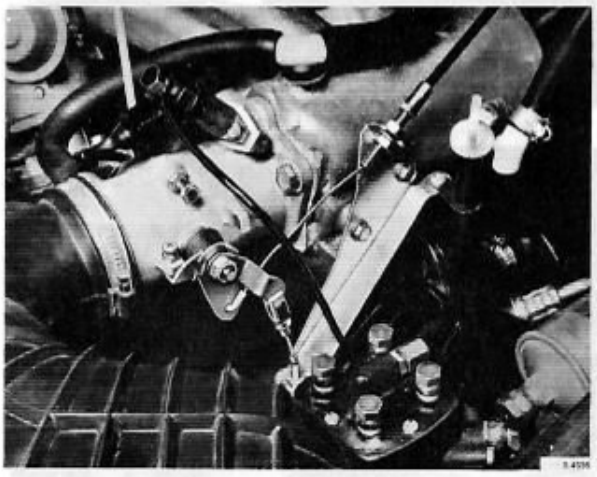
15. Fill the cooling system with coolant.

16. Start the engine and let it run at idling speed until the thermostat has opened. Avoid revving-up the engine during this running-in of the new pump.

THROTTLE CONTROL



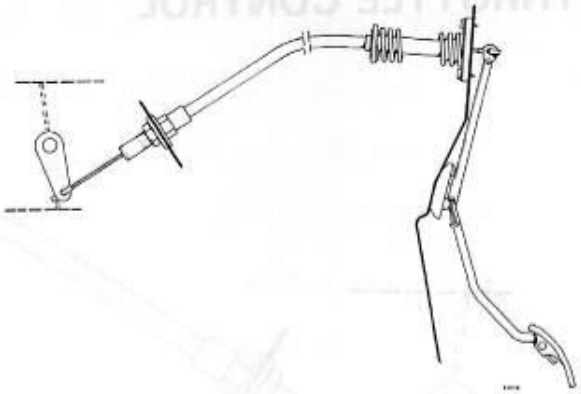
THROTTLE CONTROL CABLE



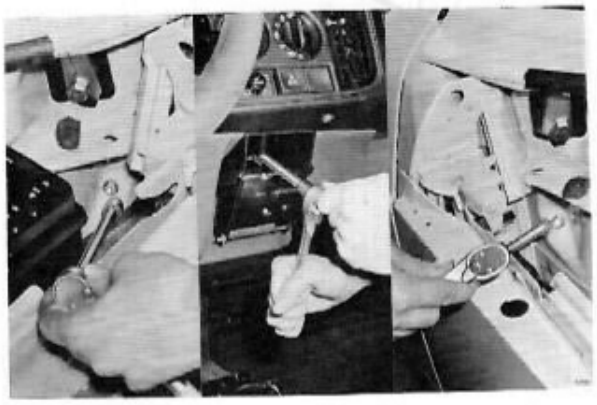
CABLE CONTROL

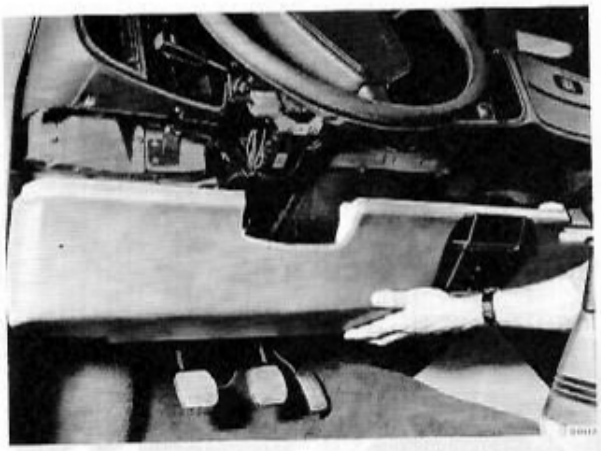
Removal

1. Disconnect the throttle cable at the throttle housing and remove the sheath from the bracket.

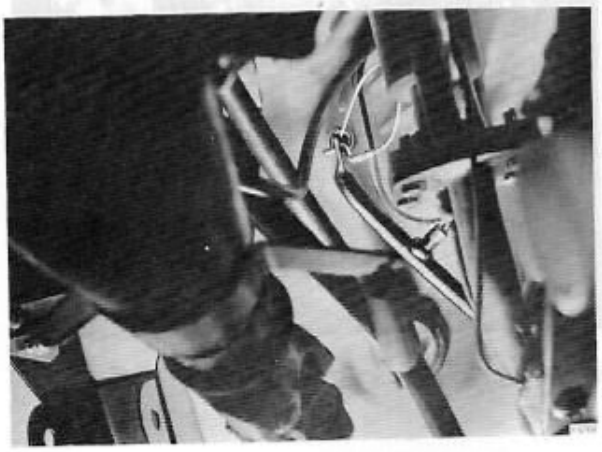


2. Remove the safety padding below the instrument panel.

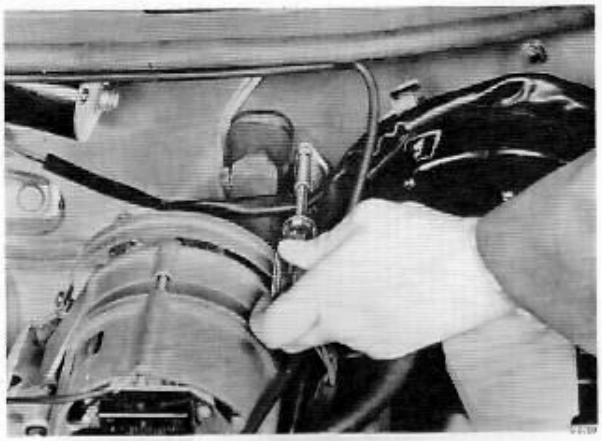




3. Unhook the cable from the accelerator arm.



4. Unscrew the grommet in the dash panel and remove the cable.



Fitting

1. Fit the grommet in the bulkhead.
2. Connect the cable to the accelerator arm.
3. Fit the safety padding below the instrument panel.
4. Fit the throttle cable to the driver (throttle-valve arm).
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

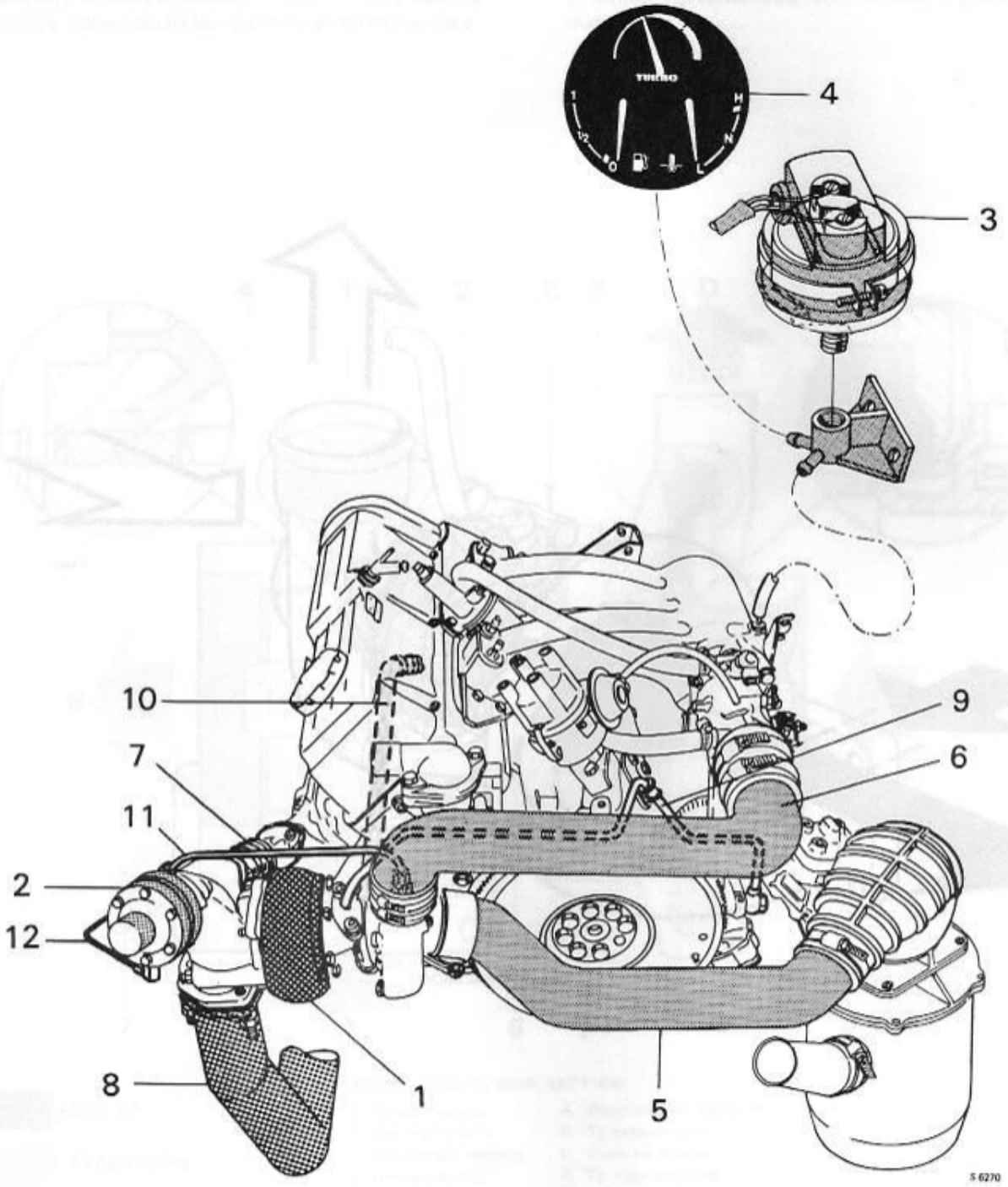
Removal

1. Remove the safety padding below the instrument panel.
2. Unhook the throttle cable and remove the pedal assembly.

TURBO SYSTEM

Supercharging, general

In contrast to conventional engines, a supercharged engine provides improved charging on the induction stroke, which produces more effective combustion of the mixture and an increase in power output and torque. With a supercharged engine, it is possible to achieve performance that is comparable to that of a larger engine, while, at the same time, maintaining the advantages of a smaller engine with respect to fuel economy, space, weight, etc.

