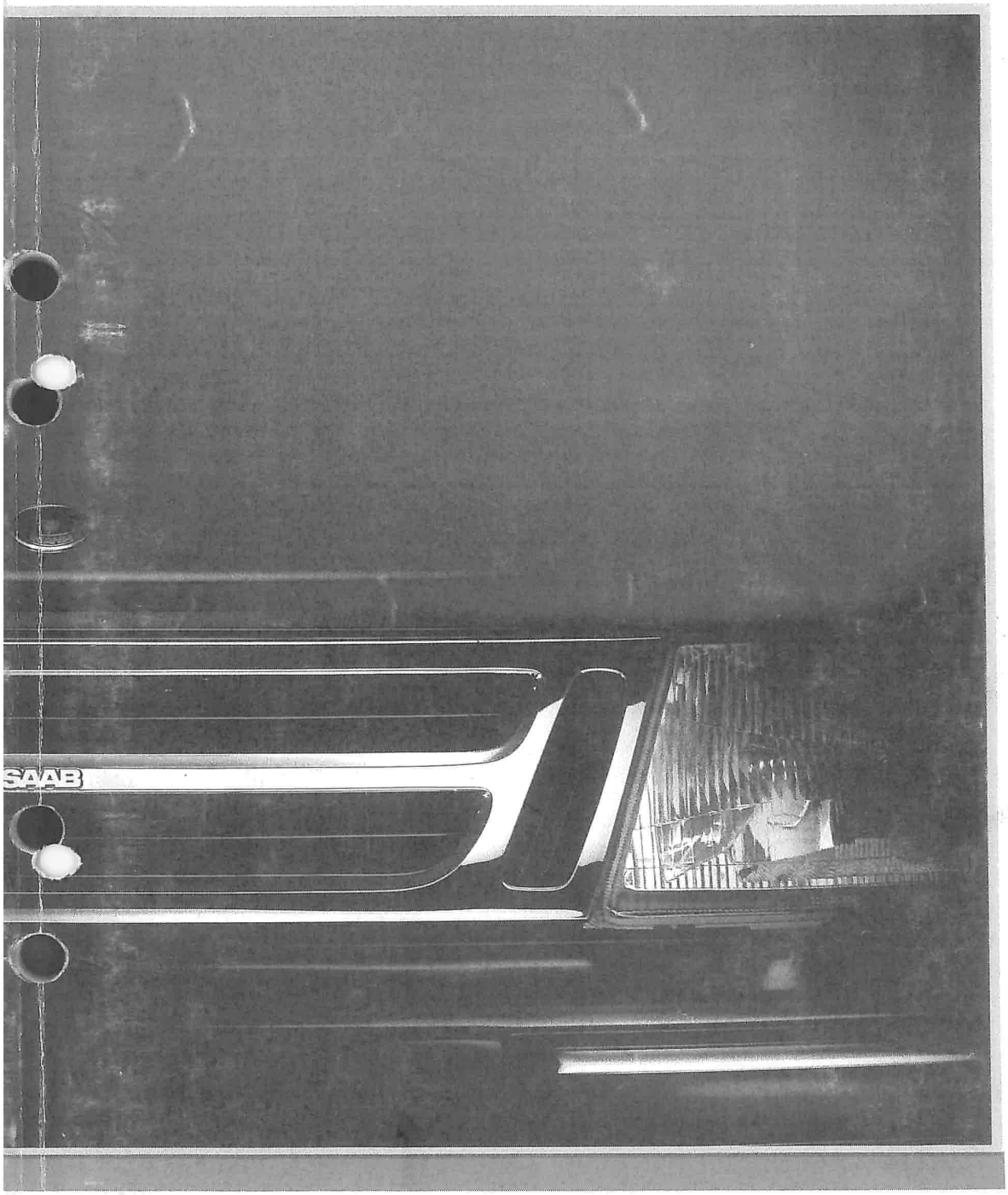
Saab 900

SERVICE MANUAL



SAAB

2:1 Basic engine

M 1981 – 88–

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SAAB 900

SERVICE MANUAL

2:1 Basic engine

M 1981–88

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Units

The basic and derived units used throughout the Service Manual are in accordance with the SI system.

For users not familiar with the SI units, some non-Continental units are given in brackets after the respective SI unit.

The following symbols and abbreviations are used:

SI unit	Equivalent unit and symbol
mm	inch (in)
kg	pound (lb)
N	pound-force (lbf)
Nm	pound-force foot (lbf ft)
bar	pound-force per square inch (lbf/in^2) (Also abbreviated: psi)
l (litre)	US liquid quart (liq qt) (Also abbreviated: qts) US gallon (USgal)
°C	°F

Conversion factors

1 in = 25.4 mm	1 mm = 0.039 in
1 lbf = 4.45 N	1 N = 0.23 lbf
1 lbf ft = 1.36 Nm	1 Nm = 0.74 lbf ft
1 psi = 0.07 bar	1 bar = 14.5 lbf/in^2
1 liq qt = 0.95 l	1 l = 1.05 liq qt
1 US liq qt = 0.83 UKqt	1 USgal = 0.83 UKgal

Market codes

The codes refer to market specifications

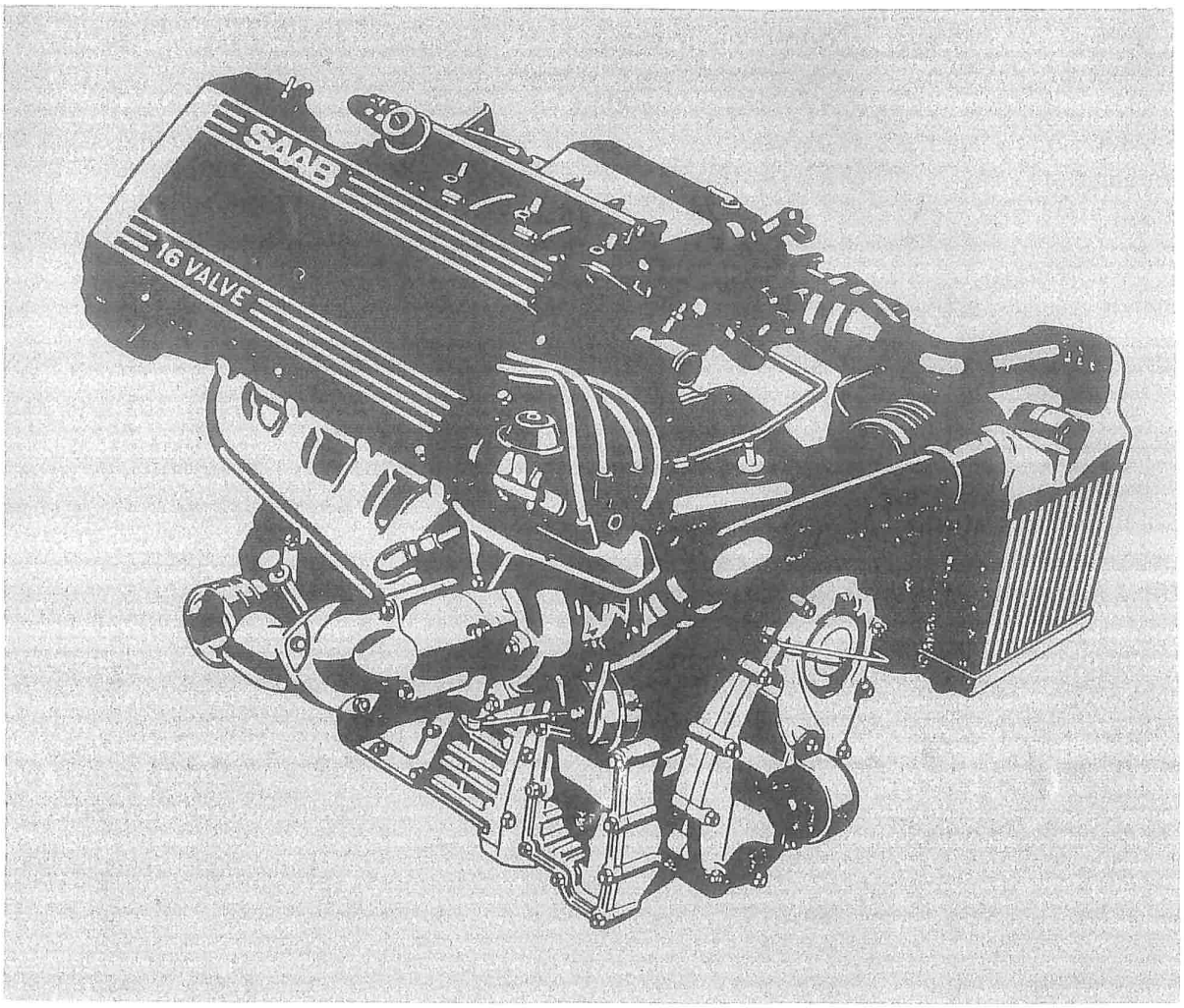
AT	Austria	FR	France
AU	Australia	GB	Great Britain
BE	Belgium	GR	Greece
CA	Canada	IS	Iceland
CH	Switzerland	IT	Italy
DE	Germany	JP	Japan
DK	Denmark	ME	Middle East
ES	Spain	NL	Netherlands
EU	Europe	NO	Norway
FE	Far East	SE	Sweden
FI	Finland	US	USA

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Technical data



Engine

General data

Type: B201		4-cylinder, 4-stroke engine with overhead cam shaft
B202		4-cylinder, 4-stroke engine with twin overhead camshafts
Cylinder bore	mm (in)	90 (3.54)
Stroke	mm (in)	78 (3.07)
Swept volume	cm^3 (in^3)	1985 (121)
Firing order (No. 1 cylinder at rear)		1-3-4-2
Approximate weight, B201	kg (lb)	140 (309)
B202	kg (lb)	150 (331)

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Performance, compression ratio, fuel octane number, etc.

Engine Variant	Model Year	Octane Requirement RON (AKI)*	Suitable for lead-free fuel	Compression ratio	Rating (DIN), kW (hp)/rpm	Torque Nm (lbf ft)/ rpm
Single carburettor	81-84	Min 96		9.5	73(100)/5200	162(120)/3000
	85-	Min 95	X			
Twin carburettor	81-84	Min 96		9.5	79(108)/5200	164(120)/3300
B201i	81-84	Min 96		9.5	87(118)/5500	167(124)/3000
	85-	Min 95	X			
B201i with catalytic converter	81-	Min 91(87)	X	9.25	81(110)/5250	161(119)/3000
B202i with catalytic converter	86-	Min 91 Rec 95(91)	X	10.1	96(130)/5500	173(128)/3000
B201 Turbo, (N/A APC)	81-82	Min 98		7.2	107(145)/5000	235(174)/3000
B201 Turbo (N/A APC) with catalytic converter	81-82	Min 95 (91)	X	7.2	99(135)/4800	217(160)/3500
B201 Turbo with APC	82-84	Min 91 Rec 98		8.5	107(145)/5000	235(174)/3000
	85	Min 91 Rec 98	X			
B201 Turbo with APC	86-	Min 91 Rec 98	X	8.5	114(155)/5000	240(178)/3000
B201 Turbo with APC and	82-86	Min 91 (87) Rec 95 (91)	X	8.5	99(135)/4800	217(160)/3500
catalytic converter	87-	Min 91 (87) Rec 95 (91)	X	8.5	103(140)/5000	235(174)/2500
B202 Turbo	84-	Min 91 Rec 98	X	9.0	129(175)/5300	273(200)/3000
B202 Turbo with catalytic converter	85-	Min 91 (87) Rec 95 (91)	X	9.0	118(160)/5500	255(188)/3000
B202 Turbo SPG USA**	87-	Min 95 (91)	X	9.0	121(165)/5500	265(195)/3000

The specified octane ratings are minimum values and may deviate from those specified in the Owner's Manual, as the ratings specified in the latter are adapted to the quality of fuel available in the country concerned.

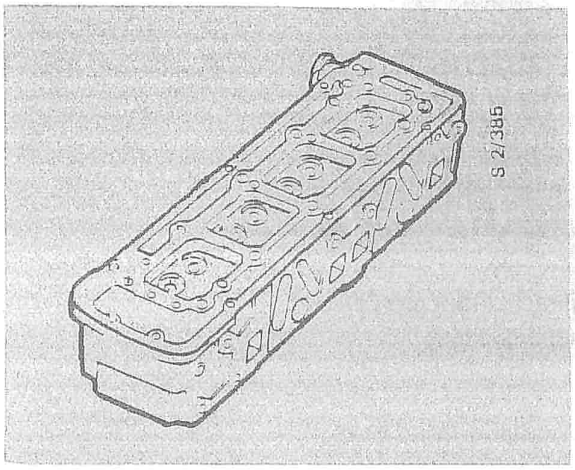
*) $AKI = \frac{MON + RON}{2}$

**) Uprated B202 Turbo with catalytic converter (US & CA)

Premium = 91 AKI
Regular = 87 AKI

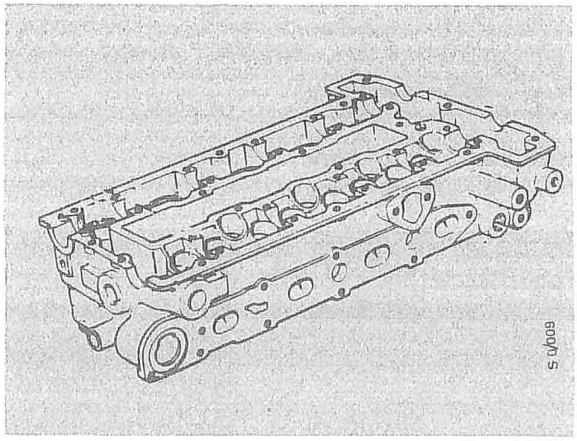
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Engine block



Cylinder head (B201)

Height of new cylinder head:	mm (in)	92.75 ± 0.05 (3.652 ± 0.002)
Minimum after regrinding:	mm (in)	92.35 ± 0.05 (3.636 ± 0.002)
		For cylinder heads that have been reground, a head gasket, 0.3 mm (0.012 in) thicker, is available for H engines (M81 onwards).

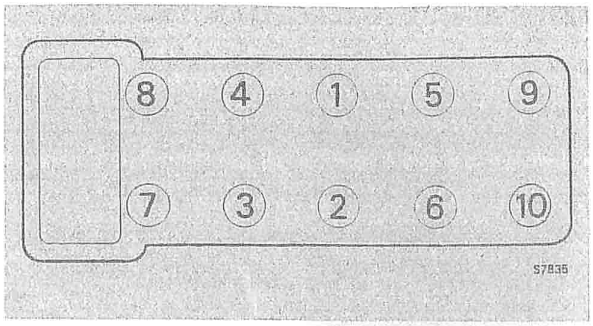


Cylinder head (B202)

Height of new cylinder head:	mm (in)	140.5 ± 0.1 (5.533 ± 0.003)
Minimum after regrinding:	mm (in)	140.1 ± 0.1 (5.516 ± 0.004)

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Tightening sequence



Tightening torques

The specified torques applied to lubricated bolts and washers and to new head gaskets.

Tightening torques for M17 cylinder head bolts:

Stage I	Nm (lbf ft)	60 (44)
Stage II	Nm (lbf ft)	80 (59)
Stage III		Run the engine to normal temperature and then allow it to cool for 30 min
Stage IV	Nm (lbf ft)	Slacken and thenretighten each bolt to 95 (70)
Stage V		Tighten a further quarter-turn (90°)

Tightening torques for M15 and TORX M12 head bolts (M87 and earlier with cylinder head gasket 75 16 529 or 75 05 217)

Stage I	Nm (lbf ft)	60 (44)
Stage II	Nm (lbf ft)	80 (59)
Stage III		Run the engine to normal temperature and then allow it to cool for 30 min
Stage IV	Nm (lbf ft)	Slacken and then retighten each bolt to 80 (59)
Stage V		Tighten a further quarter-turn (90°)

Tightening torques for M15 and TORX M12 head bolts (M88 onwards with cylinder head gasket 75 61 301 or 75 85 037)

Stage I	Nm (lbf ft)	60 (44)
Stage II	Nm (lbf ft)	80 (59)
Stage III		Tighten a further quarter-turn (90°)

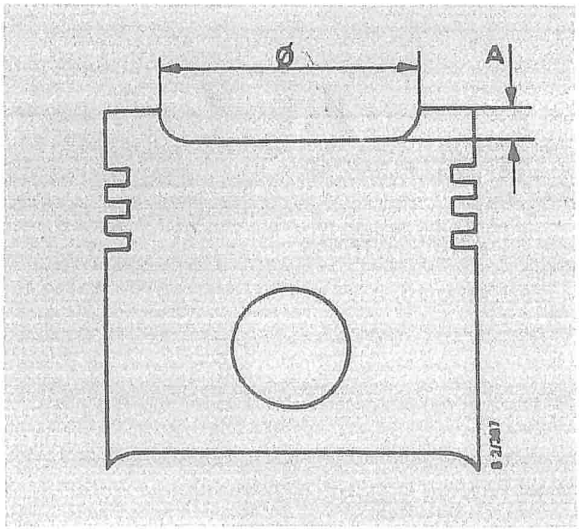
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Cylinder block

Standard (A)	mm (in)	90.00 - 90.01 (3.543 - 3.544)
Standard (B)	mm (in)	90.01 - 90.02 (3.544 - 3.544)
First oversize	mm (in)	90.50 (3.563)
Second oversize	mm (in)	91.00 (3.583)

Pistons

Make		Mahle, Karl Schmidt or Hepolite
Piston speed (average)	m/s (ft/s)	13 (39.7) at 5000 rpm



Pistons

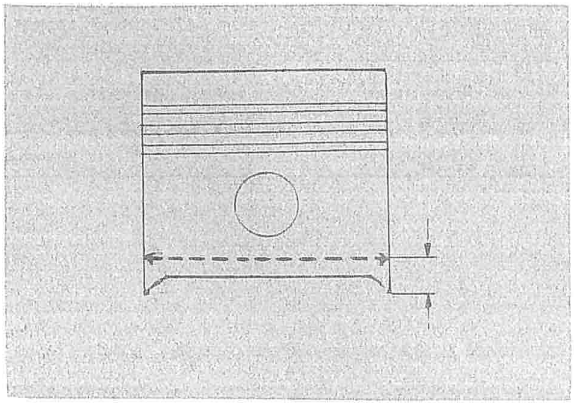
The type of piston used varies with the compression ratio of the engine.

Engine	Model year	Piston dia, mm (in)	A, mm (in)	Piston weight, g (oz)
B201, Carb.	1981-	58 (2.28)	0.4 (0.016)	480-492 (17.2-17.7)
B201i	1981-	58 (2.28)	0.4 (0.016)	480-492 (17.2-17.7)
B202i	1986-	64 (2.52)	1.0 (0.04)	504-516 (18.1-18.6)
B201, Turbo	1981	70 (2.76)	6.6 (0.260)	492-504 (17.7-18.1)
B201, Turbo APC	1982-	70 (2.76)	2.65 (0.104)	497-506 (17.8-18.2)
B202, Turbo	1984-	64 (2.52)	4.7. (0.185)	514-526 (18.5-18.9)
B202, Turbo	1986-	64 (2.52)	3.85 (0.152)	519-531 (18.7-19.1)

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Piston diameter

Measured at right angles to gudgeon pin and:
- Mahle: 16 mm above lower edge
- Schmidt: 26 mm above lower edge



N.B.
Pistons of different makes must not be fitted in the same engine.

Classification of pistons and cylinder bores

The piston classification code is stamped on the crown of the piston. The codes for servicing are:

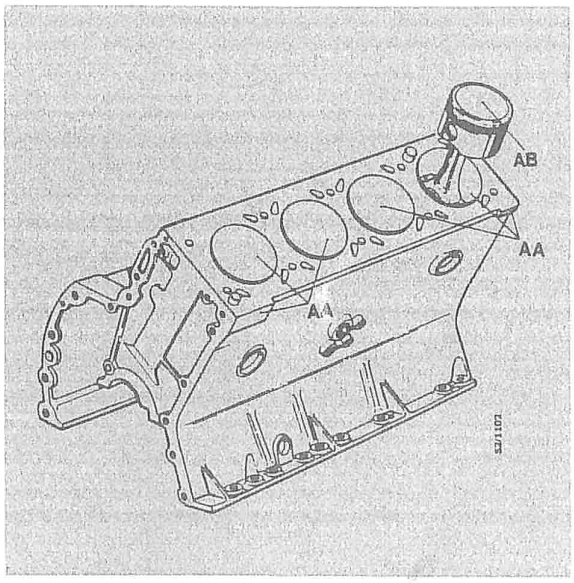
AB

B

C

The cylinder classification code is punched on the block adjacent to each cylinder.

Cylinders are either class A or B. Both classes may occur in the same block.



Earlier classification
Turbo (Mahle)

Standard A (not spare part)	mm (in)	89,960-89,970 (3.5417-3.5421)
Standard AB	mm (in)	89,970-89,976 (3.5421-3.5424)
Standard B	mm (in)	89,976-89,986 (3.5424-3.5428)
Standard C	mm (in)	89,986-90,002 (3.5428-3.5434)
First oversize (0.5 mm)	mm (in)	90,460-90,475 (3.5614-3.5620)
Second oversize (1.0 mm)	mm (in)	90,960-90,975 (3.5811-3.5817)
Piston clearance (nominal)	mm (in)	0,024-0,050 (0.0009-0.0020)

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Other engines (Schmidt)

Standard A (not spare part)	mm (in)	89,972-89,980 (3.5422-3.5425)
Standard AB	mm (in)	89,980-89,986 (3.5425-3.5428)
Standard B	mm (in)	89,986-89,994 (3.5426-3.5431)
Standard C	mm (in)	89,994-90,010 (3.5431-3.5437)
First oversize (0.5 mm)	mm (in)	90,472-90,487 (3.5619-3.5625)
Second oversize (1.0 mm)	mm (in)	90,972-90,987 (3.5816-3.5822)
Piston clearance (nominal)	mm (in)	0,014-0,040 (0.0006-0.0016)

New classification

Turbo + carburettor (Mahle)

Standard A (not spare part)	mm (in)	89,960-89,970 (3.5417-3.5421)
Standard AB	mm (in)	89,970-89,978 (3.5421-3.5424)
Standard B	mm (in)	89,978-89,986 (3.5424-3.5428)
Standard C	mm (in)	89,986-90,002 (3.5428-3.5434)
First oversize (0.5 mm)	mm (in)	90,460-90,475 (3.5614-3.5620)
Second oversize (1.0 mm)	mm (in)	90,960-90,975 (3.5811-3.5817)
Piston clearance (nominal)	mm (in)	0,02-0,050 (0.0009-0.0020)

Turbo + injection (Mahle & Schmidt)

Standard A (not spare part)	mm (in)	89,978-89,988 (3.5424-3.5428)
Standard AB	mm (in)	89,988-89,996 (3.5428-3.5431)
Standard B	mm (in)	89,996-90,004 (3.5431-3.5435)
Standard C	mm (in)	90,004-90,020 (3.5435-3.5441)
First oversize (0.5 mm)	mm (in)	90,482-90,497 (3.5623-3.5629)
Second oversize (1.0 mm)	mm (in)	90,982-90,997 (3.5820-3.5826)
Piston clearance (nominal)	mm (in)	0,004-0,032 (0.0002-0.0013)

Non-Turbo injection (Hepolite)

Standard A (not spare part)	mm (in)	89,977-89,985 (3.5424-3.5427)
Standard AB	mm (in)	89,985-89,991 (3.5427-3.5430)
Standard B	mm (in)	89,991-89,999 (3.5430-3.5433)
Standard C	mm (in)	89,999-90,015 (3.5433-3.5439)
First oversize (0.5 mm)	mm (in)	90,477-90,492 (3.5621-3.5627)
Second oversize (1.0 mm)	mm (in)	90,977-90,992 (3.5818-3.5824)
Piston clearance (nominal)	mm (in)	0,009-0,035 (0.0004-0.0014)

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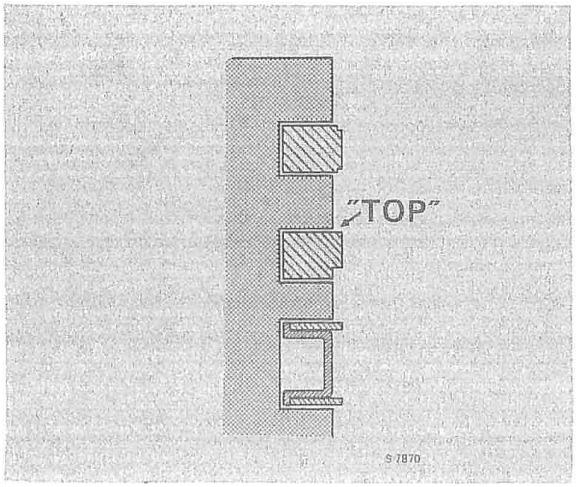
Resulting piston clearances

Earlier classification

Piston/cylinder	Clearance, Schmidt	1/1000 mm Turbo
A/A	20-38	30-50
AB/A	14-30	24-40
AB/B	24-40	35-50
B/A	6-24	14-34
B/B	-	8-34

New classification

Piston/cylinder	Clearance, Non-turbo (Schmidt)	1/1000 mm Turbo Carburettor)	Non-turbo (Hepolite)
A/A	12-32	30-50	15-33
AB/A	4-22	22-40	0-25
AB/B	14-32	32-50	19-35
B/A	-	14-32	1-19
B/B	6-24	24-42	11-29
C/B	-	8-34	-



Piston rings

		Top compression ring	Second compression ring	Scraper ring
Width (thickness),	mm (in)	1.73-1.75 (0.0681-0.0689)	1.98-1.99 (0.0780-0.0783)	2.63-2.73* (0.1035-0.1075)
Side clearance in groove	mm (in)	0.050-0.082 (0.0020-0.0032)	0.040-0.072 (0.0016-0.0028)	
Working gap in new cylinder,	mm (in)	0.35-0.55 (0.0138-0.0217)	0.30-0.45 (0.0118-0.0177)	0.38-1.40** (0.0150-0.0551)

* Segment width (thickness): 0.58-0.64 mm (0.0028-0.0252 in)
** Applies to segment

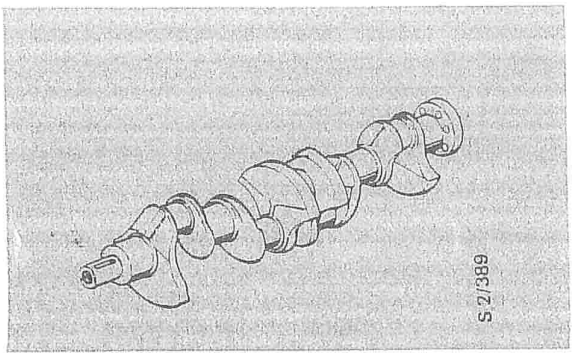
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Gudgeon pins

Diameter:	mm (in)	23.996-24.000 (0.9447-0.9449)
Fit	mm (in)	0.005-0.014 (0.0002-0.0006) (sliding fit under gentle thumb pressure)

Connecting rods

Diameter of big-end	mm (in)	56.000-56.019 (2.2047-2.2055)
Diameter of small-end bush	mm (in)	24.005-24.010 (0.9451-0.9453) (fitted)
Maximum permissible weight variation per set	g (oz)	9 (0.32)



Crankshaft

Maximum variation in straightness	mm (in)	0.10 (0.0039)
End float	mm (in)	0.08-0.28 (0.0031-0.0110)
Maximum journal out-of-round	mm (in)	0.05 (0.0020)
Maximum taper of journals	mm (in)	0.05 (0.0020)
Radius of main journal fillet	mm (in)	2.2-2.5 (0.0866-0.0984)
Main bearing clearance	mm (in)	0.020-0.062 (0.0008-0.0024)
Big-end bearing clearance	mm (in)	0.026-0.061 (0.0010-0.0024)

Colour markings of main bearing and big-end bearing shells

	Thin	Thick
Standard	Red	Blue
First undersize	Yellow	Green
Second undersize	White	Brown

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Crankpin diameter:

Standard	mm (in)	51.981-52.000 (2.0465-2.0472)
First undersize	mm (in)	51.731-51.750 (2.0367-2.0374)
Second undersize	mm (in)	51.481-51.500 (2.0268-2.0276)
Third undersize	mm (in)	51.237-51.250 (2.0172-2.0177)
Fourth undersize	mm (in)	50.987-51.000 (2.0074-2.0079)

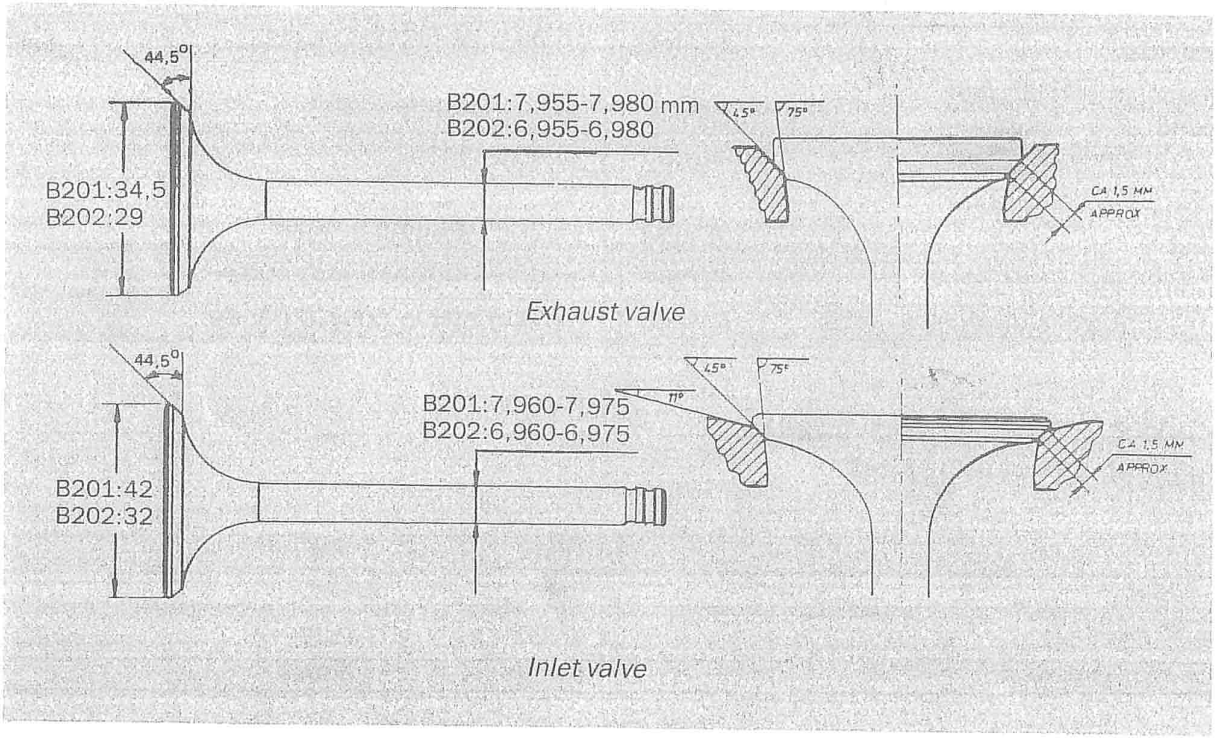
Main journal diameter:

Standard	mm (in)	57.981-58.000 (2.2827-2.2835)
First undersize	mm (in)	57.731-57.750 (2.2729-2.2736)
Second undersize	mm (in)	57.481-57.500 (2.2630-2.2638)
Third undersize	mm (in)	57.237-57.250 (2.2534-2.2539)
Fourth undersize	mm (in)	56.987-57.000 (2.2436-2.2441)

Valve gear

Valve clearance, mm, in engine having stood for 30 min after running at normal temperature
N.B.: B201 engines only.

B201 engines		Turbo	Other engines
On checking:	inlet	0.15-0.30	0.15-0.30
	exhaust	0.40-0.50	0.35-0.50
On adjusting:	inlet	0.20-0.25	0.20-0.25
	exhaust	0.45-0.50	0.40-0.45

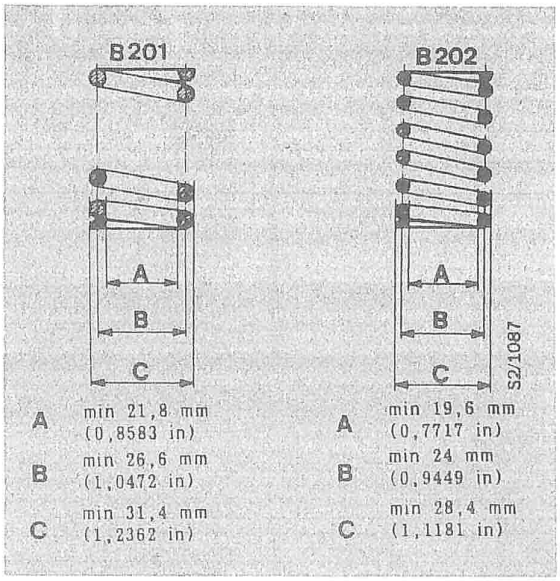


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N.B.
The exhaust valves have a stellite coating and should therefore not be machined. Grinding using valve grinding paste is the only recommended method. The exhaust valves in engines with fuel injection are sodium filled and the sodium must therefore be removed before the valves are scrapped.

Valve guides

		B201	B202
Length	mm (in)	46.65 (1.837)	49.0 (1.9291)
Outer diameter	mm (in)	13.040-13.051 (0.5134-0.5138)	12.039-12.050 (0.4740-0.4744)
Bore for valve guides in cylinderhead	mm (in)	13.000-13.018 (0.5118-0.5125)	12.000-12.018 (0.4724-0.4731)
Maximum clearance between valve stem and valve guide	mm (in)	0.5 (0.2) measured on valve head raised 3 (0.2) above seat	



Valve springs

		B201	B202
Length when fitted	mm (in)	39.5 (1.56)	37.0 (1.4567)
Free length	mm (in)	45.7 (1.88)	45 ± 1.5 (1.78 ± 0.05)
Length when under load of 740-800 N (162 - 174 lbf)	mm (in)	29.5 (1.16) Length when under	
load of 595-645 N (131 - 141 lbf)	mm (in)		28.4 (1.12)

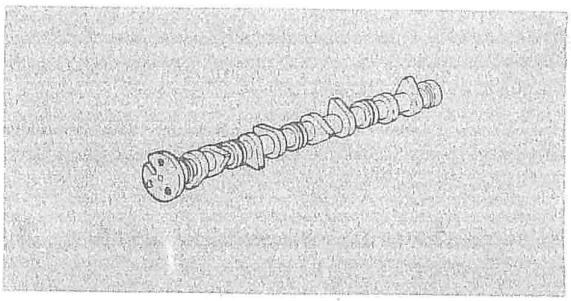
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Cam followers

		B201	B202
Diameter	mm (in)	37.87-38.98 (1.4909-1.4953)	32.959-32.975 (1.2976-1.2982)
Height	mm (in)	33 (1.2992)	26 (1.0236)
Bore for cam followers in cylinderhead (camshaft bearing assembly)	mm (in)	38.000-38.016 (1.4961-1.4967)	33.000 - 33.016 (1.2992-1.2998)

Shims for valve adjustment

Diameter	mm (in)	15.5 (0.6102)
Thickness	mm (in)	1.77-2.89 (0.0697-0.1138) 23 shims available within the range, at intervals of 0.05 mm (0.002 in)



Camshaft

		B201	B202
No. of bearings		5	5
Bearing diameter	mm (in)	28.94 (1.1394)	28.922-28.935 (1.1387-1.1392)
End float	mm (in)	0.08-0.25 (0.0031-0.0098)	0.08-0.35 (0.0031-0.0138)

Cam lift at 0 valve clearance

			Inlet Valves	Exhaust Valves
B201 carburettor	1981-	mm (in)	10.8 (0.425)	11.0 (0.433)
B201i	1981-	mm (in)	10.8 (0.425)	11.0 (0.433)
B201 Turbo	-1982	mm (in)	9.1 (0.358)	10.5 (0.413)
B201 Turbo APC	1981-	mm (in)	10.8 (0.425)	11.0 (0.433)
B202 Turbo	-1985	mm (in)	8.65/6.65	8.65
B202 Turbo with cat. converter	-1986		(0.341/0.262)	(0.341)
B202i	1986-			
B202 Turbo	1986-			
B202 Turbo with cat. converter	1987-	mm (in)	8.65 (0.341)	8.65 (0.341)

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Valve timing

(at design clearance: 0.35 mm, inlet; 0.55 mm, exhaust)

	Inlet Valves		Exhaust Valves	
Engine Model Year	Open BTDC	Close ABDC	Open BBDC	Close ATDC
B201 Carburettor 1981-	10°	54°	46°	18°
B201i 1981-	10°	54°	46°	18°
B202i 1986-	16°	44°	61°	13°
B201 Turbo -1982	12°	40°	62°	2°
B201 Turbo APC 1981-	10°	54°	46°	18°
B202 Turbo -1985	10°	56°	56°	16°
B202 Turbo 1986-	16°	56°	61°	13°

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Tightening torques

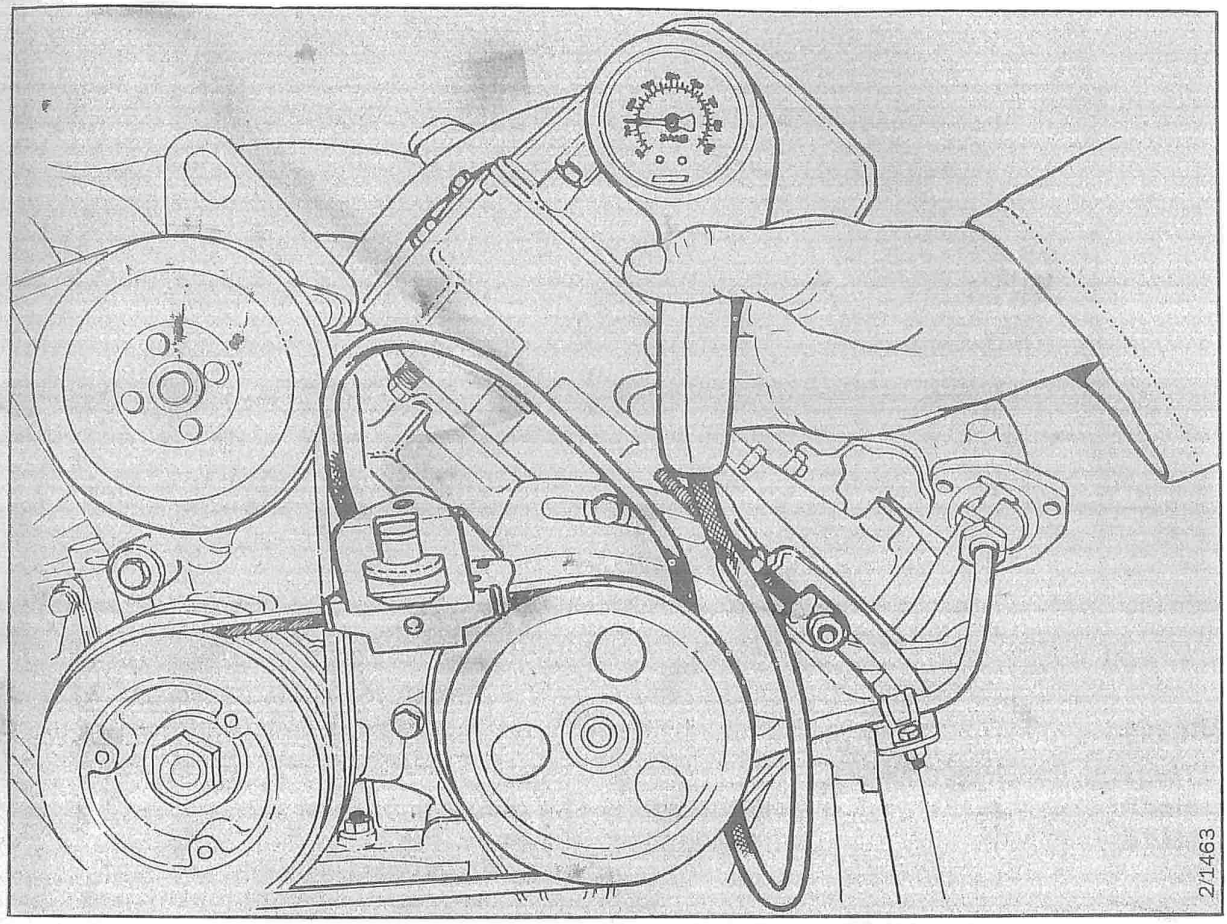
		Torque, Nm	Torque, lbf ft	Dimension
Main bearings		110	81	M 12
Big-end bearings		55	41	M 10
Camshaft bearing caps,	B201	15	11	M 8
	B202	15	11	M 8
Valve cover	B201	5	3.7	M 6
	B202	15	11	M 8
Crankshaft pulley		190	141	M 16
Rear engine plate (flywheel end)		20	14.8	M 8
Flywheel		59	44	M 10
Oil pump		8	5.9	M 6
Spark plugs		28	20.7	M 14 x 1.25
Chain tensioner,	B201	12	8.9	M 6
Chain guide,	B201	12	8.9	M 6
Chain tensioner,	B202	63	46.6	M 10
Camshaft sprocket,	B201	20	14.8	M 8
Camshaft sprocket,	B202	63	46.6	M 10
Engine to gearbox		25	18.5	-
Inlet manifold		18	13.5	M 8
Thermostat housing		18	13.5	M 8
Throttle housing		18	13.5	M 8
Exhaust manifold, Turbo		25	19	M 8
allother models		20	14.8	M 8
Timing cover Distributor,	B201	5	3.7	M 6
	B 202	20	14.8	M 8
Oil filter		10	7.4	3/4"-16 UNF
Oil pressure switch		10	7.4	1/4"-18 NPTF
EGR valve		15	11	M 14 x 1.5
Engine block heater plug		55	40.7	3/8" BSP
Drain plug, coolant		30	22.2	M 14 x 1.5
Knock detector,	M82 earlier	8	5.9	-
	M83 onwards	20	14.8	-

All other bolts should be tightened as follows:

Dimension	Tightening torque	
	Nm	lbf ft
M 5	5	3.6
M 6	10	7.2
M 8	20	14.4
M 10	40	23.8

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Drive-belt tension



Alternator

		Single belt	Dual belts	
			Measuring of one belt	Measuring of both belts
Minimum	N (lbf)	265 (60)	200 (45)	420 (95)
After adjusting	N (lbf)	355 ± 20 (80 ± 5)	310 ± 20 (70 ± 5)	645 ± 20 (145 ± 5)
New belt	N (lbf)	535 ± 45 (120 ± 10)	535 ± 45 (120 ± 10)	

Steering servo

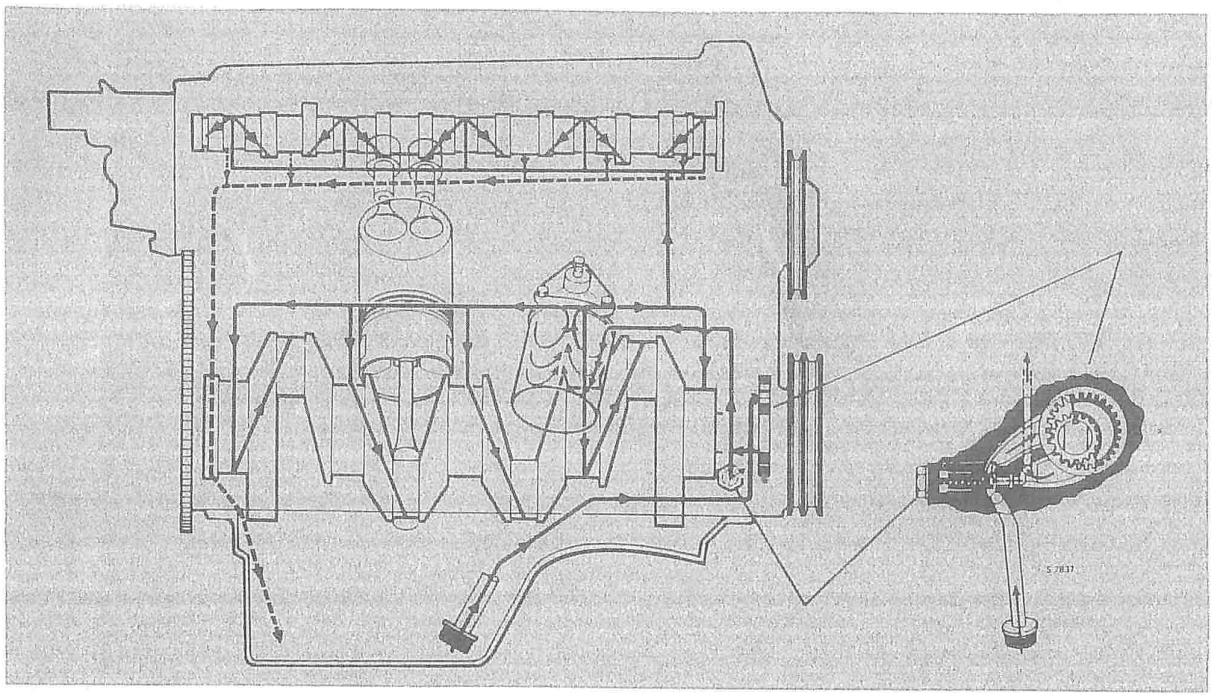
Minimum	N (lbf)	220 (50)
After adjusting	N (lbf)	310 ± 20 (70 ± 5)
New belt	N (lbf)	445 ± 45 (100 ± 10)

AC compressor

Minimum	N (lbf)	245 (55)
After adjusting	N (lbf)	355 ± 20 (80 ± 5)
New belt	N (lbf)	535 ± 45 (120 ± 10)

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Lubricating system



Oil

Oil capacity, including oil cleaner,		
B201	litre (liq qt)	3.8 (4.0)
B202	litre (liq qt)	4.0 (4.2) Turbo: The oil cooler holds an additional 0.5 ltr (0.52 liq qt)
Volume between MAX and MIN marks on dipstick	litre (liq qt)	1.0 (1.05)
Recommended grade,		Turbo Saab Turbo Motor oil or oil to API Service SF/CD, SF/CC orCCMC G3/PD1 Others API-Service SF/CC
Viscosity:		SAE 10W-30 or 10W-40. In markets where these viscosities are not available, 15W-40 or 15W-50 oil may be used. Synthetic engine oil for winter or year-round use SAE 5W-30

Oil pressure

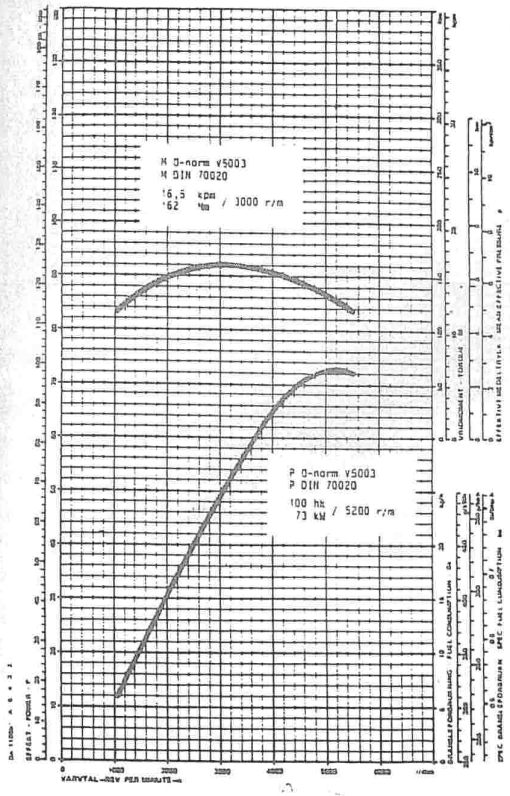
Oil pump pressure-reducing valve opens at: B201	bar (psi)	4.5 - 5.0 (65 - 72)
B202	bar (psi)	3.6 - 5.2 (52 - 75)
Warning light comes on at	bar (psi)	0.3 - 0.5 (4.4 - 7.2)
Oil pressure at 2000 rpm, engine temperature of 80°C (176°F) and 10W-30 oil	bar (psi)	Minimum of 2.7 (39)

Oil pump

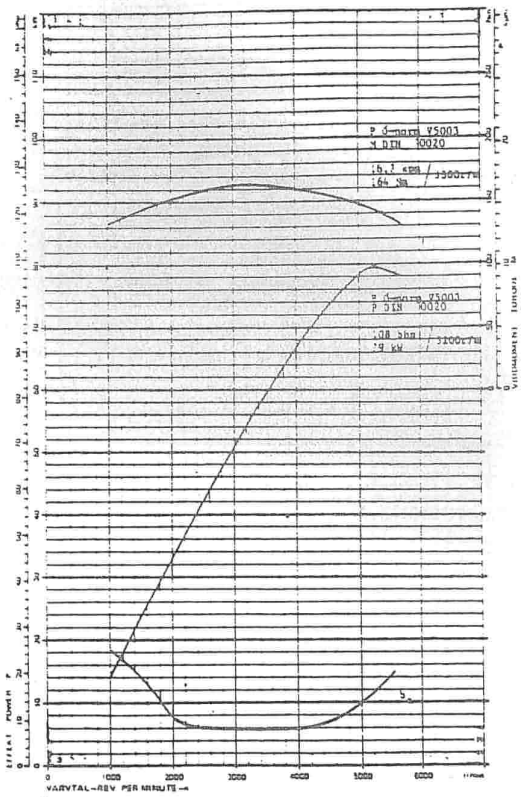
End float between rotor and housing	mm (in)	0.03 - 0.08 (0.001 - 0.003)

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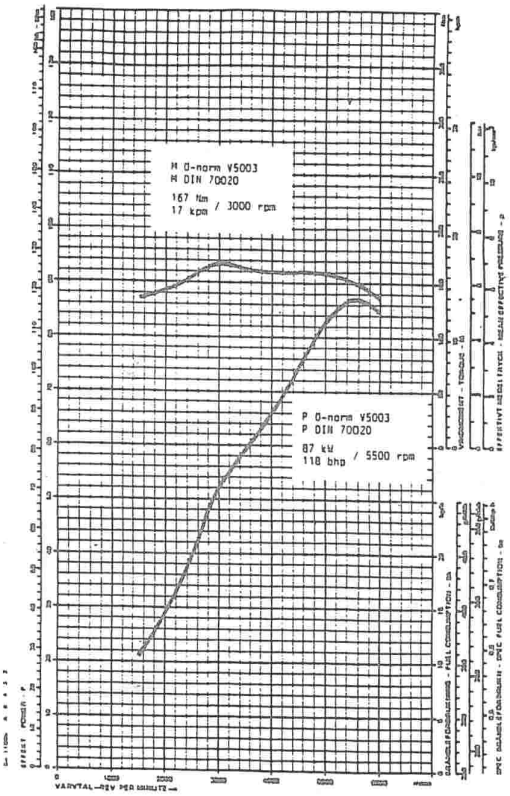
Engine performance graphs



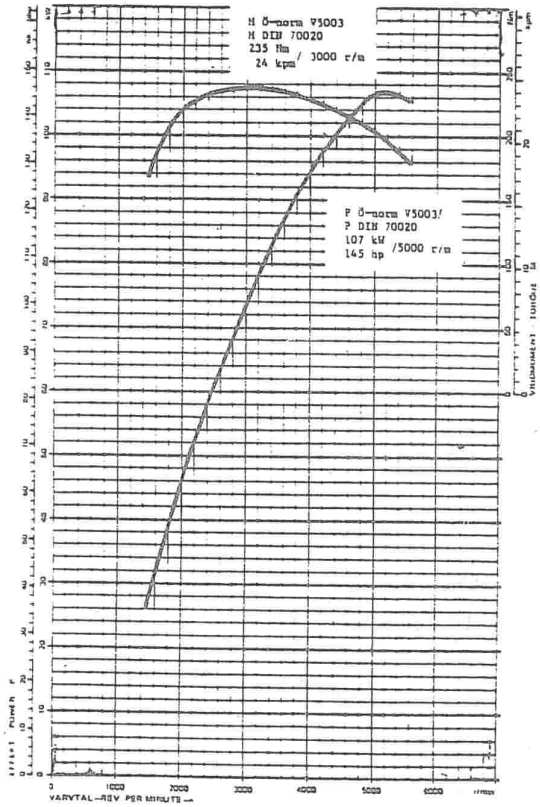
B201 single carburettor, M81 onwards



B201 twin carburettors, M81 onwards

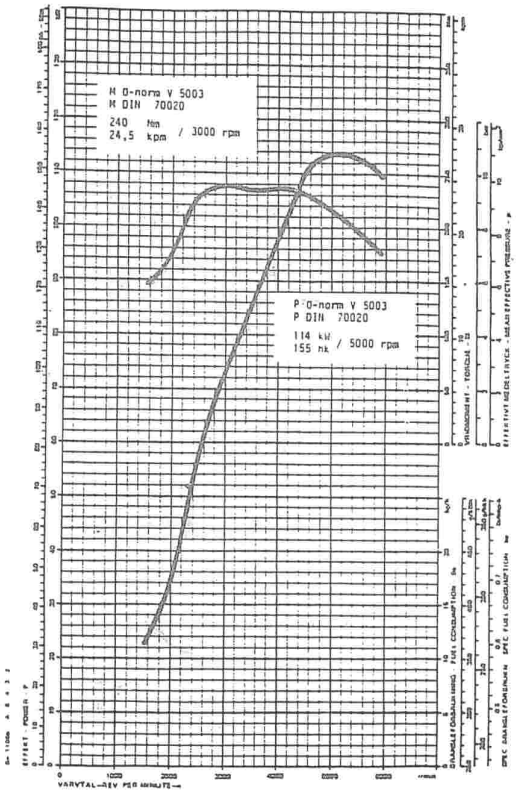


B201i, M81 onwards

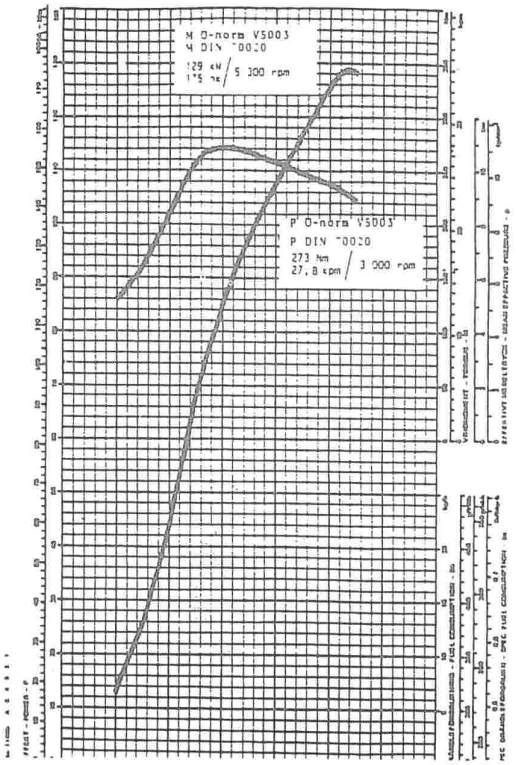


B201 Turbo, M85 and earlier

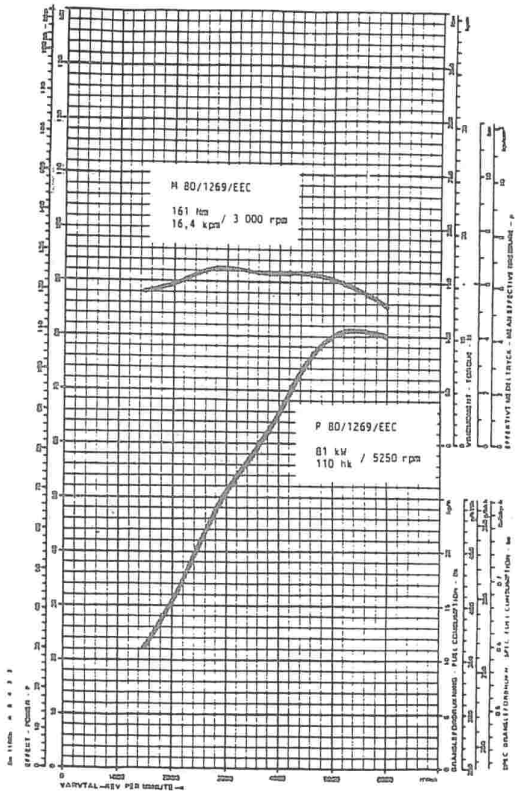
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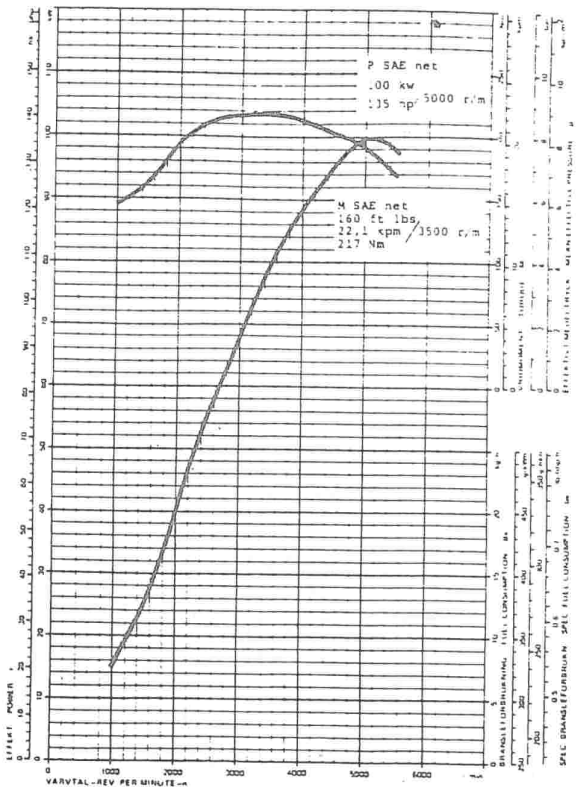
B201 Turbo, M86 onwards



B202 Turbo

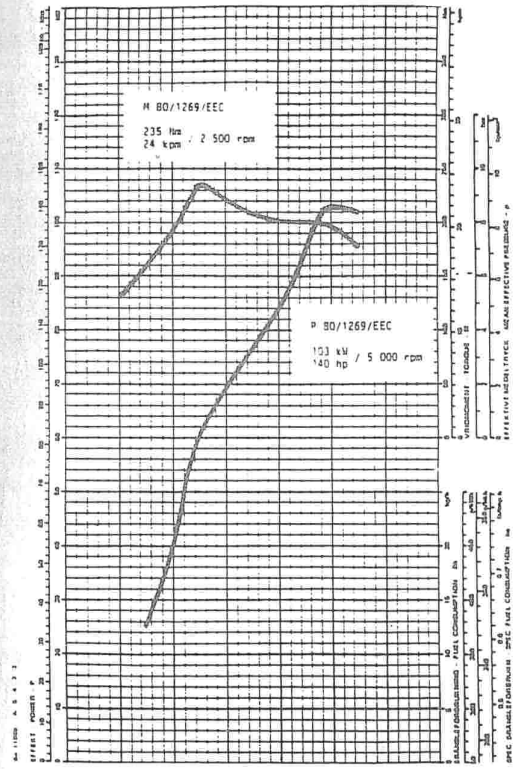


B202i with catalytic converter

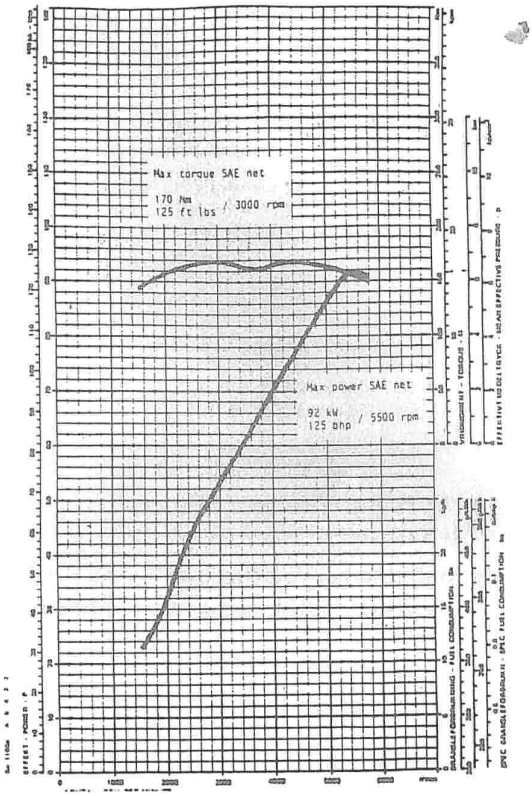


B201 Turbo with catalytic converter, M86 and earlier

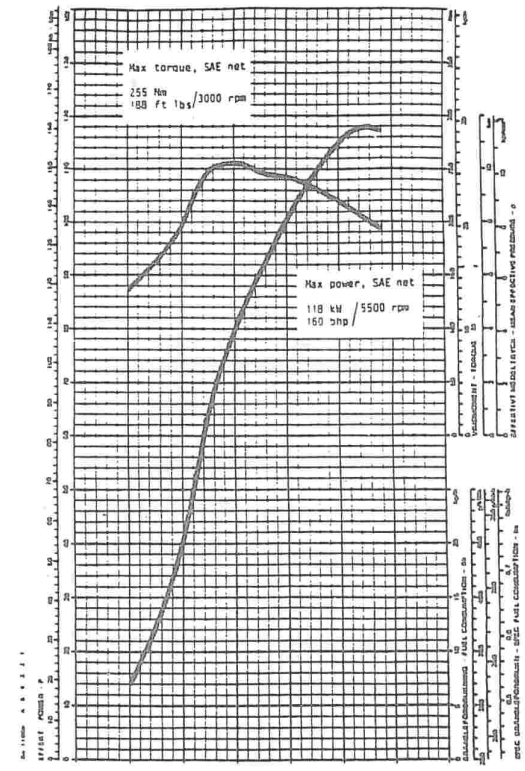
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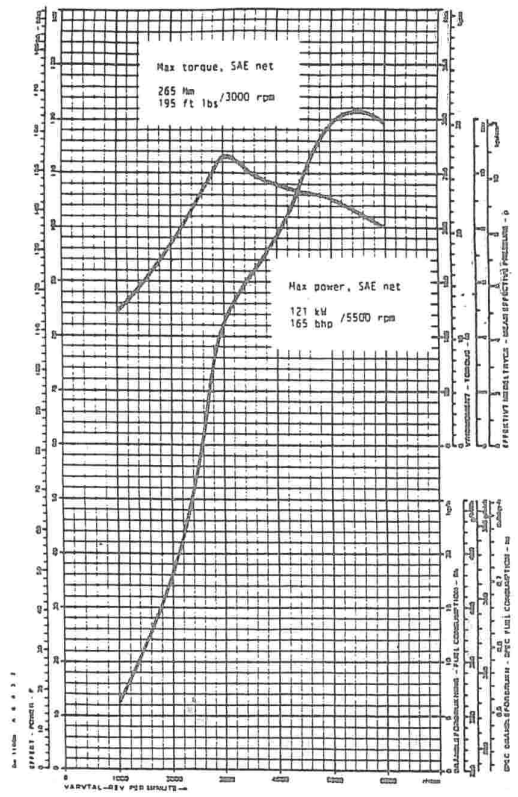
B201 Turbo with catalytic converter, M87 onwards



B202i with catalytic converter



B202 Turbo with catalytic converter



B202 Turbo 16S with catalytic converter (US)

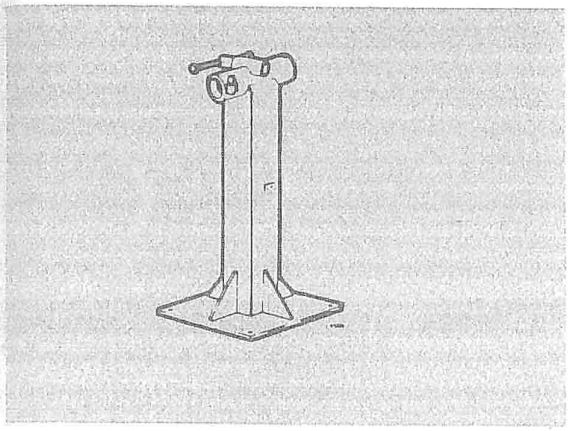
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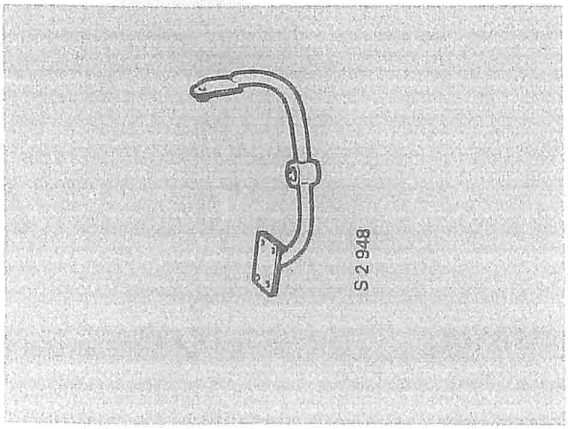
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Special Tools

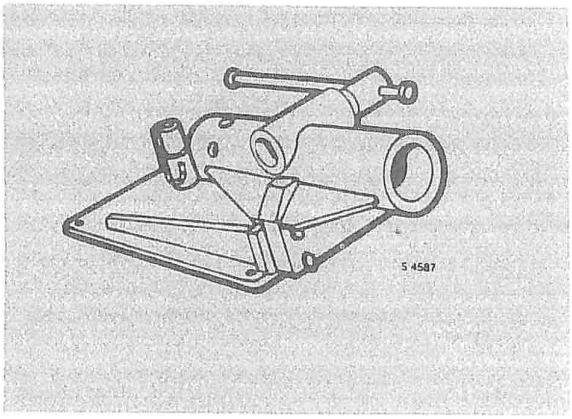
Some of the tools listed here may also be used in work detailed in other sections of the Manual.



78 60 794 Floor stand for permanent installation

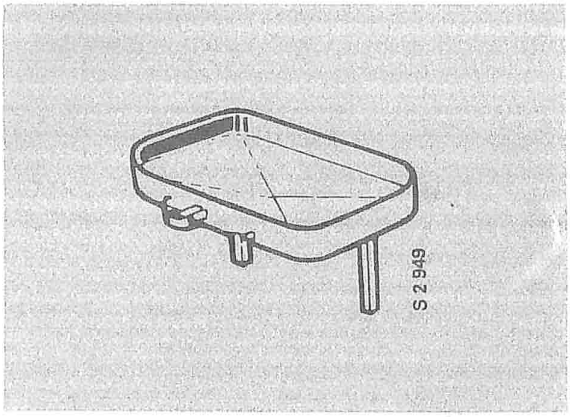


83 92 169 Bracket for use with floor stand
83 93 951 Bracket, M85 onwards.

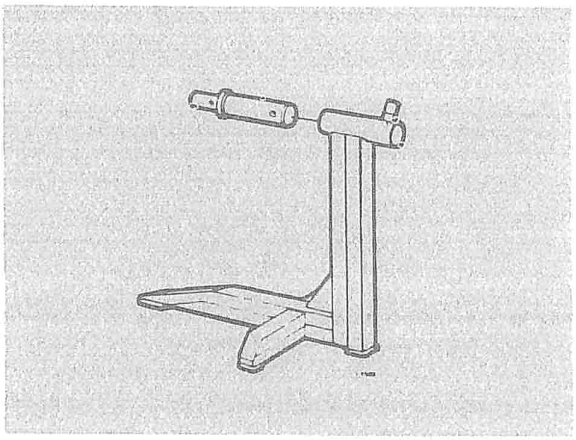


78 60 877 Bench stand

78 60 885 Vice stand

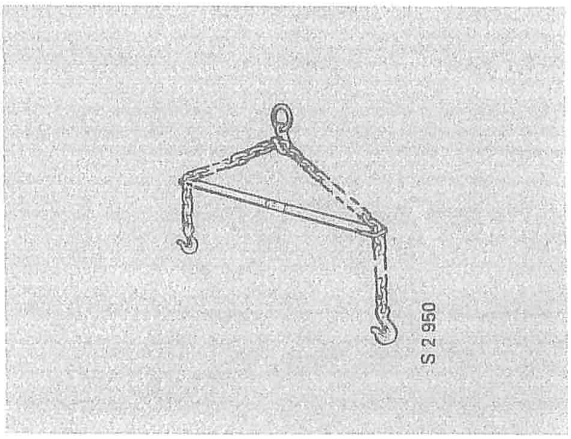


78 60 802 Oil pan for floor stand



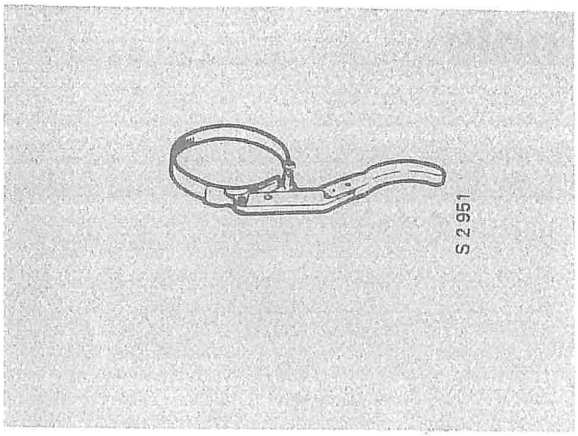
78 61 479 Mobile stand (alternative to 78 60 794)

83 90 478 Spindle for floor stand



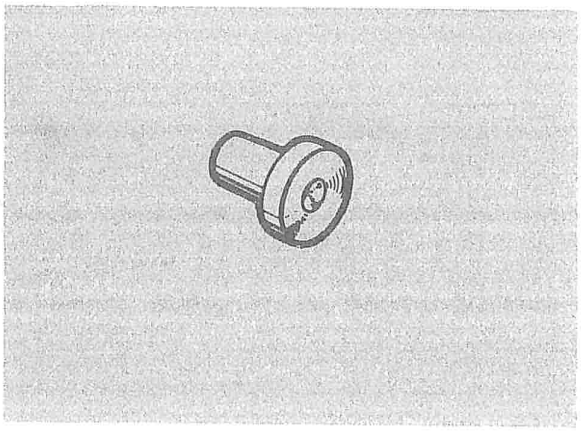
83 92 409 Lifting sling for power train

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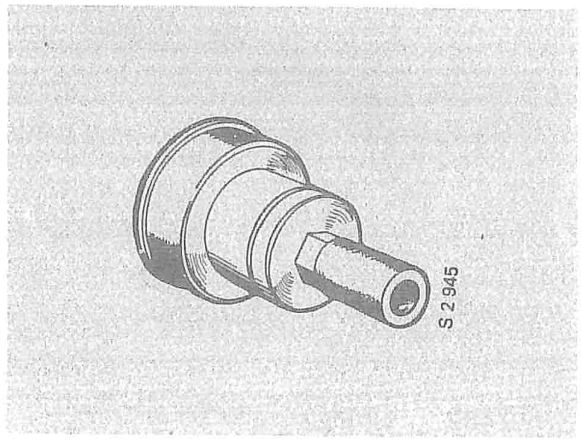


78 62 014 Strap wrench for standard oil filter

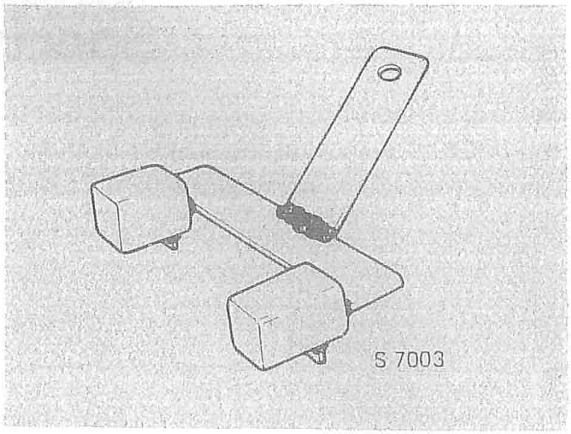
83 93 332 Strap wrench for removal of factory-fitted oil filter at 1200-mile (200-km) service



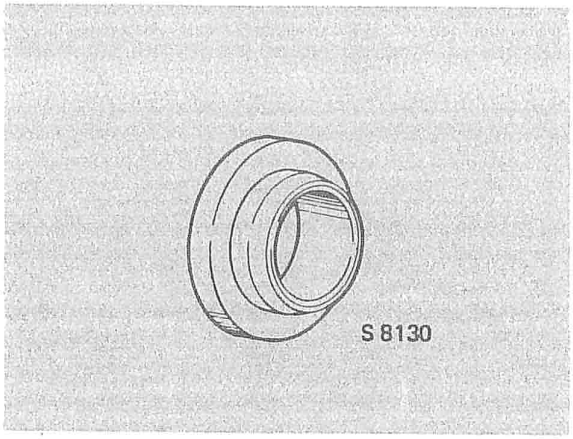
83 91 849 Dolly for removal of crankshaft sprocket



83 92 540 Tool for fitting of crankshaft seal at flywheel end.

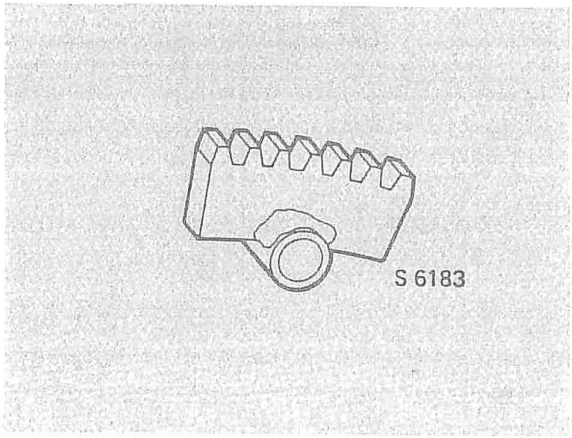


83 93 209 Tool for relieving pressure in front suspension (e.g. when removing power train)



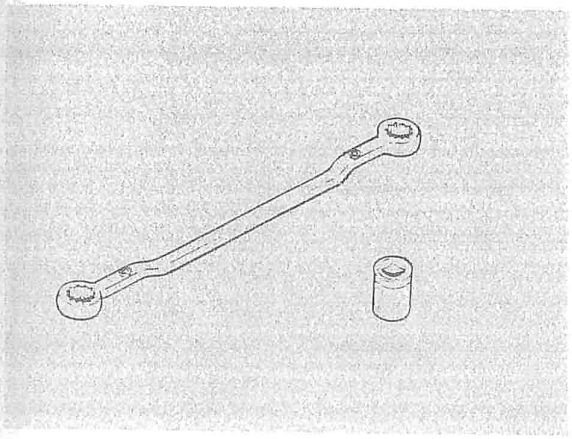
83 93 340 Tool for fitting crankshaft seal at timing-chain end

83 94 215 Tool for fitting crankshaft seal at timing-chain end, M85 onwards. Supersedes tool 83 93 340.



