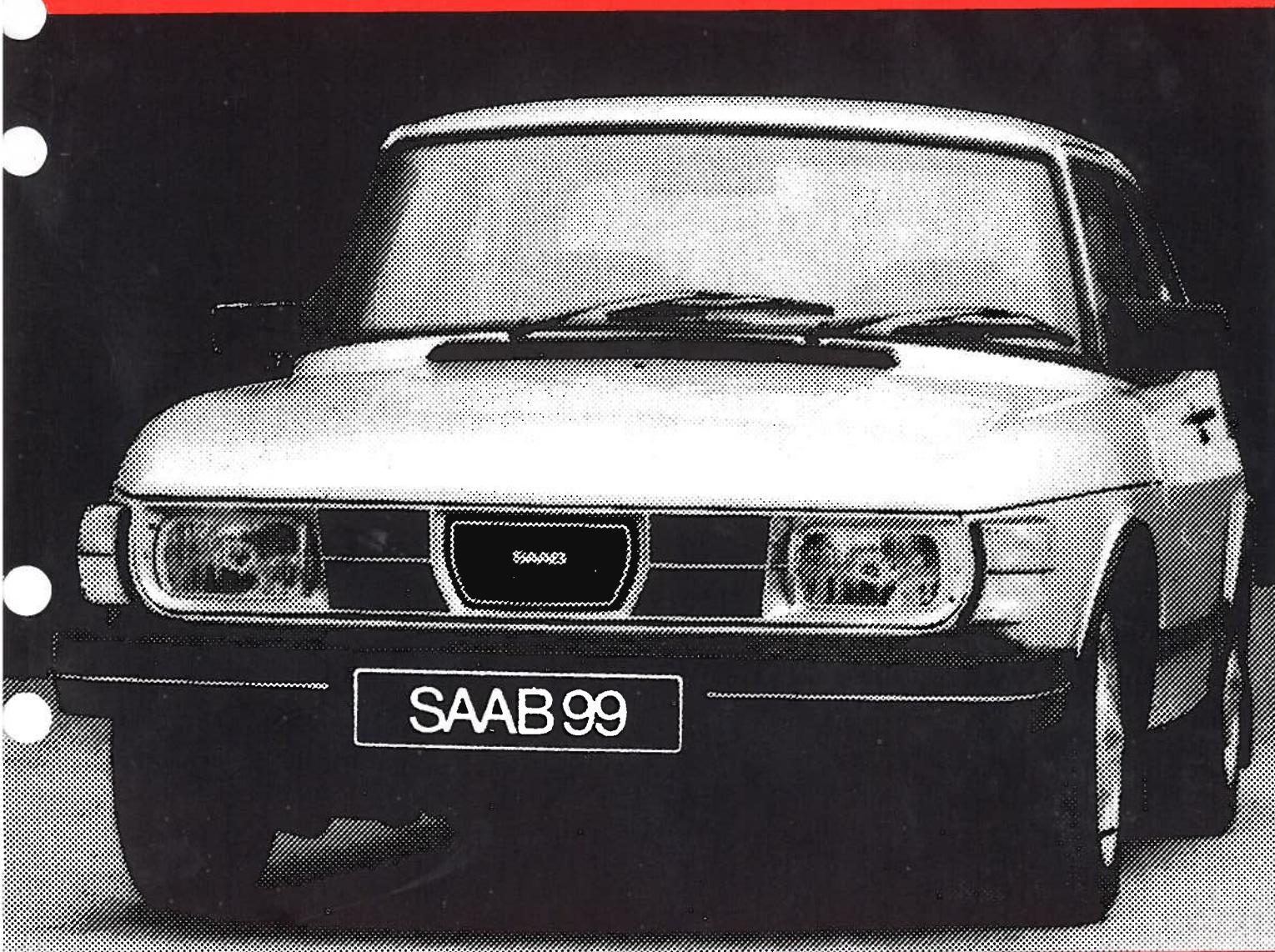


SAAB

Service Manual Saab 99



M 1975—81

Engine **2**

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2 Engine

M 1975–81

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2. Engine

M 1975-87

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299	Oil change service indicator
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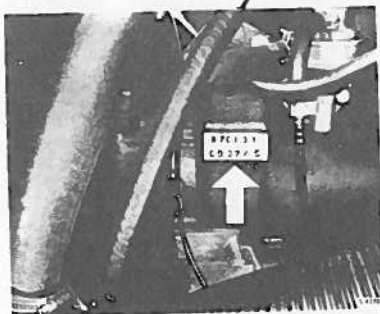
Specifications

UPPLYSNINGAR OM AVGASKONTROLL	
TILVERKARE: SAAB-SCANIA AB	MOTORSTORLEK: 1900 cm ³
MOTORFAMILJ: B1 20 P	(BRÄNSLEINSPR: MANUELL VZ LÅDA)
SAAB 90-FORDONSTYP IM	(BRÄNSLEINSPR: AUTOMATISK VZ LÅDA)
SAAB 90-FORDONSTYP IA	
TOMGÅNGSVÄRDET MED TÄT HALVLÖS	
FORDONSTYP IM, IA: 815 ± 30 R/MIN	
CO-HALT VID TOMGÅNG	
FORDONSTYP IM, IA: 1.5 % ± 0.5	
TÄNDSTÄLLNING VID 800 R/MIN OCH VACUUMLEDNINGEN BORTKOPPLAD	
VÄGELLADAN I NEUTRALLÅGE	
FORDONSTYP IM 14" F O D	
FORDONSTYP IA 17" F O D	
VENTILSPEL KALL MOTOR INLOPP 0.15-0.30 UTLOPP 0.25-0.50	
KAMMERSPEL 50" ± 3 ELEKTRODÅRSTÅND TÄNDSTIFT 0.6-0.7	
DETTA FORDON ÖVERENSSTÄMMER MED FÖRESKRIFTERNA I DEN SVENSKA	
BRÄVGÅSKUNGÖRELSEN FÖR FORDON AV 1976 ELLER SENARE ÅRS MODELL	
SAAB-SCANIA S 5570	

Information concerning exhaust gas emission control



S 07003



Engine number

Engine number

B - petrol engine, single carburetor	<u>B</u>	<u>20</u>	<u>P01</u>	<u>000001</u>
BT - petrol engine, twin carburetor				
BI - petrol engine, fuel injection				
BSI - petrol engine, fuel injection and Turbocharger				
Cylinder volume in dl				
Variant designation				
Manufacturing number				

Engine

General data

Single-carburetor

Type	4-cyl, 4-stroke with overhead camshaft
Power rating, DIN (SAE net)	73 kW (100 hp)/5.200 r/min
Max. torque, DIN	162 Nm (115 ftlb, 16.5 kgm) 3.500 r/min
Compression ratio	9.2:1
Cylinder bore	3.543" (90.0 mm)
Stroke	3.071" (78.0 mm)
Cylinder volume	121.0 in ³ (1985 cm ³)
Ordering of firing (No. 1 at rear)	1-3-4-2
Engine idling speed (warm engine and headlamps on low beam)	875 ± 50 r/min
Weight incl. clutch, throttle valve housing, exhaust manifold, starter and oil filter	appr. 308 lb. (140 kg)
Fuel, octane number, min.	RON 97

Twin-carbureted engine

Type	4-cyl., 4-stroke with overhead camshaft
Power rating, DIN (SAE net)	79 kW (108 hp)/5.200 r/min
Max. torque, DIN	164 Nm (121 ftlb, 16.7 kgm) 3300 r/min
Compression ratio	9.2:1
Cylinder bore	3.543" (90.0 mm)
Stroke	3.071" (78.0 mm)
Cylinder volume	121.0 in ³ (1985 cm ³)
Ordering of firing (No. 1 at rear)	1-3-4-2
Engine idling speed (warm engine and headlamps on low beam)	850 ± 50 r/min
Weight incl. clutch, throttle valve housing, exhaust manifold, starter and oil filter	appr. 308 lb. (140 kg)
Fuel, octane number, min.	RON 97

Injection engine

Type	4-cyl., 4-stroke with overhead camshaft
Power rating, DIN (SAE net)	87 kW (118 hp)/5.500 r/min
Max. torque, DIN	167 Nm (123 ftlb, 17.0 kgm) 3.700 r/min
Compression ratio	9.2:1
Cylinder bore	3.543" (90.0 mm)
Stroke	3.071" (78.0 mm)
Cylinder volume	121.0 in ³ (1985 cm ³)
Ordering of firing (No. 1 at rear)	1-3-4-2
Engine idling speed (warm engine and headlamps on low beam)	850 ± 50 r/min
Weight incl. clutch, throttle valve housing, exhaust manifold, starter and oil filter	appr. 308 lb. (140 kg)
Fuel, octane number, min.	RON 97

Type	<u>Turbo engine</u>
Power rating, DIN (SAE net)	4-cyl., 4-stroke with overhead camshaft
Max. torque, DIN	107 kW (145 hp) at 5.000 r/min
Compression ratio	235 Nm (24 kgm)/3000 r/min
Cylinder bore	7.2:1
Stroke	90 mm
Cylinder volume	78 mm
Ordering of firing (No. 1 at rear)	121.0 in ³ (1985 cm ³)
Engine idling speed (warm engine and headlamps on low beam)	1-3-4-2
Weight incl. clutch, throttle valve housing, exhaust manifold, starter and oil filter	875 ± 50 r/min
Fuel, octane number, min.	appr. 308 lb. (140 kg) RON 97

Cylinder block

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

Cylinder head

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

Pistons

Make	"MAHLE" or "KARL SCHMIDT"
	Pistons of different makes must not be fitted to the same engine.
Material	Light 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 pin):	
Standard (AB)	89.980-89.986 mm
Standard (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/s at 5000 r/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 bush, installed	24.004-24.010 mm
Maximum allowed weight difference between connecting rods in same engine	6 g

Crankshaft

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

Crank pin diameter:

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

Main journal diameter:

Standard	57.981-58.000 mm
1st undersize	57.731-57.750 mm
2nd undersize	57.481-57.500 mm
3rd undersize	57.237-57.250 mm
4th undersize	56.987-57.000 mm
Radius at journal end	2.2-2.5 mm

Max. out-of-round of journals	0.05 mm
Max. conicity of journals	0.05 mm
Bearing material	Lead-bronze
Crankshaft end float	0.08-0.28 mm
Big-end bearing clearance	0.020-0.062 mm
Crank bearing clearance	0.025-0.062 mm

Colour markings, main and connecting rod bearing shells:

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

Camshaft

Carbureted engine, 1975 model

Carbureted engine, as from model 1976

Number of bearings	5	5
Bearing diameter	Up to and incl. engine number B20P01 45992 and B20P02 10500: 25,94 mm As from engine number B20P01 45993 and B20P02 10501: 28.94	28.94 mm
Camshaft end float	0.08-0.25 mm	0.08-0.25 mm
Cam lift (at 0 valve clearance):		
Inlet valve	10.4 mm	10.3 mm
Exhaust valve	10.6 mm	10.5 mm
Valve timing:		
Inlet (nominal valve clearance)	opens at 12° BTDC closes at 56° ABDC	opens at 10° BTDC closes at 54° ABDC
Exhaust (nominal valve clearance)	opens at 56° BBDC closes at 12° ATDC	opens at 54° BBDC closes at 10° ATDC

Fuel-injection engines

Turbo engine

Number of bearings	5	5
Bearing diameter	28.94 mm	28.94 mm
Camshaft end float	0.08-0.25 mm	0.08-0.25 mm
Cam lift (at 0 valve clearance):		
Inlet valve	10.8 mm	10.3 mm
Exhaust valve	11.0 mm	10.5 mm
Valve timing:		
Inlet (nominal valve clearance)	opens at 10° BTDC closes at 54° ABDC	opens at 12° BTDC closes at 40° ABDC
Exhaust (nominal valve clearance)	opens at 46° BBDC closes at 18° ATDC	opens at 62° BBDC closes at 2° ATDC

Valve mechanism

Valve face angle, inlet and exhaust	44.5°
Valve seat angle in cylinder head, inlet and exhaust	45°
Valve seat width, inlet and exhaust	1-2 mm
Valve stem diameter:	
Inlet	7.960-7.975 mm
Exhaust	7.955-7.980 mm
Max. clearance valve stem- valve guide	0.5 mm Measured on valve head, raised 0.12" (3 mm) above seat
Valve head diameter:	
Inlet	42.0 mm
Exhaust	35.5 mm (34.5 mm later design)

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:

	1975 model	As from 1976 model
Installed length	39.5 mm	39.5 mm
Free length	44.3 mm	43.1 mm
Length at full elevation	29.5 mm	29.5 mm
Load at full elevation	795-880 N (178-198 lb, 81-90 kg)	755-815 N (170-183 lb., 77-83 kg) (N.B This valve spring (83 58 467) must only be fitted in combination with camshaft 83 58 186 (carbureted engines as from 1976 model and camshaft 83 56 057 (injection engine as from 1975 model.

Valve depressors:

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

Materials:

Exhaust valve	Stellited steel Sodium-cooled exhaust valve are fitted in 1977 model cars with fuel injection engines, as from engine Nos. BI 20 P01006201, BI 20 P02002615 BI 20 P04003376, BI 20 P05001556 BI 20 P07001001 (and P07000604-P07000625
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N.B.

Sodium-cooled valves for scrapping must under no circumstances be mixed with ordinary scrap before they have been specially treated, owing to the risk of explosion. Refer to Section 214 under "Scrapping of sodium-cooled valves".

Inlet valve	Steel
Valve guides	(Valve spindles are chromium plated)
Valve seats	Cast iron
	Sintered metal
Valve clearances, cold engine (30 minutes after running the engine warm):	
Inspection tolerance zone:	
Inlet	0.006-0.012" (0.15-0.30 mm)
Exhaust	0.014-0.020" (0.35-0.50 mm)
	Turbo 0.016-0.020 (0.40-0.50 mm)
Adjustment tolerance zone:	
Inlet	0.008-0.010" (0.20-0.25 mm)
Exhaust	0.016-0.018" (0.40-0.45 mm)
	Turbo 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
Pressure-lubricated points	Dual-rotor type oil pump
Splash-lubricated points	Camshaft, crankshaft, idler shaft, connecting rods, transmission chain
Oil filter	Gudgeon journals, cylinder walls, valve depressors and valve stems
Crankcase ventilation, fully enclosed	Full-flow type
	From crankcase through valve cover - restriction to inlet manifold. Valve cover is connected to atmospheric pressure via the air cleaner.
Lubricating oil, grade:	
SAE 10 W 30, 10 W 40 or 5 W 30.	
If no oil meeting these specifications is available, oil with a viscosity of SAE 10 W 50 may be used.	
Service SE in API-system or Ford spec. ESE-M2C-101C	
Oil volume incl. filter	6 Imp. pints (3.5 litres)
Oil pump pressure-reducing valve opens at	4.0-5.0 bar (kgf/cm ² , 57-71 lb/in ² .)
Oil pressure warning light comes on at	0.3-0.5 bar (kgf/cm ² , 4.2-7.1 lb/in ² .)
Oil pressure at 2000 r/min (oil SAE 10 W 40 at 80°C)	Min. 3.0 bar (kgf/cm ² , 43 lb/in ² .)
Oil pump:	
Axial clearance between rotor and housing	0.002-0.003" (0.05-0.09 mm)
Oil cooler air (Turbo) opening temp. of thermostatic valve	approx. 75°C

Fuel system

Single-carburetor

	<u>As from 1975 model</u>	<u>Modifications as from 1977 model</u>
Make	Zenith	
Model	175 CD-2S(E)	175 CDSEVX
Diameter	1 3/4"	
Metering needle	BIDS	
Float setting	0.63-0.67 in (16-17 mm) between the highest point on the float and the seal of the carburetor body.	
Float valve	0.08 in (2.0 mm)	
Oil type in carburetor damper	Automatic transmission oil to Ford specification M2C.33F or equivalent	
Level or oil in carburetor damper	Min. of 0.040 in (10 mm) be- low top of damper	
Clearance between fast idling cam and adjusting screw (choke in)	0.04 in (1.0 mm)	
Normal idling speed (engine warmed up and headlights dipped)	850 \pm 50 rpm	
CO content		
Up to and incl. 1976 model:	max 3.5 % at 850 r/min	
As from 1977 model Europe	1.5 \pm 1 % at 850 r/min	
As from 1977 model Sweden	1.75 \pm 0.25 % at 2000 r/min (check value: max. 4.5 % at idling speed)	
On setting at 2000 r/min: Vacuum pipe to distributor, crankcase ventilation hose and, where applicable, vacuum pipe to the EGR valve disconnected.		
Fuel jet setting (adjustable up to and incl 1976 model	0.098 \pm 0.008 in (2.5 \pm 0.2 mm) between upper sur- face of fuel jet jet bridge surface in carburetor housing	
Fuel jet setting (fixed as from 1977 model		Inserted to a distance of 0.098 in (2.5 mm) from jet bridge surface
Fuel needle setting in vacuum piston (initial setting for adjustment)	Lower part of groove for plastic washer level with the underside of vacuum piston	
Initial setting for adjustment of fuel needle as from 1977 model		Shoulder of needle level with bottom edge of vacuum piston
Temperature compensator, opening at room temperature (+68 °F/+20 °C)	0.004-0.012 in (0.1-0.3 mm)	
Colour coding of vacuum piston return spring	Red	

<u>Twin-carburetor</u>	<u>As from 1975 model</u>	<u>Modifications as from 1977 model</u>
Make	Zenith	
Model	150 CD-2S(E)	150 CDSEVX
Diameter	1 1/2"	
Metering needle	B1DS	B5EJ (as from 1980 model B5EQ)
Float setting	0.63-0.67 in (16-17 mm) between the highest point of the float and the mating surface at the carburetor housing	
Float valve	0.08 in (2.0 mm)	
Oil type in carburetor damper	Automatic transmission oil to Ford specification M2C.33F or equivalent	
Level of oil in carburetor damper	Min. 0.39 in (10 mm) under the upper part of the damper cylinder	
Clearance between fast idling cam and adjusting screw (choke in)	0.04 in (1.0 mm)	
Normal idling speed (engine warmed up and headlights dipped)	850 \pm 50 rpm	
CO content		
Model 1975:	max 3.5 % at 850 r/min	
As from 1977 model Europe	1.5 \pm 1 % at 850 r/min	
As from 1977 model Sweden	1.0 \pm 0.25 % at 2000 r/min (check value: max. 4.5 % at idling speed)	
On setting at 2000 r/min: Vacuum pipe to distributor, crankcase ventilation hose and, where applicable, vacuum pipe to the EGR valve disconnected.		
Fuel jet setting (adjustable up to and incl 1976 model)	0.098 \pm 0.008 in (2.5 \pm 0.2 mm) between upper surface of fuel jet bridge surface in carburetor housing	
Fuel jet setting (fixed as from 1977 model)		Inserted to a distance of 0.098 in (2.5 mm) from jet bridge surface
Fuel needle setting in vacuum piston (initial setting for adjustment)	Lower part of groove for plastic washer approx. 0.016 in (0.4 mm) below bottom of vacuum piston	
Initial setting for adjustment of fuel needle as from 1977 model		Shoulder of needle level with bottom edge of vacuum piston
Temperature compensator, opening at room temperature (+68°F/+20°C)	0.004-0.012 in (0.1-0.3 mm)	
Return spring for vacuum piston, color	Blue	
<u>Others</u>		
Fuel pump (mechanical) type	AC Delco No. 7990045	
Static fuel pressure at starter speed	0.17-0.25 bar (kg/cm ² , 2.4-3.6 lb/in ² .)	
Fuel tank capacity	12.1 Imp. gal. (55 liters)	

Fuel system, injection engine

Components

Injection valve	0 437 502 004	As from 1980 model 0 437 502 012
Cold start valve	0 280 170 401	
Mixture control unit:		
Up to and incl. 1976 model	0 438 040 004	
1977 model	0 438 040 034	
As from 1978 model	0 438 120 049	Turbo 0 438 040 041
Air flow sensor:		
Up to and incl. 1976 model	0 438 120 013	
1977 model	0 438 120 046	
As from 1978 model	0 438 120 071	Turbo 0 438 120 087
Fuel distributor:		
Up to and incl. 1977 model	0 438 100 005	
As from 1978 model	0 438 100 023	Turbo 0 438 100 057
Warm up regulator, up to and incl. 1976 model	0 438 140 013	
Warm up regulator, up to and incl. 1977 model	0 438 140 020	Turbo up to and incl. model 1979: 0 438 140 051 Turbo as from 1980 model 0 438 140 070
Auxiliary air valve	0 280 140 107	
Fuel filter, up to and incl. 1978 model	0 450 905 005	
Fuel filter, as from 1977 model	0 450 905 021	
Fuel accumulator:		
Up to and incl. 1977 model	0 438 170 001	
1978 model	0 438 170 014	
As from 1979 model	0 438 170 010	
Fuel pump		
Up to and incl. 1977 model	0 580 254 994	
As from 1978 model	0 580 245 978	
Temperature-sensing		
Up to and incl. 1977* model	0 280 130 214	
As from 1977** model	0 280 130 217	
* Up to and incl. engine number:	PI20 PO1-8201, BI20 PO2-3301, BI20 PO7-1626	
** As from engine number:	PI20 PO1-8202, BI20 PO2-3302, BI20 PO7-1627	

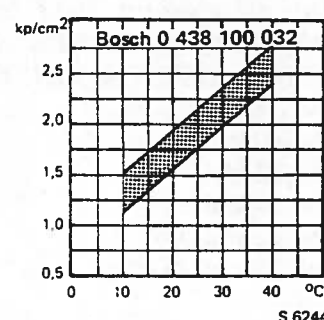
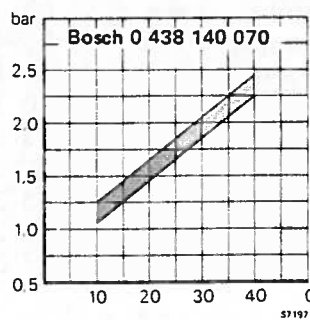
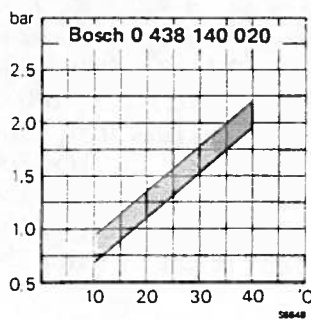
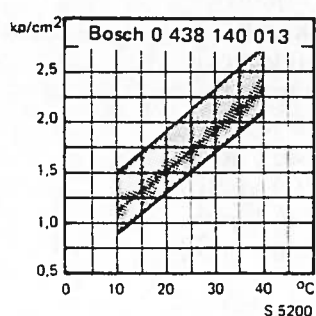
Test values

- Fuel pump, capacity. (minimum flow against system pressure, ie. measured in the return pipe)

Up to and including 1977 model
750 cm³/30 s
As from 1978 model 900 cm³/30 s

- Control pressure, cold engine

Up to and incl. 1976 model



3. Control pressure, warm engine	3.4-3.8 bar (kg/cm ² , 48.5-54.0 lb/in ²)
4. Control pressure, full-laden Turbo 1978-1979 models: 62 ⁰ or speed above 130 km/h	2.5-2.9 bar (kg/cm ² , 35.6-41.2 lb/in ²)
1980 model Simulated charging pressure in excess of 0.33-0.40 bar	2.5-2.9 bar (kg/cm ² , 35.6-41.2 lb/in ²)
5. Line pressure: Test value	4.5-5.1 bar (kg/cm ² , 64.0-72.5 lb/in ²) Turbo 5.2-5.8 bar (kg/cm ² , 74-82.5 lb/in ²)
Setting value	4.7-4.9 bar (kg/cm ² , 66.9-69.7 lb/in ²) Turbo 5.4-5.6 bar (kg/cm ² , 76.8-79.7 lb/in ²)
6. Leakage check: Minimum pressure af- ter 20 minutes As from 1978 model	1.0 bar (kg/cm ² , 14.2 lb/in ²) 1.5 bar (kg/cm ² , 21.3 lb/in ²)
7. Injection valve: Opening pressure as from date code 828 (1978)	2.5-3.6 bar (kg/cm ² , 35.6-49.8 lb/in ²)
Opening pressure as from date code 829 (1979 model)	2.7-3.8 bar (kg/cm ² , 38.4-54 lb/in ²)
Opening pressure 1980 model	3.0-4.1 bar (kg/cm ² , 42.6-58.3 lb/in ²)
Maximum variation between injection valves in same engine	0.6 bar (kg/cm ² , 8.5 lb/in ²)
8. Leakage check, injection valve	Test system should maintain a pressure of 2.4 bar (kg/cm ² , 34.1 lb/in ²) for 15 s
9. Idling speed setting (warm engine and cars to swedish specification: day warning lights on. CO content: Up to and including 1976 model Europe as from 1977 model Sweden as from 1977 model	850 ± 50 r/min Max. 3.5 % at 850 r/min 1.5 ± 1 % at 850 r/min 1.5 ± 0.5 % at 850 r/min

Tightening torques

Air flow sensor:	
Stop bracket retaining bolts	4.7-5.3 Nm (3.4-8.8 ftlb, 47-53 kgcm)
Counterweight retaining bolts	4.7-5.3 Nm (3.4-8.8 ftlb, 47-53 kgcm)
Air flow sensor plate retaining screw	5.0-5.5 Nm (3.6-4.0 ftlb, 50-55 kgcm)
Fuel distributor retaining bolts	3.2-3.8 Nm (2.3-2.7 ftlb, 32-38 kgcm)
Line pressure regulator screw plug	13-15 Nm (9.4-10.8 ftlb, 130-150 kgcm)
M 8 bolt	10-12 Nm (7.2-8.7 ftlb, 100-120 kgcm)
M 10 bolt	13-15 Nm (9.4-10.8 ftlb, 130-150 kgcm)
M 12 bolt	20-24 Nm (14.4-17.4 ftlb, 200-240 kgcm)
M 14 bolt	15-20 Nm (10.8-14.4 ftlb, 150-200 kgcm)
M 12 cap nut	15-20 Nm (10.8-14.4 ftlb, 150-200 kgcm)
M 14 cap nut	25-30 Nm (18.1-21.8 ftlb, 250-300 kgcm)

Turbo system

Turbo compressor make	Garrett AiResearch
Maximum charging pressure (see Measuring the charging pressure)	0.70 ± 0.05 bar kg/cm^2 , 12.8 ± 1.4 lb/in ²
Approximate length of spring in charge pressure regulator (basic setting)	Approx. 18 mm (0.708 in)
Pressure switch actuating pressure	0.9 ± 0.1 bar (kg/cm^2 , 12.8 ± 1.4 lb/in ²)
Clearance, turbo shaft bearings:	
End float	0.025-0.10 mm
Radial clearance	0.075-0.18 mm
Fuel boosting device, 1979 model:	
Type	Full-load enrichment dependent on speed and throttle valve position
Throttle valve switch (throttle opening when switch closes)	62°
Speed transmitter (closing speed)	80 ± 3 mph (130 ± 5 km/h)
Pressure regulator (reduced control pressure)	2.5-2.9 bar (kg/cm^2 , 35-41.2 lb/in ²)
CO value with throttle valve switch depressed (CO value at idling speed set at 1.0-2.0 %)	4-6 % CO approx
Fuel boosting device as from 1980 model	
Type	Charging pressure controlled full-load boosting. Warm-up regulator and special control system)
Warm-up regulator	
Simulated charging pressure when the control pressure is reduced	0.33-0.40 bar kg/cm^2 , 4.7-5.7 lb/in ²
Reduced control pressure (with charging pressure over 0.4 bar (5.7 lb/in ²))	2.5-2.9 bar (kg/cm^2 , 35-41.2 lb/in ²)
Throttle valve switch (throttle opening when contact closes)	62° approx.
CO value at idling speed with simulated charging pressure over 0.4 bar (5.7 lb/in ²)	4-6 % CO approx.

Exhaust emission control system

EGR system

	<u>On-off</u>	<u>Two port (Injection engine with automatic transmission), as from 1978 model</u>
EGR cut-in speed (fast idling)	Around 1 900 r/min	$2\ 600 \pm 300$ r/min
Vacuum necessary to open EGR valve	2.36 ± 0.20 in (60 ± 5 mm) Hg	2.36 ± 0.2 in (2.36 ± 5 mm) Hg
Opening temperature of PVS valve	Approx. 100°F (38°C)	Approx. 100°F (38°C)
Restriction diameter at EGR outlet in exhaust manifold	0.16 in (4 mm)	No restriction

Deceleration valve, carbureted engines (up to and incl. 1977 model)

Setting:

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

Checking:

Rev up the engine and release the throttle.

Check that the engine speed - after slight delay - returns smoothly and distinctly to idling speed.

Electrically controlled deceleration device

Speed transmitter	Energizes the solenoid when the speed of the car exceeds 19-22 mph/30-35 km/h.
Deceleration solenoid, adjusting	Increases the idling speed to $1\ 550 \pm 50$ r/min (Turbo 1978-1979 model: $1\ 400 \pm 50$ r/min) when the throttle is closed and the solenoid connected to battery voltage (at speeds above 19-22 mph/30-35 km/h)

N.B.

The solenoid cannot open the throttle valve but merely functions as a stop to prevent the throttle closing completely during engine overrun at speeds exceeding 19-22 mph/30-35 km/h.

Deceleration valve, injection engine

	Up to and incl. 1976 model	As from 1977 model
Time for engine to drop from 3 000 r/min to idling speed	4-5 s	3-6 s

Delay valve

Delay of vacuum signal to vacuum regulator in distributor

6 ± 2 s (Turbo Sweden as from 1979 model: 20 ± 4 s)

Dashpot

Check. Deceleration time from 3000 r/min to idling speed

3-6 s

Setting: r/min when the dashpot rod hits the stop on the throttle spindle. (Vacuum pipe disconnect from the distributor, engine warm)

1979 model: 2600 ± 100
As from 1980 model: 2000 ± 100

Exhaust system

Exhaust pipe inner diameter 1.73" (44 mm)

Cooling system

Type Pressurized
Liquid capacity of cooling system incl. heating system 7 Imp. quarts (8 l)
Thermostat opens at $89^{\circ} \pm 2^{\circ}$
Radiator pressure cap opens at 0.9-1.2 bar (kg/cm², 12.8-17.0 lb/in²)

Water pump

Clearance between pump shaft and pump cover No. adjustment needed. Original gasket gives correct clearance.

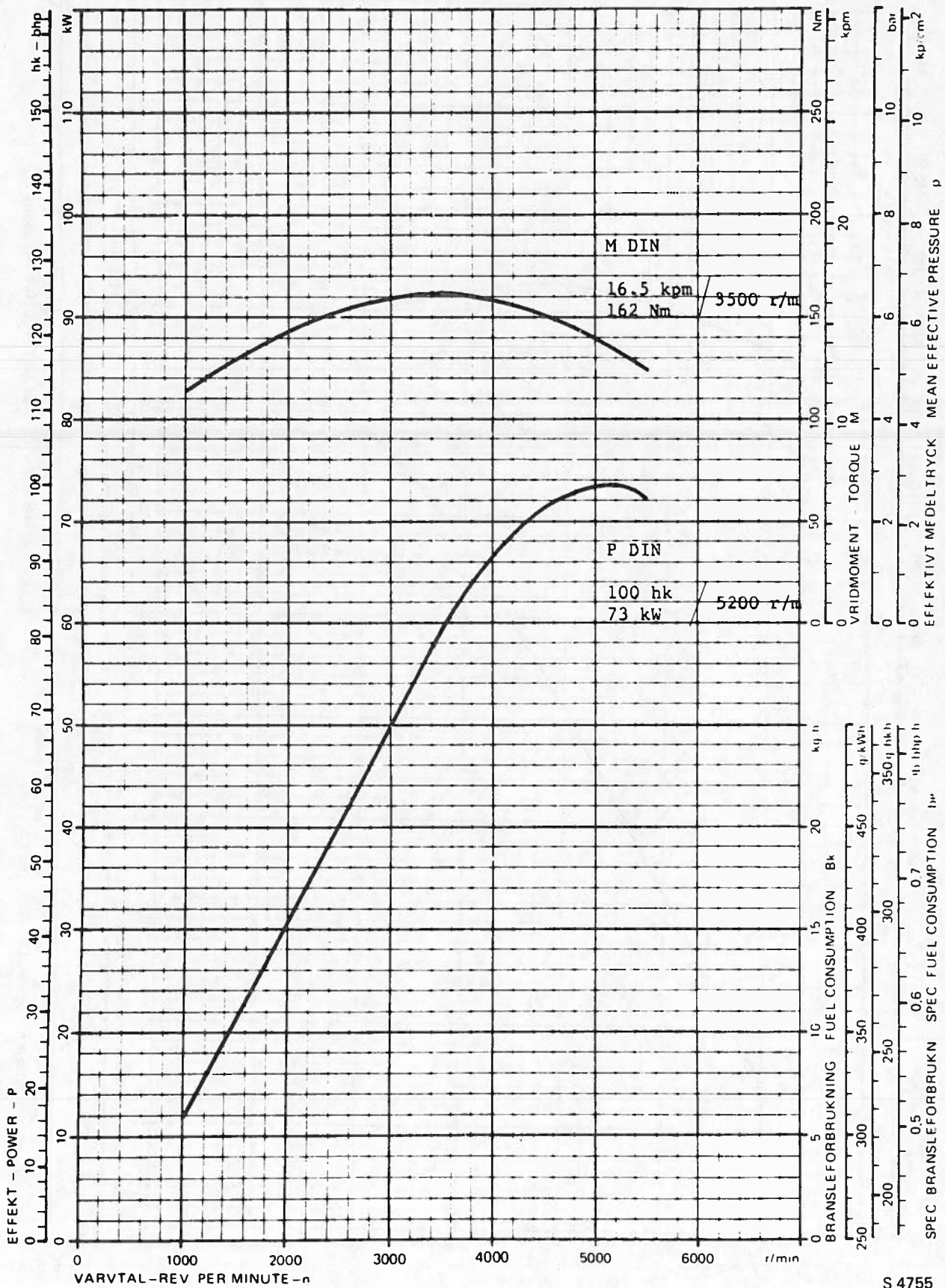
Hammers must never be used when removing or fitting the later version of water pump (impeller retained by nut). As from 1977 model, the thread on the water pump shaft is only used during removal of the pump.
Se Group 2.

Tightening torques

	<u>Dimension</u>	<u>Nm</u>	<u>Torque</u> <u>kgm</u>	<u>ftlb</u>
Main bearings	M 12	108	11	79
Big-end bearing bolts	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
Seal 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
Water pump impeller (earlier version, bolt)	M 8 (left-hand thread)	25	2.5	18
Water pump impeller (later version, nut)	M 12 (left-hand thread)	15	1.5	11
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
Chain sprocket idler shaft	M 10	25	2.5	18
Chain sprocket 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 1975 model	M 10	25	2.5	18
Exhaust manifold 1976 model	M 8	20	2.0	14

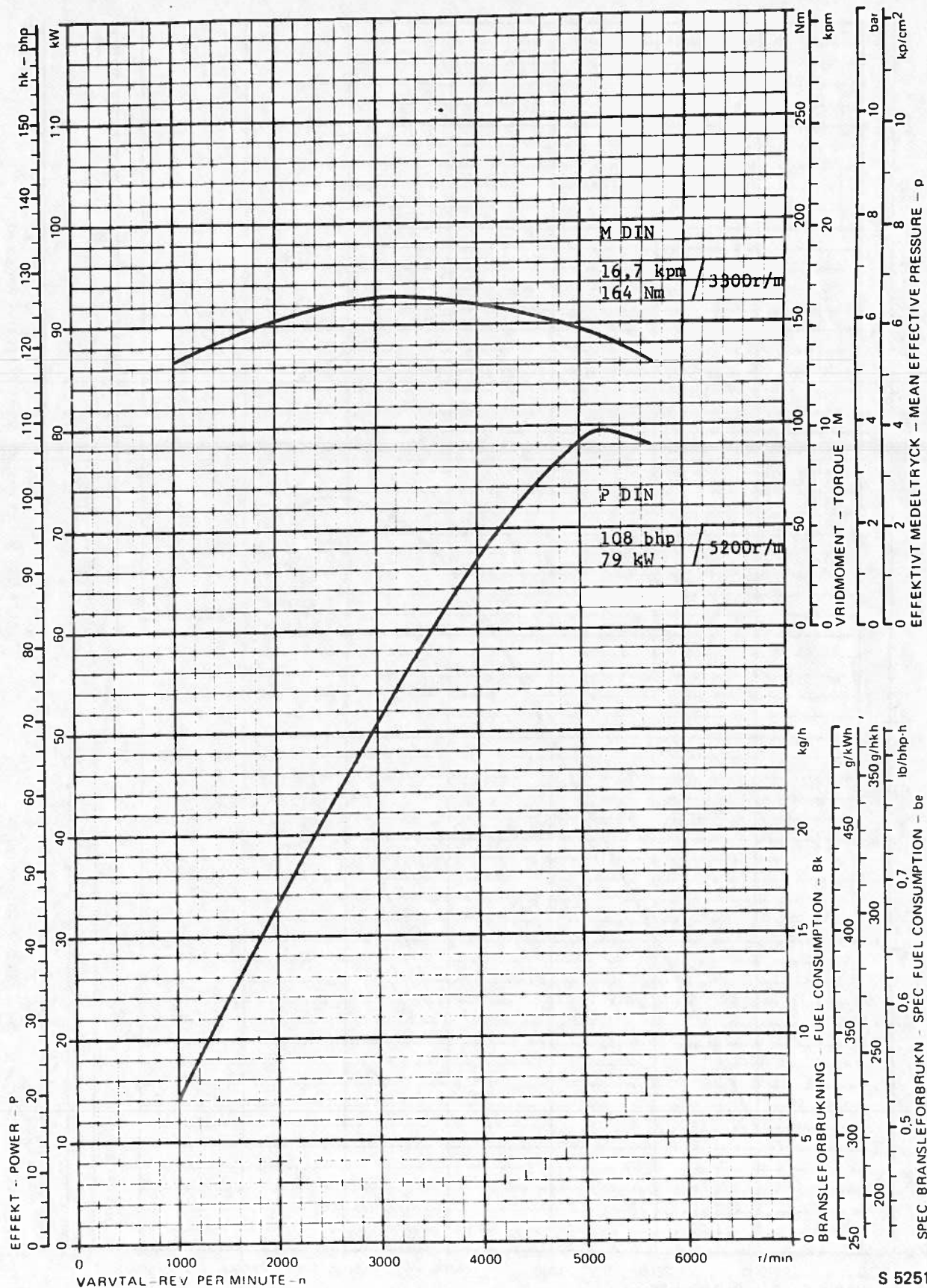
For other bolts, use general tightening torques:

Dimensions	Tightening torque		
	Nm	kgm	ftlb
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



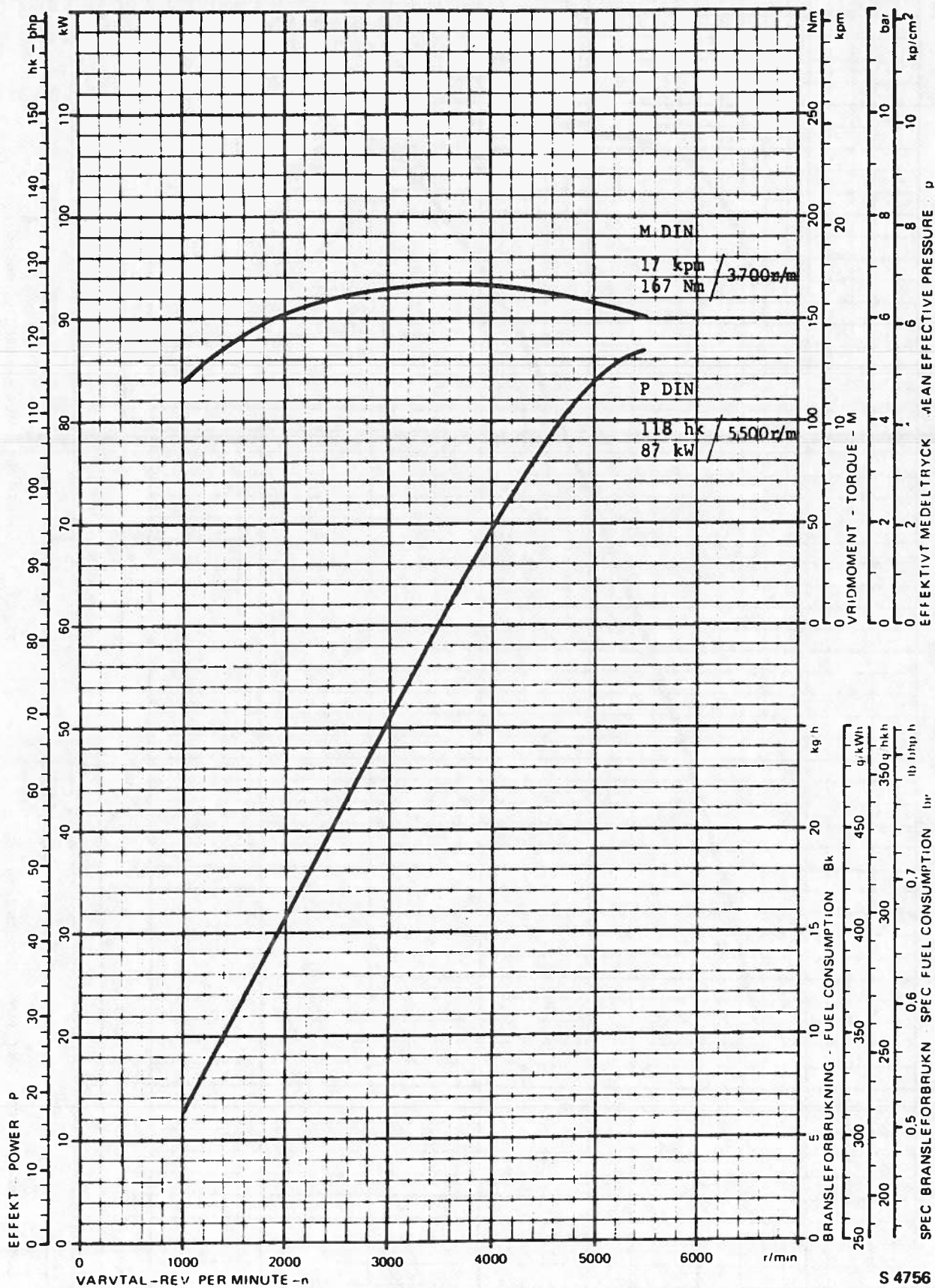
S 4755

Engine performance graphs, single-carbureted engine



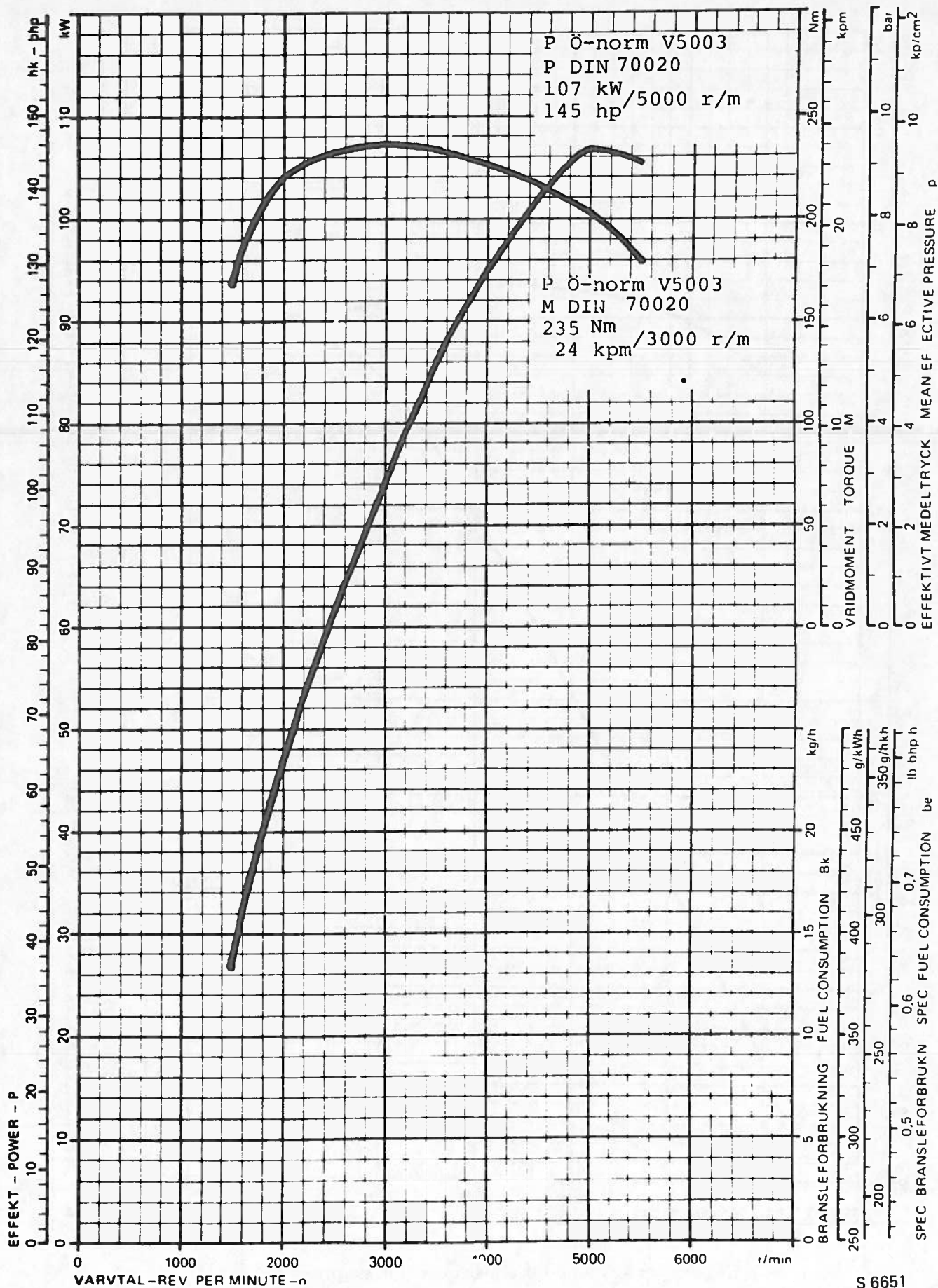
S 5251

Engine performance graphs, twin-carbureted engine



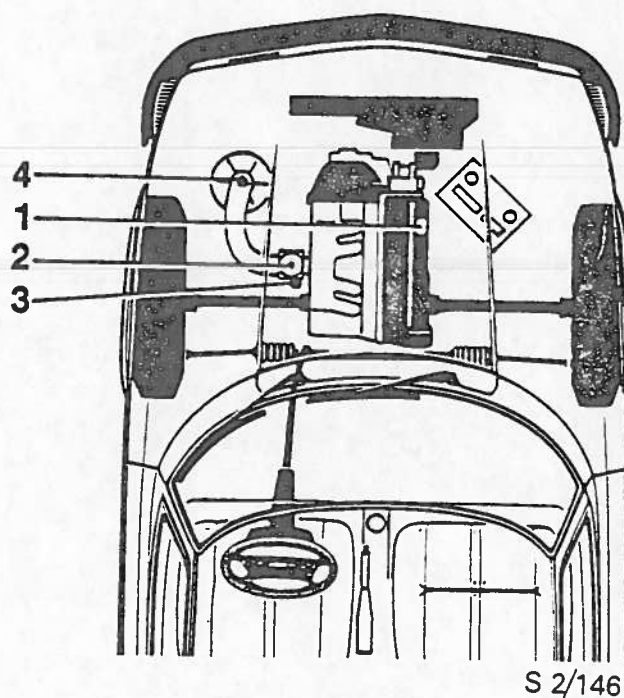
S 4756

Engine performance graphs, injection engine



S 6651

Engine performance graphs, Turbo engine



S 2/146

Item	Lubrication point	Lubricant
1	Engine, oil	SAE 10 W 30 alt. 10 W 40 or 5 W 30 engine oil to Service SF in the API system or to Ford specification ESE M2C-101C Automatic gearbox oil Engine oil (N.B. The accelerator cable must not be lubricated)
2	Carburetor dashpot	
3	Throttle controls	
4	Mixture control unit, lever bearing	Bosch Ft 2 v 2 grease

THE UNIVERSITY OF CHICAGO

PHYSICS DEPARTMENT

PHYSICS 321

LECTURE 1

MECHANICS

1.1. Kinematics

1.2. Dynamics

1.3. Energy

1.4. Momentum

1.5. Angular momentum

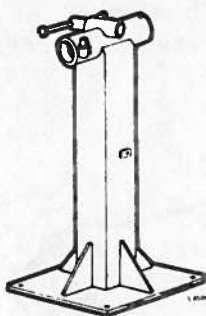
1.6. Oscillations

1.7. Waves

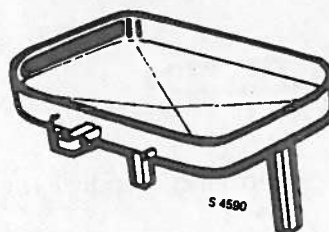
1.8. Relativity

1.9. Quantum mechanics

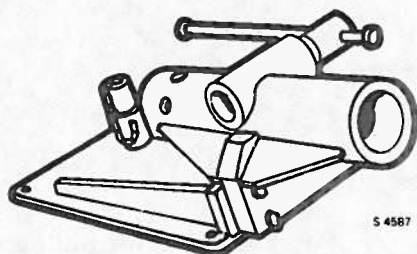
Special tools



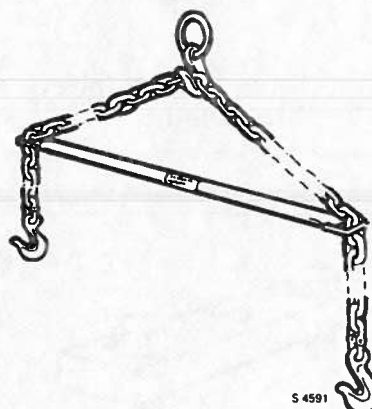
78 60 794 Floor stand



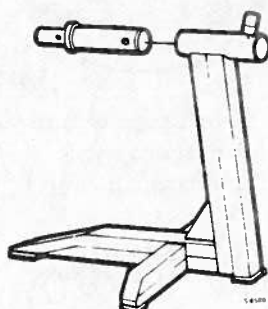
78 60 802 Oil pan



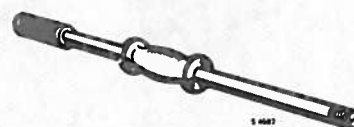
78 60 877 Bench stand
78 60 885 Vice stand



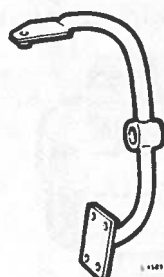
83 92 409 Lifting yoke



78 61 479 Stand
83 90 478 Shaft for stand



83 90 270 Tapping hammer



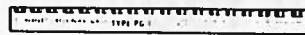
83 92 169 Holder for engine



87 90 529 Universal joint for
dismantling the clutch
plate shaft



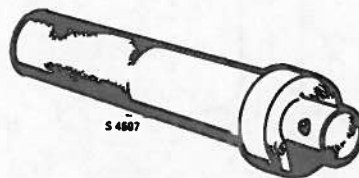
83 92 060 Centring mandrel for clutch plate



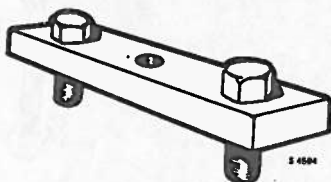
78 60 505 "Plastigage" for measuring bearing clearances



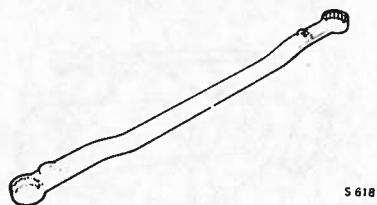
78 62 014 Strap wrench for oil filter element



83 90 445 Drift for assembly



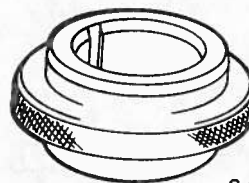
83 92 151 Extractor for belt pulley



83 92 961 Ring spanner for pulley bolt



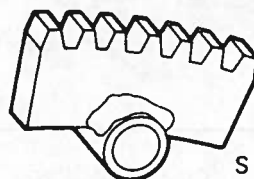
83 91 849 Dolly for removal of chain sprocket



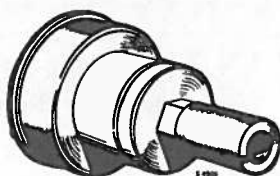
83 92 979 Press sleeve for fitting the crankshaft seal, transmission end



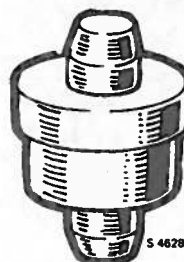
83 91 260 Crank for transmission side



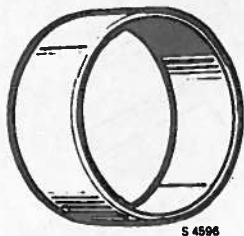
83 92 987 Locking segment for locking of crankshaft



83 92 540 Fitting tool for crankshaft seal, flywheel end



83 91 997 Drift for flywheel bearing



78 62 287 Piston fitting tool



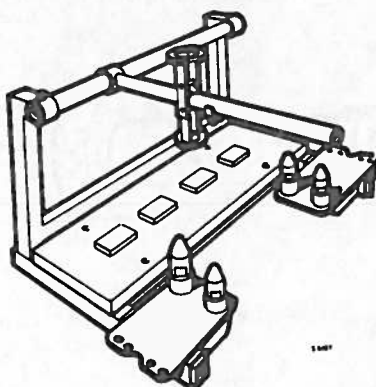
83 92 128 Guide pin, cylinder head



83 90 130 Spring balance for checking of piston clearance



83 92 300 Valve spring depressor
(for use in car or on removed cylinder head)



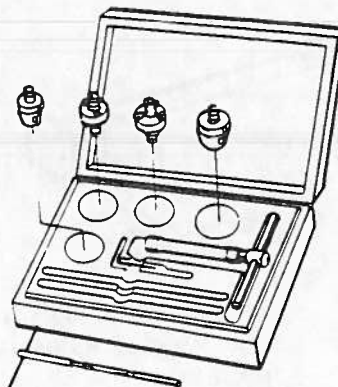
83 93 050 Fitting and removing tool for valves
The fitting and removing tool for valves is also available in two earlier versions.



83 91 401 Magnet tool



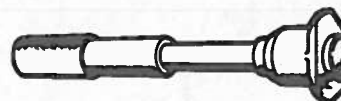
83 92 326 Air adapter for spark plug hole



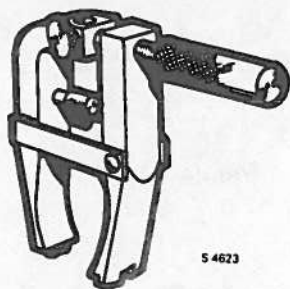
83 92 193 Valve cutter assy
83 92 201 Cutter 75°
83 92 219 Cutter 11° -45°
78 61 057 Guide spindle
78 61 065 T-key
Other details in the set are used for other Saab models



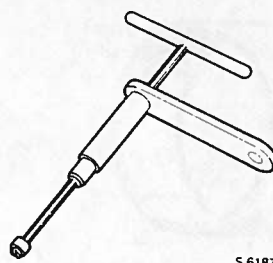
83 92 268 Reamer for valve guide, 8 mm H8 dia.



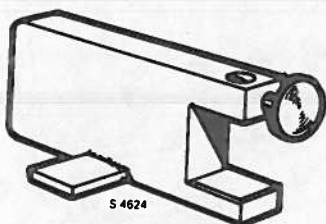
83 92 631 Valve guide tool (for removal and fitting in a press) (Also available in an earlier version)



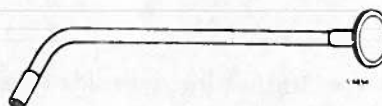
83 91 450 Measuring tool for valve clearance
83 92 250 Measuring lip



83 93 095 Adjusting tool for fuel needle
(as from 1978 model)



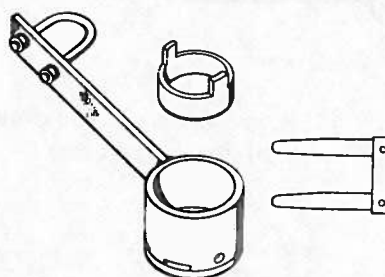
83 91 633 Measuring plate for
checking of adjusting
pallets



83 92 953 Spanner for deceleration valve,
carburetor



78 40 622 Dial indicator (0.01
mm)



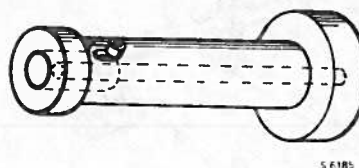
83 92 995 Adjusting tool for fuel needle
(CO adjustment), carburetor, as
from 1976 model

83 93 001 Sleeve (for 83 92 995) for twin
carburetors

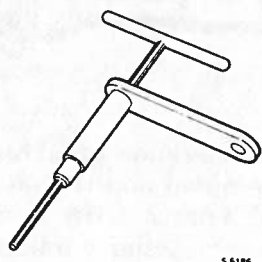
83 93 019 Feeler gauge set (for 83 92 995)



83 92 185 Spanner for crankshaft
bolt



83 93 027 Measuring tool for fuel jet



83 92 896 Adjusting tool for fuel needle,
earlier version, complete

83 92 904 Adjusting tool for fuel needle,
later version, spanner



83 92 763 Adjusting tool for fuel needle
(CO adjustment), carburetor,
as from 1977 model, complete



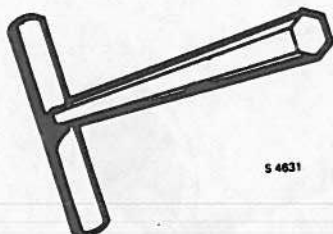
83 92 771

Spanner for fuel needle
adjusting tool



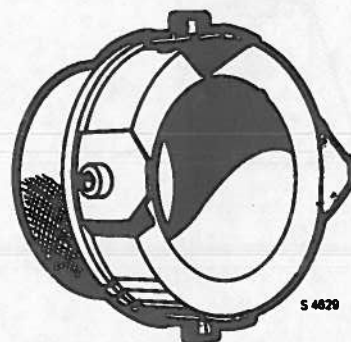
83 92 433

Spanner for fuel pump mounting



83 92 482

Spanner for adjustment
of CO-value, injection
engine

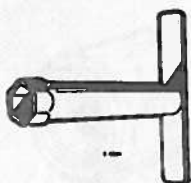


83 92 474

Centering tool

83 92 623

Shims for above (4)



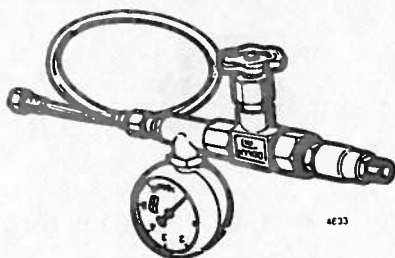
83 92 466

Key, deceleration valve



83 92 557

Connecting sleeves for synchro-
tester, twin carburetors



83 92 516

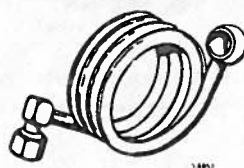
Pressure testing equipment

83 92 607

Hose

83 92 615

Adapter



83 93 183

Test hose

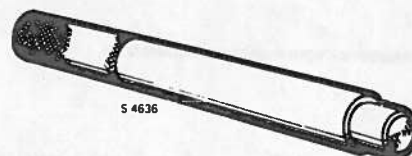


83 93 126

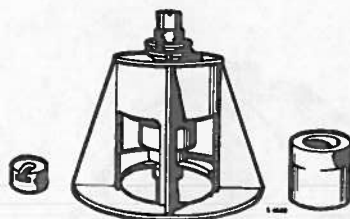
Drive for speedometer (for
checking the speedrelated
enrichment on the Turbo, Europe,
up to and incl. 1979 model)



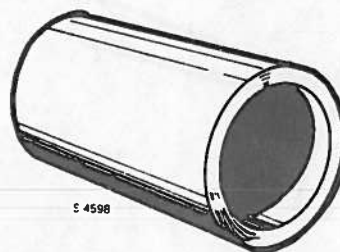
83 92 136 Spacer for dismantling the water pump (earlier version)



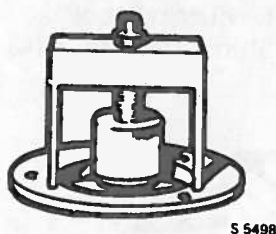
83 90 585 Drift for removal of shaft from impeller



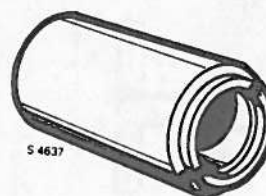
83 92 490 Dismantling and fitting tool for water pump (earlier tool version)



83 90 536 Sleeve for dismantling and fitting of ball bearings, Version 1

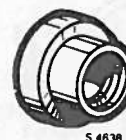


83 92 649 Dismantling and fitting tool for water pump (later tool design)

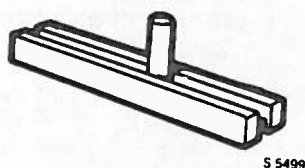


83 90 551 Sleeve for fitting of ball bearings

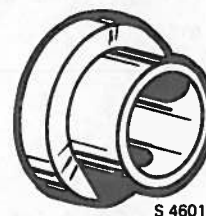
83 92 664 Press sleeve for water pump tool



83 90 569 Fitting sleeve for thrower ring



83 92 672 Dolly for water pump impeller



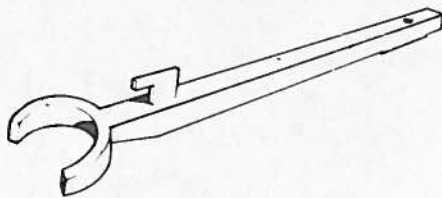
83 92 524 Fitting sleeve for ball bearings (later version)



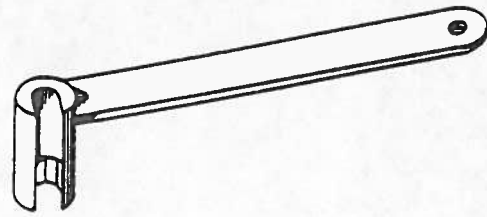
83 90 544 Dolly for removal of shaft from impeller



83 92 789 Drift for fitting of fuel jet



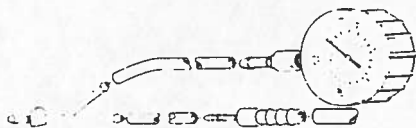
83 93 175 Tool for removal of clutch shaft



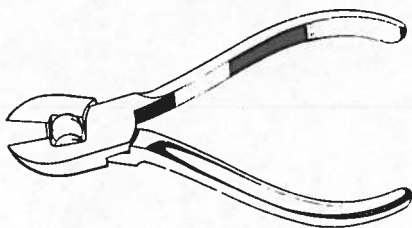
83 93 571 Spanner for pressure tube to slave cylinder



83 92 805 Guide spindle for milling the seat in the charging pressure regulator



83 92 813 Measuring equipment for the charging pressure and for checking the full-load enrichment, Turbo



83 92 912 Sealing pliers, charge pressure regulator, Turbo, control unit



1. The first part of the document is a brief introduction to the project. It describes the purpose of the study and the scope of the work. The introduction is followed by a list of the objectives of the study.

2. The second part of the document is a detailed description of the methodology used in the study. This section includes a description of the data collection methods, the data analysis techniques, and the results of the study.

3. The third part of the document is a discussion of the results of the study. This section includes a discussion of the findings of the study, a comparison of the results with previous research, and a discussion of the implications of the results.

4. The fourth part of the document is a conclusion. This section summarizes the findings of the study and provides a final statement on the results of the study.

5. The fifth part of the document is a list of references. This section includes a list of the sources used in the study, including books, articles, and other documents.

6. The sixth part of the document is an appendix. This section includes additional information that is not included in the main body of the document, such as raw data, additional figures, and other supporting materials.

7. The seventh part of the document is a list of figures. This section includes a list of the figures included in the document, including tables, charts, and graphs.

8. The eighth part of the document is a list of tables. This section includes a list of the tables included in the document, including tables of data, tables of results, and other tables.

9. The ninth part of the document is a list of equations. This section includes a list of the equations used in the study, including equations of motion, equations of state, and other equations.

10. The tenth part of the document is a list of symbols. This section includes a list of the symbols used in the study, including symbols for variables, constants, and other symbols.

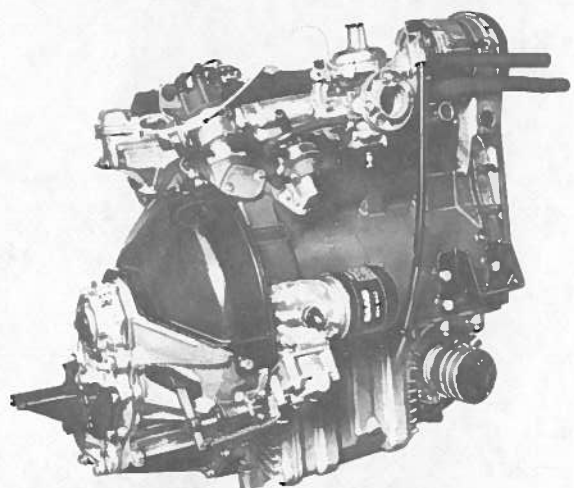
11. The eleventh part of the document is a list of abbreviations. This section includes a list of the abbreviations used in the study, including abbreviations for units, symbols, and other abbreviations.

General

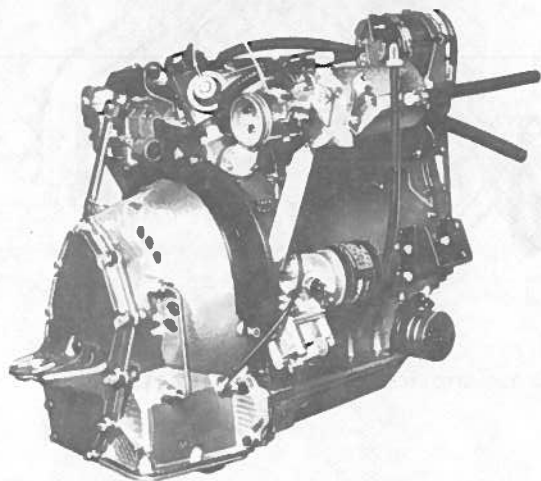
The car has a four-cylinder in line, water-cooled overhead camshaft engine. The crankcase ventilation is totally enclosed. The cylinder block is inclined at an angle of 45° and the cylinder head is of the cross-flow type, i.e. with the inlet passages on one side and the exhaust passages on the other. 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 available in two versions: carbureted or with fuel injection.

The carburetor is a horizontal Zenith-Stromberg.

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 unit, carburetted engine and manual transmission, seen from left



Power unit, injection engine and automatic transmission, seen from left

Cylinder block

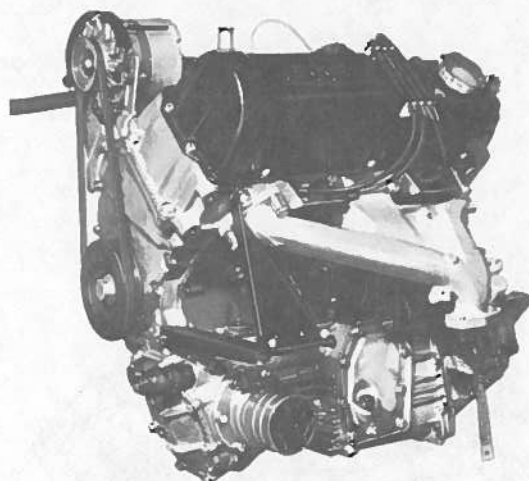
The cylinder block is made of special cast iron, cast in one piece. The cylinder bores, surrounded by cooling jackets, are bored straight out of the block. The block also contains oilways for the lubricating system.

Cylinder head and valves

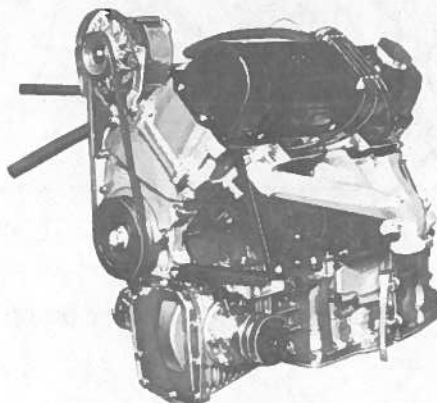
The cylinder head is made of aluminium and is bolted to the block. The camshaft is made of special casting and it is seated in bearings in the camshaft bridge which is bolted to the cylinder head.

The valves are of steel with chromium-plated stems and the valve heads are induction hardened.

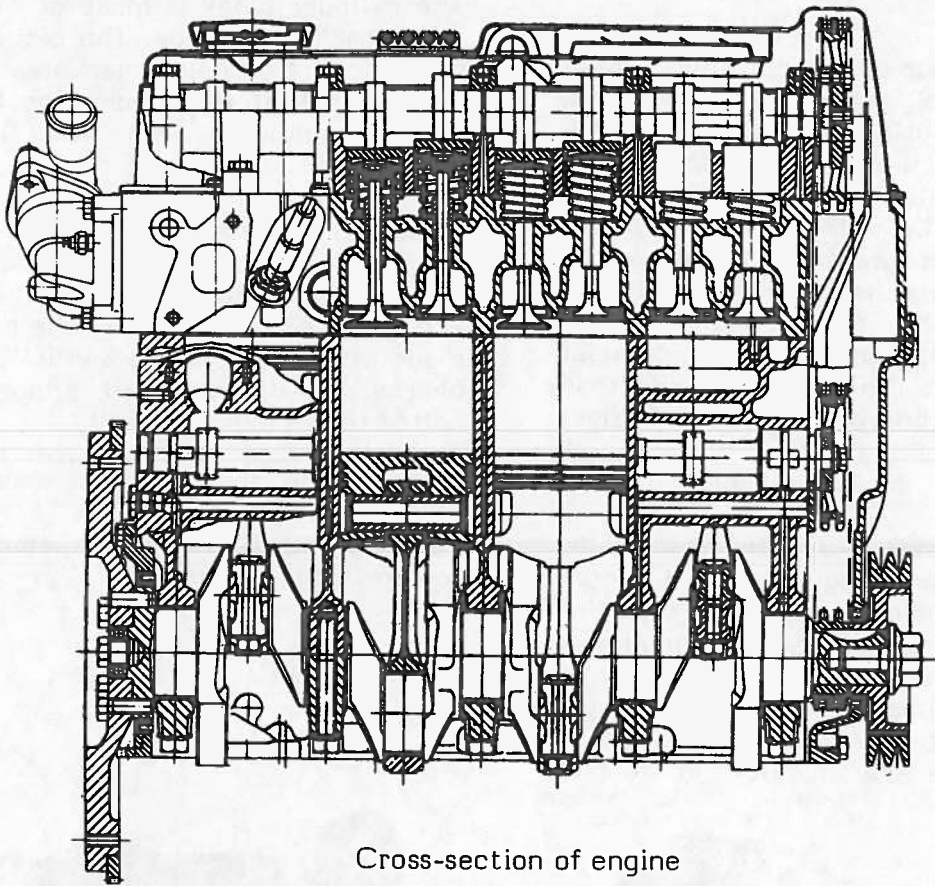
The fuel injection engine is equipped with sodium-filled valves.



Power unit, carburetted engine and manual transmission, seen from right

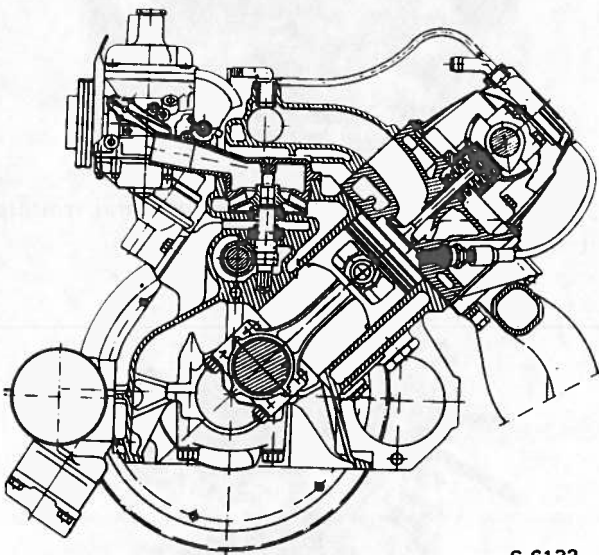


Power unit, injection engine and automatic transmission, seen from right



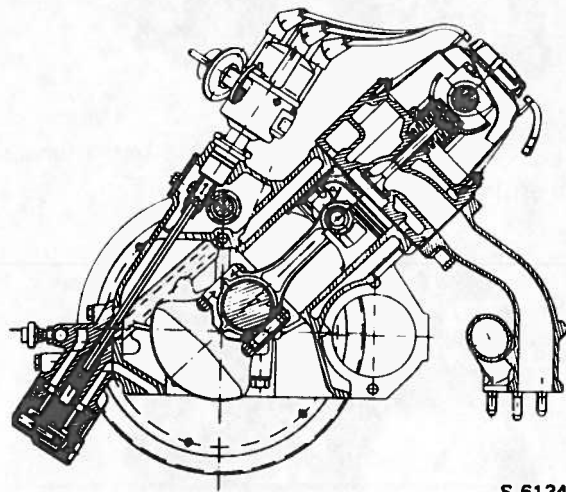
S 6132

Cross-section of engine



S 6133

Cross section of engine at water pump



S 6134

Cross section of engine at distributor

Crankshaft and bearings

The crankshaft is forged and has 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 centre 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 drives the oil pump, water pump and distributor through gears and the fuel pump by means of 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 cams 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 and has a chromium-plated finish. The lower compression ring has oil-scraping characteristics and is somewhat wider than the upper one. The actual oil scraper ring is a three-piece ring.

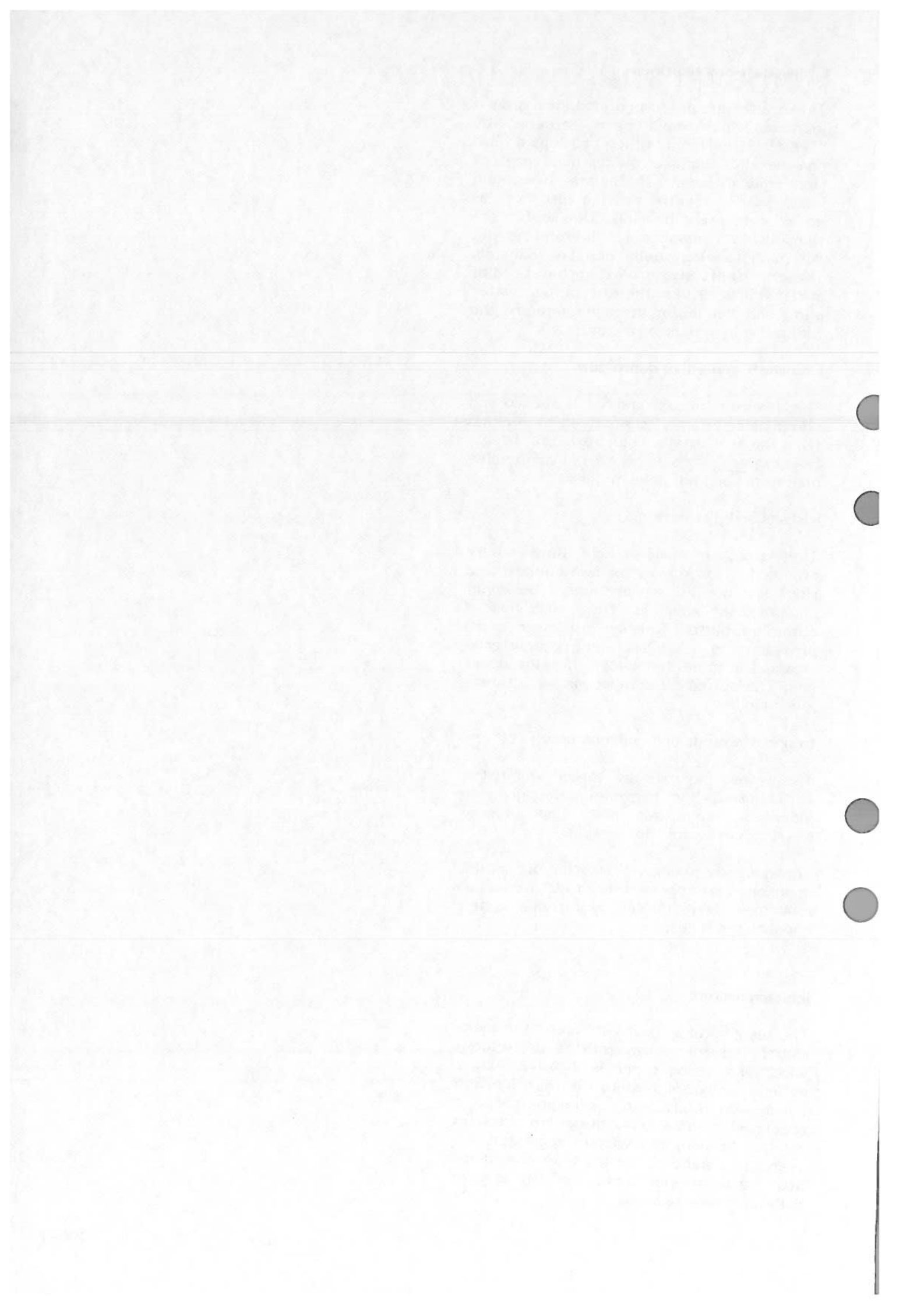
Connecting rods and gudgeon pins

The connecting rods are forged and fitted with bushes for journaling the gudgeon pins. The small-end bush and big-end bearing halves are replaceable.

