Cylinder head, assembly

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

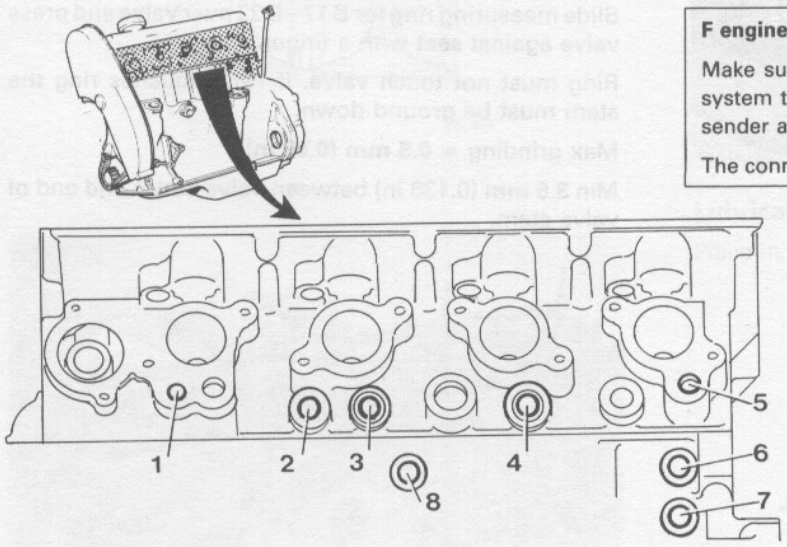
Location of senders/contacts on cylinder head and block *C45*

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.

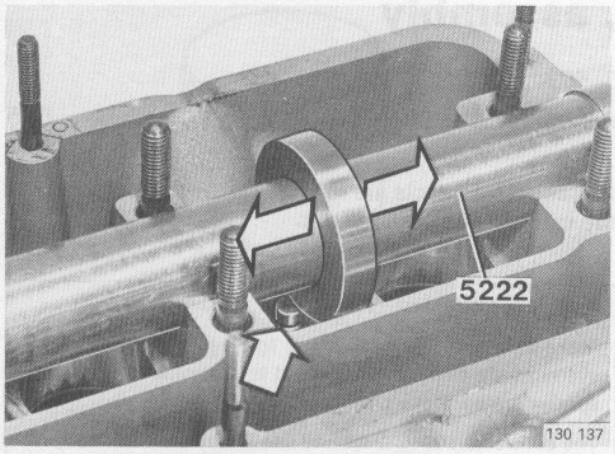
The connectors look alike and can easily be interchanged.



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 1981 USA	– 1[4]	2[3] –	– 2	3 3	5 5	– –	– –	– –
B 21 F-9[2] 1981 1982	1 1	– –	2 2	3 3	5 5	– –	– 7	– –
B 21 F-Turbo 1981 1982–1985	6 6	– –	2 2	3 3	4 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

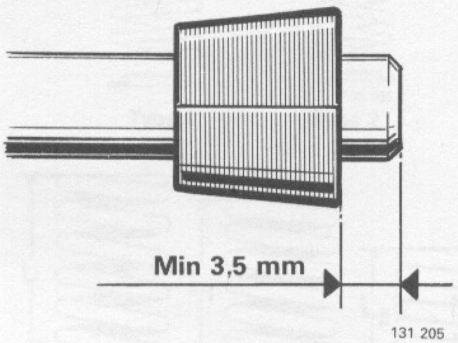
This measurement should be carried out to ensure that there is sufficient space for valve adjustment.

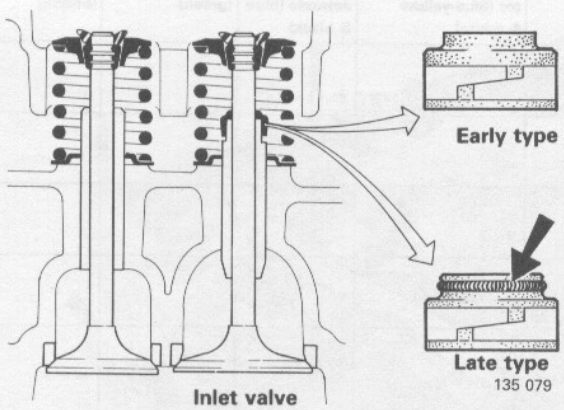
Place valves in cylinder head.
Remove measuring rings for D 20/D 24 (largest ring) from gauge 5222 and place gauge in cylinder head.
Slide measuring ring for B 17–B 23 over valve and press valve against seat with a finger.

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.