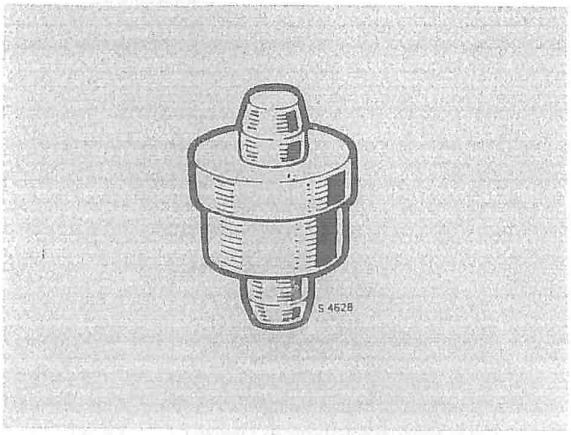
83 92 987 Flywheel locking segment for immobilizing crankshaft

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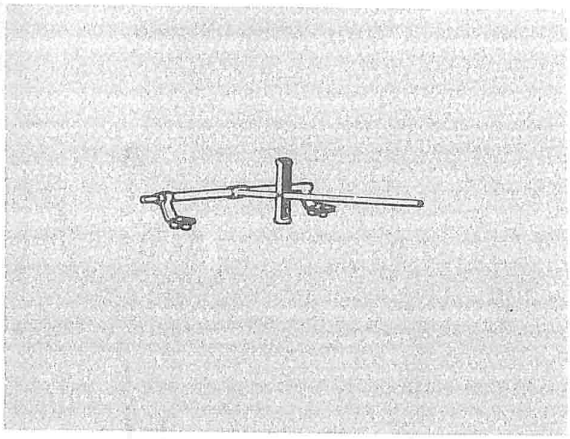


83 92 961 Ring spanner for pulley bolt

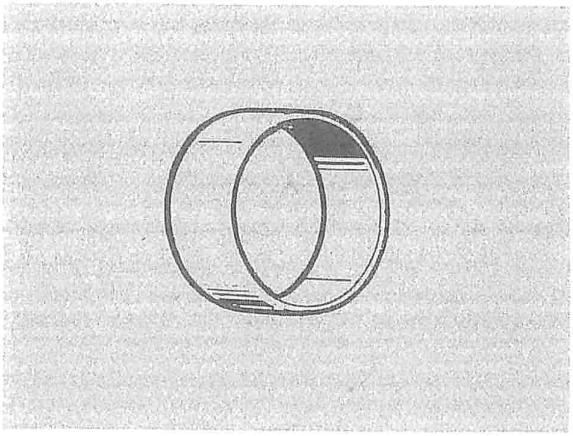
83 93 639 Socket for pulley bolt, M84 onwards



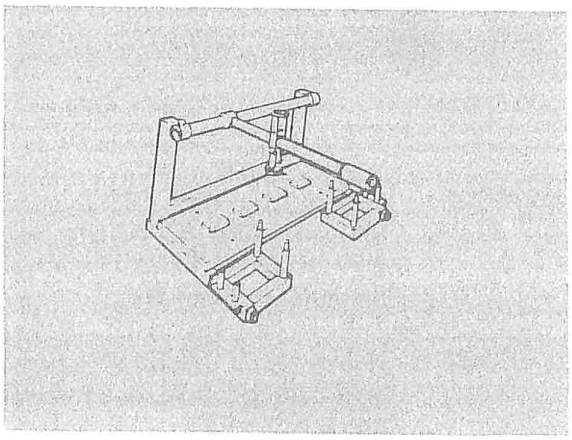
83 91 997 Drift for flywheel bearing



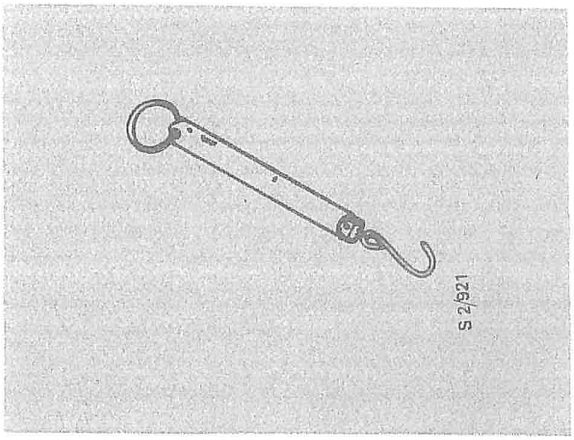
83 92 300 Valve spring compressor (cylinder head in car or removed)



78 62 287 Piston ring clamp

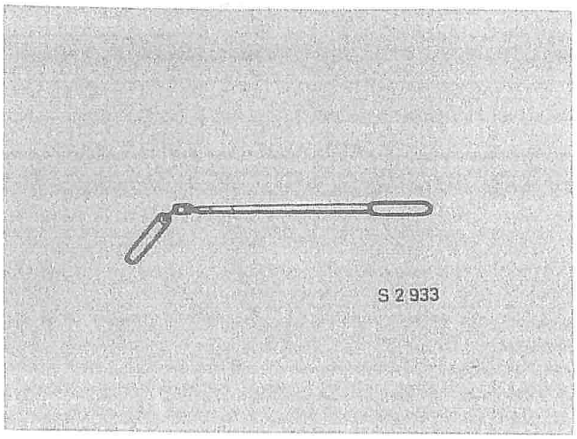


83 93 050 Fixture used in conjunction with removal/fitting of valves

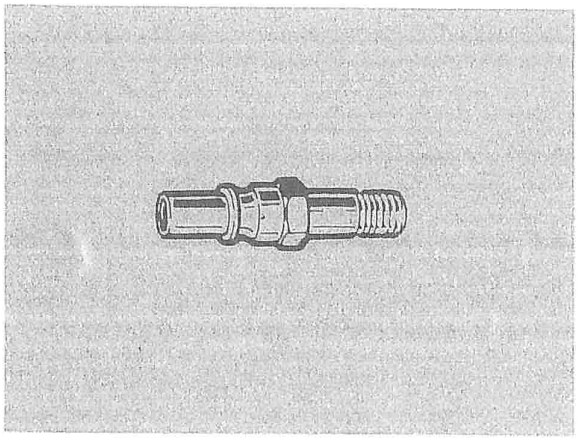


83 90 130 Spring balance for checking piston clearance

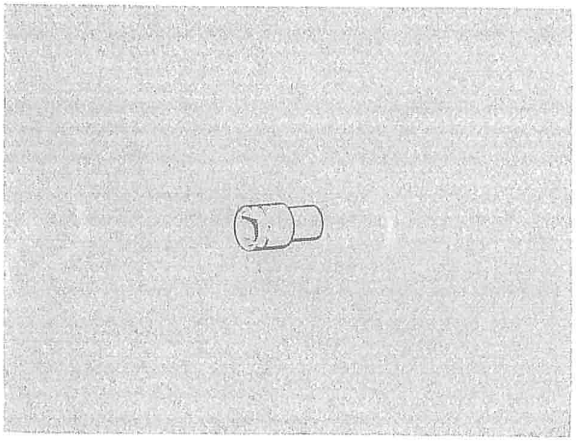
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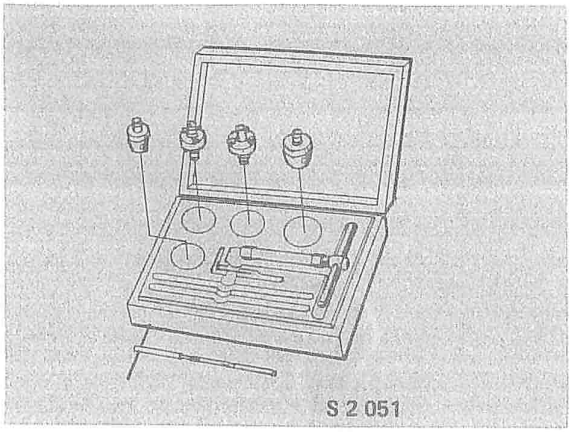
83 91 401 Magnetic tool for removal of cam followers



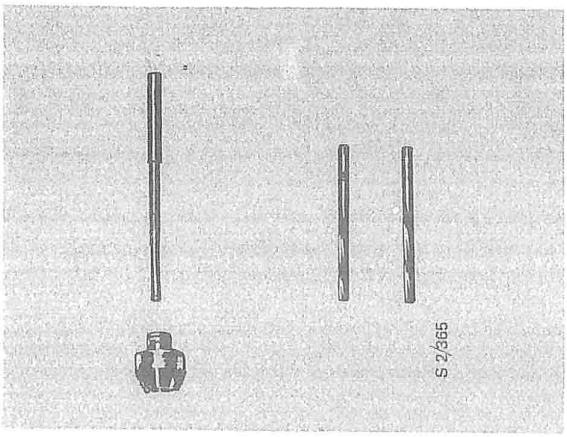
83 92 326 Compressed-air adaptor for spark plug hole



83 93 910 TORX E16 socket with 1/2-inch drive for cylinder head bolts



83 92 193 Valve cutter set
83 92 201 Cutter 75°
83 92 219 Cutter 11°-45°
78 61 057 Pilot
78 61 065 T-wrench
The remaining tools in the set are for other Saab models

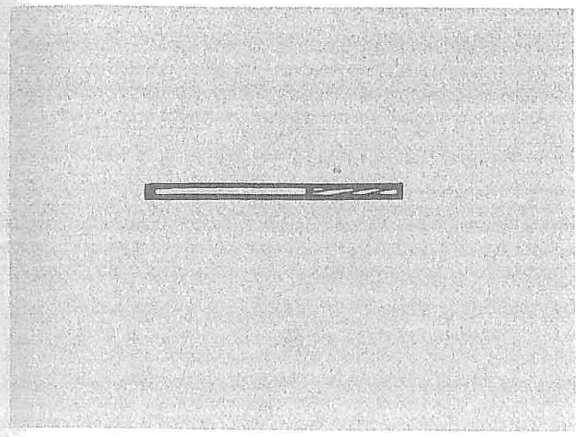


83 93 928 Neway type 008 150-7 (AGB) pilot for 45° and 60° cutters. Suitable for valve guides with inside diameter of 7 mm (H7).

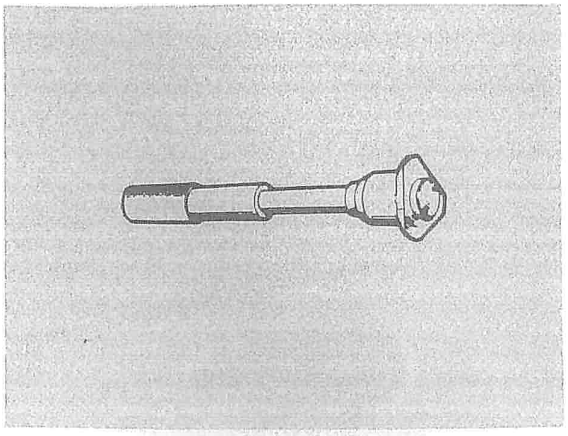
83 93 936 Neway type 8-270 60 (AGB) valve seat cutting tool for use with 45° and 60° cutters

83 93 944 Valve guide reamer, 7 mm dia., for stiff H7 fit (6.97 mm dia. valve stem)

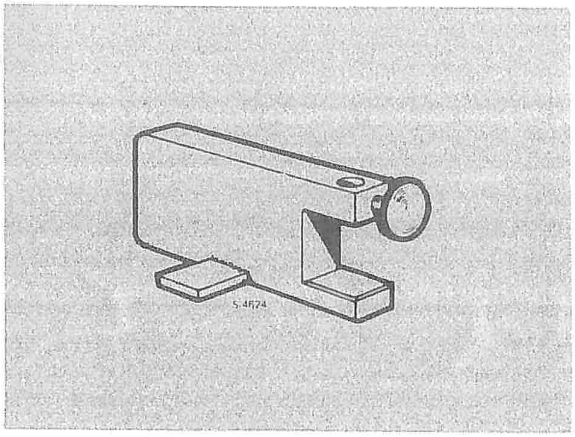
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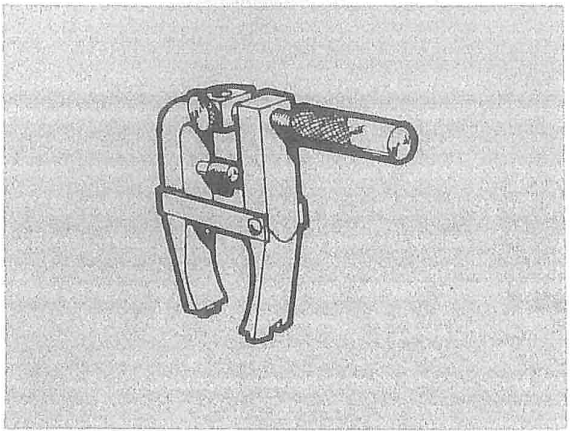
83 92 268 Valve guide reamer, 8 mm H8



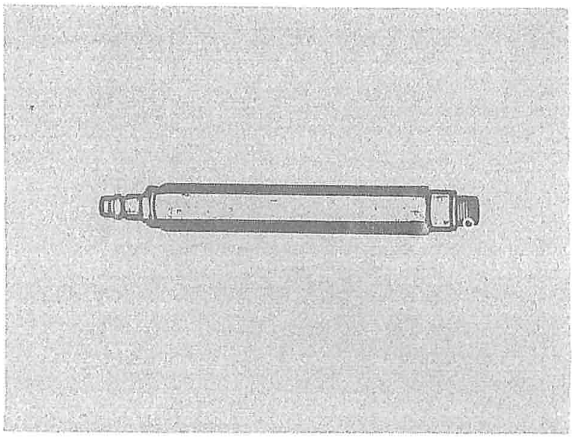
83 92 631 Valve guide tool (for fitting/removal from press)



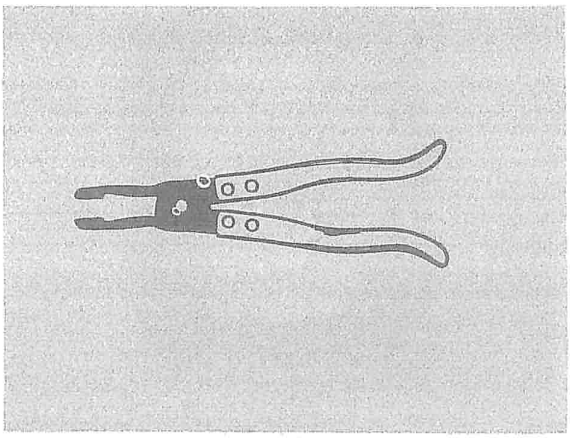
83 91 633 Measuring tool for checking adjusting pallets



83 91 450 Valve clearance measuring tool
83 92 250 Measuring anvil

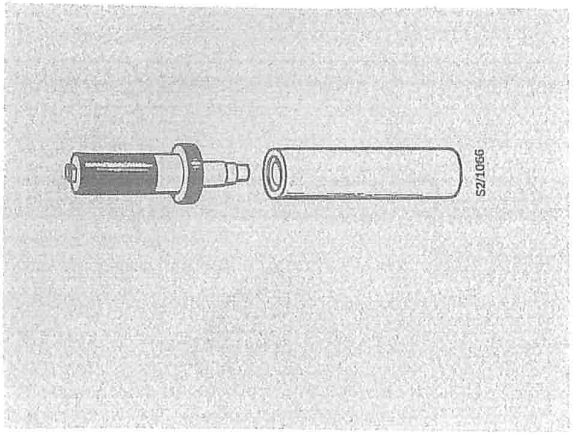


83 94 173 Compressed-air adaptor

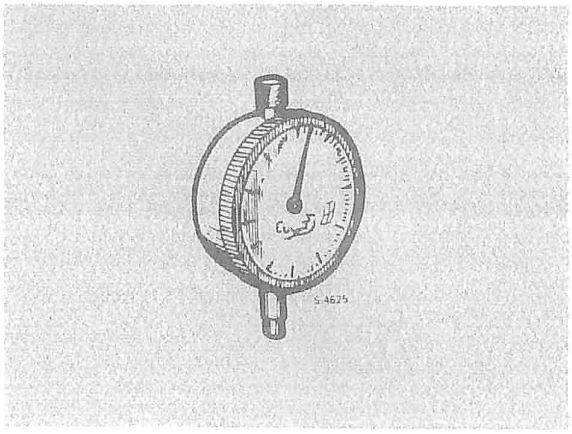


83 94 157 Tool for removal of valve guide seals

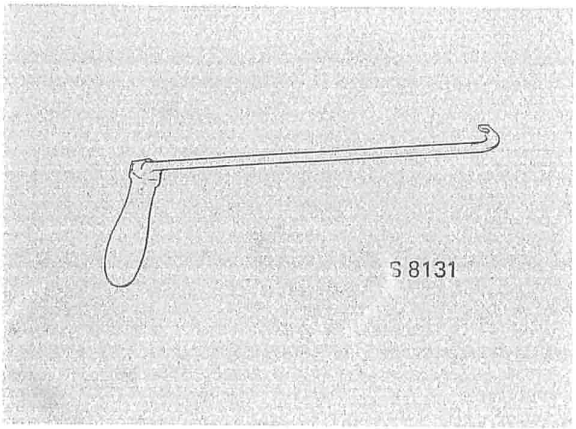
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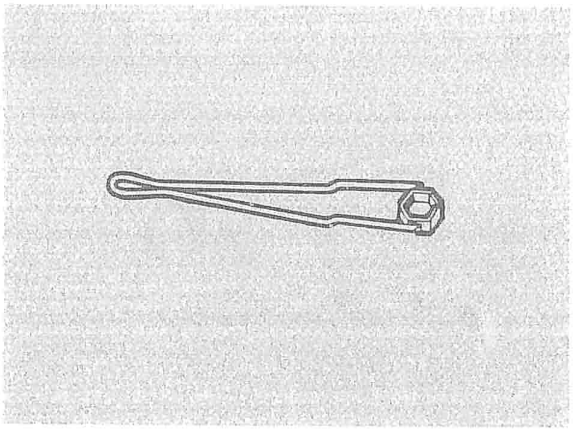
83 94 181 Socket
83 94 207 Tool for fitting valve collets



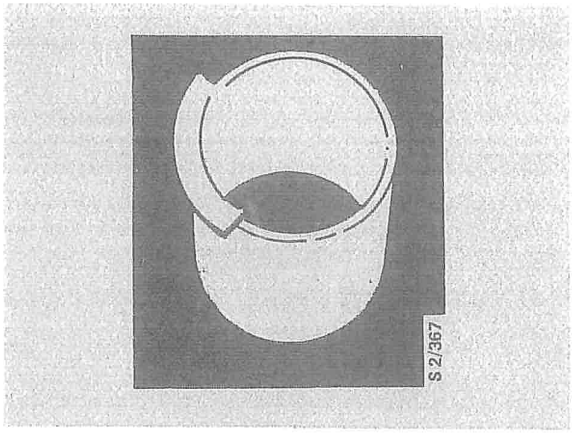
78 40 622 Dial indicator



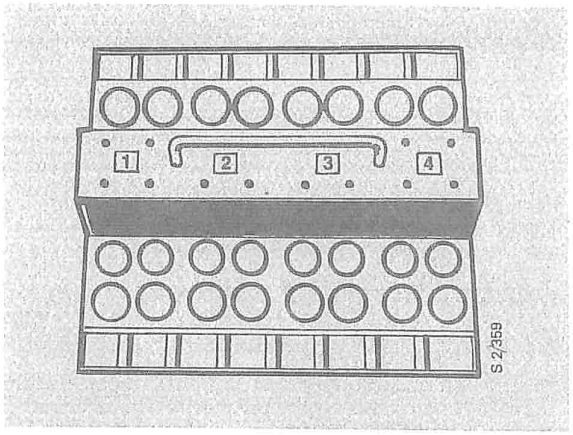
83 93 357 Tool for chain tensioner



83 92 185 Key for crankshaft bolt (for turning crankshaft for valve adjustment)

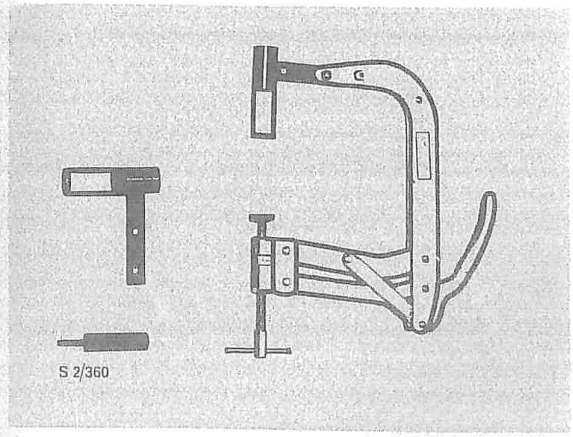


83 93 746 Protective collar for tappet guides (set of 16)



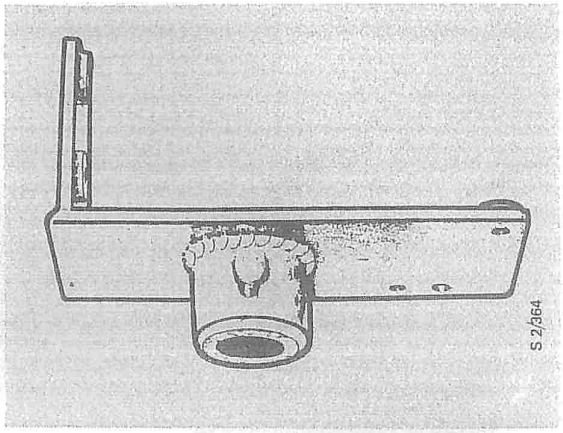
83 93 787 Valve stand

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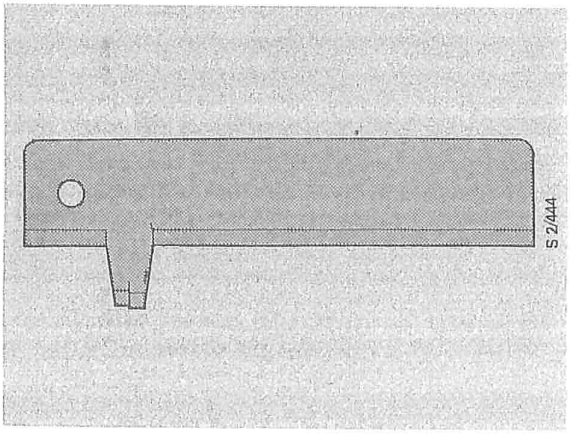


83 93 761 KD-tools 308 valve spring compressor for use with special anvil 83 93 779

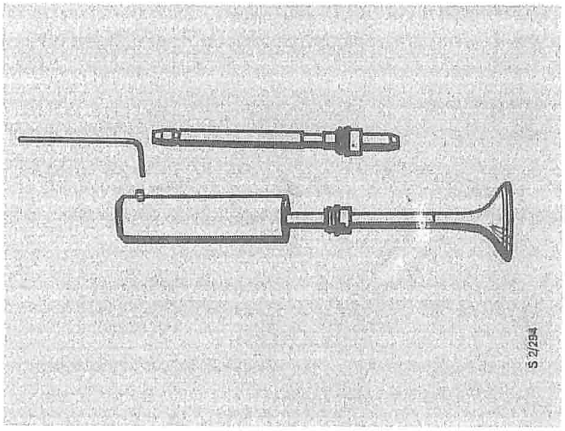
83 93 779 Special anvil for use with valve spring compressor 83 93 761



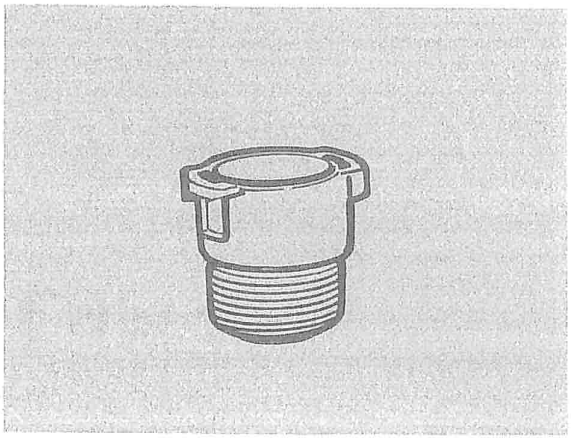
83 93 795 Cylinder head bracket for use with floor stand 78 60 794



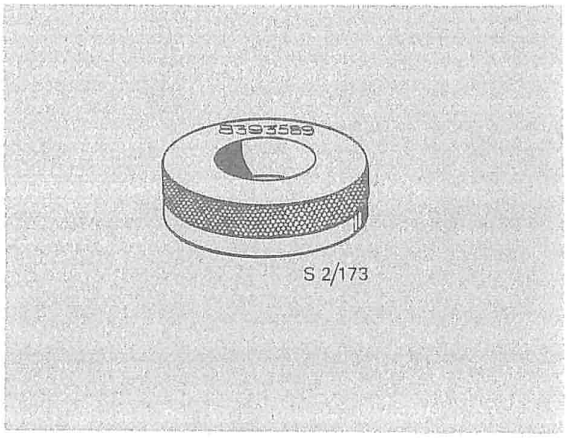
83 93 753 Measuring tool for valve clearance



83 93 803 Tool for fitting valve guide seal

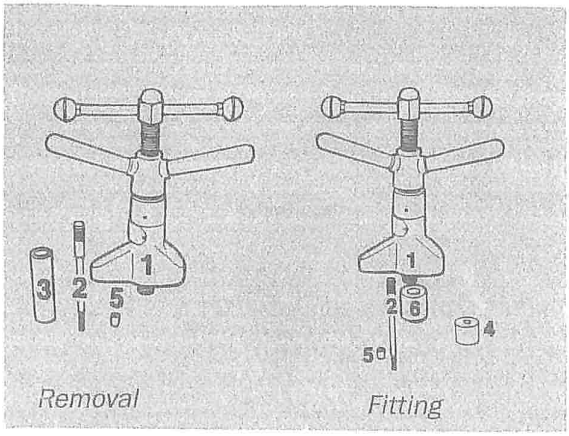


83 94 140 Adaptor for checking expansion tank pressure cap

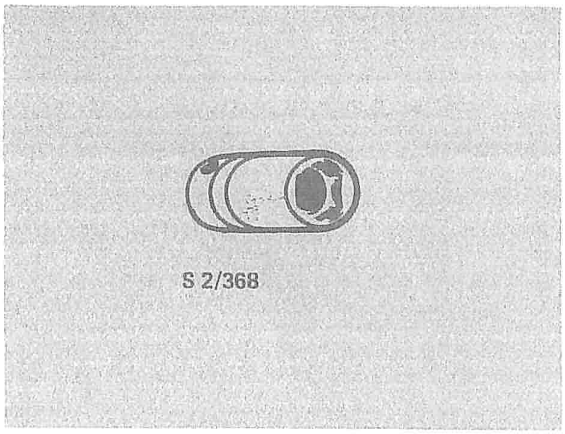


83 93 589 Oil pump centring tool

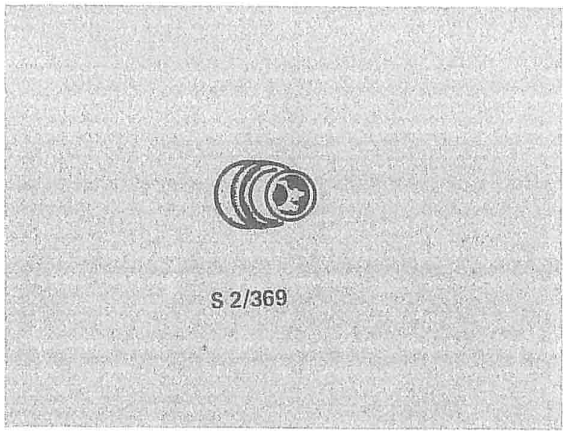
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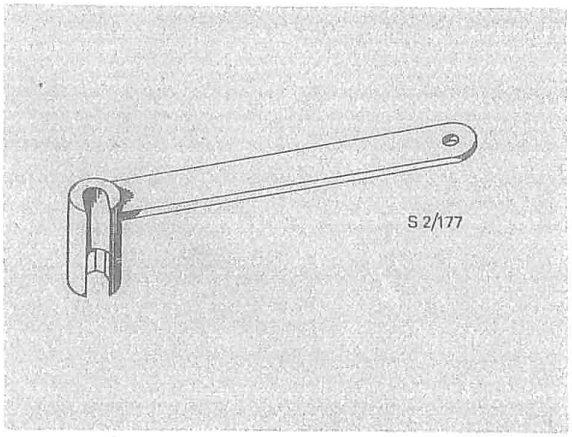
83 93 803 (1)	Tool for fitting/removal of valve guide
83 93 811 (2)	Pull rod for removal/fitting of valve guide
83 93 829 (3)	Sleeve for removal of valve guide
83 93 837 (4)	Depth gauge for fitting of valve guide
83 93 845 (5)	Nut for removal/fitting of valve guide
83 90 379 (6)	Mandrel The above tools (2 - 6) are for use with valve guide tool 83 93 803 (1)



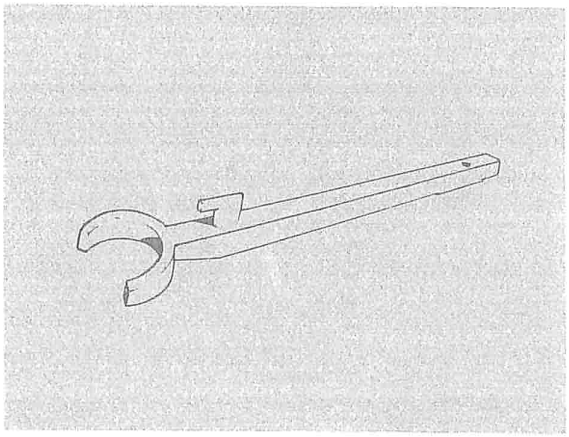
83 93 902 16-mm spark plug socket with 3/8-inch drive



83 93 910 TORX E16 socket with 1/2-inch drive for cylinder head bolts

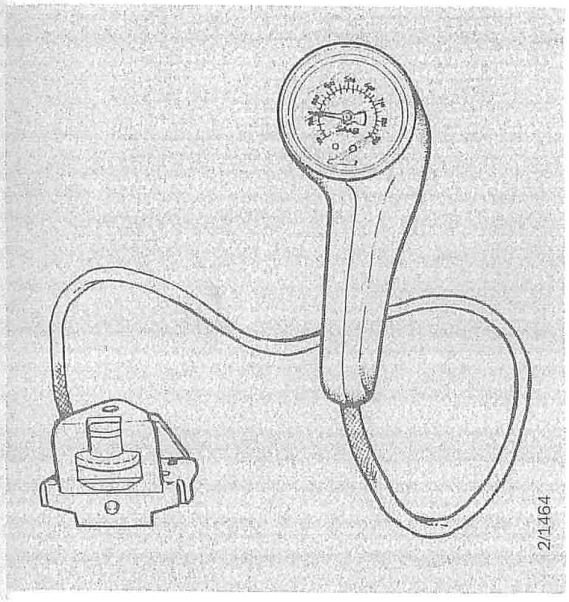


83 93 571 13-mm key for slave cylinder pressure line fitting

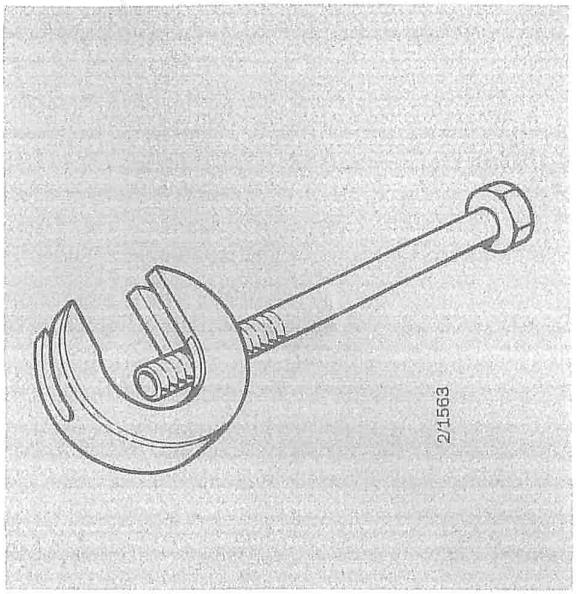


83 93 175 Tool for removal of gearbox input shaft

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83 93 985 Belt-tension meter



87 91 394 Tool for removal of taper pin in gear selector rod

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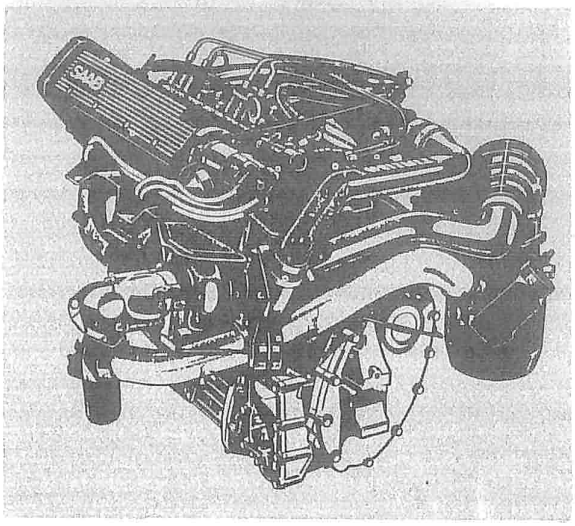
Technical Description

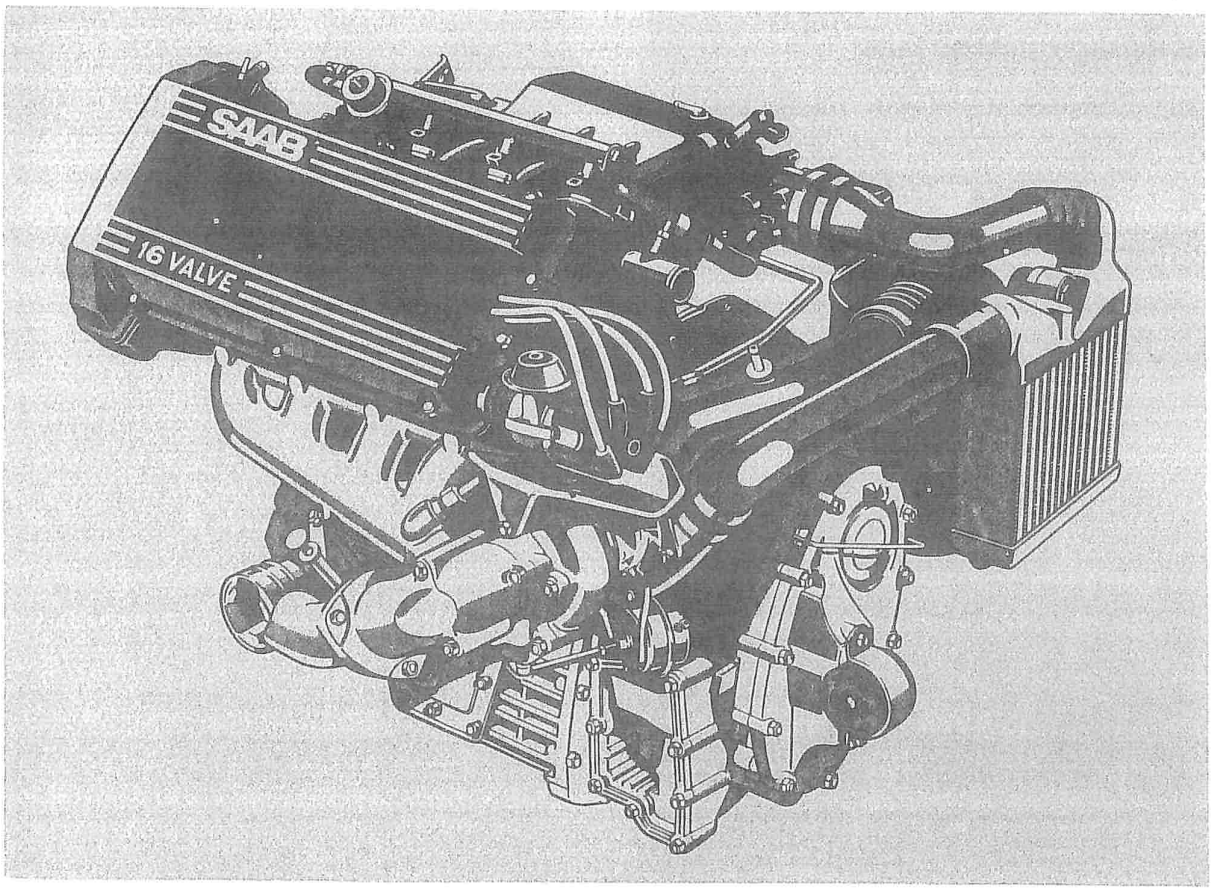
Engine 200-1
Engine mountings B201 200-7
Lubricating system 200-5

Engine body

General

The water cooled engine is a four-in-line with either single (B201) or twin (B202) overhead camshafts. The crankcase ventilation is totally enclosed. The cylinder block is inclined at an angle of 45 to the right and the cylinder head is of the cross-flow type, i.e. with the inlet ports on one side and the exhaust ports on the other. The engine is mounted with the clutch towards the front of the car and with the timing chain and the no. 1 cylinder towards the rear. The engine is available in carburettor, fuel injection and turbocharged versions and in 8-valve and 16-valve variants.

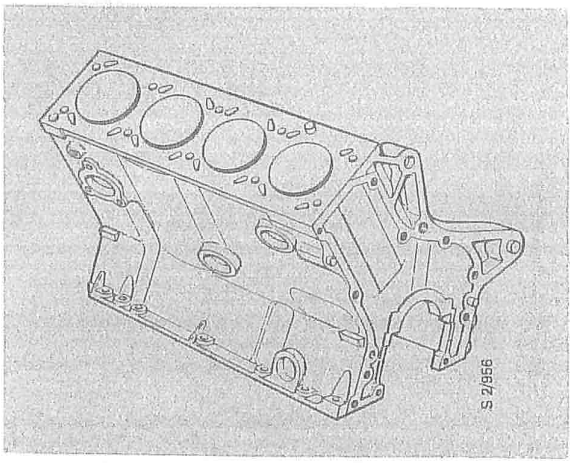




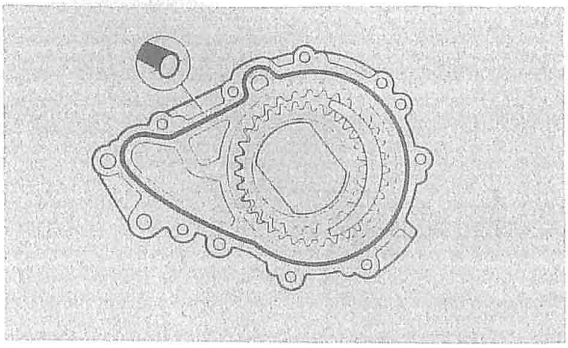
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Cylinder block

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



The crankshaft drives the oil pump which is interposed between the timing cover and the crankshaft pulley.

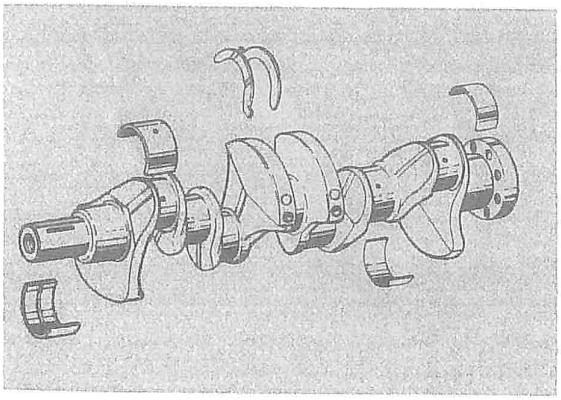


The waterpump and alternator are driven from the crankshaft by a V-belt.

The steering servo pump and AC compressor are also driven by V-belts from the crankshaft pulleys.

Crankshaft and bearings

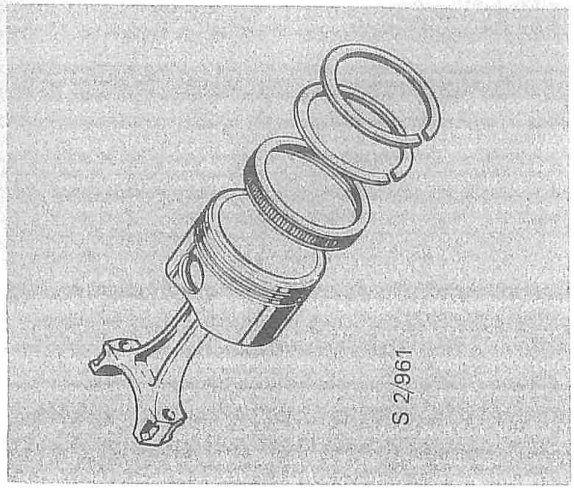
The crankshaft is a forging. The journals have been ground, hardened and have undergone 'Tenifer' treatment to provide a hard, non-metallic surface, which affords good protection against bearing seizure. The crankshaft is supported by five main bearings, with end-float adjustment made at the centre bearing. Oilways are drilled in the shaft for lubrication. All main bearing shells are replaceable.



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Pistons

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



Cylinder head

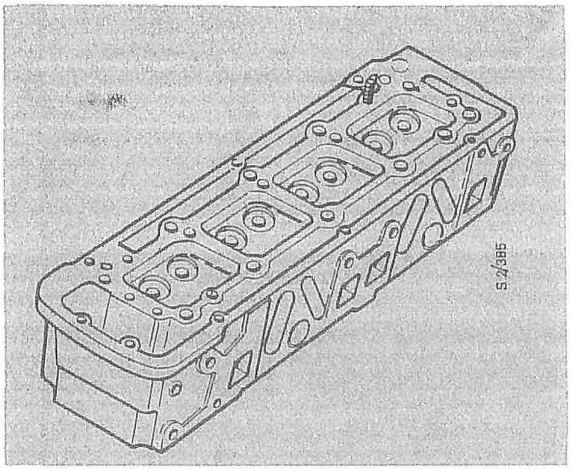
The cylinder head is a precision, light-alloy casting and the steel valve seats are press-fitted in the head. The head is bolted to the block.

The valves are made of steel and have chromium-plated stems. The heads on the inlet valves are induction hardened and those on the exhaust valves stellited.

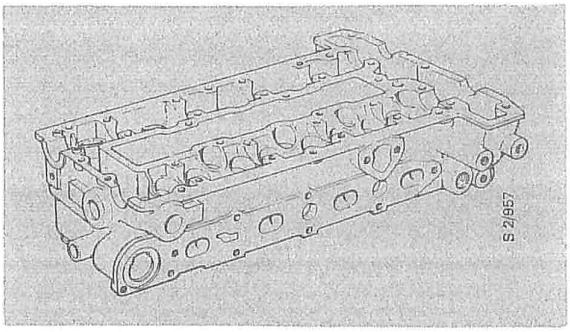
Connecting rods

The connecting rods are forged and incorporate bushes for the gudgeon pins. Gudgeon-pin bushes and big-end bearing shells are replaceable.

The gudgeon pins are of the fully-floating type, being free to turn in both piston and connecting rod. Axial movement of the pins is limited by circlips inside the piston boss.



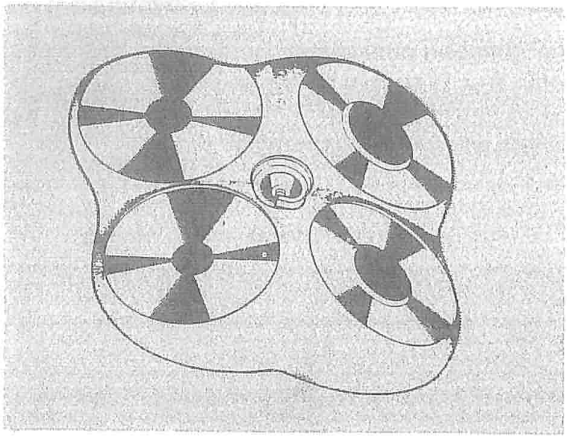
Cylinder head on 8-valve B201 engine



Cylinder head on 16-valve B202 engine

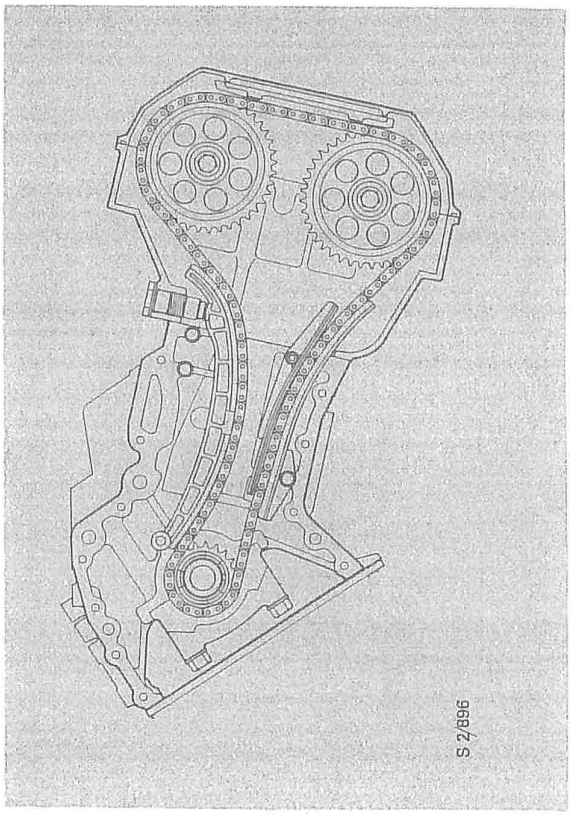
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The combustion chambers are hemispherical and, on the B202 engine, each cylinder has four valves, with the spark plug being located centrally.

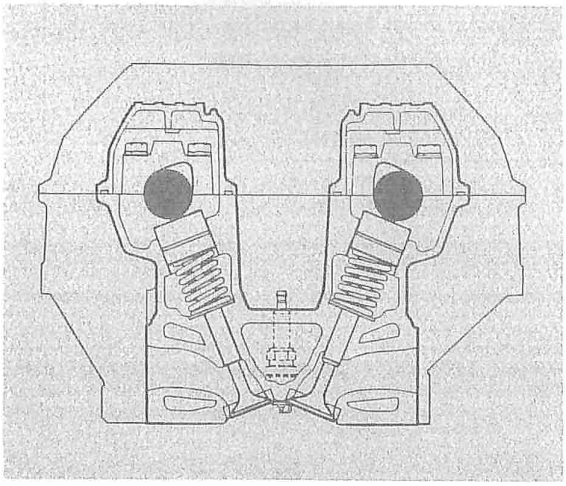


Camshafts and cam followers (B202)

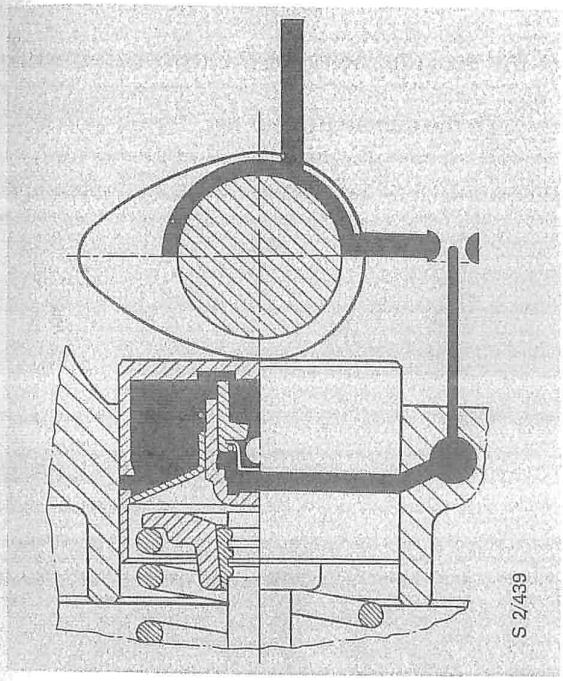
The engine has twin overhead camshafts, each of which is mounted in five bearings. The cams have a wide base circle, which provides a large amount of lift but little stress. The camshafts are driven by a chain with an effective automatic chain tensioner. The camshafts are direct acting on the valves via hydraulic bucket-type cam followers. The distributor is driven direct from one of the camshafts.



The hydraulic cam followers adjust automatically to differences in valve clearance caused by variations in temperature. The main advantage of the hydraulic cam followers is that they operate silently and are extremely reliable.

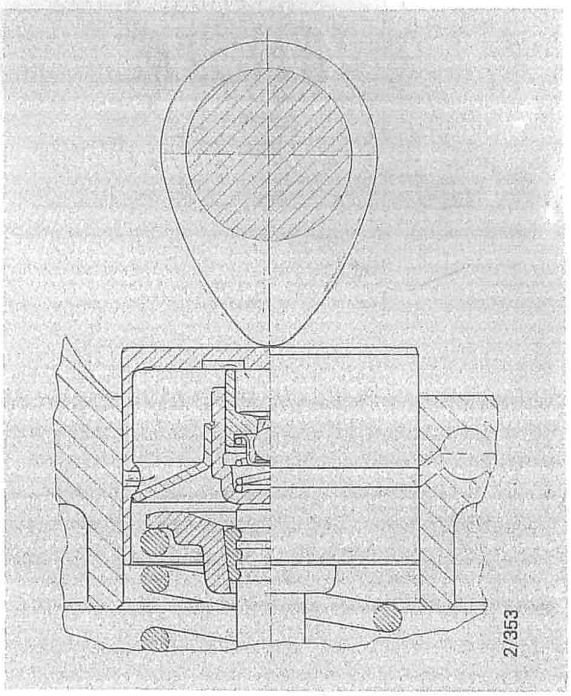


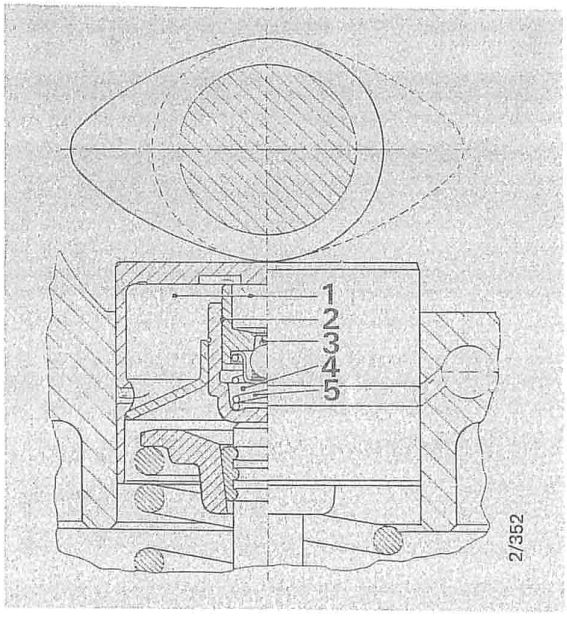
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Oil flow through the cam follower

Each cam follower has two storage chambers and one high-pressure chamber. A spring-loaded ball valve seals the orifice between the high-pressure chamber and the adjacent storage chamber. A return spring in the high-pressure chamber acts on the sliding piston, to maintain a constant clearance between the cam follower and the base circle of the cam. At the same time, the high-pressure chamber expands and makes up the oil volume, to compensate for leakage losses occurring at actuating pressure in the orifice between the piston and the cylinder.



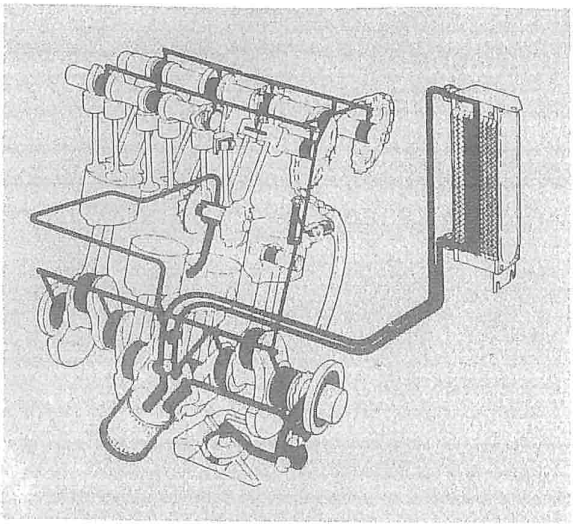


1 Storage chamber
2 Leakage orifice
3 Check valve
4 High-pressure chamber
5 Spring

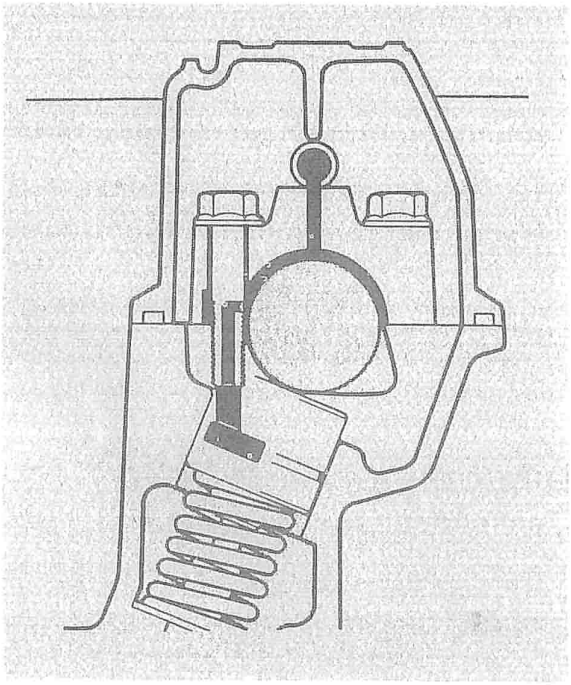
Lubricating system (B202)

The lubricating system for the engine has forced-flow circulation. The oil pressure is generated by a gear-type pump consisting of a pinion and an eccentric ring gear. The pump is driven by the crankshaft and is interposed between the timing cover and the crankshaft pulley. A relief valve in the timing cover limits the oil pressure and diverts surplus oil to the inlet side of the pump.

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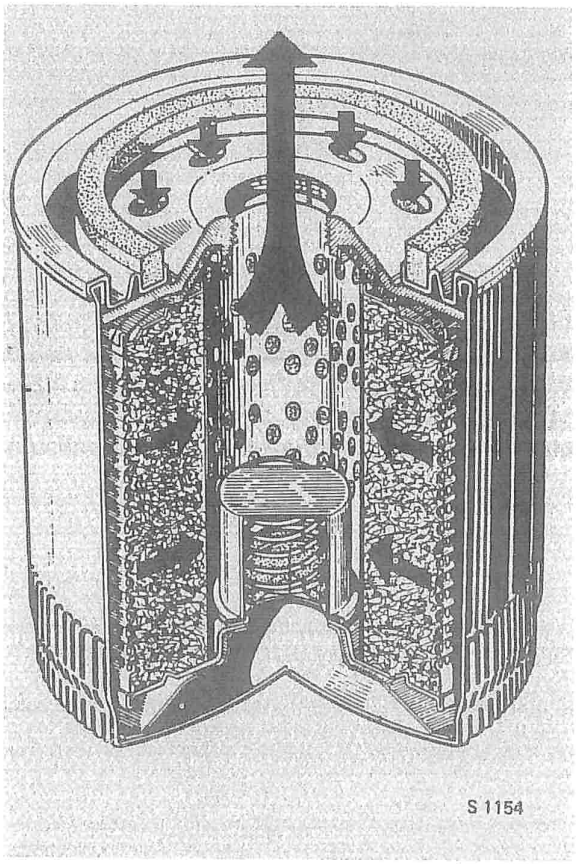


The oil flows from the inlet strainer in the sump through the oil pump and relief valve and via the oil filter to the main gallery in the cylinder block. Oilways run from the gallery to the main bearings and a rising oilway runs to the cylinder head for lubrication of the camshafts and valve mechanism. A pipe for lubrication of the turbo unit is also connected to the main oil gallery.



The hydraulic cam followers operate in an oil bath, with oil supplied via oilways incorporated in the securing bolts for the camshaft bearing caps. Deaeration of the oil is effected as it flows through the camshaft bearing.

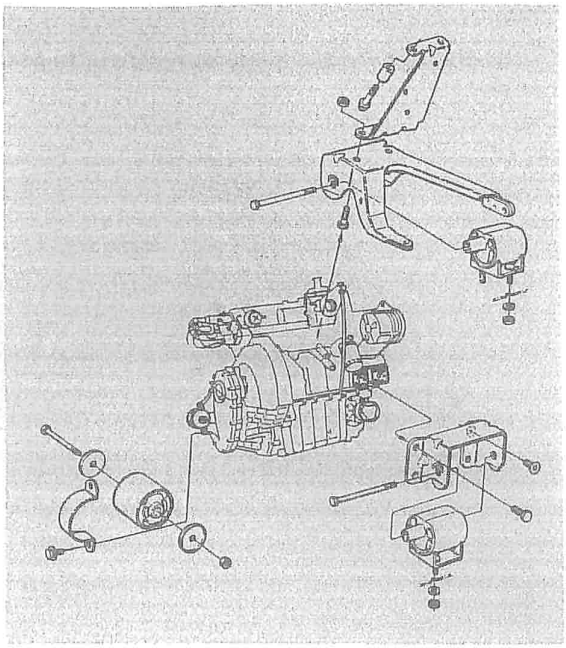
Oil filter



The oil filter is of the full-flow type: i.e. all of the oil circulated to the lubrication points flows through the filter.

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Engine mountings



General

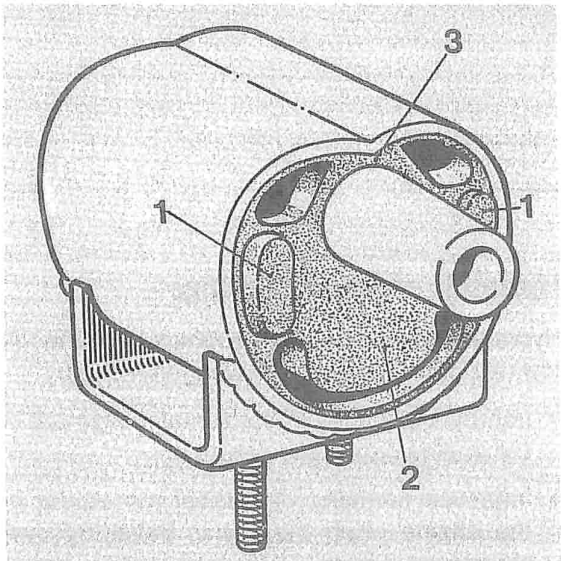
The engine mountings are designed to absorb the movement of the engine while it is running and also to limit the transmittance of engine vibration and noise to the body.

The damping action of the engine mounting rubbers is progressive - the greater the load on the mounting rubbers the greater the resistance.

Thus, the engine mountings protect the surrounding components from excessive movement of the engine.

Engine mounting rubbers

The engine mounting rubbers have two primary modes of operation: under normal driving conditions, only the No. 1 sections of the mountings are operative, providing low damping resistance. However, when the car is accelerating or braking hard, sections 2 and 3 also come into play, providing a considerably greater damping effect.

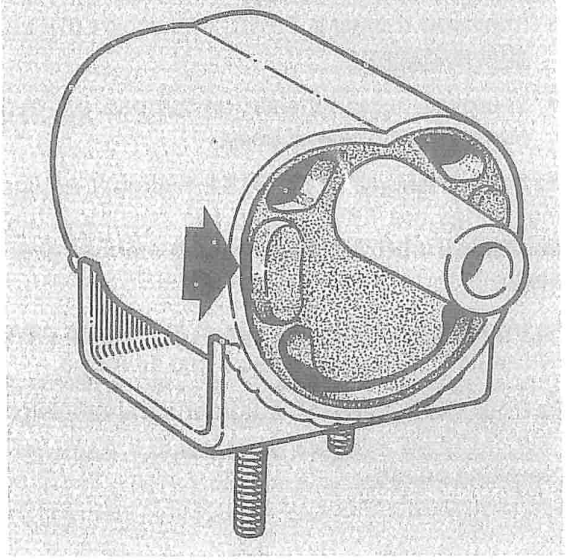


Checking the engine mountings

The engine mountings can be inspected in situ.

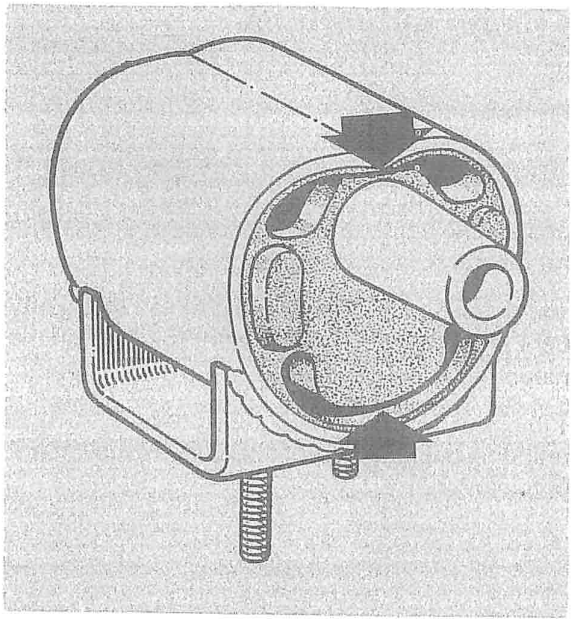
Check:

- to see if the rubber bonding has come away from the mounting body.



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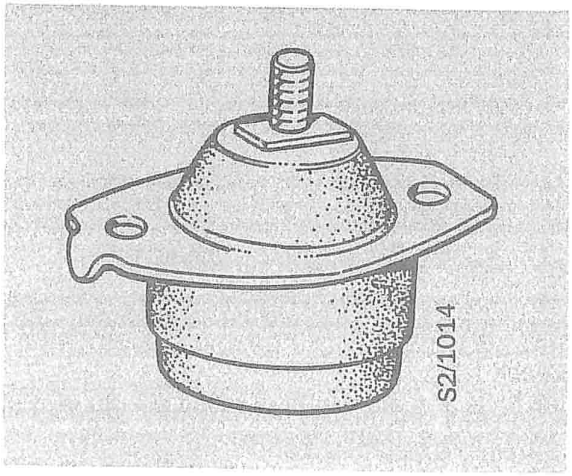
- that there is clearance between the rubber and the mounting body at both top and bottom.



Hydraulic engine mountings

Hydraulic engine mounting rubbers have the following advantages over conventional ones:

- Improved damping of horizontal movement of the engine during acceleration.
- Improved damping of vertical movement of the engine when the car is travelling over bumpy ground.
- Improved damping of vibration when the engine is idling.
- Improved sound-insulation properties between the engine and body.



As from chassis No. F1033151, hydraulic engine mountings are fitted at the two rear mounting points in Turbo 16 models (with manual gearbox).

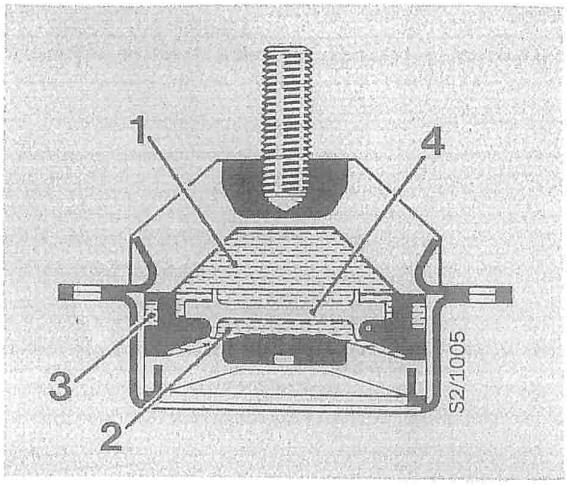
As from M86, cars with manual gearboxes have hydraulic engine mountings fitted all round.

As from M86, cars with automatic transmission have hydraulic engine mountings at the two rear mounting points.

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The hydraulic engine mounting has two chambers containing a special damping fluid. Linking the two chambers is a port, and the length and cross-sectional area of this port govern the damping properties of the mounting. The chambers are also separated by a diaphragm which takes up the forces generated by the small movements of the engine occurring under normal conditions.

The capacity of the diaphragm is not sufficient to damp large engine movements; under these conditions, fluid is forced from the upper to the lower chamber, equalizing the pressures. The damping action of the hydraulic mounting is therefore progressive, with the resistance to movement increasing with load.



1 Upper chamber
2 Lower chamber
3 Port
4 Diaphragm

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Removal and refitting

Removal and refitting, B201 201-1
Removal and refitting, B202 201-26
Separation of engine and manual gearbox, B201 and B202 . . 201-47
Separation of engine and automatic gearbox, B201 and B202 201-49

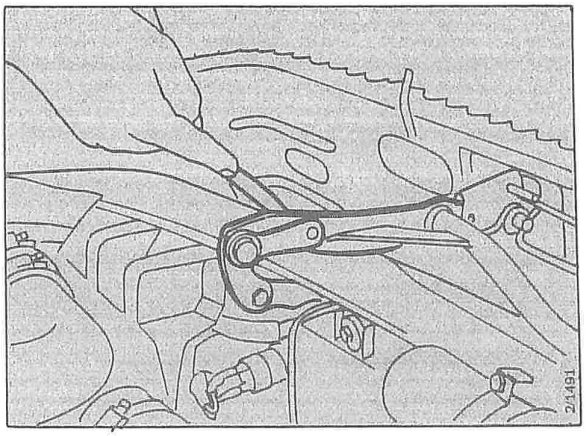
Removal and refitting B201

The following procedure for removal and refitting applies to the M88 B201 Turbo engine equipped with intercooler, catalytic converter and water-cooled turbocharger.

Various departures from the method described will have to be made on account of differences in different model years and engine variants.

To remove

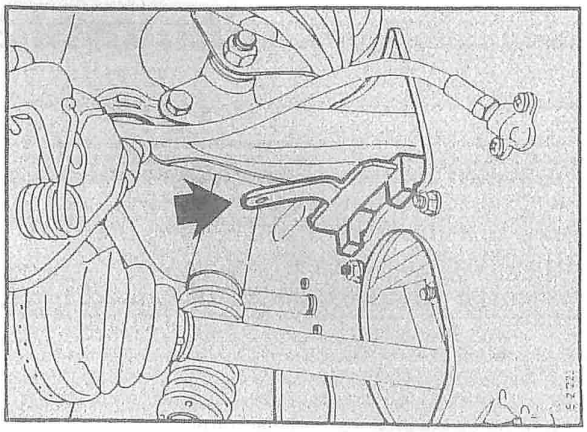
1 Disconnect the linkages for the bonnet hinges, disconnect the washer hose and remove the bonnet.



Stand the bonnet where it will not be damaged, e.g. leaning securely against a wall.

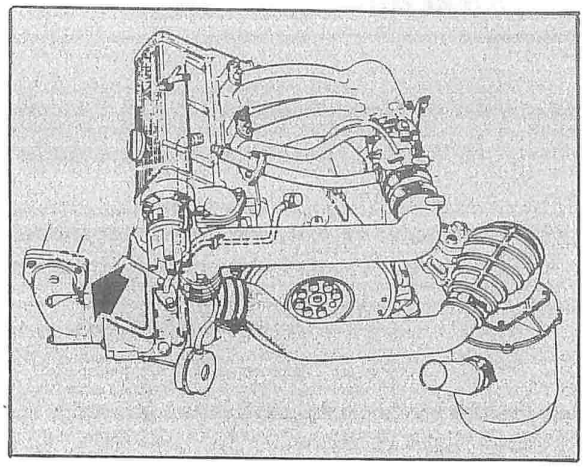
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2 .Insert tool 83 93 209 between the upper wishbone and body on the RH side: turn the wheel to full RH lock and insert the tool from the wheel-arch side.



3 Disconnect both battery leads.
Remove the battery (Turbo cars only).

4 Unbolt the exhaust pipe from the exhaust manifold.



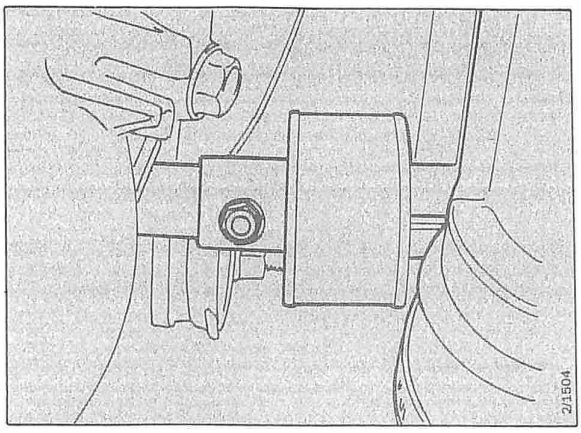
5 Slacken the wheel bolts on the RH wheel.

6 Drain the power-steering fluid reservoir.

7 Raise the car.

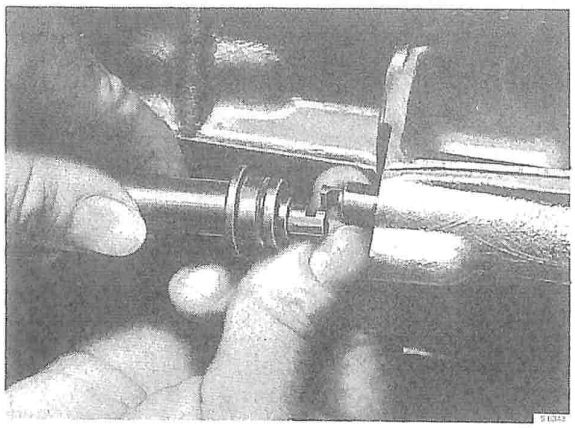
8 From underneath the car:

a Manual cars:
Remove the nut and carefully tap the taper pin out of the selector rod.
Separate the selector rod from the linkage.



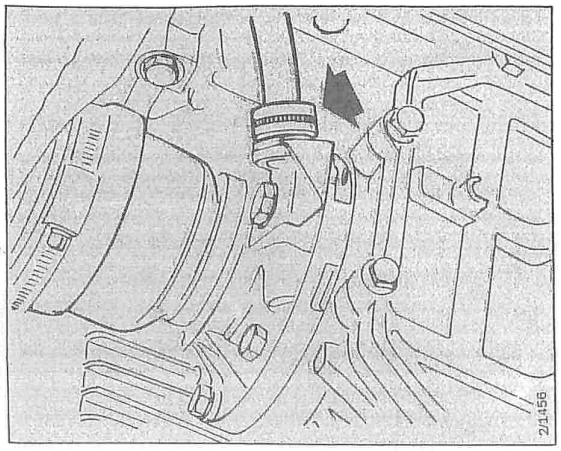
Automatics:

- Remove the retaining screw for the gear selector cable on the gearbox.
- With the gear selector rod fully extended (selector set to P) withdraw the cable.
- Slide back the spring-loaded sleeve on the rod and unhook the end of the cable.

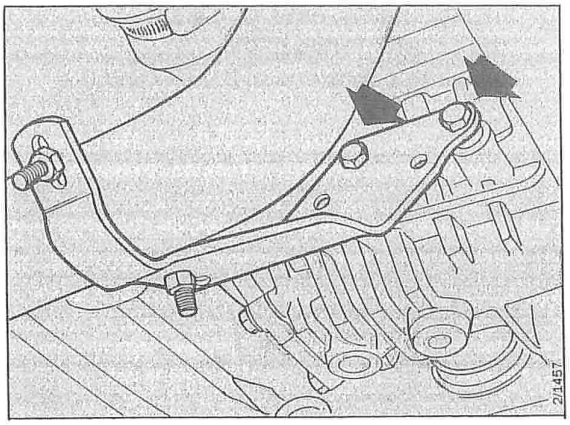


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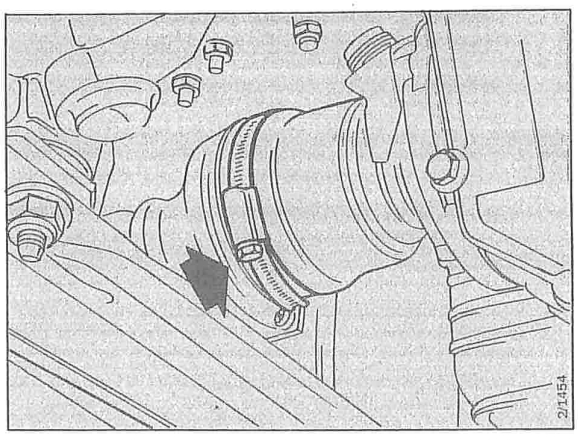
b Disconnect the speedometer drive.



c Remove the exhaust pipe bracket bolts from the gearbox.



d Undo the clips on the gaiters over the inboard drive-shaft joints and pull the gaiters off the driver cups.

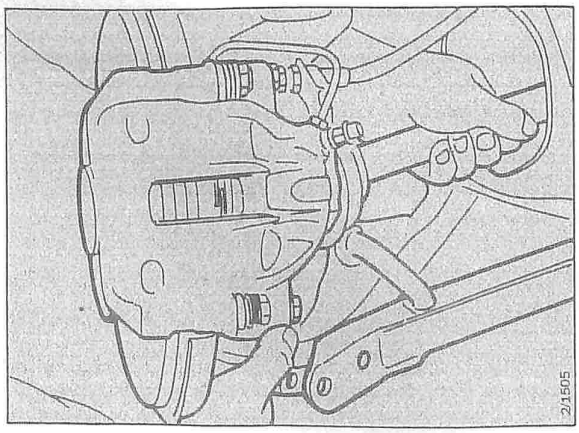


9 Lower the car to a convenient working height.

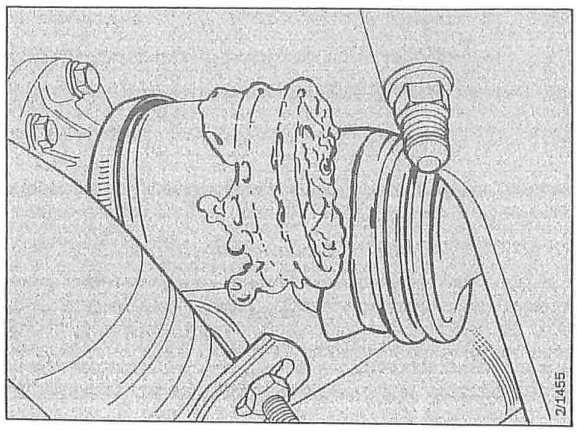
10 Remove the RH front road wheel.

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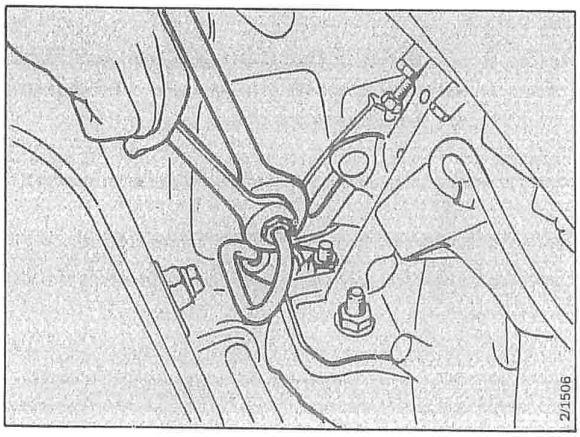
11 Separate the lower wishbone from the ball joint.



12 Separate the inboard drive-shaft joint on the RH side and move the inboard end of the drive shaft forward of the driver cup. Support the shaft on the end of the wishbone.



13 Disconnect the discharge pipe from the steering servo pump and cap the open end. Don't get any fluid on the engine mounting rubber.



14 Cars with AC only:

Slacken the tensioner and remove the drive belt for the AC compressor.

15 Drain the coolant through the drain plugs on the block and at the bottom of the radiator.

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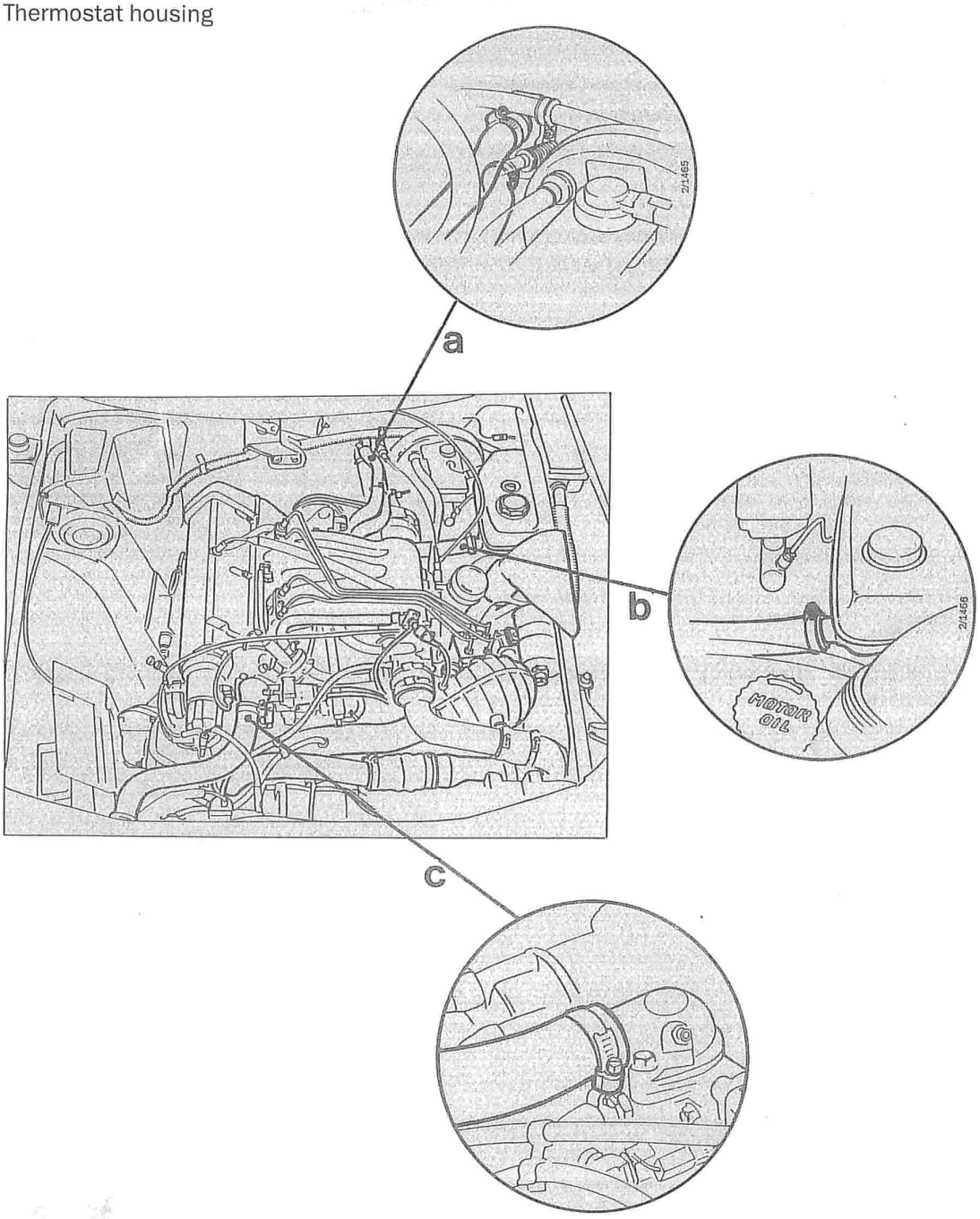
16 Disconnect the coolant hoses from the following:

a Heat exchanger valve

N.B.
Label the hoses to ensure they are reconnected properly.