The gudgeon pin has a floating fit in the gudgeon and connecting rod. Its axial movement is restricted by circlips in the gudgeon pin holes.

Ignition system

The distributor is gear-driven by the jackshaft. The rotor arm rotates anti-clockwise. The firing order is 1-3-4-2, No. 1 cylinder being farthest to the rear. Ignition advance in relation to the 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.

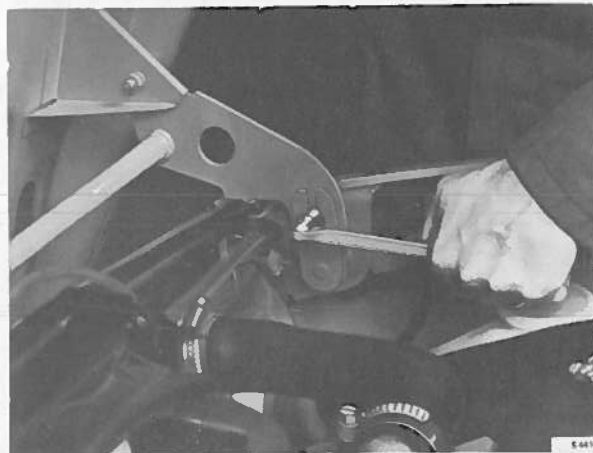


Removal and installation

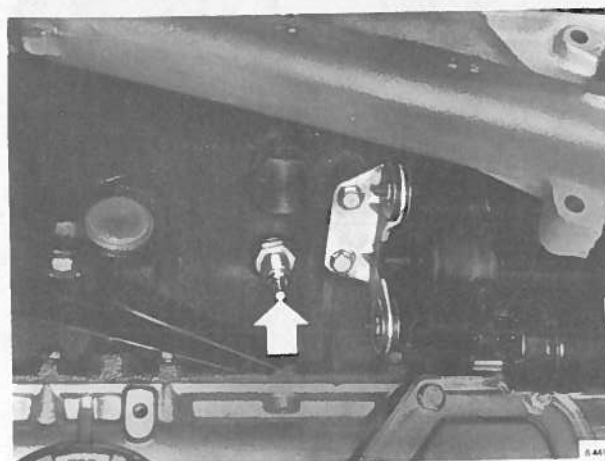
Removing the power unit

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

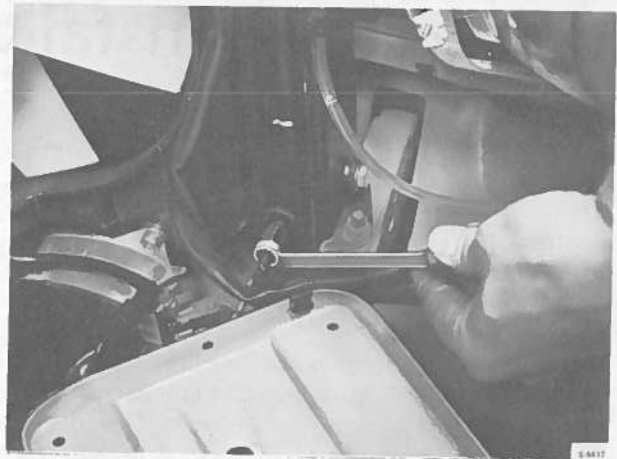
1. Remove the hood as follows:
back off both the hood retaining bolts. Lift off the hood. For this, you will need a helper to hold one side of the hood and help to lift it clear.



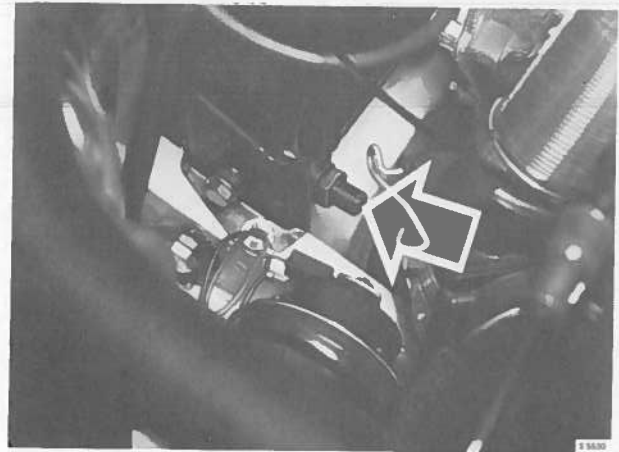
2. Disconnect the battery cables. Release and lift out the battery.
3. Drain the coolant through the radiator drain cocks.



Engine block drain cock (superseded by a drain plug on later cars during the 1977 model year)



Radiator drain cock, up to and incl. 1976 model



Radiator drain cock, as from 1977 model

4. Carbureted engine:

Disconnect the vacuum hose of the servo cylinder from the inlet manifold and pull the fuel hose off the suction side of the fuel pump. As from the 1981 model, also the hose for fuel recirculation.

4. Injection engines:

- a. Disconnect the vacuum hose of the servo cylinder from the inlet manifold and remove the rubber bellows between the air flow sensor and inlet manifold.
- b. Thoroughly clean the areas around the fuel line connections on the fuel distributor and disconnect the lines. Plug the holes and blank off the fuel line ends in a suitable manner.
- c. Disconnect the electrical connection on the air flow sensor, up to and incl. 1977 model. Relay function introduced during 1977 model year.
- d. Undo the clamps on the air cleaner and remove the air cleaner and mixture control unit.

5. Carbureted engine:

Disconnect the cables from the ignition coil, temperature transmitter, oil pressure transmitter, radiator fan, thermostat contact, headlights, headlight wipers and the switch on the gearbox on cars with automatic transmission.

5. Injection engine:

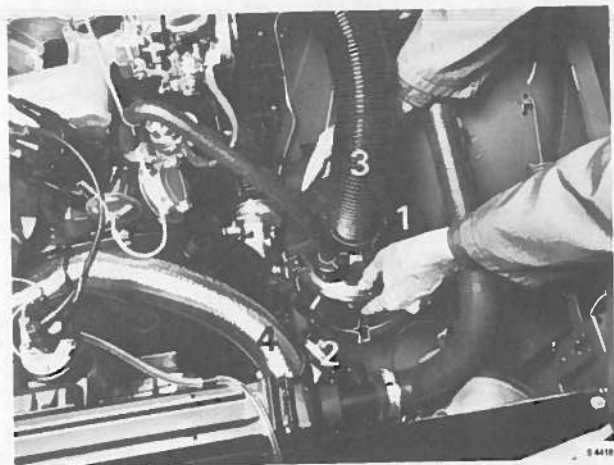
- a. Disconnect the cables from the ignition coil, temperature transmitter, oil pressure transmitter, radiator fan, thermostat contact, headlights, headlight wiper motor and the switch on the gearbox on cars with automatic transmission. (Pressure impulse switch on certain variants).
- b. Disconnect the cables of the injection system at the warm-up regulator, auxiliary air valve, cold start valve and temperature time switch.

Caution

Do not detach the connections by pulling the cables. Grip the connecting pieces.

6. Carbureted engine:

- a. Remove the air cleaner, the inlet hose and the preheater complete with hose.
- b. Detach the throttle control cable from driver and bracket.
- c. Detach the choke control cable and sheath from the carburetor.



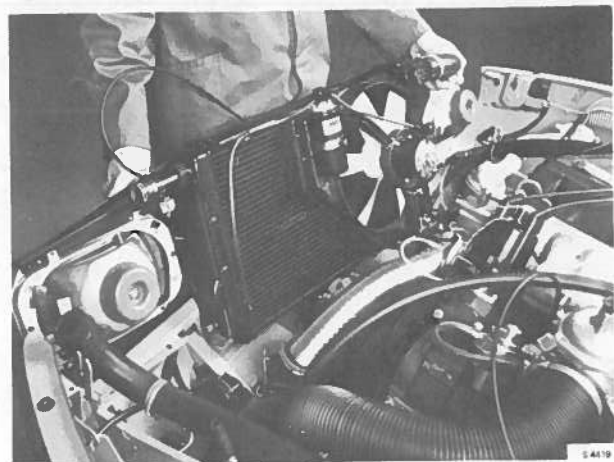
Air cleaner with hoses, carbureted engine

1. Air cleaner
2. Valve housing
3. Inlet hose
4. Preheater hose

6. Injection engine

Detach the throttle control cable from driver and bracket on the throttle valve housing.

7. Detach the hoses at the connections to the thermostat housing, radiator, inlet manifold and water pump. Automatic transmission as from 1977 model: Disconnect the hydraulic hoses from the water-cooled oil cooler.
8.
 - a. Remove the grille.
 - b. Remove the hood lock operating cable from its mountings at the firewall and wheel housing.
 - c. Remove the two front sheet retaining screws and nuts, and the four screws holding the headlights to the body.
 - d. Remove the front sheet and radiator lifting forward and upward.



Removing the front sheet

9. Manual transmission:

1975 model: Remove the slave cylinder and hang it up in a convenient place. As from 1976 model:

Disconnect the clutch hose from the slave cylinder. Plug the hose and the hole in the slave cylinder.

9. Automatic transmission:

Remove the protective cover from the exhaust manifold.

10. Disconnect the exhaust pipe from the exhaust manifold.

11 a. Disconnect the ground cable from the transmission.

b. Remove the alternator.

12. Jack up the front end of the car and place blocks under the body.

13. a. Set the gear lever to neutral.

b. By means of tool 78 40 838, tap out the front taper pin from the gear shift rod joint and pull the rubber bellows free of the groove in the gear selector rod. The rubber bellows is discontinued during 1977 model and need not be installed in older cars in connection with repair. Separate the gear selector rod joint from the gear selector rod.

Caution

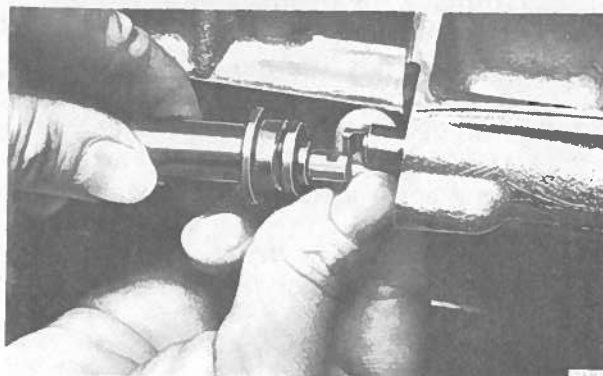
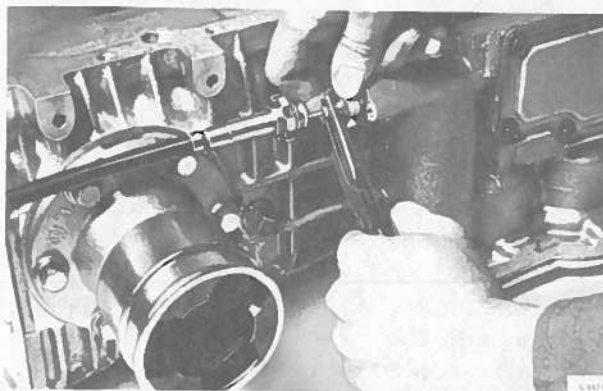
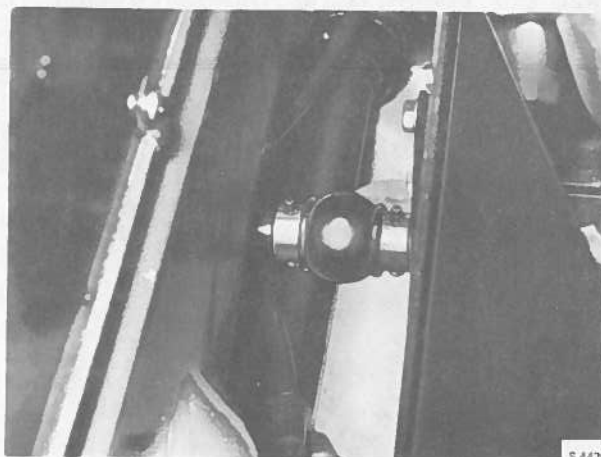
Both steel and plastic versions of the gear selector rod joint are available. The taper pin must not be tapped out in the case of plastic gear selector rod joints.

Automatic transmission:

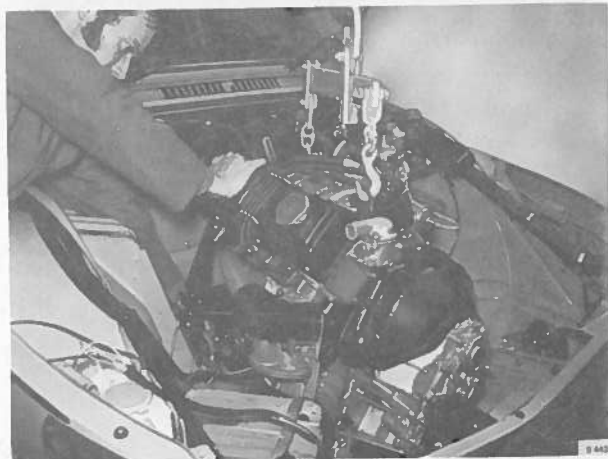
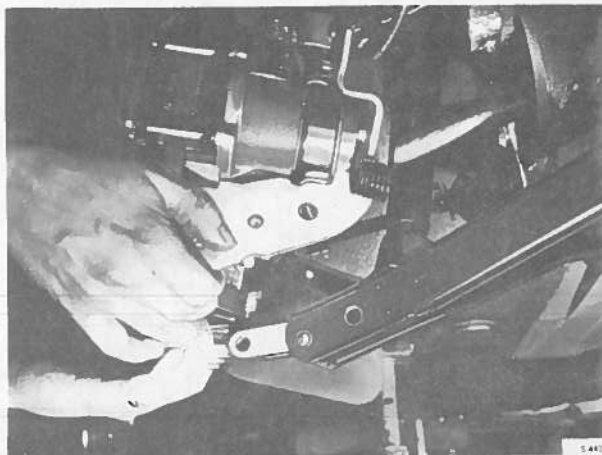
Remove the gear selector cable retaining screw from the gearbox and withdraw the selector rod to the outer (position position "D").

Earlier design: detach the spring which holds the cable to the gear selector lever using tool 87 90 388. (Insert the tool in the end of the spring, rotate it slightly and pull out the cable).

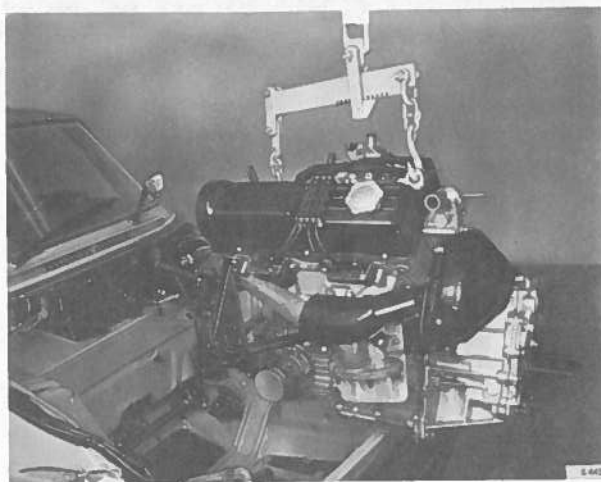
Later design: push back the spring loaded sleeve on the gear selector lever and release the end of the cable.



14. Disconnect the speedometer cable from the transmission.
15. Undo the engine brackets.
16. Undo the larger clips round the rubber bellows on the inner universal joints.
17. Fit the lifting yoke to the two engine lifting lugs.
18. Undo the lower end piece from the control arm on the right-hand side and turn the steering wheel to the left. Raise the power unit from the rear engine mountings (the front bracket may rest on the mounting) and withdraw the left universal joint, by moving the power unit to the right. Move the power unit to the left and withdraw the right universal joint.

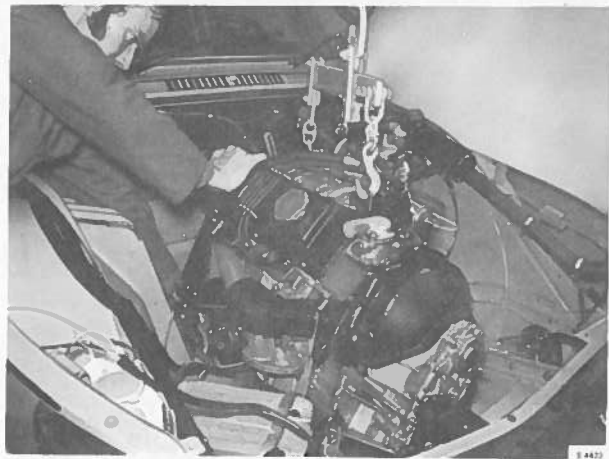
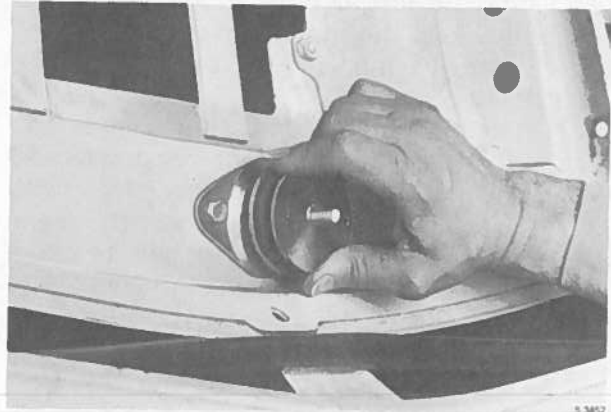


19. Lift the power unit to a convenient height for access to the cable connections on the starter motor. Disconnect the cables.
20. Hoist out the power unit. Fit protective caps over the inner drivers and rubber bellows.



Installing the power unit

1.
 - a. Check that the inner universal joints are packed with grease.
 - b. Check the front engine mounting. Make sure that the washer is properly tightened.
2. Raise the power unit using the lifting yoke (tool 82 92 177), balancing the engine in such a way that the engine mounting at the flywheel end comes into position before the other two mountings. Position the power unit in the engine compartment.
3. Lower the power unit to a convenient height for fitting the starter motor. Connect the cables.
4. Assemble the inner universal joints as follows: Hang the clips on the inner drivers. Lower the power unit until it is about 2-2 1/2" (50-60 mm) from the engine mountings. Assemble the right-hand universal joint, then lower the power plant until it is about 1" (20-30 mm) above the engine mountings while guiding the left-hand universal joint into place. Connect the end piece to the lower control arm.
5.
 - a. Align the engine brackets.



Cars with power assisted steering are equipped with special rear engine mountings. The mountings are designed to prevent the power unit from hitting the steering gear and damaging it in the event of a collision. A cable runs between the rear edge of the upper retaining plate and the front edge of the lower retaining plate in the mountings. The position of the mountings is determined by guides in the engine bracket and the mounting.

- b. Bolt the power unit to the engine mountings.
6. Remove the lifting yoke.
7.
 - a. Push the rubber bellows over the inner universal joint drivers and fit the clamps.
 - b. Wipe any surplus grease off the rubber bellows and check that the bellows are not deformed.

8. Manual transmission:
 - a. Connect the gear shift rod joint to the gear selector rod and insert the taper pin.
 - b. 1975 model: Fit the slave cylinder and adjust the clutch. As from 1976 model: Connect the hose to the slave cylinder and bleed the clutch system.
8. Automatic transmission:

Connect the gear selector cable to the transmission.
9. Connect the speedometer cable to the transmission.
10. Bolt the exhaust pipe to the exhaust manifold.
11. Lower the front end of the car.
12.
 - a. Connect the ground cable.
 - b. Fit the alternator
13. Mount the front sheet complete with radiator and connect the hood lock operating cable to the attachment at the firewall.
14. Fit the headlights and grille.
15. Reconnect the cables to the radiator fan, thermostat contact, headlights, headlight wiper motor and clip the cable harness to the front sheet.
16. Connect the coolant hoses to the radiator, thermostat housing, water pump and inlet manifold. Automatic transmission with water-cooled oil cooler:

Connect the hydraulic hoses to the water-cooled oil cooler.
17. Connect the vacuum hose and fuel hose and connect cables to the temperature transmitter, ignition coil and oil pressure transmitter. (Pressure impulse switch on USA variants).
18.
 - a. Connect the throttle control cable to driver and bracket.
 - b. Carbureted engine:

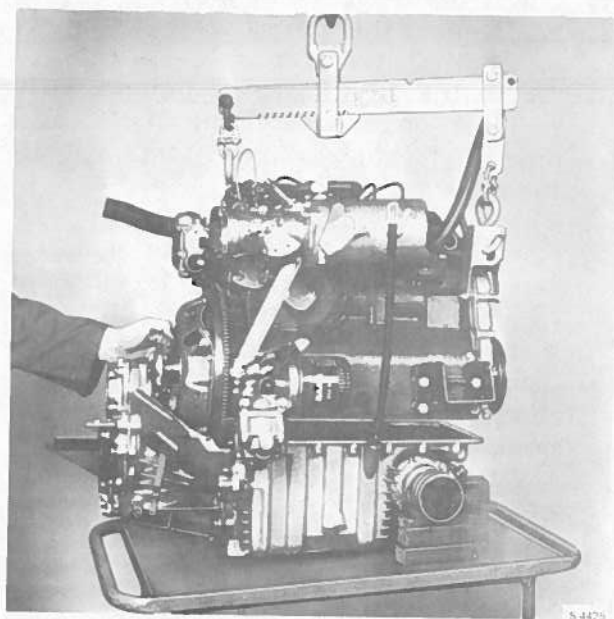
Connect the choke control cable to the carburetor.
19. Carburetor engines:
 - a. Mount the air cleaner and pre-heater complete with hoses.
 - b. Connect the ventilation hose.
 - c. Connect the cables between the distributor and ignition coil.
 - d. Connect the fuel hose. As from the 1981 model, also the hose for fuel recirculation.
19. Injection engines:
 - a. Mount the air cleaner and mixture control unit and connect the rubber bellows to the throttle valve housing and the air flow sensor.
 - b. Fit the fuel lines.
 - c. Fit the cables to the warm-up regulator, auxiliary air valve, cold start valve, temperature-time switch and air flow sensor. (up to and incl. 1977 model).
20. Install the battery and connect the cables.
21. Close the radiator and engine block drain cocks. Fill with coolant and oil.
22. Start the engine, checking the oil pressure and coolant temperature. Check the operation of the transmission. Check the operation of the radiator fan by grounding the thermostat contact cable to the radiator.
23.
 - a. Mount the hood and connect the windshield washer hose.
 - b. Check the fit of the hood. Close the hood, open the doors and check that the door jambs clear the rear edge of the hood.
 - c. Check the headlight alignment.
24. Take the car out for a test run. Check the coolant level after driving.

Separating the engine from the manual transmission

1. Clean the power unit.
2. Drain the engine oil.
3. Take off the clutch cover.
4. Remove the starter.
5. Withdraw the clutch shaft (see instructions for dismantling the clutch).
6. 1975 model: Undo the three bolts of the release bearing guide sleeve.
As from 1976 model: Remove the three retaining bolts for the slave cylinder.
7. Back off the adjusting screw and disconnect the clutch lever 1975 model.
8. Undo all bolts in the mating flanges of engine and transmission.
9. Lift the engine carefully off the transmission (see illustration). At the same time, remove the release bearing guide sleeve.

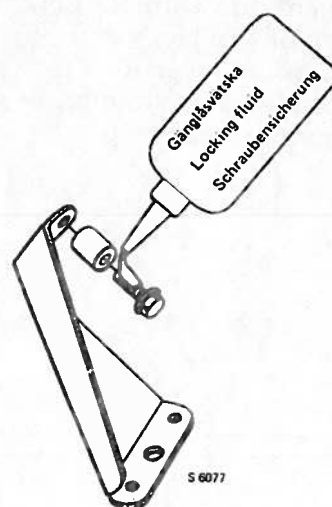
Caution

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



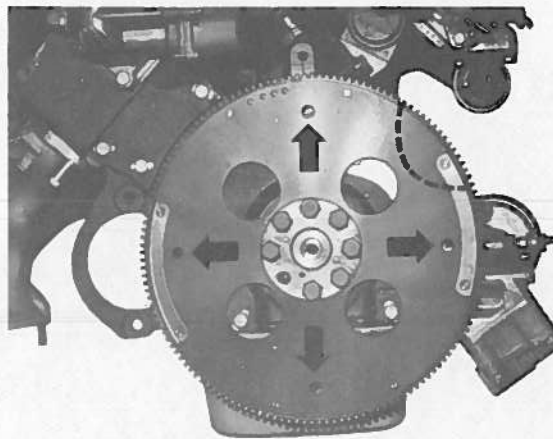
Reassemble in the reverse order.

The threads of the following bolts through the mating flanges of the engine/transmission should be coated with a sealing compound (e.g. Permatex): 1,2,3,6,8 and 9 (refer to automatic transmission section for illustration). Lock the bolt securing the engine stay to the cylinder head by means of Loctite or equivalent.



Separating the engine from the 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 motor.
5. Disconnect the throttle cable from the throttle valve housing (carburetor).
6. Remove all bolts in the mating flanges of engine and transmission.
7. Remove the four screws securing the flywheel ring gear to the torque converter. The bolts can be reached from above the oil pump mounting.

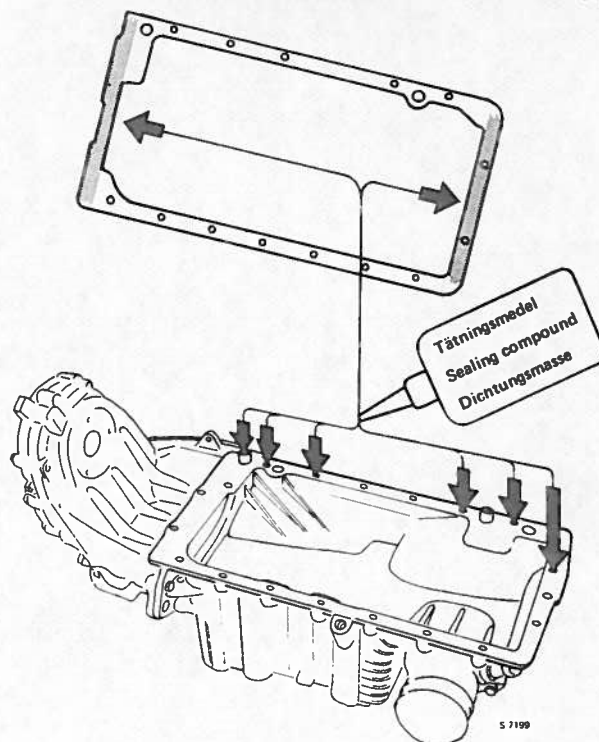


S 6847

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 87 90 255).

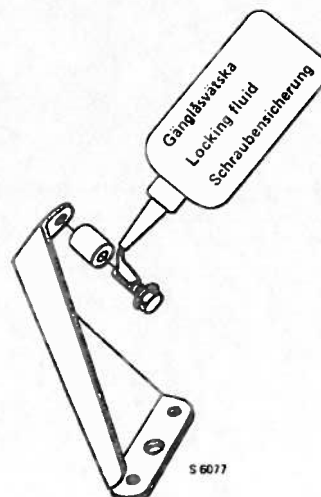
When fitting together the engine and transmission:

- Ensure that the mating flanges between the engine and transmission are absolutely clean.
- Check that the two guide sleeves are fitted in the transmission casing.
- Fit a new gasket on the transmission housing. Apply sealing compound to both sides of the gasket as shown in the illustration above.
- Apply thread sealing compound to the six bolts in the holes indicated in the lower illustration.



S 7199

Lock the bolt securing the engine stay to the cylinder head by means of Loctite or equivalent.



S 6077

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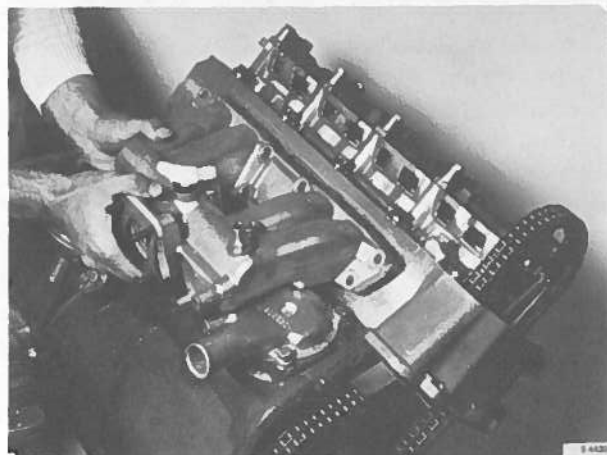
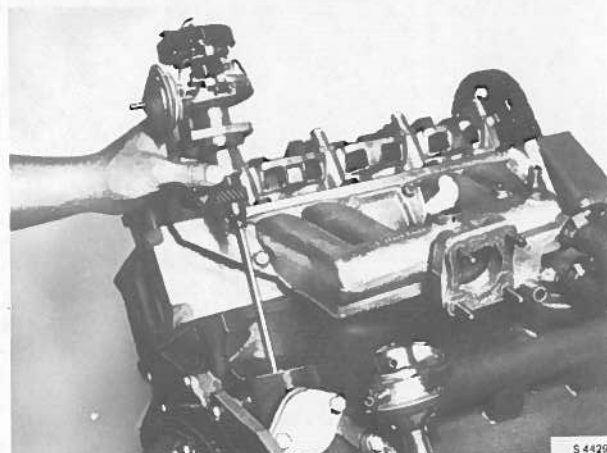
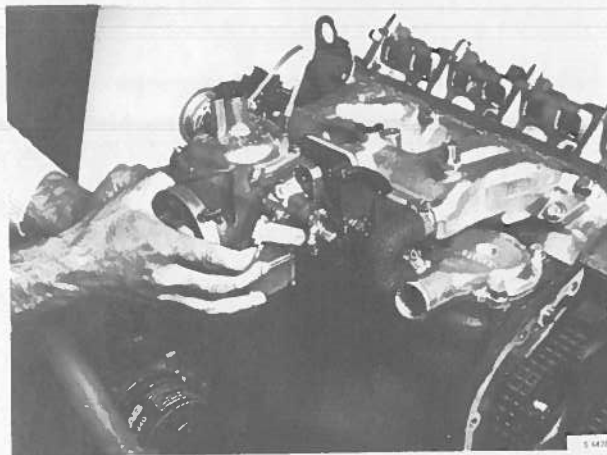
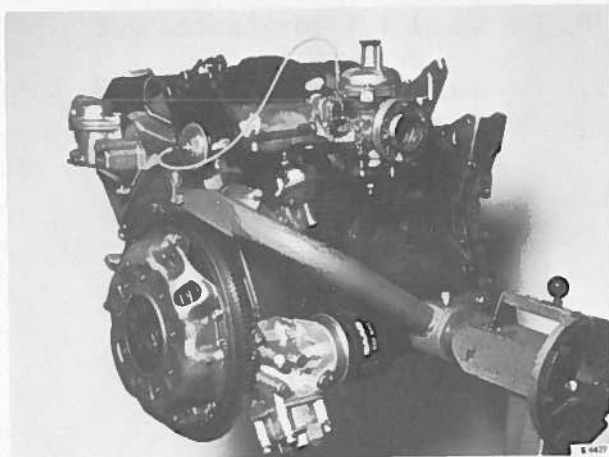
Engine body

Dismantling the engine

1. Mount the engine in a work stand.
2. Remove the distributor cap and disconnect the ignition cables.
3. Carbureted engine:
Remove the carburetor.
Injection engine:
Remove the throttle valve housing.
4. Undo the hose connections from the water pump, by-pass system and crank-case 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 intermediate piece.
d. Remove the suction line to the pump.
9. Remove the water pump (see section 262).

Note

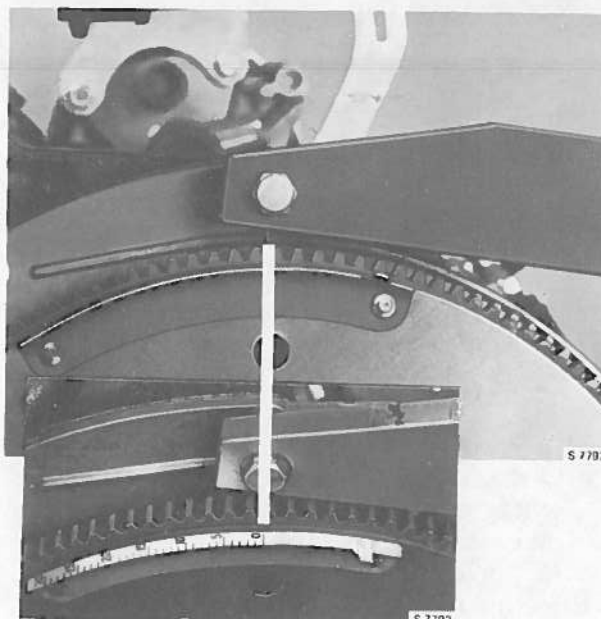
The water pump is available in different versions and the procedure for removal and assembly of each is different. Under no circumstances must tapping-out hammers or the like be used during the removal or assembly of pumps of versions II and III.



10. Remove the thermostat housing.
11. Remove the exhaust manifold with radiation shield.



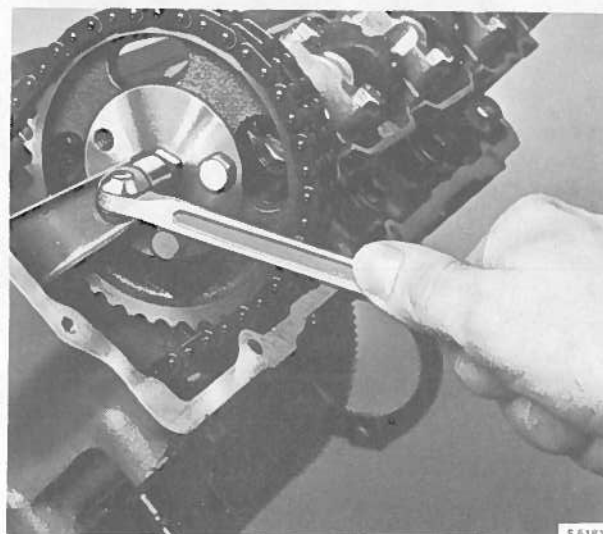
12. Remove the camshaft sprocket as follows:
 - a. Turn the crankshaft to firing position for No. 1 cylinder.



- b. 1975 model: screw a M8 nut on to the threaded centre stud of the camshaft sprocket and tighten the centre stud against the mounting plate provided for the purpose.
As from 1976 model: Bolt the mounting plate to the centre of the camshaft sprocket using one of the camshaft sprocket retaining bolts.

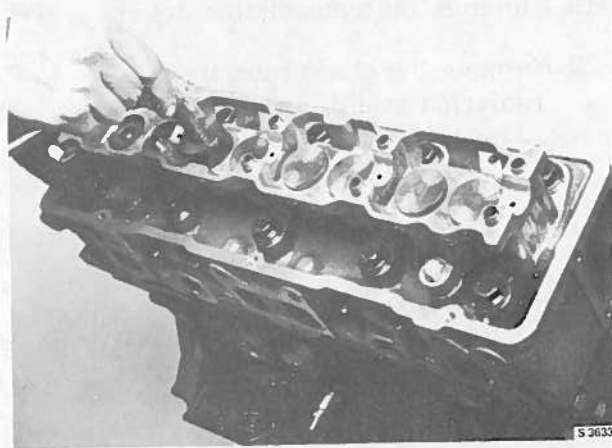
Caution

Tighten the nut (bolt) securely to immobilize the centre stud. Otherwise the chain tensioner will tighten the chain and lock in a new position so that the sprocket cannot be refitted.

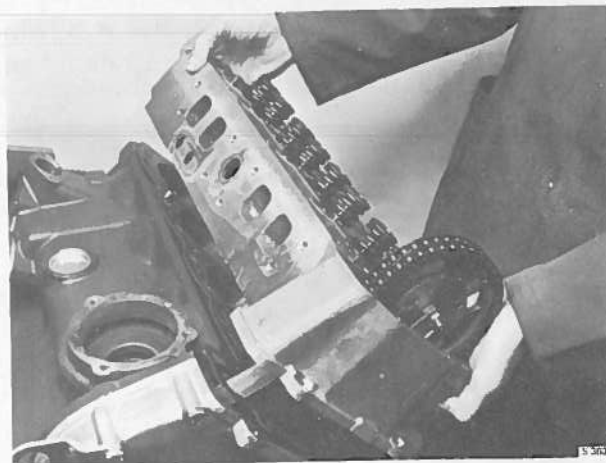


- c. Undo the retaining bolts from the camshaft sprocket. Separate the wheel from the camshaft plate until it hangs free on the centre stud in the mounting plate.
13. Remove the camshaft bearing caps and lift out the camshaft.

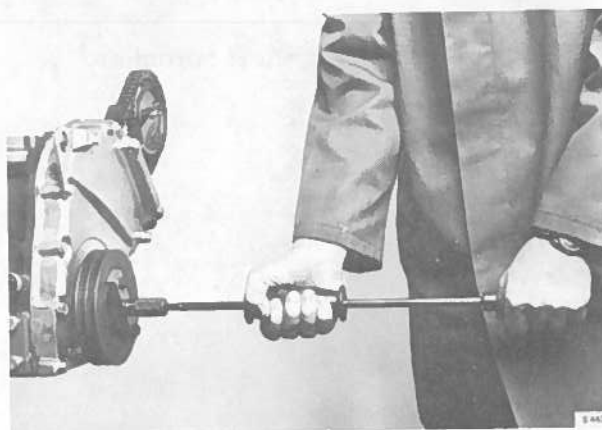
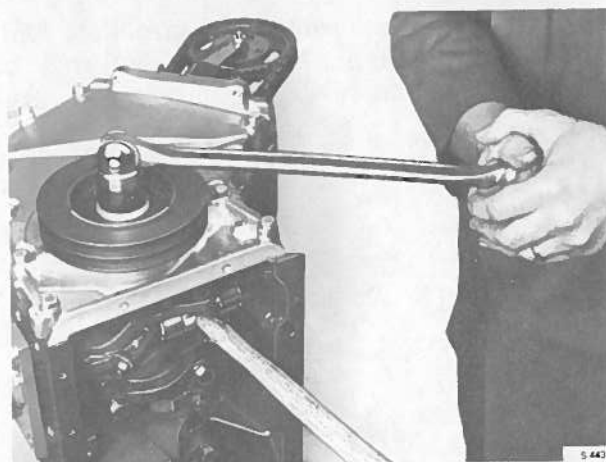
14. Remove the valve depressors and adjusting pallets. Tool 83 91 401.
15. Remove the camshaft bearing assembly.
16. Unscrew all cylinder head bolts.



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

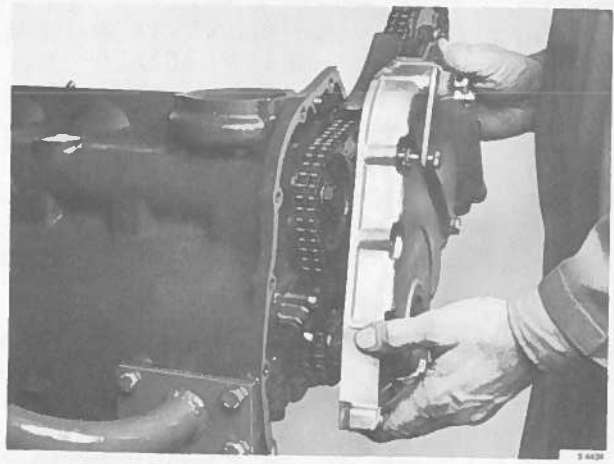


18. Remove the belt pulley bolt and the pulley, using puller 83 92 151, if necessary.

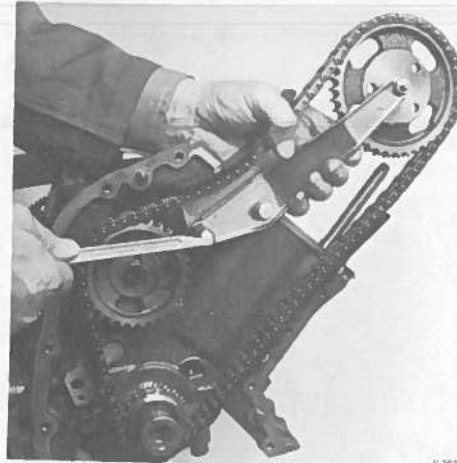


19. Remove the transmission cover.

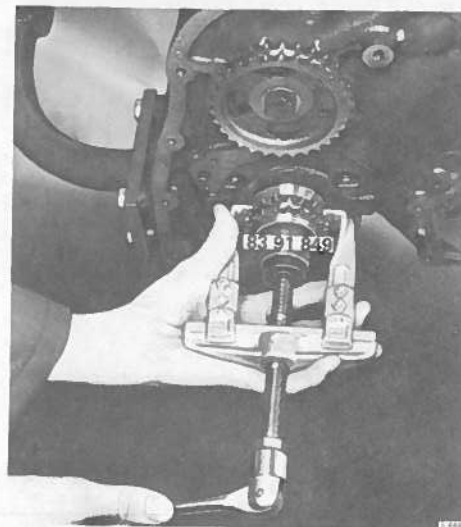
20. Remove the chain tensioner.



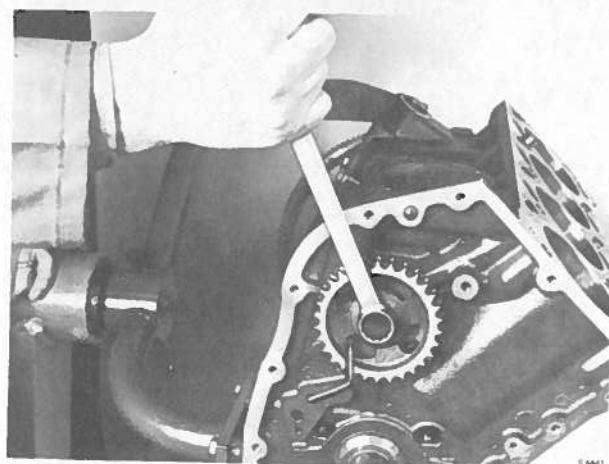
21. Remove the chain guides, the mounting plate with the camshaft sprocket and transmission chain.



22. Remove the crankshaft sprocket. Universal puller and tool 83 91 849 may be used, if necessary.

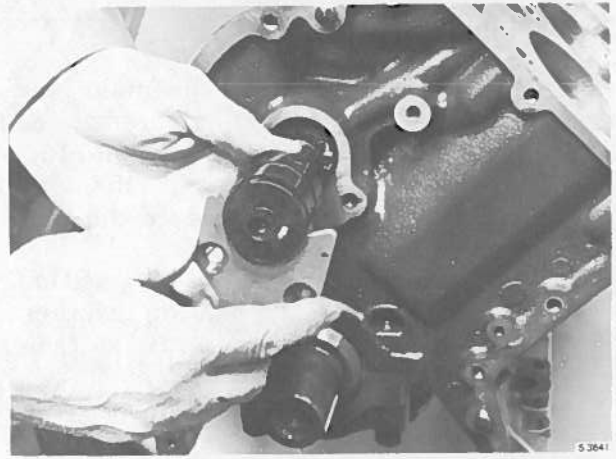


23. Remove the idler shaft sprocket.



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

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

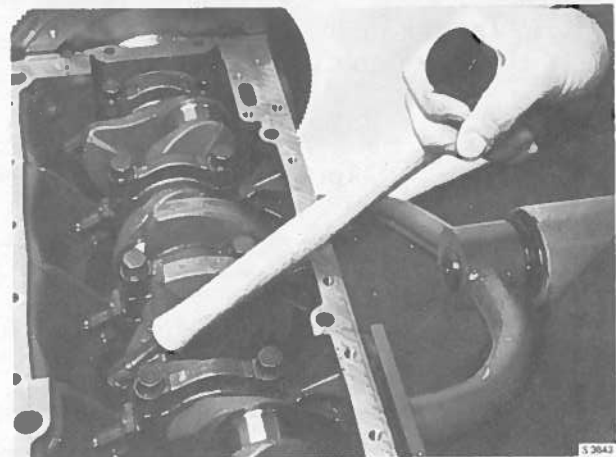
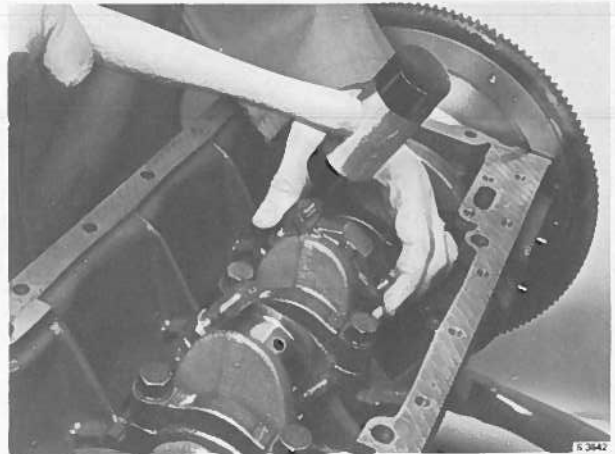


26. Note the markings on the connecting rods and big-end bearing caps so that they can be reassembled later in their original positions. Remove the nuts and bearing caps and push the pistons complete with connecting rods out of the cylinders (see illustration). Protect the stud threads with pieces of plastic hose when dismantling the pistons and connecting rods.

For instructions with regard to replacing the 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.
Automatic transmission:
Remove the driver disc.

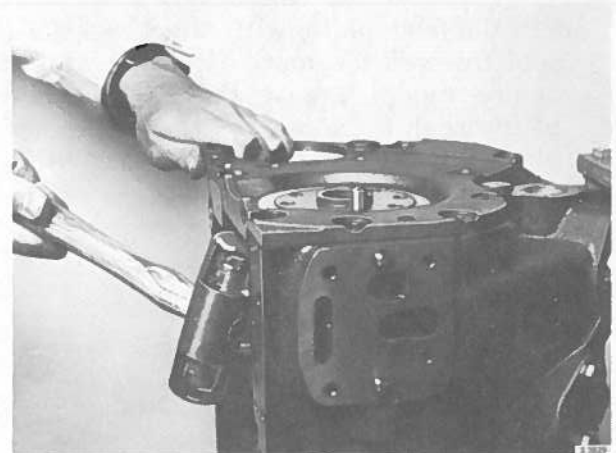


29. Remove the end plate and shaft seal.

30. Remove the main bearing bolts and remove the bearing caps.

31. Lift out the crankshaft.

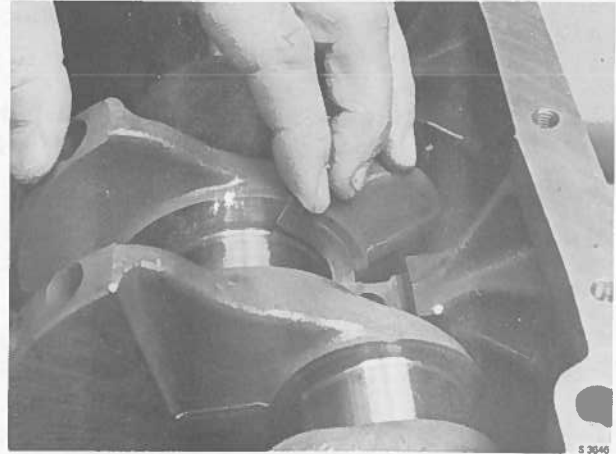
32. Remove the bearing shells and thrust bearing washers and put them carefully aside so that they can be reassembled in their original positions.



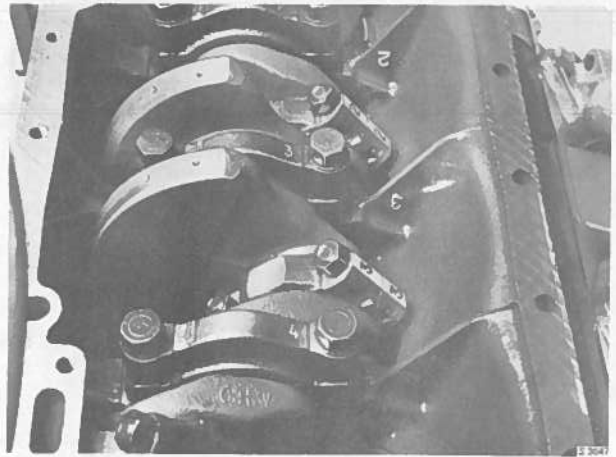
Assembling the engine

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

1. Fit the bearing shells in the main bearing journals and lubricate the bearings with engine oil.
2. Fit the crankshaft carefully in position.
3. Locate the thrust bearing washers. Check the end float with a feeler gauge.

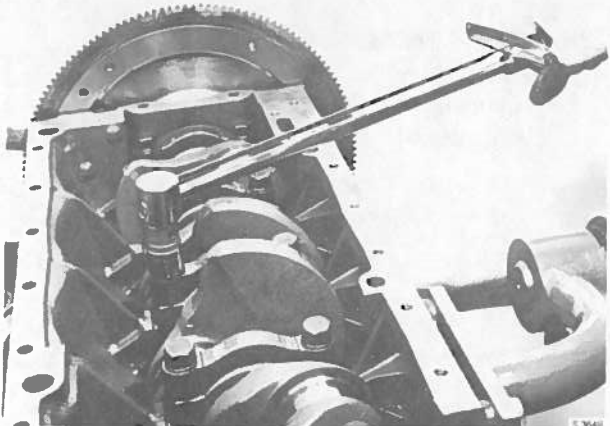


4. Fit the main bearing caps with bearing shells already in position and oiled. (NOTE! Make sure the markings match up!) The main bearing caps are numbered; No. 1 fits the transmission chain end and the others run consecutively towards the flywheel end with the bearing locks facing each other. A number cast in the crankcase corresponds to each number on the bearing caps.

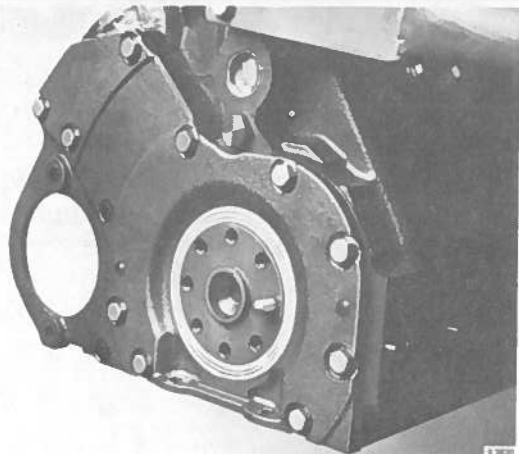


5. Tighten the main bearing bolts with the specified torque.

<p>Torque 108 Nm (79 ftlb/11 kpm)</p>
--

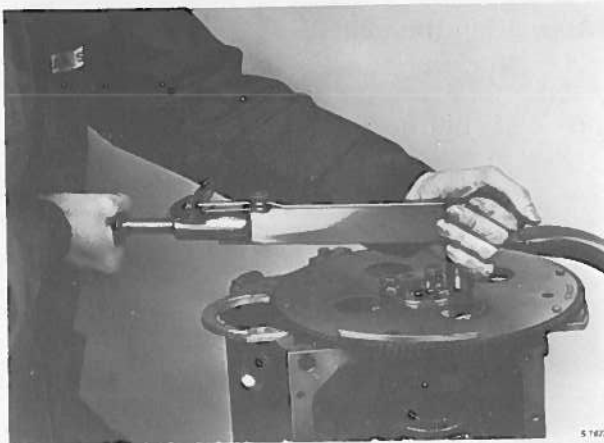


6. Fit the end plate with the crankshaft seal towards the mating surface of the engine block. Grease the inner circlip of the seal. Fit a new gasket to the end plate and trim it flush with the mating surface of the transmission.

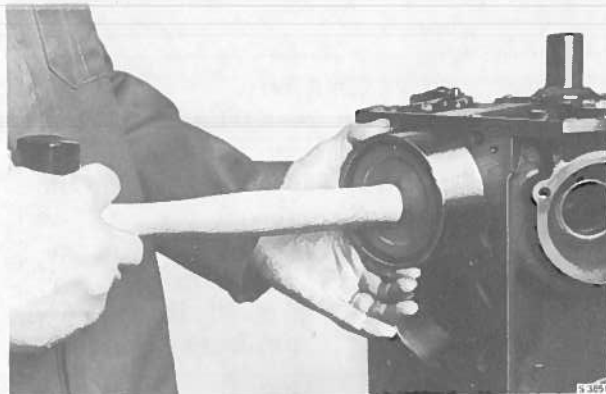


7. Fit the flywheel (driver disc). Apply thread sealing compound to the bolt threads.

Torque
60 Nm (44 ftlb/6.0 kgm)

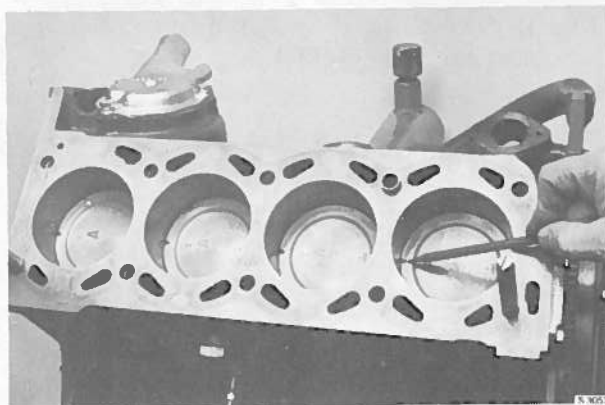


8. Fit the pistons and connecting rods using tool 78 62 287. Make sure that the studs are still protected by their plastic sleeves. The connecting rods and big-end bearing caps are numbered to match the corresponding cylinders. Instructions for fitting the piston rings are given on page 212-2.



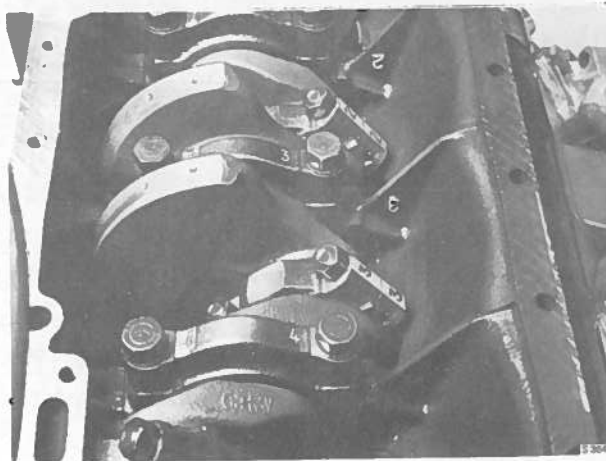
Note

The marking in the top of the piston should be towards 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 ftlb/5.5 kgm)



10. a. Fit the idler shaft and the keeper plate.

Caution

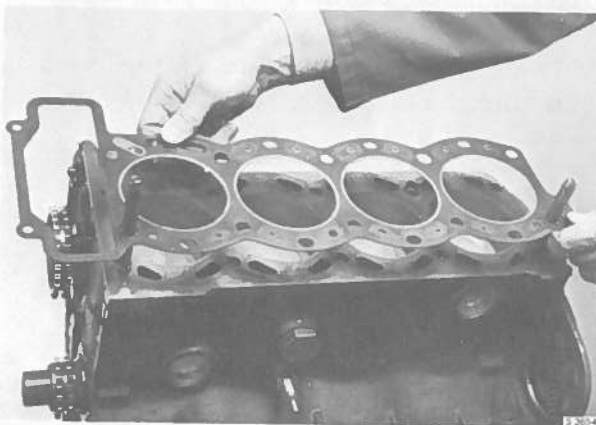
The idler shaft is available in two versions which must not be confused. Idler shafts of the later version are made of cast-iron and the gears for the distributor and water pump have a larger number of teeth.

- b. Fit the sprocket to the idler shaft.
11. Fit the water pump (see section 262).

Caution

The water pump is available in two versions. Later version pump shaft are made of cast-iron and the gear for the idler shaft is of different design. The two types of pump must never be confused. Tapping-out hammers or the like must never be used in the assembly of pumps of the later version.

12. Fit the sprocket to the crankshaft.
13. Fit the cylinder head gasket. Fit two locating pins 83 92 128.

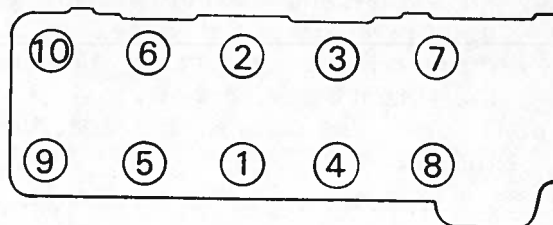


14. a. Fit the cylinder head.
b. Tighten the bolts in two steps.

Sequence shown below.

Torque

Step 1: 60 Nm (44 ftlb/6.0 kgm)
Step 2: 95 Nm (70 ftlb/9.5 kgm)

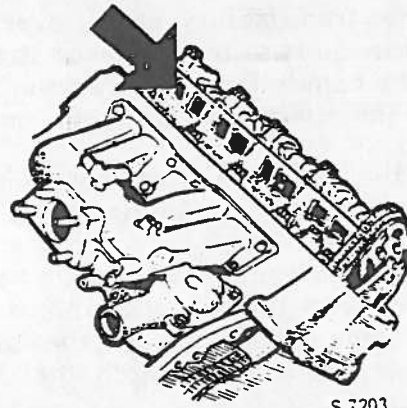


- c. Do the final tightening after the engine has been allowed to cool for about 30 minutes.

15. Fit the camshaft bearing assembly.

Note

Turn the camshaft bearing assembly so that the feeler gauge openings point upwards. If the camshaft bearing assembly is fitted the wrong way round, the camshaft bearings will not be lubricated.

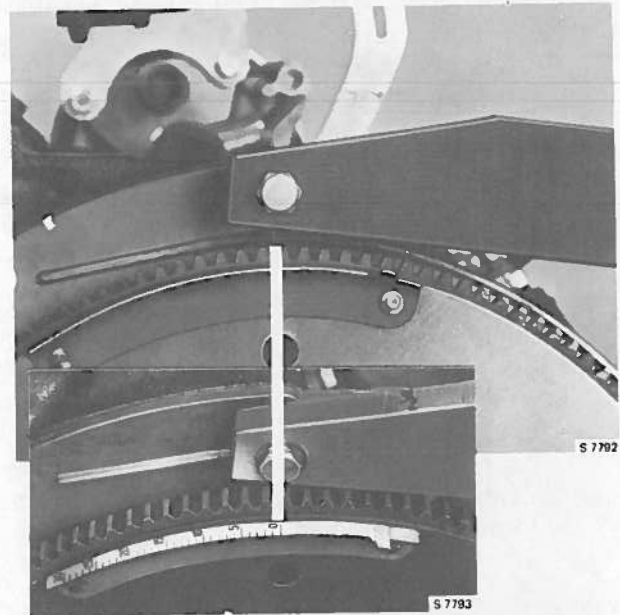


16. Fit the adjusting pallets and valve depressors.

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: The exhaust valves may come into contact with the piston crowns if the chain transmission is not correctly fitted. **A fully open exhaust valve will collide with the piston crown at the top dead centre of the piston.**

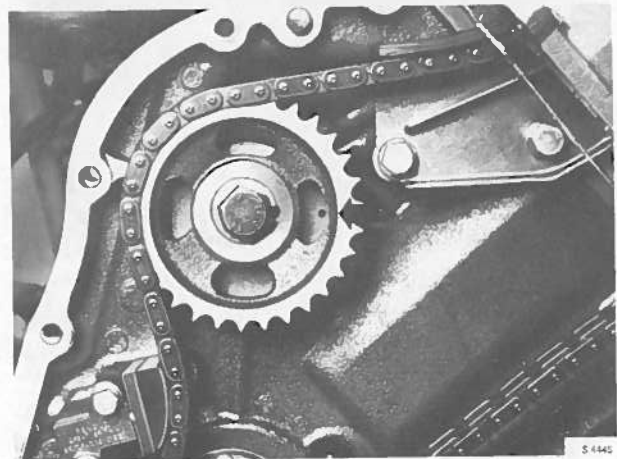


18. Fit the camshaft bearing caps. Note the marks.

19. Fit the straight chain guide plate.

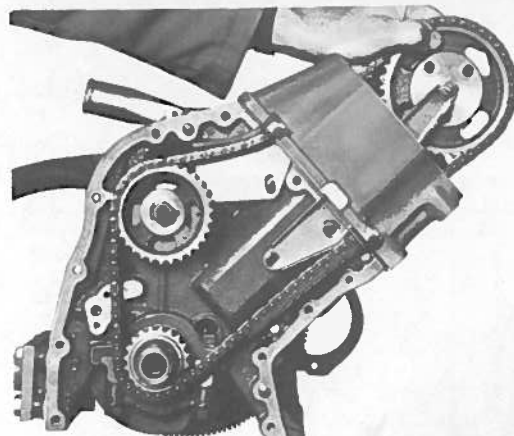
20. Check that the setting marks on the crankshaft, camshaft and idler shaft are in the right position, i.e. the firing position for No. 1 cylinder.

Idler shaft marking, the bulge in the hole on the idler shaft sprocket should line up with the small hole in the keeper plate.



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

22. Rotate the camshaft sprocket until the bolt holes are in line with 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 centre stud of the camshaft sprocket into the camshaft. Fit the bolts.

25. Fit the curved chain guide plate together with the mounting plate (the chain guide plate nearest the block) with two bolts 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.

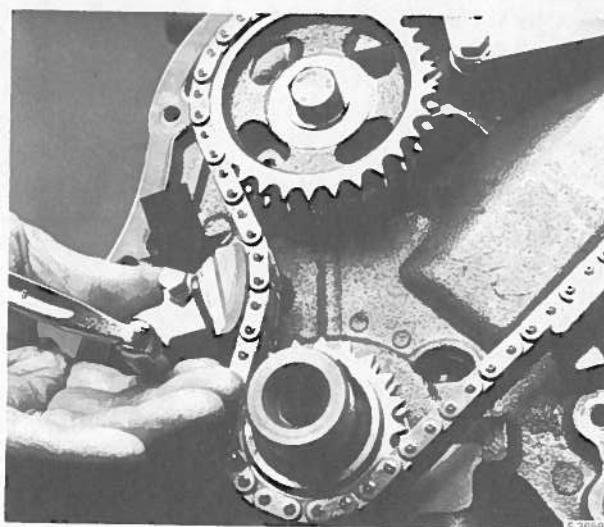
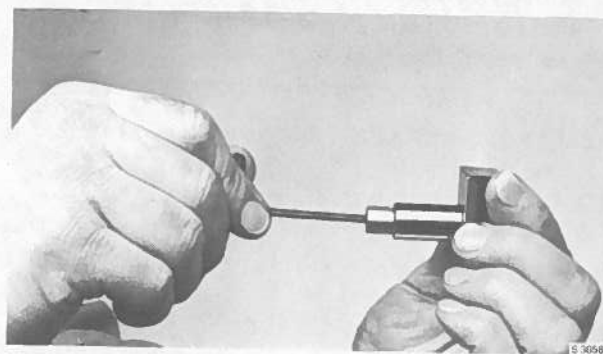
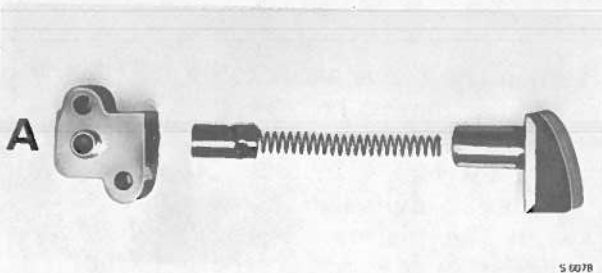
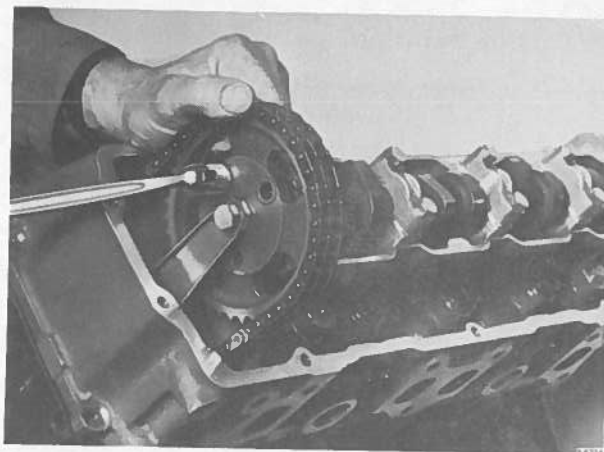
Version A of REYNHOLDS manufacture

a. Before fitting remove the tensioner

pad.

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



Versions B and C of "JWIS manufacture

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

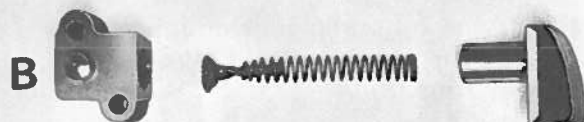
Version A, B and C:

- d. Fit the chain tensioner with guide plate to the engine block.
- e. Press the curved chain guide against the chain to stretch it and push the tensioner pad 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 pad. 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 pad from its bottom position must be at least 0.02" (0.5 mm) and not more than 0.06" (1.5 mm).

28. Remove the bolt from the camshaft sprocket centre.
29. Fit the transmission chain cover and the alternator bracket. Fit a new gasket on the transmission chain cover and trim the gasket flush with the mating surface of the transmission.

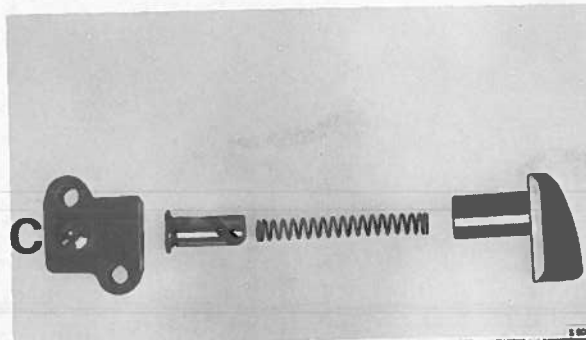
30. Fit the belt pulley and tighten the bolt with the prescribed torque.

Tightening torque
190 Nm (137 ftlb/19 kgm)



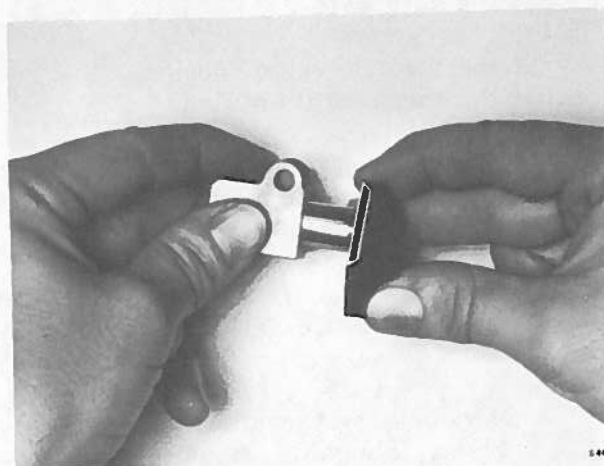
S 6079

Earlier version

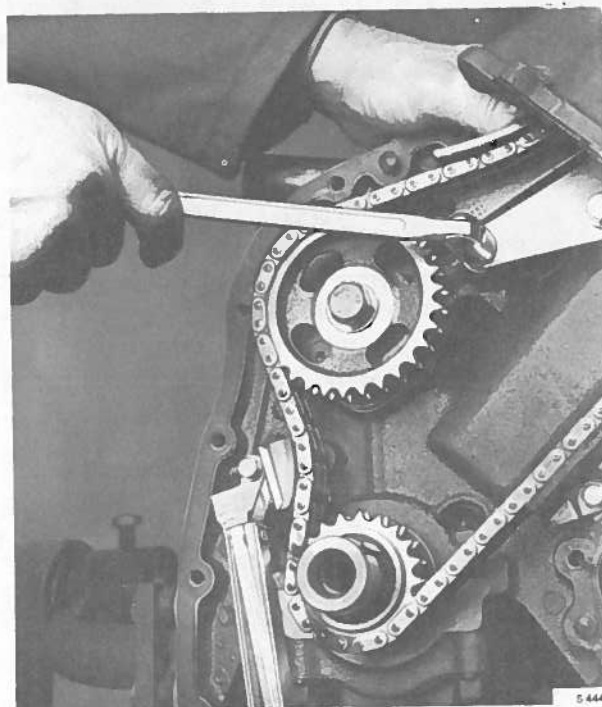


S 6080

Later version

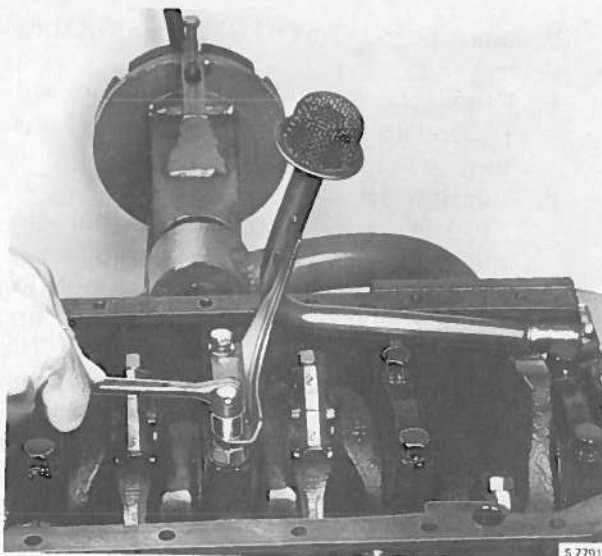


S 4440



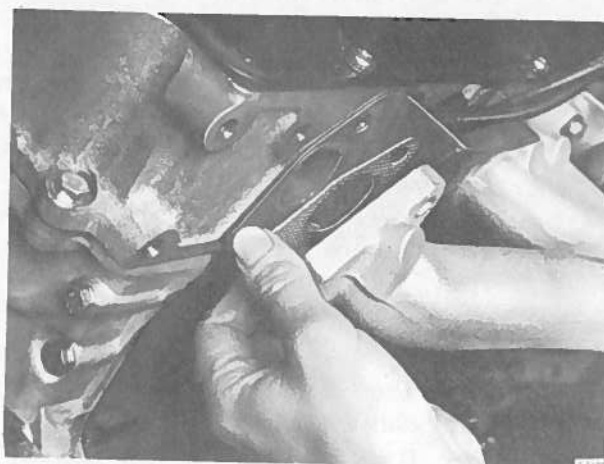
S 4440

31. Fit the oil pump spacing piece with gasket.
32. Fit the oil pump suction line. Make sure that the suction pipe 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. Carbureted engine:
Fit the carburetor.
35. Injection engine:
Fit the throttle valve housing.
36. Fit the thermostat housing.
37. Fit the exhaust manifold and radiation shield. As from 1976 model (2-branch exhaust manifold):

- Check on a face-plate that the sealing surfaces are flat and parallel.
- If necessary, grind the sealing surfaces, checking against a face-plate.
- Fit "service gaskets" (two smaller and one larger) between the exhaust manifold and the radiation shield.

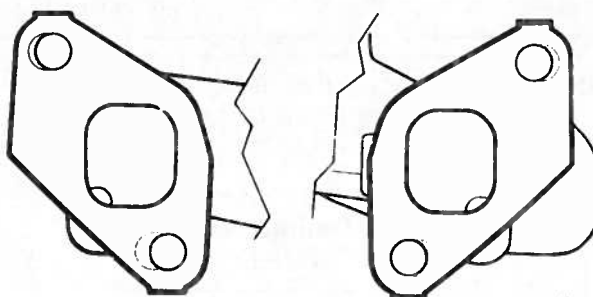


Note

Gaskets are not fitted at the factory but are recommended for re-assembly in conjunction with repairs.

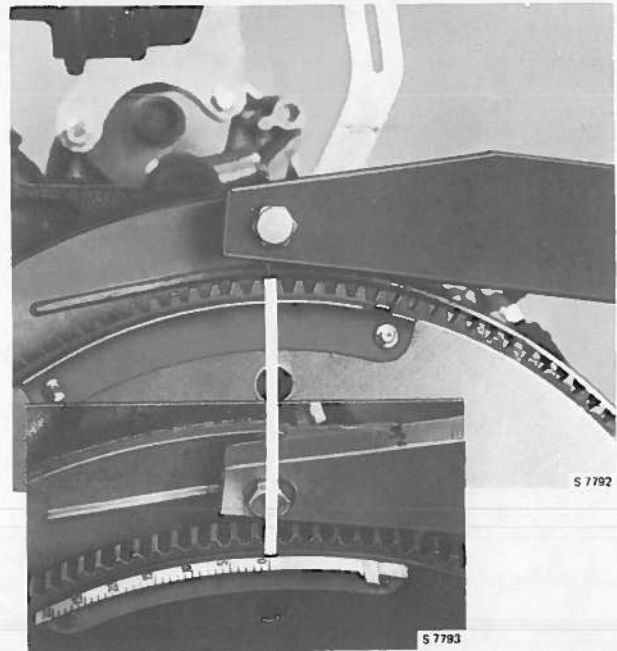
The reason is that a certain amount of deformation will occur due to the temperature variations to which the exhaust manifold is subjected.

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

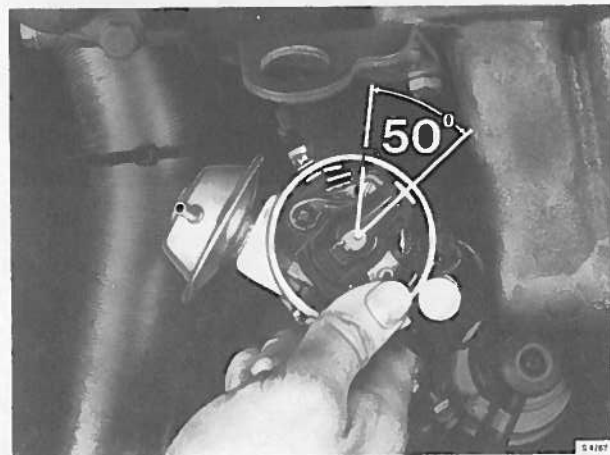


38. Fit the distributor as follows:

- 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. (When fitting, the rotor will move approximately 50° , due to the helix of the teeth.)



- c. Fit the distributor into the engine with the marking 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.