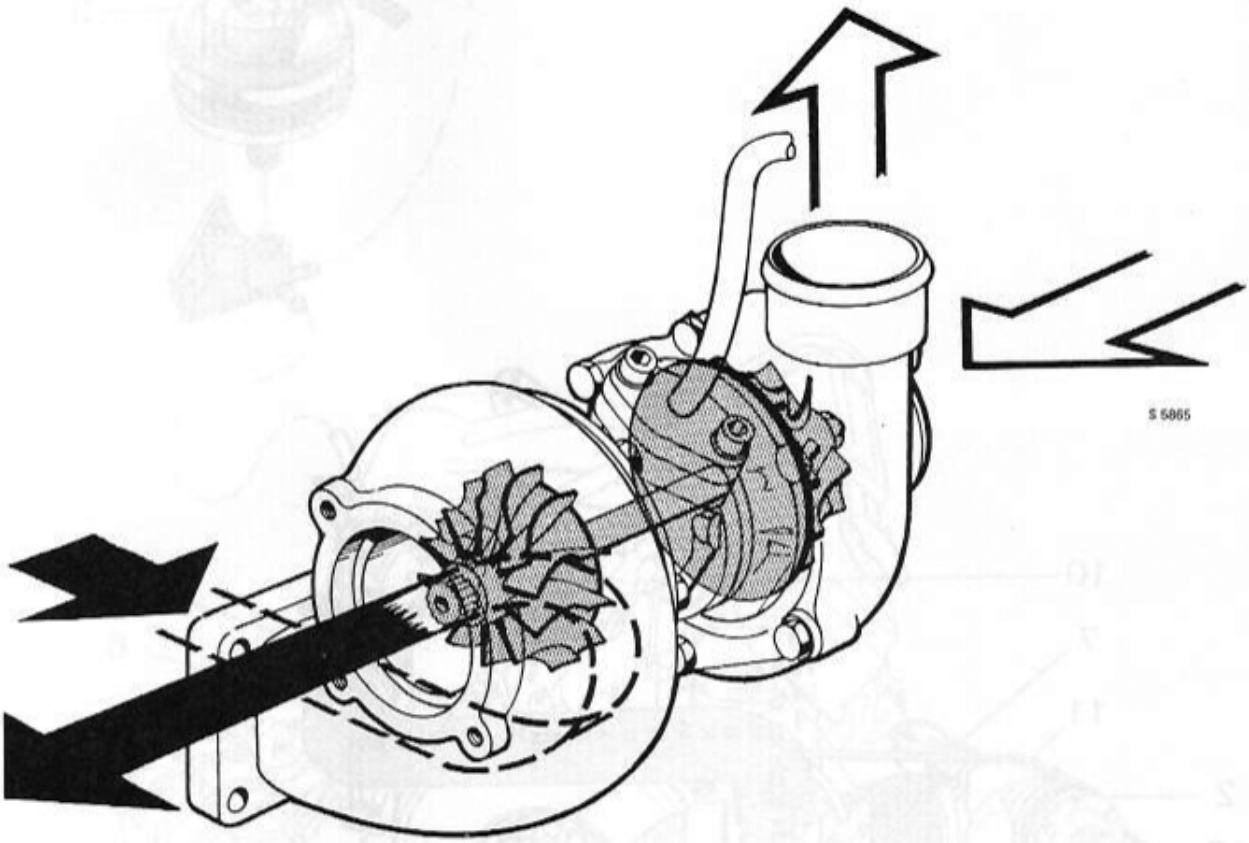


TURBO ENGINE

1. Turbo-compressor
2. Charge pressure regulator
3. Pressure switch
4. Turbo instrument
5. Suction pipe
6. Pressure pipe
7. Bellows pipe
8. Exhaust pipe
9. Oil supply line
10. Oil return line
11. Cooling air pipe
12. Exhaust pressure line

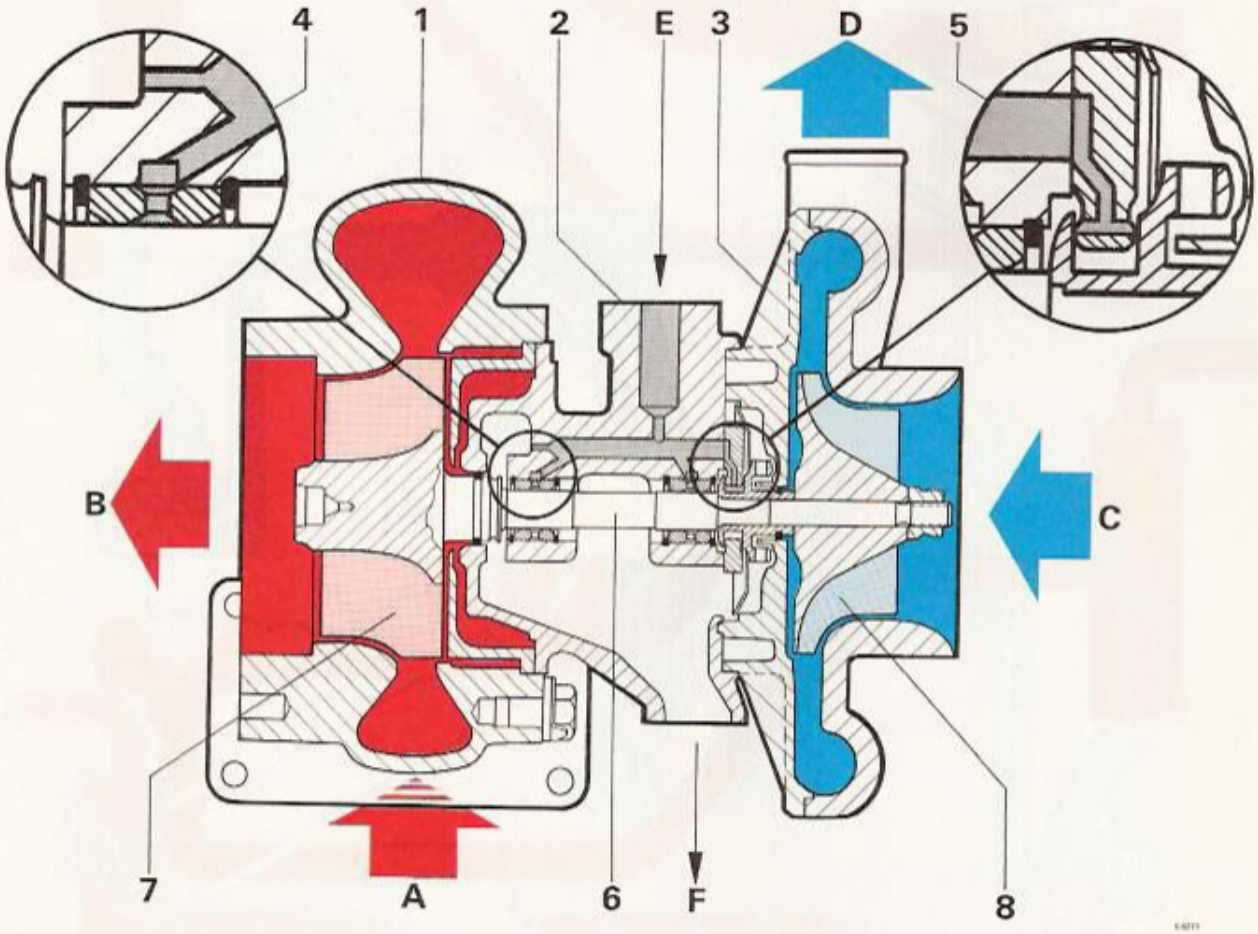
Turbocharging

Turbocharging is achieved by means of a turbo-compressor which implies utilizing the exhaust gases from the engine to drive the turbine.
The exhaust gases are led to an exhaust gas turbine, causing the turbine wheel to rotate. The turbine wheel is mounted on the same shaft as a compressor impeller which rotates at the same speed.
The compressor is located in the induction system where it effects an increase in the charging pressure in the combustion chamber.



TURBO-COMPRESSOR

The Saab Turbo has been designed to start operating at relatively low engine speeds, in order to provide increased torque at engine speeds typical of normal driving conditions. In contrast to the Saab Turbo, earlier turbochargers have been designed po provide increased performance, which implies that they are only utilized at full throttle.
The turbine shaft which rotates at very high speed has been very accurately balanced. The shaft is mounted in a floating sliding-contact bearing through which there is a relatively high oil flow. Thus, during rotation, the shaft floats on a film of oil.
The lubricating oil is supplied by the engine lubricating system through a special line running from the oil pump. Return oil flows through a relatively large-bore pipe back to the sump.
Sealing between the shaft and the bearing housing consists of sealing rings (piston ring type) installed in grooves in the shaft.



Inlet air

Exhaust gases

TURBO-COMPRESSOR, SECTION

1. Turbin housing
2. Bearing housing
3. Compressor housing
4. Radial bearing
5. Axial bearing
6. Turbo shaft
7. Turbine impeller
8. Compressor impeller

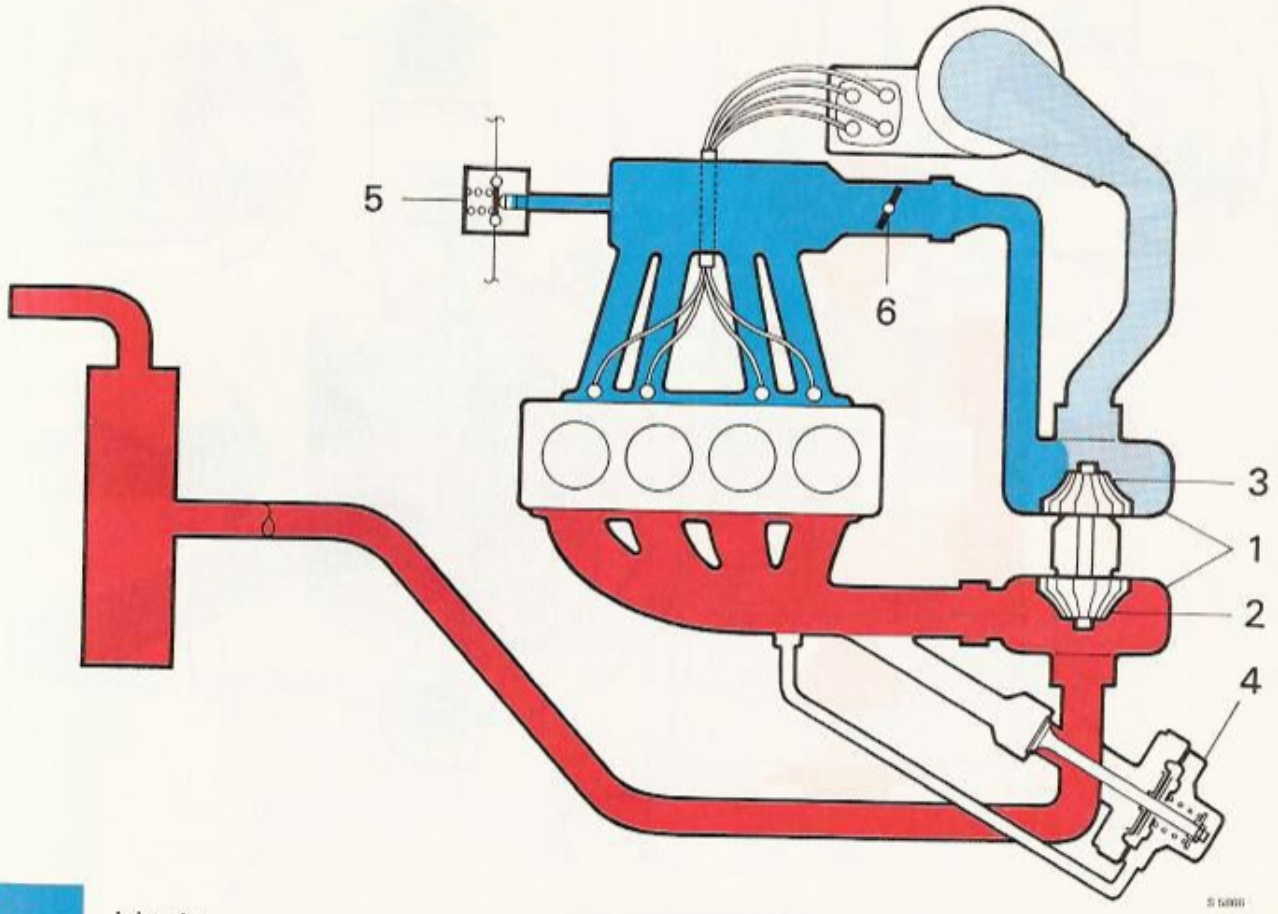
A. From exhaust manifold
B. To exhaust pipe
C. From air cleaner
D. To inlet manifold
E. Lubricating oil line
F. Lubricating oil return pipe

Charging pressure regulation

The charging pressure in the inlet manifold is governed mainly by the speed and loading of the engine. However, under high load conditions, the charging pressure is limited by a charge pressure regulator.
The charge pressure regulator is located on the exhaust side of the engine and controls the exhaust gas flow by means of a by-pass passage at the side of the turbine.
When the load on the engine is normal or below normal the charge pressure regulator valve (waste-gate) is closed. As the load increases and the charge pressure approaches the preset limit, the waste-gate opens, which decreases the load on the turbine by allowing exhaust gases to flow through the by-pass passage.