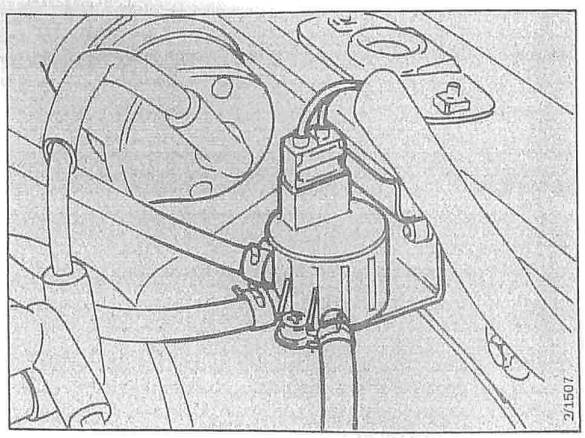
b Expansion tank

c Thermostat housing



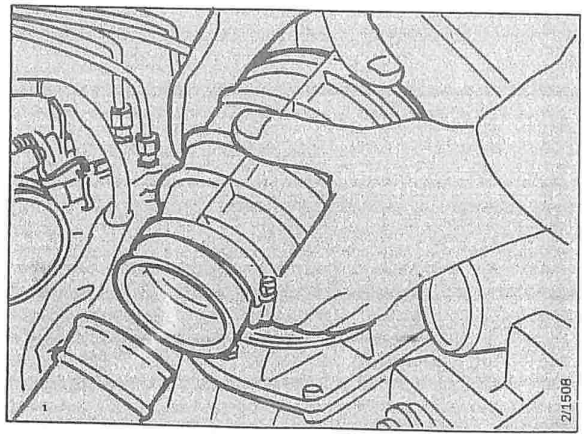
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17 Disconnect the signal hoses from the solenoid valve.



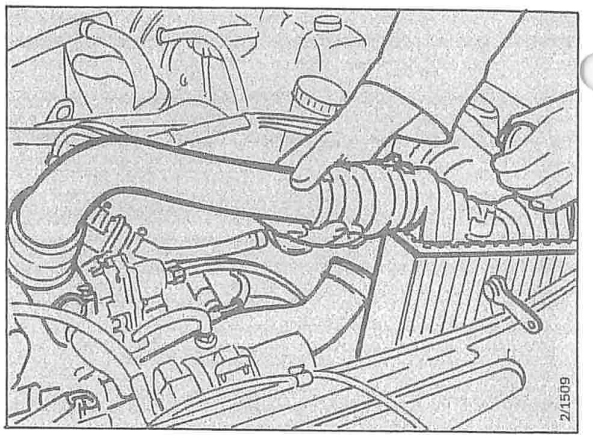
18 Remove the turbo discharge pipe between the intercooler and throttle housing.

19 Remove the rubber socket connector from the mixture control unit.



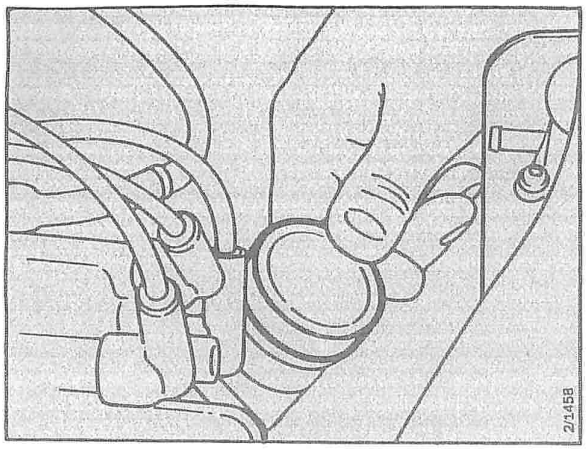
20 Remove the cover from the top of the intercooler.

Remove the intercooler complete with air pipe.

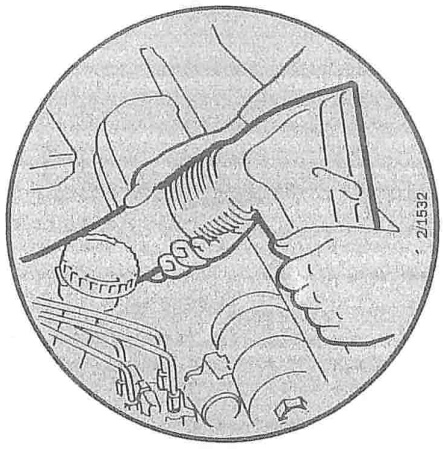


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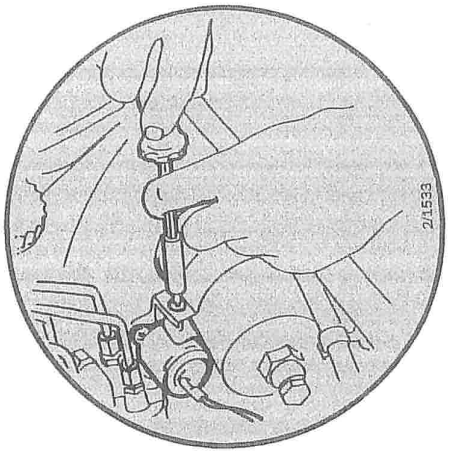
Cap the inlet to the turbocharger.



21 Remove the mixture control unit and air cleaner as follows:



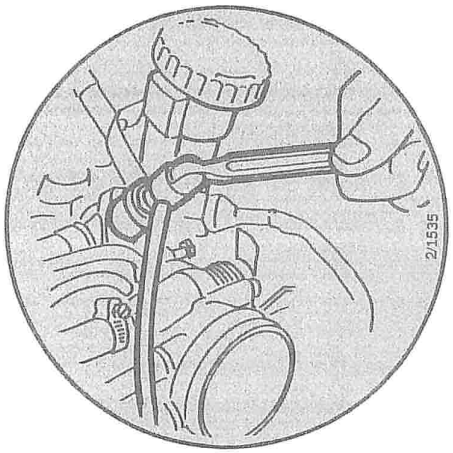
a Remove the air cleaner intake.



b Release the vacuum hose and slacken the securing screw for the fuel booster pressure switch and move the switch to one side.



c Disconnect the fuel hoses from the warm-up regulator (use two spanners).



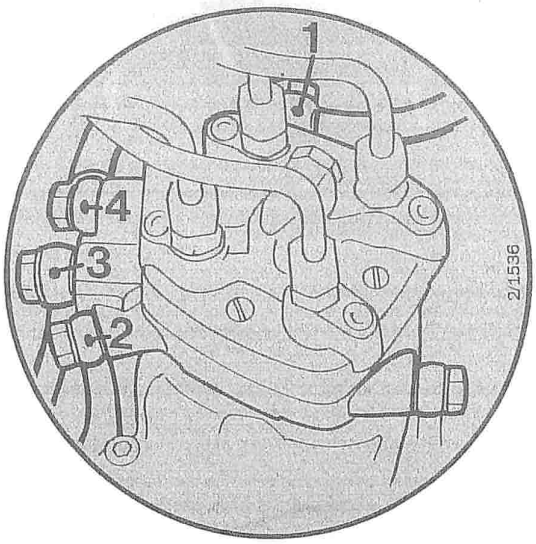
d Disconnect the fuel hose from the cold-start valve.

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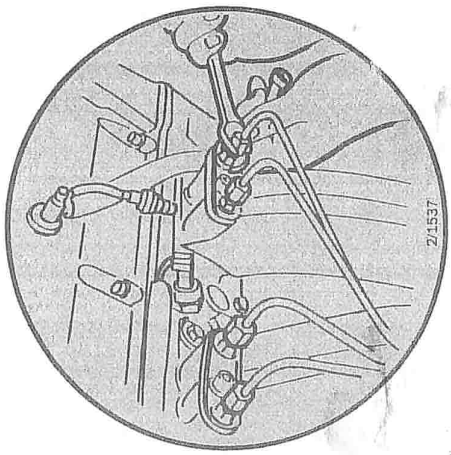
N.B.
Make a careful note of the way the hoses are run to the mixture control unit, and which hose goes to which connection. If necessary, label the hoses.

e Disconnect the following hoses from the mixture control unit:

- Hose from fuel filter (1)
- Hose from cold-start valve (2)
- Fuel return hose (3)
- Hose for warm-up regulator and modulating valve (4)

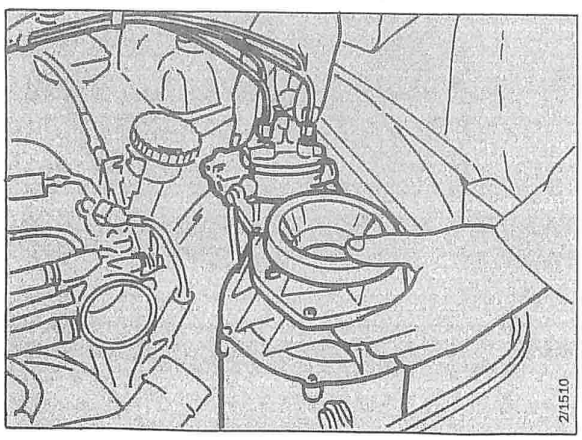


f Disconnect the fuel pipes from the injection valves (use two spanners).



g Disconnect the earth lead from the mixture control unit.

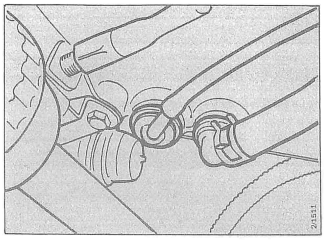
Release the clip and lift off the mixture control unit complete with air cleaner and fuel hoses.



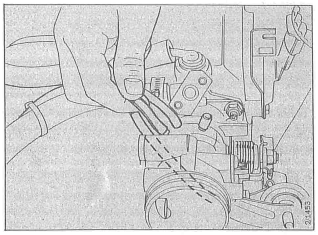
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22 Disconnect the throttle cable.

23 Disconnect the vacuum hoses from the brake servo unit, and the fuel-tank breather system from the inlet manifold



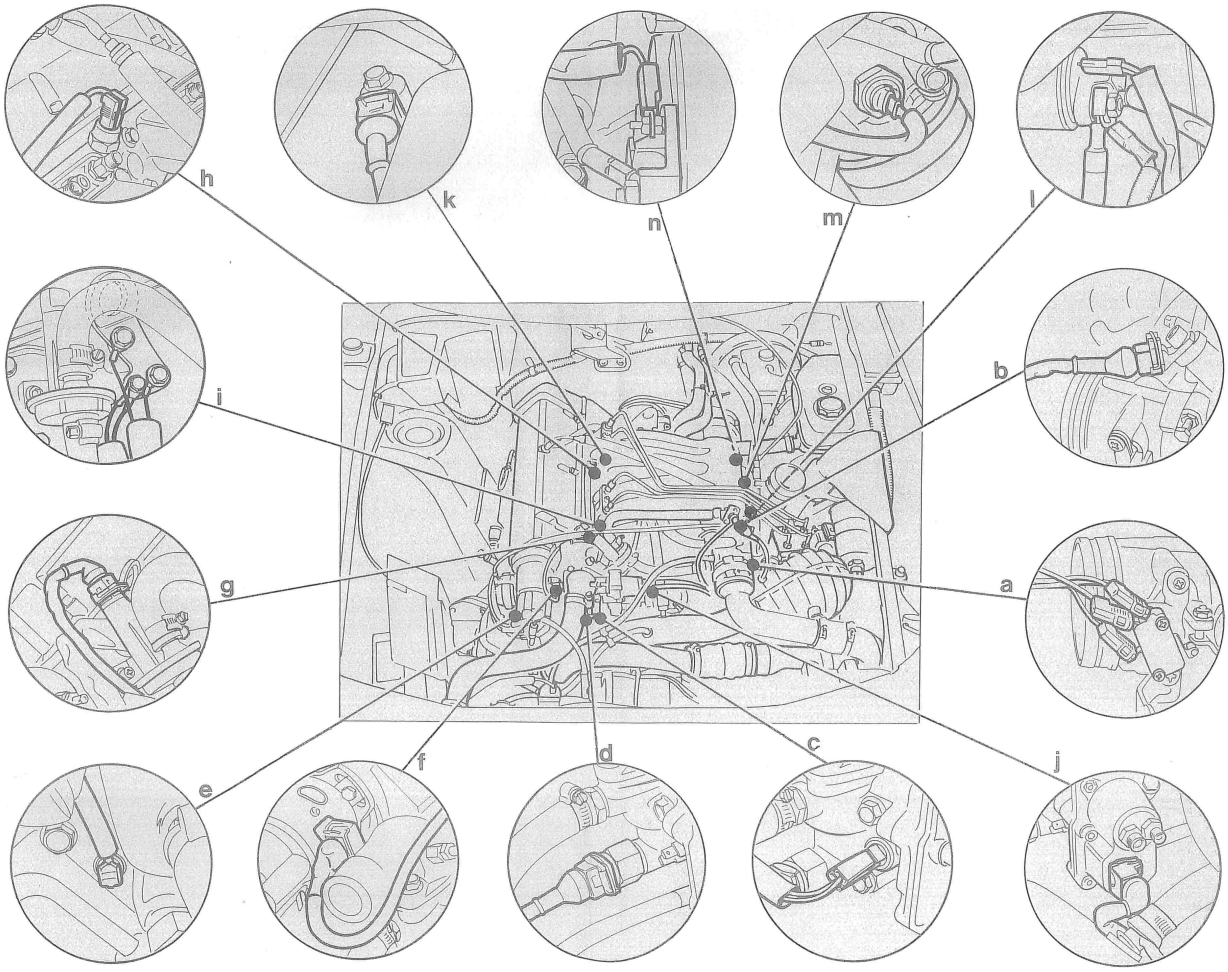
and the throttle housing.



24 Remove the dipstick tube.

25 Snip through the cable ties and release the wiring loom on the LH side of the engine.

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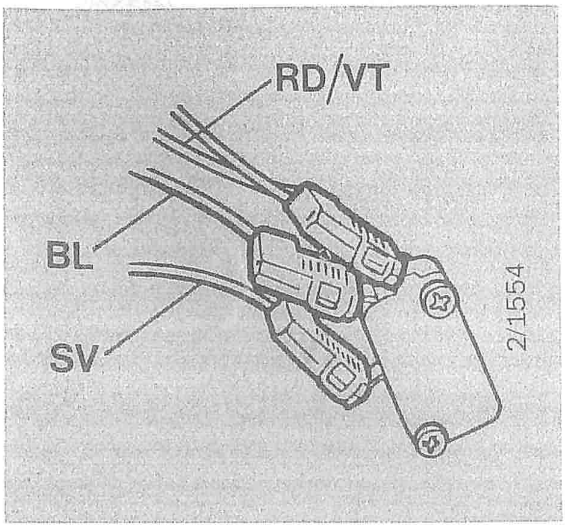


Disconnecting the wiring loom, B201

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Disconnect the electrical leads at the following:

a Throttle-position sensor



N.B.
Note the arrangement of the leads.

b Cold-start valve

c Thermostatic switch (Lambda system)

d Thermostatic time switch

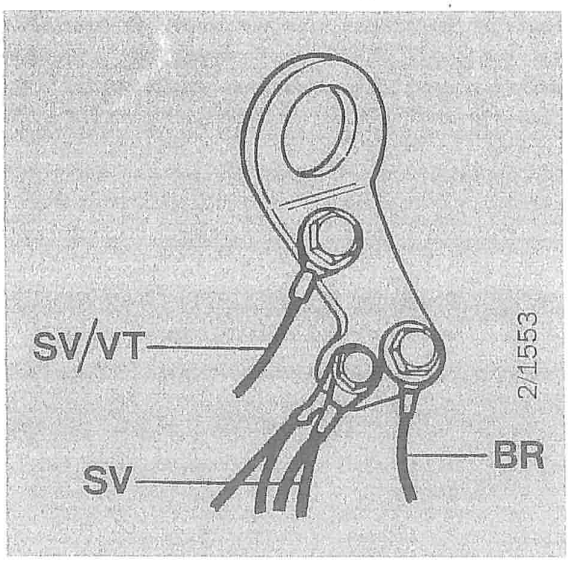
e Temperature sensor

f Hall generator

g Auxiliary air valve

h Thermostatic switch

i Earthing points on engine lifting lug



N.B.
Note the arrangement of the leads.

j Warm-up regulator

k Knock detector

l Starter motor (disconnect the positive (+) feed from the battery at the same time.

m Oil pressure sensor

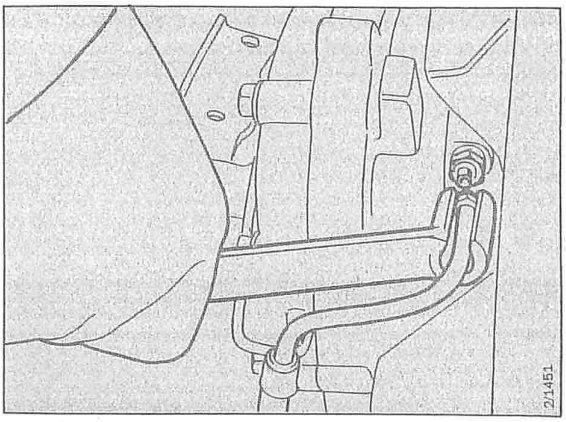
n Alternator

Rest the wiring loom on the radiator member.

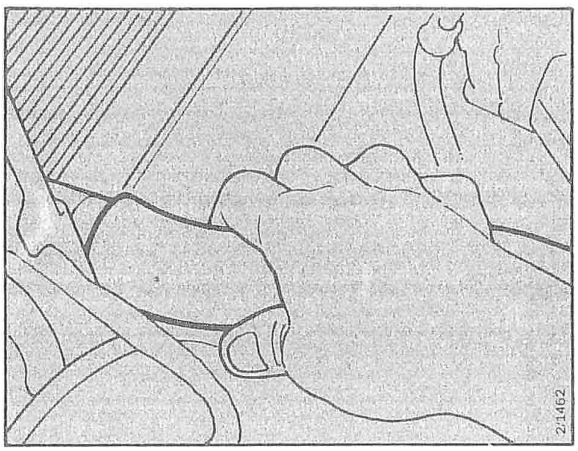
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26 Release the coolant pipe for the turbocharger from the clip on the timing cover and remove the earth lead.

27 Disconnect the hydraulic hose from the slave cylinder using tool 83 93 571. Plug the end of the hose.



28 Disconnect the coolant hose from the bottom of the radiator.



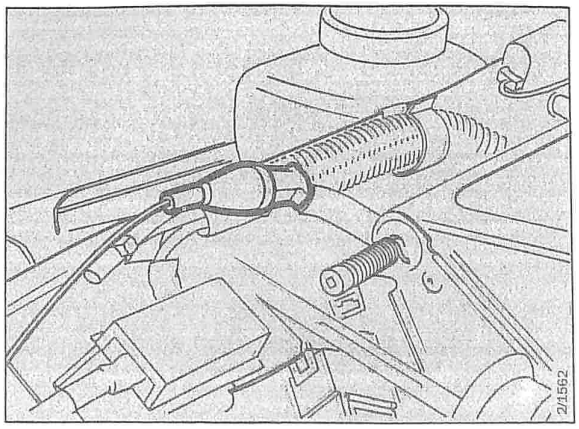
Cars with AC only:
Remove the auxiliary cooling fan.

29 Release the positive battery lead from the clips on the engine and rest it on the battery shelf.

30 Remove the ignition coil and disconnect the lead from the distributor cap. Lay the coil on the radiator member.

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31 Unplug the connector in the oxygen sensor lead above the RH wheel arch. Release the lead from the clip on the wing and rest it on top of the engine.



32 Cars with AC only:
Unbolt the AC compressor (4 bolts) and stand the compressor on the heat exchanger.

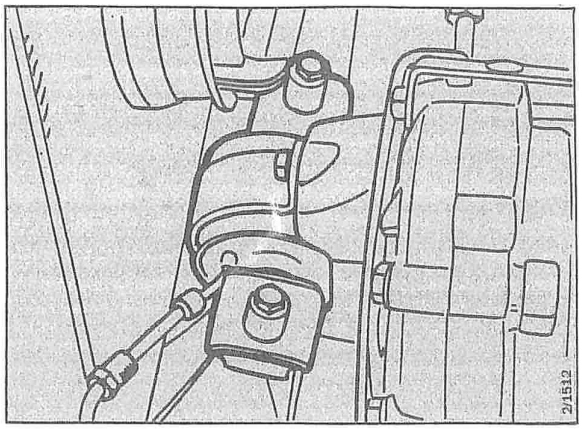
33 Undo all engine mounting bolts.

LH engine mounting:

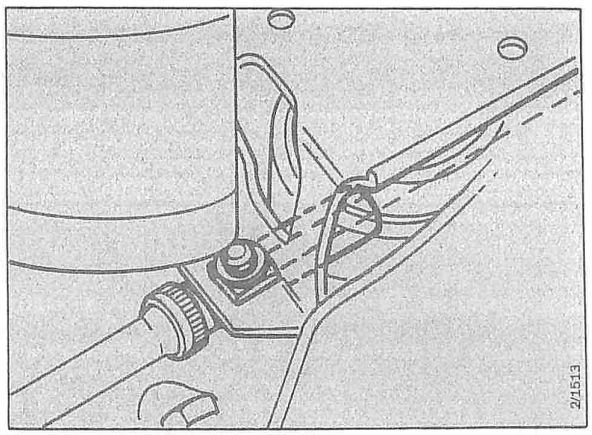
The bolt is a through-bolt and is equipped with a spacer.

Cars to US spec.:

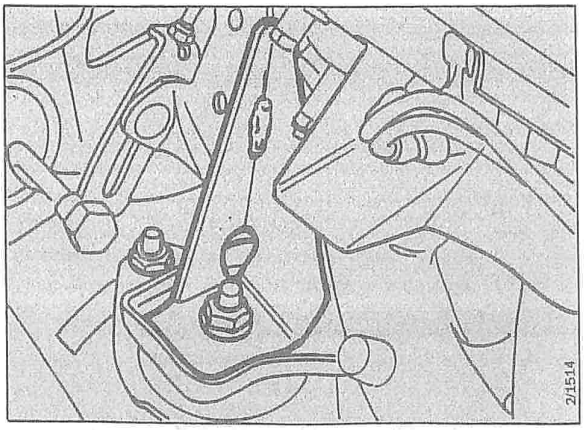
Remove the bump stops on the front and RH mountings.



Front engine mounting



LH engine mounting



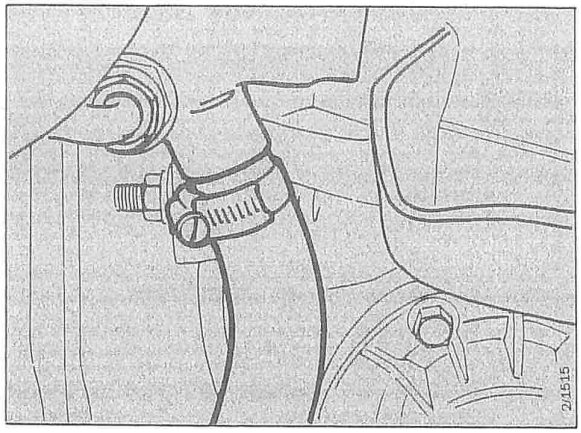
RH engine mounting

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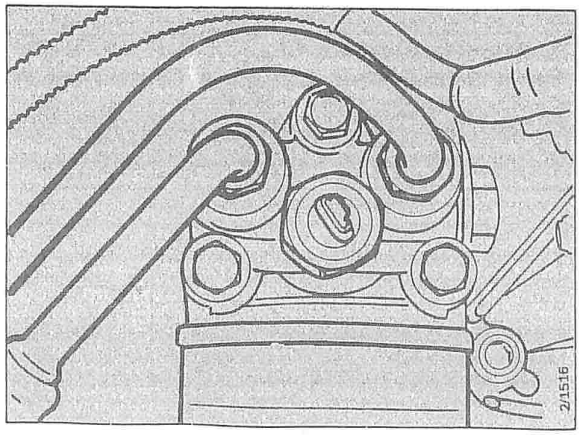
N.B.
Cars with AC: the AC bracket has a hole for attachment of a lifting sling hook. If the bracket has been removed, bolt a separate lifting lug, 93 13 222, onto the water pump cover using the existing bolts.

34 Attach the lifting sling, raise the engine slightly and separate the inboard drive-shaft joint.

35 Disconnect the return line from the steering servo pump.

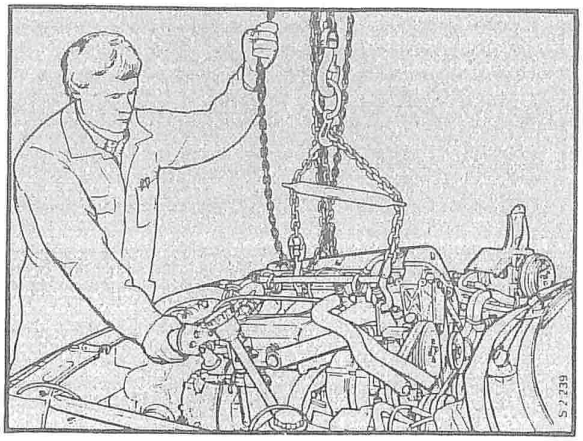


36 Remove the oil pressure sensor and disconnect the oil cooler (air cooled) hoses from the oil filter.



37 Lift the power train out of the car, taking particular care not to damage the radiator or the solenoid valve.

Fit covers over the driver cups.



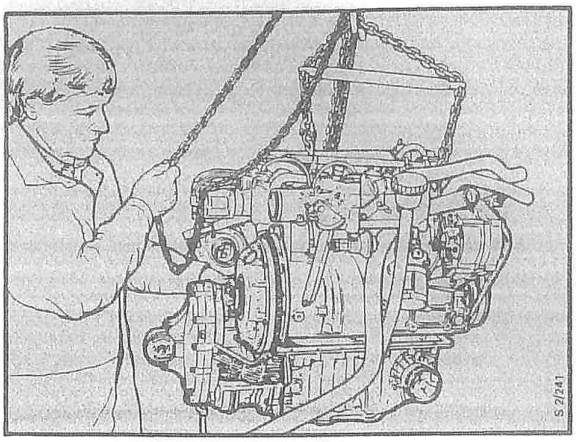
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To fit the power train

1 Check that the driver cups are packed with grease.

Refit the coolant drain plugs.

2 Suspend the power train in the lifting sling with the engine tilted slightly forward.

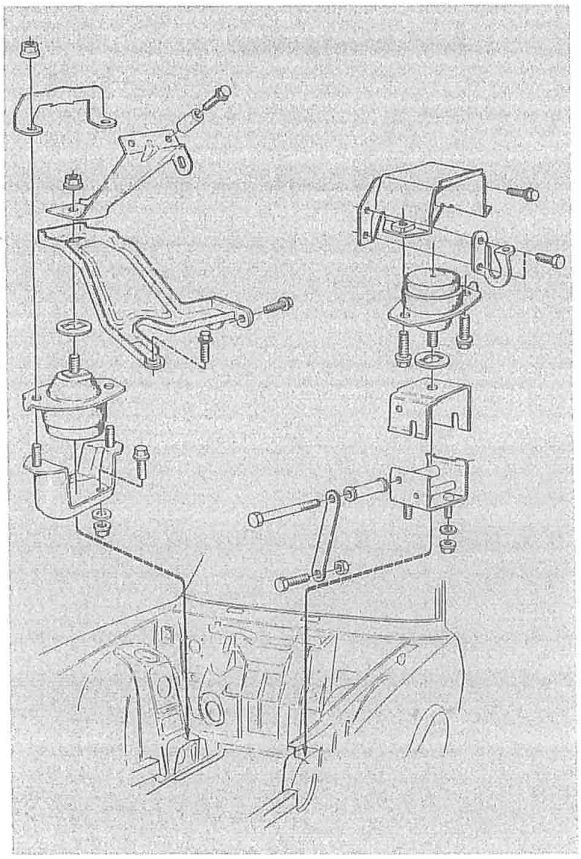


3 Lower the power train into the engine bay to a suitable height for fitting the oil cooler hoses, oil pressure sensor and return hose to the steering servo pump.

4 Adjust the position of the engine to enable the following steps to be carried out in the given order:

- Fit to front engine mounting
- Connect the LH inboard drive-shaft joint
- Connect the RH inboard drive-shaft joint

Lower the engine onto the rear mountings and fit the bolts. Remember to fit the spacer for the LH mounting.



5 Detach the lifting sling and, when applicable, remove the lifting lug from the water pump (AC only).

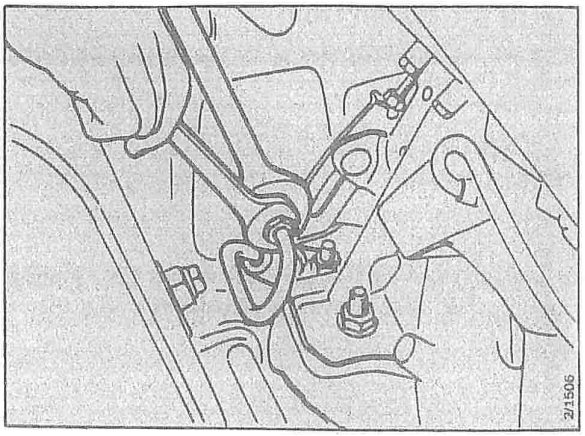
6 Cars with AC only:

Fit the AC compressor.

Fit and adjust the tension of the compressor drive belt.

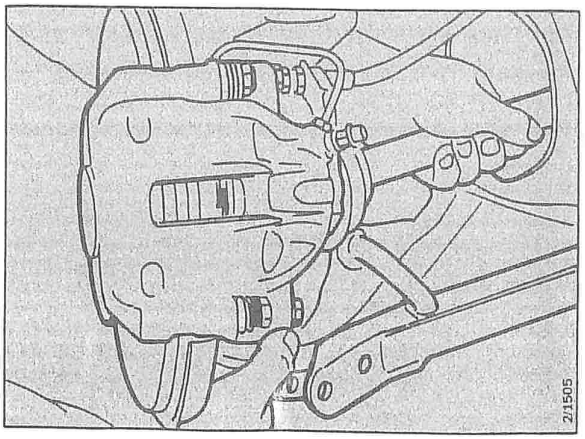
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7 Connect the discharge pipe to the steering servo pump.



8 Fit the exhaust pipe to the manifold, but do not tighten.

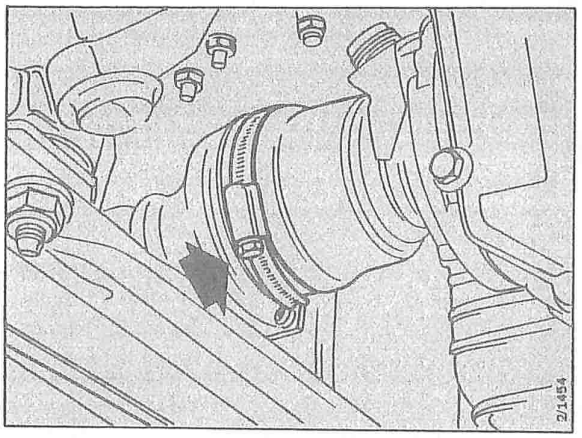
9 Raise the car to a suitable height and reconnect the ball joint to the lower wishbone.



Refit the road wheel.

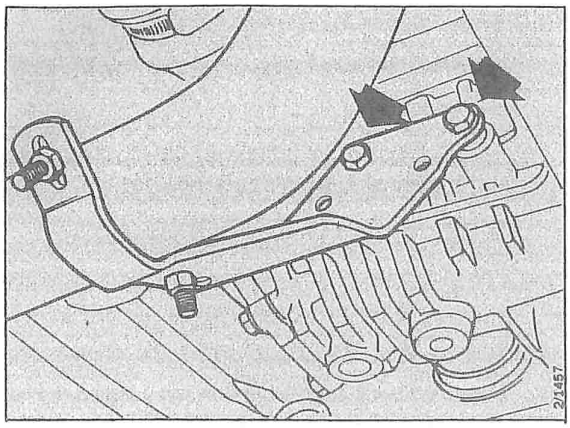
10 Raise the car again and fit the following:

a Gaiters and clips on the drive-shaft joints.



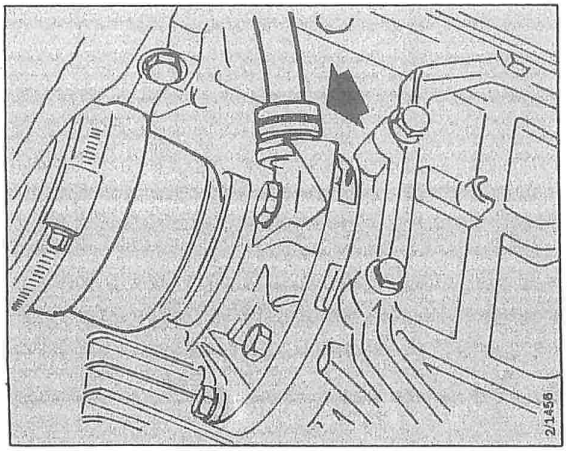
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b Bolts in the exhaust pipe bracket on the gearbox.

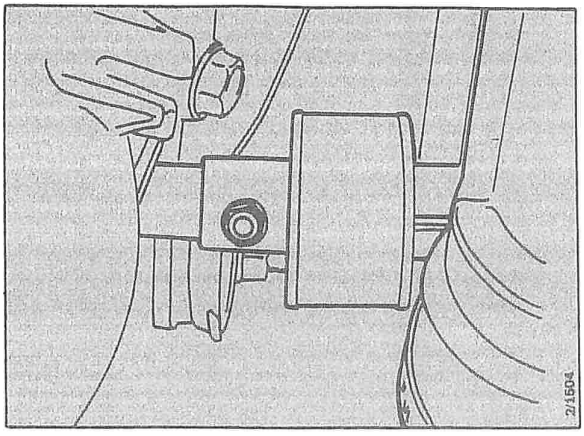


It may be necessary to undo the U-bolt on the pipe to enable the bracket to be bolted to the gearbox.

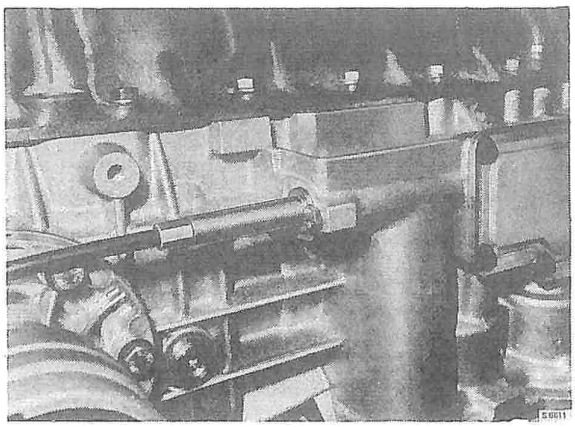
c Speedometer drive.



d Selector rod and taper pin.



Automatic gearbox:
Connect the cable to the gear selector rod and clip the cable to the gearbox.
Check the gear positions and adjust as necessary (see section 444 of the Manual).

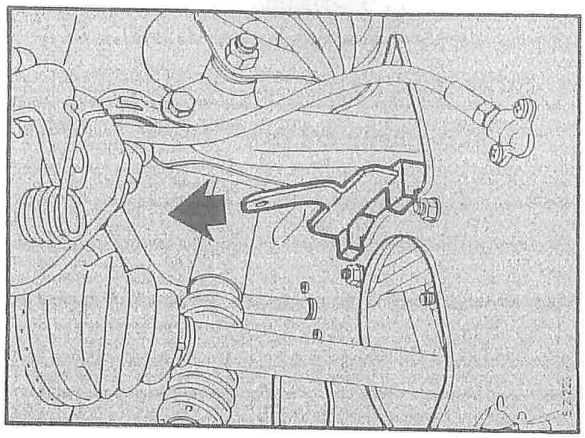


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11 Lower the car to a suitable height and:

- Connect the earth lead to the timing cover.
- Connect the coolant pipe to the turbocharger (water-cooled turbos).
- Clip the positive lead to the engine.

12 Remove tool 83 93 209 from under the RH upper wishbone and tighten the wheel bolts.

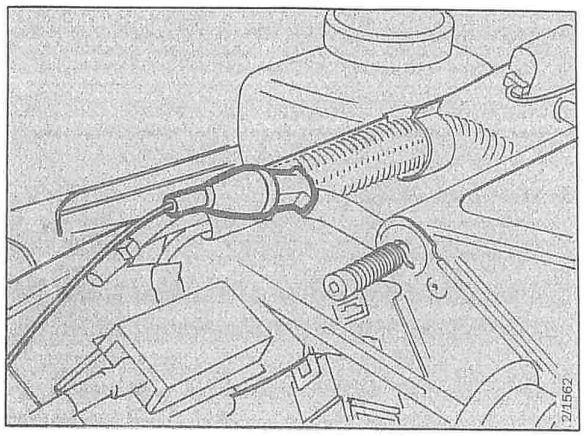


Wheel bolt tightening torque M87 and earlier:
90 - 110 Nm (66 - 81 lbf ft)

Wheel bolt tightening torque M88 onwards:
105 - 125 Nm (77 - 92 lbf ft)

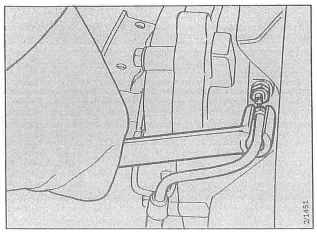
13 Tighten the exhaust pipe flange.

14 Plug together the oxygen sensor connectors, refit the clip on the wing and secure the lead.



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15 Reconnect the coolant hose to the bottom of the radiator and reconnect the discharge pipe to the clutch slave cylinder.

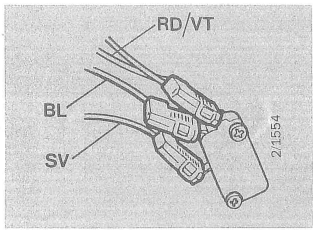


Bleed the clutch!

(See section 411 of the Manual.)

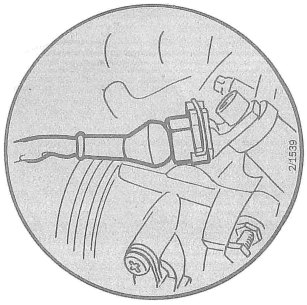
16 Lift the wiring loom back into position and reconnect the leads to the following components in the order given:

a Throttle-position sensor

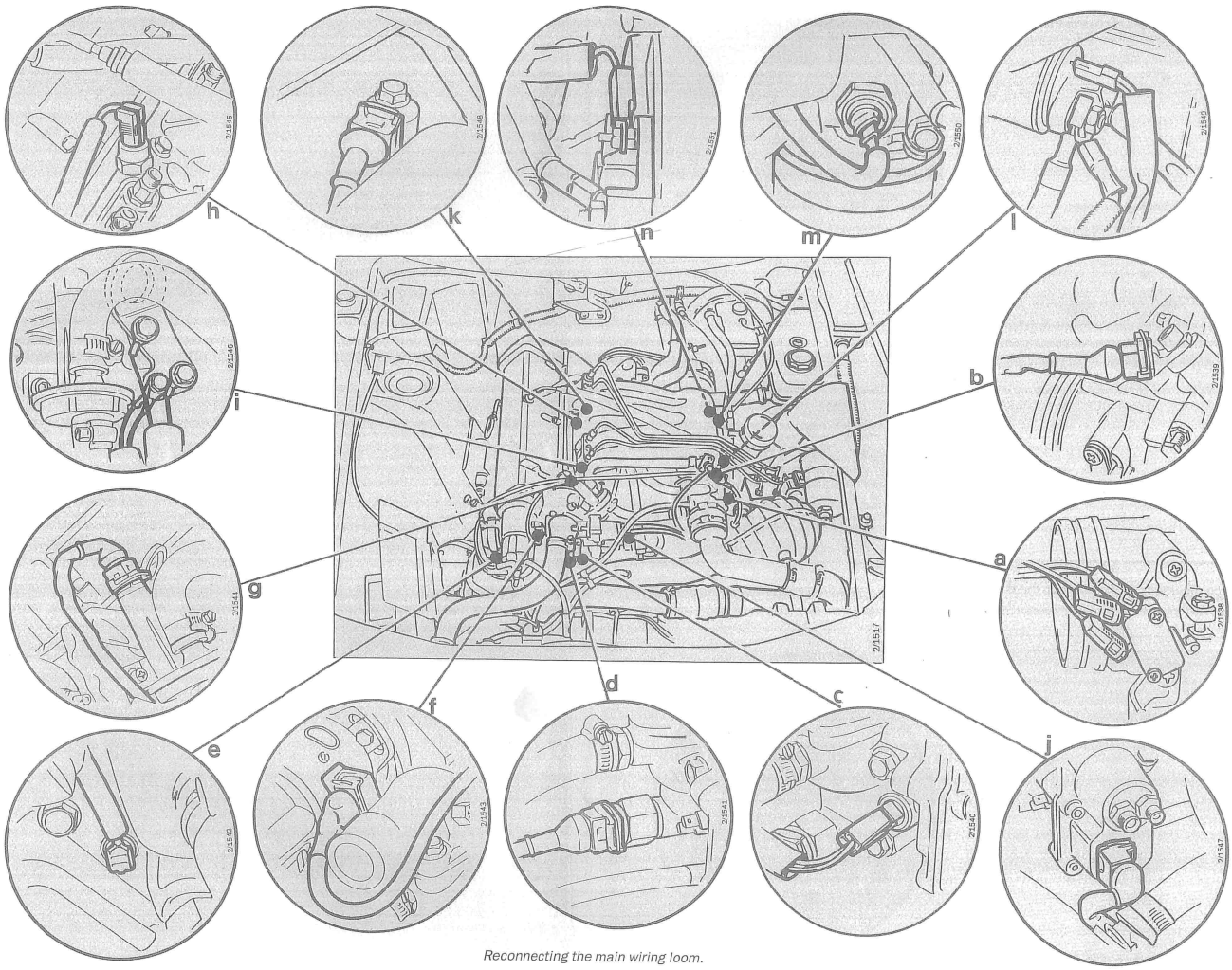


N.B.
Note the configuration of the leads on the throttle-position sensor and at the earthing points on the lifting lug.

b Cold-start valve



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Reconnecting the main wiring loom.

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c Thermostatic switch (Lambda system)

d Thermostatic time switch

e Temperature sensor

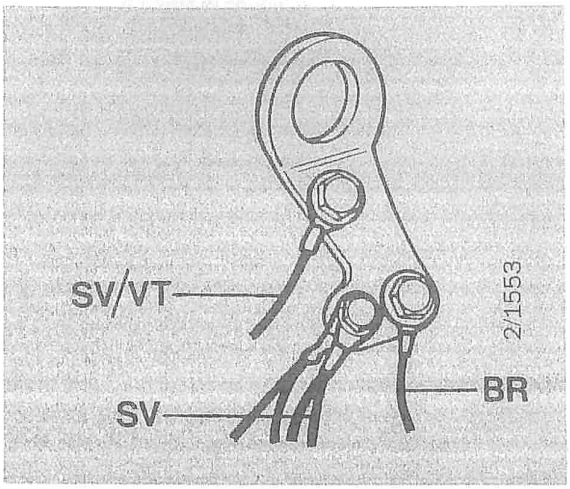
f Hall generator

g Auxiliary air valve

h Thermostatic switch

i Earthing points on lifting lug

Note the arrangement of the leads!



j Warm-up regulator

k Knock detector

l Starter motor

(connecting the positive lead from the battery at the same time)

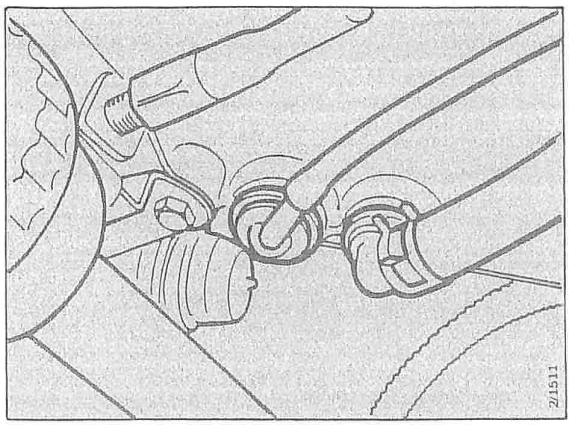
m Oil pressure sensor

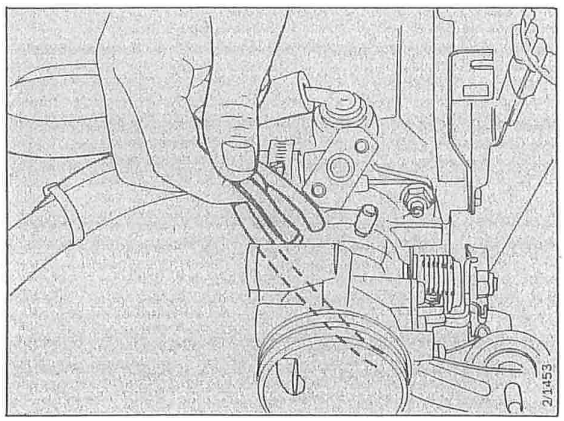
n Alternator

Secure the wiring loom by means of cable ties to the positive battery lead and to the clips on the flywheel cover.

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17 Connect the vacuum hoses for the brake servo and fuel tank breather system to the inlet manifold and throttle housing.



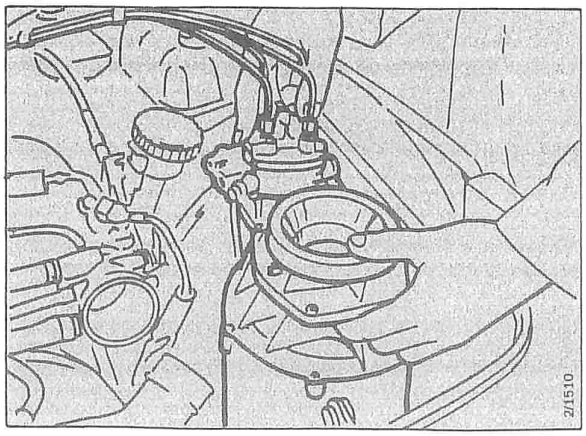


18 Reconnect the throttle cable.

19 Lift the mixture control unit complete with air cleaner into position and secure.

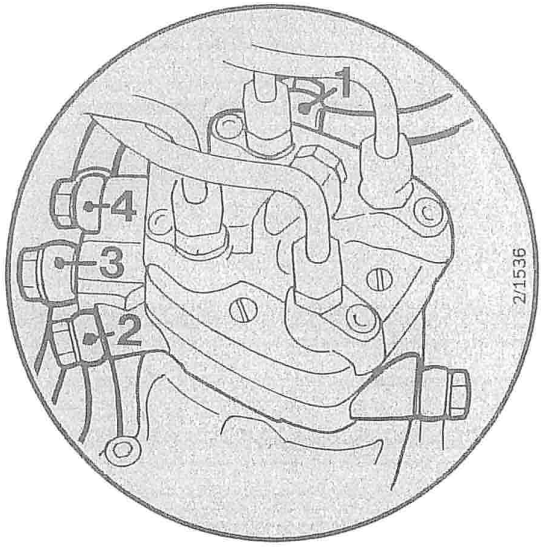
Reconnect the mixture control unit in the following order:

a Connect the earth lead to the unit.

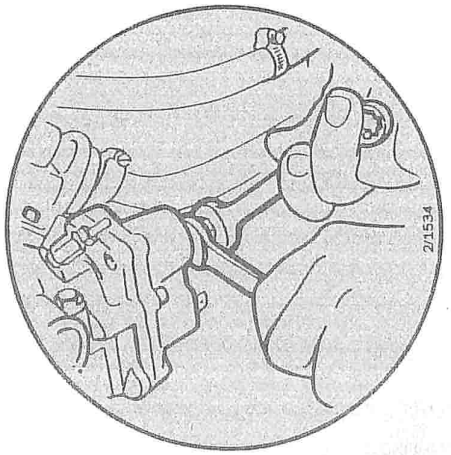


b Connect the following to the unit:

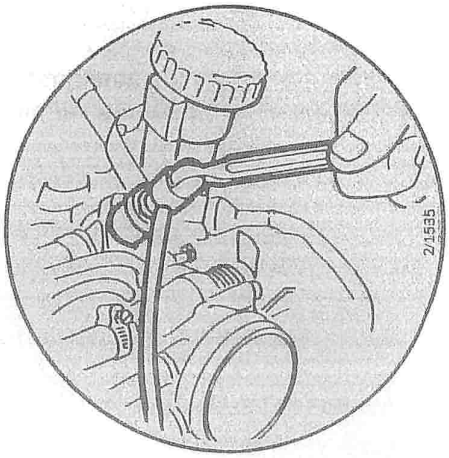
- Hose from fuel filter (1)
- Hose from cold-start valve (2)
- Fuel return hose (3)
- Hose for warm-up regulator and modulating valve (4)



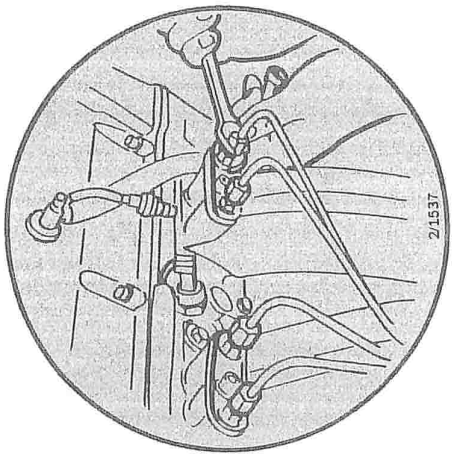
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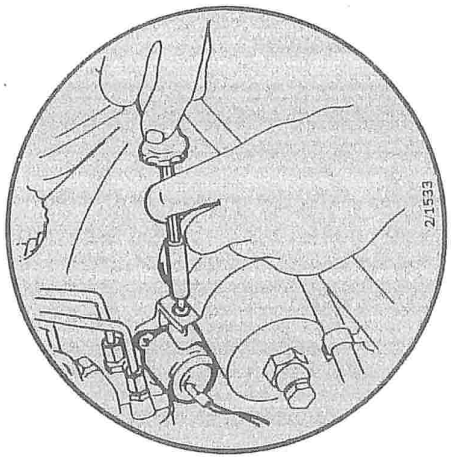
c Connect the fuel lines to the warm-up regulator.



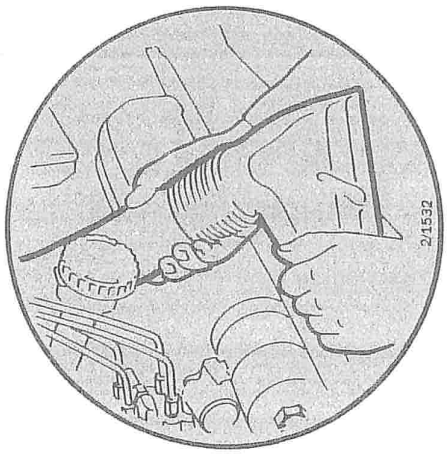
d Connect the fuel line to the cold-start valve.



e Connect the fuel pipes to the injector valves.



f Fit the fuel booster pressure switch and connect the vacuum hose.

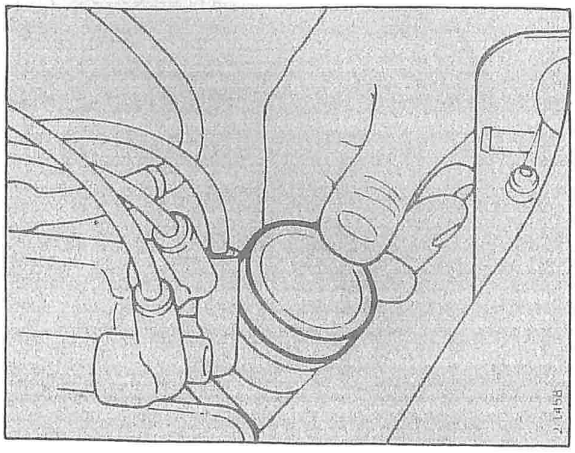


g Fit the air cleaner intake.

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20 Fit the dipstick pipe.

21 Remove the cover from the turbo intake and fit the intercooler complete with air pipe.

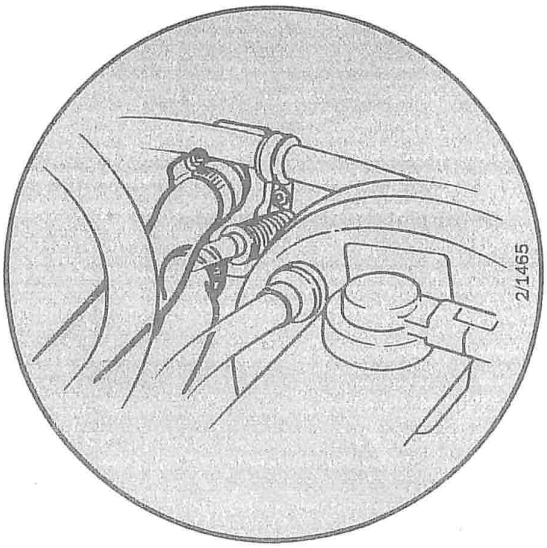


Fit the cover over the intercooler.

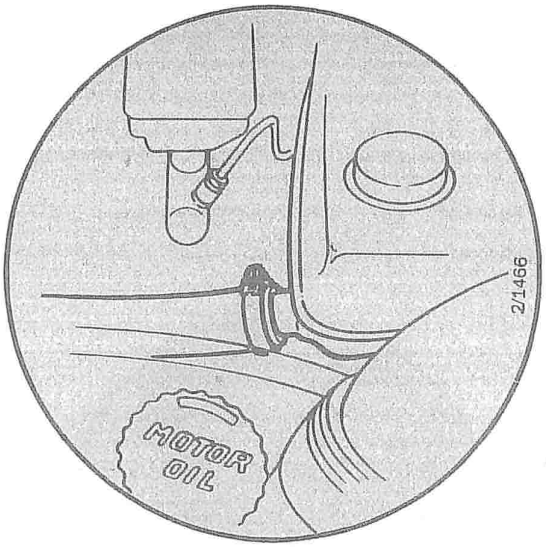
22 Fit the rubber socket connector for the mixture control unit.

23 Fit the turbo discharge pipe between the intercooler and the throttle housing.

24 Connect the coolant hoses to:

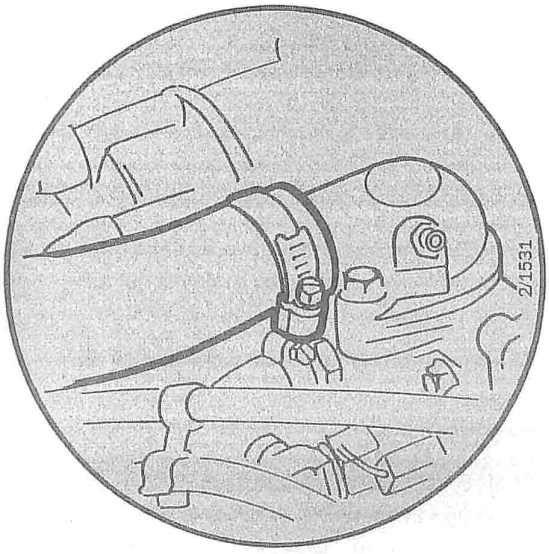


a Heat exchanger valve.



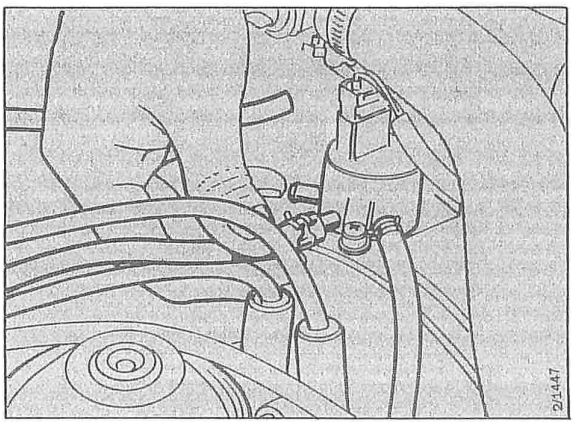
b Expansion tank.

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c Thermostat housing.

25 Connect the signal hoses to the solenoid valve.



26 Fit the ignition coil and reconnect the HT lead to the distributor cap.

27 Fill the power steering fluid reservoir with Texaco Power Steering Fluid 4634 or the equivalent.

28 Refill the cooling system and pressure test it.

29 Fit the battery and reconnect the leads.

30 Fit the bonnet and reconnect the windscreen washer hose.

31 Start the engine, check all functions and inspect for leaks.

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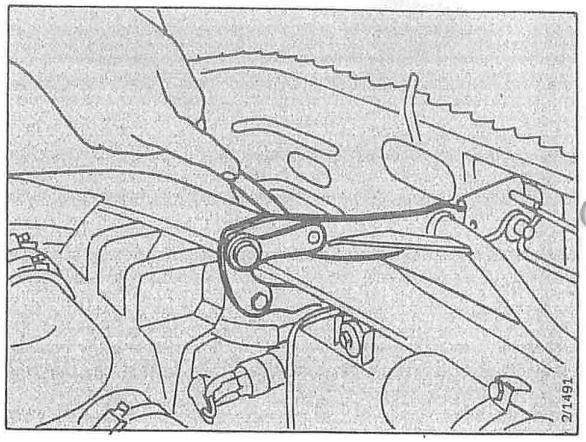
Removal and refitting, B202

The following procedure for removal and refitting applies to the M88 B202 Turbo engine equipped with intercooler, catalytic converter, AC system, water-cooled turbocharger and manual gearbox.

Various departures from the method described will have to be made on account of differences in different model years and engine variants.

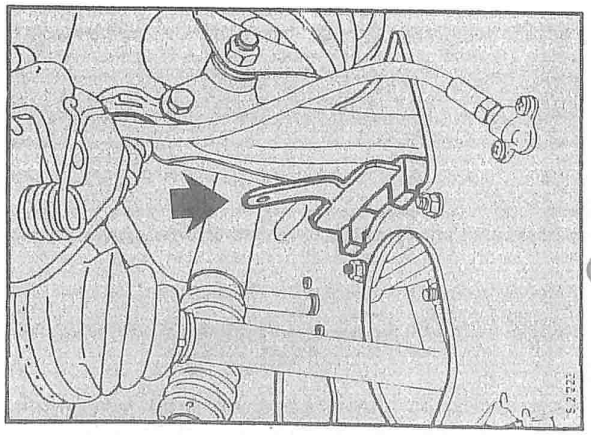
To remove

1 Disconnect the linkages for the bonnet hinges, disconnect the washer hose and remove the bonnet.



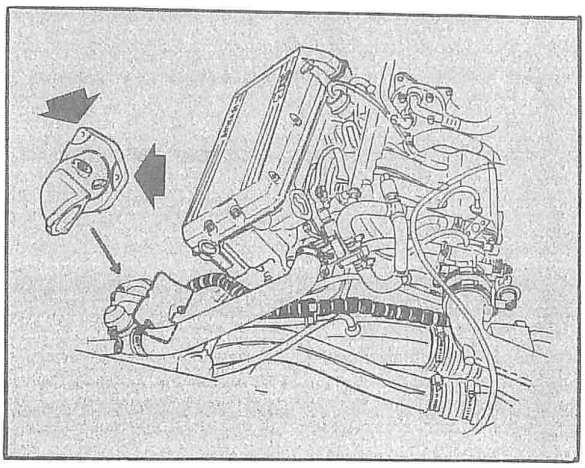
Stand the bonnet where it will not be damaged, e.g. leaning securely against a wall.

2 Insert tool 83 93 209 between the upper wishbone and body on the RH side: turn the wheel to full RH lock and insert the tool from the wheel-arch side.



3 Disconnect both battery leads. Remove the battery.

4 Unbolt the exhaust pipe from the exhaust manifold.



5 Slacken the wheel bolts on the RH wheel.

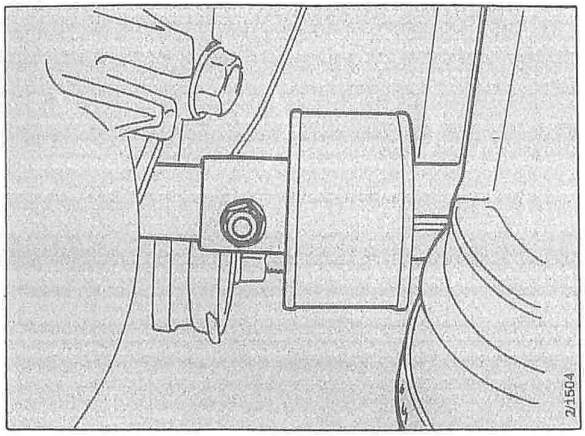
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6 Drain the power-steering fluid reservoir.

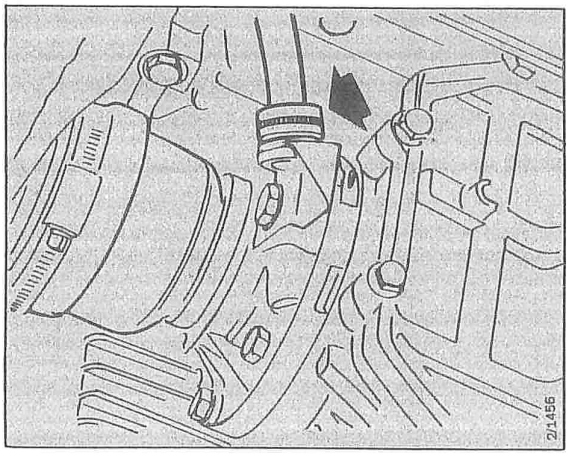
7 Raise the car.

8 From underneath the car:

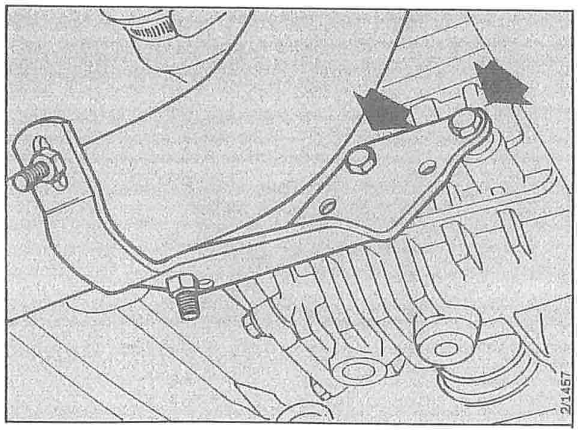
a Remove the nut and carefully tap the taper pin out of the selector rod. Separate the selector rod from the linkage.



b Disconnect the speedometer drive.



c Remove the exhaust pipe bracket bolts from the gearbox.



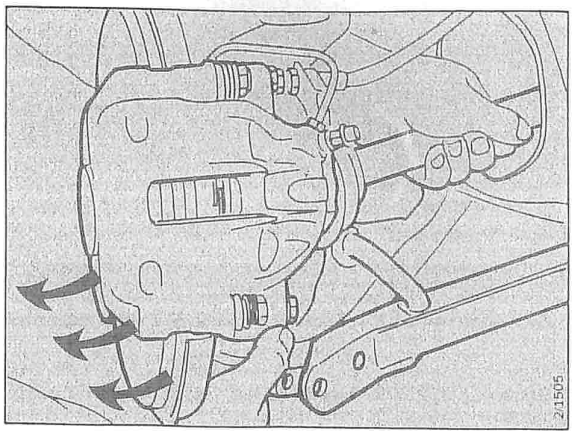
d Undo the clips on the gaiters over the inboard drive-shaft joints and pull the gaiters off the driver cups.

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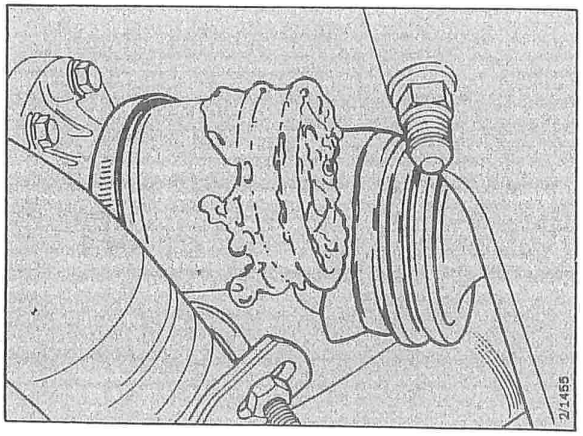
9 Lower the car to a convenient working height.

10 Remove the RH front road wheel.

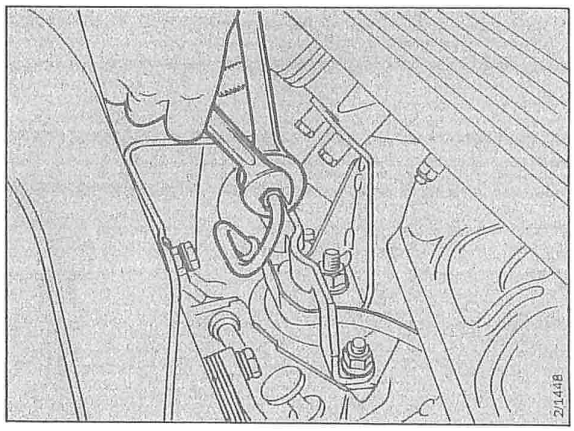
11 Separate the lower wishbone and anti-roll bar from the ball joint.



12 Separate the inboard drive-shaft joint on the RH side and move the inboard end of the drive shaft forward of the driver cup. Support the shaft on the end of the wishbone.



13 Disconnect the discharge pipe from the steering servo pump and cap the open end. Don't get any fluid on the engine mounting rubber.



14 Slacken the tensioner and remove the drive belt for the AC compressor.

15 Drain the coolant through the drain plugs on the block and at the bottom of the radiator. Disconnect the oil filler pipe.

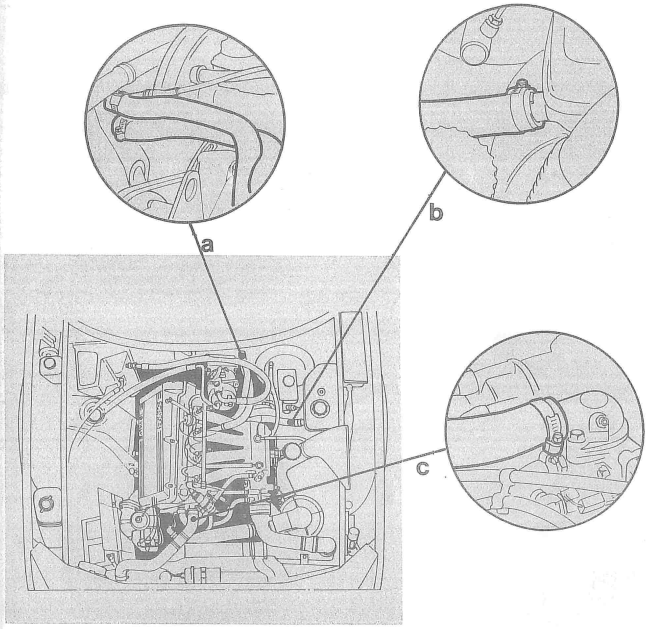
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16 Disconnect the coolant hoses from the following:

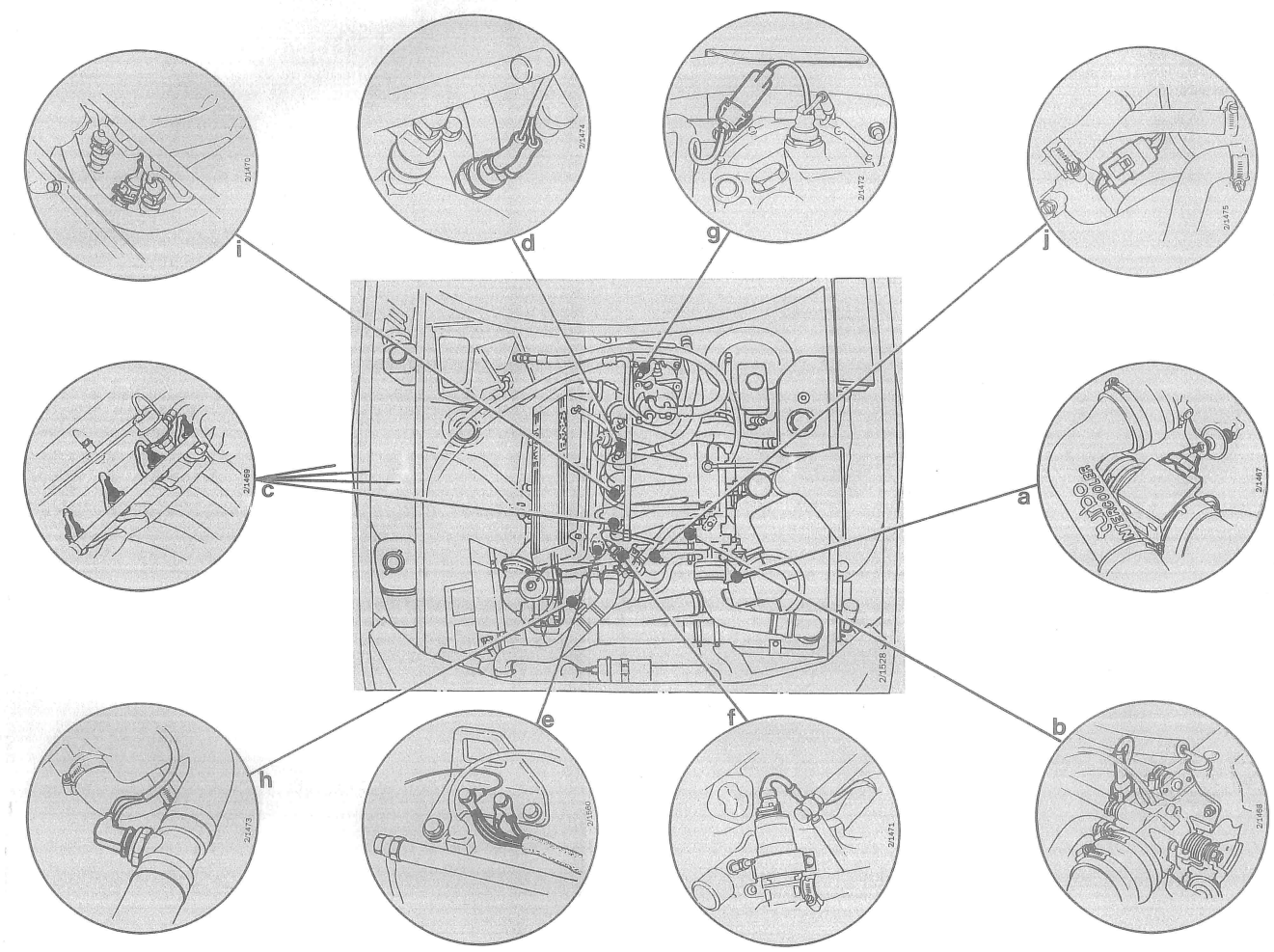
a Heat exchanger valve
N.B. Label the hoses to ensure they are reconnected properly.

b Expansion tank

c Thermostat housing



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Removal of main wiring loom incorporating loom for the LH fuel injection system, B202.

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17 Disconnect the LH fuel injection system wiring loom at:

a Air mass meter

b Throttle-position sensor

c Injection valves

d Temperature sensor

e Earthing points on engine lifting lug

f AIC valve

N.B.
If necessary, use a small screwdriver to release the catches on the connectors.

18 Disconnect the remaining leads in the loom from:

g AC compressor thermostatic switch

h Thermostatic switch for AC fan

i AC temperature sensor

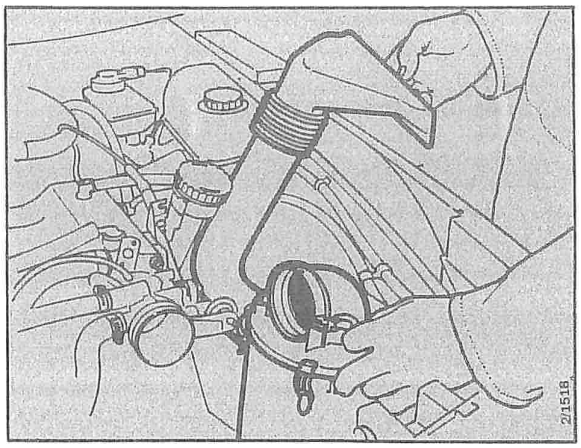
j Unplug the connector for the shift-up indicator vacuum switch

19 Pull clear all the disconnected leads, lift the loom out of the engine bay and rest it on the AC heat exchanger.

20 Remove the turbo discharge pipe.

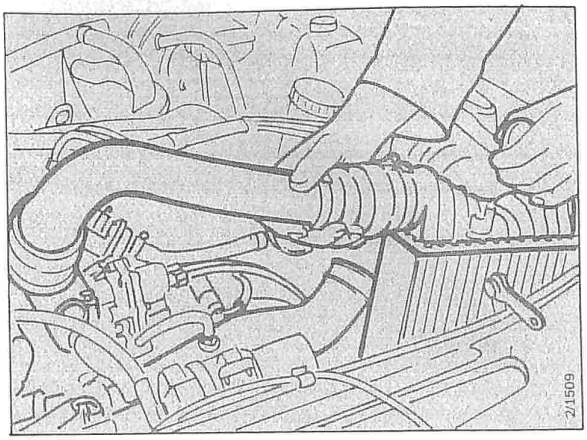
21 Remove the air mass meter complete with rubber socket connector.

22 Remove the air cleaner complete with air intake.

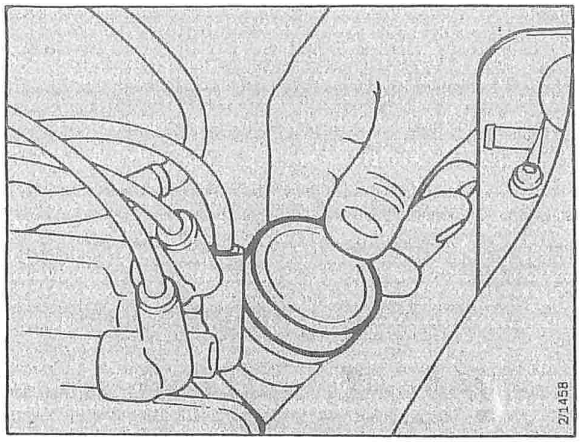


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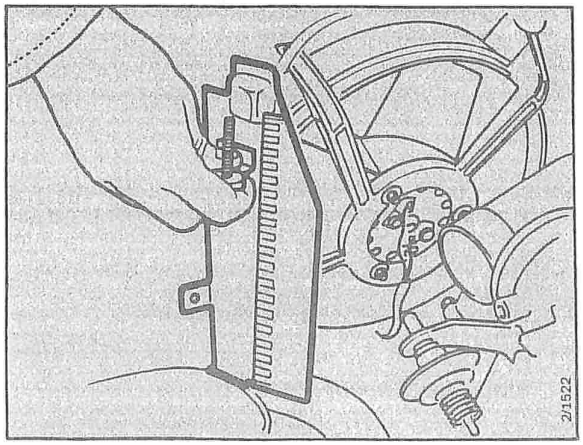
23 Remove the intercooler complete with air pipe.



Cap the inlet to the turbocharger.



24 Remove the baffle plate from the side of the intercooler and the top cover.

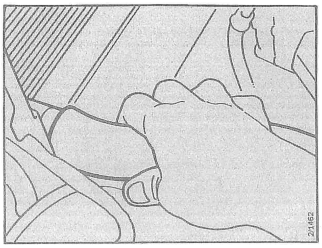


25 Remove the ignition coil.

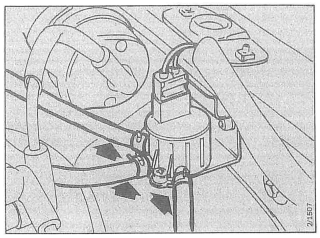
26 Remove the AC cooling fan.

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27 Disconnect the coolant hose from the bottom of the radiator.

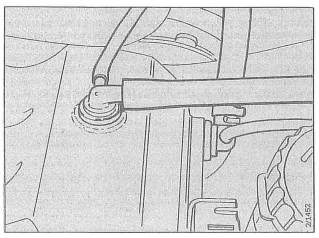


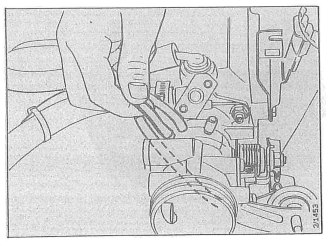
28 Disconnect the signal hoses from the solenoid valve.