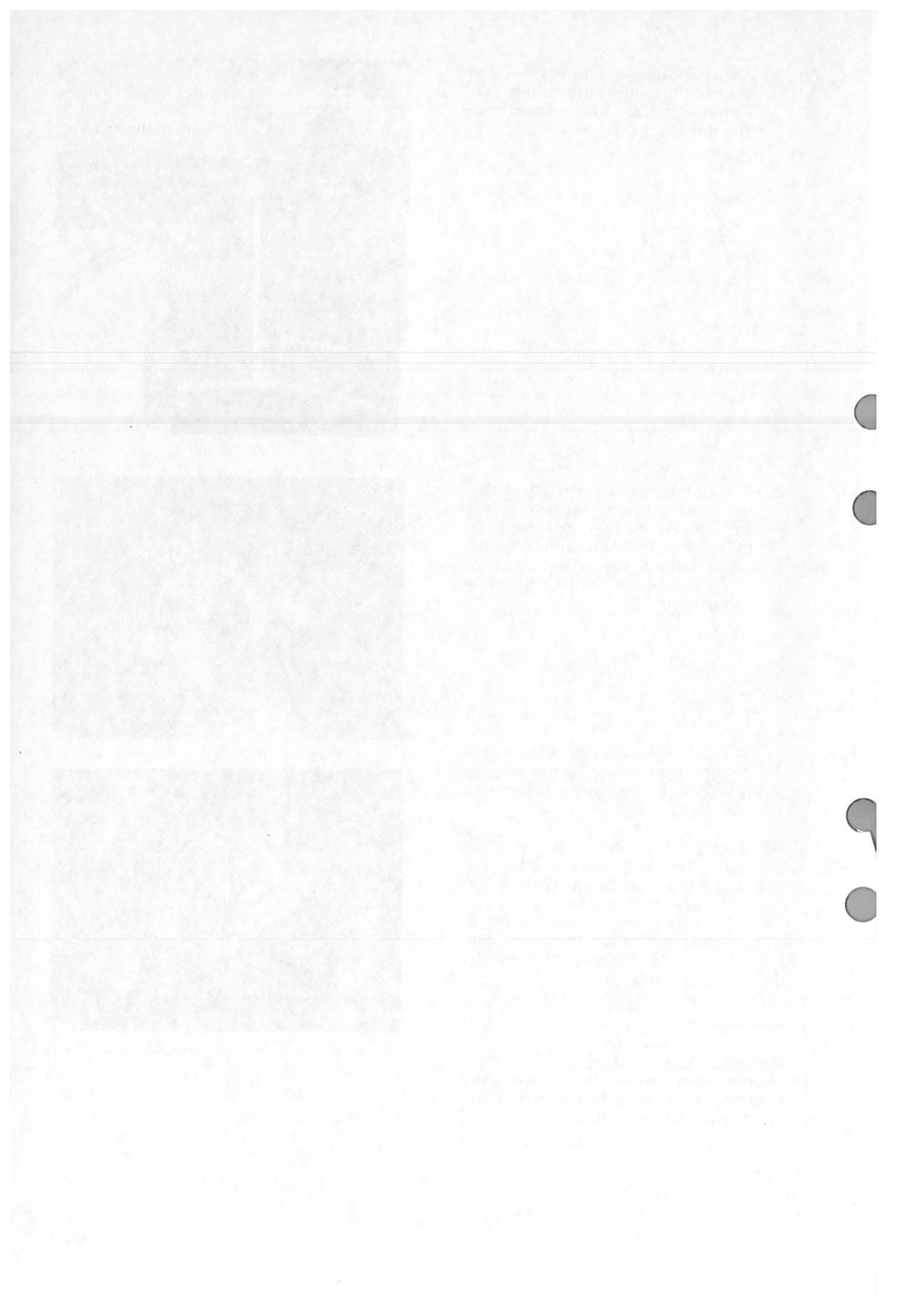
Caution

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. Fit the clutch (manual transmission).



Cylinder head

To remove

(Engine in car)

Caution

Tighten the bolt securely to immobilize the centre 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.

1. Disconnect the battery leads.
2. Drain off the coolant through the radiator and engine block drain cocks.
3. Carbureted engines:
Remove the inlet hose and disconnect the throttle and choke cables from the carburetor.
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. Disconnect the vacuum hose of the servo cylinder from the inlet manifold.
- b. Carbureted engine:
 Disconnect the fuel hose and the vacuum hose from the carburetor.
- b. Injection engine:
 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. Release 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:
 - a. 1975 model:
Screw a M8 nut on the threaded centre stud of the camshaft sprocket and clamp the centre stud against the mounting plate provided for the purpose.
 - As from 1976 model:
Bolt the mounting plate to the centre of the camshaft sprocket using one of the camshaft sprocket retaining bolts.

- b. Remove the retaining bolts from the camshaft sprocket. Separate the wheel from the camshaft plate until it hangs free in the mounting plate by the centre stud.
11. a. Unscrew and remove all cylinder head bolts.
- b. Fit two guide pins (tool 83 92 128) in two of the cylinder head bolt holes.
- c. Remove the bolts 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 flat.
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 to fire on No. 1 cylinder.

Caution

When the cylinder head is fitted, the marking of the camshaft and crankshaft must be in the firing position for No. 1 cylinder. Reason: The exhaust valves may come into contact with the piston crown if the transmission is not correctly fitted.

A fully open exhaust valve may collide with the piston crown at the top dead centre position.

- 5.a. Fit the cylinder head. Tighten the cylinder head bolts wire to the specified torque in two stages. The order of tightening is shown in the illustration. Insert and tighten the transmission chain cover bolts. Retighten after the engine has been warmed up and then cooled off for about 30 minutes.
- b. Retighten the bolts after 2000 km (1,200 miles).

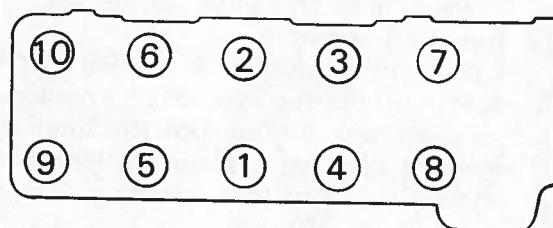
Torque

Step 1: 60 Nm (44 ftlb/6.0 kgm)
Step 2: 95 Nm (70 ftlb/9.5 kgm)

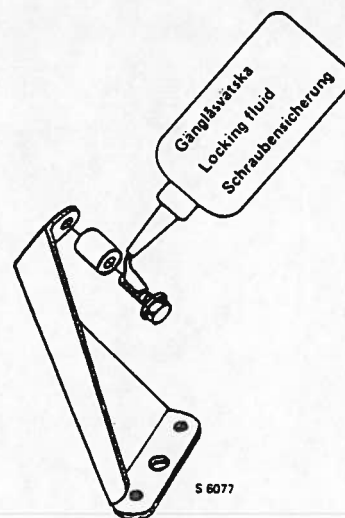
6. Mount the camshaft sprocket on the camshaft. Unscrew the nut (screw) from the centre of the sprocket.

Caution

The nut (bolt) on the camshaft sprocket centre must on no account be unscrewed before the sprocket is tightly secured to the camshaft.



7. Fit the engine mounting bolt to the cylinder head. Remove the blocks under the power unit.
8. Fit the valve cover. The gasket may be refitted if it is not damaged.
9. Fit the distributor cap complete with ignition cables.
10. Bolt the exhaust pipe to the exhaust manifold.
11. Connect the throttle control cable (choke 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. Fit the stay at the throttle valve housing.
14. Connect the cables to the ignition coil and temperature transmitter.
15. Fit the inlet hose (rubber bellows).
16. Close the drain cocks and fill with coolant.
17. Connect the battery cables.



S 6077



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Pistons, connection rods, cylinder bores

Changing the pistons, piston rings and big-end bearings

(Engine mounted in work stand)

Dismantling

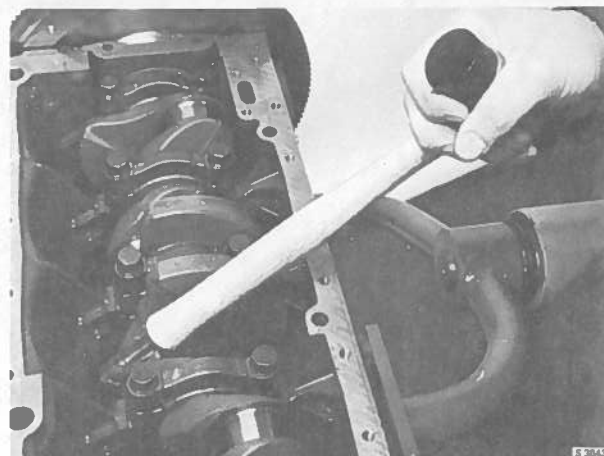
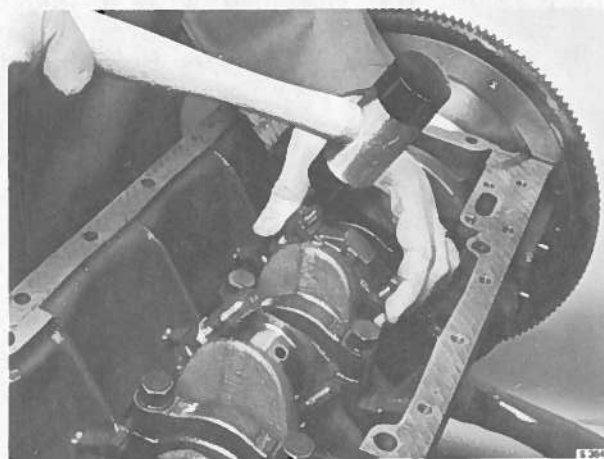
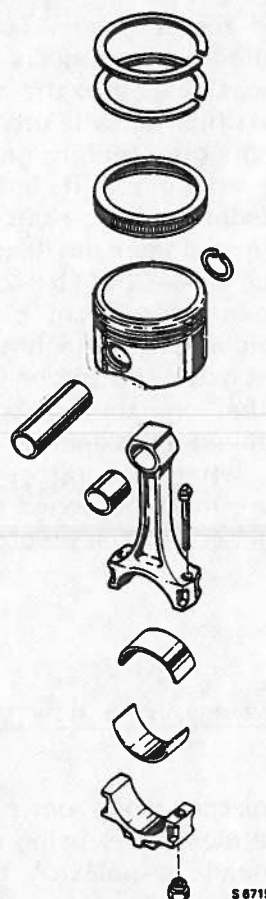
1. Remove the oil filter.
2. Remove the valve cover.
3. Remove the camshaft sprocket as follows:
 - a. Turn the crankshaft to firing position for No. 1 cylinder.
 - b. Screw an M8 nut onto the threaded centre stud of the camshaft sprocket 1975 model or use a camshaft sprocket retaining bolt (as from 1976 model and clamp the sprocket against the mounting plate provided for the purpose.

Caution

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

- c. Remove the retaining bolts from the camshaft wheel. Separate the wheel from the camshaft plate until it hangs freely by its centre stud in the mounting plate.
4. a. Unbolt all cylinder head bolts.
b. Remove the cylinder head bolts and fit 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 burrs and carbon deposits from the top ends of the cylinders.



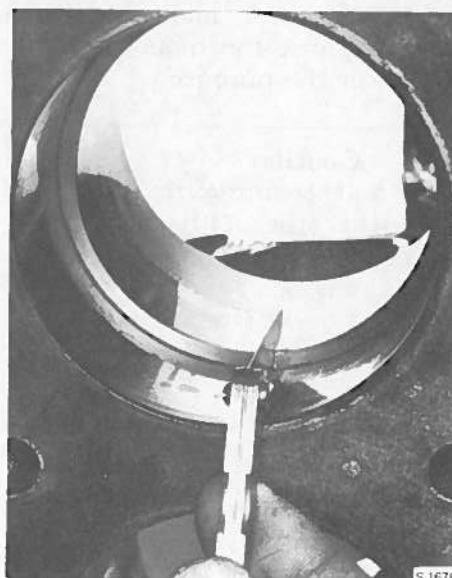
Fitting the pistons

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



Fitting piston rings in a new or rebored cylinder

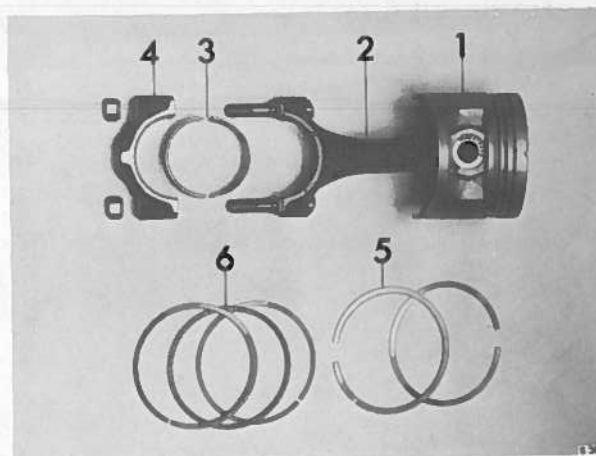
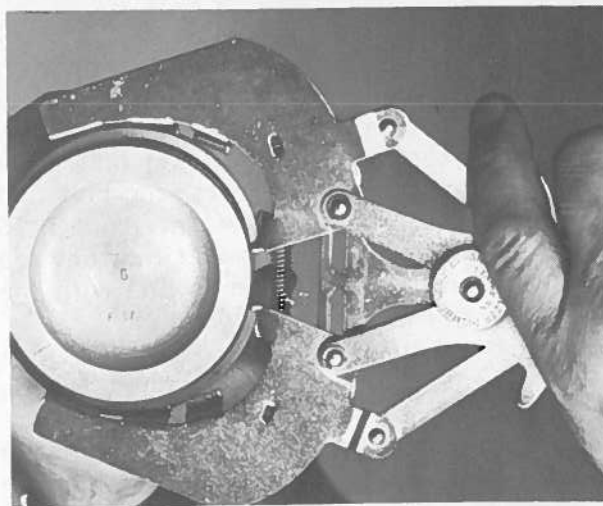
1. Push the piston rings down into the cylinder one at a time, using an inverted piston head to position them correctly.
2. Measure the ring gap with a feeler gauge (see illustration). Correct gap sizes are given in the specifications. If necessary, widen the gap using a special file.
3. Try the piston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



Fitting the 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 fitting them. Turn the compression rings so that gaps in alternate rings will be at 180° to each other, positioned alternately over the two ends of the gudgeon 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

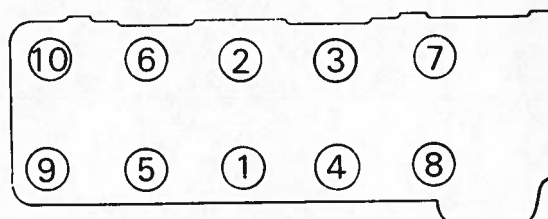
Fitting

1. Fit the pistons and connecting rods using the piston fitting tool 78 62 287.

Note

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

2. Fit the big-end bearing caps with bearing shells.
3. Fit the cylinder head gasket.
4. Fit the cylinder head. Remove the guide pins and refit the bolts. Tighten the cylinder head bolts to the specified torque in two steps; first to 59 Nm (6 kgm, 43 ftlb) and then 93 Nm (9.5 kgm, 69 ftlb). 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 bolts. Retighten the bolts after 2000 km (1200 miles).



Tightening torque

- Step 1: 60 Nm (44 ftlb/6.0 kgm)
Step 2: 95 Nm (70 ftlb/9.5 kgm)

5. Fit the camshaft sprocket to the camshaft, making sure that the markings on the camshaft and bearing cap are in line. Tighten and lock the retaining bolts. Remove the retaining bolt 1975 model or remove the retaining bolt and refit it to the sprocket (as from 1976 model). Check at the same time that the mark on the flywheel is in line with the mark on the cylinder block.
6. Fit the valve cover.
7. Connect the 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. Fit the oil filter.

Valve mechanism

Valve cover

Removing

1. Disconnect the crankcase ventilation hose.
2. Disconnect the ignition cables from the valve cover and spark plugs.
3. Remove the bolts and lift off the cover.

Refitting

If the bolts have been tightened too hard so that the contact surface around the bolt holes has been deformed, 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 bolts so hard that the cover will be deformed.

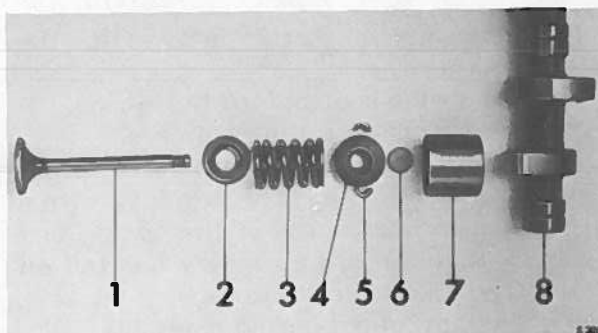
Tightening torque
2.0 Nm (0.2 kgm)

Valves

Removing

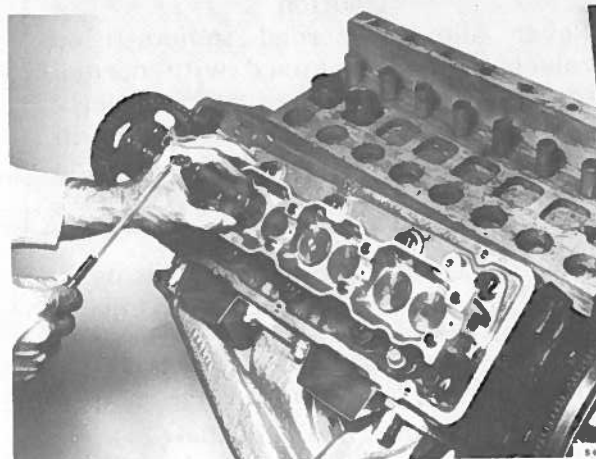
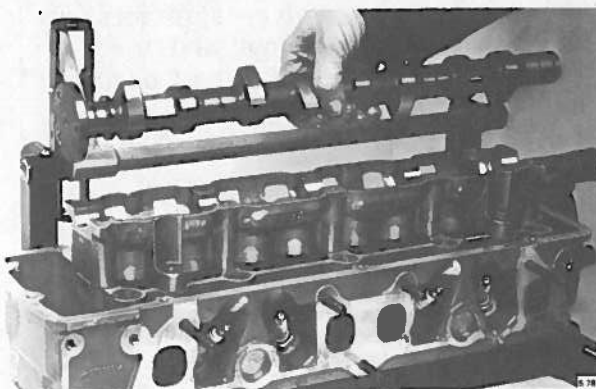
(Cylinder head removed from cylinder block)

1. Remove the camshaft bearing caps.
2. Lift out the camshaft.
3. Withdraw the valve depressors, using the magnetic tool, and put them aside in the correct order.
4. Remove the adjusting pallets. Be careful not to mix them up.

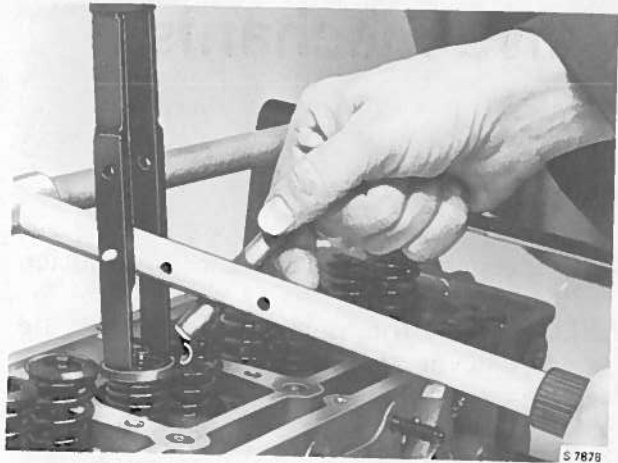


Valve mechanism

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



5. Remove the camshaft bearing assembly. Place the cylinder head in fixture 83 93 050.
6. a. Depress the valve spring.
 - b. Remove the valve collets, release the spring tension and remove the tool.
7. Remove the top valve retainer, valve spring and guide sleeve.
8. Withdraw the valve.



Refitting

1. Oil the valve stems and refit the valves.
2. Fit the spring seat before the spring.
3. Fit the springs and top retainers.
4. Depress the spring, using a valve spring tool, and fit the valve collets. Then release the pressure on the spring and check that they are correctly located on the stem. Remove the tool.
5. Fit the camshaft bearing assembly.
6. Fit adjusting pallets in their original positions.
7. Fit the valve depressors, lubricating the bearing surfaces with engine oil.
8. Fit the camshaft.
9. Fit the bearing caps. (NOTE the markings!)

Caution

Do not turn or tip 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 confused.

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 (introduced during 1977 model) are fitted in injection engines as from engine Nos:

BI 20 1006201, BI 20 P02002615, BI 20 P04003376, BI 20 P05001556, BI 20 P07001001 (and BI 20 P07000604-625).

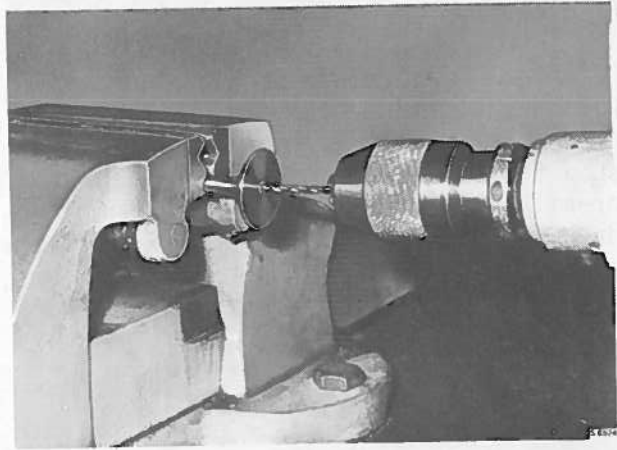
Valves to be scrapped should be treated as follows:

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.

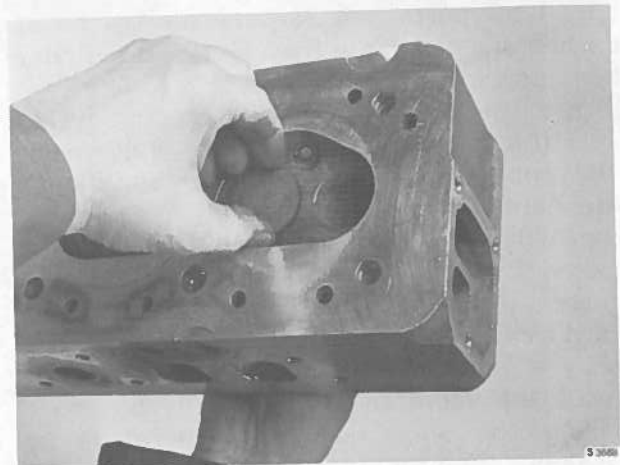
3. Throw the valve into a bucket of water. This will cause an explosive chemical reaction. The manufacturer recommends that you should withdraw to a distance of at least 3 metres from the bucket. After a period of one or two minutes, the reaction will die down and the valve may be scrapped in the normal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



Valve guide

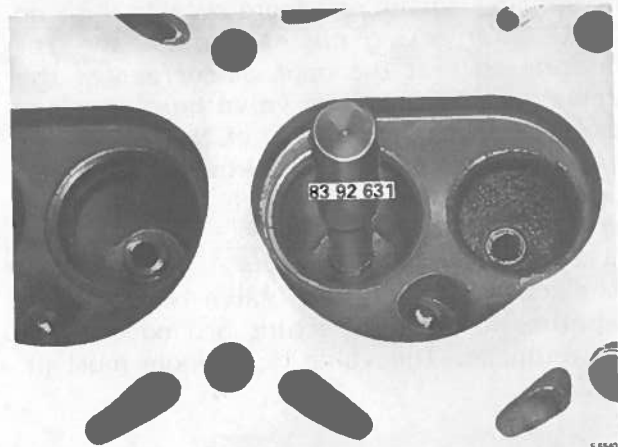
Checking the wear

Withdraw 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" (0.05 mm), the valve guide (should be replaced).



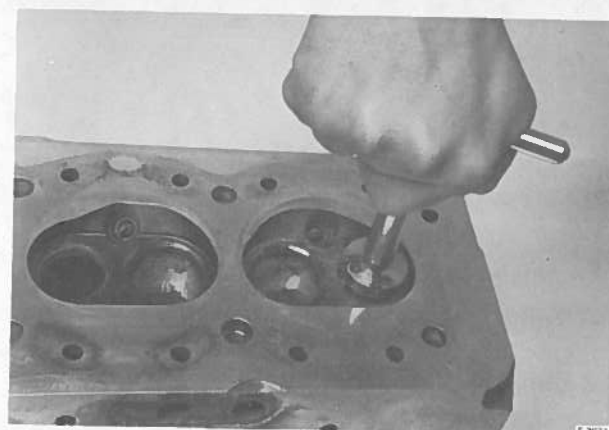
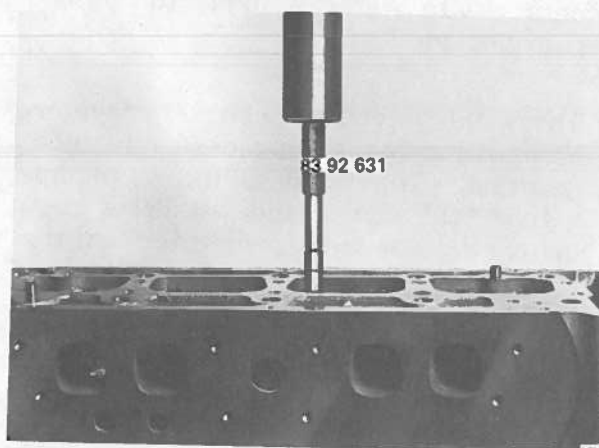
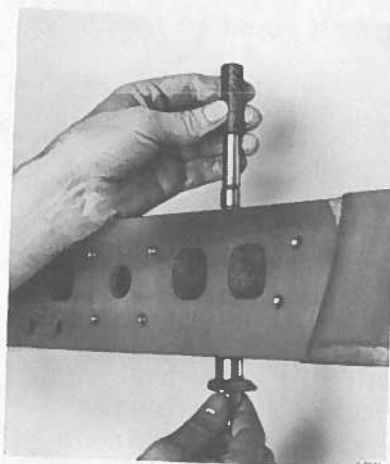
Removing

Before removing a valve guide, flush the cylinder head with warm water. The guide should be pressed out using a press and the drift belonging to valve guide tool 83 90 437 can be used as an alternative).



Refitting

Flush the cylinder head with hot water. Press in the guide using a press and valve guide tool 83 92 631. Insert the centering stop from the underside of the head and press in the guide from above, using the drift. In the final stage of the pressing-in operation, the valve guide tool will deflect and the valve guide can then be pressed into its final position.



Refitting the valve seats

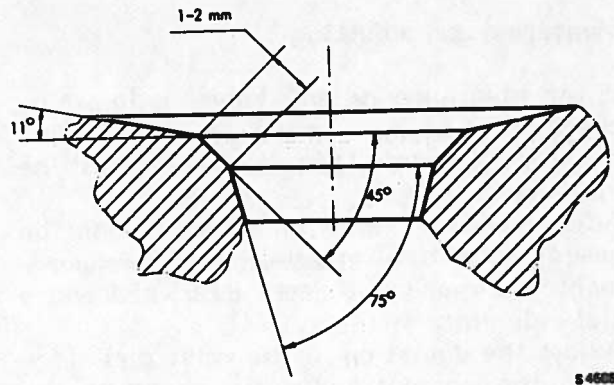
Clean all parts and remove all traces of carbon and dirt from the valve and cylinder head ports.

Insert the centring guide for the cutter into the valve guide from the valve seat end and tighten the clamping bolts until the centring guide is securely clamped in the valve guide. The valve seats in the cylinder head should be cut with a 45° cutter. It may be necessary to break up the hard surface of the exhaust valve seat first with a piece of emery cloth. After being recut 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 $11-12^{\circ}$ correcting cutter. Adjust the reduction so that the contact surface of the valve seat touches the valve head as close as possible to the centre of the seat. This can be checked with marking blue. 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 replaced. The valve head angle must be 44.5° .

Grinding the valves

Smear a thin coat of grinding paste on the valve seat and insert the valve into the cylinder head. Turn grinding tool back and forth a few times, clean all traces of paste off the seat, and check the contact with marking blue. Grind once more if required and recut the seat if necessary.



Valve seat angles

Valve clearance

General

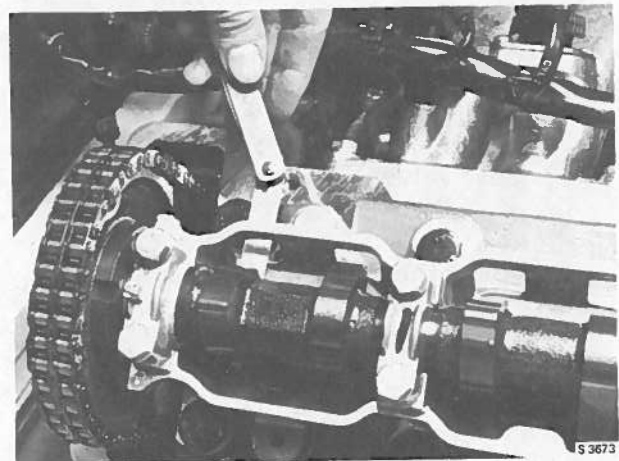
The valve clearance is stable and adjustment is needed only after long periods or when the valves are being reconditioned. However the valve clearance should be checked as follows:

1978 model every 25000 miles (40000 km)
1979 model every 30000 miles (45000 km)
Turbo every 20000 miles (30000 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) 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 crankshaft using special wrench 83 90 817 to bring the camshaft into position for measurement. This special wrench fits the centre bolt of the crankshaft belt pulley at the fire-wall.
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 should be based on actual measurement. Measurement are made with tool 83 91 450 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. Mount tool 83 91 450 and screw it on so that its three jaws grip the valve depressor and the tip of the dial indicator rests on the rest of the cam. Zero the indicator.
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 which it is not within the following limits:

Inlet valves

0.008"-0.010" (0.20-0.25 mm)

Exhaust valves

0.016"-0.018" (0.40-0.45 mm)

5. Remove the camshaft and the valve depressors and adjusting pallets of any valves needing adjustment.
6. Measure and make a note of the thickness of the pallet using tool 83 91 633 or a micrometer.

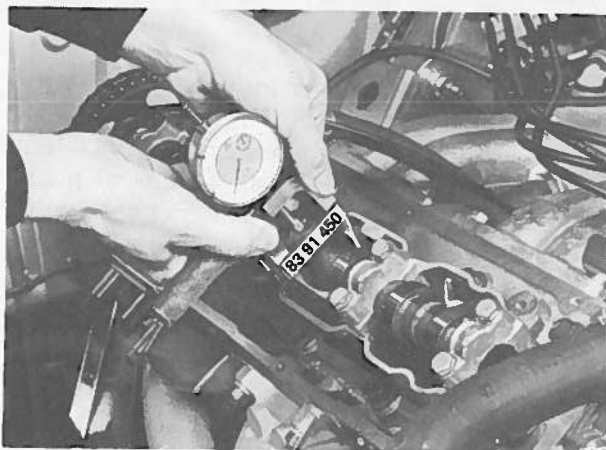
This thickness plus the valve clearance is the total distance between the valve and the cam.

Example:

Measured valve clearance 0.005" (0.13 mm)

Measured pallet thickness 0.100" (2.54 mm)

Total distance 0.105" (2.67 mm)



S2210

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:

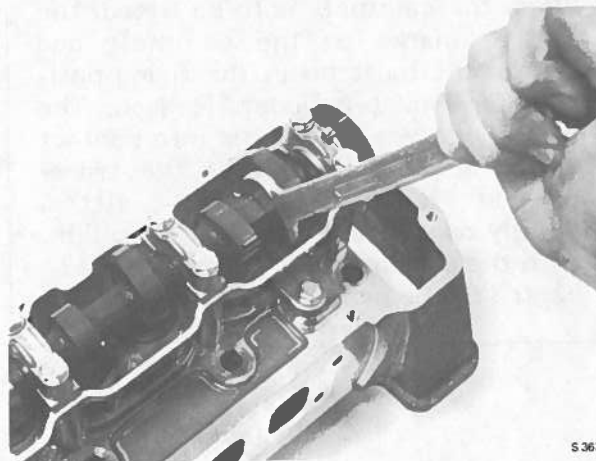
Total distance	0.105" (2.57 mm)
Less specified inlet valve clearance	0.008"-0.010" (0.20-0.25 mm)
Required pallet thickness	0.097" (2.44 mm)

Choose a pallet with thickness 0.096" (2.43 mm)

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

Measuring and adjusting the valve clearances after valve reconditioning

1. Fit adjusting pallets with a minimum thickness of 0.070" (1.77 mm).
2. Fit depressors and fit 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, remove the 0.070" (1.77 mm) pallets and insert new pallets to give the correct clearances.
6. Replace the depressors and refit the camshaft.
7. Check the clearances once more with the dial indicator. To make your choice of adjusting pallets easier, use the table in this section.



S 3675

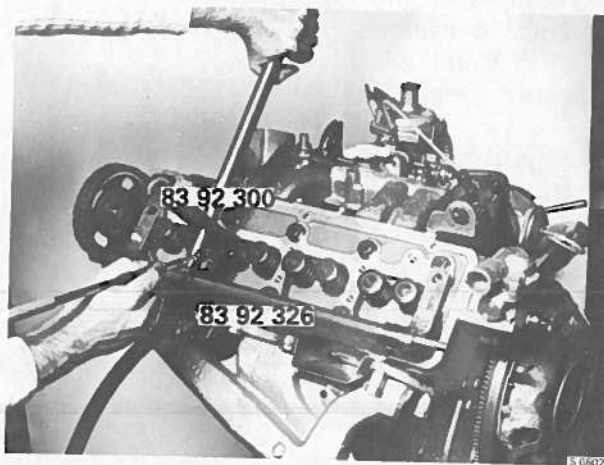
Replacement of valve springs without removing the cylinder head

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

Caution

Tighten the bolt fully, so that the centre 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 bolts holding the camshaft sprocket to the camshaft.
5. Remove the camshaft caps and remove the camshaft.
6. Remove the valve depressors and adjusting pallets.
7. Remove the camshaft bridge.
8. Remove the spark plug for the cylinder requiring a new valve spring and fit an air hose connector (tool 83 92 326) into 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 83 92 300) as shown in the illustration. Compress the valve spring and remove the collets 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: The exhaust valves may come into contact with the piston crowns if the transmission is not correctly fitted.

A fully open exhaust valve will collide with the piston crown at the top dead centre of the piston

Pallet thickness measured	Valve clearance measured with dial indicator (mm)																											
	Inlet, mm																											
Exhaust (standard) mm	2.89 2.84 2.79 2.74 2.69 2.64 2.59 2.54 2.48 2.43 2.38 2.33 2.28 2.23 2.18 2.13 2.08 2.03 1.98 1.93 1.88 1.82 1.77																											
Exhaust (Turbo) mm	2.89 2.84 2.79 2.74 2.69 2.64 2.59 2.54 2.48 2.43 2.38 2.33 2.28 2.23 2.18 2.13 2.08 2.03 1.98 1.93 1.88 1.82 1.77																											

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.

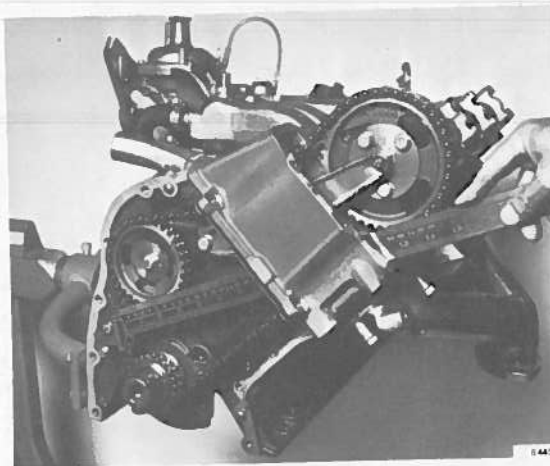
Transmission

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 too 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).



Transmission

Transmission is the process of sending data from one device to another. It can be done over a network or a direct connection.

There are two main types of transmission:

- 1. **Point-to-Point**: This is the most common type of transmission. It involves sending data from one device to another directly.
- 2. **Broadcast**: This type of transmission involves sending data from one device to multiple devices at the same time.

Transmission can be done over a network or a direct connection.

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There are two main types of transmission:

Crank mechanism

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 under-sizes 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 centre journal, and rotate the shaft.

Measuring the clearance

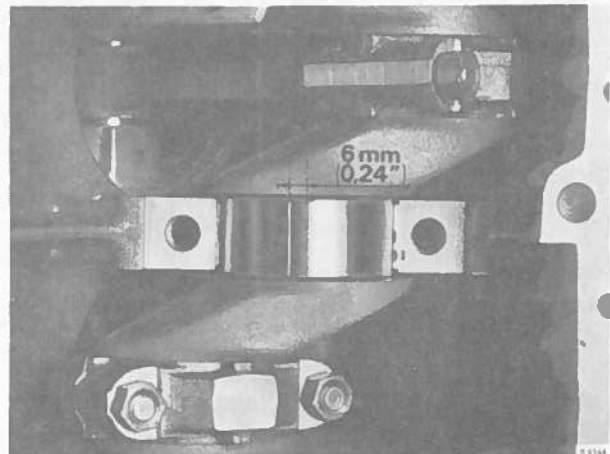
Before the bearing clearance is measured in connection with the fitting of new bearings, the out-of-round and taper of the big-end bearing journals should be checked. This clearance can be measured with a "Plastigage" which can be obtained as spare part number (45) 30 06 558. The Plastigage is available 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 face 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 with a torque of 108 Nm (79 ftlb, 11 kgm). The crankshaft must not be turned during the measurement.
4. Remove the cap. The strip should now have been firmly pressed into the bearing cap or onto the big-end bearing journal.



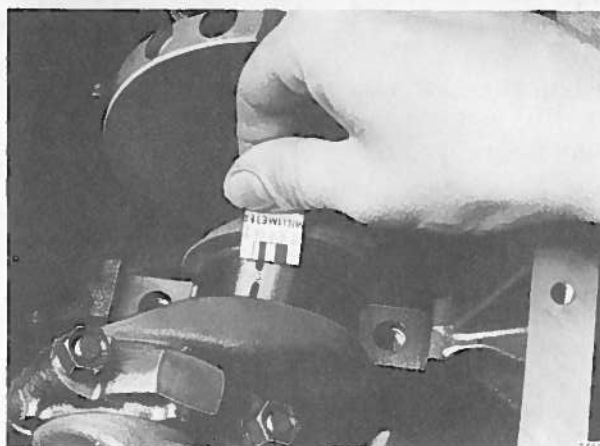
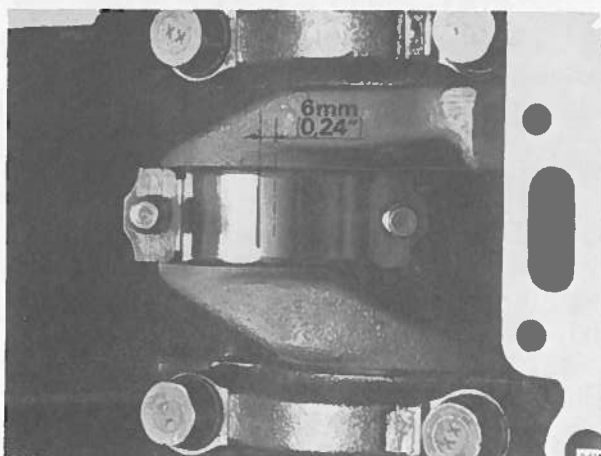
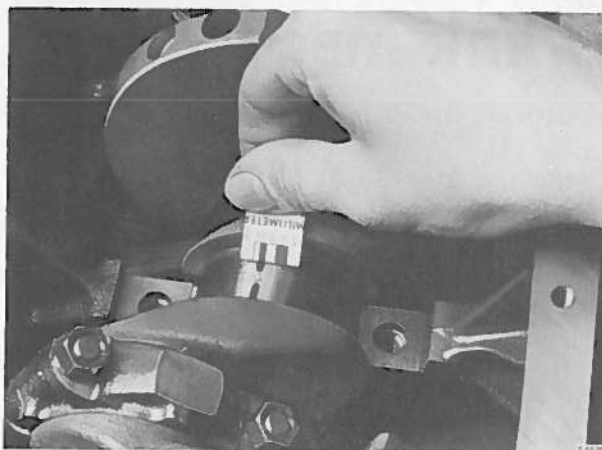
5. Measure the width of the Plastigage strip, using the scale printed on the Plastigage package and read off the clearance. One side of the package gives the dimension in mm, the other side in thousandths of an inch. Measure the strip at its widest point, but do not touch it with your fingers.

Big-end bearings

Plastigage strips cannot be used to measure 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 the 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 ftlb, 5.5 kgm). 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 shells for main and big-end bearings

Bearing shells 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 shells are only available in one thickness.

The classified bearing shells are colour-coded as follows:

Standard size:

Red - thin bearing shell, gives INCREASED clearance

Blue - thicker bearing shell, gives REDUCED clearance.

Yellow - thin bearing shell, gives INCREASED clearance.

Green - thicker bearing shell, gives REDUCED clearance.

2nd undersize:

White - thin bearing shell, gives INCREASED clearance.

Brown - thicker bearing shell, gives REDUCED clearance.

Example:

First try to obtain the proper clearance by fitting two thin bearing shells. If the clearance is too large between two thin bearing shells, fit a thin and a thick or two thick shells to reduce the clearance.

If the clearance is too large even after two thick bearing shells have been fitted, the crankshaft must be ground down to the next possible undersize and bearing shells of corresponding size must be fitted. See group 0.

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

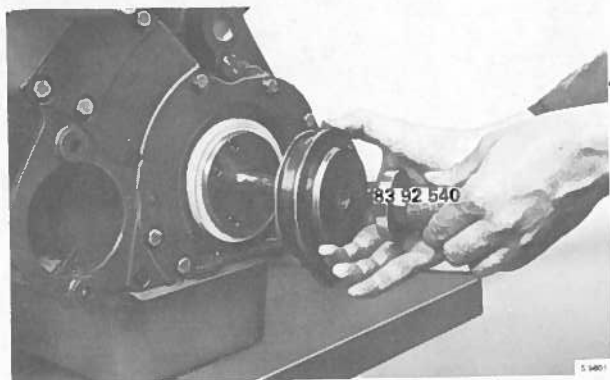
The seal can be changed with the engine in place in the car. The clutch and flywheel must first be removed.

1. Remove the old seal using a screwdriver.
2. Fit a new seal with the spring ring facing inwards towards the crankshaft. Grease the sealing surfaces of the seal prior to fitting. Use tool 83 92 540 or earlier tools 83 91 971, 83 91 963 83 91 963 and 83 91 922.

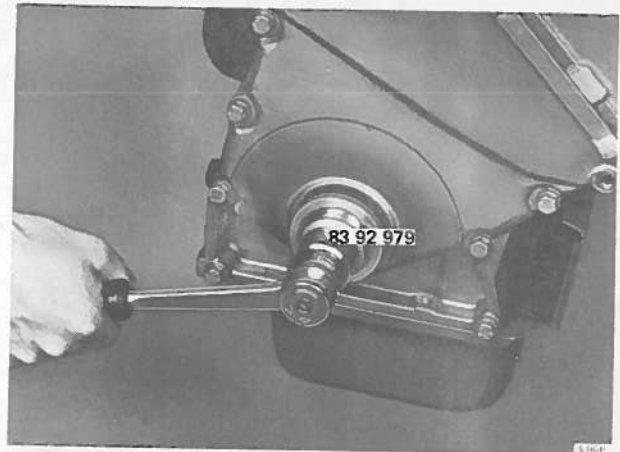
Changing the crankshaft seal (seal ring) at the transmission end

Power unit out of car

1. Remove the seal by means of a screwdriver.
2. Lubricate the lips of the new seal liberally with grease.

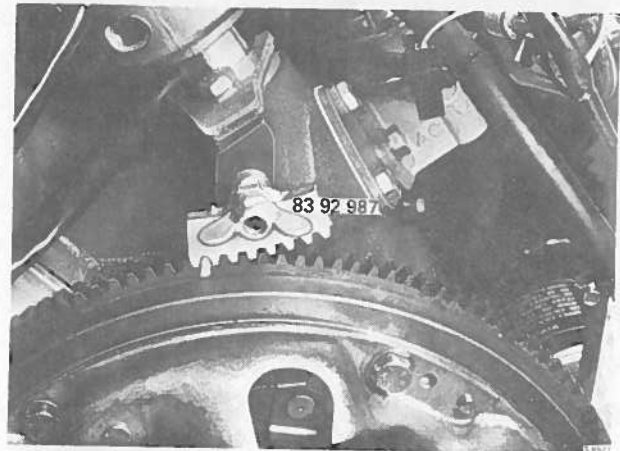
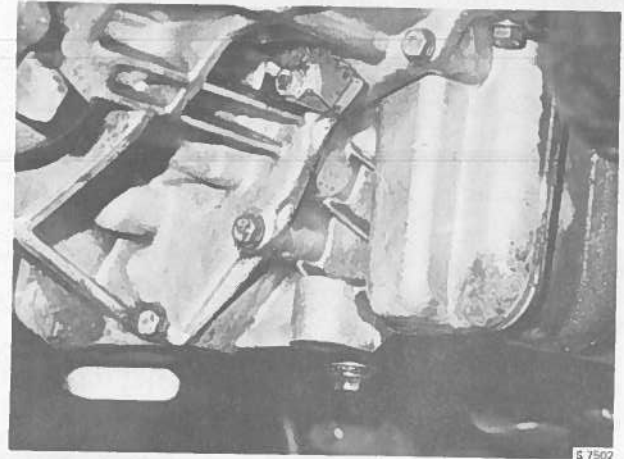


3. Press the seal ring into by means of sleeve 83 92 279, using the pulley bolt to press it in.



Power unit mounted in the car

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. Move the power unit slightly forward by inserting two wooden wedges between the bulkhead and the engine. This will be easier if the engine mounting nuts are first removed.
3. Remove the clutch housing (torque converter cover and lock the crankshaft by fitting locking segment 83 92 978 to the ring gear.
4. Manual gearbox:
Fit the tool into the opening on the underside of the primary gear housing.
Automatic transmission:
Remove the torque converter cover and fit the tool.

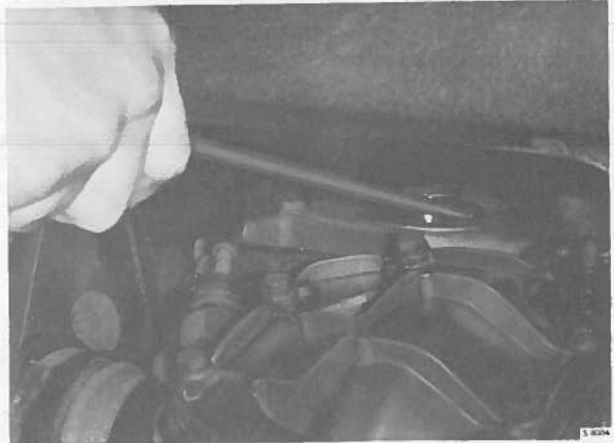


5. Raise the car by means of a hoist.
6. From beneath the car, remove the pulley retaining bolt, using special wrench 83 92 961 and remove the pulley.

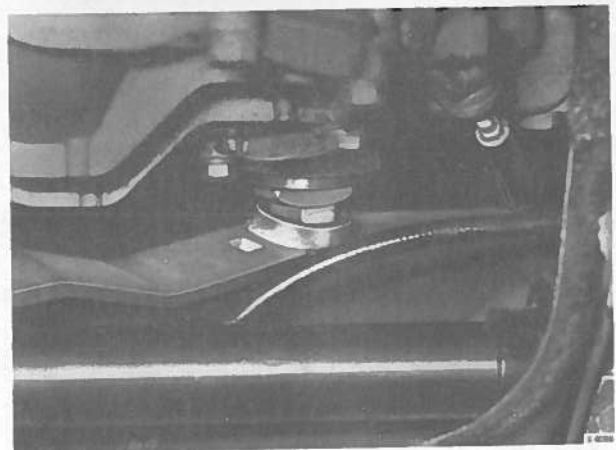




7. Prise off the old seal by means of a screwdriver.



8. Grease the lip of the new seal and press it into position using sleeve 83 92 979 and the pulley retaining bolt.



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

Tightening torque with torque wrench (15.8 in, 400 mm) long attached to special wrench 83 92 961.



2.0 l engine	70 Nm (51.7 ftlb, 7.0 kgm) which gives a torque of 190 Nm (137.7 ftlb, 19 kgm) at the bolt
1.85 l engine	35 Nm (25.8 ftlb, 3.5 kgm) which gives a torque of 83 Nm (61 ftlb, 8.3 kgm) at the bolt).

From the engine compartment:

10. Remove the wooden wedges and locking segment and fit the alternator belt (or other V-belts).

Variation depending on length of torque wrench:

2.0 l engine:	
Length, torque wrench	Torque approx.
11.8 in (300 mm)	55 Nm (40.6 ftlb, 5.5 kgm)
15.8 in (400 mm)	70 Nm (51.7 ftlb, 7.0 kgm)
19.7 in (500 mm)	80 Nm (59.0 ftlb, 8.0 kgm)
1.7 and 1.85 l engine:	
Length, torque wrench	Torque approx.
11.8 in (300 mm)	30 Nm (22.1 ftlb, 3.0kgm)
15.8 in (400 mm)	35 Nm (25.8 ftlb, 3.5 kgm)
19.7 in (500 mm)	35 Nm (25.8 ftlb, 3.5 kgm)

Changing the seal on removed transmission cover

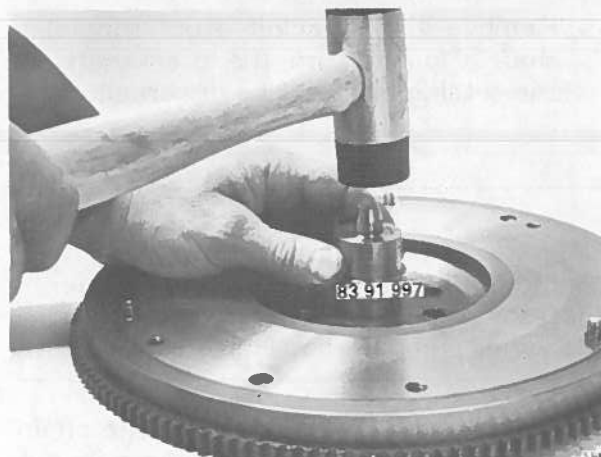
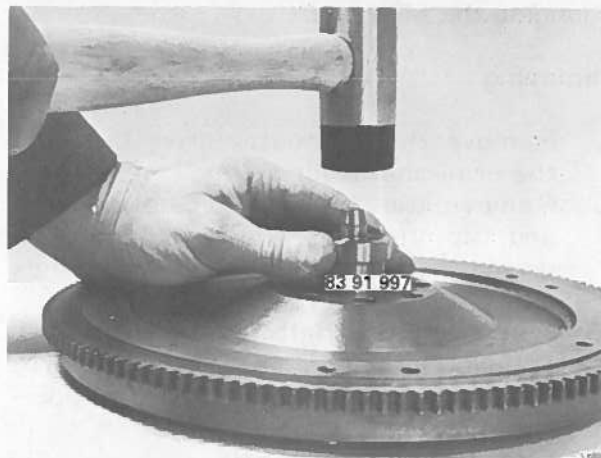
1. Remove the old seal.
2. Place the cover on a flat surface to avoid damaging the sealing surface. Press the seal into the cover, using tool 83 90 445.

Note

If the transmission cover is removed or fitted when the engine is fitted to the gearbox, the seal between the cover and the gearbox will be damaged.

Changing the clutch shaft bearing

1. Remove the flywheel.
2. Remove the clutch shaft bearing from the flywheel, using drift 83 91 997.
3. Fit a new clutch shaft bearing into the flywheel, using the same drift.



Measuring and shimming the crankshaft sprocket on crankshaft after overhauling

When a new crankshaft, idler shaft or sprocket has been fitted, 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. Place the edge of a rule against the idler shaft sprocket as close as possible to the centre of the sprocket and across the crankshaft sprocket. Make sure that the edge of the rule lies 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 that no axial throw will occur.



Changing the idler shaft

Removing

1. Remove the alternator drive belt and the crankshaft belt pulley.
2. Remove the transmission cover bolts and tap the cover gently forward to unseat it from the locating studs without damaging the gaskets.
3. Turn the crankshaft to TDC for No. 1 cylinder. The distributor rotor arm should then also be in the firing position for No. 1 cylinder.
4. Remove the distributor
5. Remove the sprocket from the idler shaft. Do not turn the crankshaft as the setting must not be disturbed.

Note

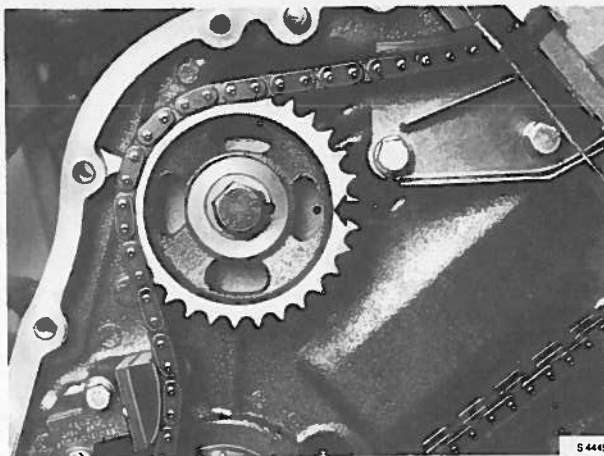
Hold the idler shaft sprocket when the centre bolt is to be removed. The idler shaft must never be held by means of the water pump or distributor drive.

6. Remove the two bolts from the chain tensioner and turn the tensioner up out of the way.
7. Remove the idler shaft.

If the transmission cover gasket is damaged in the course of assembly or dismantling, a new gasket must be cut to shape and glued in place with Tikatät 2. Apply the adhesive to the transmission casing flange at the gasket joints. Allow the adhesive to harden for a while, then position the gasket and let it dry on thoroughly before fitting the transmission cover.

Assembling

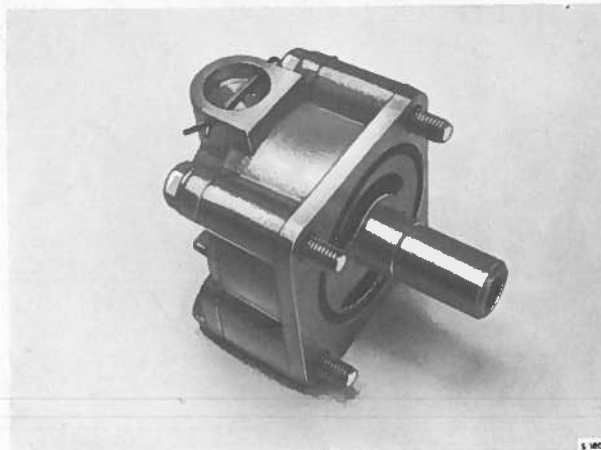
1. Fit the idler shaft and fixing plate. Tighten the two countersunk screws with the prescribed torque.
2. Fit a new locating pin in the new idler shaft.
3. Fit the chain to the sprocket in the correct position relative to the hole in the fixing plate (see illustration). Turn the idler shaft until the locating pin and hole correspond and the sprocket can be fitted. Then check that the guide sleeve is flush with the sprocket.
4. Fit the locking plate with the retaining screw. Place a suitable dolly through one of the holes in the sprocket and tighten the screw. Lock the screw with the locking plate.
5. Turn the chain tensioner self-adjusted into its innermost position. Mount the chain tensioner and stretch the chain. Adjust the chain to obtain play of 0.02-0.04" (0.5-1 mm) between the tensioner and the pad.
6. Fit the transmission cover. **Note** Before fitting the cover, knock the guide studs a fraction of an inch (a few mm) deeper into the cylinder block.
7. Fit the belt pulley and alternator drive belt.
8. Fit the distributor and adjust the ignition timing. See section "installing of engine".



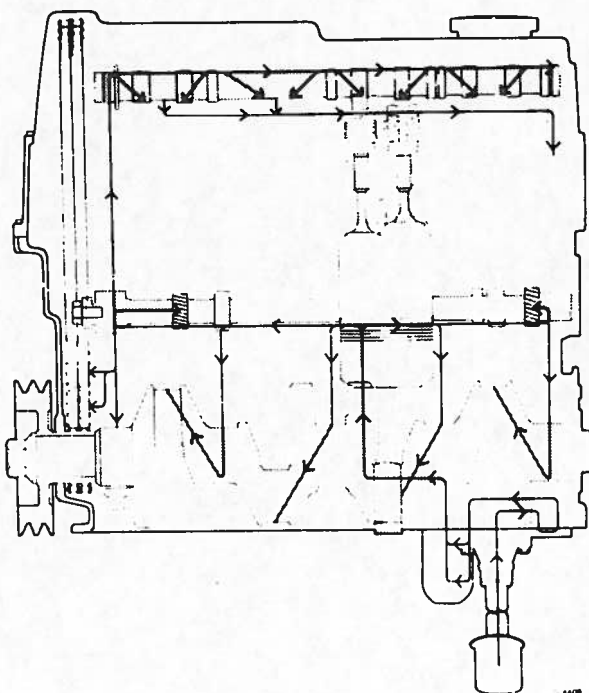
Idler shaft marking. The bulge in the hole on the idler shaft chainwheel should line up with the small hole in the fixing plate.

Lubricating system

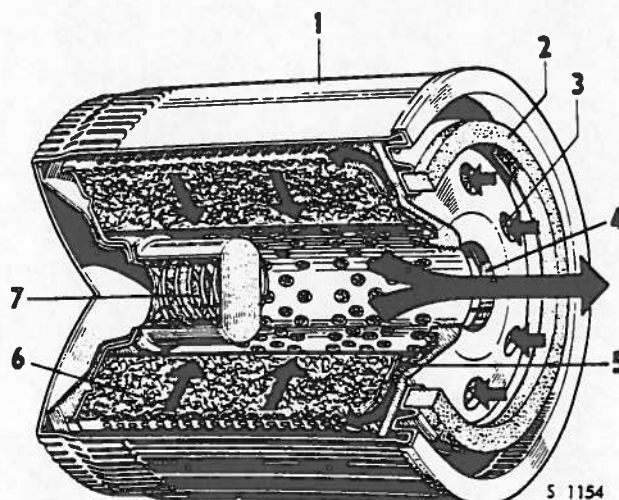
The engine has a pressurized lubrication system (see fig. below). The pressure is generated by a birotary pump driven from the idler shaft. The pump is located on an intermediate piece, together with the oil filter. The rotors of the pump deliver oil through a reducing valve in the pump itself and then through the oil filter and the oilways, to the various lubrication points. Each big-end bearing has a separate oilway from the main bearing. The oil filter is of the full-flow type, ie. all oil delivered to the lubrication points flows through the filter.



Oil pump



Lubrication system



Oil filter

1. Filter casing
2. Rubber seal
3. Oil inlet
4. Oil outlet
5. Check valve
6. Filter element
7. By-pass valve

Oil pump

Removal

1. Remove the four retaining bolts through the corners of the pump.
2. Remove the pump and the seal ring between the pump and the intermediate plate.

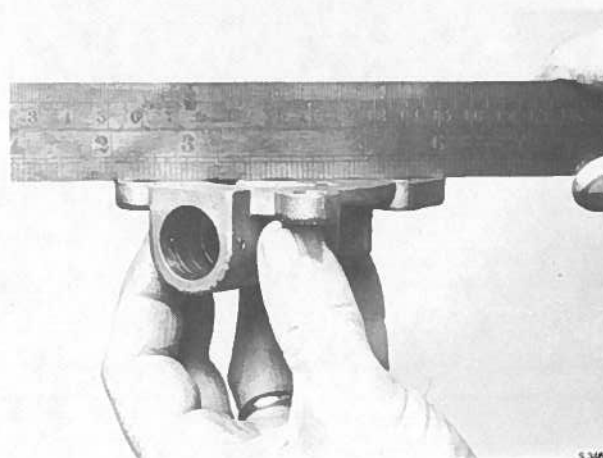
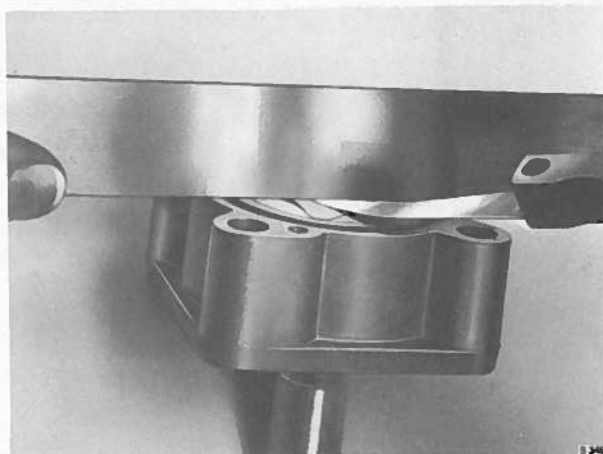
Dismantling

1. Remove the two bolts 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 between the inner and outer rotors and the rotor housing, a rule and feeler gauge. The clearance 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 wheel.

Check the flatness of the cover with a rule (see illustration). All deformations scratches and pits must be removed by grinding.

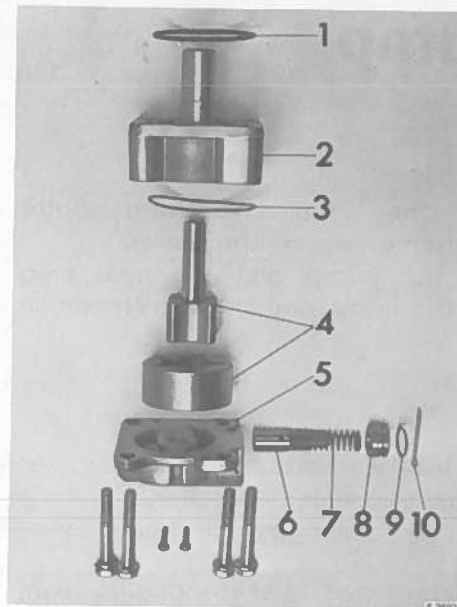


Reassembly

1. Lubricate the rotors with engine and oil 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 into 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.

Assembly

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 bolts.



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

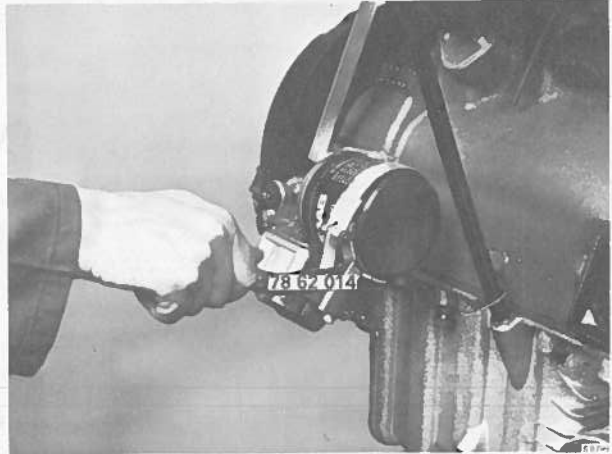
Replacement of filter cartridge

1. Release the oil filter cartridge with a filter wrench (tool 78 62 014).
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.

If leakage should occur, the filter can be retightened by means of wrench 78 62 014 with a torque of approx. 15 Nm (1.5 kgm).

Note

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



1. Remove the old oil filter.

2. Clean the oil filter base.

3. Install the new oil filter.

4. Check the oil level.

5. Run the engine for 5 minutes.

6. Check the oil level again.

7. Dispose of the old oil filter.

8. Clean the oil filter base.

9. Install the new oil filter.

10. Check the oil level.

11. Run the engine for 5 minutes.

12. Check the oil level again.

13. Dispose of the old oil filter.

14. Clean the oil filter base.

15. Install the new oil filter.

16. Check the oil level.

17. Run the engine for 5 minutes.

18. Check the oil level again.

19. Dispose of the old oil filter.

20. Clean the oil filter base.

21. Install the new oil filter.

22. Check the oil level.

23. Run the engine for 5 minutes.

Oil cooler

Removal and fitting

1. Drain the coolant through the radiator drain cock.
2. Disconnect the oil hoses.
3. Undo the hose clamps and remove the oil cooler.
4. Refit in the reverse order.

Adapter

Removal and fitting

1. Remove the oil filter.
2. Disconnect the oil hoses at the oil cooler.
3. Unscrew the adapter.

Refit in the reverse order. Make sure that the O-ring is not damaged. Tighten the adapter somewhat harder than the oil filter, to avoid the adapter to working loose when the oil filter is changed.

Carburetor

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Single-carburetor

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Twin-carburetors

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Single- and Twin-carburetors

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General

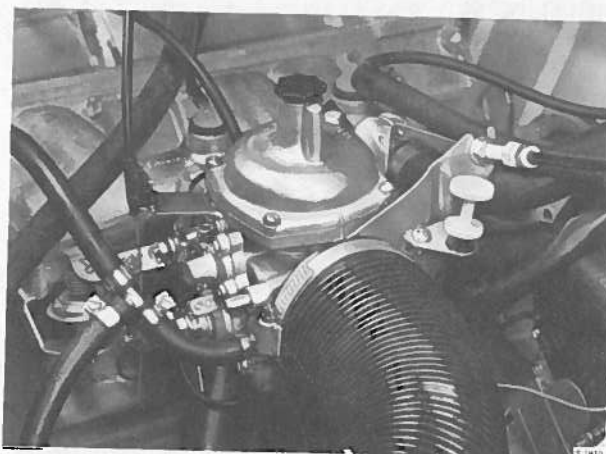
The engine is equipped with one or two Zenith horizontal carburetors. The carburetor has a single jet with a tapered needle which meters the amount of fuel flowing through the jet orifice. The position of the needle relative to the jet orifice is determined by the depression in the carburetor body acting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

The carburetor is made of light alloy. It consists of three main sections, the central one being the carburetor housing. The bottom section is the float chamber. The float chamber surrounding the jet. Up to and including the 1976 model, the jet is equipped with an adjusting device for its vertical position. As from the 1977 model, the jet is pressed permanently into the carburetor housing and a device has been introduced for adjusting the height of the fuel needle from the outside. The top section is the vacuum chamber, the lower boundary of which is a diaphragm in which the piston is suspended. The vacuum chamber communicates with the carburetor inlet duct via two channels in the piston.

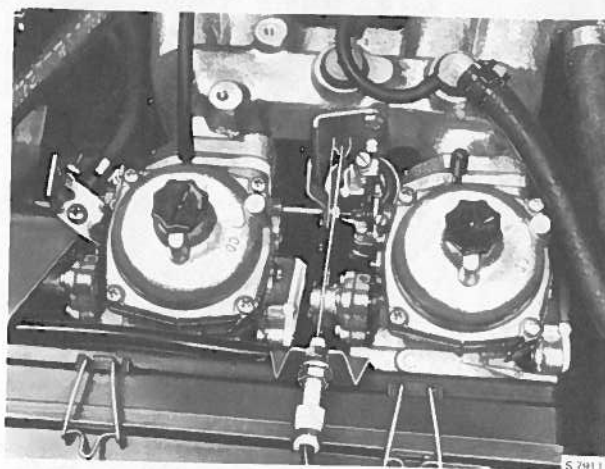
The vacuum in the carburetor housing determines the rate of fuel flow, which is controlled by the needle, as well as the rate of air flow, which is regulated by the position of the piston in the air duct. In this way the engine always receives a correct mixture of fuel and air under all load conditions.

Twin carburetors

The carburetors used on twin-carbureted engines are in principle similar to those provided on single-carbureted engines. Located in front of the two carburetors is an air box which serves both carburetors and which is connected to the air cleaner by means of a hose. The inlet manifold passages from the rear carburetor to number 1 and 2 cylinders and from the front carburetor to cylinders number 3 and 4. A connecting passage links the two manifolds and this serves to correct any minor variations in the fuel-air mixture from the two carburetors.



Single-carburetor



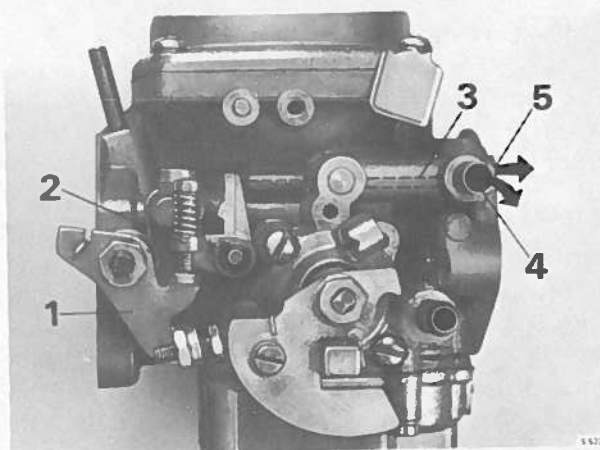
Twin-carburetors

Float system

Fuel enters the float chamber through the float valve. The float, which is double, is located by a bridge on the underside of the carburetor housing. As the fuel level rises, the float rises with it, and when the correct level is reached, the float valve will be closed by a tongue on the float arm. Fuel is also drawn into the jet, where the level will be the same as in the float chamber (engine at rest).

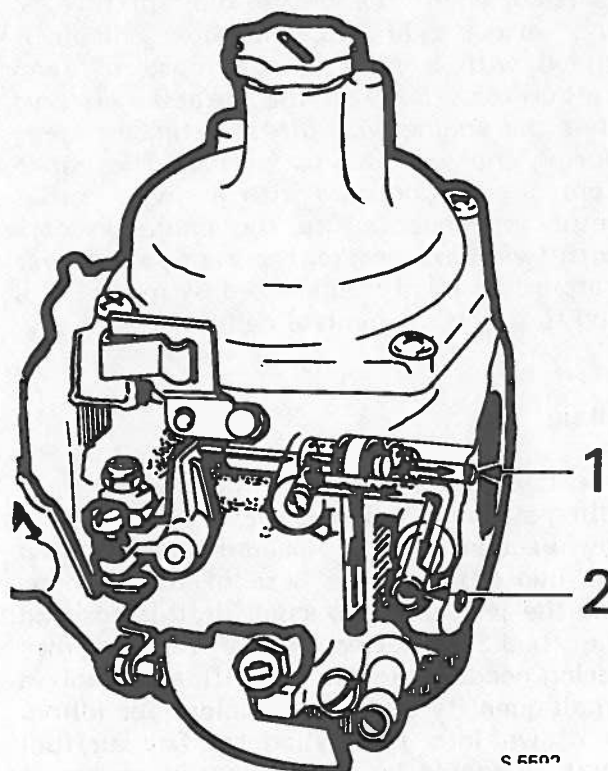
As from 1977 model, the jet is permanently mounted in the carburetor housing. Earlier models have an adjustable jet.

As from the 1977 model (twin-carburetor as from the 1976 model), the carburetor is equipped with a special float chamber vent valve. When the throttle valve is closed, venting takes place directly through a hole and a branch in the carburetor. When the throttle valve is opened, the float chamber will be vented through the air cleaner connection. On earlier models, all venting takes place through the air cleaner.



Float chamber ventilation, twin-carburetor

1. Throttle stop and fast idle lever
2. Throttle relay lever and idle screw adjust
3. Ventilation valve
4. Ventilation outlet, stopped engine
5. Ventilation outlet, running engine



Float chamber ventilation

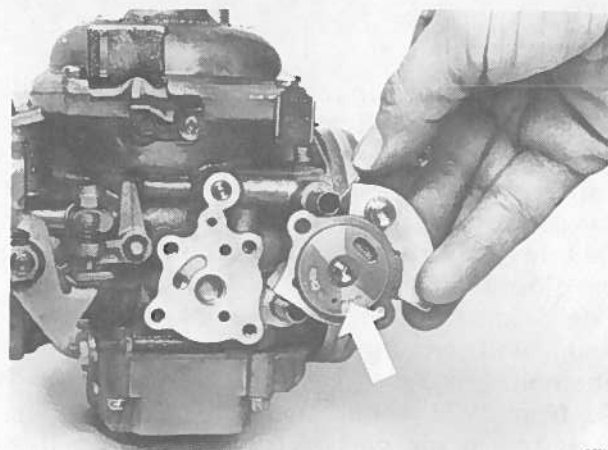
1. Ventilation through air cleaner
2. Direct external ventilation

Cold-start device and fast idling

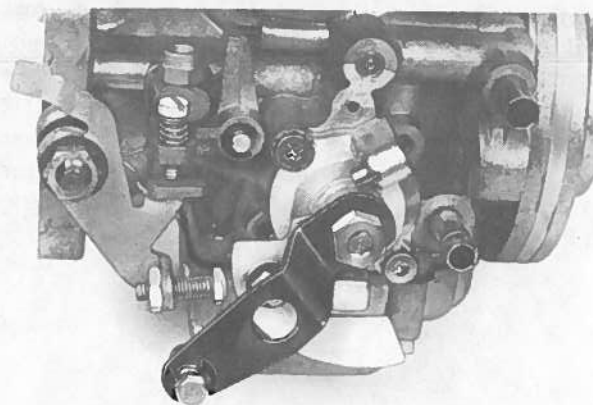
The carburetor is equipped with a cold-start device to assist starting the engine from cold.

The cold-starting device consists of a valve disc which, when the choke spindle is turned, gradually opens four fuel holes of different sizes and an emulsion air passage, and opens the choke fuel mixture passage to the carburetor housing. When the choke control is fully withdrawn, all four fuel holes are operative and the emulsion air passage is fully open. At partial choke, one or several of the fuel holes are shut off, although the emulsion air passage is open as long as one of the fuel holes is open. When the choke is pushed in fully, the fuel holes and the emulsion air passage are both shut off, and so is the choke fuel passage to the carburetor housing.

The emulsion air is drawn through a nozzle from the carburetor housing. The function of the emulsion air is to improve the distribution of the choke fuel mixture to the various cylinders. The choke spindle is fitted with a cam (in the case of twin carburetors, only on the throttle arm, so that the engine will idle at a higher speed during the warming-up period. The choke control cable on cars with a single carburetor is connected to the cam. On cars with twin carburetors, the cam on the rear carburetor is interconnected by means of a rod to which the control cable is fitted.



Cold start device, single-carburetor



Cold start device, twin-carburetor

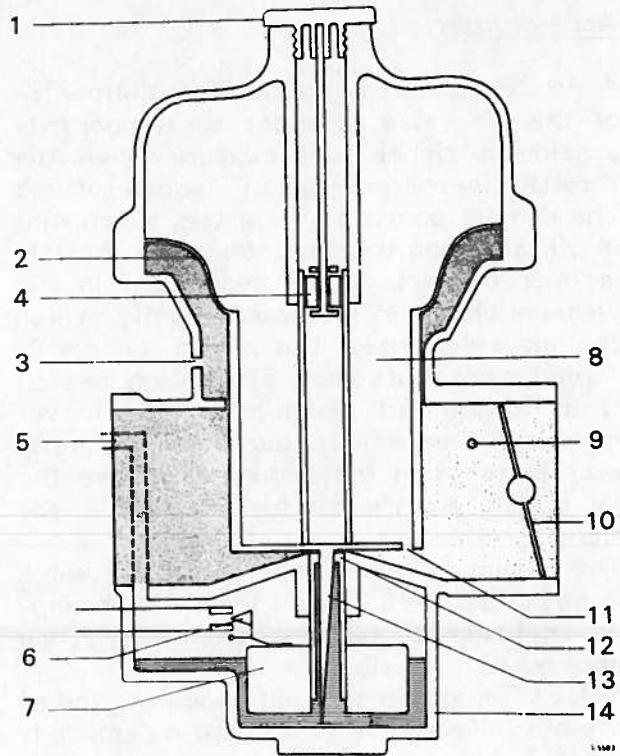
Idling

The carburetor does not have a separate idling system. At idling speed there is only low vacuum in the vacuum chamber and the gap between the base of the dashpot and the jet seating is small. In this position the thickest section of the tapered metering needle is in the jet orifice and only a small quantity of fuel, sufficient for idling, is drawn into the cylinders. The air/fuel mixture should be set while the engine is idling by adjusting in height metering needle in height. The idling speed is changed by adjusting the setting of the throttle stop screw. On twin-carburetor engines, the throttles can be synchronized by adjusting the clamping bolt on the coupling assembly between the two throttle spindles. The carburetor is equipped with a temperature compensator to maintain a constant fuel/air mixture regardless of the engine temperature. The temperature compensator consists of an atmospheric valve controlled by a bi-metal

spring. The valve starts to open when the carburetor temperature reaches approx. $+50^{\circ}\text{F}$ ($+10^{\circ}\text{C}$). Additional air is introduced through a passage which discharges behind the air valve shaft.

