Service Manual

Repairs and maintenance

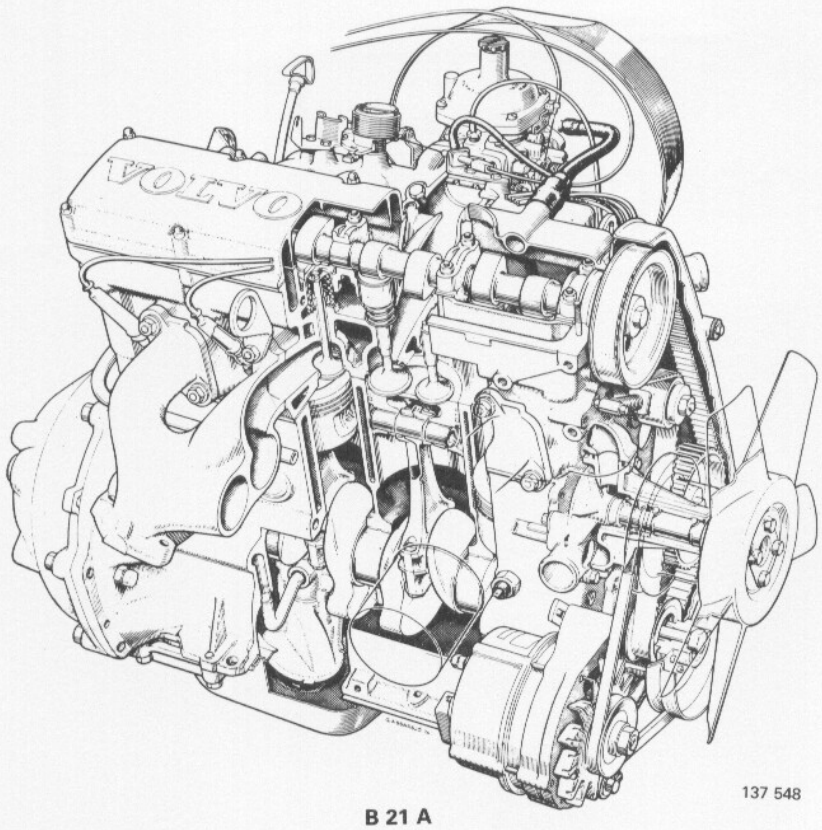
Section 2 (20–22)

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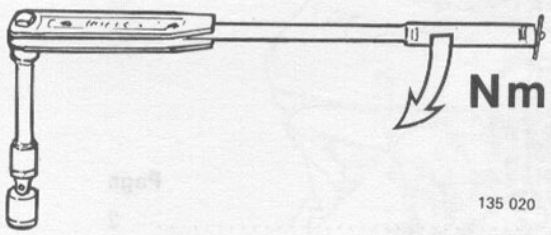
Order number: TP 30156/2
Replaces: TP 30156/1

Important information



135 020

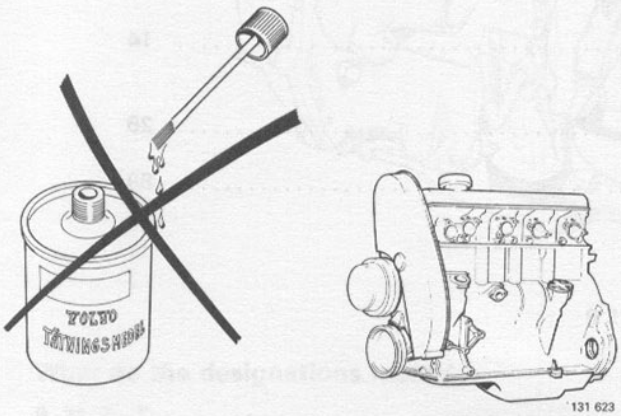
Tightening torques

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

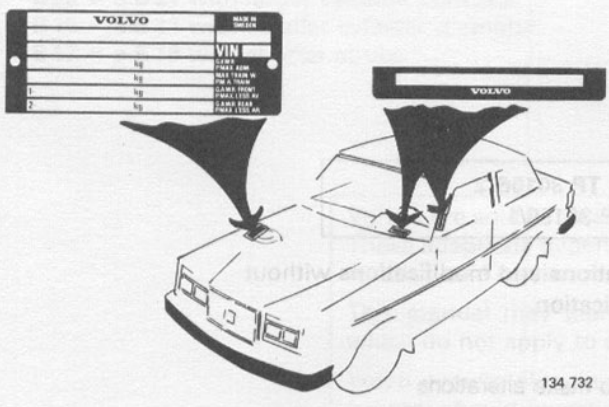
Do not use sealants when carrying out repairs on turbo engines.

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.

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

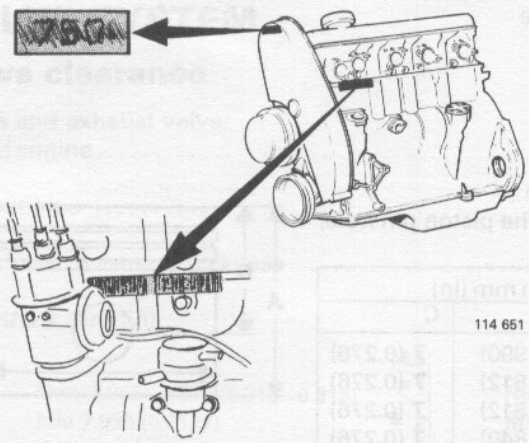
Chassis number

134 733

Identification number (type designation)

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

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

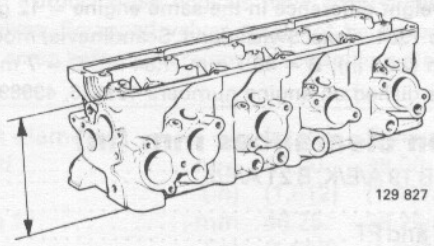
Punched on the left-hand side of the cylinder block behind the distributor.

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

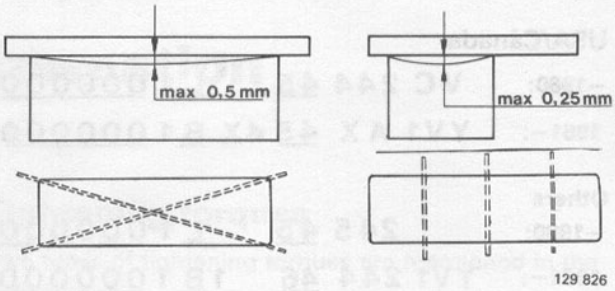
CYLINDER HEAD

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

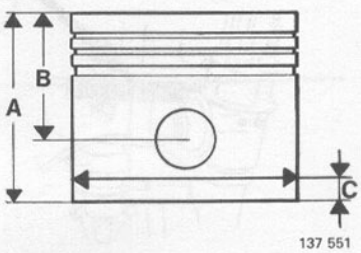
Cylinder diameter mm (in)

	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)

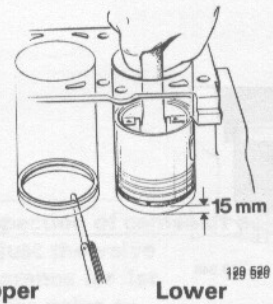
[1]Max weight difference in the same engine = 12 gms (0.43 oz)
[2]Europe 1984– (excl Switzerland, Scandinavia) models have high compression pistons, A = 71.7 mm (2.82 in); B = 46.7 mm (1.84 in); C = 7 mm (0.28 in)
[3]Pistons dished on engine numbers 499846, 499890.

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)

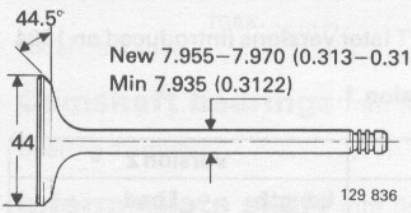
VALVE SYSTEM

Valve clearance

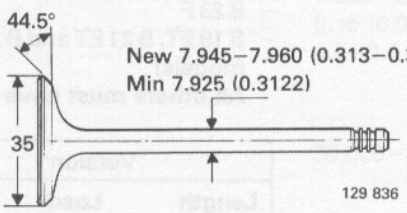
		Control	Adjustment
Intake and exhaust valve:			
cold engine	mm	0.30–0.40	0.35–0.40
	(in)	(0.012–0.016)	(0.014–0.016)
hot engine	mm	0.35–0.45	0.40–0.45
	(in)	(0.014–0.018)	(0.016–0.018)

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

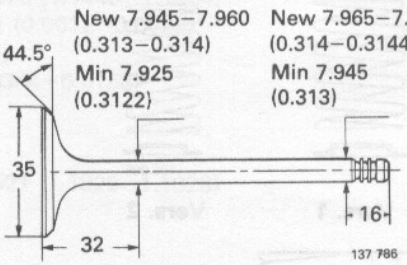
Valves mm (in)



Intake valve



Exhaust valve
A, E, F engines

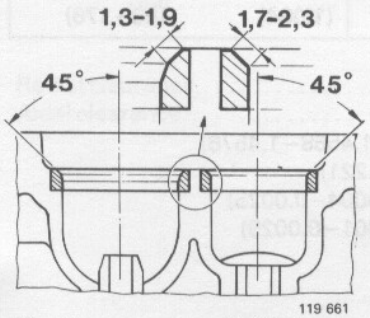


Exhaust valve
Turbo engines

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.

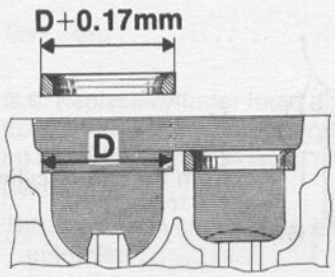
Warning: Turbocharged engines have sodium-filled exhaust valves. Scrapped valves must not be mixed with ordinary scrap before first removing the sodium. See step C19.

Valve seats



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

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)



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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)

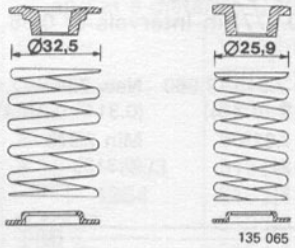

113 946

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)



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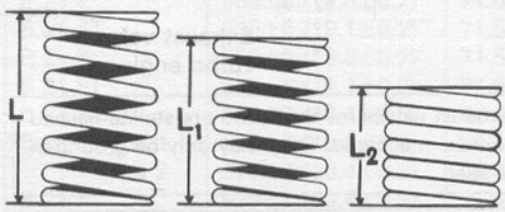
Vers. 1 Vers. 2



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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

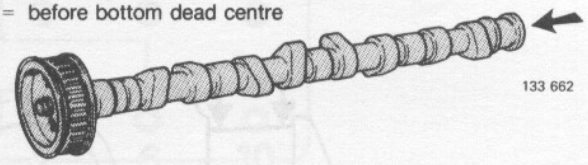
Camshaft mm (in)

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	47.020–47.050
	(1.8508–1.8518)	(1.8526–1.8538)
centre	43.025–43.050	43.070–43.100
	(1.6952–1.6962)	1.6970–1.6981)
rear	42.925–42.950	42.970–43.000
	(1.6912–1.6922)	(1.6930–1.6942)

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

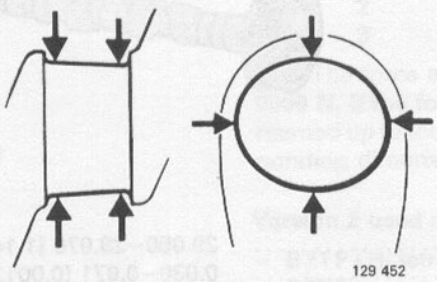
CRANK MECHANISM

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)

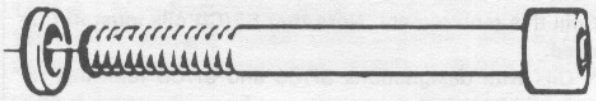
Flywheel mm (in)

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

TIGHTENING TORQUES

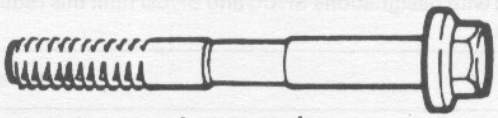
The tightening torques apply to oiled bolts and nuts. Degreased (cleaned) parts must be oiled before assembly.

Cylinder head, tightening in stages:



Early version

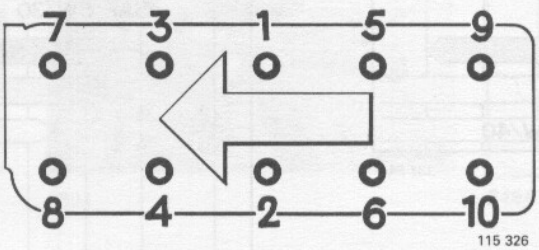
1 = **60 Nm** (43 ft lbs)
2 = **110 Nm** (80 ft lbs)
3 = Warm up. Then allow engine to cool.
4 = Slacken bolt 1 approx. 30°. Then tighten to 110 Nm (80 ft lbs).
(The bolt must first be slackened to ensure that the rest tension is broken. Otherwise the incorrect tightening torque is obtained).
5 = Tighten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



115 326

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

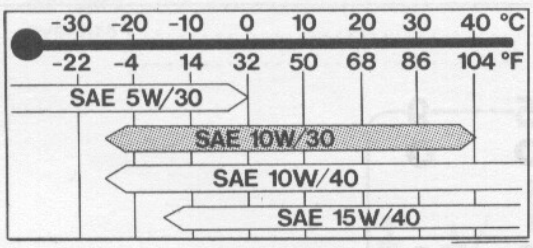
USA, Canada and Japan

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)



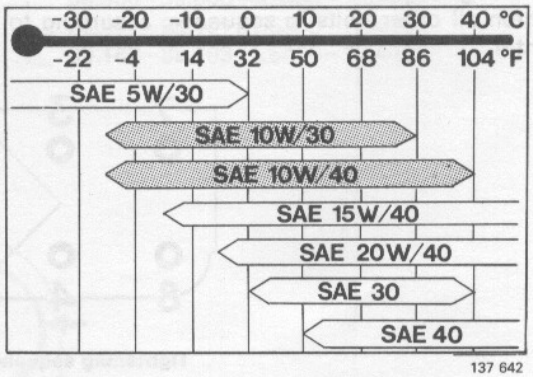
Other markets

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)

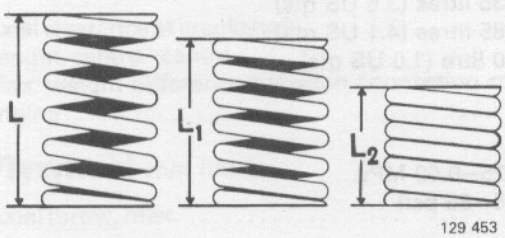


USA, Canada & Japan SAE 15W/40 oils are recommended for use in extreme driving conditions which involve high oil consumption e.g. mountain driving with frequent deceleration or fast highway driving. However, do not use 15W/40 oils at very low temperatures; see chart.