The charge pressure regulator contains a spring-loaded diaphragm valve which is kept closed under normal conditions by means of the spring. The valve is connected by means of a pipe to the exhuast manifold and is actuated by the exhaust gas pressure. Presetting of the charging pressure is achieved by adjustment of the spring.
The valve spindle of the charge pressure regulator is cooled by means of a pipe running from the compressor to the charge pressure regulator bearing housing.

CAUTION
Never increase the preset pressure as specified in section 0 as this is likely to damage the engine.



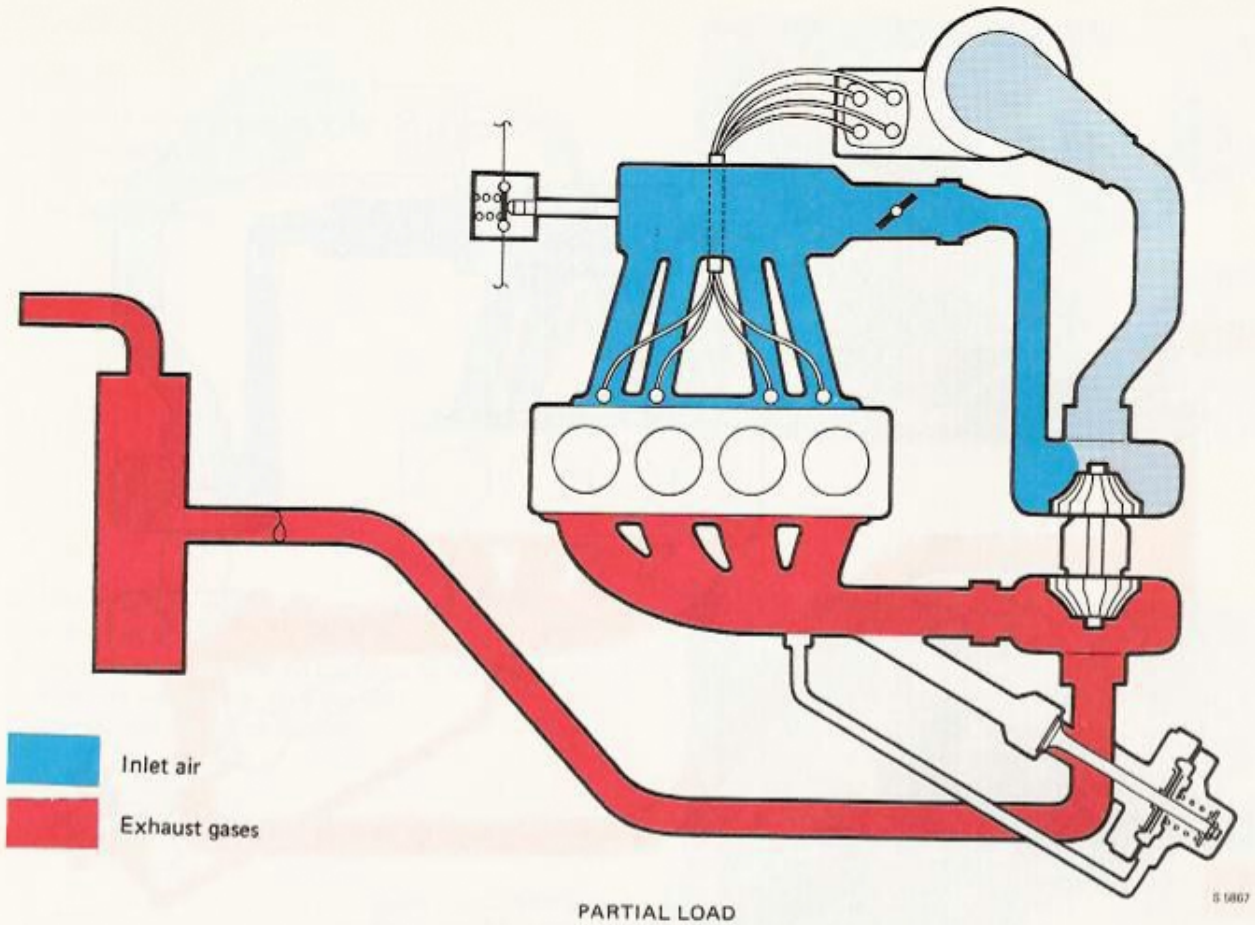
Inlet air

Exhaust gases

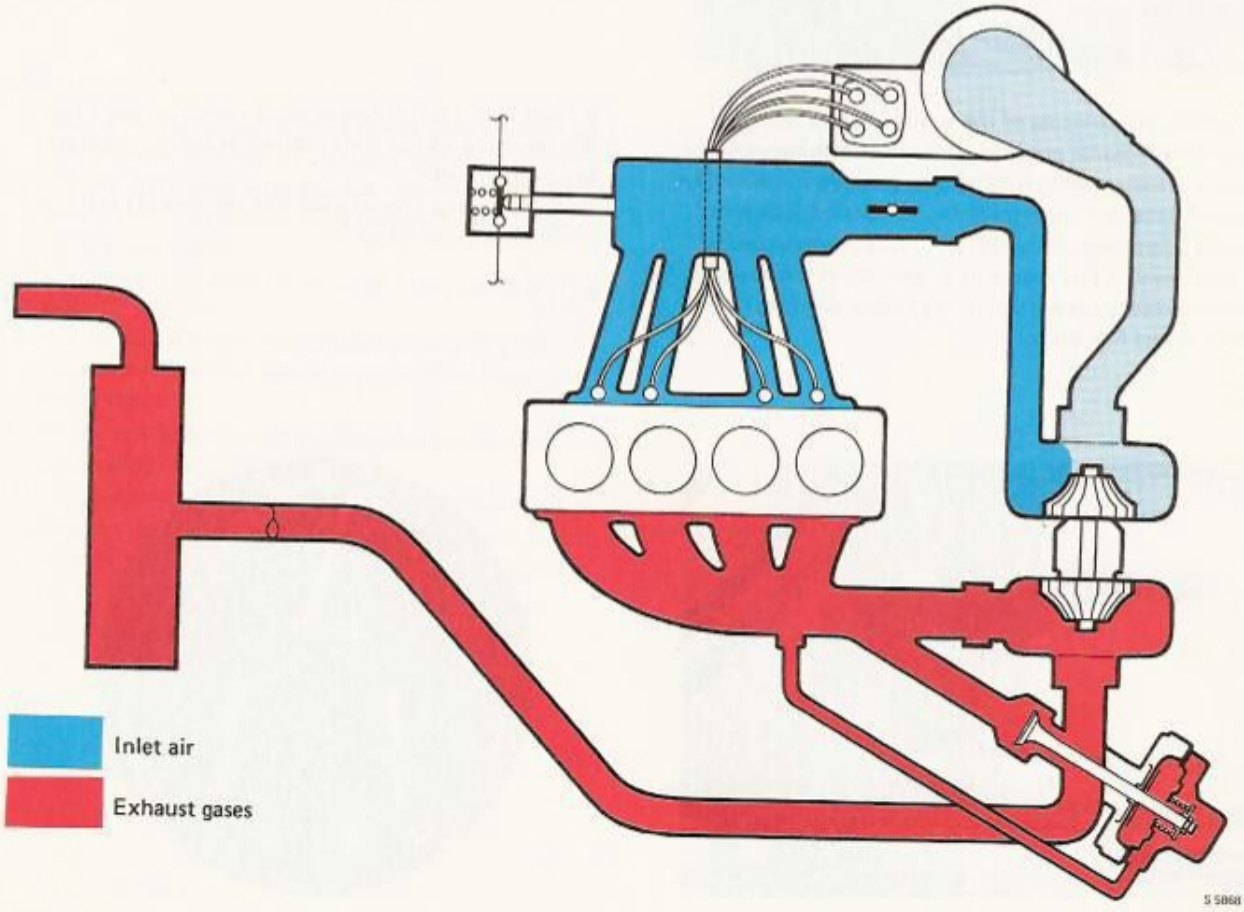
ENGINE IDLING

1. Turbo-compressor
2. Turbin impeller
3. Compressor impeller
4. Charge pressure regulator
5. Pressure switch
6. Throttle valve