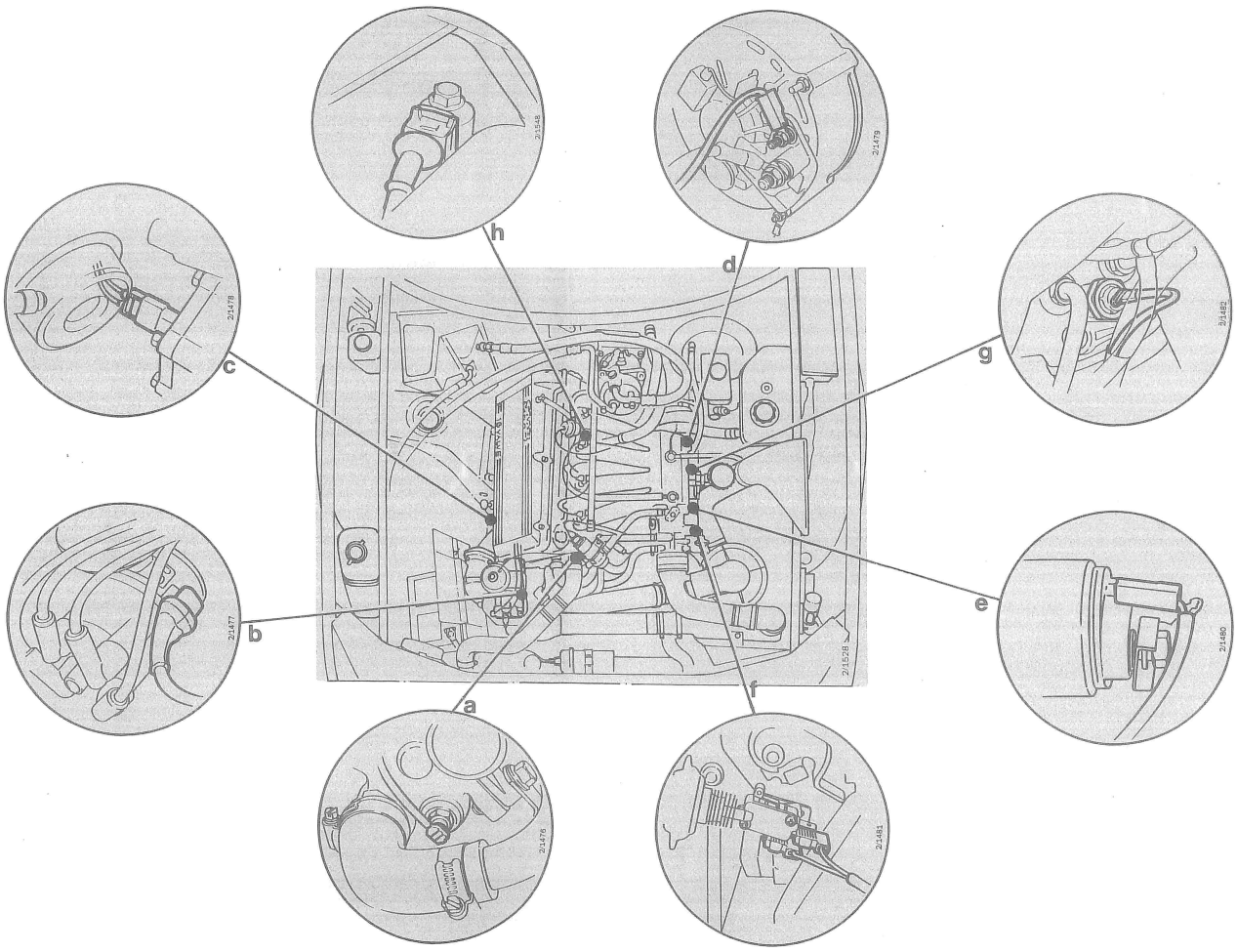
29 Disconnect the throttle cable and sheath.

30 Disconnect the vacuum hoses for the brake servo and the fuel tank breather system at the inlet manifold and throttle housing.





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Removal of the main wiring loom from the left-hand side of the engine bay, B202

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31 Snip through the cable ties and release the wiring loom for the starter motor, alternator, temperature sensor, etc., on the left-hand side of the engine.

32 Disconnect the leads in the wiring loom from the following:

a Engine temperature sensor

b Hall generator

c Shift-up indicator switch

d Alternator

e Starter motor

f Throttle-position sensor (AC)

g Oil pressure sensor

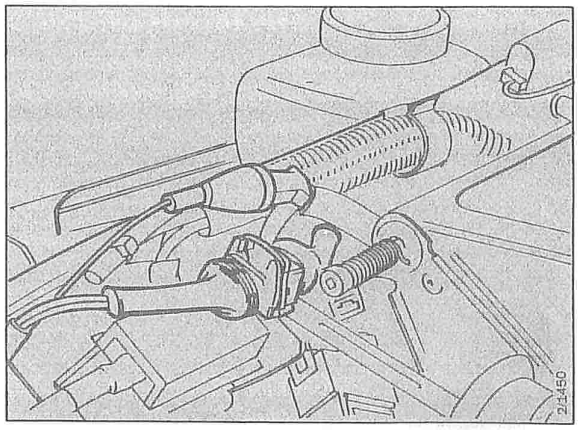
h Knock detector

Rest the wiring loom on the radiator member.

33 Remove the clips for the positive battery lead from the engine. Disconnect the lead from the starter motor and rest it on the battery shelf.

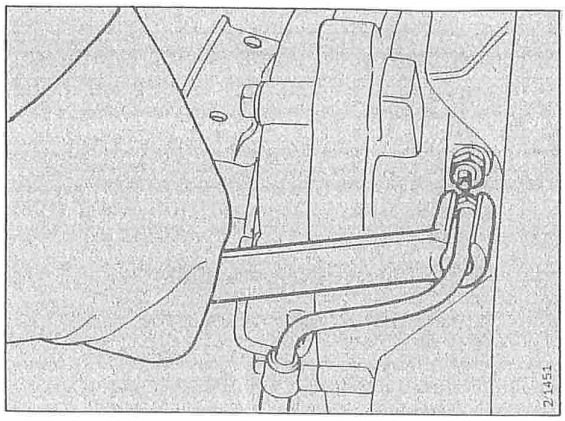
34 Disconnect the earth lead from the earthing point on the timing cover.

35 Unplug the oxygen sensor connector above the RH wheel arch. Release the lead from the clip on the wing and rest it on top of the engine.



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36 Disconnect the hydraulic hose from the slave cylinder using tool 83 93 571. Plug the end of the hose.



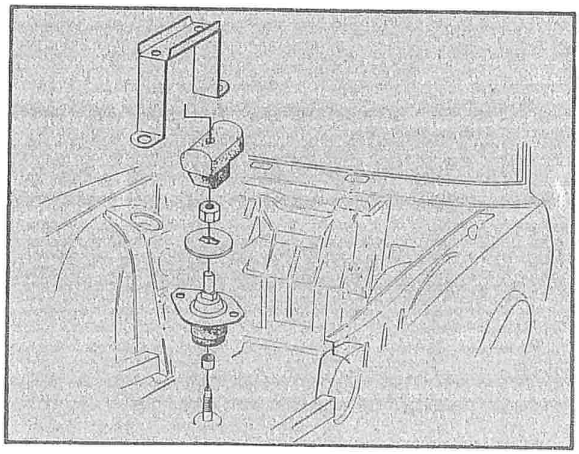
37 Disconnect the fuel hoses from the fuel injection manifold and the fuel pressure regulator.

38 Unbolt the AC compressor (4 bolts) and stand the compressor on the heat exchanger.

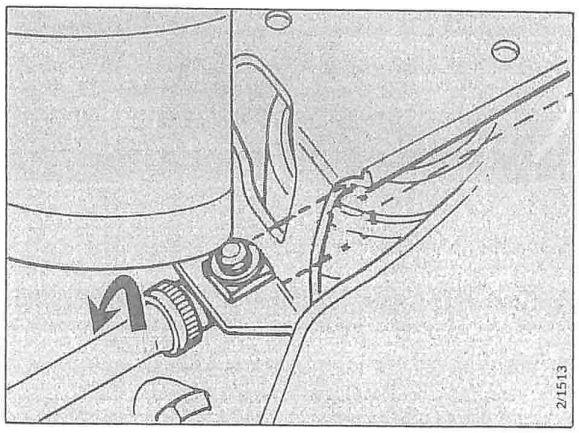
39 Undo all engine mounting bolts.

LH engine mounting:
The bolt is a through-bolt and is equipped with a spacer.

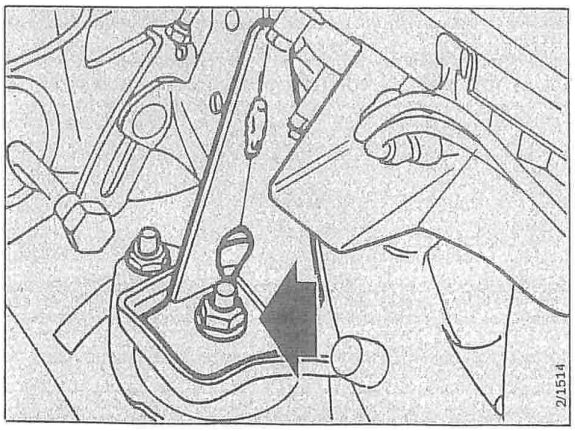
Cars to US spec.:
Remove the bump stops on the front and RH mountings.



Front engine mounting



LH engine mounting

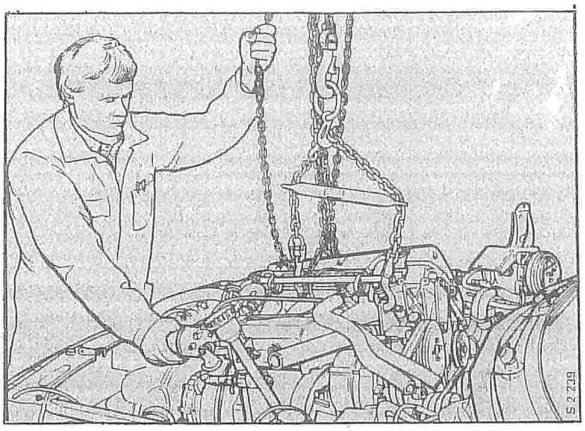


RH engine mounting

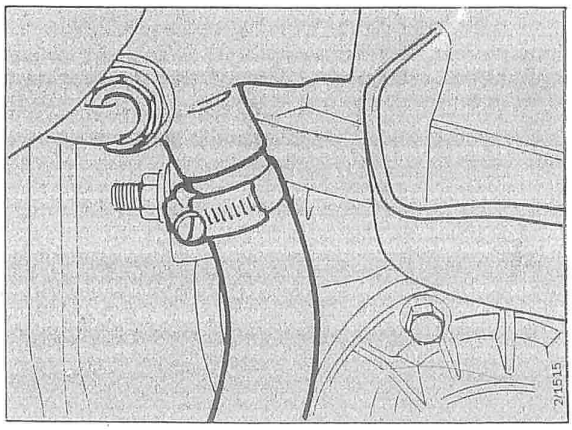
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N.B.
Cars with AC: the AC bracket has a hole for attachment of a lifting sling hook. If the bracket has been removed, bolt a separate lifting lug, 93 13 222, onto the water pump cover using the existing bolts.

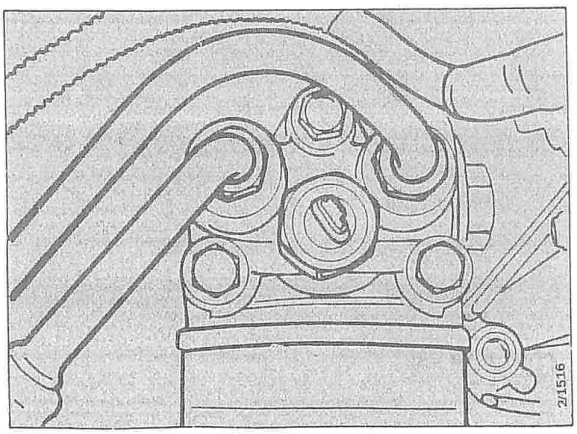
40 Attach the lifting sling, raise the engine slightly and separate the inboard drive-shaft joint.



41 Disconnect the return line from the steering servo pump.



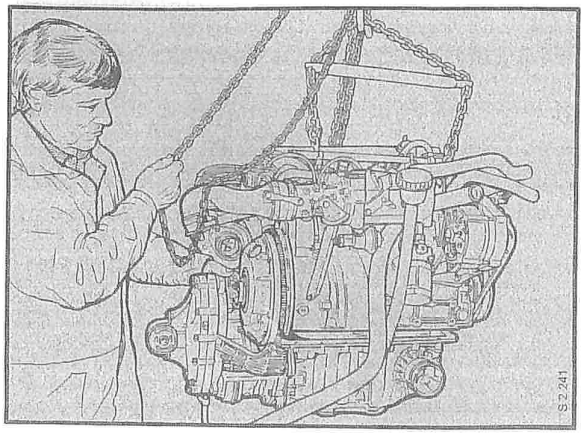
42 Remove the oil pressure sensor and disconnect the oil cooler (air cooled) hoses from the oil filter.



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43 Lift the power train out of the car, keeping it close to the bulkhead to avoid damaging the radiator or the solenoid valve.

Fit covers to the driver cups.



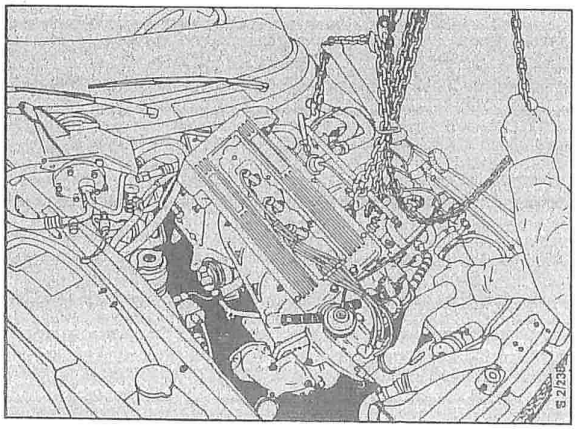
To fit the power train

1 Check that the driver cups are packed with grease.

Refit the coolant drain plugs.

2 Suspend the power train in the lifting sling with the engine tilted slightly forward.

3 Lower the power train into the engine bay to a suitable height for fitting the oil cooler hoses, oil pressure sensor and return hose to the steering servo pump.



4 Adjust the position of the engine to enable the following steps to be carried out in the given order:

- Fit to front engine mounting
- Connect the LH inboard drive-shaft joint
- Connect the RH inboard drive-shaft joint

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Lower the engine onto the rear mountings and fit the bolts. Remember to fit the spacer for the LH mounting.

5 Detach the lifting sling and, when applicable, remove the lifting lug from the water pump (AC only).

6 Cars with AC only:

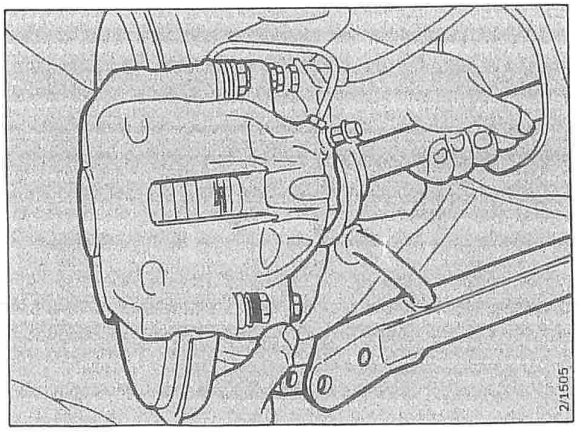
Fit the AC compressor.

Fit and adjust the tension of the compressor drive belt.

7 Connect the discharge pipe to the steering servo pump.

8 Fit the exhaust pipe to the manifold, but do not tighten.

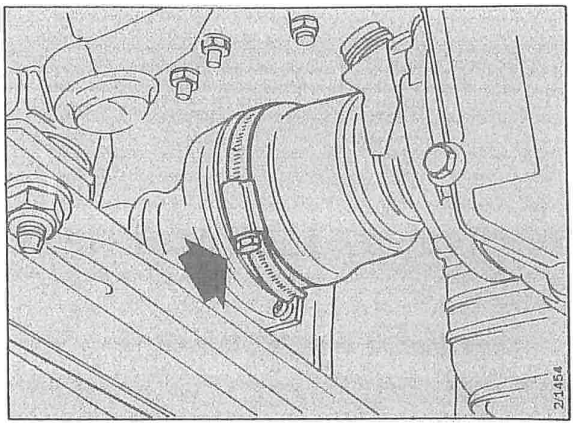
9 Raise the car to a suitable height and reconnect the ball joint to the lower wishbone and anti-roll bar.



Refit the road wheel.

10 Raise the car again and fit the following:

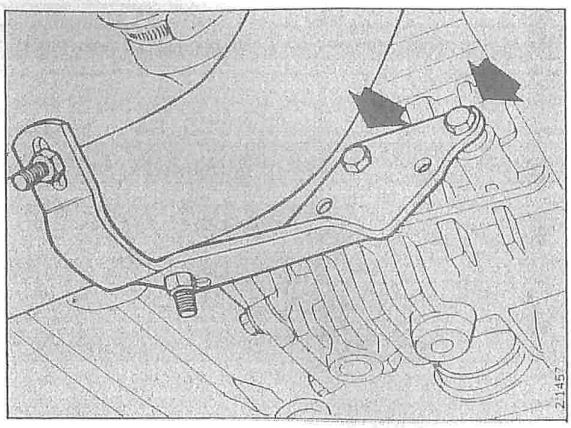
a Gaiters and clips on the drive-shaft joints.



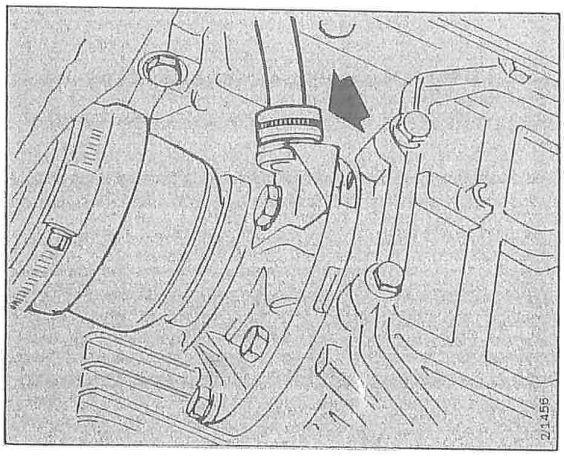
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b Bolts in the exhaust pipe bracket on the gearbox.

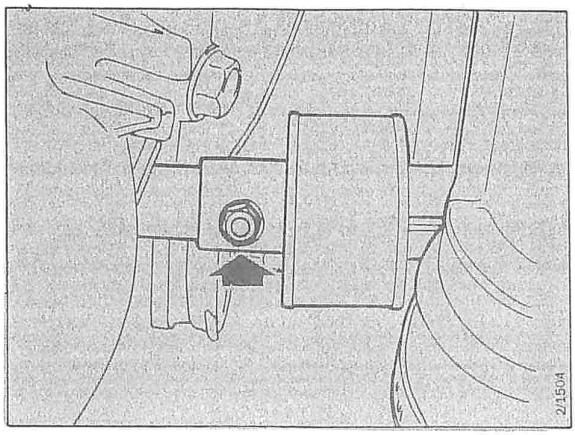
It may be necessary to undo the U-bolt on the pipe to enable the bracket to be bolted to the gearbox.



c Speedometer drive.



d Selector rod and taper pin.

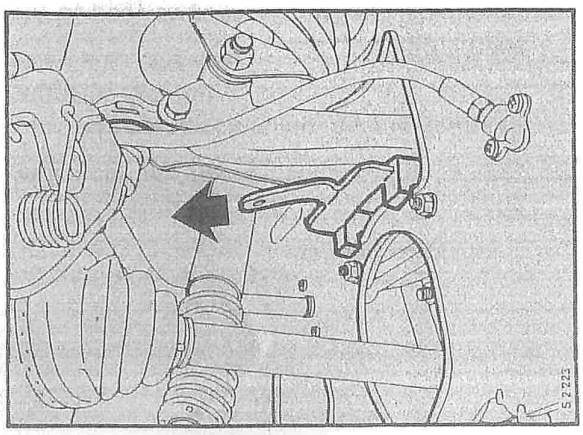


11 Lower the car to a suitable height and connect the battery earth (-) lead to the timing cover.

Clip the positive lead to the engine.

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12 Remove tool 83 93 209 from under the RH upper wishbone and tighten the wheel bolts.

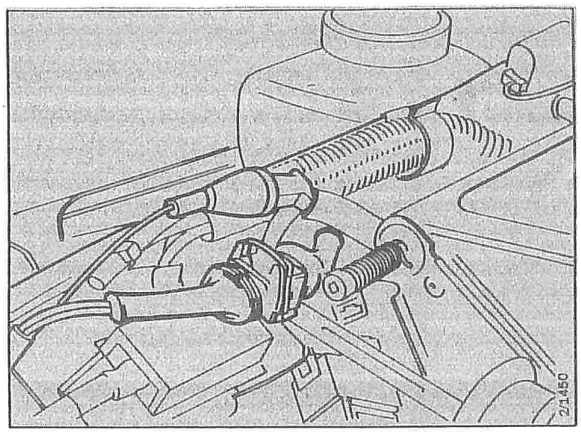


Wheel bolt tightening torque M87 and earlier:
90 - 110 Nm (66 - 81 lbf ft)

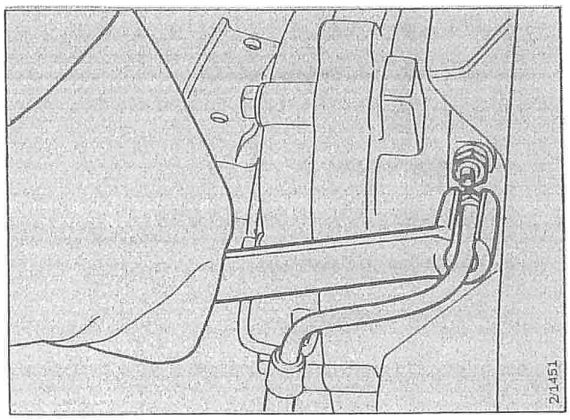
Wheel bolt tightening torque M88 onwards:
105 - 125 Nm (77 - 92 lbf ft)

13 Tighten the exhaust pipe flange joint.

14 Reconnect the oxygen sensor lead and use a cable tie to tie the lead to the AC hose.



15 Reconnect the coolant hose to the bottom of the radiator and reconnect the discharge pipe to the clutch slave cylinder.



Bleed the clutch!

(See section 411 of the Manual.)

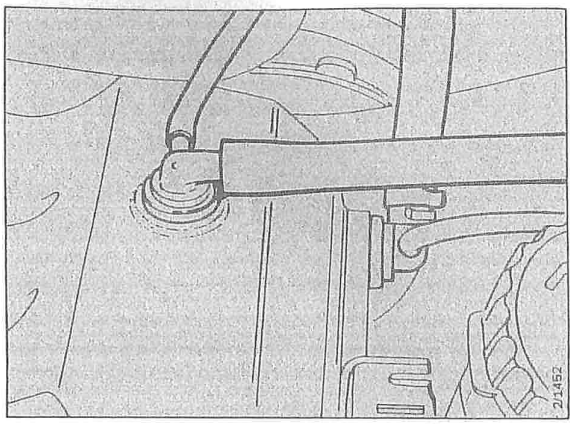
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16 Reconnect the battery positive lead to the starter motor.

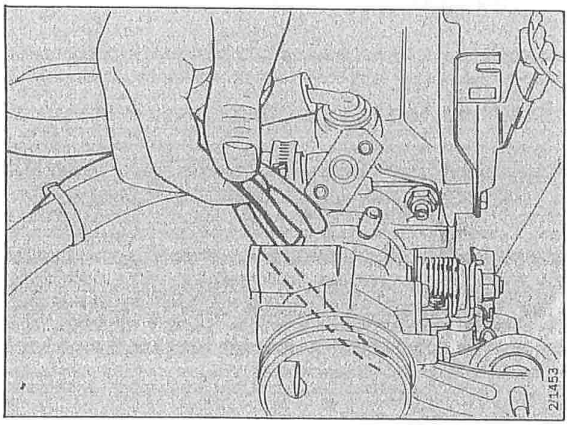
17 Connect the fuel lines to the fuel injection manifold and the fuel pressure sensor.

18 Connect the vacuum hoses for the brake servo and fuel tank breather system to:

... the inlet manifold ...



... and the throttle housing.



19 Refit the main wiring loom on the left-hand side of the engine and reconnect the following:

a Temperature sensor

b Hall generator

c Shift-up indicator switch

d Alternator

e Starter motor

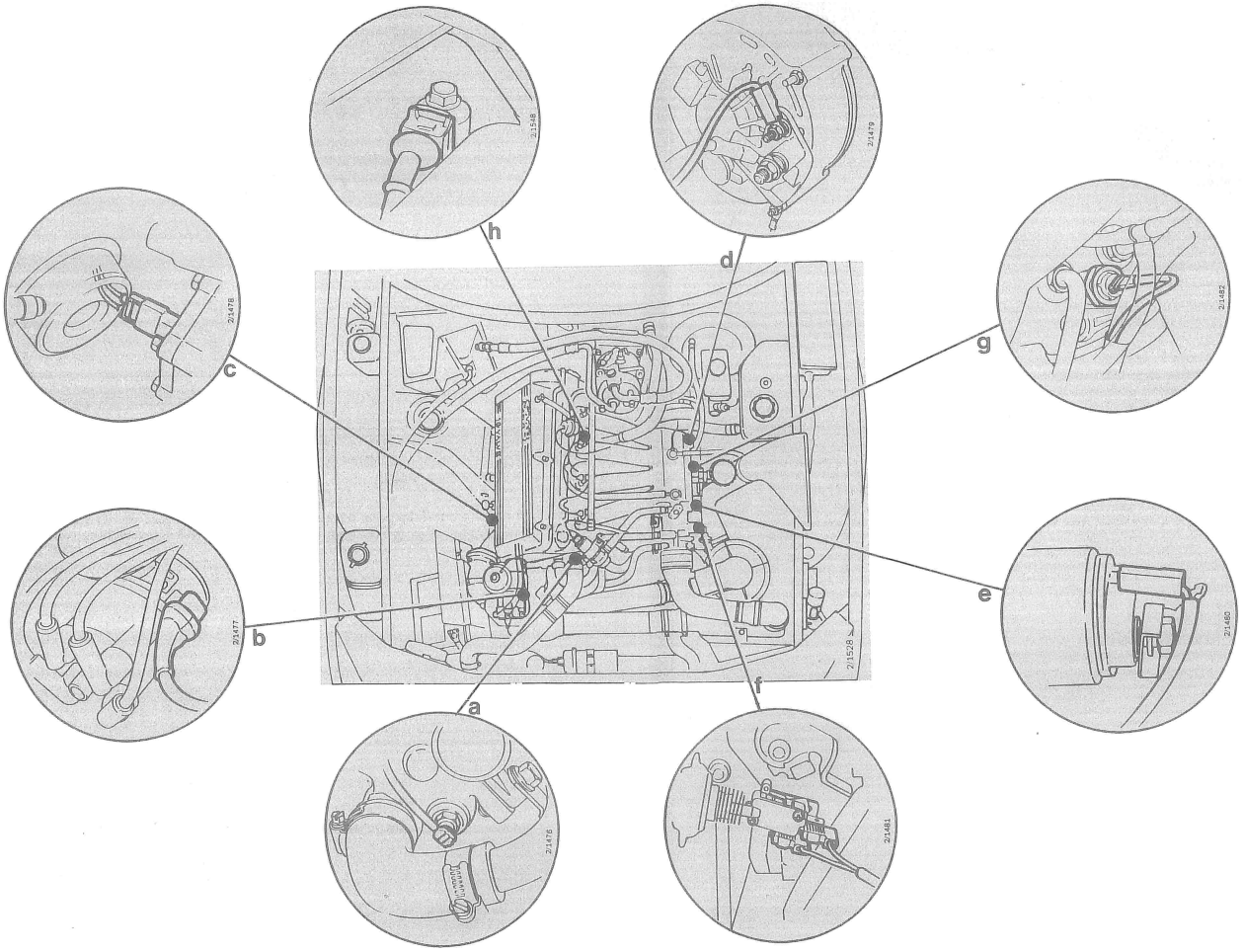
f Throttle-position sensor (AC)

g Oil pressure sensor

h Knock detector

20 Use cable ties to secure the wiring loom to the battery positive lead (including the run between the starter motor and alternator) and to the hoses for the air-cooled oil cooler.

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Reconnecting the main wiring loom on the left-hand side of the engine, B202

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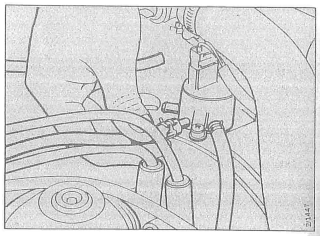
21 Reconnect the coolant hoses to the expansion tank and the heat exchanger valve.

22 Refit the auxiliary cooling fan for the AC system.

23 Refit the baffle plate at the side of the intercooler.

24 Remove the cover from the turbo intake and fit the intercooler complete with air hose. Refit the cover over the intercooler.

25 Reconnect the signal hoses to the solenoid valve.



26 Reconnect the coolant hose to the thermostat housing.

27 Fit the ignition coil and reconnect the HT lead to the distributor cap.

28 Fit the wiring loom incorporating the loom for the LH fuel injection system and reconnect the:

- a AC compressor thermostatic switch (Fig. g)
- b AC temperature sensor (Fig. i)
- c Throttle-position sensor (Fig. b)
- d connector for the shift-up indicator vacuum switch (Fig. j)
- e Thermostatic switch for AC fan (Fig. h)
- f Temperature sensor (Fig. d)
- g Earthing points on engine lifting lug (Fig. e)

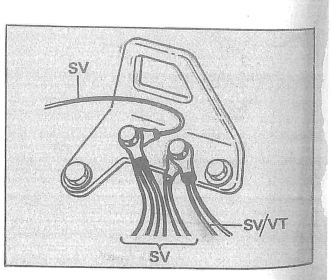
  Remember to connect the earth lead from the wiring loom on the left-hand side.
- h Injection valves (Fig. c)
- i AIC valve (Fig. f)

29 Fit the oil filler pipe.

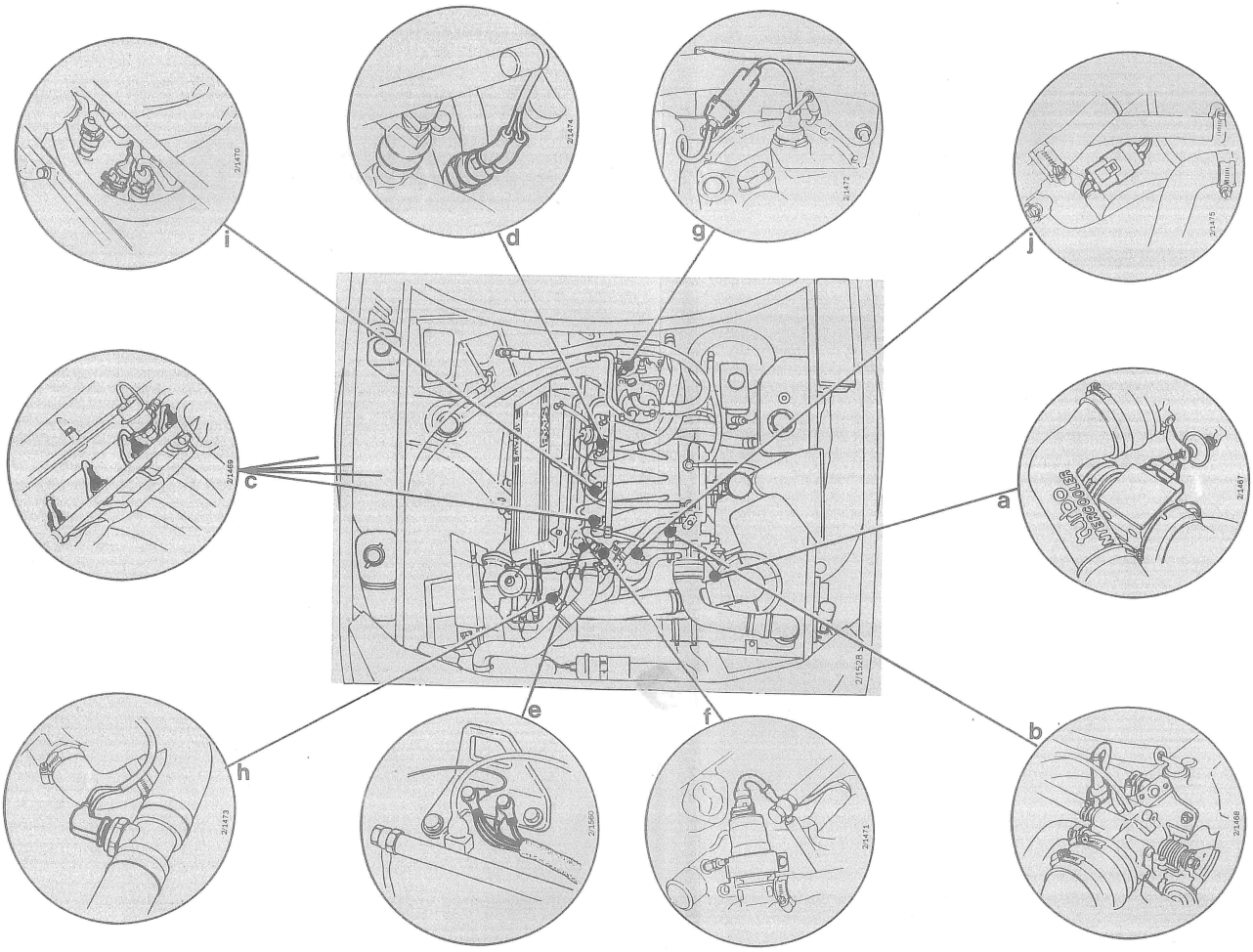
30 Fit the air cleaner complete with air intake.

31 Fit the air mass meter complete with rubber socket connector.

Reconnect the electrical leads (Fig. a).



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Reconnecting the main wiring loom incorporating the loom for the LH fuel injection system, B202.

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32 Fit the turbo discharge pipe between the intercooler and throttle housing.

33 Fill the power steering fluid reservoir with Texaco Power Steering Fluid 4634 or the equivalent.

34 Refill the cooling system and pressure test it.

35 Fit the battery and reconnect the leads.

36 Fit the bonnet and reconnect the windscreen washer hose.

37 Start the engine, check all functions and inspect for leaks.

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Separating the engine and gearbox (manual) B201 and B202

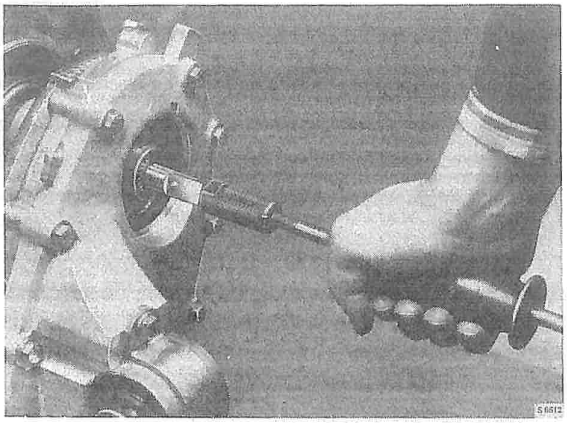
1 Clean the external surfaces of the engine and gearbox.

2 Drain the engine oil and remove the EGR pipe.

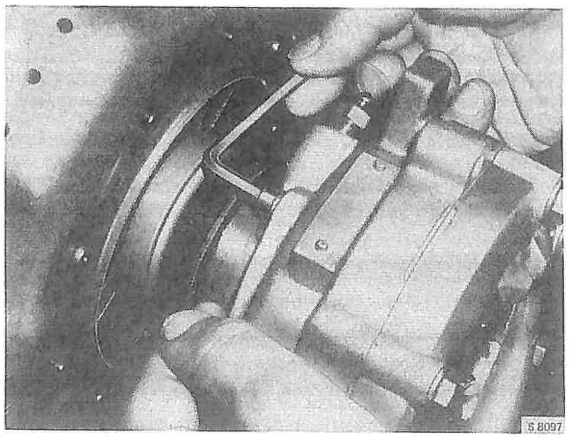
3 Remove the clutch cover and dipstick tube and disconnect the oil return pipe from the turbo.

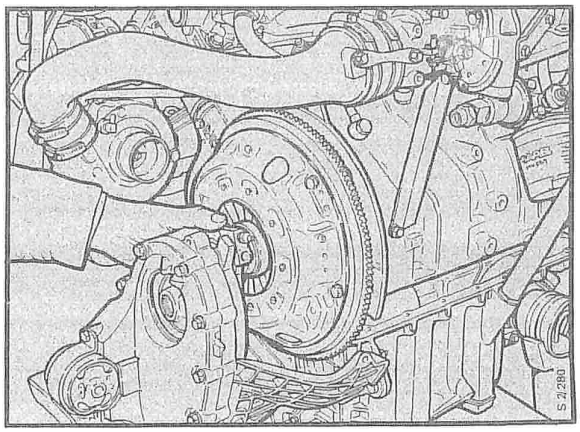
4 Remove the starter motor and unscrew the steady bar from the gearbox.

5 Withdraw the gearbox input shaft using slide hammer 83 90 270 and joint 87 90 529.



6 Unscrew the slave cylinder (3 screws).



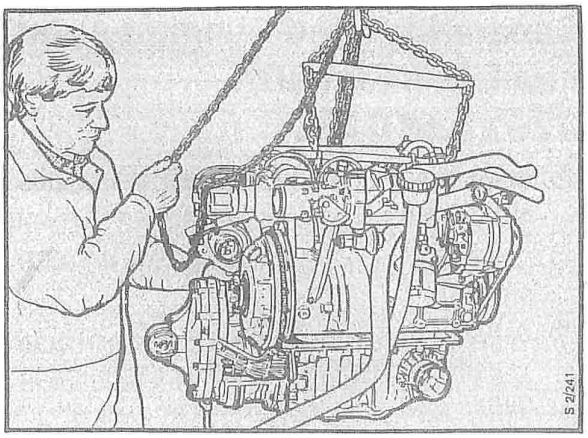


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7 Remove all bolts from the mating flanges between engine and gearbox and the bracket for the oil filler pipe at the throttle control on the inlet manifold.

8 Carefully lift the engine away from the gearbox (as shown), removing the release-bearing sleeve at the same time.

9 Remove the oil pump suction line complete with 'O' ring.



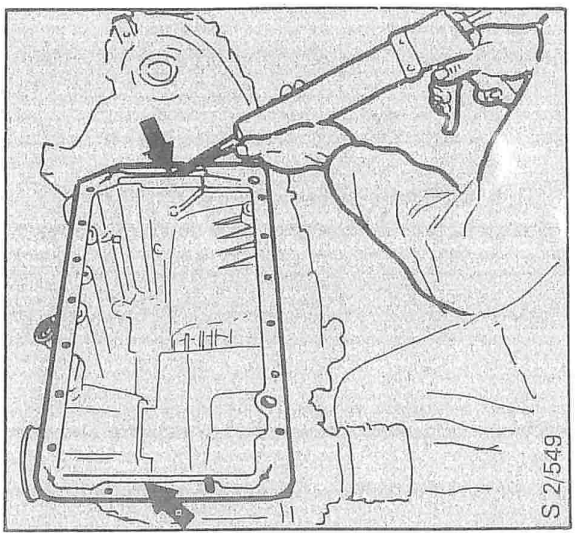
Caution

If the engine and gearbox fail to separate, make no attempt to prise them apart without first checking that all the bolts have been removed.

Before fitting engine to gearbox

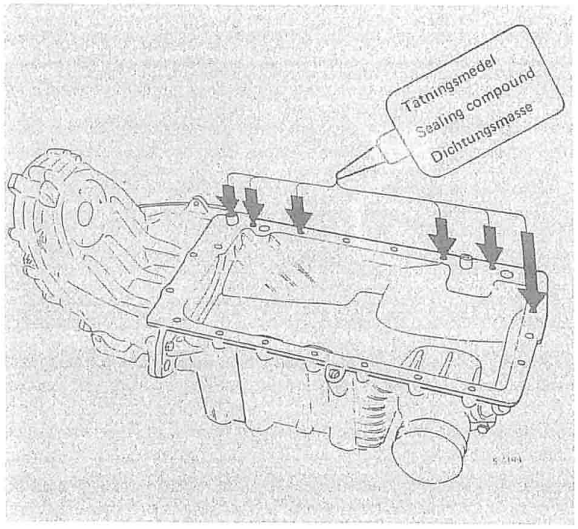
- Remove all traces of oil and dirt from the flanges.
- Make sure that the two guide sleeves are fitted in the gearbox.
- Fit a new gasket onto the gearbox flange and apply sealing compound to the slots, as shown.
- Apply thread sealing compound to the six bolts for the holes illustrated.

Refit in the reverse order.

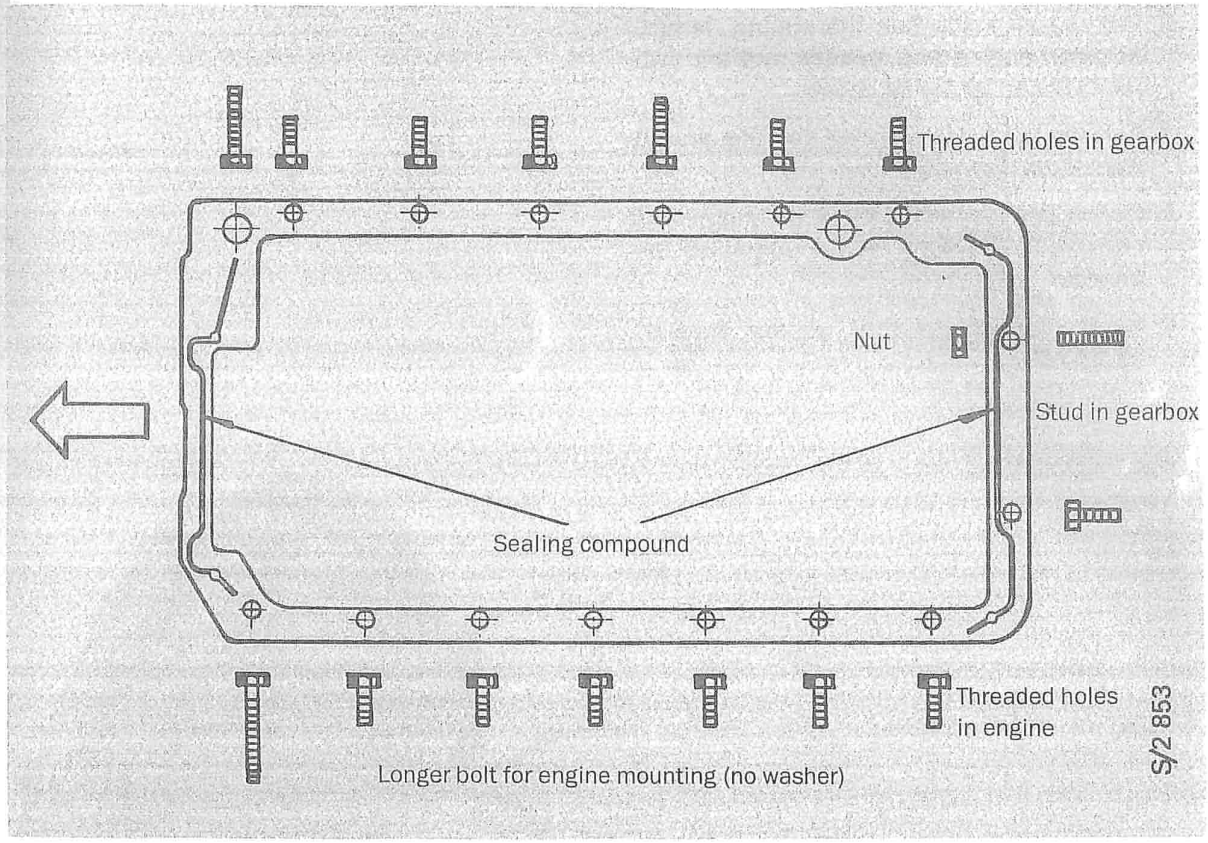


N.B.

The release bearing and sleeve must be held in position against the clutch when the engine is lifted onto the gearbox.



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Tightening torque for engine-gearbox flange bolts:
25 ± 3 Nm (18.5 ± 2.2 lbf ft)

Separating the engine and gearbox (automatic) B201 and B202

1 Clean the external surfaces of the engine and gearbox.

2 Drain the engine oil.

3 Remove the cover over the ring gear.

4 M84 and earlier only: Remove the starter motor.

5 Disconnect the throttle cable from the throttle housing (carburettor engines only).

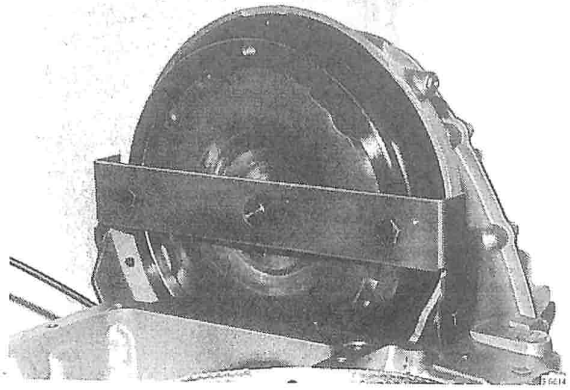
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6 Remove all bolts from the mating flanges between engine and gearbox and the hydraulic hoses for the oil cooler.

7 Remove the bolts securing the ring gear to the torque converter.

8 Rotate the flywheel to bring the angle irons horizontal. Carefully lift the engine off the gearbox.

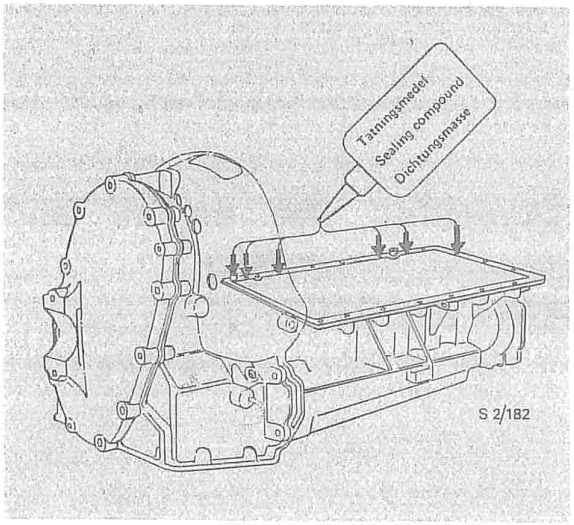
9 Fit the torque converter support bracket, 87 90 255.



Before fitting engine to gearbox

- Remove all traces of oil and dirt from the flanges.
- Make sure that the two guide sleeves are fitted in the gearbox.
- Fit a new gasket onto the gearbox flange and apply sealing compound to the slots, as shown.
- Apply thread sealing compound to the six bolts for the holes illustrated.
- Take care when lifting the engine onto the gearbox not to damage the torque converter spindle.

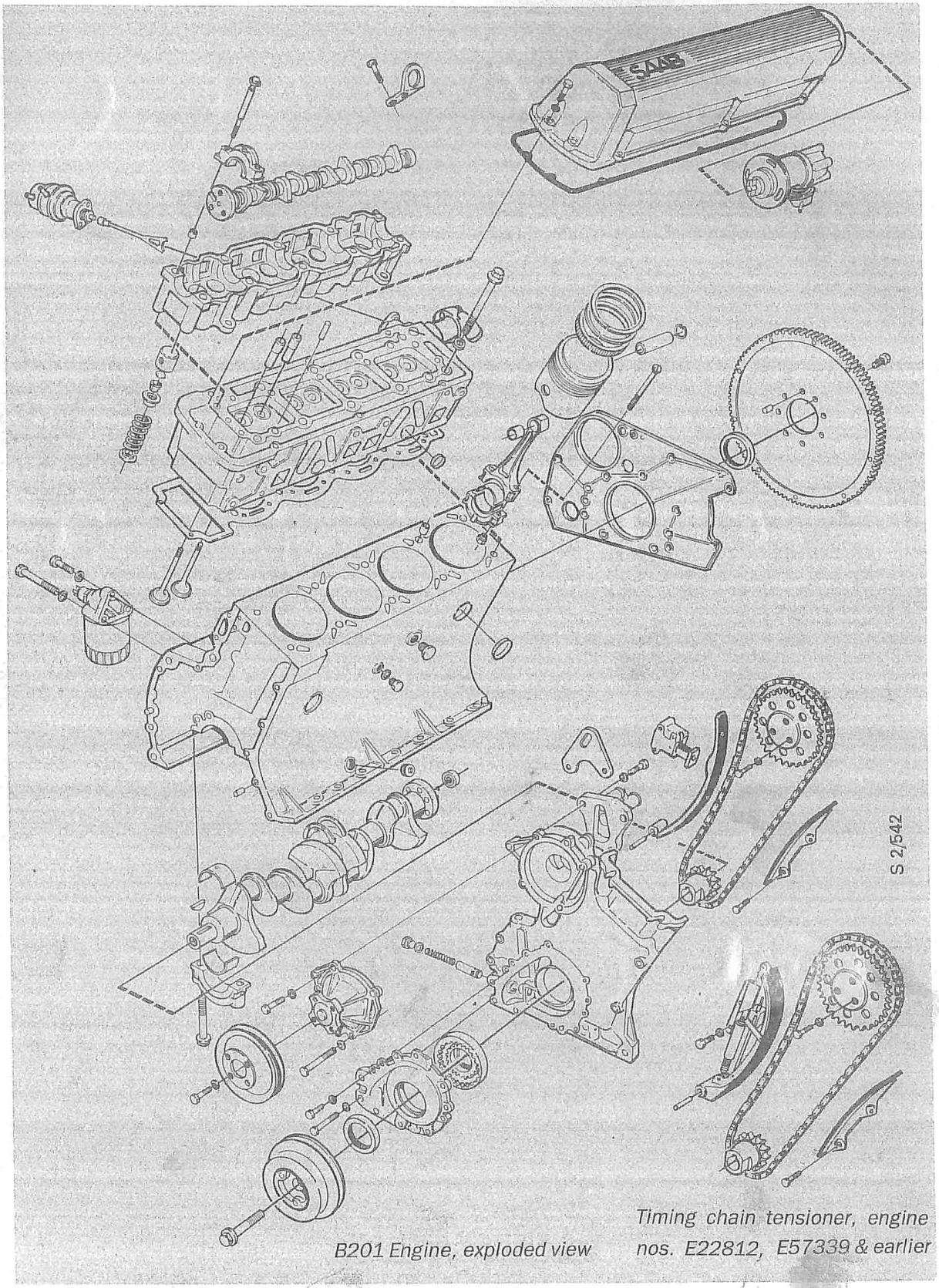
Refit in the reverse order.



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Engine

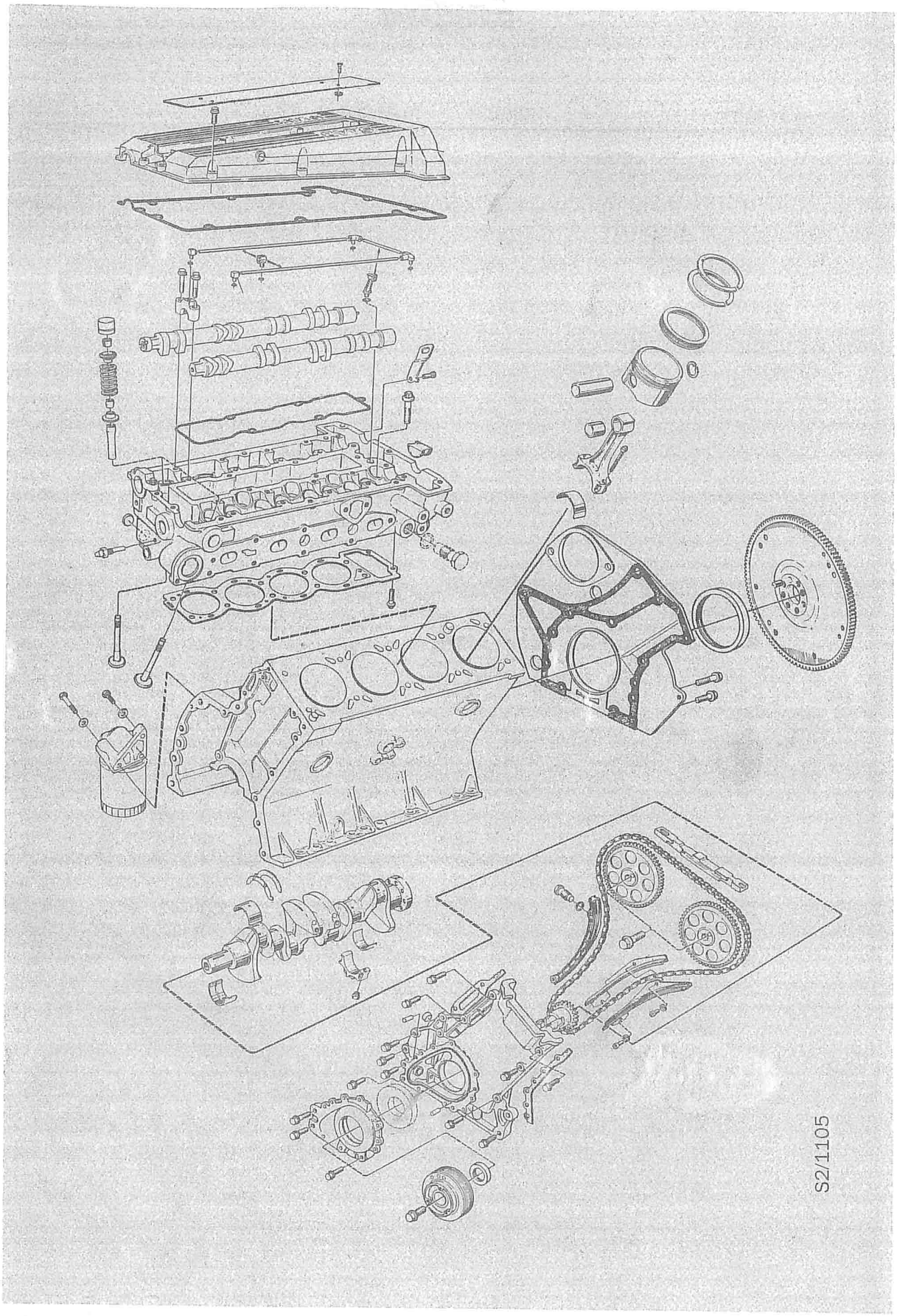
To dismantle, B201 . . . . . 210-3 To assemble, B201 210-8



B201 Engine, exploded view

Timing chain tensioner, engine nos. E22812, E57339 & earlier

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B202 Engine, exploded view

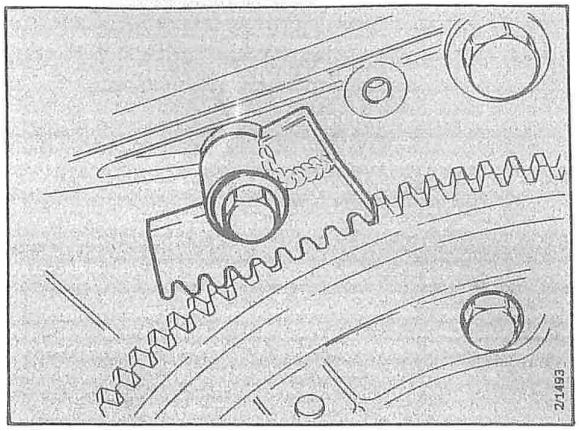
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To dismantle, B201

1 Remove the cylinder head (see Section 211).

2 Remove the flywheel cover.

3 Immobilize the crankshaft by fitting the flywheel locking segment, tool 83 92 987.

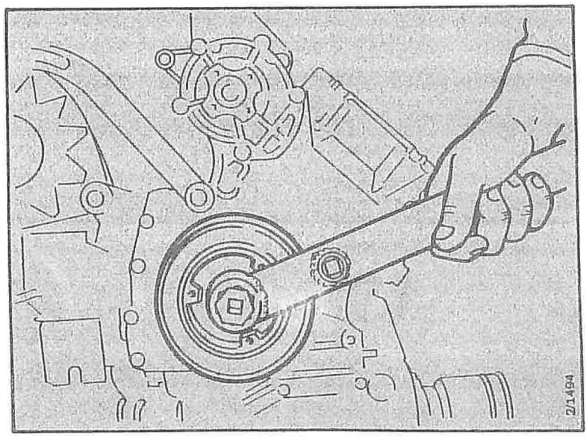


4 Slacken the water-pump pulley bolts.

5 Slacken the alternator bolts, release the tensioner and remove the drive belts.

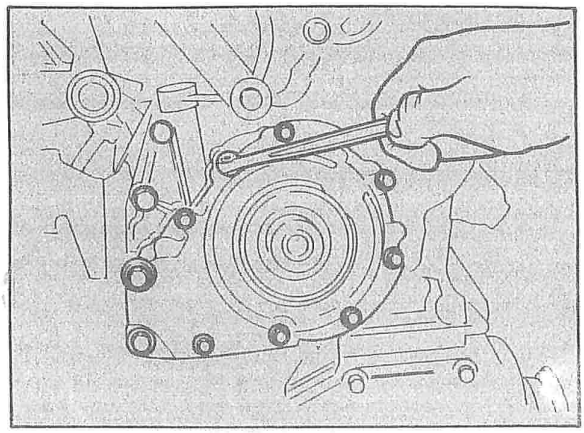
6 Remove the water-pump pulley bolts and pulley.

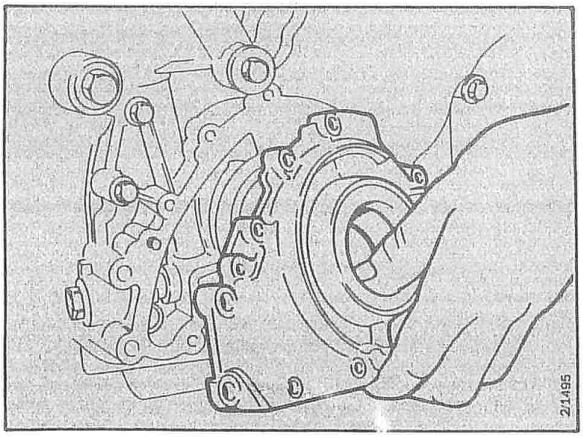
7 Remove the crankshaft pulley.



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8 Remove the oil pump.



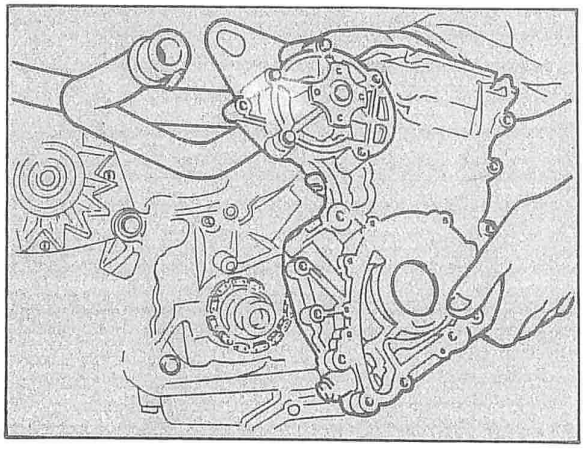


9 Disconnect the bottom hose from the water pump.

10 Remove the alternator complete with steady bar.

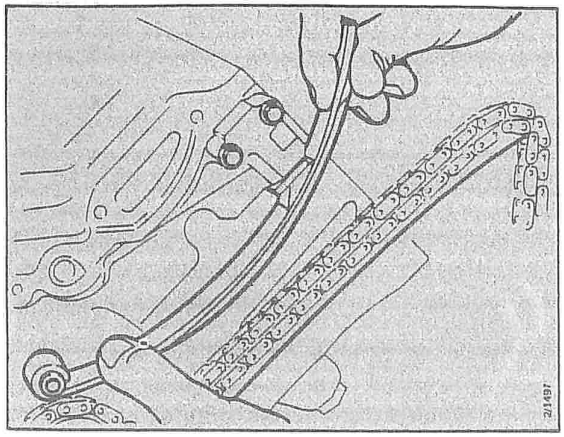
11 Remove the timing cover bolts.

12 Lift off the timing cover complete with water pump and hoses.

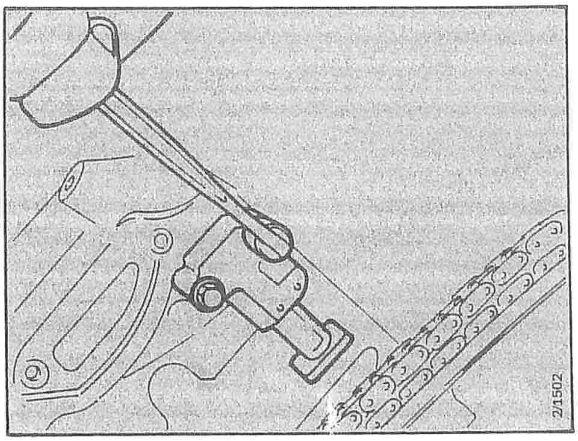


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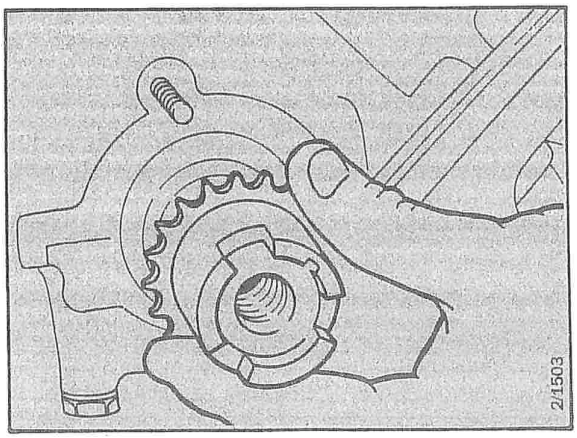
13 Remove the pivoting chain guide.



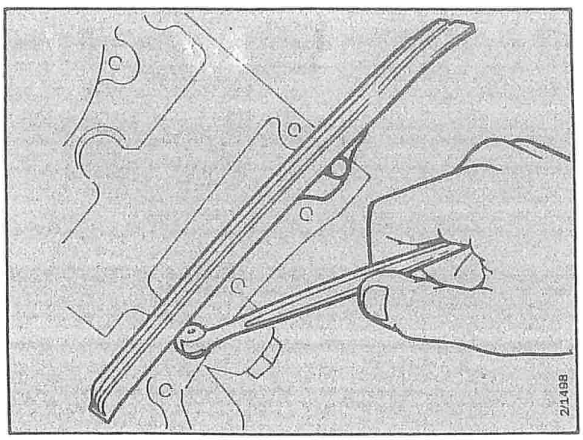
14 Remove the chain tensioner.



15 Remove the key in the keyway in the crankshaft, the sprocket and the timing chain.

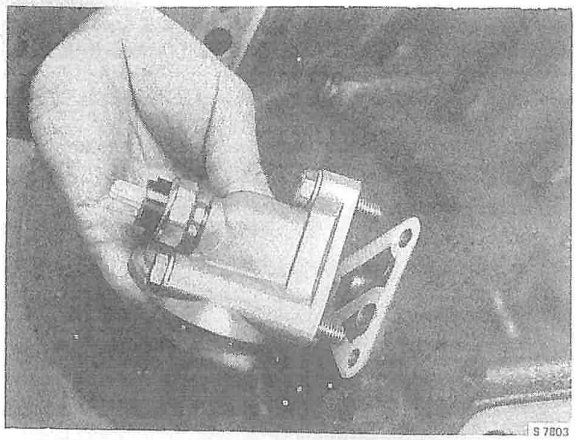


16 Remove the fixed chain guide.



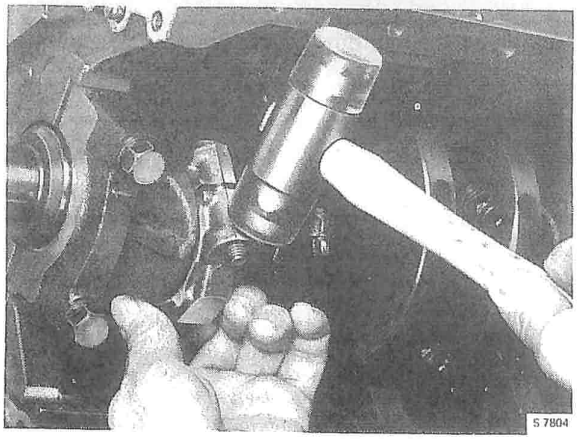
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17 Remove the oil filter adaptor.

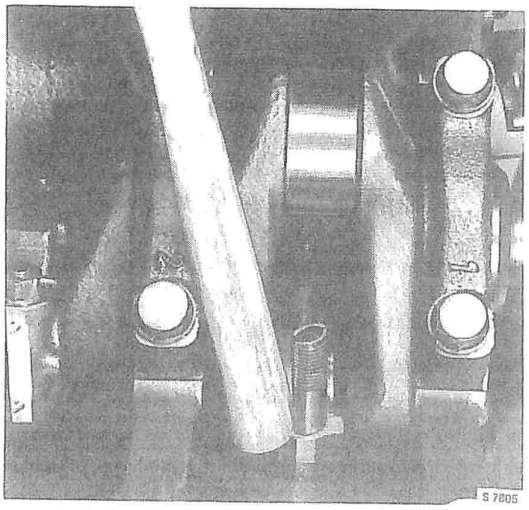

S 7803

18 Remove the pistons and connecting rods as follows:

- Scrape off any carbon deposits or burrs from the top of the cylinders.
- Remove the big-end bearing caps.
- Fit protective sleeves to the studs.


S 7804

- Push the pistons down the bores and remove them.


S 7805

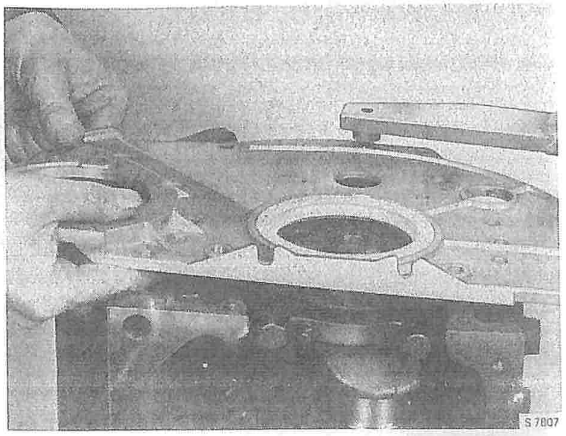
N.B.
Note the markings on the con rods. Keep the bearing shells in order so that they can be refitted in their original positions.

19 Turn the engine block on end, flywheel to the top, and remove the flywheel.

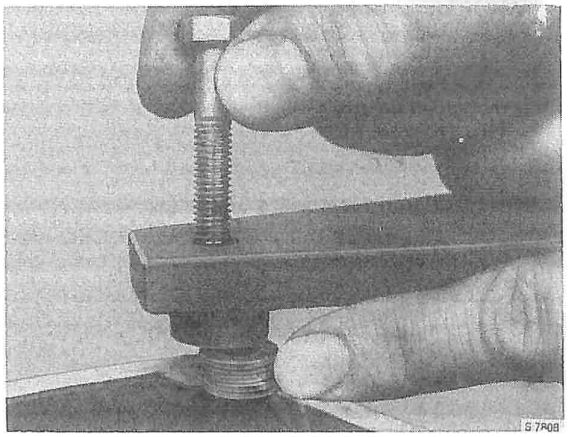

S 2492

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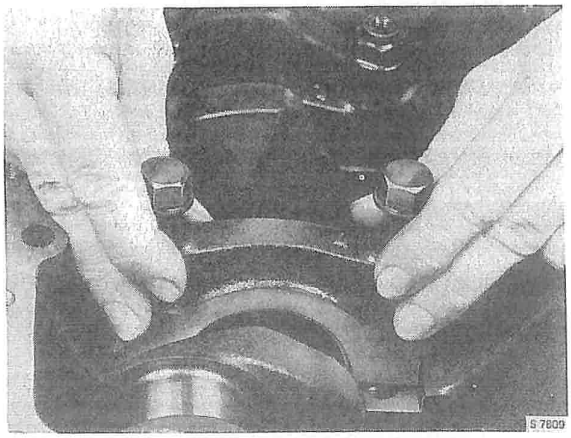
20 Remove the bolt from the engine bracket and remove the end plate.



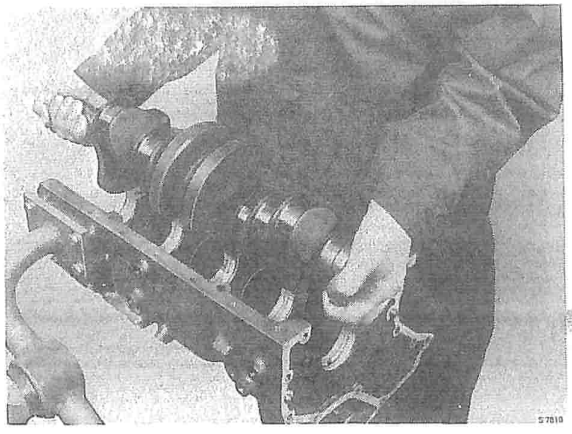
Pack the gap between the block and bracket with washers and refit the bolt.



21 Remove the main bearing bolts and bearing caps.
Note the markings!



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



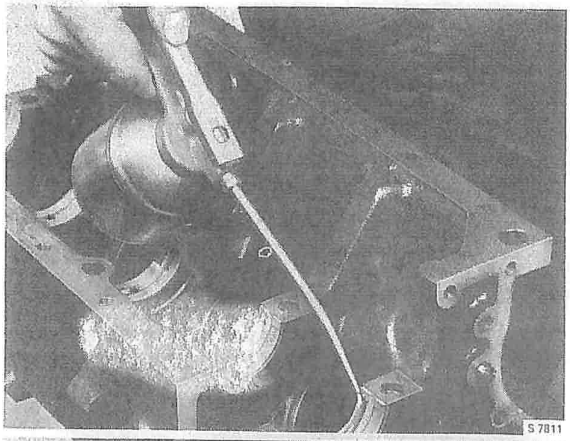
Clean and inspect all parts. Remove all traces of sealant from the flanges. For measuring and matching of pistons and piston rings, see Section 212.

For measuring and matching main bearings and big-end bearings, see Section 216.

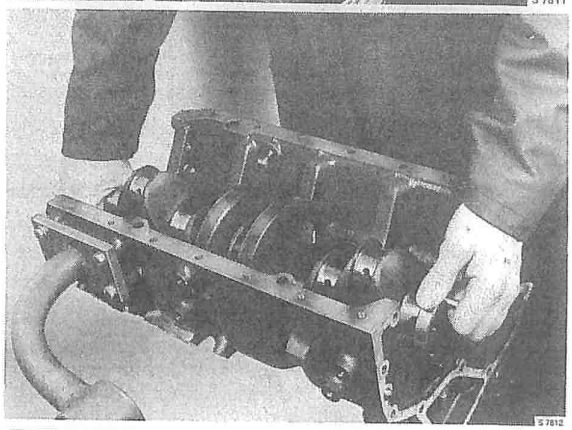
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To reassemble, B201

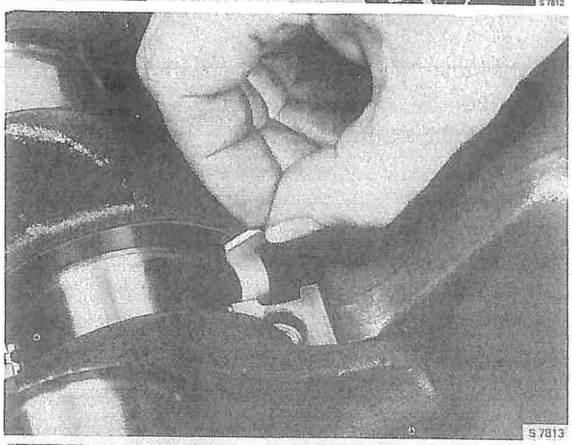
1 Place the bearing shells in the seats and lubricate them with engine oil.

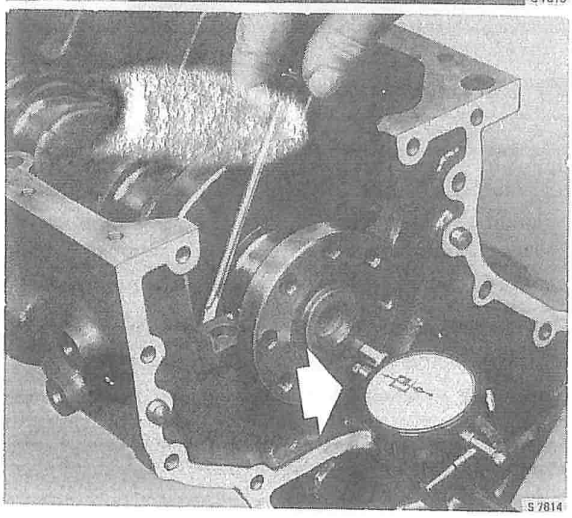


2 Carefully lift the crankshaft into position.



3 Fit the thrust washers and check the end float.

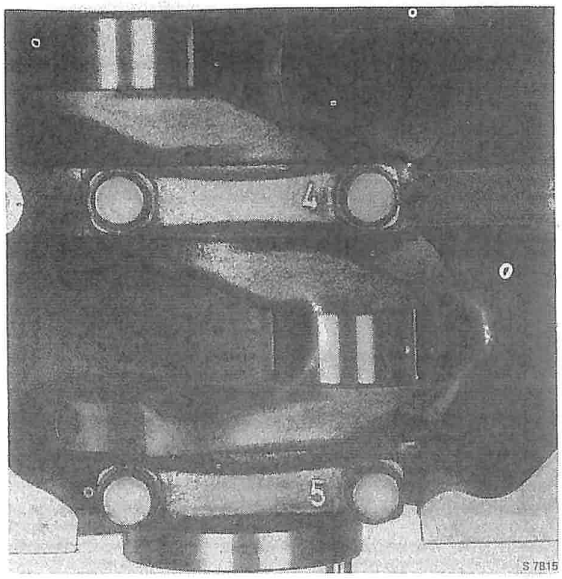




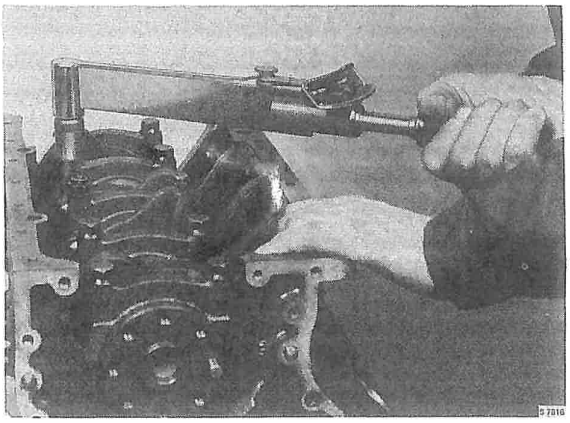
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4 Lubricate the bearing shells and refit the bearing caps.

Note the markings!

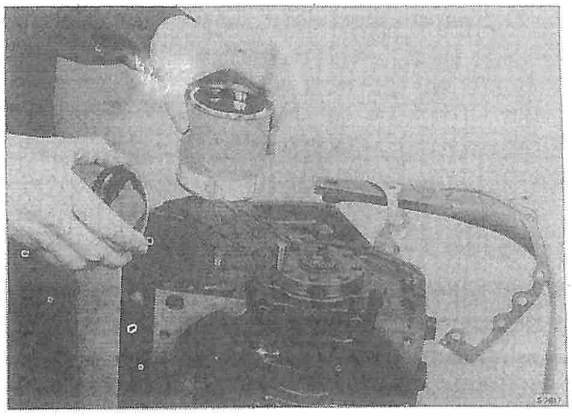


Tightening torque for main bearings:
100 Nm (81 lbf ft)



5 Refit the end plate as follows:

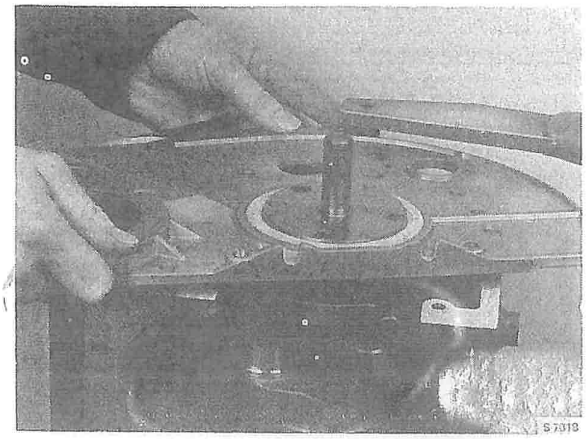
- Turn the engine on end, flywheel-end up, and remove the bolt in the engine bracket.
- Apply dabs of grease to the flange on the block (to hold the gasket in position) and fit a new gasket.