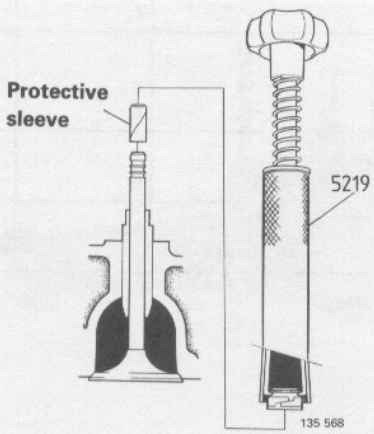


C47

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.

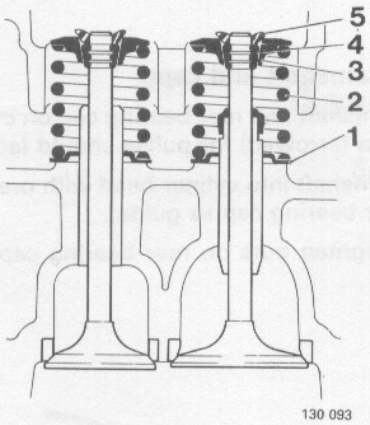
To install seal:

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)

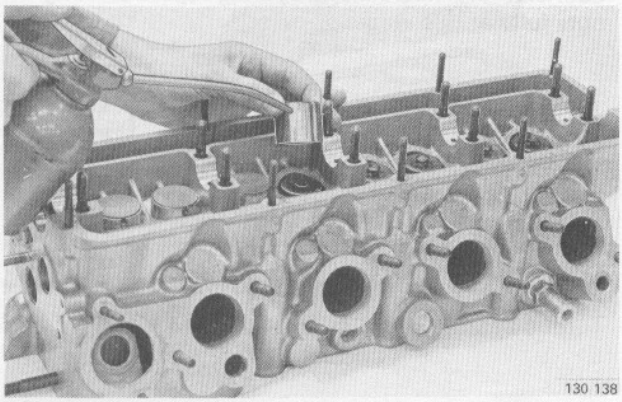
Important:

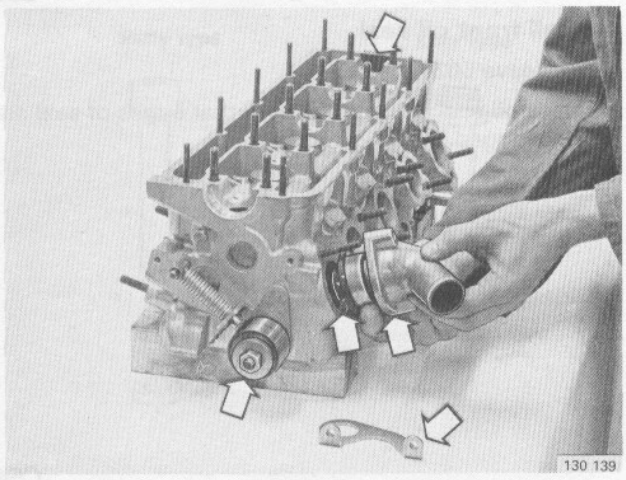
Two different types of springs and seats are in use, see C42.

C49

Lubricate and install tappets and adjusting shims

Place in same position as found.

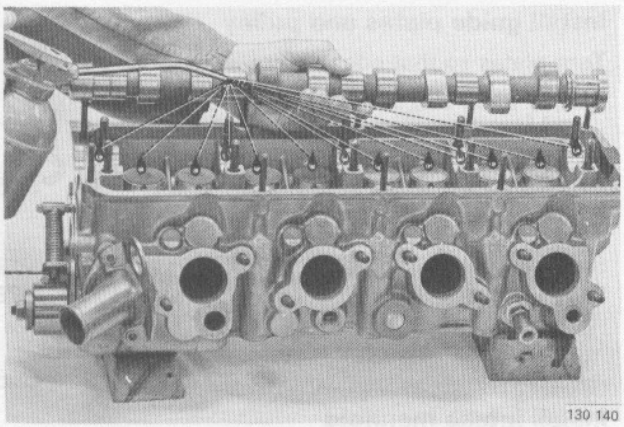

130 138


130 139

C50

Install:

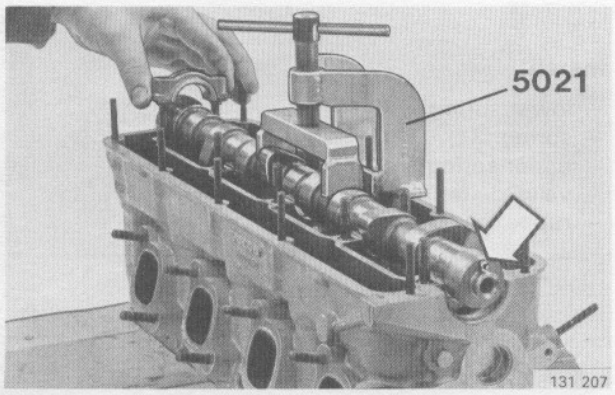
- belt tensioner
- thermostat + O-ring, thermostat housing and lifting eyelet
- half-moon shaped rubber seal at rear of cylinder head.