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:

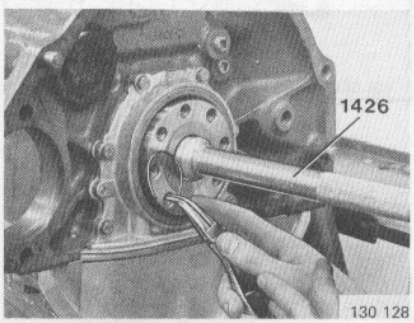


Length mm (in)	**Load** N (lbf)
39.2 (1.54)	0
26.25 (1.03)	46–54 (10.35–12.15)
21.0 (0.83)	62–78 (13.95–17.55)

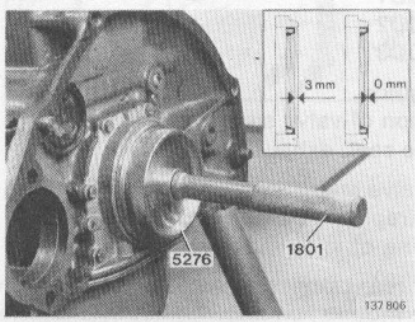
Special tools

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



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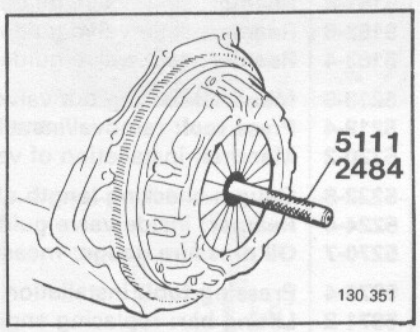

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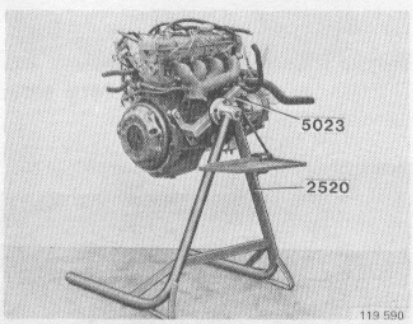

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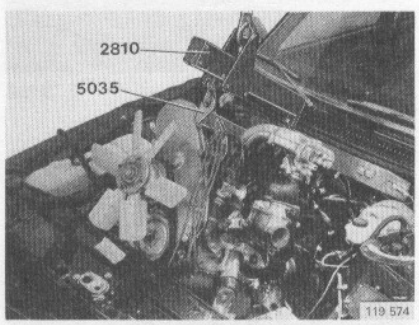

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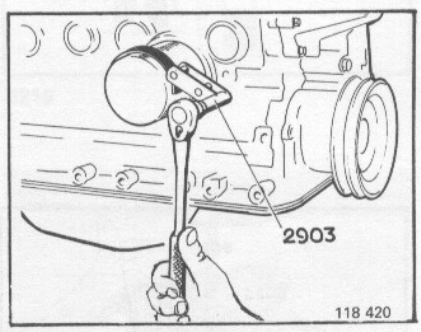

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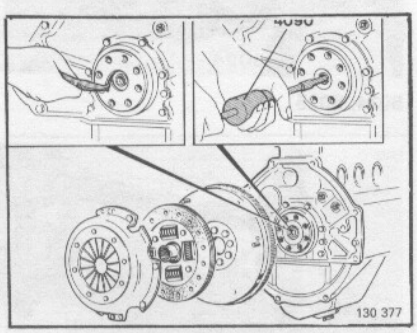

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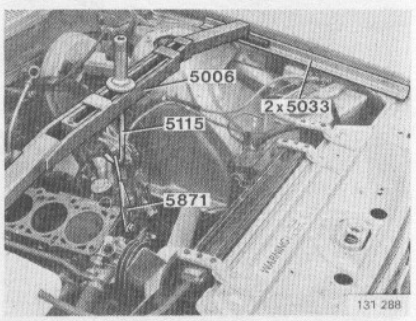
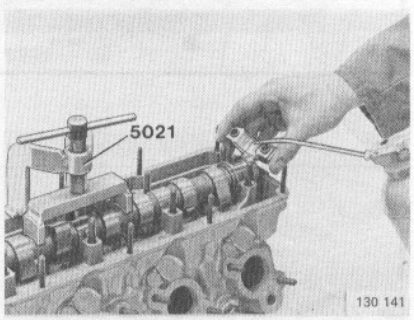
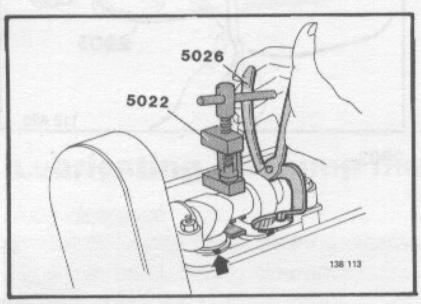


5006



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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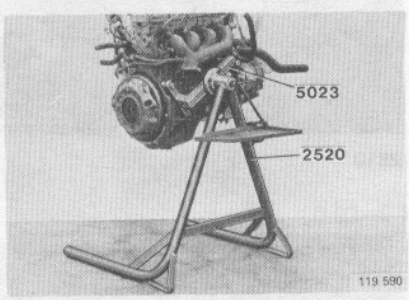

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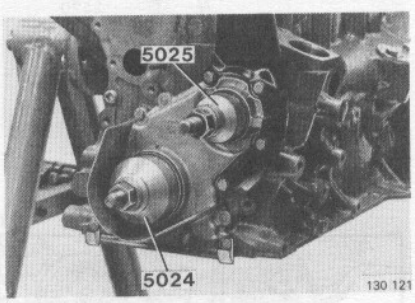
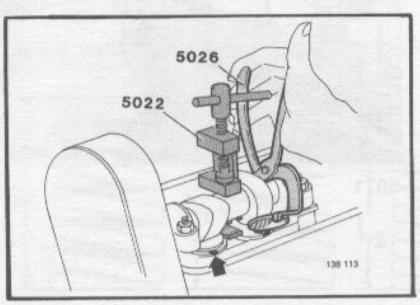


5024, 5025



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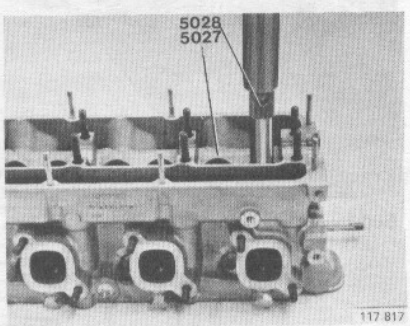

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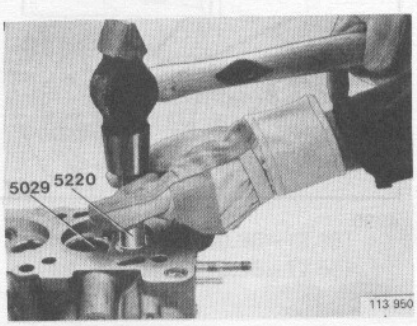

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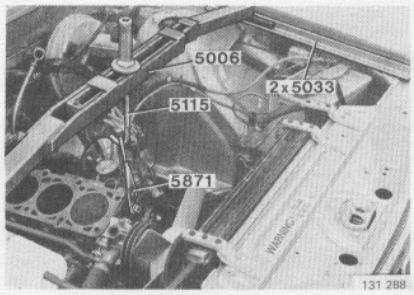

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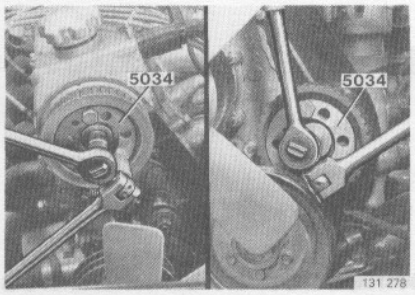

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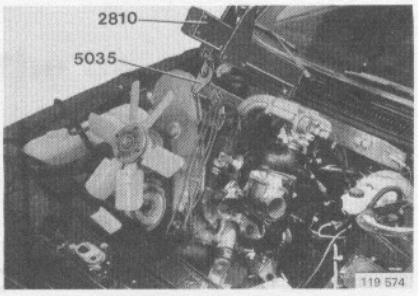

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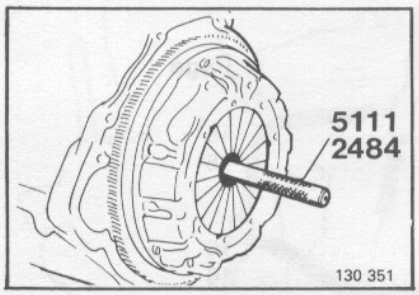

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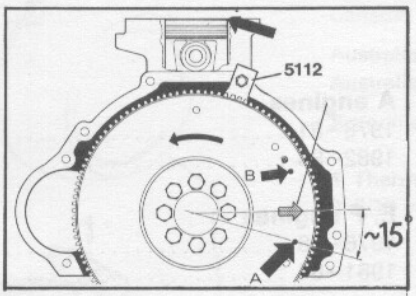

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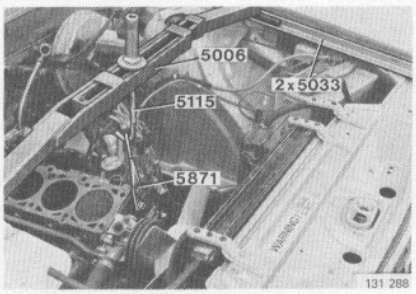

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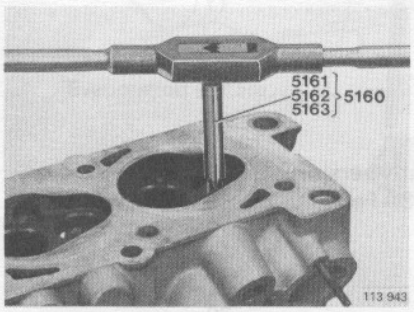
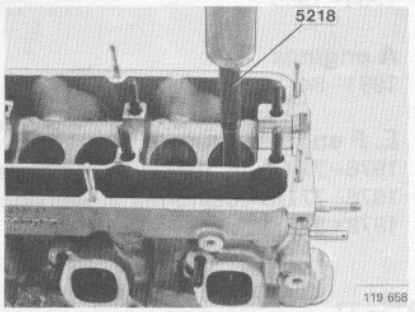


5160, 5161, 5162, 5163



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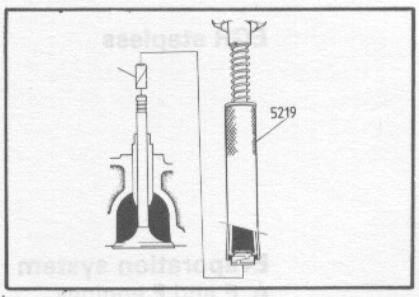

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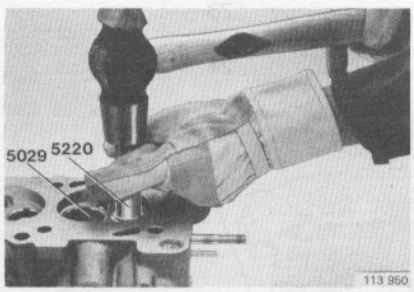

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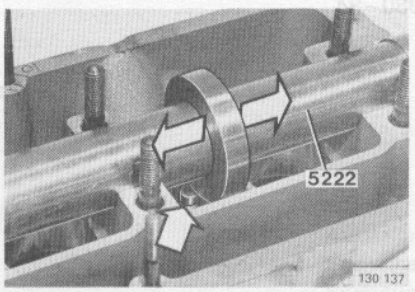

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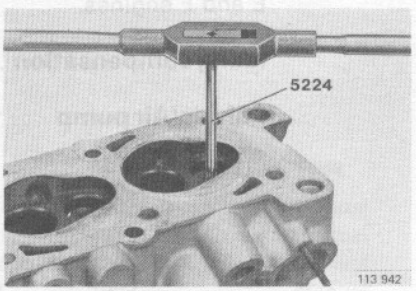

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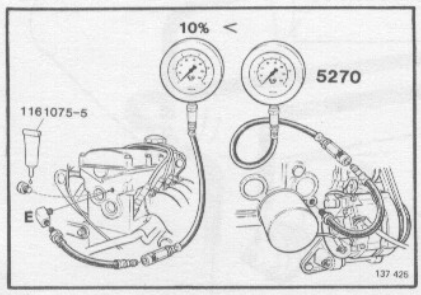

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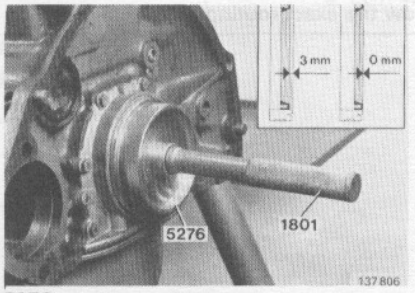

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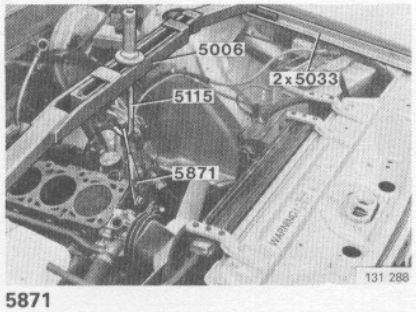

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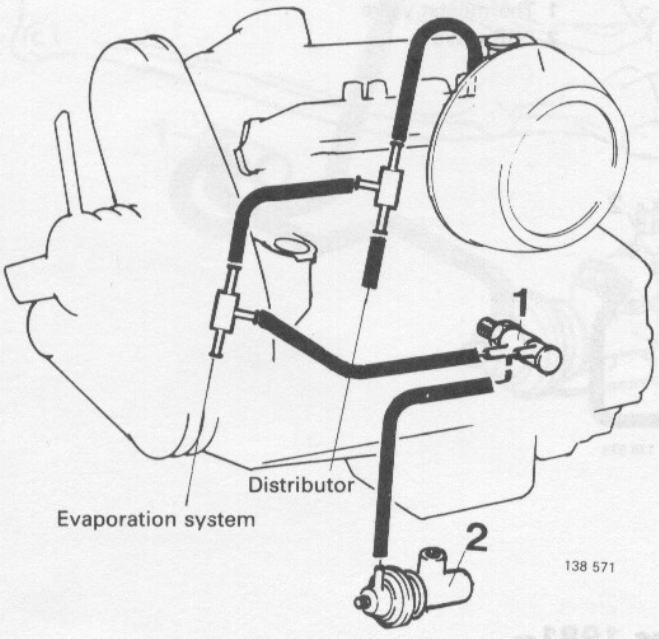
Group 20 General