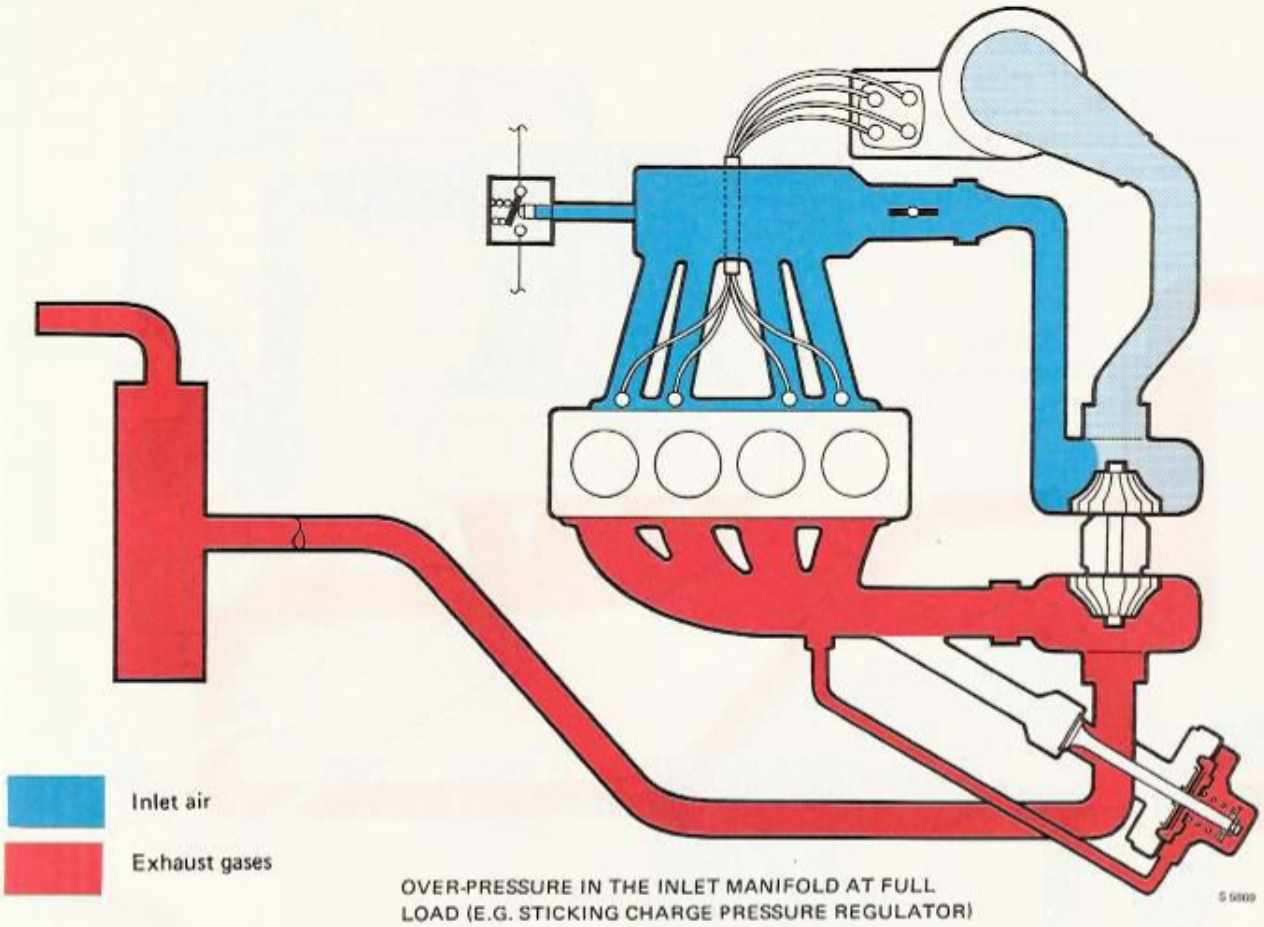
SAAB



PARTIAL LOAD



FULL LOAD

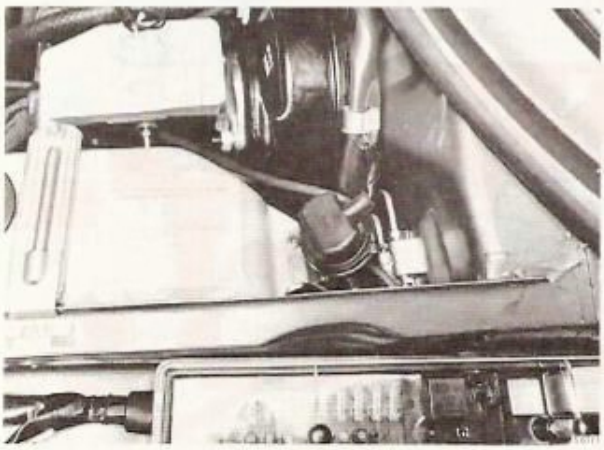


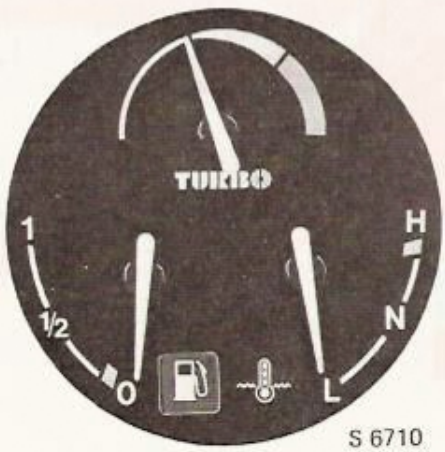
OVER-PRESSURE IN THE INLET MANIFOLD AT FULL LOAD (E.G. STICKING CHARGE PRESSURE REGULATOR)

Over-Pressure guard

To prevent overstressing of the engine in the event of failure of the charge pressure valve, an over-pressure guard, which is actuated when the charging pressure in the intake manifold exceeds the preset limit, is provided. The over-pressure guard comprises a pressure switch connected to the inlet manifold by means of a hose. When the charging pressure exceeds a preset limit, the switch will break the current to the fuel pump.

A rotor with a built-in centrifugal switch prevents over-revving of the engine by breaking the ignition at excessive engine speeds.
A pressure gauge showing the charing pressure is fitted in the instrument panel.





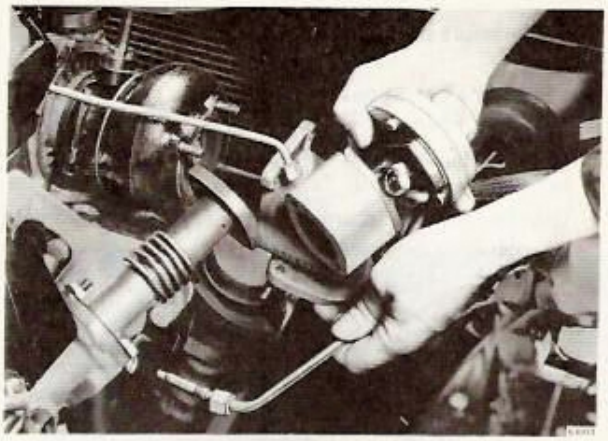
S 6710

SAAB

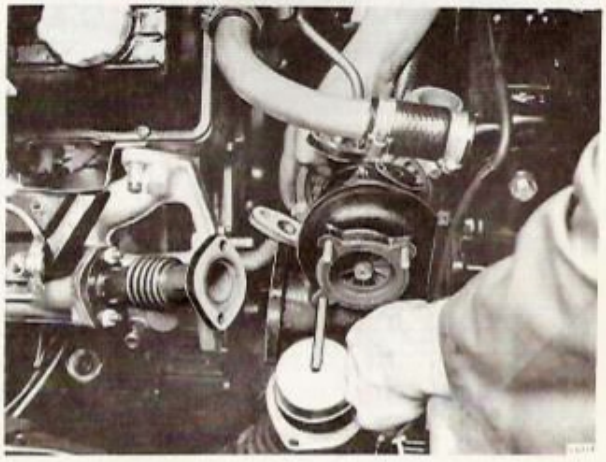
Turbo unit

Removal

1. Remove the charge pressure regulator and blank off the exhaust pipe.
2. Disconnect the hose between the compressor and the throttle housing.



3. Disconnect the oil supply line and the oil return line at the turbo unit.
4. Remove the bolts securing the turbo to the exhaust manifold and remove the turbo unit.
   Plug all holes in the turbo unit.

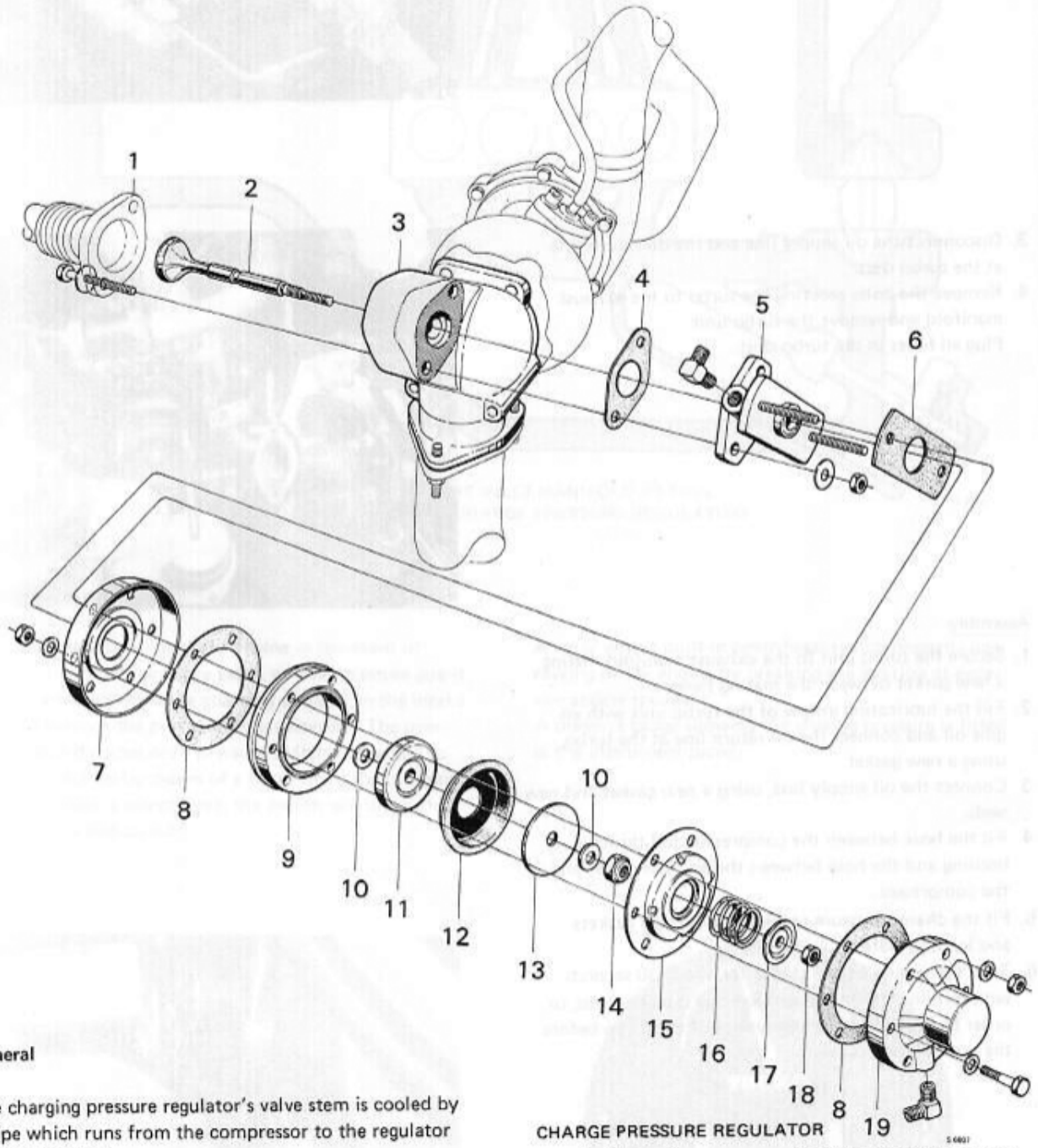


Assembly

1. Secure the turbo unit to the exhaust manifold, fitting a new gasket between the mating flanges.
2. Fill the lubricating inflow of the turbo unit with engine oil and connect the oil return line at the turbo, using a new gasket.
3. Connect the oil supply line, using a new gasket and new seals.
4. Fit the hose between the compressor and throttle housing and the hose between the air flow meter and the compressor.
5. Fit the charge pressure regulator using new gaskets and locking plates.
6. Turn the engine on the starter for about 30 seconds with terminal 15 on the ignition coil disconnected, in order to fill the lubricating system of the turbo before the engine starts running.

