Service Manual

Repairs and maintenance

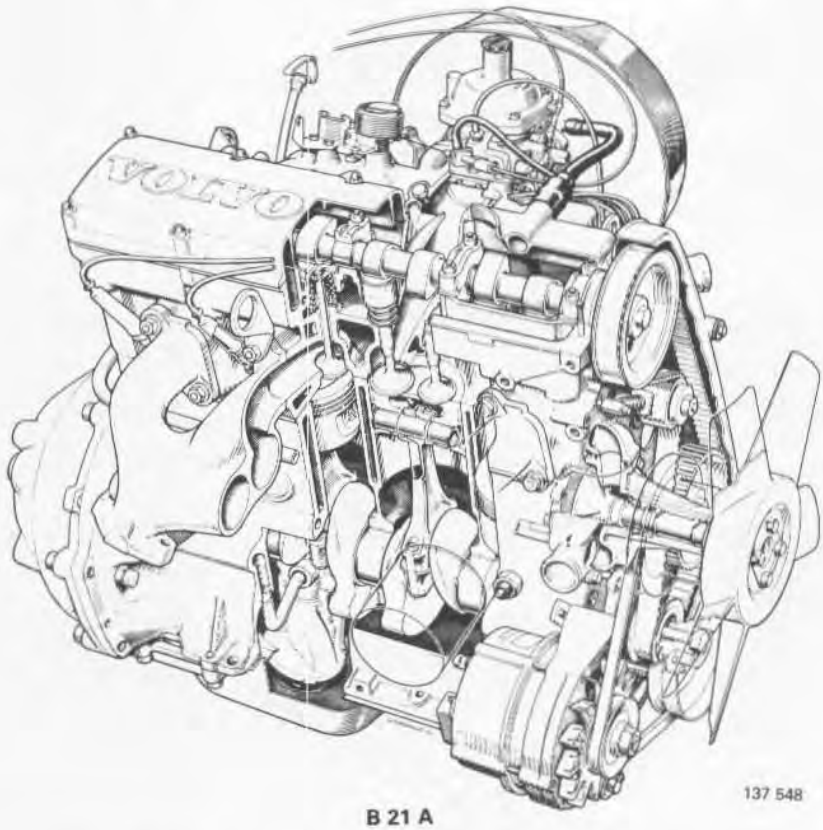
Section 2 (20–22)

Engine B 17, B 19
B 21, B 23

240 1975–1985

VOLVO

B 17, B 19, B 21, B 23



137 548

B 21 A

What do the designations mean?

B 21 E T

T = Turbo

A = carburretor engine
K = carburretor engine
E = injection engine
F = injection engine "USA version"

21 = cylinder capacity (litres × 10)

B = petrol (gasoline)

B 21 = basic engine
B 23 = a **B 21** with larger cylinder diameter
B 19 = a **B 21** with smaller cylinder diameter
B 17 = a **B 19** with shorter stroke

This manual covers the following engines

Engine type	Model (year)
B 17 A	1979–1985
B 19 A	1977–1984
B 19 K	1984
B 19 E	1977–1984
B 19 ET	1982–1985
B 21 A	1975–1984
B 21 E	1975–1983
B 21 ET	1981–1985
B 21 F–5[1]	1976–1984[3]
B 21 F–8[2]	1982
B 21 F–9[4]	1981–1982
B 21 FT	1981–1985
B 23 A	1981–1984
B 23 E	1979–1984
B 23 F (LH-Jetronic)	1983–1984

Notes

[1]B 21 F–5 = CI system with Bosch ignition system.
[2]B 21 F–8 = LH-Jetronic ignition system.
[3]Introduced in 1982 for USA and Canada. Replaced by B 21 F–8.
[4]B 21 F–9 = CI system and Chrysler ignition system.

Volvos are sold in versions adapted for different markets. These adaptions depend on many factors including legal, taxation and market requirements.

This manual may therefore show illustrations and text which do not apply to cars in your country.

Volvo owners planning to export their car(s) to another country should investigate the applicable safety and exhaust emission requirements. In some cases it may be impossible to comply with these requirements.

Contents

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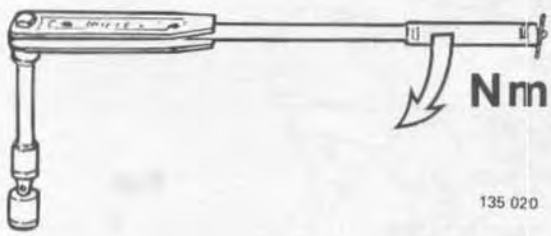
Order number: TP 30156/2
Replaces: TP 30156/1

Important information



135 020

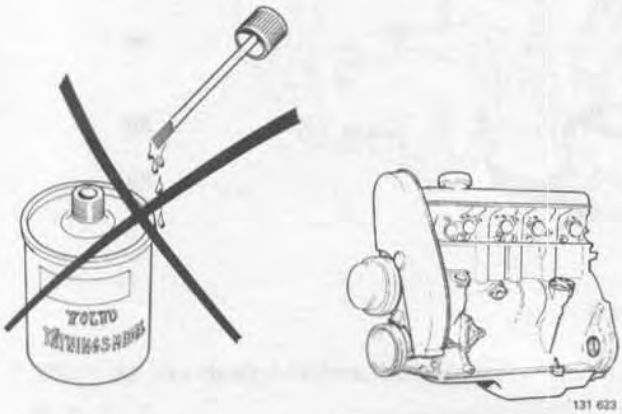
Tightening torques

Two types of tightening torques are mentioned in the manual:

I. Tightening to **40 Nm** (30 ft.lbs) = indicated for parts which must be tightened with a torque wrench.

II. Torque 40 Nm (30 ft.lbs) = recommended value, the part need not to be tightened with a torque wrench.

The specifications section indicates torques for those parts which are to be tightened with a torque wrench.



131 623

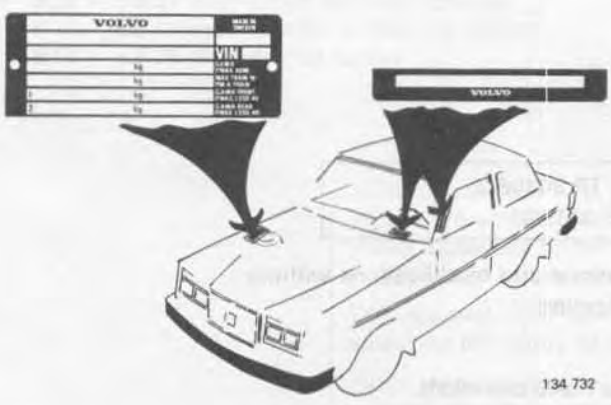
Do not use sealants when carrying out repairs on turbo engines.

The sealant may penetrate the engine lubricating system and block the turbocharger oil ducts.

Specifications

Group 20 General

PLATES AND DECALS



134 732

Product plate

On right-hand inner wing (fender).

Indicates identification number (type designation).

N.B. Different versions for different models. The illustration shows the 1981 version.

Identification plate (type designation)

Only provided on cars for USA and Canada. Visible from the outside of the car.

–1979: on the left-hand windshield pillar
1980–1985: at the top of the dashboard.

Identification number (type designation)

N.B. Different number structure on different models and markets. The numbers shown are only examples.

USA/Cánada

–1980: VC 244 45 L 1 000000

1981–: YV1 AX 45 4X B 1 000000

Others

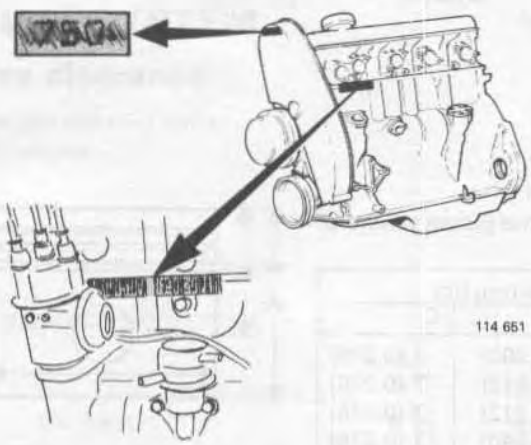
–1980: 245 45 L 1 000000

1981–: YV1 244 46 1B 1 000000

Engine type — Model designation — Chassis number

134 733

Engine type	Model designation
11 = B 17 A	B = 1975
21 = B 19 A	E = 1976
23 = B 19 K	H = 1977
24 = B 19 E	L = 1978
26 = B 19 ET	M = 1979
41 = B 21 A	A = 1980
44 = B 21 E	B = 1981
45 = B 21 F-5	C = 1982
46 = B 21 ET	D = 1983
48 = B 21 F-8	E = 1984
49 = B 21 F-9	F = 1985
47 = B 21 FT	
81 = B 23 A	
84 = B 23 E	
88 = B 23 F (LH-Jetronic)	



114 651

Engine production and part number

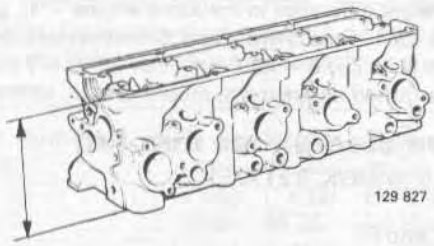
Punched on the left-hand side of the cylinder block behind the distributor.

On 1977 and later models, a decal has also been provided on the gear case indicating the last three digits of the part number.

Group 21 Engine body

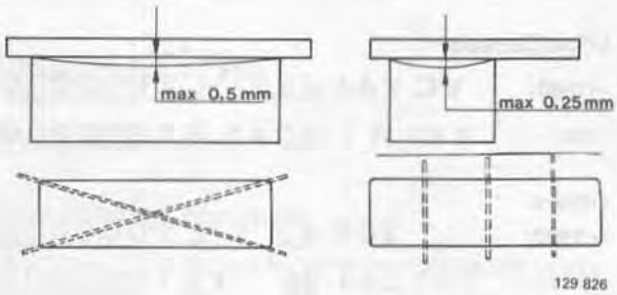
CYLINDER HEAD

Height ..... New = 146.1 mm (5.76 in)
Min. after machining = 145.6 mm (5.74 in)



129 827

Max warp .....



N.B. Replace cylinder head if warp exceeds 1.0 mm (0.04 in) along the longitudinal axis, or 0.5 mm (0.02 in) along the lateral axis. Do not reface such cylinder heads.

Thickness of cylinder head gasket,
unloaded ..... 1.3 mm (0.051 in)
loaded ..... 1.2 mm (0.047 in)

CYLINDER BLOCK

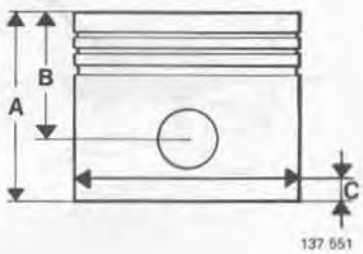
Cylinder diameter mm (in)

	B 17, B 19	B 21	B 23
Standard (C-marked) ..... mm	88.90–88.91	92.00–92.01	96.00–96.01
	(3.5027–3.5031)	(3.6248–3.6252)	(3.7824–3.7828)
(D-marked) ..... mm	88.91–88.92	92.01–92.02	96.01–96.02
	(3.5031–3.5034)	(3.6252–3.6256)	(3.7828–3.7832)
(E-marked) ..... mm	88.92–88.93	92.02–92.03	96.02–96.03
	(3.5034–3.5038)	(3.6256–3.6260)	(3.7832–3.7836)
(G-marked) ..... mm	88.94–88.95	92.04–92.05	96.04–96.05
	(3.5042–3.5047)	(3.6264–3.6268)	(3.7840–3.7844)
Oversize 1 ..... mm	89.29–89.30	92.5	96.3
	(3.5180–3.5184)	(3.6445)	(3.7942)
2 ..... mm	89.67–89.68	93.0	96.6
	(3.5330–3.5334)	(3.6642)	(3.8060)

Rebore cylinder if wear exceeds 0.10 mm (0.004 in) and engine displays abnormal oil consumption.

PISTONS

A = Height of piston
B = Height of piston from centre of piston pin to top of piston
C = The piston diameter must be measured at right angles to the piston pin hole, and at a distance C from the bottom of the piston.



Engine	Weight in gms[1] (oz)	Dimensions in mm (in)		
		A	B	C
B 17 A	530±6 (18.9±0.2)	75.5 (2.975)	50.5 (1.990)	7 (0.276)
B 19 A	505±6 (18.0±0.2)	71.0 (2.797)	46.0 (1.812)	7 (0.276)
B 19 E –1983	515±6 (18.4±0.2)	71.0 (2.797)	46.0 (1.812)	7 (0.276)
1984	515±6 (18.4±0.2)	73.9 (2.912)	46.7 (1.840)	7 (0.276)
B 19 ET	510±6 (18.2±0.2)	71.0 (2.797)	46.0 (1.812)	7 (0.276)
B 19 K	515±6 (18.4±0.2)	73.9 (2.912)	46.7 (1.840)	7 (0.276)
B 21 A[2]	555±6 (19.8±0.2)	71,0 (2.797)	46.0 (1.812)	6 (0.236)
B 21 E	555±6 (19.8±0.2)	71.0 (2.797)	46,0 (1.812)	6 (0.236)
B 21 ET	535±6 (19.1±0.2)	71.5 (2.817)	46.5 (1.832)	7 (0.276)
B 21 F	555±6 (19.8±0.2)	71.5 (2.817)	46.5 (1.832)	7 (0.276)
B 21 FT	535±6 (19.1±0.2)	71.5 (2.817)	46.5 (1.832)	7 (0.276)
B 23 A	570±7 (20.4±0.3)	76.4 (3.010)	46.4 (1.828)	8 (0.315)
B 23 E tupe 1	555±6 (19.8±0.2)	80.4 (3.168)	46.4 (1.828)	15 (0.591)
type 2	570±7 (20.4±0.3)	76.4 (3.010)	46.4 (1.828)	8 (0.315)
B 23 F[3]	570±7 (20.4±0.3)	76.4 (3.010)	46.4 (1.828)	8 (0.315)

[1]Max weight difference in the same engine = 12 gms (0.43 oz)
[2]Europe 1984– (excl Switzerland, Scandinavia) models have high compression pistons, A = 71.7 mm (2.82 in); B = 46.7 mm (1.84 in); C = 7 mm (0.28 in)
[3]Pistons dished on engine numbers 499846, 499890.

Piston clearances mm (in)

B 17 A, B 19 A/E/K, B 21 A/E/F 0.01–0.04 (0.0004–0.0016)
B 19 ET 0.03–0.06 (0.0012–0.0024)
B 21 ET and FT 0.02–0.04 (0.0008–0.0016)
B 23 A 0.01–0.04 (0.0004–0.0016)
B 23 E version 1 ..... 0.05–0.07 (0.0020–0.0028)
version 2 ..... 0.01–0.04 (0.0004–0.0016)
B 23 F 0.01–0.04 (0.0004–0.0016)

Piston rings

Axial clearance

Measure ring gap 15 mm (0.591 in) from bottom of cylinder.

		Upper comp.ring	Lower comp.ring	Oil ring
Height, version 1	mm	1.978–1.990	1.978–1.990	4.74
	(in)	(0.0779–0.0783)	(0.0779–0.0783)	(0.1866)
version 2	mm	1.728–1.740	1.978–1.990	3.978–3.990
	(in)	(0.0681–0.0685)	(0.0779–0.0783)	(0.1566–0.1571)
Axial clearance (measured with ring on piston, see diagram)	mm	0.040–0.072	0.040–0.072	0.030–0.062
	(in)	(0.0016–0.0028)	(0.0016–0.0028)	(0.0012–0.0024)
Ring gap (measured in cylinder, see diagram)	mm	0.35–0.65	0.35–0.55	0.25–0.60
	(in)	(0.014–0.026)	(0.014–0.022)	(0.010–0.024)

Piston pin

Fit, in connecting rod		Light thumb pressure (close running fit)
in piston		Thumb pressure (sliding fit)
Diameter, standard	mm (in)	24.00 (0.946)
oversize	mm (in)	24.05 (0.948)

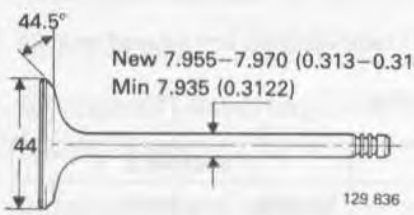
VALVE SYSTEM

Valve clearance

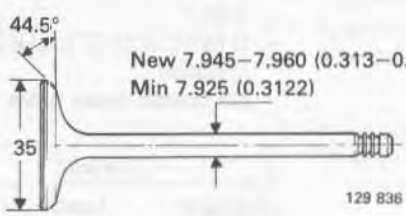
		Control	Adjustment
Intake and exhaust valve:			
cold engine	mm	0.30–0.40	0.35–0.40
	(in)	(0.012–0.016)	(0.014–0.016)
hot engine	mm	0.35–0.45	0.40–0.45
	(in)	(0.014–0.018)	(0.016–0.018)

Adjustment washers, thickness ..... 3.30–4.50 mm (0.13–0.177) in intervals of 0.05 mm (0.002 in)

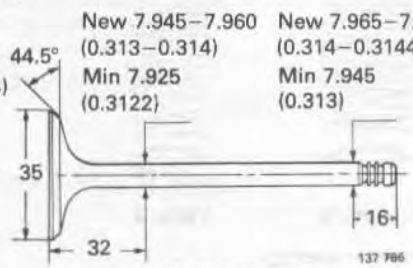
Valves mm (in)



Intake valve

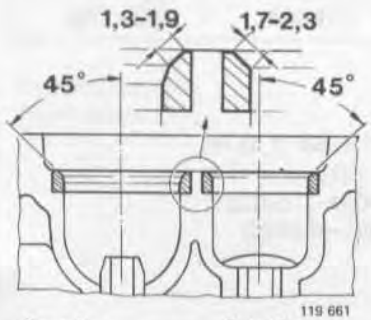


Exhaust valve
A, E, F engines



Exhaust valve
Turbo engines

Valve seats

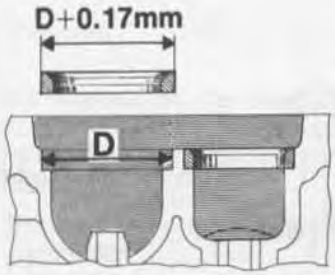


Seat for intake valve — **Seat for exhaust valve**

N.B. The exhaust valves for the Turbo are stellite-flashed and must not be machined. They may only be ground in against the seat.

Warning: Turbocharged engines have sodium-filled exhaust valves. Scrapped valves must not be mixed with ordinary scrap before first removing the sodium. See step C19.

Valve seat diameter		Intake	Exhaust
standard	mm	46.00	38.00
	(in)	(1.812)	(1.497)
oversize 1	mm	46.25	38.25
	(in)	(1.822)	(1.507)
2	mm	46.50	38.50
	(in)	(1.832)	(1.517)



Note: When replacing valve seats, make sure that there is a negative clearance of 0.17 mm (0.0067 in) between the valve seat and the cylinder head recess. This means the the valve seat diameter must be 0.17 mm (0.0067 in) larger than the diameter of the recess in the cylinder head.

Valve guides

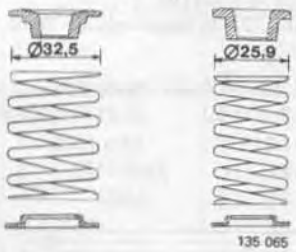
		Intake valve	Exhaust valve
Length	mm	52	52
	(in)	(2.0488)	(2.0488)
Inside diameter	mm	8.000–8.022	8.000–8.022
	(in)	(0.3152–0.3161)	(0.3152–0.3161)
Height above upper plane of cylinder head	mm	15.4–15.6	17.9–18.1
	(in)	(0.6068–0.6146)	(0.7053–0.7131)
Clearance, valve spindle – guide (measured with new valve)			
new	mm	0.030–0.060	0.060–0.090
	(in)	(0.0012–0.0021)	(0.0024–0.0035)
max.	mm	0.15	0.15
	(in)	(0.0059)	(0.0059)

The valve guides are available in three oversizes, and are marked with grooves.

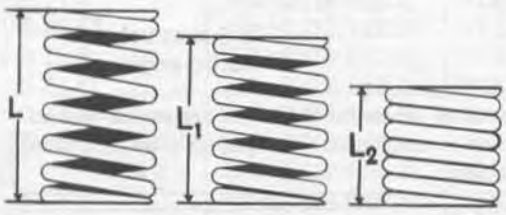
	Marking	Reamer for seat
Standard	No groove	–
Oversize 1	1 groove	5161
2	2 grooves	5162
3	3 grooves	5163

N.B. The force exerted when pressing in valve guides must be **9000 N.** If the force is lower, the position of the guide must be reamed up to the nearest oversize, and the guide with the corresponding dimension pressed in.

Valve springs mm (in)



Vers. 1 **Vers. 2**



Version 2 used on:

- B 21 F LH-Jetronic, later version (introduced on 1983 models)
- B 23 F
- B 19 ET, B 21 ET and B 21 FT later versions (introduced on 1984 models)

All others must have version 1.

Version 1		Version 2	
Length mm (in)	**Load N (lbf)**	**Length mm (in)**	**Load N (lbf)**
45.0 (1.773)	0	45.5 (1.793)	0
38.0 (1.497)	280–320 (63–72)	38.0 (1.497)	280–320 (63–72)
27.0 (1.064)	710–790 (160–178)	27.5 (1.084)	702–782 (158–176)

Tappets mm (in)

Diameter	36.975–36.995 (1.4568–1.4576)
Height	30–31 (1.182–1.221)
Clearance, adjusting shim–tappet	0.009–0.064 (0.0004–0.0025)
tappet–cylinder head	0.030–0.075 (0.001–0.0029)

Adjusting shims mm (in)

Thickness	3.30–4.50 (0.130–0.177) in intervals of 0.05 (0.002)
Diameter	32.980–33.0 (1.299–1.300)

TIMING GEARS

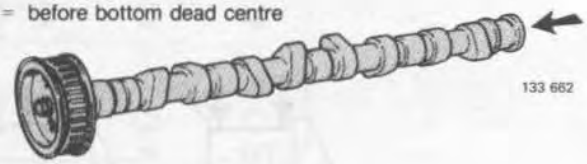
Camshaft mm (in)

Engine version	Marking
B 17 A, B 19 A	A
B 19 K	L
B 19 E 1977–1983	D
1984	A
B 19 ET	T
B 21 A 1975–1983	A
1984 Switerland	A
Scandinavia and Australia,	
Others	L
B 21 E	D
B 21 ET	T
B 21 F-5	B
B 21 F-8	M
B 21 F-9	L
B 21 FT	T
B 23 A	A
B 23 E 1979–1980	H
1981–1982	K
1983 Canada	A
Others	K
1984	A
B 23 F	M

Max. lifting height in.	Inspection of camshaft adjustment (cold engine)	
	Adjust the valve clearance for 1st intake valve to	The intake valve must then open at[2]
A/0.414[1]	0.7 (0.028)	13° BTDC
B/0.418	0.7 (0.028)	19° BTDC
D/0.441	0.7 (0.028)	15° BTDC
H/0.473	0.5 (0.020)	28° BTDC
K/0.470	0.5 (0.020)	22.6° BTDC
L/0.386	0.7 (0.028)	10° BTDC
M/0.374 int.	0.7 (0.028)	3° ATDC
0.414 exh.	0.7 (0.028)	48° BBDC
T/0.390	0.7 (0.028)	7° BTDC

[1]1975 (temp. vers.): max. lifting height 0.386 in. and 5° BTDC. The camshaft is replaced by later type as spare part.

[2]BTDC = before top dead centre
ATDC = after top dead centre
BBDC = before bottom dead centre



Bearing journal, diameter	29.050–29.070 (1.1445–1.1454)
Radial clearance, new	0.030–0.071 (0.0012–0.0028)
max.	0.15 (0.0059)
Axial clearance	0.1–0.4 (0.0344–0.0158)

Camshaft bearings mm (in)

Bearing diameter	30.000–30.021 (1.1820–1.1828)

Intermediate shaft mm (in)

	Bearing journal	Bearing in cylinder block
Diameter, front	46.975–47.000 (1.8508–1.8518)	47.020–47.050 (1.8526–1.8538)
centre	43.025–43.050 (1.6952–1.6962)	43.070–43.100 1.6970–1.6981)
rear	42.925–42.950 (1.6912–1.6922)	42.970–43.000 (1.6930–1.6942)

Radial clearance	0.020–0.075 (0.0008–0.0030)
Axial clearance	0.20–0.46 (0.0079–0.0181)

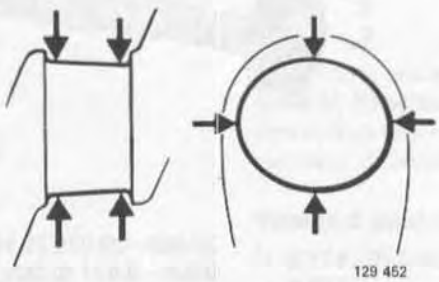
CRANK MECHANISM

Crankshaft mm (in)

Max. out-of-true	0.05 (0.0020)
Crankshaft, axial clearance, max.	0.25 (0.0098)
radial clearance (main bearing)	0.028–0.083 (0.0011–0.0033)
Connecting rod bearings, axial clearance	0.15–0.35 (0.0059–0.0138)
radial clearance	0.024–0.070 (0.0009–0.0028)

Main bearing journals mm (in)

Ovality, max.	0.07 (0.0028)
Taper, max.	0.05 (0.0020)
Diameter, standard	63.451–63.464 (2.5000–2.5005)
undersize 1	63.197–63.210 (2.4900–2.4905)
2	62.943–62.956 (2.4800–2.4805)
Width dimension on crankshaft for flanged bearing cup,	
standard	38.960–39.000 (1.5350–1.5366)
oversize 1	39.061–39.101 (1.5390–1.5406)
2	39.163–39.203 (1.5430–1.5446)



Taper Out-of-round

Connecting rod, bearing journals mm (in)

Out-of-round, max.	0.05 (0.002)
Taper, max.	0.05 (0.002)
Diameter, standard	53.987–54.000 (2.1271–2.1276)
undersize 1	53.733–53.746 (2.1171–2.1176)
2	53.479–53.492 (2.1071–2.1076)
Width dimension of the bearing position	29.95–30.05 (1.1800–1.1840)

Connecting rods mm (in)

Axial clearance at crankshaft	0.15–0.35 (0.0059–0.0138)
Length, centre–centre	145±0.1 (5.713±0.0039)
Max. weight difference between connecting rods in the same engine	10 grams (0.36 ounces)

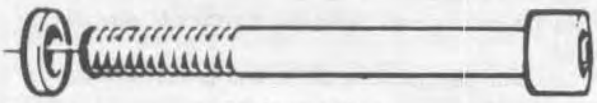
Flywheel mm (in)

Axial throw, max.	0.05/150 (0.0020/5.91) in diameter

TIGHTENING TORQUES

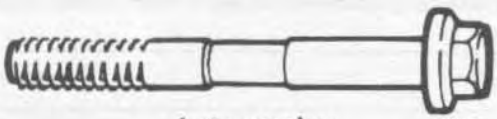
The tightening torques apply to oiled bolts and nuts. Degreased (cleaned) parts must be oiled before assembly.

Cylinder head, tightening in stages:



Early version

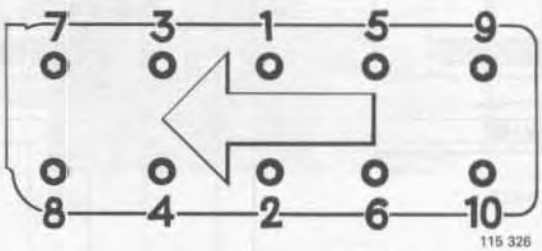
1 = **60 Nm** (43 ft lbs)
2 = **110 Nm** (80 ft lbs)
3 = Warm up. Then allow engine to cool.
4 = Slacken bolt 1 approx. 30°. Then tighten to 110 Nm (80 ft lbs).
(The bolt must first be slackened to ensure that the rest tension is broken. Otherwise the incorrect tightening torque is obtained).
5 = Tighten all other bolts in sequence, according to point 4.



Late version 134 266

1 = **20 Nm** (15 ft lbs)
2 = **60 Nm** (43 ft lbs)
3 = Angle-tighten **90°**.

Bolts should be replaced if center section shows signs of stretching. Do not re-use bolts more than 5 times. If in doubt, fit new bolts.



Tightening sequence for cylinder head screws

	Nm	ft lbs
Main bearing	110	80
Crankshaft bearing, old bolts	63	45
new bolts	70	50
Flywheel (use new bolts)	70	50
Spark plug (must not be oiled)	20–30	14–22
Camshaft sprocket	50	36
Intermediate shaft gear	50	36
Camshaft cover	20	14
Crankshaft, centre bolt, pulley	165	120

Group 22 Lubricating system

General

Oil capacity,[1] excl. oil filter	3.35 litres (3.5 US qts)
incl. oil filter	3.85 litres (4.1 US qts)
Volume difference, max.–min.	1.0 litre (1.0 US qts)

[1]Turbo: Add 0.6 l (0.7 US qts) if oil cooler is completely drained.

Oil pressure at 33 r/s (2000 rpm), with hot engine and new oil filter	0.25–0.60 MPa (35–85 psi)

Oil quality

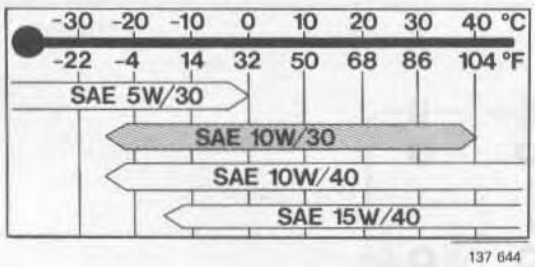
USA, Canada and Japan

Oil quality
According to API ..... SF*

*Oils with designations SF/CC and SF/CD fulfil this requirement.

Supplementary engine oil additives are not recommended because of potential damage to engine.

Viscosity (stable ambient temperatures)



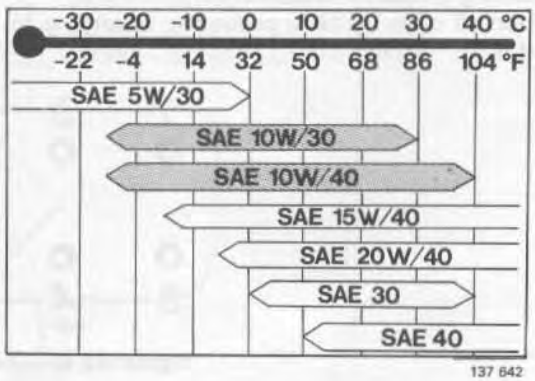
Other markets

Oil quality
According to API–1983 ..... min SE*
1984– ..... SF**

*Oils with designations SE, SF, SE/CC, SF/CC and SF/CD fulfil this requirement. **Note that SE/CD oils must not be used.**
**Oils with designations SF/CC and SF/CD fulfil this requirement.

Supplementary engine oil additives are not recommended because of potential damage to engine.

Viscosity (stable ambient temperatures)

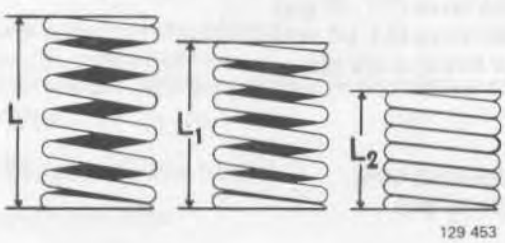


USA, Canada & Japan SAE 15W/40 oils are recommended for use in extreme driving conditions which involve high oil consumption e.g. mountain driving with frequent deceleration or fast highway driving. However, do not use 15W/40 oils at very low temperatures; see chart.

Lubricating oil pump mm (in)

Axle clearance	0.02–0.12 mm	(0.0008–0.0047)
Radial clearance (excl. bearing clearance)	0.02–0.09 mm	(0.0008–0.0035)
Backlash (excl. bering clearance)	0.15–0.35 mm	(0.0059–0.0138)
Bearing clearance, drive shaft	0.032–0.070 mm	(0.0013–0.0028)
idling shaft	0.014–0.043 mm	(0.0006–0.0017)

Relief valve spring length under different loads:

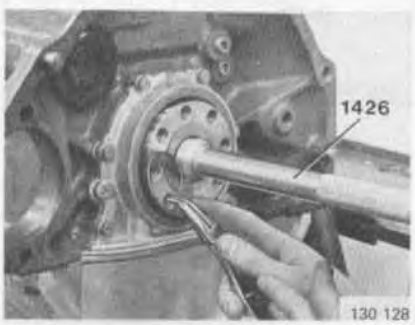


Length mm (in)	**Load** N (lbf)
39.2 (1.54)	0
26.25 (1.03)	46–54 (10.35–12.15)
21.0 (0.83)	62–78 (13.95–17.55)

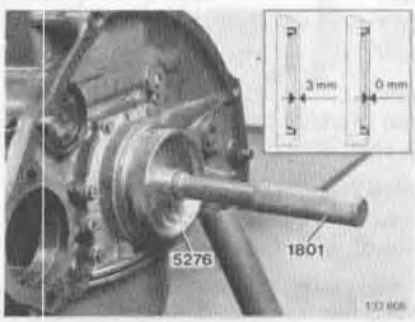
Special tools

999	Description–application
1426-6	**Mandrel**: installation of pilot bearing in crankshaft
1801-3	**Standard shank**: used together with 5276
2484-7	**Centering mandrel**: clutch, gearbox M 45/M 46, early version
2520-8	**Stand**: used together with fixture 5023
2810-3	**Lifting eye**: lifting engine out and in. Used together with lifting stirrup 5035
2903-6	**Key**: removal of oil filter
4090-0	**Extractor**: pilot bearing in crankshaft
5006-5	**Lifting stirrup**: replacing engine mounts, used together with 5115, 5033 (2), and possibly 5871
5021-4	**Pressing tool**: removal/installation of camshaft

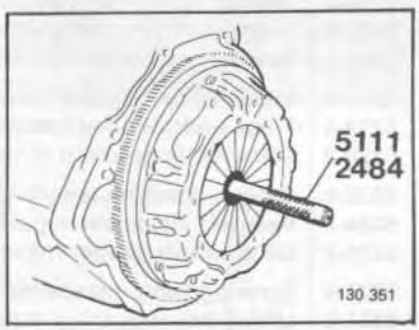
Continued on page 12



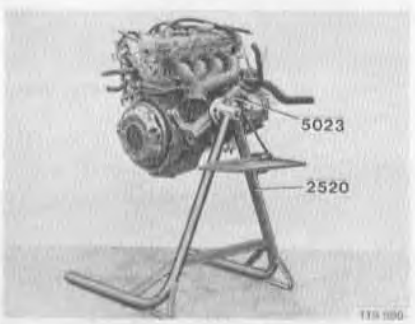
1426



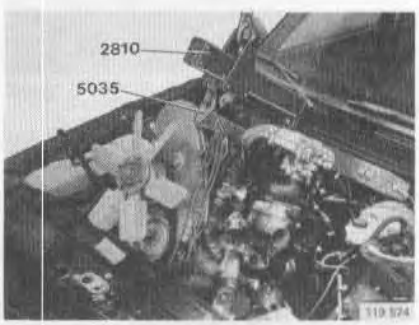
1801



2484



2520



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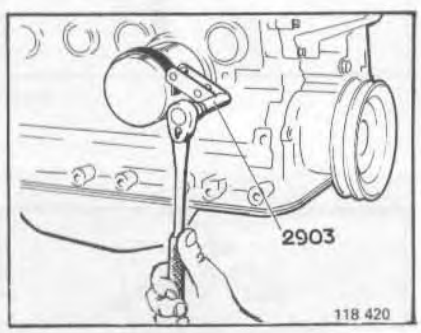

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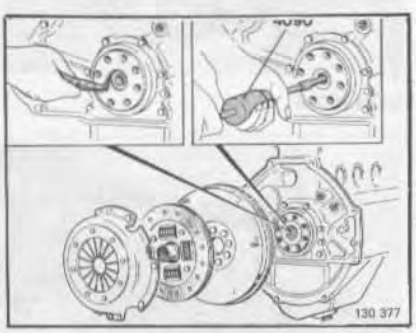
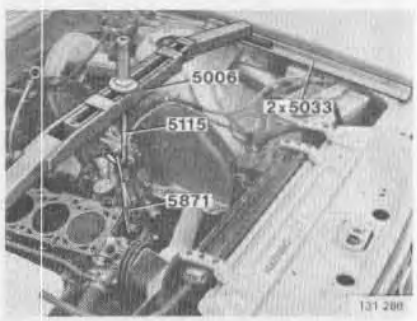
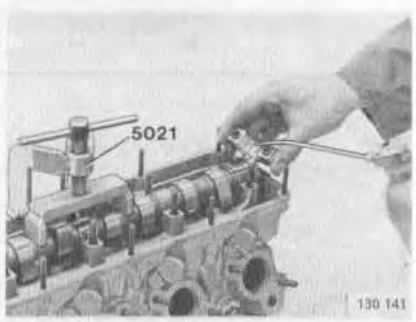


4090

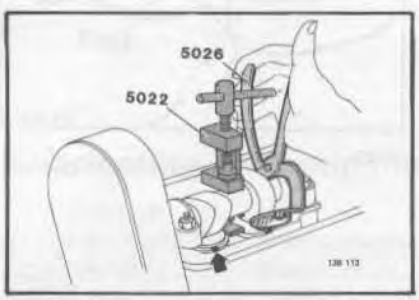


5006



5021

999	Description–application
5022-2	**Pressing tool:** valve adjustment
5023-0	**Fixture:** for engine. Used together with 2520
5024-8	**Sleeve:** installation of front crankshaft seal
5025-5	**Sleeve:** installation of camshaft and transmission shaft seal
5026-3	**Pliers:** removal of adjustment shims, valve adjustment
5027-1	**Mandrel:** pressing in valve guide, intake
5028-9	**Mandrel:** pressing in valve guide, exhaust
5029-7	**Mandrel:** installation of valve seat, intake
5033-9	**Support:** 2 ×, used together with 5006, 5115 and possibly 5871
5034-7	**Dolly:** used when installing pulley/drive belt, crankshaft, intermediate shaft, camshaft
5035-4	**Lifting stirrup:** lifting engine out and in. Used together with lifting eye 2810
5111-3	**Centering mandrel:** clutch (gearbox, late version)
5112-1	**Tooth sector:** blocking of flywheel
5115-4	**Lifting hook:** used together with 5006, 5033 (2) and possibly 5871
5160-0	**Reamer kit:** contains 5161, 5162, 5163, 5164 (early version), alternatively 5224 (late version)
5161-8	**Reamer:** seat, valve guide, OD1
5162-6	**Reamer:** seat, valve guide, OD2
5163-4	**Reamer:** seat, valve guide, OD3
5218-6	**Mandrel:** forcing out valve guide
5219-4	**Press tool:** removal/installation of valve stem seal
5220-2	**Mandrel:** installation of valve seat, exhaust
5222-8	**Gauge:** checking length of valve stem
5224-4	**Reamer:** inside valve guide (replaces 5164)
5270-7	**Oil pressure gauge:** measuring of engine oil pressure
5276-4	**Pressing tool:** installation of rear crankshaft seal, used together with 1801
5871-2	**Lifting bar:** replacing engine mounts, engine without cylinder head. Used with 5006 and 5033 (2)