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

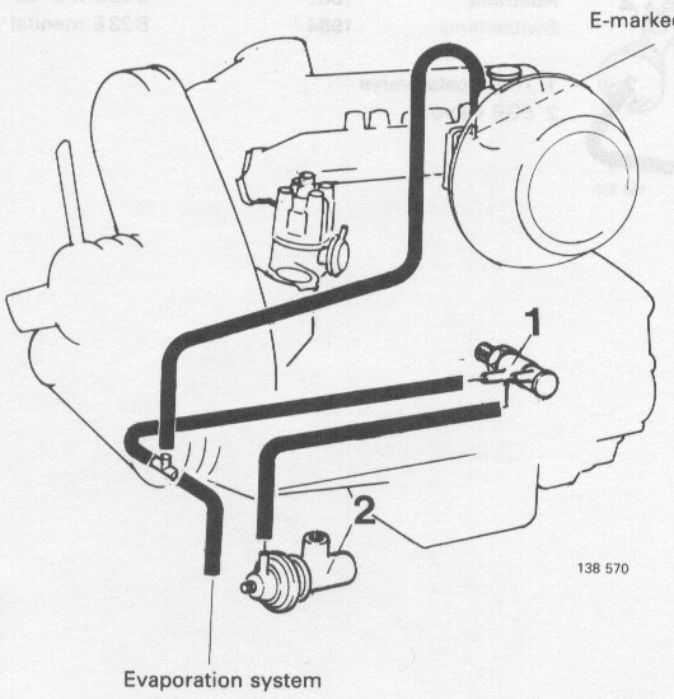
A engines 1978–81



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

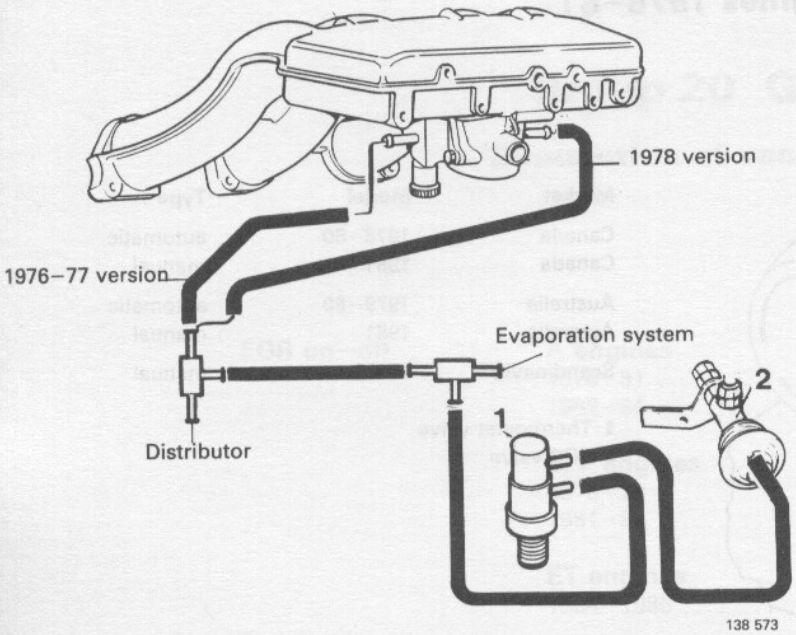
A engines 1982–



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

1 Thermostat valve
2 EGR valve

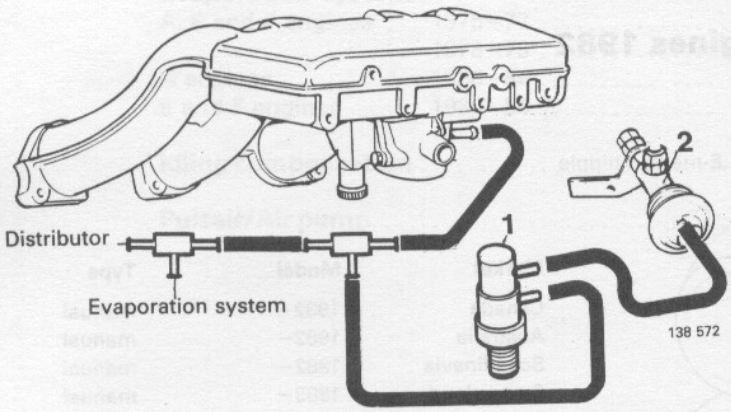
E/F engines 1976–78



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

1 Thermostat valve
2 EGR valve

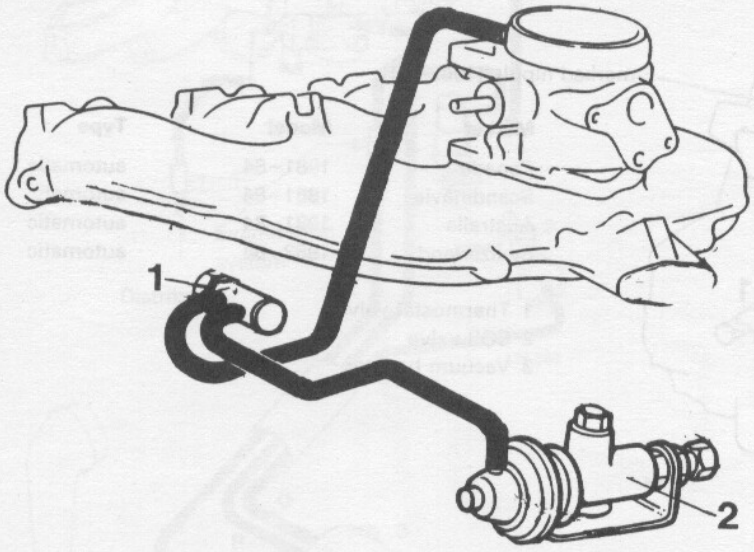
E engines 1981–



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



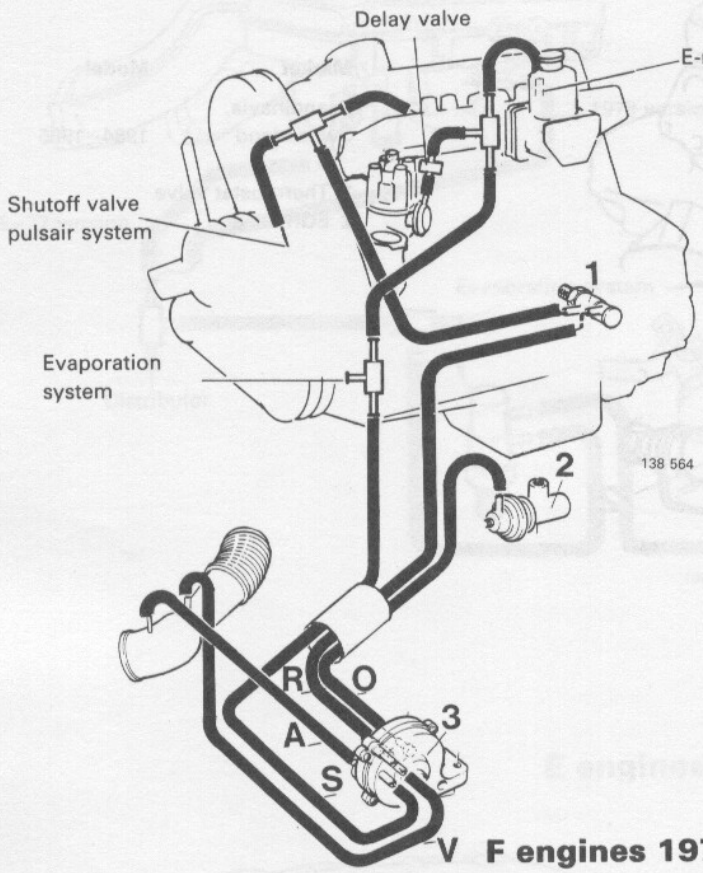
138 569

Market	Model
Scandinavia, Switzerland	1984–1985

1 Thermostat valve
2 EGR valve

Exhaust gas recirculation (EGR), stepless type

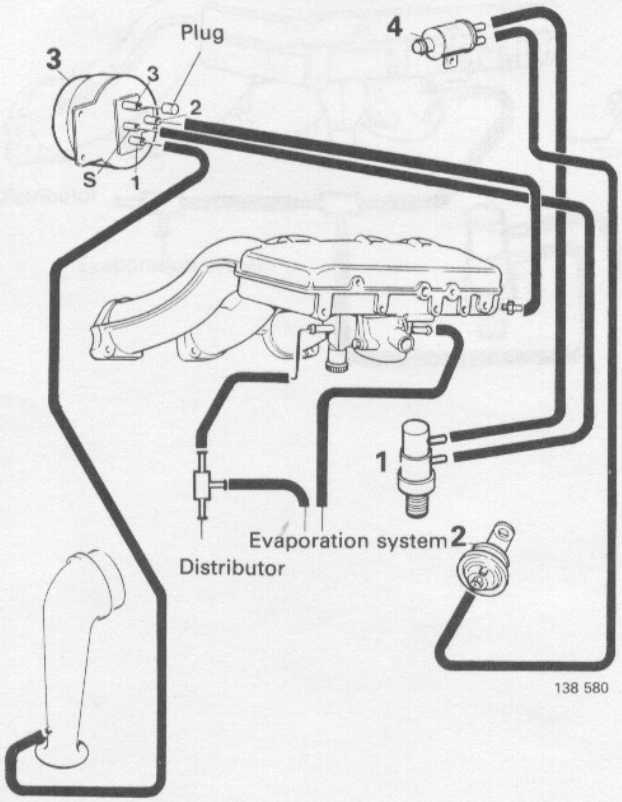
A engines 1981–



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

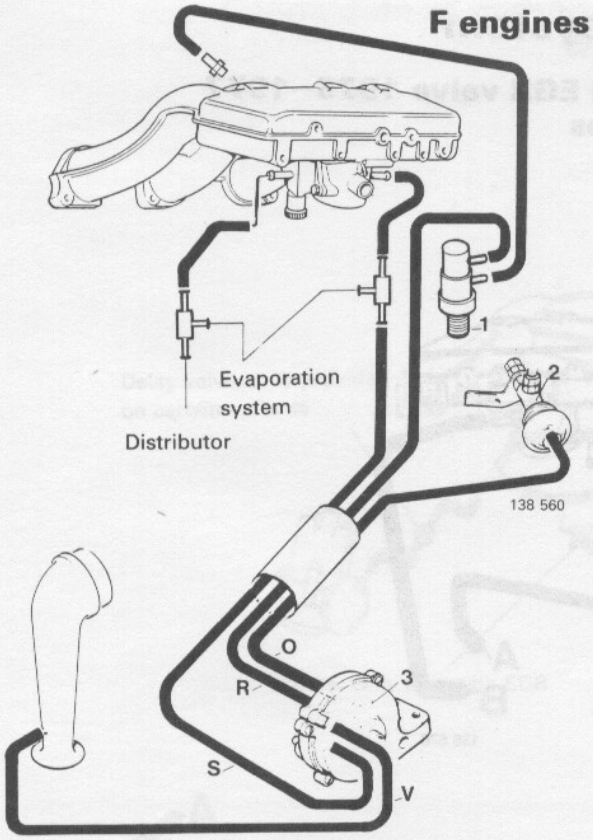
F engines 1976–77, version 1



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

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

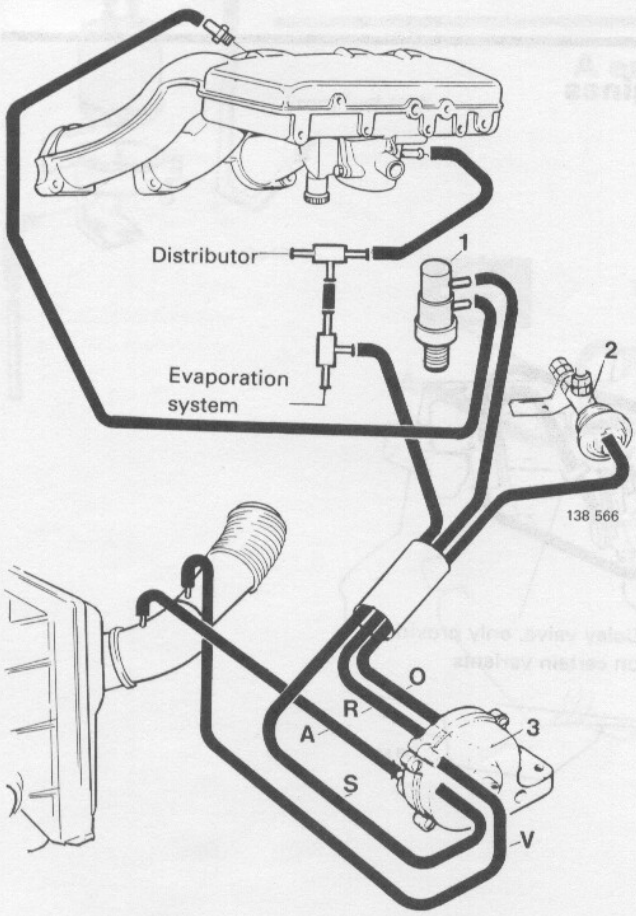
F engines 1976–77, version 2



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

1 Thermostat valve
2 EGR valve
3 Vacuum booster

E/F engines 1978–

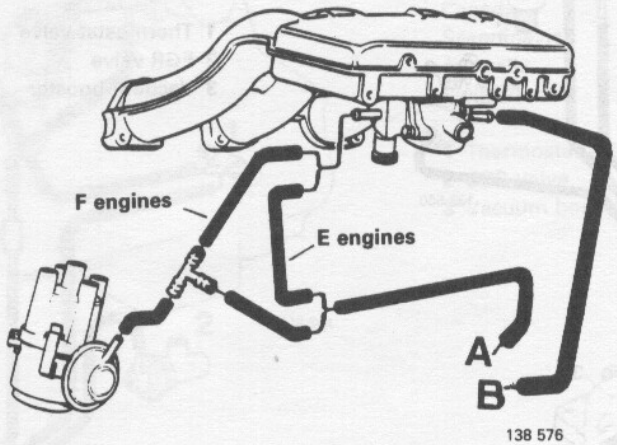


Market	Model	Type
USA Federal	1978–79	B 21 F
Canada	1981–83	B 23 E automatic
Australia, Scandinavia	1981–84	B 23 E automatic
Switzerland	1983–84	B 23 E automatic

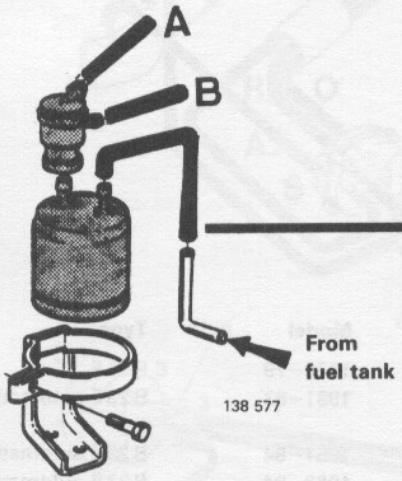
1 Thermostat valve
2 EGR valve
3 Vacuum booster