Charge pressure regulator

The following operations are included:
- Removal, fitting
- Dismantling, assembly (charge pressure regulator removed)
- Grinding of valve (charge pressure regulator dismantled)
- Changing the diaphragm (in the car)
- Measuring the charging pressure
- Adjusting the charging pressure
- Cleaning the diaphragm housing (every 24 000 miles)
- Sealing the charge pressure regulator



CHARGE PRESSURE REGULATOR

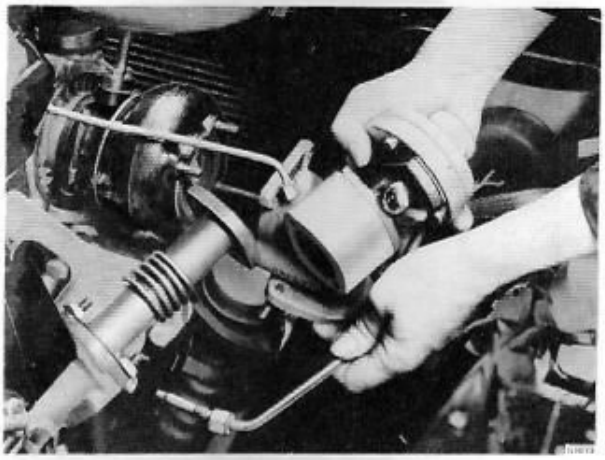
1. Bellows pipe
2. Valve
3. Regulator housing
4. Gasket
5. Bearing housing
6. Gasket
7. Heat shield
8. Gasket
9. Diaphragm housing
10. Flat washer
11. Inner diaphragm washer
12. Diaphragm
13. Outer diaphragm washer
14. Diaphragm nut
15. Inner spring seating (Model 1979 six holes, as from model 1980 four holes)
16. Spring
17. Inner spring seating
18. Lock nut
19. Diaphragm housing cover
20. Cooling air pipe

General

The charging pressure regulator's valve stem is cooled by a pipe which runs from the compressor to the regulator bearing housing.
The spring in the charging pressure regulator is canted slightly because the inner spring seat is intentionally offset in relation to the valve stem in order to reduce valve chatter. An uneven wear profile in the valve seat, valve guide and valve stem is therefore perfectly normal and is not detrimental to the operation of the unit.

Removing the charge pressure regulator

1. Disconnect the exhaust and cooling air lines from the charge pressure regulator.
2. Unbolt the exhaust manifold flange. Save the taper seal ring and plug the exhaust pipe.
3. Prize up the locking plate and remove the bolts from the bellows pipe.
4. Prize up the locking plate, remove the bolts from the turbo and remove the charge pressure regulator.



Fitting the charge pressure regulator

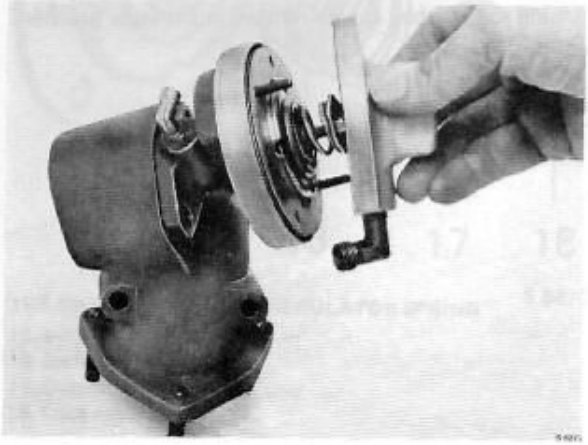
1. Bolt the charge pressure regulator to the turbo (fit new gasket) and lock the nuts by means of locking plates.
2. Fit the bellows pipe retaining bolts, locking them by means of the locking plate.
3. Remove the plug from the exhaust pipe and connect the pipe with taper seal ring to the charge pressure regulator housing.
4. Connect the exhaust and cooling air lines.

> Cover the exhaust pressure line connection with NEVER SEIZE or Molycote 1000 to prevent it being burnt stuck.

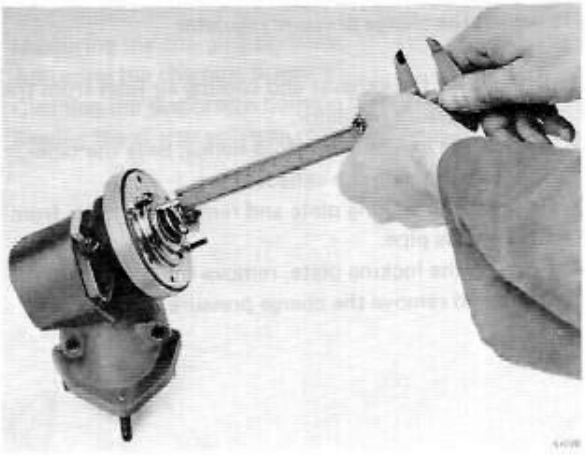
5. Test drive the car, checking the charging pressure and adjusting as necessary.
6. Seal the charge pressure regulator and fit the heat shield.

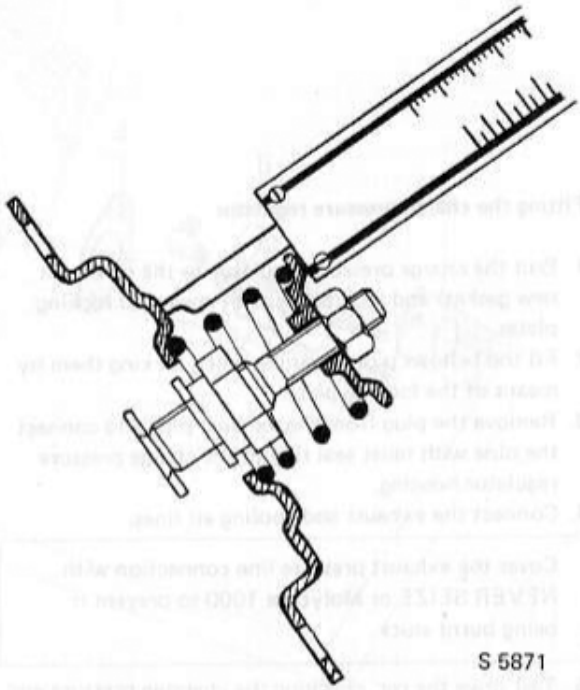
Dismantling the charge pressure regulator
(Charge pressure regulator removed)

1. Remove the diaphragm housing cover.



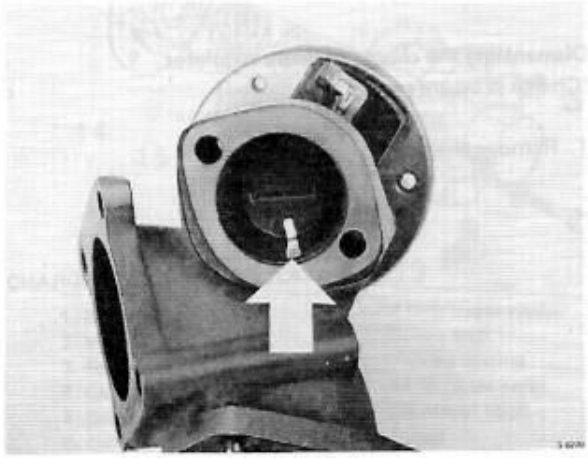
2. Measure and note the length of the compressed spring (distance between the outer and inner spring seatings, see illustration). Measure the length at two diametrically opposed points and note the mean value.





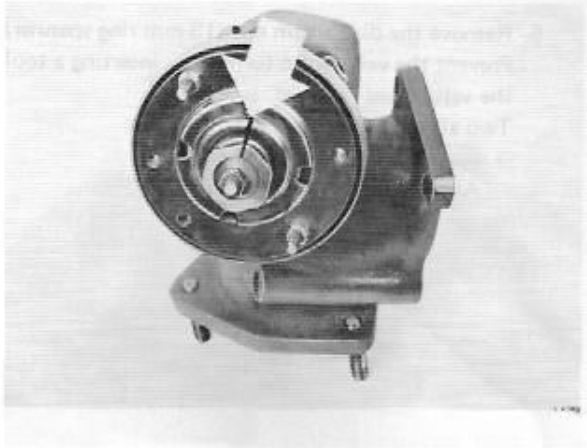
S 5871

3. Mark the position of the valve and outer spring seating so that they can be refitted in the same position.



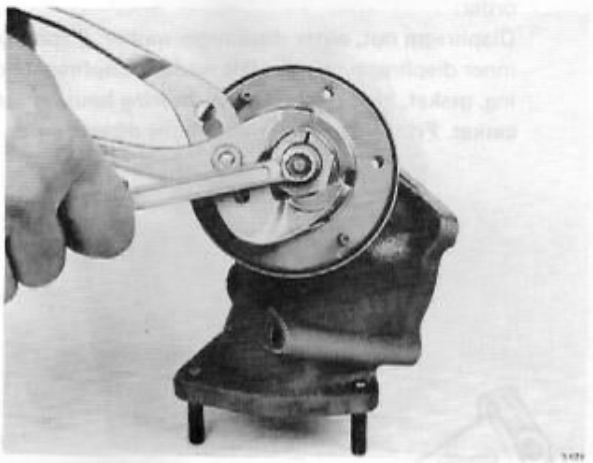
3. a. Mark the position of the valve.
   b. Mark the position of the spring and the outer spring seating.

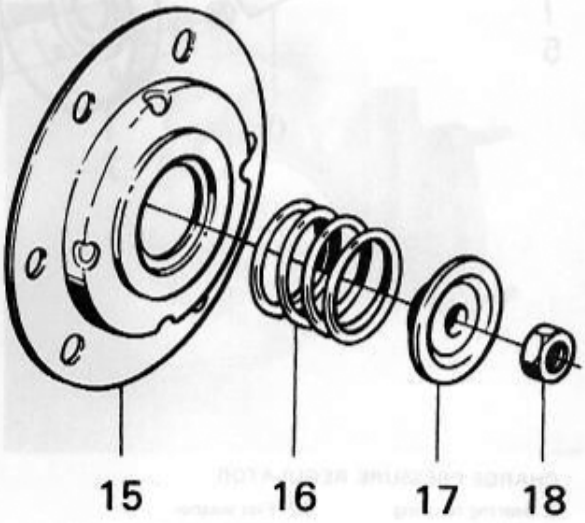
> Mark the parts when removing and install in the initial position.



4. Loosen the lock nut using a 10 mm ring spanner and polygrip pliers and then remove the nut, the outer spring seating, the spring and the inner spring seating.

> CAUTION
> Always grip the valve seat when removing the spindle nut to avoid damaging the diaphragm.