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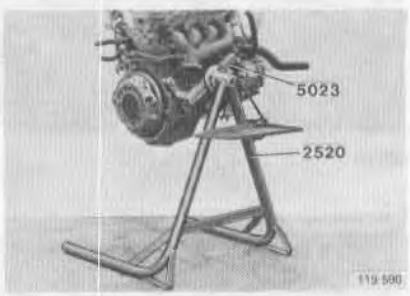
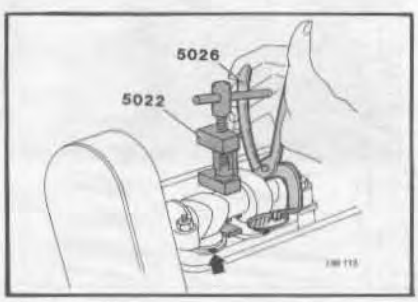


5023

5024, 5025



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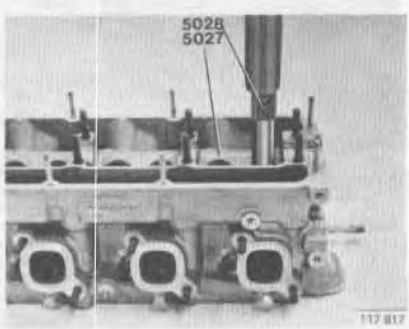

5027, 5028

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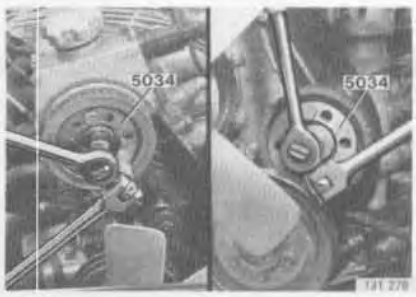
5033



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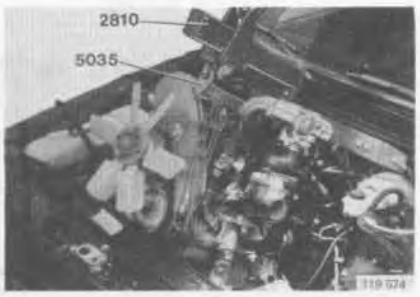

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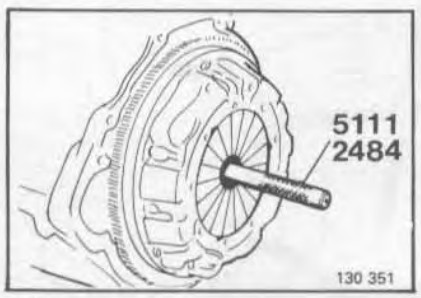

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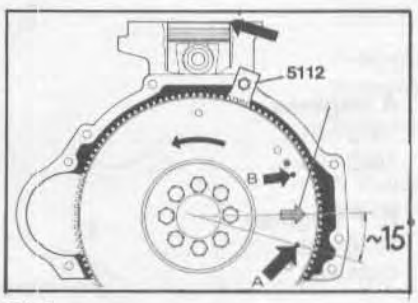

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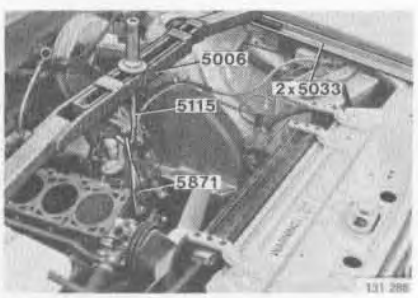

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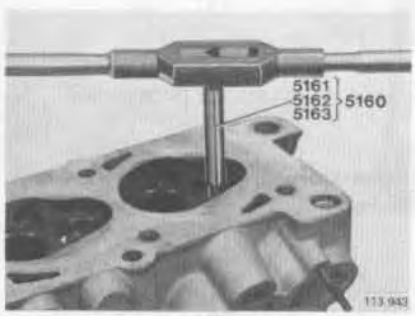
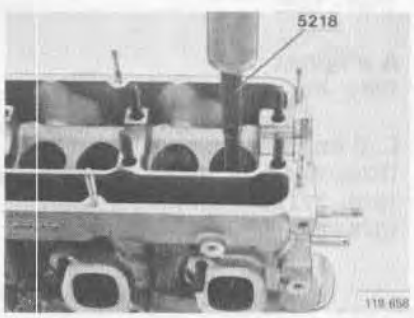


5160, 5161, 5162, 5163



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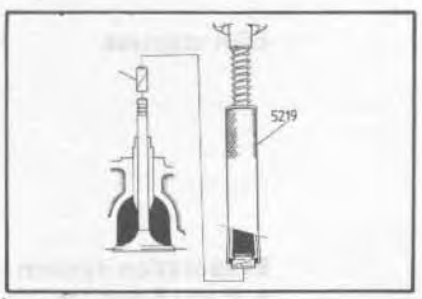
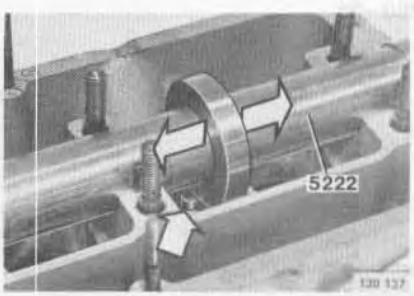


5219

5220



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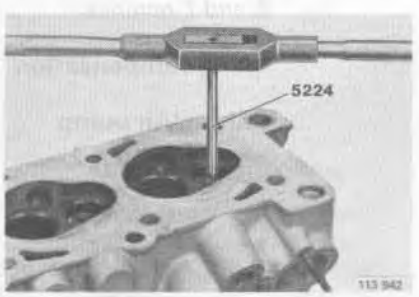

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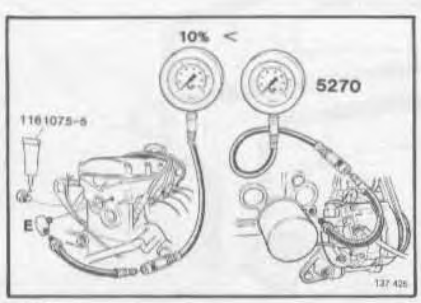

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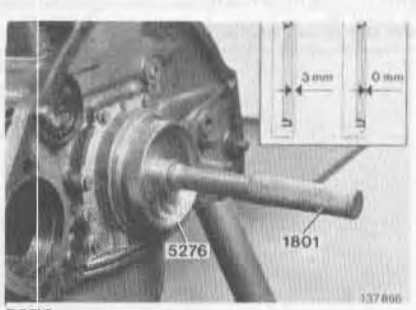

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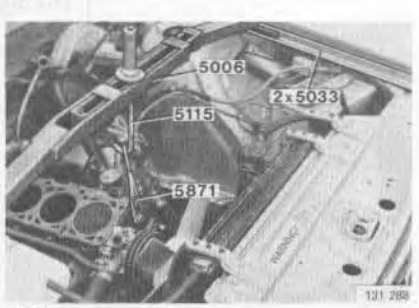


5871

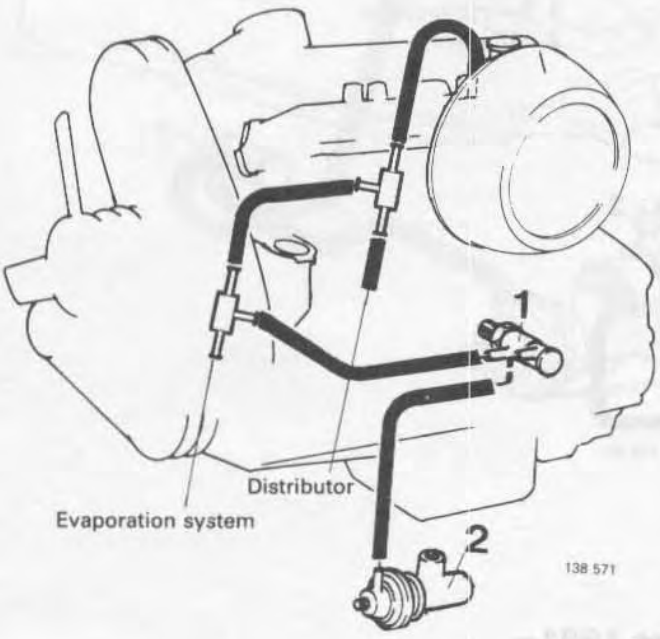
Group 20 General

Connection of vacuum hoses

The diagrams shows how the hoses should be connected, but they do not show the exact routing of the hoses.

Exhaust gas recirculation (EGR) of the on–off type

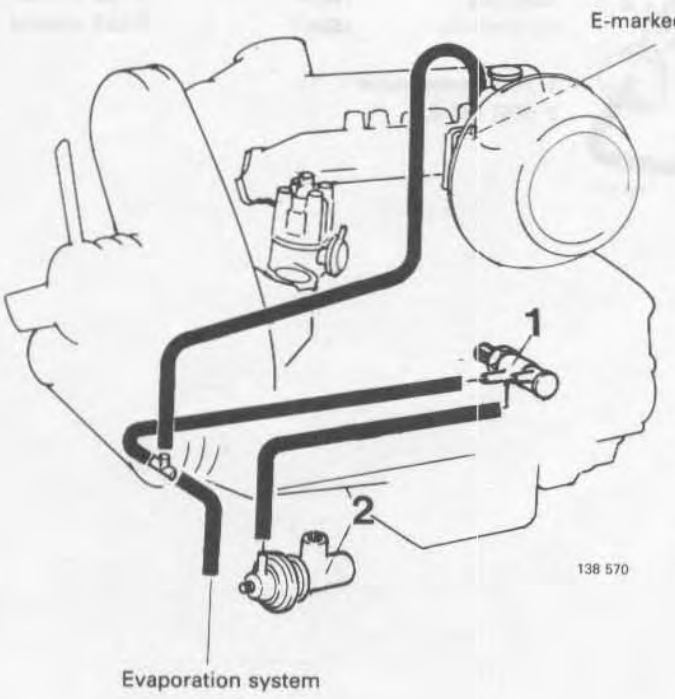
A engines 1978–81



Market	Model	Type
Canada	1978–80	automatic
Canada	1981	manual
Australia	1979–80	automatic
Australia	1981	manual
Scandinavia	1981	manual

1 Thermostat valve
2 EGR valve

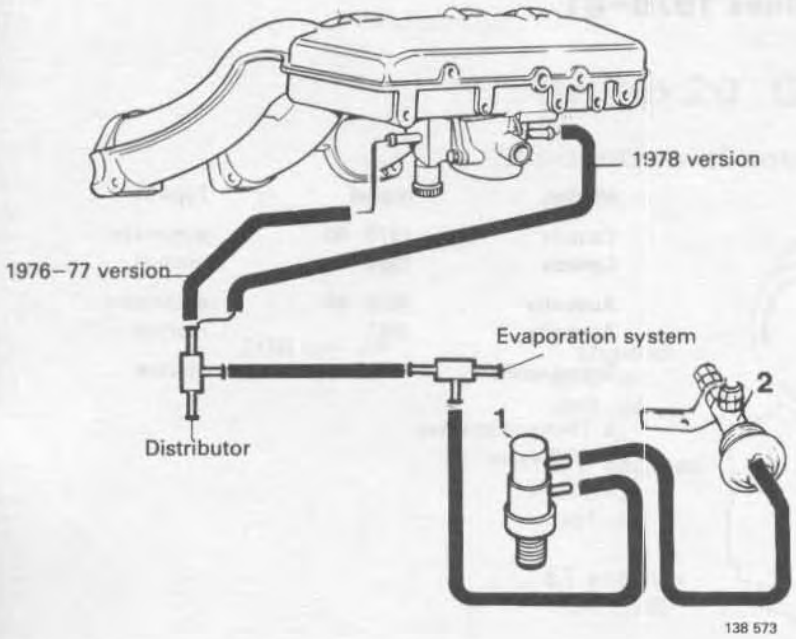
A engines 1982–



Market	Model	Type
Canada	1982–	manual
Australia	1982–	manual
Scandinavia	1982–	manual
Switzerland	1983–	manual

1 Thermostat valve
2 EGR valve

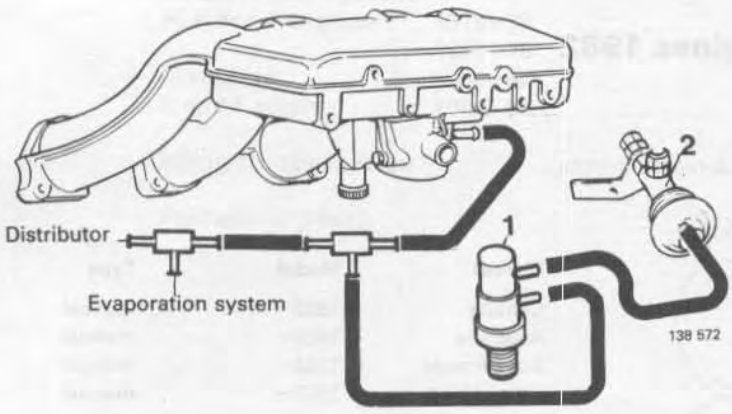
E/F engines 1976–78



Market	Model	Type
USA Federal	1976	B 21 F automatic
Canada	1976–78	B 21 F automatic

1 Thermostat valve
2 EGR valve

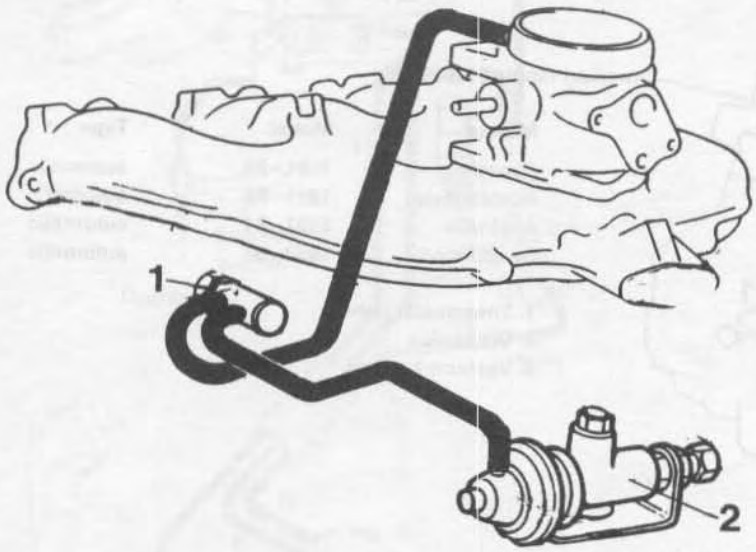
E engines 1981–



Market	Model	Type
Canada	1981–83	B 23 E manual
Scandinavia, Australia	1981–	B 23 E manual
Switzerland	1984–	B 23 E manual

1 Thermostat valve
2 EGR valve

ET engines 1984–1985



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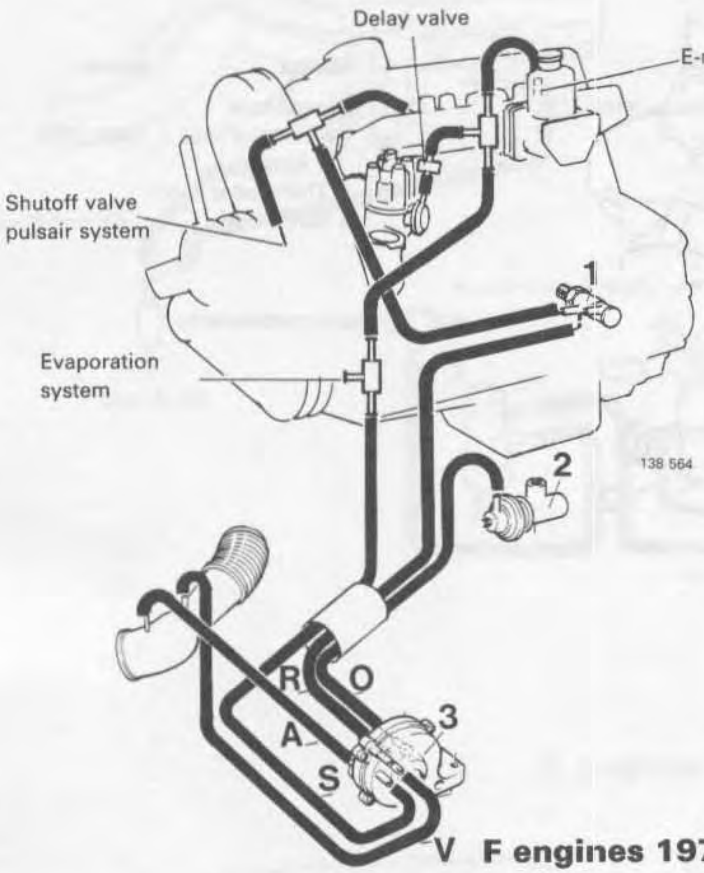
Market	Model
Scandinavia, Switzerland	1984–1985

1 Thermostat valve
2 EGR valve

Exhaust gas recirculation (EGR), stepless type

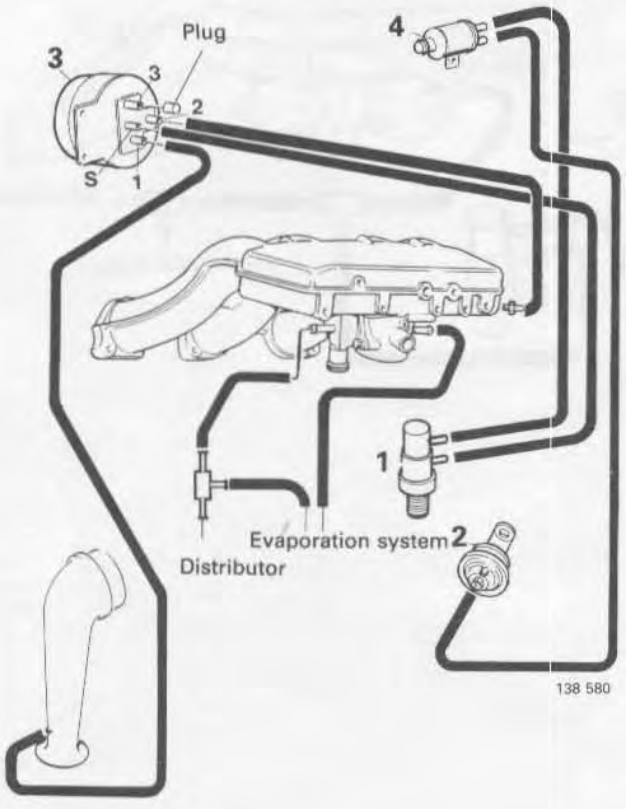
A engines 1981–



Market	Model	Type
Canada	1981–84	automatic
Scandinavia	1981–84	automatic
Australia	1981–84	automatic
Switzerland	1983–84	automatic

1 Thermostat valve
2 EGR valve
3 Vacuum booster

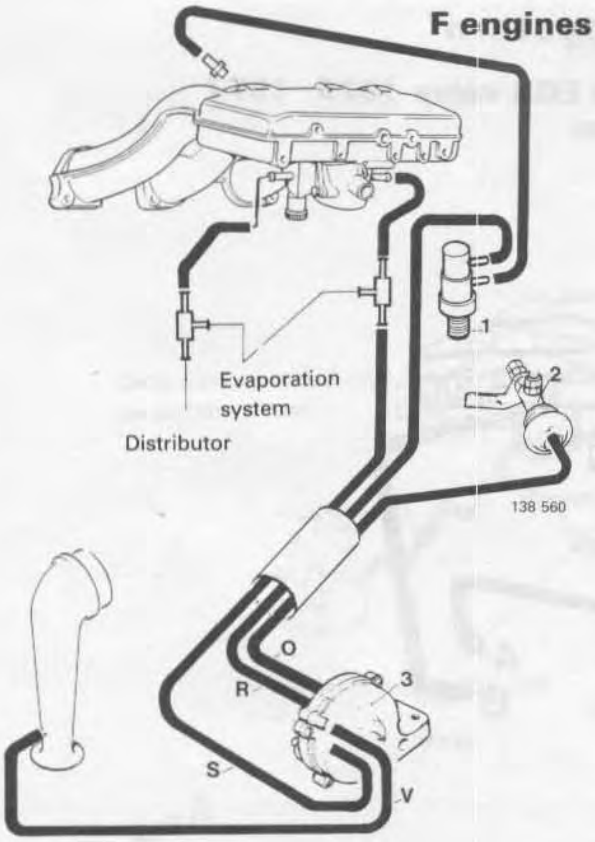
V F engines 1976–77, version 1



Market	Model	Type
Japan	1976–77	
USA, Calif.	1976	early version

1 Thermostat valve
2 EGR valve
3 Vacuum booster
4 Solenoid valve

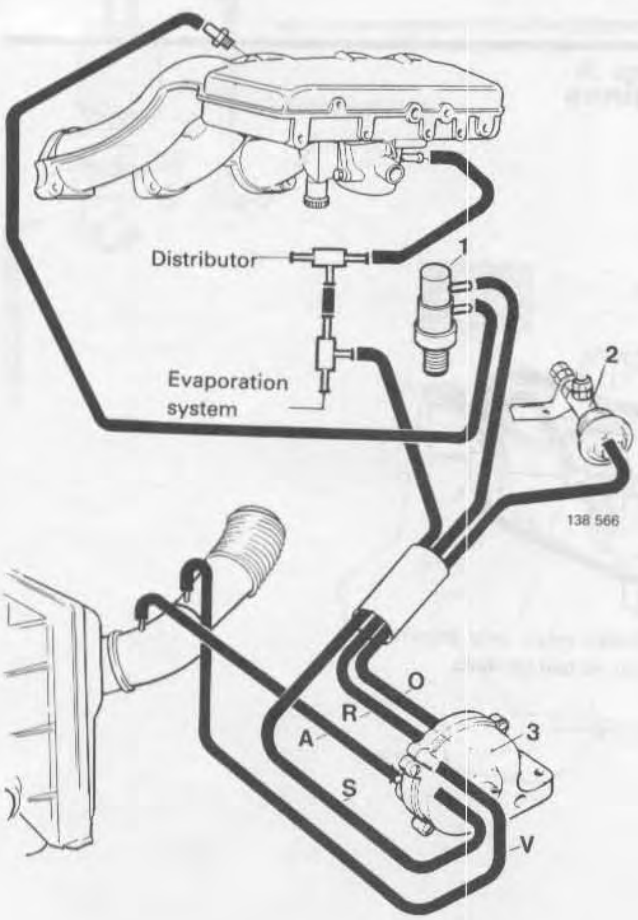
F engines 1976–77, version 2



Market	Model	Type
USA, California	1976	late version
USA Federal	1977	

1 Thermostat valve
2 EGR valve
3 Vacuum booster

E/F engines 1978–

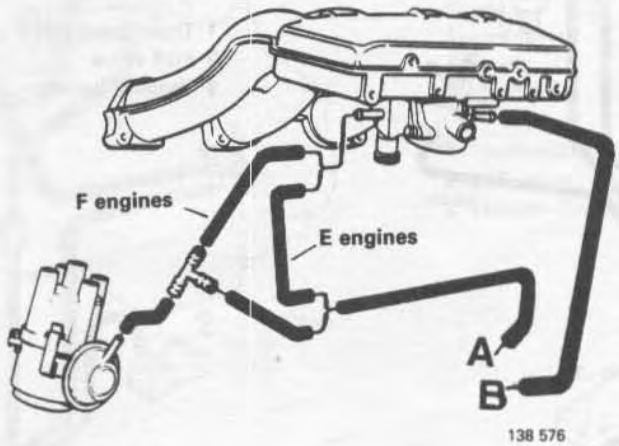


Market	Model	Type
USA Federal	1978–79	B 21 F
Canada	1981–83	B 23 E automatic
Australia, Scandinavia	1981–84	B 23 E automatic
Switzerland	1983–84	B 23 E automatic

1 Thermostat valve
2 EGR valve
3 Vacuum booster

Evaporation system

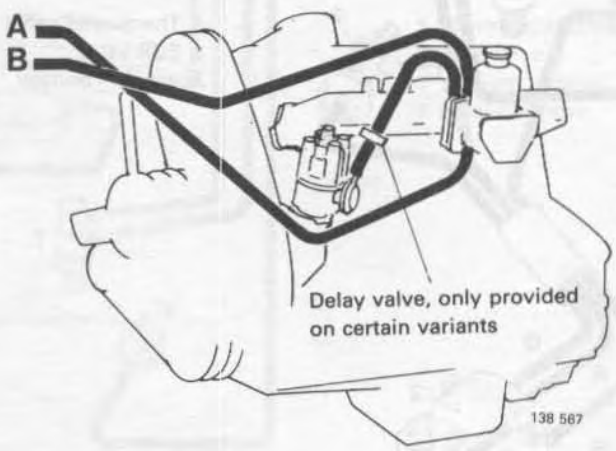
Connection of carbon filter and EGR valve 1975–1977
E/F engines



138 576

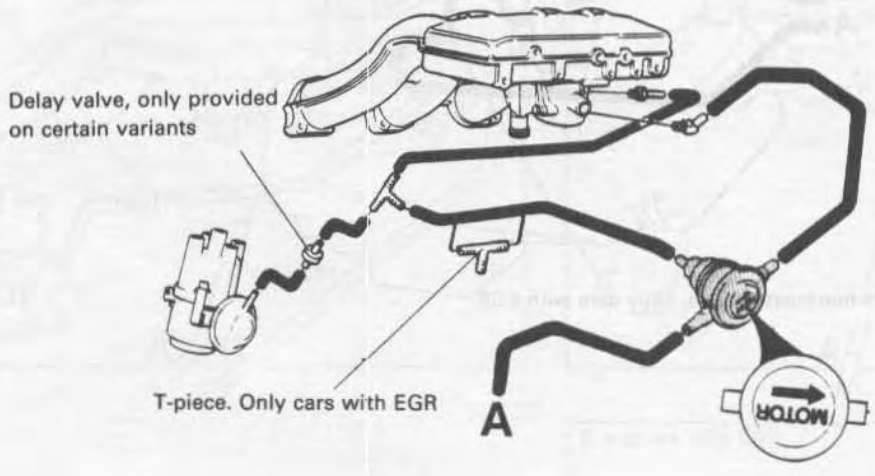
138 577

A engines

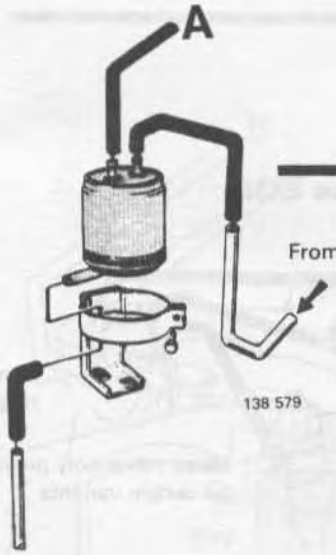


138 567

Connection of carbon filter and EGR valve 1978–79
E/F engines

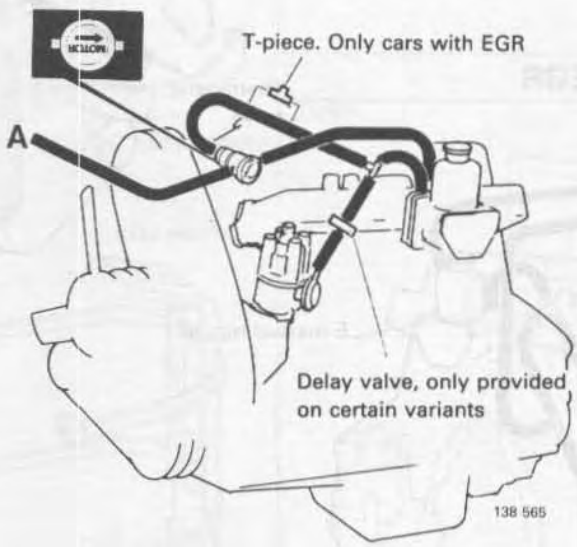


138 578



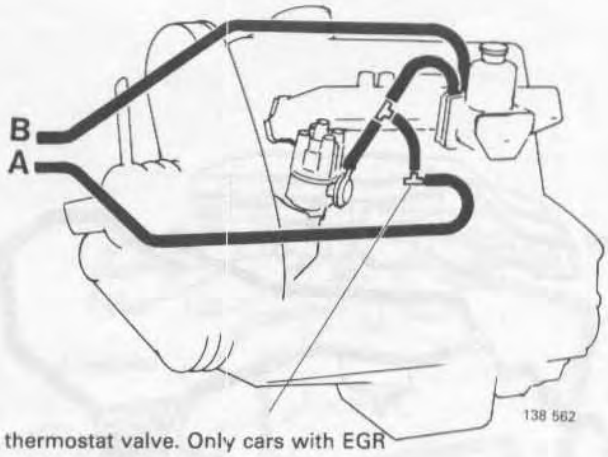
138 579

A engines

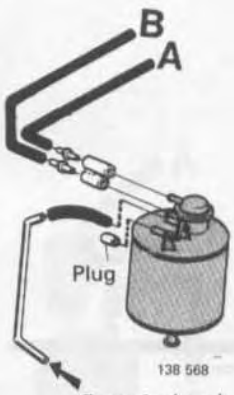


138 565

Connection of carbon filter and EGR valve
A engines 1980–81



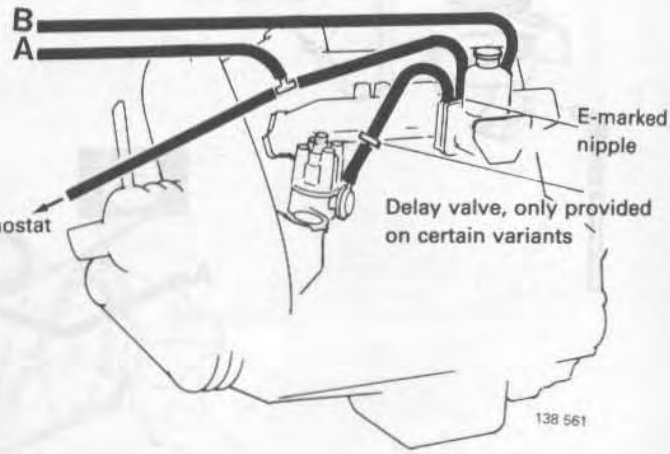
To thermostat valve. Only cars with EGR



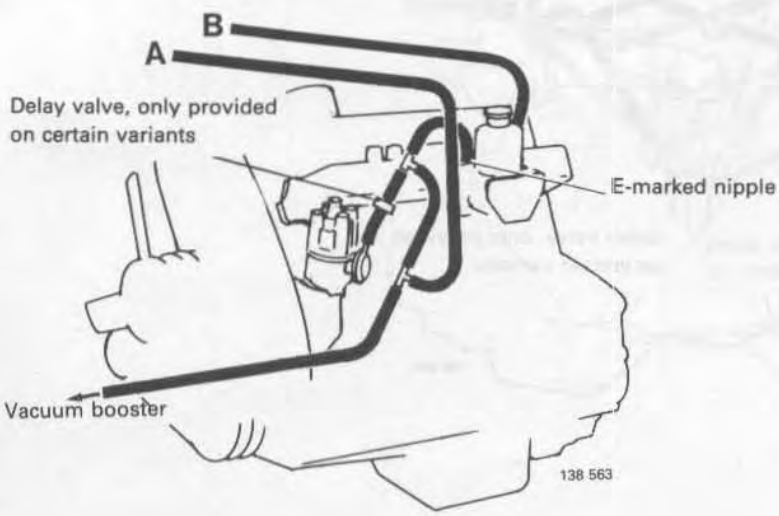
From fuel tank

A engines 1982–84

With on–off type EGR

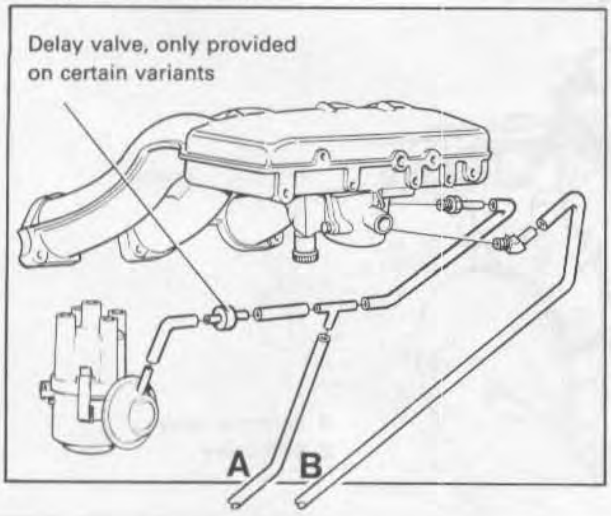


With stepless type EGR

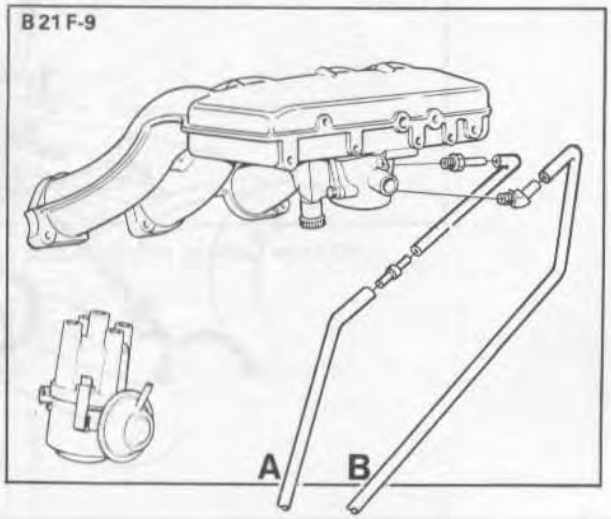


Connection of carbon filter and EGR valve
E/F engines 1980–84

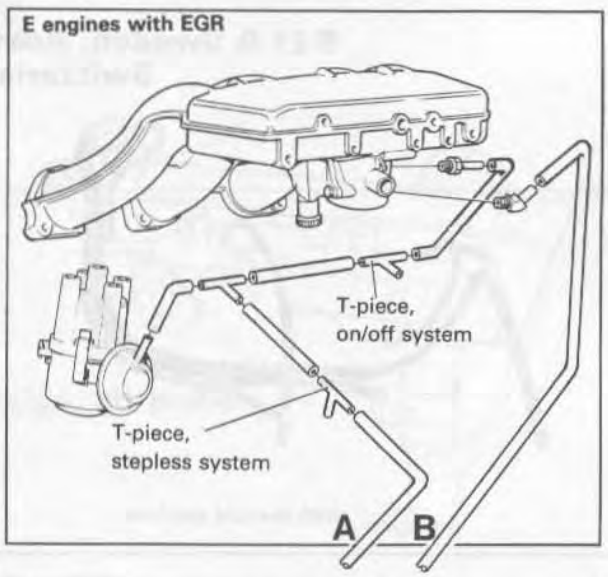
B 21 F-5 and
E engines without EGR

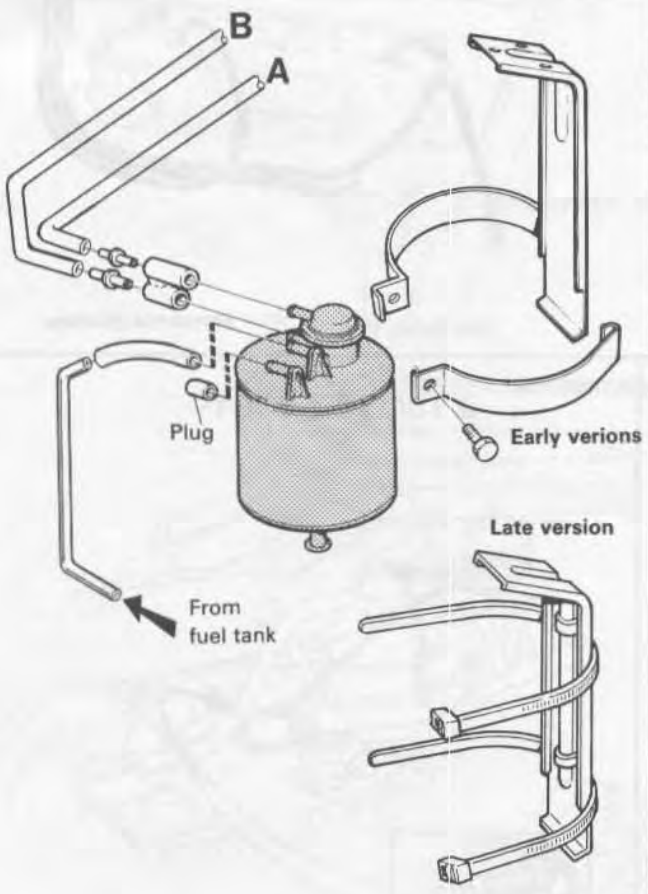


B 21 F-9

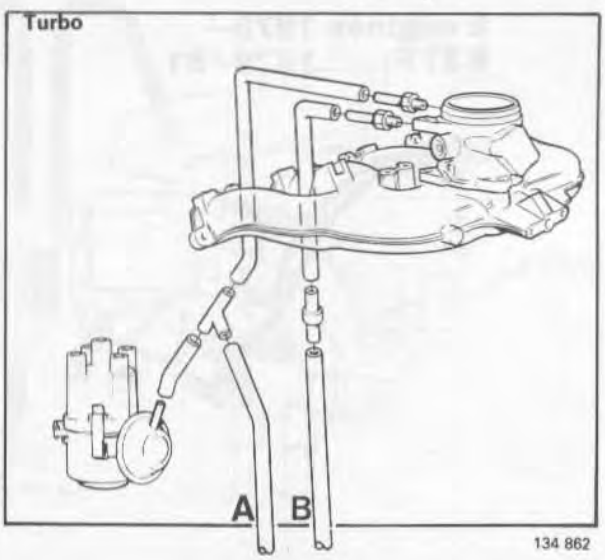


E engines with EGR





Turbo

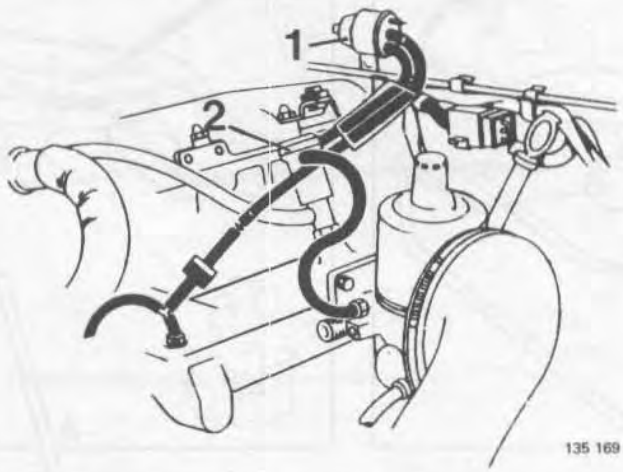


134 862

Idling compensation

A engines 1979–

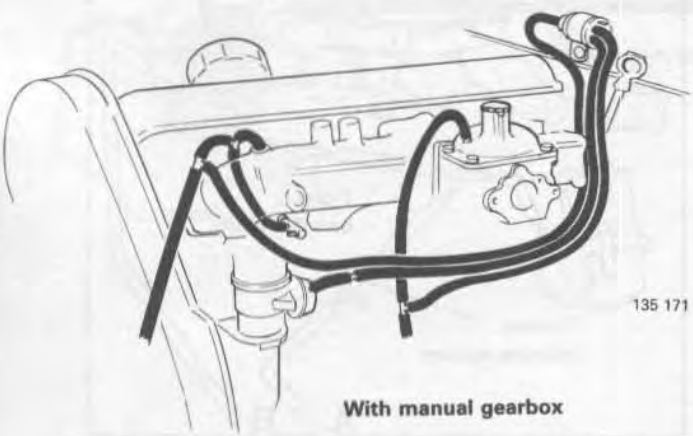
(Does not apply to Sweden, Australia, Canada B 21 A 1982–, Switzerland 1983–)