Evaporation system

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

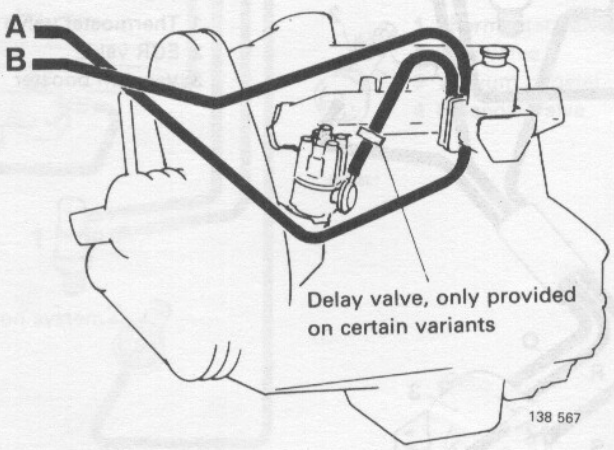


138 576



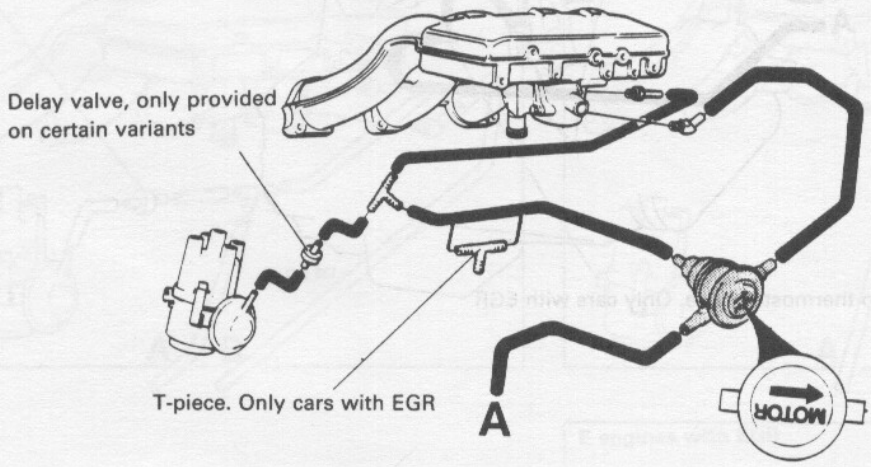
138 577

A engines

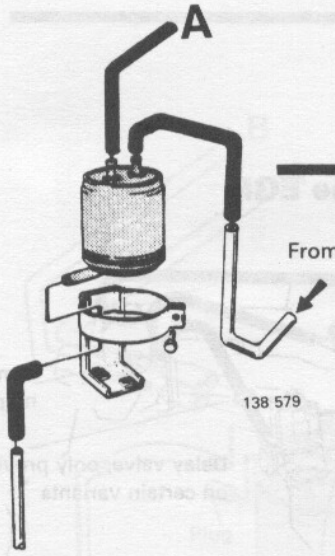


138 567

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

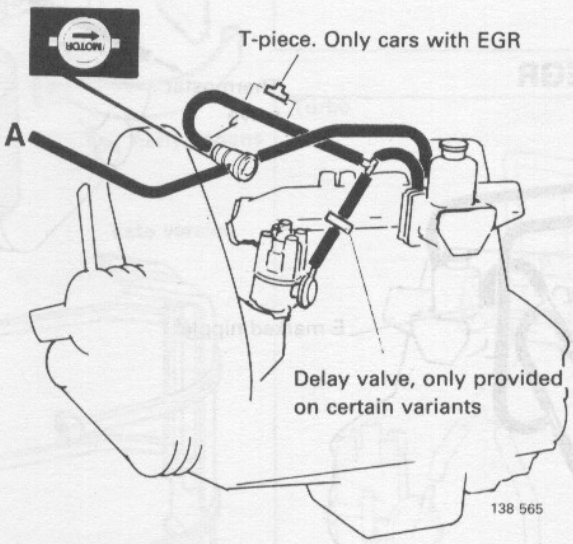


138 578



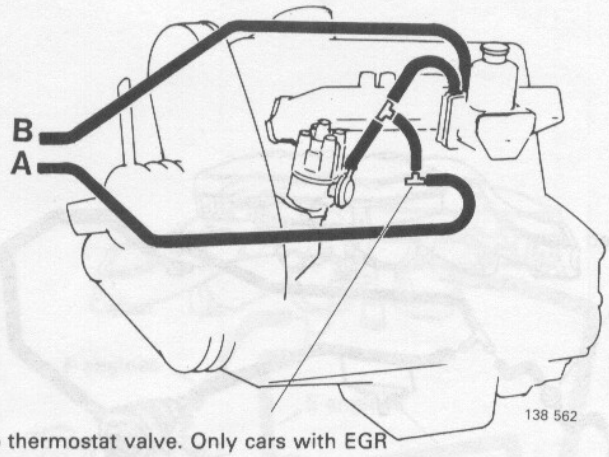
138 579

A engines

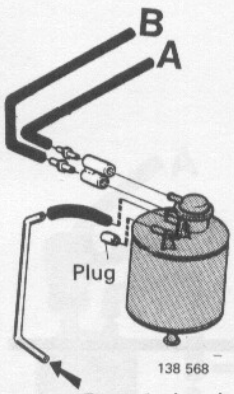


138 565

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



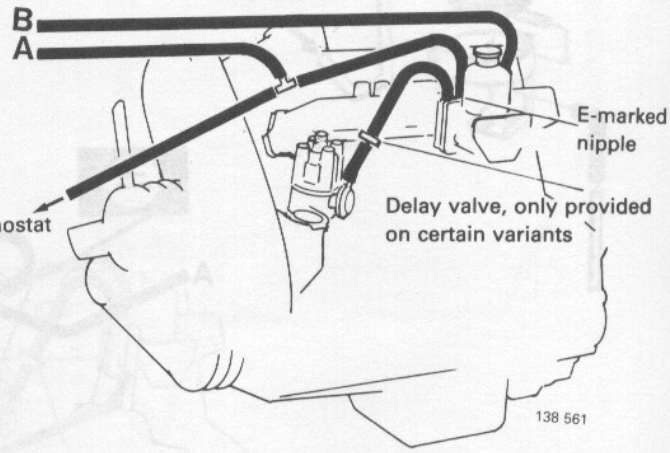
To thermostat valve. Only cars with EGR



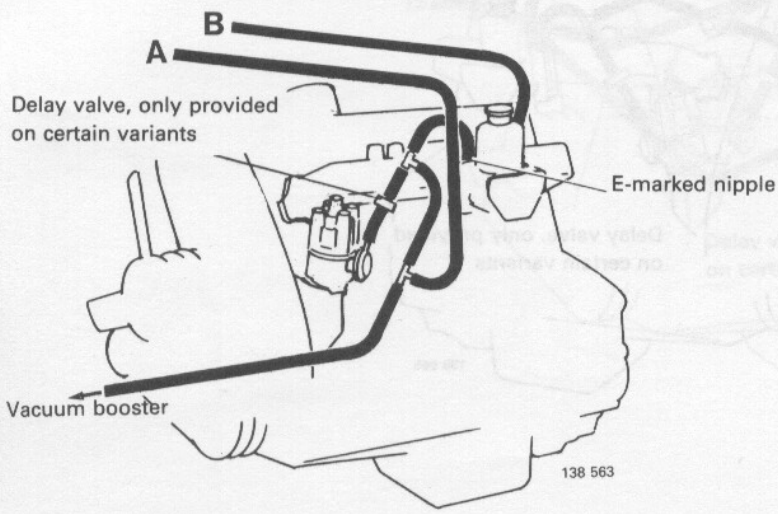
From fuel tank

A engines 1982–84

With on–off type EGR

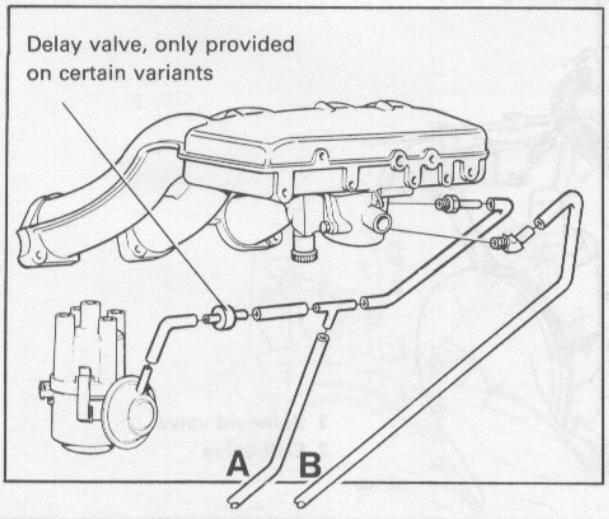


With stepless type EGR

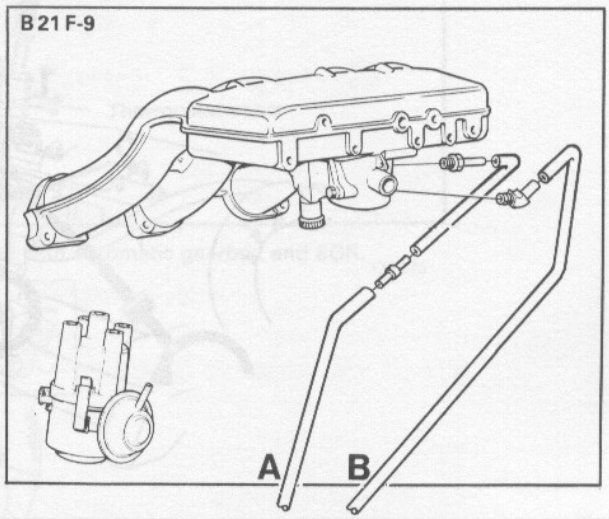


Connection of carbon filter and EGR valve
E/F engines 1980–84

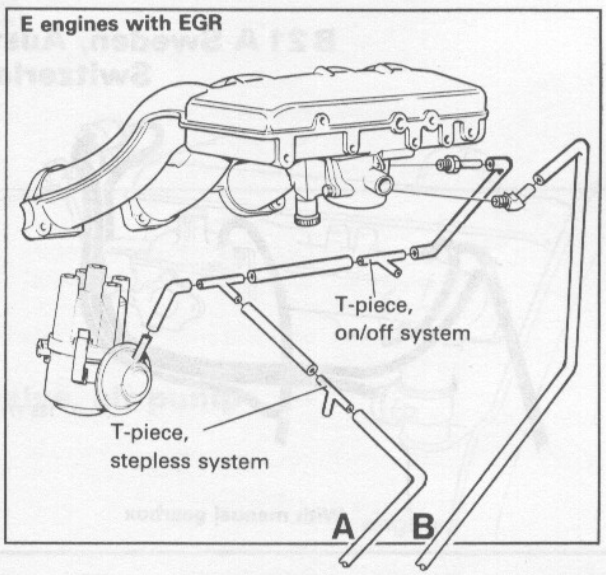
B 21 F-5 and
E engines without EGR

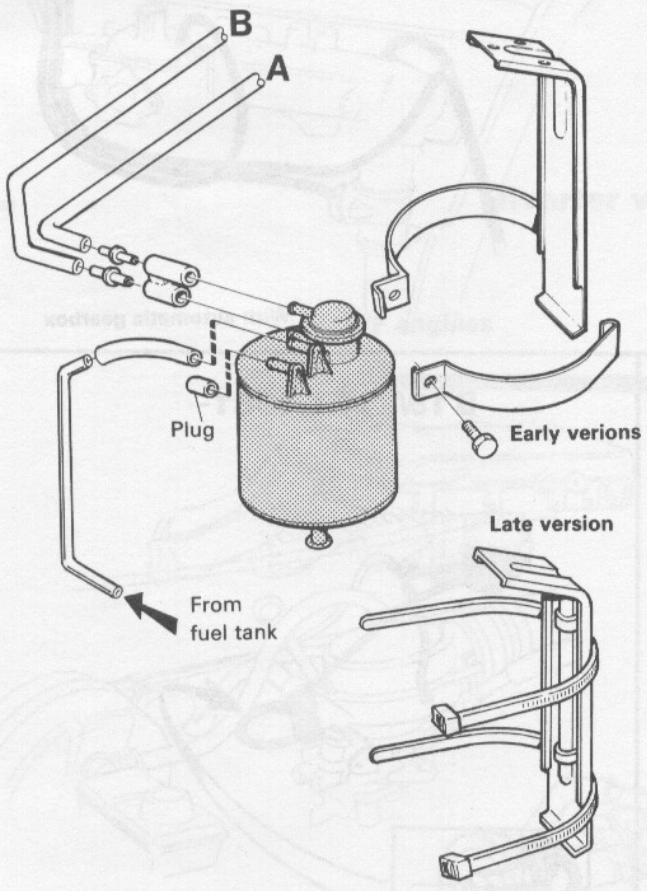


B 21 F-9

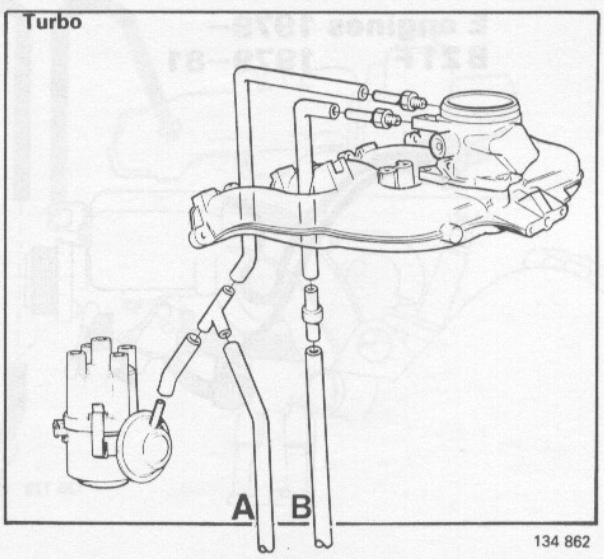


E engines with EGR





Turbo

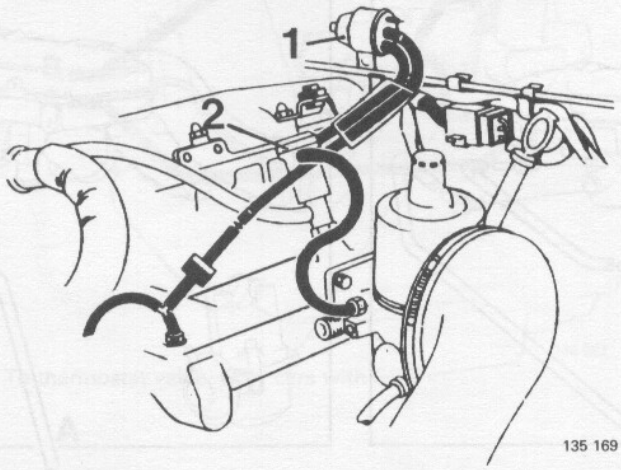


134 862

Idling compensation

A engines 1979–

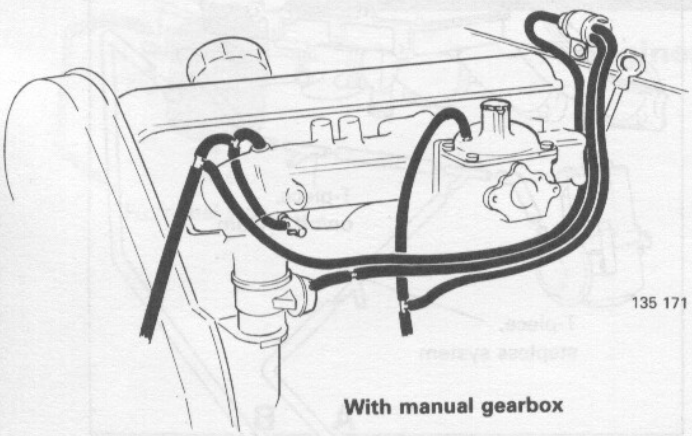
(Does not apply to Sweden, Australia, Canada B 21 A 1982–, Switzerland 1983–)