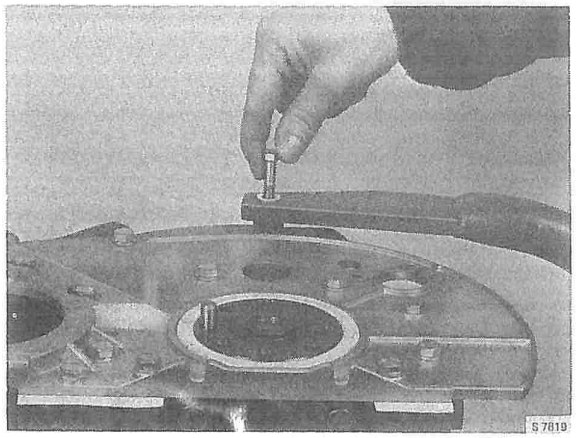
N.B.
Do not use adhesive to hold the gasket - the heat of the engine will cause most adhesives to melt, causing the gasket to soften and the torque loading on the bolts to be reduced. Using grease will ensure that the torque loading on the bolts is retained.

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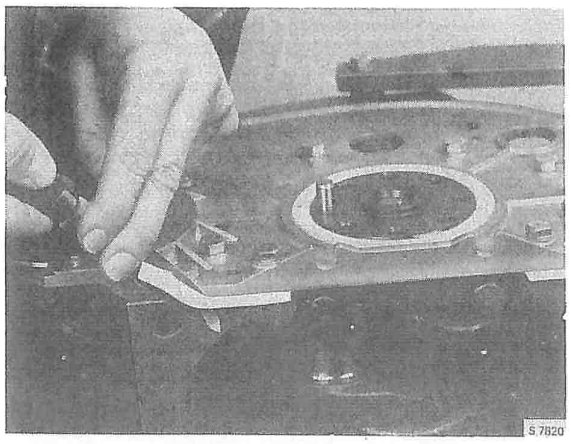
- Place the guide to tool 83 92 540 on the flywheel flange and fit the end plate and bolts.



- Put the bolt back in the bracket.



- Trim the gasket on the flange for the gearbox.



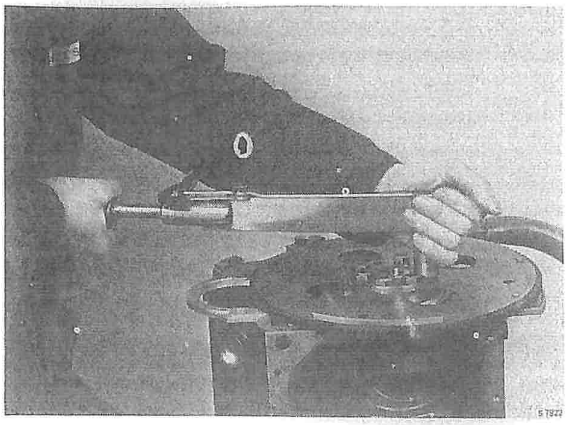
6 Refit the flywheel.



If the old bolts are to be refitted, remove old sealant from the threads and apply fresh. Alternatively, use new bolts pre-coated with sealant.

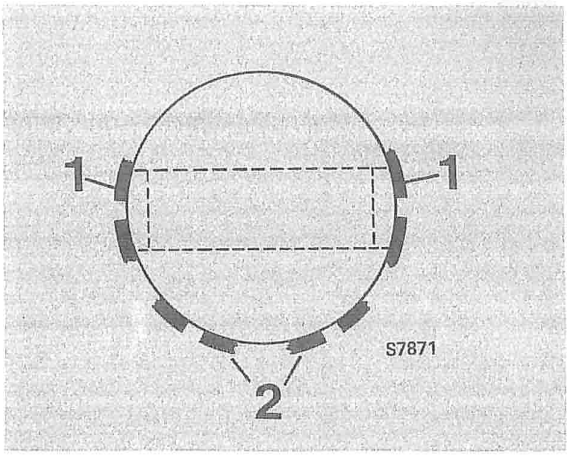
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Tightening torque for flywheel:
59 Nm (44 lbf ft)



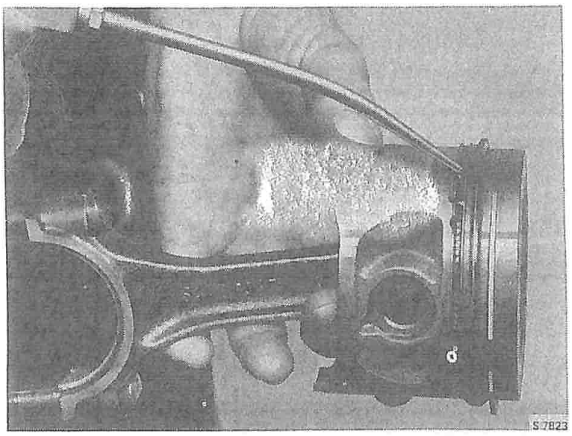
7 Fit the pistons and connecting rods as follows:

- Line up the gaps in the piston rings as shown.
- Rotate the compression rings through 180° to bring them in line with the boss for the gudgeon pin.
- Rotate the scraper rings so that the gaps do not coincide.



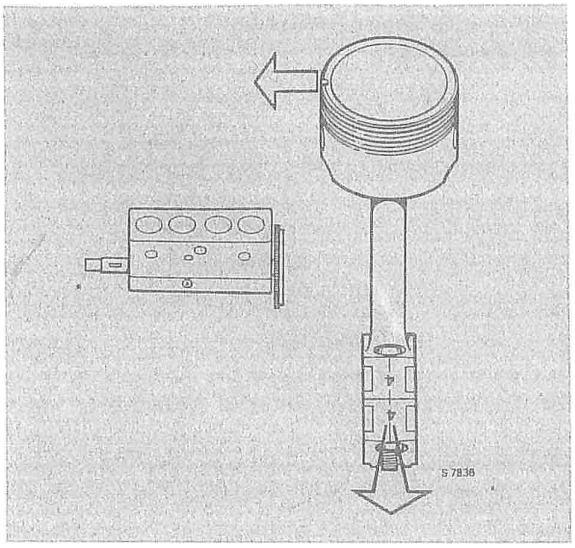
1 Compression rings
2 Scraper ring

- Lubricate and place the bearing shells in the big-end bearing.
- Lubricate the piston rings and bearings.

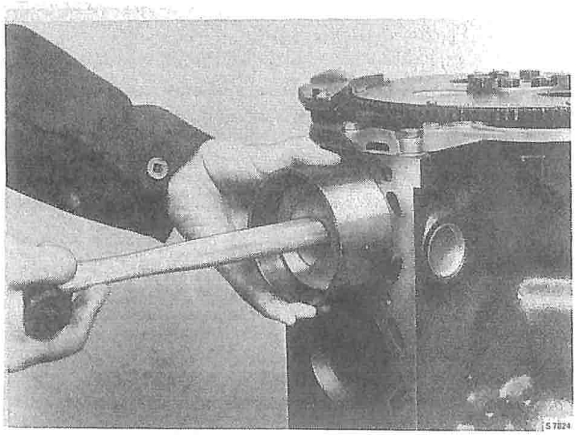


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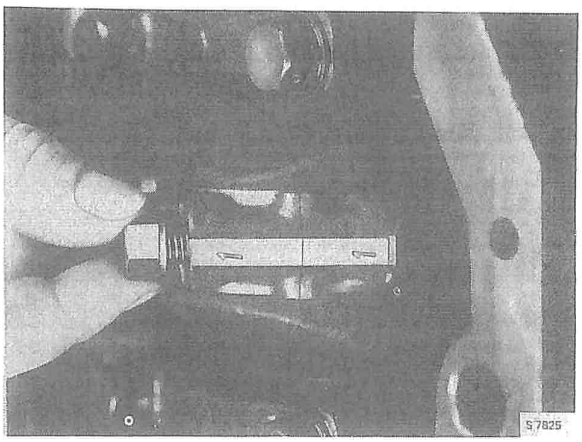
- Make sure that the notch in the top of the piston points towards the timing end, and the mark on the big-end towards the exhaust side of the block.



- Fit the piston using piston ring clamp 78 62 287.



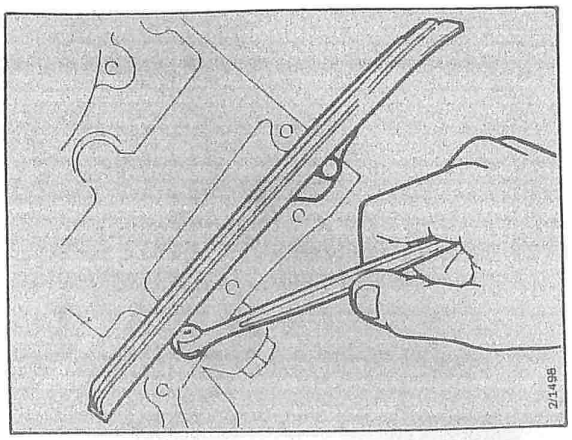
- Fit the big-end bearing caps, making sure that the numbers line up and that the flange on the nut is on the inside.



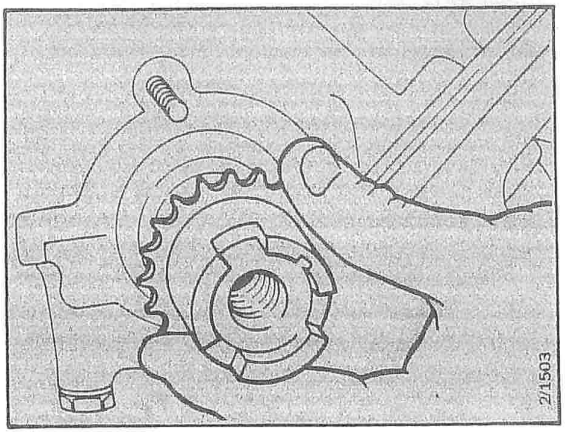
Tightening torque for big-end bearings:
54 Nm (40 lbf ft)

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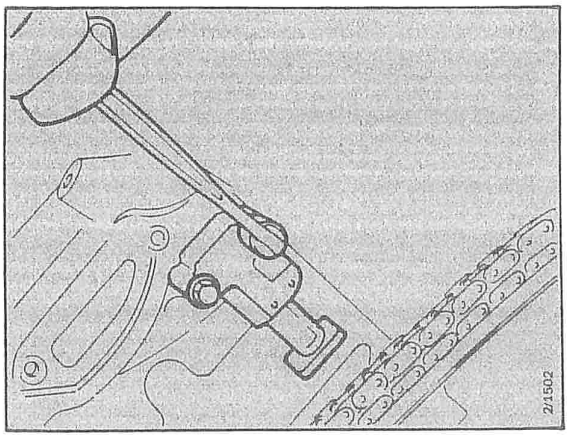
8 Refit the fixed chain guide.



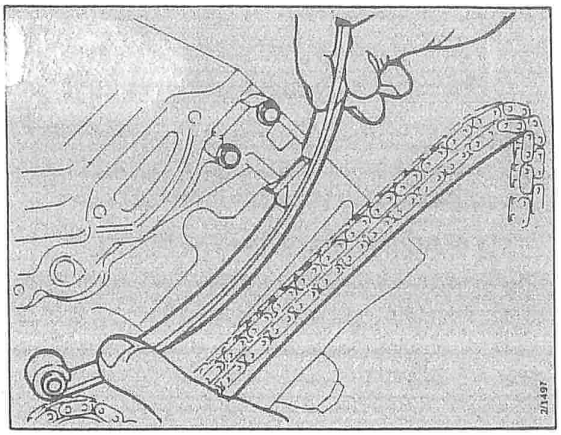
9 Refit the key in the keyway on the crankshaft, the sprocket and the timing chain.



10 Fit and set the chain tensioner.



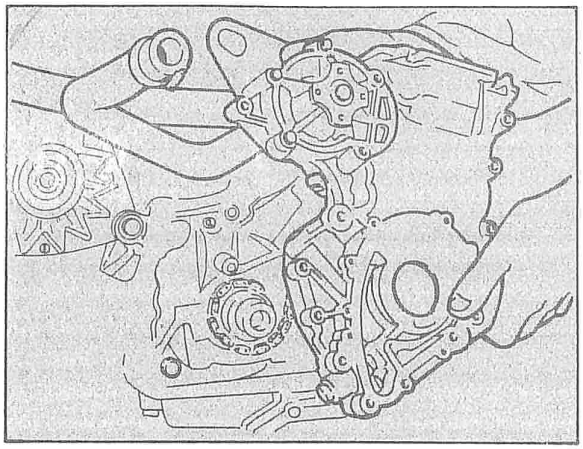
11 Fit the pivoting chain guide.



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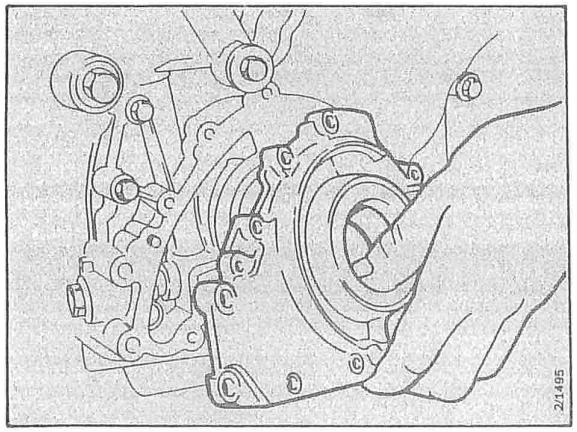
12 Fit new gaskets to the timing cover, using dabs of grease to hold the gaskets in place.

13 Fit the timing cover.



14 Fit the timing cover bolts and the alternator steady bar and reconnect the coolant hose to the bottom of the water pump.

15 Fit a new 'O' ring for the oil pump and offer up the pump, locating it on the guide pins.



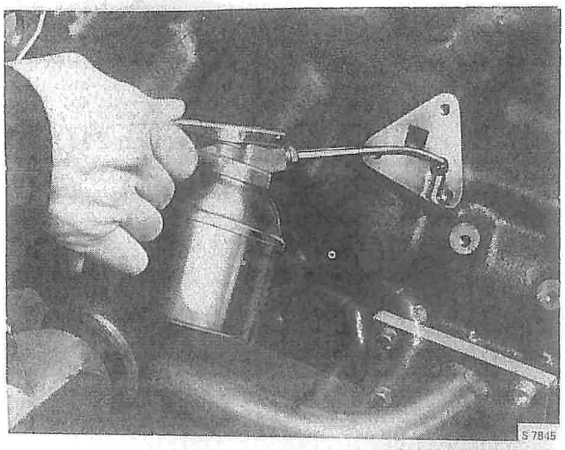
If there are no guide pins, centre the pump using tool 83 93 589.

Remove the old stuffing box, put the tool in position and fit a new stuffing box.

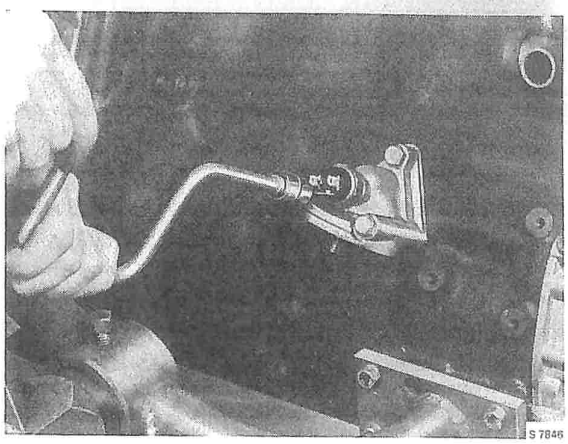
For further details, see page 221-2.

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16 Fill the passage between the oil pump and adaptor with engine oil.

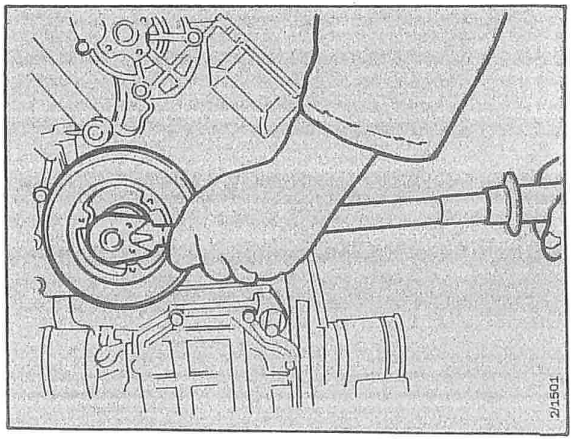


17 Fit the oil filter adaptor complete with new gasket.



18 Fit the crankshaft pulley.

Tightening torque for crankshaft pulley: 190 Nm (141 lbf ft)



19 Refit the water pump pulley leaving the bolts slack.

20 Fit the alternator.

21 Fit the drive belts and adjust to correct tension.

22 Tighten the bolts in the water pump pulley.

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23 Remove the locking segment (tool 83 92 987) from the flywheel.

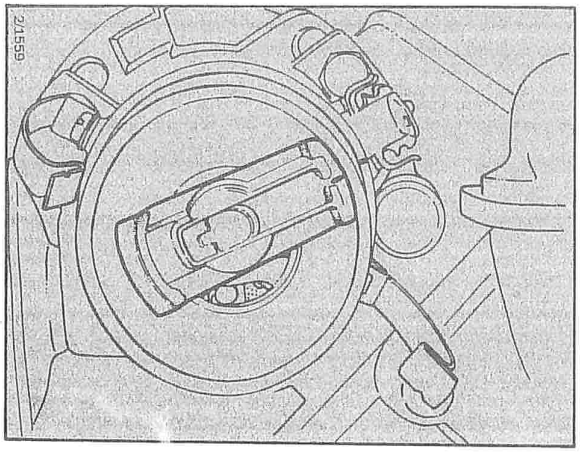
24 Fit the flywheel cover.

25 Fit the cylinder head (see section 211).

26 Fit the rubber seal in the groove in the valve cover and refit the cover.

Line up the rotor in the distributor with the line on the distributor so that the distributor drive dog engages the slot in the camshaft.

Tightening torque for valve cover:
B201: 5 Nm (3.7 lbf ft)
B202: 15 Nm (11 lbf ft)

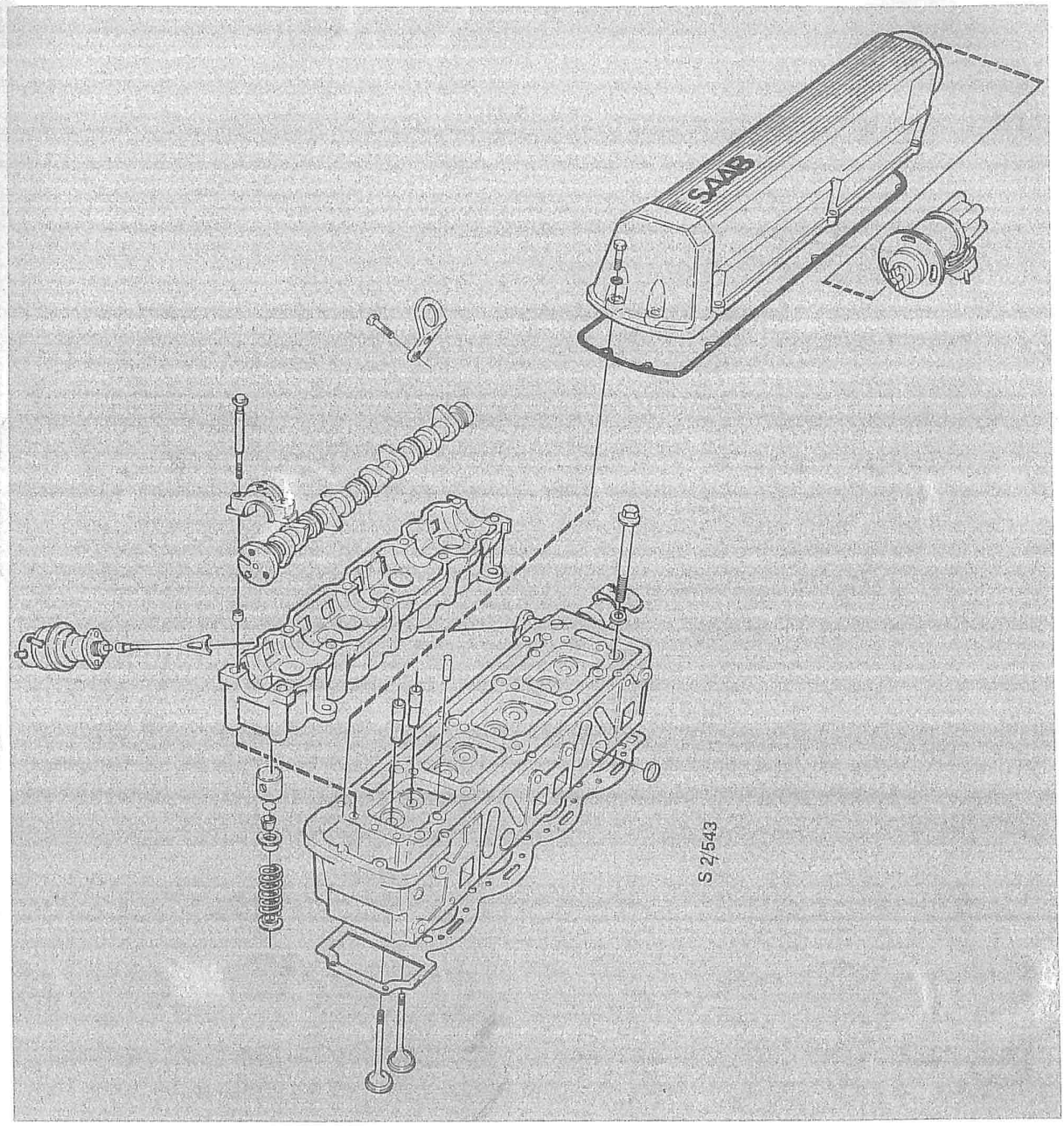


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Cylinder head

Cylinder head, B201 . . . . . 211- 1
Cylinder head, B202 211-21
Retightening the cylinder head . . . 211-31

Cylinder head, B201



To remove (engine in car)

1 Remove the bonnet.

Disconnect and remove the battery.

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2 Drain the coolant through the drain cock on the radiator and drain plug in the block.

3 Disconnect the coolant hose from the thermostat housing.

4 Disconnect the crankcase ventilation hoses from the valve cover.

5 Disconnect the wiring loom from the following:

a Warm-up regulator

b Hall generator

c Thermostatic switch

d Thermostatic time switch

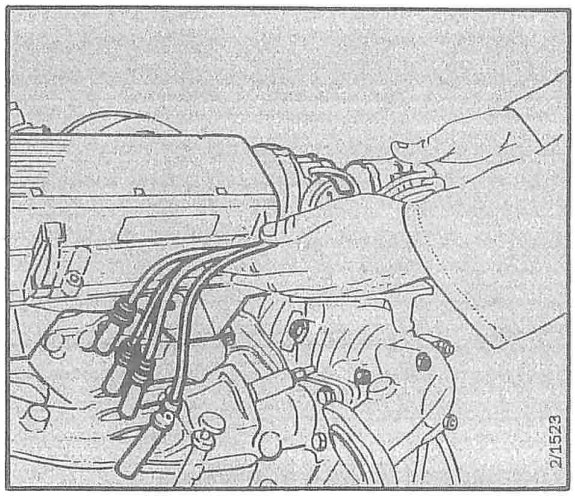
e Thermostatic switch (Lambda system)

f Temperature sensor

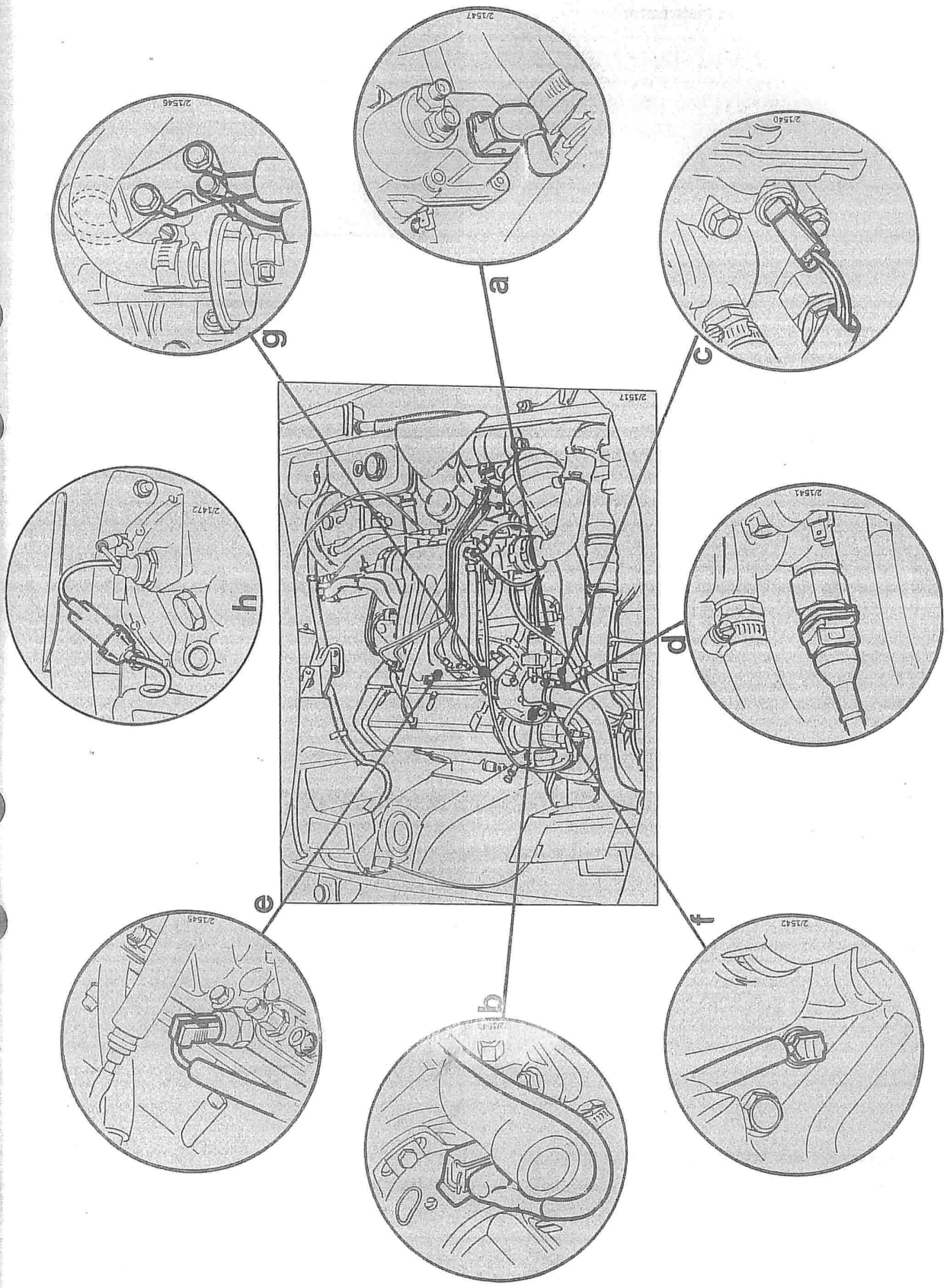
g Earthing points on engine lifting lug

h Cars with AC: AC compressor

6 Disconnect the HT leads and vacuum hose and remove the distributor cap complete with leads.

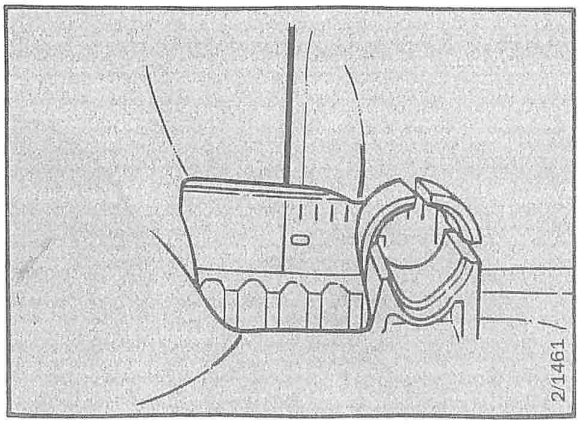


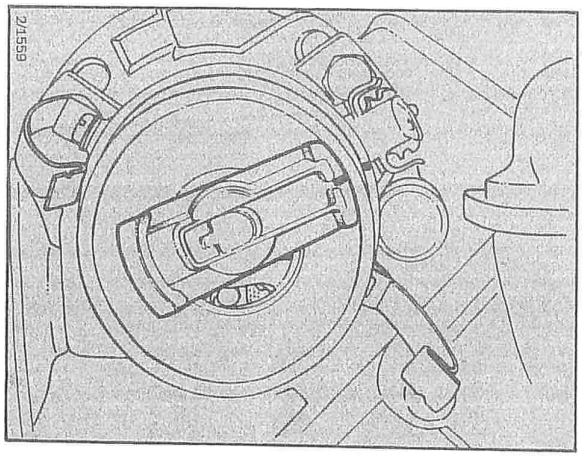
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7 Rotate the crankshaft to bring the 0° mark on the flywheel in line with the timing mark on the cover, and the mark on the rotor in line with the mark on the distributor.



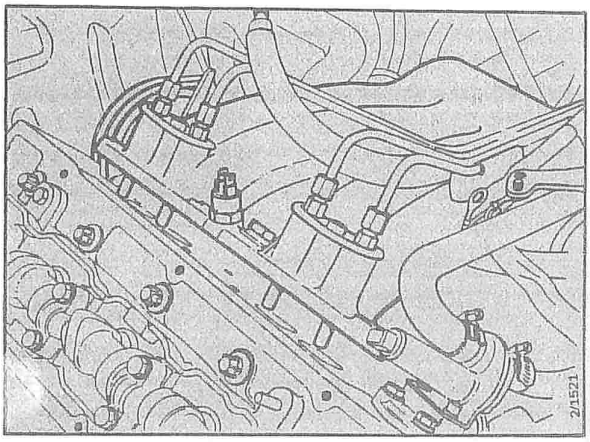


N.B.
Because of the design of the slot for the distributor dog, No. 1 cylinder must be at top dead centre for the valve cover to be removed.

8 Remove the valve cover.

9 Unbolt the inlet manifold and lift it back to ensure that the cylinder head will clear the injection valves.

Prop up the manifold in a suitable way.

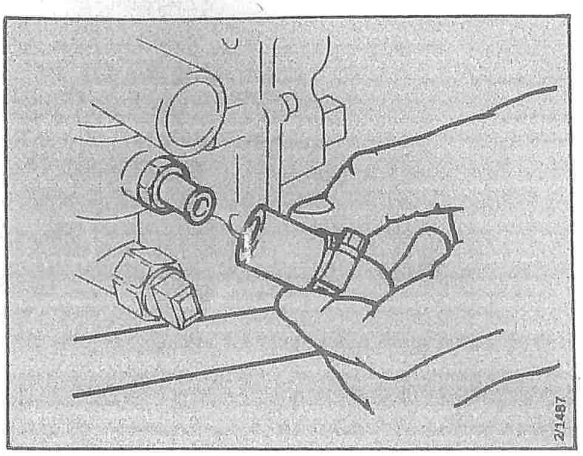


10 Disconnect the hoses from the auxiliary air valve.

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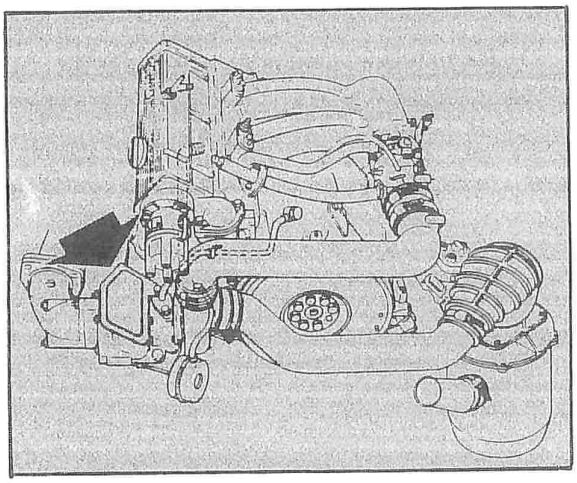
11 Disconnect the fuel hoses from the warm-up regulator.

12 Disconnect the coolant hose for the turbo unit from the thermostat housing.



13 Undo the fitting for the turbo oil supply pipe at the thermostat housing.

14 Remove the heat shield from the turbo unit.

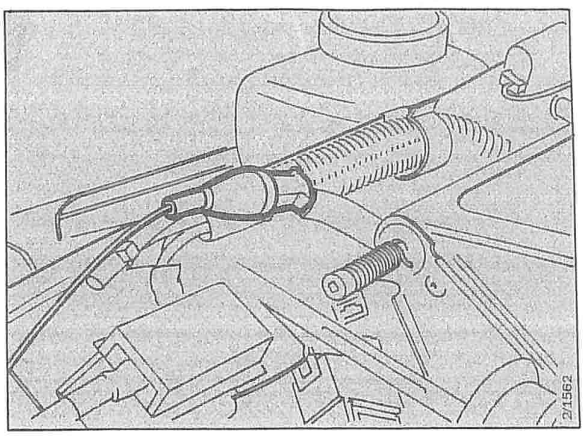


15 Remove the intermediate pipe between the turbo and exhaust pipe.

16 Unbolt the turbo unit from the exhaust manifold.

17 Remove the gearbox dipstick tube.

18 Unplug the connector in the lead for the oxygen sensor and remove the clip from the wing.

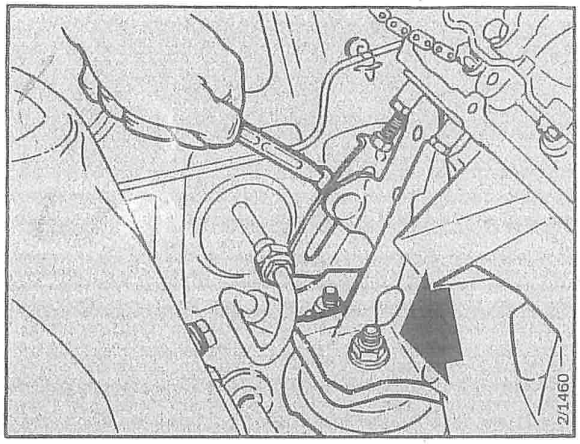


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19 Remove the bolts in the steady bar for the RH engine mounting. Remove the bottom bolt from underneath the car using a socket extension.

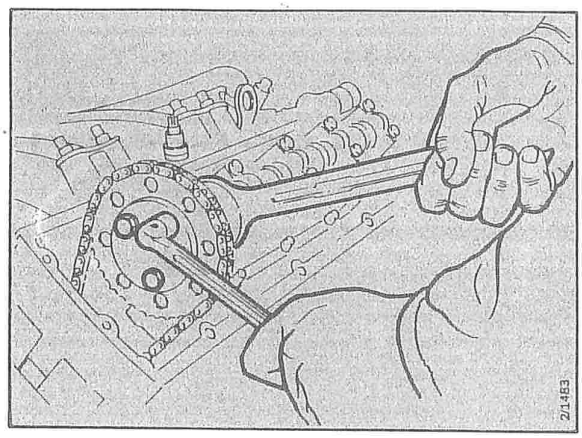
20 Place a suitable support under the gearbox to take the weight off the engine mounting.

Remove the nut on the engine mounting and the bolts for the steering servo pump.



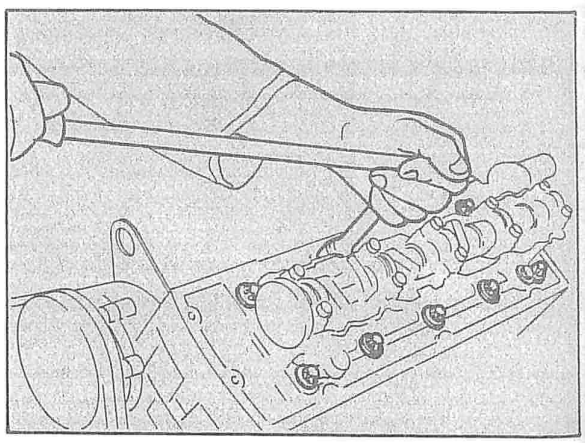
Remove the steady bar.

21 Remove the camshaft sprocket bolts.



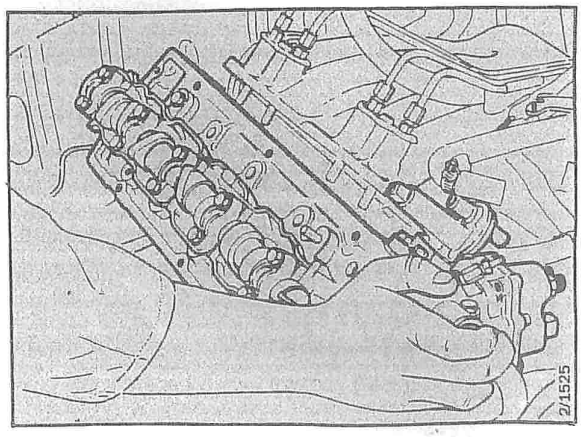
22 Remove the camshaft sprocket and insert a screwdriver between the chain guide and the chain tensioner to support the chain.

23 Remove the two cylinder head bolts in the timing cover and all bolts in the top of the head.



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24 Fit two locating studs in the bolt holes and lift off the cylinder head.



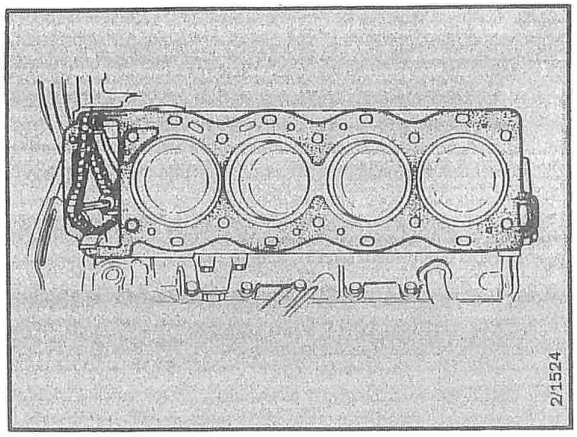
25 Clean all flanges on the cylinder head, block, inlet manifold and exhaust manifold.

Carefully scrape off the remains of old gasket and sealant. Do not use emery cloth.

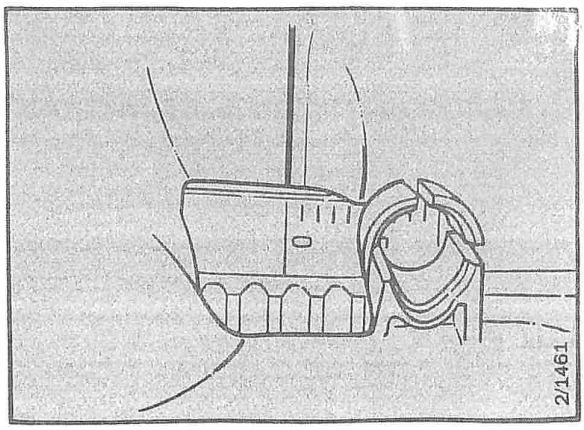
Check that the flanges are flat.

To refit

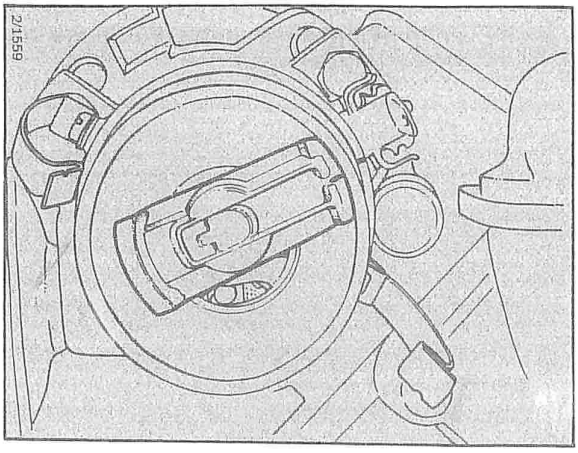
1 Fit a new cylinder head gasket on the block.



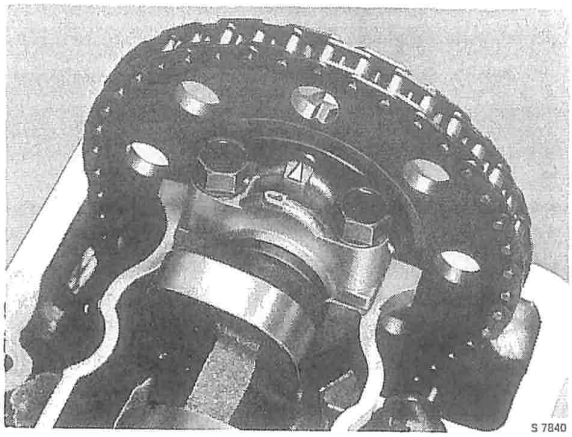
2 Make sure that the flywheel and rotor are still lined up with their timing marks.



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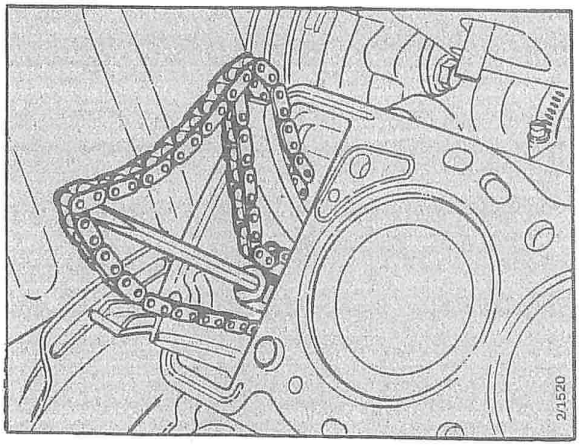
Refit the camshaft sprocket temporarily and rotate the camshaft to bring No. 1 cylinder to top dead centre.



N.B.
Never move the camshaft or crankshaft with the timing chain removed, as a fully open valve can collide with the piston at top dead centre.

3 Set the chain tensioner.

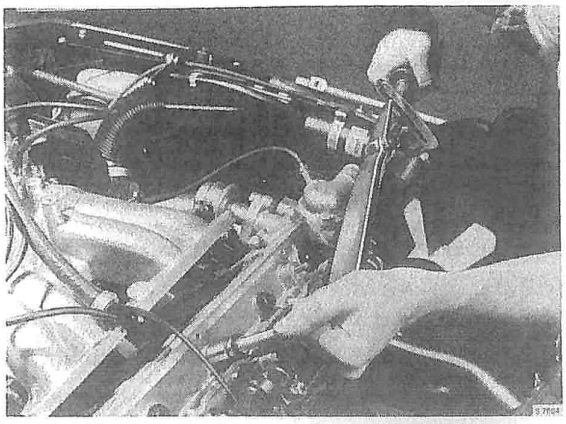
Insert a screwdriver between the tensioner and chain guide to keep the chain out of the way of the head when it is replaced on the block.



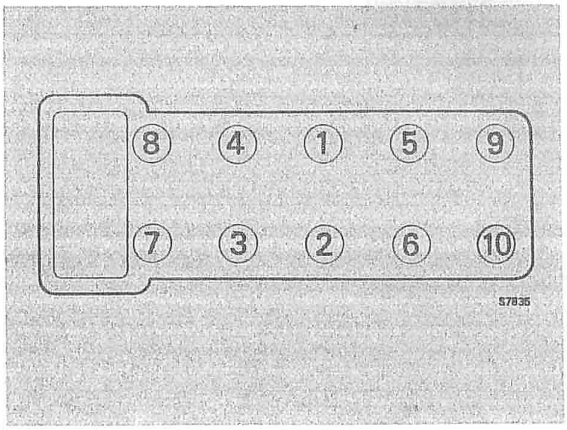
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4 Replace the cylinder head and tighten the head bolts to the specified torque (see 'Technical Data').

Remember to fit the two bolts in the timing cover.



Tighten down the head as detailed on Page 211-31.

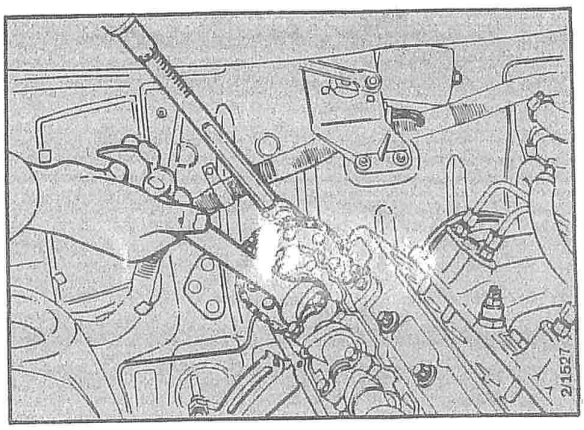


N.B.
TORX bolts are precoated with lubricant and do not normally require further lubrication the first time they are refitted. The bolts can usually be refitted up to five times before the coating wears off. Thereafter, remove all traces of the old coating and lubricate the bolts with Molycote 1000

5 Refit the timing chain as detailed in Section 215.

6 Refit the three camshaft securing bolts complete with plain washers.

Tightening torque: 20 Nm (14.8 lbf ft)



7 Offer up the steady bar for the RH engine mounting and fit the nut on the mounting.

Fit the three bolts in the steady bar and remove the support from under the gearbox.

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N.B.
Remember to fit the bolt in the bottom of the steady bar.
Tighten the nut on the engine mounting last.

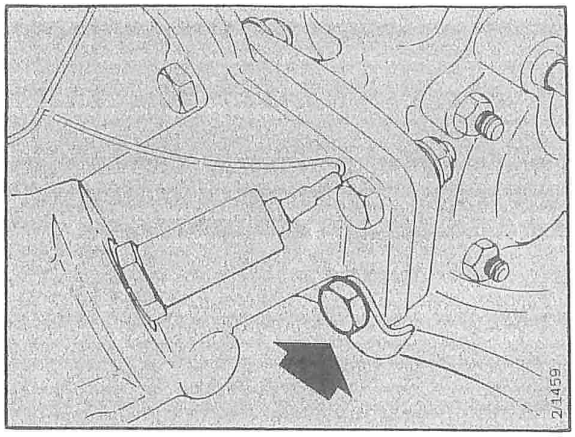
Insert the bolts for the steering servo pump.

Tension the drive belt and tighten the bolts.

8 Fit a new gasket and tighten the flange joint between the turbo and exhaust manifold.

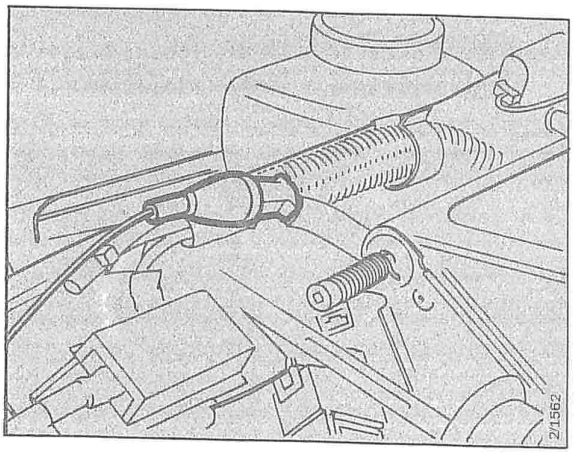
It may be necessary to slacken the bolts in the turbo steady bar before the flange bolts can be fitted.

N.B.
One of the bolts (arrowed in picture) is shorter than the others



9 Fit the gearbox dipstick tube.

10 Reconnect the oxygen sensor and fit the clip on the wing.



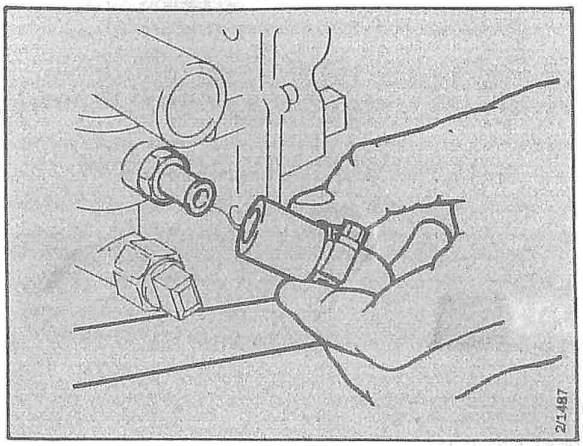
11 Fit the intermediate pipe between the turbo and exhaust pipe.

12 Fit the heat shield for the turbo unit.

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13 Fit the clip for the turbo oil supply pipe to the thermostat housing.

14 Reconnect the coolant hose for the turbo to the thermostat housing.



15 Reconnect the coolant hose to the thermostat housing.

16 Reconnect the hoses to the auxiliary air valve.

17 Refit the inlet manifold complete with new gasket.

Tightening torque: 18 Nm (13.3 lbf ft)

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18 Put back the main wiring loom, reconnecting the leads at the following:

a Warm-up regulator

c Thermostatic switch

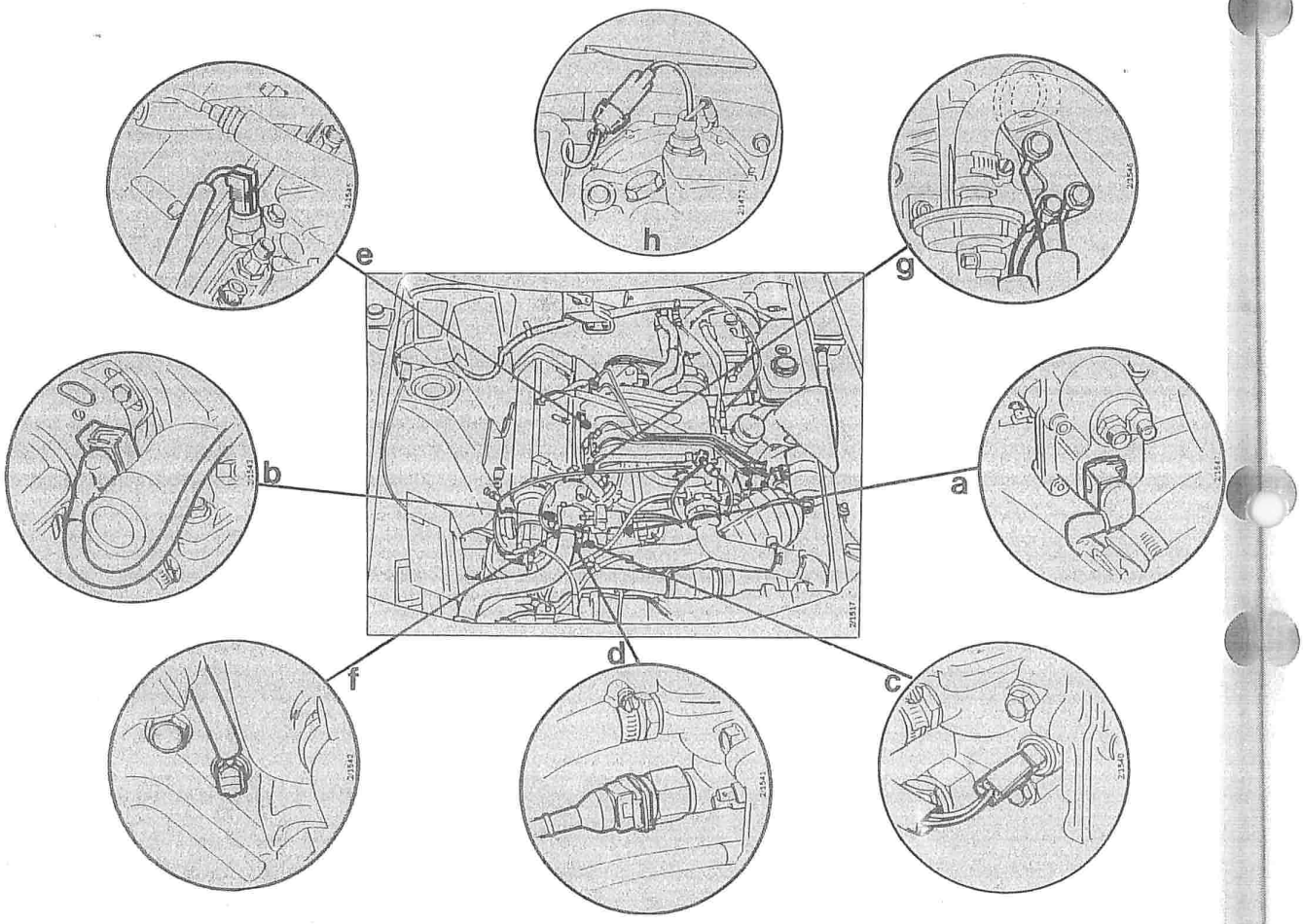
d Thermostatic time switch

e Thermostatic switch (Lambda system)

f Temperature sensor

g Earthing points on engine lifting lug. Note the configuration of the leads.

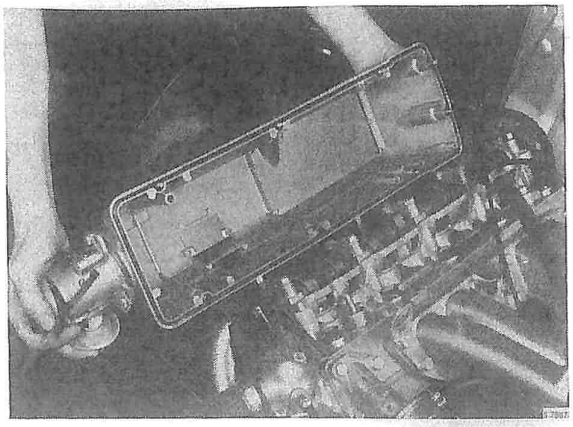
h Cars with AC: AC compressor.



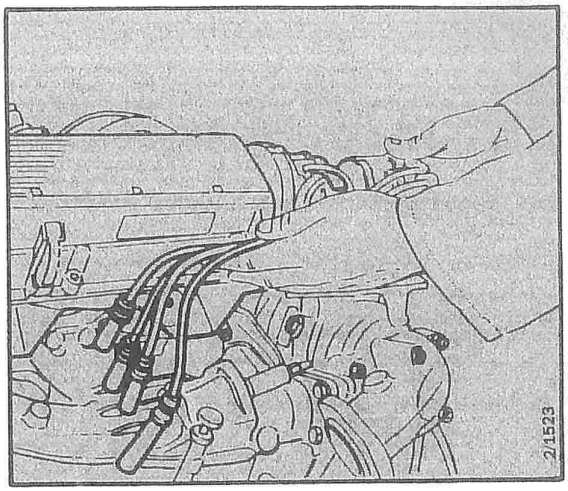
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19 Make sure that the seal in the groove in the valve cover is correctly seated and refit the cover.

Tightening torque: 5 Nm (3.7 lbf ft)



20 Refit the distributor cap and HT leads and reconnect the vacuum hose and the connector for the Hall generator.



21 Reconnect the crankcase ventilation.

22 Close the drain cock on the radiator and tighten the drain plug in the block and fill the system with coolant.

23 Put back and reconnect the battery.

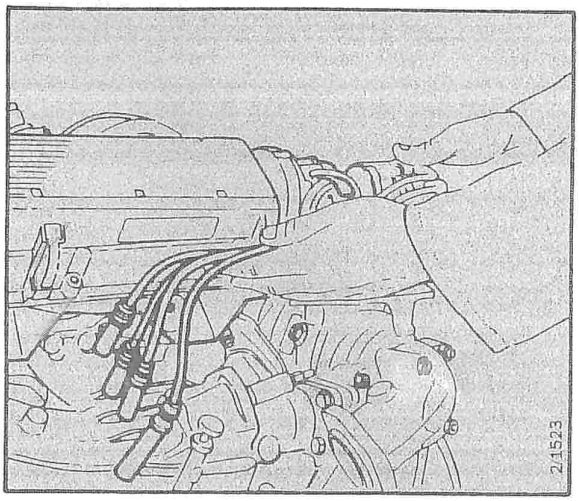
24 Start the engine. Check that all functions are working properly and that no connections are leaking.

25 Refit the bonnet and reconnect the windscreen washer hose.

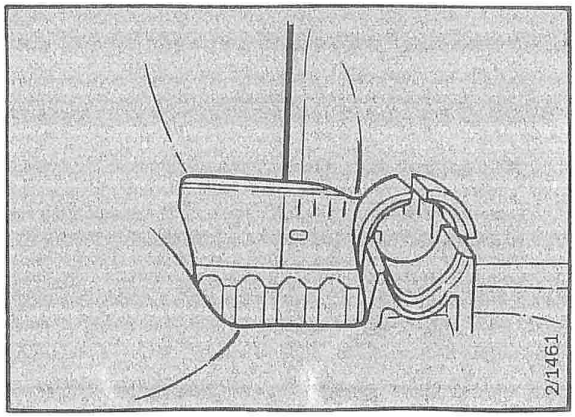
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To remove the cylinder head (engine removed from car)

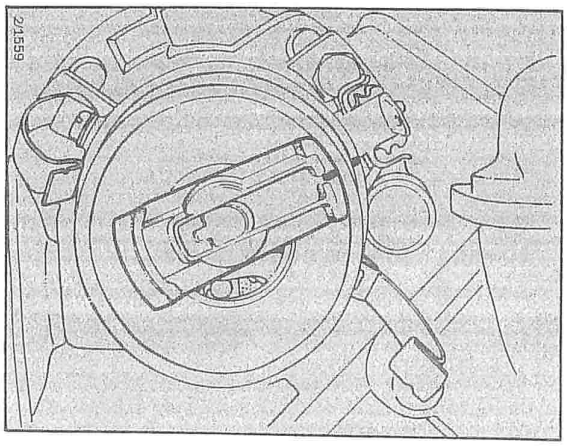
1 Disconnect the HT leads and vacuum hose. Remove the distributor cap complete with leads.



2 Remove the valve cover and rotate the crankshaft to line up the O° mark on the flywheel with the timing mark on the end plate ...

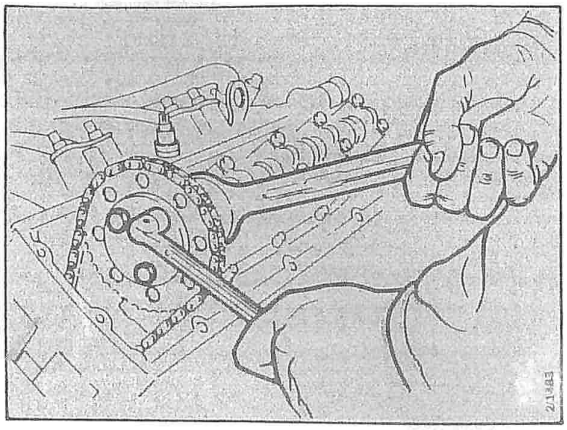


... and the rotor in line with the mark on the distributor..



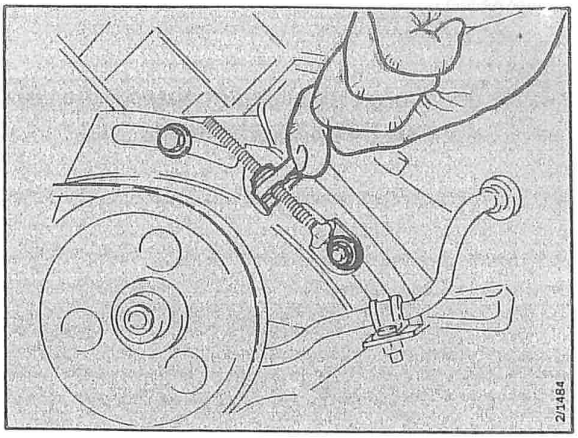
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3 Remove the camshaft sprocket bolts.

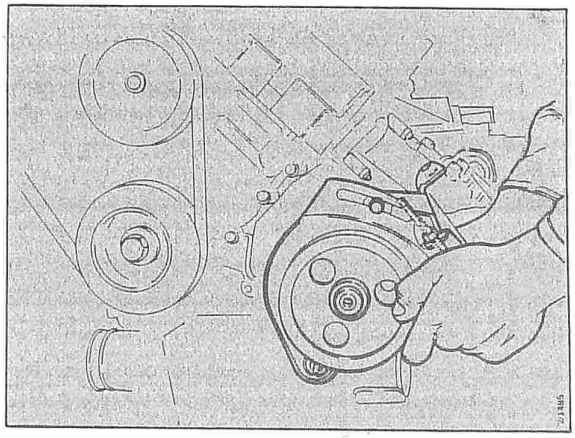


N.B.
Never move the camshaft or crankshaft with the timing chain removed, as a fully open valve can collide with the piston at top dead centre.

4 Slacken the bolts for the steering servo pump, release the tensioner and remove the drive belt.



5 Unbolt the bracket for the engine mounting and servo pump (five bolts) and remove the bracket complete with pump.

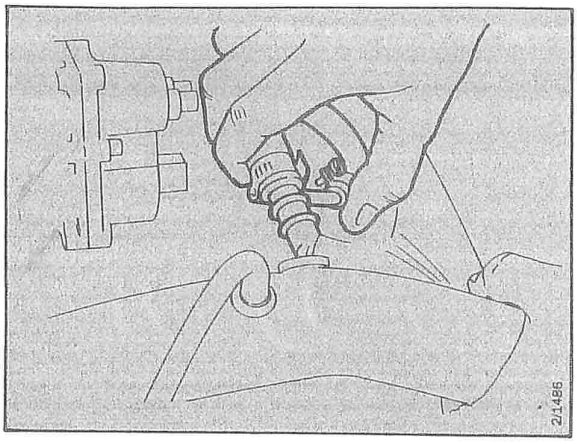


6 Remove the gearbox dipstick tube.

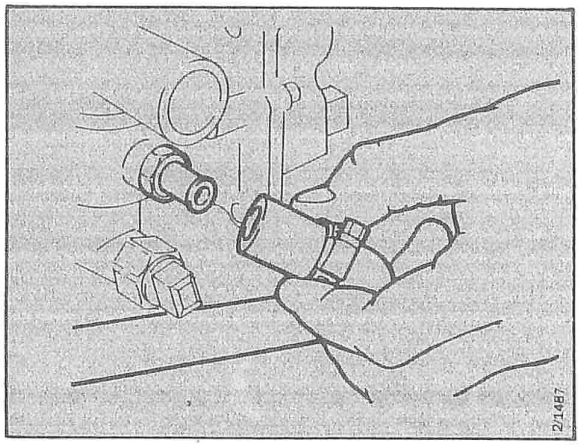
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7 Remove the exhaust manifold and turbo unit as follows:

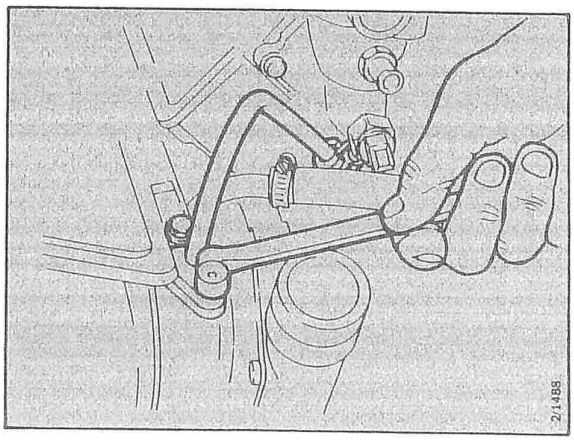
- Disconnect the crankcase ventilation hose and the preheater hose from the turbo suction pipe.



- Disconnect the coolant hose for the turbo from the thermostat housing.



- Disconnect the turbo oil supply pipe from the clip on the thermostat housing and from the turbo unit.

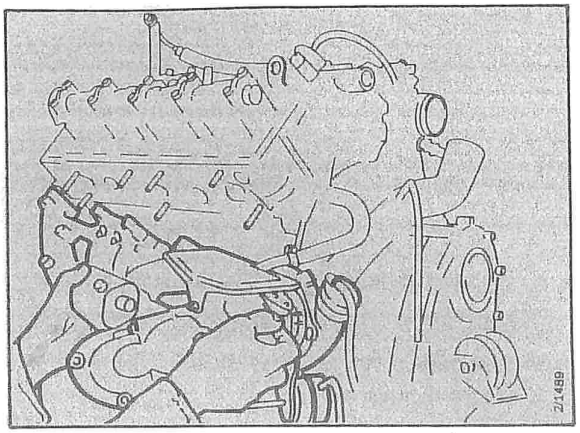


- Unbolt the turbo bracket.
- Disconnect the oil return pipe from the turbo unit.
- Undo and remove the exhaust manifold nuts.

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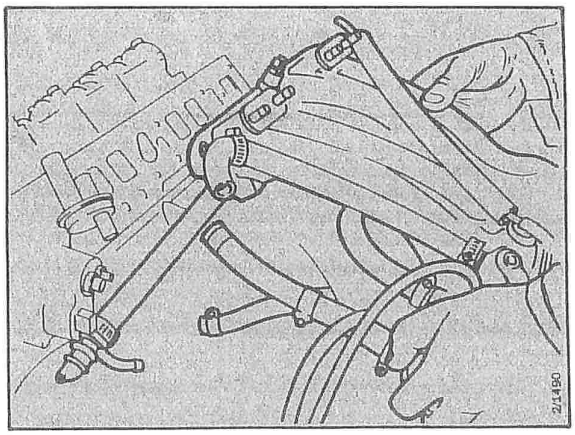
Lift off the exhaust manifold and turbo unit.

Remove the heat shield.

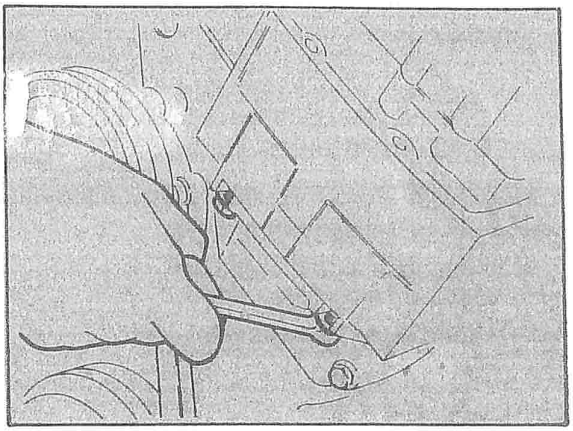


8 Remove the inlet manifold as follows:

- Disconnect the hoses from the auxiliary air valve.
- Snip through the tie around the coolant hoses for the heater system and disconnect the preheater hose for the throttle housing.
- Disconnect the hose for the crankcase ventilation at the non-return valve.
- Undo the inlet manifold bolts in the cylinder head and the nut on the steady bar and lift off the manifold.

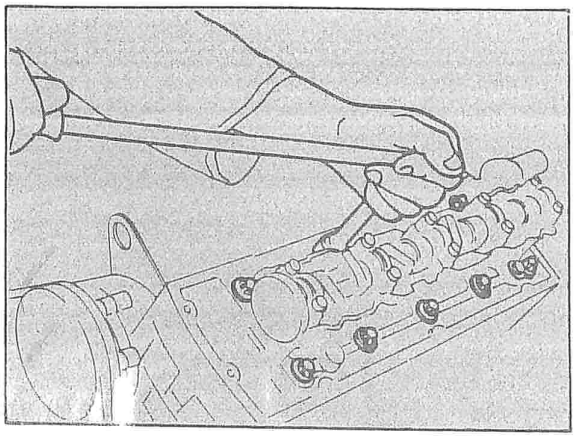


9 Remove the two cylinder head bolts in the timing cover.

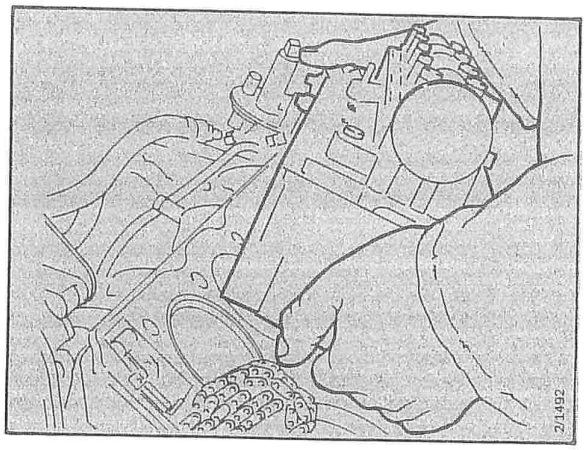


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10 Remove the cylinder head bolts.



11 Lift off the cylinder head and stand it on blocks of wood to avoid damaging the valves.



To refit the cylinder head (engine removed from car)

1 Put the timing chain between the chain guides to keep it out of the way of the cylinder head being replaced.

Fit a new gasket and lift the cylinder head onto the block. Tighten the bolts, remembering to fit the two in the timing cover.

For tightening torques see the 'Technical Data' Section.

2 Fit the inlet manifold complete with new gasket, aligning the injection valves and steady bar at the same time.

- Reconnect the crankcase ventilation hose to the non-return valve.
- Reconnect the preheater hose for the throttle housing and tie the cooling hoses for the heater system together.
- Reconnect the hoses to the auxiliary air valve.

Tightening torque for inlet manifold: 18 Nm (13.3 lbf ft)

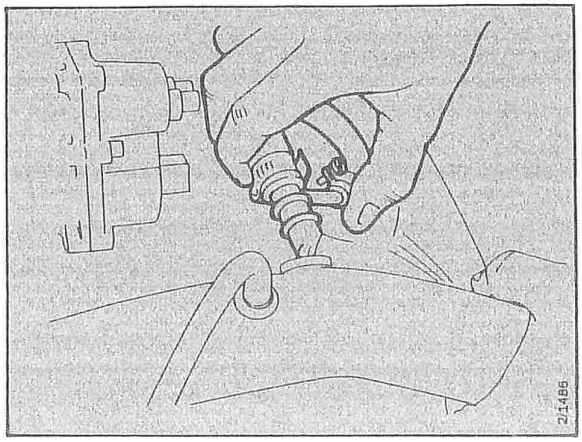
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3 Fit the heat shield for the turbo unit followed by the exhaust manifold and turbo assembly as follows:

- Fit the exhaust manifold nuts but leave them slack.

N.B.
Fit the bracket, oil return pipe and oil supply pipe to the unit before tightening the manifold.
Fit new gaskets at the oil pipe fittings.

- Fit the bracket for the turbo unit.
- Fit the oil return pipe to the turbo.
- Fit the oil supply pipe to the turbo and the pipe clip on the thermostat housing.
- Reconnect the coolant hose for the turbo unit to the thermostat housing.
- Reconnect the crankcase ventilation hose and the throttle housing preheater hose to the turbo suction pipe.



Tightening torque for exhaust manifold:
Turbo: 25 Nm (18.5 lbf ft)
Non-Turbo: 20 Nm (14.8 lbf ft)

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4 Fit the gearbox dipstick tube.

5 Refit the camshaft sprocket and reset the tensioner.

N.B.
Place a cover over the chamber for the timing chain to prevent any bolt, nut or other item dropping inside the timing cover.

Check the settings of the sprocket, flywheel and rotor.

6 Fit the valve cover.

Tightening torque: 5 Nm (3.7 lbf ft)

7 Refit the distributor cap and reconnect the HT leads and vacuum hose.

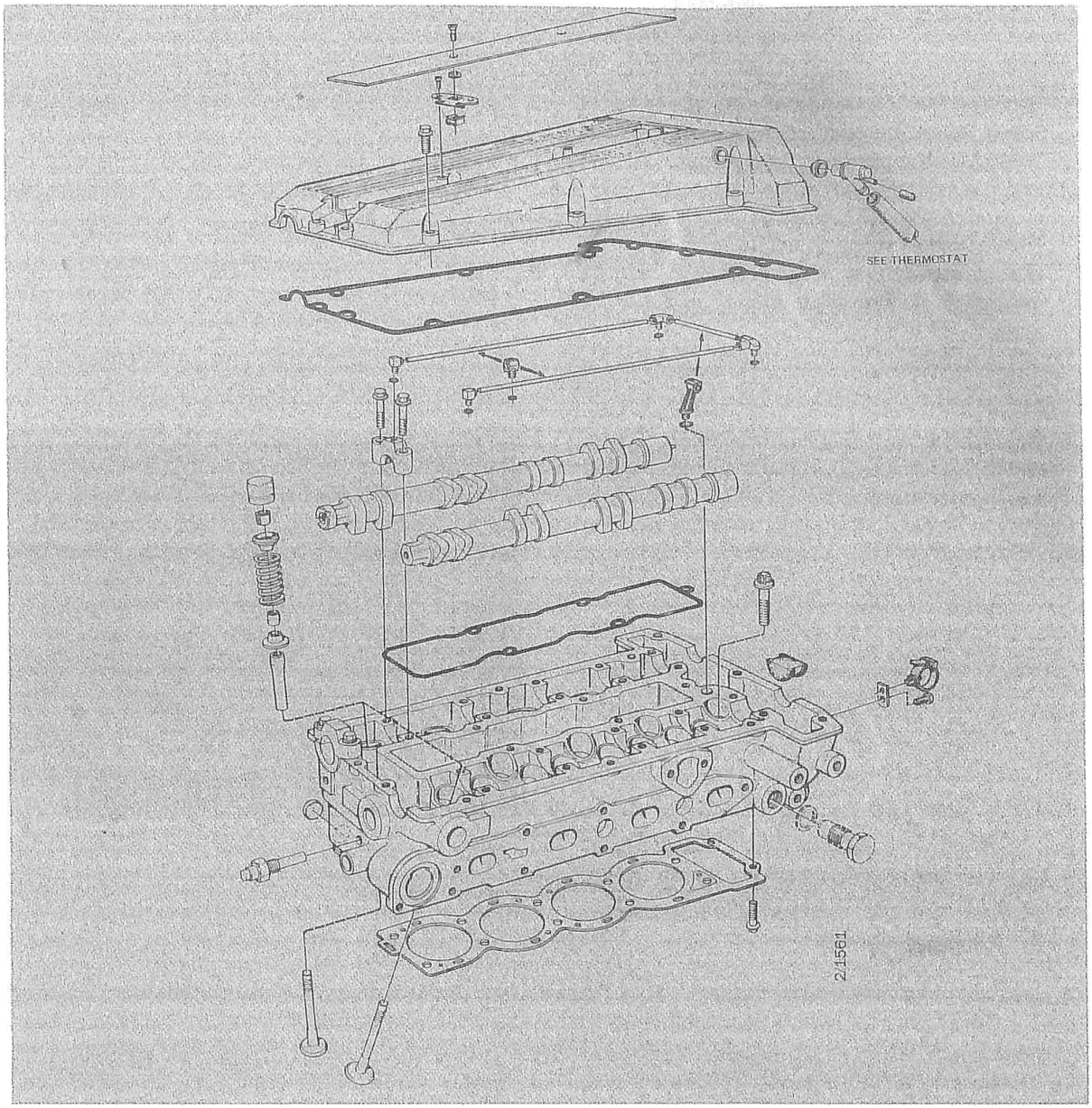
8 Refit the alternator and the engine mounting bracket. Tighten the mounting.

9 Refit and adjust the tension of the drive belt and tighten the servo pump securing bolts.

For correct belt tension see the 'Technical Data' Section.

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Cylinder head, B202



To remove (engine in car)

1 Remove the bonnet.

2 Remove the battery.

3 Drain the coolant from the radiator and block.

4 Remove the exhaust manifold and turbo unit.

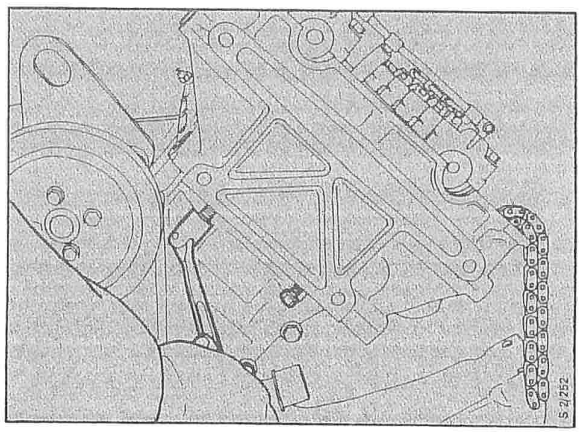
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5 Remove the tensioning pulley and drive belt for the AC compressor.

6 Slacken the securing bolts for the steering servo pump bracket, remove the drive belt and push the pump out of the way.

7 Release the wiring loom from the clips on the cylinder head. If the cylinder is to be mounted on the floor stand, remove the clips.