135 169

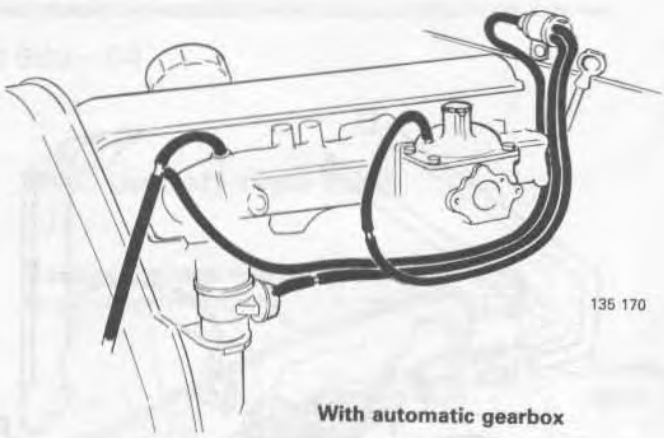
1 Solenoid valve
2 EGR valve

B 21 A Sweden, Australia, Canada 1982– Switzerland 1983–



135 171

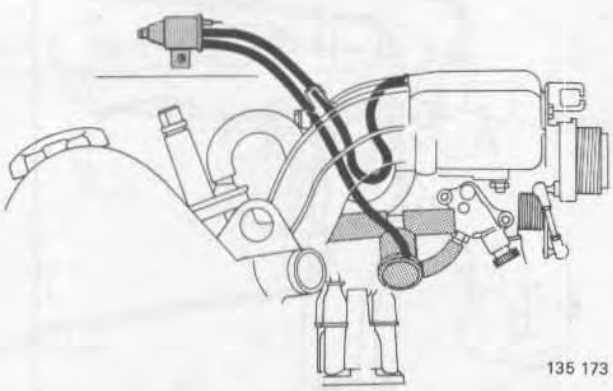
With manual gearbox



135 170

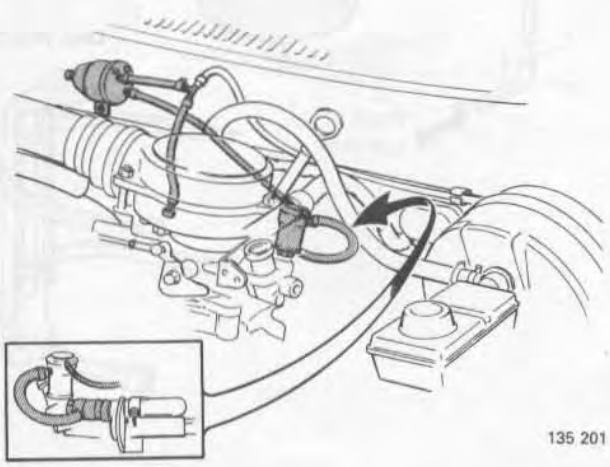
With automatic gearbox

E engines 1979–
B 21 F 1979–81



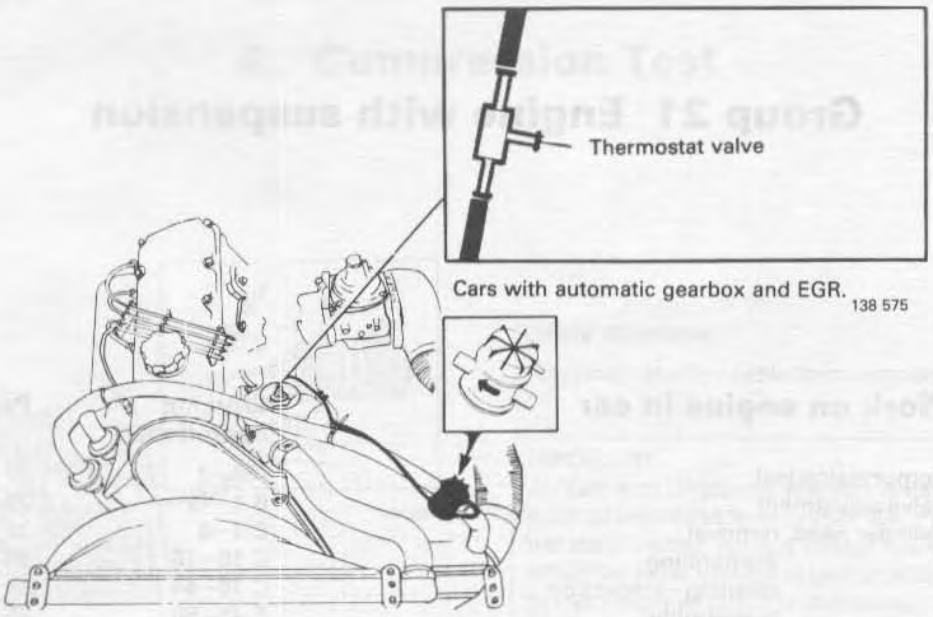
135 173

B 19/21 ET 1981–



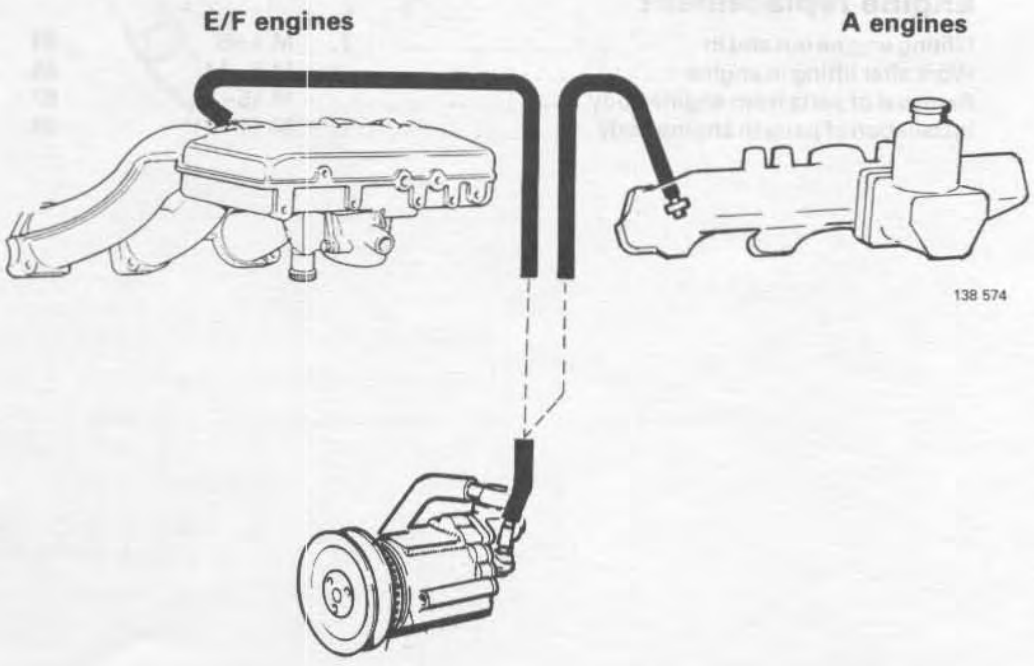
135 201

Shutoff valve, Pulsair system



Cars with automatic gearbox and EGR.
138 575

Diverter valve, air pump



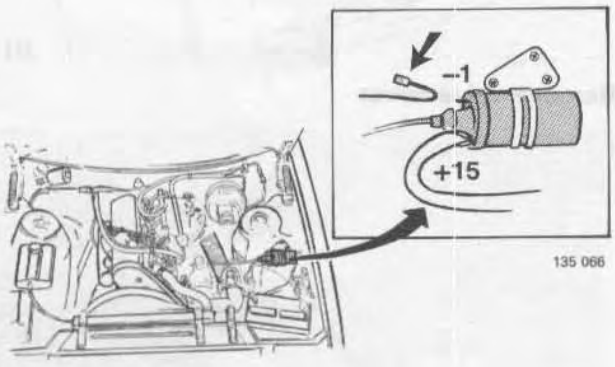
138 574

Group 21 Engine with suspension

Work on engine in car

Engine replacement

A. Compression Test



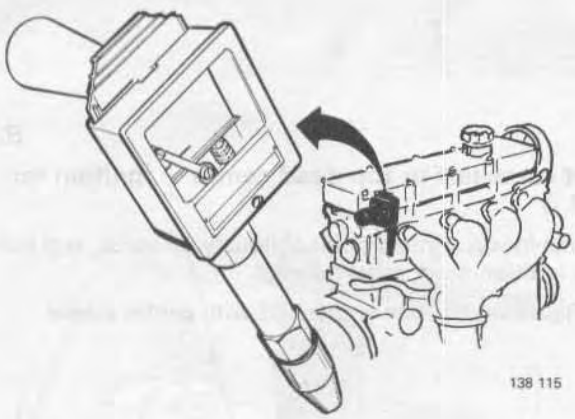
135 066

A1

Safety measure

Disconnect electric cable from connection 1 on ignition coil.

IMPORTANT!
On cars with LH-jetronic injection systems, connection 1 must be unscrewed from ignition coil. If ignition system is not disconnected, ignition voltage sparkover may result, which can cause damage to ignition system control unit or to Hall integrated circuit in distributor.



138 115

A2

Measure compression (hot engine and full throttle)

Normal value ..... **0.9–1.1 MPa** (128–156 psi).

N.B. Applies to hot engine, fully open throttle, and cranking starter motor, 4.2–5.0 r/s (250–300 rpm).

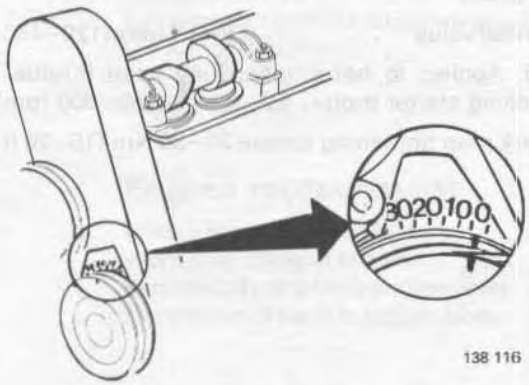
Spark plug tightening torque 20–30 Nm (15–20 ft lbs)

B. Valve Adjustment

Special tool: 5022, 5026

B1

Remove valve cover

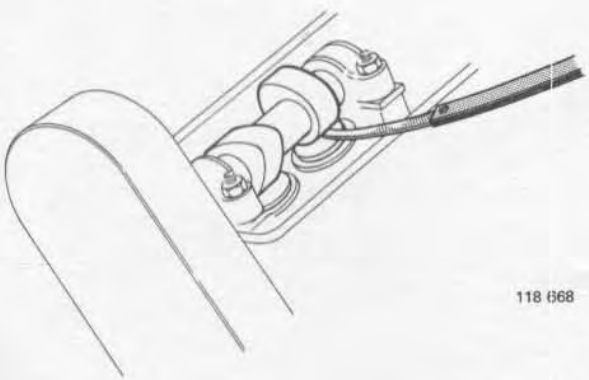


B2

Set camshaft to top dead centre – ignition for cyl. 1

Cams for cyl. 1 must point obliquely upwards, and pulley ignition mark must be at 0°.

N.B.: Always rotate crankshaft with centre screw.



B3

Measure and note down valve clearance for cyl. 1

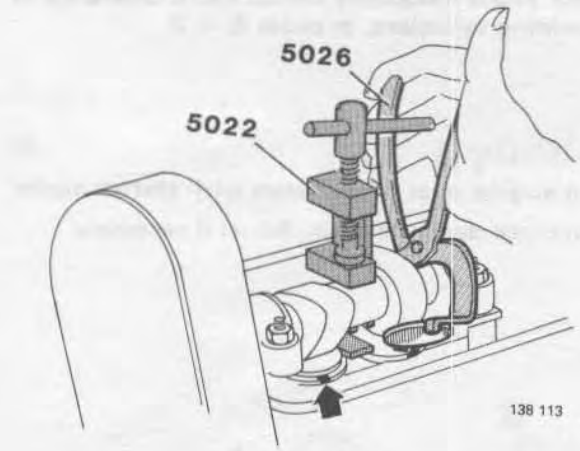
Clearance when **checking**:

Cold engine: ..... **0.30–0.40 mm** (0.012–0.016 in)
Hot engine: ..... **0.35–0.45 mm** (0.014–0.018 in)

Clearance when **adjusting**:

Cold engine: ..... **0.35–0.40 mm** (0.014–0.016 in)
Hot engine: ..... **0.40–0.45 mm** (0.016–0.018 in)

Same clearance for intake and exhaust valves.

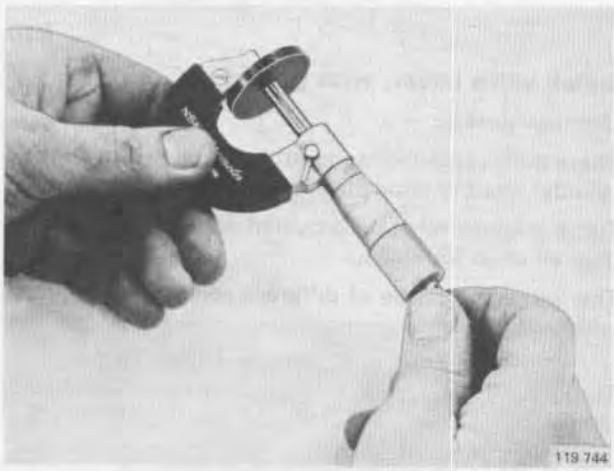


If clearance is incorrect *B4*

Remove adjustment washer

Rotate tappets so that the groove is completely to side.

Force down tappets with pressing tool 5022. Remove washer with pliers 5026.



B5

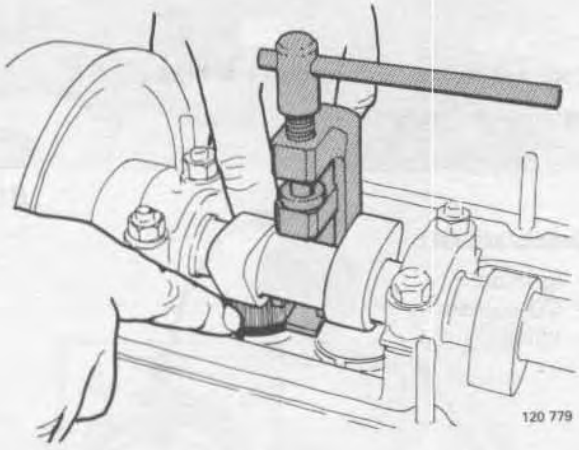
Select adjustment washer of correct thickness

Washers are available in thicknesses of **3.30–4.50 mm** (0.13–0.18 in) at increments of 0.05 mm (0.002 in). Only use **new washers.**

Measure thickness of old washer using a micrometer.

Example:

Correct clearance	0.40 mm (0.016 in)
Measured clearance	0.25 mm (0.010 in)
Difference	0.15 mm (0.006 in)
Measured thickness on existing washer	3.80 mm (0.150 in)
Difference in clearance	0.15 mm (0.006 in)
Correct thickness of new washer	3.65 mm (0.144 in)



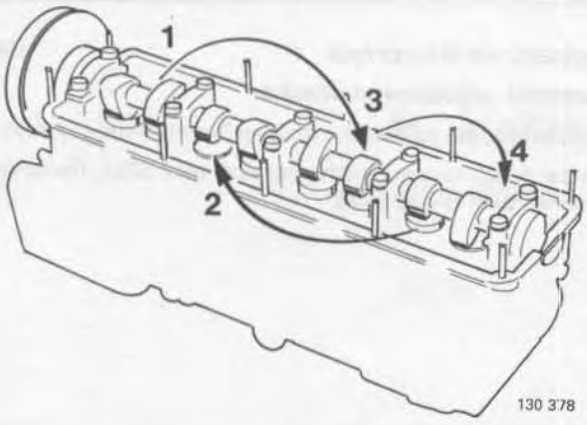
B6

Oil and install new washer

Turn washer with marking pointing downwards.

B7

Remove pressing tool 5022



130 378

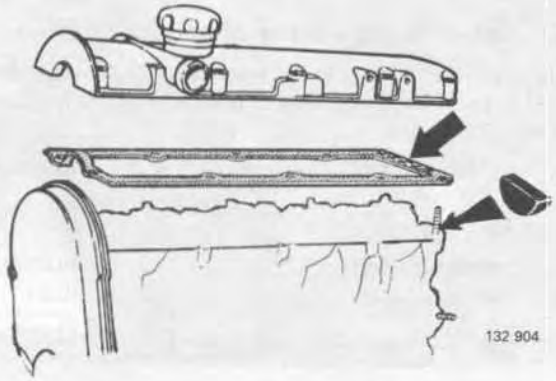
B8

Check and if necessary adjust valve clearance of remaining cylinders, in order 3, 4, 2

B9

Turn engine over a few times with starter motor

Then check clearance again. Adjust if necessary.


132 904

B10

Install valve cover, with gasket

Use new gasket.

Check that crescent-shaped rubber seal on rear edge of cylinder head is in position and is not damaged.

Turbo engines must be provided with a harder gasket than all other versions.

The gaskets must be of different colours and marked with part number.

	Gasket colour	Part no.
Turbo	Light beige	1326640-8
Others	Blue	463999-3

131 414

B11

Connect hoses and ignition cables

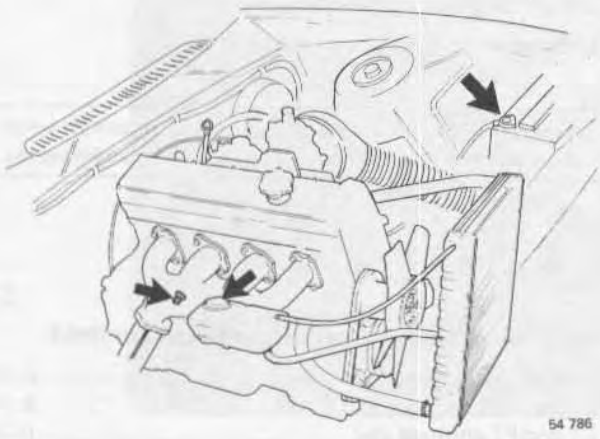
Install parts, as applicable.

B12

Check/adjust:

- ignition
- CO content
- idling.

C. Cylinder head, removal



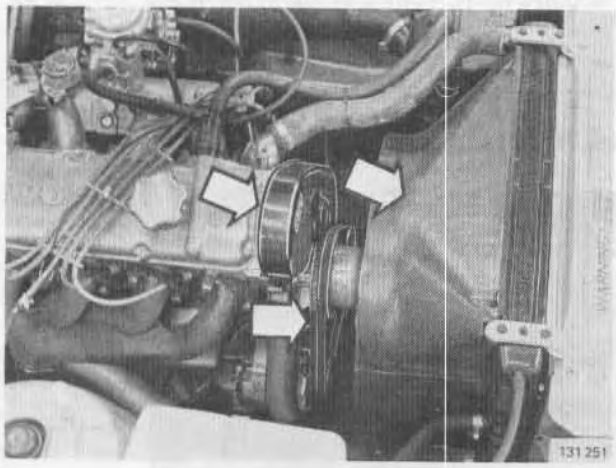
C1

Disconnect battery ground lead

C2

Drain coolant

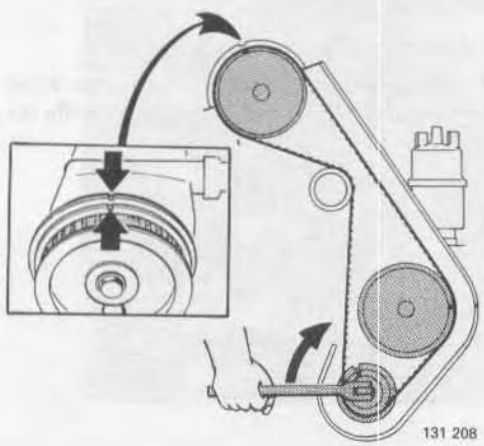
Unscrew nipple on right-hand side of engine. Connect a hose to nipple to prevent spillage.



C3

Remove:

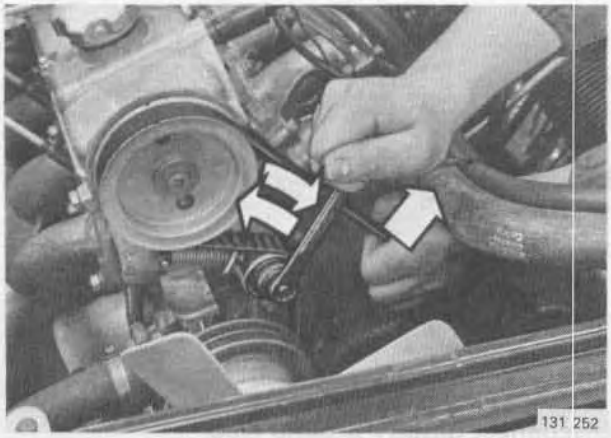
- fan cover
- all drive belts from crankshaft pulley
- gear case.



C4

Set engine

Rotate crankshaft clockwise, using centre screw. Set camshaft so that marking on pulley is opposite marking on valve cover.



C5

Slacken drive belt

- Unscrew nut on belt tensioner
- Pull out belt so that belt tensioner spring is compressed
- Tighten nut.

C6

Lift off drive belt

Lift off belt from camshaft pulley.

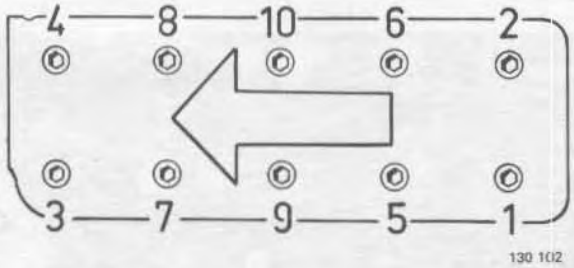
Leave belt in engine compartment.

Important! Do not rotate crankshaft or camshaft when drive belt has been removed as pistons may strike valves.

C7

Remove cylinder head and intake manifold

A and K engines see ..... p. 33
E and F (CI) engines see ..... p. 34
ET and FT engines see ..... p. 34
F engines with LH-Jetronic fuel systems see ..... p. 35



C8

Remove cylinder head

Loosen screws in order shown in diagram.

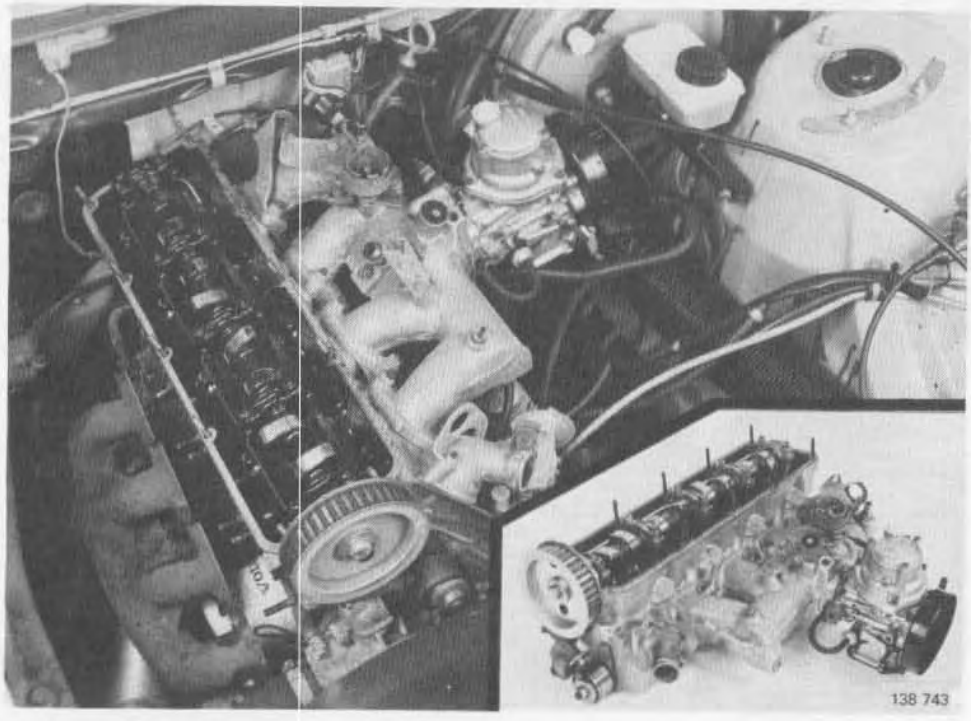
IMPORTANT!
The cylinder head is manufactured from aluminum. To avoid damage place it on wooden blocks.

C9

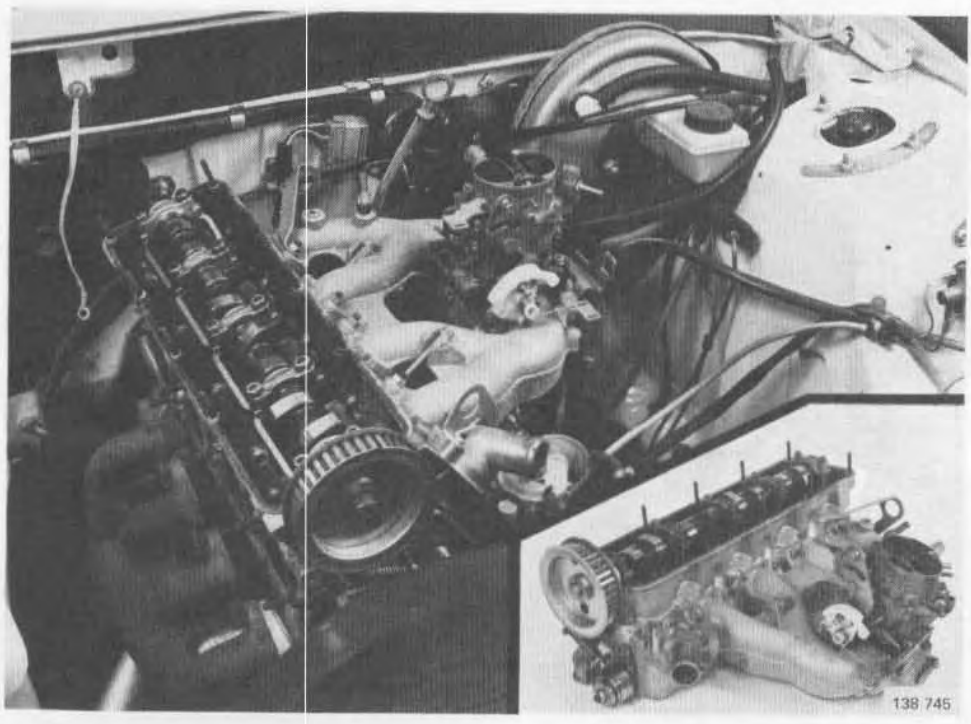
Clean gasket surfaces

On cylinder head and cylinder block. Use steel putty knife for cylinder block. Use wood putty knife for cylinder head.

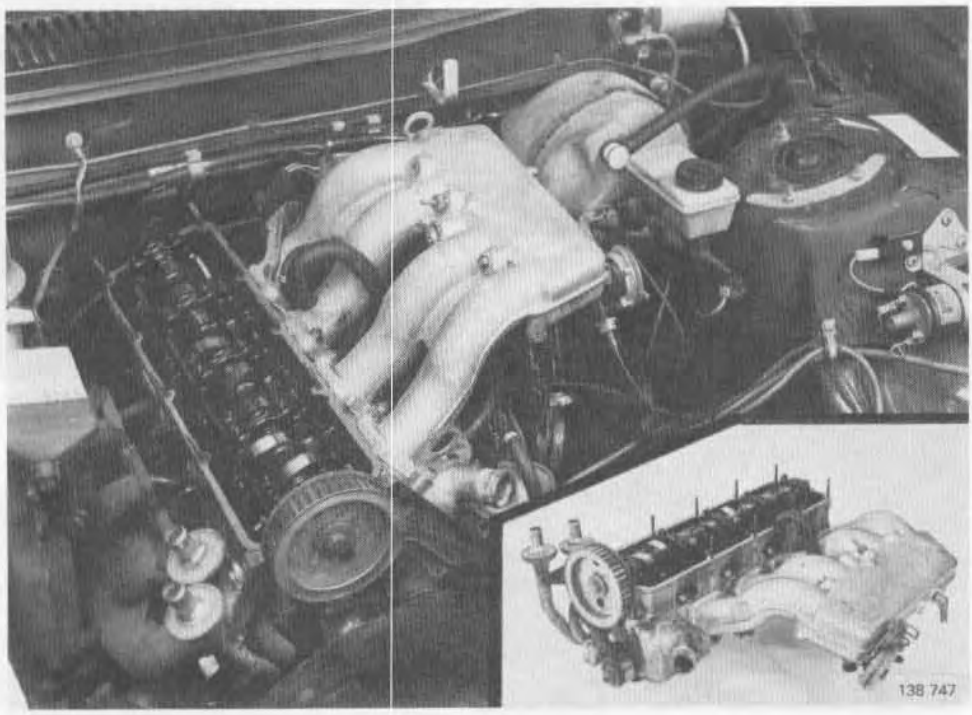
A engines



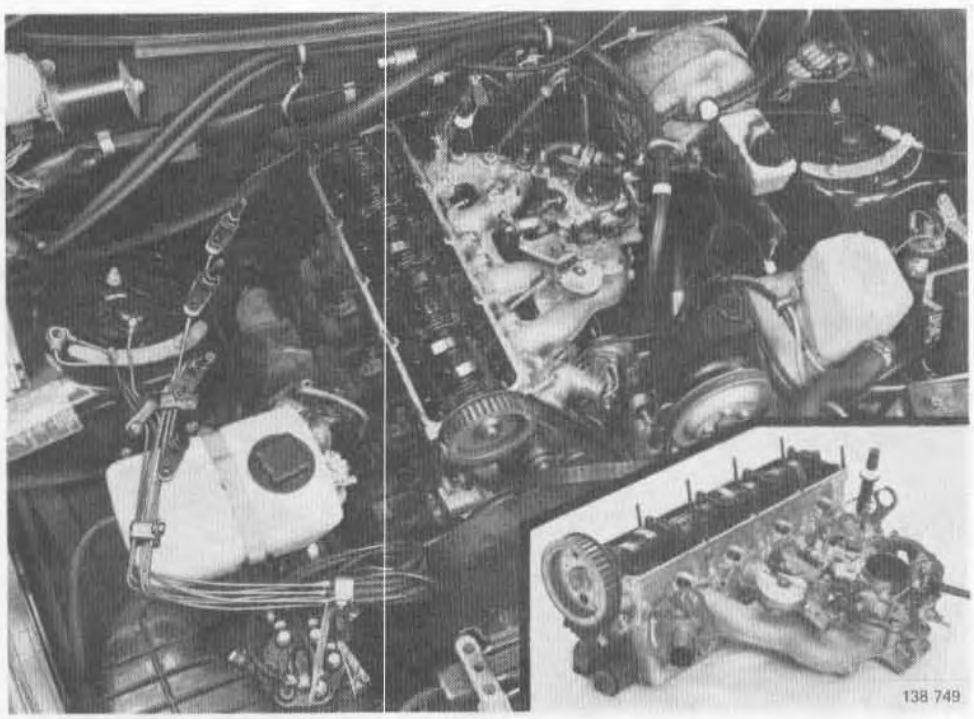
K engines



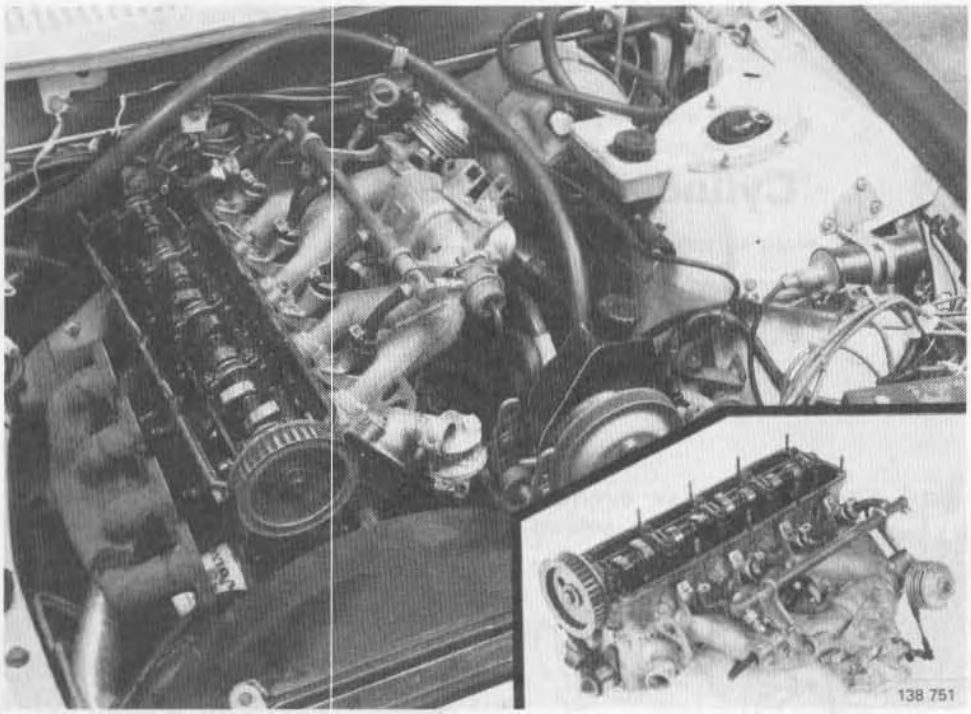
E and F engines



ET and FT engines

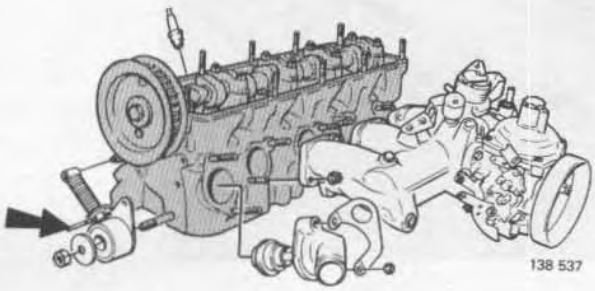


F engines with LH-Jetronic fuel systems



Cylinder head, dismantling

Special tools: 5021, 5034, 5219
Do not place cylinder head on screws, tools etc, as gasket surface may be damaged.

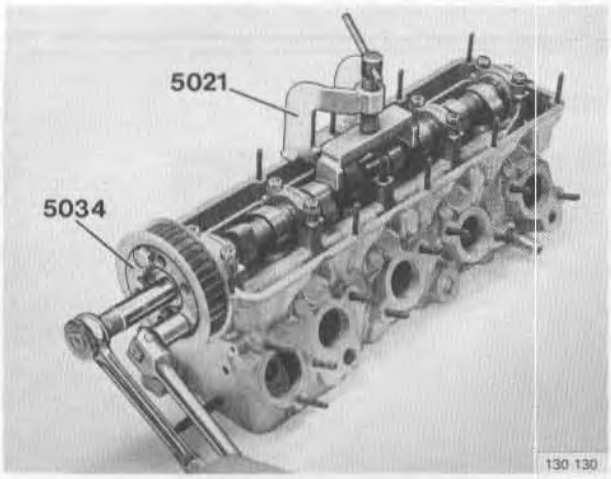


C10

Uncover cylinder head

Remove:

- intake manifold
- belt tensioner. First loosen the spring with a 3 mm drill
- lifting eye, thermostat housing and thermostat.



C11

Remove camshaft pulley

Use dolly 5034.

C12

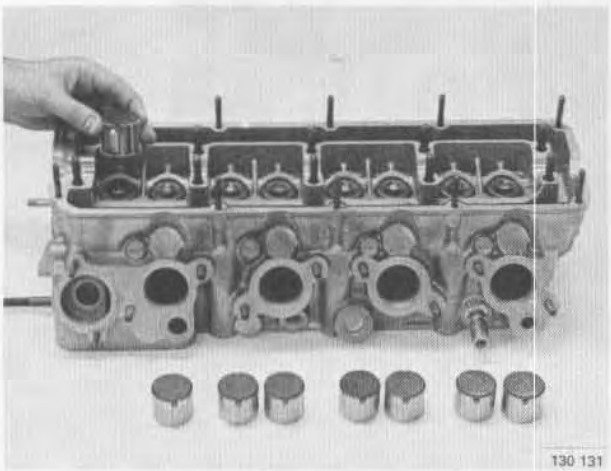
Remove camshaft

Remove centre cap.

Install tensioning tool **5021**, and loosen camshaft.

Remove remaining 4 caps.

Remove tensioning tool, camshaft and camshaft seals.

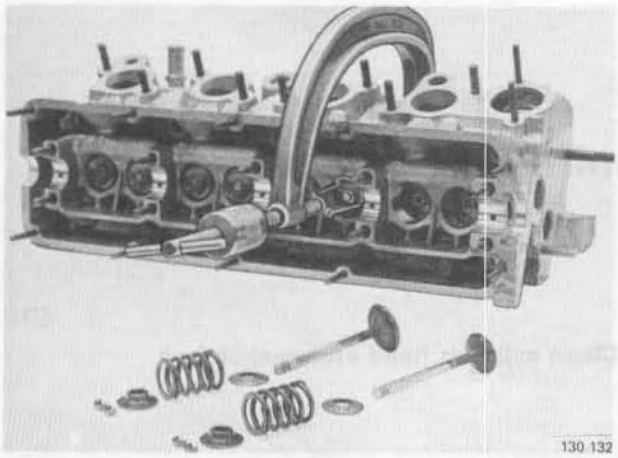


C13

Remove:

- tappets and adjustment washers
- rubber rings from valve stems.

N.B. Place tappets in order, so that they can be reinstalled in their original locations.

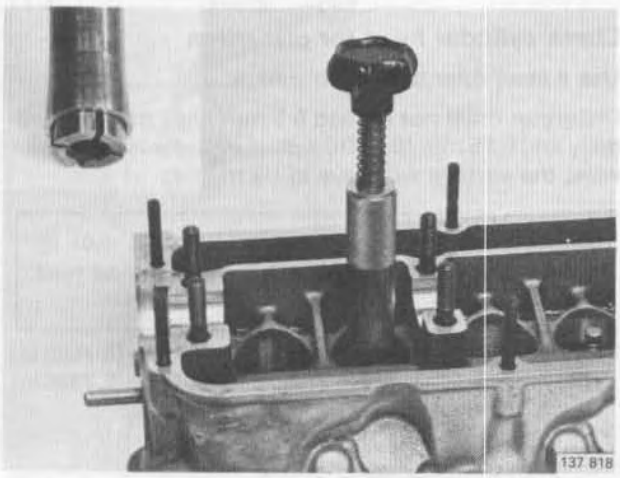


C14

Remove:

- valve locks
- upper valve washers
- valve springs
- lower spring washers
- valves

Do not interchange parts.