Normal driving

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



Carburetor with throttle closed

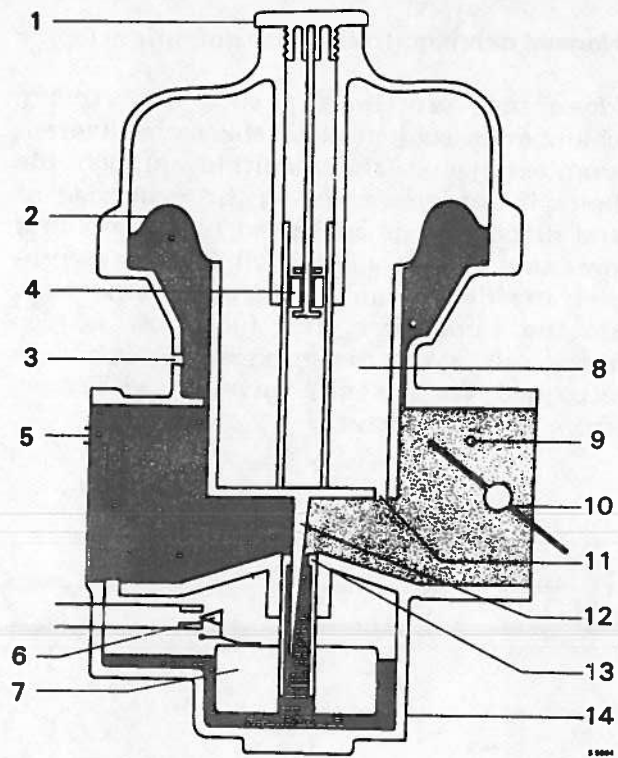
1. Damper cap
2. Diaphragm
3. Compensating aperture
4. Damper piston
5. Float chamber vent.
6. Needle valve
7. Float
8. Air valve shaft
9. Starting-up fuel aperture
10. Throttle
11. Vacuum aperture
12. Jet orifice
13. Fuel needle
14. Float chamber

Acceleration

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

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

NOTE! Do not fill with oil above the top of the air valve sleeve in which the damper is located. Use automatic transmission oil to Ford specification M2C 33F or GM specification type A, Suffix A or Dexron.



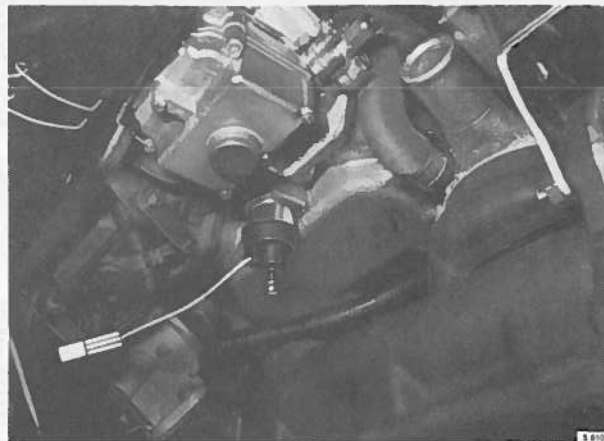
Carburetor with throttle open

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

Engine overrun, to Swedish specification

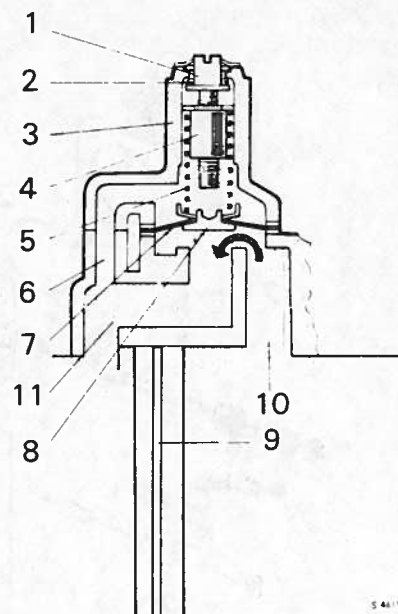
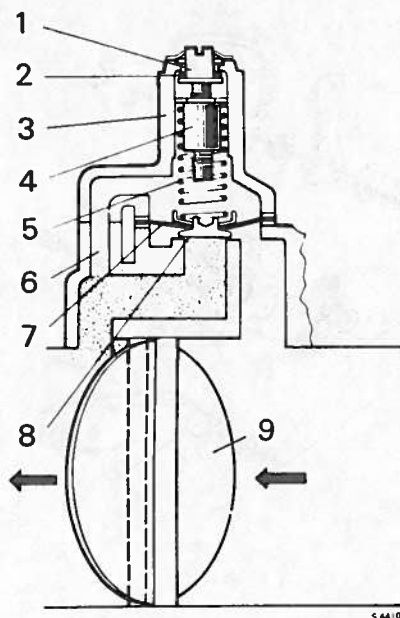
As from 1978 model

The carburetor is equipped with an electrically operated deceleration device. The device consists of a solenoid which actuates an arm on the throttle spindle. The solenoid is energized by a transmitter in the speedometer when the road speed is above 30 ± 5 km/h, and the idling speed of the engine will then be raised.



Engine overrun, European specification

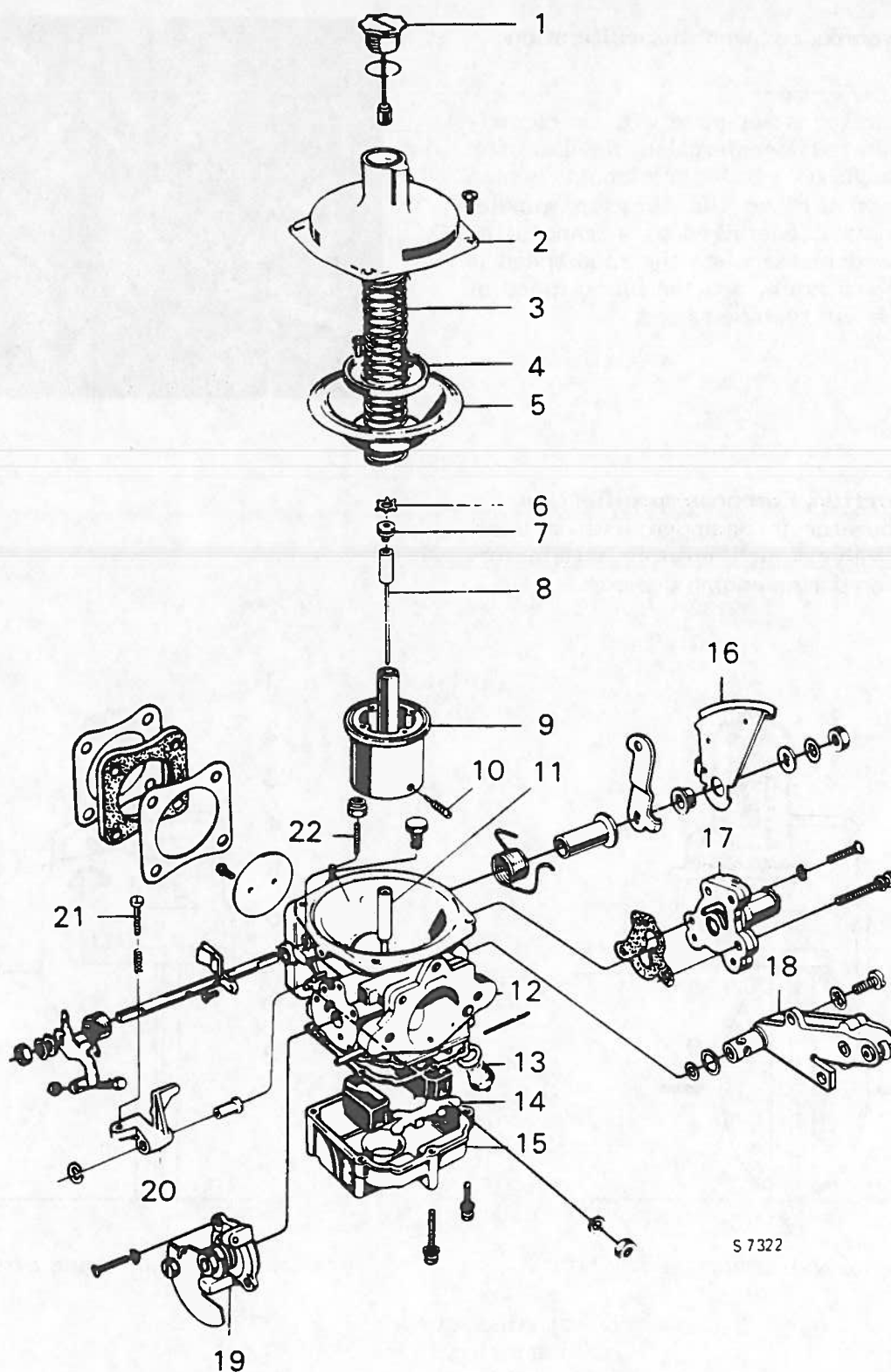
The carburetor is equipped with a deceleration valve which ensures satisfactory combustion during engine overrun.



Deceleration valve, normal driving

Deceleration valve, engine overrun

1. Adjusting screw
2. Rubber ring
3. Cover
4. Nut
5. Spring
6. Channel to top of diaphragm
7. Diaphragm
8. Valve
9. Throttle
10. Inlet channel for fuel-air mixture
11. Outlet channel for fuel-air mixture



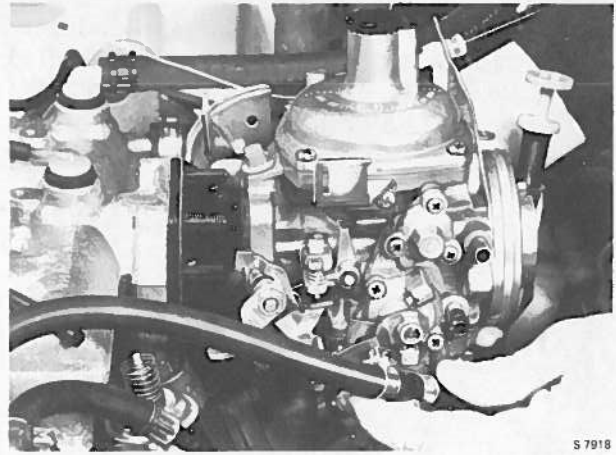
Carburetor

- | | |
|---|--|
| 1. Dashpot and oil cap assembly | 13. Float valve |
| 2. Vacuum chamber cover | 14. Float |
| 3. Spring | 15. Float chamber |
| 4. Retaining ring for diaphragm | 16. Throttle cam lever |
| 5. Diaphragm | 17. Deceleration valve |
| 6. Circlip | 18. Temperature compensator |
| 7. Adjusting screw | 19. Cold start device with cam |
| 8. Fuel needle | 20. Arm, float chamber ventilation |
| 9. Vacuum piston | 21. Adjusting screw for idling |
| 10. Lock screw with spring loaded plunger | 22. Adjusting screw, float chamber ventilation |
| 11. Jet | |
| 12. Carburetor body | |

Single-carburetor

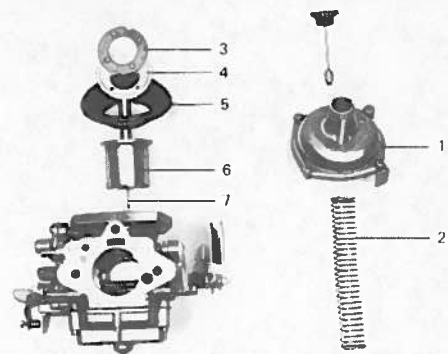
Removing

1. Disconnect the inlet hose from the carburetor.
2. Disconnect the fuel line, throttle and choke control cables and vacuum hose to the distributor.
3. Remove the screw for the dipstick tube.
4. Back off the four retaining nuts and lift off the carburetor.



Dismantling

1. Remove the vacuum chamber cover (1), (see illustration) and take out the spring (2).
2. Remove the piston (6) with the diaphragm (9).

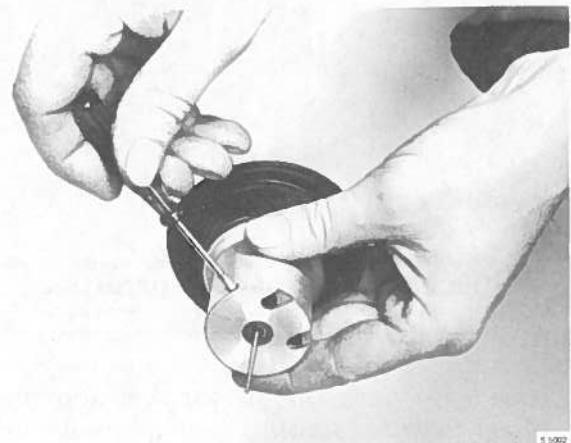


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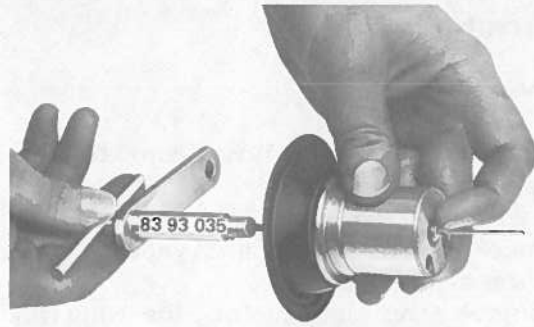
Carburetor

1. Vacuum chamber cover
2. Spring
3. Metal washer
4. Screw
5. Plastic washer
6. Vacuum piston
7. Locking screw
8. Fuel needle
9. Diaphragm

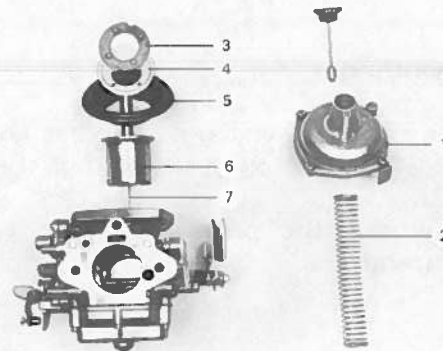
3. Remove the fuel needle as follows:
 - a. Remove the locking screw.



- b. Turn the adjusting screw counter-clockwise, use tool 83 93 035 (screwdriver slot) or tool 83 92 763 or 83 92 896 (internal hexagon grip).



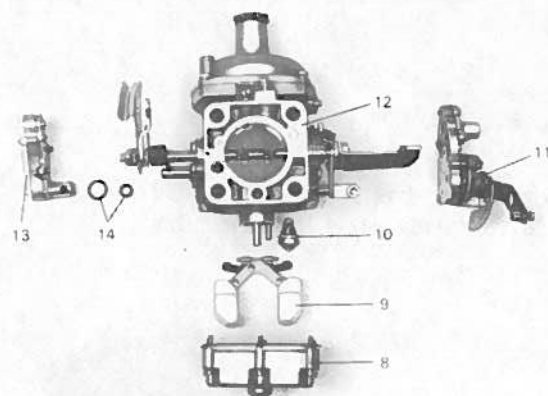
4. Remove the screws (4), the plastic and metal washers (3) and the diaphragm (5).



Carburetor

1. Vacuum chamber cover
2. Spring
3. Metal washer
4. Plastic washer
5. Membrane
6. Vacuum piston
7. Needle

5. Remove the float chamber (8).
6. Carefully disengage the float spindle from the bridge and remove the float (9).
7. Remove the float valve and the washer.
8. Up to and incl. 1976 model:
Unscrew and remove the jet retainer with adjusting screw jet spring bushes washer. As from 1977 model:
The jet is pressed into the carburetor and normally need not be removed.
9. Remove the float valve and washer.
10. Remove the cold-starting device (11).
11. Remove the temperature compensator.



Wash the carburetor parts in paraffin.

Caution

Use only paraffin oil for washing the diaphragm. Avoid using volatile cleaning agents such as trichloroethylene.

8. Fuel needle
9. Diaphragm
10. Choke mechanism
11. Temperature compensator
12. Seal
13. Idling speed adjusting screw
14. Synchronization screw

Cleaning

Clean the hole in the choke valve disc by means of compressed air. Check that the diaphragm is not faulty. If the diaphragm is distorted or has cracked, it should be replaced. Check the fuel needle for wear; bent or worn needles should be replaced. Check that the contact and sealing surfaces are not damaged. Check that the choke plate and the corresponding sealing surface in the carburetor housing are not scuffed. Clean the temperature compensator and check that the valve moves freely.

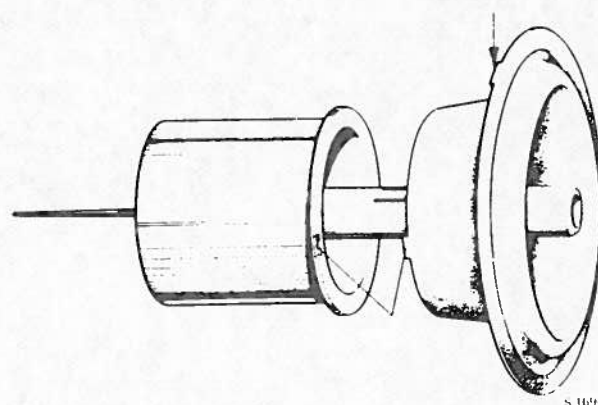
For "orifice adjusting screw, jet, temperature compensator and float chamber ventilation" see "Common to single and twin carburetors".

Assembling

1. Fit the diaphragm to the vacuum piston so that the locating lip (see illustration) engages the corresponding recess in the piston and the inner edge fits easily into the matching groove in the piston.

Note

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



Place the plastic washer (4, see illustration) and the metal washer (3) carefully in position, lining up the screw holes with those in the piston and diaphragm without twisting the washer and matching the groove in the washer to the locating edge of the diaphragm.

2. Fit the fuel needle as follows:

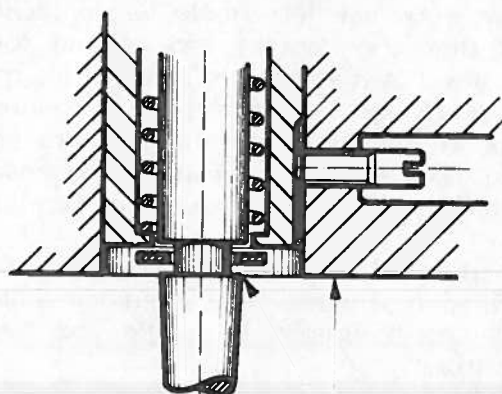
Up to and incl. 1976 model

- a. Place the milled outer surface of the spring housing so that it faces the stop screw, i.e. the needle should spring away from the throttle when the piston is fitted.
- b. The needle should be fitted so that the shoulder (at the recess for the plastic washer) is line with the bottom of the piston.
The position is the initial setting for subsequent CO-adjustment.

As from 1977 model

- a. Insert the spring housing of the needle into the vacuum piston. Screw the spring housing onto the adjuster by turning the latter using tool 83 93 035.

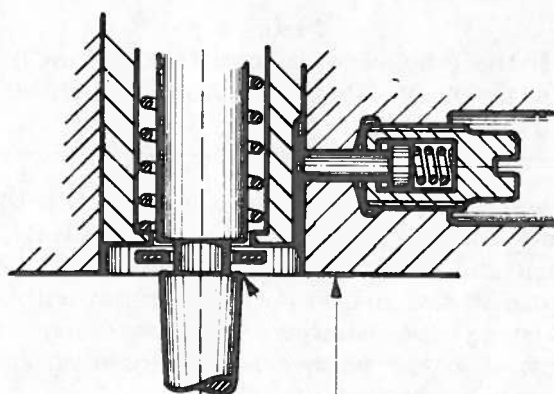
- b. Screw in the stop screw so that the spring-loaded locking pin presses against the spring housing.
- c. Use tool 83 93 035 to turn the spring housing so that the locking pin engages the milled groove.
- d. Tighten the stop screw.
- e. Use tool 83 93 035, adjust the height of the needle so that the shoulder of the sleeve (at the recess for the washer) is in line with the underside of the piston.



Fitting the fuel needle, up to and incl 1976 model

S 5606

Needle shoulder in line with bottom of piston



Fitting the fuel needle, as from 1977 model

Needle shoulder in line with bottom of piston

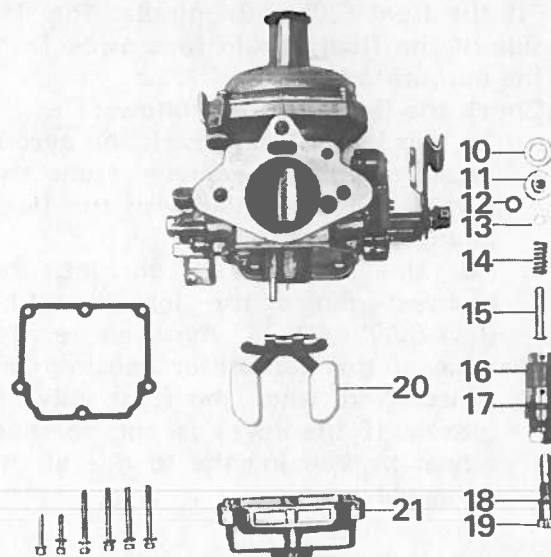
This position is the initial setting for subsequent CO-adjustment.

1. Up to and incl. 1976 model:

Screw the adjusting screw (19) with a new O-ring (18) into the jet retainer (16). Fit a new O-ring (17) on the jet retainer. (See fig.)

2. Up to and incl. 1976 model:

Place the spring (14), guide bush (13), bush (11), O-ring (12) and aluminium washer (10) on the jet and fit the complete assembly together with the jet retainer and adjusting screw in the carburetor housing. Screw in and tighten the jet retainer.



S 4457

- *10. Washer
- *11. Bush
- *12. O-ring
- *13. Bush
- *14. Spring
- *15. Jet
- *16. Jet retainer
- *17. O-ring
- *18. O-ring
- *19. Adjusting screw
- 20. Float
- 21. Float chamber

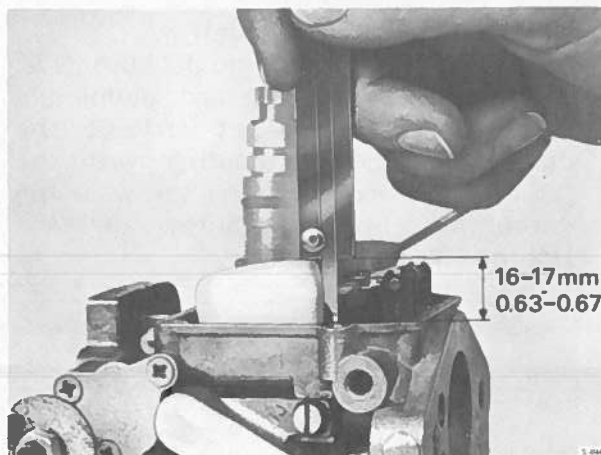
(* up to and incl 1976 model)

3. Up to and incl. 1976 model:

Screw in the adjustment screw until the top of the jet is at a level 0.098 ± 0.008 " (2.5 ± 0.2 mm) below the level of the jet bridge. Check the dimension by means of vernier calipers or using tool 83 93 027. (If the jet is set at exactly 0.098 " (2.5 mm), a quarter turn in either direction is permitted during the subsequent CO setting. One quarter turn equals 0.008 " (0.2 mm) vertical adjustment).

4. Fit the piston complete with diaphragm and spring in the carburetor housing. Make sure that the outer lip of the diaphragm engages the matching recess in the housing (see illustration). Place the vacuum chamber cover carefully in position according to the markings. The groove and locating rim should be a good fit; if not, replace the diaphragm. Tighten the screws.

5. Fit the float (20) with spindle. The flat side of the float should face away from the carburetor housing.
6. Check the float level as follows:
 - a. To check the float level, the carburetor must be removed from the engine, and inverted with the float chamber off.
 - b. For the level to be correct, the highest point of the float should be 0.63-0.67" (16-17 mm) above the edge of the carburetor housing (see illustration) when the float valve is closed. If the level is not correct, adjust by bending the tongue at the float valve.

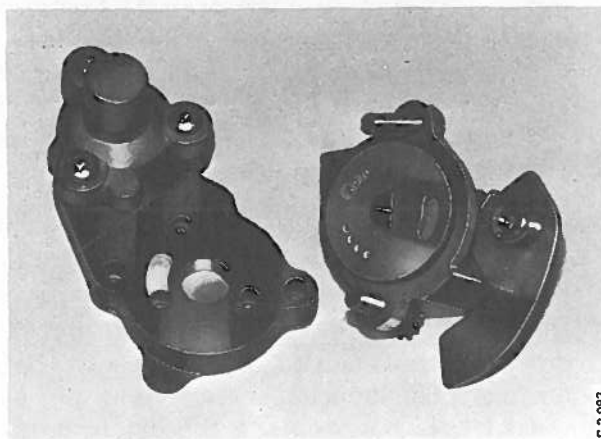
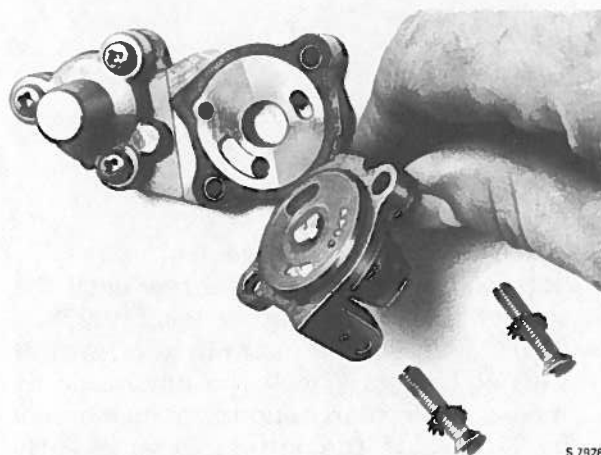


Note

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

7. Fit a new gasket and slide the float chamber on until it cushions against the O-ring. First insert all screws and give them a few turns, then push down the float chamber until it butts firmly and tighten the screws.
8. Fit the choke mechanism. (If the mechanism has been removed, fit the choke plate, choke shaft and cam plate as illustrated.) The calibrated hole should face away from the cable securing point on the cam plate.

Installation is made in the reverse order.

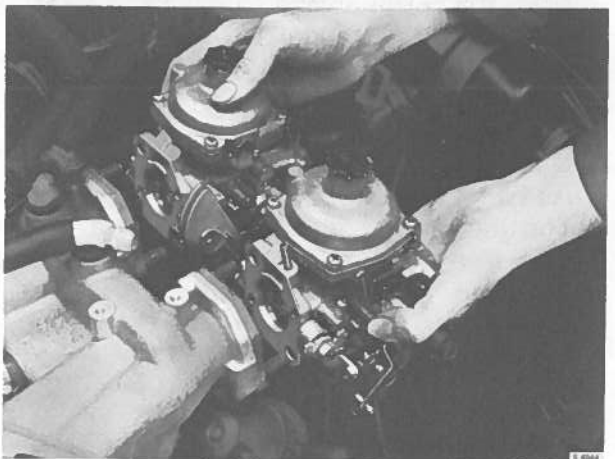
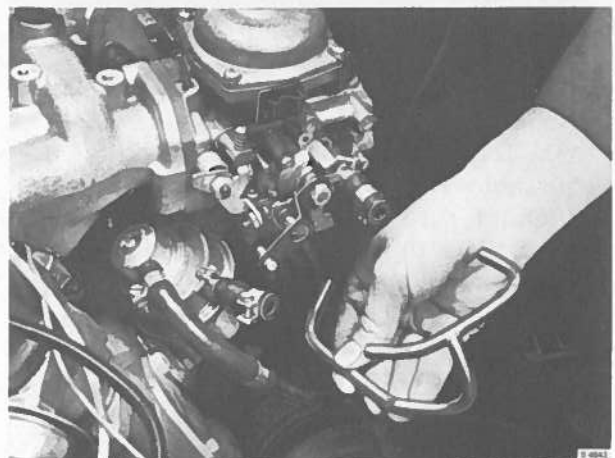
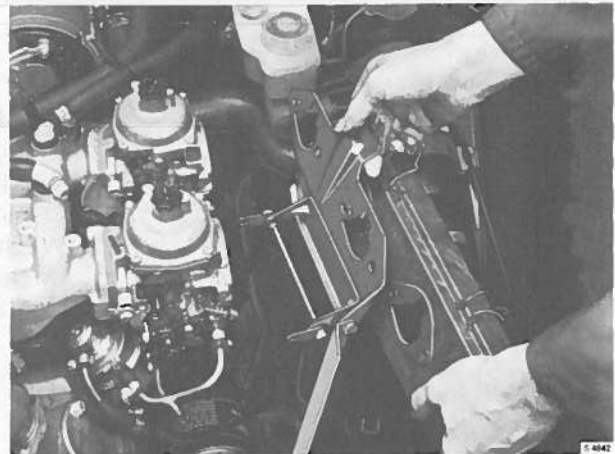
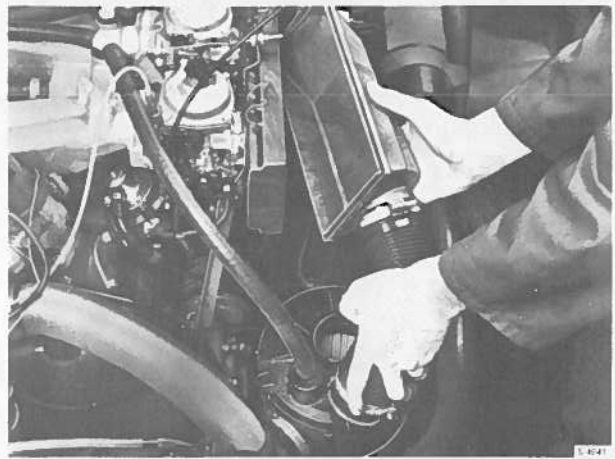


Twin-carburetors

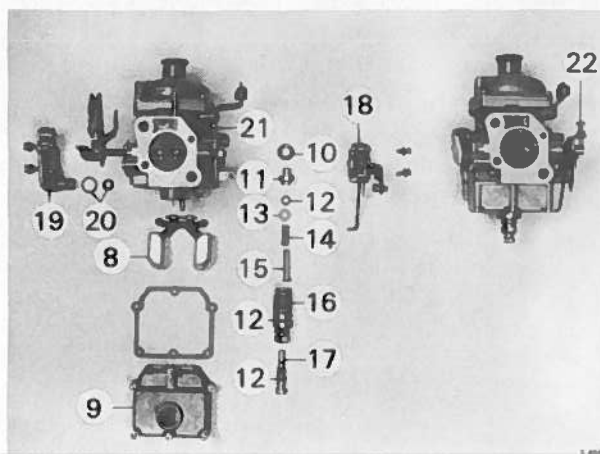
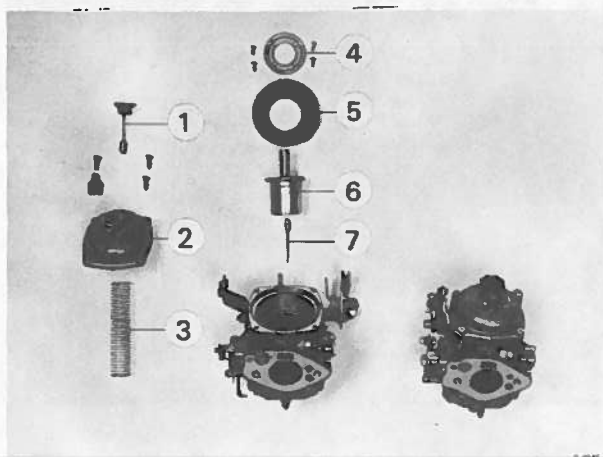
To remove

1. Unclip the four wire clips holding the air box cover, loosen the air cleaner hose clip and remove the cover together with the intake hose.
2. Disconnect the throttle and choke cables from the carburetors.
3. Remove the clips from the choke linkage and remove the linkage from the operating rod.
4. Remove the air box retaining screws and remove the box, the throttle cable bracket, the choke lever and the gasket.
5. a. Undo the clips and disconnect the fuel pipe.

b. Remove the suction hose from the carburetor.
6. Remove the carburetor retaining nuts and remove both carburetors simultaneously.



Dismantling



Carburetor

- | | | |
|-------------------------|-----------------------|----------------------------------|
| 1. Damper | 8. Float | *15. Fuel jet |
| 2. Vacuum chamber cover | 9. Float chamber | *16. Jet retainer |
| 3. Spring | *10. Aluminium washer | *17. Adjusting nut |
| 4. Aluminium washer | *11. Bushing | 18. Choke mechanism |
| 5. Diaphragm | *12. O-ring | 19. Temperature compensator |
| 6. Piston | *13. Washer | 20. Seal |
| 7. Fuel needle | *14. Spring | 21. Idling speed adjusting screw |
| | | 22. Synchronization screw |

* Up to and incl. model 1976.

1. Remove the vacuum chamber cover and spring.
2. Remove the vacuum piston with diaphragm.
3. Remove the screw and remove the fuel needle.

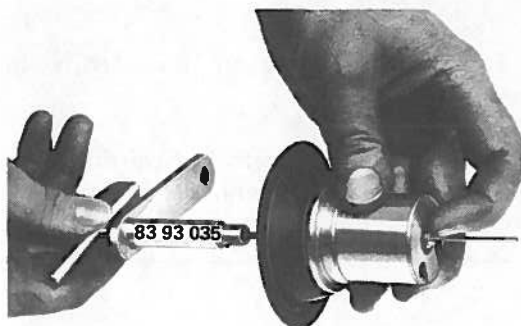
As from 1977 model (externally adjustable fuel needle), first remove the locking screw and then turn counter-clockwise the needle adjustment at the bottom of the damper cylinder, using the CO adjusting tool, so that the fuel needle can be removed. (Grip the needle sleeve to prevent it from turning).

4. Remove the screws, aluminium washer and diaphragm.
5. Remove the float chamber.
6. Carefully separate the float spindle from the retainer and remove the float.
7. Up to and incl. model 1976:

Unscrew and remove the jet retainer with adjusting screw, jet spring, bushing, O-ring bushing and aluminium washer.

As from 1977 model:

The jet is permanently pressed into the carburetor and need not normally be removed.



8. Remove the float valve and washer.
9. Remove the choke mechanism.
10. Remove the temperature compensator.
Save both rubber gaskets.

Wash the components with kerosene (paraffin).

Caution

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

Cleaning

Clean the hole in the choke valve disc by means of compressed air. Check that the diaphragm is not faulty. If the diaphragm is distorted or has cracked, it should be replaced. Check the fuel needle for wear; bent or worn needles should be replaced. Check that the contact and sealing surfaces are not damaged. Check that the choke plate and the corresponding sealing surface in the carburetor housing are not scuffed. Clean the temperature compensator and check that the valve moves freely.

For "orifice adjusting screw, jet, temperature compensator and float chamber ventilation" see "Common to single and twin carburetors".

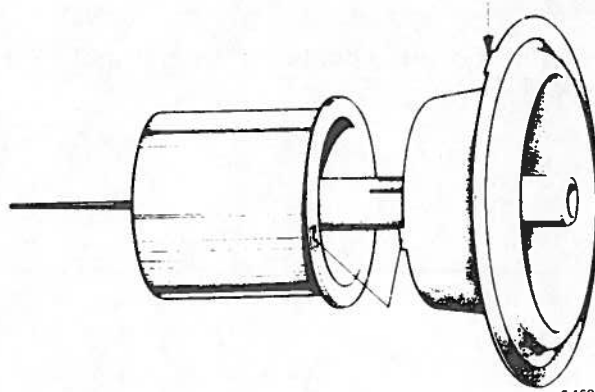
Assembling

1. Fit the diaphragm on the vacuum piston so that the locating lip engages in the corresponding recess in the piston and the inner edge fits easily into the matching groove in the piston.

Caution

If the diaphragm is distorted and will not fit the groove then it should be renewed.

Place the plastic washer and aluminium washer carefully in position, checking that the screw holes are lined up with the corresponding holes in the piston and diaphragm and without twisting the washer and that the groove in the washer fits the guide edge of the diaphragm. Secure the washer by means of the screws.



2. Fit the fuel needle according to the following description:

Up to and incl. 1976 model:

Turn the milled outer surface of the spring housing so that it faces the stop screw, i.e. the needle should spring away from the throttle when the piston is fitted into the carburetor.

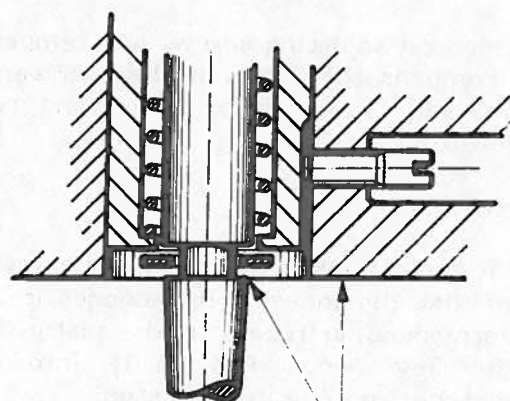
Fit the needle in height so that the shoulder (at the recess for the plastic washer) is in line with the underside of the piston.

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

As from 1977:

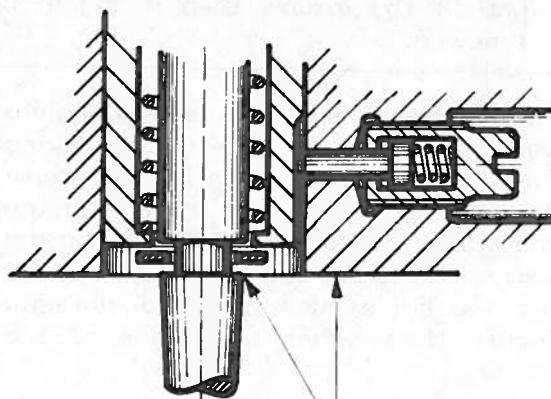
- Push the needle spring housing into the vacuum piston. Screw on the spring housing onto the adjustment device by turning this with the aid of tool 83 93 035.
- Screw in the lock screw so that the spring loaded pin is pressed against the spring housing.
- Rotate the spring housing with the aid of tool 83 93 035 so that the pin enters the groove.
- Tighten the lock screw.
- Adjust with the aid of tool 83 93 035 the needle height position so that the shoulder of the needle (at the groove for the washer) faces the piston underside.

This procedure gives initial position for the subsequent CO adjustment.



Needle shoulder in line with bottom of piston

S 5606



Needle shoulder in line with bottom of piston

S 5607

Fitting the fuel needle, up to and incl 1976 model

Fitting the fuel needle, as from 1977 model

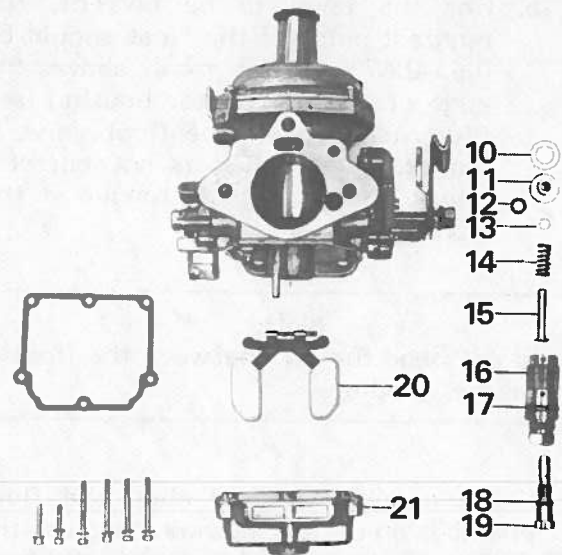
This position is the initial setting for subsequent CO-adjustment.

1. Up to and incl. 1976 model:

Screw the adjusting screw (19) with a new O-ring (18) into the jet retainer (16). Fit a new O-ring (17) on the jet retainer. (See illustration).

2. Up to and incl. 1976 model:

Place the spring (14), guide bush (13), bush (11), O-ring (12) and aluminium washer (10) on the jet and fit the complete assembly together with the jet retainer and adjusting screw in the carburetor housing. Screw in and tighten the jet retainer.



S 4457

- *10. Washer
- *11. Bush
- *12. O-ring
- *13. Bush
- *14. Spring
- *15. Jet
- *16. Jet retainer
- *17. O-ring
- *18. O-ring
- *19. Adjusting screw
- 20. Float
- 21. Float chamber

(* up to and incl 1976 model)

3. Up to and incl. 1976 model:

Screw in the adjustment screw until the top of the jet is at a level 0.098 ± 0.008 " (2.5 ± 0.2 mm) below the level of the jet bridge. Check the dimension by means of vernier calipers or using tool 83 93 027. (If the jet is set at exactly 0.098" (2.5 mm), a quarter turn in either direction is permitted during the subsequent CO setting. One quarter turn equals 0.008" (0.2 mm) vertical adjustment).

4. Fit the piston complete with diaphragm and spring in the carburetor housing. Make sure that the outer lip of the diaphragm engages the matching recess in the housing (see illustration). Place the vacuum chamber cover carefully in position according to the markings. The groove and locating rim should be a good fit; if not, replace the diaphragm. Tighten the screws.

5. Fit the float with spindle. The flat side of the float should face away from the carburetor housing.

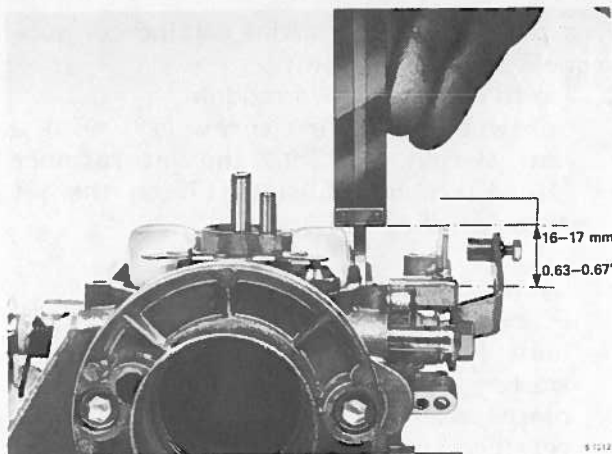
6. Check the float level as follows:

- a. To check the float level, the carburetor must be removed from the engine, and inverted with the float chamber off.

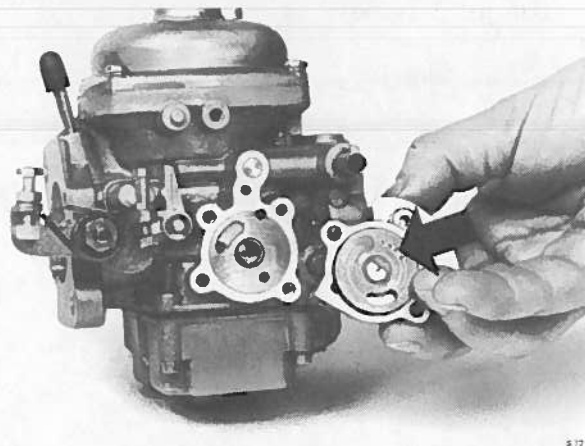
- b. For the level to be correct, the highest point of the float should be 0.63-0.67" (16-17 mm) above the edge of the carburetor housing (see illustration) when the float valve is closed. If the level is not correct, adjust by bending the tongue at the float valve.

Note

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

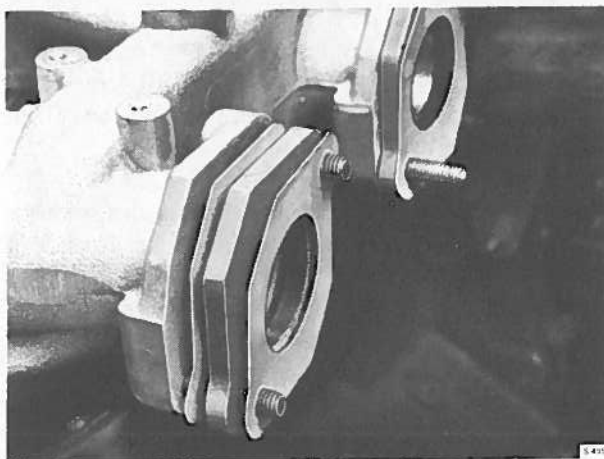


7. Fit a new gasket and slide the float chamber on until it cushions against the O-ring. First insert all screws and give them a few turns, then push down the float chamber until it butts firmly and tighten the screws.
8. Fit the choke mechanism. (If the mechanism has been removed, fit the choke plate, choke shaft and cam plate as illustrated.) The calibrated hole should face away from the cable securing point on the cam.
9. Check the setting of the temperature compensator and that it operates freely (see section "temperature" compensator"), and fit the compensator together with the two rubber gaskets.



Fitting

1. Fit the two gaskets with the insulation between them to each of the inlet manifold flanges.
2. Fit the two carburetors simultaneously and secure by means of the nuts and washers. Ensure that the spring which keeps the rear carburetor arm and adjusting screw in contact with the arm of the front carburetor is fitted.
3.
 - a. Connect the fuel pipe and fit the clips.
 - b. Connect the vacuum hose.
4. Mount the gaskets, bracket, air box and flange washers to the carburetors.
5. Fit the choke links to the connecting rod and fit the clips.
6. Connect the throttle and choke cables.
7. Fit the air box cover and connect the inlet hose to the air cleaner. Avoid causing deformation of the flange by overtightening the clip.
8. Top up the damper with oil. The oil level should be at least 0.39 in (10 mm) below the top of the cylinder.

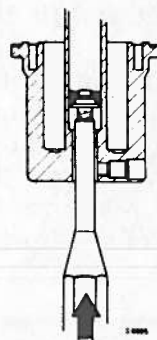


Single and twin-carburetor engine

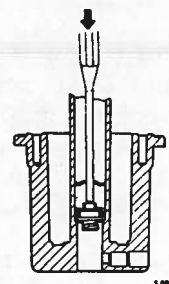
Changing adjustment screw in vacuum piston (as from 1977 model)

Removal (vacuum piston with fuel needle removed)

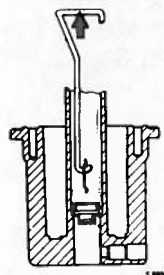
1. Using a drift, press out the adjusting screw a few centimetres from the bottom of the piston.



2. Press in the adjusting screw again.



3. Turn the locking clip loose and remove it by means of a bent piece of wire. The adjusting screw can now be removed.



Refitting

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

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

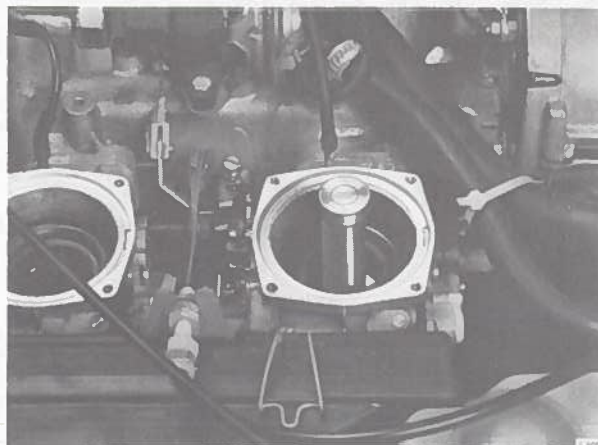
2. Press in a new locking clip in the damper cylinder using a drift.



Changing the fuel jet

Up to and incl. 1976 model.

1. Fit the float valve.
2. Screw in the adjusting screw together with a new O-ring into the jet retainer. Fit a new O-ring to the jet retainer.
3. Fit the spring, washer, O-ring, bush and aluminium washer to the jet and fit the assembly together with the jet retainer and adjusting screw into the carburetor housing. Screw in the jet retainer and tighten it. Screw in the adjusting screw so that the jet will be 2.5 mm below the level of the jet bridge. Measure by means of vernier calipers or measuring tool 83 93 027.



As from 1977 model.

The fuel jet is pressed into the carburetor housing and should not be moved from the specified position. However, the jet can be changed using tool 83 92 789 as follows:

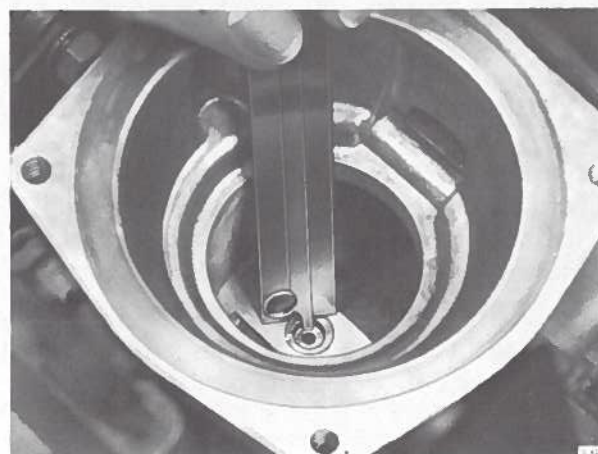
1. Remove the carburetor and then remove the vacuum chamber cover, the vacuum piston and float chamber cover.
2. Press out the jet using tool 83 92 789.



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

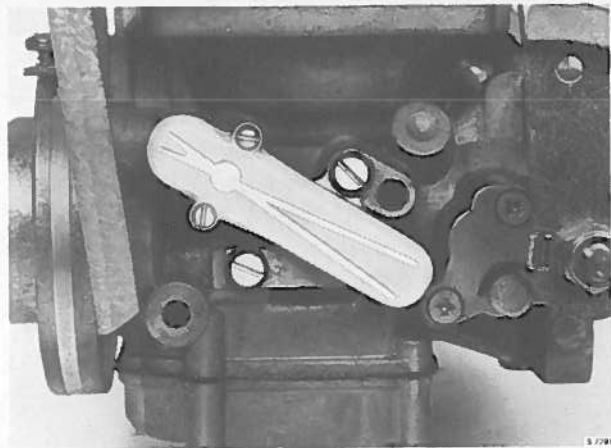
Caution

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

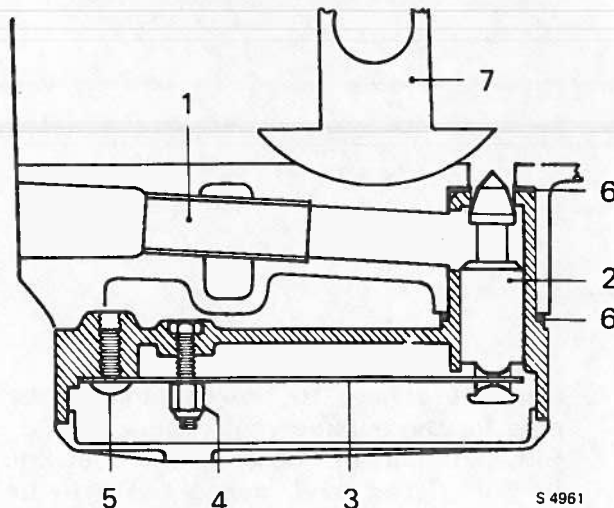


Temperature compensator

The temperature compensator serves to maintain a constant fuel-air mixture, regardless of engine temperature. The temperature compensator valve is governed by a bi-metallic strip which, on heating, opens an air passage past the vacuum piston. The valve opens at around 50°F ($+10^{\circ}\text{C}$).



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



Adjustment

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

Setting

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

Changing

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

NOTE

Both the outer and inner rubber gaskets must be replaced.

Temperature compensator

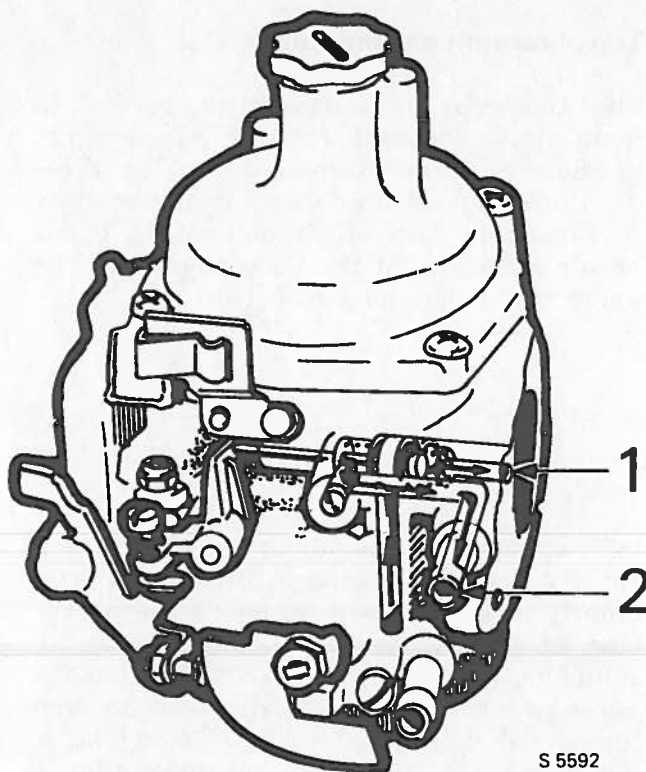
1. Air passage
2. Valve
3. Bi-metallic strip
4. Adjusting nut
5. Bi-metallic strip retaining screw
6. Seal
7. Jet bridge



Valve for float chamber ventilation

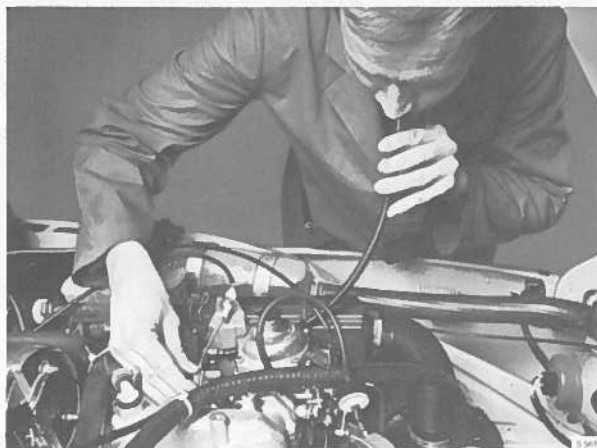
Checking and setting

The valve should be set so that air is drawn in from the outside when the throttle valve is closed (idling setting). When the throttle valve opens, ventilation should be supplied through the connection on the air cleaner.

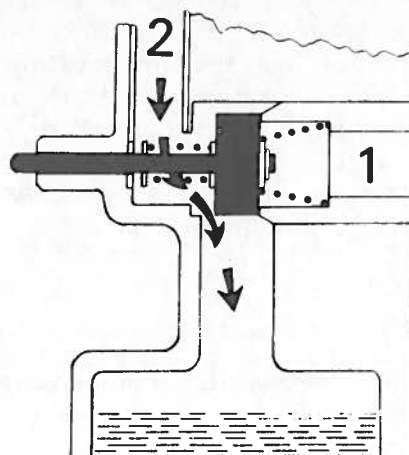


S 5592

1. Connect a hose to the opening of the pipe for the outside ventilation.
2. Blow through the hose. If the fuel line is not fitted and connected to the pump, the fuel inlet nipple must be blanked off.



- a. When the throttle valve is fully closed, it should not be possible to blow through the nipple (since the float chamber is an enclosed space).

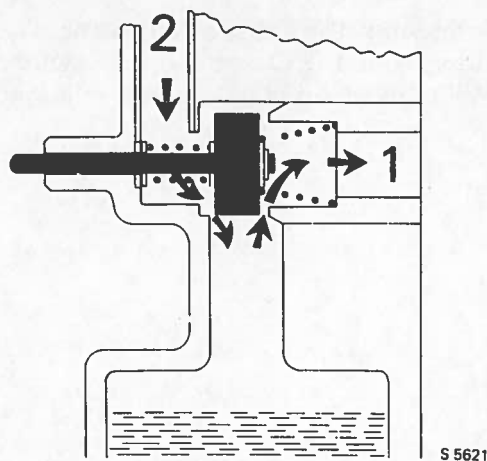


S 5620

Throttle valve fully closed

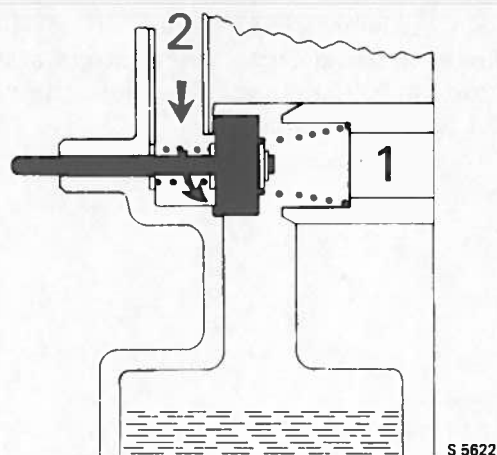
1. Venting via air cleaner
2. Venting to atmosphere

- b. If the throttle is opened between 0.5-1.0 mm (by means of cable on carrier), a passage will open to the inner ventilation, making it possible to blow through the nipple.



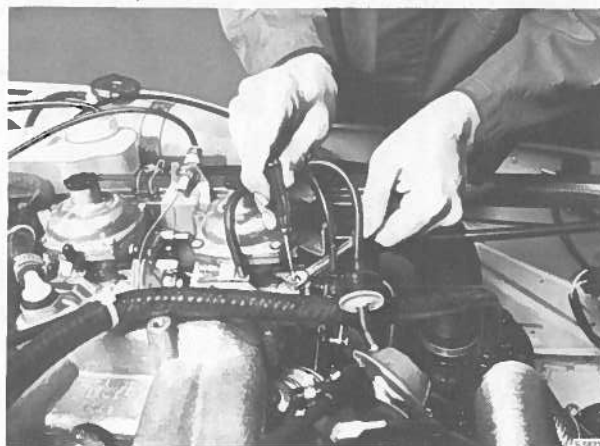
Throttle valve open between 0.5-1.0 mm

- c. If the throttle valve is opened a few more millimetres, the connection will close again.



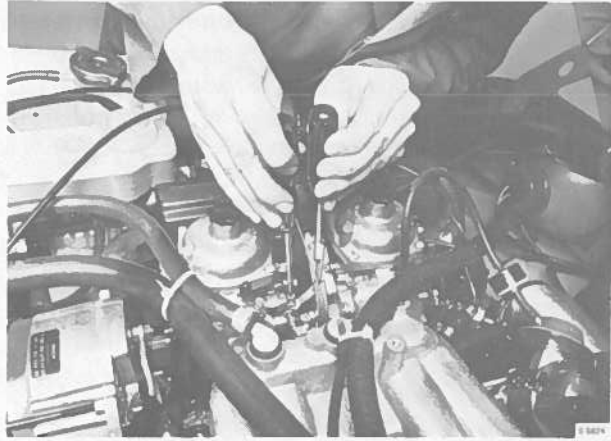
Throttle valve open a few more millimetres

3. Release the lock nut and adjust the valve by rotating the adjusting screw as outlined in 2a and 2b above.



Front carburetor

4. Following the above adjustments, the idling speed, CO-setting and synchronization must be checked and adjusted.

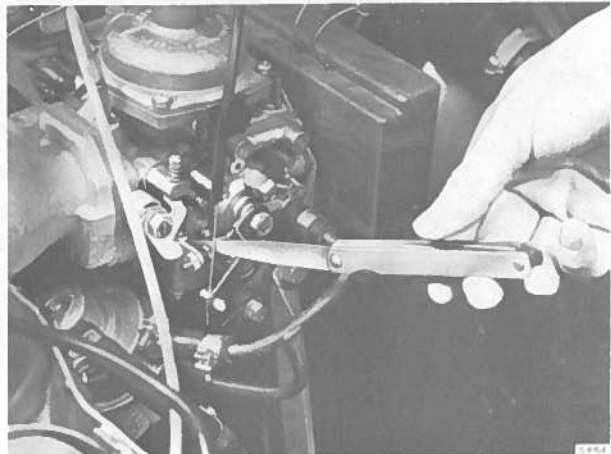
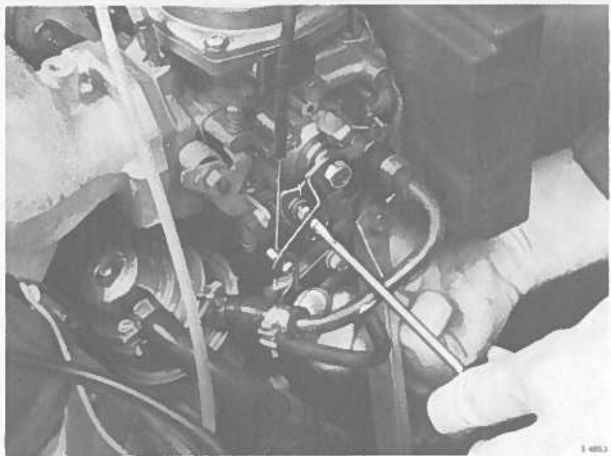


Rear carburetor

Setting

Choke control

1. Twin carburetors: Check that both choke controls strike their stops at the same time. If necessary, adjust the control spindle linkages.
2. Check that the distance between the throttle lever stop screw and the choke cam is 1 mm (on the front carburetor). The choke control should be in the "OFF" position so that the choke discs are totally out of operation. This distance should be checked after the idling adjustments have been performed and should be adjusted if necessary.

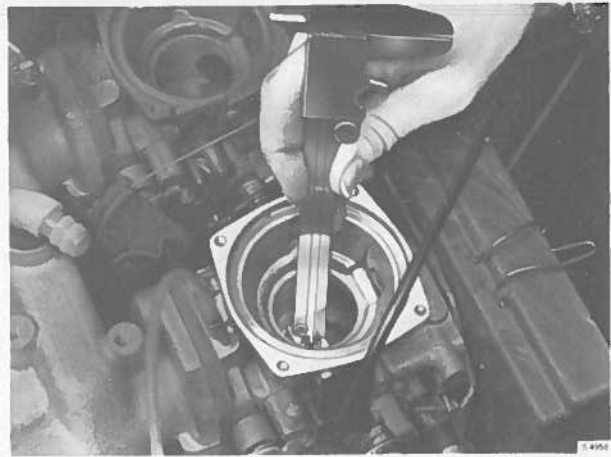


Basic setting up to and incl. 1976 model
(single and twin carburetors)

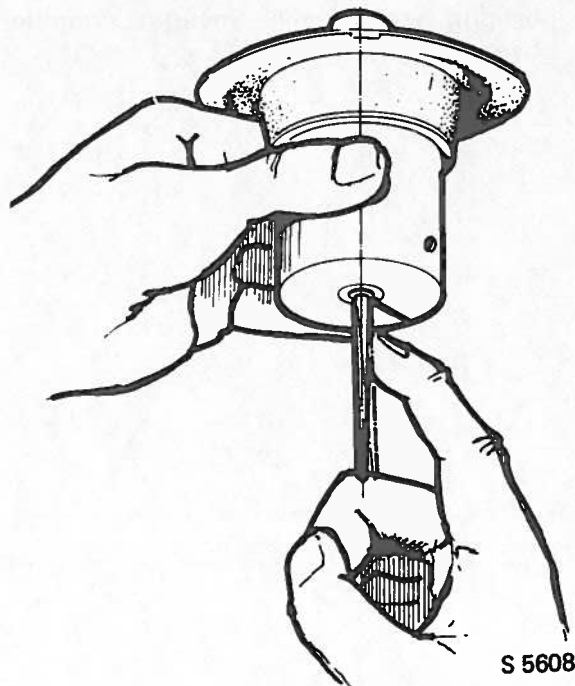
1. Remove the vacuum chamber cover together with the spring, and the vacuum piston and diaphragm.



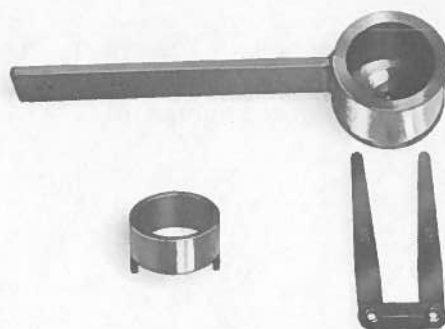
2. Using a vernier or measuring tool 83 92 027, measure the distance between the jet bridge and the jet and adjust to 0.098 in (2.5 mm).



3. Adjust the height of the fuel needle in the piston by backing off the retaining screw and moving the needle up or down.



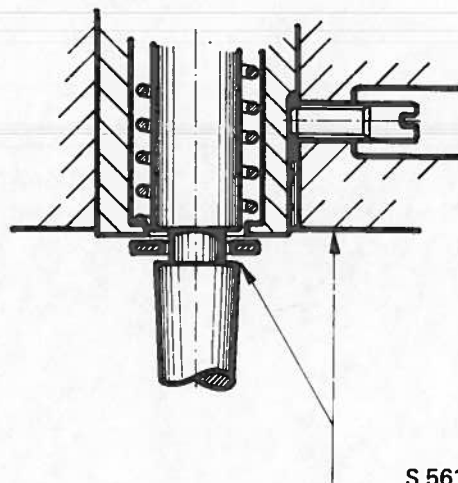
Up to and incl. 1976, a special adjusting tool, No. 83 92 995, with insert No. 83 93 001 (designed for twin carburetors) and a set of feeler gauges, No. 83 93 019, are available to facilitate adjustment of the fuel needle.



Insert the vacuum piston into the tool, with the feeler gauges inserted in the slot of the tool.

The tool is present to 0.04 in (1.0 mm) and consequently 0.04 in (1.0 mm) feeler gauge will provide the basic setting for the fuel needle (i.e. the needle shoulder about 0.4 mm below the bottom of the piston).

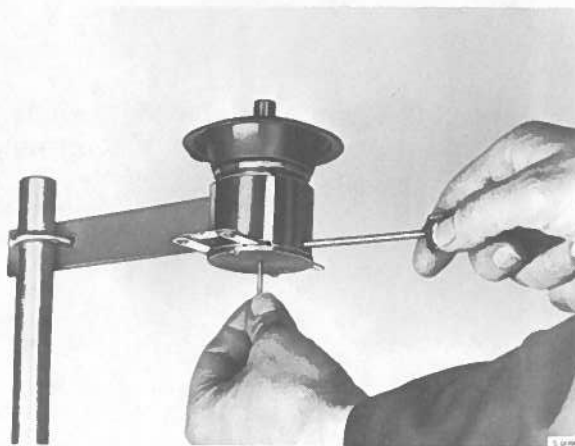
If during subsequent adjusting adjustment of the CO setting it proves necessary to lower the fuel needle, use a thicker feeler gauge, and to raise the needle, use a thinner feeler gauge.



S 5615

Needle shoulder about 0.4 mm below the bottom of the piston.

4. Fit the vacuum piston with the diaphragm, spring and vacuum chamber cover.



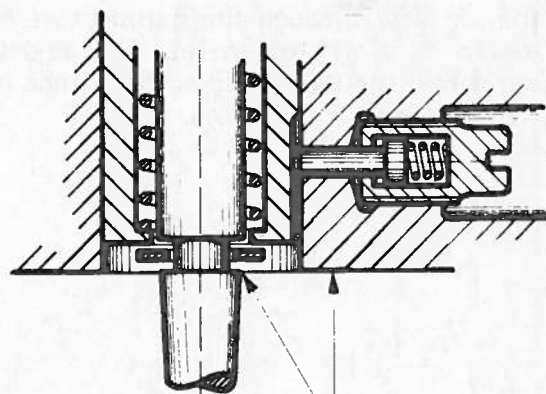
Basic setting as from 1977 model
(single and twin carburetors)

1. Remove the plastic cover and damper piston.
2. Remove the vacuum chamber cover and spring.
3. Remove the piston with diaphragm.
4. Adjust the shoulder of the needle so that it is flush with the underside of the vacuum piston.
5. Fit the piston with diaphragm and spring into the carburetor housing. Ensure that the guide fits into the corresponding recess in the housing.
6. Fit the vacuum chamber spring and cover in accordance with the markings, fit the screws and tighten them.
7. Check the oil level in the damper cylinder and top up if necessary, and fit the damper piston.

Fine adjustment should be carried out in conjunction with the subsequent CO setting.

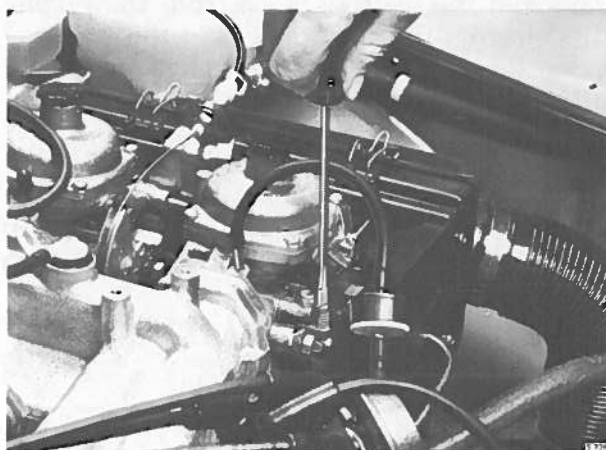
Synchronizing the carburetors, twin carburetors

1. Run the engine until warm and then let it run at normal idling speed. The idling speed adjusting screw serves both carburetors and is located on the front carburetor.

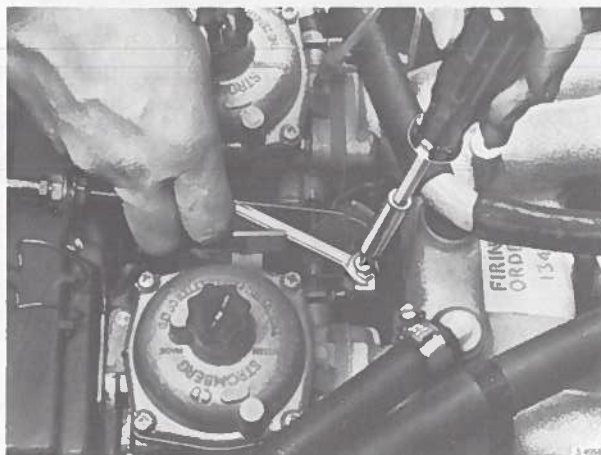
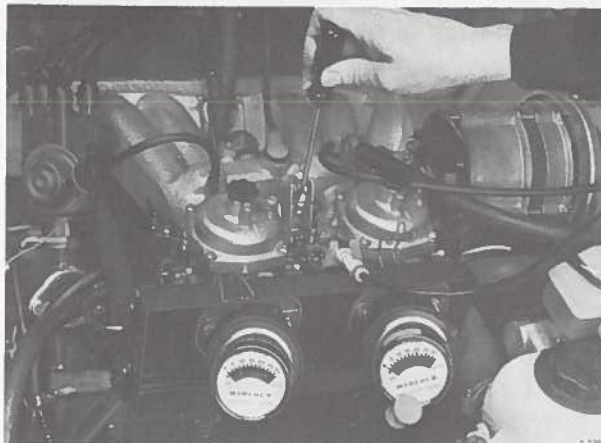


S 5607

Needle shoulder flush with bottom of piston



2. Synchronize the carburetors by means of the adjusting screw on the linkage between the two carburetors. Compare the air flow through the carburetors by means of a synchro-tester. The adjusting screw should be locked by means of the lock nut after setting.



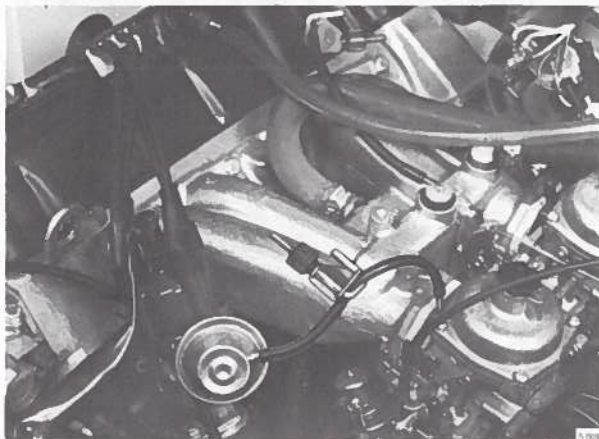
CO-setting

As from 1977 model (swedish specification).

To minimize the possible effects on the setting of various engine and exhaust emission components, the CO-setting should be carried out at an engine speed of 2 000 rev/min.

To avoid the hydrocarbons from the engine oil (dilution by fuel) affecting the CO setting, the crankcase ventilation should be disconnected during the setting procedure.

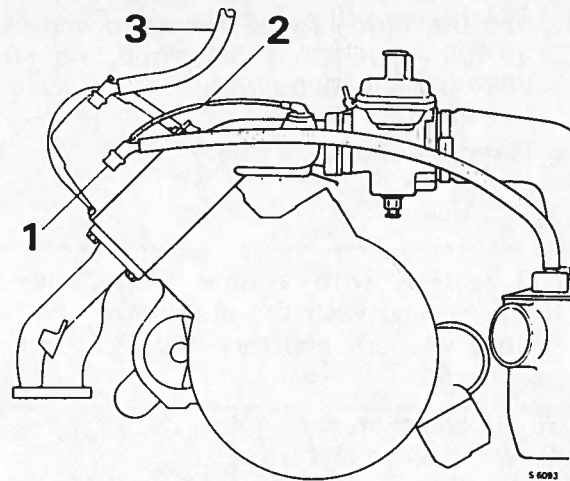
1. Preparing to measure the CO setting:
 - a. Run the engine until it is warm so that the CO reading may be carried out after the radiator fan has cut in for the second time.
 - b. Up to and incl. 1977 model: Check that the preheater valve is in the "summer" position.
 - c. Check that the choke control is fully inserted.
 - d. Check that the float chamber ventilation valves are correctly adjusted.
 - e. Check that the ignition timing is set correctly.
 - f. Check the synchronisation of the carburetors.
 - g. Plug or clamp shut the vacuum hose to the vacuum control unit on the distributor.



h. Disconnect the crankcase ventilation as follows:

1. The hose removed from valve cover.
2. The small-bore hose plugged (as from 1977 model).
3. Evacuation hose connection to valve cover.

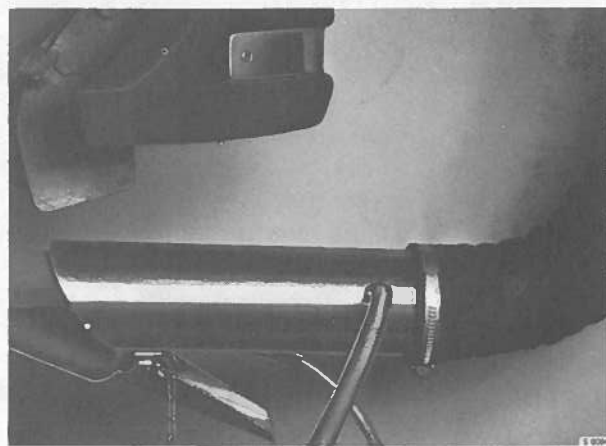
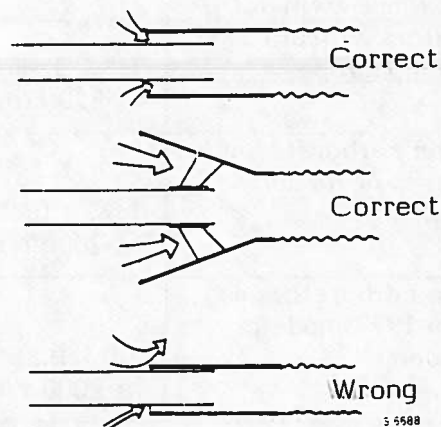
Evacuate the crankcase gases from the opening in the valve cover by connecting a hose for the workshop's evacuation hose, slightly behind the probe of the CO-meter to ensure that the readings will not be affected.



Connection to exhaust extraction equipment

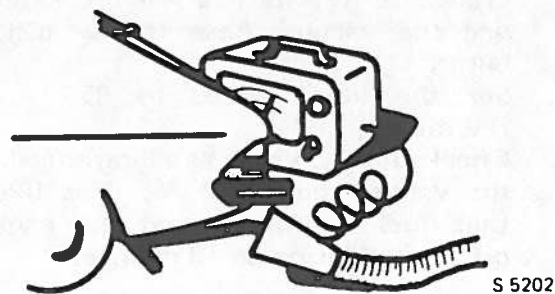
When connecting the exhaust extraction equipment while running the engine indoors, avoid an excessively high vacuum in the exhaust system, since this may affect the readings of the CO content.