8 Remove the two bolts in the timing cover, which are screwed into the cylinder head from underneath.



9 Remove the RH engine mounting bolts screwed into the cylinder head, together with the spacer sleeves.

10 Disconnect the coolant hose from the thermostat housing.

11 Remove the fuel pressure regulator.

12 Disconnect the earth connections for the LH fuel injection system.

13 Remove the auxiliary air valve (N/A to cars with catalytic converter).

14 Unbolt the AC bracket from the cylinder head.

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15 Remove the inlet manifold complete with injection valves and fuel injection manifold.

16 Disconnect the lead from the temperature sensor.

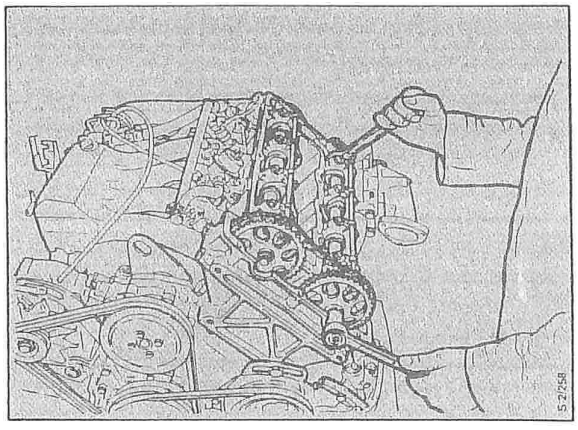
17 Remove the inspection plate on the valve cover, and the HT leads complete with distributor cap.

18 Remove the valve cover. Disconnect the crankcase ventilation hose and remove the split rubber plugs from the cylinder head.

19 Line up the timing marks on the crankshaft and camshafts as detailed in section 214.

20 Remove the chain tensioner (see section 215).

21 Remove the camshaft sprockets.

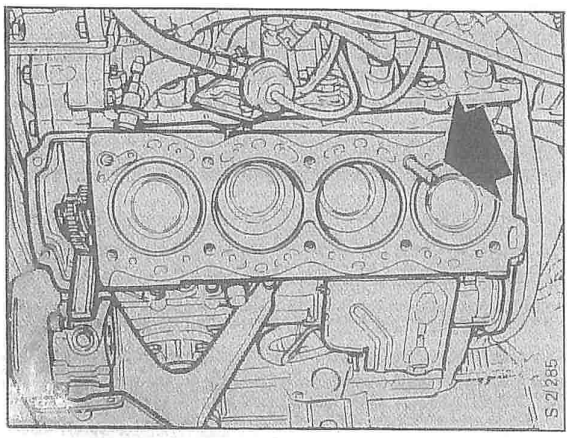


N.B.
Do not alter the setting of the camshaft or crankshaft after the sprockets have been removed, as rotation of one of the shafts can result in damage to the valves.

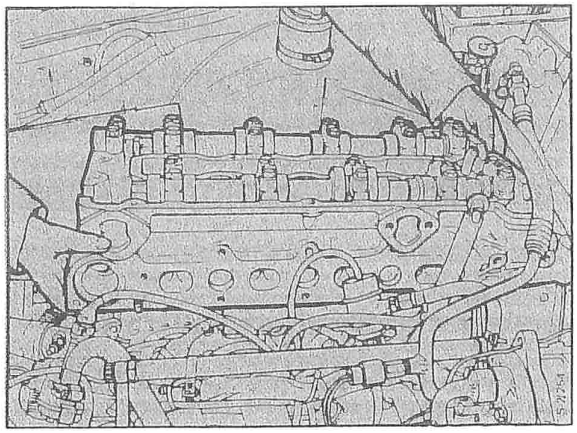
22 Block up the engine to lift the cylinder head off the engine steady bar. Remove the cylinder head bolts and siphon off the oil from the cylinder head.

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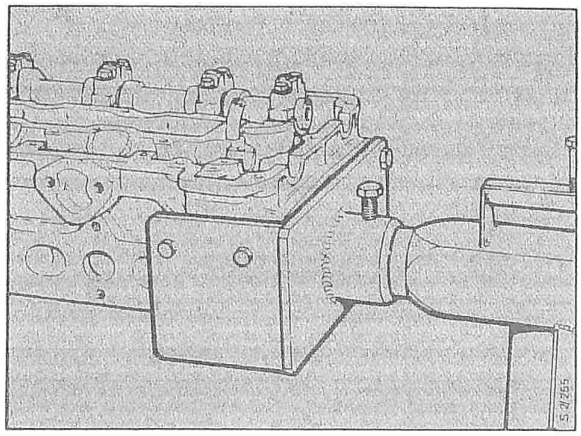
23 Fit a guide pin in one of the bolt holes ...



... (see illustration) and lift off the cylinder head, taking care to ensure that the pivoting and fixed guides for the timing chain are not damaged. Refit the drain plug in the block and close the drain valve on the radiator.



For work on the cylinder head, use the bracket (available as a special tool) for mounting the cylinder head on the engine stand.



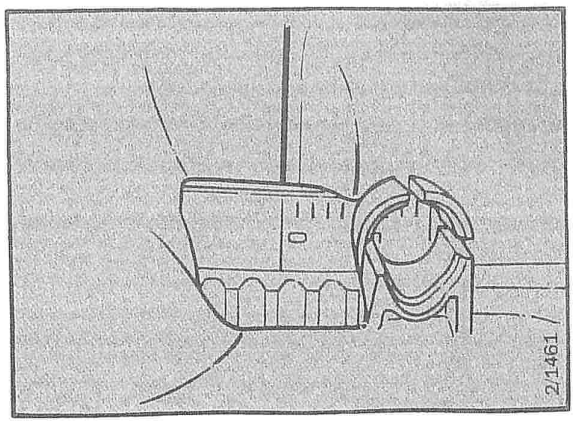
N.B.
Never stand the cylinder head on its flanges as open valves will protrude. Stand the cylinder head on wooden blocks.

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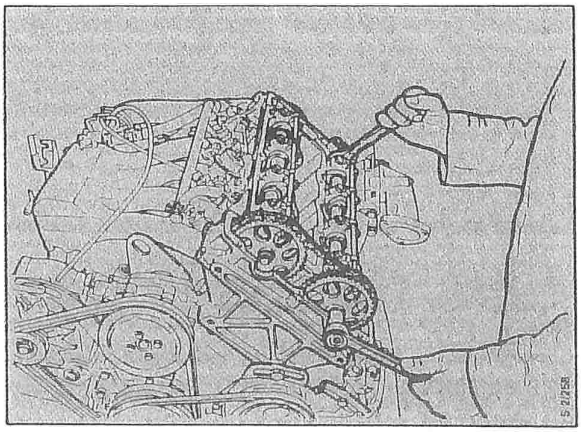
Dismantling the cylinder head (engine removed from car)

1 Remove the inspection plate on the valve cover. Disconnect the HT leads and vacuum hose and remove the distributor cap complete with leads.

2 Remove the valve cover and turn the crankshaft to bring the '0' mark on the flywheel in line with the timing mark on the end plate.



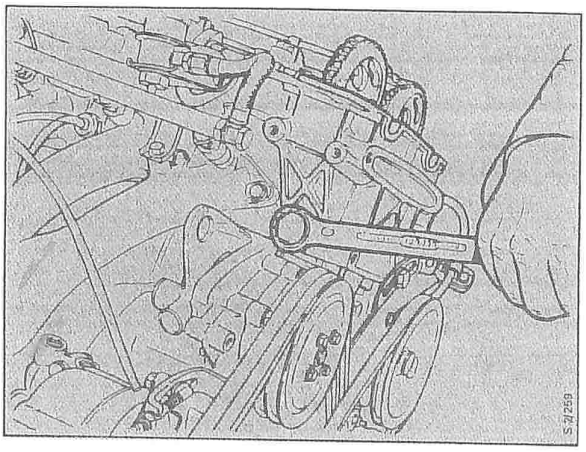
3 Remove the centre bolts securing the camshaft sprockets.



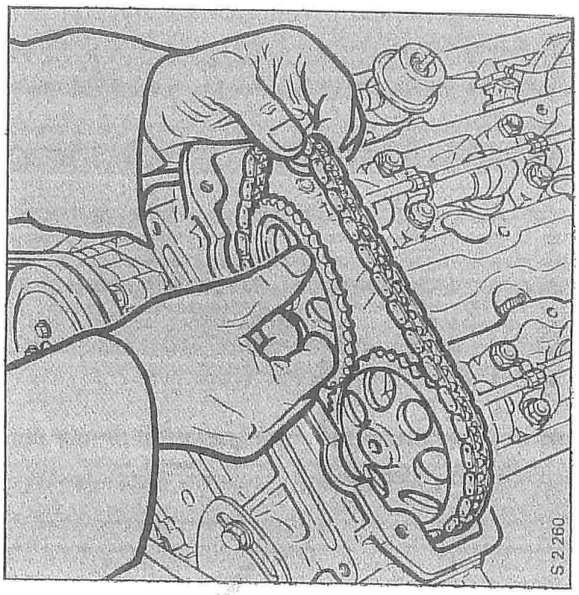
N.B.
Never move the camshaft or crankshaft with the timing chain removed, as a fully open valve can collide with the piston at top dead centre.

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4 Remove the chain tensioner.

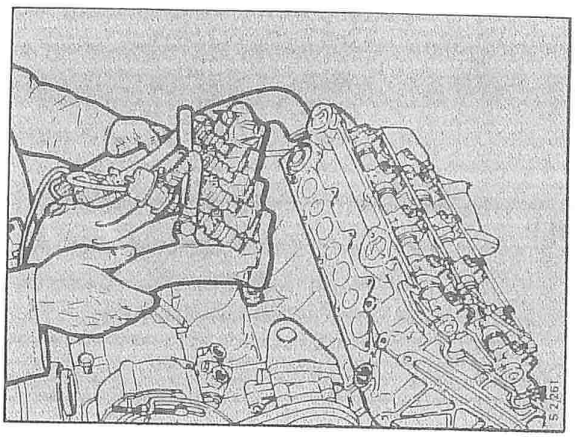


5 Remove the camshaft sprockets.



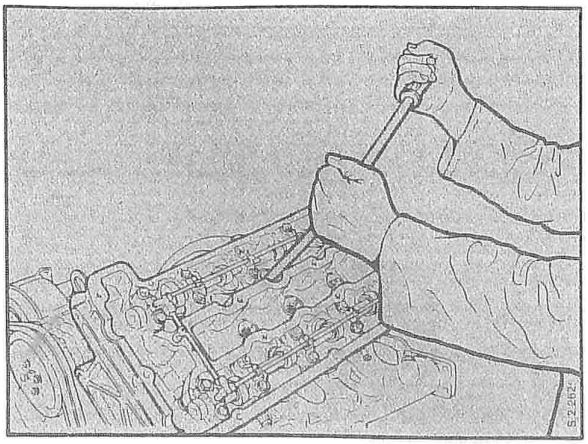
6 Remove the EGR pipe, the turbo discharge pipe, and the oil supply and return pipes.

7 Remove the inlet manifold complete with pressure regu lator, and the auxiliary air valve.



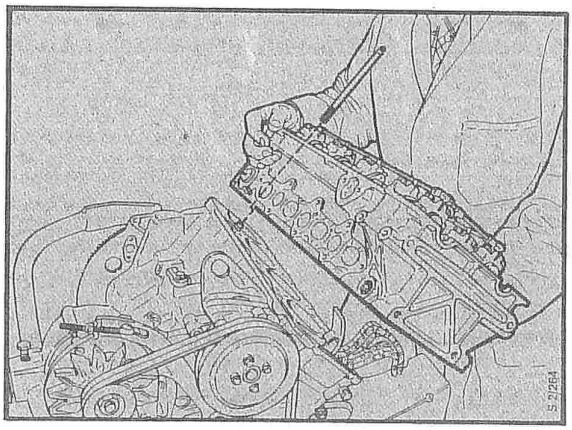
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8 Remove the cylinder head bolts.



9 Arrange the timing chain and the pivoting chain guide to allow the cylinder head to be lifted off.

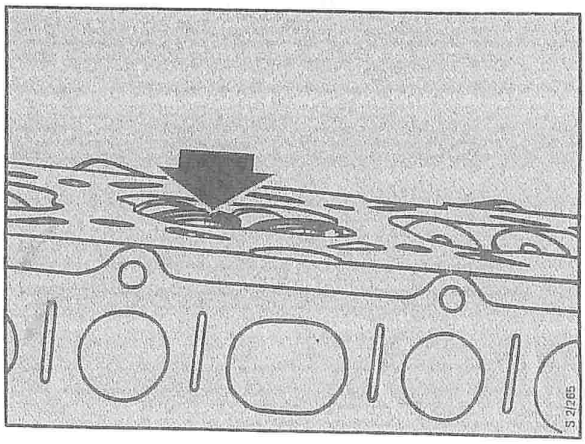
10 Lift off the cylinder head; if necessary, screw guide pin 83 92 128 into the block, as shown.



11 Remove the exhaust manifold and turbo unit.

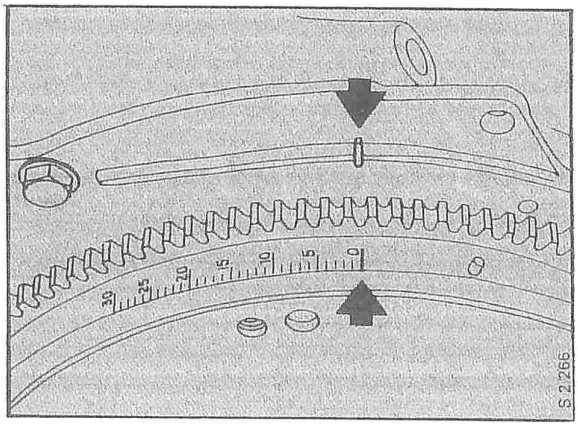
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N.B.
Never stand the cylinder head on its flanges as open valves will protrude. Stand the cylinder head on wooden blocks.

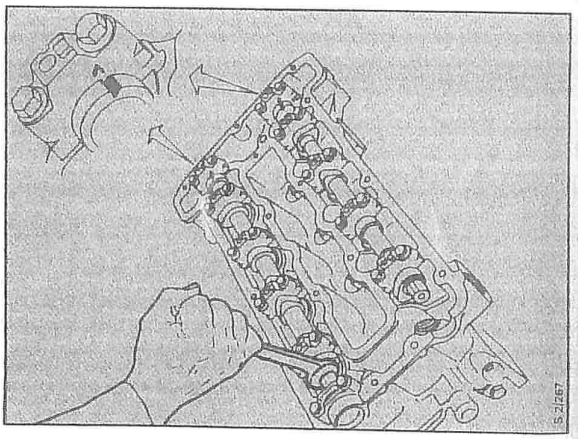


To refit the cylinder head

1 Align the '0' mark on the flywheel with the timing mark on the end plate.



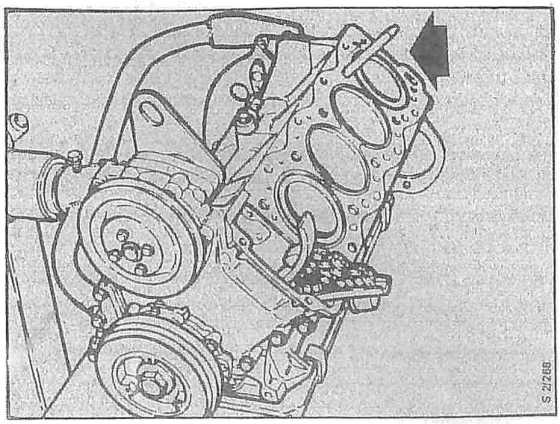
2 Line up the marks on the camshafts with their respective timing marks.



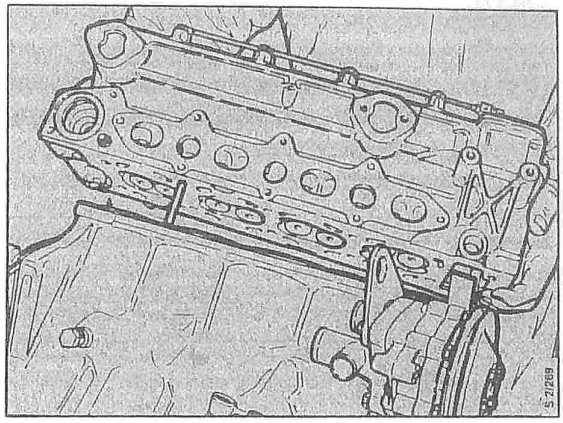
3 Fit the cylinder head gasket, making sure that it is held in position by the guide sleeves in the cylinder head flange.

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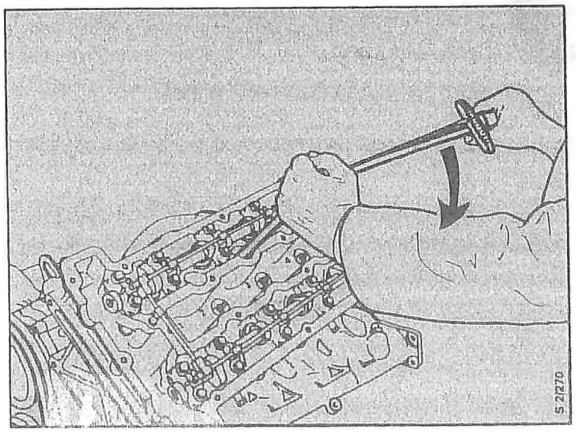
4 Fit guide pin 83 92 128 and position the timing chain and pivoting guide as shown.



5 Fit the cylinder head. Use the guide pin as a pivot for the cylinder head, which must be swivelled slightly to enable it to pass the pivoting guide. Thereafter, the head will be guided by the sleeves.



6 Fit the cylinder head bolts and tighten them to the specified torque (see the 'Technical data' section). Remember to fit the two M8 bolts in the underside of the cylinder head.

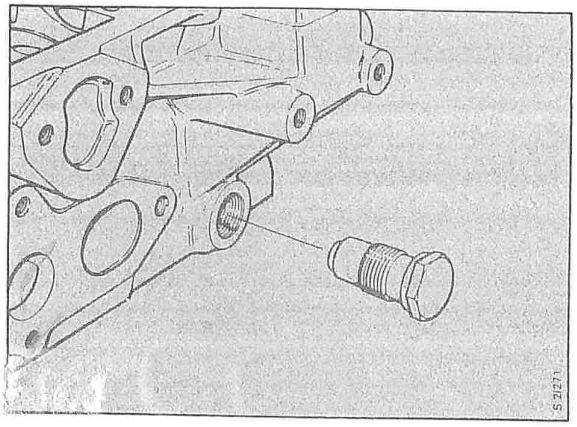


7 Fit the camshaft sprockets, fitting the sprocket for the exhaust-valve camshaft first. Make sure that the chain between the crankshaft sprocket and the camshaft sprocket is kept tight and properly located in the guide channel. Next fit the sprocket on the inlet-valve camshaft. Keep the chain tight between the sprockets.

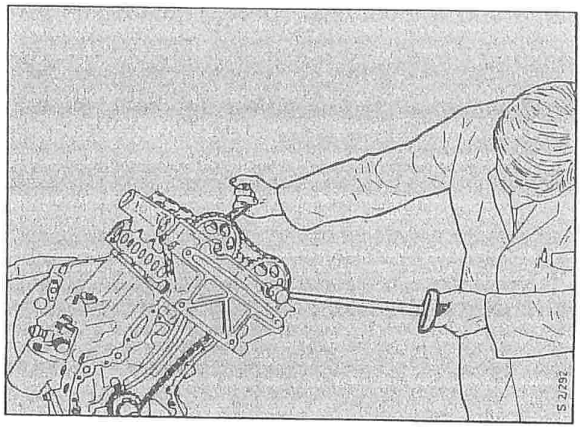
8 Lightly tighten the centre bolts securing the camshaft sprockets.

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9 Fit the chain tensioner (see section 215).



10 Rotate the crankshaft two complete turns clockwise, viewed from the timing end. Check that the earlier settings of the crankshaft and camshafts have not altered (timing marks lined up).

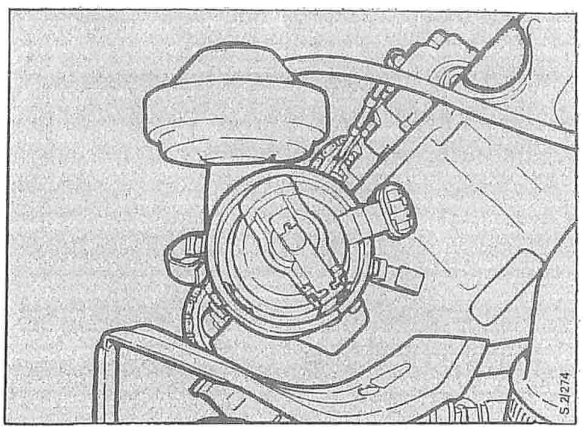


11 Tighten the centre bolts for the camshaft sprockets.

Tightening torque: 63 Nm (47 lbf ft)

N.B.
Use a spanner on the flats on each camshaft to hold the shaft still when tightening the bolts, to ensure that the set positions do not alter.

12 Refit the valve cover. Make sure that the seals and split rubber plugs are properly seated in their grooves.



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13 Fit the distributor cap and reconnect the HT leads and vacuum hose.

14 Fit the inspection plate on the valve cover.

15 Fit the exhaust manifold and turbo unit, and connect the EGR pipe, the turbo discharge pipe, the oil supply pipe and the oil return pipe.

16 Fit the inlet manifold, the auxiliary air valve, the pressure regulator and the lifting lug. Connect the vacuum hose to the distributor.

Retightening the cylinder head

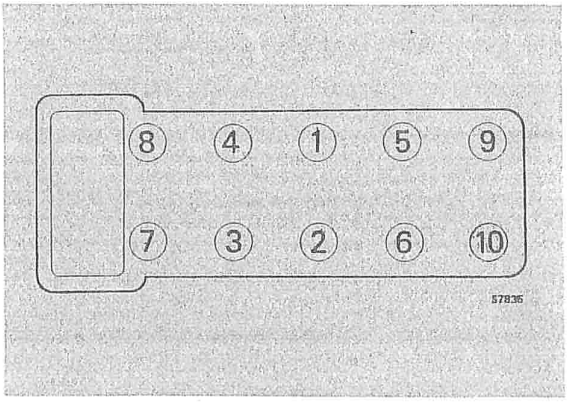
(Applies to bolts 15-mm across flats and Torx M12 bolts.)

The cylinder head bolts must be tightened down at the following times (does not apply to heads fitted with the new, special gasket that eliminates the need for retorquing):

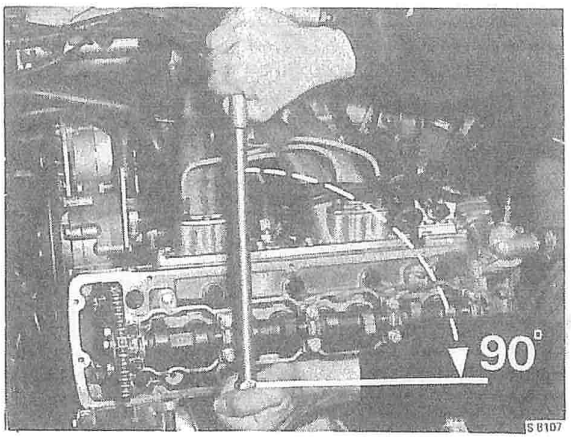
a At the 600-mile (1000-km) Warranty Service.

b After refitting the cylinder head in conjunction with engine overhaul or repair. After fitting the head, run the engine to normal temperature, allow to cool for 30 min and then retighten the head.

1 In the sequence shown, slacken and retorque each bolt to **80 Nm (59 lbf ft).**



2 In the same sequence, tighten the bolts through a further 1/4-turn (90°).



Stage 1 Tightening torque: 80 Nm (59 lbf ft)
Stage 2 Tighten through further 1/4-turn (90°)

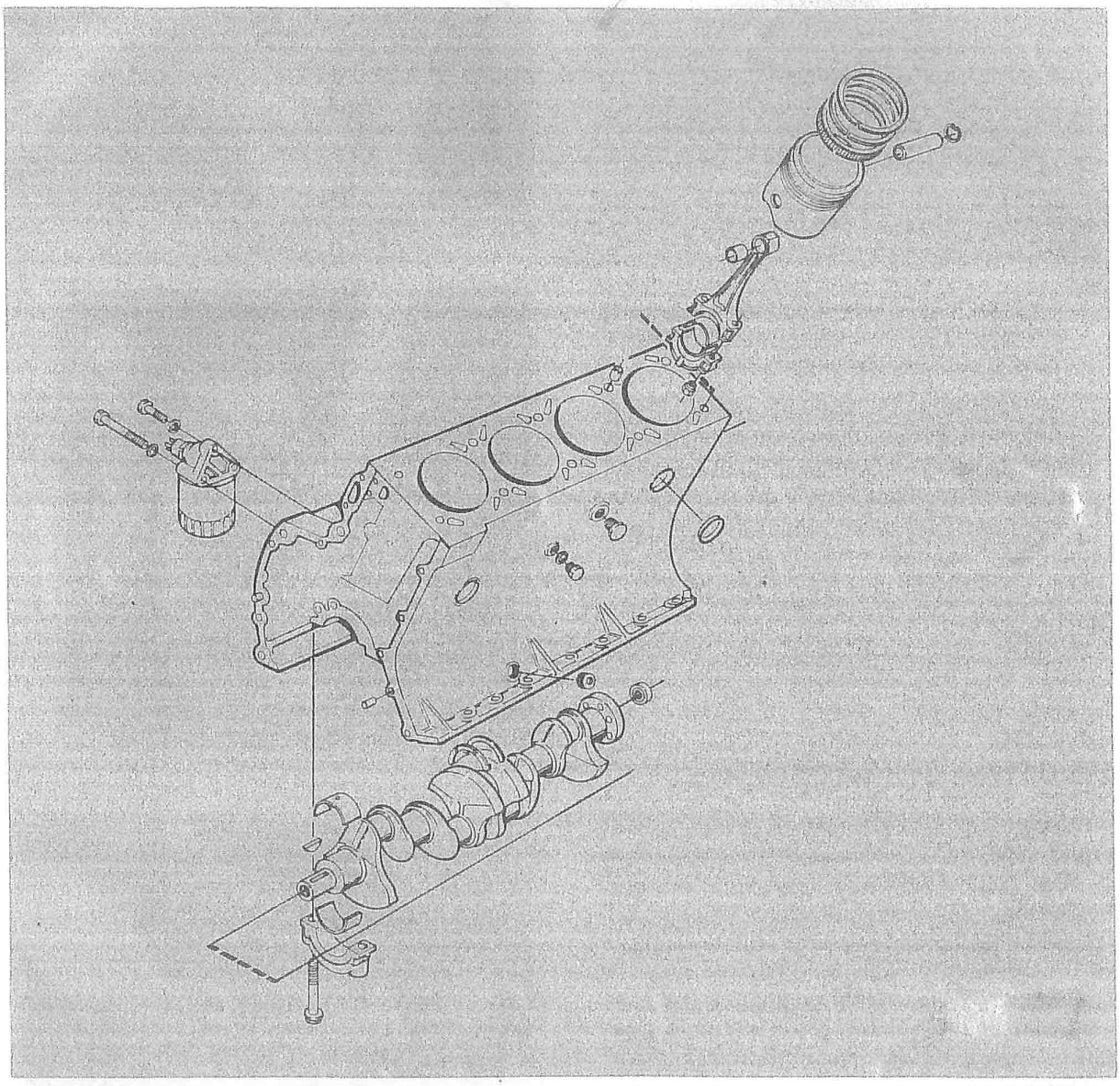
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Pistons, connectingrods and cylinder bores

To replace pistons, piston rings and big-end bearings 212-1

Classification of pistons and bores 212-4



To renew pistons, piston rings and big-end bearings

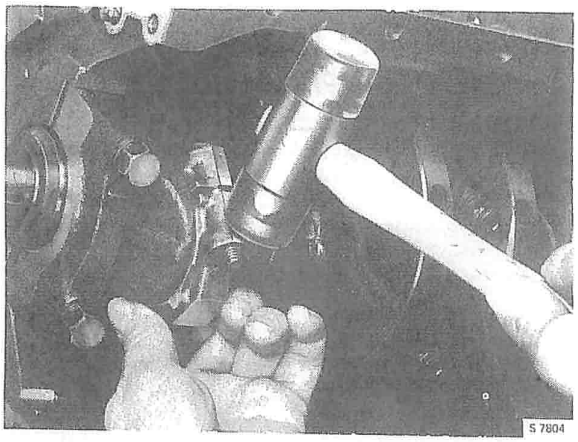
(Engine mounted in workstand, cylinder head removed)

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To remove

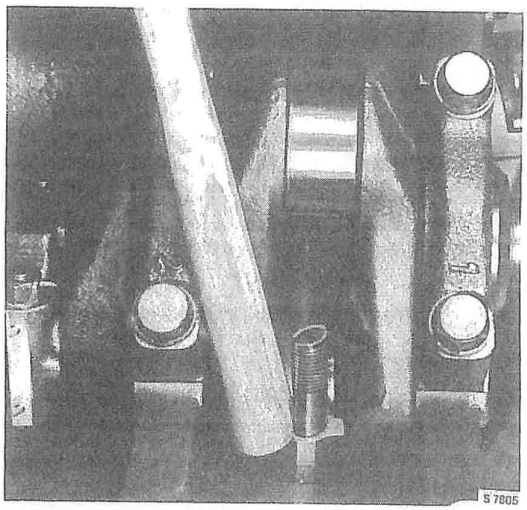
1 Remove any burrs or carbon deposits from the tops of the cylinders.

2 Remove the big-end bearing caps.



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

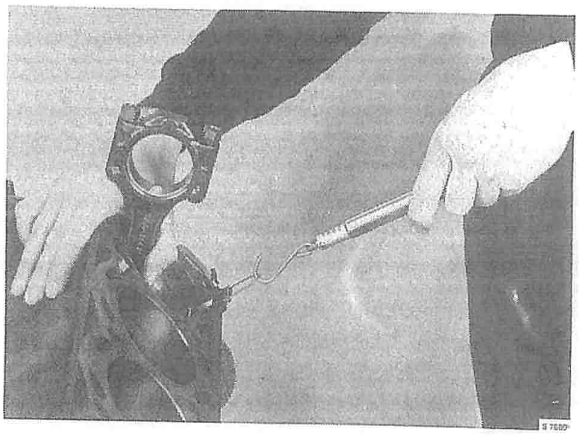
To ensure that the parts are refitted in their original positions, note the markings on the pistons and con necting rods, put the bearing shells and caps back in position on the respective con rods and keep each set separately.



For measurement of bearing clearance, see section 216.

Matching the pistons to the bores

To match pistons to the cylinder bores, use a feeler gauge, 1/2-in wide. To measure, first oil the bore lightly and insert the piston without rings in the bore in which it will be working. Attach the feeler gauge to a spring balance and insert it between the piston and cylinder bore at right angles to the axis of the gudgeon pin. At a tractive force of 8 - 12 N (1.7 - 2.6 lbf), the mean value of the clearance equals the thickness of the feeler gauge.



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Repeat the test with the piston at several different depths. For piston clearances, see the 'Technical data' section.

Spare pistons are stocked in both standard and oversize diameters. Where the latter are used, the cylinder bore must be honed or rebored to obtain the correct piston clearance.

Carry out the matching as follows:

Using a feeler gauge and spring balance, determine which piston (or pistons) has abnormally large clearance. Replace the piston (or pistons) with a piston (or pistons) of the next oversize. Check the piston clearance of the new piston (or pistons), using the feeler gauge and spring balance.

Example of class A cylinder and class A piston

When the piston clearances are measured in the engine by means of a 0.05-mm (0.002-in) feeler gauge, no measurable force is recorded on the spring balance when withdrawing the feeler gauge from no. 2 and no. 3 cylinders.

In no. 1 and no. 4 cylinders, the pistons cannot be fitted into the cylinder bores with a 0.05-mm (0.002-in) or 0.04-mm (0.0016-in) feeler gauge. When the piston is inserted with a 0.03-mm (0.0012-in) feeler gauge, the force necessary to pull out the feeler gauge is 20 N (4.4 lbf) and, with a 0.02-mm (0.0008-in) feeler gauge, 6 N (1.3 lbf). The piston clearance in no. 1 and 4 cylinders is therefore estimated to be 0.032 mm, (0.0013 in), and the pistons in these cylinders need not be replaced.

Since the piston clearance in no. 2 and no. 3 cylinders is greater than 0.05 mm (0.002 in), it is estimated that the diameter in these bores at maximum tolerance is 90.010 mm (3.5437 in); allowing a further + 0.003 mm (0.0001 in) for bedding-in, this gives a bore of 90.013 mm (3.5438 in).

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Assume a standard B piston.

The theoretical piston clearance will then be 0.009 - 0.017 mm (0.0004 - 0.0007 in). Allowing a further 0.02 mm (0.0008 in) for bedding-in, this gives a maximum clearance of 0.037 mm (0.0015 in), which should be sufficient to eliminate unacceptable piston slap. Choose standard B pistons for these bores and check with a feeler gauge

N.B.
Pistons of different makes must not be used in the same engine. The name of the piston manufacturer is cast-in on the inside of the piston. Pistons of the following makes are fitted in production:

Mahle
Karl Schmidt
Hepolite

The weight difference between the various piston classes is negligible.

Classification of Pistons and cylinder bores

The piston class is stamped on the piston crown. The piston classes for service are:

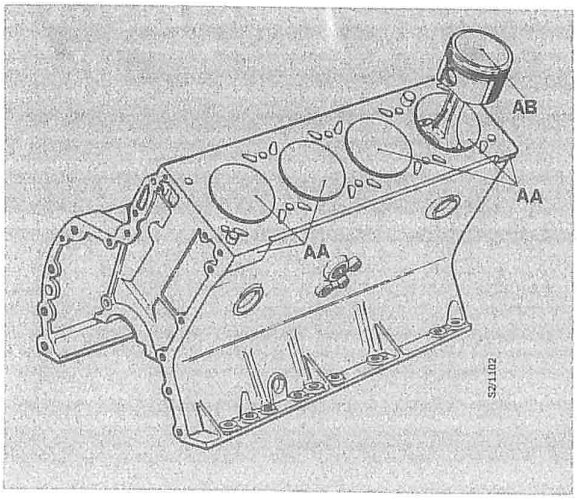
AB

B

C

The cylinder class is stamped on the cylinder plane and is specified for each cylinder.

The cylinder class may be A or B, and both classes may occur in any cylinder block.



Classification of pistons

See "Technical data".

Cylinder block

See "Technical data".

Resulting piston clearances

See "Technical data".

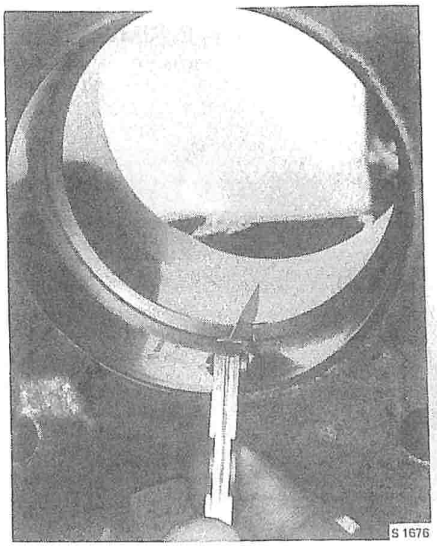
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Matching piston rings to a new or re-bored cylinder

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, as shown. Correct gap sizes are given in the 'Technical data' section. If necessary, widen the gap with a special file.

3 Try the piston rings in their respective grooves by rolling. Measure the clearance at a few points too.



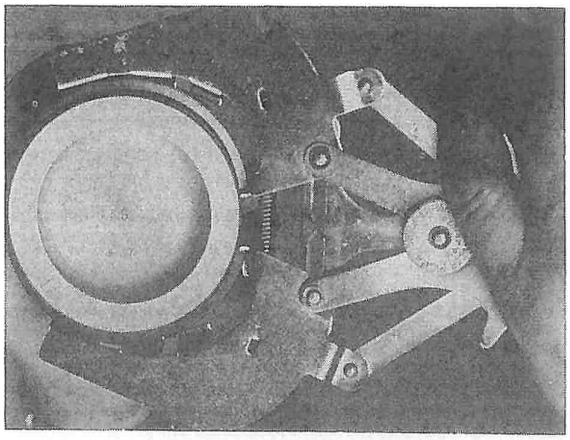
Fitting piston rings in a worn cylinder

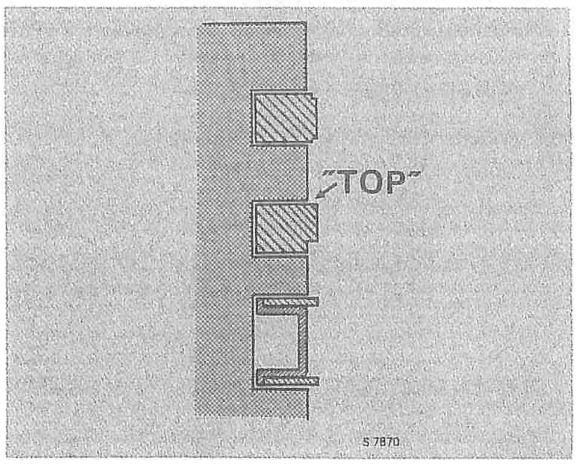
Rings to be fitted in a worn cylinder must be tried at the lower limit of travel of the piston (BDC), as the bore is narrowest at this point.

To fit piston rings to pistons

Use the piston ring clamp (special tool) to fit the rings as shown. The lower compression ring must be fitted with the side marked "TOP" uppermost.

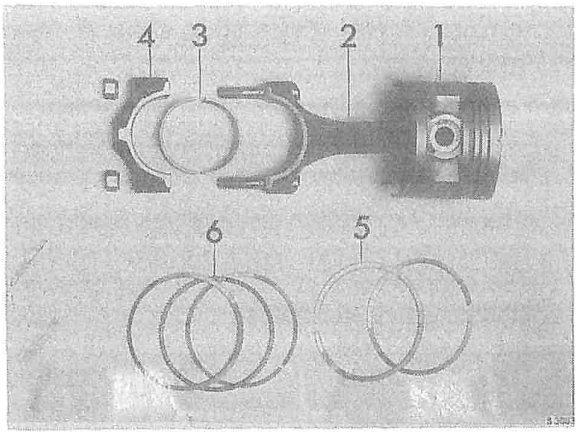
Oil the piston and rings before assembly.





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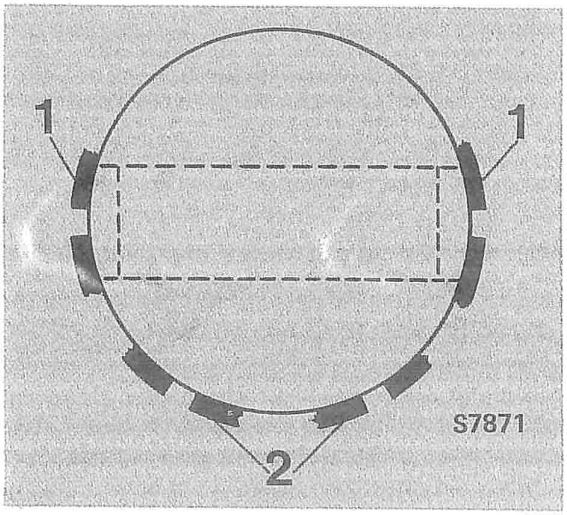
Position the compression rings so that the gaps



Piston and connecting rod with bearings and piston rings

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

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

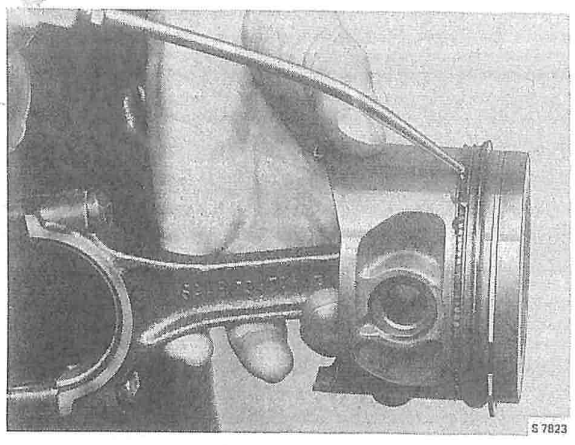


1 Compression rings
2 Scraper ring

To fit the pistons in the bores

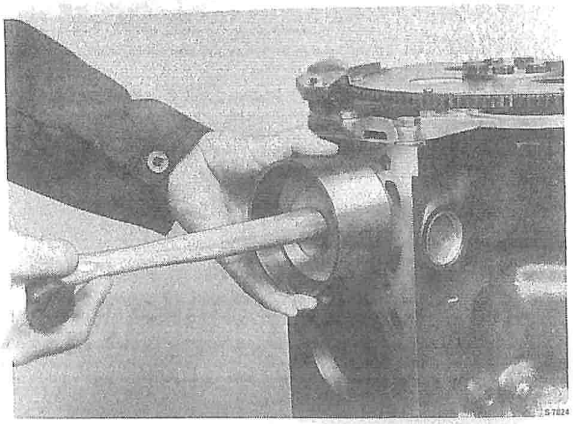
1 Place the bearing shells in position in the connecting rods and fit protective sleeves to the connecting rod studs.

2 Oil the piston rings and bearings.

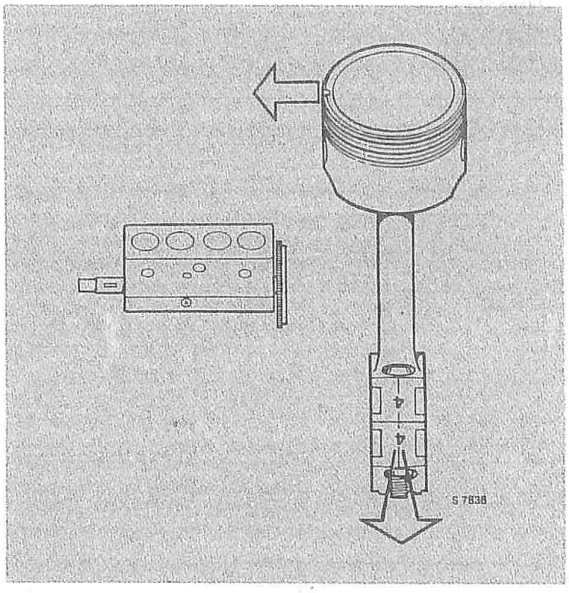


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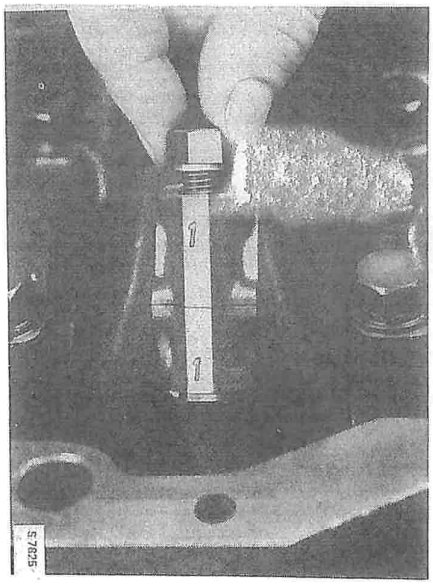
3 Refit the pistons using piston ring compressor 78 62 287.



Ensure that the notch in the piston crown points towards the timing cover and that the numbers on the connecting rod face the exhaust side.

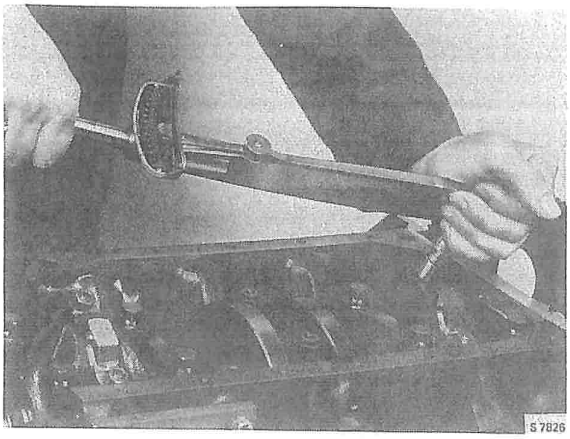


4 Refit the big-end bearing caps with bearing shells (the big-end bearing and big-end bearing cap identifying numbers should coincide). The big-end bearing nuts should be fitted with the flanges towards the connecting rods.



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Tightening torque big-end bearings 55 Nm (40 lbf ft).

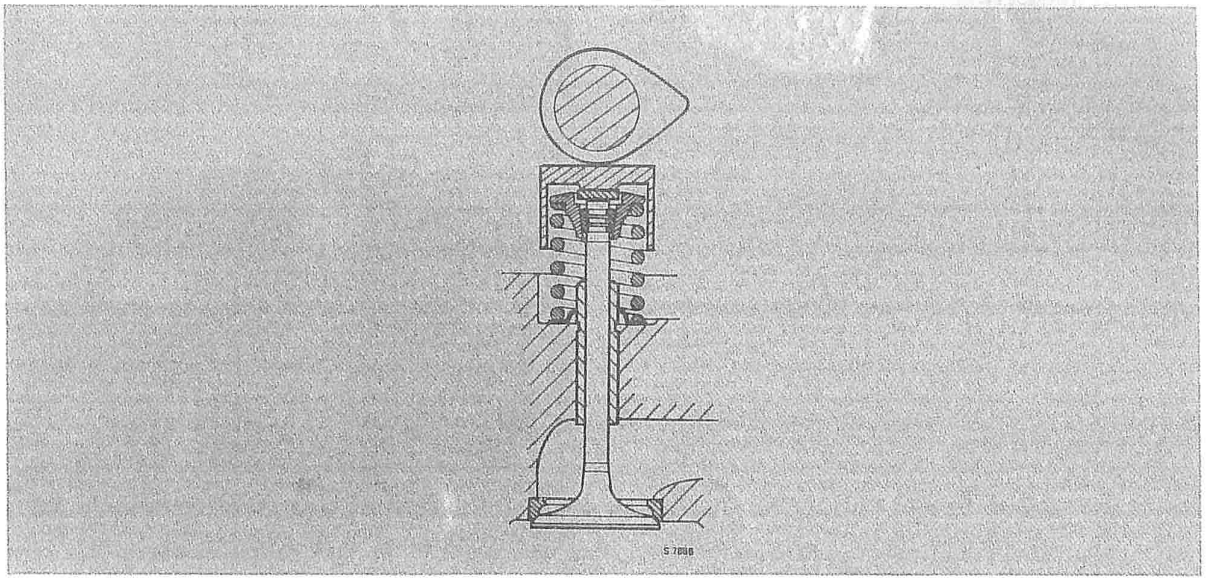


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Valve gear, B201 and B202

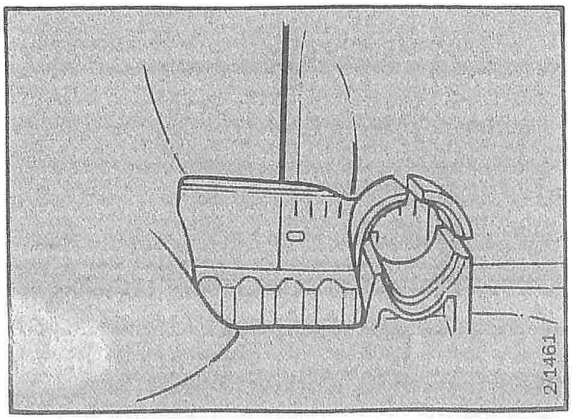
Valve gear, B201 214-1
Valve gear, B202 214-16
Replacing valve guide seals (engine in car) 214-23

Valve gear, B201



To remove the valve cover

1 Rotate the crankshaft to line up the 0° mark with the timing mark (top dead centre for no. 1 and no. 4 cylinders).



2 Disconnect the crankcase ventilation hose.

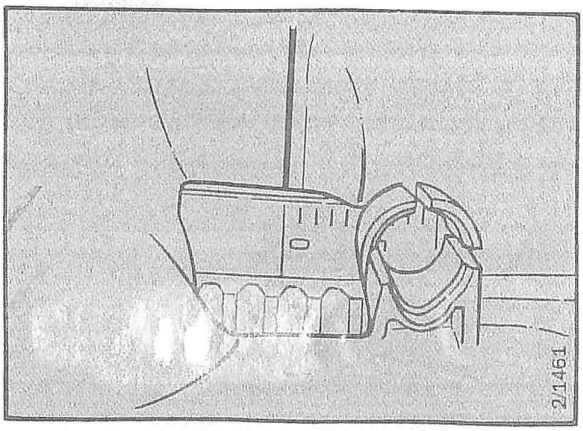
3 Disconnect the HT leads from the spark plugs.

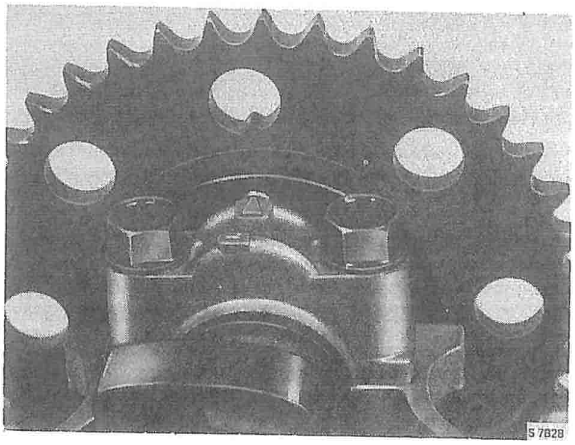
4 Remove the bolts and lift off the cover.

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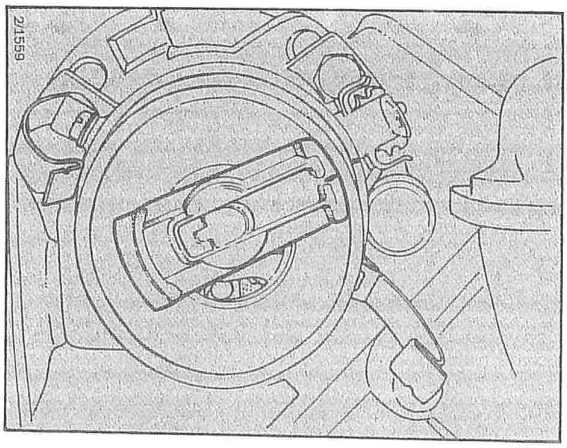
To refit the valve cover

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





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



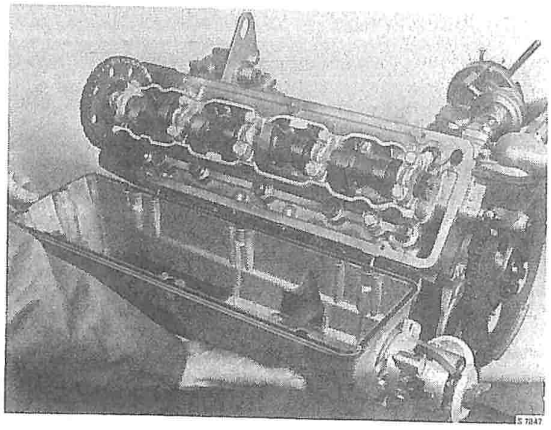
2 Insert the gasket in the groove in the cover.

3 Refit the valve cover.

Tightening torque: 5 Nm (3.7 lbf ft)

4 Refit the distributor cap and HT leads.

5 Refit the crankcase ventilation hose.

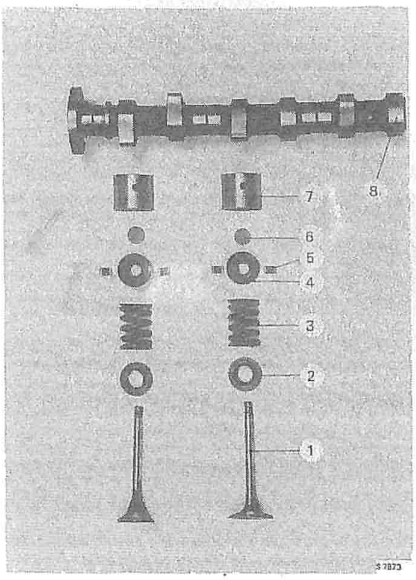


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To remove the valves

(Cylinder head removed)

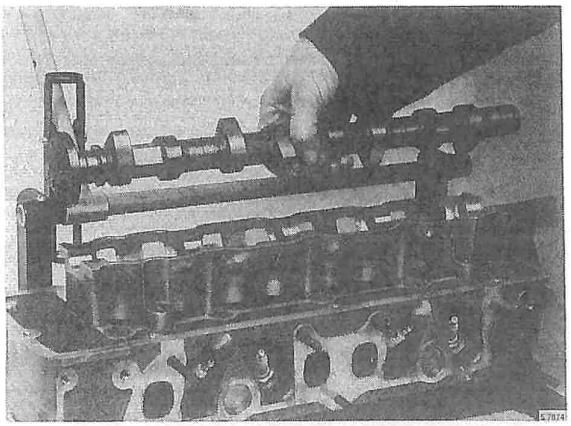
1 Remove the camshaft bearing caps.



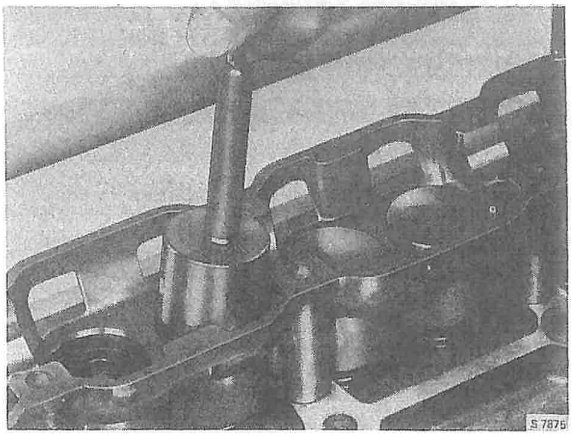
Valve gear

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

2 Lift off the camshaft.

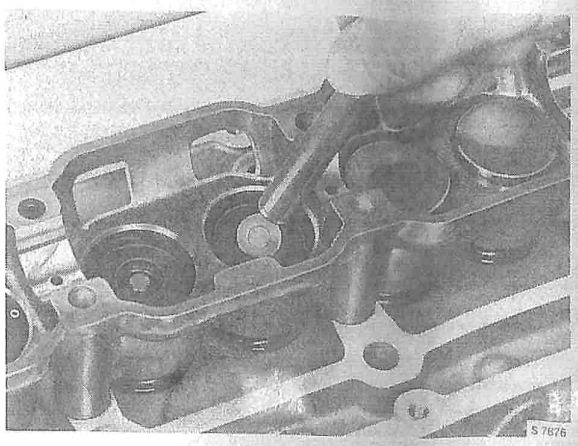


3 Use the magnetic tool to extract the cam followers and store them in the correct sequence.

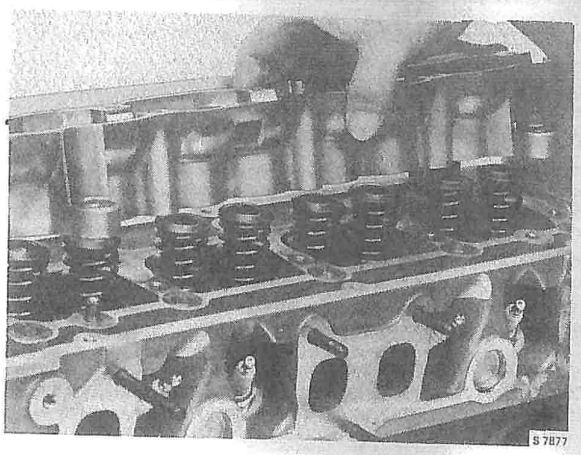


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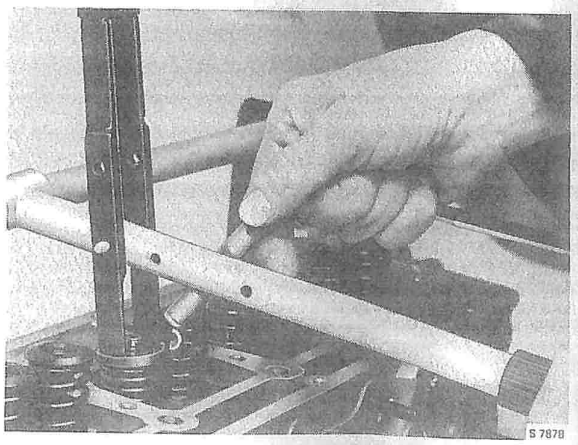
4 Remove the adjusting pallets. Store them carefully in sequence.



5 Remove the camshaft carrier assembly.



Mount the cylinder head in fixture 83 93 050.



6 a Compress the valve springs.

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

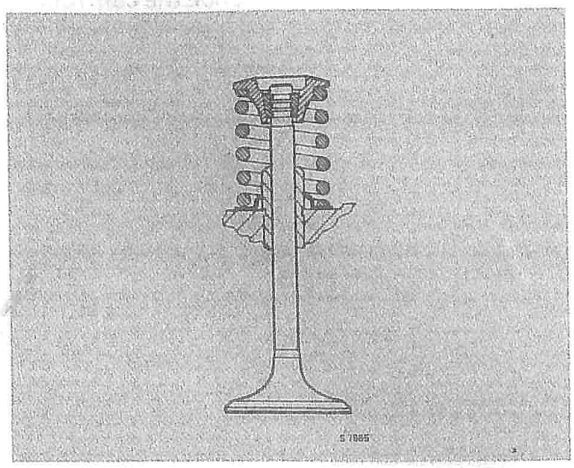
7 Remove the valve spring retainer, valve spring and valve spring seat.

8 Withdraw the valve.

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To refit

1 Oil the valve stems and refit the valves.



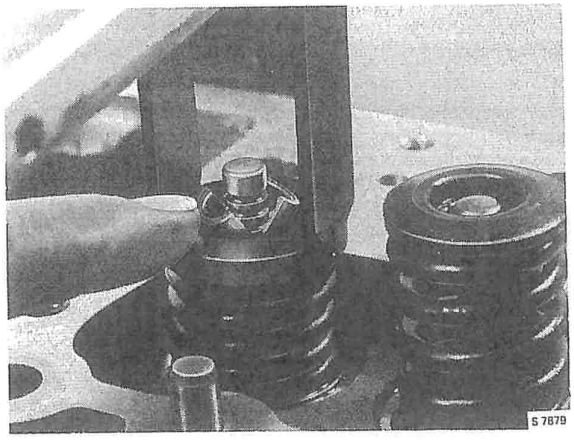
2 Refit the valve spring seats.

3 Refit the valve springs and the valve spring retainers.

4 Compress the valve springs using the valve spring compressor and refit the collets.

Release the valve spring compressor and check that the collets are correctly positioned round the valve stem.

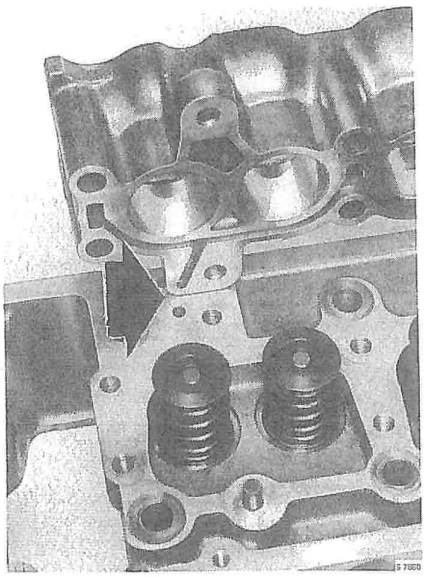
Remove the tool.



5 Refit the camshaft carrier assembly.

N.B.
Ensure that the feeler gauge apertures face the inlet side. Incorrect installation of the camshaft carrier assembly cuts off lubrication to the valve gear.

6 Refit the adjusting pallets in their original positions.



Fit the carrier assembly, with the oilway in the carrier in line with that in the head.

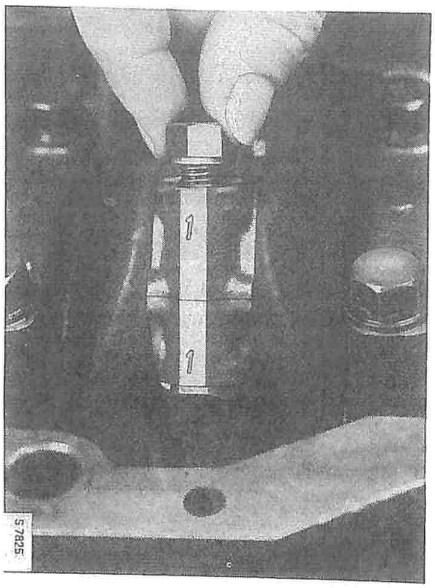
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N.B.
Do not tilt the cylinder head once the cam followers have been refitted. Moving the head can cause the cam followers and adjusting pallets to fall out.

7 Apply a thin coat of engine oil to the cam followers and refit them.

8 Refit the camshaft.

9 Refit the bearing caps, with the numbers in line.



Tightening torque B201: 18 Nm (13.3 lbf ft)
B202: 15 Nm (11 lbf ft)

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Scrapping sodium-filled exhaust valves

Caution

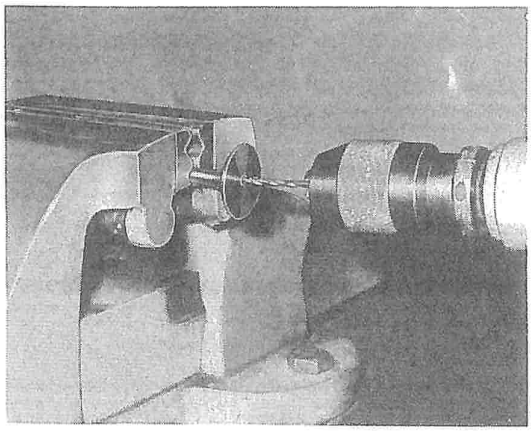
Discarded sodium-filled valves should never under any circumstances be mixed with normal scrap as they are liable to explode when melted down.

When drilling, cutting or in any way releasing the sodium filling, keep away from water to avoid explosions.

Sodium-filled exhaust valves are fitted in injection engines.

Before scrapping the valves, render them safe as follows:

1 Drill a hole in the centre of the valve head until contact is made with the sodium filling.



2 Drill a second hole in the valve stem or cut off approx. 25 mm (an inch) from the end of the stem.

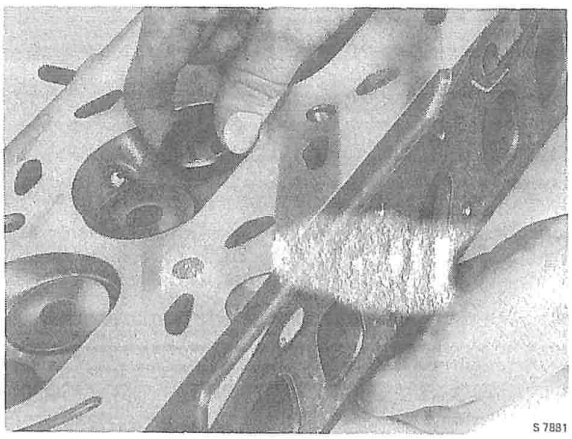
3 Throw the valve into a bucket of water, whereupon a powerful explosive reaction will occur. The manufacturer recommends 3 m (3.5 yards) as the minimum safety distance. After a minute or two the reaction will die down and the valve may now be scrapped in the normal way.

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Valve guides

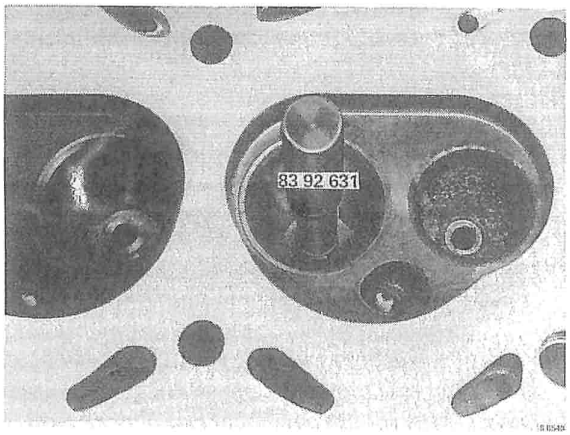
To check for wear

Raise the valve 3 mm (0.12 in) from its seat and check the radial play by rocking the valve head. If the play at the head exceeds 0.5 mm (0.02 in) replace the valve guide.



To remove

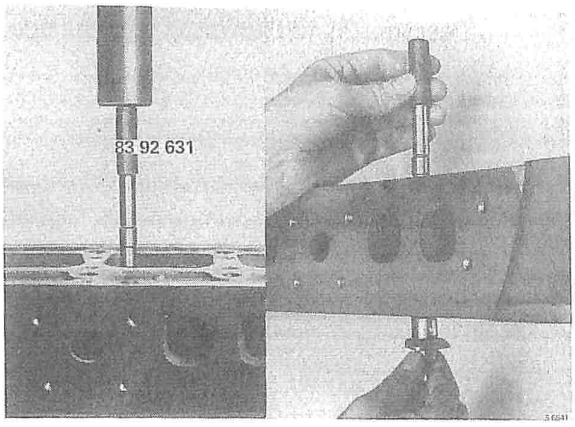
Before removing the valve guide, flush the cylinder head with hot water. Press out the guide using tool 83 92 631.



To fit

Insert the guide using a press and valve guide tool 83 92 631. Insert the 0.02-in drift from the underside of the head and press in the guide from above using the drift. In the final stages the valve guide tool springs to one side, allowing the valve guide to be located in its proper position.

Finish the guide by reaming with tool 83 92 268.

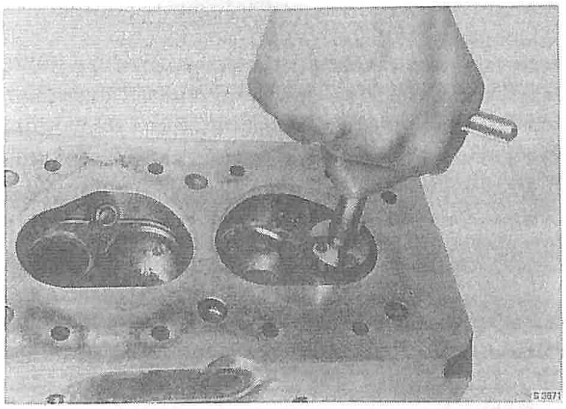


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Recutting valve seats

Clean all parts and remove all traces of carbon and dirt from the valves and ports.

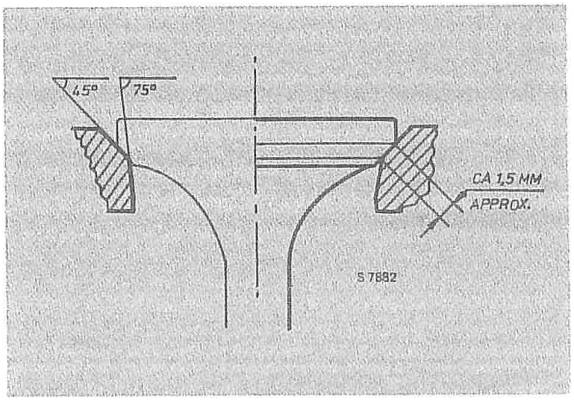
Insert the cutter pilot in the valve guide and tighten the bolt until the pilot is secured in the guide.



The valve seats in the cylinder head should be recut with a 45° cutter. It may be necessary to use an emery cloth first to remove the hard deposits on the surface of the exhaust valve seats. After recutting, the valve seat may be too wide, and will often need to be narrowed down.

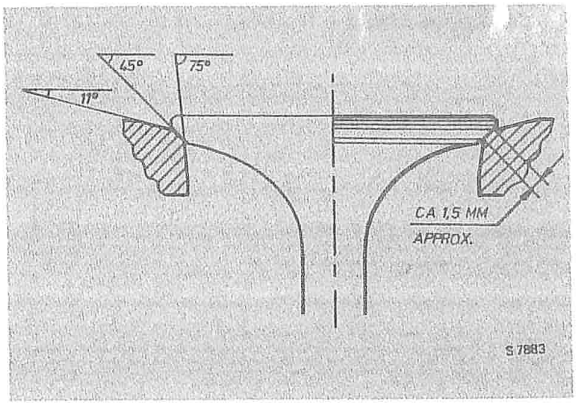
N.B.
Valves with valve-seat inserts cannot be recut, as the cutter may snag in the insert (carburettor engines).

Exhaust valve seats must be narrowed down from underneath using a 75° cutter. The contact surface of the valve should extend to the edge of the head.



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

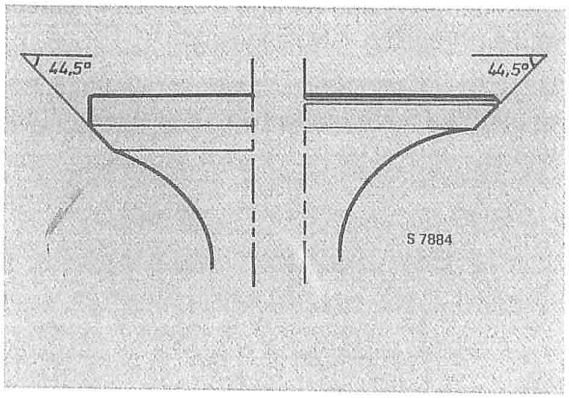
Engineers' marker can be used to check the finished seat dimension, which should be approx. 1.5 mm (0.06 in) for both inlet and exhaust valve seats.



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To grind in valves

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



Place a small amount of valve grinding paste evenly round the valve seat and insert the valve. Rotate the valve by means of the tool, using light pressure. Remove the valve, clean away all grinding dust and check for a good seal using engineers' marker. Repeat the procedure as required and, if necessary, recut the valve seats.

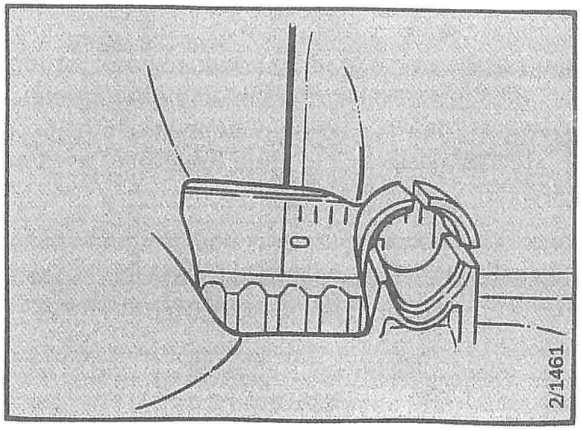
N.B.
The exhaust valve seats are stellited and not suitable for machine grinding. Lapping is the only method recommended.

Valve clearance

General

The valve clearances do not vary and adjustment under normal conditions is only required after long periods or when work has been performed on the valves. However, the valve clearance should be checked in accordance with the Service Programme.

1 Rotate the crankshaft to line up the 0° mark with the timing mark. Use key 83 92 185 on the pulley bolt.



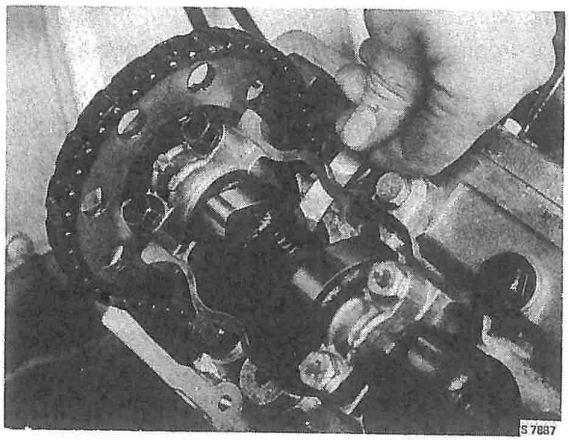
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2 Remove the valve cover.

N.B.
Because of the design of the slot for the distributor dog, No. 1 cylinder must be at top dead centre for the valve cover to be removed.

3a Rotate the crankshaft until the cam lobe for the valve to be measured is at 180° to the valve stem.

b Check the valve clearance with the feeler gauge. (See the 'Technical data' section for the specified values.)



4 Rotate the crankshaft to TDC on the compression stroke for No. 1 cylinder and fit the valve cover.

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To measure and adjust

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

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

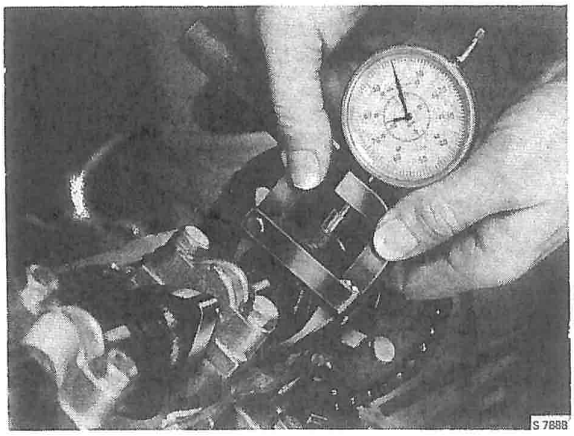
Adjustments in valve clearances are made by fitting adjusting pallets of different thicknesses.

Measurement and adjustment are performed as follows:

1 Position the cam lobe at 180° to the valve stem.

2 Set up measuring tool 83 91 450 and the dial indicator and clamp the three jaws onto the cam follower. Position the point of the plunger on the top of the cam lobe and set the dial to zero.

3 Using the measuring tool, lift the cam follower and read off the valve clearance on the dial. Note the reading.



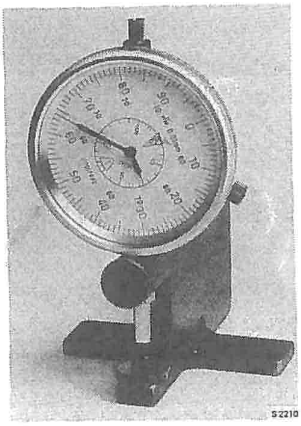
4 Measure and note the clearances of all valves in the same way. Adjust the clearance of any valve which does not lie within the following limits:

Inlet valves:	0.20 - 0.25 mm (0.008 - 0.010 in)
Exhaust valves:	0.40 - 0.45 mm (0.016 - 0.018 in)
Exhaust valves (Turbo):	0.45 - 0.50 mm (0.018 - 0.020 in)

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5 Remove the camshaft, cam followers adjusting pallets of the valves requiring adjustment.

6 Measure and note the thickness of the pallets using tool 83 91 633 or a micrometer. This thickness plus the valve clearance equals the total distance between the cam follower and the cam.



Example

Valve clearance measured:	0.13 mm (0.005 in)
Pallet thickness measured:	2.54 mm (0.100 in)
Total distance:	2.67 mm (0.105 in)

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

Example

Total distance:	2.67 mm (0.105 in)
Less specified inlet valve clearance:	- 0.23 mm (0.009 in)
= Pallet thickness required:	2.44 mm (0.096 in)

Select an adjusting pallet: 2.43 mm (0.096 in)

7 Fit the new adjusting pallet and refit the cam follower and the camshaft.

8 Repeat the measuring procedure to check that the clearances are now correct.

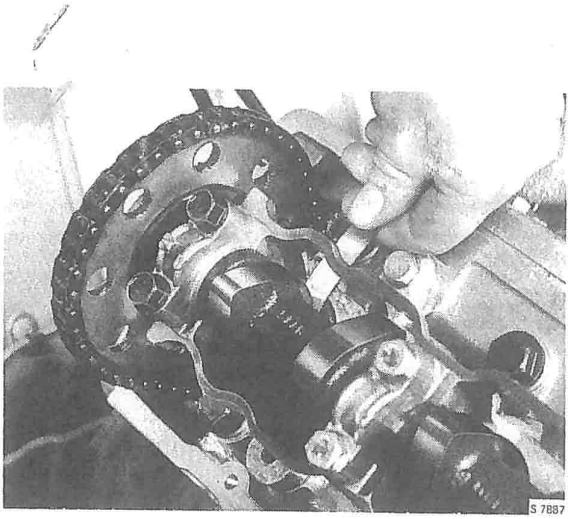
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To measure and adjust valve clearance after work on valves

1 Fit the thinnest adjusting pallets (1.77 mm or 0.07 in).

2 Refit the cam followers and camshaft.

3 Measure the clearances for each valve and calculate the total distance between the cam and the cam follower.

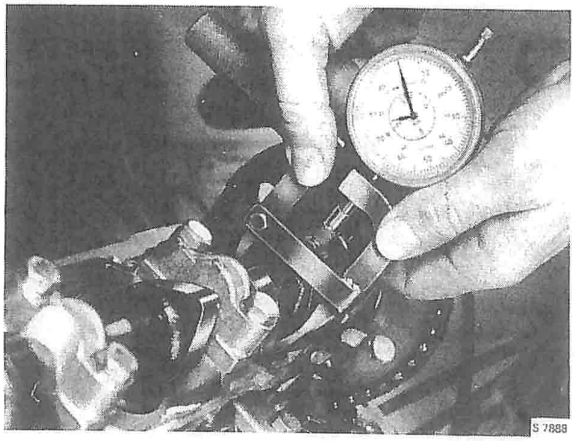

S 7887

4 Select the adjusting pallets required to give the correct clearance.

5 Remove the camshaft and cam followers, extract the adjusting pallets (1.77 mm or 0.07 in) and fit the new pallets.

6 Refit the cam followers and camshaft.

7 Use the dial indicator to check the valve clearance. Use the following table to simplify calculating the thickness of the adjusting pallets.