C15

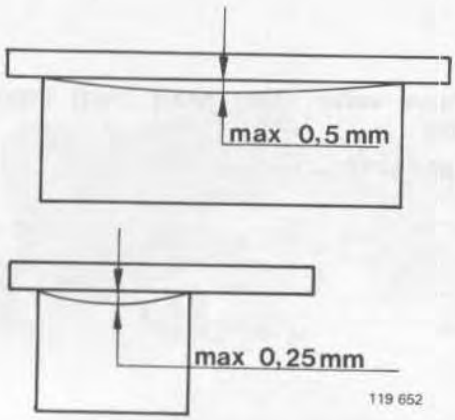
Remove valve stem seals from intake valve guides

Use tool **5219.**

Cylinder head, cleaning/inspection

C16

Clean cylinder head and gasket face



C17

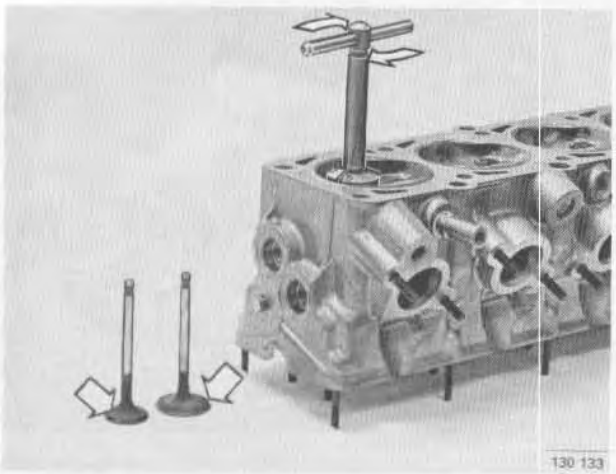
Check cylinder head for distortion

Use a steel ruler and feeler gauge.

Distortion must not exceed 0.5 mm (0.02 in) longitudinally and 0.25 mm (0.01 in) across cylinder head. Otherwise, the surface will have to be milled.

Important: If distortion is greater than 1.0 mm (0.04 in) longitudinally, or 0.5 mm (0.02 in) corsswise, cylinder head must be replaced.

Cylinder head height, new ..... **146.1 mm (5.7563 in)**
min (after machining) ..... **145.6 mm (5.7366 in)**



C18

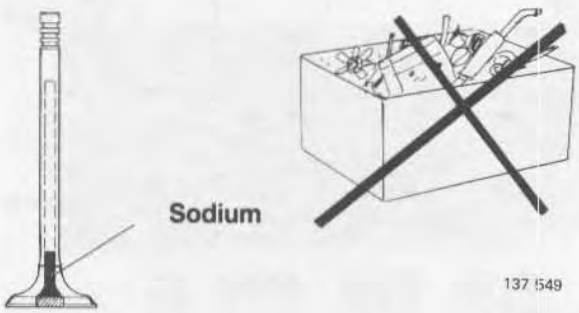
Clean/inspect valves and valve seats

Clean valve seats with a cutter.

Remove carbon from combustion chambers and valves.

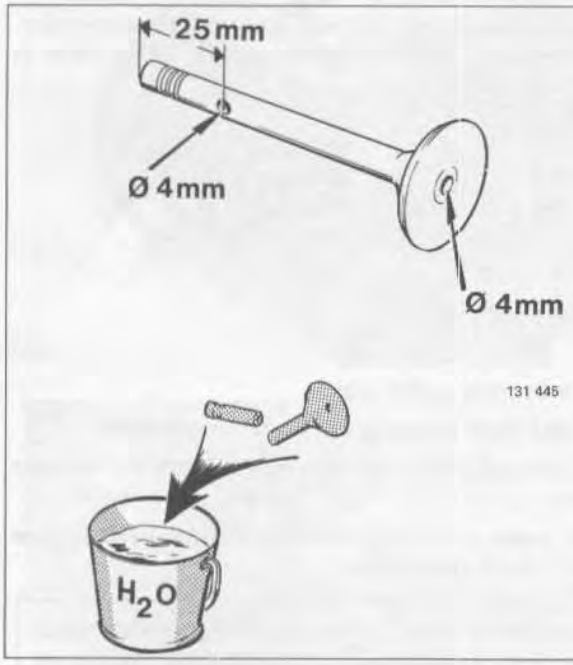
If valve seats are fractured or show signs of excessive wear they must be replaced.

Clean and check spark plug threads for damage.



Turbocharged engines have sodium-filled exhaust valves. Scrapped valves must not be mixed with ordinary scrap iron before first removing the sodium.

See instructions on next page.

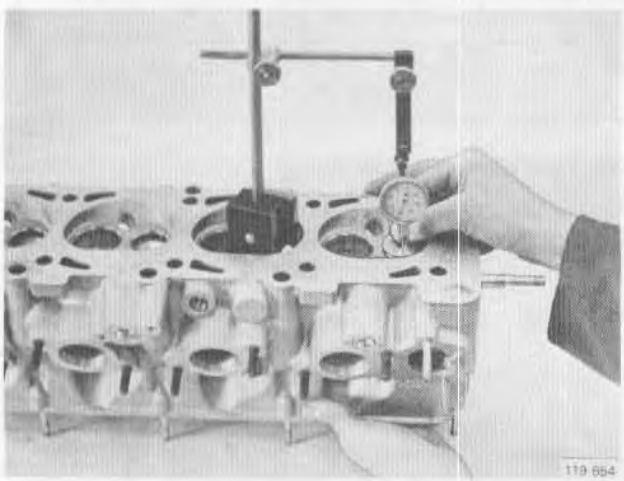


C19

Scrapping sodium-filled exhaust valves

Caution: Sodium in contact with water is explosive. Consequently when drilling, cutting or performing any form of work which involves separating sodium, ensure the sodium does not come in contact with water.

1. Drill a hole (4.0 mm) in the valve crown as illustrated.
2. Drill a hole (4.0 mm) in the valve stem, or cut the stem approximately 25 mm from the end.
3. Throw the valve into a bucket of water. A powerful reaction of an explosive nature will occur and you are advised to stand at least 3 meters from the bucket. The reaction lasts 1–2 minutes and afterwards the valve can be mixed with ordinary scrap metal.



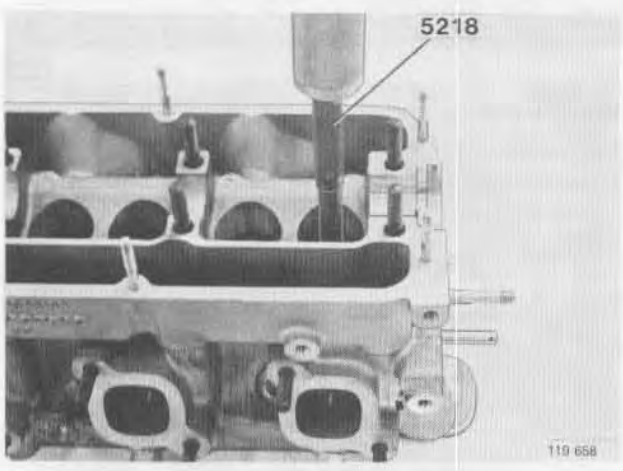
C20

Check valve guides for wear

Check wear with a dial indicator mounted on a magnetic stand.

Use new valves and press valves up **1–2 mm** with finger.

		Inlet	Exhaust
Clearance, with new valve and new guide	mm	0.030–0.060	0.060–0.090
	in	0.0012–0.0024	0.0024–0.0035
Max. clearance measured with new valve and old guide	mm	**0.15**	**0.15**
	in	0.0059	0.0059



Replacing valve guides

Operations C21–25

C21

Press valve guide out

Heat cylinder head to 100±10°C (212°±18°F).

Drive guide out with drift **5218**.

Check that guide has not damaged bore during removal.

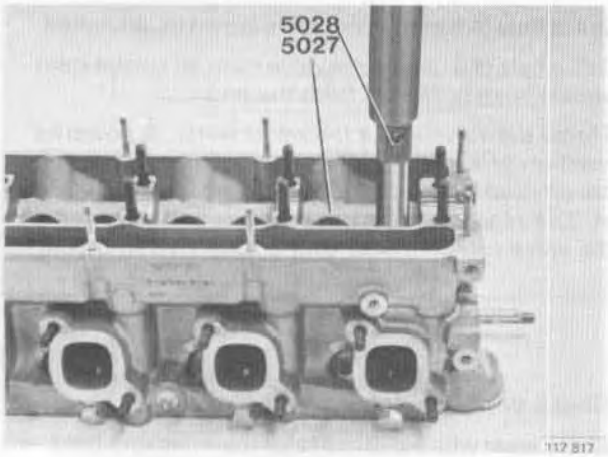
If so, valve guide bore must be reamed to oversize.

C22

Identification of valve guides

Valve guides are marked with grooves to indicate oversize. Use new guide of same number of grooves as previous guide.

No.of grooves	Size
0	Standard
1	Oversize 1
2	Oversize 2
3	Oversize 3



C23

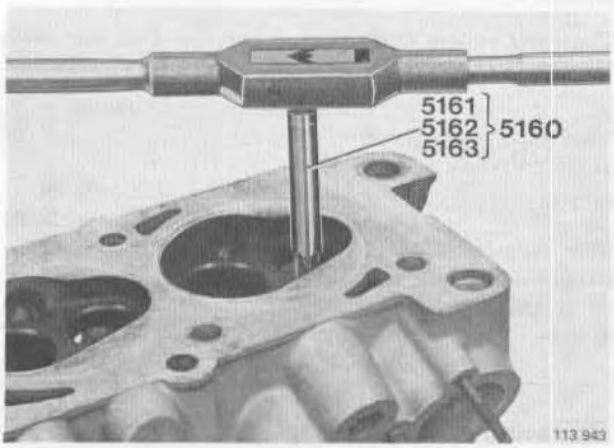
Press in new valve guide

Cylinder head should be at room temperature

Use drift **5027** for inlet valves and **5028** for exhaust valves.

Press guide until drift contacts cylinder head to give valve correct protrusion.

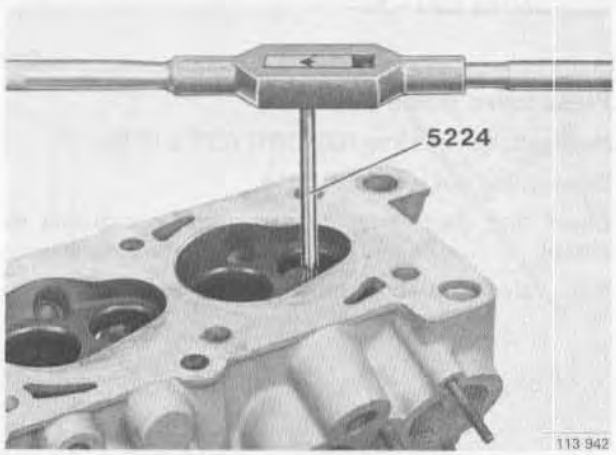
Important: Force used for pressing valve guide into position must be at least 9000 N (2 016 lbf). If this force is not reached the guide must be removed again and valve seat reamed to next oversize and appropriate guide installed.



C24

Reamer part number

Oversize	Reamer
1	5161
2	5162
3	5163

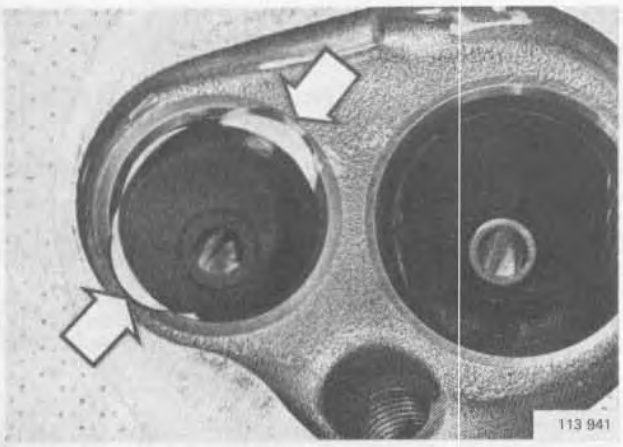


C25

Clean valve guide

Use reamer **5224** or 5164.

Valve and seat must be ground in after replacing valve guide.



Valve seat, replacement

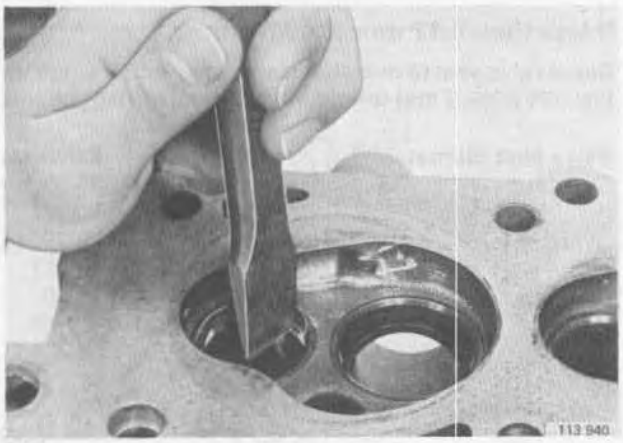
Operations C26–37

Important: Valve guides should always be replaced before replacing valve seats. See C21–25.

C26

Cut two notches in ring of old valve seat

This makes it easier to remove seat. Grind an additional notch for chisel taking care not to damage cylinder head.

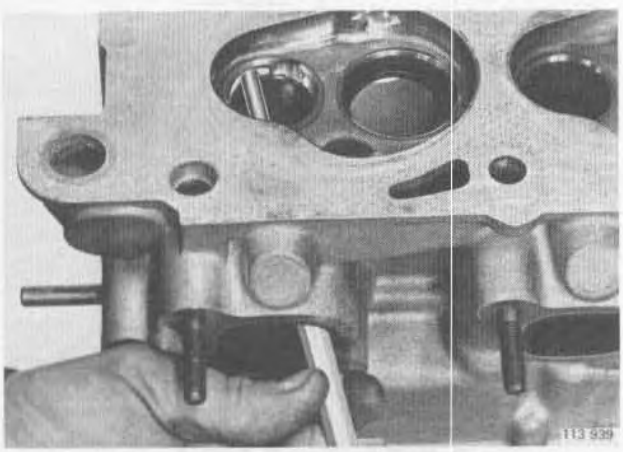


C27

Split valve seat

Split seat with a chisel.

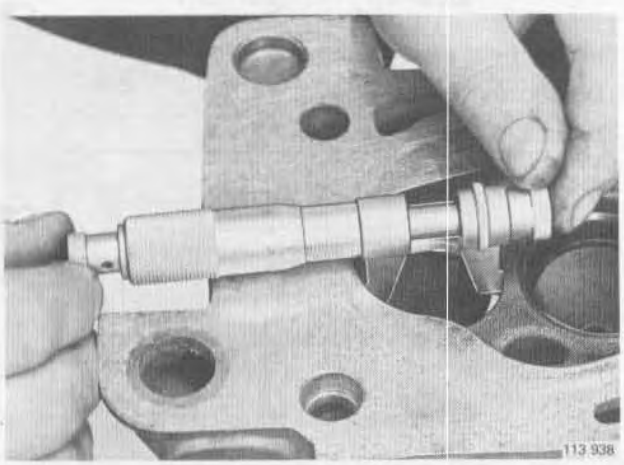
Be careful not to damage cylinder head.



C28

Tap out valve seat

Use a long drift as illustrated.



C29

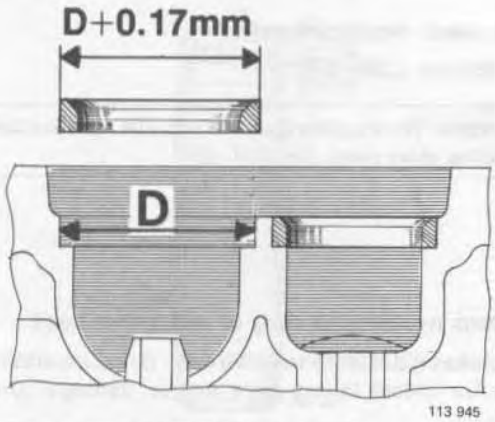
Check valve seat recess

If damaged, ream recess to nearest oversize.

C30

Measure diameter

Use an inside micrometer.

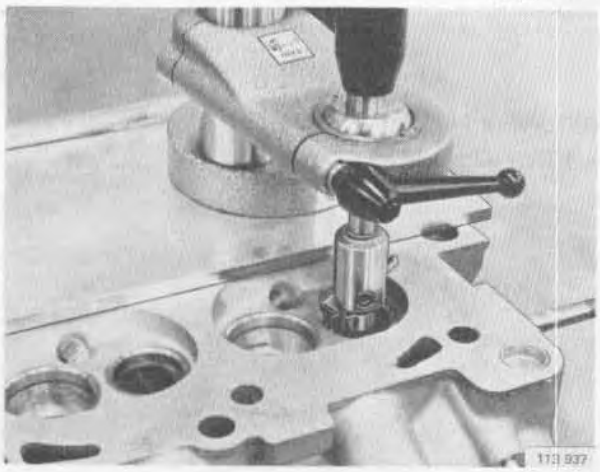


C31

Measuring new valve seat

Size of new valve seat is not marked but must be measured. Two oversizes are available.

Valve seat insert should be **0.17 mm** (0.0067 in) larger than recess in cylinder head.

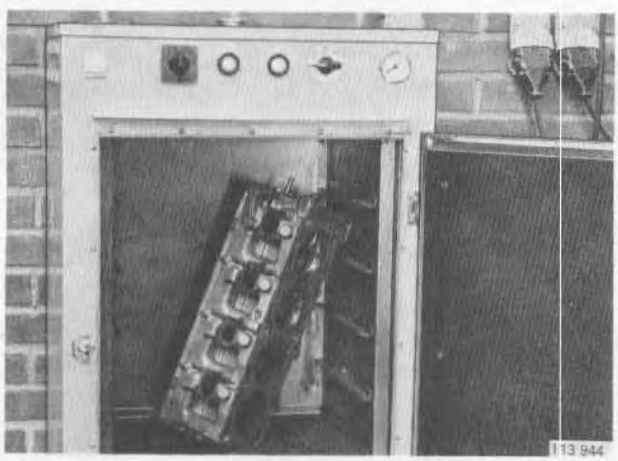


C32

If less than 0.17 mm (0.0067 in):

Recut valve seat to oversize. Use a valve cutter e.g. Mira P/N 998 6045-5 and follow manufacturers instructions.

Valve seat diameter		Inlet	Exhaust
Standard	mm	46.00	38.00
	in	1.8124	1.4972
Oversize 1	mm	46.25	38.25
	in	1.8223	1.5071
Oversize 2	mm	46.50	38.50
	in	1.8321	1.5169



C33

Heat cylinder head

Heat to 100 ° C (212°F).

C34

Install new seat insert on drift

Drift 5029 = inlet valves

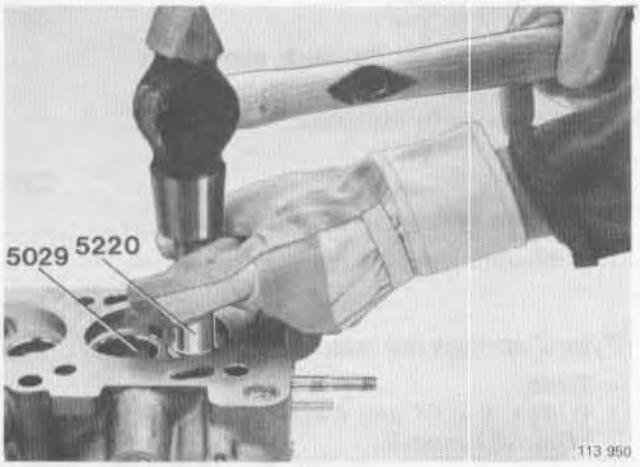
Drift 5220 = exhaust valves.

C35

Cool seat insert to −70°C (−94°F)

Use carbon dioxide.

Wear protective gloves for safety.



C36

Tap valve seat insert into cylinder head

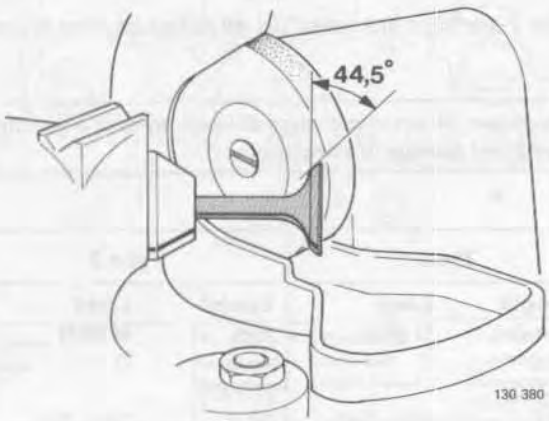
This operation must be carried out very quickly, within 3–4 seconds to avoid temperature loss.

C37

Check seat fit

If seat is not secure, oversize seat must be used.

After replacing valve seat, seat must be ground and valves ground-in.



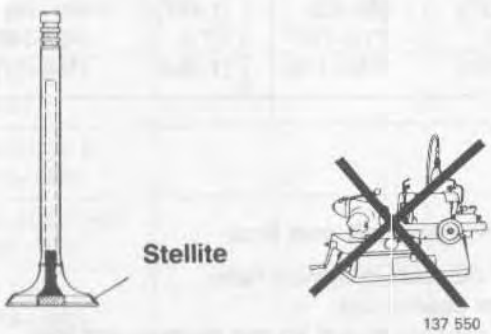
Grinding-in valves and valve seats

Operations C38–40

C38

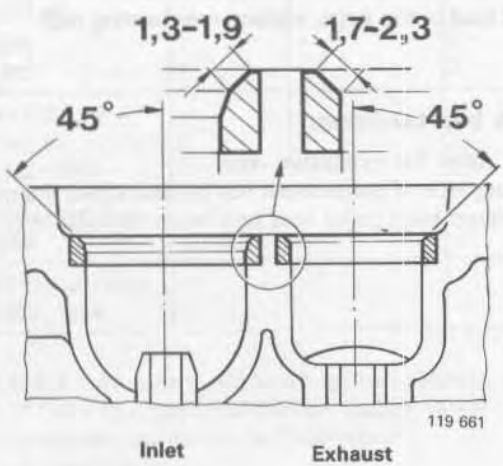
Machine valves to specified angle

Same angle for inlet and exhaust valves.



Important:

Exhaust valves in turbo engines are stellite coated and must not be machined. They can only be ground-in with lapping paste against valve seat. If stellite coating is removed valves will lose heat resistance.



C39

Mill or grind valve seats

Same angle for inlet and exhaust valves.

Valve diameter

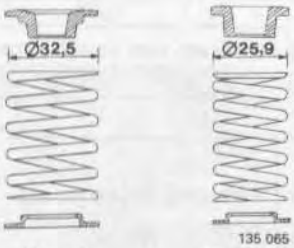
Inlet	**1.3–1.9 mm (0.0512–0.0749)**
Exhaust	**1.7–2.3 mm (0.0670–0.0906)**

C40

Check valve fit

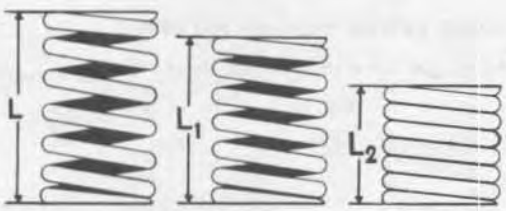
Grind-in valves if necessary with lapping paste.

137 819



135 065

Type 1 Type 2



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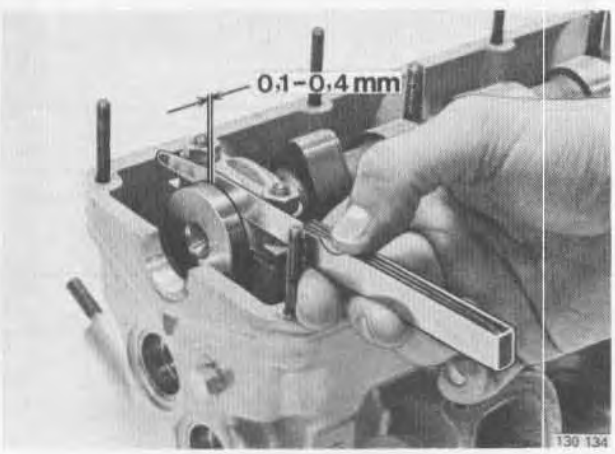

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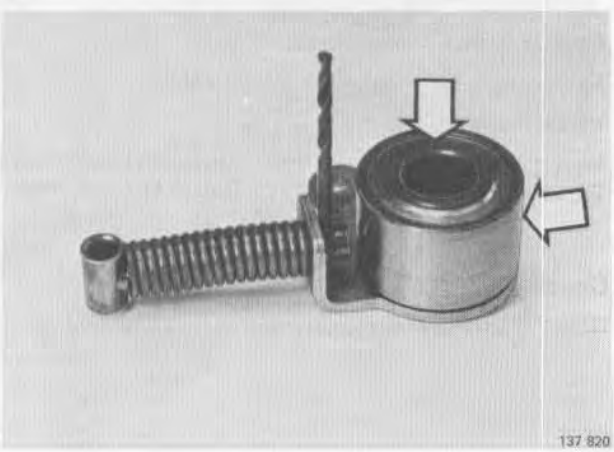


137 820

C41

Check tappets for damage, scoring etc

C42

Test valve springs in a spring tester

Two different types are in use.

Type 2 springs are used on

- B 23 F
- B 19 ET, B 21 ET and B 21 FT late types (introduced from 1984 models)

Type 2 springs can also be used on B 21 F LH-Jetronic early types and B 19 ET, B 21 ET and B 21 FT early types.

Type 1 springs are used on all other engine types.

Important: Do not interchange different types of adjusting shims and springs in same engine.

Type 1		Type 2	
Length mm (in)	**Load N (lbf)**	**Length mm**	**Load N (lbf)**
45.0 (1.773)	0	45.5 (1.793)	0
38.0 (1.497)	280–320 (63–72)	38.0 (1.497)	280–320 (63–72)
27.0 (1.064)	710–790 (160–178)	27.5 (1.084)	702–782 (158–176)

C43

Check camshaft end float

Place camshaft in cylinder head.
Fit rear bearing cap.
Slide camshaft to and fro and measure end float.
End float = 0.1–0.4 mm (0.004–0.0158 in)
If end float is too large, replace rear bearing cap.

C44

Check belt tensioner

Check roller for excessive wear.
Running face of roller must not be damaged. If surface is grooved both roller and belt must be replaced.

Cylinder head, assembly

Special tools: 5021, 5025, 5034, 5219, 5222

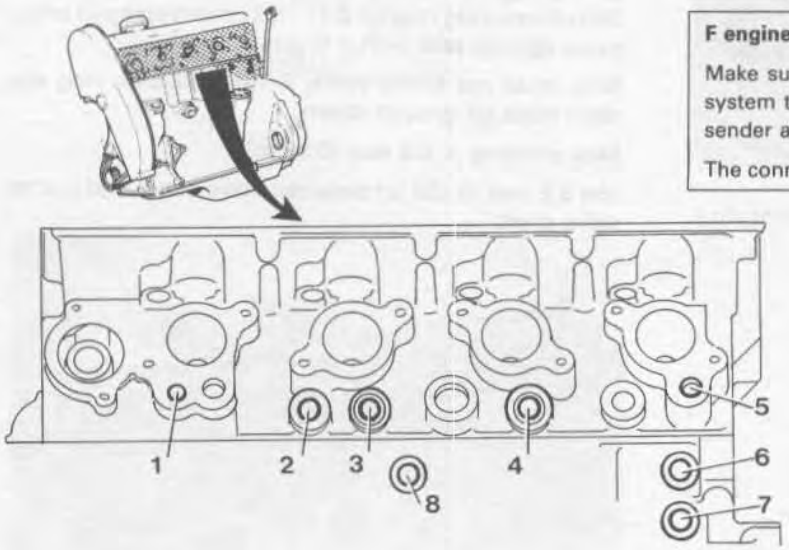
Location of senders/contacts on cylinder head and block *C45*

All senders/contacts are located on the left-hand side of the cylinder head and block.

F engines USA 1981–1985

Make sure that the connectors for the start injector, CIS system temperature sender and LH-Jetronic temperature sender are correctly connected.

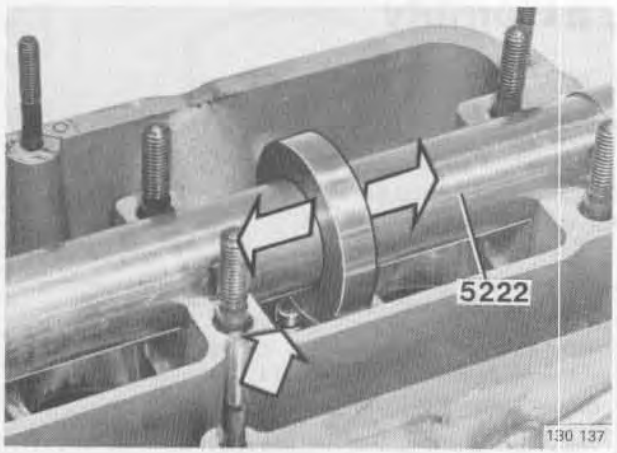
The connectors look alike and can easily be interchanged.



136 019

Engine type	Temperature sender CIS (blue & red)	Thermostat valve EGR (black hoses)	Thermostat valve acceleration enrichment (black hoses)	Temperature sender gauge (yellow)	Thermal time-switch, start injector (blue-yellow & white)	Temperature sender LH-Jetronic (blue & black)	Thermal contact, Lambda-sond (green)	Knock sensor ignition (brown)
B 17, 19, 21, 23 A 1975–1984	–	2[3]	–	3	–	–	–	–
B 19 K 1984	–	–	–	3	–	–	–	–
B 19, 21, 23 E 1975–1984	–	2[3]	–	3	5	–	–	–
B 19, 21 E-Turbo 1981–1984	–	2[5]	–	3	4	–	–	–
B 21 F-5[1] 1976–1984	–	2[3]	–	3	5	–	–	–
1981 USA	1[4]	–	2	3	5	–	–	–
B 21 F-9[2] 1981	1	–	2	3	5	–	–	–
1982	1	–	2	3	5	–	7	–
B 21 F-Turbo 1981	6	–	2	3	4	–	–	–
1982–1985	6	–	2	3	4	–	7	–
B 21 F LH-Jetronic 1982	1	–	–	3	5	4	–	–
B 23 F LH-Jetronic 1983–1984	–	–	–	3	–	4	–	8

[1] B 21 F-5 = CI system and Bosch ignition system
[2] B 21 F-9 = CI system and Chrysler ignition system
[3] Only certain year models and markets
[4] Only California
[5] Only B 21 ET Scandinavia and Switzerland 1984–1985



C46

Check valve stem position in relation to camshaft

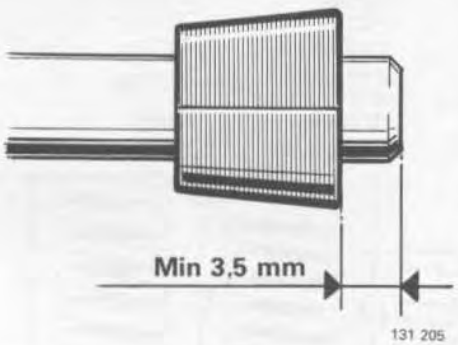
This measurement should be carried out to ensure that there is sufficient space for valve adjustment.

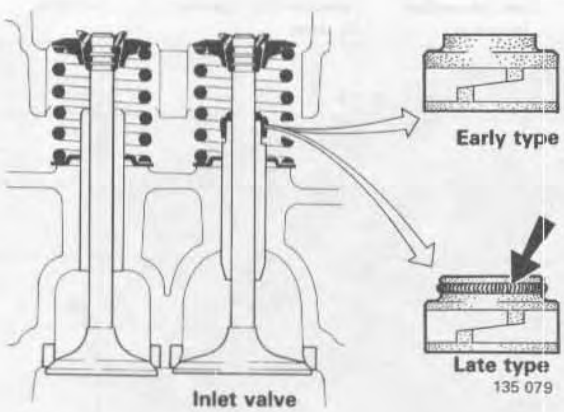
Place valves in cylinder head.
Remove measuring rings for D 20/D 24 (largest ring) from gauge 5222 and place gauge in cylinder head.
Slide measuring ring for B 17–B 23 over valve and press valve against seat with a finger.

Ring must not touch valve. If valve touches ring the stem must be ground down.

Max grinding = **0.5 mm (0.02 in)**

Min **3.5 mm** (0.138 in) between valve cotter and end of valve stem.



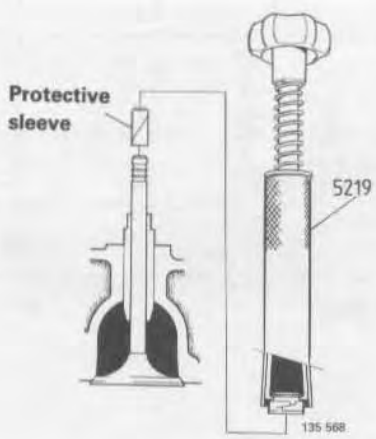


C47

Install new valve stem seals

Seals are required on inlet valves only.

Use only late type seals.



Always use the protective sleeve supplied with new parts.

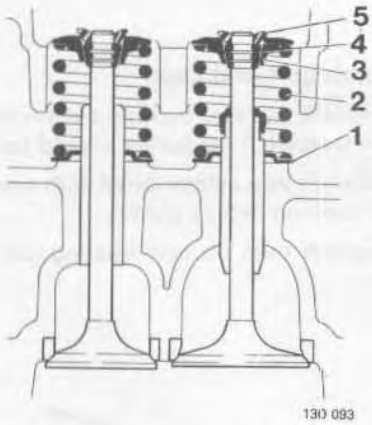
To install seal:

Oil and place valve in position.

Place protective sleeve on valve stem.

Fit seal using tool 5219. The tool should abut seal flange.

Remove protective sleeve.



130 093

C48

Install:

- lower spring seat (1)
- spring (2)
- upper spring seat (3)
- valve cotter (4)
- rubber seal (5)

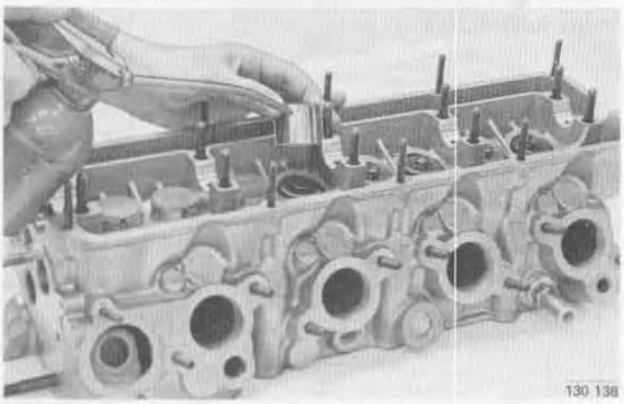
Important:

Two different types of springs and seats are in use, see C42.

C49

Lubricate and install tappets and adjusting shims

Place in same position as found.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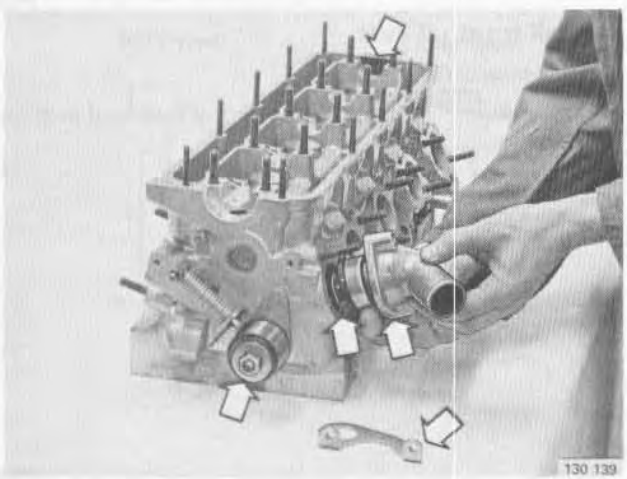
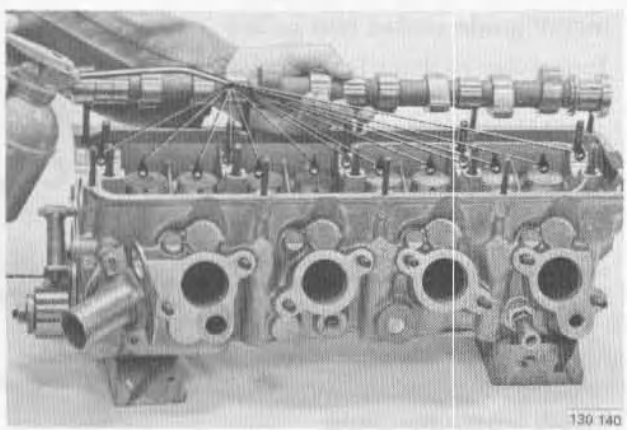

130 139

C50

Install:

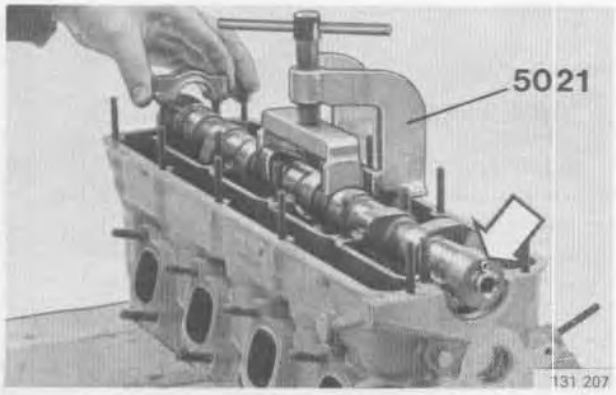
- belt tensioner
- thermostat + O-ring, thermostat housing and lifting eyelet
- half-moon shaped rubber seal at rear of cylinder head.


130 140

C51

Lubricate:

- bearing shells
- cams
- tappets and adjusting shims.



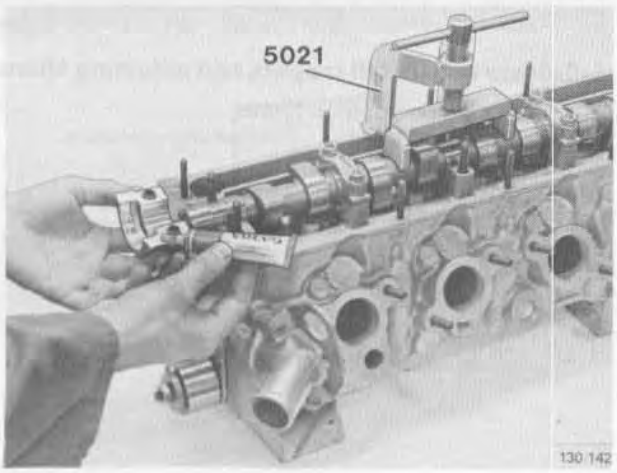
C52

Install camshaft and caps

Place camshaft and rear bearing cap on cylinder head. Guide pin (arrowed) for pulley should face up.

Press camshaft into cyliner head with press tool 5021. (Use rear bearing cap as guide).

Do not tighten nuts on rear bearing cap fully at this stage.



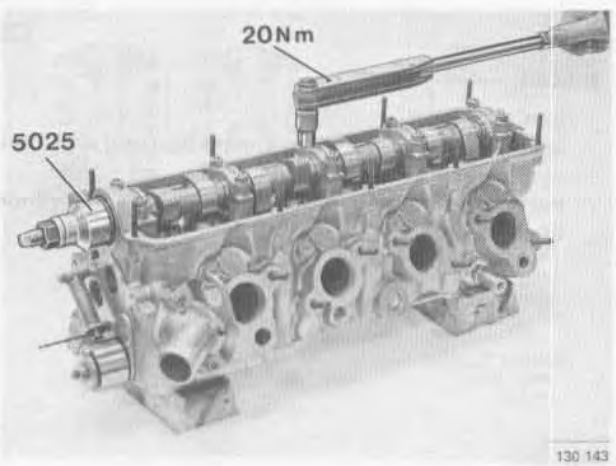
Smear front bearing cap sealing face with sealer P/N 1161 027–6.

Lubricate and fit remaining bearing caps. Do not tighten nuts fully at this stage.

Remove press tool 5021.

Lubricate and fit centre bearing cap.

Torque bearing cap nuts to **20 Nm** (14 ft.lbs).