135 169

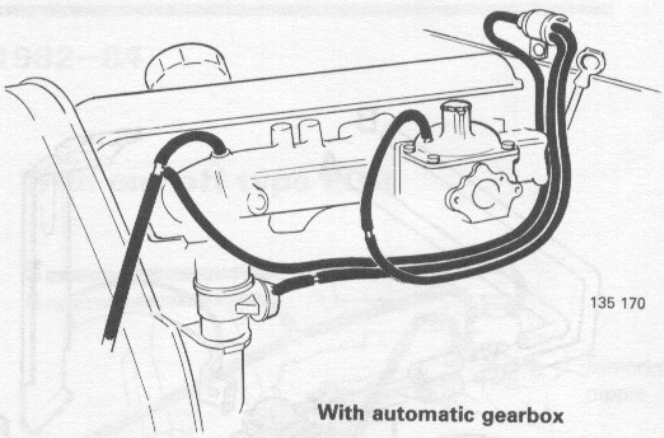
1 Solenoid valve
2 EGR valve

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



135 171

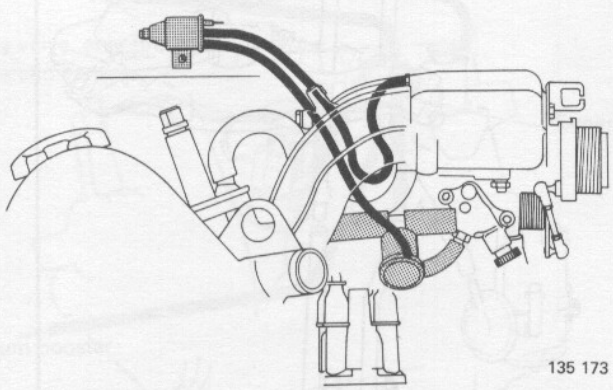
With manual gearbox



135 170

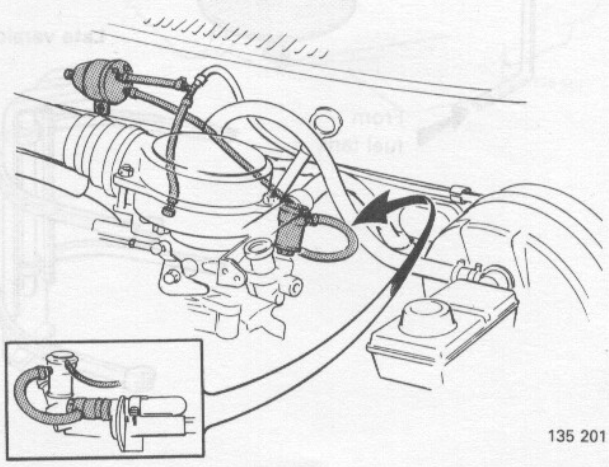
With automatic gearbox

E engines 1979–
B 21 F 1979–81



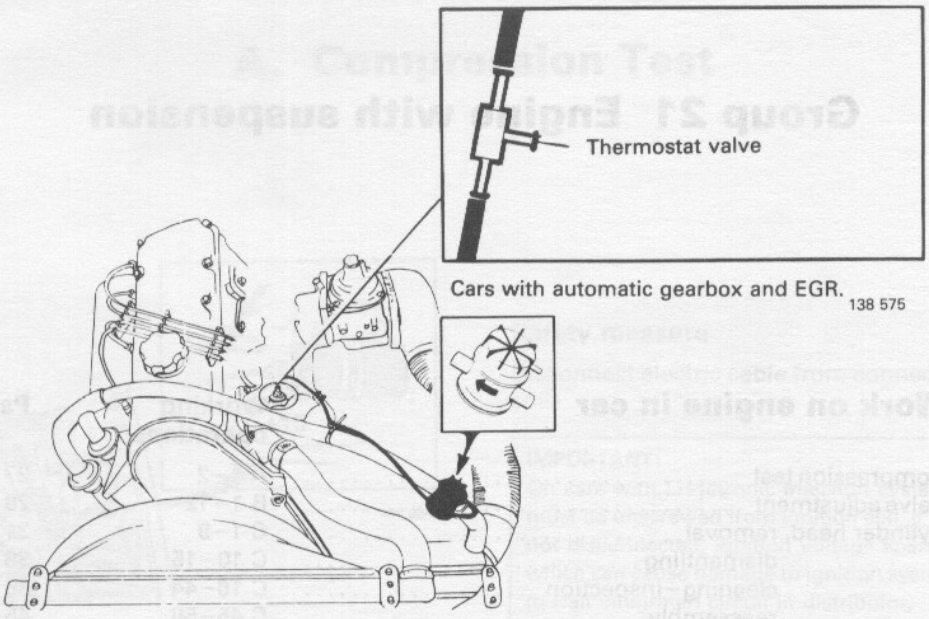
135 173

B 19/21 ET 1981–



135 201

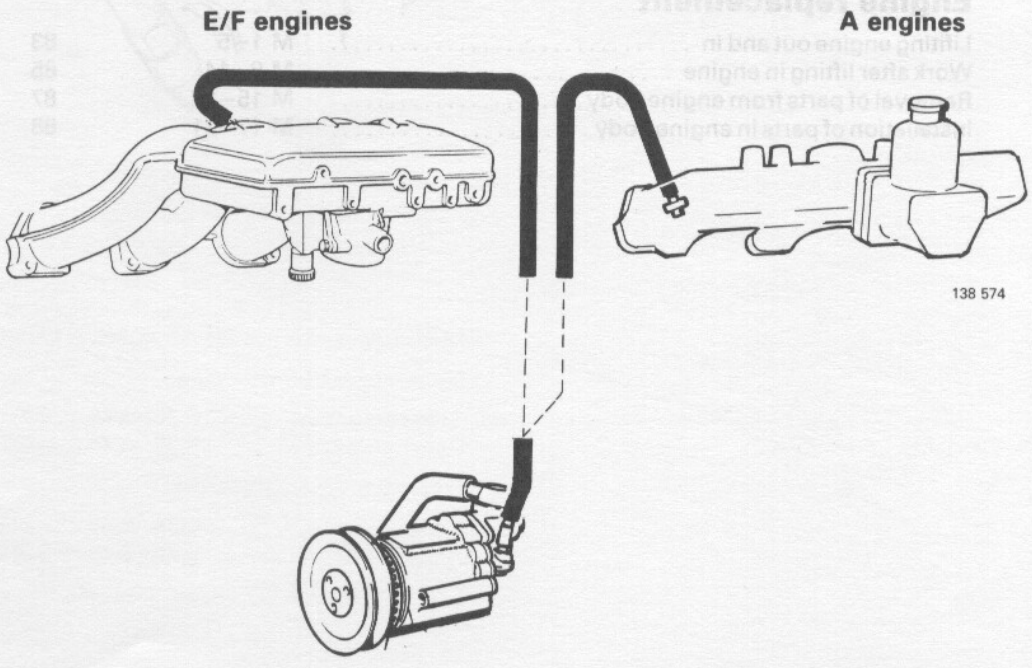
Shutoff valve, Pulsair system



Cars with automatic gearbox and EGR.

138 575

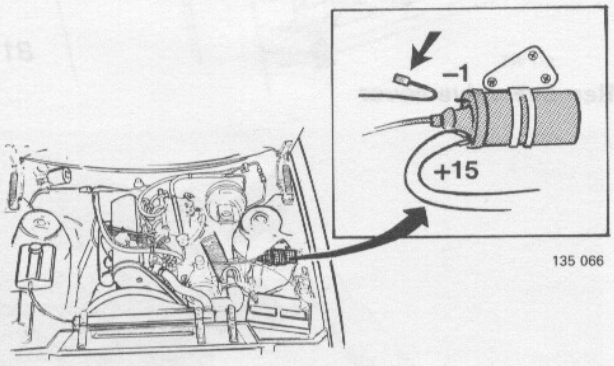
Diverter valve, air pump



138 574

Group 21 Engine with suspension

A. Compression Test



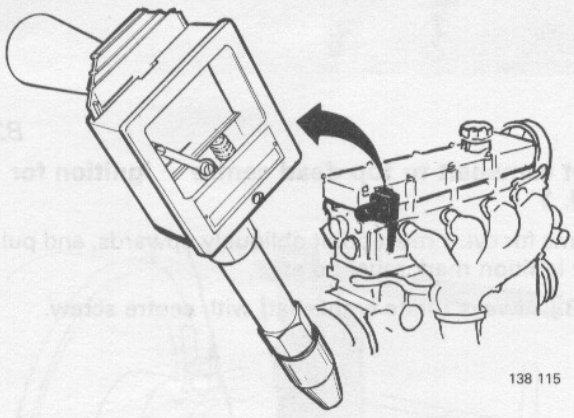
135 066

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)

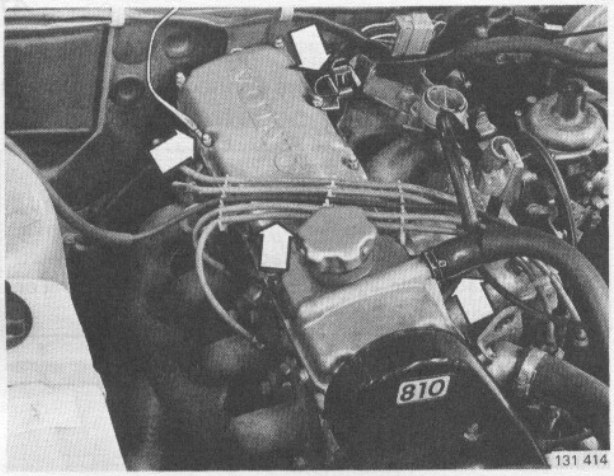
Normal value ..... **0.9–1.1 MPa** (128–156 psi).

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)

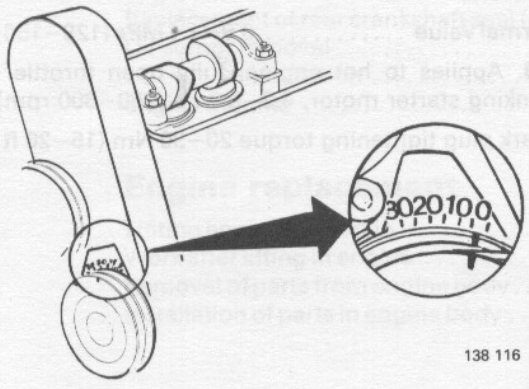
B. Valve Adjustment

Special tool: 5022, 5026



B1

Remove valve cover

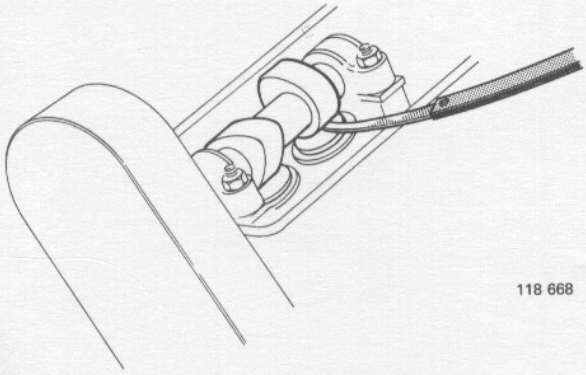


B2

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

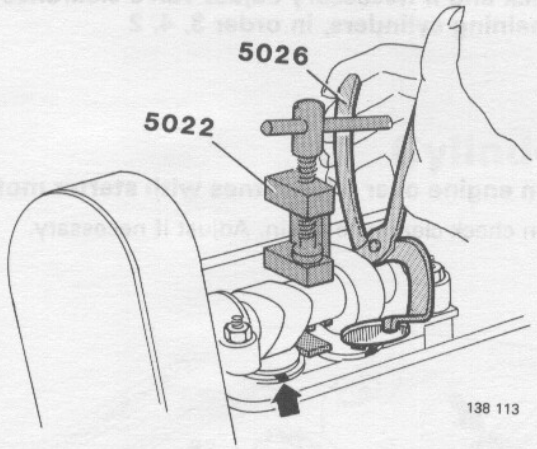
Clearance when **checking**:

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.

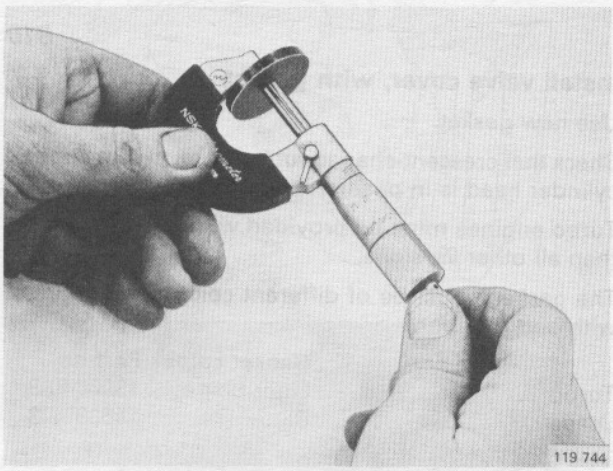


If clearance is incorrect *B4*

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

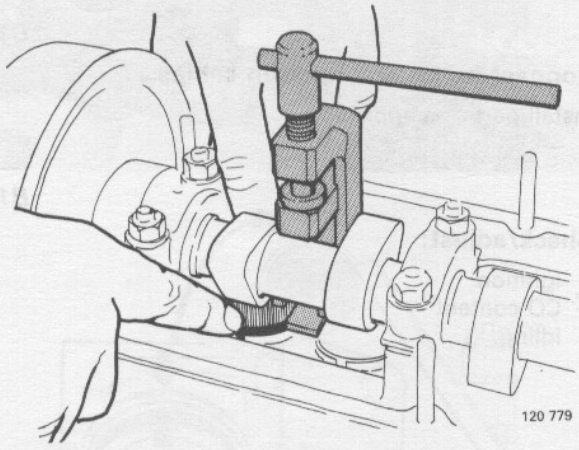
Select adjustment washer of correct thickness

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)



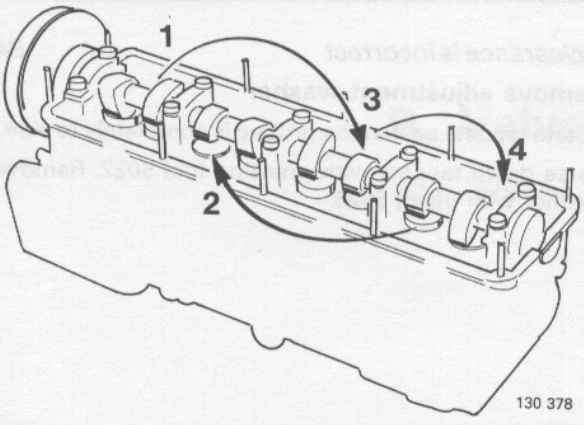
B6

Oil and install new washer

Turn washer with marking pointing downwards.