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Valve clearance measured with dial indicator (mm)	Pallet thickness measured: Inlet, mm	Exhaust (standard) mm	Exhaust (Turbo) mm
0.00	2,64 2,59 2,54 2,48 2,43 2,38 2,33 2,28 2,23 2,18 2,13 2,08 2,03 1,98 1,93 1,88 1,82 1,77		
0,02	2,69 2,64 2,59 2,54 2,48 2,43 2,38 2,33 2,28 2,23 2,18 2,13 2,08 2,03 1,98 1,93 1,88 1,82 1,77		
0,05	2,69 2,64 2,59 2,54 2,48 2,43 2,38 2,33 2,28 2,23 2,18 2,13 2,08 2,03 1,98 1,93 1,88 1,82 1,77		
0,07	2,74 2,69 2,64 2,59 2,54 2,48 2,43 2,38 2,33 2,28 2,23 2,18 2,13 2,08 2,03 1,98 1,93 1,88 1,82 1,77		
0,10	2,74 2,69 2,64 2,59 2,54 2,48 2,43 2,38 2,33 2,28 2,23 2,18 2,13 2,08 2,03 1,98 1,93 1,88 1,82 1,77		
0,12	2,79 2,74 2,69 2,64 2,59 2,54 2,48 2,43 2,38 2,33 2,28 2,23 2,18 2,13 2,08 2,03 1,98 1,93 1,88 1,82 1,77		
0,15	2,79 2,74 2,69 2,64 2,59 2,54 2,48 2,43 2,38 2,33 2,28 2,23 2,18 2,13 2,08 2,03 1,98 1,93 1,88 1,82 1,77		
0,17	2,84 2,79 2,74 2,69 2,64 2,59 2,54 2,48 2,43 2,38 2,33 2,28 2,23 2,18 2,13 2,08 2,03 1,98 1,93 1,88 1,82 1,77		
0,20	2,84 2,79 2,74 2,69 2,64 2,59 2,54 2,48 2,43 2,38 2,33 2,28 2,23 2,18 2,13 2,08 2,03 1,98 1,93 1,88 1,82 1,77		
0,22	2,89 2,84 2,79 2,74 2,69 2,64 2,59 2,54 2,48 2,43 2,38 2,33 2,28 2,23 2,18 2,13 2,08 2,03 1,98 1,93 1,88 1,82 1,77		
0,25	2,89 2,84 2,79 2,74 2,69 2,64 2,59 2,54 2,48 2,43 2,38 2,33 2,28 2,23 2,18 2,13 2,08 2,03 1,98 1,93 1,88 1,82 1,77		
0,27	2,89 2,84 2,79 2,74 2,69 2,64 2,59 2,54 2,48 2,43 2,38 2,33 2,28 2,23 2,18 2,13 2,08 2,03 1,98 1,93 1,88 1,82 1,77		
0,30	2,89 2,84 2,79 2,74 2,69 2,64 2,59 2,54 2,48 2,43 2,38 2,33 2,28 2,23 2,18 2,13 2,08 2,03 1,98 1,93 1,88 1,82 1,77		
0,32	2,89 2,84 2,79 2,74 2,69 2,64 2,59 2,54 2,48 2,43 2,38 2,33 2,28 2,23 2,18 2,13 2,08 2,03 1,98 1,93 1,88 1,82 1,77		
0,35	2,89 2,84 2,79 2,74 2,69 2,64 2,59 2,54 2,48 2,43 2,38 2,33 2,28 2,23 2,18 2,13 2,08 2,03 1,98 1,93 1,88 1,82 1,77		
0,37	2,89 2,84 2,79 2,74 2,69 2,64 2,59 2,54 2,48 2,43 2,38 2,33 2,28 2,23 2,18 2,13 2,08 2,03 1,98 1,93 1,88 1,82 1,77		
0,40	2,89 2,84 2,79 2,74 2,69 2,64 2,59 2,54 2,48 2,43 2,38 2,33 2,28 2,23 2,18 2,13 2,08 2,03 1,98 1,93 1,88 1,82 1,77		
0,42	2,89 2,84 2,79 2,74 2,69 2,64 2,59 2,54 2,48 2,43 2,38 2,33 2,28 2,23 2,18 2,13 2,08 2,03 1,98 1,93 1,88 1,82 1,77		
0,45	2,89 2,84 2,79 2,74 2,69 2,64 2,59 2,54 2,48 2,43 2,38 2,33 2,28 2,23 2,18 2,13 2,08 2,03 1,98 1,93 1,88 1,82 1,77		
0,47	2,89 2,84 2,79 2,74 2,69 2,64 2,59 2,54 2,48 2,43 2,38 2,33 2,28 2,23 2,18 2,13 2,08 2,03 1,98 1,93 1,88 1,82 1,77		
0,50	2,89 2,84 2,79 2,74 2,69 2,64 2,59 2,54 2,48 2,43 2,38 2,33 2,28 2,23 2,18 2,13 2,08 2,03 1,98 1,93 1,88 1,82 1,77		
0,52	2,89 2,84 2,79 2,74 2,69 2,64 2,59 2,54 2,48 2,43 2,38 2,33 2,28 2,23 2,18 2,13 2,08 2,03 1,98 1,93 1,88 1,82 1,77		
0,55	2,89 2,84 2,79 2,74 2,69 2,64 2,59 2,54 2,48 2,43 2,38 2,33 2,28 2,23 2,18 2,13 2,08 2,03 1,98 1,93 1,88 1,82 1,77		
0,57	2,89 2,84 2,79 2,74 2,69 2,64 2,59 2,54 2,48 2,43 2,38 2,33 2,28 2,23 2,18 2,13 2,08 2,03 1,98 1,93 1,88 1,82 1,77		
0,60	2,89 2,84 2,79 2,74 2,69 2,64 2,59 2,54 2,48 2,43 2,38 2,33 2,28 2,23 2,18 2,13 2,08 2,03 1,98 1,93 1,88 1,82 1,77		
0,62	2,89 2,84 2,79 2,74 2,69 2,64 2,59 2,54 2,48 2,43 2,38 2,33 2,28 2,23 2,18 2,13 2,08 2,03 1,98 1,93 1,88 1,82 1,77		
0,65	2,89 2,84 2,79 2,74 2,69 2,64 2,59 2,54 2,48 2,43 2,38 2,33 2,28 2,23 2,18 2,13 2,08 2,03 1,98 1,93 1,88 1,82 1,77		
0,68	2,89 2,84 2,79 2,74 2,69 2,64 2,59 2,54 2,48 2,43 2,38 2,33 2,28 2,23 2,18 2,13 2,08 2,03 1,98 1,93 1,88 1,82 1,77		
0,70	2,89 2,84 2,79 2,74 2,69 2,64 2,59 2,54 2,48 2,43 2,38 2,33 2,28 2,23 2,18 2,13 2,08 2,03 1,98 1,93 1,88 1,82 1,77		
0,72	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		

for use

The following example illustrates how the table is used:

The inlet valve clearance is 0.13 mm and therefore needs adjusting.

The pallet thickness measured for this pallet is 2.54 mm.

Find the figure on the vertical axis which is closest to the clearance measured (in this case: 0.12 mm).

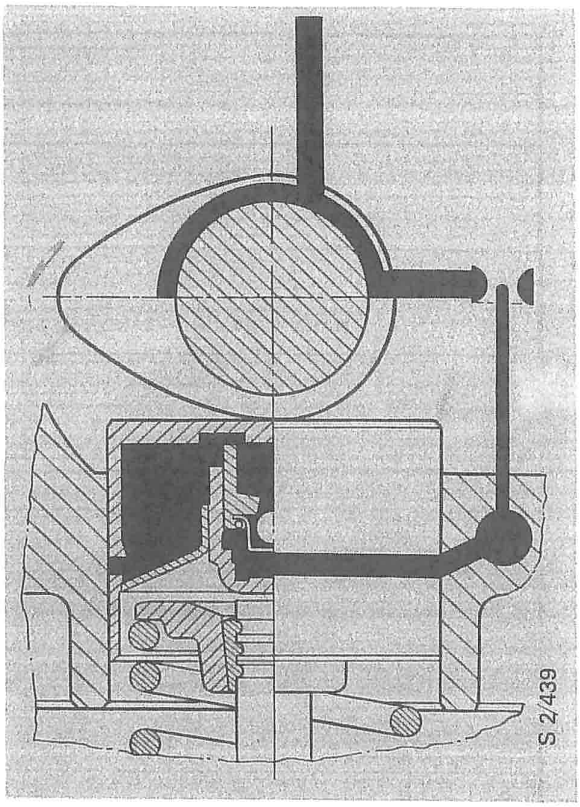
Follow the line across until it coincides with the column for the (inlet valve) pallet thickness measured, viz. 2.54 mm.

Thus, the pallet thickness required in this example is 2.43 mm.

Valve gear, B202

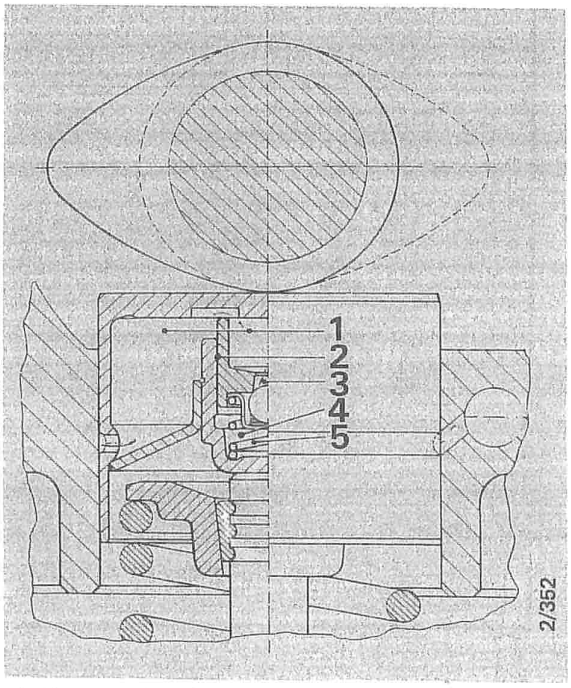
General

The valve gear incorporates hydraulic cam followers, which keep the valve clearance within a limited working range of 2.05 mm (0.081 in). This range lies between 18.75 and 20.8 mm (0.738 -0.819 in) from the camshaft to the end of the valve stem.



Oil flow through the cam follower

Each cam follower has two storage chambers and one high-pressure chamber. The opening of the port between the high-pressure chamber and the adjacent storage chamber is controlled by a spring-loaded ball valve. A return spring in the high-pressure chamber acts on the sliding piston, to eliminate any clearance between the cam follower and the cam. At the same time, the high-pressure chamber expands and makes up the oil volume, to compensate for leakage losses occurring at actuating pressure in the passage between the piston and the cylinder.



1 Storage chamber
2 Leakage passage
3 Check valve
4 High-pressure chamber
5 Spring

The hydraulic cam followers are sealed units; if defective, they cannot be repaired but must be replaced. Under various conditions, the hydraulic cam followers may give rise to a tapping or chattering noise. In most cases, the noise will be short-lived and remedial action will not required. The following list details the commonest times that chatter is likely to be heard and what initial action, if any, should be taken to eradicate it.

1 Valve chatter on starting the engine after an oil change.
If the noise from the valves did not occur before the oil change, the noise will disappear of its own accord as soon as the oil in the engine has reached normal working pressure.

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2 Initial noise on starting a cold engine.
This noise is perfectly normal and will disappear of its own accord as soon as the oil in the engine has reached normal working pressure.

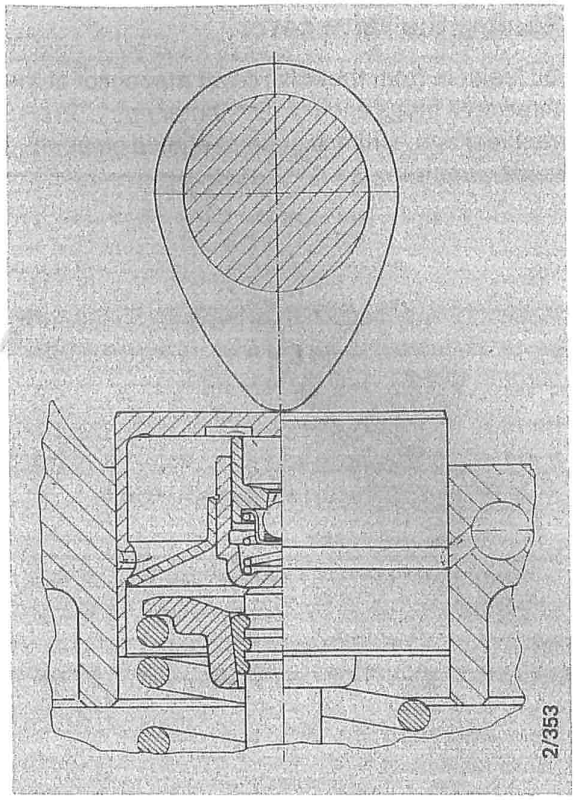
3 Valve chatter on starting after work on the car that has involved cranking the engine by hand or on the starter motor.
The noise is due to one or more of the cam followers having been drained of oil and will therefore disappear after the engine has been running for a while. At worst, it may take fifteen minutes at between 2000 and 3000 rpm for the noise to disappear. At lower engine speeds, it will obviously take considerably longer to expel the air. Do not run the engine at a speed greater than 3000 rpm as this may damage the cam followers.

4 Noise after fitting new cam followers.
Same cause as item 3 above.

5 Noise occurring after a short period of idling with a hot engine (hot oil).
If the engine is run at 1500 rpm or more, the noise will disappear after a while.
The noise is due to low oil pressure in the hydraulic cam followers when the engine is idling. Check the oil feed pipe, connectors and 'O' rings for leaks.

6 Noise occurring at high engine speeds and disappearing after the engine has been left idling for some time.
This noise is due to an excessive amount of air in the oil at high engine speeds. The ingress of air is caused by leakage on the suction side of the oil pump, a poorly sealing 'O' ring in the suction pipe or a leak in the suction pipe caused, for instance, by a porous weld.

7 Noise from an individual cam follower regardless of how the car is being driven.
The most likely cause is that a particle of dirt has become trapped in the check valve for the cam follower. Fit a new cam follower. The defective cam follower (or followers) can be identified most readily by switching off the engine, removing the valve cover and using a screwdriver to depress the cam followers while they are at rest. If the follower feels light or spongy, it is defective.



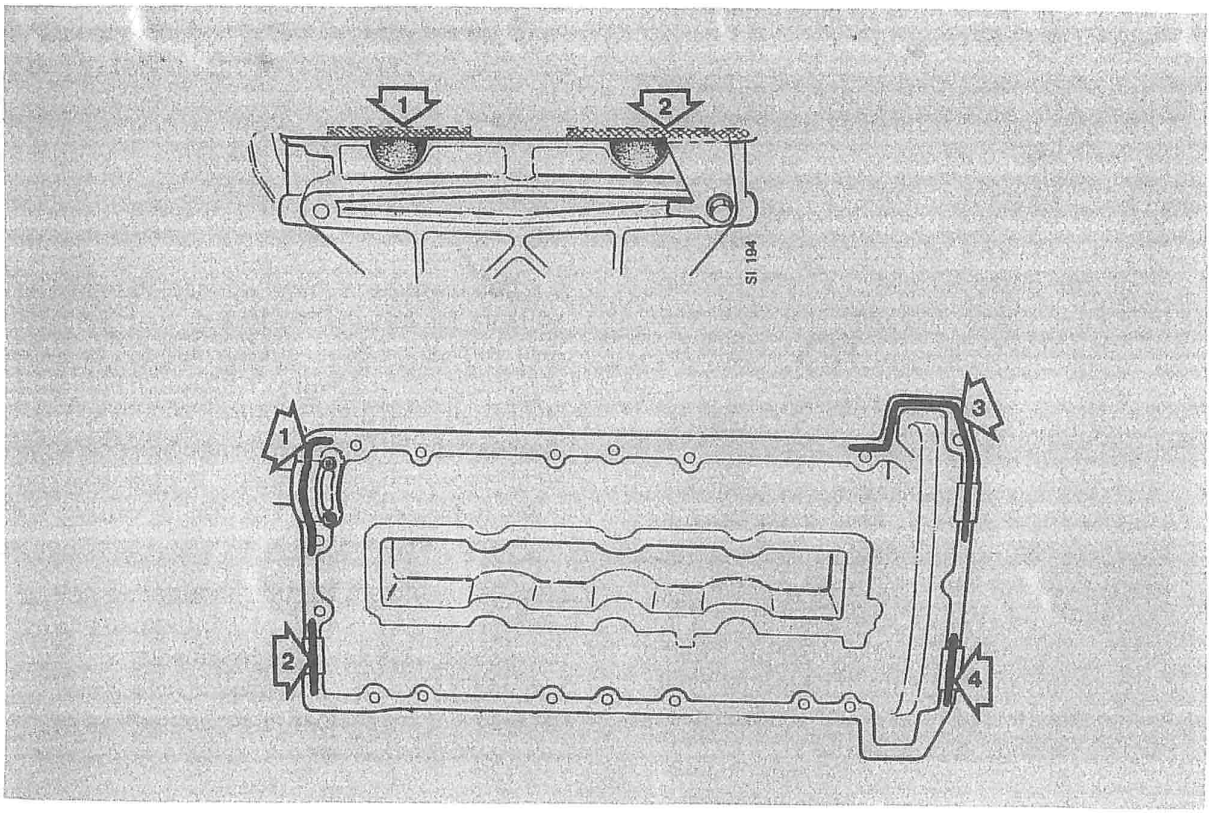
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Sealing the valve cover

Oil leakage from the valve cover may occur at the three split plugs and the distributor entry. To prevent leakage, silicone sealant should be applied at these points.

If leaks have occurred or whenever the valve cover is removed, apply Bostik Silicone 2680 sealant to the cylinder head flange.

Remove all traces of old sealant and then apply a bead of the new sealant, approx. 4.5 mm (0.2 in) thick to the cylinder head flange.

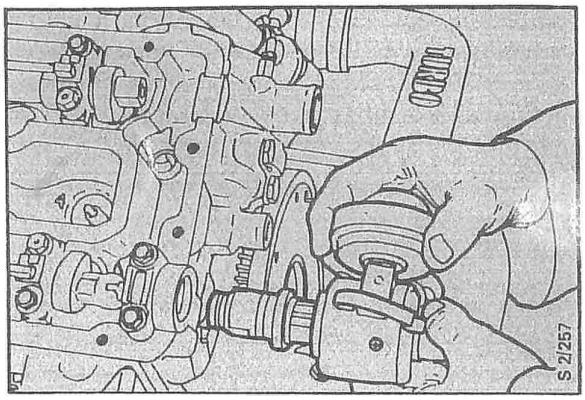


Apply sealant at these points

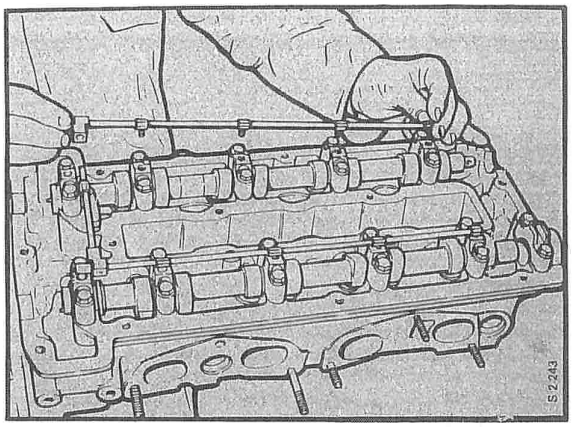
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To dismantle the valve gear (cylinder head removed from car)

1 Remove the distributor.



2 Remove the oil pipes and the camshaft bearing caps and lift out the camshafts.



N.B.
Do not twist the pipes when removing them as this is liable to damage the contact surfaces between the pipes and fittings.

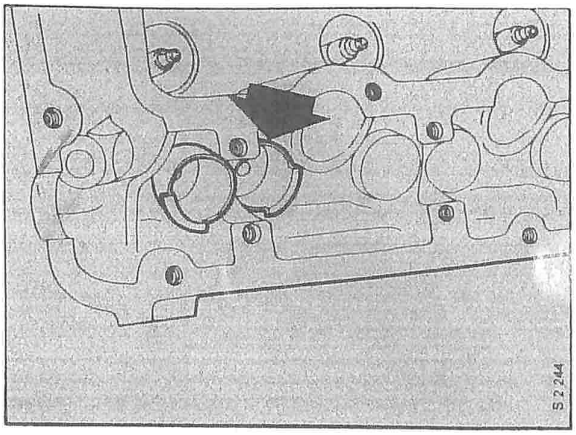
3 Remove the cam followers and place them in stand 83 93 787 to ensure they will not be confused when refitted.

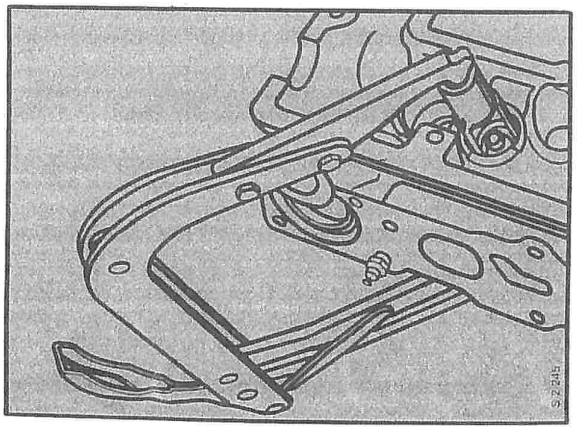
4 Remove the valves. Place the valves in stand 83 93 787 to ensure they will not be confused when refitted.

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N.B.

The cylindrical tappet guides around the valve springs constitute the sealing surfaces for the cam followers. These surfaces must not be scratched or scored, so use a plastic sleeve to protect the guides. Use the special valve spring compressor, 83 93 761, and special anvil 83 93 779. Withdraw the plastic sleeve by inserting the special angled tool under the reinforced edge.

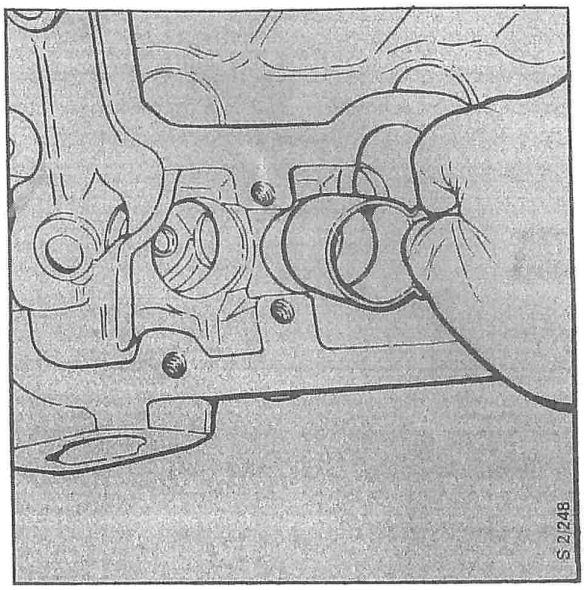




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Assembling the valve gear

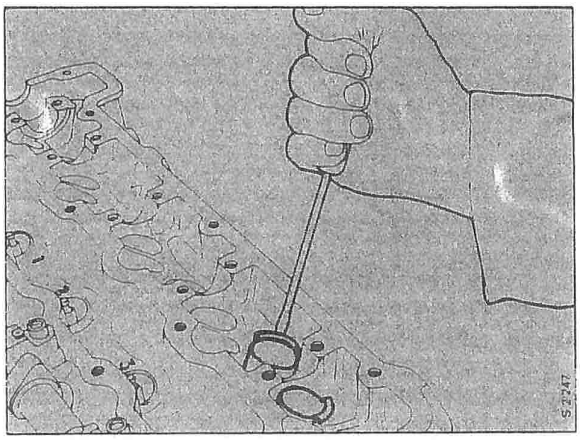
1 Fit the valves and springs. Use plastic sleeves to protect the tappet guides.



N.B.
Prior to assembly, thoroughly lubricate all the parts. Replace any defective valve stem seals before fitting the valves.

2 Check the valve adjustment, following the procedure described in this section.

3 Fit the cam followers.

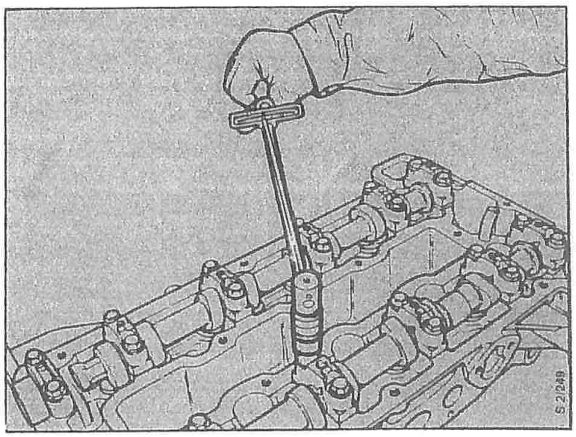


N.B.
Stand the cylinder head on wooden blocks to avoid bending the valves as the camshafts are tightened down.

4 Fit the camshafts and bearing caps.
Bearing cap markings:
1 - 5 = Inlet-valve camshaft
6 - 10 = Exhaust-valve camshaft.

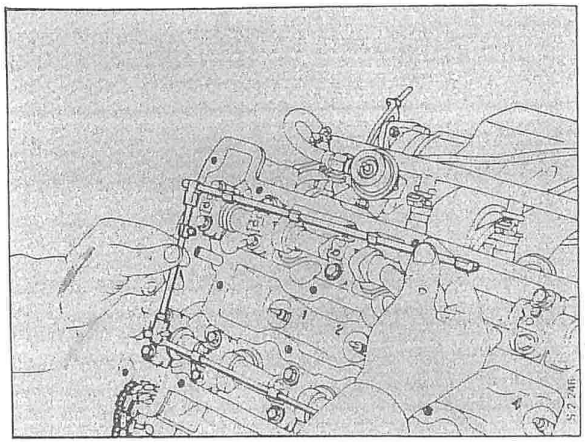
Tighten the bearing caps to the specified torque.

Tightening torque: 15 Nm (11 lbf ft)



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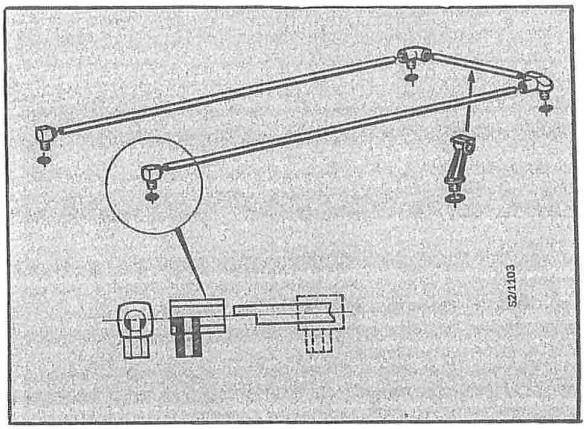
5 Refit the distributor and the lubricating oil pipes. Check the condition of the 'O' rings in the fittings.



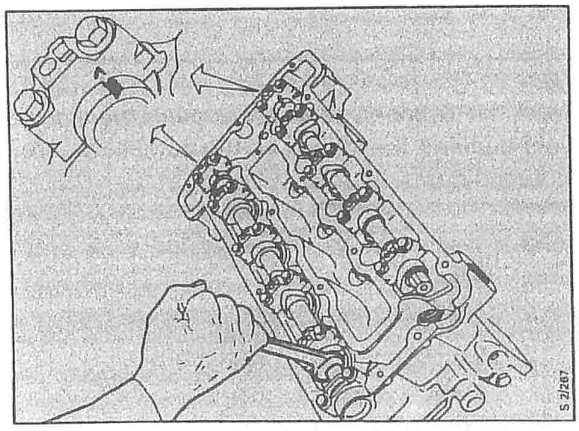
N.B.
Make sure when refitting the pipes that the outlet holes face the right way. The longer pipes locate in the straight couplings and the shorter ones in the elbows.

After reassembling the pipes, reconnect the pipework to the oilways in the bearing caps and cylinder head.

N.B.
Do not twist the pipes as this is liable to damage the mating surfaces between the pipes and the fittings.



6 Line up the marks on the camshafts with the respective timing marks.



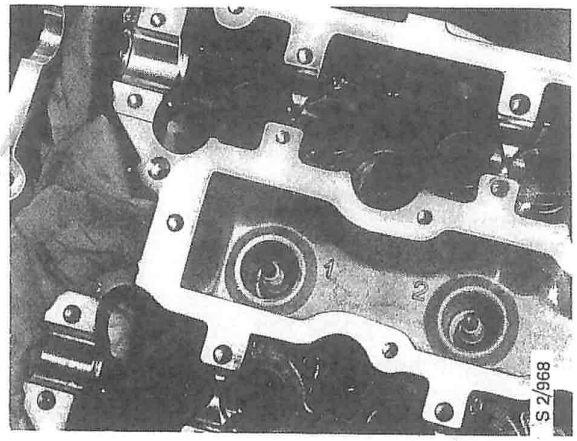
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Valve stem oil seals

To change (in situ)

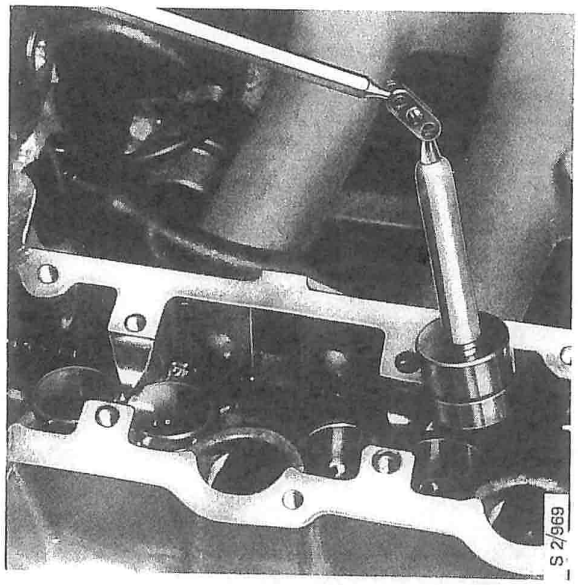
Follow the same procedure as that detailed for the replacement of valve springs, valve heads or collets.

1 Rotate the crankshaft, line up the 0° mark with the timing mark (top dead centre for no. 1 and no. 4 cylinders) and remove the camshafts (all valves are closed in this position). Place a cover over the timing cover aperture to prevent collets or seals falling inside.

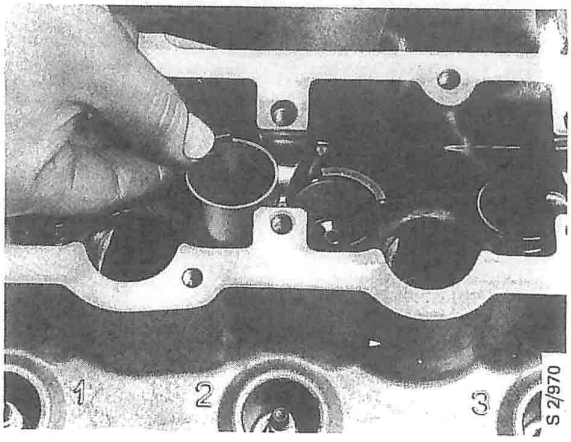


2 Using magnetic tool 83 91 401, lift out the cam followers.

N.B.
Set aside the parts carefully to avoid confusing them on refitting.

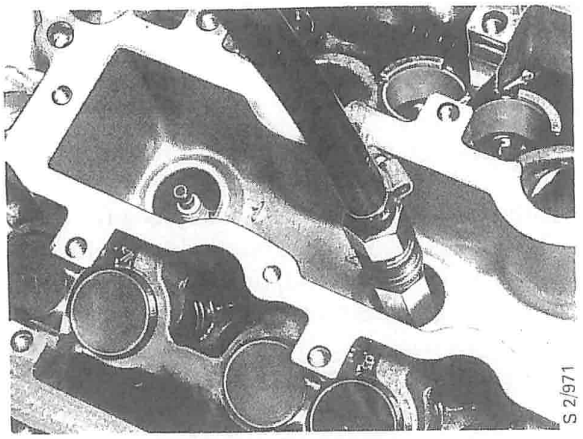


3 Fit plastic sleeves (special tool 83 93 746) to the valve springs to prevent the tappet-guide bores from scoring or scratching. Note the way in which the sleeves are oriented.

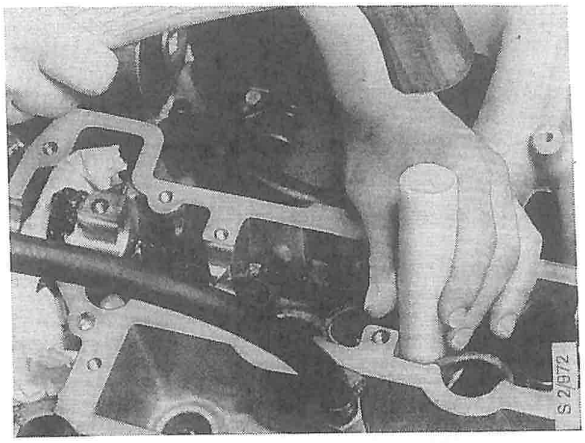


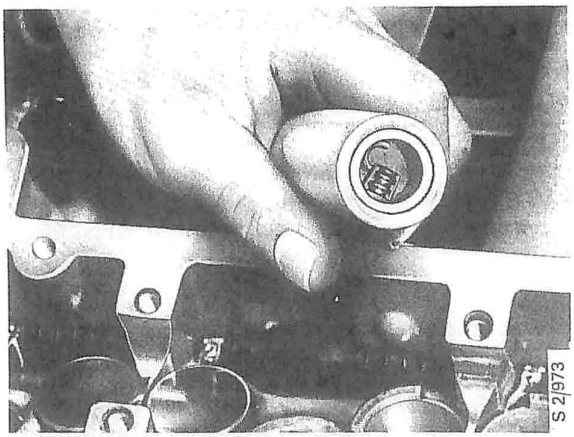
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4 Unscrew the spark plug for the cylinder concerned and fit compressed-air adaptor 83 92 326. Connect the adaptor to an air line and raise the pressure on the piston and valves.

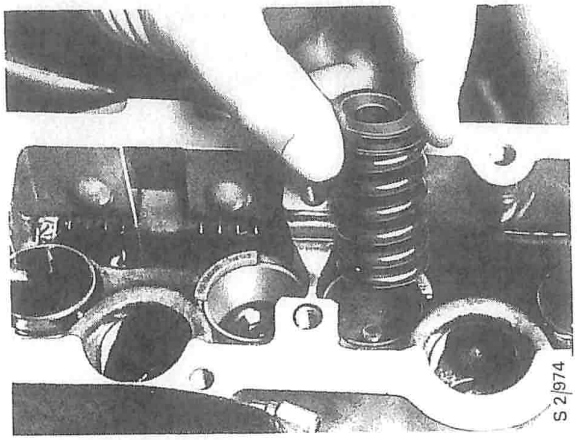


5 Position tool 83 94 181 on the valve head, direct in line with the valve stem. Using a hammer, tap the tool firmly once, whereupon the collets should come free from the valve and follow the tool out.



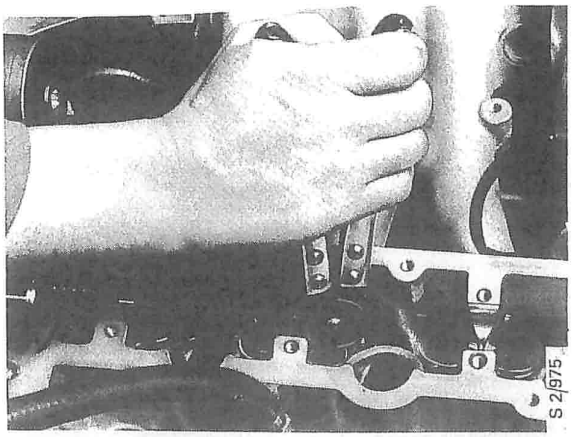


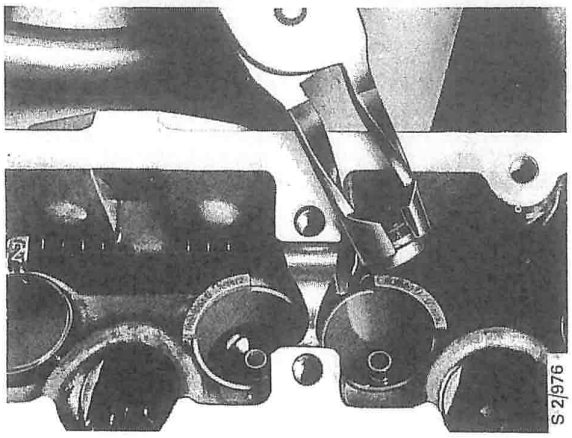
6 Lift out the spring cap and valve spring.



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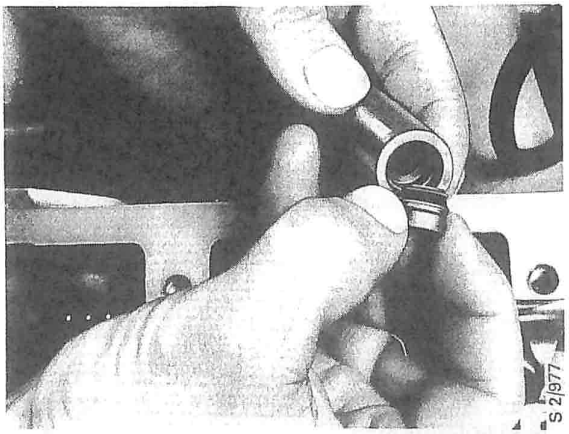
7 Remove the valve seal using tool 83 94 157.



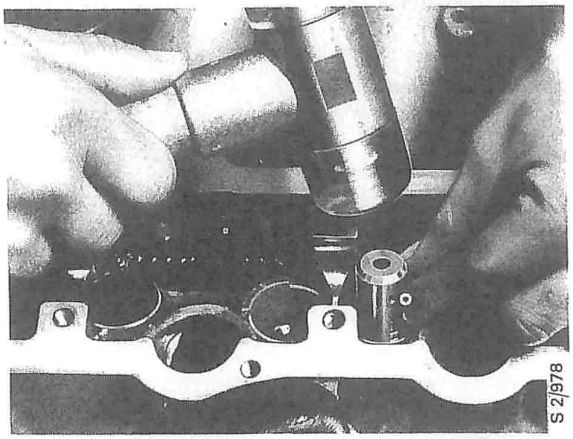


To refit

1 Remove the shank from tool 83 93 803 and fit the valve seal in the tool with the taper facing inwards (away from the valve head).

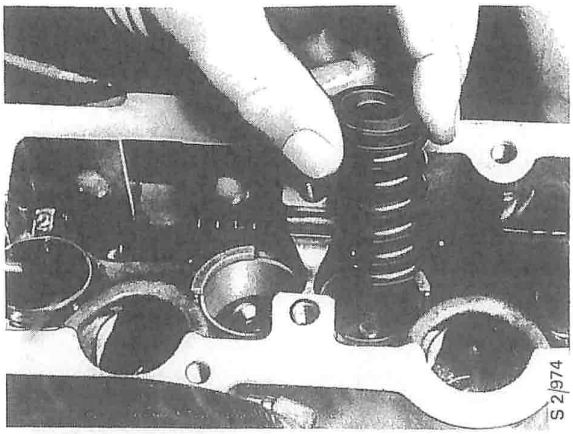


2 Fit the seal on the valve stem. Use a plastic-faced mallet to tap the seal carefully into position.

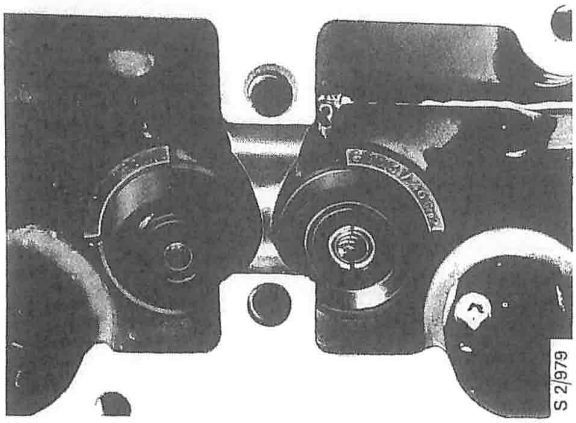


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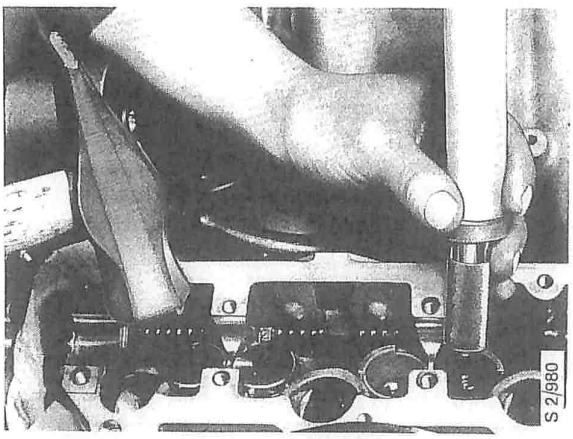
3 Fit the spring and spring cap.

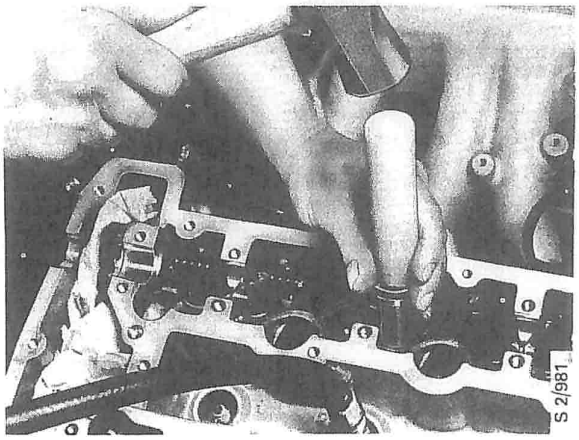


4 Position the collets in the groove in the spring cap as shown.



5 Using tool 83 94 181 with sleeve 83 94 207 and a hammer, carefully tap the collets home.





6 Remove the plastic sleeves and fit the cam followers.

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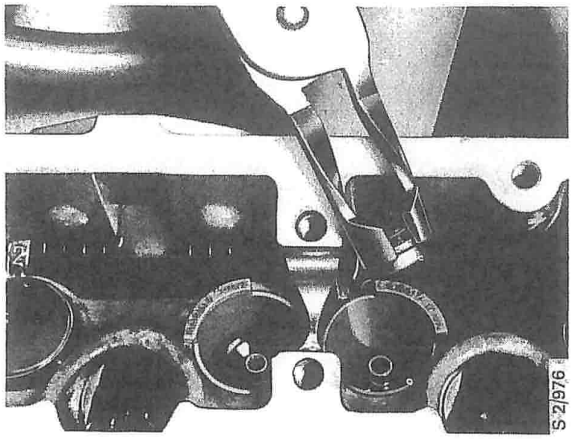
Overhaul of valves, valve guides and valve seats and replacement of valve stem seals (cylinder head removed)

Remove the valves, see "To dismantle the valve gear".

Valve stem seals

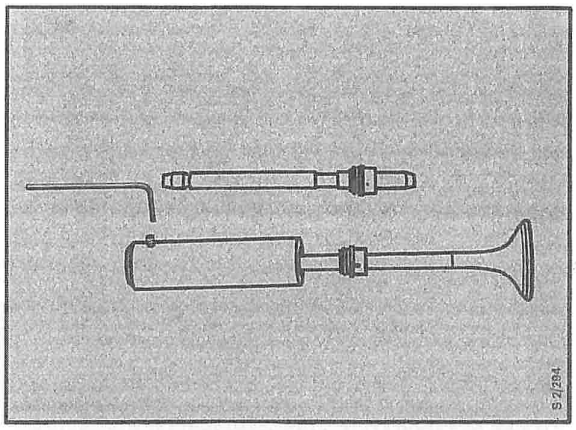
To remove

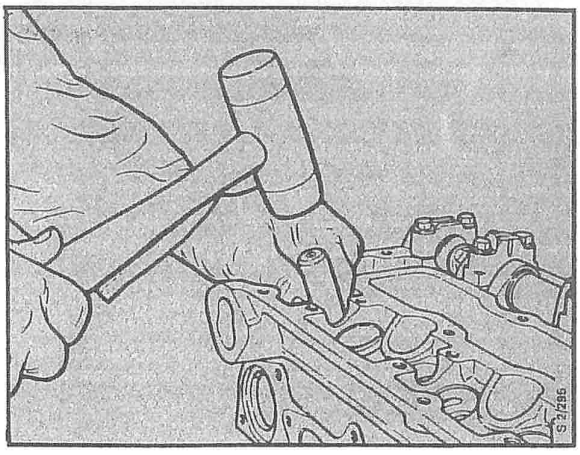
Remove the seals from the valve guides using tool 83 94 157. If the guides are to be replaced, remove the guides and seals together.



To refit

Refit the seals using special tool 83 93 803. Place the seal in the tool and then allow the tool to be guided by the valve guide. If the valve is fitted, use the stem as a guide. Tap the seal into position using a plastic-headed mallet.

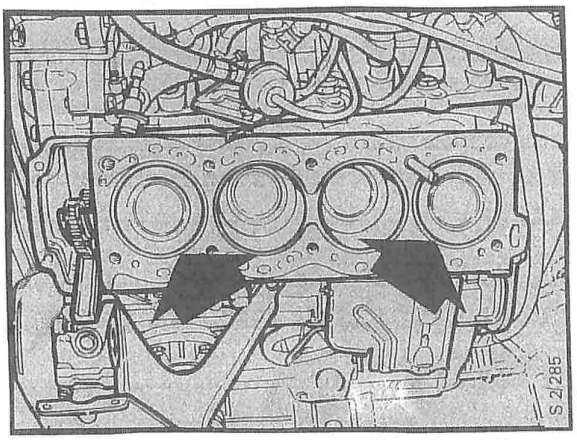


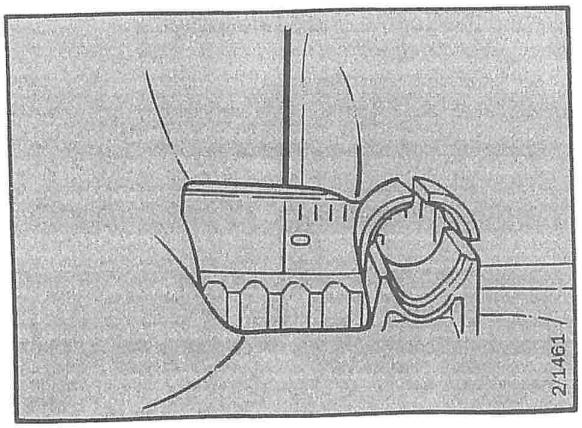


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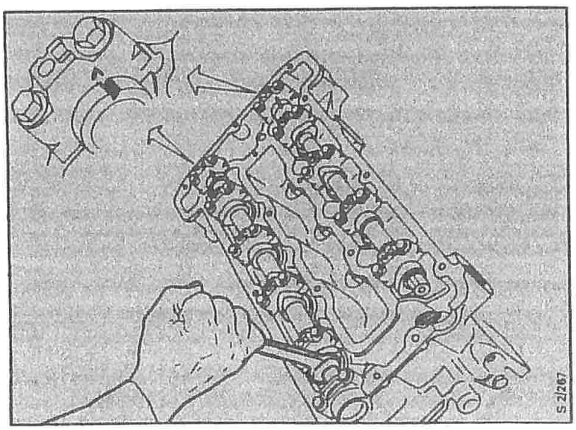
Setting the valve and crankshaft

When the pistons in No. 1 and No. 4 cylinders are at top dead centre, the 0° mark on the flywheel must be in line with the timing mark on the clutch cover (or end plate if the clutch cover has been removed).



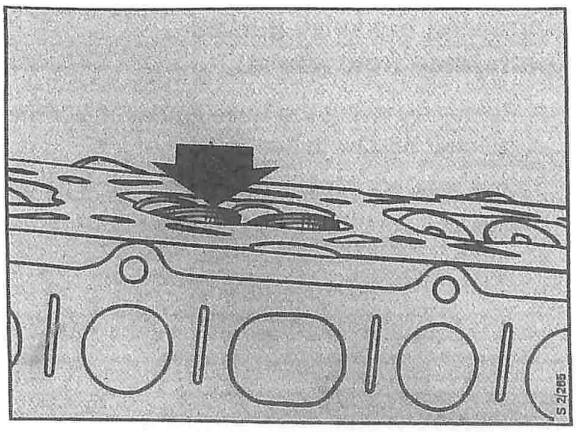


When the timing marks on the camshafts are in line with those on the bearing caps, the inlet and exhaust valves for No. 1 and No. 4 cylinder are closed.



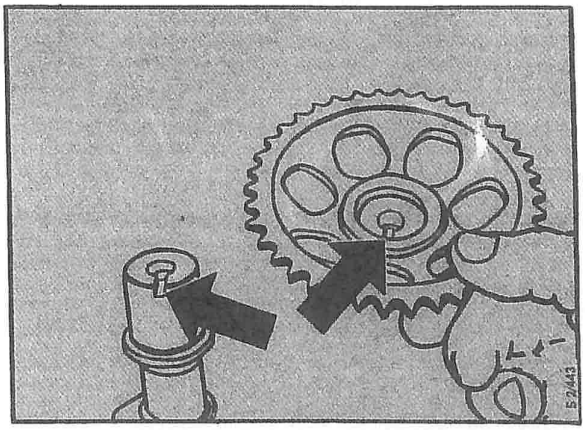
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As the valves open, they extend beyond the cylinder head and into the zone in which the pistons move (combustion chamber). Consequently, an alteration in the setting of the crankshaft and valve gear may result in the valves and other vital components in the engine being damaged.



The timing gear comprises sprockets and a chain. The chain has two guides, one fixed and one pivoting. The pivoting guide maintains the tension in the chain, assisted by an hydraulic chain tensioner.

The camshaft sprocket is guided by means of a dog on the shaft. Each sprocket has 38 teeth and is secured to the camshaft by a centre bolt.



The crankshaft sprocket incorporates a keyway to locate it on the crankshaft. The sprocket, which has 19 teeth, is secured by the centre nut for the crankshaft pulley.

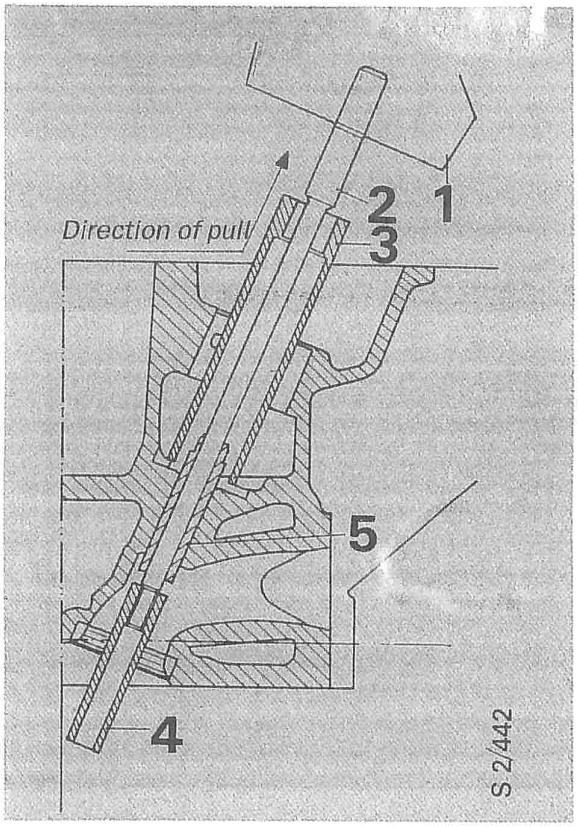
The chain is an endless, single chain with 126 links. The diameter of the rollers is 6.35 mm (0.25 in).

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Removing the valve guides (performed from above)

1 Before removing the valve guides, flush the cylinder head with hot water.

2 Withdraw the valve guides using special tool and pull rod 83 93 811, spacer 83 93 829 and nut 83 93 845.

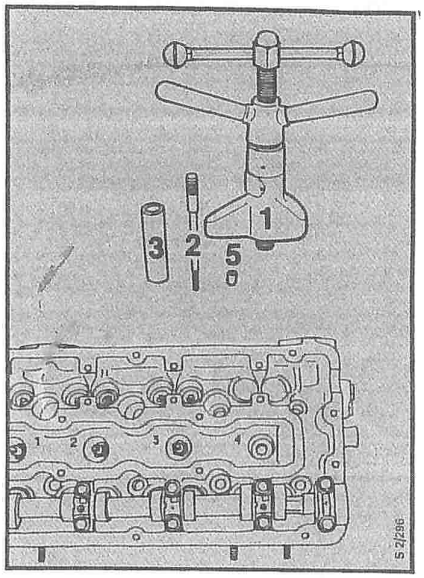


1 Jackscrew
2 Pull rod
3 Spacer sleeve
4 Nut
5 Valve guide

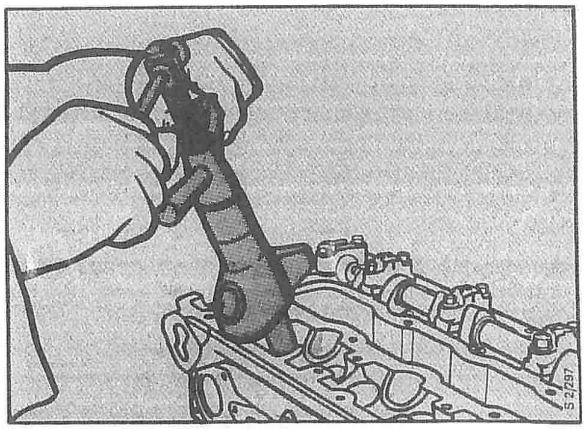
To refit

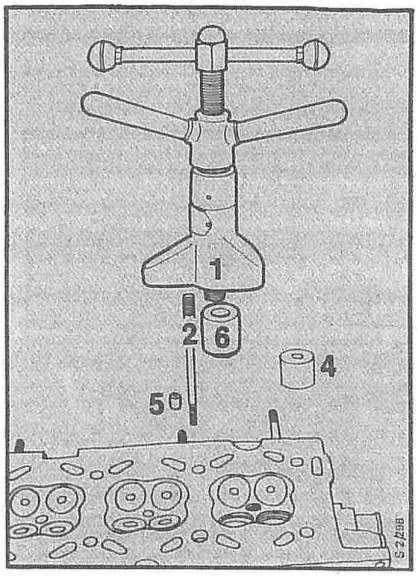
1 Insert the valve guide from above and apply the tool from below.

2 Before fitting the guides, flush the cylinder head with hot water and cool the guides by immersing them in cold water.



1 Jackscrew
2 Pull rod
3 Spacer sleeve
5 Nut



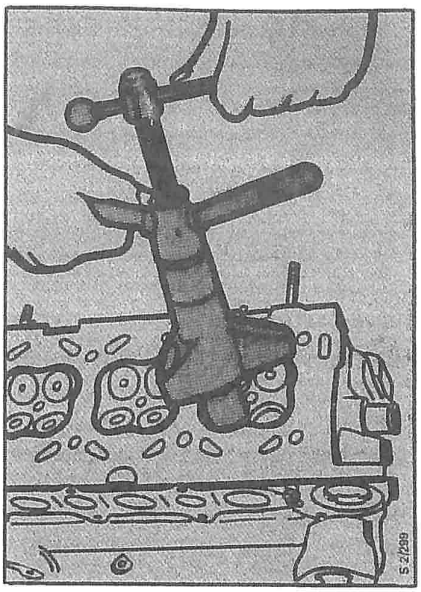


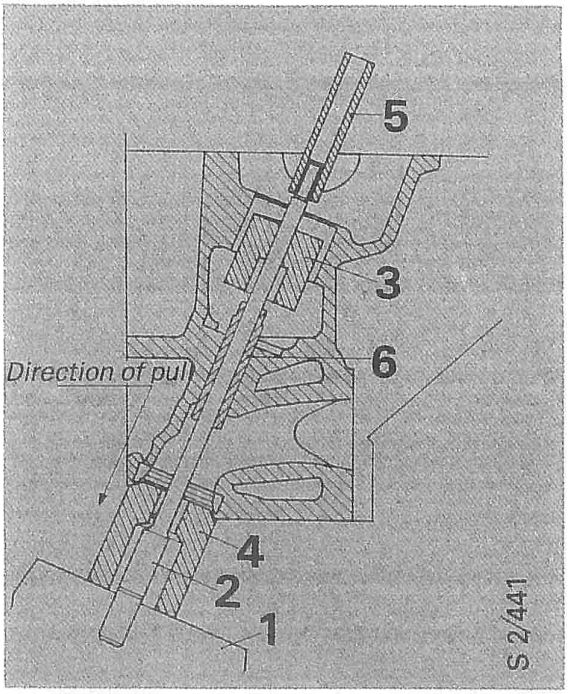
1 Jackscrew
2 Pull rod
4 Stop
5 Nut
6 Valve guide

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3 Fit the guides using special tool and pull rod 83 93 811, stop 83 93 837, 83 90 379 and nut 83 93 845.

4 Centre the tool in the valve seat and, using the tool, draw the guide into its correct position, as shown.





1 Jackscrew
2 Pull rod
3 Stop
4 Centring sleeve
5 Nut
6 Valve guide

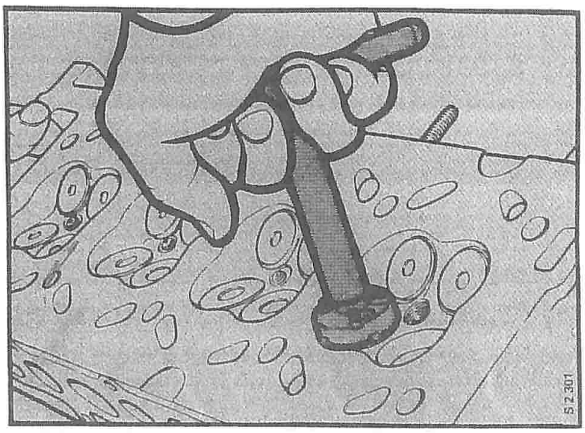
5 a Run the 7.0-mm undersize reamer, 83 93 944, through the guide.

b Follow up with the 7.0-mm H7 valve guide reamer.

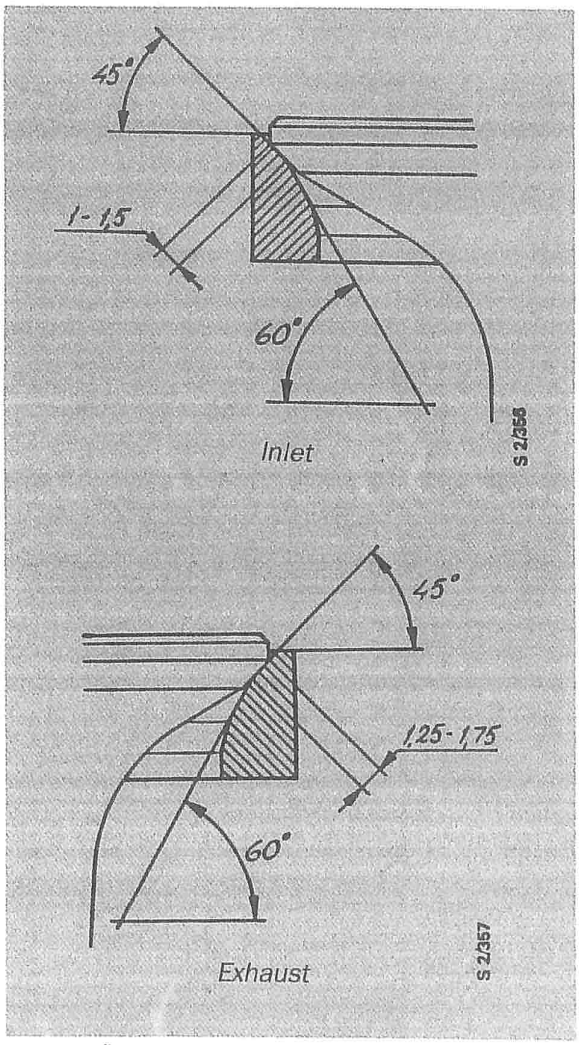
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Valve seats

For recutting the valve seats, use the cutter kit comprising a T-wrench, pilot 83 93 928 and cutters 83 93 936, Neway types 286 45° and 270 60°.



Valve seat angles for inlet and exhaust valve seats: 45°.
Recutting angle: 60°.
Width of inlet valve seat: 1 - 1.5 mm (0.0394 - 0.0591 in)
Width of exhaust valve seat: 1.25 - 1.75 mm (0.0492 - o.0689 in)
(See drawing)



Valves

Inlet valve face angle: 44.5°
Valve head diameter: 32 ± 0.1 mm
(1.26 ± 0.004 in)

Exhaust valve face angle: 44.5°
(The contact surface of the valve has a 0.006-mm (0.0002-in) coating of stellite.)
Valve head diameter: 29 ± 0.1 mm
(1.14 ± 0.004 in)

N.B.
Only a limited amount of material can be removed from exhaust valve seats, since the stellite coating must be preserved as far as possible. Consequently, if the valve seat is badly pitted, the valve should be replaced.

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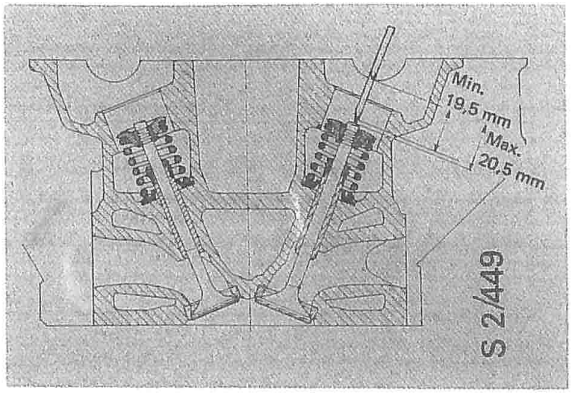
Checking the valve clearance (Cylinder head removed)

The valve clearance is checked relative to the working range of the cam follower.

The **checking values** for the valve clearance are 19.5 ± 0.05 mm (0.77 ± 0.002 in) minimum, and 20.5 ± 0.05 mm (0.81 ± 0.002 in) maximum.

The **setting values** are 20.0 mm (0.78 in) minimum, 20.4 mm (0.80 in) maximum, with a nominal value of 20.2 mm (0.79 in).

The valve clearance is equivalent to the distance between the end of the valve stem and the camshaft bearing seat. It is checked using tool 83 93 753 (measuring head).

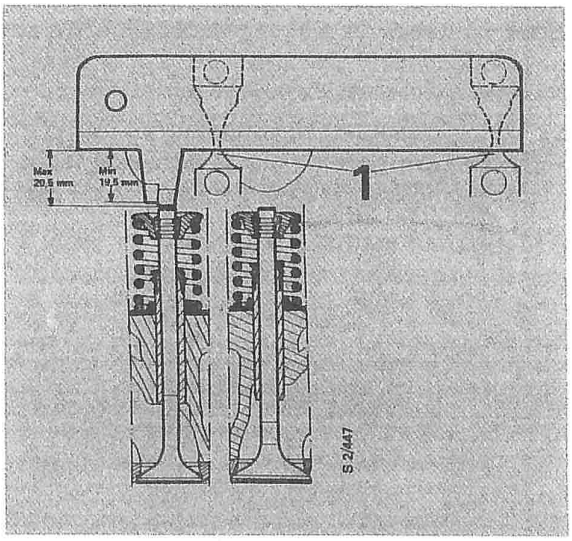


Working range of the cam follower

Before the valve clearance can be checked, the camshafts and cam followers must be removed (see 'Dismantling the valve gear' earlier in the section).

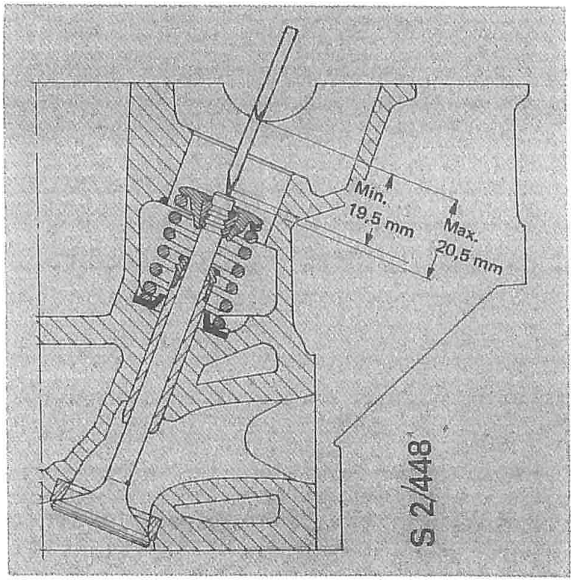
Check the valve clearance using tool 83 93 753 as follows.

Place the measuring head on two of the camshaft bearing seats. Line up the instrument to read the depth to the end of the valve stem. Check that when the instrument is displaying the maximum depth reading of 20.5 mm (0.8 in) it actually reaches the end of the valve stem, which will be confirmed by the fact that the measuring head does not make contact with the bottom of the bearing seat closest to the instrument. Thereafter, check that the contact point of the instrument does not touch the end of the valve stem when showing the minimum depth reading of 19.5 mm (0.77 in).



The valve clearance is correct when the reading obtained is between the minimum and maximum values.

If the valve clearance deviates from the specified checking values, adjustment must be made to the valve stem or the valve seat: if the value is lower than the minimum value then the length of the valve must be reduced; if the value is greater than the maximum value, then the valve seat must be milled. The nominal value for adjusting the position of the valve is 20.2 mm (0.79 in).



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Timing chain, B201 and B202

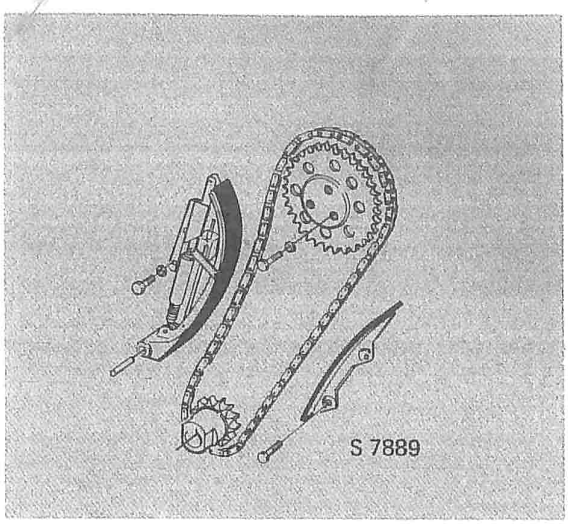
Timing chain, B201 . . . . . 215-1 Timing chain, B202 215-5

Timing chain, B201

M84 and earlier

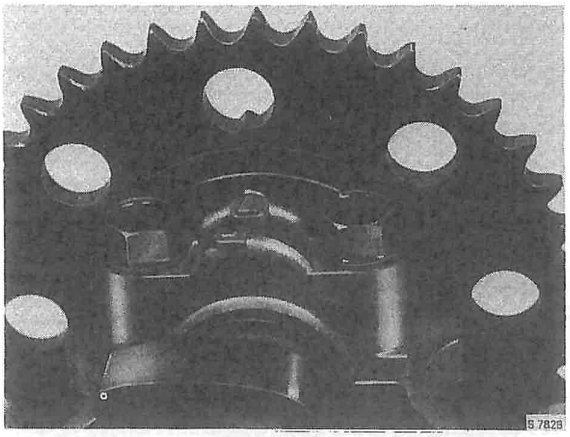
CM CA: Engine No. E22812 and earlier
IM IA: Engine No. E57339 and earlier
SM SA: Engine No. E57339 and earlier

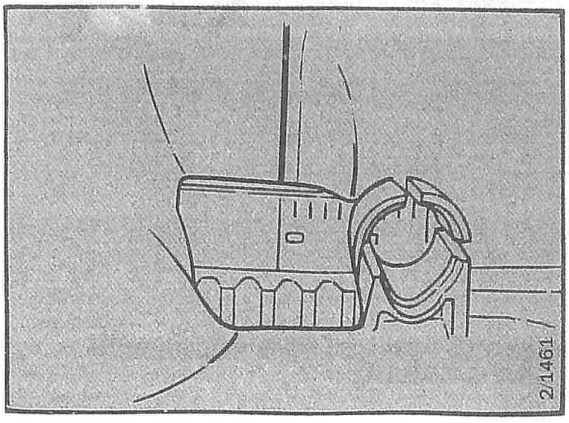
The camshaft is driven by a single chain with a mechanical chain tensioner and a straight chain guide.



N.B.
Never rotate the crankshaft or the camshaft once the timing chain has been detached.
A fully open valve can come into contact with a piston at top dead centre.

To remove or refit the timing chain, the camshaft and crankshafts must be lined up with their respective timing marks (No. 1 cylinder at top dead centre).

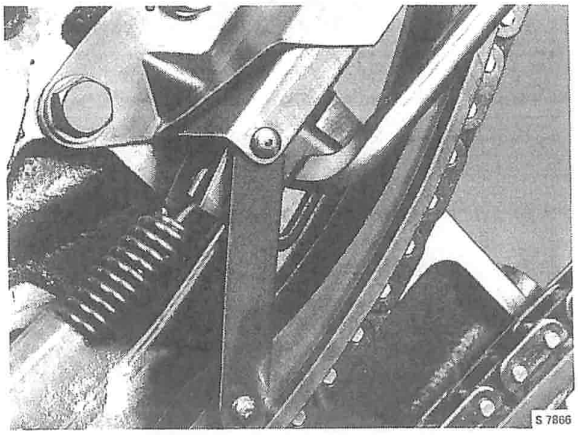




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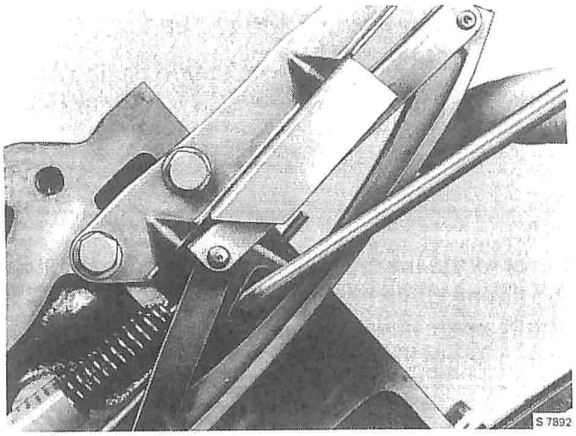
When removing or refitting the camshaft sprocket, use tool 83 93 357 to take the tension off the chain.

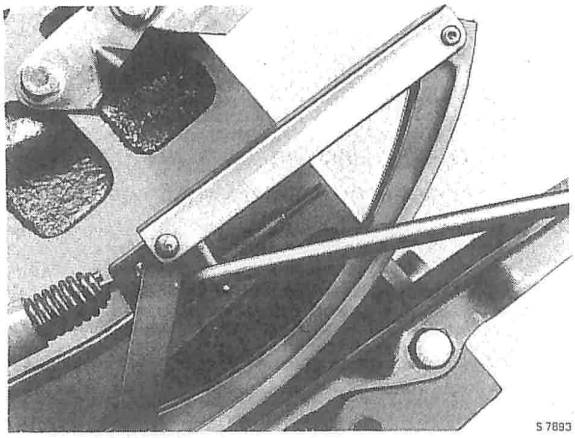
Insert the hook as shown and pull upwards to release the chain tensioner.


S 7866

To fit the chain tensioner

After fitting the tensioner, set it by inserting the tool as shown, and rotating it to allow the tensioner to slide back against the chain.


S 7892


S 7893

Fit the camshaft sprocket and move the chain on the sprocket teeth until the marks on the sprocket and bearing cap coincide.

N.B.
The 0° mark on the crankshaft must be in line with the timing mark.

Fit the sprocket bolts complete with plain washers.

Warning

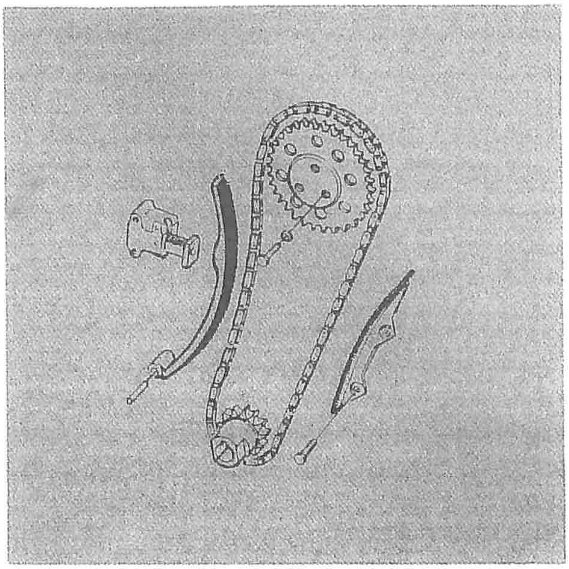
If the washers are omitted, the bolts will foul the camshaft carrier.

Tightening torque for camshaft sprocket:
20 Nm (14.8 lbf ft)

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M84 onwards

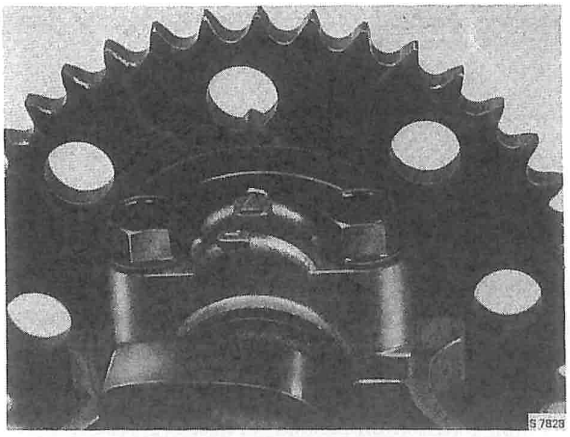
CM CA: Engine No. E22813 onwards
IM IA: Engine No. E57340 onwards
SM SA: Engine No. E57340 onwards

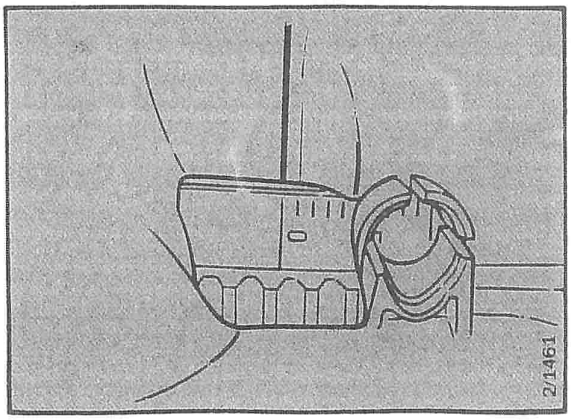


The camshaft is driven by a single chain with a mechanical chain tensioner, a pivoting guide and a fixed chain guide.

N.B.
Never rotate the crankshaft or the camshaft once the timing chain has been detached.
A fully open valve can come into contact with a piston at top dead centre.

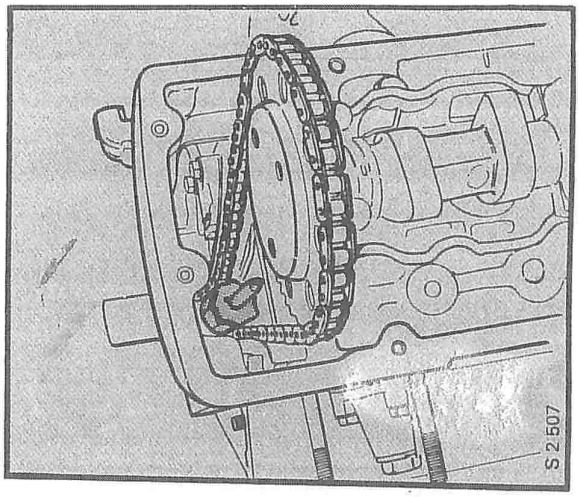
To remove or refit the timing chain, the camshaft and crankshafts must be lined up with their respective timing marks (No. 1 cylinder at top dead centre).