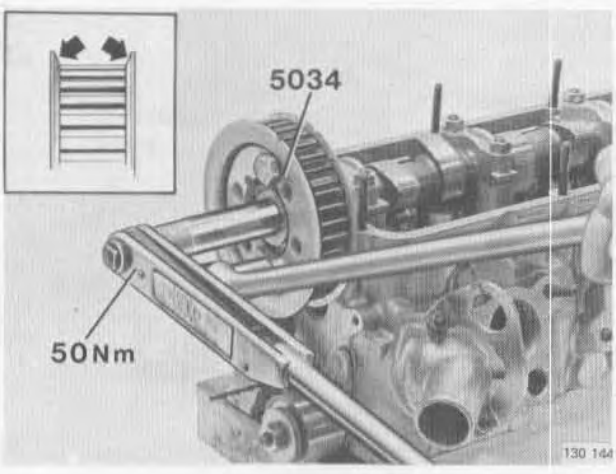


C53

Install front oil seal

Use sleeve 5025.

Grease oil seal and shaft. Check that edges of seal are not damaged.



C54

Install guide plates and pulley

Turn plates so that edges point away from pulley.

Torque to **50 Nm** (36 ft.lbs). Use counterhold 5034.

C55

Valve adjustment

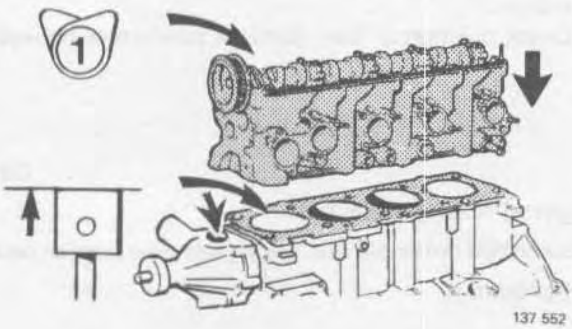
See operations ..... B 1–12
Page 28

C56

Install intake manifold

Assembling, engine

Special tools: 2810, 5035



137 552

C57

Check position of crankshaft and camshaft

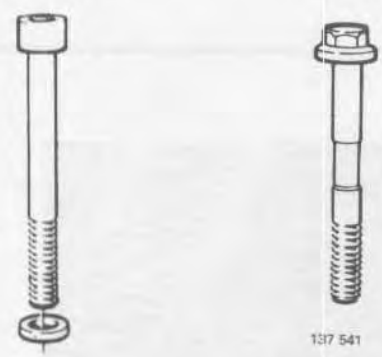
Check that:
- No. 1 piston at T.D.C.
- camshaft is at T.D.C. firing for No. 1 cylinder

C58

Place gasket and cylinder head in position

Check that water pump O-ring sits correctly in groove.

IMPORTANT! Do not rotate camshaft or crankshaft as pistons may strike valves.



137 541

C59

Torque cylinder head bolts

Two types of bolts are in use.

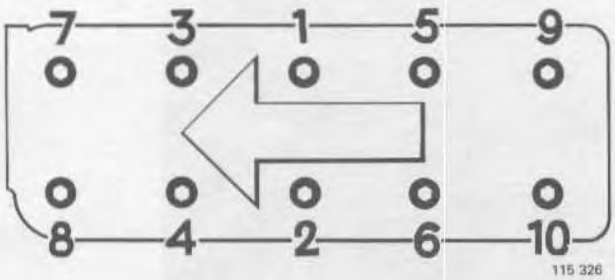
Do not interchange different types.

Late type bolts:

Bolts should be replaced if center section shows signs of extension. Do not re-use bolts more than 5 times. If in doubt, fit new bolts.

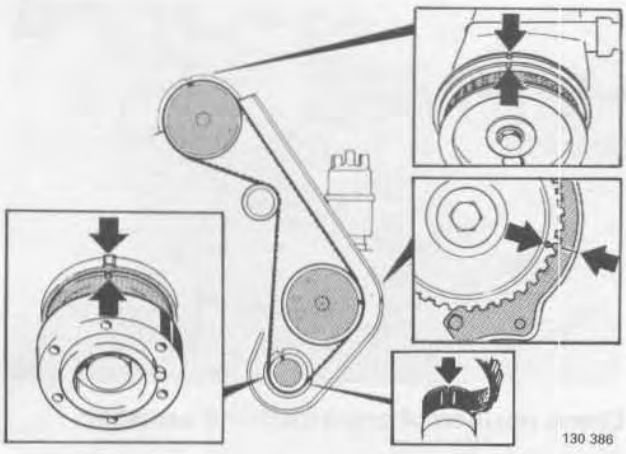
Oil bolts.

Place bolts in cylinder head and tighten each bolt in sequence according to following stages.



115 326

Early-type	Late-type
1 = **60 Nm** (43 ft.lbs)	1 = **20 Nm** (14 ft.lbs)
2 = **110 Nm** (80 ft.lbs)	2 = **60 Nm** (43 ft.lbs)
Note: Retorque early type type bolts, see C9 page 54	3 = Angle-tighten **90°**

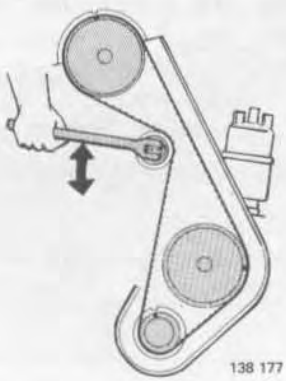

130 386

C60

Install timing gear belt

Important: Do not turn crankshaft or camshaft as pistons can strike valves and cause damage.

- Check that camshaft, intermediate shaft and crankshaft are aligned as shown adjacent.
- Place belt around crankshaft and intermediate shaft pulleys so that two lines on belt align with timing mark on crankshaft.
- Stretch belt and place over camshaft and belt tensioner.
- Check position of belt. Recheck position of pulleys.


138 177

C61

Tighten timing gear belts

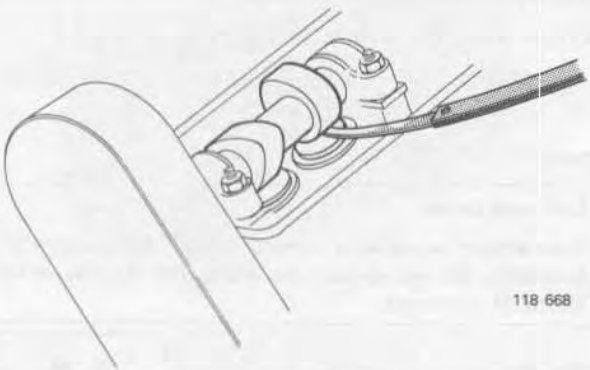
Slacken belt tensioner nut. Spring will now tension belt.

Retighten nut.

C62

Install:

- timing gear case
- fan belts. It should be possible to depress belt 5–10 mm in centre of a run
- fan shroud.

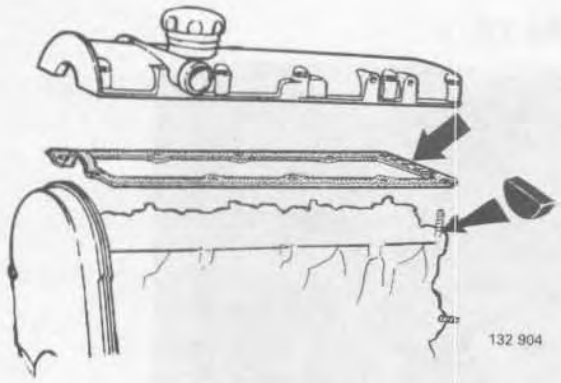

118 668

C63

Valve adjustment

(as applicable)

See operation ..... B 1–12
Page 28


132 904

C64

Install rubber seal on rear edge of cylinder head

C65

Install gasket

Check that half moon-shaped seal at rear of cylinder head is in position.

Use a new gasket.

Turbo engines require a harder type of gasket. Part number and colour of gasket are shown below.

	Colour	P/N
Turbo	Light beige	1326640-8
Other models	Blue	463999-3

C66

Install:

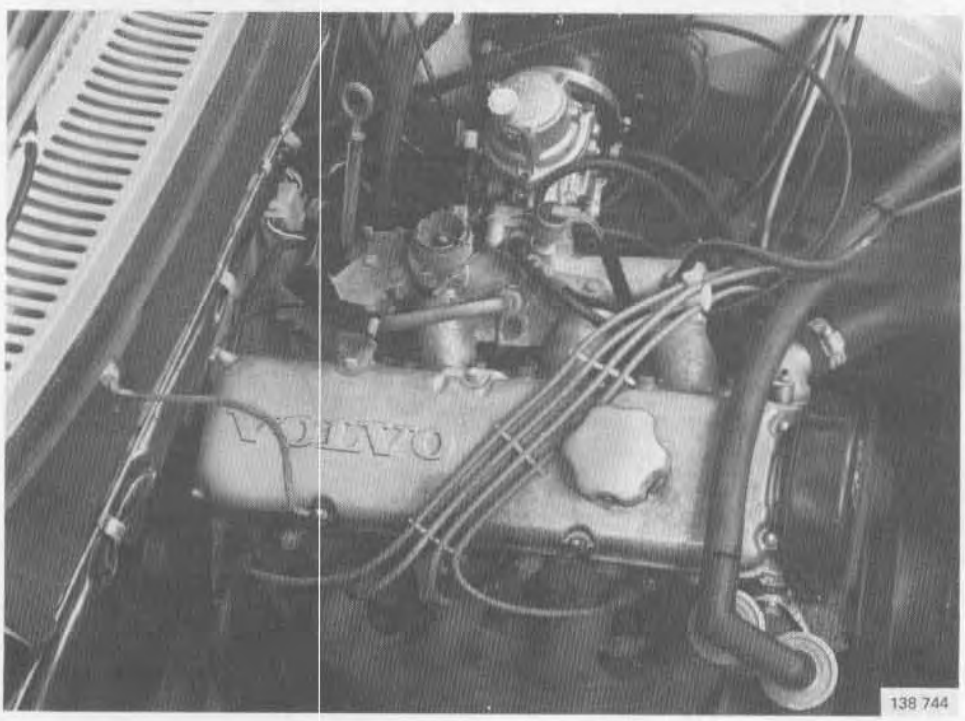
- valve cover
- ground cable
- electrical connection contact for timing advance
- nuts for valve cover, and tighten securely

C67

Install all other parts to cylinder head and intake manifold

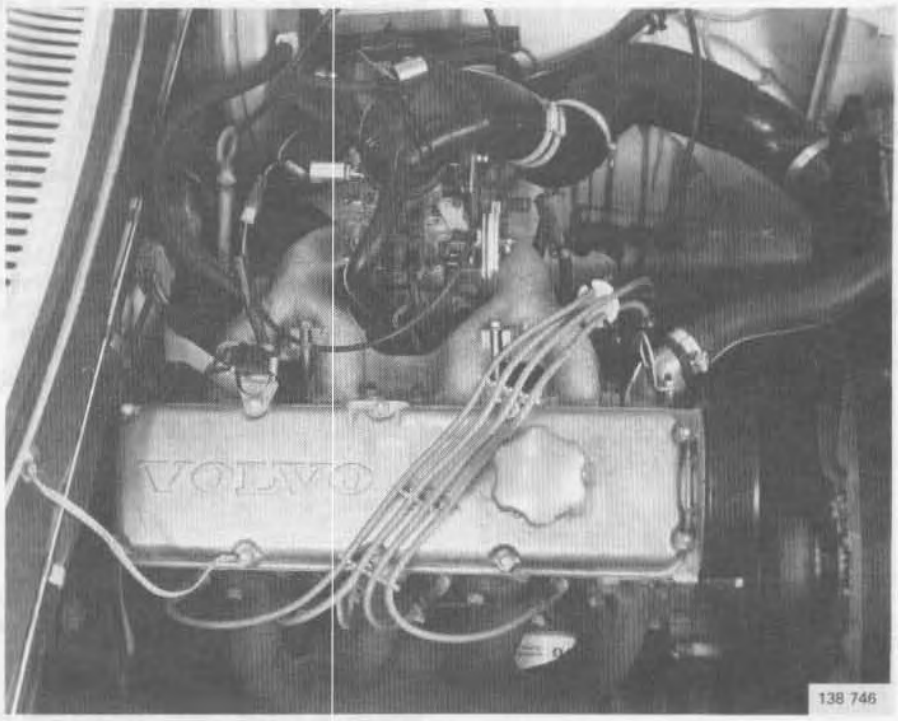
A engines see below
K engines see ..... page 52
E and F engines see ..... page 52
ET and FT engines see ..... page 53
F engines with LH-Jetronic fuel systems see ... page 53

A engines

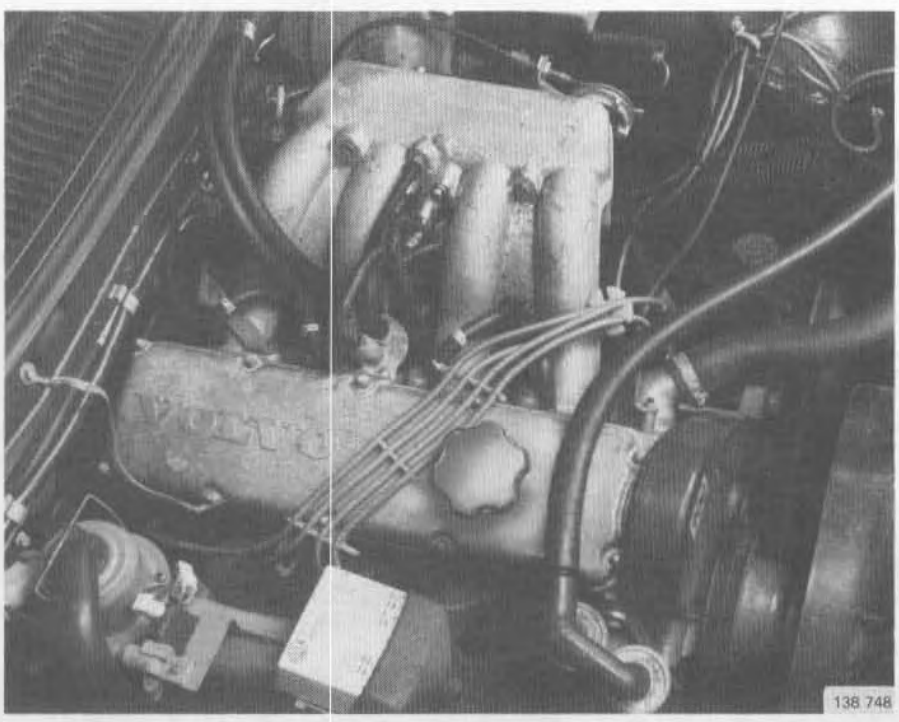


138 744

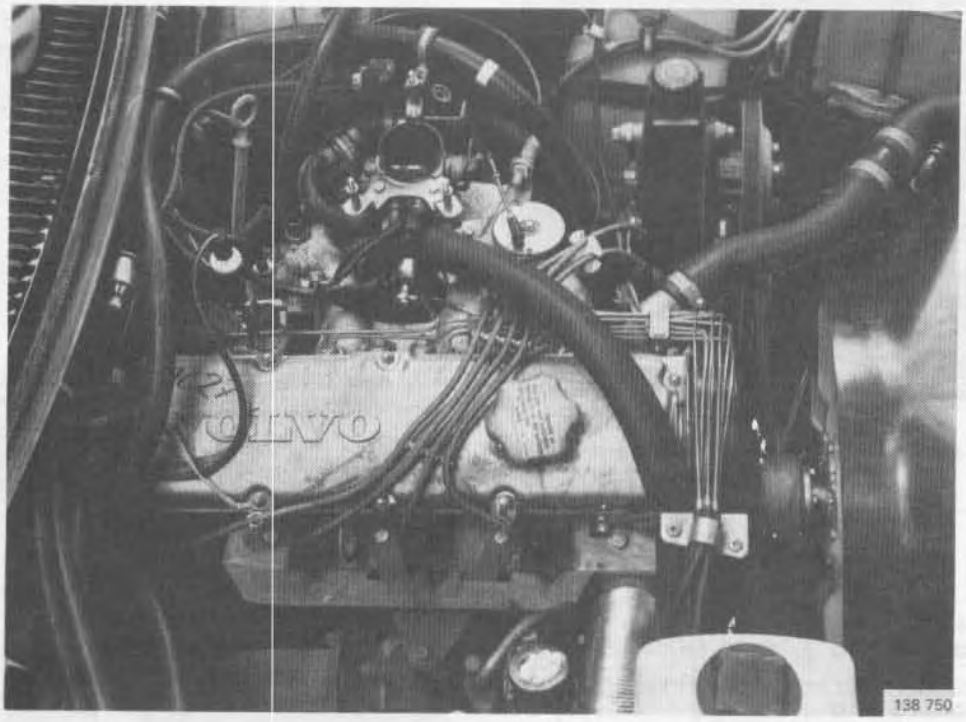
K engines



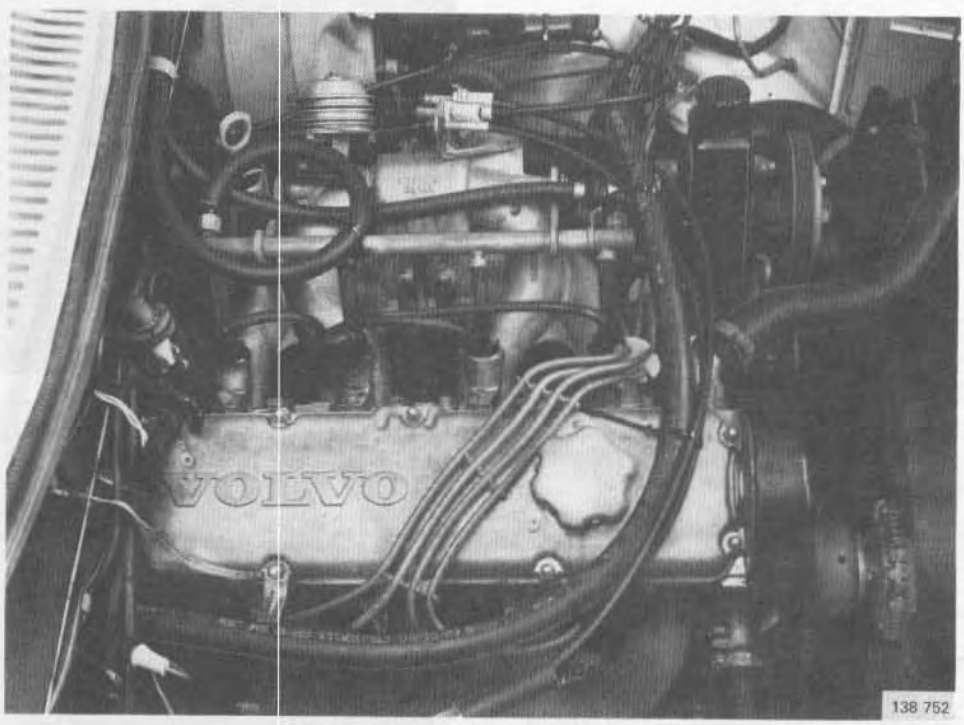
E and F engines

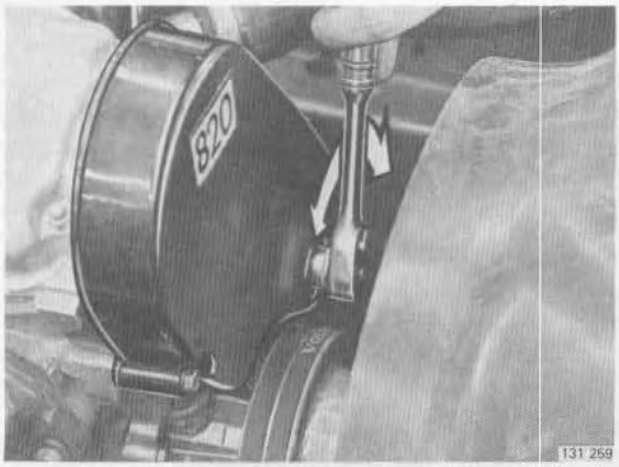


ET and FT engines



F engines with LH-Jetronic fuel systems





C68

Warm up engine

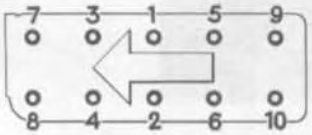
- Check/adjust ignition, idle speed and CO content.
- Check cooling system, and top up coolant if necessary.
- Adjust drive belt tension. Remove rubber plug in gear case.
  Slacken belt tensioner nut. Spring now extends belt. Retighten nut.

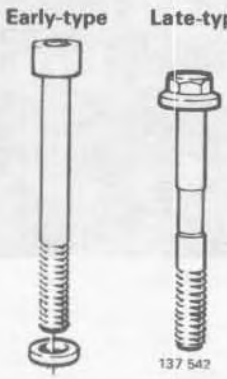
C69

Fit rubber plug

After 1000 km (600 miles):

- Check/adjust new timing gear belts.
- If new parts have been fitted to valve assembly, recheck valve clearance.





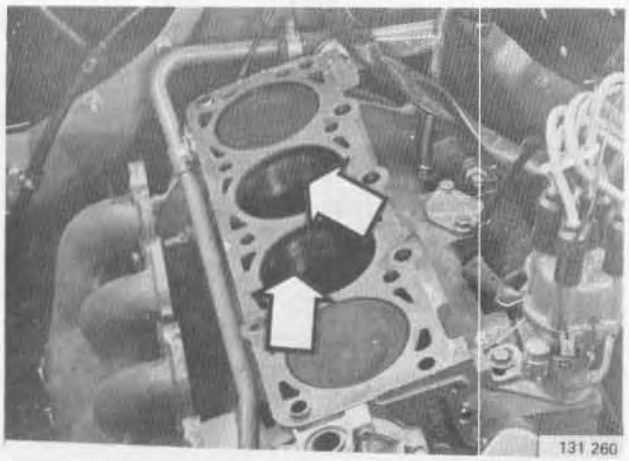
Retorquing cylinder head bolts

Applies only to early type bolts

1. Warm-up engine. Leave to cool for 30 minutes.
2. Slacken bolt 1 approx. 30°.
   Retorque to **110 Nm** (80 ft lbs).
3. Repeat for remaining bolts in sequence shown in illustration.

D. Piston rings, replacement

Special tools: 5006, 5033, 5115, 5871, 2810, 5035



D1

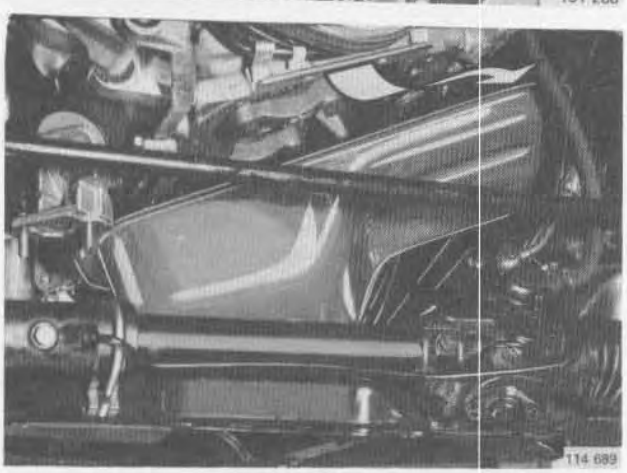
Remove cylinder head by method described on page 31

D2

Check cylinder bores

Check for score marks and other visible damage.

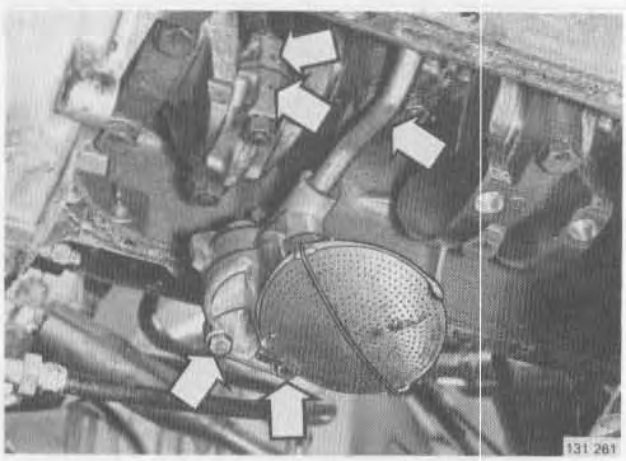
> If damaged, the cylinder head **must** be fitted with at least 6 bolts before lifting the engine out and reconditioning.
>
> Engine removal, see page 83.



D3

Remove oil sump

See K 1–10, page 78



D4

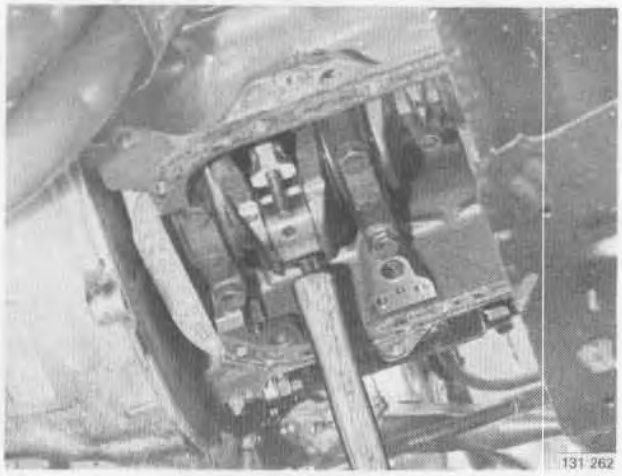
Remove oil pump and pipe

D5

Rotate crankshaft

Turn crankshaft to obtain crank pins for No. 1 and No. 4 cylinders at their lowest positions.

Check to see if caps are marked, they must not be interchanged during reassembly.


131 262

D6

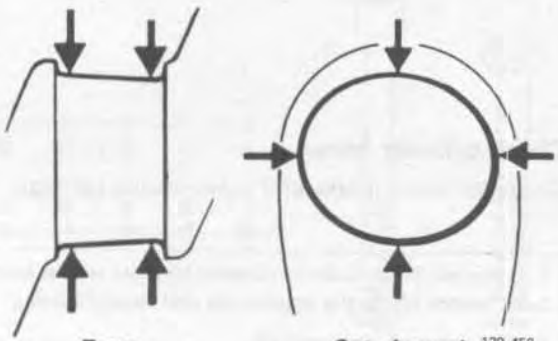
Remove connecting rod bearings and bearing shells

Check shells for score marks and other visible damage.

Do not mix up parts.

D7

Push out pistons with wooden handle of a hammer



129 452

D8

Check and measure bearing journals

Measure for taper and out-of-round. Use a micrometer and measure at several points round the periphery and along the length.

Max. out-of-round ..... **0.05 mm** (0.002 in)
Max. taper ..... **0.05 mm** (0.002 in)

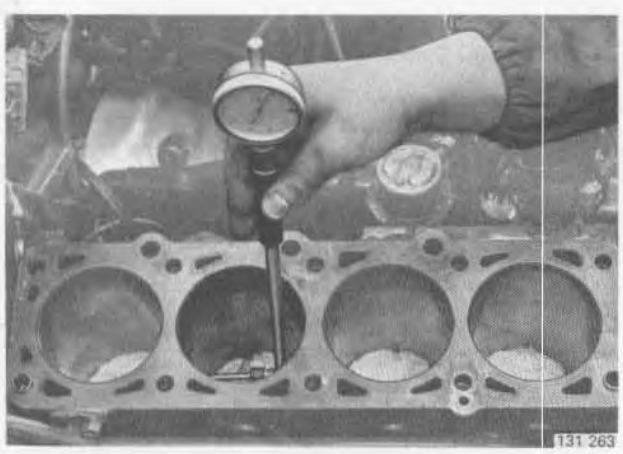
If journals are damaged or taper/out-of-round exceeds specifications, the engine must be lifted out and crankshaft replaced/reground.

N.B. When lifting out the engine, the **cylinder head must be secured** with at least 6 screws. See page 83.

D9

Clean cylinder bores

Push paper down into cylinder bores to prevent dirt entering crankshaft oil ducts. Clean the cylinder bores with fine emery cloth or a honing tool.


131 263

D10

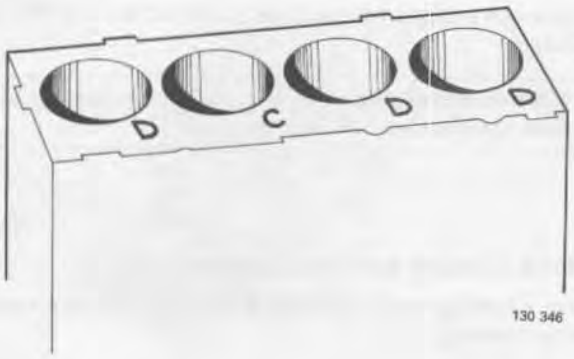
Measure cylinder bores

Use a 50–100 mm (1.97–3.94 in) hole gauge.

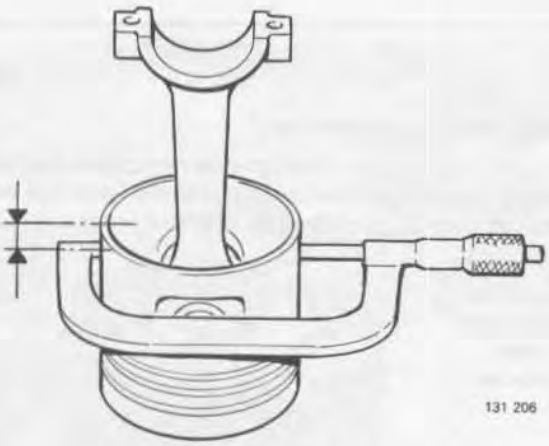
Measure for **maximum wear** in lateral direction of engine, just below top dead centre.

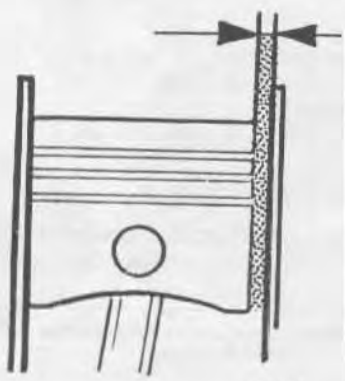
Measure for **minimum wear** in longitudinal direction of engine at bottom dead centre.

D11



130 346


131 206


131 370

Class marking

A class letter is punched on every cylinder (C, D, E and G).

Oversizes are denoted by the abbreviation OD1 or OD2. When drilling, the new marking must be punched on.

Standard	**B 17, B 19**	**B 21**	**B 23**
(C-marked)	88.90–88.91	92.00–92.01	96.00–96.01
	(3.5027–3.503)	(3.625–3.6252)	(3.7824–3.783)
(D-marked)	88.91–88.92	92.01–92.02	96.01–96.02
	(3.503–3.5034)	(3.6252–3.6256)	(3.783–3.7832)
(E-marked)	88.92–88.93	92.02–92.03	96.02–96.03
	(3.5034–3.5038)	(3.6256–3.626)	(3.7832–3.7836)
(G-marked)	88.94–88.95	92.04–92.05	96.04–96.05
	(3.5042–3.5046)	(3.6264–3.6268)	(3.784–3.7844)
Oversize:			
OD(OS)	89.29–89.30	92.5	96.3
	(3.518–3.5184)	(3.645)	(3.794)
OD(OS)	89.67–89.68	93.0	96.6
	(3.533–3.5334)	(3.6642)	(3.806)

D12

Measure piston diameter

Measure piston diameter **at right angles to piston pin hole.**

The diameter must be measured at different heights, according to the piston/engine type.

- B 21 A/E = **6 mm** (0.236 in) from bottom
- B 23 E = **8 mm** (0.315 in) from bottom
- B 23 E version 1 (piston height 80.4 mm = 3.168 in) = **15 mm** (0.591 in) from bottom
- B 23 E, version 2 (piston height 76.4 mm = 3.010 in) = **8 mm** (0.315 in) from bottom
- Others = **7 mm** (0.276 in) from bottom

D13

Calculate piston clearance

Example:

Measure cylinder diameter	min 3.6256 in	max. 3.6260 in
Measured piston diam.	−3.6248 in	−3.6248 in
Piston clearance =	0.008	to 0.0012 in

Piston clearance mm (in):

B 17 A, B 19 A/E/K, B 21 A/E/F **0.01–0.04** (0.0004–0.0016)
B 19 ET **0.03–0.06** (0.0012–0.0024)
B 21 ET and FT **0.02–0.04** (0.0008–0.0016)
B 23 A **0.01–0.04** (0.0004–0.0016)
B 23 E version 1 (piston height 80.4 mm = 3.168 in) **0.05–0.07** (0.002–0.0028)
B23 E version 2 (piston height 76.4 mm = 3.010 in) **0.01–0.04** (0.0004–0.0016)
B 23 F **0.01–0.04** (0.0004–0.0016)

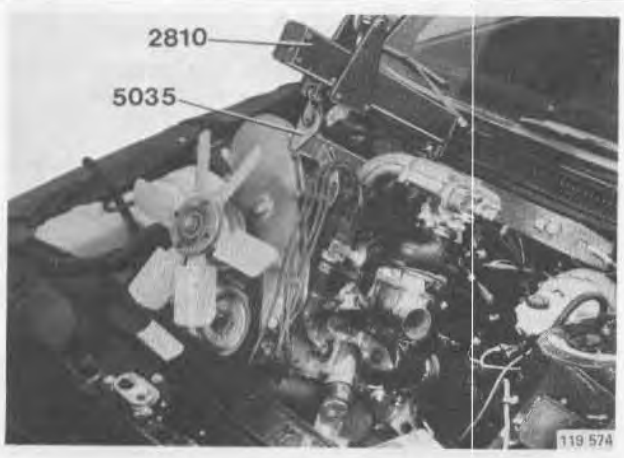
Too large piston clearance in cylinder marked G or oversize:

D14

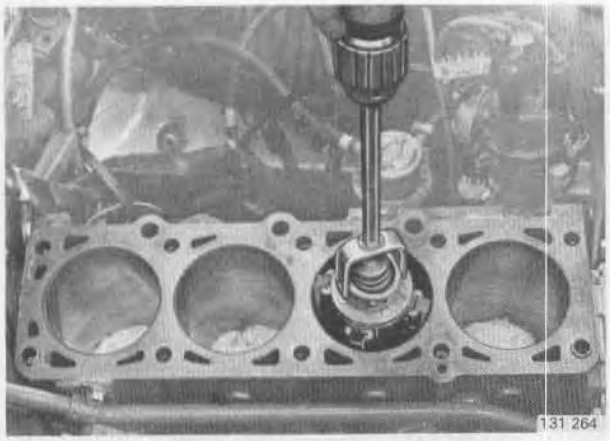
Lift out engine and repair it

Before lifting it out, the cylinder head must be secured with **at least 6 bolts.**

See page 83.



119 574



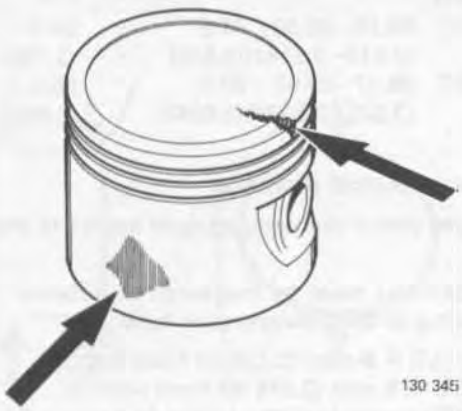
Excessive piston clearance in cylinders marked C, D or E

N.B. Rotate crankshaft a quarter turn so that the honing tool does not strike against crank pins.

D15

Hone cylinder bore to next oversize

Use a honing tool. Carefully wipe clean cylinder bores after honing.



D16

Clean and check pistons

Remove piston rings. Use a piston ring pliers. Remove all soot deposits, scrape clean piston ring grooves with a groove cleaner, for example, or with a broken, ground piston ring.

Check for:
- damage
- wear
- cracks.

D17

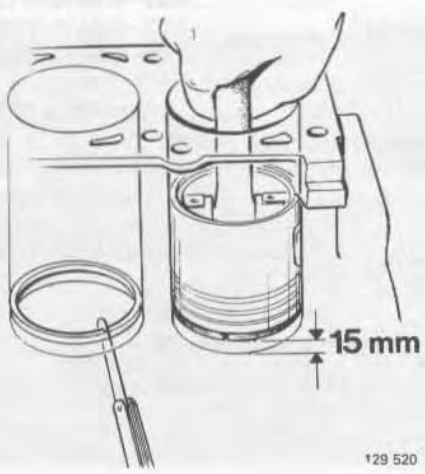
Check axial clearance of piston rings

Use new piston rings.

Upper compression ring
0.040–0.072 (0.002–0.0028)
Lower compression ring
0.040–0.072 (0.002–0.0028)
Oil ring
0.030–0.062 (0.0012–0.0024)

N.B.: The oil ring and upper compression ring are available in two versions, with different heights.

If clearance is excessive, change the piston



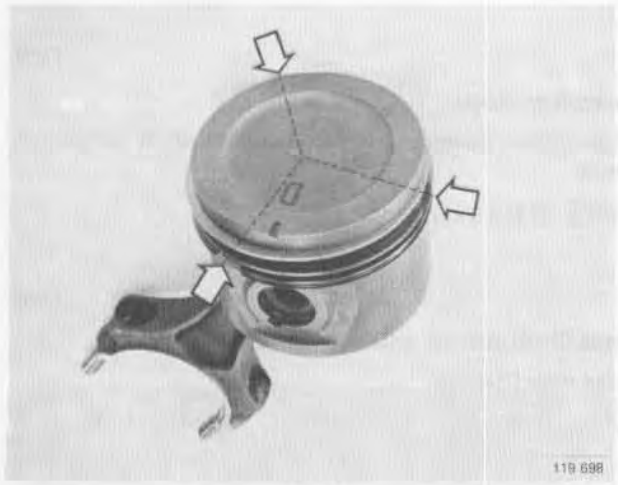
D18

Measure piston ring gap

Insert piston ring in cylinder bore. Use a piston turned upside down so that ring is brought into correct position.

Measure gap with the ring **15 mm** (0.591 in) above bottom of cylinder. Measure gap with a feeler gauge.

Upper compression ring
0.35–0.65 (0.014–0.026)
Lower compression ring
0.35–0.55 (0.014–0.022)
Oil ring
0.25–0.60 (0.010–0.024)

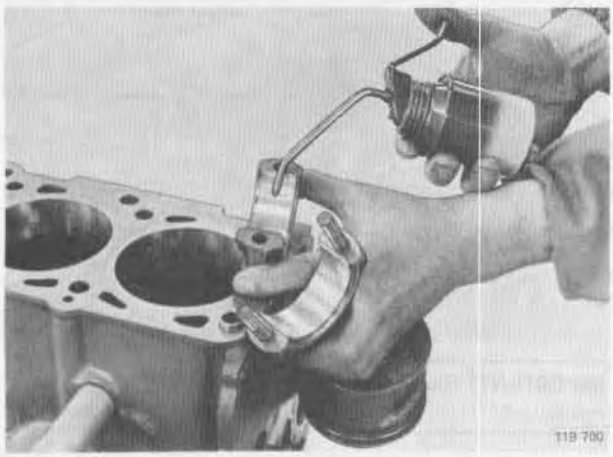

119 698

D19

Install new piston rings

Rotate piston rings so that gaps are approx. 120° from each other.