B7

Remove pressing tool 5022



130 378

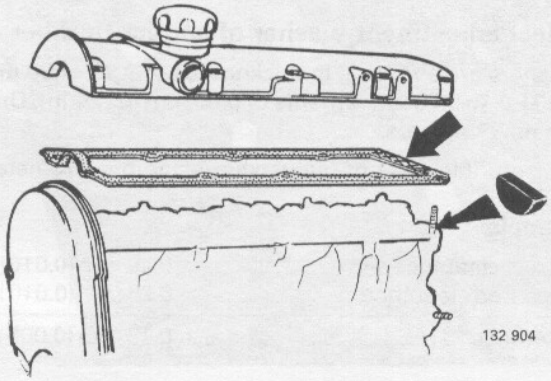
B8

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

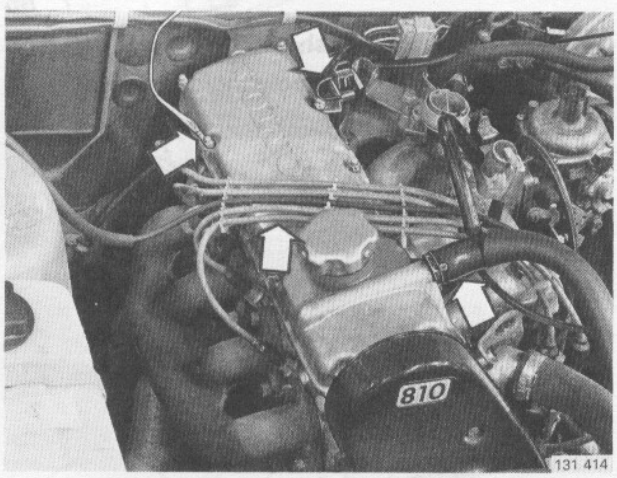
Use new gasket.

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

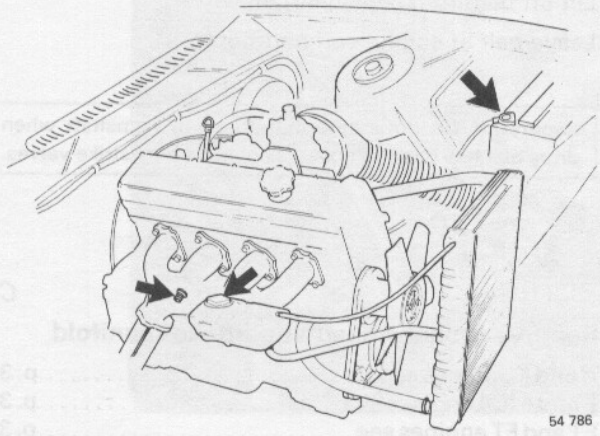
Install parts, as applicable.

B12

Check/adjust:

- ignition
- CO content
- idling.

C. Cylinder head, removal



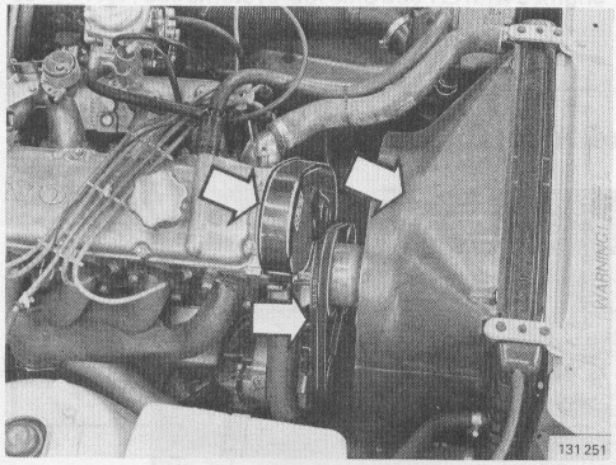
C1

Disconnect battery ground lead

C2

Drain coolant

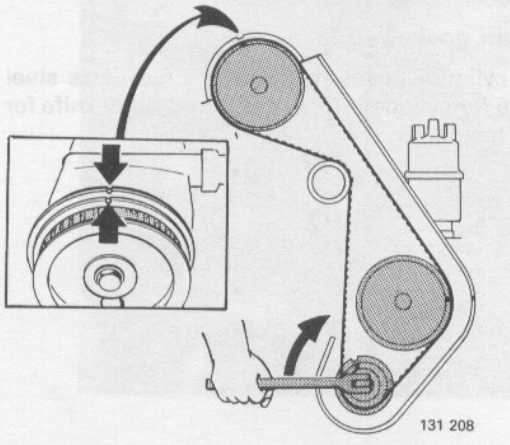
Unscrew nipple on right-hand side of engine. Connect a hose to nipple to prevent spillage.



C3

Remove:

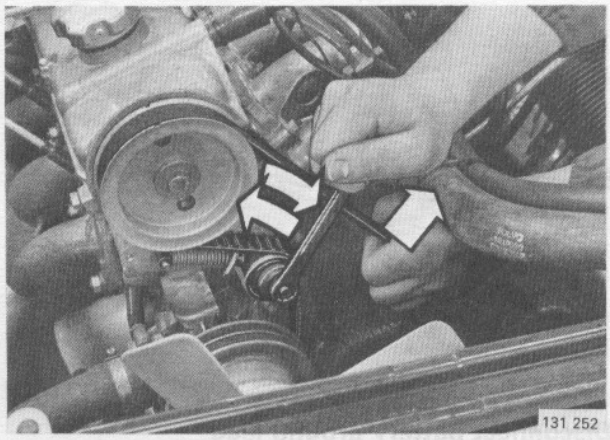
- fan cover
- all drive belts from crankshaft pulley
- gear case.



C4

Set engine

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


131 252

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.

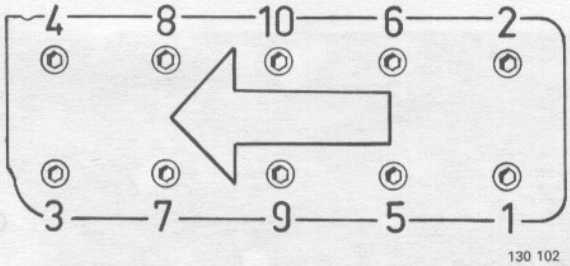
Leave belt in engine compartment.

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



130 102

C8

Remove cylinder head

Loosen screws in order shown in diagram.

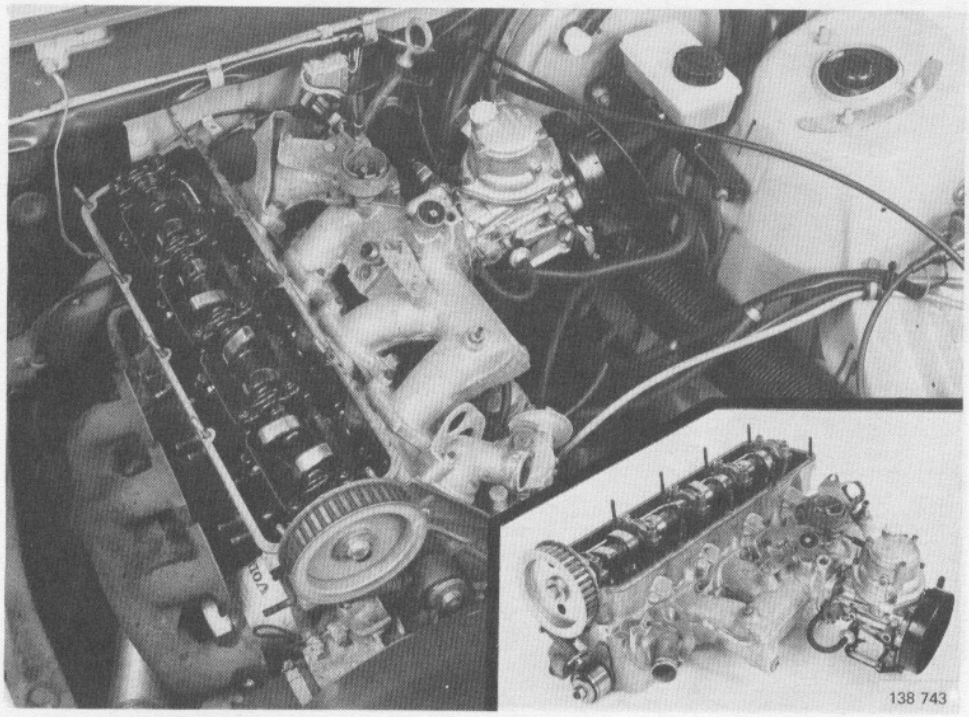
IMPORTANT!
The cylinder head is manufactured from aluminum. To avoid damage place it on wooden blocks.