Use an extraction hose with an open connection to avoid an excessively high vacuum

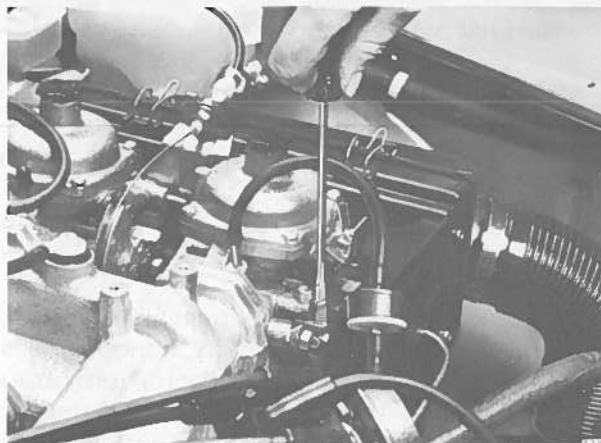


i. Plug the end of the vacuum hose to the EGR valve where applicable.

2. Connect the CO meter and tachometer.



3. Set the idling speed to: up to and incl.
1976 model: 850 ± 50 r/min. As from
1977 model: $2000 \pm$ r/min.
4. Read off the CO value.



CO setting with engine warm, day-lights on and with the crankcase ventilation, vacuum controls and EGR disconnected.	
Single and twin carburetors up to and incl. 1976 model	Max 3.5 % at 850 r/min
Single and twin carburetors as from 1977 model, Europe	1.5 ± 1 % at 850 r/min
Single carburetor as from 1977 model, Sweden	1.75 ± 0.25 % at 2000 r/min
Twin carburetors as from 1977 model, Sweden	1.0 ± 0.25 % at 2000 r/min

Up to and incl. 1976 model:

To adjust the CO setting, raise or lower the fuel needle to increase or reduce the CO value, respectively. Do not turn the jet adjusting screw more than $1/4$ of a turn from the basic setting.

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

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

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



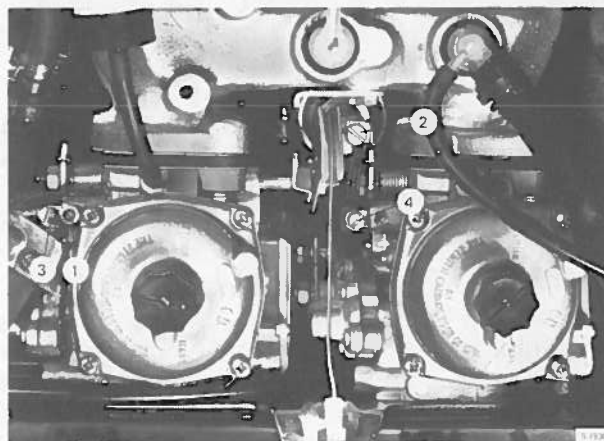
5. Remove the plugs and connect up the crankcase ventilation, the EGR hose and the vacuum hose to the distributor.
6. Set the idling speed to 850 ± 50 rev/min.
7. Check the CO value at idling speed. If the value exceeds 4.5 %, it is likely that fuel has penetrated the engine oil, necessitating an oil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

Caution

Check the calibration of the CO meter regularly.

Adjusting screws, general

1. Vent valve, float chamber, front carburetor
The setting is fixed and adjustment is not normally necessary. In the event of any adjustment being made, this will affect the settings of adjusting screws 2, 3 and 4. These must therefore be readjusted in the given order.
2. Synchronizing the throttle valve
This is carried out in conjunction with checking the idling speed and CO-setting. Any adjustment will affect the settings of adjusting screws 3 and 4, which must also subsequently be readjusted in the given order.
3. Idling setting
If any adjustment is made it will affect the setting of adjusting screw 4, which should also be checked.
4. Vent valve, float chamber, rear carburetor
This should be checked if any of the adjustment screws 1, 2 or 3 have been moved.



Adjusting screws

1. Vent valve, float chamber, front carburetor
2. Synchronizing the throttle valve
3. Idling setting
4. Vent valve, float chamber, rear carburetor.

Choke control

To remove

1. Make loose the throttle cable and the sheath at the carburetor underside. Note the position of the cable. Remove the cable from the engine compartment.

The end of the cable is with by a rubber protective piece to prevent damage to the hands when working on the controls.

2. Remove the left-hand trim panel below the instrument panel.
3. Remove the control knob and the transparent plastic washer on the warning light.
4. Unscrew the nut which holds the control onto the instrument panel and disconnect the warning light cable from the control switch.
5. Pull the control cable out of the grommet in the bulkhead.

To fit

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

Inlet system

Air cleaner

The air cleaner is located at the front of the left-hand wheel housing. It serves as a cleaner for the inlet air and as a silencer to cut down the noise caused by the inlet air. The air cleaner element is made of a special grade of paper and must not be washed or wetted. When servicing, the element may only be blown clean with compressed air or replaced.

Cars with carbureted engines have a hose connecting the air cleaner with the carburetor.

Cars with fuel injection engines have an air flow sensor bolted directly to the air cleaner.

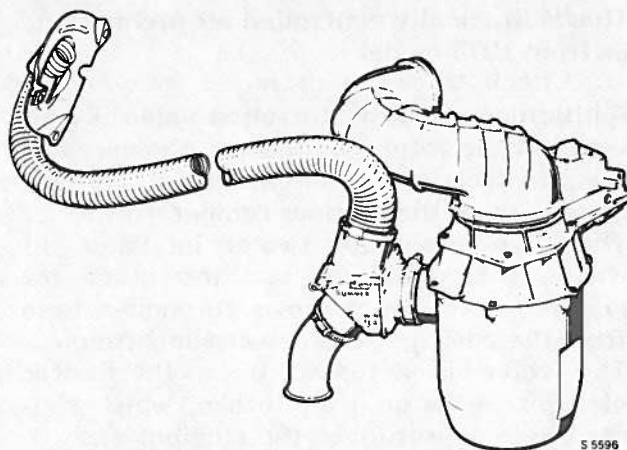
Manually adjustable, up to and incl. 1977 model

Carbureted engines (and 1977 model fuel injection engines) are equipped with a pre-heating valve which is adjustable to two settings. The valve is located at the air intake of the air cleaner.

In the summer position, air is drawn directly from outside. In the winter position, air is drawn through a hose from casings surrounding the exhaust manifold.

If the outdoor temperature is permanently below $+10^{\circ}\text{C}$, the valve should be set to the Winter position.

In connection with adjustment and checking of the CO setting, the valve should be in the summer position.



Thermostatically controlled air preheating, as from 1978 model

A thermostatically controlled valve is provided in the intake of the air cleaner, and this controls the preheating of the air, depending on the outdoor temperature.

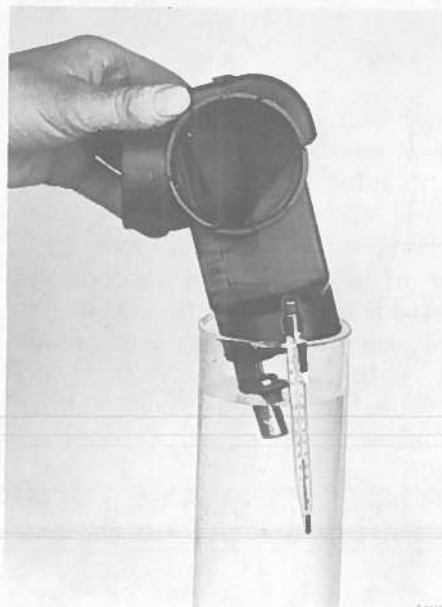
The valve housing has two air inlets, one of which is for cold air and the other for preheated air which flows through a hose from the casing at the exhaust manifold.

The valve is actuated by a thermostat element in the cold air intake, which senses the temperature of the ambient air.

At temperatures higher than $+18^{\circ}\text{C}$ ($+5^{\circ}\text{C}$ on the Saab 99 Turbo), the engine is supplied with cold air only.

At temperatures between $+8^{\circ}\text{C}$ and $+18^{\circ}\text{C}$ (-5° and $+5^{\circ}\text{C}$ on the Saab 99 Turbo), the valve gradually moves between the preheated air and the cold air settings.

A more accurate check can be carried out by dipping the thermostat element in warm water or by cooling it (Saab Turbo), simultaneously checking the position of the valve.



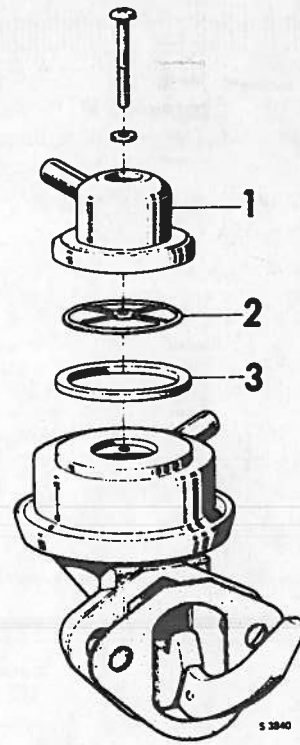
Fuel pump

Fuel pump, carbureted engine

Removing and reassembling

Disconnect the fuel line hose from the pump. Remove the retaining screws and washers, remove the pump and remove the old gasket. Always use a new gasket when reassembling. The fuel pump cannot be dismantled and cannot be repaired if there is any defect in the diaphragm or the valves. If the pump is faulty, the whole unit must be replaced.

If the cover is removed the fuel filter can be replaced or cleaned. The gasket should also be replaced.



Fuel pump
1. Cover
2. Filter
3. Gasket

Fuel pump

Fuel lines

Fuel pump, carburetor, injectors

Flowchart and assembly drawing

The fuel pump is a mechanical device that draws fuel from the tank and pumps it to the carburetor. It is driven by the engine's camshaft. The fuel lines connect the pump to the carburetor and the injectors. The fuel pump is located in the engine compartment, and the fuel lines run along the side of the engine block.

The fuel pump is a mechanical device that draws fuel from the tank and pumps it to the carburetor. It is driven by the engine's camshaft. The fuel lines connect the pump to the carburetor and the injectors. The fuel pump is located in the engine compartment, and the fuel lines run along the side of the engine block.



Fuel pump
Fuel lines
Fuel pump
Fuel lines

Fuel tank and fuel lines

Fuel tank

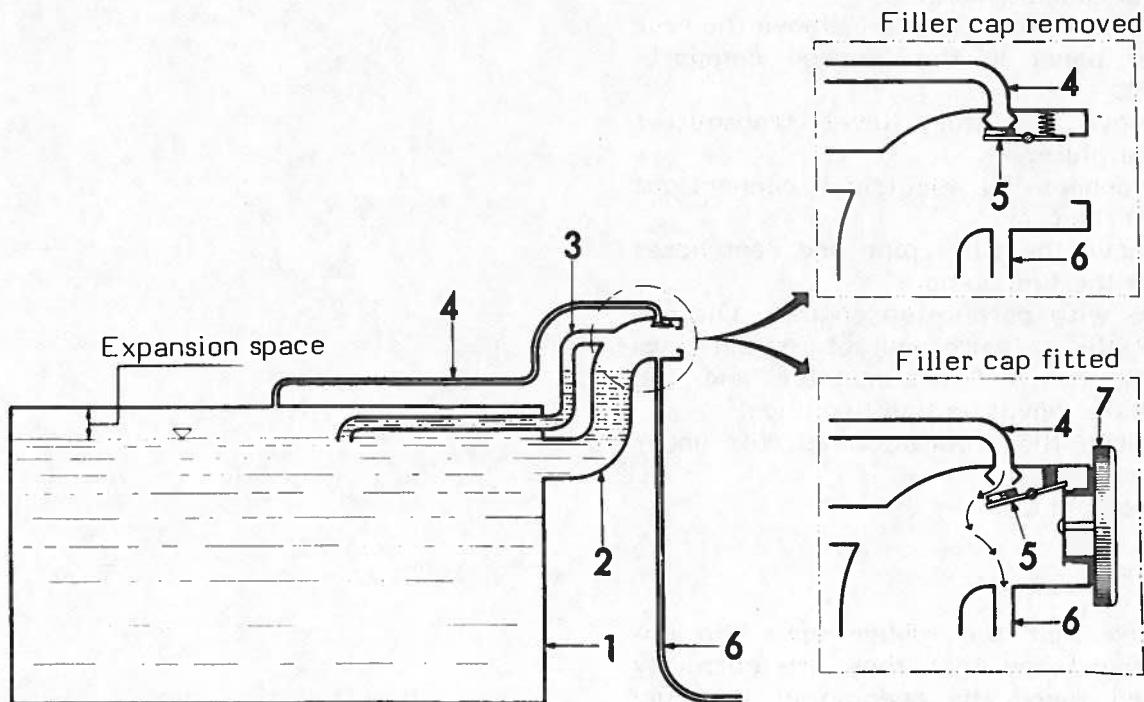
The fuel tank is designed so as to allow internal expansion of the fuel. The expansion space is opened by a valve which is actuated by the filler cap.

Fuel tank venting, introduced during the 1977 model year

When the car is fuelled, the tank (1) will not be completely filled, the level only reaching slightly above the lower opening of the vent pipe (3). This is due to an air cushion forming above this level, thus preventing the tank accepting any more fuel. The formation of this air cushion is due to the spring-loaded valve (5) located in the filler pipe (2) shutting off the upper opening of the vent hose (4) running from the top 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.



S 2951

Fuel tank ventilation, arrangement diagram

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

Fuel tank

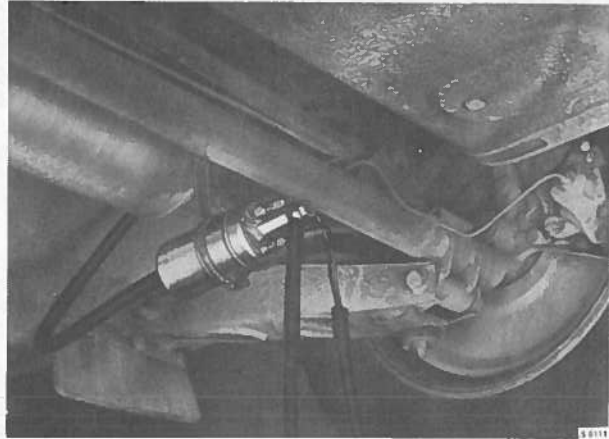
Removing

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. Saab 99 (99 L), 99 L (99 GL), 99 GLE and 99 EMS: Remove the carpet in the trunk compartment.
Saab 99 Combi Coupé: Remove the rear floor panel in the luggage compartment.
5. Remove the fuel level transmitter cover plate.
6. Disconnect all electrical connections from the tank.
7. Remove the filler pipe and vent hoses from the fuel pump.
Cars with carbureted 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.

Refitting

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 cables to the top of the tank. Lift the tank into position and suspend it in the two straps.
4. Centre the tank and tighten the nuts. Remove the masking tape from the filler pipe and vent hose.
5. Connect the fuel lines and the hose to the filler pipe. Make sure that the rubber grommet is in place.
6. Connect the vent hoses to the top of the filler pipe and to the top of the tank. Connect the cables to the fuel level transmitter (fuel pump) and replace the access panel.
Saab 99 (99 L), 99 L (99 GL), 99 GLE and 99 EMS. Replace the carpet in the trunk 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 may cause wear by chafing.

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

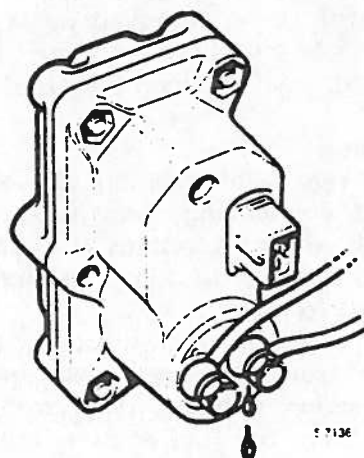
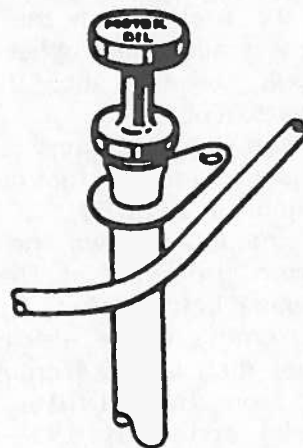
It is therefore of special importance when working in the engine compartment that all fuel pipes are run clear of such equipment. Sheath the pipes with PVC sleeves if contact is unavoidable.

Checking fuel pipes (every 10 000 miles (15.000 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, the fuel pipe should be replaced.



Checking pipe connections (every 10 000 miles (15.000 km))

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

Replacing the 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. In 1975 model cars with injection engines, the return fuel line runs along the right-hand sill beam.

Removal

1. Remove the kick plate and turn back the carpet from the sill beam.
2. Remove the tape holding the fuel line.
3. Remove the insulation felt from the bulkhead.
4. Disconnect the fuel line in the engine compartment remove the rubber grommets and pull the line into the passenger compartment.

Cars with carbureted engines: Disconnect the connection at the fuel pump.

Cars with injection engines:

On the 1975 model, remove the return fuel line from the joint at the right hand side spring link bracket. As from 1976 model, remove the return fuel line from the fuel distributor. Remove the pressure line from the fuel filter.

In 1975 model and early 1976 model cars, the holes in the bulkhead and spring link bracket are too small for the banjo nipple on the fuel line. The nipple must therefore be removed before the line can be withdrawn (see under "Removing and fitting the fuel line nipple").

5. 1975 model:

Lift the rear seat cushion, disconnect the angle connecting piece (pieces) at the point where it passes through the body, and remove the fuel line (lines).

As from 1976 model:

Remove 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

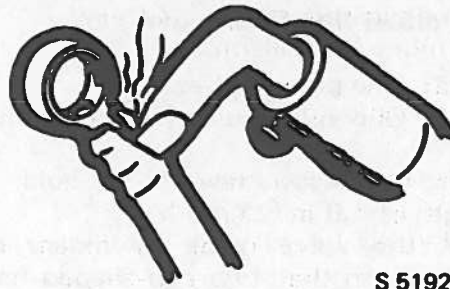
1. Clean the fuel line by blowing through with compressed air. Close the ends with masking tape.
2. Push the fuel line through the hole in the bulkhead and the spring link bracket and connect the line in the engine compartment.

In 1975 model and early 1976 model cars, the banjo nipple should be fitted to the fuel line after the line has been inserted through the bulkhead and the spring link bracket (see under "Removing and fitting the fuel line nipple").

3. Insert the rubber grommets in the hole in the bulkhead and in the front hole in the spring link bracket.
4. Push the fuel line into position and connect it at the rear where it passes through the body. Secure the line with tape in two places along the sill beam.
5. Fit the insulation felt on the dash panel. Replace the carpet and kick plate.

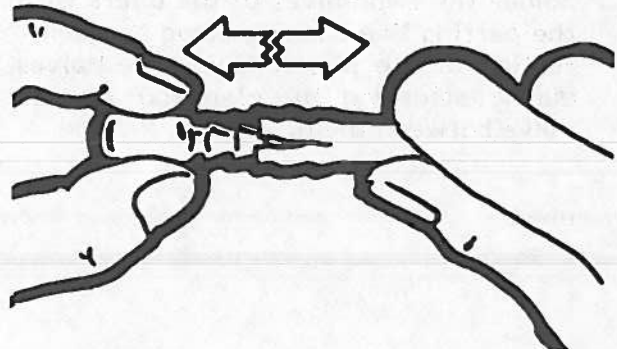
Removal and installation of nipple on fuel line

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



S 5192

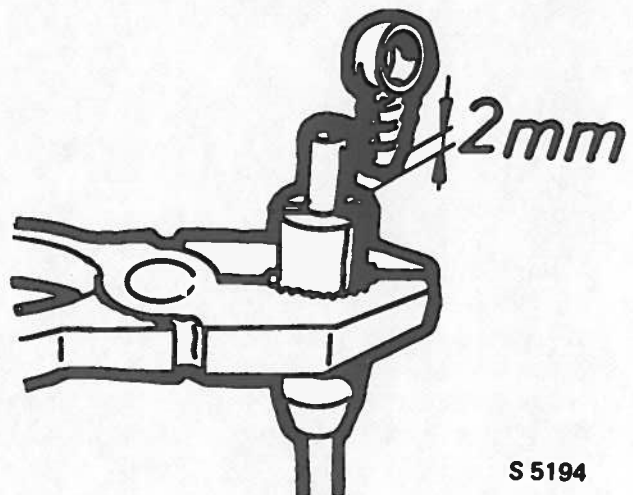
- b. Pull the fuel line off the banjo coupling. (Do not cut the fuel line with a knife as this may damage the banjo coupling and cause leakage.)



S 5193

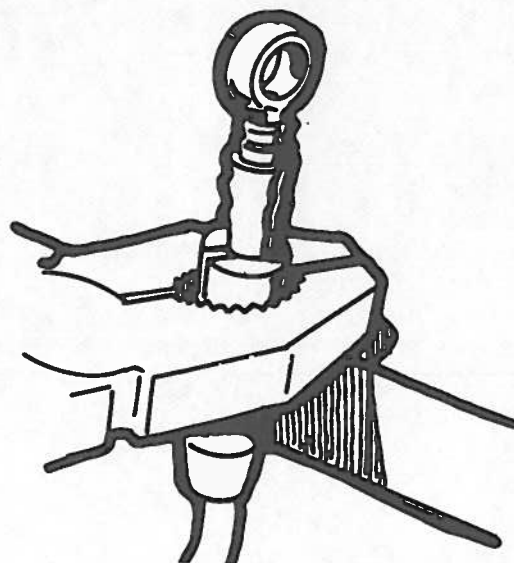
2. Fit the nipple to the fuel line as follows:

- a. Cut the fuel line with a knife, cutting off as short a piece as possible.
 - b. Secure the fuel line in the fitting tool in such a way that the protruding length is the same as the length of the banjo coupling plus 0.08 in (2 mm).



S 5194

- c. Knock down the nipple with the aid of a hammer. Hold the tool against a firm base to prevent the nipple from fitting.

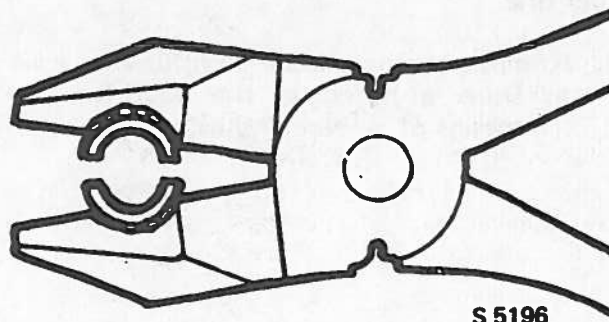


S 5195

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 clamping an old valve between them.



S 5196

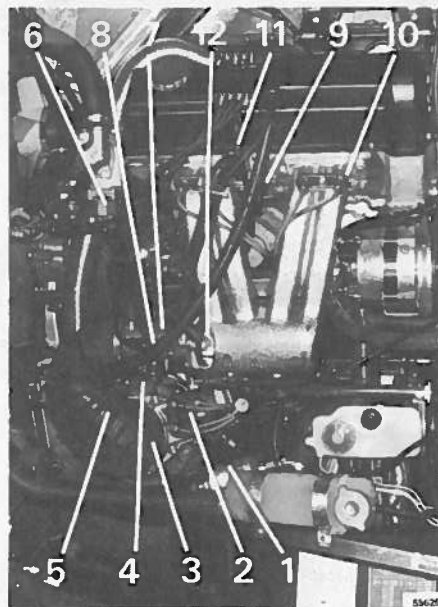
Fuel injection

General

The CI system (Continuous Injection), manufactured by Bosch, is a mechanical injection system which is based on the measurement of air flow.

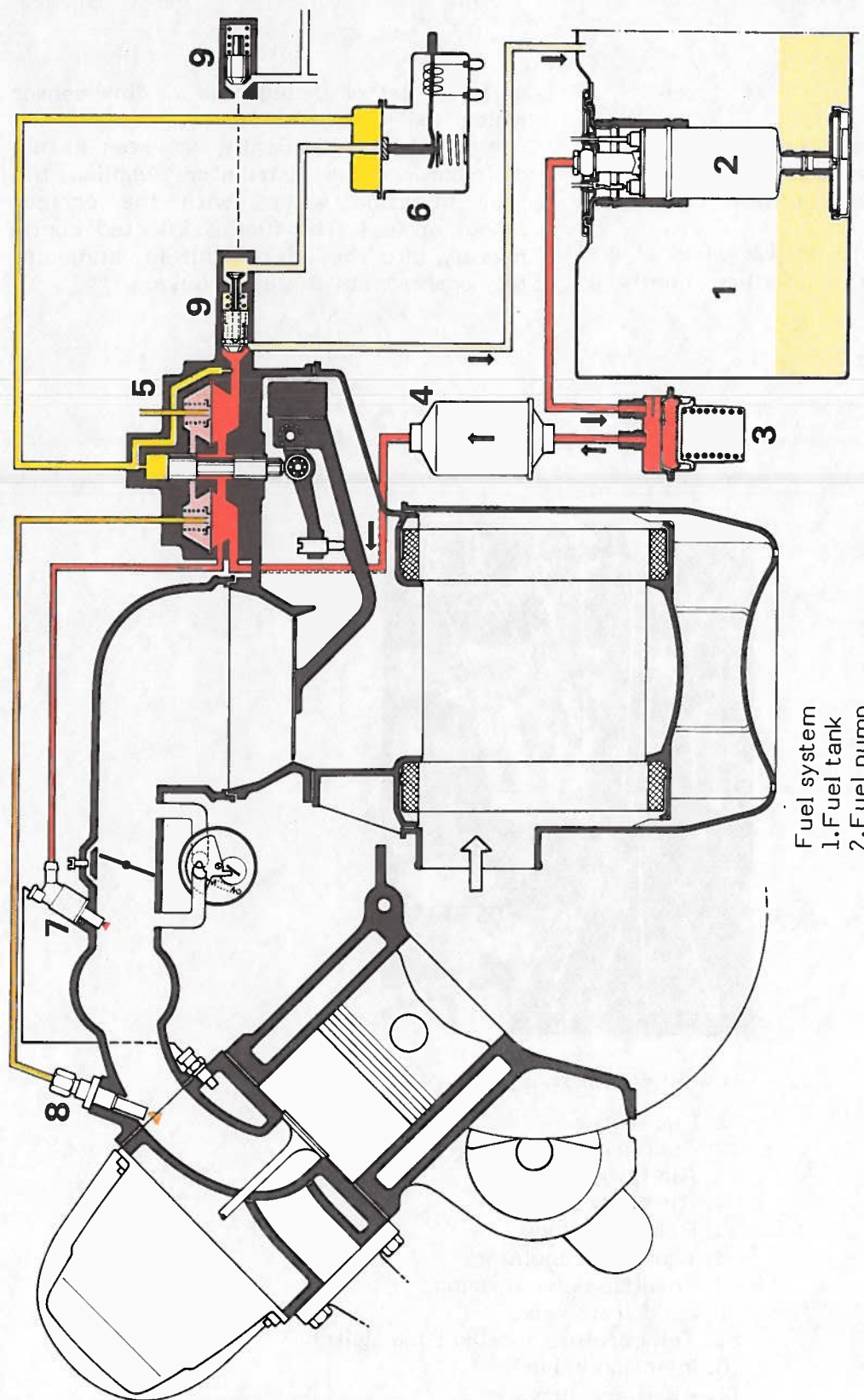
An electrical fuel pump delivers fuel at a constant pressure to a mixture control

unit. The latter includes an air flow sensor which measures the flow of air to the engine and mechanically actuates a fuel distributor. The distributor supplies the four injection valves with the correct amount of fuel. The fuel is injected continuously into the inlet manifold, immediately upstream of the inlet valve.



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. Temperature sensing time switch
10. Injection valve
11. Auxiliary air valve
12. Deceleration valve



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 (up to and incl. 1977 model)
10. Line pressure regulator with stop valve (as from 1978 model)

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

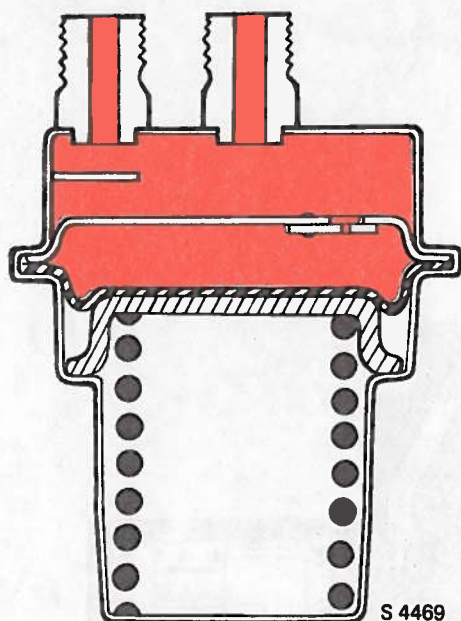
The fuel accumulator is connected to the fuel pipes between the fuel pump and the fuel filter.

Up to and including 1979 model, the fuel accumulator is situated on the left end of the fuel tank.


As from 1980 model, the fuel accumulator is located on the underside of the body in front of the fuel tank.

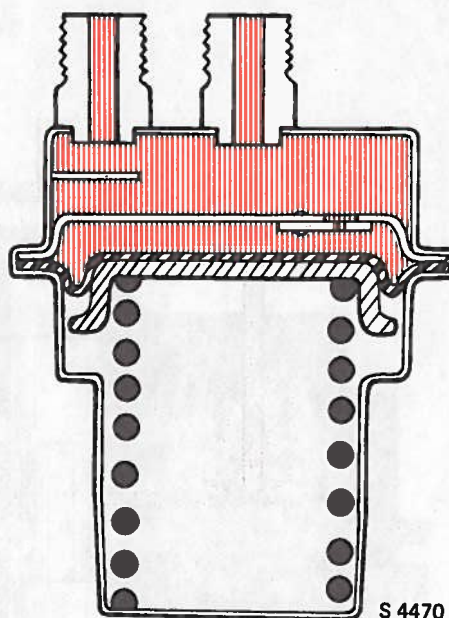
The fuel accumulator has three functions:

1. When the engine stops, the fuel pressure in the system will drop to approximately 2 bar (kg/cm^2 , 28 lb/in^2). This pressure will be maintained as a result of the fuel accumulated in the fuel accumulator. This means that the system will remain pressurized at the "rest pressure" while the engine is cooling, and this prevents the fuel from vaporizing, this 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

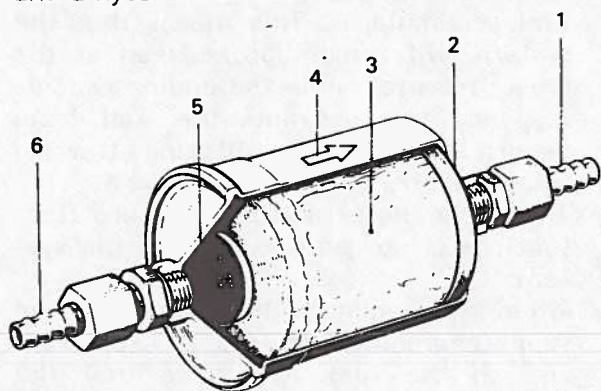


The fuel accumulator when the engine has been stopped

 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.



S 4471

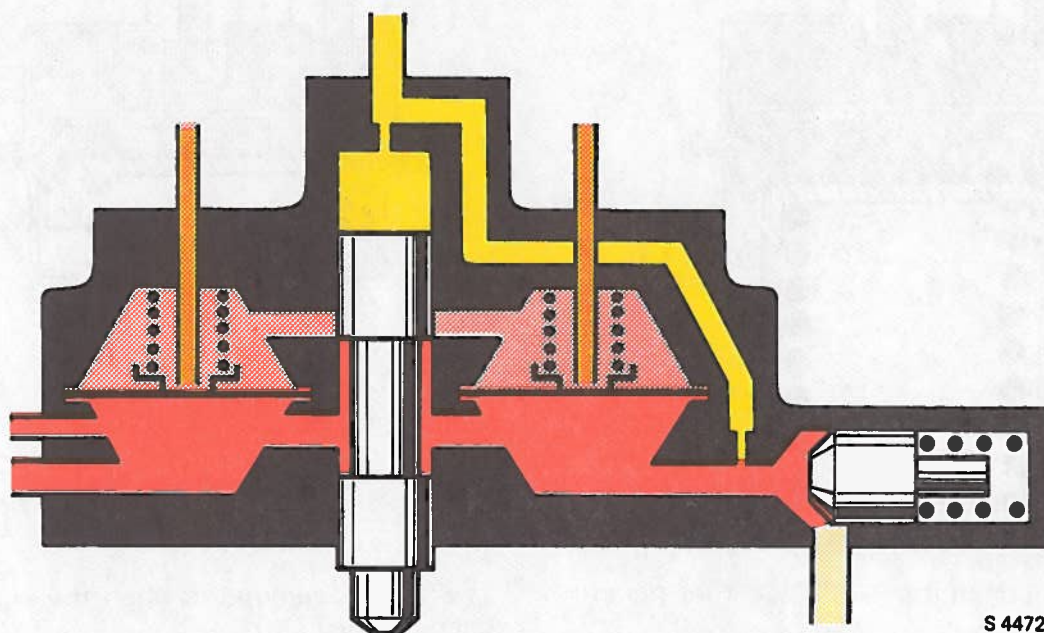
Fuel filter

1. Outlet
2. Nylon strainer
3. Paper element
4. Arrow, marking the 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.

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



S 4472

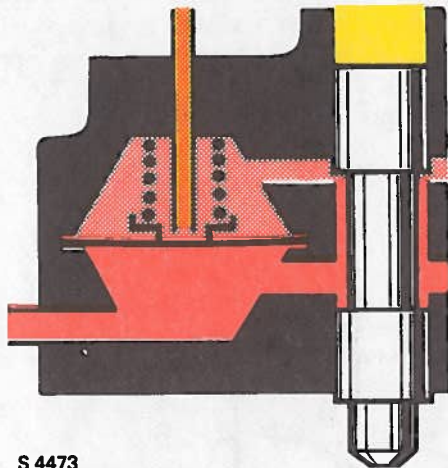
Fuel distributor

- | | |
|---|--|
|  | Line pressure |
|  | Line pressure -0.1 bar (1.4 lb/in ²) |
|  | Injection pressure |
|  | Control pressure |
|  | Return, no pressure |

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 (kg/cm^2), 1.4 lb/in^2) 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. The fuel distributor also contains a line pressure regulator, passages for the control pressure, and fuel inlets and outlets.

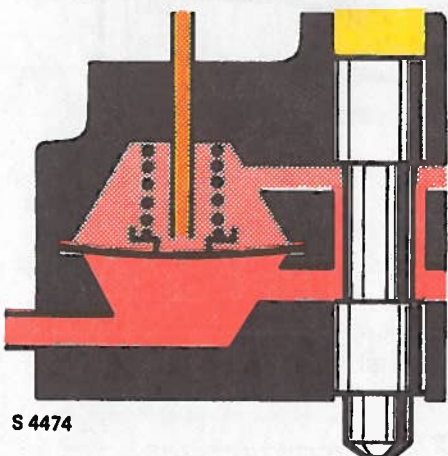
Line pressure regulator

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 (kg/cm^2 , 35 lb/in^2), 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 re-starting difficult.







S 4473

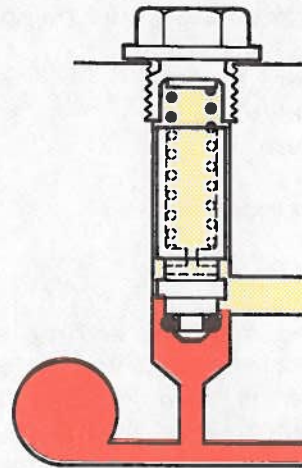
Pressure regulating valve, partial load



S 4474

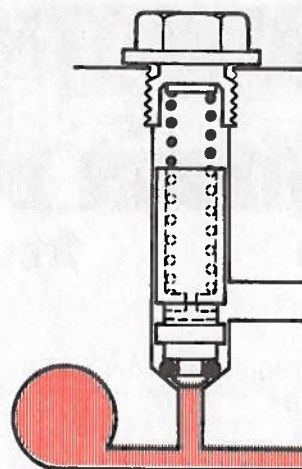
Pressure regulating valve, full load

-  Line pressure
-  Line pressure - 0.1 bar (1.4 lb/in^2)
-  Injection pressure
-  Control pressure






S 4475

Line pressure regulator when the fuel pump is working, up to and incl. 1977 model

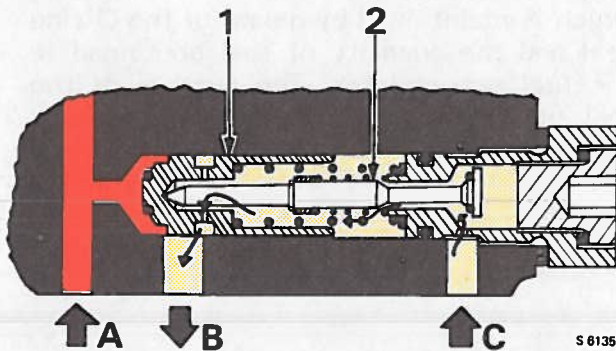


S 4476

Line pressure regulator when the engine is switched off, up to and incl. 1977 model

-  Line pressure
-  Return, no pressure
-  Rest pressure

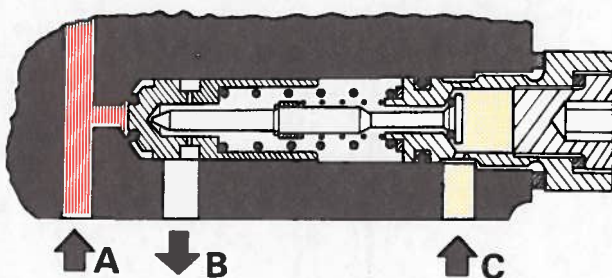
As from 1978 model, the line pressure regulator forms an integral unit with a shut-off valve to which the return fuel line from the warm-up regulator is connected. When the fuel pump is operating, the shut-off valve is actuated mechanically by the warm-up regulator whereupon the return fuel from the 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 and the warm-up regulator valve is pressed into its seat, 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

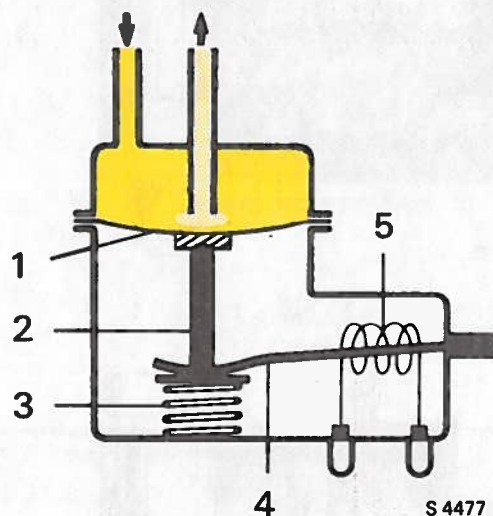
- A. Line pressure
- B. Return line
- C. Control pressure return

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 into 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 on 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.

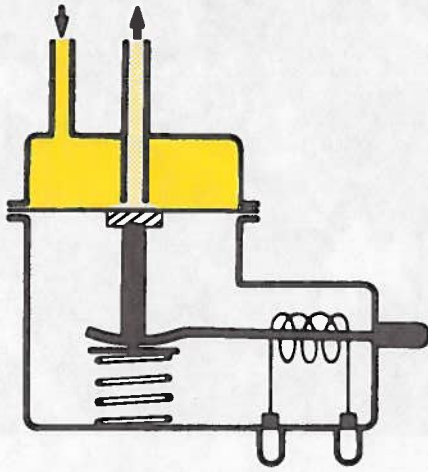


Warm-up regulator, cold engine

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

 Control pressure

 Return, no pressure



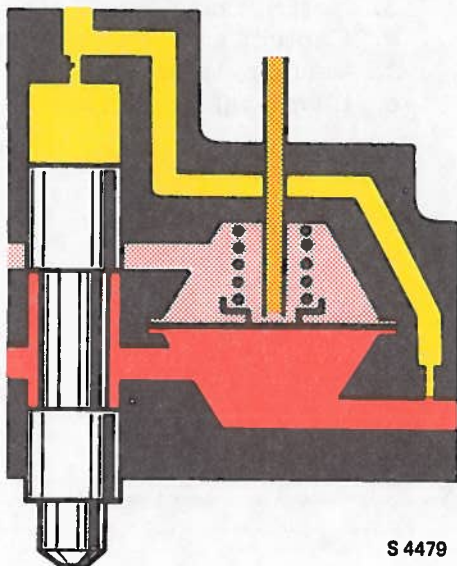
S 4478

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 (kg/cm², 52.5 lb/in²) in the control pressure regulator or to 0.5-3.7 bar (kg/cm², 7-52.5 lb/in²) 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

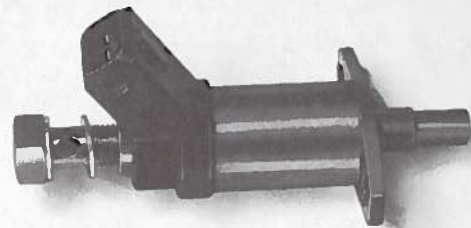
Control pressure regulation

- Line pressure
- Line pressure -0.1 bar (1.4 lb/in²)
- 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 is actuated by a temperature-sensing 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 -4°F (-20°C) the valve can inject fuel for a maximum of 8 seconds (9.5 seconds in later versions). At temperatures higher than -4°F (-20°C), the injection time is gradually reduced up to a temperature of approx. 95°F (36°C) at which temperature the valve is no longer actuated (up to approx. 113°F (45°C) on later versions).



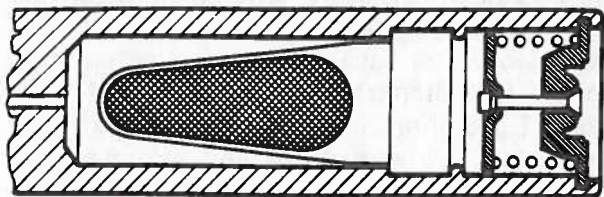
S 4480

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 (kg/cm², 47 lb/in²). The valves also contain a fuel strainer.

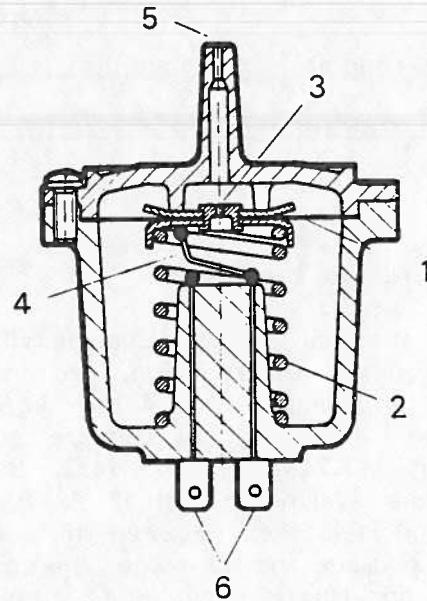
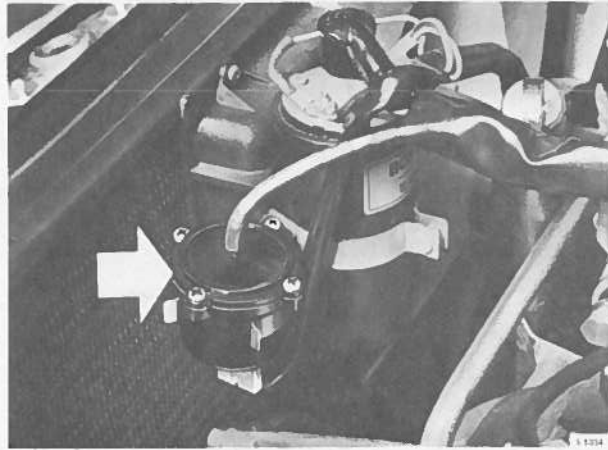


S 4481

Injection valve

Vacuum switch

The vacuum switch provides acceleration enrichment when the engine is cold. The switch is fitted adjacent to the ignition coil and is connected to the inlet system by a vacuum hose. The switch is connected to the inlet system by a vacuum hose. The switch is connected electrically to the ignition coil and to the cold-start valve. The switch is actuated by the change in pressure in the inlet manifold during acceleration. The cold-start valve will then be energized for a short instant, provided that the temperature-sensing time switch is closed (engine cold) The engine will then be supplied with extra fuel through the cold-start valve.



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

Operation of the vacuum switch

When the car is being driven at constant speed, the vacuum will be the same on both sides of the diaphragm. When the car is accelerated, the vacuum will be reduced. The change in pressure will be delayed on the underside of the diaphragm due to the restriction. The "absolute" pressure on the top of the diaphragm will therefore increase for a short instant, thus causing the diaphragm to move down and actuate the contact arm (closes the circuit).

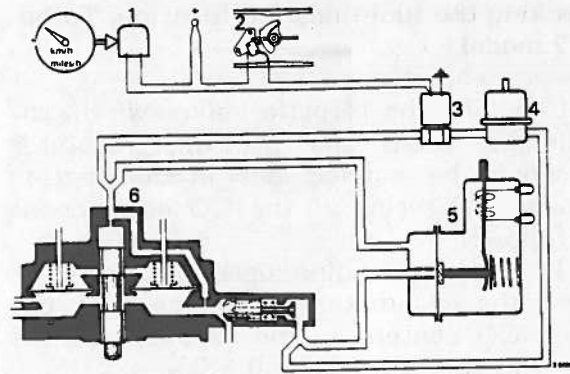
Fuel boosting system, 1979 model

Checking the fuel-boosting function, 1979 model Turbo

Turbocharged engines are equipped with a special device to provide the necessary boost in the fuel supply to the engine under heavy loads and to improve the cooling of the engine when running at sustained high speeds.

The device consists of a solenoid valve and a pressure regulator. The valve and pressure regulator are connected in parallel with the control pressure regulator in the control pressure system.

The pressure regulator is pressure approximately 1 bar lower than that of the warm-up regulator (warm engine), which means that the control pressure will drop from about 52.6 lb/in² (3.7 bar) to about 38.4 lb/in² (2.7 bar) when the solenoid valve opens. This pressure drop raises the position of the control plunger, which, in turn, boosts the fuel supply to the engine. The solenoid valve is energized either by a switch at the throttle valve which closes the circuit when the throttle opening is greater than about (62°) or by means of a transmitter which is connected to the speedometer cable and which closes the circuit at speeds in excess of about 90 mph (130 km/h).



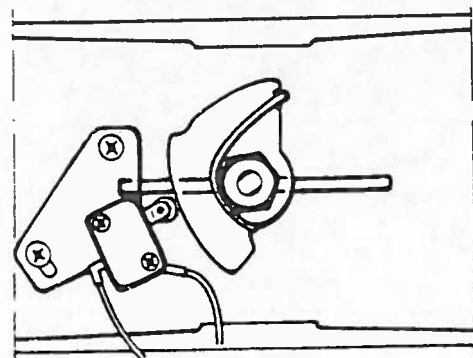
Device for fuel boosting

1. Speed transmitter
2. Throttle valve switch
3. Solenoid (valve)
4. Pressure regulator
5. Warm-up regulator
6. Fuel distributor



Solenoid switch and pressure regulator

1. Solenoid
2. Pressure regulator



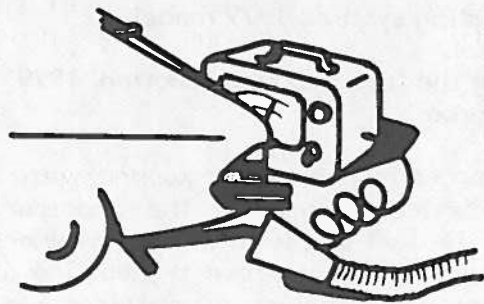
S 5738

Valve switch

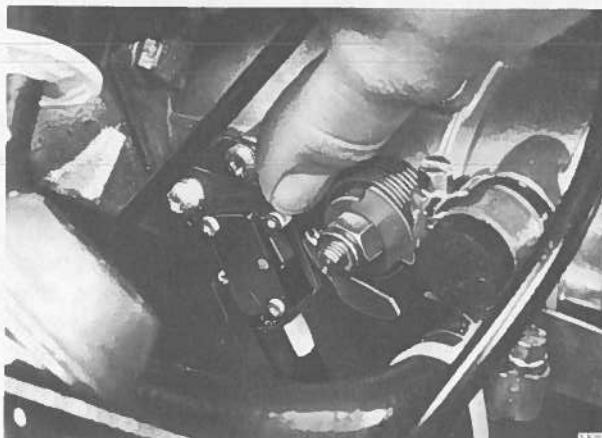
Checking the fuel-boosting function, Turbo 1979 model

A. Checking the throttle valve switch, solenoid valve and pressure regulator should be carried out in conjunction with measuring of the CO emission as follows:

1. Run the engine until hot, connect the CO meter and check that the CO content in the exhaust gases is as specified (1.5 ± 0.5 %).
2. Press in the actuating arm on the throttle valve switch and keep it depressed. The CO value should now increase to about 4-6 % CO.
3. Release the actuating arm and check that the CO value is 1.5 ± 0.5 %.

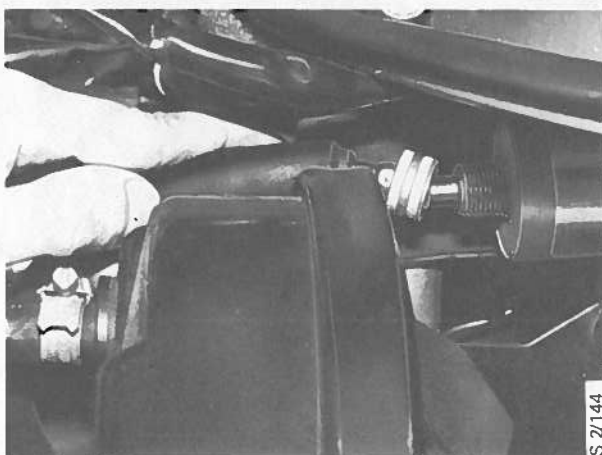


S 5202



B. Checking of the speed transmitter should be carried out in conjunction with checking of the CO setting as follows.

1. Run the engine until it is warm, connect a CO meter and check that the CO value in the exhaust gases is within the prescribed limits (1.5 ± 0.5 %).
2. Disconnect the speedometer cable.
3. Connect drive cable 83 93 126 to the speedometer.



S 2/144

4. Connect a variable-speed portable drill to the other end of the drive cable. By means of the drill, set the cable rotating and observe the reading on the speedometer. At speeds in excess of 80 ± 3 mph (130 ± 5 km/h), the CO value should increase to approximately 4-6 %.

N.B.

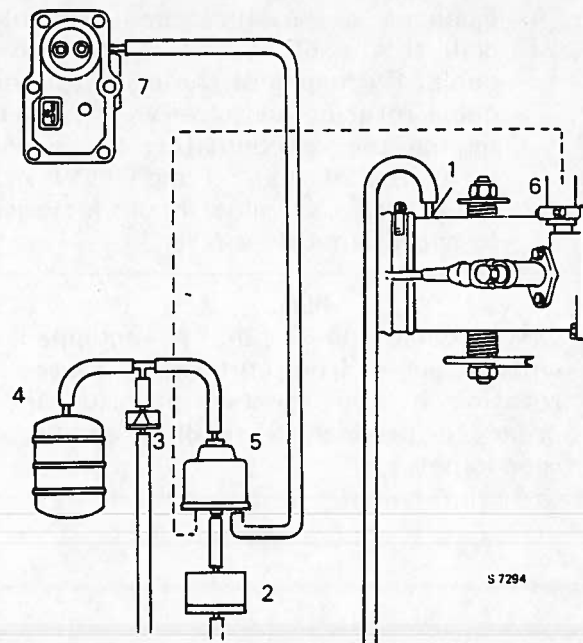
Drive cable 83 93 126, is equipped with an angle drive unit which causes rotation in the reverse direction in order to produce a reading on the speedometer.



Fuel boosting system, Turbo models as from 1980

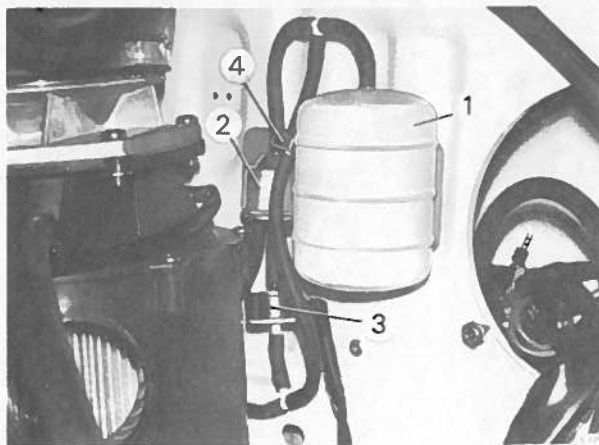
General

The fuel boosting device serves a double function: it assists the internal cooling of the engine when it is subjected to sustained periods of high load and it also provides the extra fuel required for rapid acceleration. Fuel enrichment is achieved using a special warm-up regulator/boost control which is regulated by the compressor through a control system.



The control system consists of:

1. Pressure outlet in the throttle housing (before the butterfly)
2. Delay valve (6 sec.)
3. Non-return valve
4. Pressure tank
5. Electrical control valve
6. Throttle valve switch (62° throttle opening)
7. Warm-up regulator/boost control



Fuel boosting system

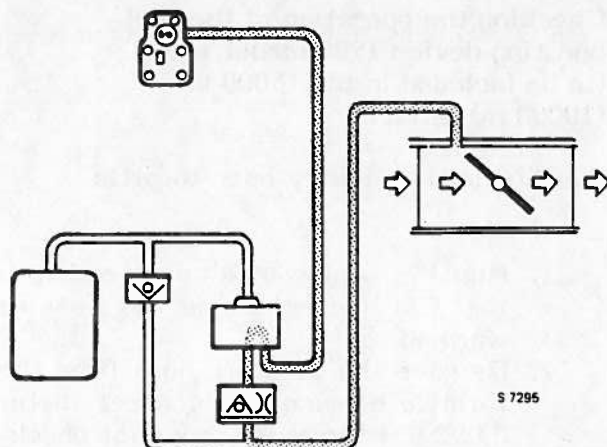
1. Pressure tank
2. Electric control valve
3. Delay valve (6s)
4. Non-return valve

The control system has the following two functions:

I. High load (partially open throttle)

Compressed air from the compressor flows via the delay valve through the electrical control valve which is in its normal position, passes the compressed air on to the warm-up regulator/boost control.

The delay valve ensures that the fuel boosting system is not activated for temporary increases in load which would otherwise result in an unnecessarily high fuel consumption and unwarranted hydrocarbon emission.

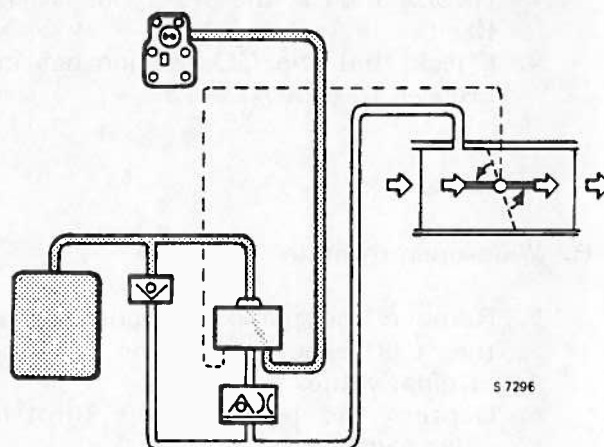


II. Wide-open throttle

The pressure tank is connected to the compressor via a non-return valve which enables it to retain compressed air for a long period.

When the throttle is wide open, the throttle valve switch activates the electrical control valve, the residual compressed air providing an immediate boost.

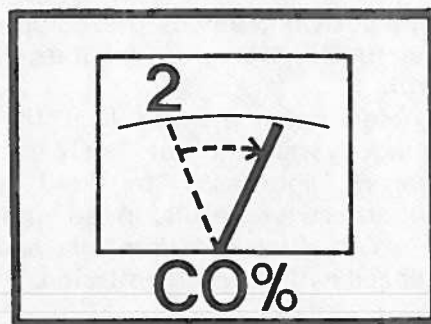
In addition to the ordinary steel diaphragm valve, the warm-up regulator/boost control has a rubber diaphragm which is activated by the boost from the compressor. The spring load of the steel diaphragm is reduced at approx. 0.4 bar charging pressure, thereby reducing the boost.



**Checking the operation of the fuel
boosting device 1980 model Turbo
(to be included in the 15000 km
(10000 m) service)**

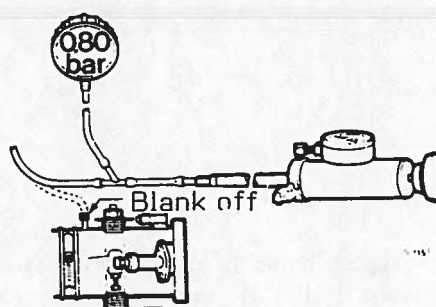
A. High load (partially-open throttle)

1. Run the engine at idling speed with the CO meter connected (engine warmed up)
2. Remove the pressure hose from the throttle housing and connect meter 83 92 831 (pressure gauge for checking the charging pressure) and a cooling system tester to the hose. Seal off the connection on the throttle housing.



S 7156

3. Increase the pressure to 0.80 bar (due to the presence of the delay valve the pressure should only be recorded once the level has stabilized).
4. Check that the CO reading has increased to approx. 4-6 %

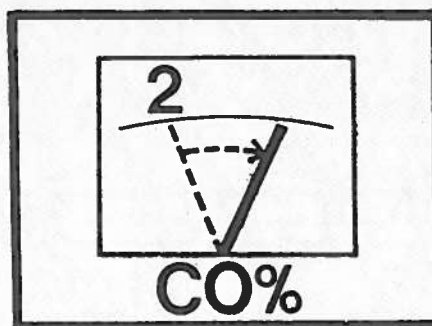


B. Wide-open throttle

5. Remove the pump and check that the CO reading returns to the original value.
6. Depress the lever on the throttle valve switch.



7. Check that the CO reading increases to approx. 4-6 %



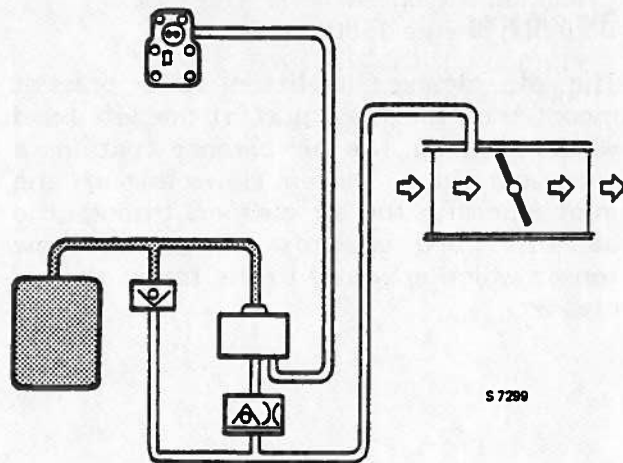
S 7156

Residual pressure

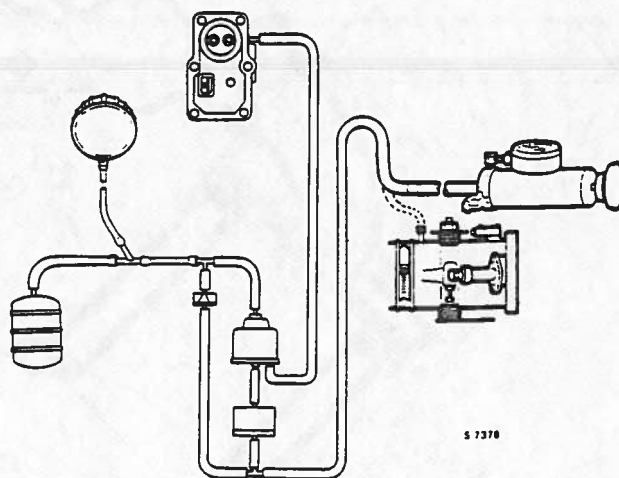
It is essential that the pressure tank and connections are completely air-tight in order that the fuel boost required in the initial stages of acceleration can be provided. Failure here means that fuel enrichment can first be achieved only once the charging pressure has reached a sufficiently high level.

Checking the residual pressure

1. Connect pressure gauge 83 92 813 (for checking the charging pressure) between the non-return valve and the pressure tank.
2. Connect a cooling system tester in front of the non-return valve and increase the pressure to 0.8 bar.
3. Check that the pressure has not dropped below 0.6 bar after 5 min.



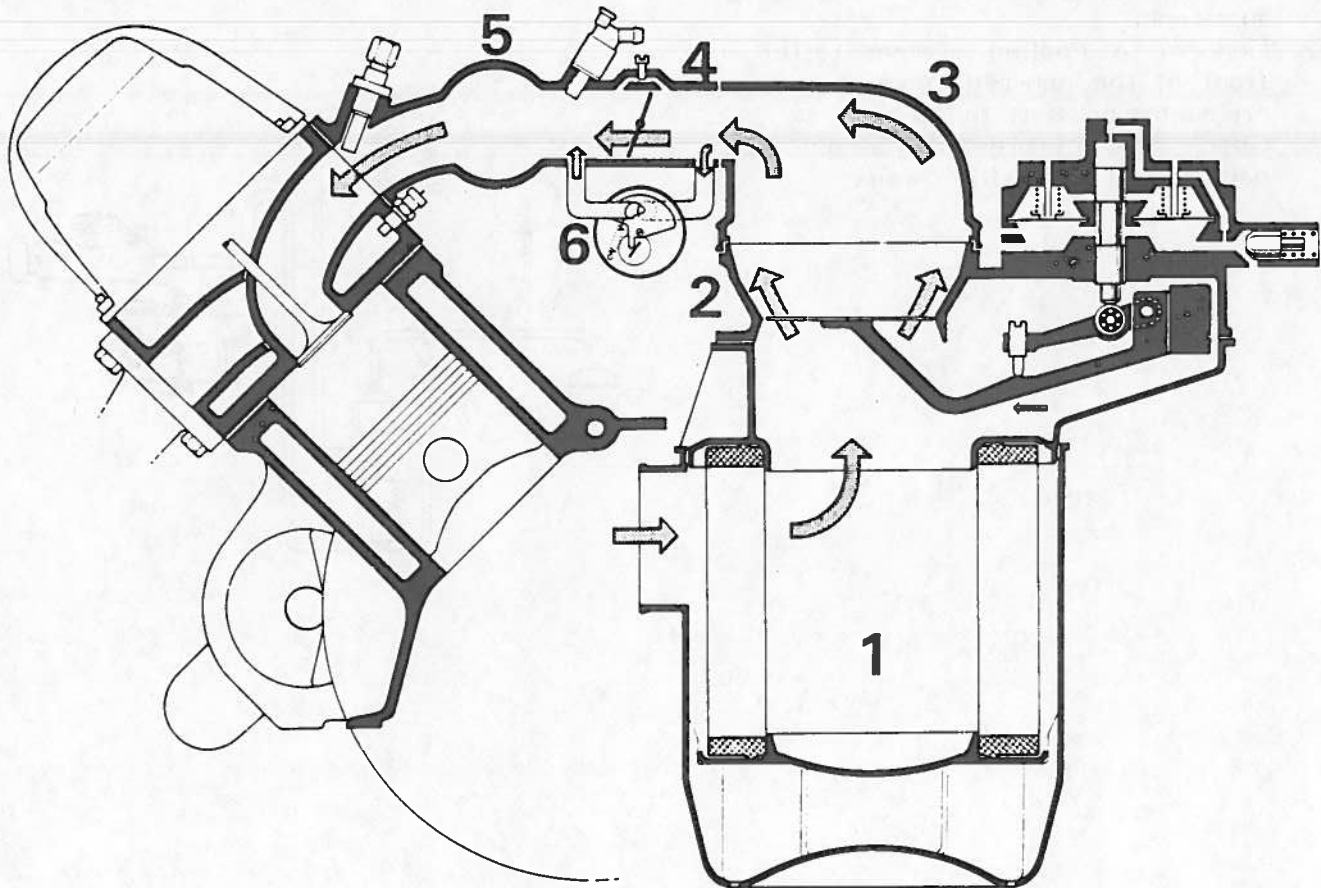
S 7299



S 7378

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.



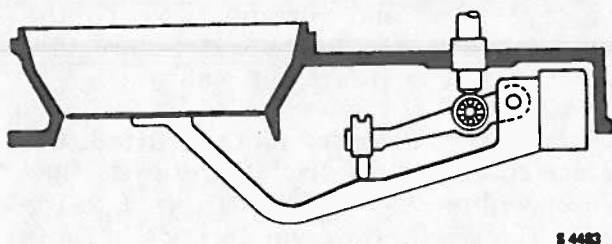
Air system

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

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 higher the flow of air, the higher the sensor plate will be raised.

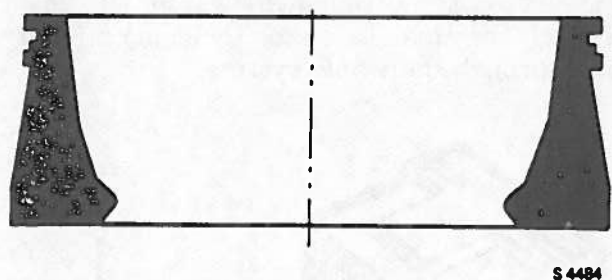
The air flow sensor plate is fitted to a lever which is compensated by a counterweight. The lever acts on the control plunger in the fuel distributor which is pressed down by the control pressure, thus counteracting the lifting force of the air flow sensor plate.



Air flow sensor

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.



The air venturi of the 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 vacuum outlet for ignition setting.

As from model 1976, an deceleration valve is fitted in the throttle valve (see section 254).

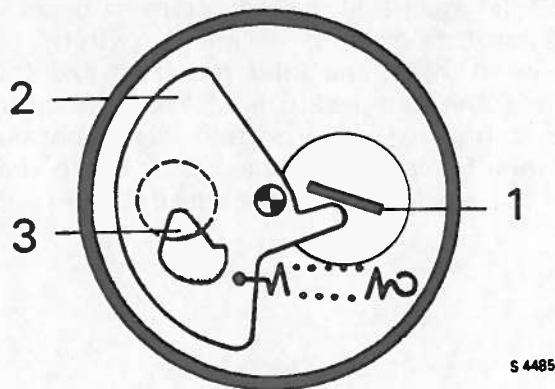
Inlet manifold

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 temperature-sensing 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

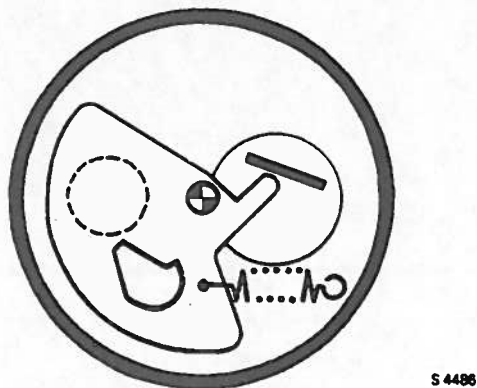
The function of the auxiliary air valve, together with the warm-up regulator, is to compensate for losses due to friction and condensation in the inlet manifold and combustion chamber on cold starting, so that the required idling speed will be obtained. The valve is located in a passage which by-passes 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 through 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

Electrical system

Up to and incl. early 1977 model (with safety switch on the air flow sensor).

When the ignition is switched on, current flows through the safety relay control circuit from terminal 15 on the ignition coil. The circuit is earthed by means of the contact in the air flow sensor which is now closed. The safety relay is then actuated.

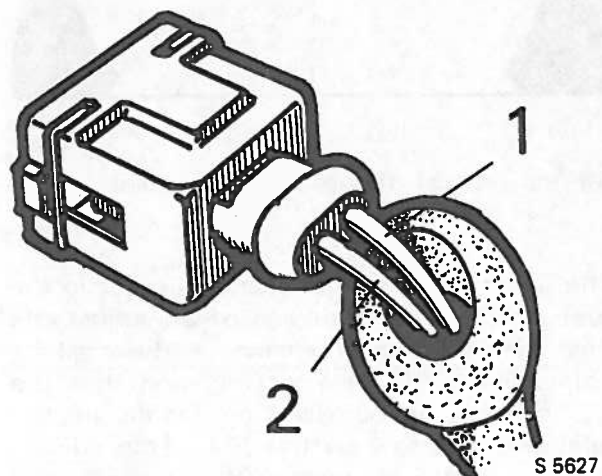
When the starter motor is engaged, current flows from terminal 50 to the cold start valve (as from 1976 model via terminal 16 on the starter motor) and the temperature-sensing time switch, and through the safety relay contacts via the pump relay control circuit to earth. The pump relay circuit is thereby closed and current flows to the fuel pump and coils in the warm-up regulator, and the auxiliary air valve is energized.

As the air flow sensor plate is lifted, the safety relay control circuit in the air flow sensor will be de-energized. Current to the pump relay will flow via terminal 87a in the safety relay.

When the starter motor is switched off, current at the cold start valve and the temperature-sensing time switch will be switched off.

Should the engine stop for any reason, the contact in the air flow sensor closes and the pump relay circuit is actuated. Since terminal 87 in the safety relay is dead, no current flows to the pump relay and the pump will be switched off as a safety measure.

When the ignition is switched off and the engine stops, current will cease to flow through terminal 15 of the ignition coil and thus through the whole system.

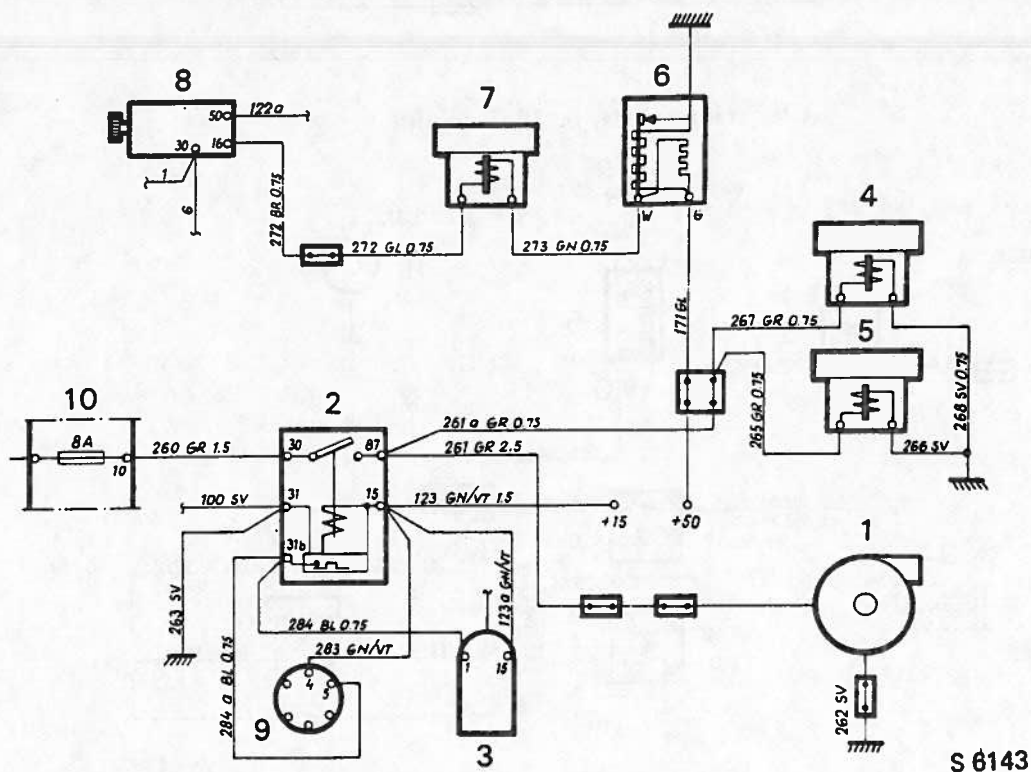


Connector, temperature-sensing switch

1. Green
2. Yellow

As from later 1977 model (with fuel pump relay with pulse sensor).

The safety function designed to break the circuit to the fuel pump when the engine has stopped consists of a pulse sensor in the pump relay which is actuated by the ignition pulses. If the ignition pulses fail to occur for a period of one second or more, the relay will break the circuit and current will cease to flow to the fuel pump and other components in the fuel system.



S 6143

Electrical system

1. Fuel pump
2. Relay with pulse sensor
3. Ignition coil
4. Warm-up regulator
5. Auxiliary air valve
6. Temperature-sensing time switch
7. Cold start valve
8. Starter motor
9. Ignition service socket (TSI)
10. Fuse

Checks

General

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.

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.

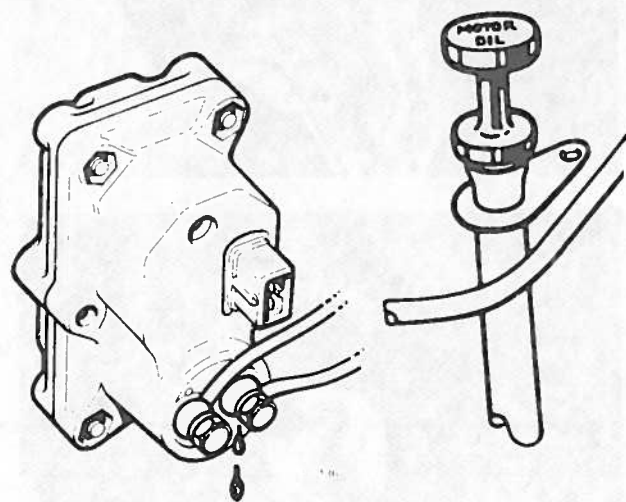
Scrupulous cleanliness must be observed during work on the fuel system. The surrounding area should be thoroughly cleaned before any lines are disconnected.

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 e.g. against the dipstick sleeve, other fuel pipes or the throttle cable, may 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 performance, 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.

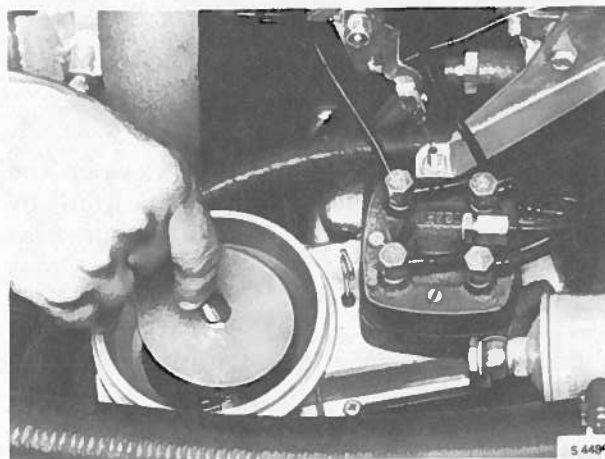
At the gasket between the inlet manifold and the cylinder head.

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, dipstick or valve cover gasket.

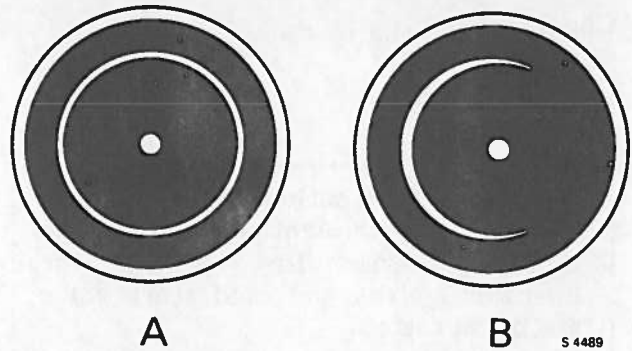
Lever mounting

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.



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 83 92 474 is used to fit the plate to the lever.