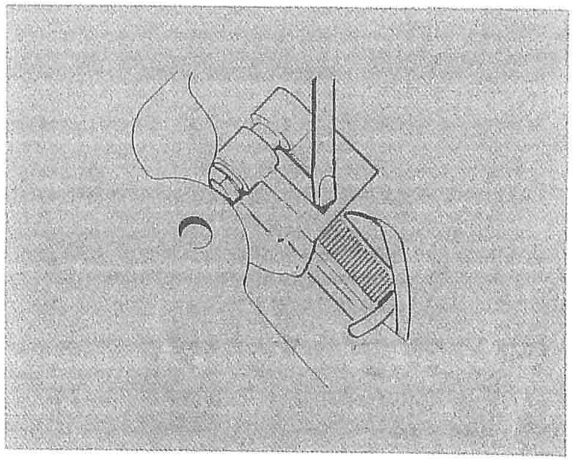
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When removing or refitting the camshaft sprocket, lock the chain in position by inserting the handle of a suitable screwdriver between the two parts of the chain as shown.



Resetting the chain tensioner

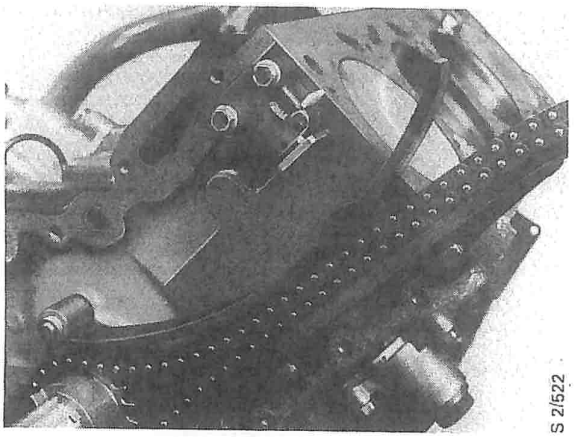
Press down the outside of the ratchet pawl on the chain tensioner to render it inoperative. Push in the chain tensioner by pressing on the chain guide.



Retain the chain guide in this position, refit the sprocket and chain and then release the chain guide, whereupon the tensioner will press against the chain.

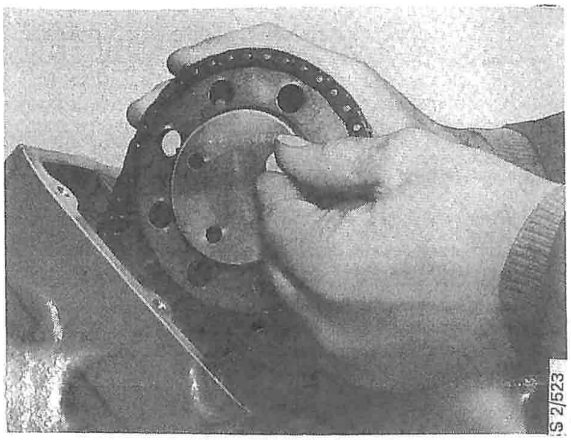
To fit a new chain tensioner

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



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2 Fit the camshaft sprocket and move the chain on the sprocket teeth until the marks on the sprocket and bearing cap coincide.



N.B.
The 0° mark on the crankshaft must be in line with the timing mark.

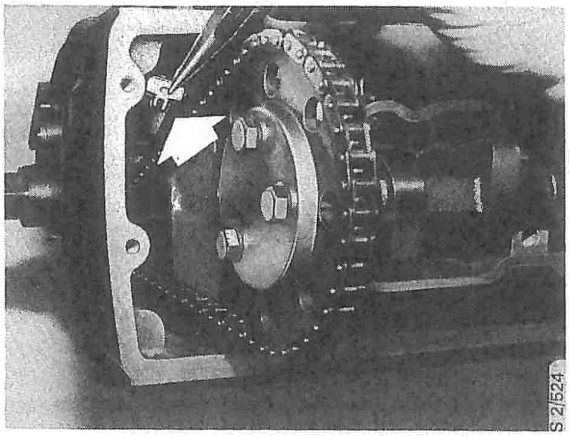
Fit the sprocket bolts complete with plain washers.

Warning

If the washers are omitted, the bolts will foul the camshaft carrier.

Tightening torque for camshaft sprocket:
20 Nm (14.8 lbf ft)

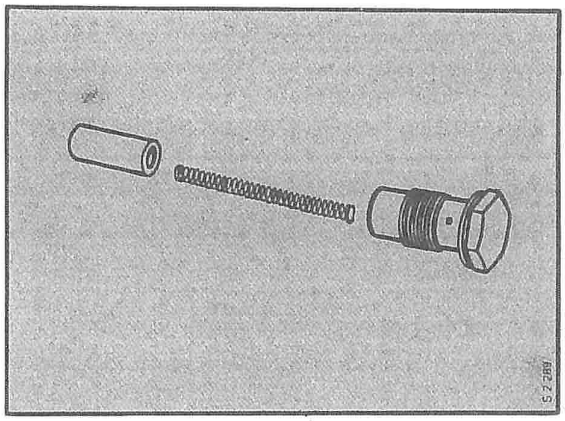
3 Remove the transit lock from the tensioner, thereby triggering the device.



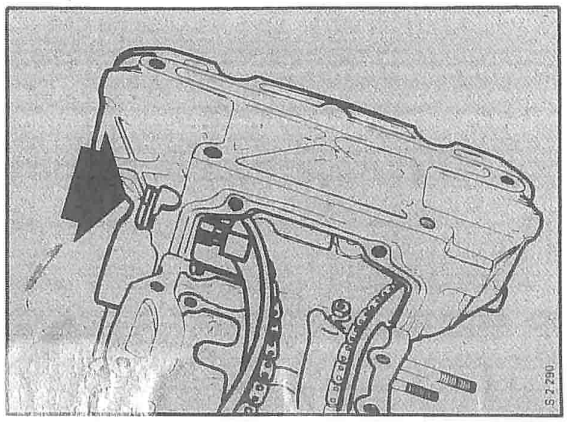
Timing chain, B202

The chain tensioner, which is hydraulic and incorporates a spring and ratchet, is fitted inside the cylinder head and has an opposing action to the pivoting chain guide.

The fixed guide, which is made of rubber-clad steel and has a groove in the rubber for the chain, is secured by means of two bolts. The pivoting guide, which is made of rubber-clad light alloy, also has a groove for the chain in the rubber and has a pivot fixing at its lower end.

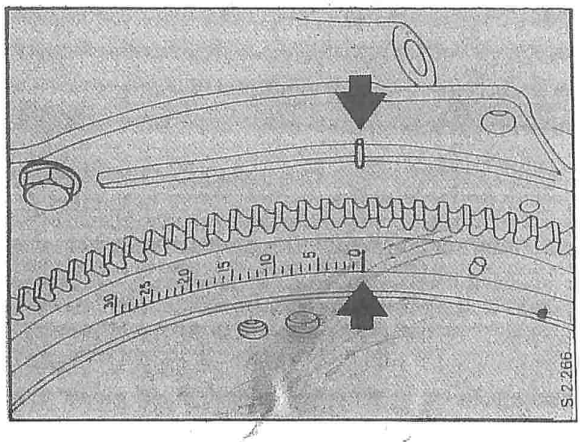


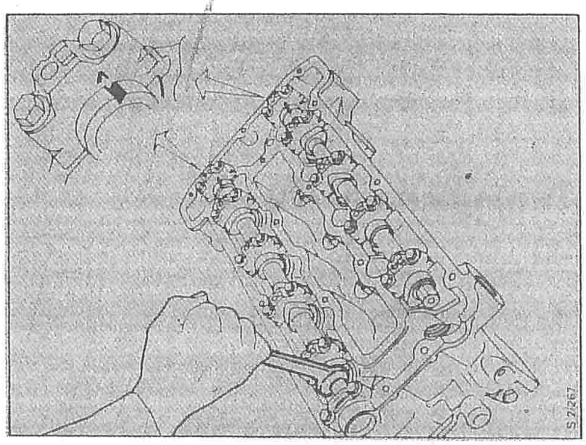
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Removal and refitting of the timing chain

Before starting work to remove the timing chain, the 0° mark on the flywheel must be turned to line up with the timing mark on the flywheel cover or end plate. The basic settings of the crankshaft and valve gear must not be altered before the camshafts or the cylinder head have been removed. Similarly, before the cylinder head is fitted, the crankshaft and valve gear must be set to their respective timing marks.



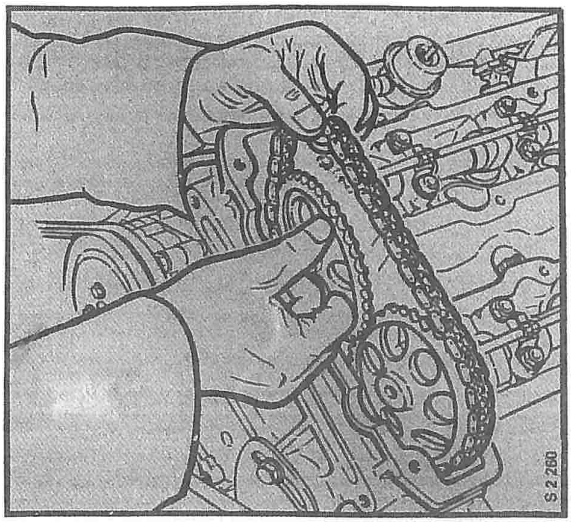


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To refit

1 Place the chain on the crankshaft sprocket.

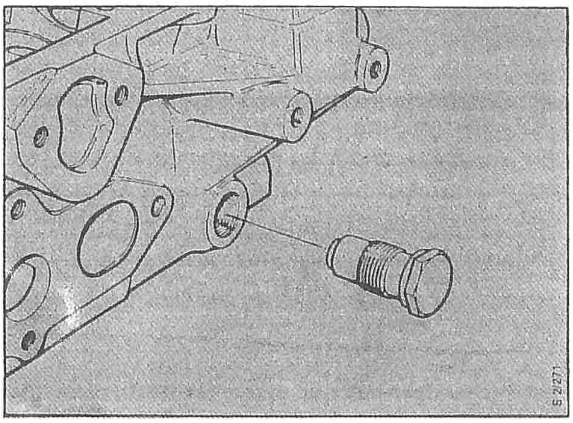
2 Fit the chain and sprocket on the exhaust-valve camshaft. Make sure the chain is taut between the crankshaft and the camshaft sprockets. Tighten the bolt.



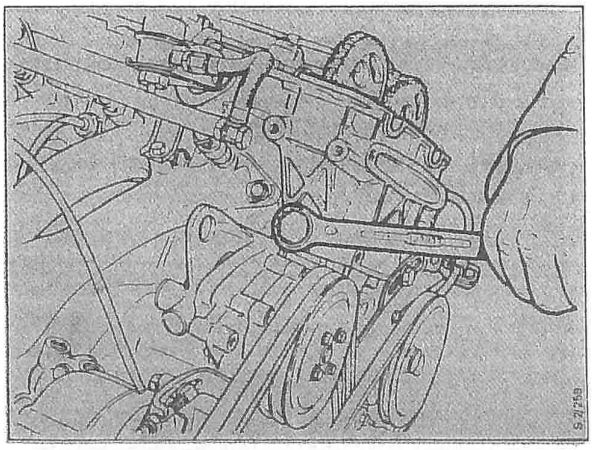
3 Fit the chain and sprocket to the inlet-valve camshaft. Keep the chain taut between the sprockets while it is being fitted. Tighten the bolt. Refer to step 7 below for permitted tolerances in the basic timing setting.

4 a Chain tensioner, early design

- Tension the chain tensioner by fully depressing the piston and then rotating it to the locked position.

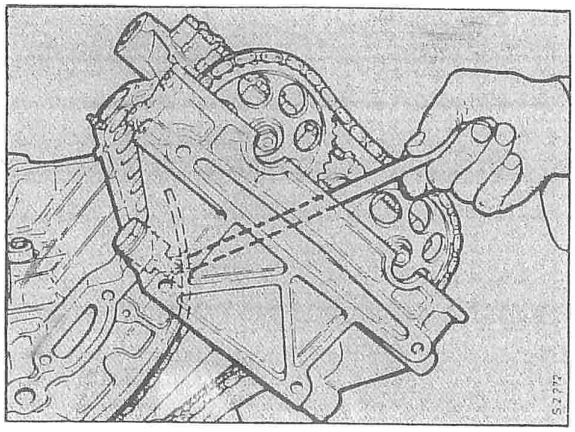


- Fit the chain tensioner with the piston under tension. Make sure that the copper gasket is in good condition and that the sealing surface is clean and free from burrs.



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- Trigger the chain tensioner by pressing the pivoting chain guide against it; thereafter, press the pivoting guide against the chain to give the chain its basic tension.



N.B.
Use a blunt instrument - not a screwdriver or similar.

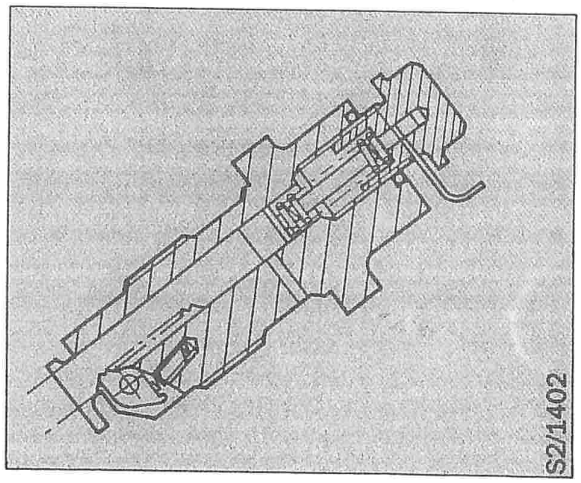
- Check that the chain tensioner maintains tension on the chain when the pressure on the chain guide is released and that the ratchet for the tensioner holds the chain guide tight against the chain. A limited amount of play will be present until the hydraulic pressure takes over once the engine is running.

4 b Chain tensioner, latest design

The latest chain tensioner has a tighter adjustment range than earlier versions, thus providing more-precise compensation for chain wear and quieter operation.

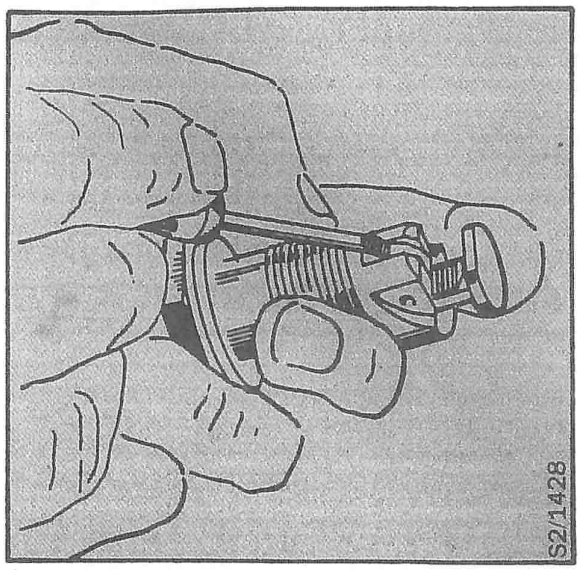
The function is both mechanical and hydraulic, the tensioning force being provided by a spring acting on the tensioning arm. A ratchet prevents return of the tensioning arm inside the tensioner unit.

Only the latest chain tensioner is carried as a spare part, the earlier version having been discontinued.

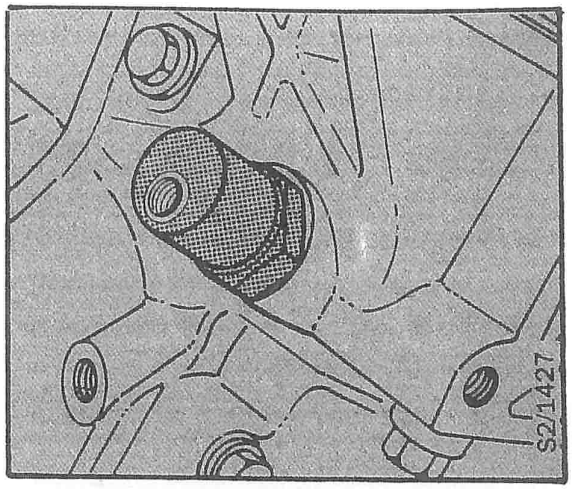


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- Preset the chain tensioner for fitting by pressing down on the ratchet and pushing in the tensioner.

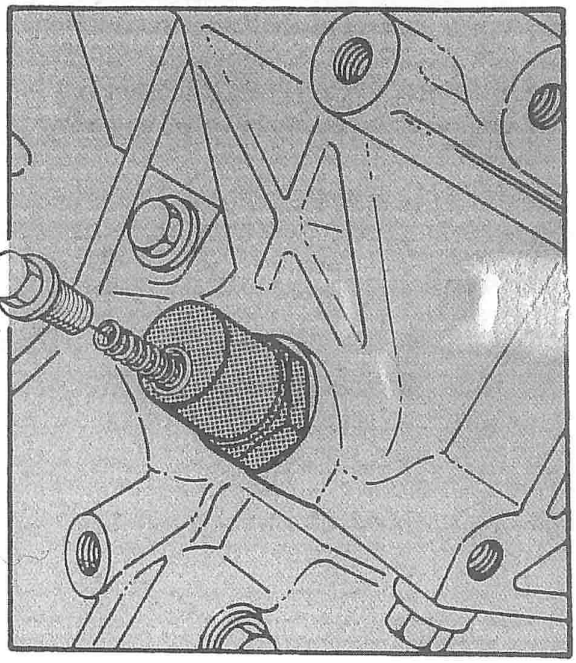


- Fit the chain tensioner complete with gasket and tighten to a torque of 65 Nm (52 lbf ft).



- Insert the spring and plastic guide pin into the tensioner body.
- Fit the plug, checking that the 'O' ring is properly seated.

  Tighten the plug to 22 Nm (16 lbf ft).

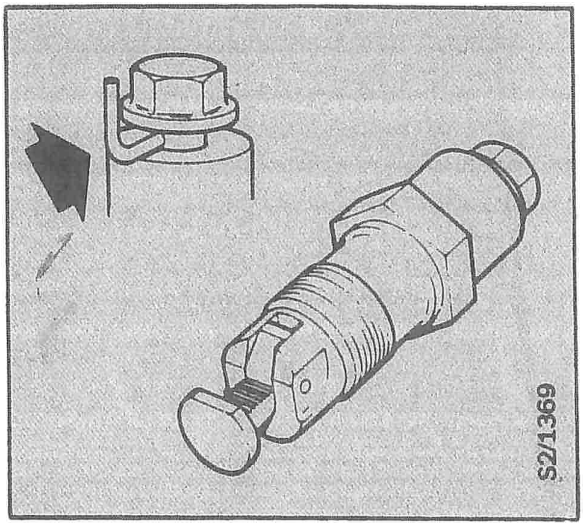


As the plug is screwed in, the spring will push the tensioning arm out, thereby tensioning the chain.

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Warning

New chain tensioners come with the spring under tension. Never remove the safety pin (step 4) before the tensioner has been fitted to the engine.

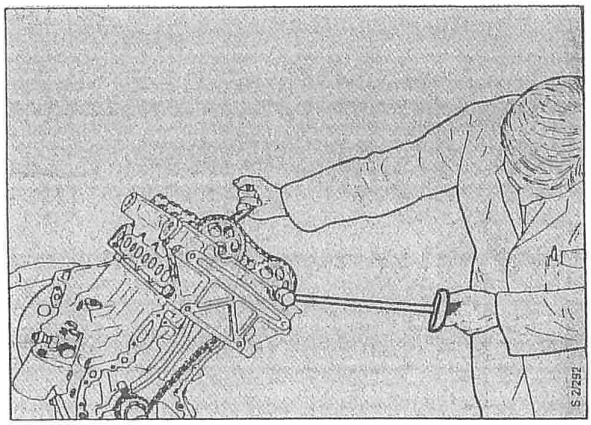


Withdraw the safety pin, whereupon the spring will push the tensioner arm out, thereby tensioning the chain.

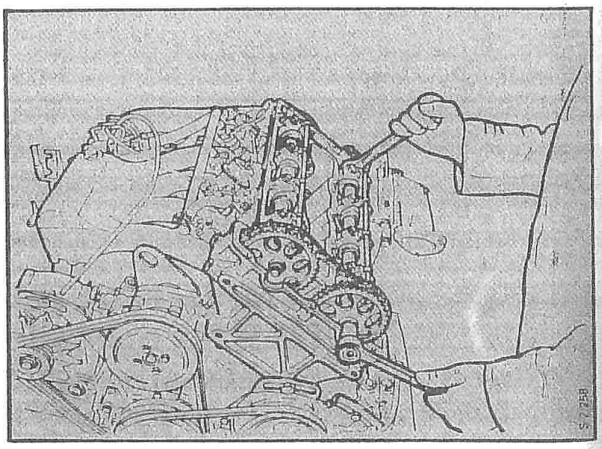
5 Check the setting by rotating the crankshaft two complete turns in its normal direction of rotation round to the timing mark. The basic setting of the camshafts should remain unaltered. Refer to step 7 for details of permitted tolerances.

Tighten the centre-bolt for the exhaust-valve camshaft sprocket.

Tightening torque: 63 Nm (47 lbf ft)



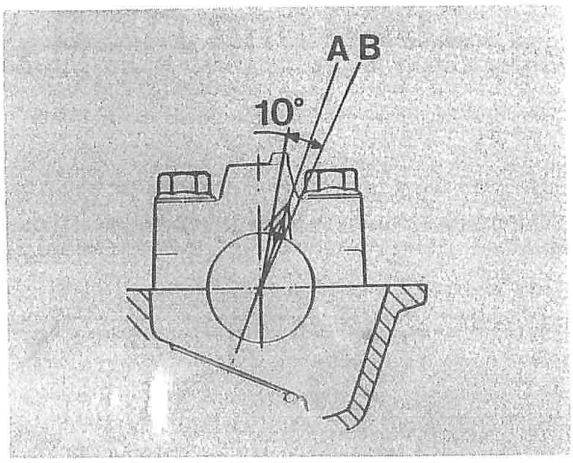
6 When undoing or tightening the centre-bolts, hold the camshaft still by means of a spanner fitted over the flats on the camshaft.



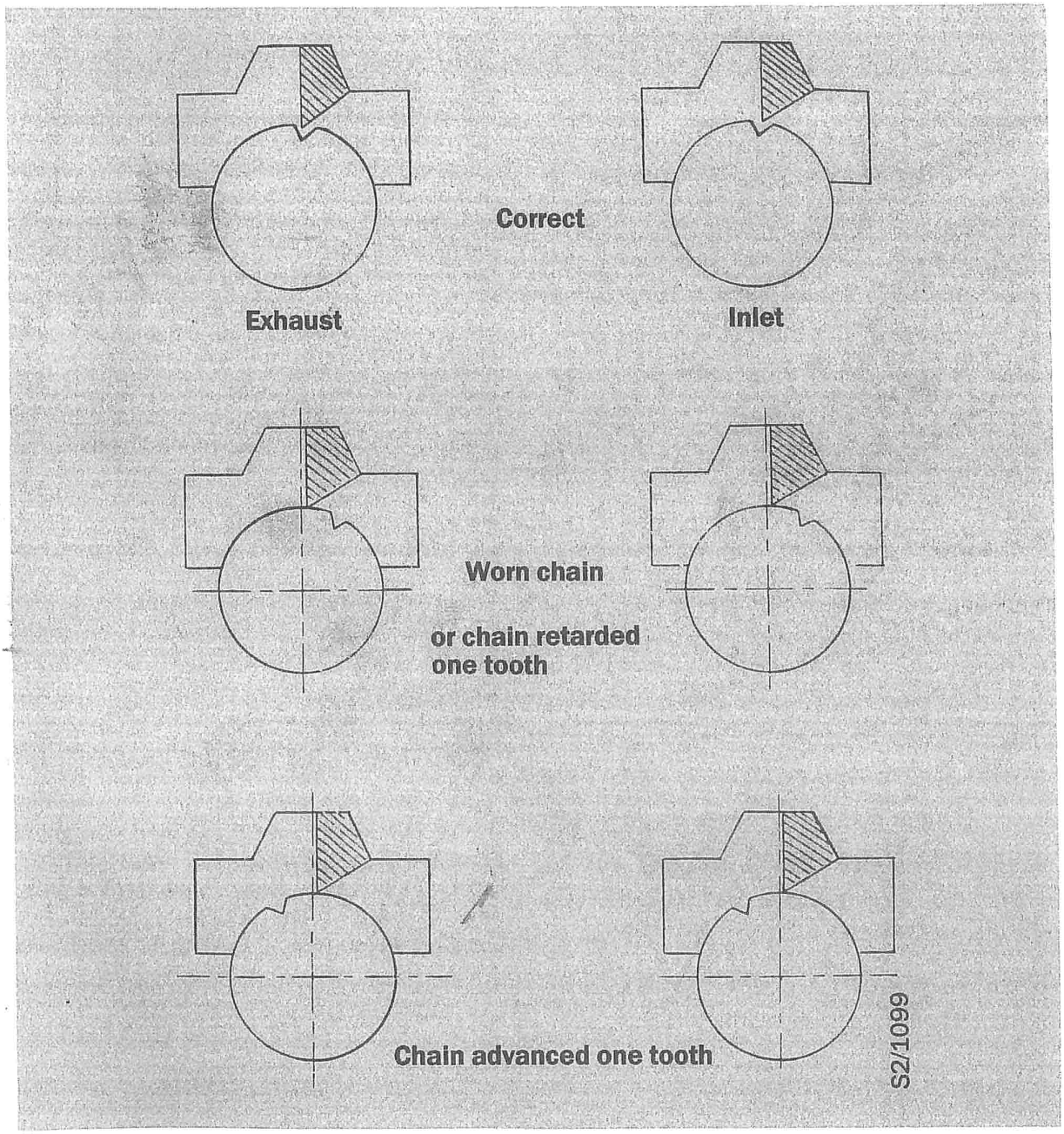
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7 The adjusting accuracy will depend on the condition of the chain.

Moving the timing chain one tooth will rotate the camshaft through 10°, corresponding to approx. 3.0 mm (0.12 in), which is the width of the camshaft timing mark.



Camshaft setting



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Crankshaft assembly, B201 and B202

To measure the crankshaft 216-1
To measure bearing clearances . . . 216-1
To choose bearing shells for main and big-end bearings 216-3
To change crankshaft seals 216-4
To measure drive-belt tension 216-9

To measure the crankshaft

Clean the crankshaft and measure the journals, using a micrometer. Measurements should be made at several points round the journal. Out-of-round of the journals and crankpins should not exceed 0.05 mm (0.002 in). If the measurements are close to or exceed the stated limit, the crankshaft should be ground down to undersize as specified. Journals and crankpins can be ground down one undersize without rehardening. Grinding to further undersizes will necessitate 'Tenifer' rehardening. Check that the crankshaft is true to within 0.05 mm (0.002 in) using a dial indicator. Mount the crankshaft in two V-blocks, place the indicator plunger against the centre journal and rotate the shaft.

To measure bearing clearance

Before measuring the bearing clearance when fitting new bearings, check the journal out-of-round and taper. Bearing clearance is measured using a 'Plastigage', which is obtainable under part no. (45) 30 06 558 and available in three thicknesses. Type PG-1 (green) should be used.

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Main bearings

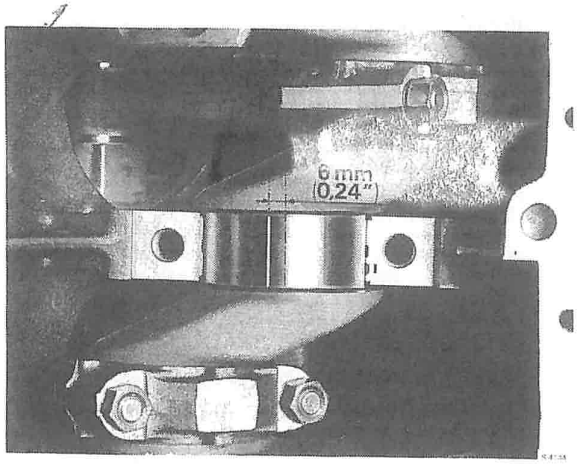
'Plastigage' can be used to measure both out-of-round and clearance.

1 Position the engine upside-down so that the weight of the crankshaft will not affect the measurements.

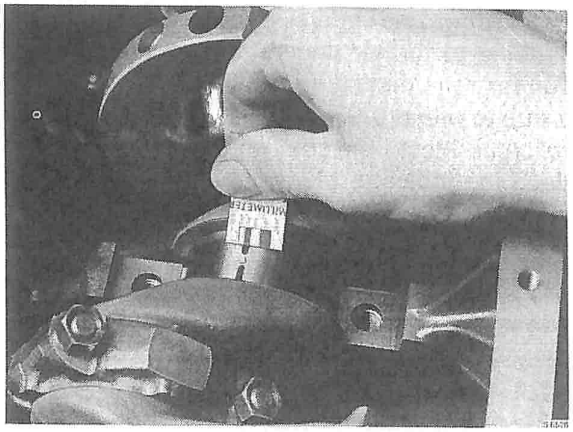
2 Ensure that the parts to be measured are free from oil and dirt. Put a strip of 'Plastigage about 6 mm (0.2362 in) to one side of the longitudinal centre-line of the journal.

3 Refit the bearing cap and tighten to a torque of 108 Nm (80 lbf ft). The crankshaft must remain stationary while the measurement is taken.

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



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



Big-end bearings

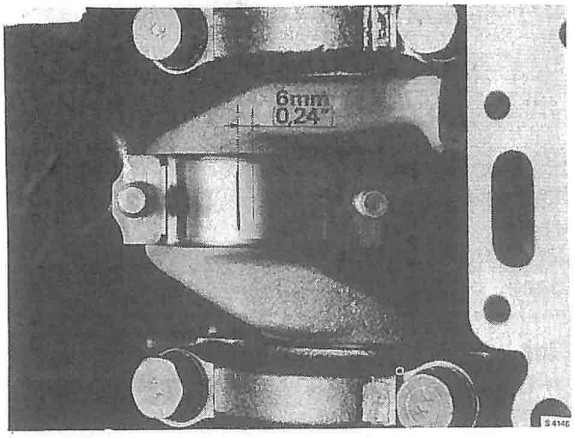
Plastigage strips cannot be used to measure the out-of-round of big-end bearings with the pistons fitted in the block. Use a micrometer instead.

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When fitting new bearings, check the big-end bearing clearance as follows.

1 Rotate the crankpin to be measured to about 60° BTDC.

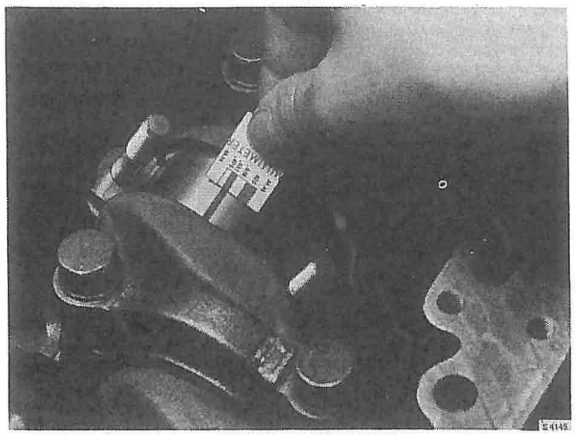
2 Ensure that the parts to be measured are dry and free from oil and dirt. Place a strip of 6 mm (0.2362 in) Plastigage to one side of the centre-line of the crankpin.



3 Refit the bearing cap and tighten to a torque of 54 Nm (40 lbf ft). The crankshaft must remain stationary while the measurement is taken.

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

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



Main bearing clearance:
0.020 - 0.062 mm (0.0008 - 0.0024 in)

Big-end bearing clearance
0.026 - 0.062 mm (0.0010 - 0.0024 in)

To choose bearing shells for main and big-end bearings

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

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

Standard size:
Red - thin bearing half, gives **increased** clearance
Blue - thicker bearing half, gives **reduced** clearance.

1st undersize:
Yellow - thin bearing half, gives **increased** clearance.
Green - thicker bearing half, gives **reduced** clearance.

2nd undersize:
White - thin bearing half, gives **increased** clearance.
Brown - thicker bearing half, gives **reduced** clearance.

Example

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

If the clearance is excessive even after two thick bearing shells have been fitted, the crankshaft must be ground down to the next undersize and the appropriate undersized bearing shells fitted. (See the 'Technical data' section).

N.B.
The journals can be ground down one undersize (0.25 mm or 0.0098 in) without requiring rehardening. Grinding to further undersize will necessitate Tenifer rehardening.

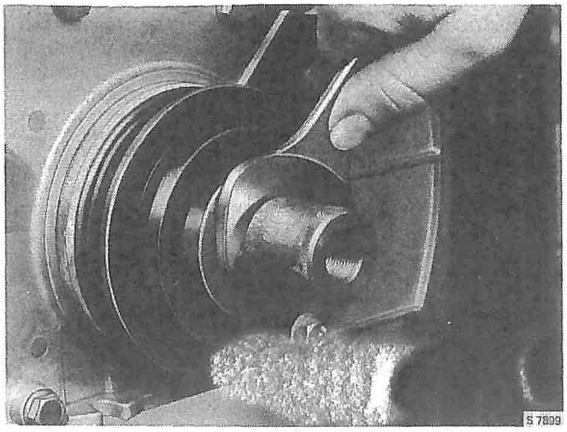
To replace the crankshaft seal at the flywheel end

The seal can be replaced with the engine in situ or removed from the car, but the clutch and flywheel must always be removed first.

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1 Use a screwdriver to remove the old seal.

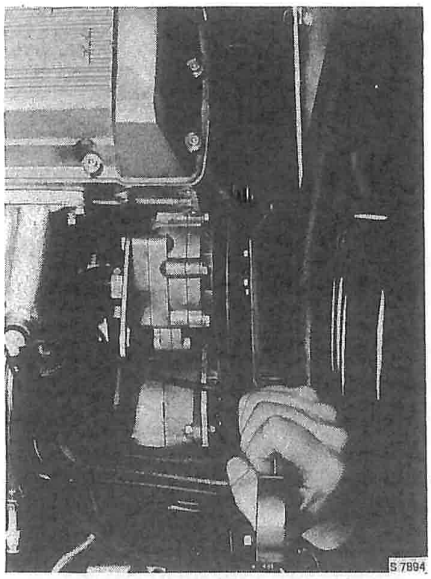
2 Fit the new seal with the spring ring towards the crankshaft. Oil the surfaces before fitting. Use tool 83 92 540 to fit the seal.

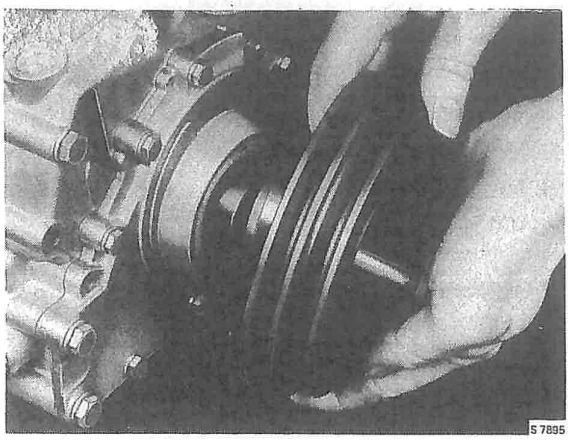


To replace the crankshaft seal at the timing chain end

The seal can be replaced with the engine in or out of the car.

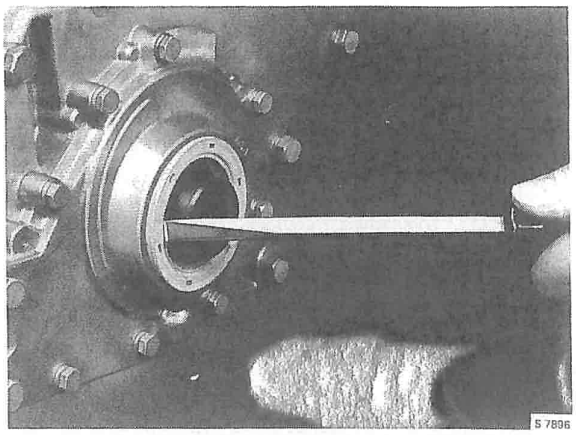
1 Remove the drive belt(s), the pulley centre-bolt (use locking segment 83 92 987 to immobilize the crankshaft) and remove the pulley.



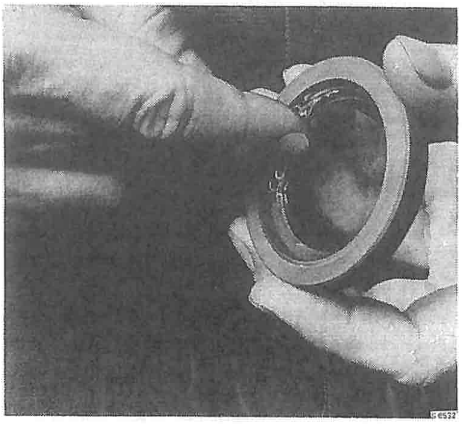


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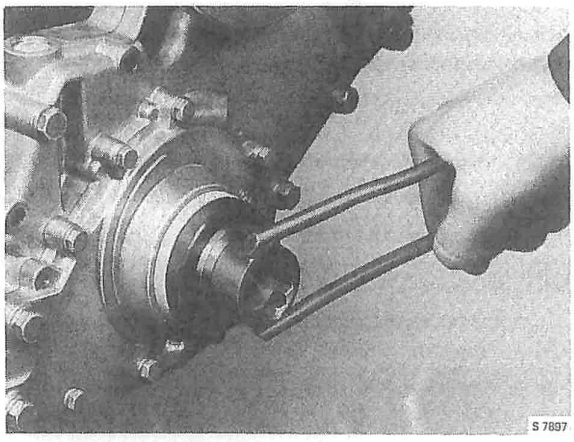
2 Remove the seal by means of a screwdriver.



3 Grease the lips of the seal.



4 Press the seal into place using sleeve 83 93 349, which is drawn in by means of the pulley centre-bolt.



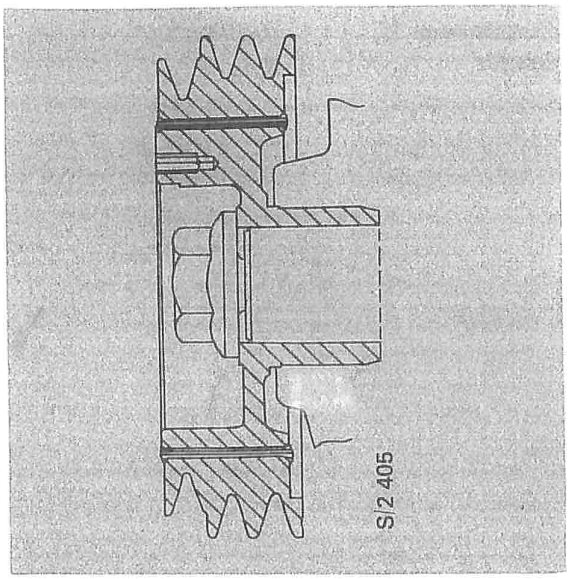
5 Fit the pulley, tightening the centre-bolt to the specified torque.

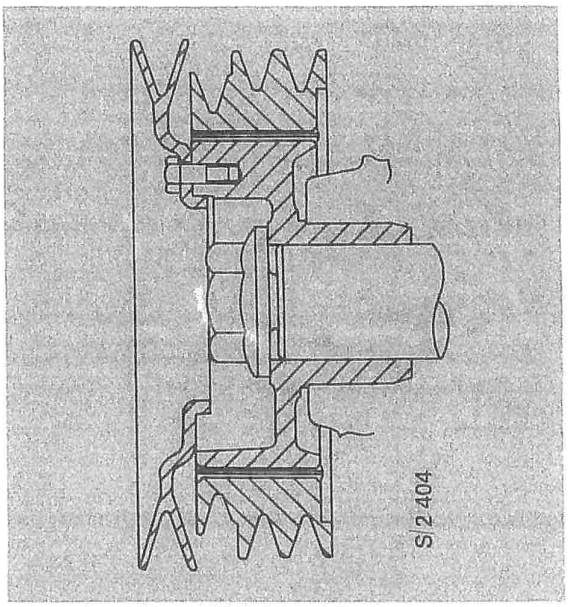
Tightening torque: 190 Nm (140 lbf ft)

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As from 1984 models, the pulley incorporates three grooves; cars with air conditioning have an auxiliary bolted-on pulley.

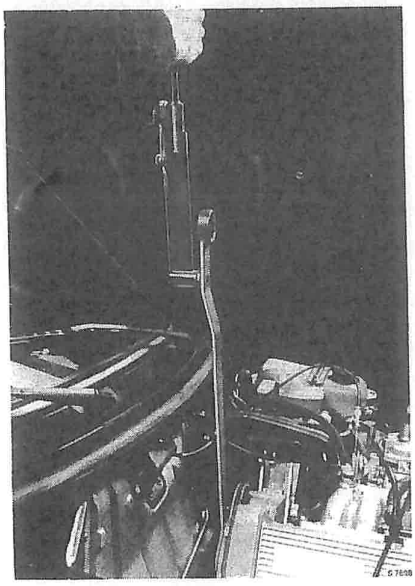
Use tools 83 92 961 and 83 93 639 to remove the pulley from the engine in situ.





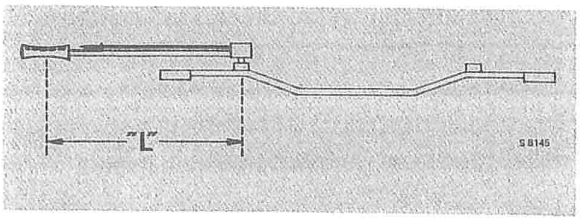
Use special spanner 83 92 961 and a torque wrench when fitting the pulley with engine in situ.

To obtain the correct torque at the bolt, the tightening torque must be adapted to the length of the torque wrench.



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Torque wrench length	Tightening torque
L = 300 mm (12 in)	55 Nm (40 lbf ft)
L = 400 mm (16 in)	70 Nm (52 lbf ft)
L = 500 mm (20 in)	80 Nm (59 lbf ft)



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

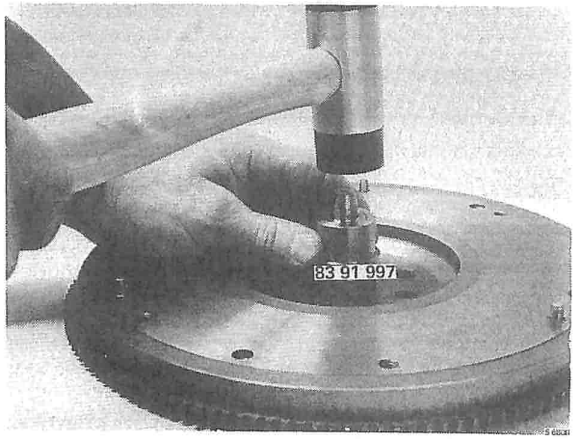
To change the clutch shaft bearing

1 Remove the flywheel.

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

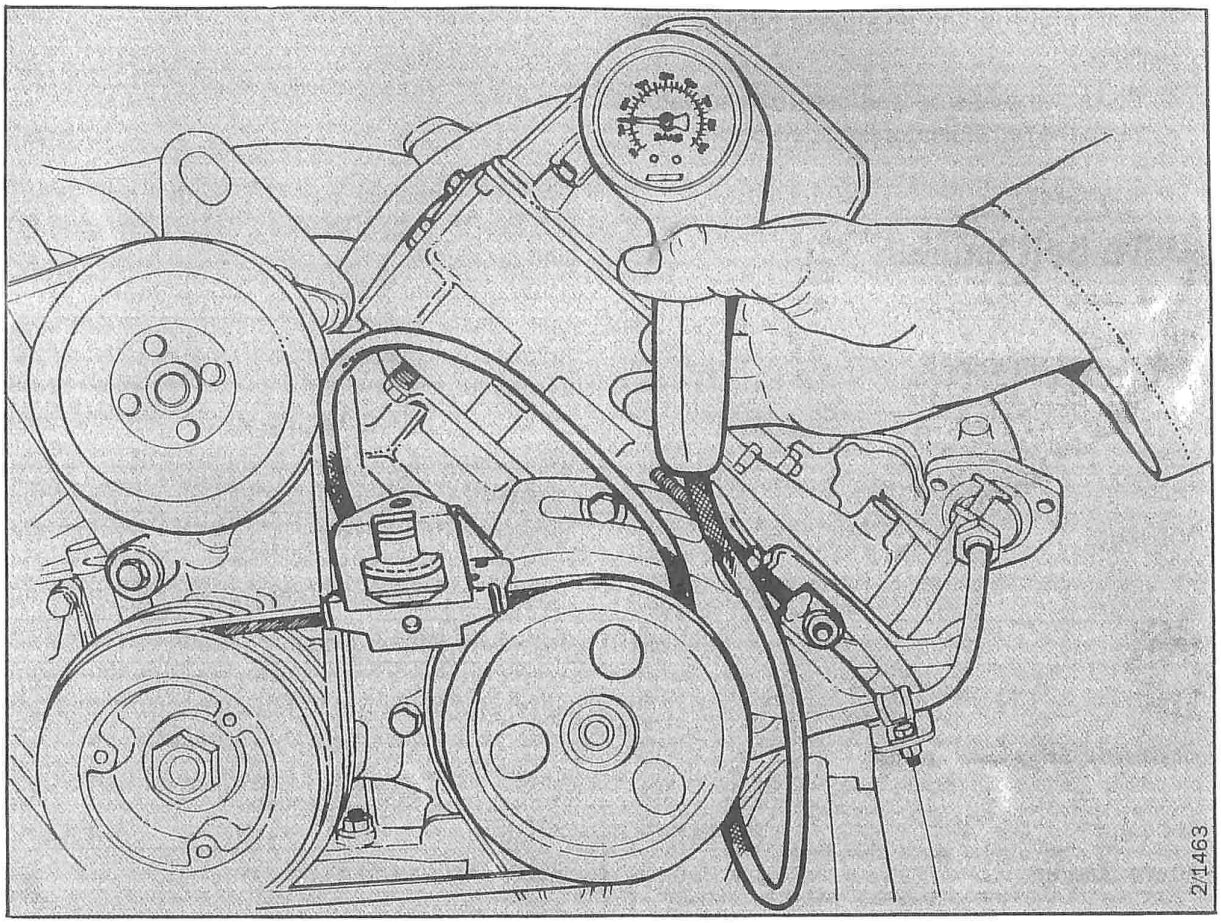


3 Fit a new clutch shaft bearing in the flywheel, using the same drift.



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To measure the drive-belt tension



Belt-tension meter

After being tightened to a certain level, a belt will very quickly lose its tension in operation. If the tension should fall below a given limit, the belt will start to slip, wear will be accelerated and it will not be long before the belt fails altogether.

To prevent this happening, it is **absolutely vital** that a new belt or belt that is being refitted is tightened to the **correct value.**

Some important reminders:

- Use belt-tension meter 83 93 985.
- Measure the tension when the belt is cold; belts are tighter when they are hot. A cold belt is one that has been idle for at least half-an-hour at room temperature.
- Leave the bonnet open.
- The tension of a newly fitted belt must be measured **before** the crankshaft is rotated.
- For a belt to be regarded as new, it must not have run for more than 60 seconds.

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To measure the tension

1 Attach the sensor head of the meter to the belt, with the belt positioned between the jaws.

2 Raise the pressure and read off the value when the red indicator light comes on.

Drive-belt tension

Alternator drive belt

		Single belt	Dual belts	
			Measuring of one belt	Measuring of both belts
Minimum	N (lbf)	265 (60)	200 (45)	420 (95)
After adjusting	N (lbf)	355 ± 20 (80 ± 5)	310 ± 20 (70 ± 5)	645 ± 20 (145 ± 5)
New belt	N (lbf)	535 ± 45 (120 ± 10)	535 ± 45 (120 ± 10)	

Steering servo drive belt

Minimum	N (lbf)	220 (50)
After adjusting	N (lbf)	310 ± 20 (70 ± 5)
New belt	N (lbf)	445 ± 45 (100 ± 10)

AC compressor drive belt

Minimum	N (lbf)	245 (55)
After adjusting	N (lbf)	355 ± 20 (80 ± 5)
New belt	N (lbf)	535 ± 45 (120 ± 10)

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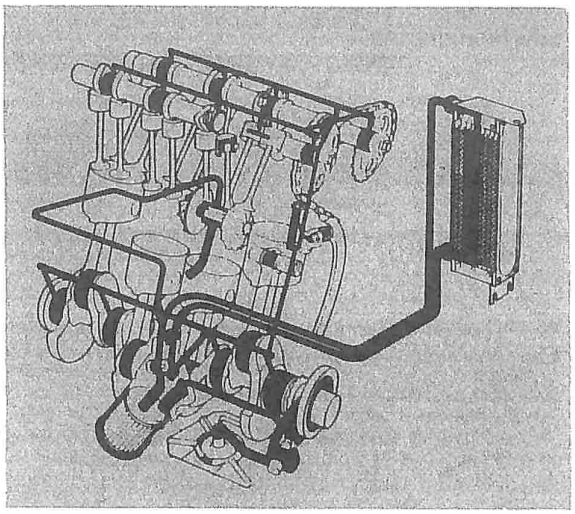
Lubrication system, B201 and B202

General

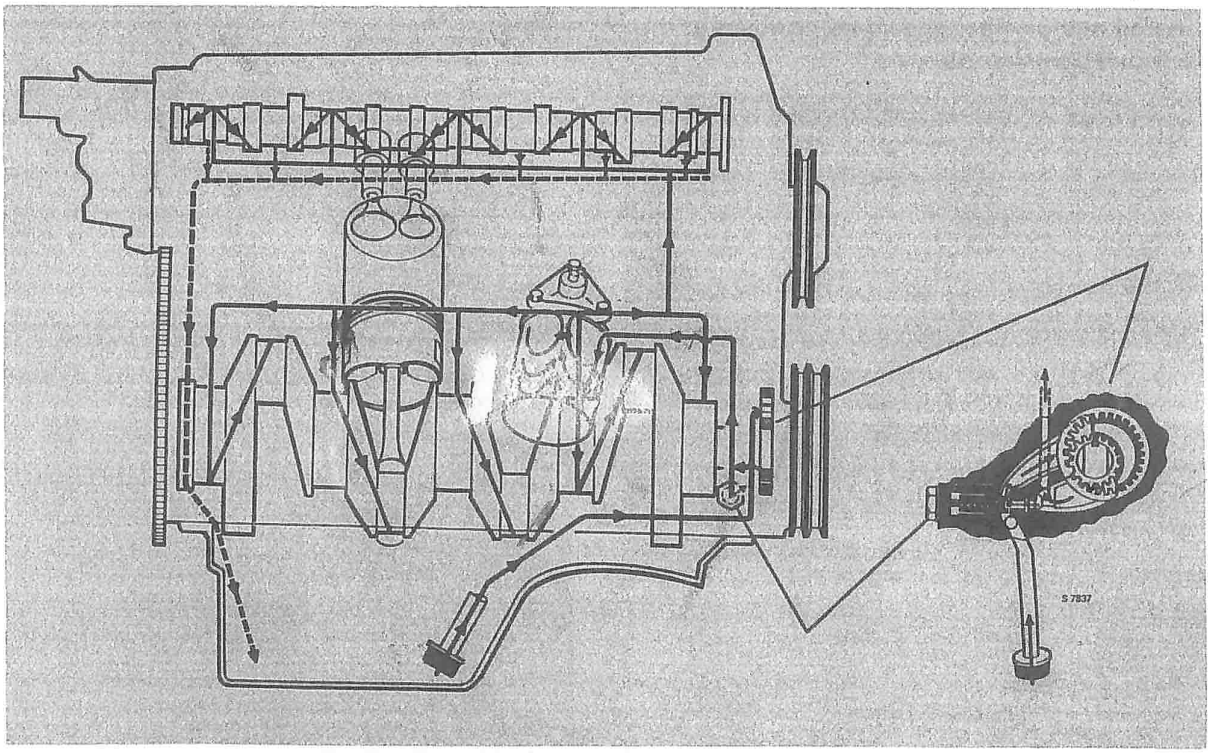
The engine has a forced-flow lubrication system. Oil pressure is generated by a gear-type pump consisting of a gear wheel and an eccentric ring gear. The pump is driven by the crankshaft and is interposed between the timing cover and crankshaft pulley. A reduction valve in the timing cover limits the oil pressure by directing excess oil to the inlet side of the pump.

The oil pan is integral with the gearbox casing but totally separated from the gearbox lubrication system. The oil filter is of the full-flow type, i.e. all the oil circulated round the lubrication points passes through the filter.

On the dipstick are marks for the minimum and maximum levels of oil in the sump. The marks represent oil quantities of 2.7 litres (2.9 liq qt) 3.7 litres (3.9 liq qt) respectively. The total capacity of oil, including that in the filter, is: B201, 3.8 litres (4 liq qt); B202, 4.0 litres (4.2 liq qt).



Lubricating system, B202



Lubricating system, B201

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Quantity of oil circulating

When the engine is running, 1.2 litres of oil is used to fill the oilways in the engine. This will result in the oil in the sump dropping to a level midway between the marks on the dipstick.

After the engine has been switched off, the oil in the engine oilways starts to drain back to the sump. The time taken for the oil to drain back into the sump depends on the temperature of the engine. If the engine has reached its normal operating temperature, it will take about an hour for all the oil to drain back, although most of the oil will have drained back to the sump within the first ten minutes.

Oil level

The sensor for the oil warning light is located on the oil filter adaptor.

The oil should be checked two or five minutes after the engine has been switched off having reached its normal operating temperature. Do not top up the oil unless the level is lower than midway between the MAX and MIN marks on the dipstick.

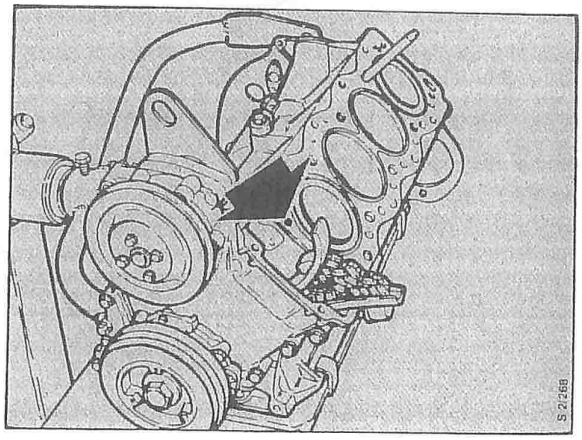
Changing the oil

The oil and oil filter should be changed at the scheduled service intervals.

To replenish the system after changing the oil, 3.8 litres (4.0 liq qt) will be required for B201 engines and 4.0 litres (4.2 liq qt) for B202 engines.

B201

The oil flows through the inlet filter in the sump, on through the oil pump and an oilway to the oil filter adaptor, and thence through the main gallery in the block. Oilways run from the gallery to the main bearings and a rising oilway runs to the cylinder head for lubrication of the camshaft and valve gear.



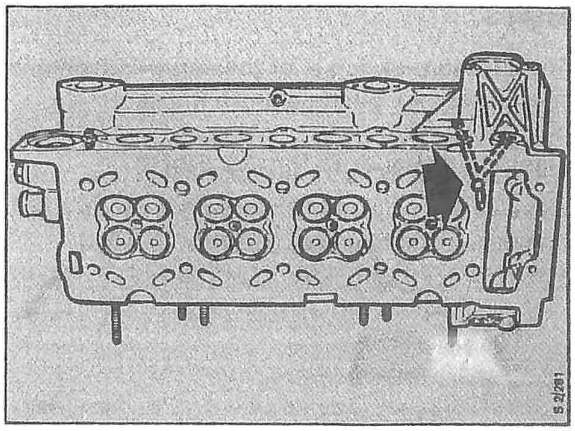
Rising oilway in the block (arrowed)

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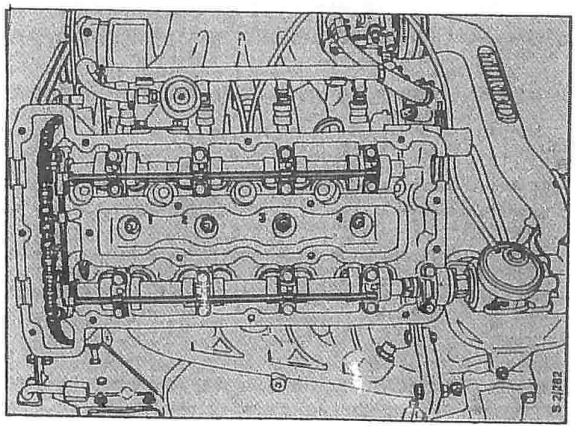
B202 engine

In the cylinder head, the oil flows through pipes to the camshaft bearings and the hydraulic cam followers. The hydraulic chain tensioner is connected to the rising oilway by a drilled passage in the cylinder head. Also connected to the main oil gallery is an oil line for lubrication of the turbo unit. On Turbo engines, the oil cooler is connected by means of a special adaptor for the oil filter, which also incorporates the oil thermostat and connectors for the oil cooler.

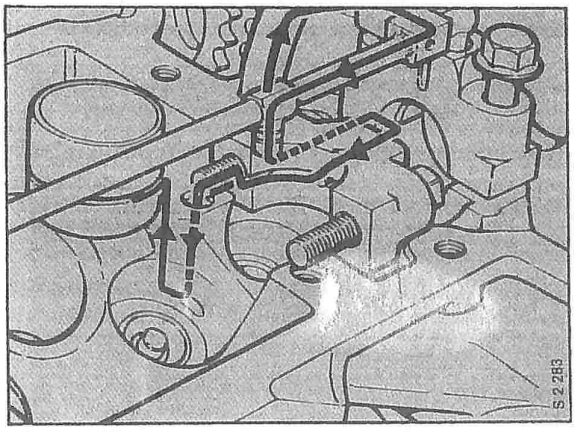
Oil is filled through the dipstick pipe.



Rising oilway in the cylinder head



Pipe system in the cylinder head



Cam follower lubrication

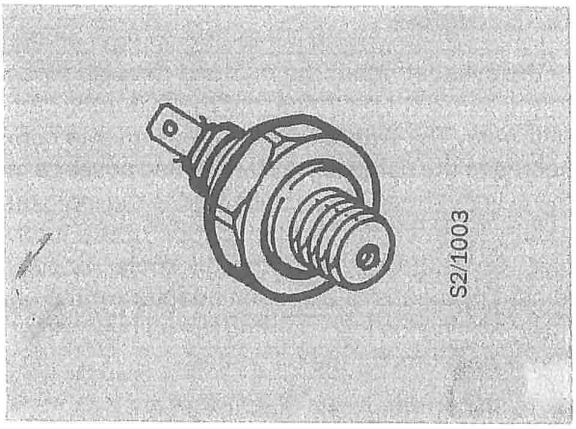
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Pressure switch and adaptor, M86 onwards

The pressure switch is of the screw-in type and has an M14 x 1.5 thread and a flat seal.

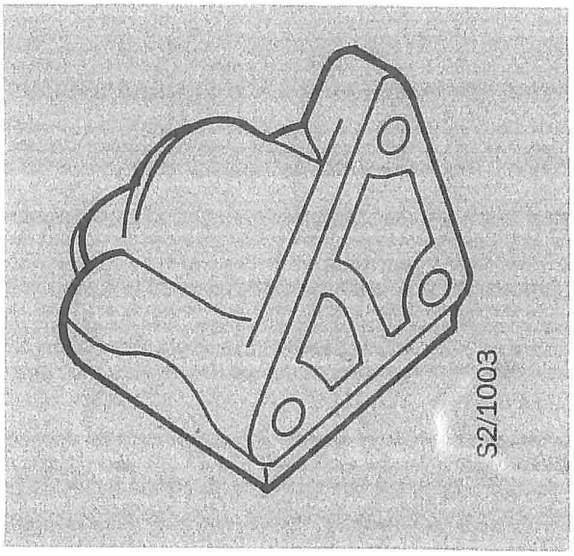
Tightening torque: 25 Nm (18.5 lbf ft)

The switch breaks the circuit at 0.3 bar (4.3 psi) and makes the circuit at 0.55 bar (8.0 psi).



Pressure switch

The adaptor for the engine oil filter matches the thread on the pressure switch and also the seal.

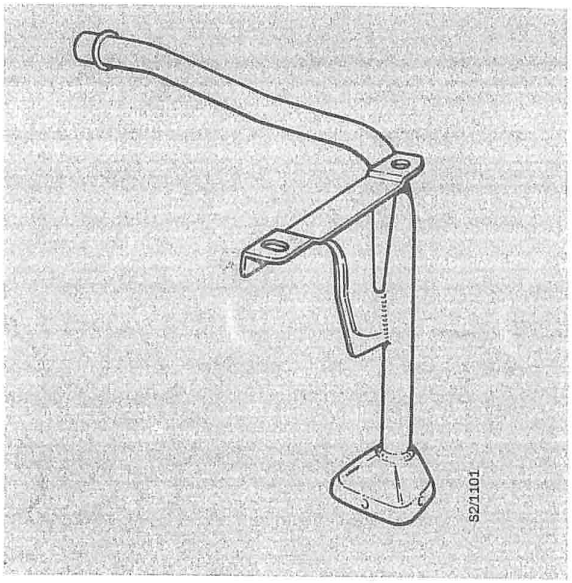


Adaptor

Oil pump filter inlet pipes of different lengths, manual and automatic cars

The length of the inlet pipe to the oil pump filter differs between manual and automatic cars.

It is essential that the correct inlet pipe be fitted; if the wrong one is fitted, inadequate lubrication can result, with consequent damage to the engine.



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Oil pump, B201 and B202

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

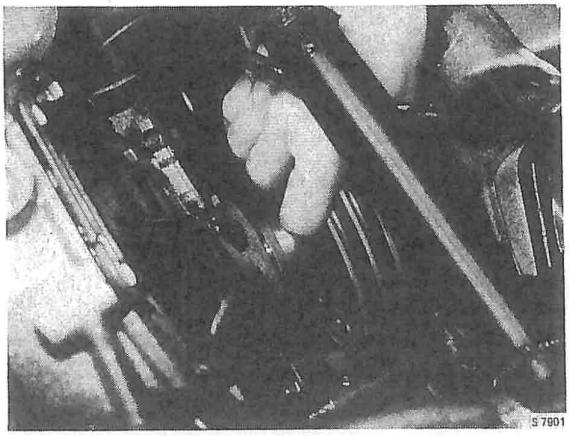
The oil pump reduction valve is situated in the timing cover and returns excess oil to the inlet side of the pump.

To remove

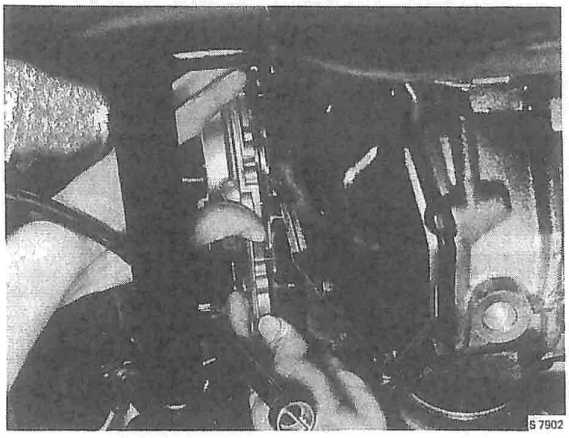
The oil pump can be removed with the engine in the car.

1 Clean the area round the oil pump.

2 Remove the crankshaft pulley centre-bolt and the pulley from the crankshaft. Immobilize the crankshaft by attaching locking segment 83 92 987 to the flywheel ring gear.



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

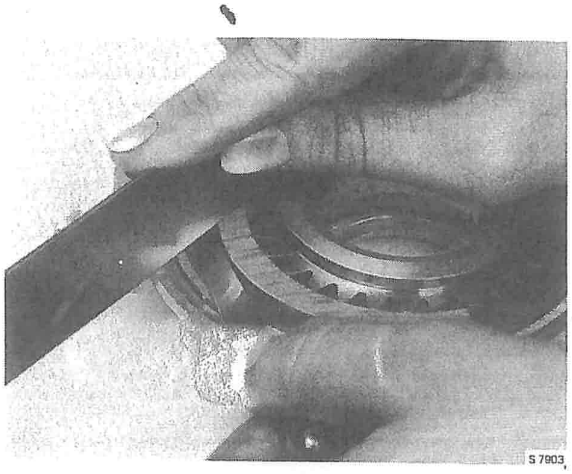


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To check

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

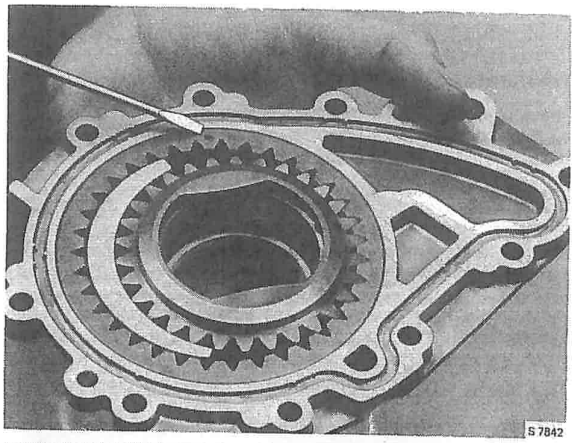
Permissible end float: 0.03 - 0.08 mm (0.0012 - 0.0031 in)



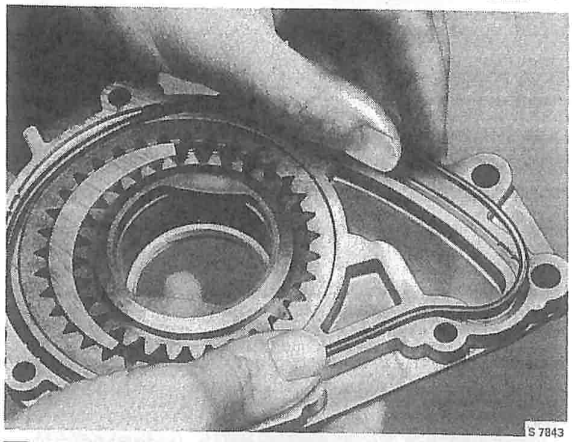
To refit

1 Oil the gearwheels.

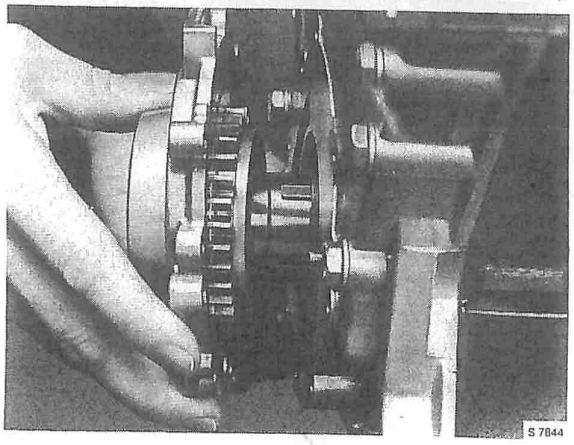
2 Refit the ring gear with the mark on its face uppermost.



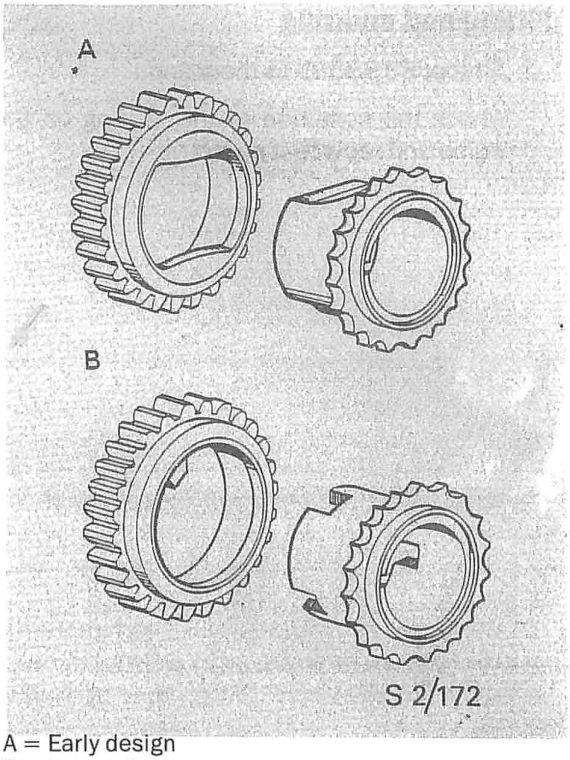
3 Fit a new seal in the groove in the pump body and check that the locating dowel is fitted.



4 Refit the pump. Extract the pump gear slightly and engage the dog on the gear in the slot in the hub.



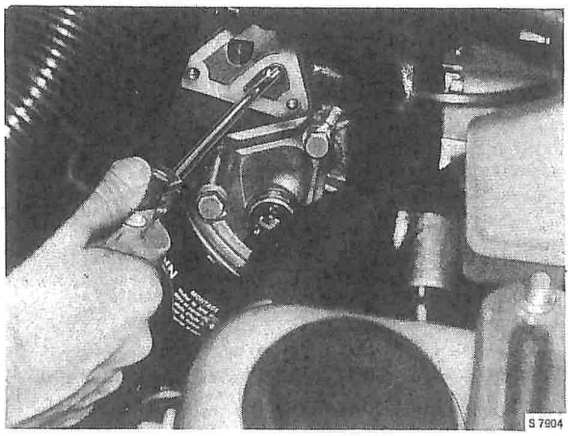
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A = Early design
B = Latest design

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

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



6 Refit the oil filter adaptor.

Centring of the oil pump

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

To remove

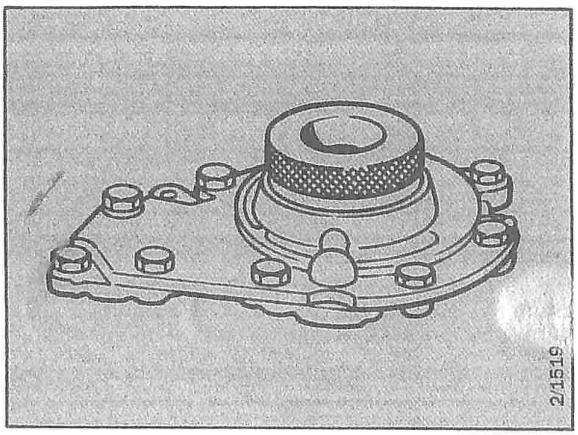
1 Remove the pulley from the crankshaft.
2 Remove the pump.
3 Remove existing locating pins.
4 Remove the shaft seal in the pump.

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Fitting and centring

1 Fit tool 83 93 589 to the pump.

Check the condition of the 'O' ring on the pump and replace if defective.



2 Fit the pump complete with the special tool.

3 Fit the pulley retaining bolt and tighten the special tool to a torque of 27 Nm (20 lbf ft) using a 400-mm (15.75-in) long torque wrench.

4 Secure the pump (8 + 2 bolts).

5 Remove tool 83 93 589, using strap wrench 83 93 332 or a large pair of water-pump pliers.

6 Fit a new shaft seal on the pump.

7 Fit the pulley.

Tightening torque: 190 Nm (140 lbf ft)

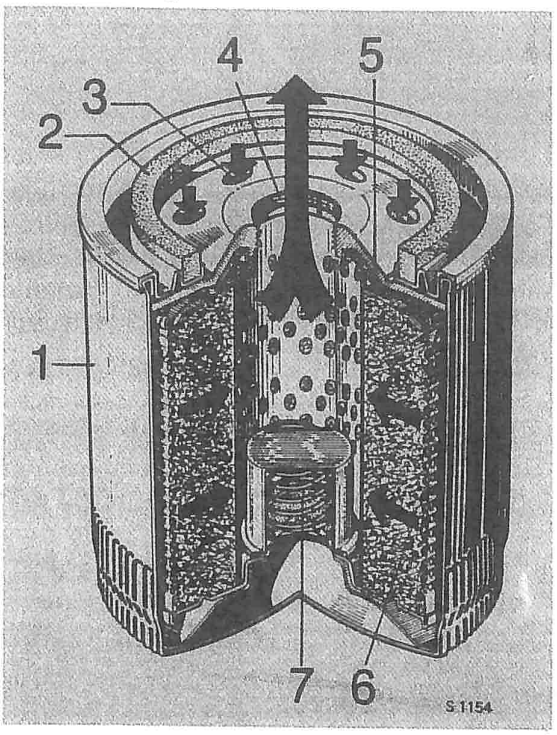
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Oil filter

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

For production reasons a smaller filter (75-mm dia.) is fitted at the factory and this should be replaced with the larger model at the 1200-mile (1000-km) service.

N.B.
Only the larger diameter filter should subsequently be used.



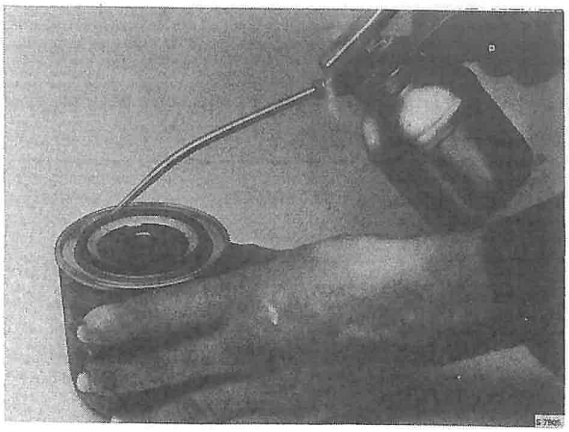
Oil filter

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

Changing the filter

1 Use the strap wrench to unscrew the filter.

- Wrench for removing factory-fitted filter (at the 1200-mile/1000-km service): 83 93 332
- Wrench for removing standard filter: 78 62 014.



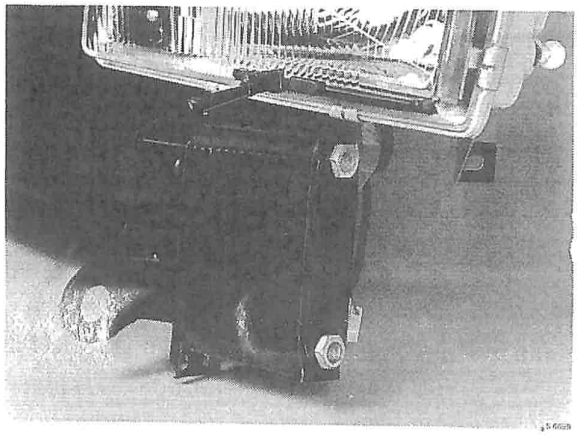
2 Oil the rubber seal at the bottom of the new filter (engine oil) and screw on the filter until it just touches the adaptor casting. Then tighten the filter a further half-a-turn.

N.B.
Overtightening of the filter is liable to distort the seal, with oil leakage as the result.

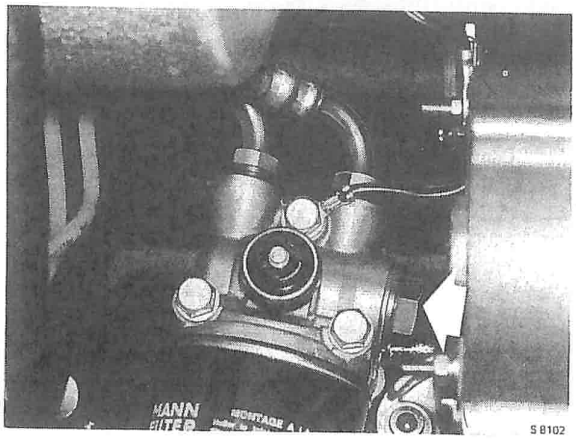
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Oil cooler

An air-cooled oil cooler for the engine oil is fitted to all Turbo cars. The oil cooler is located below the left-hand headlight.



When an air-cooled oil cooler is fitted, the radiator hoses are connected to an adaptor at the oil filter. The adaptor incorporates a thermostat which opens (initiates circulation through the oil cooler) when the temperature rises above 75°C (167°F).



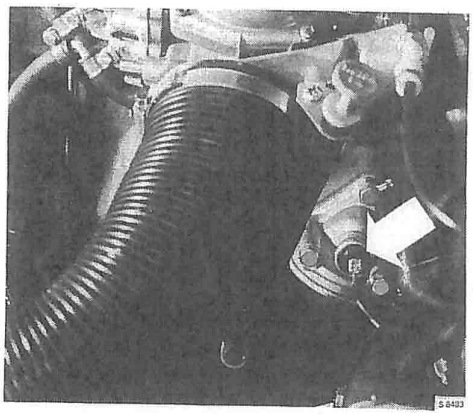
Oil pressure sensor

The oil pressure sensor is located on the oil filter adaptor.

To remove

1 Disconnect the electrical lead.

2 Unscrew the pressure sensor (7/16-in spanner).



To refit

N.B.
Apply sealant to the thread before refitting the sensor.

1 Screw in the pressure sensor and tighten to a torque of 12 - 15 Nm (8.9 - 11.2 lbf ft).

2 Reconnect the electrical lead.

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