C9

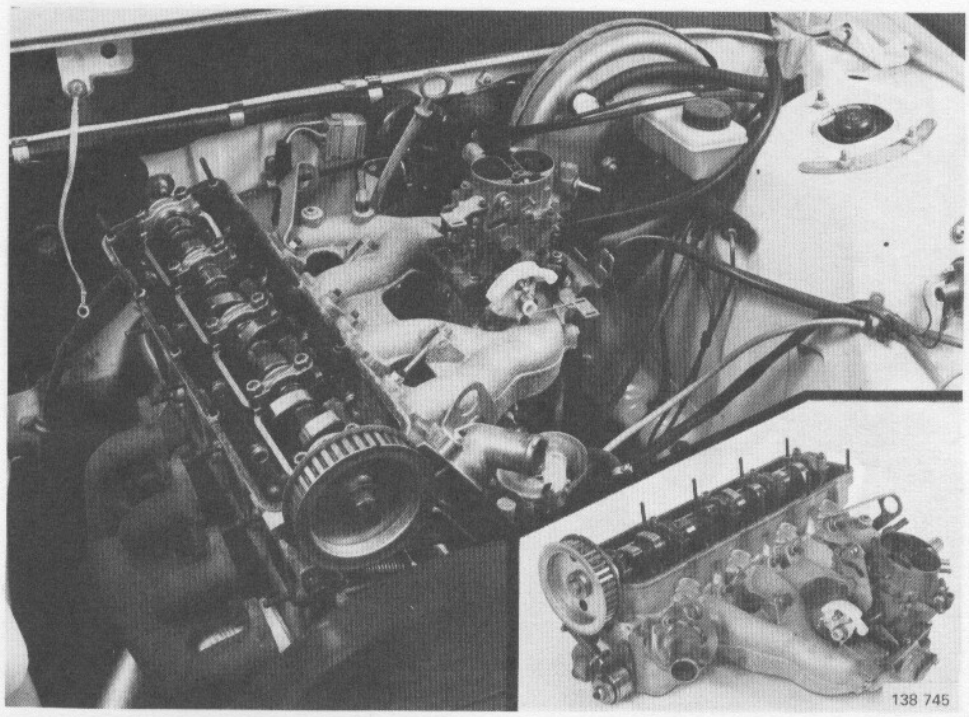
Clean gasket surfaces

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

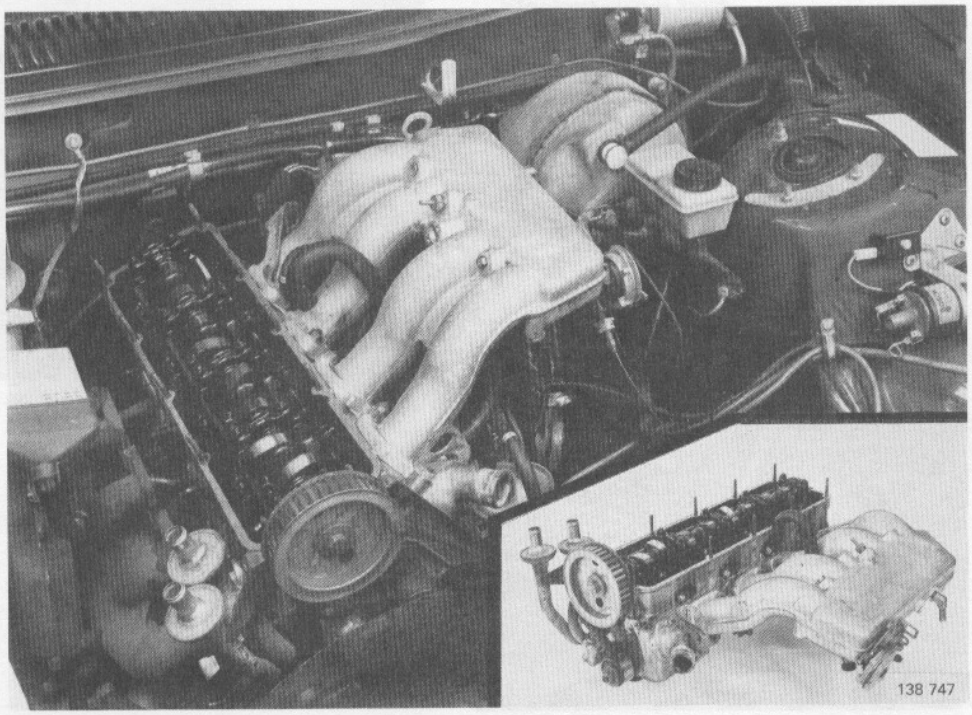
A engines



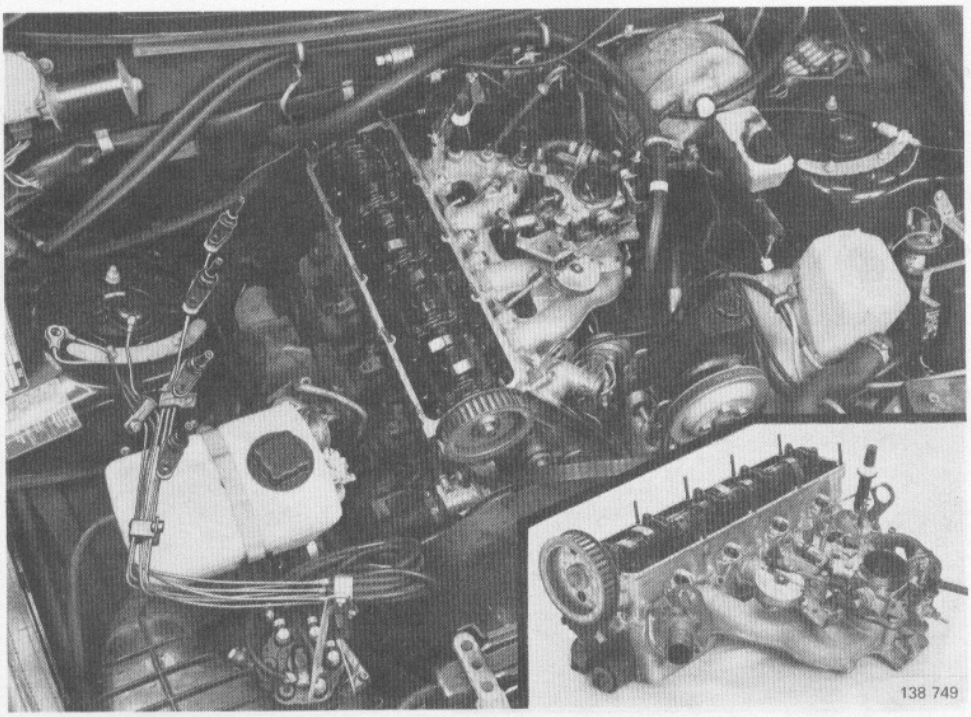
K engines



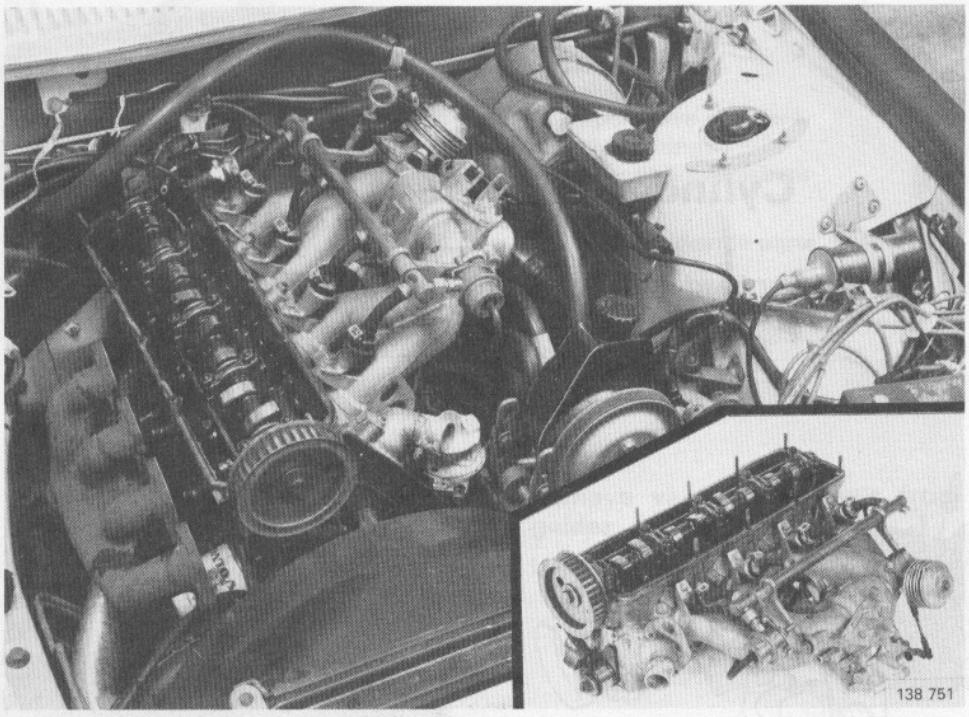
E and F engines



ET and FT engines

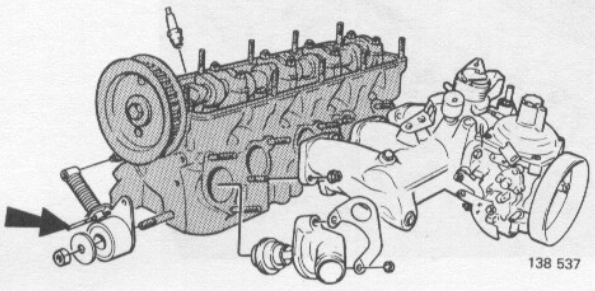


F engines with LH-Jetronic fuel systems



Cylinder head, dismantling

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

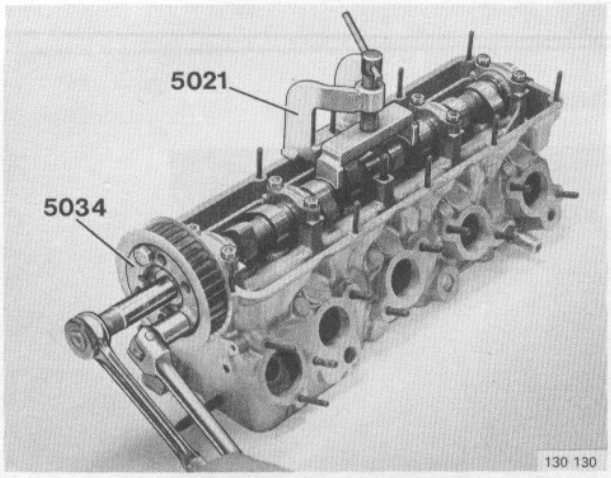

138 537

C10

Uncover cylinder head

Remove:

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



130 130

C11

Remove camshaft pulley

Use dolly 5034.

C12

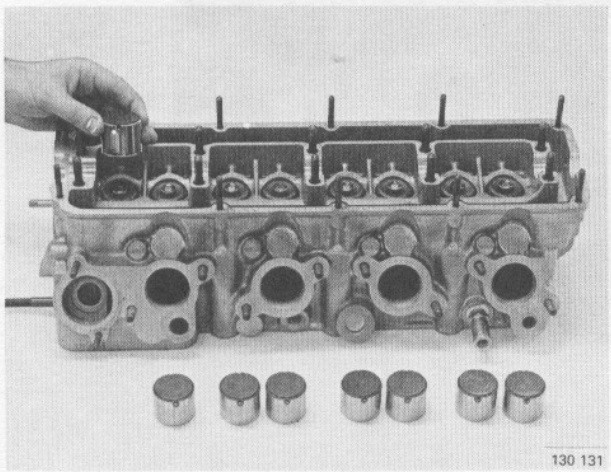
Remove camshaft

Remove centre cap.

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

Remove remaining 4 caps.

Remove tensioning tool, camshaft and camshaft seals.

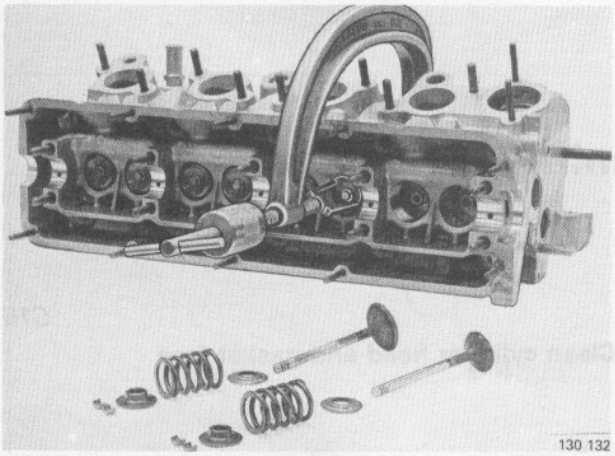

130 131

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.

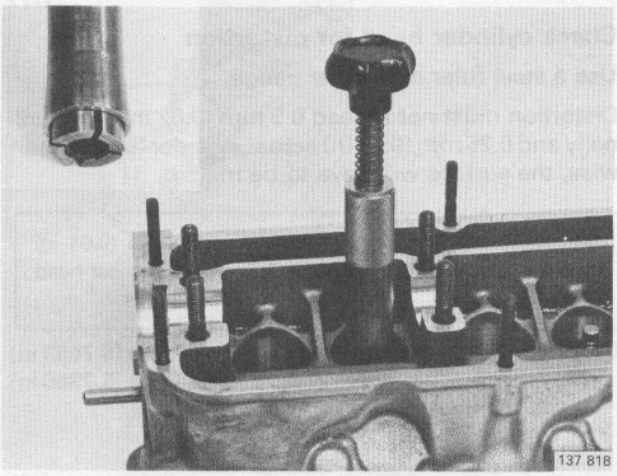

130 132

C14

Remove:

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

Do not interchange parts.


137 818

C15

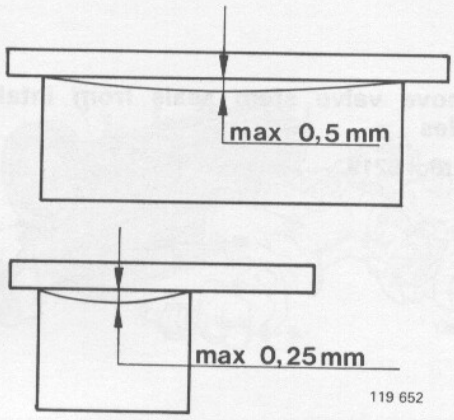
Remove valve stem seals from intake valve guides

Use tool **5219.**

Cylinder head, cleaning/inspection

C16

Clean cylinder head and gasket face



C17

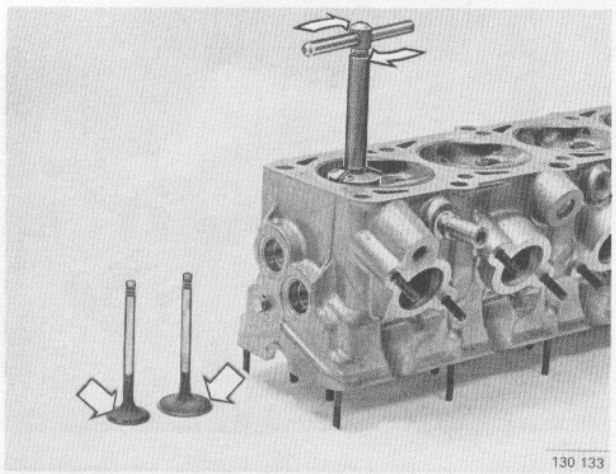
Check cylinder head for distortion

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

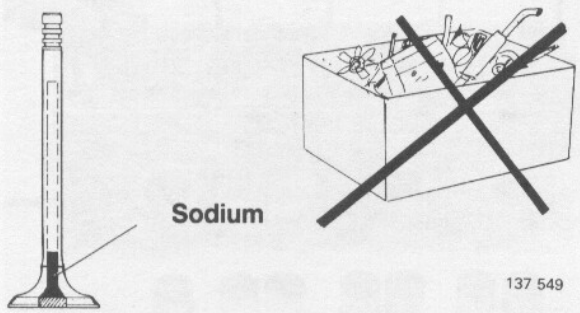
Clean/inspect valves and valve seats

Clean valve seats with a cutter.

Remove carbon from combustion chambers and valves.

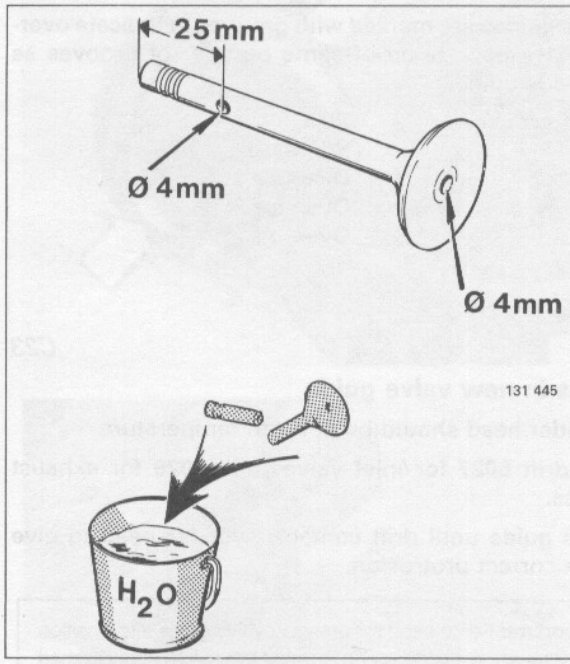
If valve seats are fractured or show signs of excessive wear they must be replaced.

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.

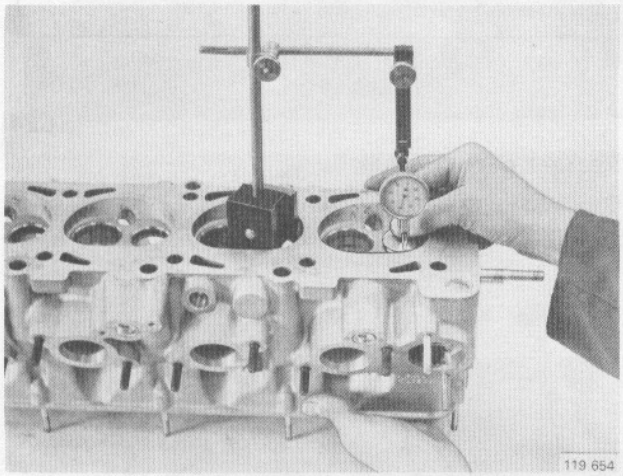


C19

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.



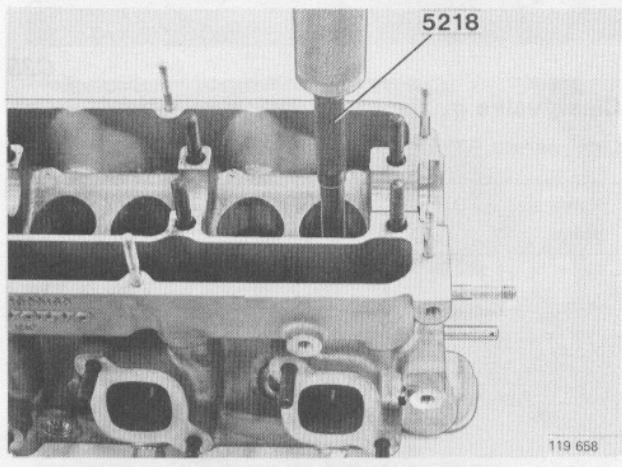
C20

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.

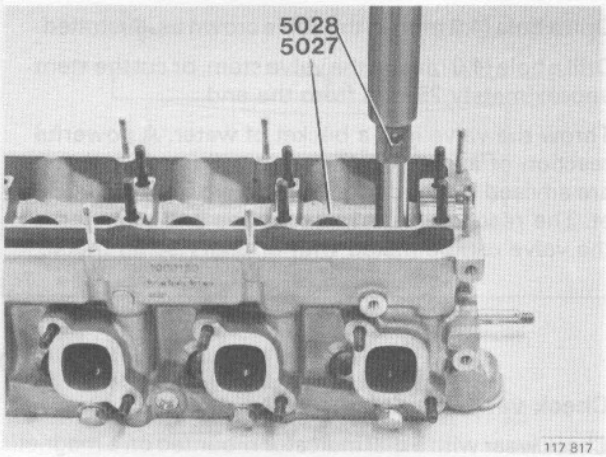
If so, valve guide bore must be reamed to oversize.

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

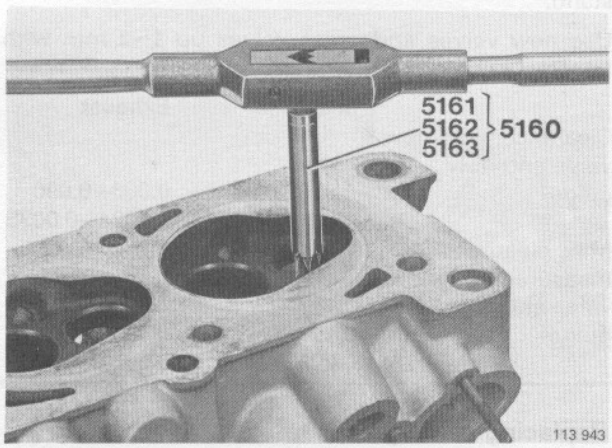
Press in new valve guide

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.