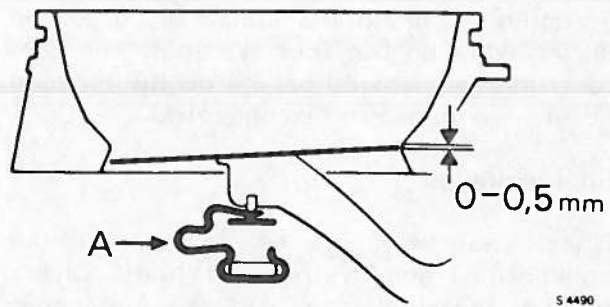


Sensor plate clearance

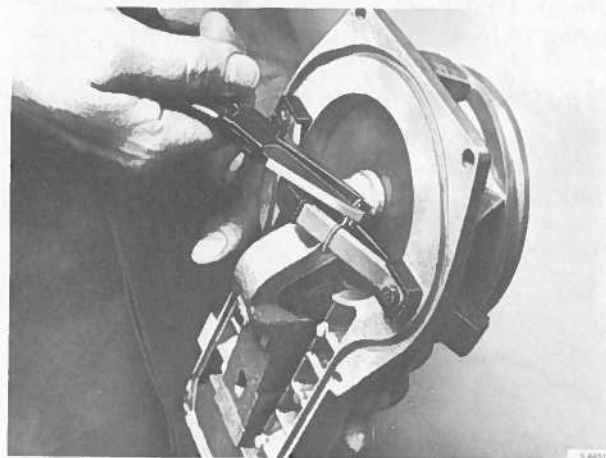
- A. Correct
- B. Faulty

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 rest 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

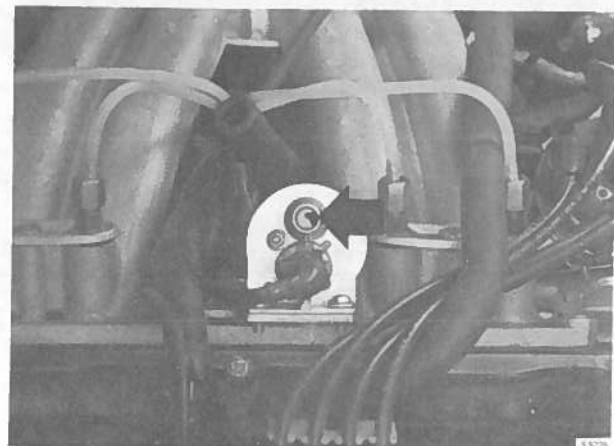
(Checking can only be carried out when the engine is cold.) Isolate the safety circuit by disconnecting the terminal on the air flow sensor.

If the "COLD ENGINE CONTROL PRES-SURE" (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 an 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.

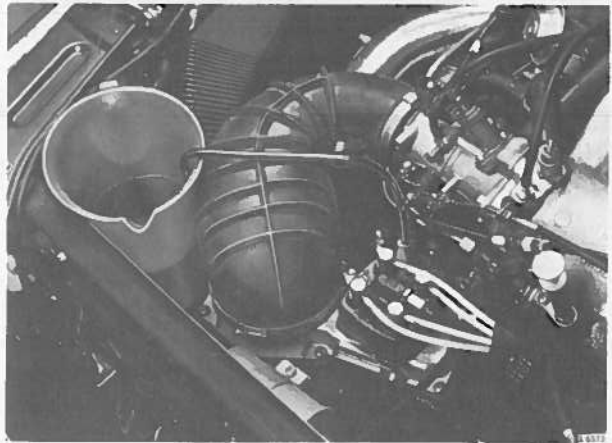


Fuel pump capacity

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 as follows:

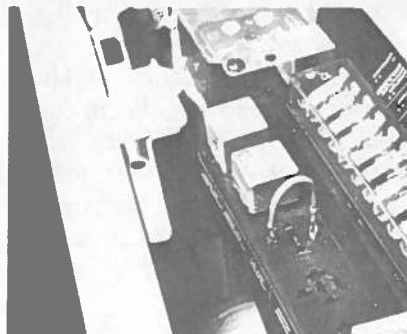
Disconnect the return fuel pipe from the fuel distributor. Connect test pipe 83 93 183 to the fuel distributor and place the open end in a suitable vessel. Connect the fuel pump and allow it to run for 30 seconds as follows:

- CI system with safety switch on the air flow sensor (up to and including early 1977 model):
Remove the connector from the air flow sensor.
- CI system with fuel pump relay with pulse sensor (from early 1977 model):



Remove the fuel pump relay and connect jumper lead between terminals 30 and 87 in the relay holder.

Switch on the ignition and allow the pump to run for 30 seconds. Measure the quantity of fuel (see the specification in group 0).

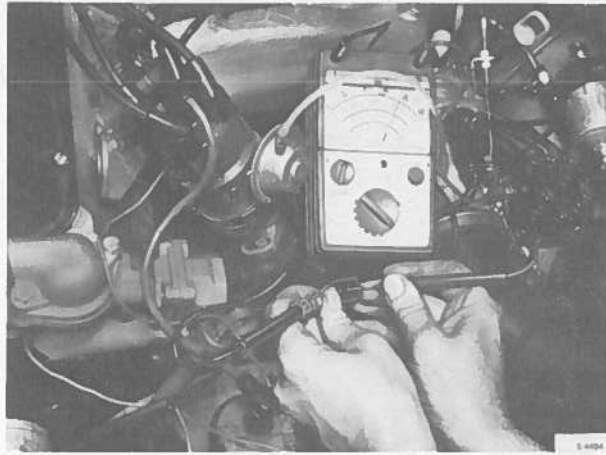


Warm-up regulator

Check the warm-up regulator lines 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 breaks in the heating 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.



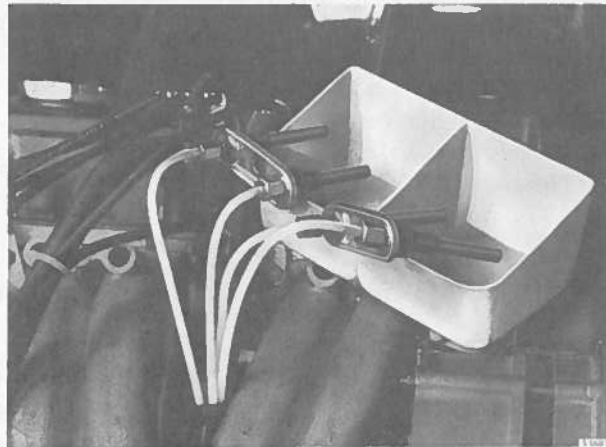
Performance and tightness of injection valves

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.

Caution

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



3. Switch on the ignition and remove the plug from the air flow sensor (up to and incl. 1976 model) or connect a jumper lead between terminals 15 and 87 in the relay holder (as from 1977 model).
4. Fuel atomization: Lift the lever in the air flow sensor and check the spray pattern 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, see under "Cleaning of injection valves".

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 be made) 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.

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

Temperature-sensing time switch

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

By means of connecting a test lamp in series across the contacts of the cold start valve plug, check that the switch closes when the engine is started.

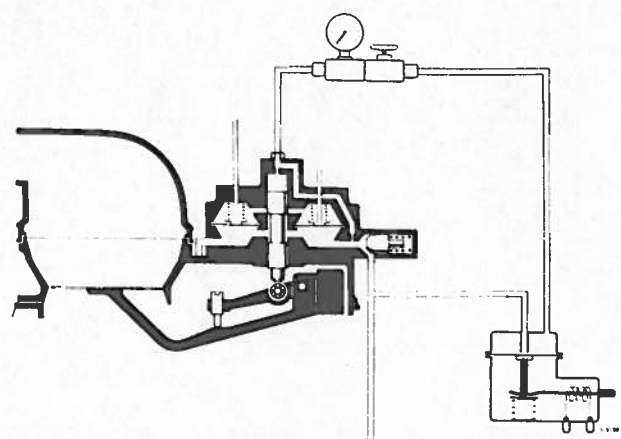
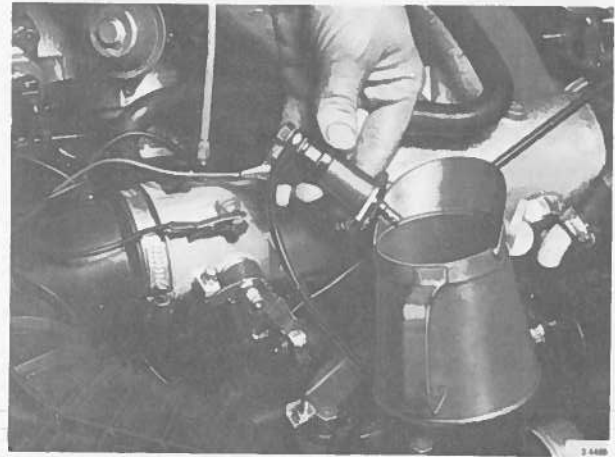
It is not possible to make a more accurate check of the cut-in time or temperature. If the condition of the switch is at all in doubt, the switch should be replaced.

Pressure reading

General

Connect pressure gauge 83 92 516 as follows:

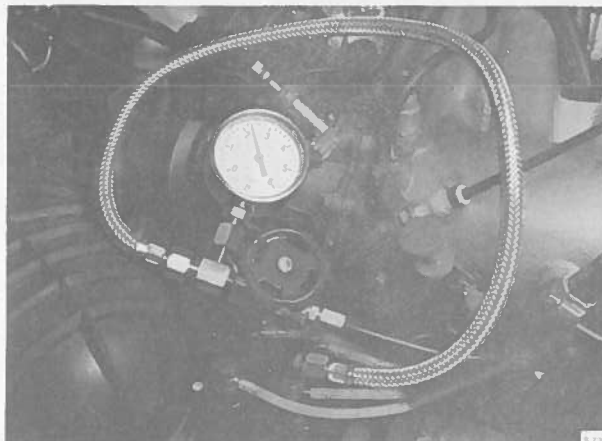
Disconnect the control pressure line from the fuel distributor and connect the pressure gauge between the fuel distributor and the line to the warm-up regulator.



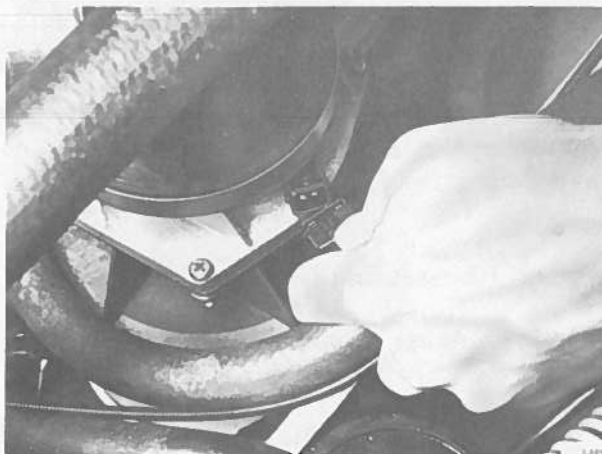
Connection of pressure gauge

Caution

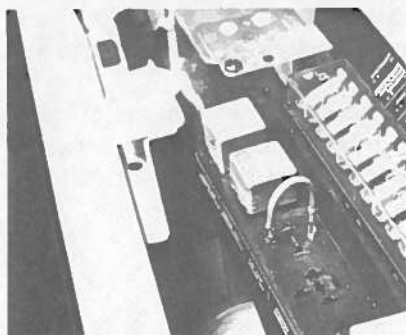
Up to early 1977 model the safety function governing the operation of the fuel pump is regulated by means of a switch on the air flow meter. As from 1977 model, the safety function is governed by a pulse sensor in the pump relay which is actuated by the ignition pulses.



Up to early 1977 model: Isolate the safety circuit by disconnecting the terminal at the air flow sensor. Thus, the fuel pump will cut in as soon as the ignition is switched on.



As from later 1977 model: Disconnect the fuel pump relay and connect a jumper lead across terminals 30 and 87 in the relay holder. The fuel pump will then cut in.



Control pressure, engine cold

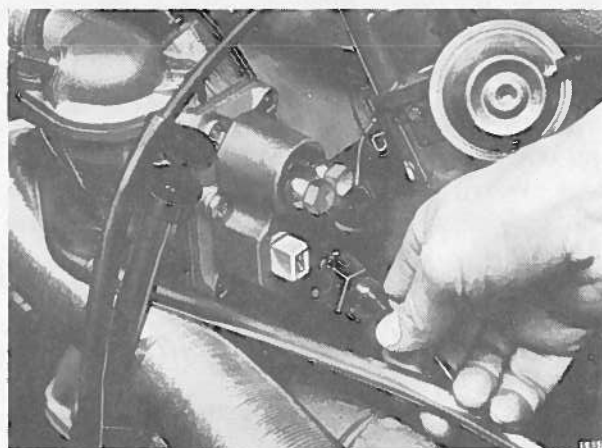
Carry out this test if poor engine performance has been experienced during cold starting and the warming up period.

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. See the test values in section 022.

If the values should differ, replace the warm-up regulator.



Control pressure, engine warm

Carry out this test when poor performance has been experienced when the engine is warm.

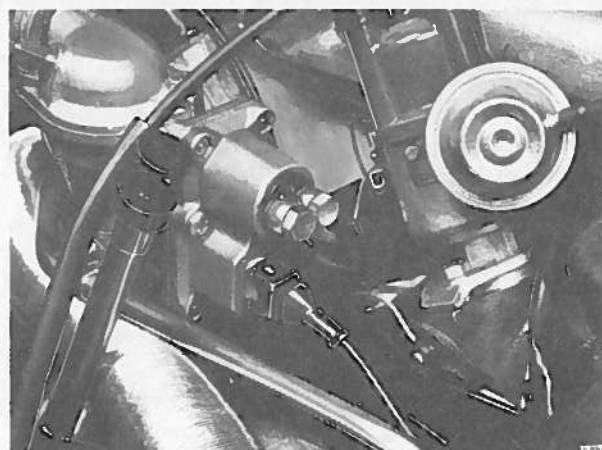
Open the valve.

Connect the warm-up regulator plug.

Leave the ignition switched on until final pressure has been attached.

See 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.

See 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 low line pressure:

Low pressure from the fuel pump.

Clogging of the strainer in the tank.

Leakage in the fuel line.

Line pressure regulator faulty.

In the case of high 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 of a 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. See the test values in section 022.

If the pressure drops too rapidly, the fault can be located by carrying out the test with the valve closed.

If the values obtained from this test are correct, the warm-up regulator (shut-off valve as from 1978 model) is faulty.

If the pressure drop is still excessive, the following components could be faulty:

The fuel pump

The fuel distributor

The injection valves

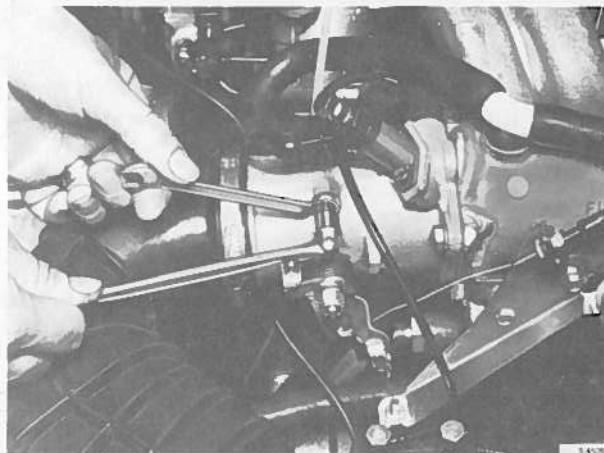
The cold start valve

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".

Idling adjustment (engine speed and CO value)

Revolution setting

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



To adjust the CO value, remove the plug from the small hole located between the fuel distributor and the rubber bellows and insert Allen key 83 92 482. As from 1977 model, the plastic plug in the adjusting hole must be removed.

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.

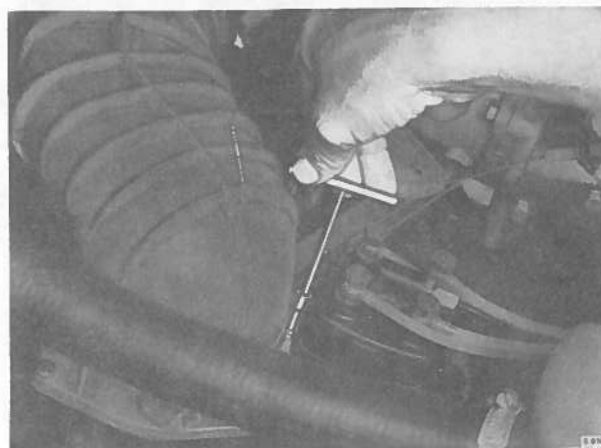


Caution

Remove the Allen key from the adjusting screw after each adjustment. If the key is left in the screw and the engine is 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

As from 1976 model:

If the idling speed is erratic or if difficulty is encountered in reducing the idling speed, check the setting of the deceleration valve.

See section 254. For exhaust gas extraction, see the next page.

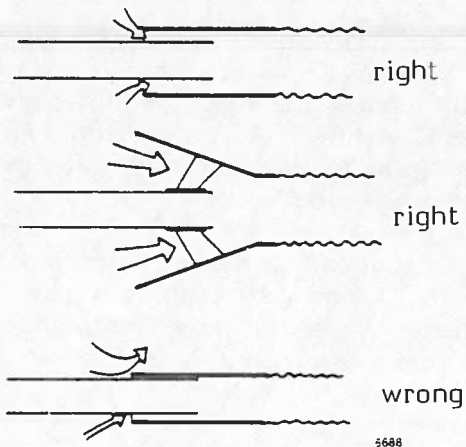
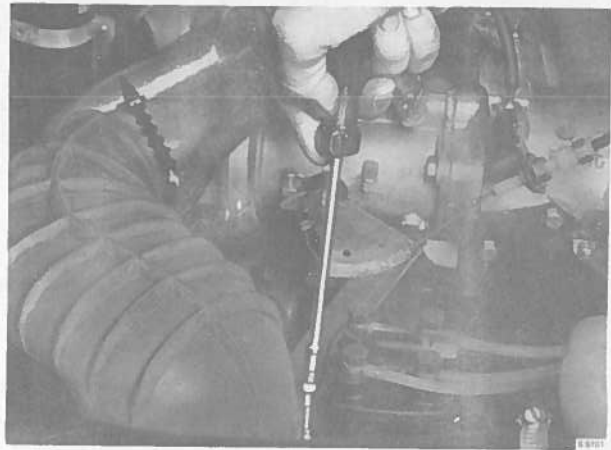
Connection to exhaust extraction equipment

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

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

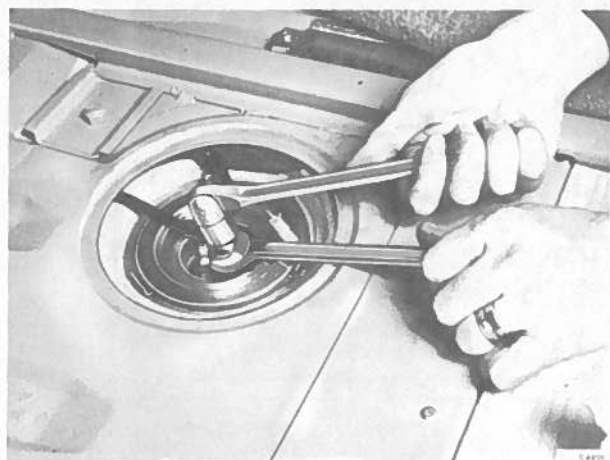
TO AVOID EXCESSIVELY POWERFUL EXHAUST EXTRACTION, CONNECT A HOSE WITH AN OPEN COUPLING.



Dismantling and assembly repairs and adjustment

Removal, metal tank up to and including 1979 model

1. Disconnect the battery to prevent flashover and the risk of fire when the fuel tank has been opened.
2. Roll back the carpet in the trunk compartment (Saab 99 Cmbi Coup : 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. Remove the rubber cover from the pump and disconnect the electric wiring from the pump.
4. Disconnect the fuel line from the pump. Hold the pump by means of an open-ended spanner when loosening the connection.



5. Using tool 83 92 433, turn the pump mounting anti-clockwise to the nearest groove, to unlock the bayonet socket. Lift out the pump unit and save the O-ring.



Note

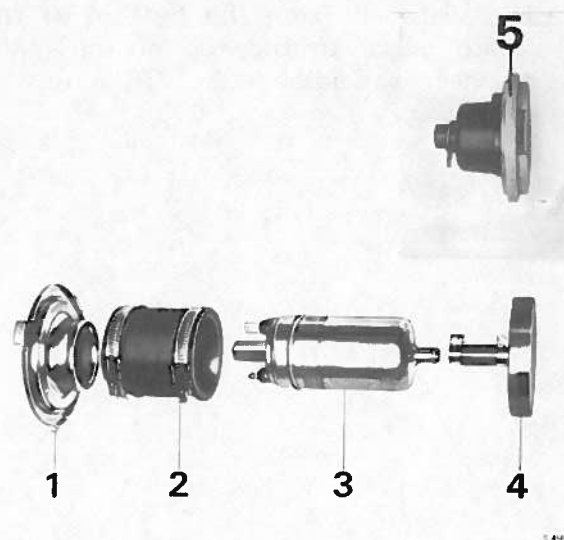
The pump can only be removed in one position, as one of the bayonet tongues is wider than the others.

6. Suitably cover the tank opening.



Dismantling (metal tank)

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



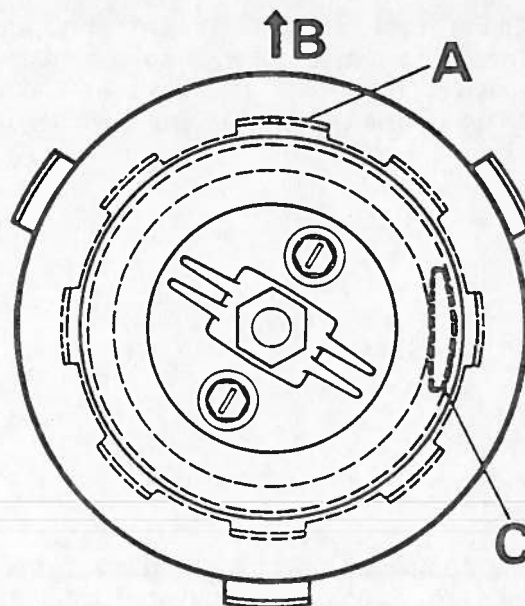
Fuel pump, dismantled

1. Bayonet socket
2. Adapter
3. Fuel pump
4. Splash guard with suction strainer up to and incl. 1976 model
5. Splash guard with suction strainer as from 1977 model.

Assembly (metal tank)

Assemble the pump. Note the following:

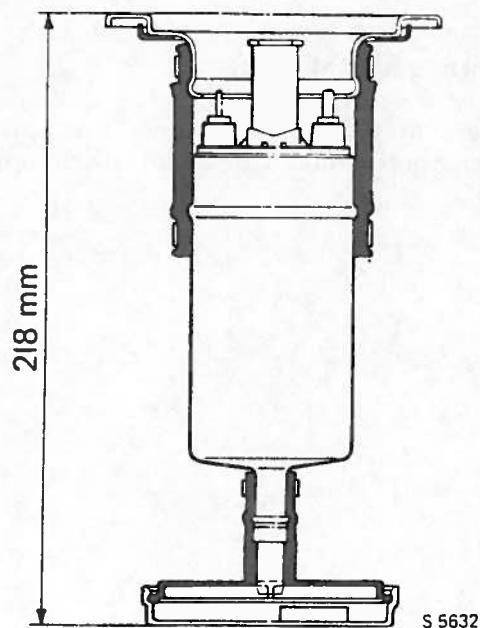
1. Turn the pump in the mounting so that none of the electric connections are in line with the wide tongue of the bayonet socket which is equipped with a locking groove. If this is neglected, the electric connection will be in the way of the fuel line.
2. Turn the splash guard so that the indent in it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

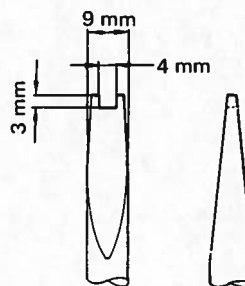
1. Place the O-ring over the tank opening and mount the pump unit. The pump unit can only be fitted in one position owing to one bayonet socket tongue being wider than the others. The wider tongue is provided with a locking groove.
2. Tighten the pump unit by means of tool 83 92 433.
3. Connect the electric wiring 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 (as from 1978 model)

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

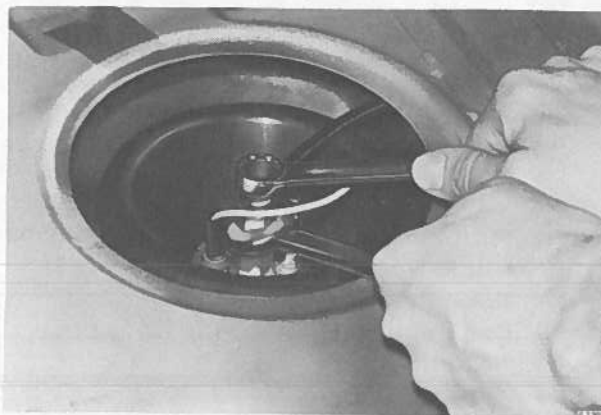
Avoid tightening the valve too hard, as this may damage it.

<p>Torque 0.4-0.6 Nm (2.9-4.3 ftlb, 4-6 kgcm)</p>
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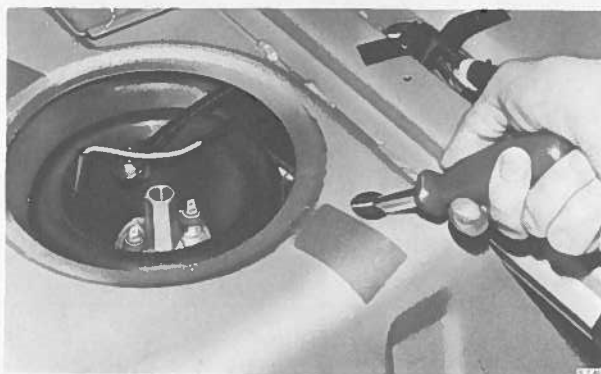


Removal (plastic tank, as from 1980-model)

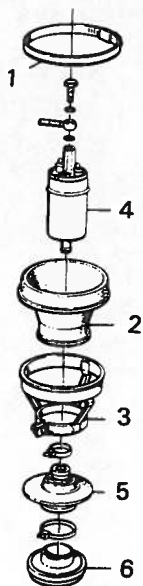
1. Disconnect the battery.
2. Remove the rear floor panel in the luggage compartment and remove the round cover from above the fuel pump.
3. Detach the fuel pump electrical connections.
4. Disconnect the fuel pipes from the pump. Use an open-ended spanner to hold the pump steadily while loosening the banjo connections.



5. Use a jointed screwdriver to undo the pump mounting clamp.



6. Lift out the pump.

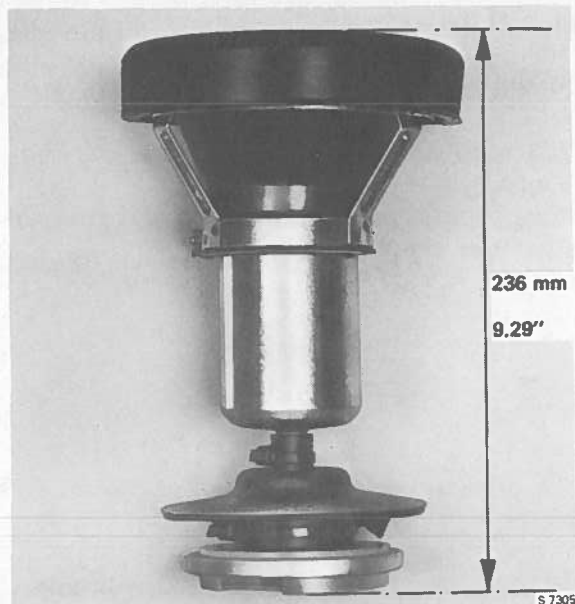


Fuel pump

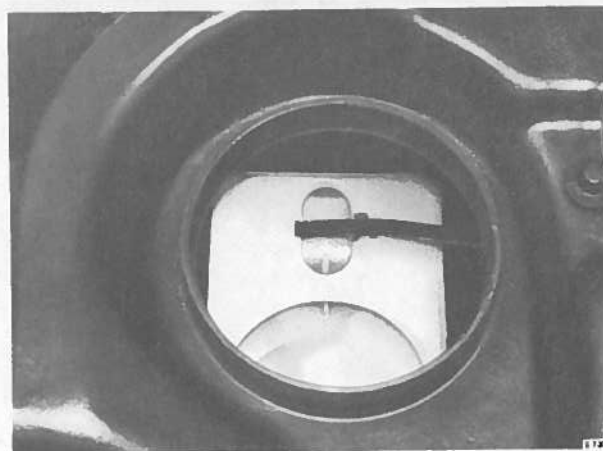
1. Clamp
2. Fitting collar
3. Pump support
4. Pump
5. Connecting bellows
6. Suction strainer

Installation (plastic tank, as from 1980 model)

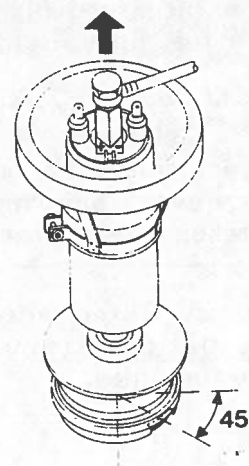
1. Position the pump on the mounting so that the distance between the base of the suction strainer and the upper edge of the rubber mounting is 236 mm (9.2 in).



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



3. Fit the pump unit in the tank as follows:
 - Tilt the + electrical connection to the left (as viewed towards the front of the car).
 - Tilt the suction strainer inlet 45° backwards to the right (as viewed towards the front the car).

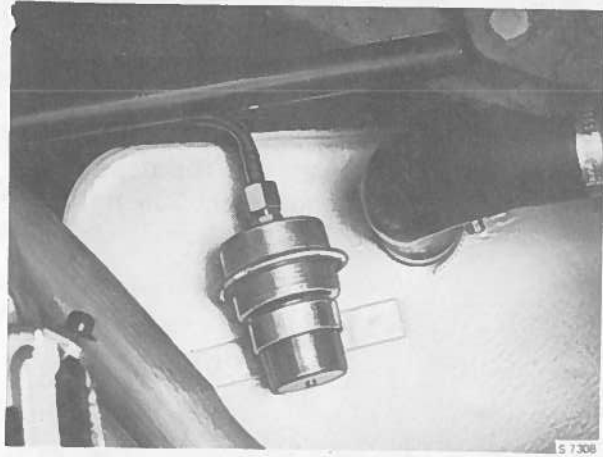


Removal is in the reverse order.

Fuel accumulator

Removal

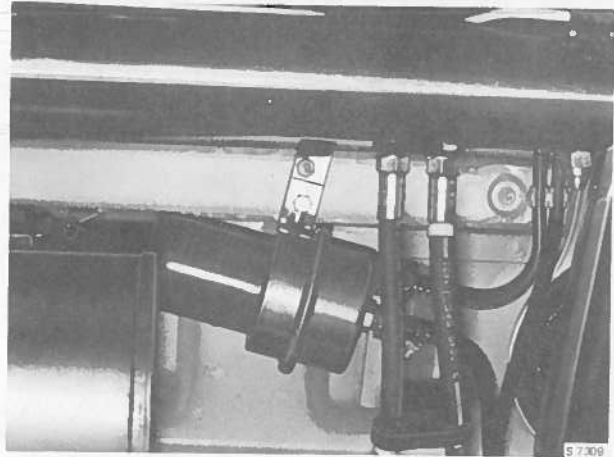
1. Clean the area around the fuel connections.
2. Disconnect the connections and remove the fuel accumulator.



Fitting

1. Mount the accumulator to 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 fuel 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 lines.

Replacing the air cleaner element

1. Remove the rubber bellows between the air flow sensor and the throttle valve housing.
2. Remove the retaining bolts holding 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 between the air flow sensor and the throttle valve housing.



4. Remove 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.

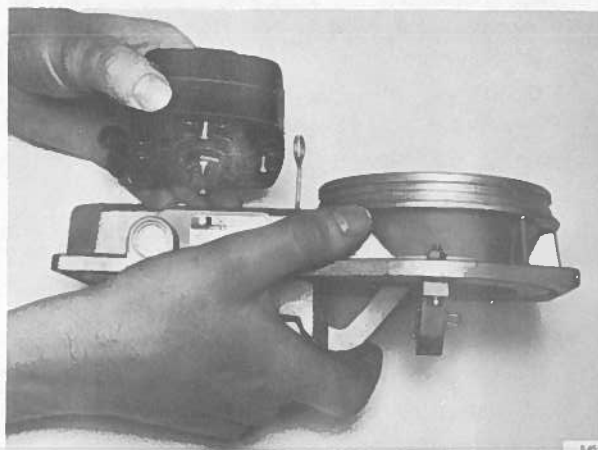


Fuel distributor

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.

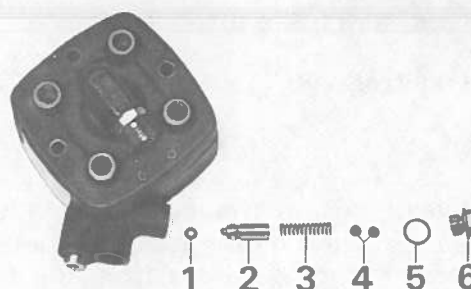
On assembly of the fuel distributor, ensure that the O-ring is located in its groove. Tighten the three retaining bolts with a torque of 3.2-3.8 Nm (2.3-2.7 ftlb, 32-38 kgcm).



Line pressure regulator

Up to and incl. 1977 model

The line pressure regulator is located inside the screw plug at the return line on the fuel distributor. It consists of a plunger with O-ring, coil spring, shims, screw plug and copper washer.



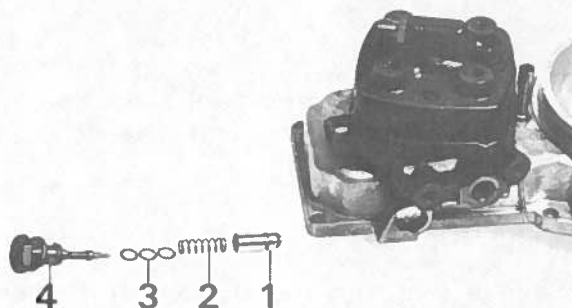
Line pressure regulator, up to and incl. 1977 model

1. O-ring
2. Piston
3. Coil spring
4. Shims
5. Copper washer
6. Screw plug

As from 1978 model

The function and appearance of the line pressure regulator are the same as before. However, the shims are now annular.

The shut-off valve for return fuel from the control pressure circuit is located in the screw plug.



Line pressure regulator, as from 1978 model

1. Piston with O-ring
2. Spring
3. Shims
4. Screw plug with O-ring and washer (contains shut-off valve for return fuel from control pressure circuit).

Adjusting the line pressure

After replacement of the O-ring, the line pressure must be checked and adjusted if necessary.

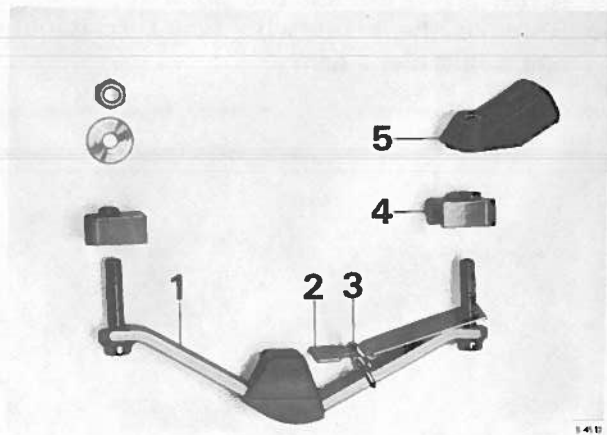
The pressure can be increased by fitting additional shims and decreased by removing shims.

A prerequisite for measuring and adjusting the line pressure 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 ftlb, 130-150 kgm).

Replacement of stop bracket

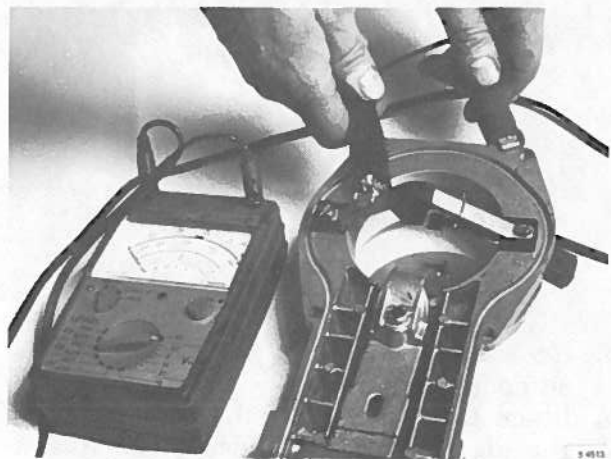
1. Separate the mixture control unit from the air cleaner.
2. Remove the lower plastic section of the air flow sensor.
3. Remove the two stop bracket mounting screws and remove the bracket, spring, insulation and connectors.



Stop bracket

1. Stop bracket
2. Stop ring
3. Wire loop
4. Insulation
5. Electric connector (up to early 1977 model)

Assemble in the reverse order. The order of the parts is shown in the illustration. Tighten the stop bracket with the prescribed torque of 4.7-5.3 Nm (3.4-3.8 ftlb, 47-53 kgcm). After reassembly, check the insulation between the air flow sensor and the stop bracket by means of a buzzer or an ohmmeter (not applicable to later 1977 model with a pulse-sensing fuel pump relay). Finally, adjust the rest position of the sensor plate.

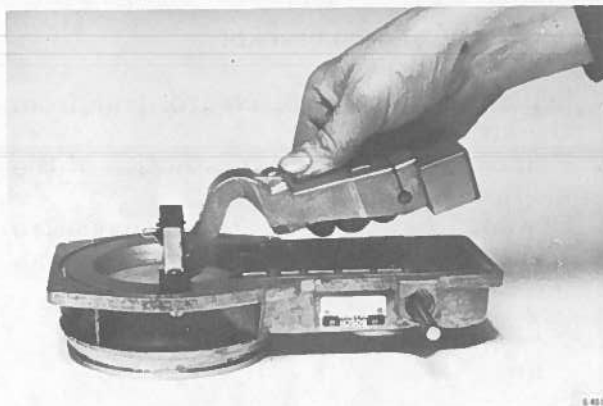


Checking the stop bracket insulation

Lever, adjustment arm and sensor plate

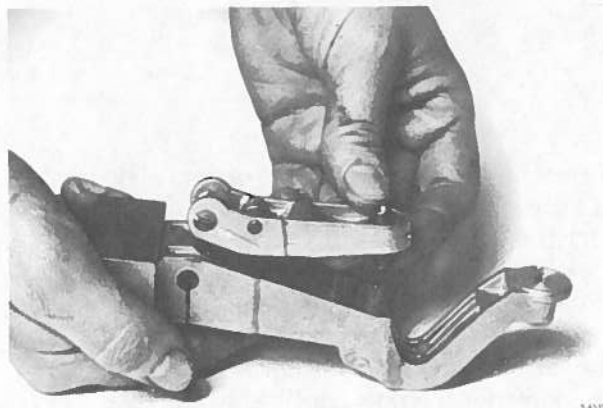
Removal

1. Remove the mixture control unit and remove the lower plastic section and the fuel distributor.
2. Remove the retaining screw 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 spindle.
5. Remove the lever with counter weight and adjustment arm.



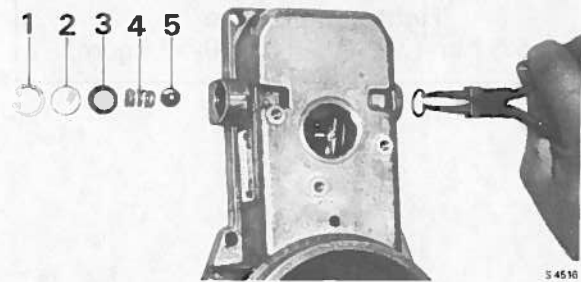
Assembly

1. Fit the counterweight to the lever but do not 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.



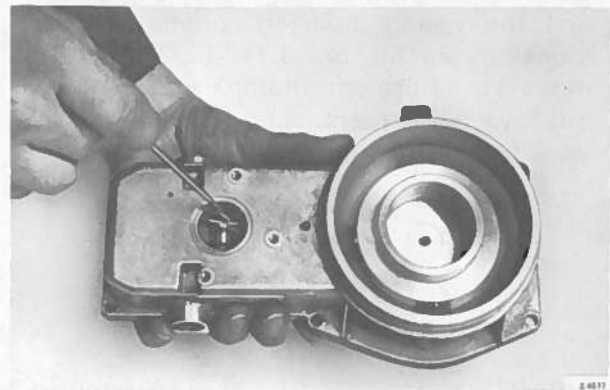
3. Grease both bearings with Bosch Ft2v2 silicone grease.
4. Place the lever with adjustment arm in the air flow sensor housing and mount the spindle.

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.



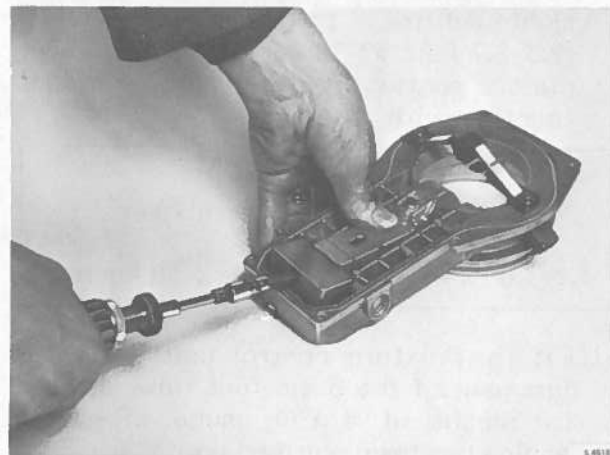
1. Circlip
2. Covering washer
3. Seal
4. Spring
5. Ball

6. Fit 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 in line with the hole in the sensor plate.



Tighten the counterweight.

Tightening torque
4.7-5.3 Nm (3.4-3.8 ft.lb., 47-53 kgcm)



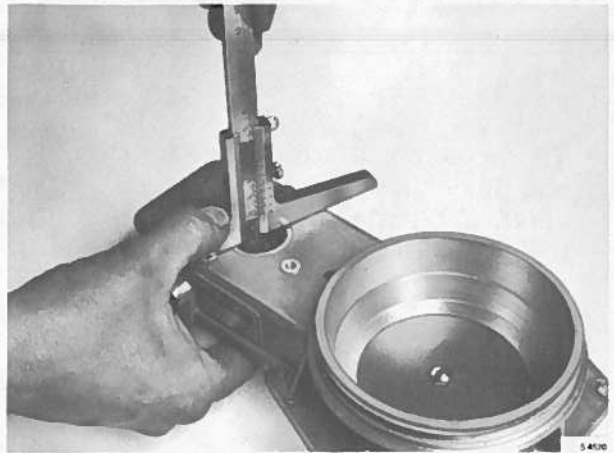
7. Fit the sensor plate retaining screw and tighten it. Check that the lever can be moved without any resistance being felt.

Tightening torque

5.0-5.5 Nm (3.6-4.0 ftlb, 50-55 kgcm)



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 between the joint surface of the fuel distributor (at 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 retaining screws should be tightened to a torque of 3.2-3.8 Nm (2.3-2.7 ftlb, 32-38 kgcm). Fit the lower plastic section of the air flow sensor together with the gasket.

Tightening torque

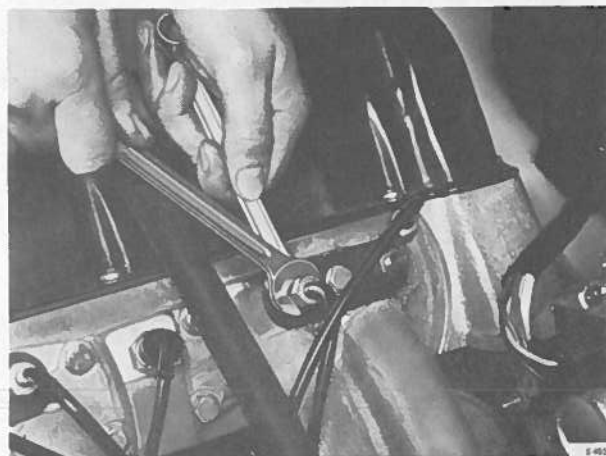
retaining screw of the mixture control unit

3.2-3.8 Nm (2.3-2.7 ft.lb., 32-38 kgcm)

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

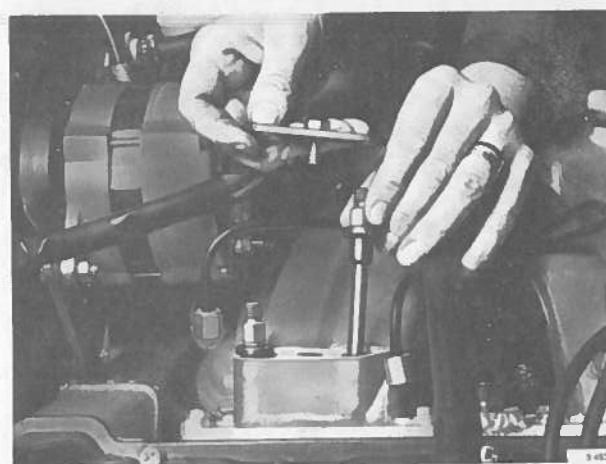
Replacing the injection valves

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.

Assemble 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.

Up to and incl. 1976 model:

Switch on the ignition and remove the plug of the safety circuit at the mixture control unit. This will allow the fuel pump to operate.

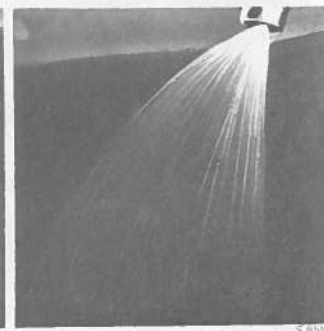
As from 1977 model:

Switch on the ignition, remove the pump relay and connect a jumper lead between terminals 30 and 87 in the relay holder. This will allow the fuel pump to operate.



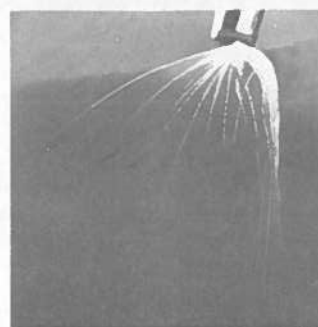
S 6596

Good atomisation

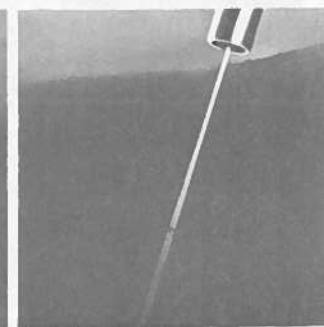


S 6595

Acceptable atomisation



S 6597



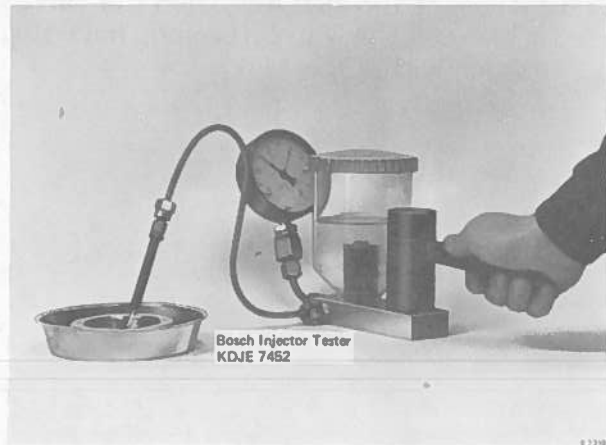
S 6598

Examples of poor atomisation

3. 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.

Injection valves which have been removed from the car can also be cleaned by means of an injector tester designed for diesel equipment. Cleaning with compressed air is not recommended.

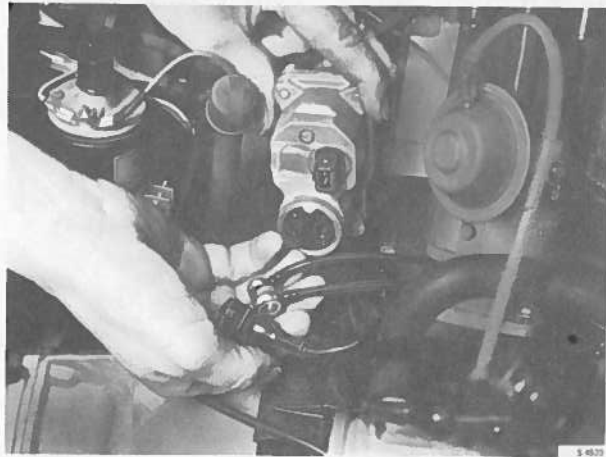
If the fault should persist, replace the injection valve.



Replacing the warm-up regulator

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

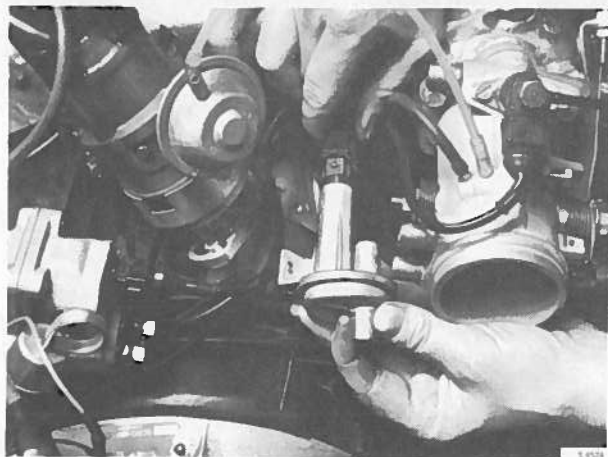
Assembly is carried out in the reverse order.



Replacing the auxiliary air valve

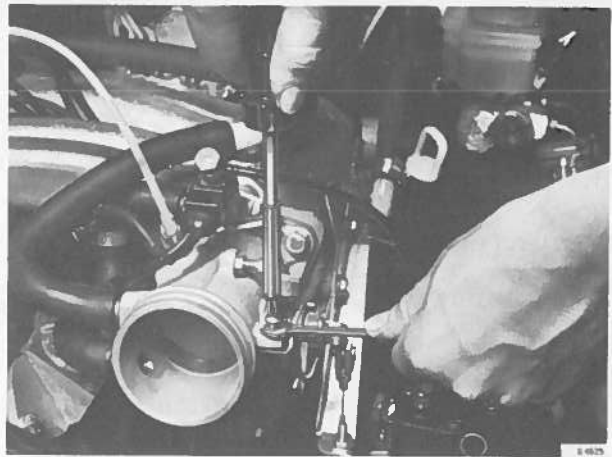
1. Pull off the hoses and disconnect the electric wiring.
2. Unscrew the auxiliary air valve.

Refit in the reverse order.



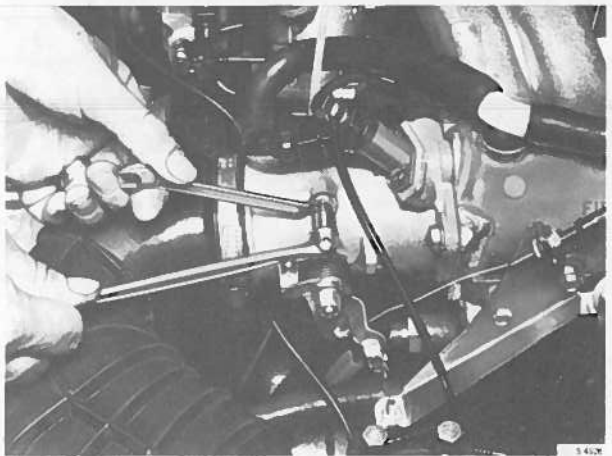
Adjusting the throttle valve stop

1. Check that the throttle valve is centred in the housing.
2. Turn the adjusting screw until it just makes contact with the stop tongue (throttle valve completely closed).
3. Turn the adjusting screw another one-third of a turn and lock it. 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 adjusting screw on the throttle valve housing by-pass passage. Adjustment should be made in connection with setting of CO value. See adjusting 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, engine cold

1. Check the operation of the cold start valve. Remove the valve and place it in a container. Fuel should be discharged from the valve when the starter motor is switched on and when the engine temperature is below $+113^{\circ}\text{F}$ ($+45^{\circ}\text{C}$). The injection time depends on the temperature.

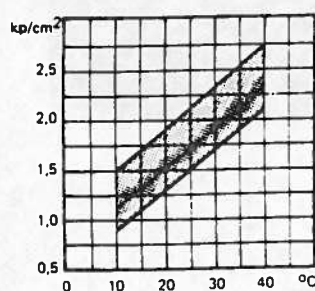
In the event of failure, check:

The cold start valve

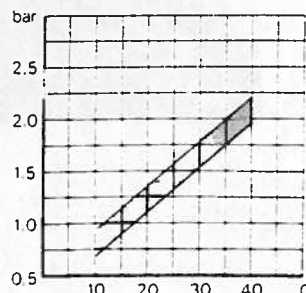
The temperature-sensing time switch

The electrical system

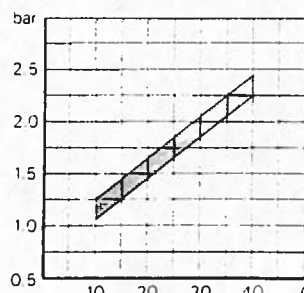
2. Measure the control pressure with the engine cold.



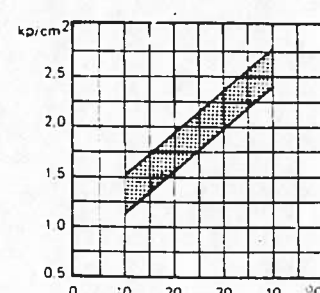
S 5200



As from 1977 model



As from 1980 model



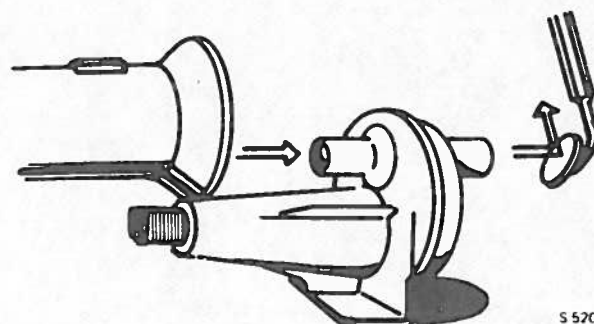
S 6244

Up to and incl. 1976 model As from 1977 model

Turbo
As from 1980 model

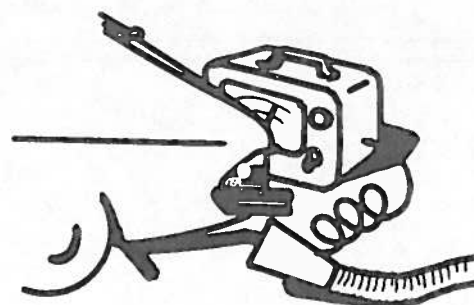
GLi

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



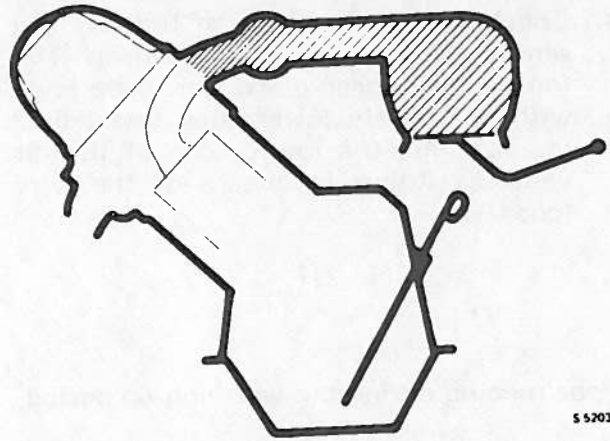
S 5201

4. Check the CO value (engine warm).



S 5202

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



S 5203

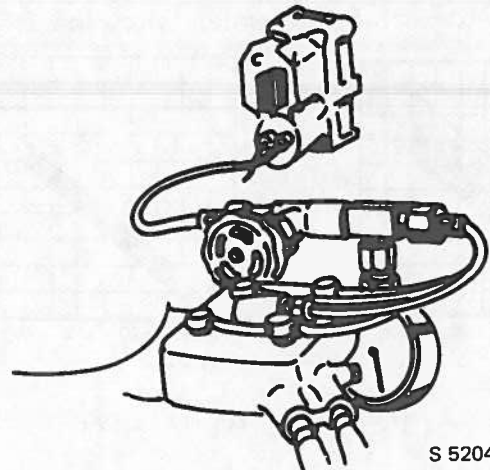
Starting difficulties, engine warm

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 (warm-up regulator disconnected).

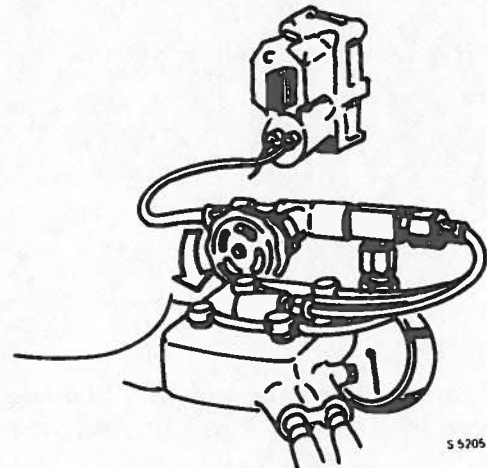
Possible leakage points:

Warm-up regulator
Non-return valve at fuel pump
Cold start valve
Line pressure regulator
Injection valves
External leakage

2. Check the control pressure with the engine warm.

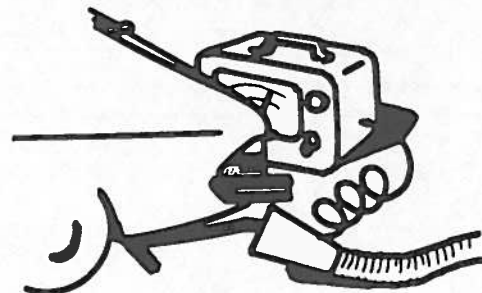


S 5204



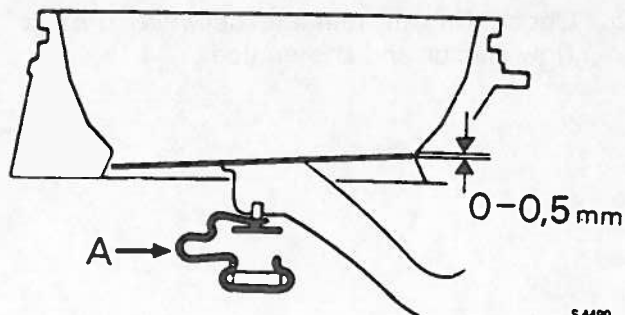
S 5205

3. Check the CO value (engine warm).



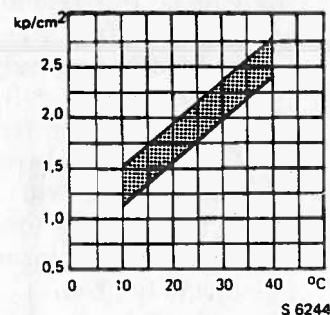
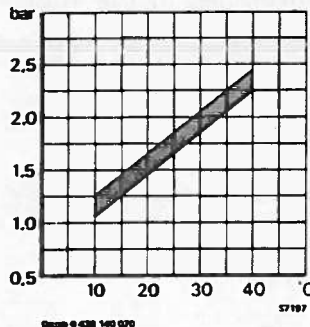
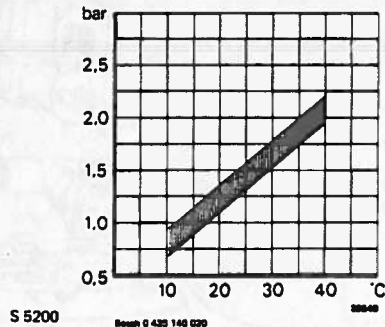
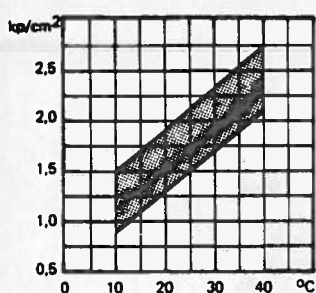
S 5202

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).



Poor running during the warming-up period

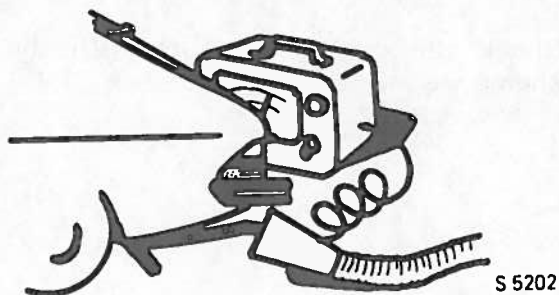
1. Check the control pressure with the engine cold. Excessive control pressure during the warming-up period produces a fuel-to-air mixture which is too lean.



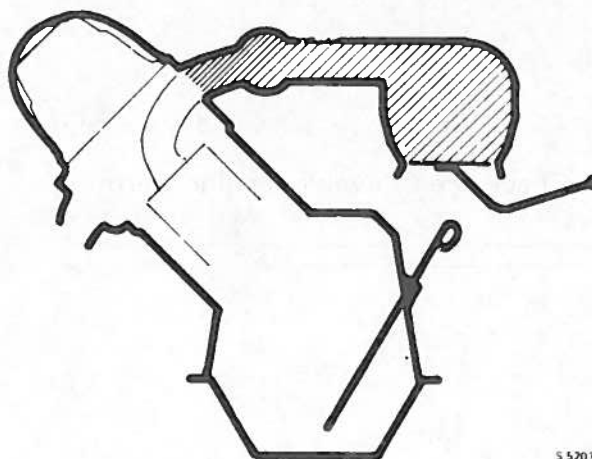
Up to and incl. 1976 model As from 1977 model

Turbo, as from 1980 model GLi

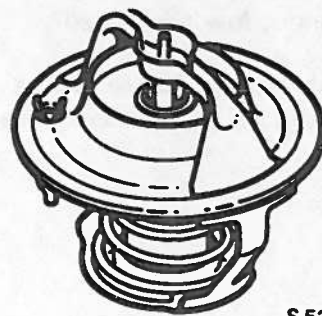
2. Check the CO value (engine warm).



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



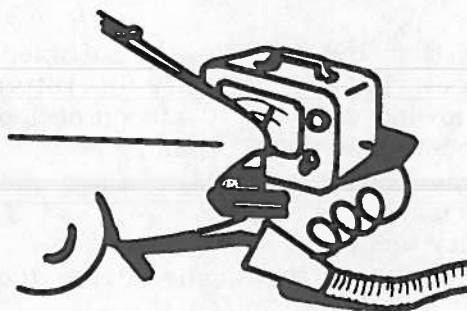
4. Check that the warming-up period for the engine is normal by observing the temperature gauge. An abnormally long warming-up period may be caused by a faulty thermostat.



S 5207

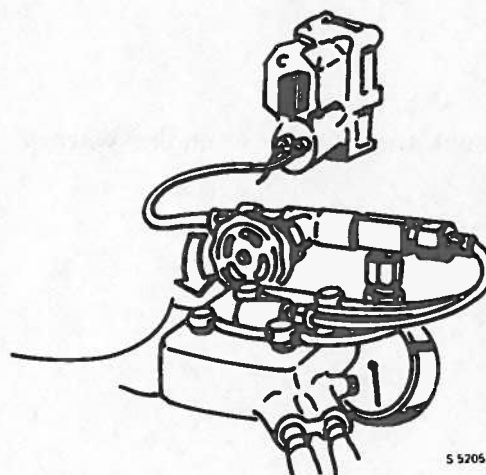
Poor running, engine warm

1. Check the CO value (engine warm).



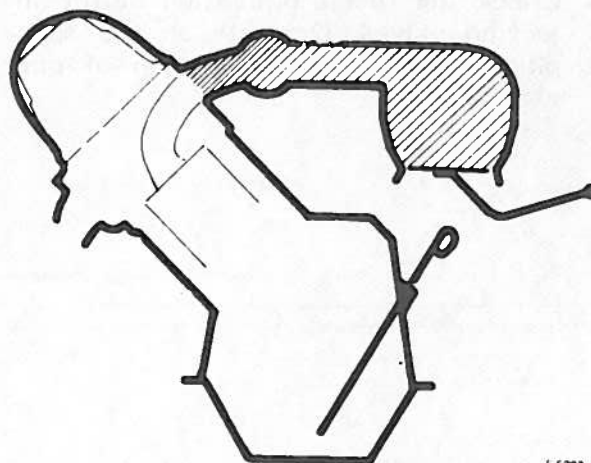
S 5202

2. Check the control pressure with the engine warm.



S 5205

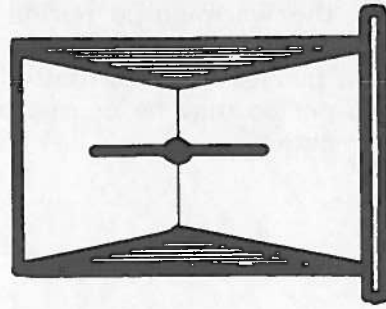
3. Check that there is no air leaking from between the air flow sensor and the engine.



S 5203

Poor performance, low top speed

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



S 5206

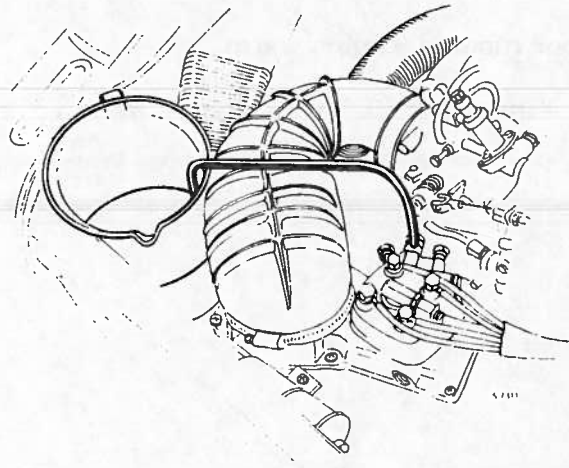
2. Check that the fuel flow is sufficient by measuring the quantity of return fuel flowing during a 30-second period. See under "Fuel pump capacity".

Faults can be caused by:

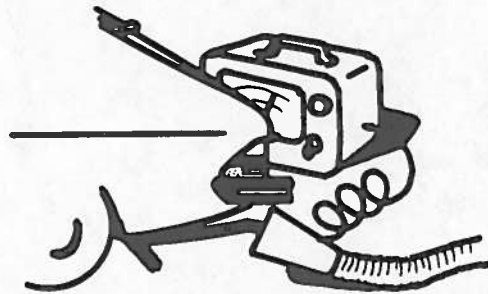
A faulty fuel pump

Low voltage of the supply to the fuel pump

A clogged filter or clogged fuel lines.

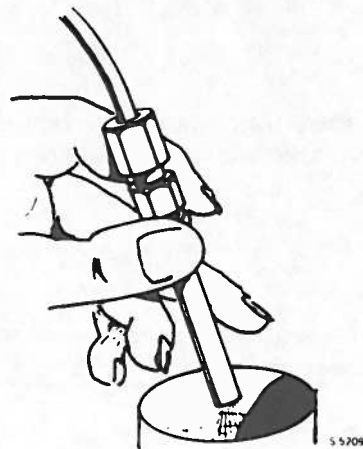


3. Check the CO value (engine warm).



S 5202

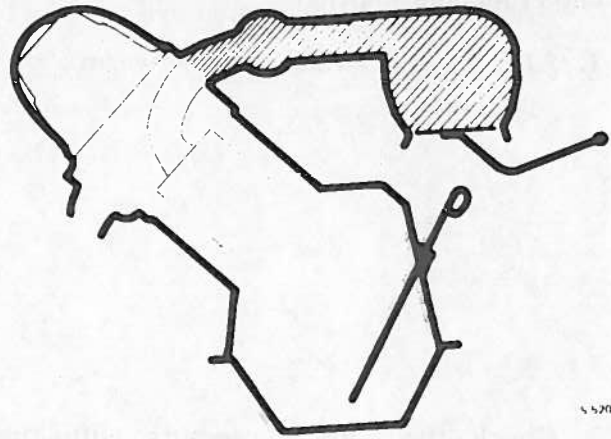
4. Check the fuel atomization of the injection valves. Deposits on the spark plugs can give an indication of poor atomization.



S 5209

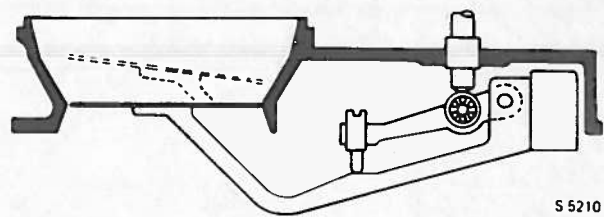
Irregular CO-value and idling speed, difficulty in adjusting

1. Check that there is no air leakage between the air flow sensor and the engine.

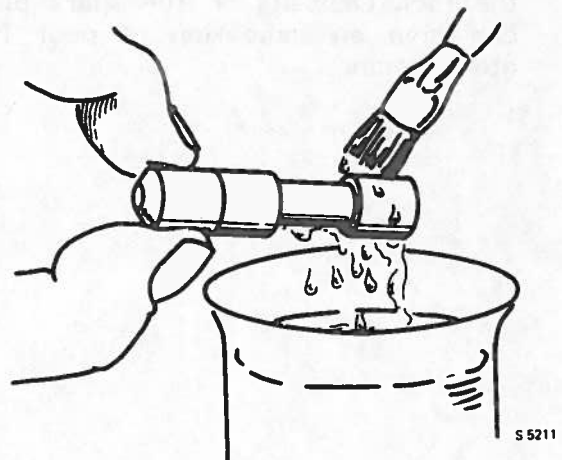


2. Check whether any parts of the air flow sensor are sticking as follows:
 - Run the engine until it is warm and then connect a CO meter.
 - Switch off the engine and then restart it without touching the accelerator. Read off the CO value.
 - Rev the engine to around 3000 r/min and then allow it to return to idling speed. If the CO value is different now from the earlier reading, either the control plunger or the lever is sticking.

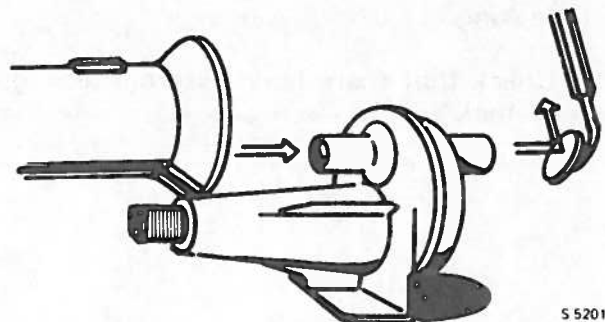
Check that the lever moves freely.



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

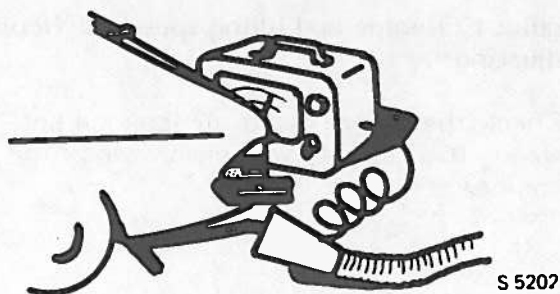


3. Check that the disc in the auxiliary air valve is not sticking.

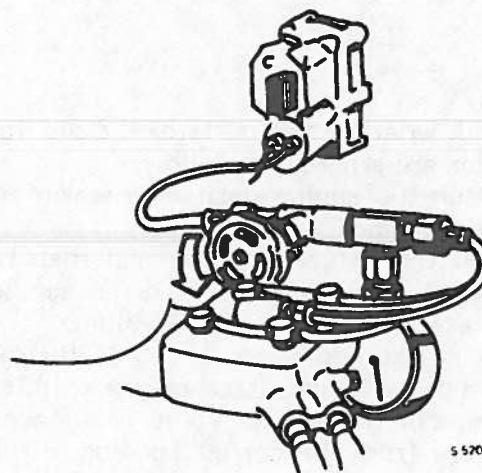


High fuel consumption

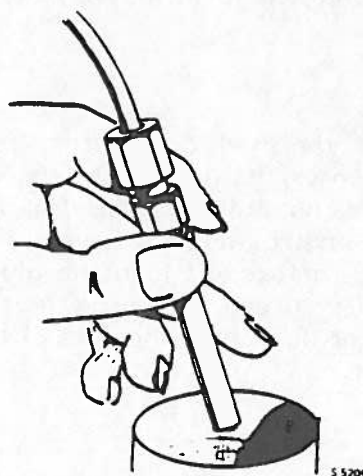
1. Check the CO value (engine warm).



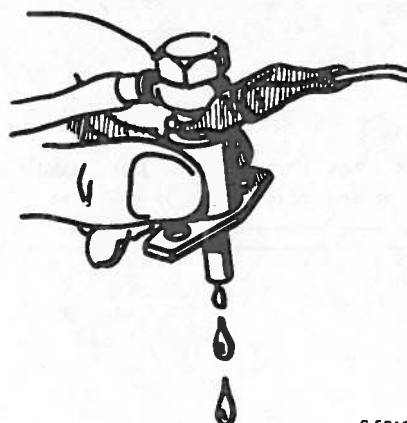
2. Check the control pressure with the engine warm. Low control pressure will cause a rich fuel/air mixture.



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



4. Check that the cold start valve is not leaking.
5. Check that there is no external leakage of fuel.



Exhaust system

General

The exhaust system comprises three parts. A muffler is mounted in the front pipe. The middle section consists of a pipe and a muffler mounted transversely 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. Remove the bolts securing the front exhaust pipe to the exhaust manifold.
3. Undo the clamp holding the connecting ring at the joint with the middle exhaust pipe and separate the pipes.

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

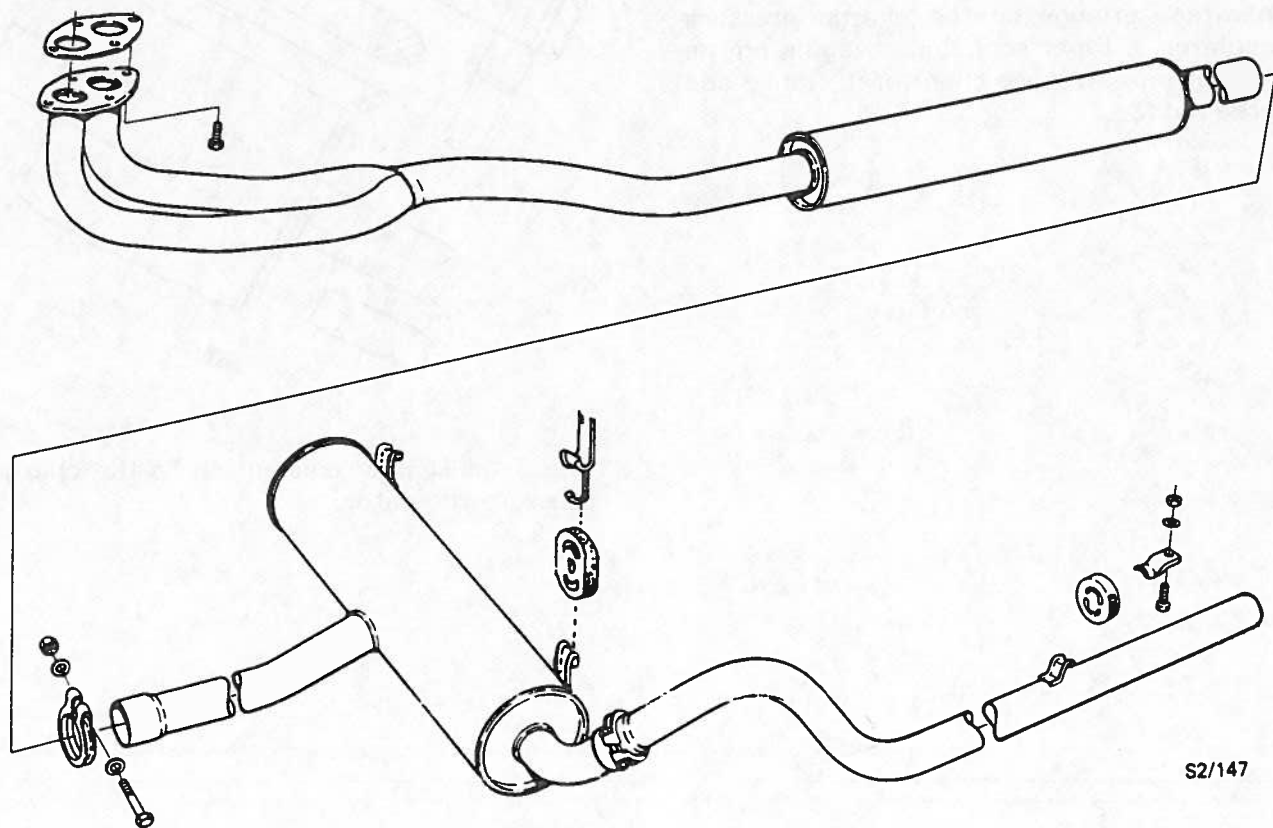
Removal of centre exhaust pipe and muffler and/or rear pipe

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

To remove the entire system, first release 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.