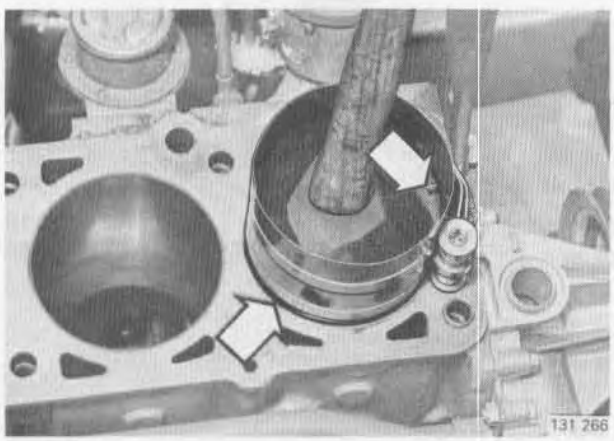
119 697


119 700

D20

Place bearing shells in connecting rods and in caps

Oil cylinder bores, pistons and bearing shells.


131 266

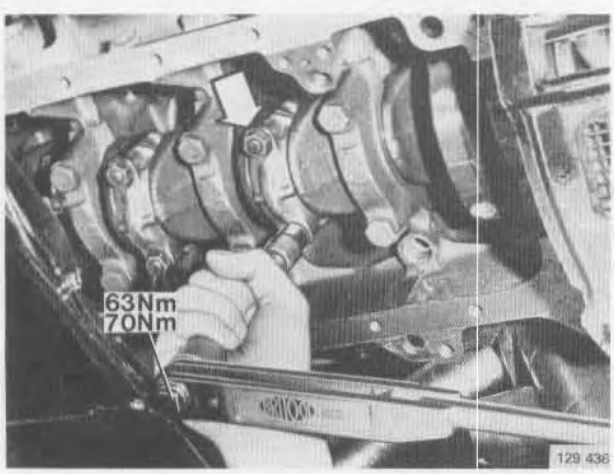
D21

Insert no. 1 piston in cylinder

Rotate crankshaft so that crank pin for cyl. 1 points straight down.

Insert piston. Use a piston ring compressor. Push down piston with handle of a hammer.

IMPORTANT! The marking on the piston must point forward.



129 436

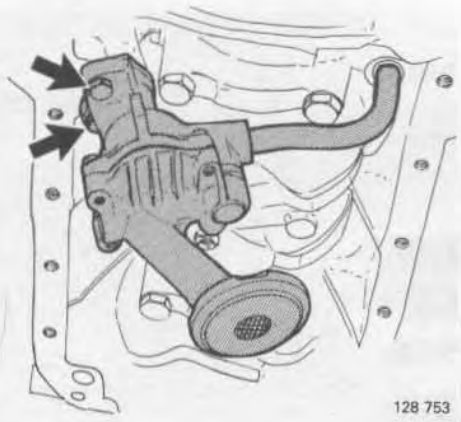
D22

Install connecting rod cap

Check marking. The marking on the connecting rod and cap must coincide.

Oil the screws and fit **new** nuts.

Tighten:
old bolts ..... **63 Nm** (45 ft lbs)
new bolts ..... **70 Nm** (50 ft lbs)


128 753

D23

Install pistons

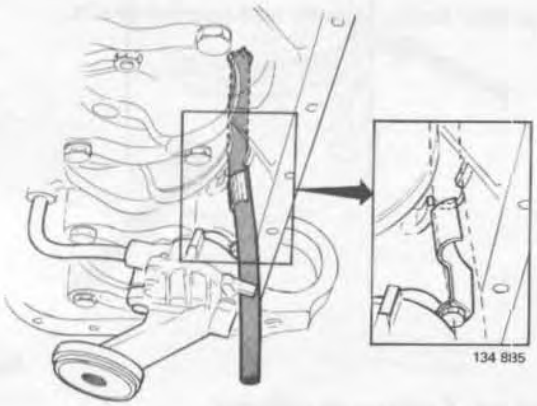
After fitting each cap, check that crankshaft can be rotated.

D24

Install oil pump and pressure pipe

Use new O rings.

Check that pump input shaft fits into drive shaft.


134 835

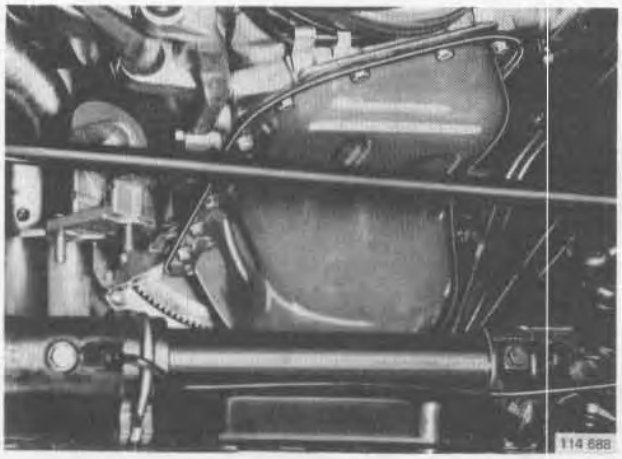
1981– *D25*

Secure drain hose from oil trap

Secure clamp to oil pump fastening screw.

Make sure that hose is securely clamped behind oil pump shoulder.

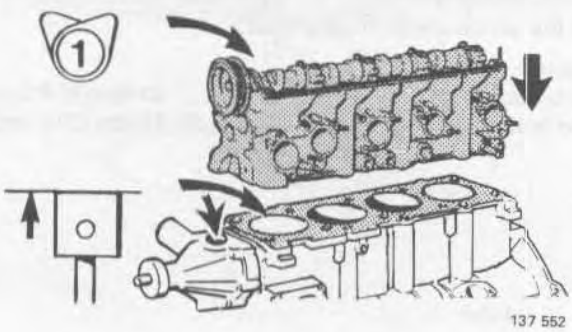
IMPORTANT! The hose must have an exact length, it must not be cut.


114 688

D26

Install oil sump

By method ..... K 11–18
page 80



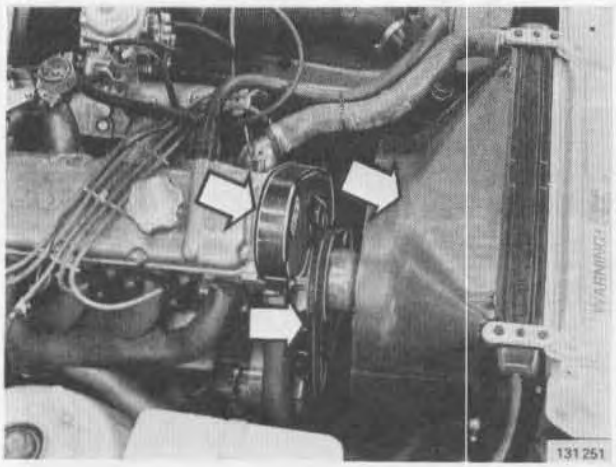
137 552

D27

Install cylinder head

By method ..... C 57–69
page 49

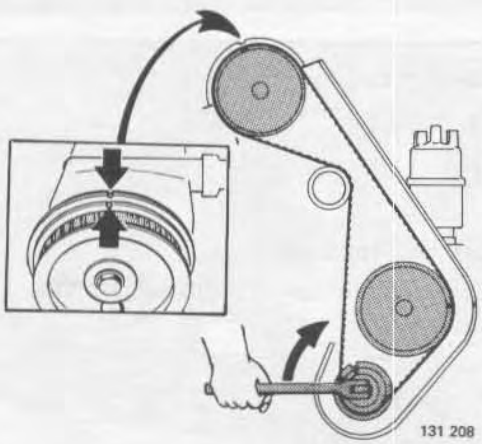
E. Drive belt, replacement



E1

Remove:

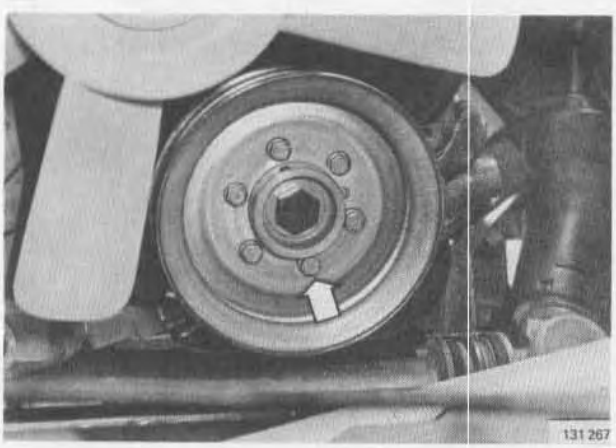
- battery ground connection
- fan cover
- all drive belts from crankshaft pulley
- gear case



E2

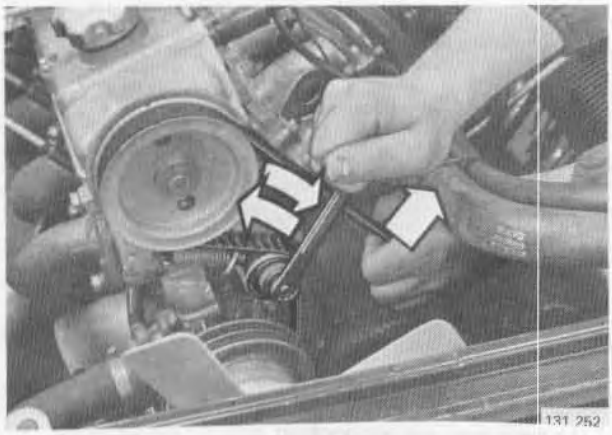
Basic engine adjustment

Rotate crankshaft clockwise with centre screw. Position camshaft so that marking on pulley is brought opposite marking on valve cover.



E3

Remove pulleys from crankshaft


131 252

E4

Remove drive belt

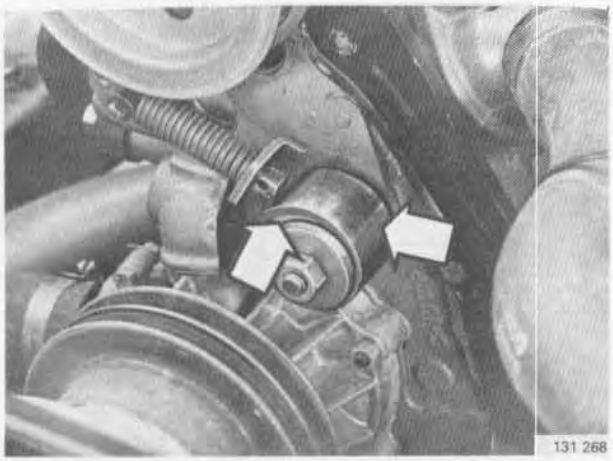
Slacken belt tensioner nut approx. 1 turn.

Pull out belt so that belt tensioner spring is compressed.

Retighten nut.

Remove belt.

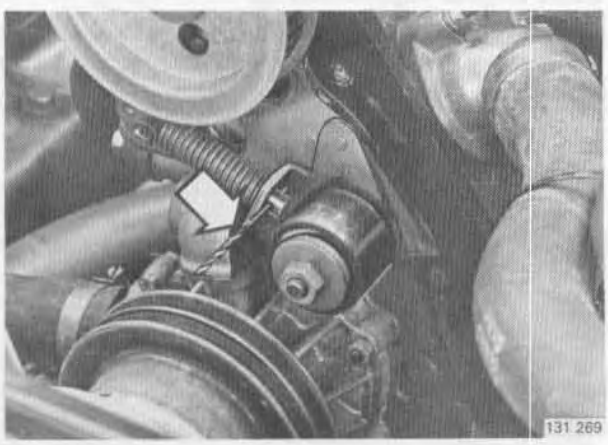
IMPORTANT! Do not rotate crankshaft or camshaft as pistons may strike against valves and cause damage.


131 268

E5

Check belt tension roller

Turn roller and listen for abnormal noise from bearing. Check that contact face against belt is free from cracks and remains of rubber.


131 269

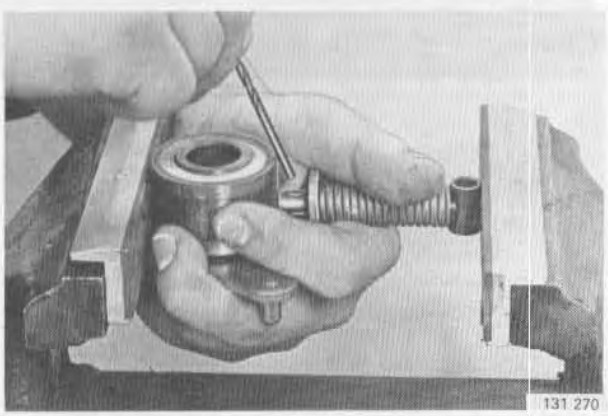
Replace belt tensioner

Operations E 6–7

E6

Remove belt tensioner

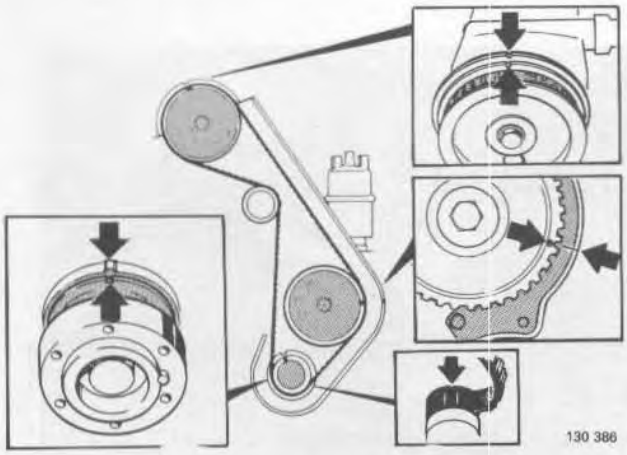
First lock spring in position with a 3 mm drill.


131 270

E7

Assemble and secure new belt tensioner

Use a vice. Lock spring with a 3 mm drill.

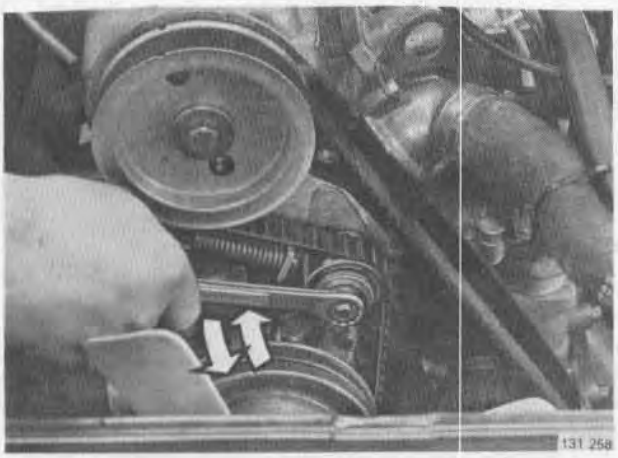

130 386

E8

Install drive belt

IMPORTANT! Do not rotate crankshaft or camshaft as pistons may strike against valves and cause damage.

- place pulley in position according to marking
- place belt round crankshaft and intermediate shaft. Two lines on belt must be brought opposite marking on crankshaft.
- strech belt and place it over camshaft and belt tensioner
- check that belt has been brought into correct position, and that markings on pulleys are opposite markings on engine.


131 258

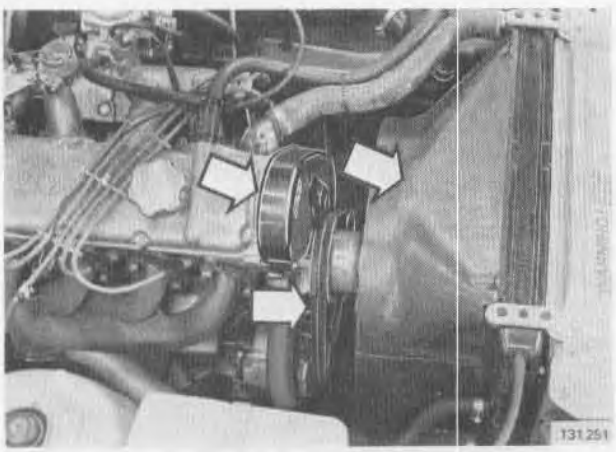
E9

Tension drive belt

Slacken belt tensioner nut. Spring now tensions belt.

Remove locking pin (drill) from belt tensioner.

Tighten nut.


131 251

E10

Install

- crankshaft pulleys
- gear case
- all drive belts on pulleys.
  It should be possible to depress belt 5–10 mm (0.2–0.4 in) with slight thumb pressure when correctly installed.
- fan cover
- battery ground connection

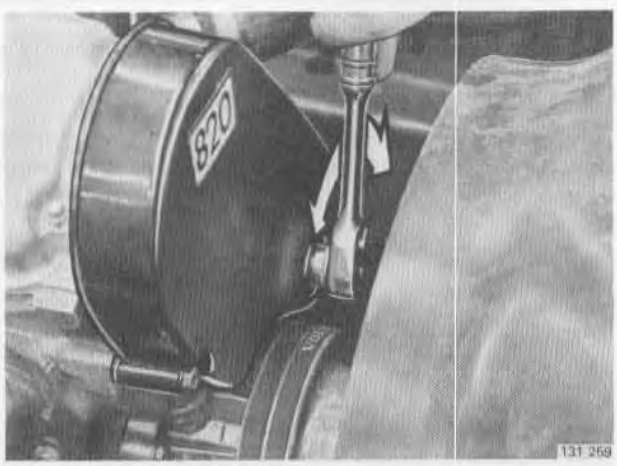
E11

Warm-up engine and check/adjust:

- ignition
- CO content
- idling.

E12

Switch off engine



131 269

E13

Tension drive belt

Remove rubber plug in gear case.

Slacken belt tensioner nut. Spring now extends belt.

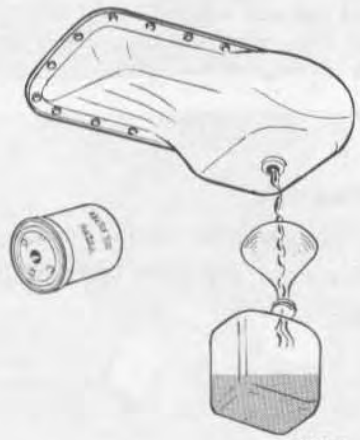
Retighten nut.

Fit rubber plug.

Recheck drive belts after 600 miles (1000 km).

F. Camshaft, removal

Special tools: 5021, 5034


137 504

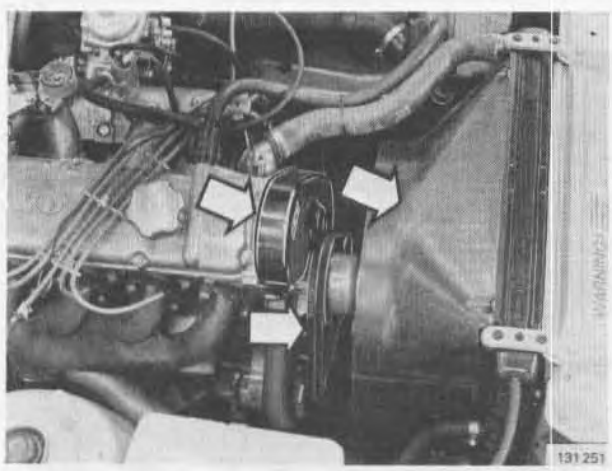
When camshaft is replaced due to wear

It is an **absolute requirement that the engine be flushed clean** before new parts are fitted.
Repeated damage to the tappets and camshaft have been shown to be due to engine contamination.

F1

Flush engine clean

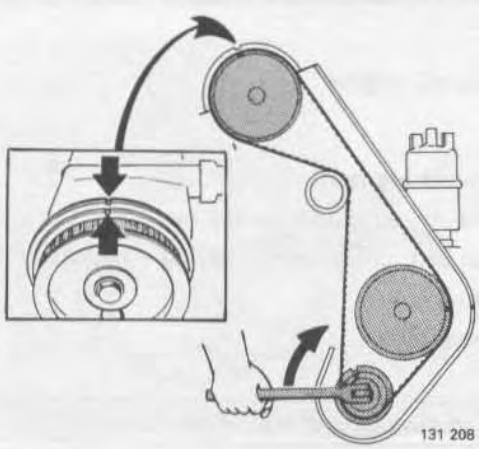
Change engine oil and oil filter.
Warm up engine for approx. 10 minutes.
Drain oil and remove oil filter.
Replace camshaft.
Install new oil filter and pour in oil.


131 251

F2

Remove:

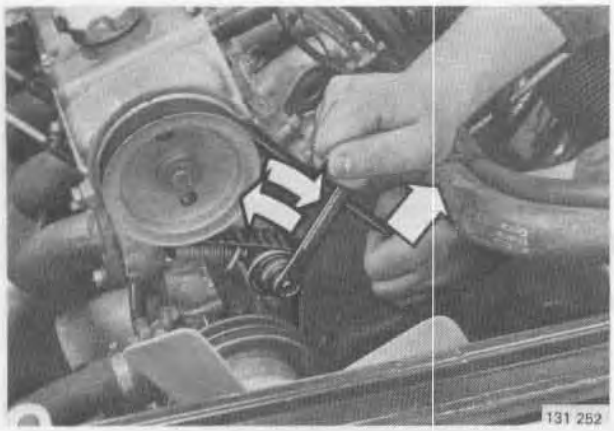
- battery ground connection
- fan cover
- fan belts
- gear case


131 208

F3

Basic engine adjustment

Turn crankshaft clockwise with centre screw. Adjust camshaft so that marking on pully is opposite marking on valve cover.

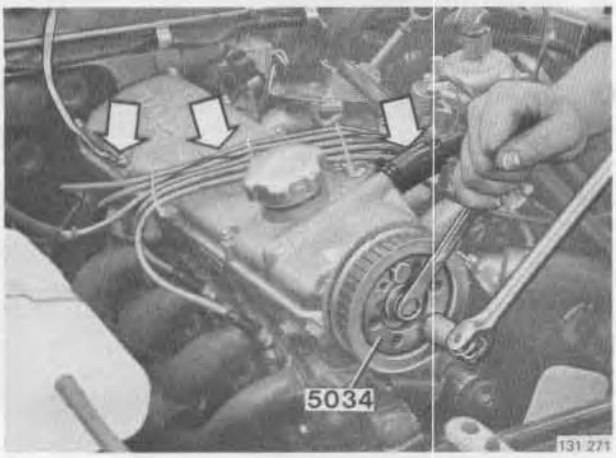


F4

Slacken drive belt. Lift it off from camshaft pulley

Slacken belt tensioner nut approx. 1 turn.
Pull out belt so that belt tensioner spring is compressed.
Tighten belt tensioner nut.
Lift off belt from camshaft pulley.

IMPORTANT!
Do not rotate crankshaft or camshaft when drive belt is removed. The pistons may strike against valves.



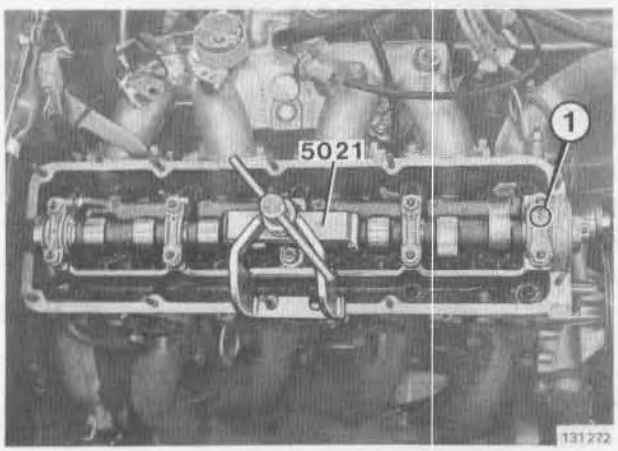
F5

Remove pulley from camshaft

Use dolly 5034.

F6

Remove valve cover



F7

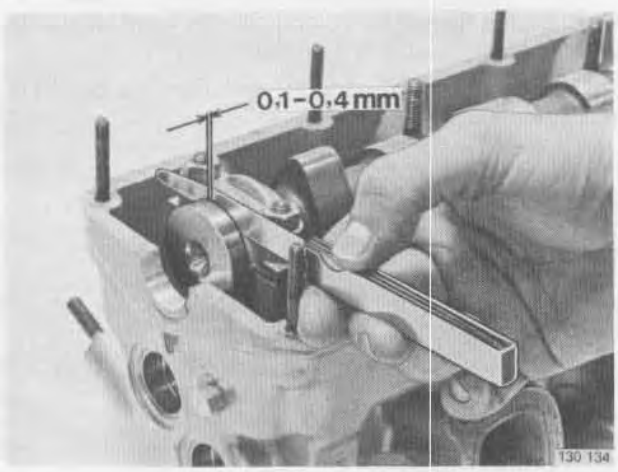
Check marking on camshaft caps. Remove centre cap

Mark caps if necessary. Carefully pry off cap with a chisel if difficult to remove.

F8

Remove camshaft

Press down camshaft with pressing tool **5021**. Remove other four caps and camshaft, with seal.



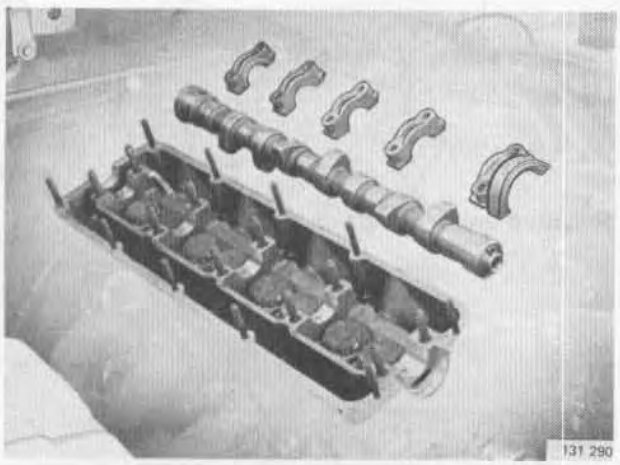
F9

Check end float of camshaft

Place camshaft in cylinder head.
Install rear cap.
Slide camshaft forward and backward.
The clearance must be **0.1–0.4 mm** (0.0039–0.0016 in).
Measure clearance with a feeler gauge. If clearance is excessive, rear bearing cap must be replaced.

Camshaft, installing

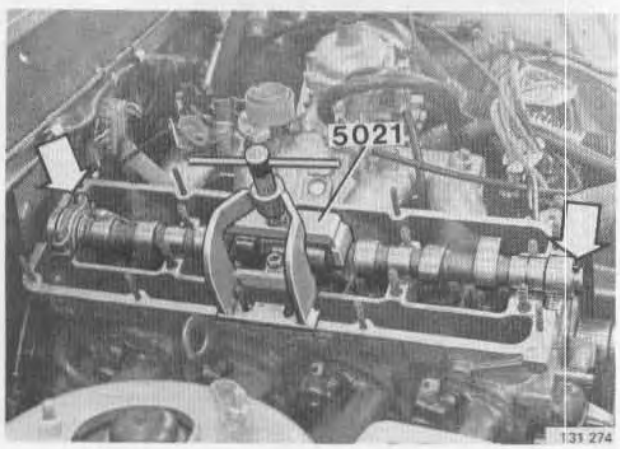
Special tools: 5021, 5026, 5034



F10

Oil:

- bearing shells
- cams
- adjustment washers on tappets.



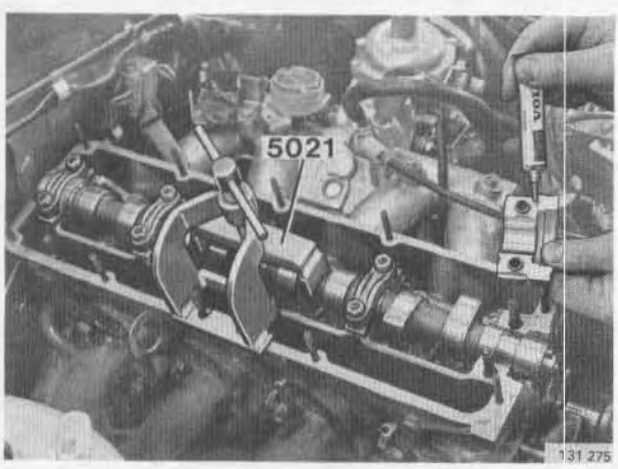
F11

Install camshaft and caps

Bring camshaft and rear cap (thrust bearing) into position.
Pulley guide pin must be turned upwards.

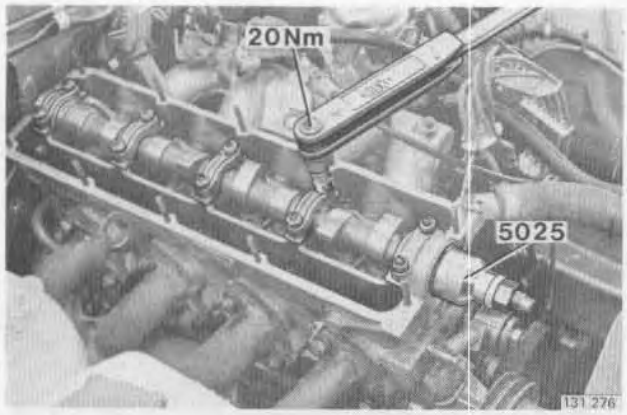
Press down camshaft with pressing tool **5021**. Use rear cap as a guide.

Tighten rear cap nuts hand-tight.



Coat sealing face of front cap (cylinder head side) with sealing compound, P/N 1161 027-6.

Oil and fit other three caps. Tighten nuts, hand tight at this stage.



Remove pressing tool 5021.

Oil and install the centre cap.

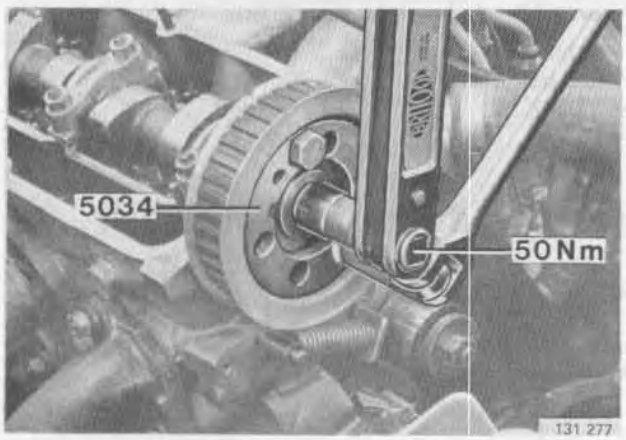
Tighten nuts **20 Nm** (14 ft lbs).

F12

Install front sealing ring

Use sleeve **5025**.

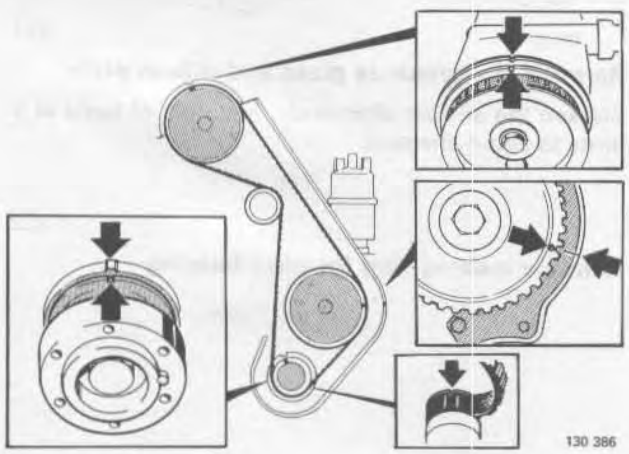
Grease the seal and shaft. Check that rubber lip on seal is not damaged.



F13

Install guide plates and pulley

Turn guide plates so that edges incline outwards from pulley. Tighten to 50 Nm (36 ft lbs). Use dolly **5034**.

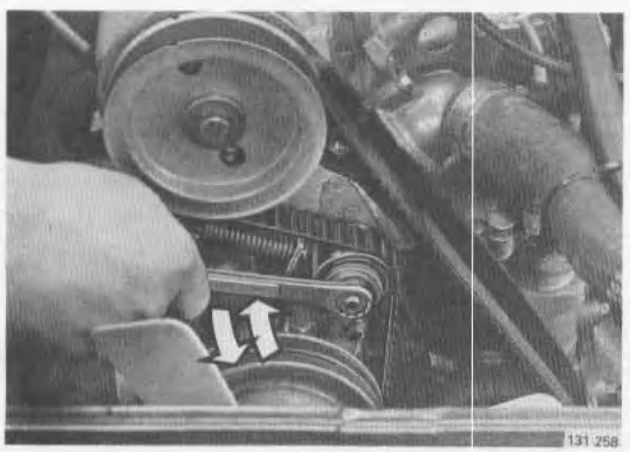


F14

Install drive belt

IMPORTANT! Do not rotate crankshaft or camshaft as pistons may strike against valves and cause damage.

- Place pulleys in position according to marking.
- Place belt round crankshaft and intermediate shaft. Two lines on belt must be opposite marking on crankshaft.
- Stretch belt and place it over camshaft and belt tensioner.
- Check that belt has been brought into correct position and that pulley markings are opposite markings on engine.

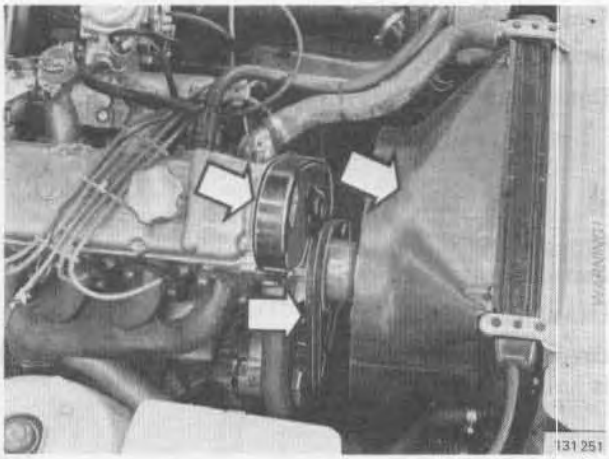


F15

Tension drive belt

Slacken belt tensioner nut. Spring now tensions belt.

Tighten nut.



F16

Install

- gear case
- fan belts. It should be possible to depress belt 5–10 mm (0.2–0.4 in) with slight thumb pressure when correctly installed.
- fan cover
- battery ground connection

F17

Adjust valves clearance

Operations B2–11, page 28.

F18

Warm up engine and check/adjust:

- ignition
- CO content
- idling.

G. Pilot bearing in crankshaft (gearbox removed)

Special tools: 1426, 2484, 4090, 5111

Pilot bearings are installed on vehicles with manual gearboxes only.
In cars with automatic transmission, there is a guide bushing in the crankshaft. The bushing is replaced by removing/installing it by hand.

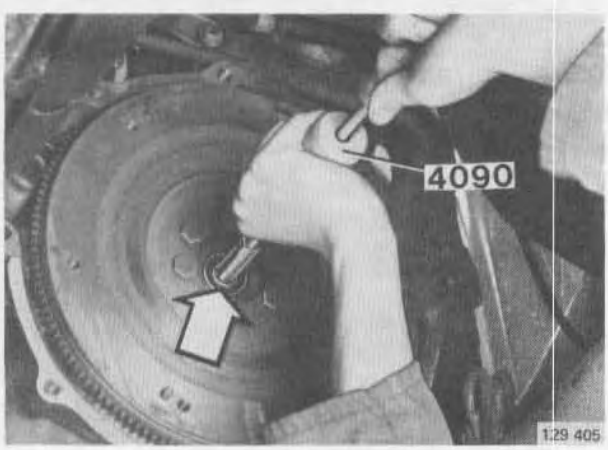
G1

Remove the pressure plate and driven plate

Slacken the screws alternately, a couple of turns at a time, to avoid stresses.

G2

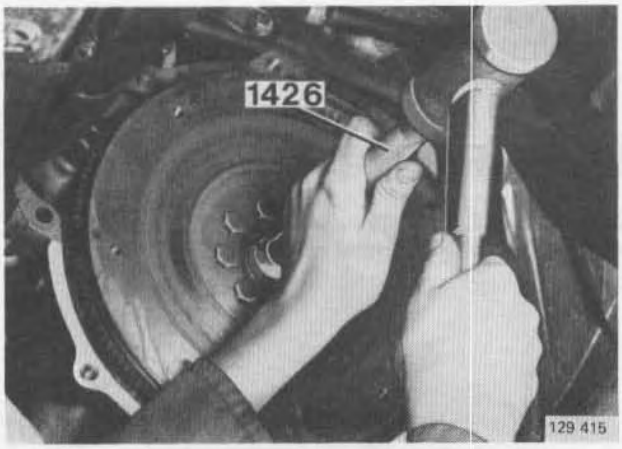
Remove locking ring for pilot bearing



G3

Pull bearing out of crankshaft

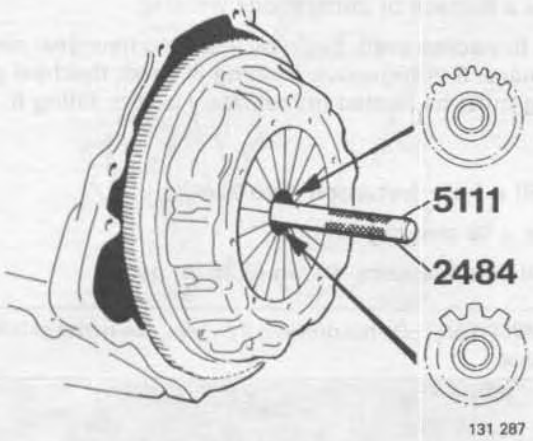
Use extractor **4090**.



G4

Install:

- bearing in crankshaft. Use drift **1426**
- locking ring.



G5

Install driven plate and pressure plate

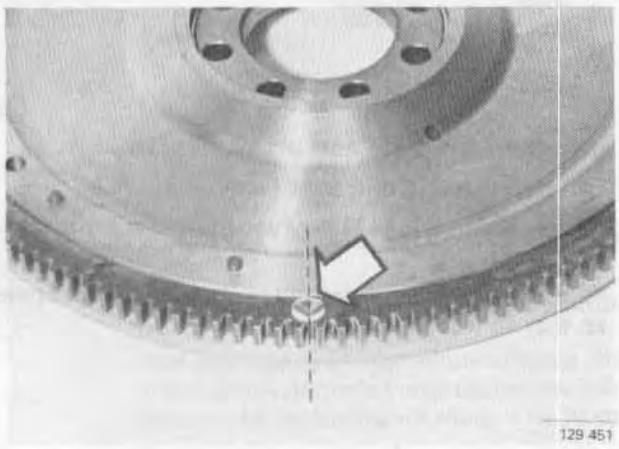
Use the centering drift **2484** (early version).

Use centering drift **5111** (late version = discs with involute teeth).

Tighten screws crosswise and a couple of turns at a time so that no fractures occur.

H. Flywheel gear ring, replacement

Only applies to cars with manual transmission. In cars with automatic transmission, the carrier plate is replaced complete with flywheel gear ring


129 451

H1

Heat new flywheel gear ring heated to 230°C

Use a furnace or autogenous welding.

If a furnace is used, begin by inserting new gear ring in furnace. If autogenous welding is used, flywheel gear ring must be heated immediately before fitting it.

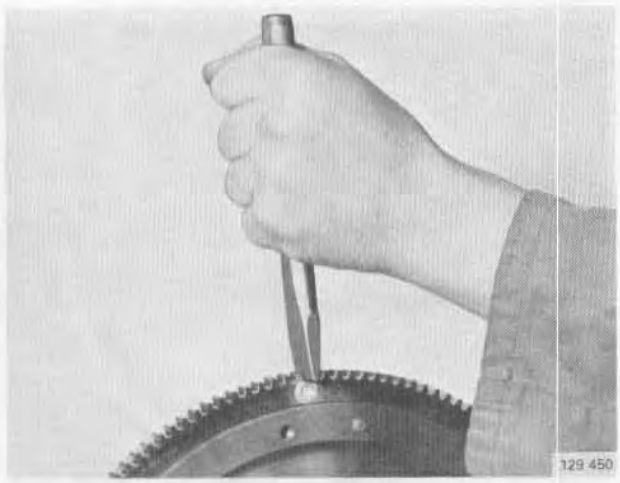
H2

Drill a hole between two teeth

Use a **10 mm** (0.4 in) drill.