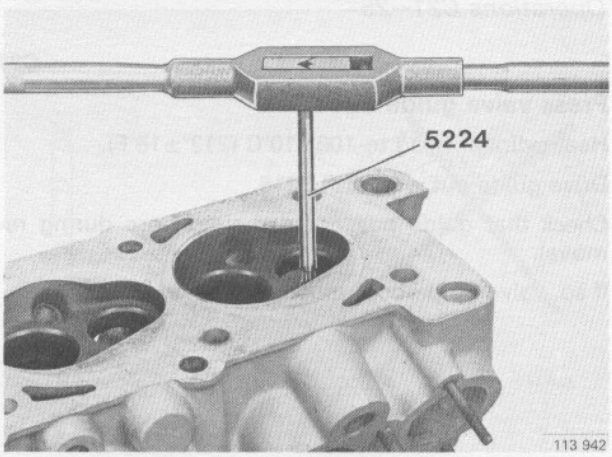
Important: Force used for pressing valve guide into position must be at least 9000 N (2 016 lbf). If this force is not reached the guide must be removed again and valve seat reamed to next oversize and appropriate guide installed.



C24

Reamer part number

Oversize	Reamer
1	5161
2	5162
3	5163

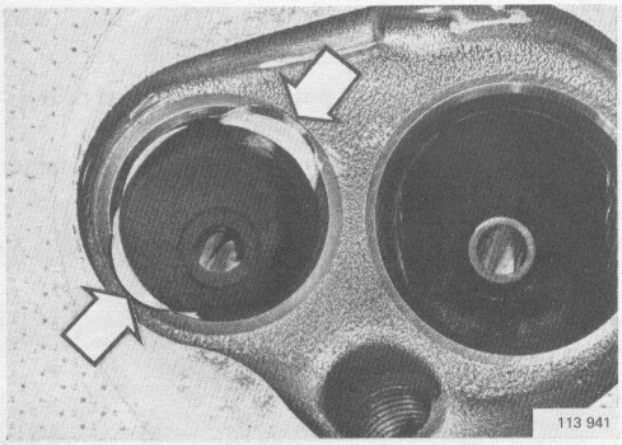


C25

Clean valve guide

Use reamer **5224** or 5164.

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



Valve seat, replacement

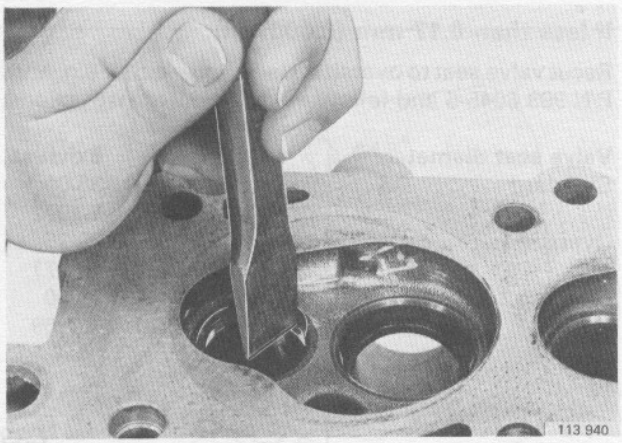
Operations C26–37

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.

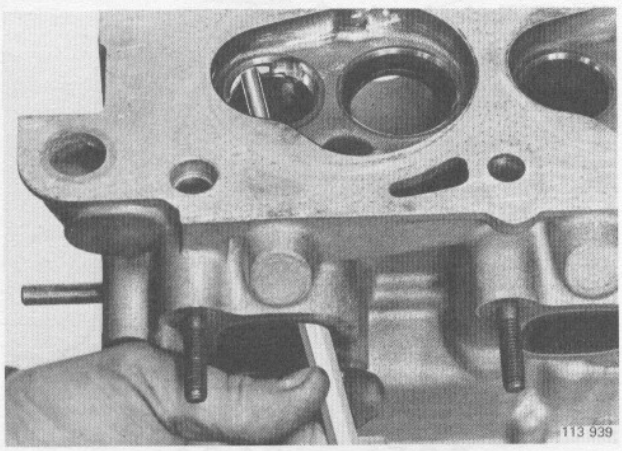


C27

Split valve seat

Split seat with a chisel.

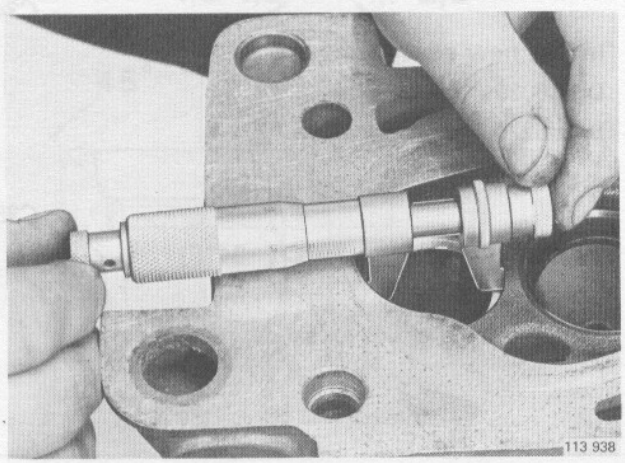
Be careful not to damage cylinder head.



C28

Tap out valve seat

Use a long drift as illustrated.



C29

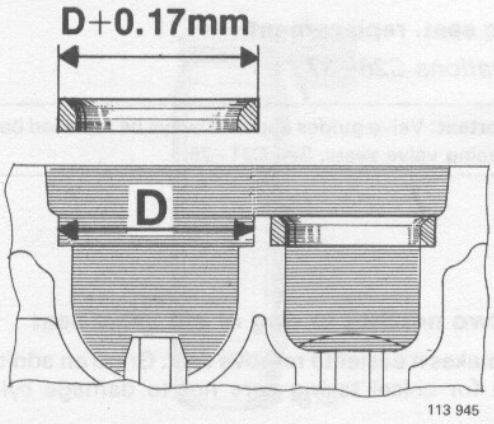
Check valve seat recess

If damaged, ream recess to nearest oversize.

C30.

Measure diameter

Use an inside micrometer.

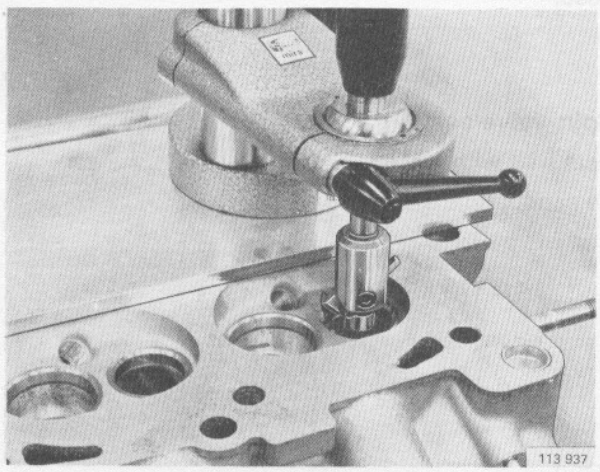


C31

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.

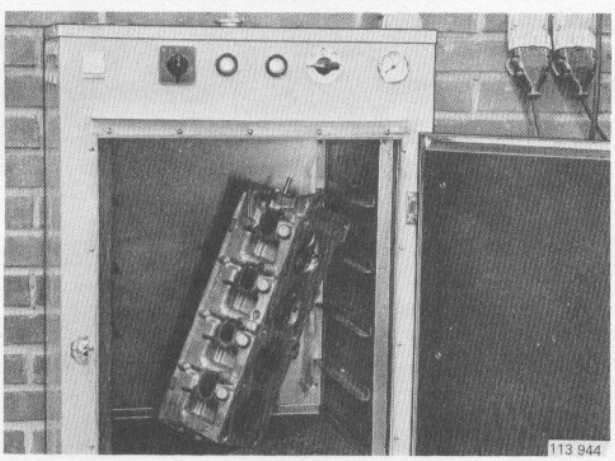


C32

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.

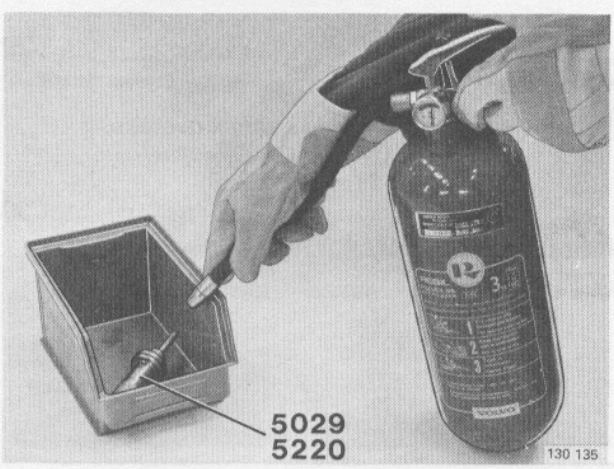
Valve seat diameter		Inlet	Exhaust
Standard	mm	46.00	38.00
	in	1.8124	1.4972
Oversize 1	mm	46.25	38.25
	in	1.8223	1.5071
Oversize 2	mm	46.50	38.50
	in	1.8321	1.5169



C33

Heat cylinder head

Heat to 100 ° C (212°F).



C34

Install new seat insert on drift

Drift 5029 = inlet valves

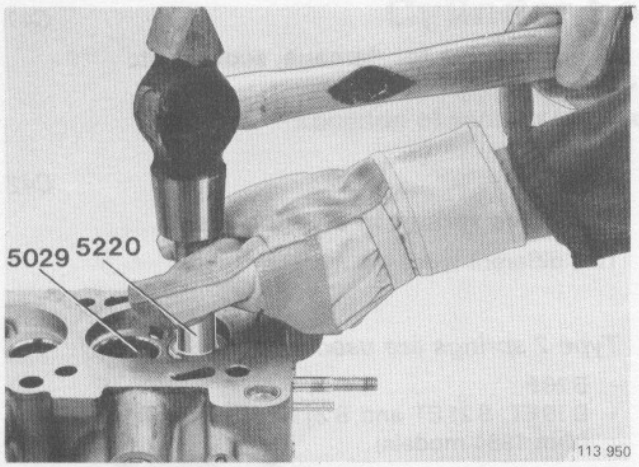
Drift 5220 = exhaust valves.

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

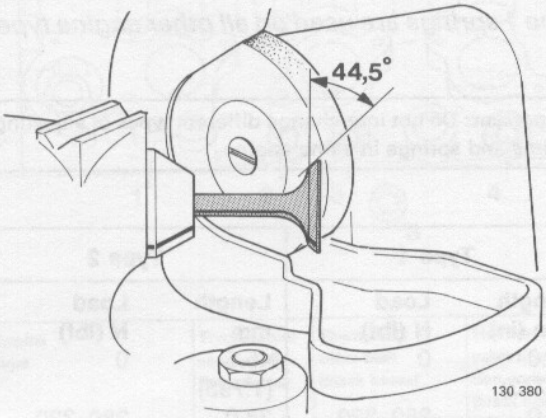
This operation must be carried out very quickly, within 3–4 seconds to avoid temperature loss.

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.



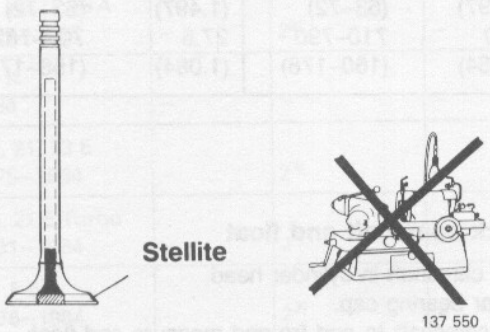
Grinding-in valves and valve seats

Operations C38–40

C38

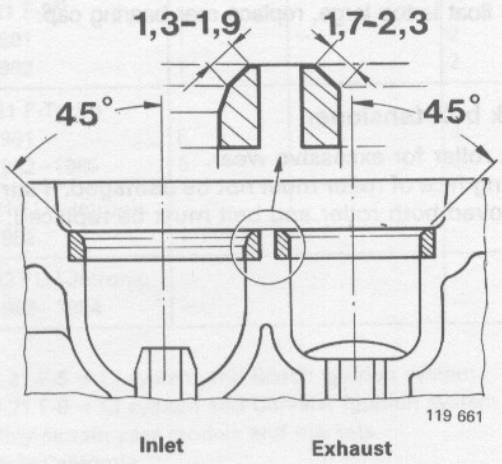
Machine valves to specified angle

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.

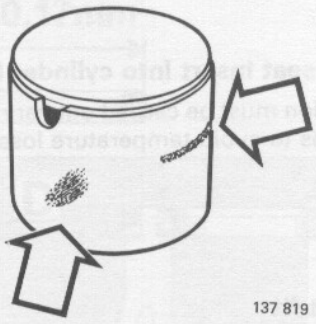
Valve diameter

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.



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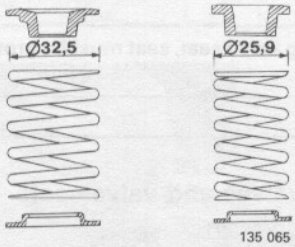
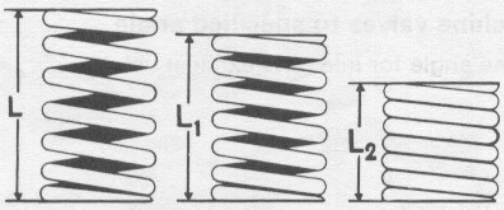
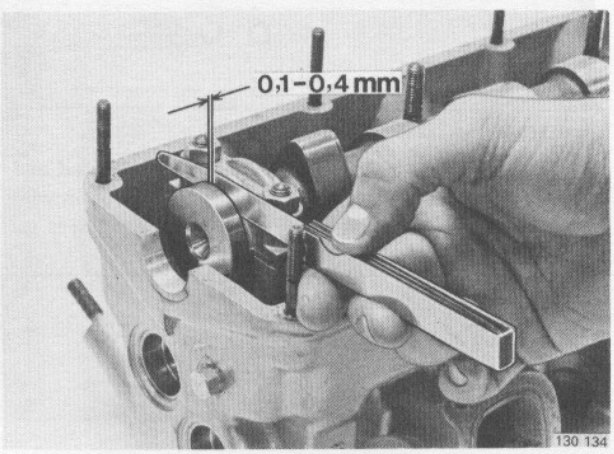


135 065

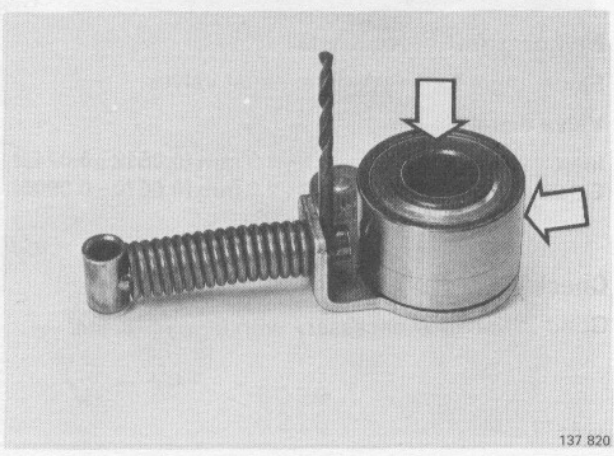
Type 1 Type 2



129 453



130 134



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.