S2/147

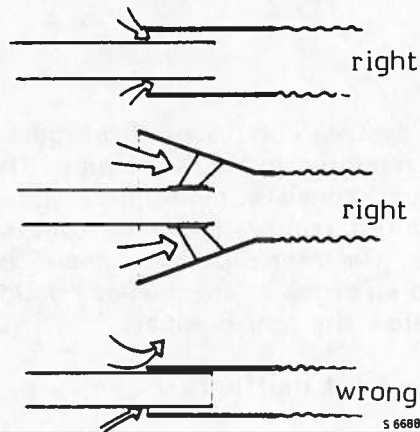
Connection to exhaust extraction equipment

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.

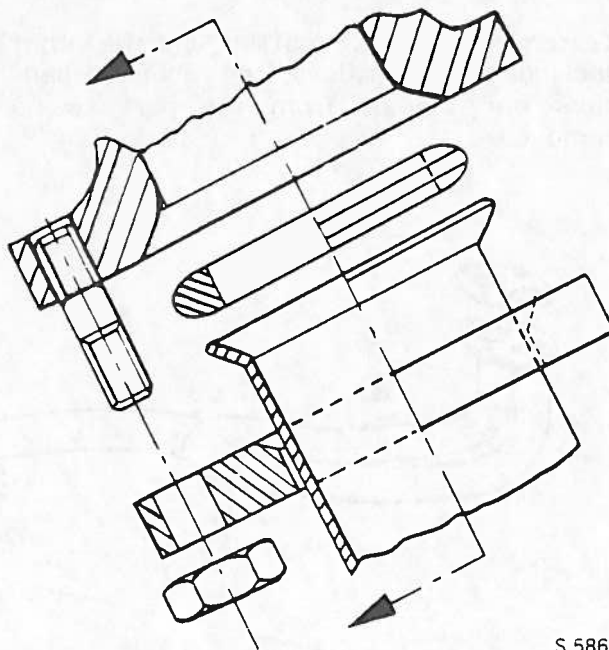
TO AVOID EXCESSIVELY POWERFUL EXHAUST EXTRACTION, CONNECT A HOSE WITH AN OPEN COUPLING.



EXHAUST SYSTEM, TURBO ENGINE

The exhaust system on cars with turbo-charged engines comprises pipes of a larger diameter than those on other Saab 900 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.



S 5860

The exhaust pipe connection to the charge pressure regulator.

Exhaust emission control system

Description

To conform to exhaust emission standards on certain markets, cars for these markets are equipped with special exhaust emission control systems. The following systems exist for exhaust emission control.

	Sweden 1975 model		Sweden As from 1976 model				Europe As from 1976 model		Turbo Europe and Sweden
	Carbu- retor engines	Fuel in jection engines	Carbureted engine		Fuel injection engines		Carbu- reted engines	Fuel in- jection engines	
			Manual trans- mission	Automa- tic trans- mission	Manual trans- mission	Automatic trans- mission			
Decelera- tion valve	x ¹⁾		x ²⁾	x ²⁾	x ³⁾	x ³⁾	x ¹⁾	x ³⁾	x ⁴⁾
Temperatu- re compen- sator	x		x	x			x		
Delay valve			x ⁵⁾		x ⁵⁾				x ⁶⁾
EGR				x ⁷⁾		x ⁸⁾			

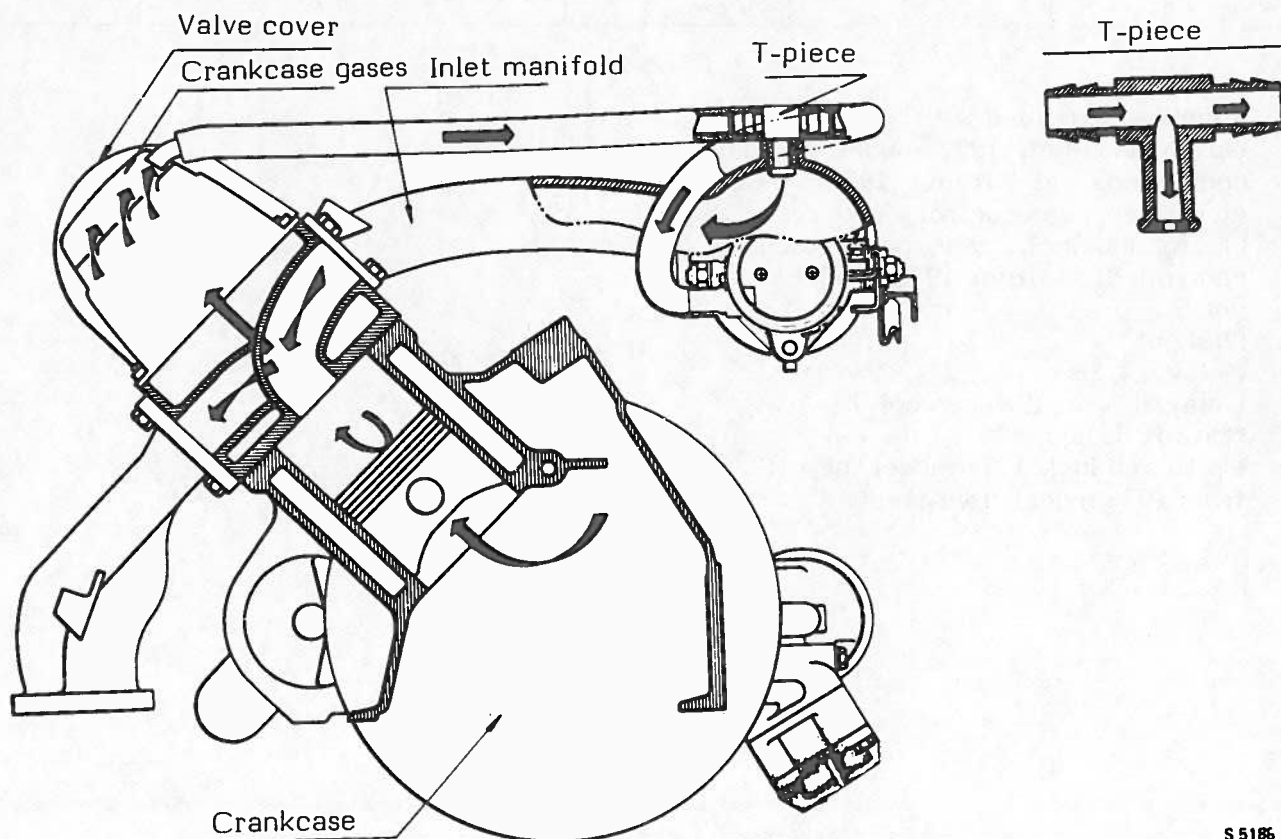
- 1) Vacuum-controlled
- 2) Up to and incl. 1977 model vacuum-controlled, as from 1978 model electrical speed control
- 3) Up to and incl. 1979 model vacuum-controlled, as from 1978 model dashpot.
- 4). Dashpot
- 5) Delay 6 + 2 s
- 6) Delay 20 + 4 s (Sweden only)
- 7) "On-off design
- 8) Up to and incl. 1977 model "on-off", as from 1978 model "two-step".

Crankcase ventilation

1975 model

The crankcase ventilation of the engine is totally enclosed.

The ventilation system consists of a hose from the valve cover, connected to a T-piece on the inlet manifold. From the T-piece, the hose runs to the air cleaner (throttle valve housing on cars with fuel injection engine). At its connection to the inlet manifold, the T-piece has a restriction which is calibrated to provide good evacuation of the crankcase gases in the engine under all operating conditions. The crankcase gases are evacuated through the T-piece directly into the inlet manifold under all conditions, except at full load, when the gases flow through the air cleaner (throttle valve housing) into the engine cylinders. On cars with carbureted engines, a flame trap is provided at the connection of the ventilation hose to the air cleaner.



Diagrammatic arrangement of crankcase ventilation, 1975 model

As from 1976 model

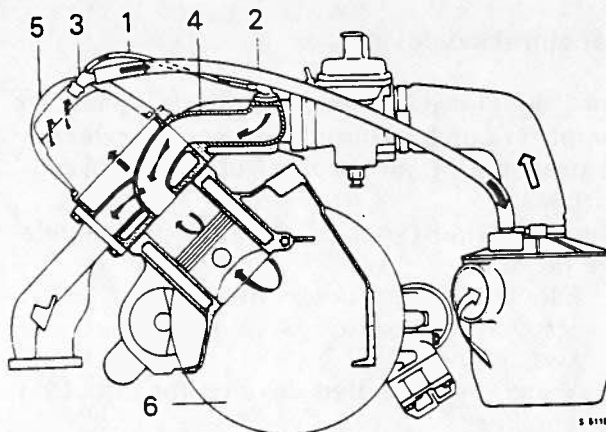
Crankcase ventilation

The crankcase ventilation of the engine is totally enclosed. The ventilation system consists of a three-way adapter at the valve cover, from which a small-bore hose is run to the inlet system upstream of the carburetor (throttle). The larger-diameter hose is connected as follows:

Carbureted engines: To the top of the air cleaner. Injection engines: To the throttle valve housing.

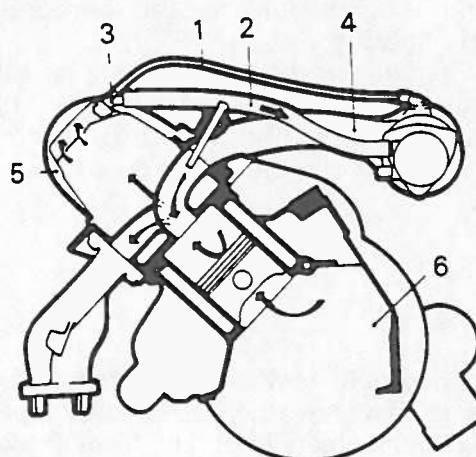
(Exception: on the 1977 model, the hose is connected between the air cleaner and the mixture control unit).

The hoses and their connections are designed to provide adequate evacuation of the crankcase gases in the engine under all operating conditions. The crankcase gases are evacuated through the small-bore hose directly into the inlet manifold under all conditions, except at full load, when the gases flow through the larger-diameter hose to the air cleaner (throttle valve housing) and then into the engine cylinders. On cars with carbureted engines, a flame trap is provided at the connection of the ventilation hose to the air cleaner.



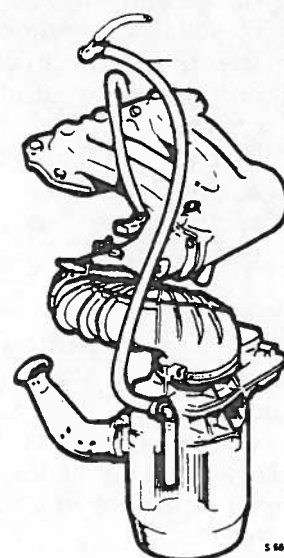
Crankcase ventilation on carbureted engines as from 1976 model

1. Hose between 3-way adapter and inlet manifold
2. Hose to air cleaner
3. 3-way adapter
4. Inlet manifold
5. Valve cover
6. Crankcase



Crankcase ventilation on carbureted engines, 1976 model and as from 1978 model

1. Hose between 3-way adapter and inlet manifold
2. Hose to air cleaner
3. 3-way adapter
4. Inlet manifold
5. Valve cover
6. Crankcase



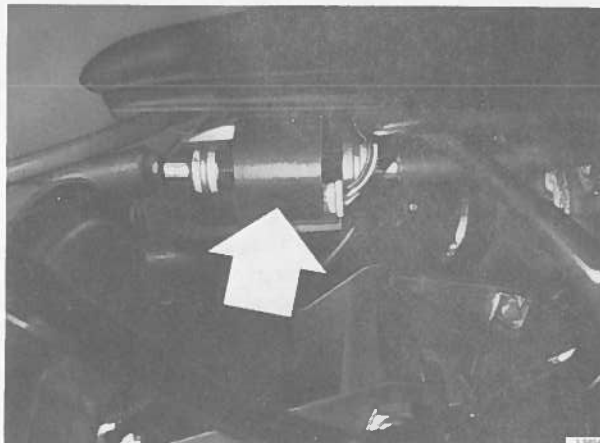
Crankcase ventilation on 1977 model

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:

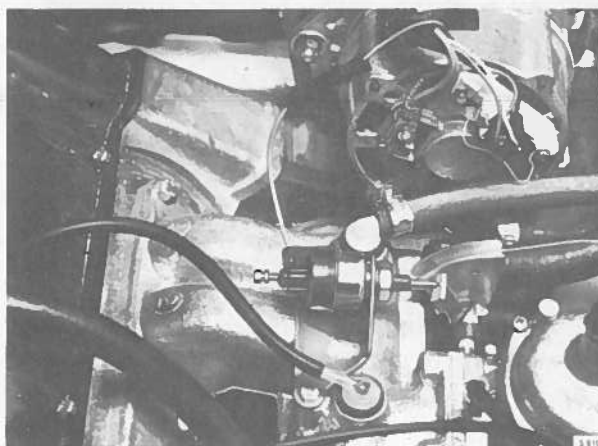
- Electric, speed-controlled
- Vacuum-controlled devices for carbureted engine
- Vacuum-controlled devices for injection engines
- Mechanical throttle damper device (dash pot)



Carbureted engines as from 1978 model:

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 carburetors (throttle housing).

The solenoid serves as a variable idling stop. During engine overrun, the idling speed is increased (approx. 1 500 rev/min) if the speed of the car exceeds 10 mph (30 km/h).



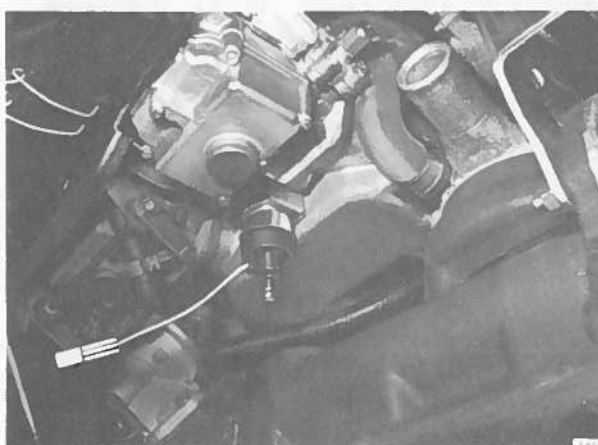
Checking

Checking should include the setting of the deceleration valve (increased idling speed) and the performance 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 accelerator pedal. Check that an increased idling speed of 1 500 r/min.

Adjustments should be made on the solenoid adjusting screw and then recheck the setting by revving the engine again.

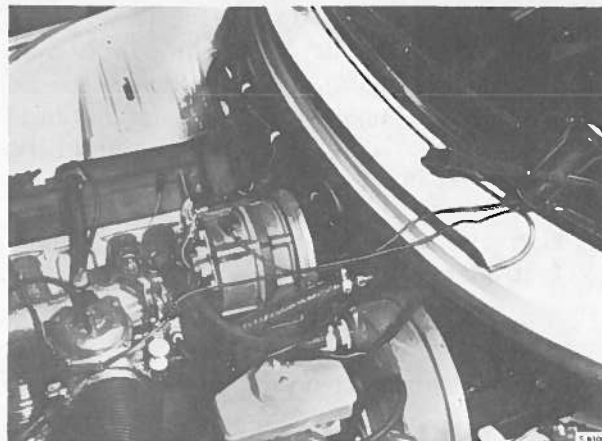


Caution

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 (performance 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. Drive the car and select neutral when the car is travelling at about 25.0 mph (40 km/h). Brake lightly and check that the test lamp goes out at about 18.3 ± 3 mph (30 ± 5 km/h). (The speed transmitter can also be checked by listening for the time at which the engine speed drops or by means of a tachometer.)



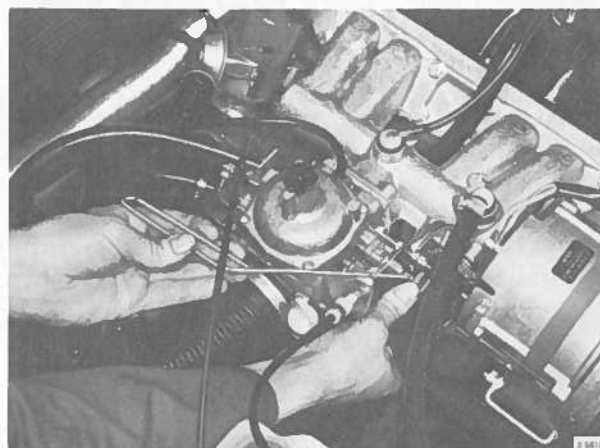
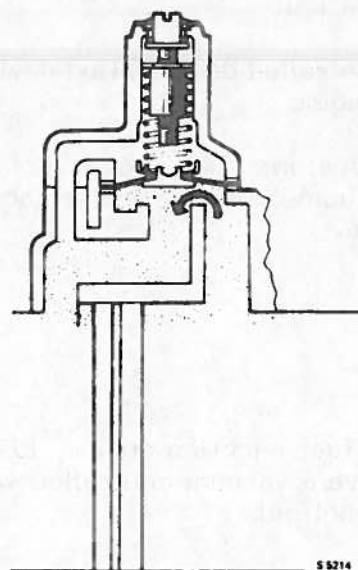
Vacuum-controlled deceleration device, carbureted engines up to and incl. 1977 model

The valve is a diaphragm valve which is opened by the vacuum on the inside of the throttle valve. This ensures a sufficient fuel/air mixture to ensure good combustion during overrun braking.

If the engine tends to run at an excessively high idling speed, the reason may be a faulty or incorrectly adjusted deceleration valve.

To adjust

1. Run the engine until it and the carburetor are at normal operating temperature. Note that the air preheater must be set to the position recommended for the season of the year.
2. Run the engine at idling speed and check that the deceleration valve is closed. If in doubt, turn the deceleration valve adjusting screw a few turns counter-clockwise.
3. Adjust the fuel flow and the engine speed to the specified idling values. (If in doubt, check also the ignition setting).
4. Open the deceleration valve fully by turning the adjusting screw clockwise until the engine speed no longer increases (approx. 1500-1800 r/min).
5. Close the deceleration valve carefully by turning the adjusting screw counter-clockwise to the position in which the valve just closes (engine speed reduced back to normal idling speed). Then turn the deceleration valve adjusting screw a further $1/2$ - $3/4$ turns counter-clockwise.



6. Check by revving the engine from idling speed up to about 3000 r/min and then quickly releasing the accelerator pedal to its idling position. The engine should then distinctly return to normal idling speed, although with a slight delay. If this is not the case, turn the deceleration valve adjusting screw slightly further counter-clockwise.

Removing and refitting

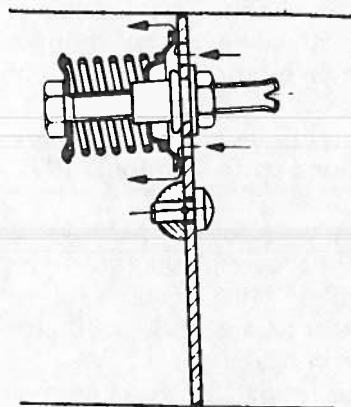
The valve unit can be removed by removing the three slotted-head screws.

Before refitting, scrape the surfaces clean to remove any gasket residues, and always fit a new gasket.

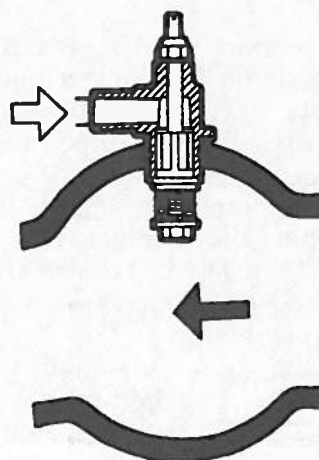
Vacuum-controlled deceleration device, injection engine

Cars with fuel injection engine, 1976 model have a vacuum-controlled valve located in the throttle.

Cars with fuel injection engine, 1977-1979 models, have a vacuum-controlled valve on the inlet manifold.



S 5215



S 5634

Checking

1. Run the engine until it is thoroughly warm.
2. Connect a tachometer and adjust the idling speed to 875 r/min.
3. Raise the engine speed to 3000 r/min and measure the time (using a stop watch) from when the throttle is release until the engine speed has fallen to the value adjusted according to point 2 above.

The retardation time should be:

1976 model 4-5 s

As from 1977 model 4-5 s

Adjusting, up to and incl. 1976 model

1. Fit the rubber bellows between the air flow sensor and the throttle valve housing.
2. Release the lock nut of the valve screw and turn the adjusting screw the number of turns obtained from the adjusting curve. Tighten the lock nut.

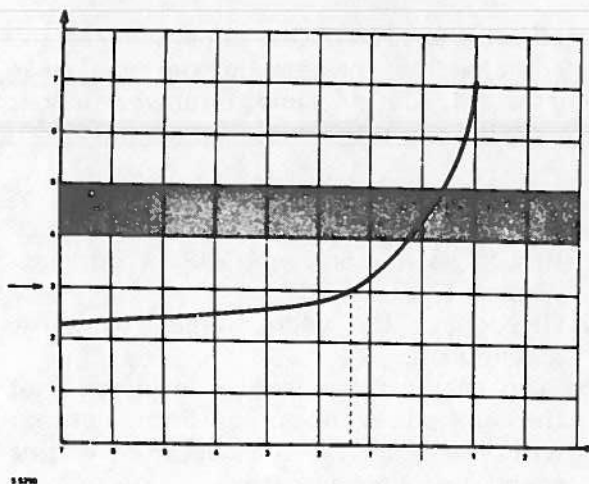


3. Fit the rubber bellows.
4. Repeat the check.

Example: The check revealed that the retardation time is 3 seconds.

Plot in the graph at 3 on the time axis.

Follow the horizontal line to the curve and then project the point down to the adjustment axis. The reading is about $1 \frac{1}{3}$ turns clockwise. Turn the adjusting screw $1 \frac{1}{3}$ turns clockwise.



Adjusting, as from 1977 model

1. Connect a tachometer and run the engine until it is warm.
2. Screw the adjusting screw up until the valve is fully closed.
3. Adjust the air screw at the throttle valve housing until the correct idling speed is obtained.
4. Screw down the adjusting screw until the speed is 1600 r/min.
5. From this position, screw the adjusting screw two turns upwards.
7. Check the retardation time and carry out fine adjustment if necessary.

Note

If the cooling fan cuts in while the retardation time is measured, the measurement will be incorrect. This can be avoided by disconnecting the cable from the temperature-sensing switch of the cooling fan for a short period while measurements are being made.

Dashpot

(Turbo and cars with fuel injection engines as from 1980 model)

The dashpot achieves mechanical damping of the the throttle spindle during closure.

Checking

1. Run the engine until it has been thoroughly warmed up.
2. Connect a tachometer and adjust the idling speed to 875 r/min.
3. Rev up the engine to 3 000 r/min and measure the time (with stop watch) between releasing the throttle and the moment at which the engine speed has fallen back to 875 r/min.
The retardation time should be 3-6 seconds.

Setting

To adjust the retardation time, release the lock nut on the throttle damper and raise (shorter retardation time) or lower (longer retardation time) the throttle damper.

Basic setting:

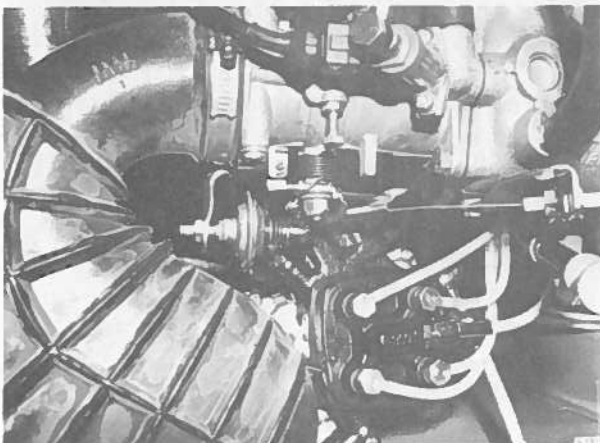
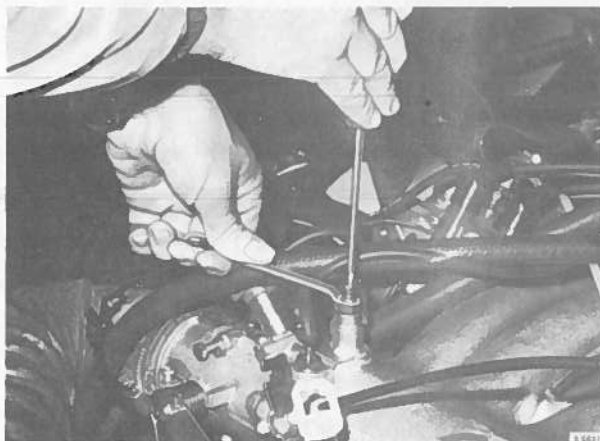
1. Run the engine until warm and check that CO-value and ignition are correctly set.
2. Disconnect the vacuum pipe from the distributor.
3. Turn the throttle lever and check that the dashpot rod comes into contact with the stop and the specified engine speed (use a tachometer).

Engine speed when dashpot hits throttle lever	
1979 model (Turbo)	2600 ± 100 r/min
1980 model (fuel injection)	2000 ± 100 r/min

4. Rev up the engine and check that it returns to idling speed within the prescribed delay time.
5. Re-connect the vacuum pipe.

Temperature compensation

Carbureted engine cars are fitted with temperature compensator which maintains a constant fuel/air ratio regardless of the engine temperature. See section 231.

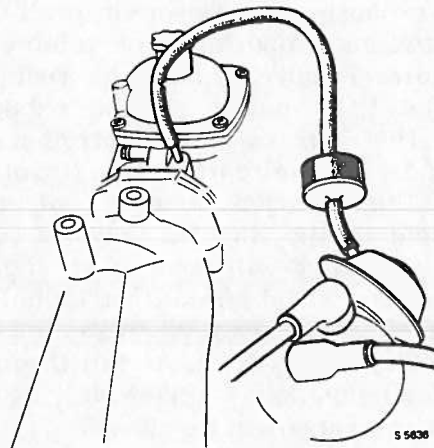


Delay valve

A delay valve is fitted in the vacuum passage between the carburetor (throttle valve housing) and the vacuum control unit of the distributor. The valve delays the raising of a vacuum by approx. 6 seconds, (Turbo Sweden, approx. 20 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 (Turbo Sweden, green) should face 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 distributor vacuum control unit.



Note

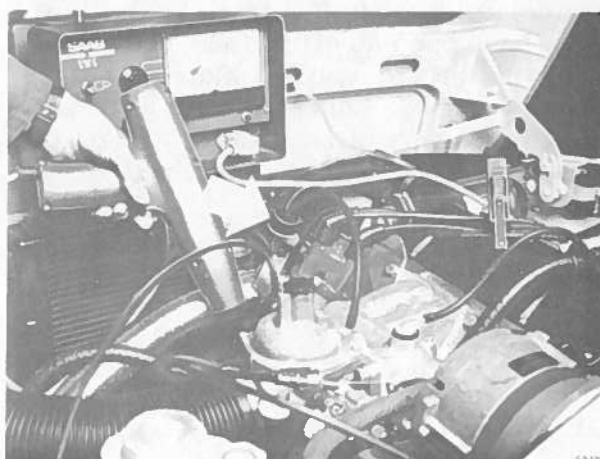
When the vacuum pipe is connected, e.g. when checking the ignition timing, always disconnect the hose from the carburetor (throttle housing) to prevent dirt entering and obstructing the delay valve.

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 approx. 3 000 r/min. Start the stop watch when the throttle is open.
b. Check the firing point using the stroboscope. The vacuum regulator should cut in after 6 seconds \pm 2 seconds (Turbo 20 \pm 4 seconds) and the ignition advance should be increased.

A faulty delay valve should be replaced.

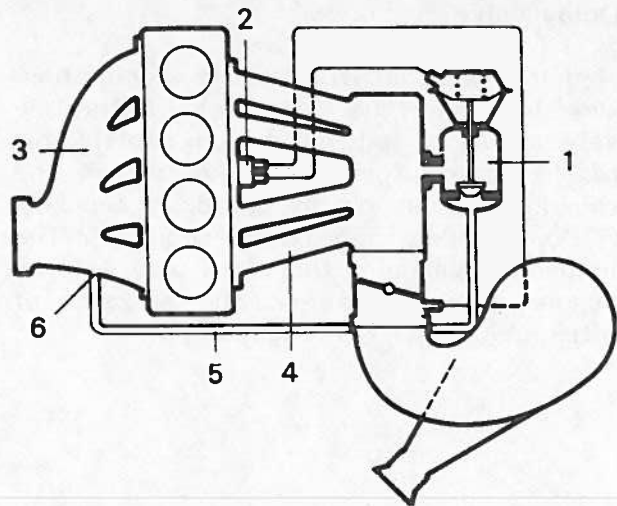


Exhaust gas re-circulation (EGR on-off)

By allowing a small amount of the exhaust gases to recirculate to the intake side of the engine, the combustion temperature is lowered, which in turn helps to reduce the emission of nitric oxides (NO_x).

When the EGR valve opens, a small quantity of the exhaust gases flows via the EGR pipe into the inlet manifold. The volume of exhaust gases is governed by the restriction in the EGR outlet on the exhaust manifold. The EGR valve is controlled by the vacuum in the carburetor (throttle housing). The relative location of the vacuum hole to the throttle valve is such that the EGR valve will open at an engine speed to around 1 900 r/min (fast idling) or at a slightly higher speed. When the load is low the valve is fully open. At full throttle and slightly below, the vacuum will be so slight that the valve will be closed.

The thermostatic valve senses the temperature of the coolant and isolates the vacuum at temperatures under approx. 100°F (38°C), which affords smoother running immediately following cold starting.



EGR on-off system

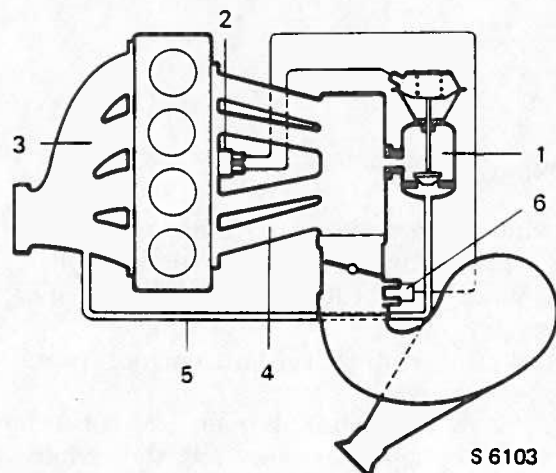
1. EGR valve
2. Thermostatic valve
3. Exhaust pipe
4. Inlet manifold
5. EGR pipe
6. Restriction (0.16 in/4 mm dia.)

Exhaust gas recirculation (EGR, two-stage) as from 1978 model

This is incorporated in cars with injection engines and automatic transmission (for sale in Sweden).

In contrast to the EGR on-off system, this system has no restriction in the exhaust manifold outlet. Instead, the volume of recirculated exhaust gases is governed by variable opening of the EGR valve.

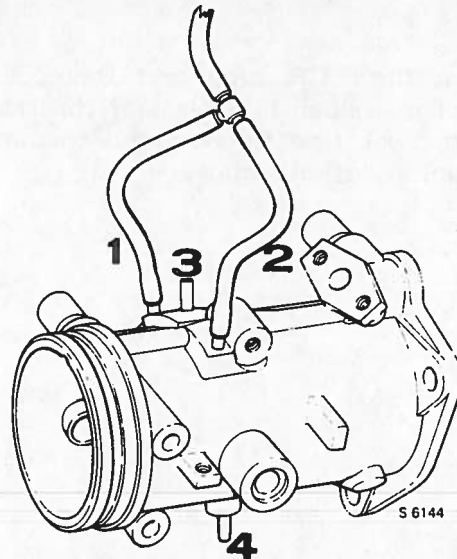
When the throttle valve is closed (at idling speed or during engine overrun) atmospheric pressure acts at both signal outlets and consequently no vacuum is obtained.



S 6103

EGR, two-stage system

1. EGR valve
2. Thermostat valve
3. Exhaust manifold
4. Inlet manifold
5. EGR pipe
6. Two stage outlet

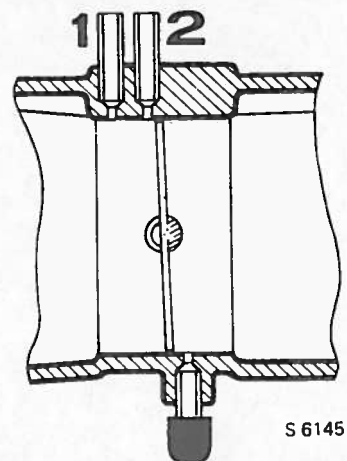


Valve housing with outlets for EGR two-stage

- 1. and 2. EGR outlets
- 3. Vacuum outlet, distributor
- 4. Plugged outlet

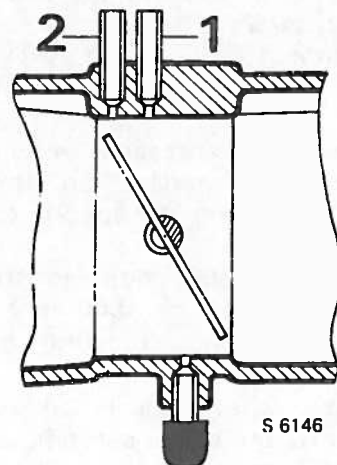
As the throttle valve passes No. 1 outlet (steady low speed, light acceleration or light engine overrun), a vacuum is created at the EGR valve through No. 1 outlet. This is then partially offset by the fact that No. 2 outlet is subject to atmospheric pressure, thus giving a lower vacuum signal to the EGR valve than that created in No. 1 outlet only. The lower signal causes the EGR valve to open partially.

When the throttle valve passes No. 2 outlet, the engine vacuum acts on both outlets and maximum exhaust gas recirculation. The function of the thermostatic valve is identical to that described in the EGR on-off system.



The outlets on the atmospheric side of the throttle valve

- 1. and 2. Outlets

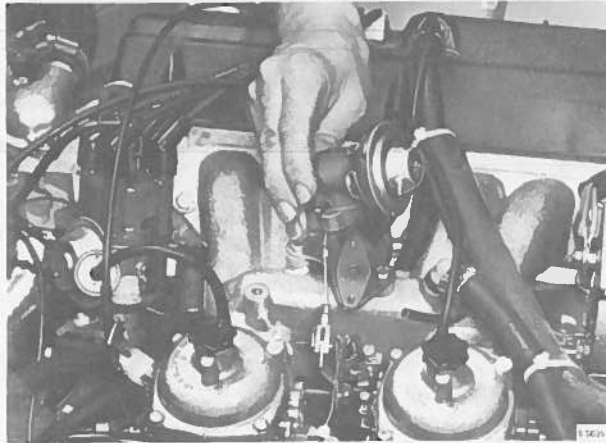
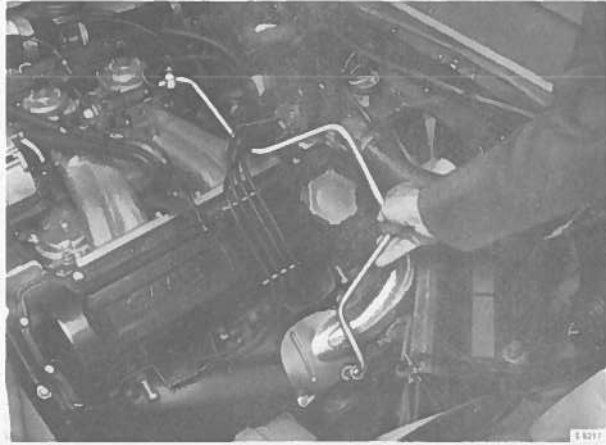


Both outlets on the vacuum side of the throttle valve

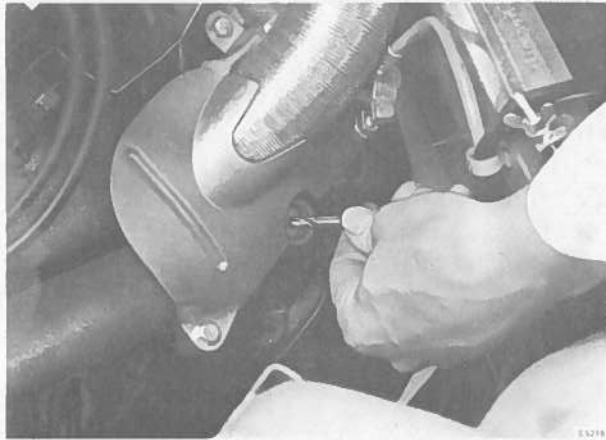
- 1. and 2. Outlets

Cleaning

1. Remove the EGR pipe and the EGR valve. The rubber bellows and throttle housing must first be removed on cars with fuel injection engines.

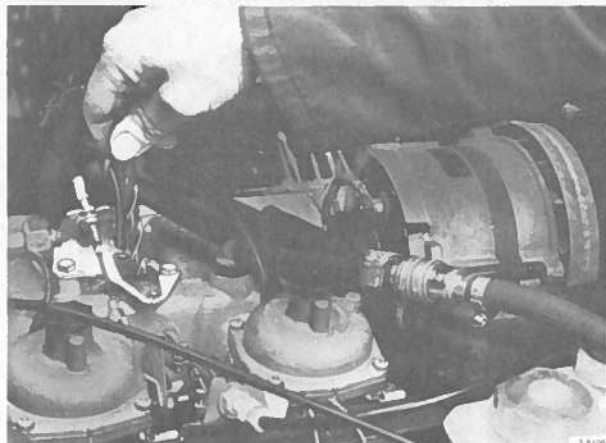


2. Clean the calibrated hole in the exhaust manifold, using a drill.



3. Clean the EGR hole in the inlet manifold as follows.

- a. Disconnect the brake servo hose from the adapter on the inlet manifold.
 - b. Connect compressed air to the brake servo outlet on the inlet manifold, using the special connecting adapter.
 - c. Clean the EGR hole in the inlet manifold using an 0.40 in (10 mm) dia. drill, thus blowing out any carbon particles.
 - d. Remove the compressed air hose and refit the brake servo hose.
4. Wash and blow clean the EGR pipe. If the pipe is heavily sooted up, clean it by means of a wire.

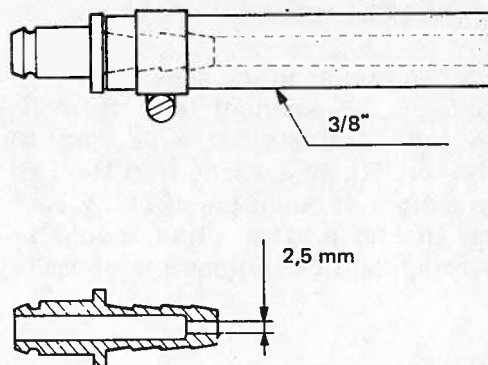


Caution

To prevent carbon particles from entering the inlet manifold when the the EGR hole is being cleaned connect a compressed air line to the inlet pipe via the connecting adapter on the brake servo unit.

A special compressed air nipple with an internal restriction of 0.09 in (2.5 mm dia.) and a length of 3/8 in compressed air hose should be used to limit the pressure.

The compressed air adapter should be made as shown in the illustration, eg.g. by soldering up the hole and then drilling a 0.09 in (2.5 mm) dia. hole.



S 6106

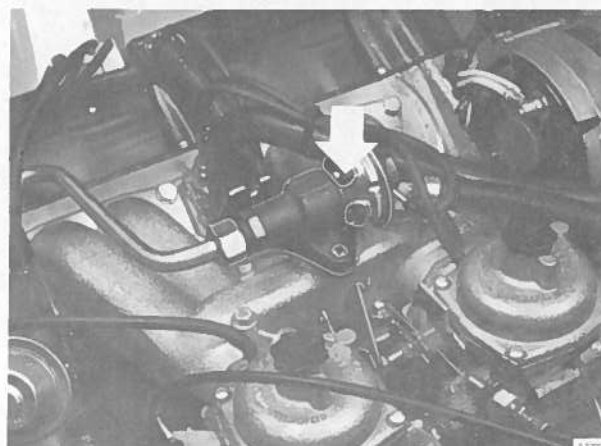
5. Clean the inlet and outlet of the EGR valve using a rotary wire brush. Take care not to damage the valve spindle when cleaning the outlet side. Rinse the valve with trichlorethylene and blow the valve clean with compressed air, keeping it open by means of a vacuum. To create a vacuum in the EGR valve, use a vacuum pump or suck through a hose connected to the valve.
6. Refit the EGR valve using a new gasket and fit the EGR pipe. Connect the vacuum hose. Cars with injection engines: Refit the throttle housing and rubber bellows.



Checking the EGR system

1. Run the engine until it is warm and connect a tachometer.
2. Rev up the engine and check when the EGR valve opens. The valve should open at fast-idling speed (see below). The valve spindle is visible between the valve casing and the vacuum bellows.

Type	Engine speed fast idling at which the valve should open
Two-stage	2 600 \pm 300 r/min



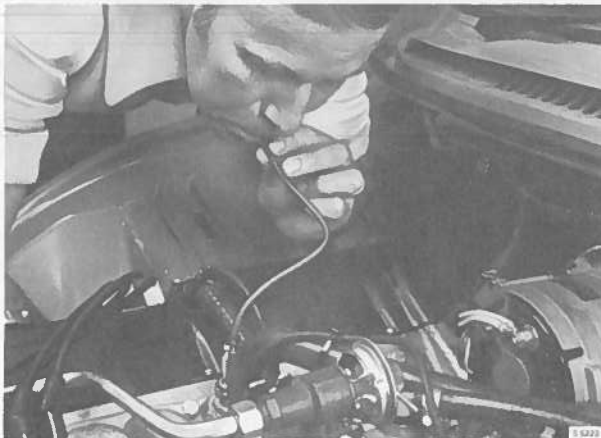
Checking the EGR valve

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



Checking the thermostatic valve

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

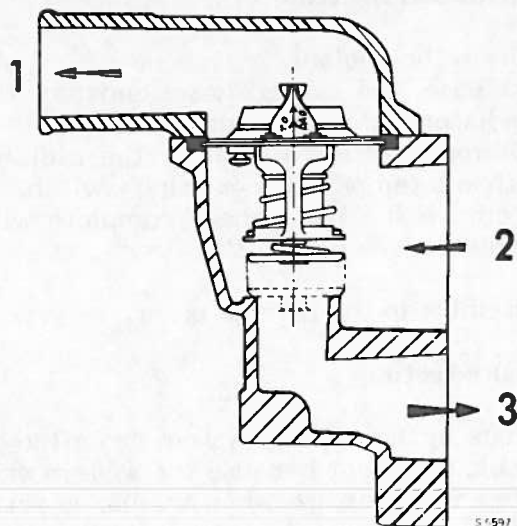


Radiator and cooling system

General

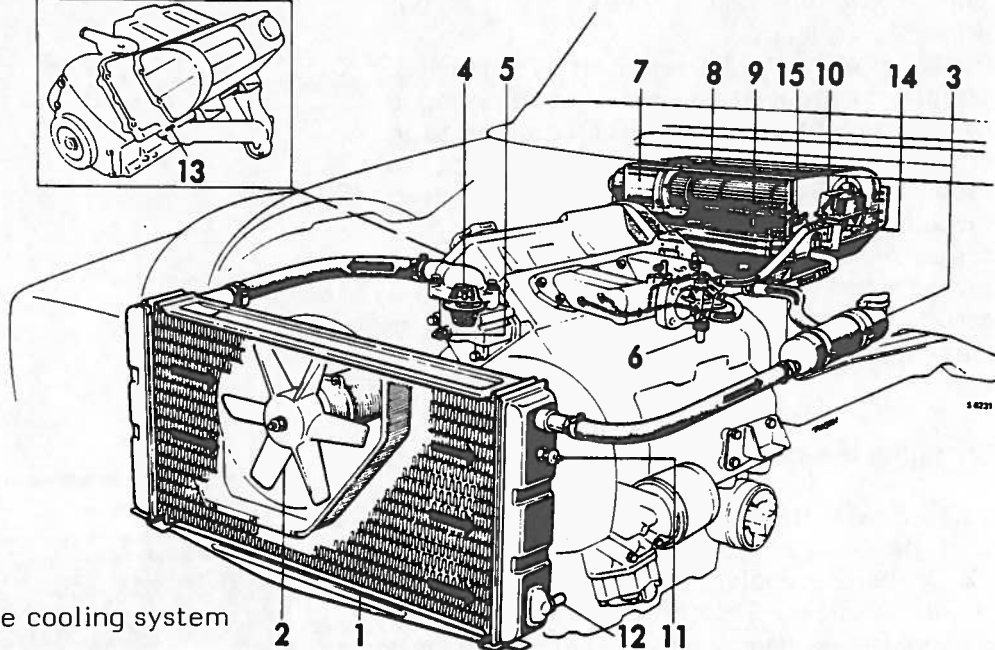
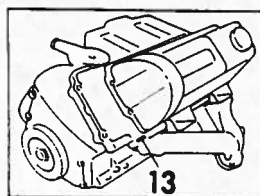
The cooling system is of pressurized type with a crossflow radiator and expansion tank. The water pump is located in the engine block and is powered by a bevel gear from the idler shaft. The thermostat is located in a housing bolted to the front end of the cylinder head. The radiator fan is electrically 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.

As from 1977 model, the engine is equipped with a 3-way thermostat. When the engine temperature is very high (i.e. when the thermostat is almost fully open), the by-pass passage to the water pump will be closed). All coolant is then forced to flow through the radiator.



3-way thermostat as from 1977 model

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



Water circulation in the cooling system

1. Radiator
2. Radiator fan
3. Expansion tank with relief valve cap
4. Thermostat
5. Temperature transmitter
6. Coolant pump
7. Fan motor
8. Fan impeller
9. Heat exchanger

10. Thermostatically controlled water valve
11. Temperature-sensing switch for the radiator fan
12. Radiator drain valve
13. Engine drain valve
14. Venting adapter (as from 1976 model)
15. Cold-air damper (as from 1977 model)

Removal and refitting

1. Drain the coolant.
2. Release the water hose clips at the radiator and disconnect the hoses.
3. Disconnect the wiring for the radiator fan and temperature-sensing switch.
4. Remove the front sheet complete with radiator (see p. 201-2).

Reassemble in the reverse order.

Pressure testing

Leakage in the cooling system can often be difficult to detect because the system only reaches 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. The maximum permissible gauge pressure is 1.0 bar (kp/cm^2 , 14 lb/in^2). A pressure tester can also be used to check the opening pressure of the radiator filler cap. For opening pressure, see Group 0.

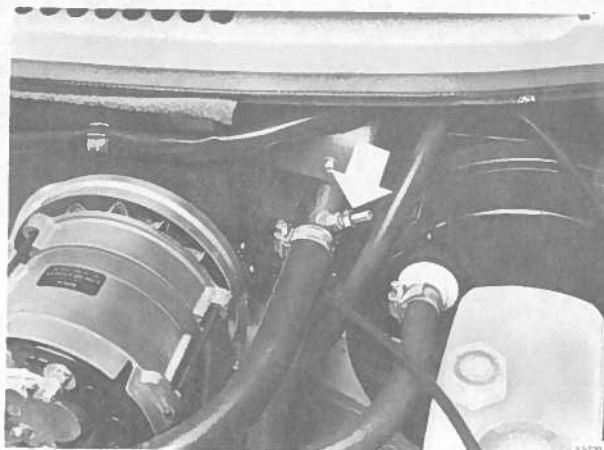
Inspecting the radiator

If the radiator has been removed from the car, it can be tested for leakage by being immersed in water with the openings plugged and supplied with compressed air. The maximum test pressure is 1.0 bar (kg/cm^2 , 14 lb/in^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 impair free circulation. The cells of the radiator may sometimes become clogged 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 cap from the expansion tank.
2. Drain the coolant through the radiator drain cocks. Set the heater control to maximum heat. As from 1976 model: Open the vent valve at the heater valve.



3. Close the drain cocks and fill the system with new coolant.
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. As from 1976 model, air can be vented from the system through a vent valve at the heater valve. Top up with coolant as the air is expelled.

Heater vent valve, as from 1976 model

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

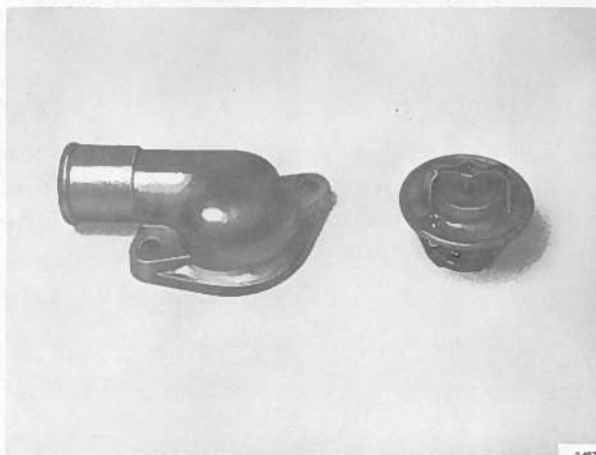
Non-freezing coolant mixtures

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 anticorrosion agent should be added. **N.B.** When anti-freeze is added, it must be premixed with a suitable quantity of water, since full circulation of the coolant is not achieved before the thermostat has opened.

Cleaning the cooling system

1. Drain the 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 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 downwards, and the radiator from the left connecting pipe. Remove the thermostat first.
7. Flush out the heater element, also in the reverse direction to the normal flow.
8. Check the operation of the valve in the line to the heater element.
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.



Thermostat and water outlet pipe

Winter thermostat

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

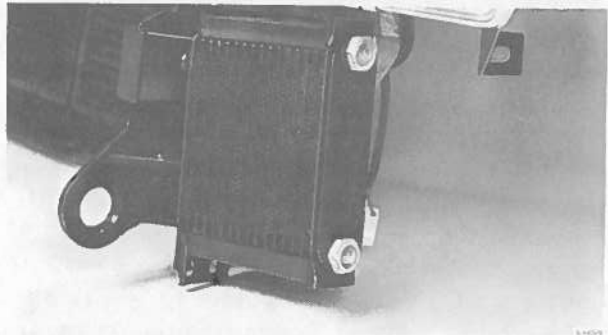
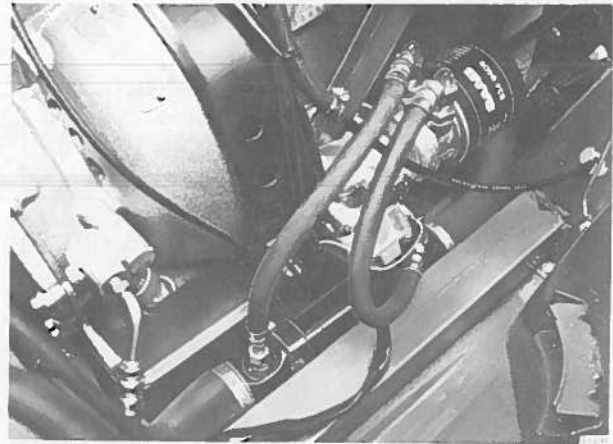
This thermostat is only intended for winter use in markets with very severe climates, i.e. Nordic countries, Canada and the northern states of USA. The ordinary $+190^{\circ}\text{F}$ ($+88^{\circ}\text{C}$) thermostat should be refitted at the end of the winter.

The winter thermostat must not be fitted to turbo engines.

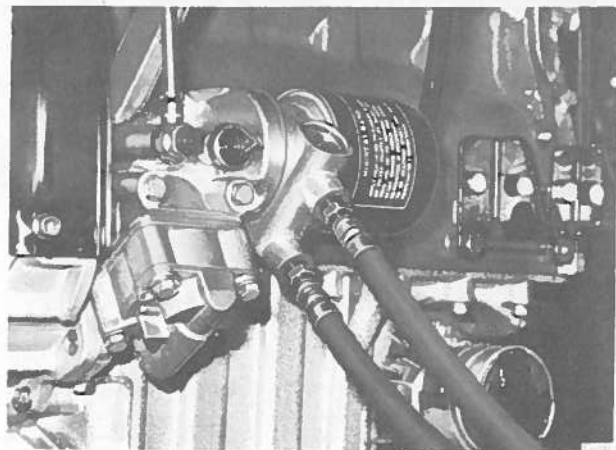
Extra cooling systems

To cope with difficult cooling conditions, several versions of additional cooling systems are fitted to certain models and for certain markets with extreme climatic conditions.

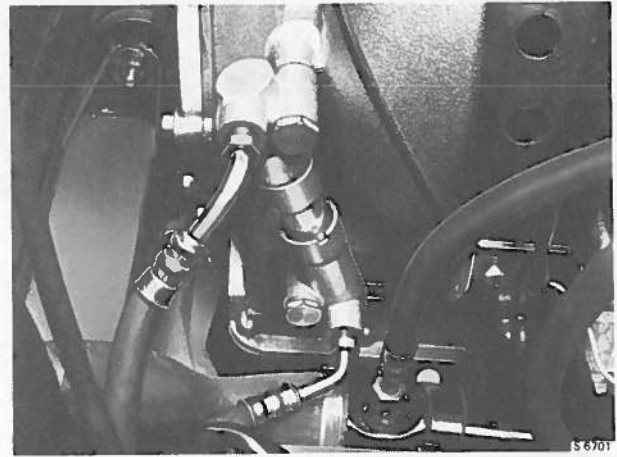
- Twin-row radiator
- Extra radiator fan located to the left of the ordinary radiator fan.
- Water-cooled oil cooler for cooling the engine oil or the automatic transmission oil. The cooler is located in the coolant line between the radiator and the water pump.
- Air-cooled oil cooler for cooling the engine oil or the automatic transmission oil. The cooler is located below the left-hand headlight.

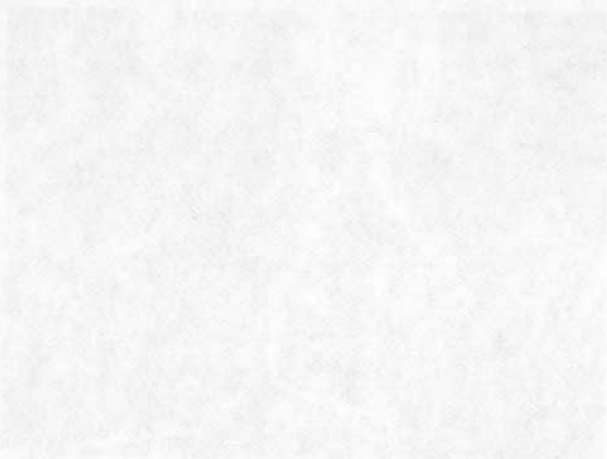


In the "engine oil cooling version", the cooler is connected by hoses to an adapter between the oil filter and its connecting housing. The adapter also contains a thermostat which opens the circulation through the oil cooler when the temperature has risen above $+75^{\circ}\text{C}$.



In the "automatic transmission oil cooling version", a thermostat connected to the automatic transmission is included, in addition to the oil cooler and hoses.





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Water pump and fan motor

Water pump

Removing

Engine in the car (engine removed, as from point 5)

1. Drain the coolant through the radiator drain cock.
2. Disconnect the battery ground cable.
3. Dismantle the inlet manifold and cover the openings.
4. a. Remove the alternator.
b. Remove the bolt holding the alternator bracket to the pump cover.
c. Unbolt both rear engine mountings.
d. Place a jack fitted with a wooden block under the rear end of the power unit and raise the engine slightly until the upper bolt holding the alternator bracket to the transmission cover can be removed.
e. Slacken the lower retaining bolt slightly and turn the bracket so that it is as far from the engine as possible.
5. Remove the other two retaining bolts from the water pump cover and remove the cover.

Caution

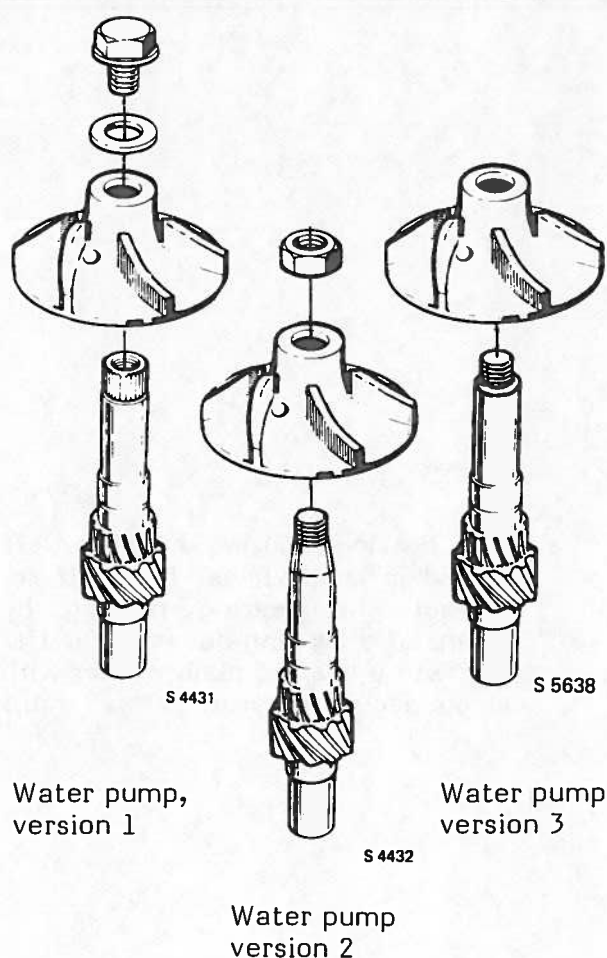
The water pump is available in three different versions which require different procedures for dismantling and assembly.

Version 1: Impeller retained by means of a bolt (cylindrical seating on shaft).

Version 2: Impeller retained by means of nut (conical seating on shaft).

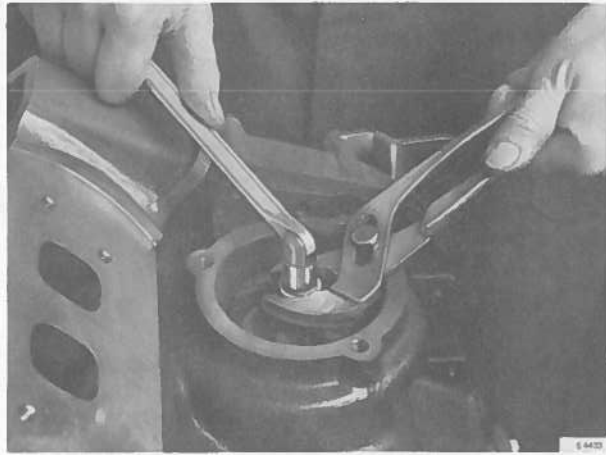
Version 3: Impeller pressed onto the shaft. The thread on the end of the shaft is only provided for dismantling purposes. No nut is required.

Tapping-out hammers or the like must not be used under any circumstances during the removal or assembly of pumps of versions 2 and 3.

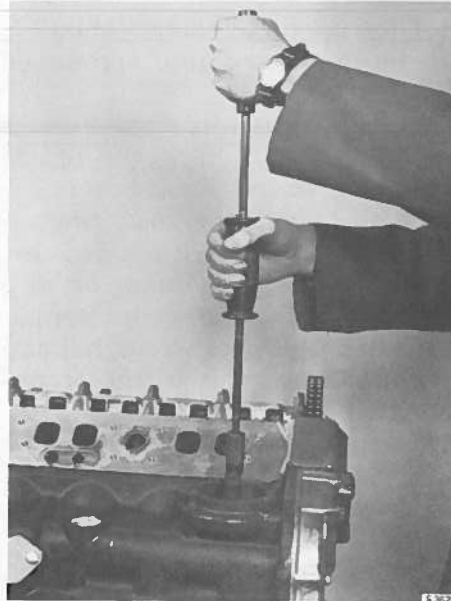


6. Version 1:

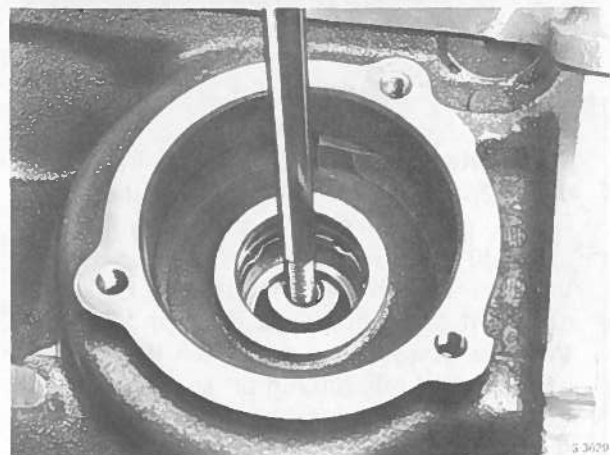
- a. Remove the centre bolt from the impeller. Hold the impeller with universal pliers and unscrew clockwise (left-hand thread). Save the washer.



- b. Fit a tapping-out hammer with adapter 83 92 136 to the water pump and withdraw the pump unit.

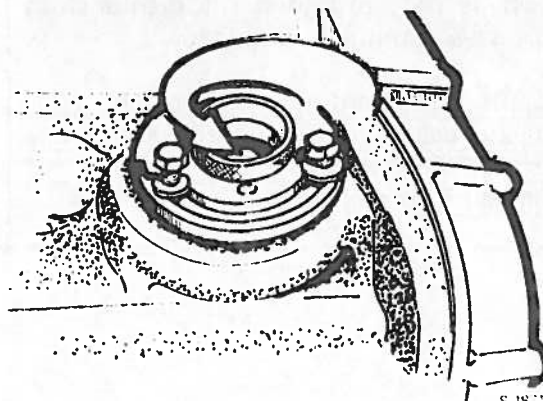


- c. The bearing housing may be left behind in the cylinder block. If so, extract the bearing housing by means of a tapping-out hammer fitted with a nut and plain washer with an outside diameter of 1.0" (25 mm).



Version 2:

- a. Place tool 83 92 441 over the water pump and fit two bolts, without tightening them. Then turn the tool counter-clockwise so that the peg on the tool engages one of the blades on the impeller. Tighten the two bolts. Loosen the impeller centre nut (left-hand thread).



- b. Remove the water pump using tool 83 92 649 (or 83 92 490, earlier design).

Caution. Hammers should never be used.



- c. The bearing housing may be left behind in the cylinder block. If so, extract the bearing housing by means of a tapping-out hammer fitted with a nut and plain washer with an outside diameter of 1.0" (25 mm).

Caution

If the impeller is not restrained while the centre bolt (nut) is unscrewed, the gear teeth on the pump shaft and idler shaft are liable to be damaged).

Up to and including 1976 model (versions 1 and 3), the pump bearing and seals are mounted in a separate bearing housing, which, in turn, is mounted in the engine block.

As from 1977 model (version 3), the pump bearing and seals are mounted directly in the engine block. Up to the late 1976 model the bottom end of the pump shaft is seated in a bush. In later engines the shaft end is seated directly in the engine block.

Version 3:

Dismantle the water pump using tool 83 92 649 (or 83 92 490, earlier design) which fits onto the threaded end of the shaft.

Caution. Hammers should never be used.

Dismantling

1. Fit the pump in tool 83 90 544 and press the impeller off using tool 83 90 585.



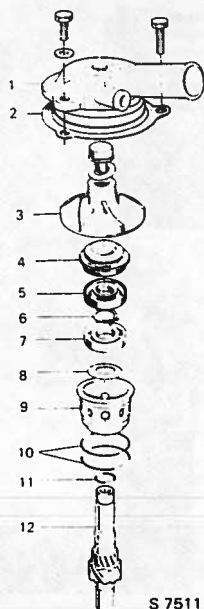
2. Up to and incl. 1976 model versions 1 and 3):

Press the pump shaft with seals and ball bearing out of the bearing housing, using tool 83 90 544. Place the pump with the gear uppermost.



3. Remove the pump seal, O-ring, thrower (version 1) and seal.
4. Remove the ball bearing circlip.
5. Place the pump shaft and bearing in tool 83 90 536 with the drive end downward and press the shaft out of the bearing.

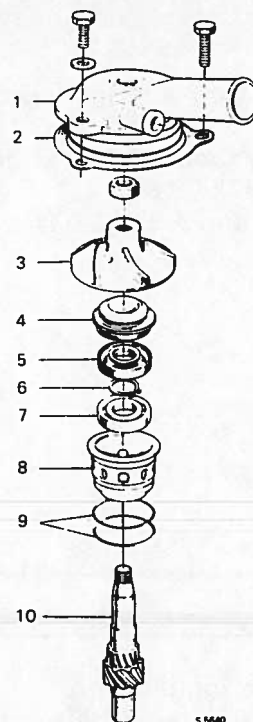




S 7511

Water pump, version 1

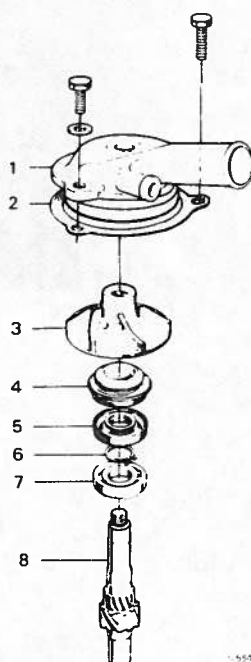
1. Pump cover
2. Gasket
3. Impeller
4. Water pump seal
5. Thrower
6. Seal
7. Ball bearing circlip
8. Ball bearing
9. Oil thrower ring
10. Bearing housing
11. O-ring
12. Seal
13. Pump shaft



S 5640

Water pump, version 2

1. Pump cover
2. Gasket
3. Impeller
4. Water pump seal
5. Seal
6. Ball bearing circlip
7. Ball bearing
8. Bearing housing
9. O-ring
10. Pump shaft



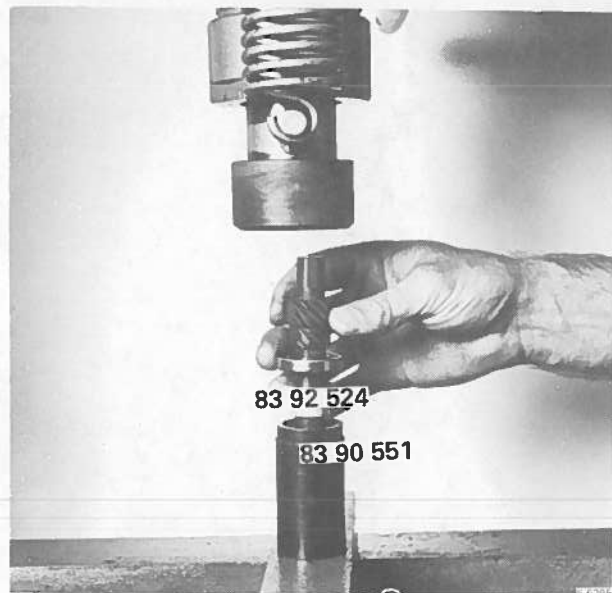
S 5551

Water pump, version 3 (as from model 1977)

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

Assembling

1. Fit the oil thrower ring (version 1).
2. Press the ball bearing onto the pump shaft using tools 83 90 551 and:
Version 1 83 90 569
Versions 2 and 3 83 92 524



3. Fit the bearing circlip.
4. Up to and including 1976 model versions 1 and 2): Press the pump shaft complete with bearing into the bearing housing (see illustration) with the housing supported in tool 83 90 544. Press with tool 83 90 551.



5. Up to and including 1976 model versions 1 and 3):
Fit the seal using tool 83 90 551.
6. Version 1: Fit the O-ring.
7. Up to and including 1976 model (version 1 and 3):
Fit the water pump seal using tools 83 90 544 and 83 90 536.



Fitting

Caution

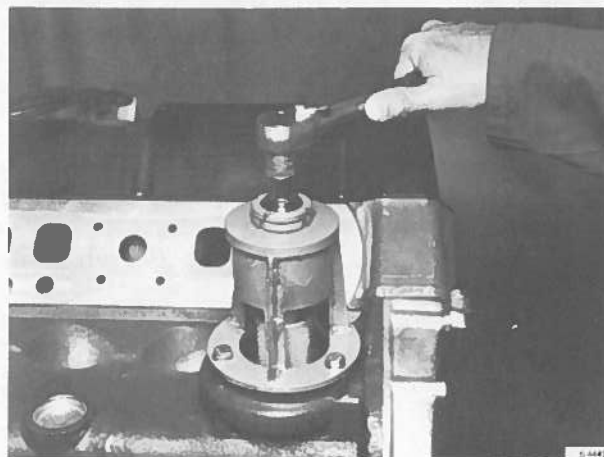
Tapping-out hammers etc. must never be used when fitting water pumps of versions 2 and 3.

1. Version 1:

- a. Fit the pump in the engine block, and check that the pump gear engages with the gear on the idler shaft. Seat the bearing housing by means of sleeve 82 90 536. Ensure that the flange on the bearing housing butts against the face in the engine block.
- b. Fit the impeller with washer and bolt. Tighten the bolt with the prescribed torque of 25 Nm (18 ftlb, 2.5 kgm) counter-clockwise (left-hand thread).

Version 2):

- a. Fit the pump in the engine block and check that the pump gear engages with the gear on the idler shaft. Seat the bearing housing using tool 83 92 649 (or 83 92 490) and sleeve 83 90 536. This relieves the gear drive of load during fitting.



- b. Fit the impeller and the nut. Place tool 83 92 441 over the pump and fit two bolts. Do not tighten the bolts. Then turn the tool clockwise so that the peg on the tool engages one of the blades of the impeller. Tighten the two bolts.

Torque

15 ± 2 Nm (10.8 ± 1.5 ftlb (1.5 ± 0.2 kgm))

Caution

If the prescribed torque is exceeded, this will damage the pump shaft.



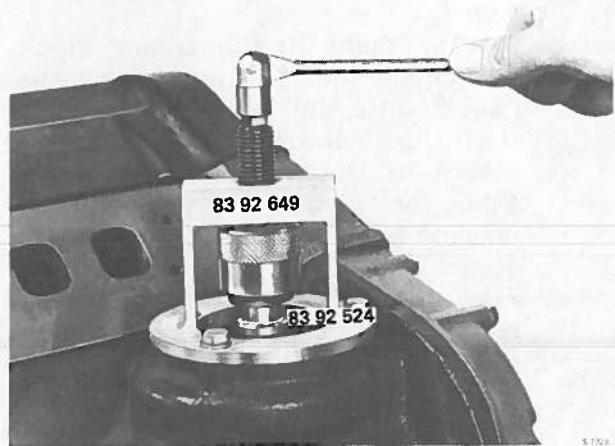
1. Version 3:

- a. Fit the pump shaft with bearing and circlip in the engine block by means of sleeve 83 90 551 and drift 83 92 490 (or 83 92 649, later version). Check that the pump gear engages with the gear on the idler shaft before pressing the shaft into position.

- b. Fit the lower seal using sleeve 83 90 551 and a hammer.
- c. Fit the upper seal using tool 83 90 536 and a suitable plastic mallet.
- d. Press on the impeller using tool 83 92 490 (or 83 92 649, later version) and sleeve 83 92 524. Turn the tightening bolt 1/4 turn at a time, unscrew it and then tighten down 1/4 turn again until the impeller is finally in position.

Caution

To avoid damaging the water pump bearing, do not use more force than necessary to fit the impeller. Ensure that the pump shaft and impeller hole have been thoroughly cleaned before assembly.

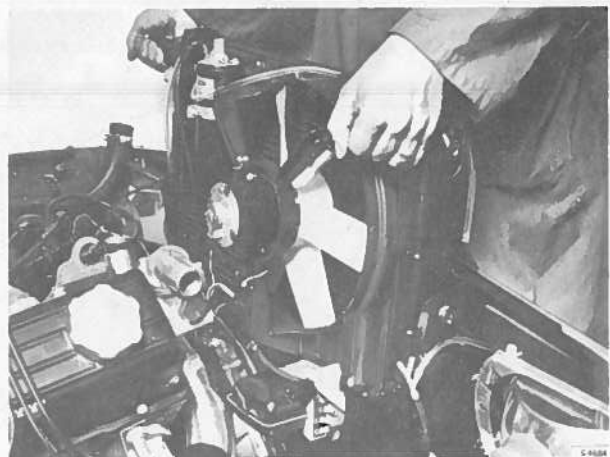


- 5. Fit the gasket and water pump cover.
- 6. Fit the alternator bracket, lower the power unit and tighten the engine mountings.
- 7. Fit the inlet manifold and the alternator.
- 8. Connect the battery and fill up with coolant.

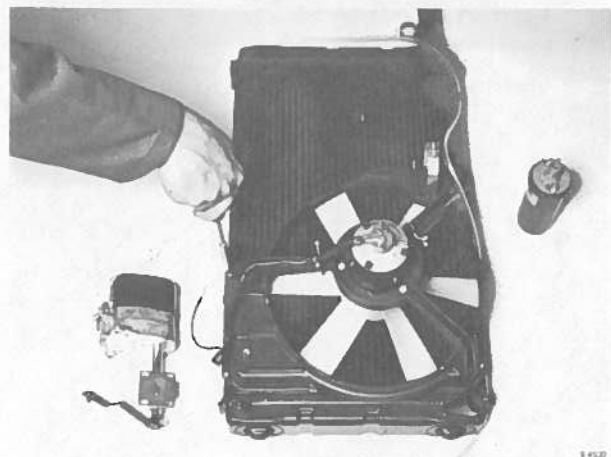
Fan motor

Removal

1. Remove the battery.
2. Drain the coolant through the radiator drain cock.
3. Disconnect the headlight wiper push rod from the crank in front of the radiator.
4. Remove the radiator retaining bolts and the radiator hoses.
5. Disconnect the electric cables from the ignition coil, headlight wiper motor, fan and temperature-sensing switch. Disconnect the cable harness from the fan housing.
6. Lift the radiator, fan housing and wiper motor.



7. Unbolt the headlight wiper motor.
8. Remove the fan housing and dismantle the fan and fan motor.



Assembly

1. Mount the fan motor and fan in the fan housing.
2. Mount the fan housing on the radiator.
3. Mount the headlight wiper motor to the fan housing and radiator.
4. Mount the radiator and connect the hoses.
5. Connect the cables to the headlight wiper motor, fan, thermal switch and ignition coil and clamp the cable harness to the fan housing.
6. Fit the headlight wiper push rod.
7. Install the battery and fill the radiator with coolant.