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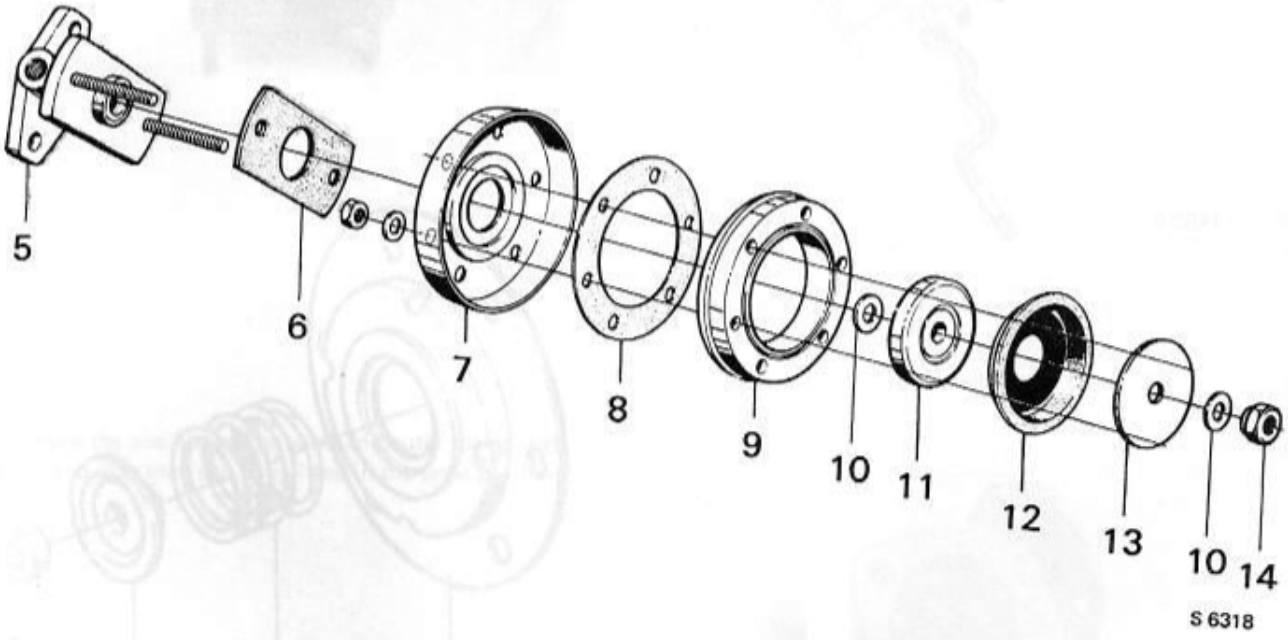
THE CHARGE PRESSURE REGULATOR SPRING

15. Inner spring seating
16. Spring
17. Outer spring seating
18. Lock nut

5. Remove the diaphragm nut (13 mm ring spanner). Prevent the valve from turning by inserting a tool in the valve head key grip.
   Two alternatives occur:
   – groove for screwdriver
   – Allen key (0.39 in., 10 mm)

6. Remove the parts (see illustration) in the following order:
   Diaphragm nut, outer diaphragm washer, diaphragm, inner diaphragm washer, falt washer, diaphragm housing, gasket, heat shield, gasket, bearing housing and gasket. Fit the valve assembly in the reverse order.

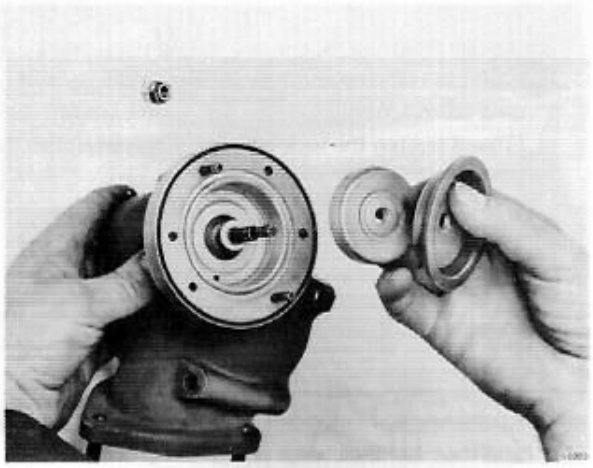


CHARGE PRESSURE REGULATOR

5. Bearing housing
6. Gasket
7. Heat shield
8. Gasket
9. Diaphragm housing
10. Flat washer
11. Inner membrane washer
12. Diaphragm
13. Outer diaphragm washer
14. Diaphragm nut

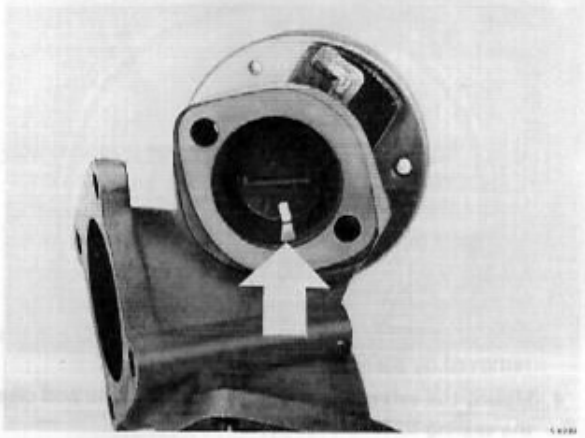
Assembly

1. Insert the valve using one hand to hold it in position. Fit the gasket, bearing housing, gasket, heat shield, gasket, diaphragm housing, flat washer, inner diaphragm washer, diaphragm, outer diaphragm washer and the diaphragm nut.

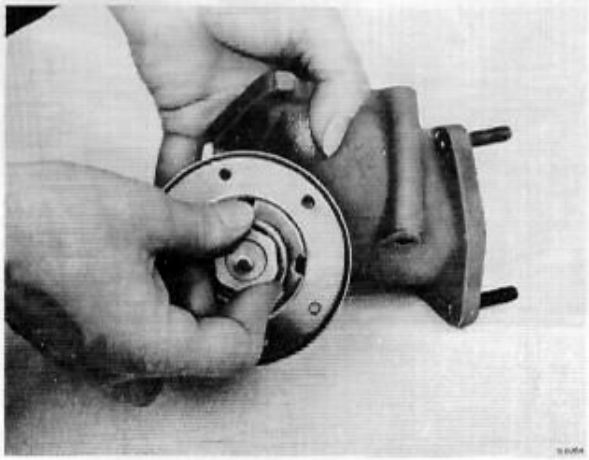


Cover the valve shaft with a thin cote of NEVER SEIZE or Molycote 1000. The valve's threads should also be lubricated with NEVER SEIZE or Molycote 1000 to prevent them being burnt stuck.

2. Check that the inner diaphragm ridge engages the groove in the diaphragm washer and tighten the diaphragm nut, preventing the valve from turning by inserting a short, thick screwdriver in the groove in the valve disc.



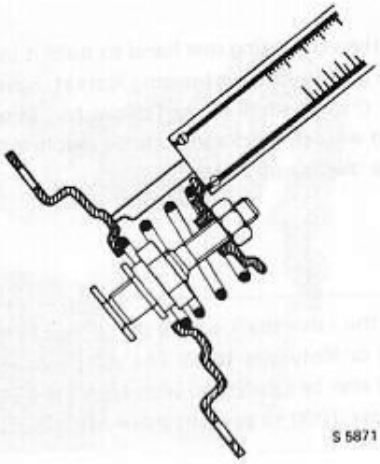
3. Align the valve with the previous markings and fit the inner spring seating, the spring and the outer spring seating. Check that the outer ridge on the diaphragm engages the groove in the diaphragm housing.



4. Adjust the spring roughly by setting the compressed length to the same value as was noted before dismantling (or in accordance with the specifications).
5. Fit and tighten the lock nut, using polygrip pliers to hold the spring seating.

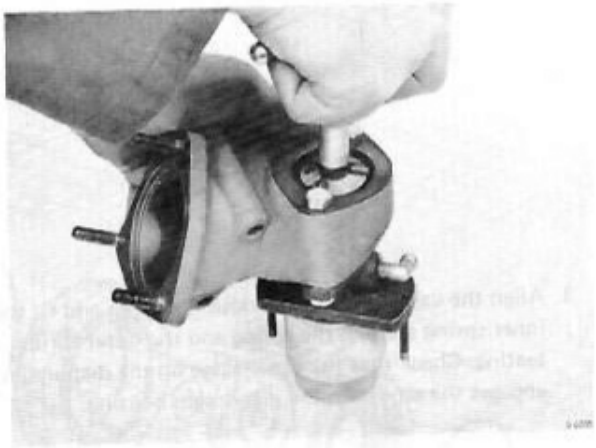
> Check that the spring is working correctly by pressing it together a few times. If it wobbles or cracks turn the spring to another position. The spring can otherwise give noise.

6. Fit the gasket and cover to the diaphragm housing. Check the charging pressure and adjust as necessary, and then seal the charge pressure regulator.



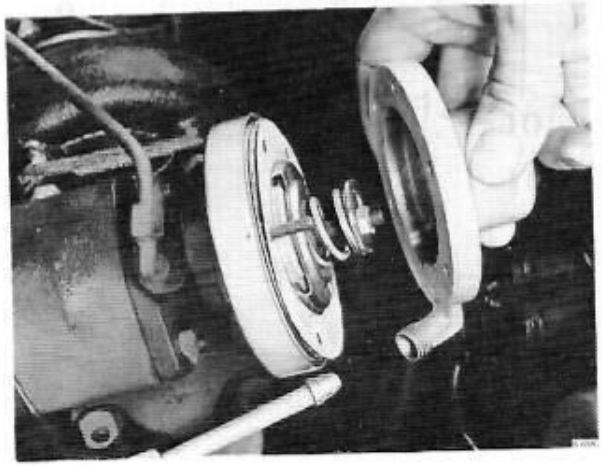
Grinding the valve and valve seat (charge pressure regulator removed)

1. Secure the valve body and bearing housing together by means of two bolts.
2. Fit guide pin 83 92 805 in the valve spindle guide.
3. Grind the valve seat using a 45° valve cutter. (The grinding work will be easier if the hard surface is first removed by means of emery clotch.)
4. Mount the valve in a valve grinding machine and clean the sealing surface (45°C).
5. Separate and thoroughly clean the valve body and bearing housing.

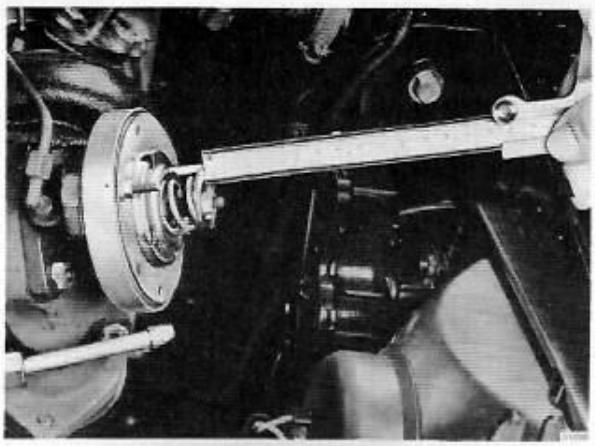


Changing the diaphragm (in the car)

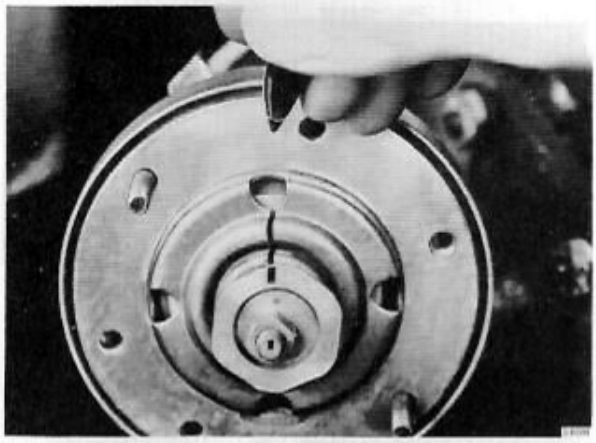
1. Remove the diaphragm housing cover.



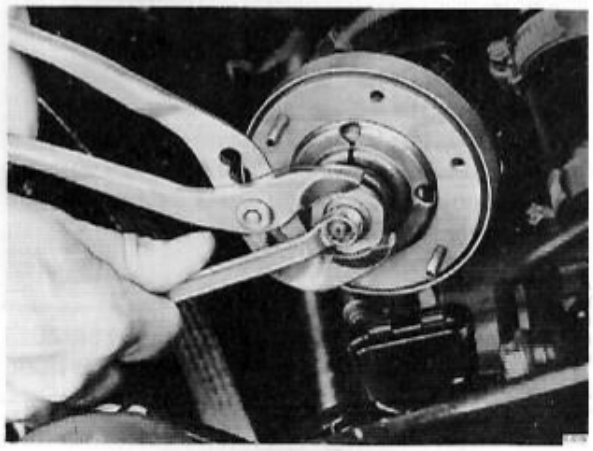
2. Measure and note the compressed length of the spring (the distance between the outer and inner spring seatings). Measure the length at two diametrically opposed points and note the mean value.