Drill a hole approx. 9 mm (0.35 in) deep.

IMPORTANT! Do not drill into flywheel, due to risk of imbalance.


129 450

H3

Remove flywheel gear ring

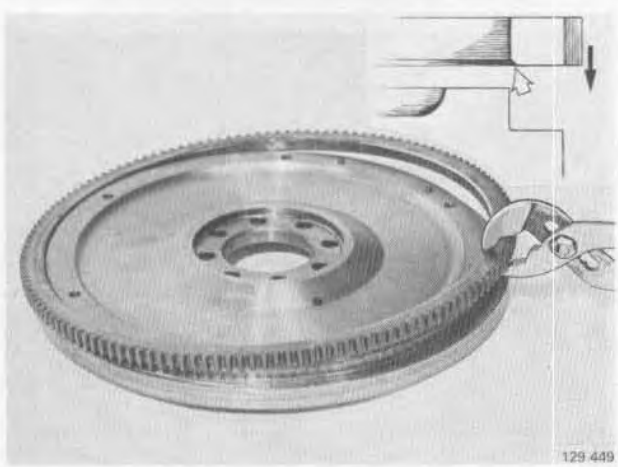
Clamp flywheel in a vice with soft jaws.

Prize loose gear ring with a screwdriver. If necessary, break gear ring at drilled hole. Clean contact faces on flywheel.

H4

Heat new gear ring to approx. 230°C (446°F)

Check temperature with soldering tin (40% tin and 60% lead). Tin melts at 220–230°C (428–446°F).


129 449

H5

Fit new gear ring

Place gear ring in position.

IMPORTANT! The inner bevel must be turned towards flywheel.

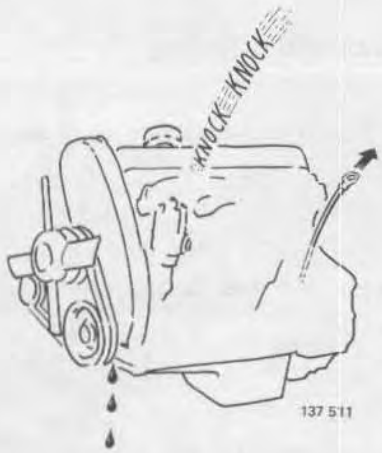
If necessary, knock gear ring down to bottom. Use a brass drift.

Allow it to cool.

I. Front seals for camshaft, intermediate shaft, crankshaft, replacement

Special tools: 5024, 5025, 5034

11

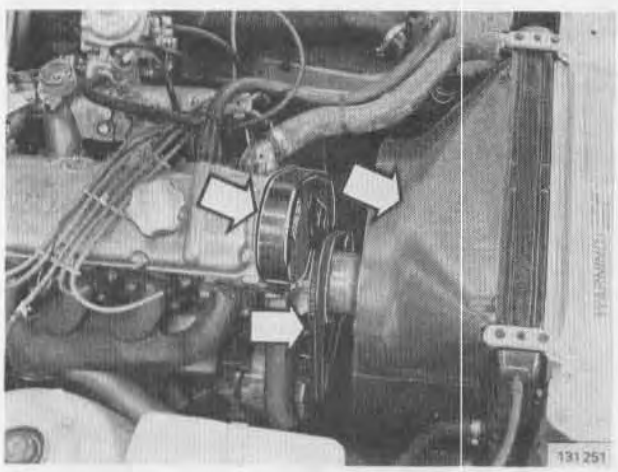


Check that flame guard is not blocked

A blocked flame guard prevents crankcase ventilation from operating properly, and means that crankcase pressure will be too high.

Symptoms of blocked flame guard are:
- oil dipstick "jumps up" out of pipe
- oil leakage from seals in cylinder block. The seals need not always be replaced if they leak due to a blocked flame guard. Repair flame guard, clean engine and check whether seals are leaking
- engine knocks.

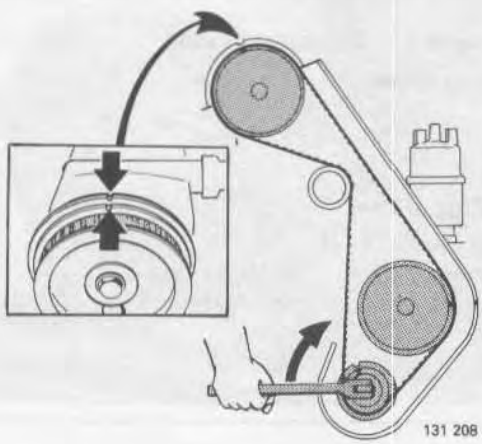
12



Remove:

- battery ground connection
- fan cover
- all drive belts from crankshaft pulleys
- gear case.

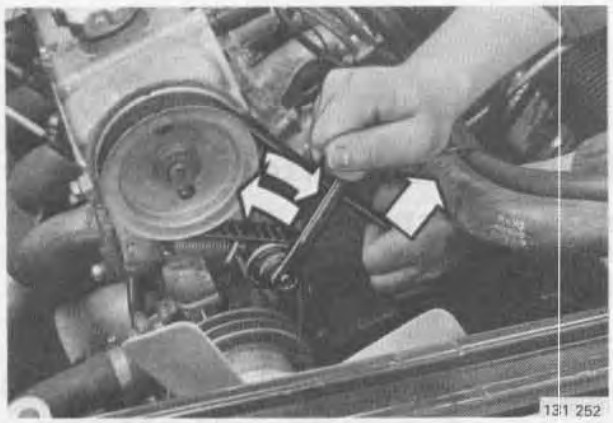
13



Basic engine adjustment

Rotate crankshaft clockwise on centre screw.

Adjust camshaft so that marking on pulley is opposite marking on valve cover.



14

Remove drive belt

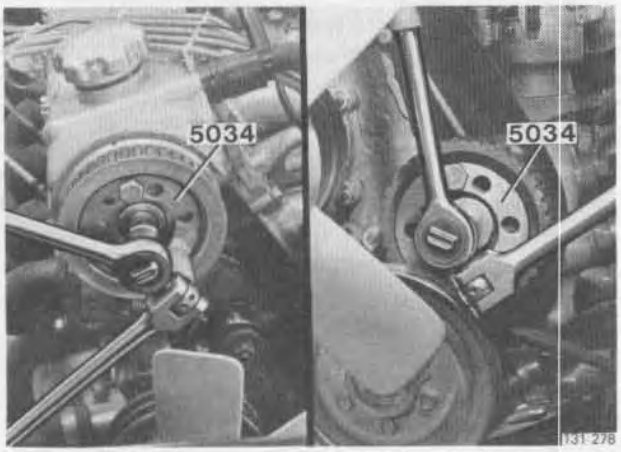
Slacken belt tensioner nut approx. 1 turn.
Pull out belt so that tensioner spring is compressed.
Tighten belt tensioner nut.
Remove belt.

IMPORTANT!
Do not rotate crankshaft or camshaft when drive belt is removed as pistons may strike against valves and cause damage.

15

Check which seal is leaking

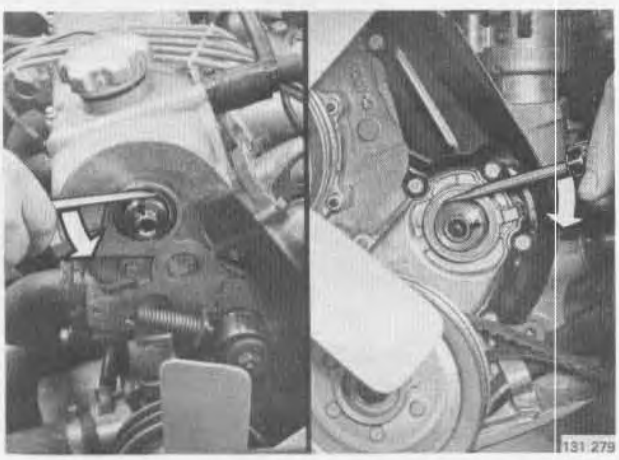
Camshaft and/or intermediate shaft seal, replacement



16

Remove pulley at seal to be replaced

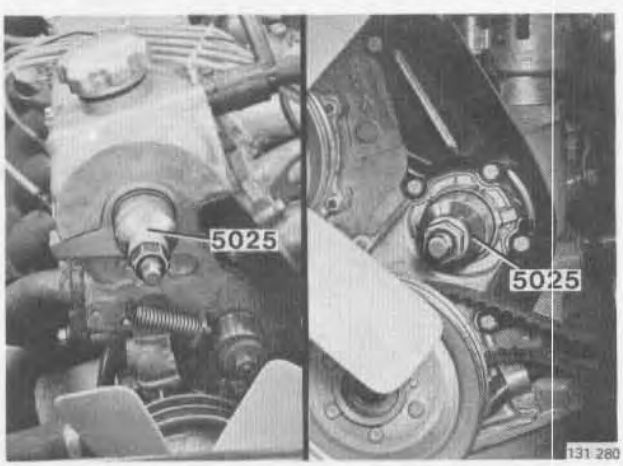
Use dolly **5034**.



17

Remove seal to be replaced

Prize the seal carefully out with a screwdriver. The contact face must not be damaged.



18

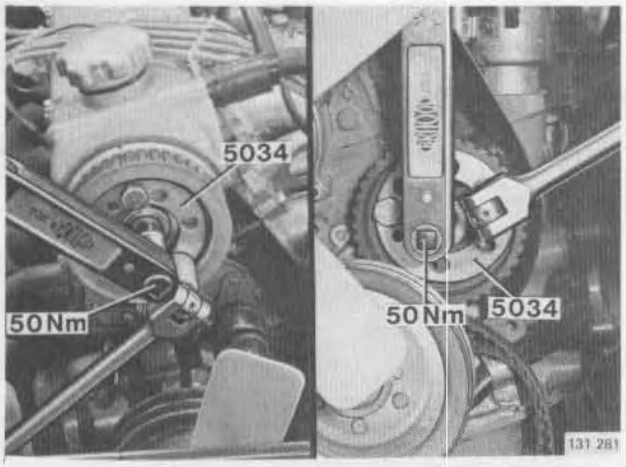
Clean and check contact faces

(For cracks and other damage.)

19

Install new seal

Grease seal and seat.
Use sleeve **5025** and press on seal.
N.B. Check that seal is not distorted or damaged during fitting.



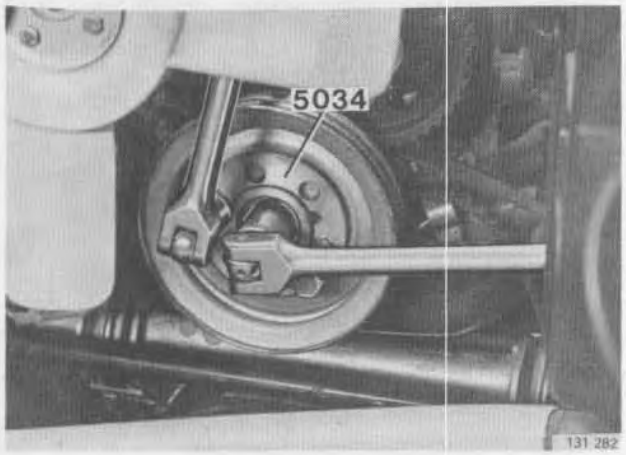
I 10

Fit pulleys as applicable

Turn guide plates of camshaft pulley so that they incline outwards from pulley.
Tighten **50 Nm** (36 ft lbs). Use dolly **5034.**

I 11

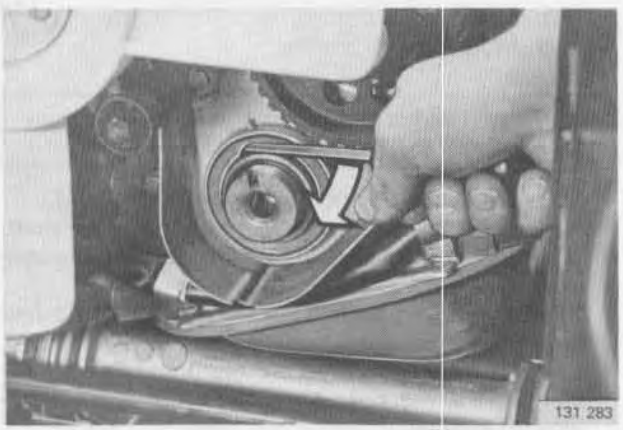
Turn intermediate shaft wheel with marking (a cavity) outwards. Tighten to **50 Nm** (36 ft lbs). Use dolly **5034.**



Crankshaft seal, replacement *I 12*

Remove:

- centre screw. Use dolly **5034**
- pulley and the hub together
- belt, wheel and guide plates



I 13

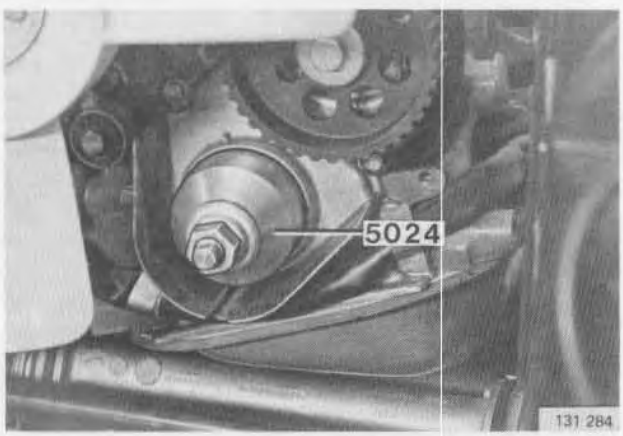
Remove seal

Carefully prize out seal with a screwdriver. The contact face must not be damaged.

I 14

Clean and check contact faces

For cracks or other damage.

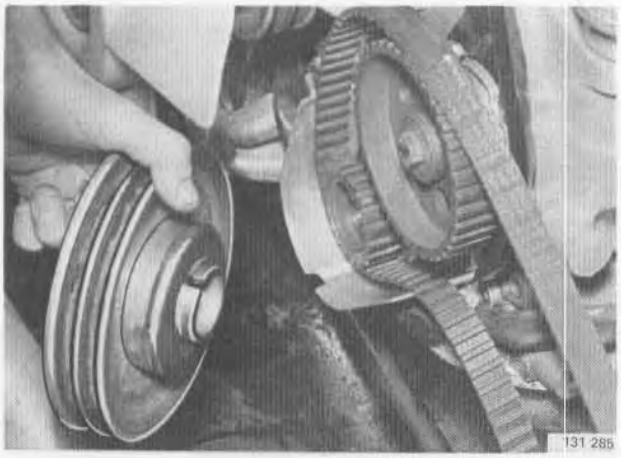


I 15

Install new seal

Grease seal and seat.
Press in seal. Use sleeve **5024.**

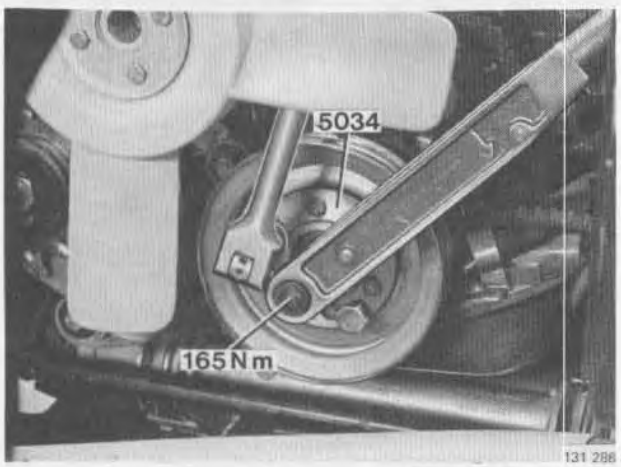
N.B. Check that seal is not distorted or damaged during fitting.



I 16

Install:

- guide plates and pulley.
  Plates must be turned so that edges are inclined outwards from pulley. The late version of pulley must be turned with key bevel towards engine
- belt. Two lines must be opposite mark on engine
- hub and pulleys together
- centre screw

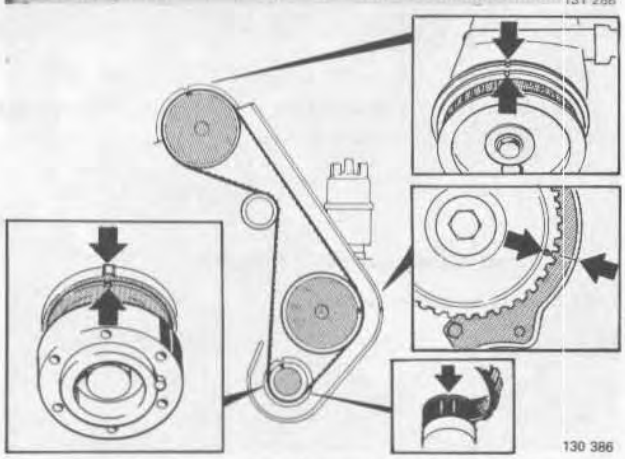


I 17

Torque crankshaft centre screw

Use dolly **5034.**

Tighten to **165 Nm** (120 ft lbs).

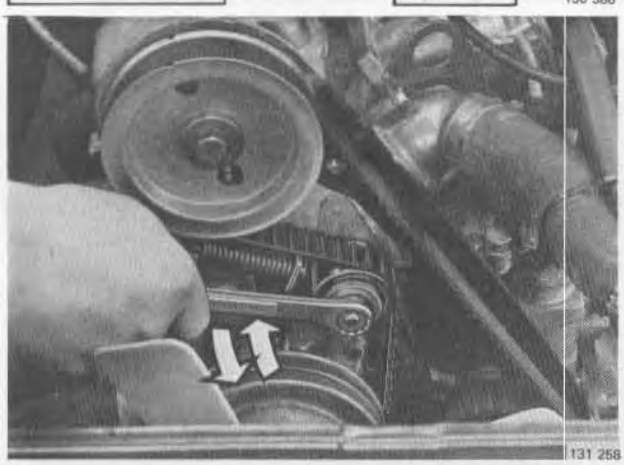


I 18

Install drive belt

IMPORTANT! Do not rotate crankshaft or camshaft as pistons may strike against valves and cause damage.

- Place pulleys in position according to marking.
- Place belt round crankshaft and intermediate shaft. Two lines on belt must be opposite marking on crankshaft.
- Stretch belt and place it over crankshaft and belt tensioner.
- Check that belt has been brought into correct position, and that markings on pulleys are opposite markings on engine.

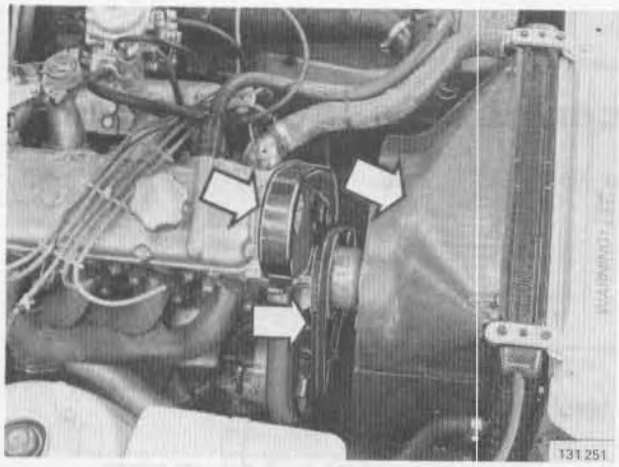


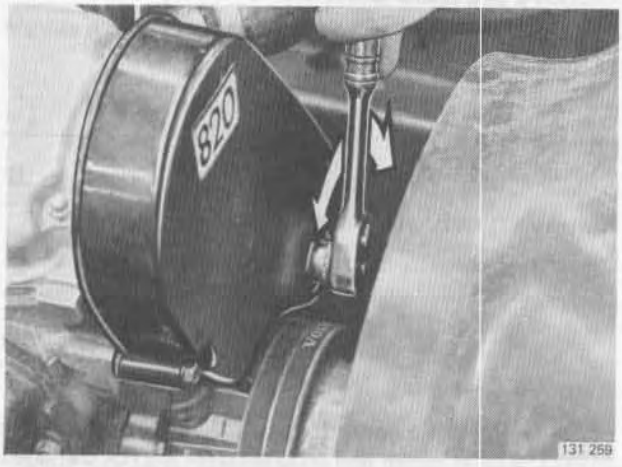
I 19

Tension drive belt

Slacken belt tensioner nut. Spring now tensions belt.

Tighten nut.





120

Install:

- gear case
- all drive belts on pulleys.
  It should be possible to depress belt by 5–10 mm (0.2–0.4 in) with slight thumb pressure when correctly installed
- fan cover
- battery ground connection

121

Warm-up engine and check/adjust:

- ignition
- CO content
- idling
- any leakage

122

Switch off engine

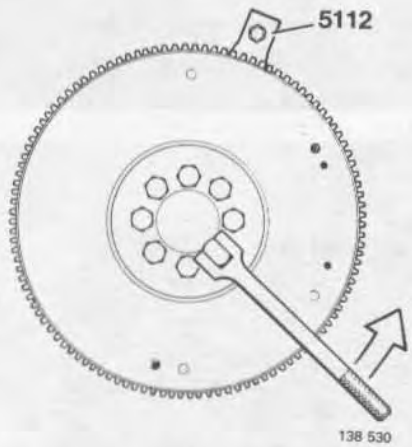
123

Re-adjust drive belt

- Remove rubber plug on gear case
- Slacken belt tensioner nut approx. 1 turn.
- Belt tensioner spring now tensions belt.
- Retighten nut.
- Install rubber plug.

J. Crankshaft rear seal, replacement (gearbox removed)

Special tools: 1801, 2484, 5111, 5112, 5276



Manual transmission

J1

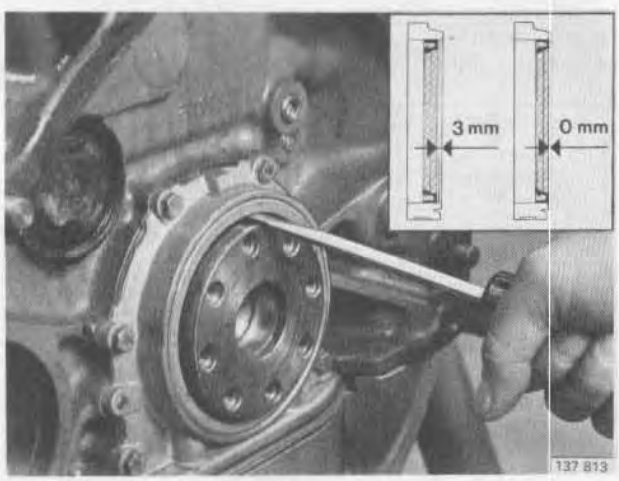
Remove pressure plate and driven plate

Slacken pressure plate screws crosswise, and a couple of turns at a time, to avoid fractures.

J2

Remove flywheel or carrier plate

Prevent flywheel from rotating with locking sector **5112**.



J3

Remove rear seal

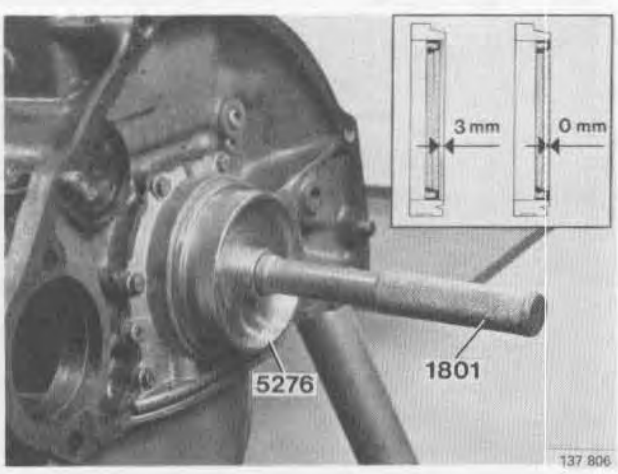
Pry out seal with a screwdriver. Take care to ensure that sealing faces in holder and on crankshaft are not damaged.

IMPORTANT!
Note position of seal in relation to sealing flange so that the correct position is known when fitting new seal (see fig).

J4

Clean and check sealing faces

(In holder and on crankshaft.)



J5

Press seal into rear sealing flange

Assemble standard shank **1801** and drift **5276**.

Oil contact face of seal against holder and sealing lips.

Thread seal onto drift.

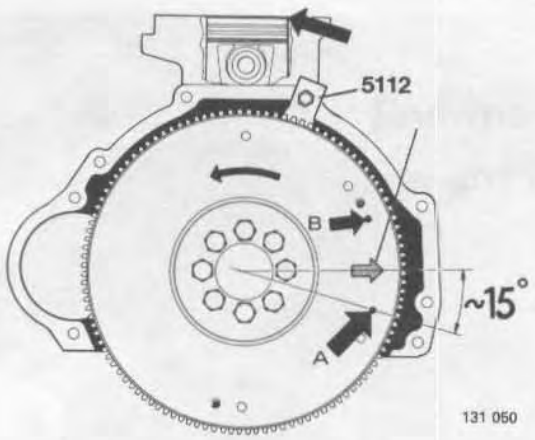
If there is a wearing surface on crankshaft, press seal further into flange than before.

Remove **one** spacer ring from drift if old seal was placed flush with flange.

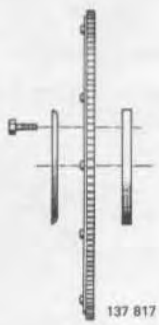
Remove **two** spacer rings from drift if old seal was 3 mm (0.1 in) inside flange.

Leave spacer rings in drift if crankshaft is undamaged.

Tap in seal until drift contacts crankshaft.



131 050


137 817

J6

Install flywheel (manual) or carrier plate (automatic)

Rotate crankshaft to top dead centre position for cyl. 1.

Place flywheel/carrier plate on crankshaft so that pin A is 15° below horizontal position, see diagram.

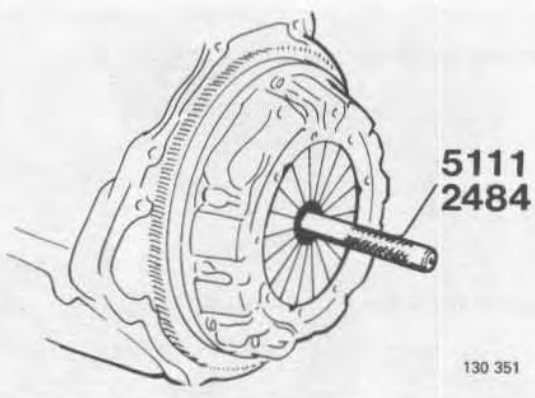
N.B. There are two pins. **Do not choose wrong one!**

An etched arrow is also provided on flywheels of later version. The arrow must point straight to right.

Install **new** screws. First coat screw threads with sealing compound (P/N 116 1056-5).

Tighten to **70 Nm** (50 ft lbs). Use toothed sector **5112** as a dolly.

Automatic transmission: Note position of base plates. The outer plate must be turned with the edge facing outwards.



130 351

Manual transmission *J7*

Install driven plate and pressure plate

Use centering drift **2484** (early version).

Use centering drift **5111** (late version = plates with involute teeth).

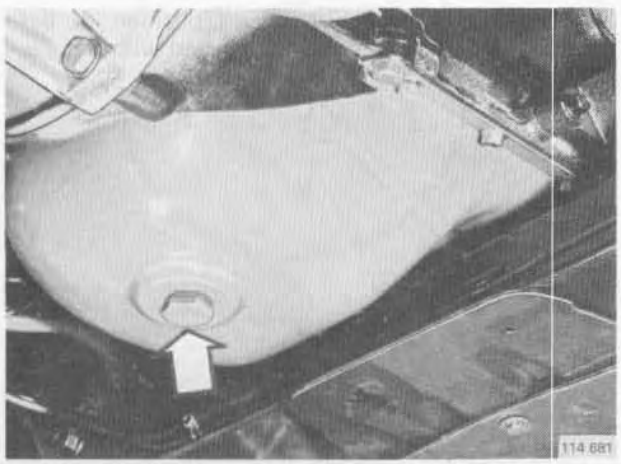
Tighten screws crosswise and a couple of turns at a time, so that no fractures occur.

J8

Remove toothed sector 5112

K. Oil sump, removal

Special tools: 5006, 5033, 5115, 5871

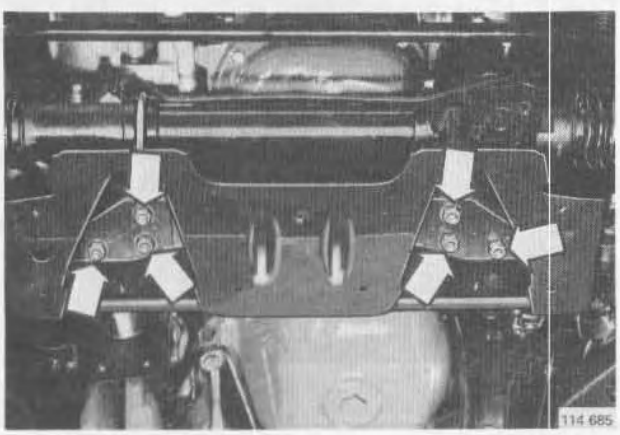


K1

Drain engine oil

Install plug and a new gasket after draining.

Tightening torque 60 Nm (43 ft lbs).



K2

Remove splashguard under engine

K3

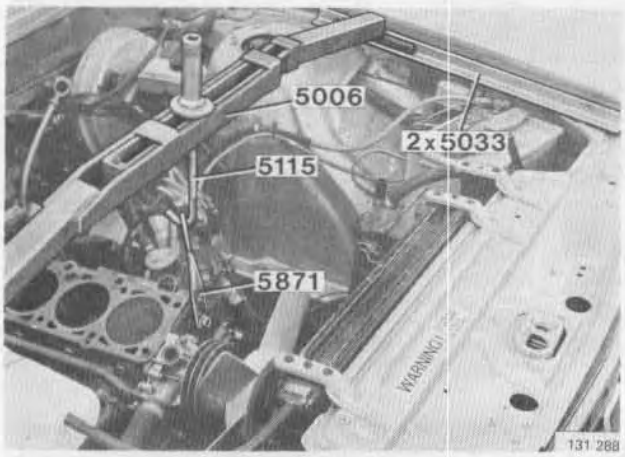
Remove nuts for engine mounts

K4

Release main steering shaft steering gear

If steering gear has a protective cover over knuckle, the cover must be pushed up.

Remove lower clamping screw and slacken upper screw. Pull up the carrier on main steering shaft.

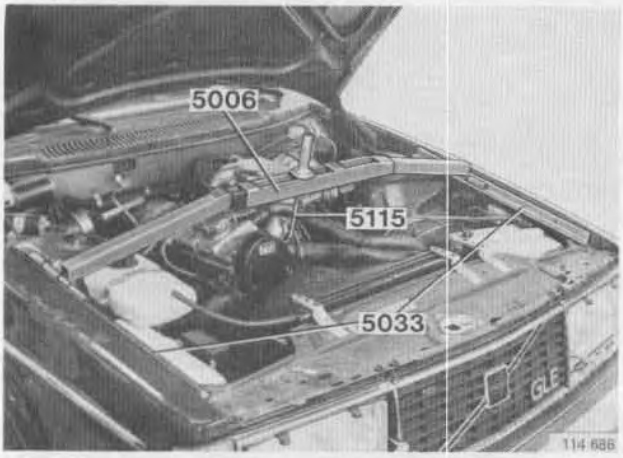


Engine without cylinder head

K5

Lift engine slightly

Use 2 support bars **5033,** lifting clamp **5006,** lifting hook **5115** and lifting bar **5871.**

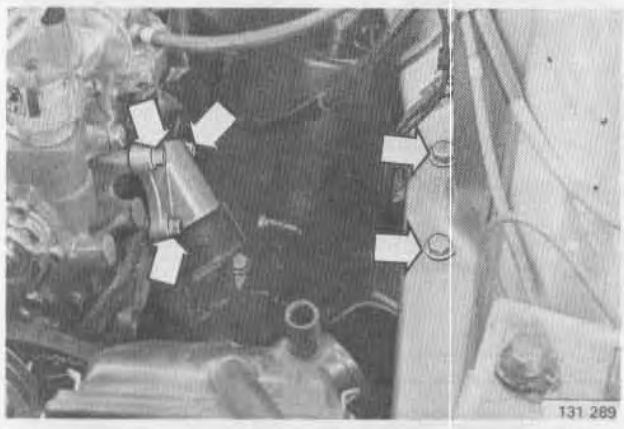


Engine with cylinder head

K6

Lift engine slightly

Use 2 support bars **5033,** lifting hook **5115** and lifting clamp **5006.**



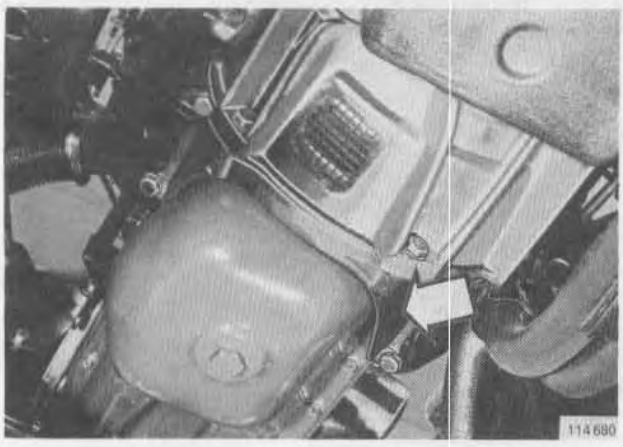
K7

Remove left engine mount

K8

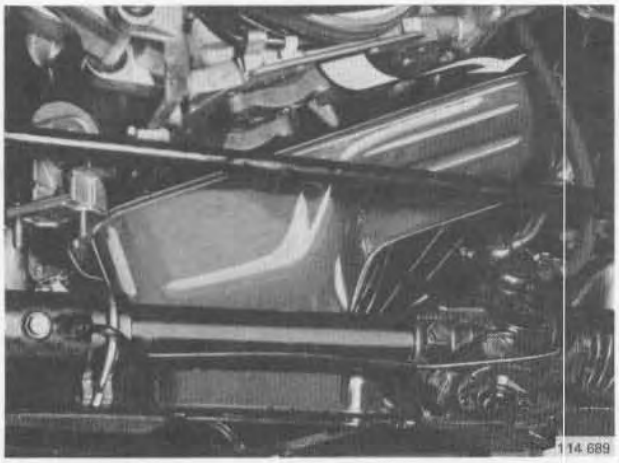
Remove screws which retain front axle cross member. Pull down cross member

Remove left and right side screws.



K9

Remove reinforcing bracket



K10

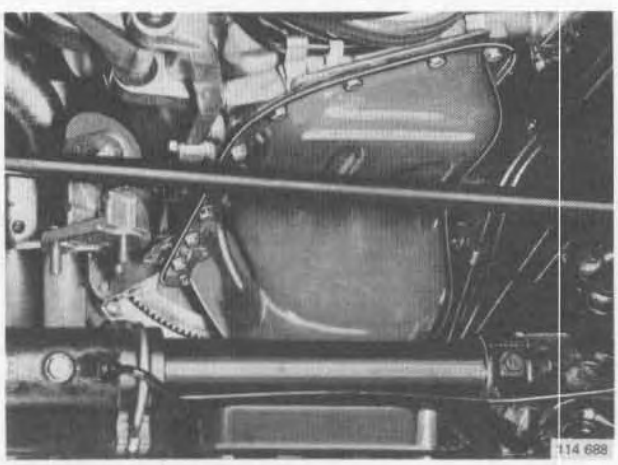
Remove oil sump

Remove all retaining screws for sump.

Loosen, rotate and pull down sump.

Remove gasket and clean contact faces.

Install oil sump



K11

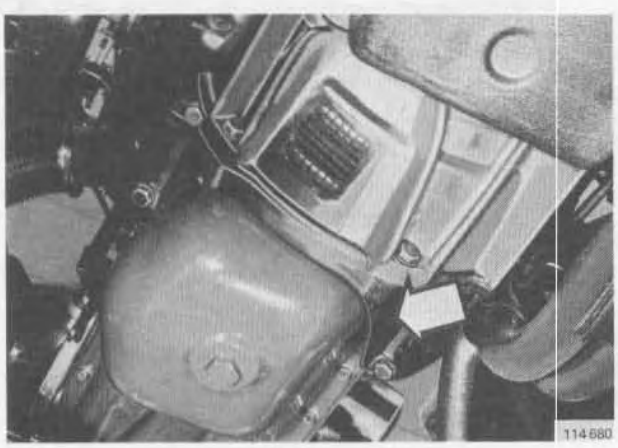
Fit the oil sump

Place a new gasket on sump.

Turn lug on gasket towards starter motor support.

Turn and lift up sump. (Secure it with two screws.)

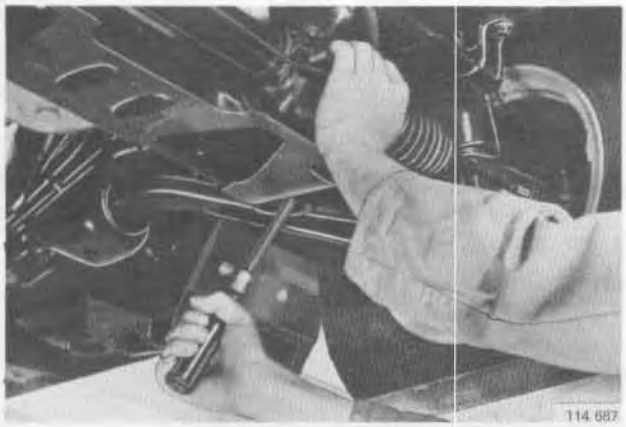
Install all the screws. Tightening torque 11 Nm (8 ft lbs).



K12

Install reinforcing bracket

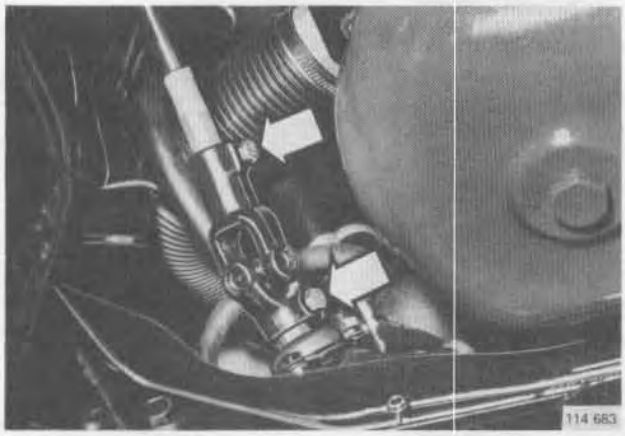
Tighten bracket retaining screws in stages so that no stresses arise.



K13

Install front axle cross member

Push up cross member, install bolts and tighten them.