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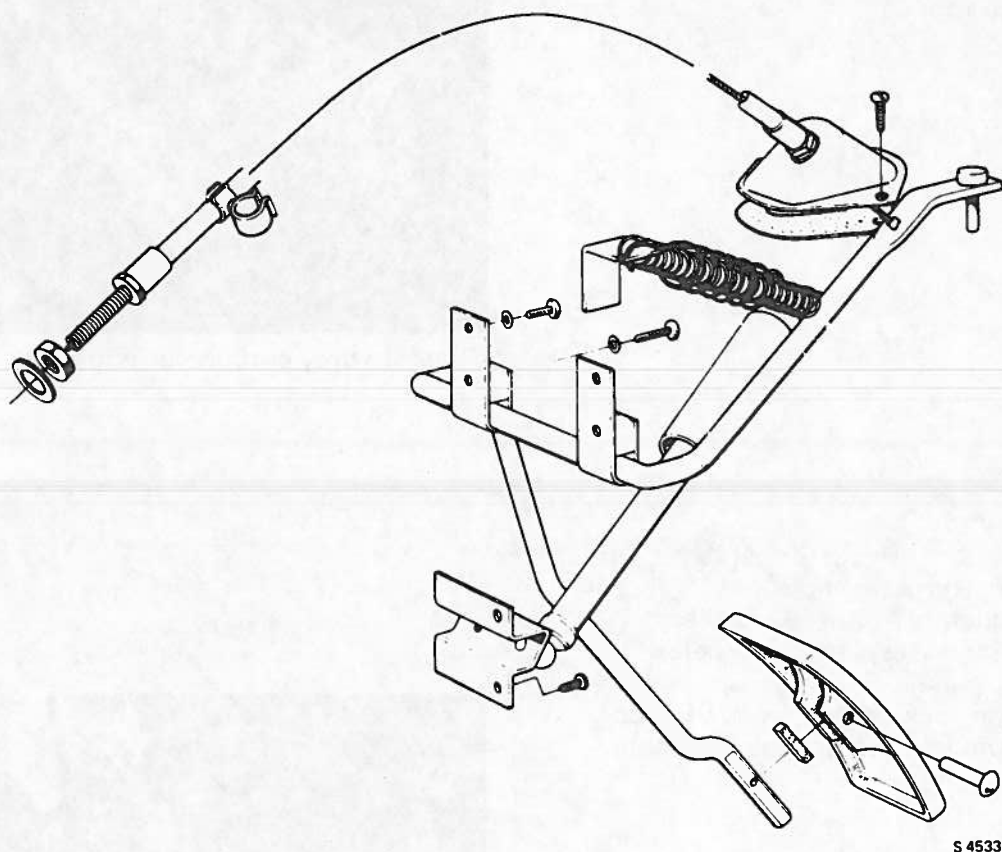
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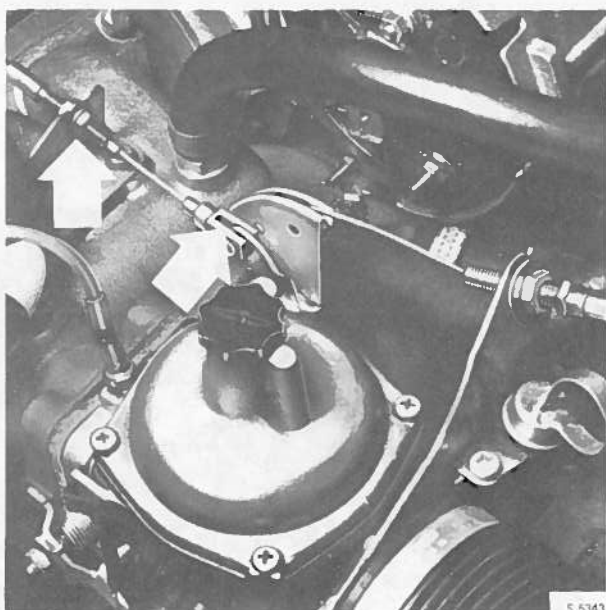
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Throttle controls

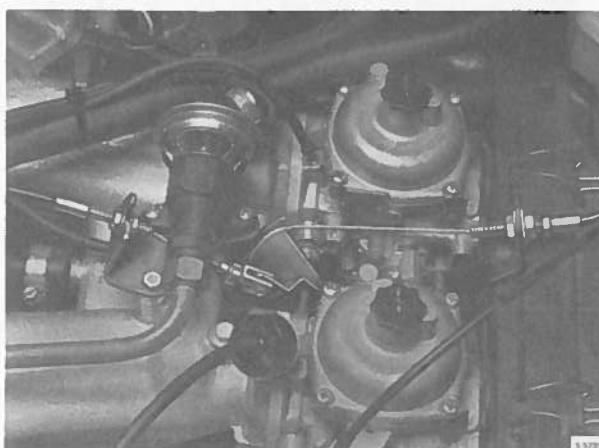


Throttle control

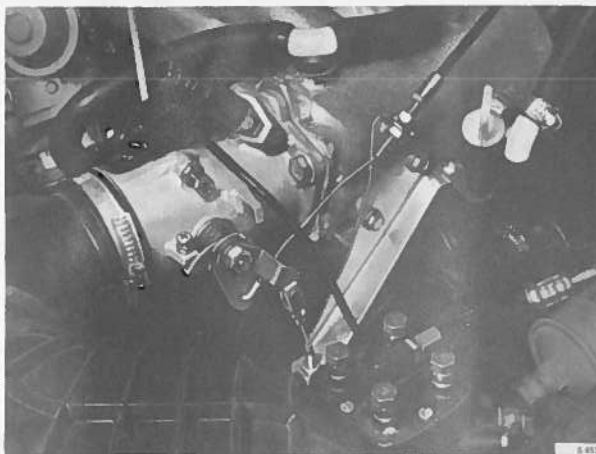
Throttle control cable



Cable control, single-carburetor engine



Cable control, twin-carburetor engine



Control wire, carburetor engine

Removal

1. Disconnect the throttle cable at the carburetor (throttle housing) and remove the sheath from the bracket.
2. Remove the safety padding below the instrument panel.
3. Remove the locking pin from the accelerator pedal and disconnect the cable.



4. Unscrew the grommet in the bulkhead.

Refitting

1. Fit the grommet in the bulkhead.
2. Connect the cable to the accelerator pedal and replace the locking pin.



3. Fit the safety padding below the instrument panel.
4. Fit the throttle cable to the driver (throttle-arm).
5. Fit the cable sheath to the bracket and adjust the tension of the cable to eliminate play in the accelerator pedal.
6. Press the accelerator down to the floor and check that the throttle valve is fully open.

Accelerator pedal

Removing

1. Remove the safety padding below the instrument panel.
2. Remove the throttle control damper assembly (does not apply to cars with automatic transmission).
3. Unhook the return springs.
4. Remove the locking pin at the anchorage point of the cable on the accelerator pedal.
5. Release the cable from the accelerator pedal.
6. Release the upper covering on the bulkhead and fold it out of the way.
7. Remove the accelerator pedal from the bulkhead.

Refitting

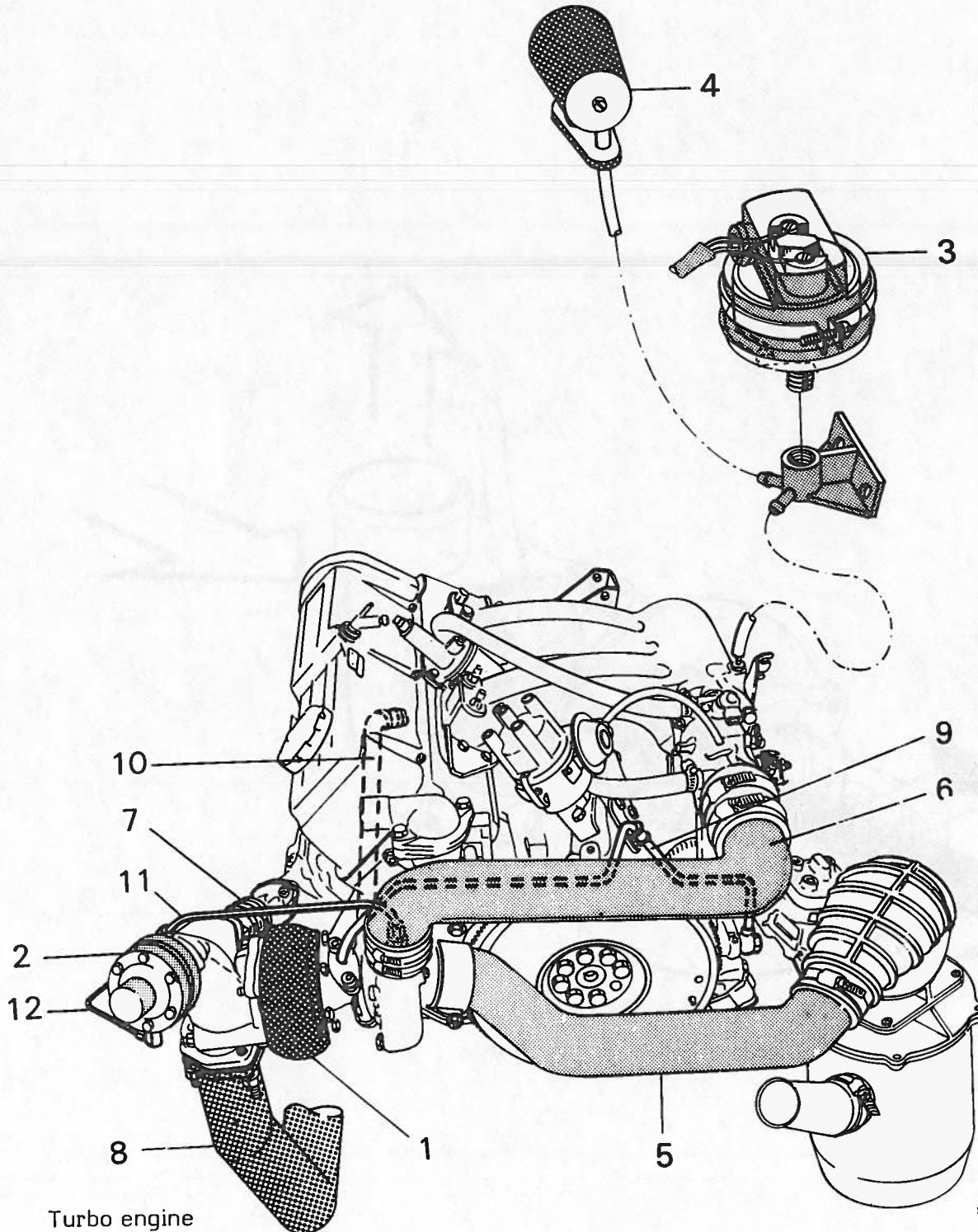
1. Fit the accelerator pedal onto the bulkhead.
2. Fold back the bulkhead covering.
3. Fit the cable to the accelerator pedal and insert the locking pin at the anchorage point for the cable at the accelerator pedal.
4. Hook on the return spring.
5. Fit the throttle control damper assembly (does not apply to cars with automatic transmission).
6. Replace the protective panelling under the instrument panel.
7. Make any necessary adjustments to the throttle control.

Turbo system

Supercharging, general

In contrast to conventional engines, a supercharged engine has 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 as regards fuel economy, space, weight, etc.



Turbo engine

- | | |
|---|----------------------------|
| 1. Turbocharger | 7. Bellows |
| 2. Wastegate boost control | 8. Exhaust outlet pipe |
| 3. Pressure transducer | 9. Oil supply line |
| 4. Turbo gauge | 10. Oil return line |
| 5. Hose, air cleaner to turbocharger | 11. Cooling air pipe |
| 6. Hose, turbocharger to inlet manifold | 12. Exhaust pressure line. |

S 6270

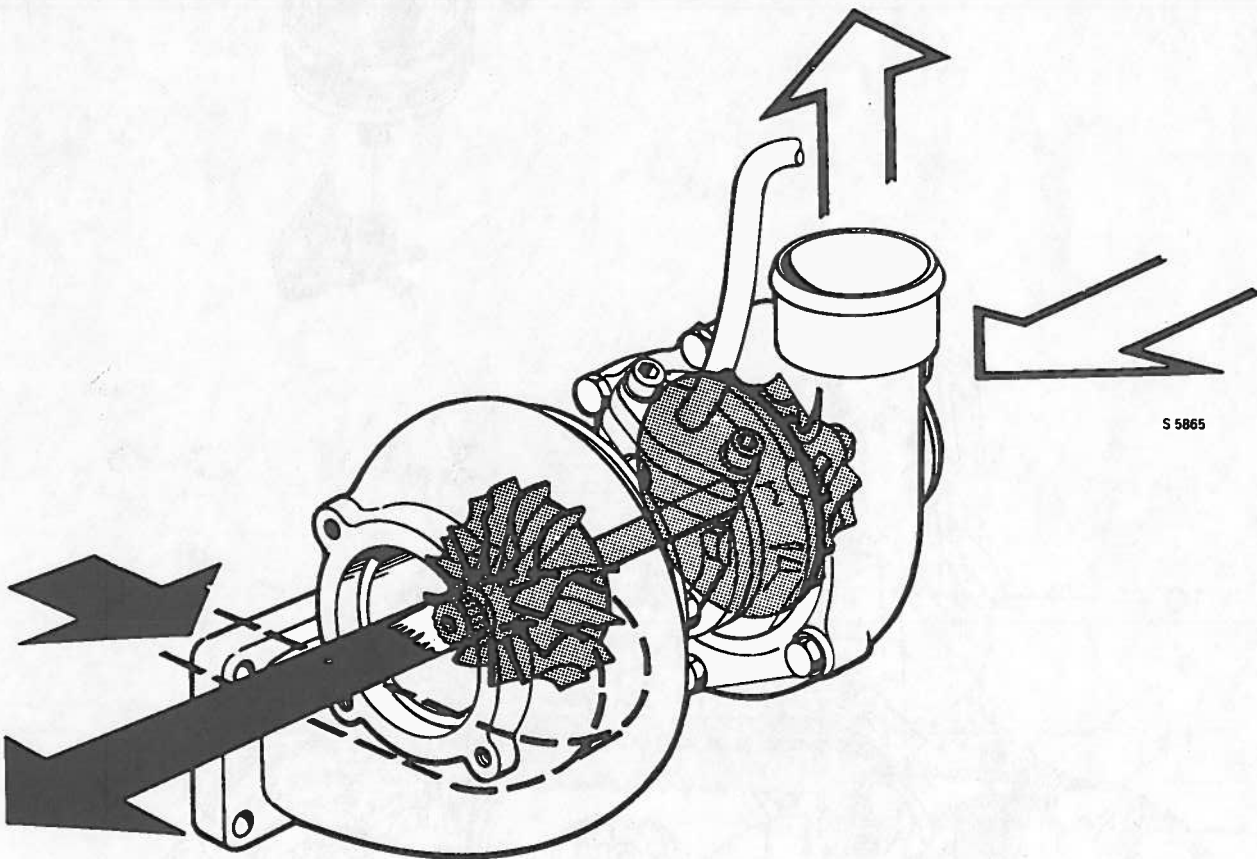
Turbocharging

Turbocharging is achieved by means of a turbo-compressor, whereby the exhaust gases from the engine are used to drive the turbine.

The exhaust gases flow through 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 thus rotates at the same speed.

The compressor is located in the induction system where it increases the charging pressure and thus more air will be supplied to the combustion chamber.



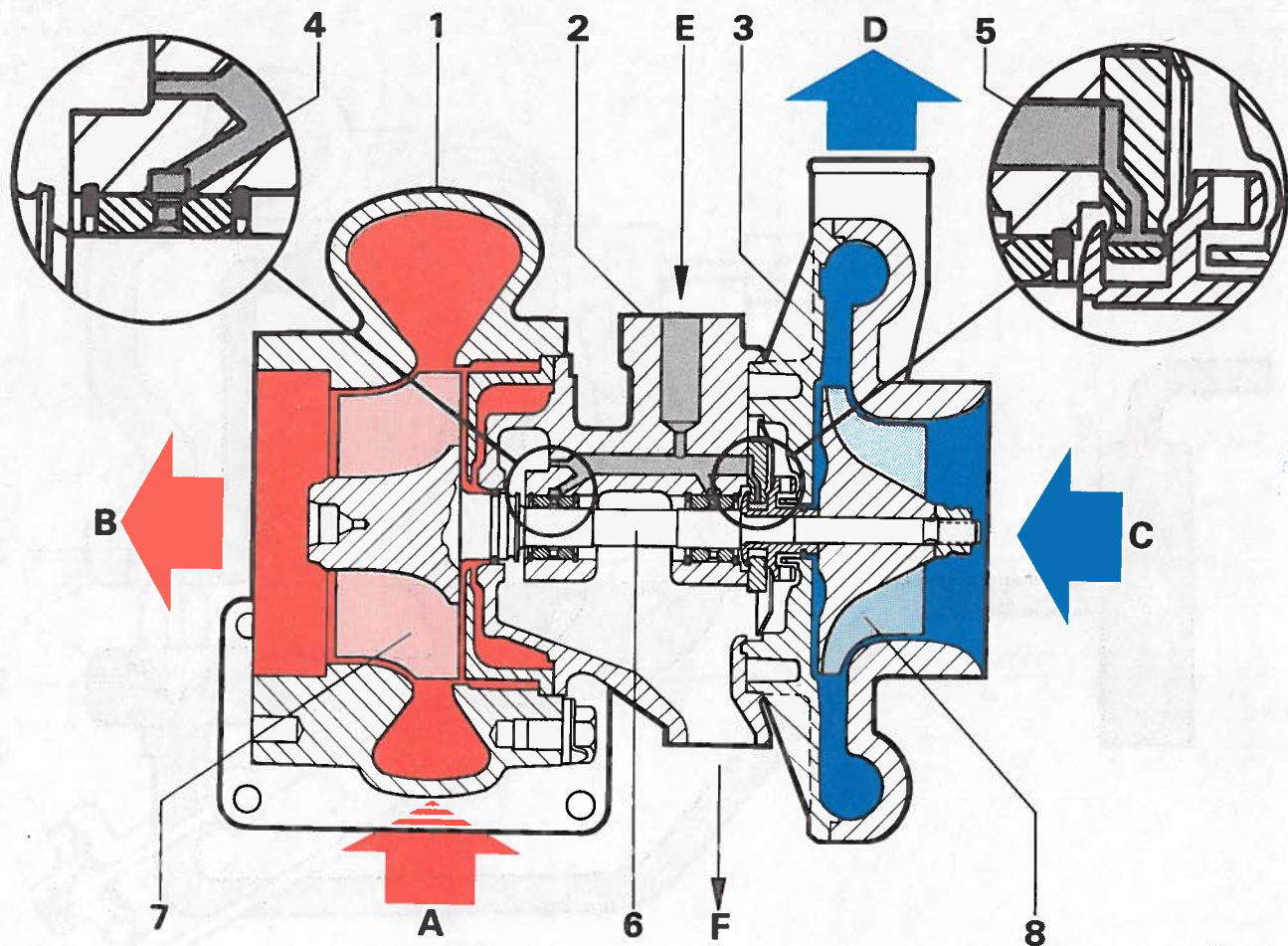
Turbo-compressor

The Saab turbocharger 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 to provide increased performance, which implies that they are only utilized at full throttle. The turbine shaft which rotates at very high speed is 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) fitted in grooves in the shaft.



Inlet air
Exhaust gases

Turbo-compressor, cross-section

1. Turbine housing
2. Bearing housing
3. Compressor housing
4. Journal bearing
5. Thrust bearing
6. Shaft
7. Turbine wheel

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 control

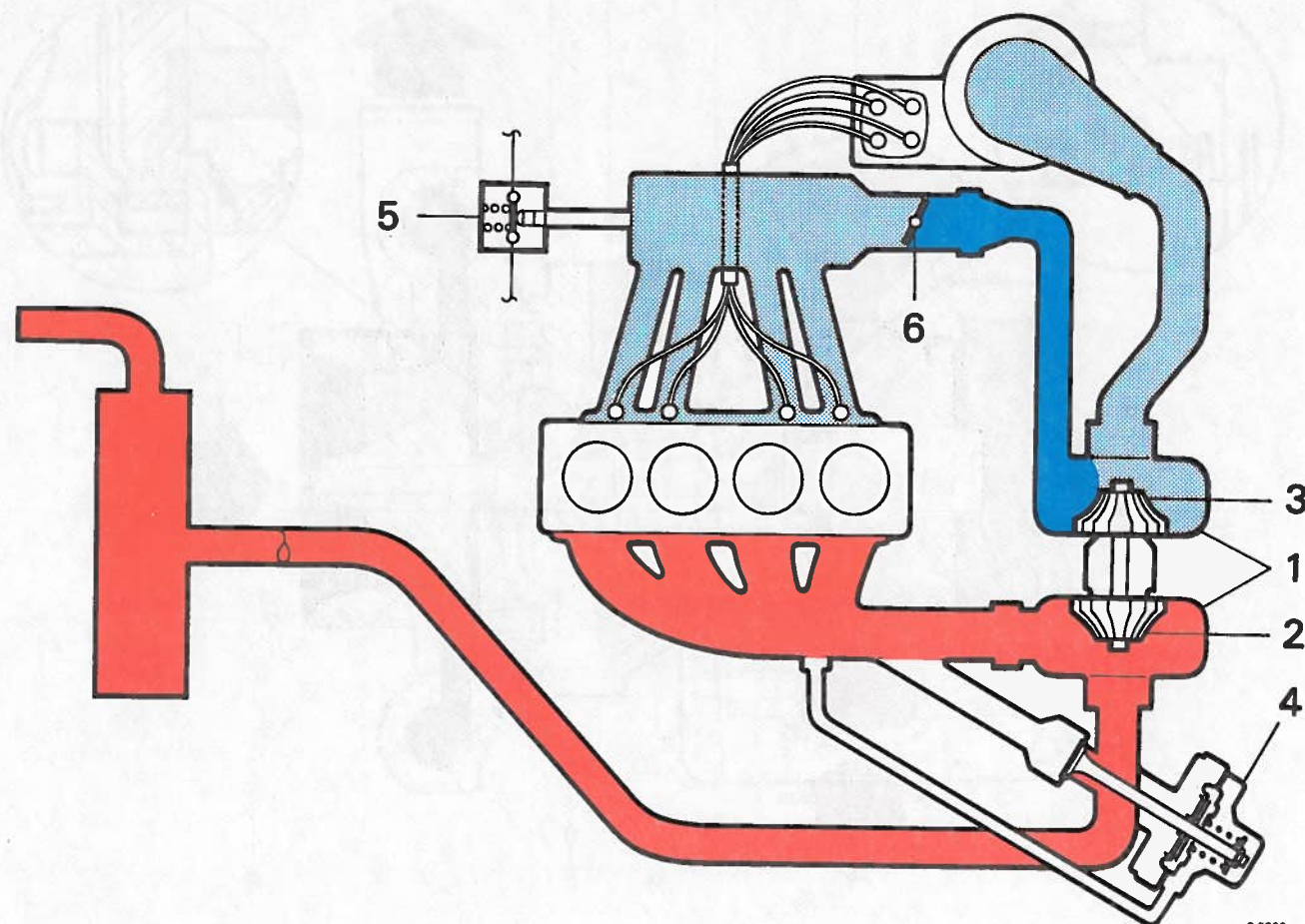
The charging pressure in the inlet manifold is governed mainly by the speed and loading of the engine. However, under high load conditions, the charging pressure is limited by a charging pressure regulator (waste gate).

The charging 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 charging pressure regulator valve (waste-gate) is closed. As the load increases and the charging 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 charging 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 exhaust 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 charging pressure regulator is cooled by means of a pipe running from the compressor to the charging pressure regulator bearing housing.

Caution

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



8 6800

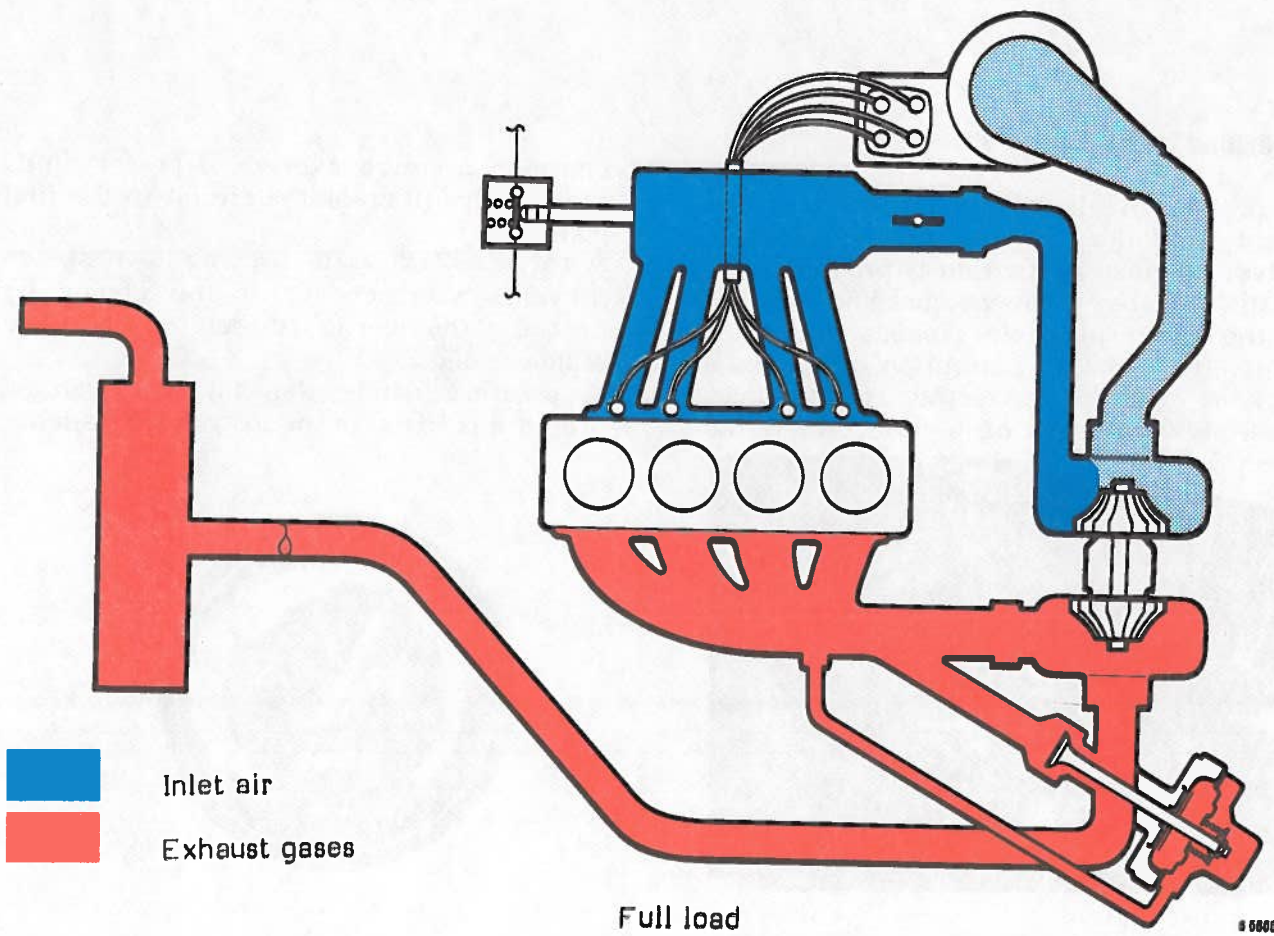
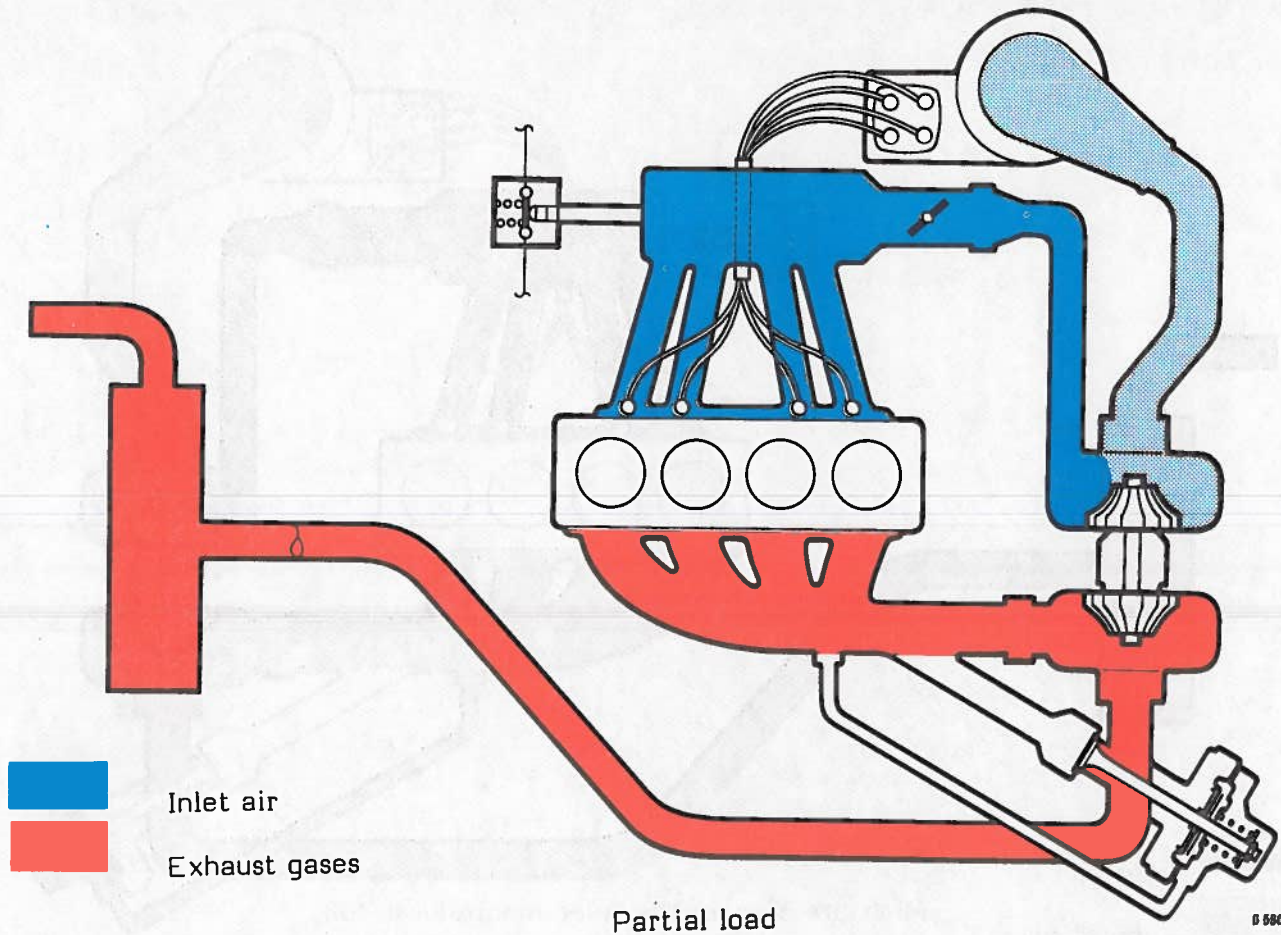


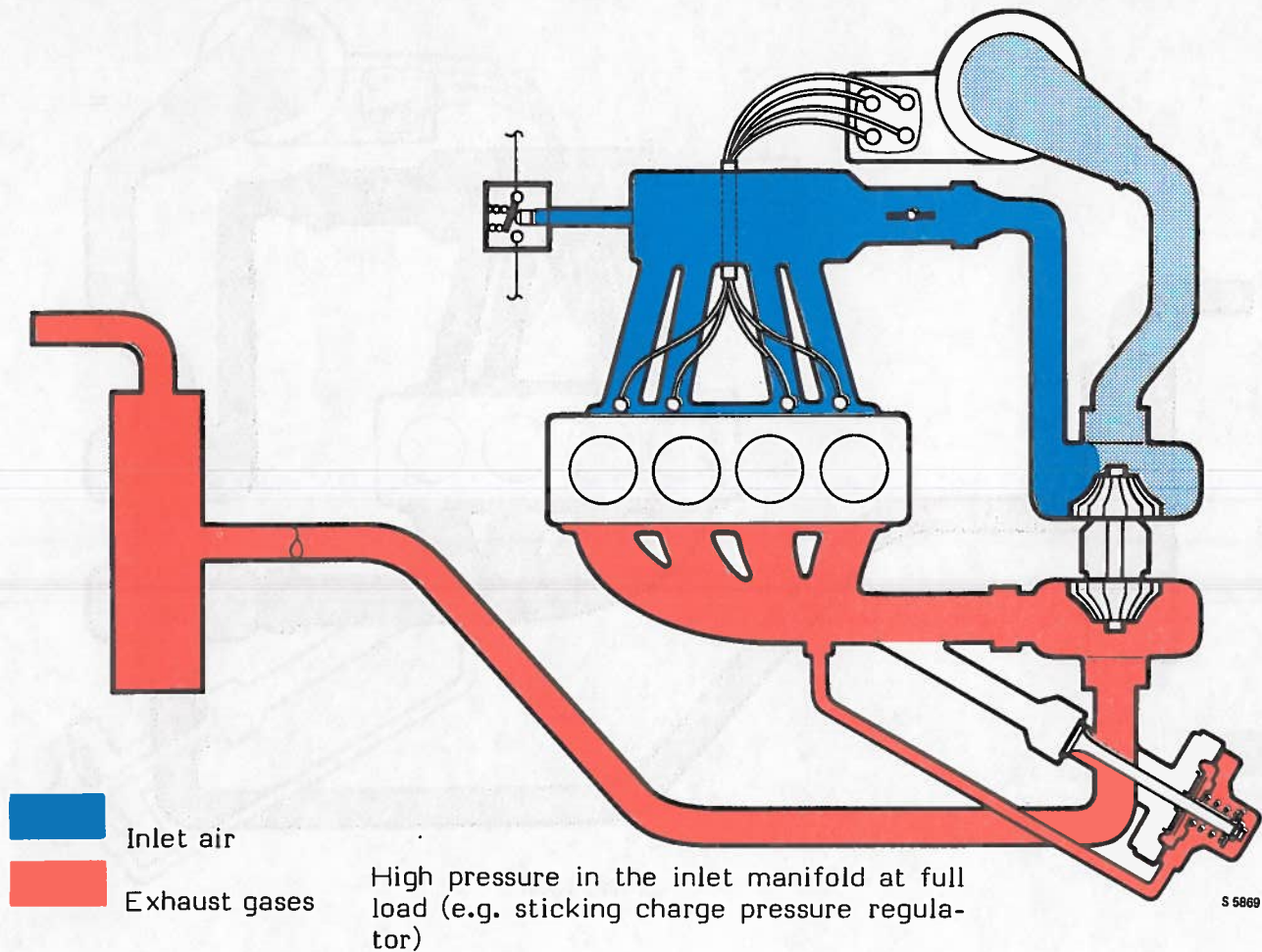
Inlet air

Exhaust gases

Engine idling

1. Turbo-compressor
2. Turbine wheel
3. Compressor impeller
4. Charge pressure regulator (waste gate)
5. Pressure switch
6. Throttle valve





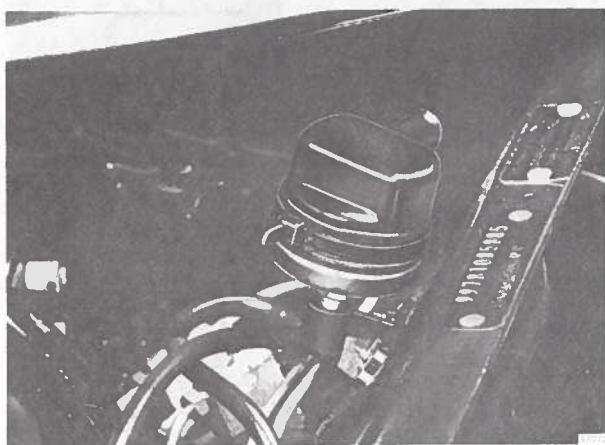
Overload protection

To prevent overloading of the engine in the event of failure of the charge pressure valve, overload protection is provided, and this is actuated when the charging pressure in the intake manifold exceeds the preset limit. The overload protection 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 circuit to the fuel pump.

A rotor with a built-in centrifugal switch prevents overspeeding of the engine by breaking the ignition circuit at excessive engine speeds.

A pressure gauge showing the charging pressure is fitted in the instrument panel.



Pressure switch



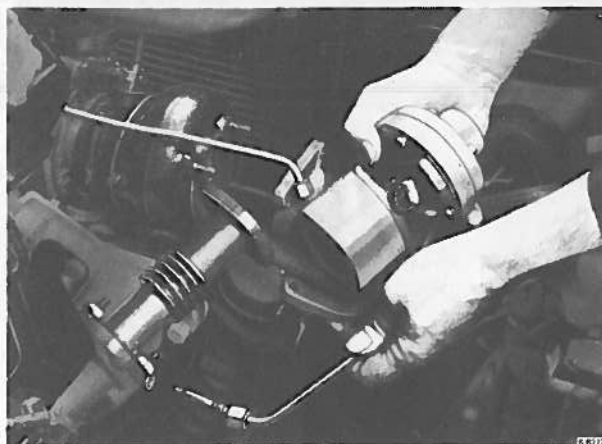
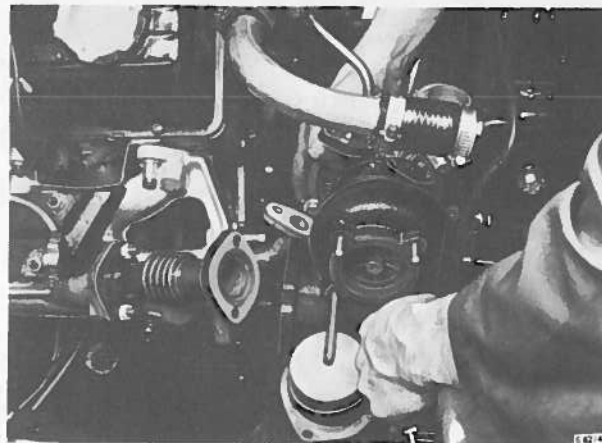
S 6218

Turboinstrument

Turbocharger unit

Removal

1. Remove the charging 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 turbocharger unit.
4. Remove the bolts securing the turbocharger to the exhaust manifold and remove the turbocharger unit. Plug all holes in the turbocharger unit.



Assembly

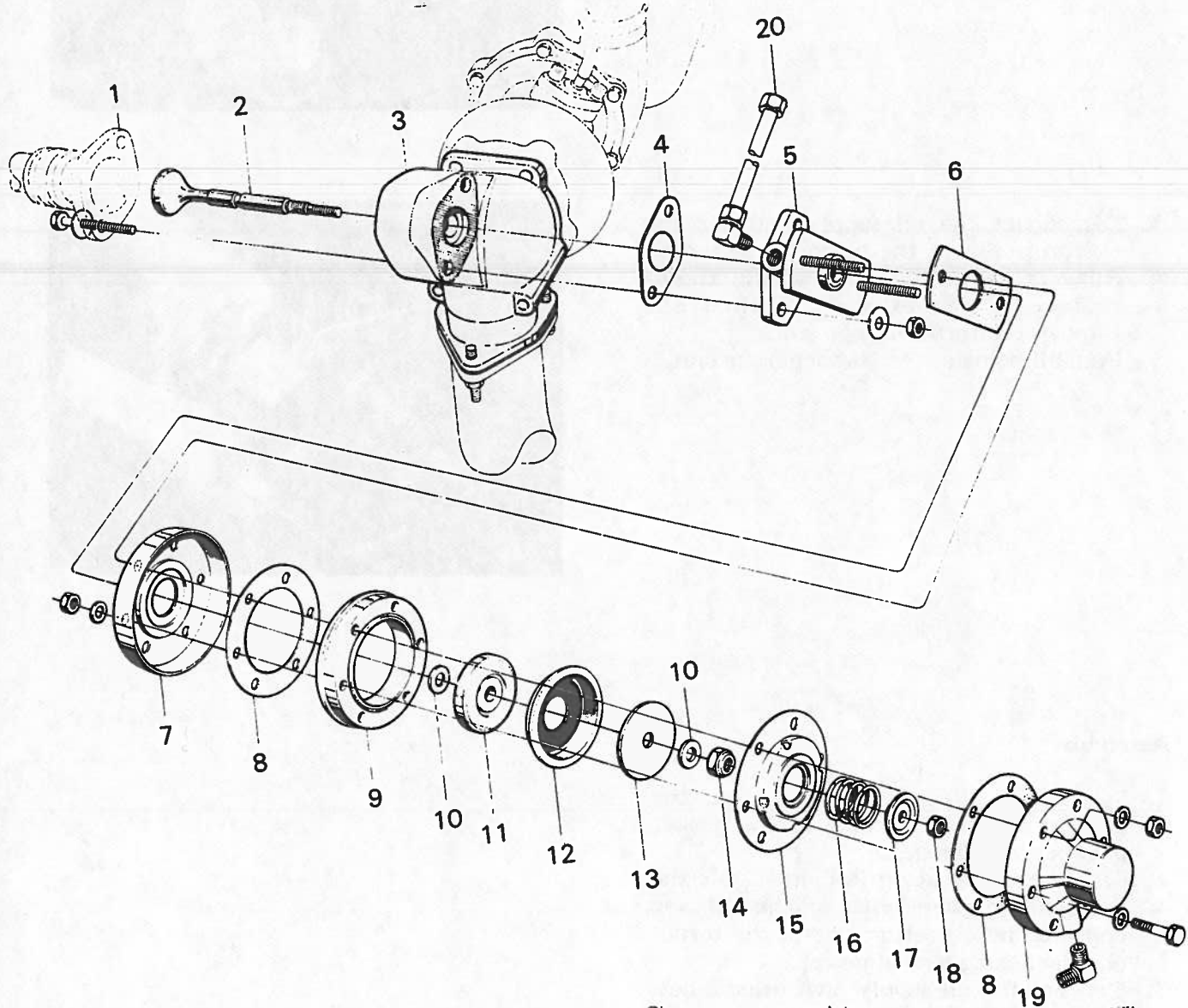
1. Secure the turbocharger unit to the exhaust manifold, fitting a new gasket between the flanges.
2. Fill the lubricating oil inlet of the turbocharger unit with engine oil and connect the oil return line at the turbocharger, using a new gasket.
3. Connect the oil supply line, using a new gasket and 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 charging 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 turbocharger before the engine in starter.

Charging pressure regulator

The following operations are included:

- Removal, fitting
- Dismantling, assembly (charging pressure regulator removed)
- Grinding of valve (charging 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 charging 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
1979 model with six holes, as from 1980 model with four holes)
16. Spring
17. Inner spring seating
18. Lock nut
19. Diaphragm housing cover
20. Cooling air pipe

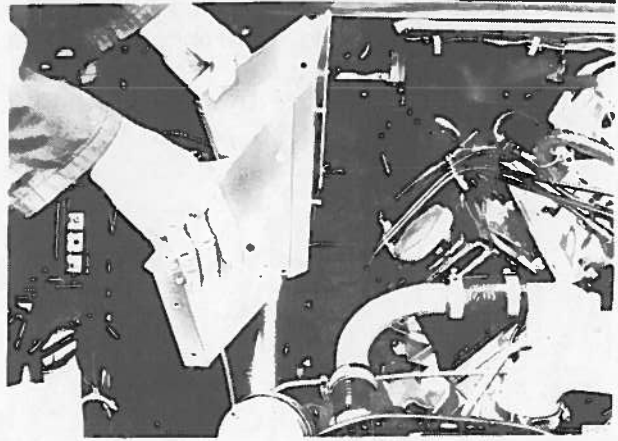
General

The charging pressure regulator 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 inclined slightly because the inner spring seat is intentionally off-set 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 charging pressure regulator

1. Remove the battery, heat shield and battery bracket.
2. Disconnect the exhaust and cooling air lines from the charging pressure regulator.
3. Unbolt the exhaust manifold flange. Save the taper seal ring and plug the exhaust pipe.
4. Prize up the locking plate and remove the bolts from the bellows pipe.
5. Prize up the locking plate, remove the bolts from the turbocharger and remove the charging pressure regulator.



Fitting the charging pressure regulator

1. Bolt the charging 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 charging pressure regulator housing.

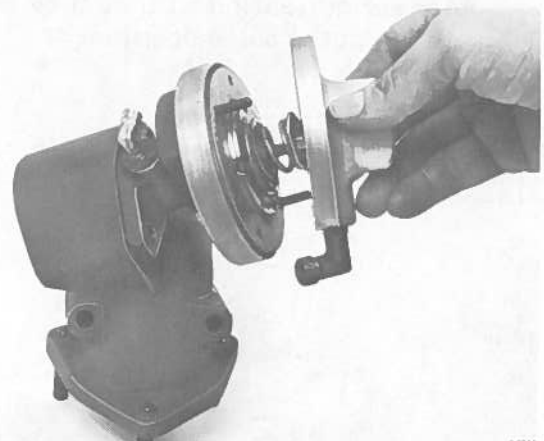
Lubricate the exhaust pipe nipple with NEVER SEIZE or Molycote 1000 to prevent it from seizing.

4. Connect the exhaust and cooling air lines.
5. Drive the car, checking the charging pressure, and adjust as necessary.
6. Seal the charging pressure regulator and fit the heat shield.

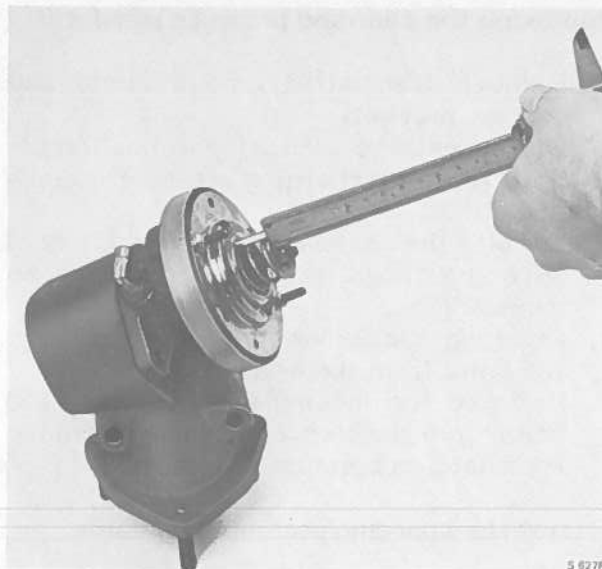


Dismantling the charging pressure regulator (Charge pressure regulator removed)

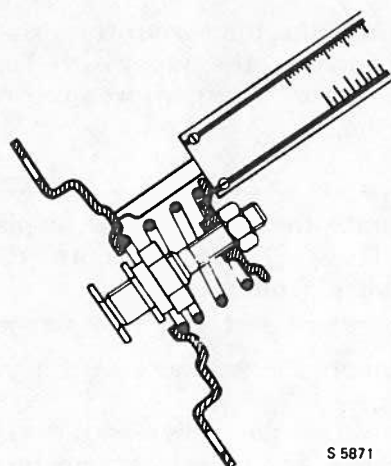
1. Remove the diaphragm housing cover.



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 627P



S 5871

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



S 627N

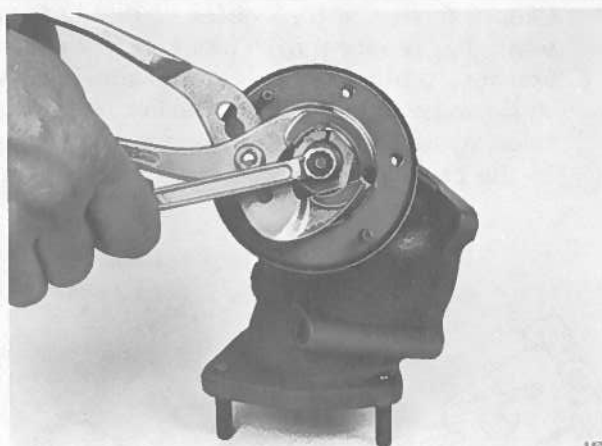
4. Release the lock nut using a 10 mm ring spanner and universal pliers and then remove the nut, the outer spring seating, the spring and the inner spring seating.

Caution

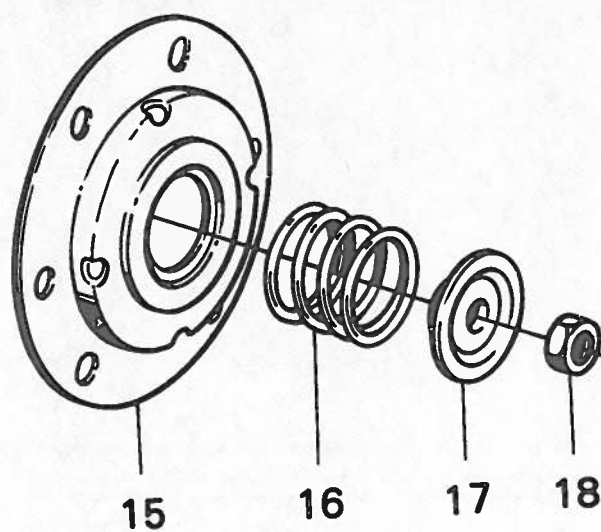
Always grip the valve seat when removing the spindle nut to avoid damaging the diaphragm.



5 8290



5 8291



The charging pressure regulator spring

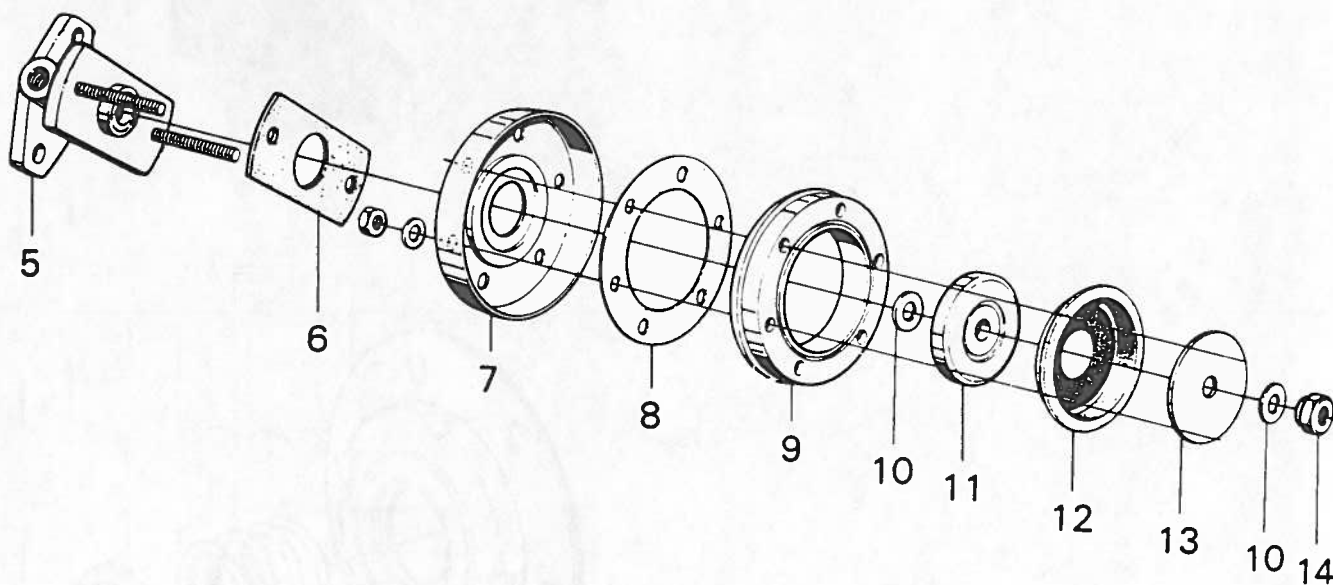
- 15. Inner spring seating
- 16. Spring
- 17. Outer spring seating
- 18. Lock nut

5. Remove the diaphragm nut (13 mm ring spanner). Prevent the valve from turning by inserting a short, thick screwdriver into the groove in the valve disc. to prevent the valve from turning.



6. Remove the parts (see illustration) in the following order:

Diaphragm nut, outer diaphragm washer, diaphragm, inner diaphragm washer, plain washer, diaphragm housing, gasket, heat shield, gasket, bearing housing and gasket. Assemble the valve in the reverse order.



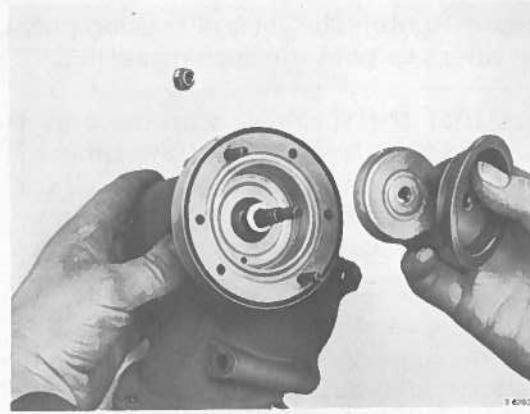
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Charging pressure regulator

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

Assembly

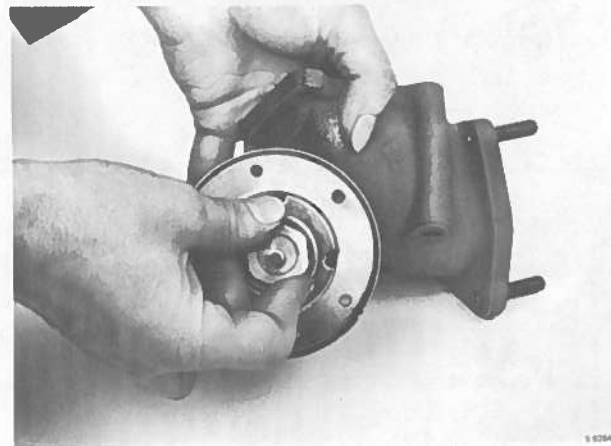
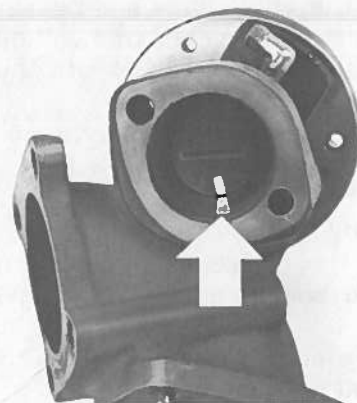
1. Insert the valve using one hand to hold it in position. Fit the gasket, bearing housing, gasket, heat shield, gasket, diaphragm housing, plain washer, inner diaphragm washer, diaphragm, outer diaphragm washer and the diaphragm nut.



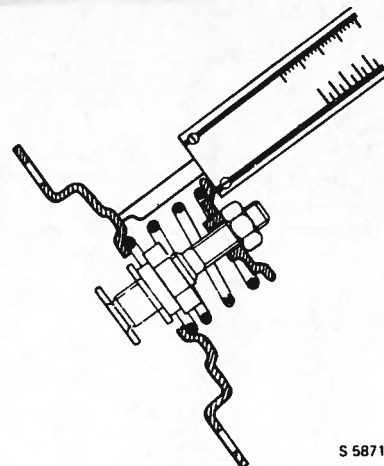
2. Check that the inner diaphragm ridge engages in the groove in the diaphragm washer and tighten the diaphragm nut, preventing the valve from turning by inserting a short, thick screwdriver in the groove in the valve disc.

Apply a thin layer of NEVER SEIZE or Molycote 1000 to the valve spindle and threads to prevent them from seizing.

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 in 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).



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5. Fit and tighten the lock nut, using poly-grip pliers to hold the spring seating.

Check that the spring is working correctly by compressing it a few times. If it wobbles or "crackles", turn the spring to another position. The spring can otherwise cause noise.

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

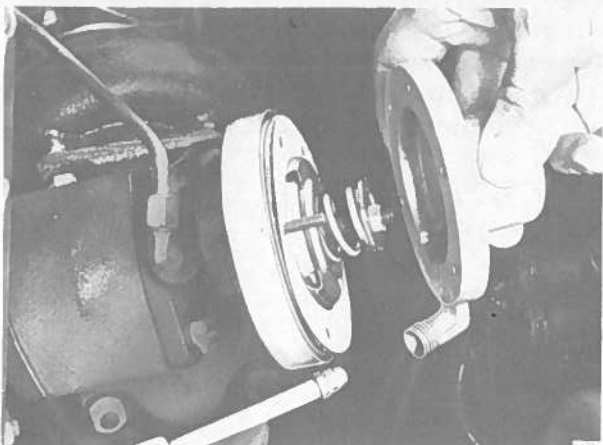
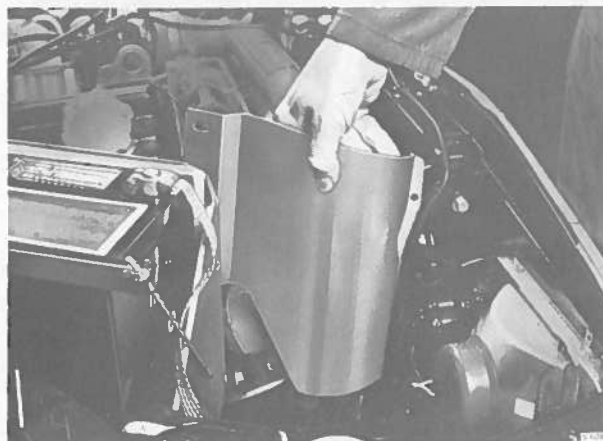
Grinding the valve and valve seat (charging pressure regulator removed)

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. Cut 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 cloth).
4. Mount the valve in a valve grinding machine and clean the seating surface (45° C).
5. Separate and thoroughly clean the valve body and bearing housing.

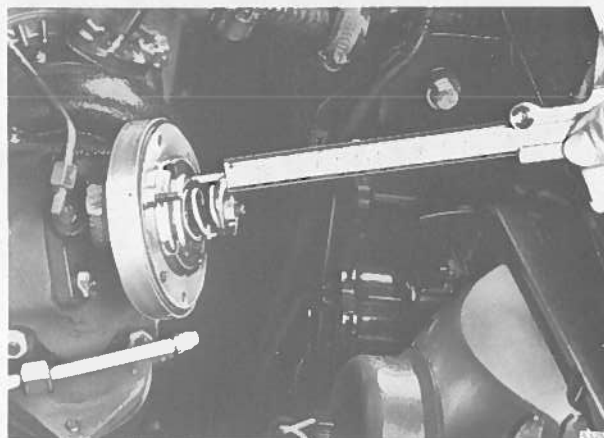


Changing the diaphragm (in the car)

1. Remove the heat shield.
2. Remove the diaphragm housing cover.



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



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

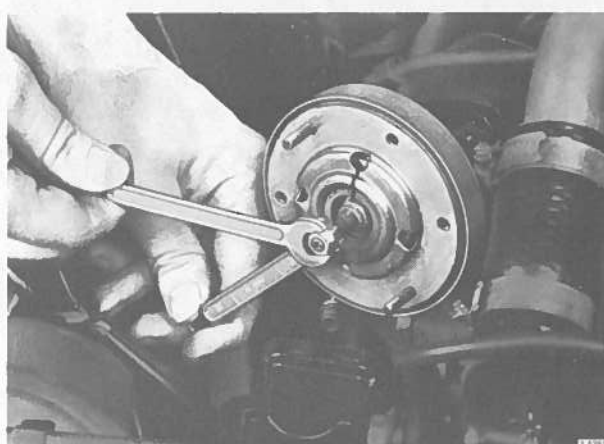
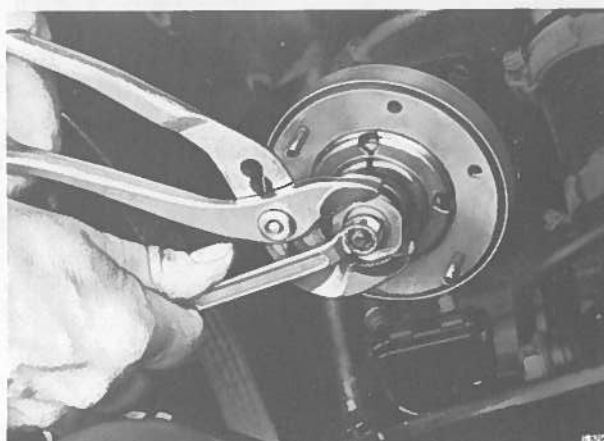


5. Loosen the lock nut (using a 10 mm ring spanner and universal pliers) and remove the nut, the outer spring seating, the spring and the inner spring seating.

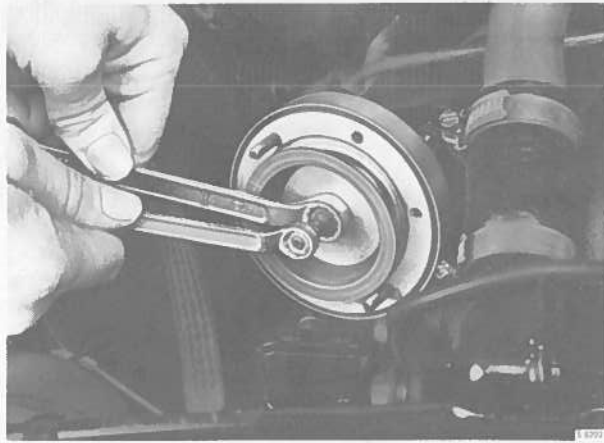
Caution

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

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



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



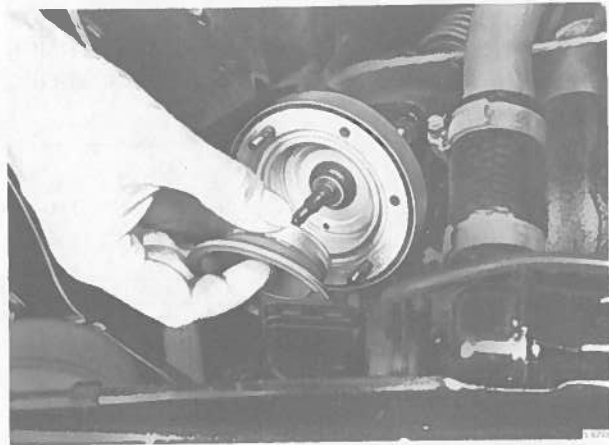
8. Remove the two nuts, the diaphragm nut, the outer diaphragm washer, the diaphragm and the inner diaphragm washer.

9. Clean the diaphragm housing and all dismantled parts.

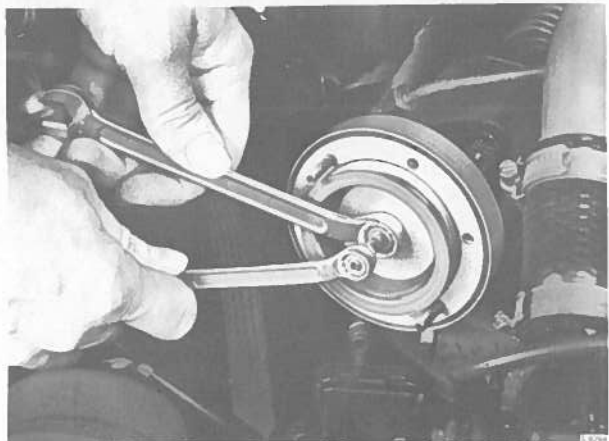
10. Check that the flat washer inside the inner diaphragm washer is in position.

Lubricate the valve's threads with NEVER SEIZE or Molycote 1000 to prevent them from seizing.

11. Fit the diaphragm with the two diaphragm washers. Ensure that the inner ridge on the diaphragm engages the groove in the diaphragm washer.



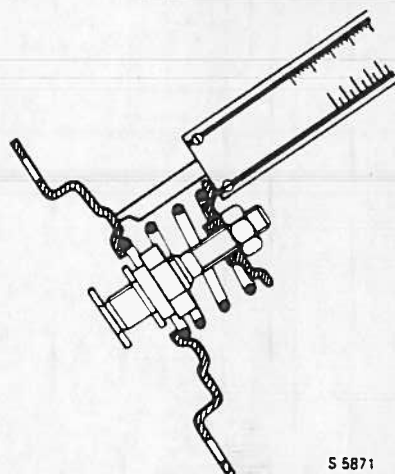
12. Fit the diaphragm nut and the two other nuts, and tighten the diaphragm nut. Remove the other two nuts.



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



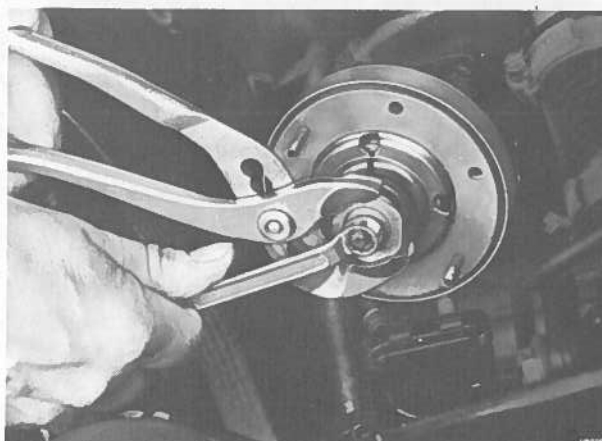
14. Fit the spring and the outer spring seating.
15. Adjust the compressed length of the spring to the length measured on dismantling (the basic length given in the specifications is approximate).
Replace and tighten the lock nut. Grip the outer spring seating by means of universal pliers.



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16. Fit the gasket and diaphragm housing cover.
17. Fit the heat shield.
Check the charging pressure and adjust as necessary, and then seal the charging pressure regulator.

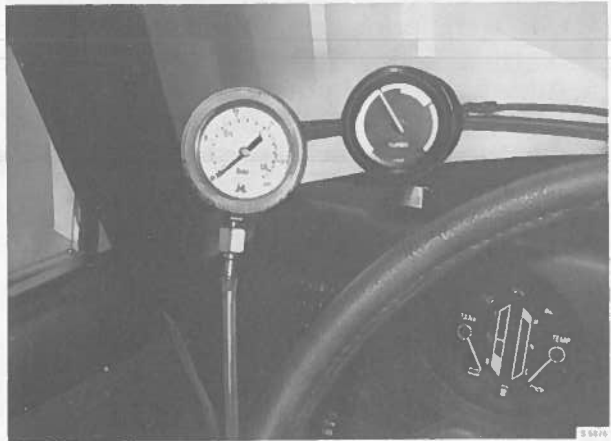
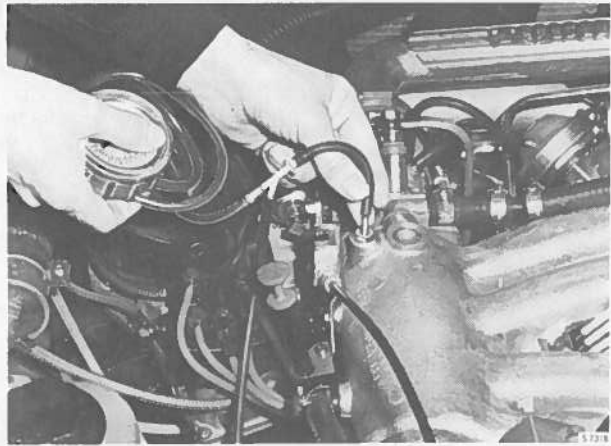
Wire, part No. (45) 300 78 79
Seal, part No. (45) 300 78 87



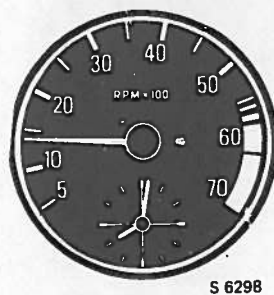
Measuring the charging pressure

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.

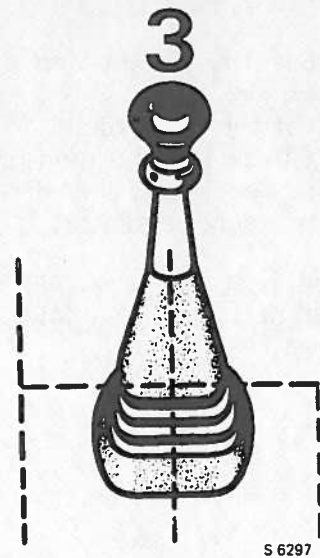
1. Connect pressure gauge 83 92 813 between the adapter on the inlet manifold and the line to the pressure switch. Run the hose into the passenger compartment and place the pressure gauge on the left-hand corner of the instrument panel.



2. Warm up the engine thoroughly by driving the car on the road.
3. To start the test, drive the car in 3rd gear at an engine speed below 1 500 r/min.

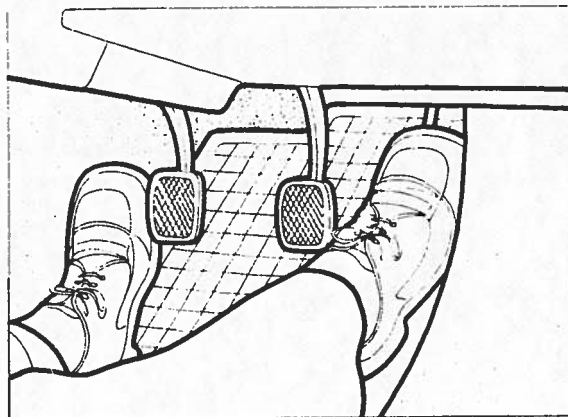


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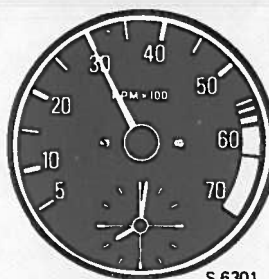
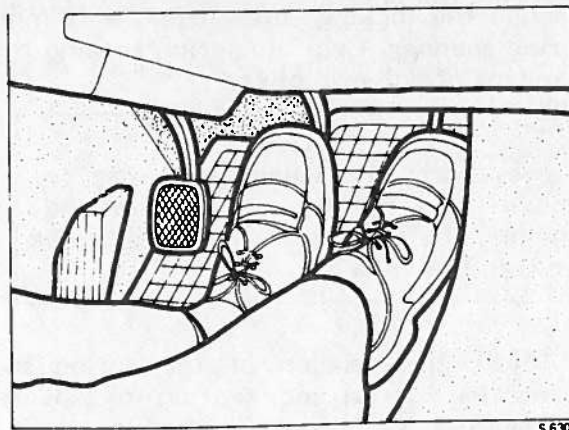
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4. Accelerate at full throttle by pressing the accelerator down to the floor.



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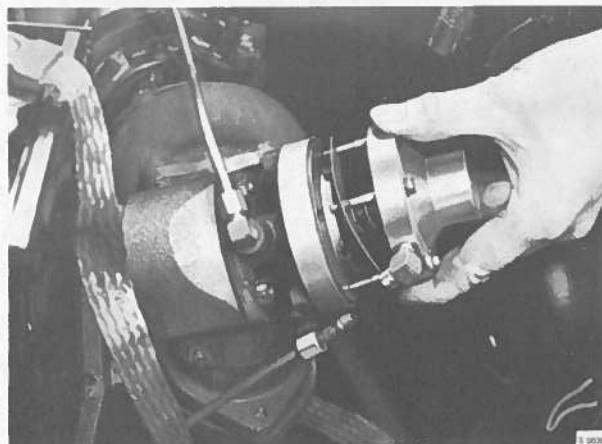
5. As the engine speed approaches 3 000 r/min, apply the brakes (still keeping the accelerator pressed down) to put the car under full load at 3 000 r/min and note the maximum pressure indicated by the pressure gauge.



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:

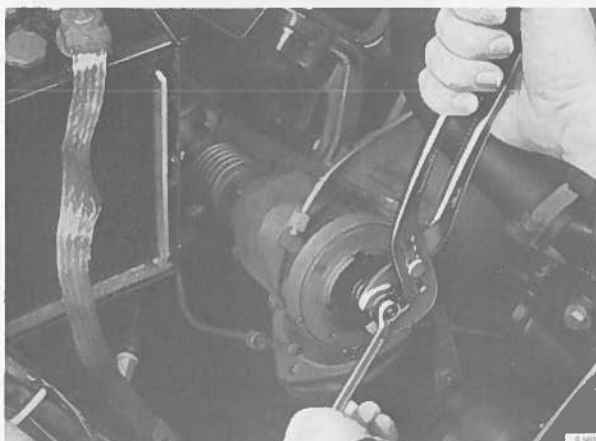
1. Remove the heat shield mounted in front of the charging pressure regulator.
2. Disconnect the exhaust line from the diaphragm housing cover.
3. Remove the diaphragm housing cover.



4. Undo the locking screw 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.



5. 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 in or out the following number of turns
0,86	1 out
0,82	3/4 out
0,78	1/2 out
0,74	1/4 out
0,70	Correct value
0,66	1/4 in
0,62	1/2 in
0,56	3/4 in
0,54	1 in

6. Replace the cover and gasket, exhaust line and heat shield.
7. Test drive the car and check the charging pressure.
8. Seal the charging pressure regulator.

Cleaning the charging pressure regulator (In conjunction with inspection)

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

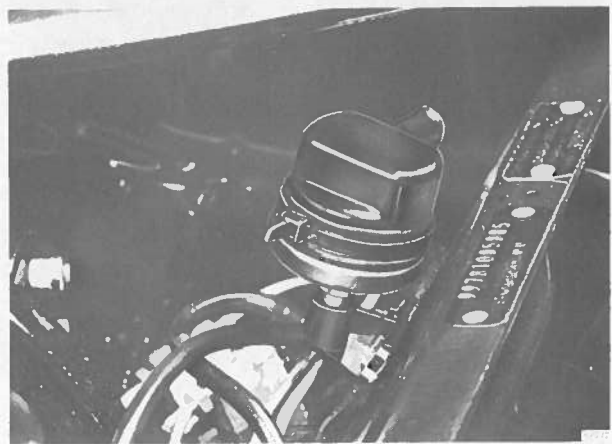
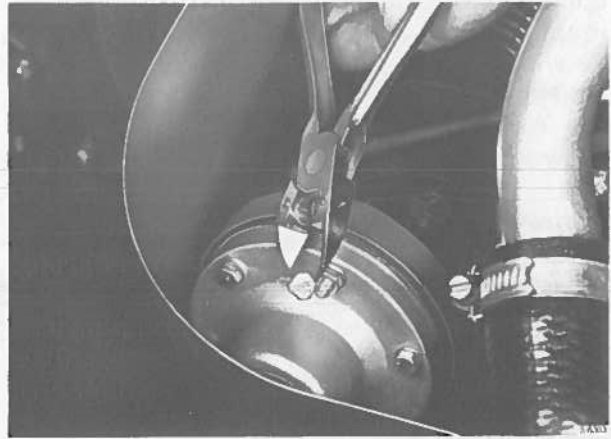
Sealing the charging pressure regulator

To avert unauthorized adjustment of the charging pressure, the charging pressure regulator must be sealed. Whenever work has been carried out on the charging pressure regulator, it must be re-sealed before the car is returned to the owner. Fit the seal to the long diaphragm bolt which has a hole for the purpose.

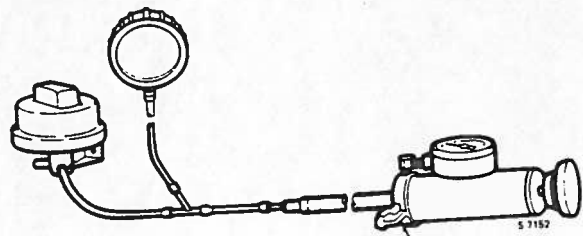
Authorized Saab workshops will be supplied with sealing pliers and special seals.

Pressure switch

1. Start the engine and run it at idling speed.



2. Disconnect the hose from 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. Raise the pressure by means of the pump and check the pressure at which the engine cuts out. See the specifications in Group 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.

Turbocharger pressure gauge

Check the turbocharger 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.



Removal and refitting

1. Remove the three screws at the bottom of the safety padding on the instrument panel side of the car.
2. Pull the safety padding away to release the spring clips (see Service Manual, section 853).
3. Disconnect the hose at the joint below the padding and disconnect the electric cables. Undo the nut underneath the safety padding and remove the instrument.

Refit in the reverse order.

To dismantle the instrument, e.g. to replace a bulb, etc. remove the screw at the front of the casing.



Fault tracing chart

FAULT	CAUSE	REMEDY
Noise or vibration from the turbo-compressor	Poor lubrication of the shaft bearing	Check the oil pressure and flow to the turbo. If the fault should persist after remedial action (permanent bearing damage) replace the turbo compressor.
	Leakage in the induction or exhaust system	Tighten leaking connections and replace defective seals and gaskets
	Unbalanced shaft owing to damage	Replace 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 charging pressure regulator
	Valve in charging pressure regulator sticks in open position	Overhaul the charging pressure regulator
	Partially clogged exhaust system	Clean or replace exhaust system
	Clogged air cleaner	Change the cartridge
	Binding shaft	Replace the 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 charging pressure regulator	Replace diaphragm
	Valve in charging pressure regulator sticks in closed position	Overhaul the charging pressure regulator
	Icing 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 starting from cold
	Incorrect setting of charging pressure	Adjust charging pressure regulator

FAULT	CAUSE	REMEDY
Metallic noise from charging pressure regulator	Play in regulator valve	Overhaul the charging pressure regulator
	Spring insufficiently offset in charging 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	Replace the turbo compressor

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