3. Mark the position of the valve to enable it to be refitted in the same position.

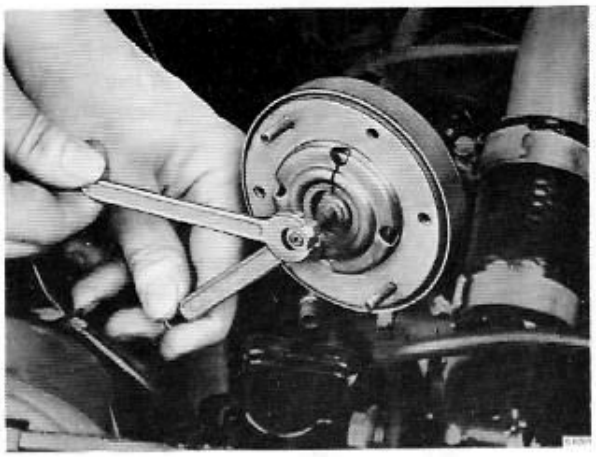


4. Loosen the lock nut (using a 10 mm ring spanner and polygrip pliers) and remove the nut, the outer spring seating, the spring and the inner spring seating.

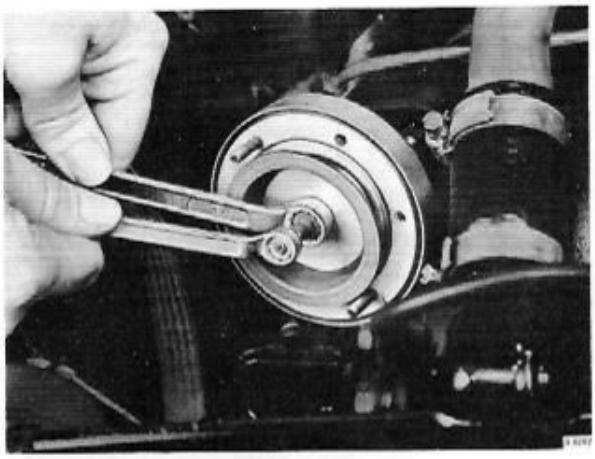


> CAUTION
> Always grip the valve seat when removing the spindle nut to avoid damaging the diaphragm.

5. Fit two nuts to the outer thread on the valve spindle and tighten both nuts.

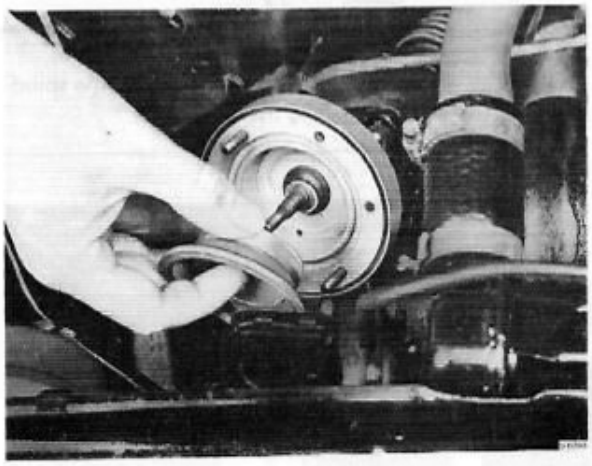


6. Holding the two nuts, undo the diaphragm nut.

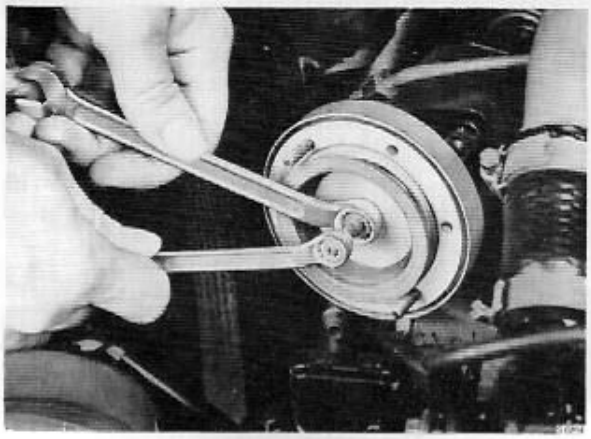


7. Remove the two nuts, the diaphragm nut, the outer diaphragm washer, the diaphragm and the inner diaphragm washer.
8. Clean the diaphragm housing and all dismantled parts.
9. Check that the flat washer inside the inner diaphragm washer is in position.
10. Fit the diaphragm with the two diaphragm washers. Ensure that the inner ridge on the diaphragm engages the groove in the diaphragm washer.

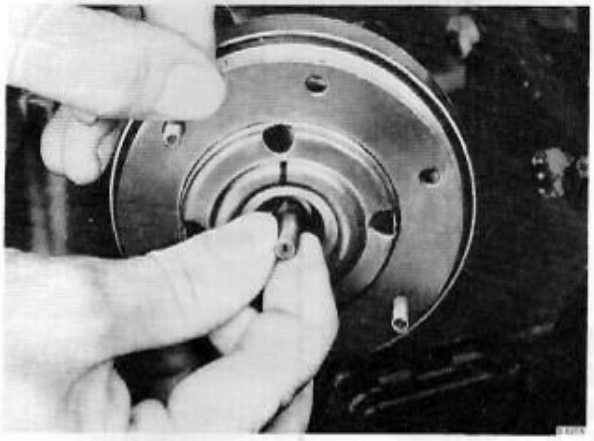
Lubricate the valve's threads with NEVER SEIZE or Molycote 100 to prevent them being burnt stuck.



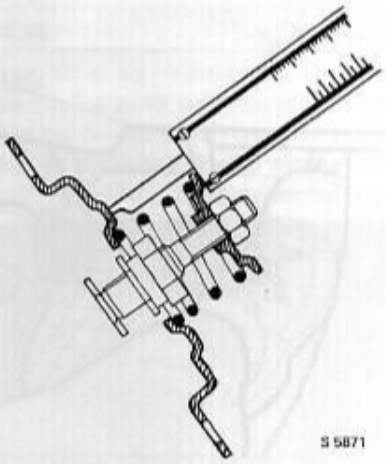
11. Fit the diaphragm nut and the two other nuts, and tighten the diaphragm nut. Remove the other two nuts.



12. Fit the inner spring seating and then align the valve with the previous markings.

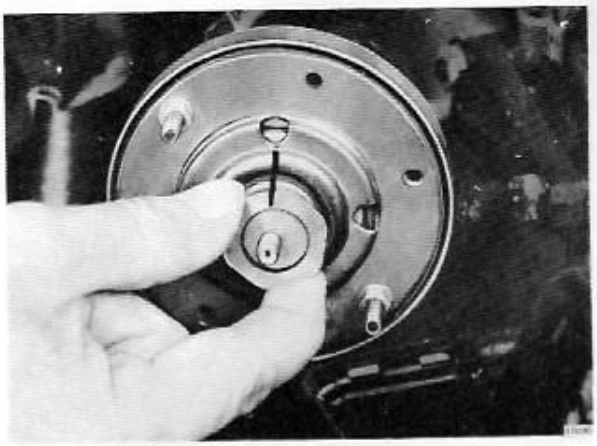


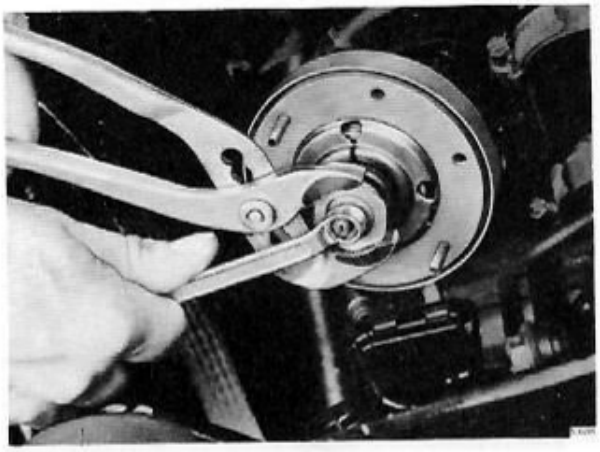
13. Fit the spring and the outer spring seating. The closest winded end of the spring should be facing the membrane.
14. Adjust the compressed length of the spring to the length measured on dismantling (the basic length given in the specifications is approximate). Replace and tighten the lock nut. Grip the outer spring seating by means of polygrip pliers.



15. Fit the gasket and diaphragm housing cover. Check the charging pressure and adjust as necessary, and then seal the charge pressure regulator.

Order nos: Wire (45) 300 78 79
Seal (45) 300 78 87

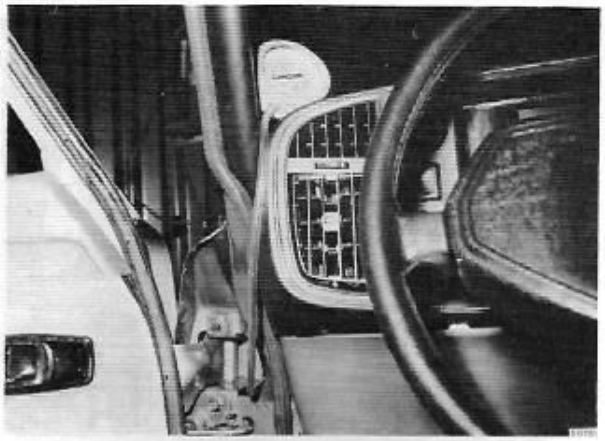




Measuring the charging pressure

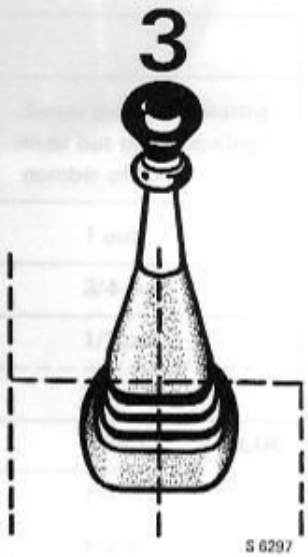
The charging pressure is measured while the car is being test driven and is indicated by means of a special pressure gauge connected to the inlet manifold.

1. Connect pressure gauge 83 92 813 between the nipple on the inlet manifold and the line to the pressure switch. Run the hose into the passenger compartment and place the pressure gauge on the left-hand corner of the instrument panel.



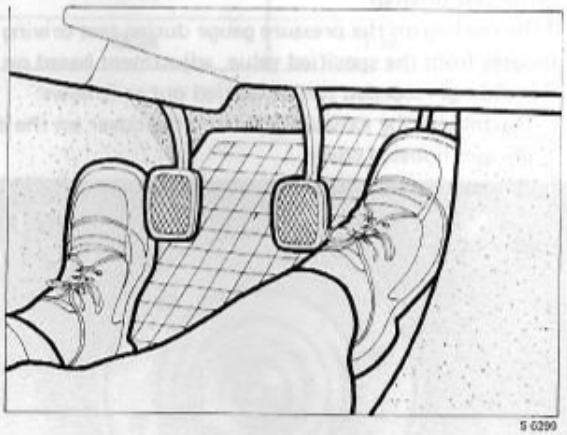
2. Warm up the engine properly by driving the car on the road.
3. To start the test, drive the car in 3rd gear at an engine speed lower than 1 500 rev/min.