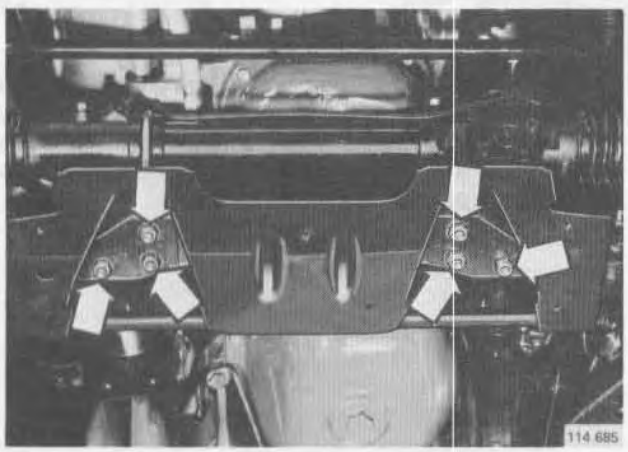
K14

Connect main steering shaft to steering gear

The carrier only fits in one position. Install lower screw and tighten upper screw. Lock with cotter pins.

Tightening torque 25±5 Nm (18±3.5 ft lbs).

If a protective cover is provided, pull it over the knuckle.



K15

Install left engine mount on engine

K16

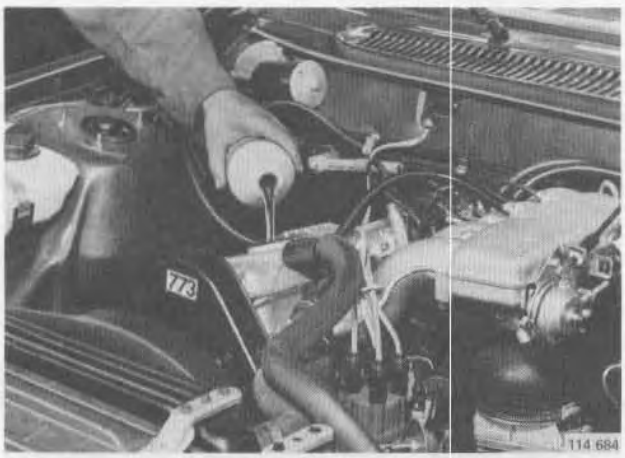
Lower engine

Install engine mounts on front axle cross member. Remove lifting tools.

K17

Install:

- engine mount nuts
- splashguard underneath engine



Motor with cylinder head in position

K18

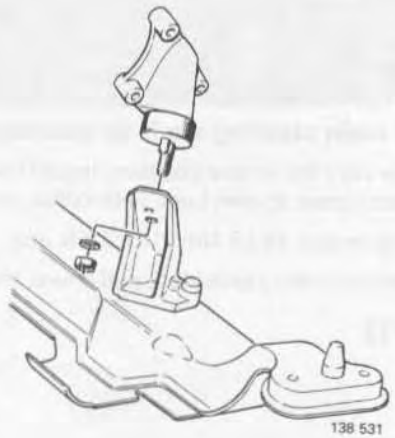
Fill with engine oil

Oil capacity,[1] excl. oil filter ..... 3.35 l (3.5 US qt)
incl. oil filter ..... 3.85 l (4.1 US qt)

[1]Turbo: add 0.6 litre (0.7 US qt) if oil cooler is drained.

L. Engine mounts

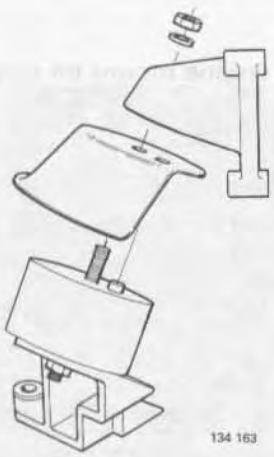
Special tools: 2903, 5006, 5033, 5115



L1

Removal/fitting

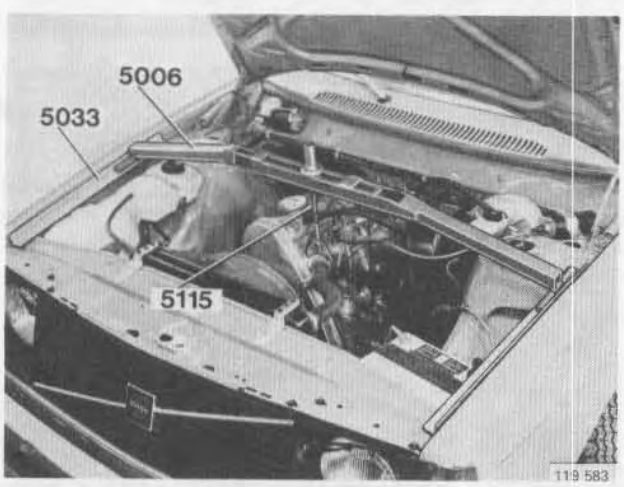
Disconnect battery.
When replacing right engine mount, the oil filter must also be removed.
Use tool **2903**.



L2

Turbo engine deflection limiter

A deflection limiter is fitted to the right engine support on turbo engines of the late version. If necessary, it may also be fitted on previously built cars. When fitting make sure that it is brought into the correct position. It is guided by a pin on the rubber cushion.



L3

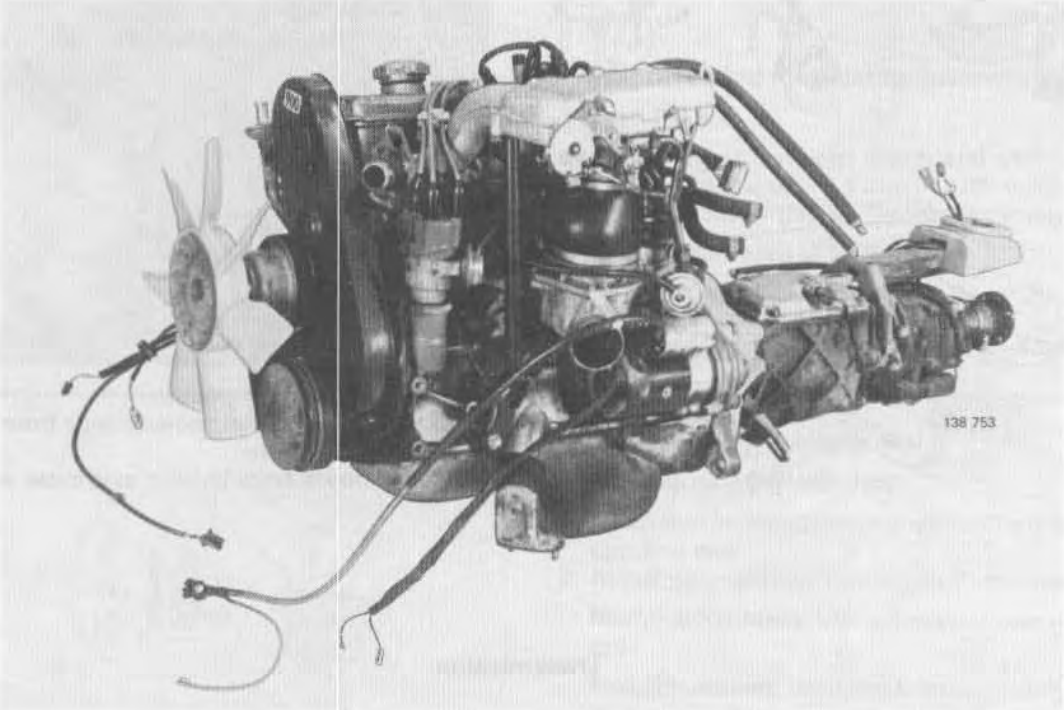
Lifting tool

The engine mount are relieved with lifting clamp **5006**, two support rails **5033** and lifting hook **5115**.

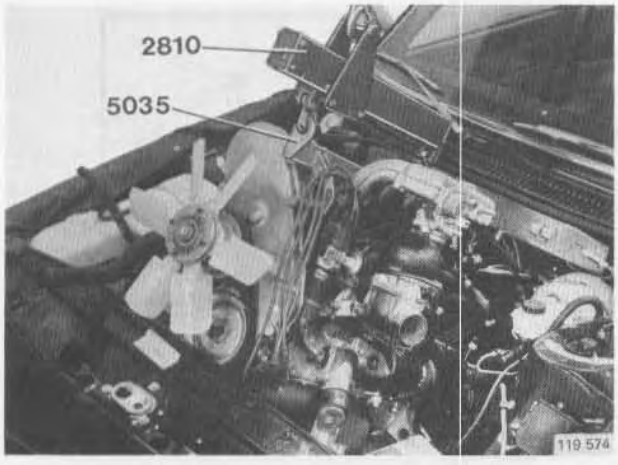
M. Engine, replacement

Operations M 1–5
Special tools: 2810, 5035

The engine is lifted out and in, complete with gearbox.



In order to be able to lift out the engine, the coolant and engine oil must first be drained.



M1

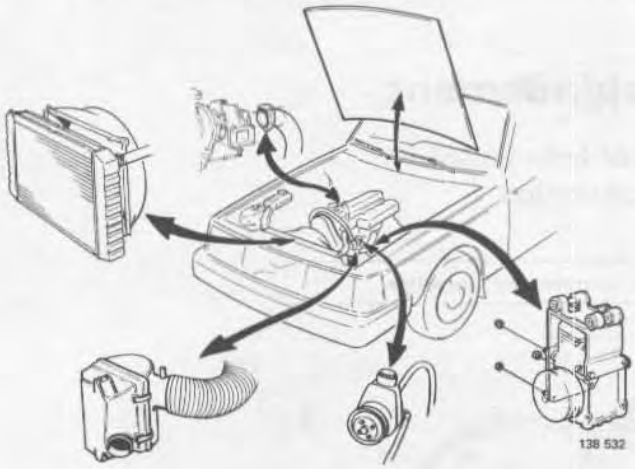
Engine replacement

Use lifting clamp **5035** and lifting eye **2810.**

For parts which must be removed or fitted, see next page.

After lifting in the engine, see page 85.

Parts which must be removed or installed when replacing engine

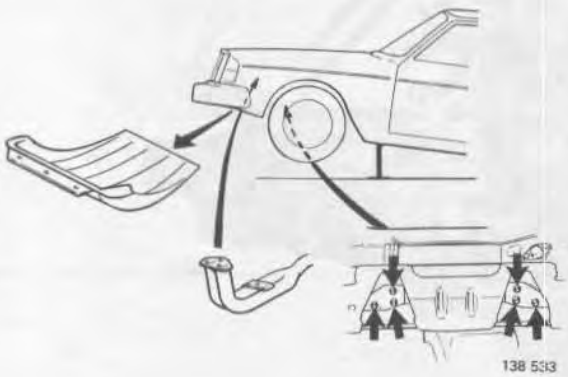

138 532

Engine compartment

M2

Remove/install

- bonnet (hood)
- battery cable from battery
- air filter
- radiator and fan cover
- turbo engine: exhaust pipe from turbocharger
- loosen and move servo pump and AC compressor to one side
  N.B. Do not disconnect the hoses
- release electric cables, water hoses, vacuum hoses and wires


138 533

M3

Underneath engine

Jack up car under jack supports.

M4

Remove/install

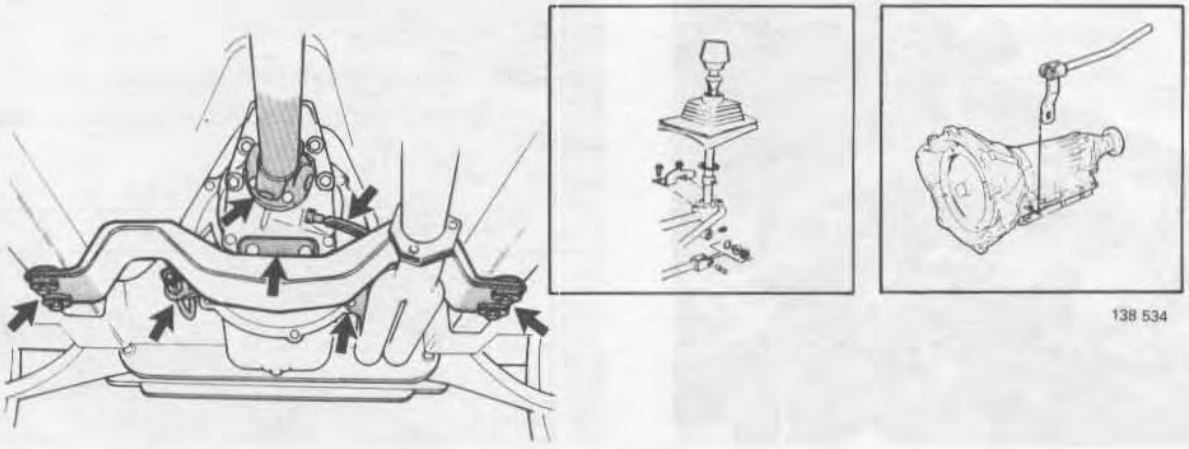
- splashguard under engine
- engine without turbo: exhaust pipe from intake and exhaust manifolds
- engine mount bolts in front axle cross member

Transmission

M5

Remove/install

- front support for exhaust pipe
- (manual transmission) clutch cable and the gear lever
- (automatic transmission): selector linkage from transmission
- speedometer cable
- propeller shaft
- transmission cross member. Support transmission with a jack
- detach electric cables


138 534

Work to be carried out after lifting in the engine

Operations M6–14

Manual transmission

M6

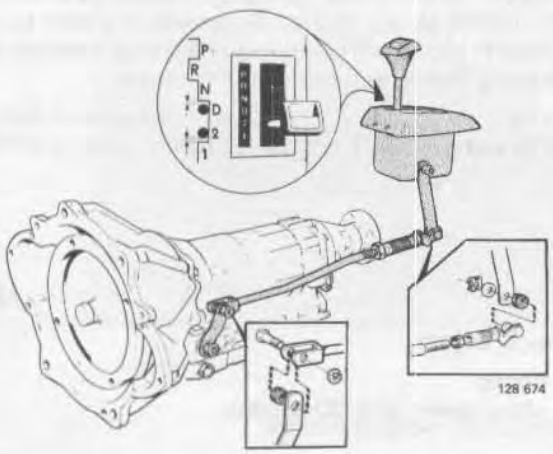
Adjust reversing lock clamp. Install rubber gaiter

Engage 1st gear.

Adjust clearance between clamp and gear lever. The clearance must be **0.5–1.5 mm** (0.020–0.059 in), measured with a feeler gauge. Tighten fastening screws.

Also check clearance in 2nd gear.

Install rubber gaiter (boot).



Automatic transmissions *M7*

Check-adjust gear selector

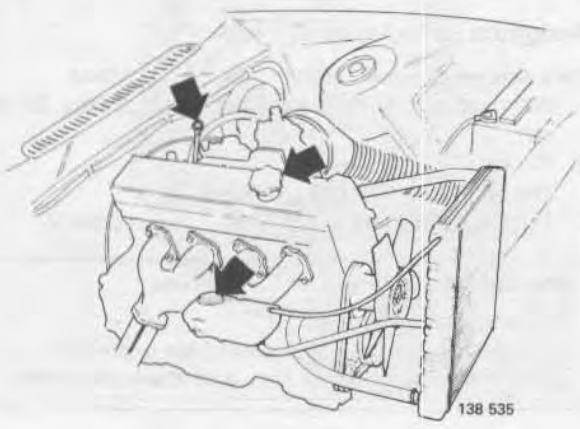
1. Check that clearance from position D to stop = position 2 to stop.
2. Adjust gear selector rod length if necessary.

   Rough adjustment, use adjuster at rear of selector rod.

   Fine adjustment, use sleeve (max. visible thread = 35 mm or 1.4 in).

   Extending rod, decreases position D clearance and increases position 2 clearance.

   After adjustment: Move selector lever to position 1 and the to P. Repeat the check according to 1.



M8

Fill with engine oil and coolant

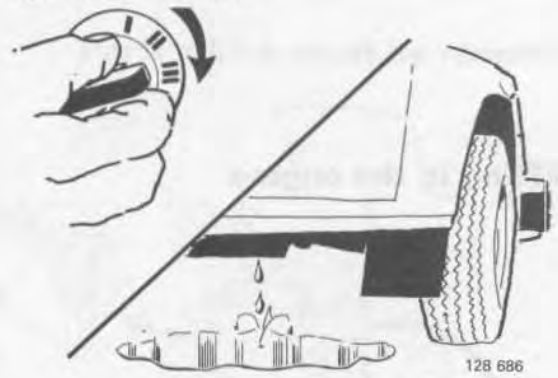
Engine oil volume 3.85 litres (4.1 US qts) (incl. oil filter). On turbo engines, add 0.6 litre (0.6 US qt) for the oil cooler.

The cooling system holds 9.5 litres (10.0 US qts) (manual transmission) and 9.3 litres (9.8 US qts) (automatic transmission). Set heater control to MAX when adding coolant.

Automatic transmission *M9*

Check oil level, top up if necessary

The engine must be running and the gear selector must be in position N or P.

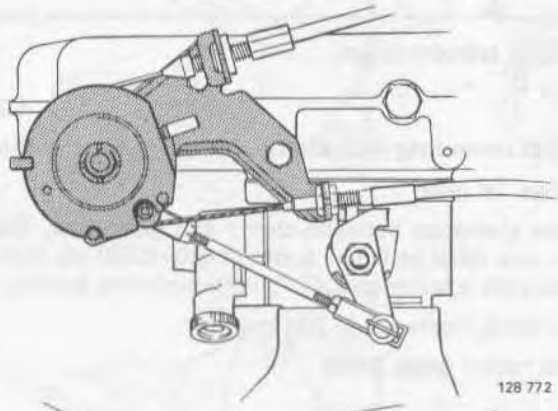

128 686

Carry out an operational check

Start engine and warm it up.

Check for oil and coolant leakage. Top up with coolant if necessary.

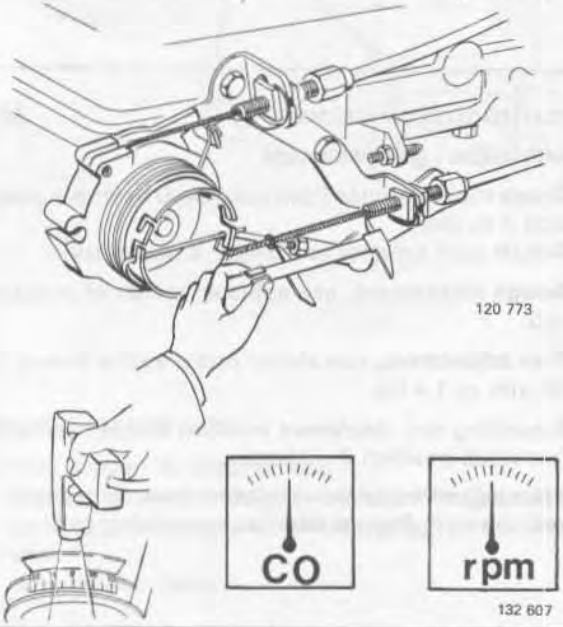
M11


128 772

Adjust throttle cable

The cable must be extended, but must not affect position of control pulley.

At full throttle the pulley must move towards the full throttle stop.



120 773
132 607

Automatic transmission *M12*

Adjust kick-down cable

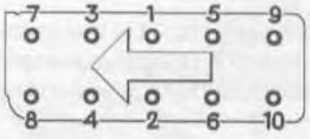
Press accelerator pedal right down to floor. **N.B.** Do not turn throttle pulley as the adjustment may then be incorrect. In kick-down position, the distance between the adjusting sleeve and cable stop must be:

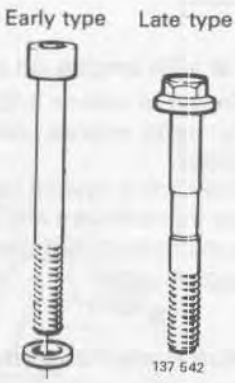
BW 35 ..... 43–47 mm (1.694–1.852 in)
BW 55 and AW 70/71 .. 50.4–52.6 mm (1.986–2.072 in)

M13

Check/adjust:

- timing
- idling speed and CO content.





137 542

If engine has been dismantled

M14

Retighten cylinder head bolts

Only screws of early version must be retightend.

1. Warm up engine, then allow to cool for approx. 30 minutes.
2. Slacken bolt approx. 30°.
   The tighten to **110 Nm** (80 ft lbs).
3. Tighten other bolts in the order given in point 2.

After approx. 600 miles (1000 km) driving:

- Check/adjust drive belt.
- If modifications have been carried out to the valve system, the valve clearance should be checked/adjusted.

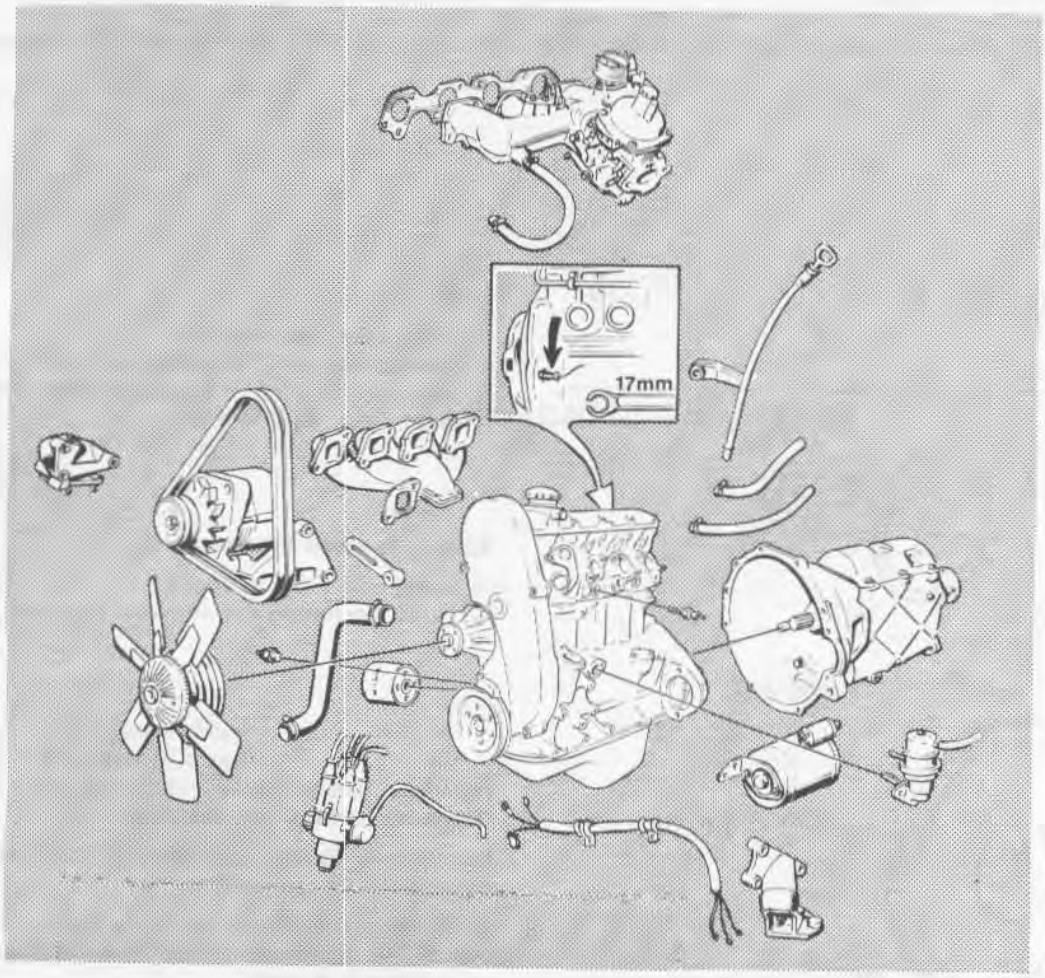
Removal of parts from engine body

Operations M 15–16

Special tools: 1426, 2520, 5023, 5112

M15

Uncover engine body by removing parts shown in diagram

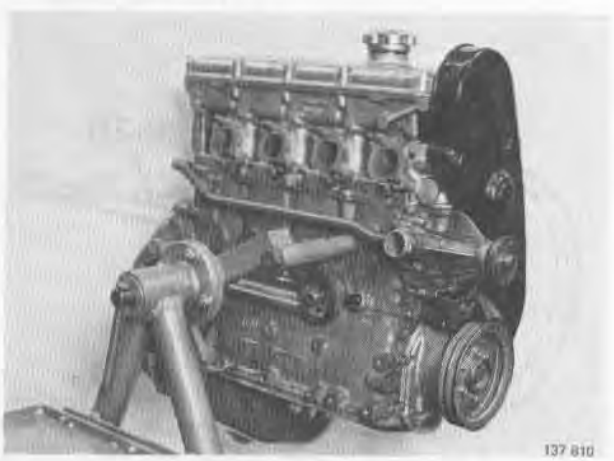


137 555

M16

Mount engine on support stand 2520 with fixture 5023

137 809



137 810

Installing parts in engine body

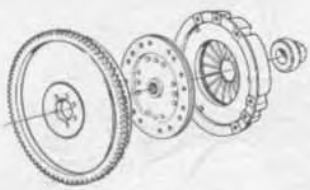
Operations M 17–21
Special tools: 1425, 5112

Included below are only those steps during which special care should be taken when installing the engine components.

M17

Use:

- new gaskets and seals
- new screws for flywheel/carrier plate
- new pilot bearing in crankshaft (manual transmission).

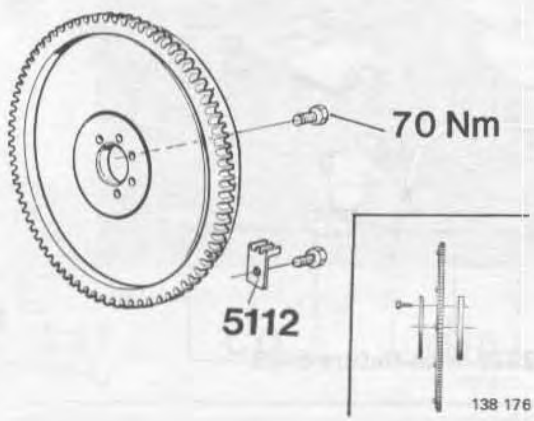


138 174

M18

Check, replace if necessary

- water and vacuum hoses
- clutch, including the throwout (release) bearing.



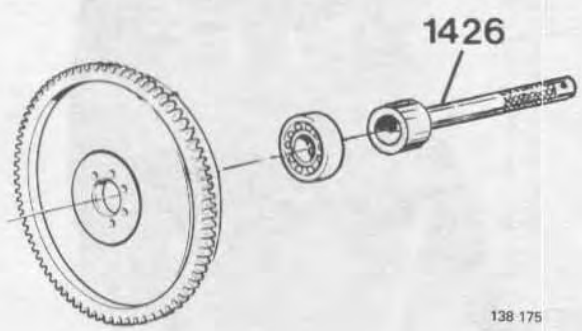
138 176

M19

Flywheel (manual)
the carrier plate (automatic)

New screws: tighten to **70 Nm** (50 ft lbs). Use the toothed sector 5112 as a dolly.

Automatic transmission: note position of support plates. The outer plate must be turned with flanged edge facing outwards.

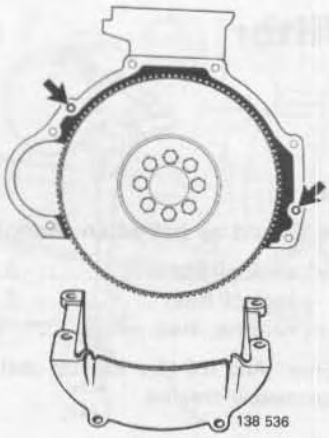


138 175

M20

Pilot bearing in crankshaft (manual)

Tap in bearing until it contacts crankshaft.
Use drift **1426**.
Install locking ring.



M21

Transmission

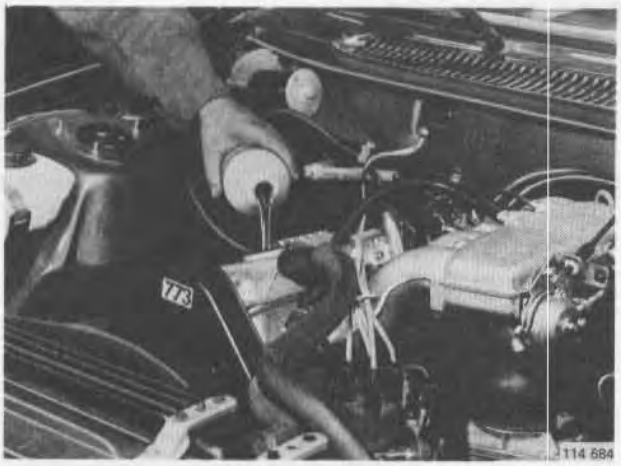
Check that dowels in engine block are in position.

Tighten reinforcing bracket in stages so that no fractures occur.

Group 22 Lubrication System

N. Engine oil, oil filter

Special tool: 2903



N1

Engine oil

The engine should be hot when changing oil.

Oil capacity[1], excl. oil filter ..... 3.35 l (3.5 US qts)
incl. oil filter ..... 3.85 l (4.1 US qts)
Difference in volume, max.–min. .... 1.0 l (1.1 US qts)

[1]Turbo engines: Add 0.6 litre (0.7 US qts) for oil cooler if system is completely drained.

USA, Canada and Japan

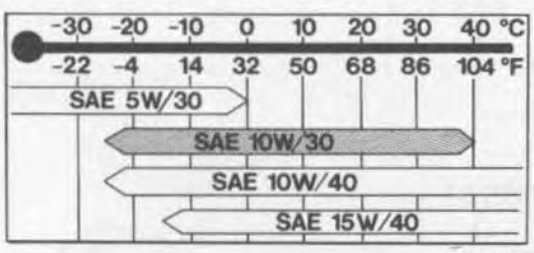
Oil quality

According to API ..... SF*

*Oils with designations SF/CC and SF/CD fulfil this requirement.

Supplementary engine oil additives are not recommended because of potential damage to engine.

Viscosity (stable ambient temperatures)



Other markets

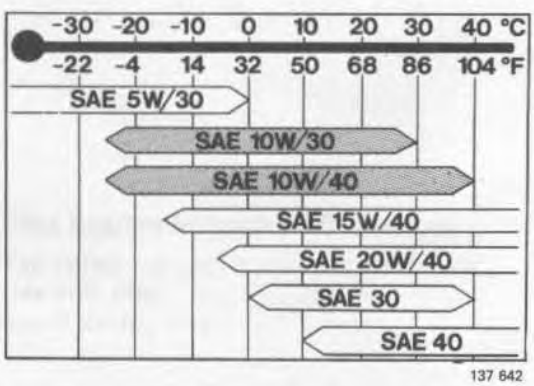
Oil quality

According to API–1983 ..... min. SE*
1984– ..... SF**

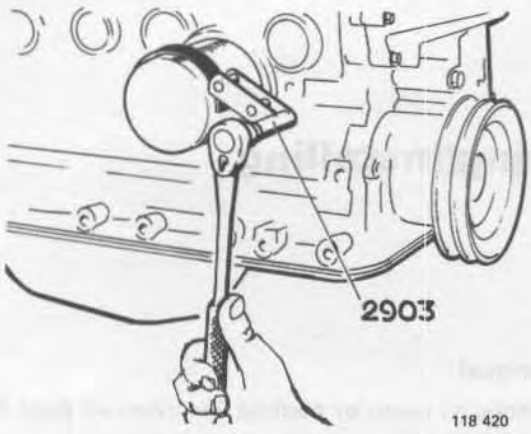
*Oils with designations SE, SF, SE/CC, SF/CC and SF/CD fulfil this requirement. **Note that SE/CD oils must not be used.**
**Oils with designations SF/CC and SF/CD fulfil this requirement.

Supplementary engine oil additives are not recommended because of potential damage to engine.

Viscosity (stable ambient temperatures)



USA, Canada & Japan SAE 15W/40 oils are recommended for use in extreme driving conditions which involve high oil consumption e.g. mountain driving with frequent deceleration or fast motorway driving. Do not, however, use 15W/40 oils at very low temperatures; see chart.



N2

Oil filter

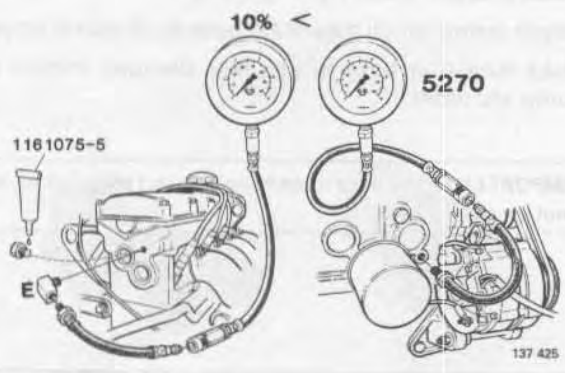
Use strap wrench **2903** to remove filter. See instructions on filter. If only the oil filter is changed, add **0.5 l** (0.5 US qt) of engine oil.

O. Oil pressure, checking

Special tool: 5270

O1

Byt oljerenare



O2

Check oil pressure

Connect oil pressure gauge **5270** to adapter at oil pressure transmitter.

On turbo engines, it is easiest to measure oil pressure at recess on rear edge of cylinder head. Use nipple 16218-0 (E).
N.B. The measured value will be approx. **10% lower** than if the pressure is measured at transmitter adapter. Coat plug with thread sealant (P/N 1161075-5) before installing.

Oil pressure, with a hot engine, specified oil and new oil filter, at:

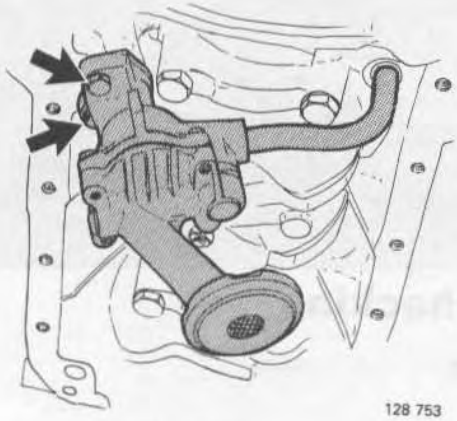
33 r/s (2000 rpm) ..... at least **250 kPa** (35.5 psi)

O3

If oil pressure is not according to specification; check:

- oil level
- oil leakage
- relief valve in oil pump

P. Oil pump, removing/installing



128 753

P1

Removal

Remove oil sump by method described on page 78.

Remove oil pump by removing two screws (arrowed).

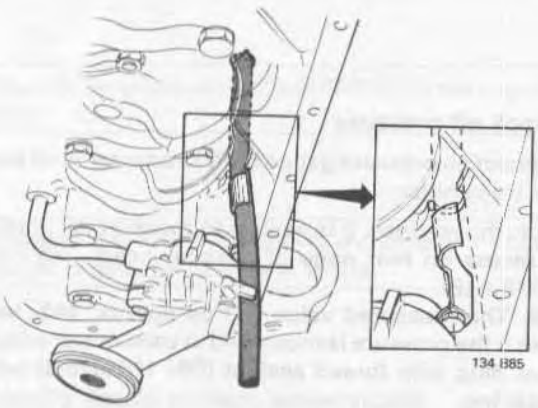
P2

Installing

Use new seals.

Pump is fitted with delivery pipe secured to pump. Align pipe to block so that seal is not damaged.

Tighten two screws.



134 885

1981– *P3*

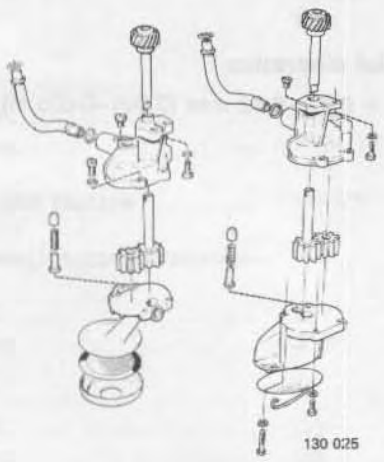
Secure drain hose from oil trap

Attach clamp for oil trap drain hose to oil pump screw.

Make sure that hose is securely clamped behind oil pump shoulder.

IMPORTANT! The hose must have an exact length, it must not be cut.

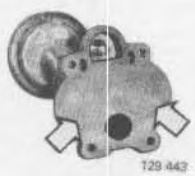
Q. Oil pump, overhaul



Q1

Dismantel oil pump

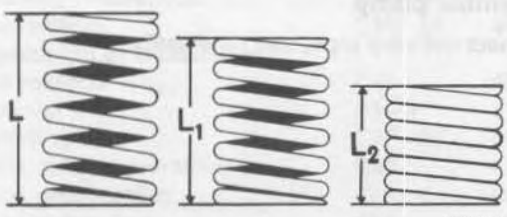
On early version the strainer must be removed to reach cover retaining screws.



Q2

Clean pump

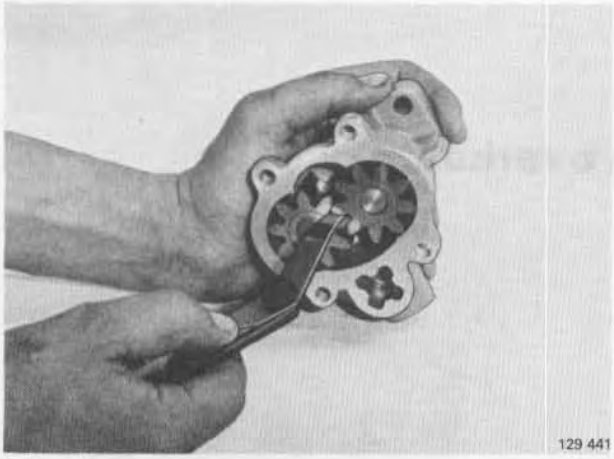
Check gearwheel, housing and cover for wear and damage.



Q3

Test relief valve spring in a spring tester

Load N (lbf)	Length mm (in)
0 (0)	39.2 (1.54)
46–54 (10.35–12.15)	26.25 (1.03)
62–78 (13.95–17.55)	21.0 (0.83)


129 441

Q4

Check tooth flank clearance

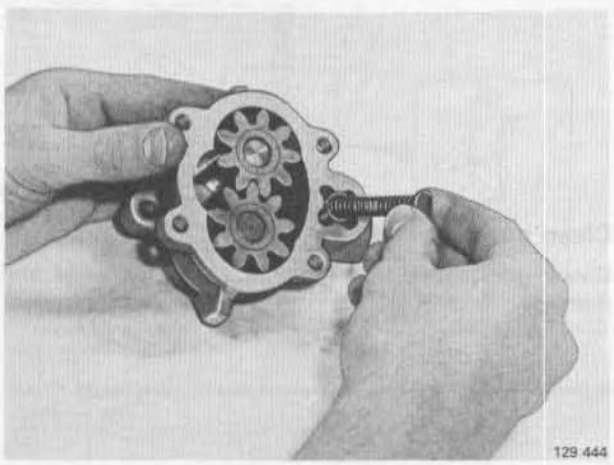
Clearance = 0.15–0.35 mm (0.006–0.014 in).


129 442

Q5

Check axial clearance

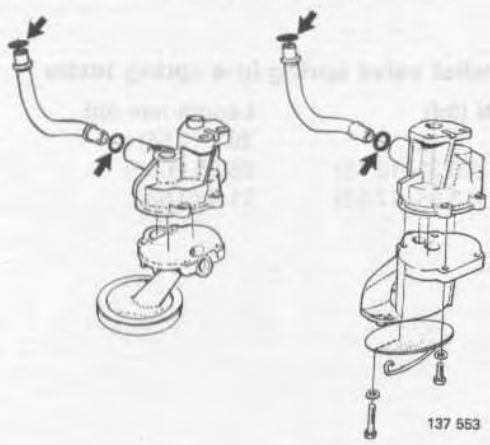
Clearance = **0.02–0.12 mm** (0.001–0.005 in).


129 444

Q6

Install piston and spring

Early version has a ball and spring.


137 553

Q7

Assemble pump

Connect delivery pipe, use new seals.

Index

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TP 30156/2
6000.11.84
PRINTED IN U.S.A.