S 6298

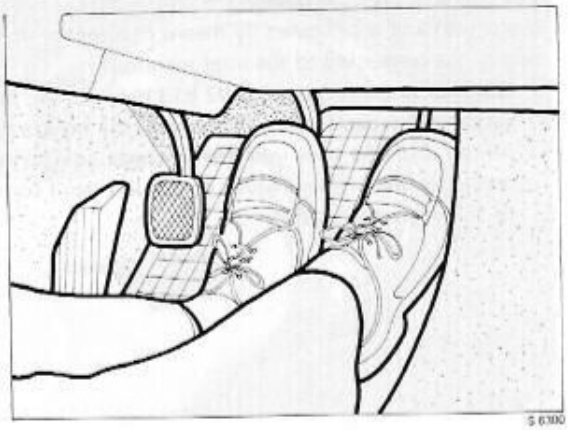


S 6297

4. Accelerate at full throttle by pressing the accelerator down to the floor.


S 6299

5. As the engine speed approaches 3 000 rev/min, apply the brakes (still keeping the accelerator pressed down) to put the car under full load at 3 000 rev/min and note the maximum pressure indicated by the pressure gauge.



S 6301

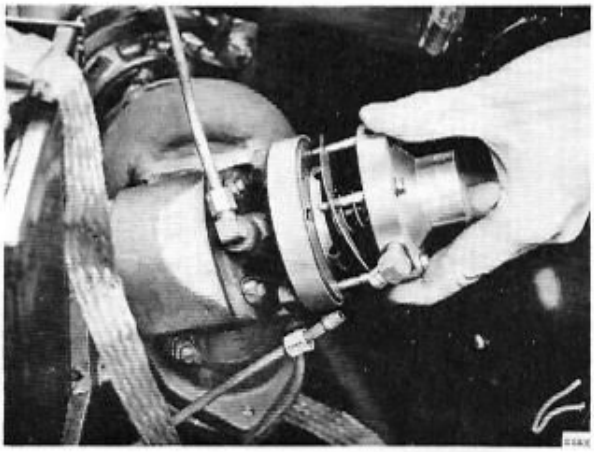
S 6302

Adjusting the charging pressure

(After test driving)

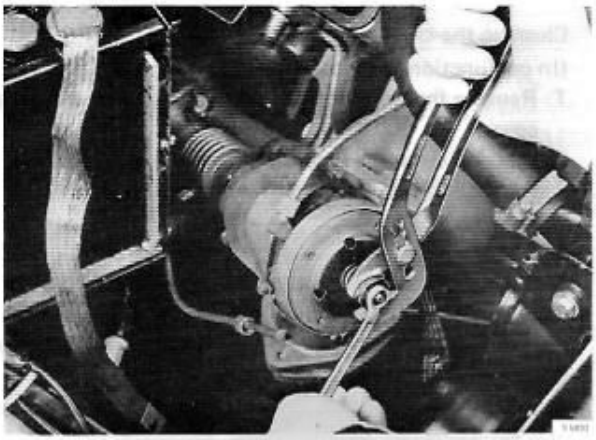
If the reading on the pressure gauge during test driving deviates from the specified value, adjustment based on the readings recorded can be carried out as follows:

1. Disconnect the exhaust line from the cover on the diaphragm housing cover.
2. Remove the diaphragm housing cover.



3. Undo the lock nut using a 10 mm ring spanner. Grip the spring seating by means of polygrip pliers.

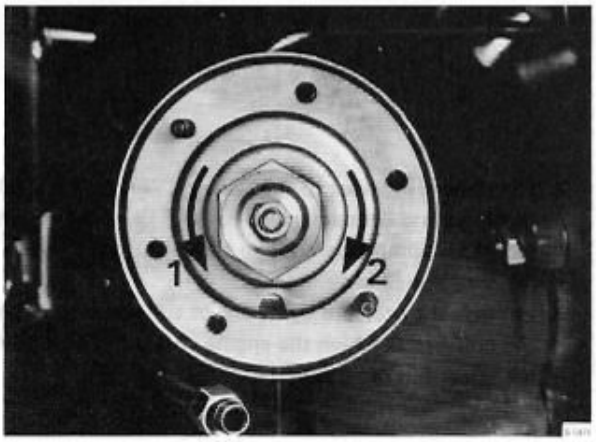
> **CAUTION**
> Always grip the valve seat when removing the spindle nut to avoid damaging the diaphragm. Never attempt to turn the valve.



4. Adjust the tension of the spring by rotating the spring seating clockwise (inwards) or counter-clockwise (outwards) in accordance with the following table. Ensure that the valve does not turn as the spring seating is rotated. Thereafter, retighten the lock nut.

Charging pressure	
Charging pressure reading from test driving (bar)	Screw the spring seating in or out the following number of turns
0.66	1 out
0.62	3/4 out
0.58	1/2 out
0.54	1/4 out
0.50	CORRECT VALUE
0.46	1/4 in
0.42	1/2 in
0.38	3/4 in
0.34	1 in

5. Replace the cover and gasket, and exhaust line.
6. Test drive the car and check the charging pressure.
7. Seal the charge pressure regulator.



ADJUSTMENT
1. Counter-clockwise
2. Clockwise

Cleaning the charge pressure regulator

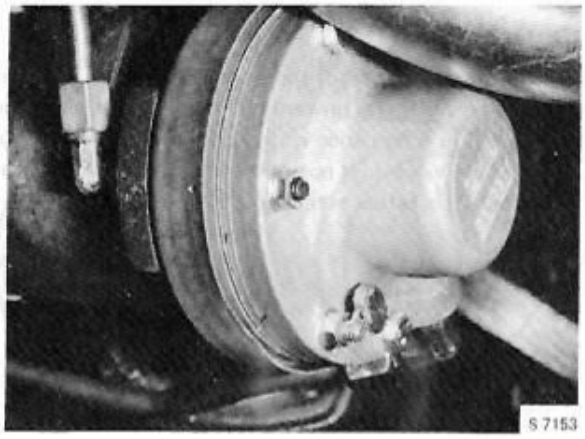
(In conjunction with inspection)

1. Remove the exhaust line and the diaphragm housing cover.
2. Dry and clean the diaphragm housing using a brush.
3. Replace the cover, exhaust line and heat shield.

Sealing the charge pressure regulator

To avert unauthorised adjustment of the charging pressure, the charge pressure regulator must be sealed. Fit the seal to the long diaphragm bolt which has a hole for the purpose.

Authorized Saab workshops will be supplied with sealing pliers and special seals.

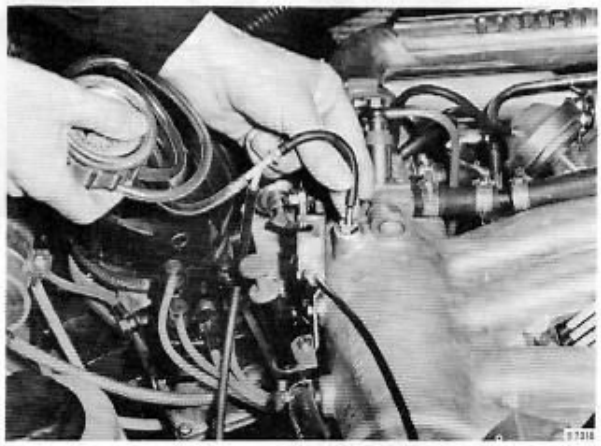


Pressure switch

Checking

1. Start the engine and have it idle.

2. Disconnect the hose to the pressure switch at the inlet manifold and connect gauge 83 92 813, together with a suitable pump (e.g. cooling system tester) to the pressure switch hose.
3. Increase the pressure by means of the pump and check the pressure at which the engine cuts out. Refer to the specifications in section 022.



Changing the pressure switch

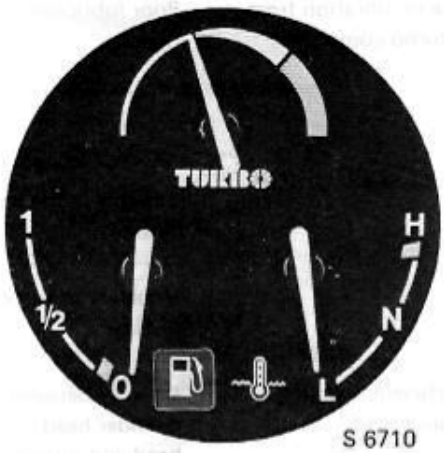
To change the pressure switch, remove the rubber cover and cables and then unscrew the pressure switch from its mounting.

Turbo pressure gauge

Checking

Check the turbo pressure gauge following the same procedure as that for checking of the pressure switch. At maximum charging pressure, the needle should be within the wide orange zone.

At the pressure switch actuating pressure, the needle should be in front of the limit between the orange and the red zones.



S 6710

Fault diagnosis chart, Saab Turbo

FAULT	CAUSE	REMEDY
Noise or vibration from the turbo compressor	Poor lubrication of the turbo shaft bearing	Check the oil pressure and flow to the turbo. If the fault should persist after remedial action (permanent bearing damage) exchange the turbo compressor.
	Leakage in the induction or exhaust system	Tighten leaking connections and replace defective seals and gaskets
	Unbalanced turbo shaft owing to damage	Exchange the turbo compressor
Insufficient charging pressure	Leakage between the compressor and cylinder head or between the cylinder head and turbine	Tighten leaking connections and replace defective seals and gaskets
	Incorrect setting of charging pressure	Adjust the charge pressure regulator
	Valve in charge pressure regulator sticks in open position	Overhaul the charge pressure regulator
	Partially clogged exhaust system	Clean or replace exhaust system
	Clogged air cleaner	Change cartridge
	Binding turbo shaft	Exchange turbo compressor
Excessive charging pressure	Leakage at exhaust pressure line connections	Tighten; if necessary, replace nipples
	Clogged exhaust pressure line	Remove and clean
	Damaged diaphragm in charge pressure regulator	Replace diaphragm
	Valve in charge pressure regulator sticks in closed position	Overhaul the charge pressure regulator
	Ice formation in exhaust pressure line. (Excessive pressure occurs 1–2 min after cold start when ambient temperature below freezing)	Avoid heavy loading of engine immediately after cold starting
	Incorrect setting of charging pressure	Adjust charge pressure regulator

FAULT	CAUSE	REMEDY
Metallic noise from charge pressure regulator	Play in regulator valve	Overhaul the charge pressure regulator
	Spring insufficiently offset in charge pressure regulator	Adjust position of spring (replace as necessary)
Engine knocking	Excessive charging pressure	Adjust charging pressure
	Unsuitable fuel (octane too low)	Change fuel
	Ignition setting too far advanced	Adjust timing
Oil leakage at turbo shaft seals (oil fumes in exhaust)	Poor return flow from turbo: – Clogged return line – Excessive crankcase pressure – Air cleaner clogged oil coating on compressor seals	Check return line Check crankcase ventilation Change air cleaner
	Turbo unit seals damaged	Exchange turbo compressor

Saab-Scania AB

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