130 140

C51

Lubricate:

- bearing shells
- cams
- tappets and adjusting shims.



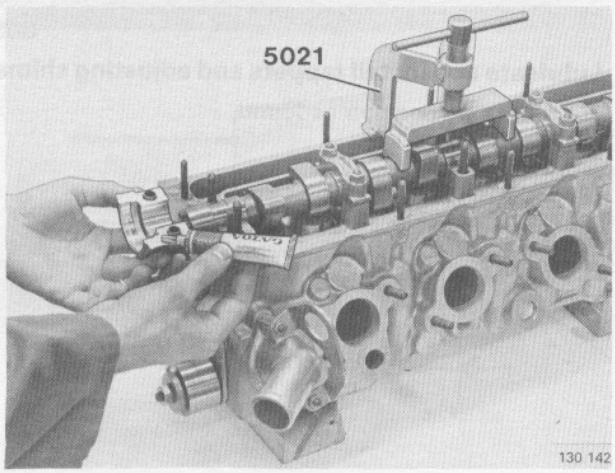
C52

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.



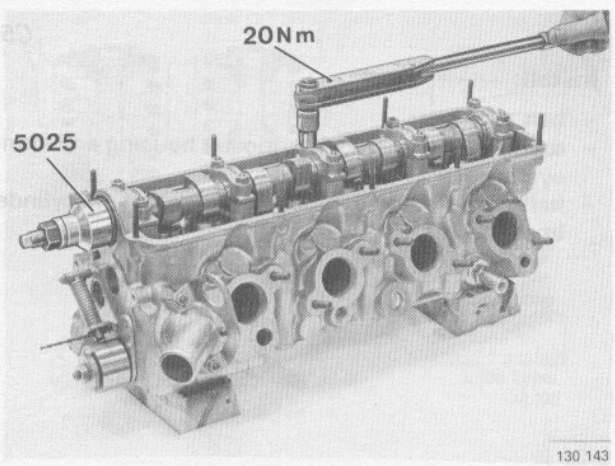
Smear front bearing cap sealing face with sealer P/N 1161 027–6.

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).

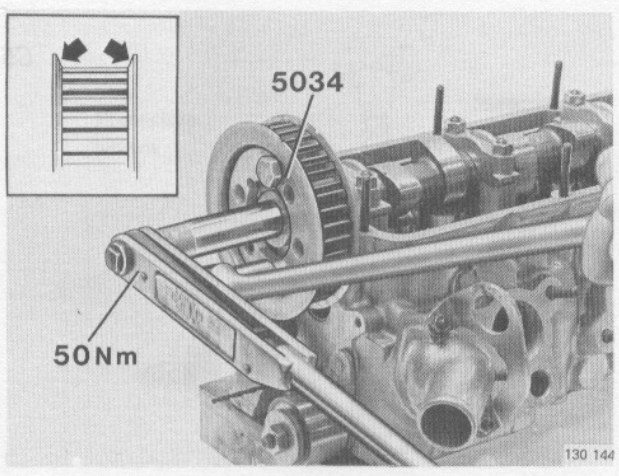


C53

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

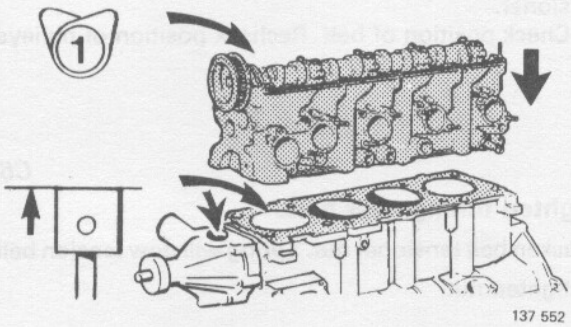
See operations ..... B 1–12
Page 28

C56

Install intake manifold

Assembling, engine

Special tools: 2810, 5035



137 552

C57

Check position of crankshaft and camshaft

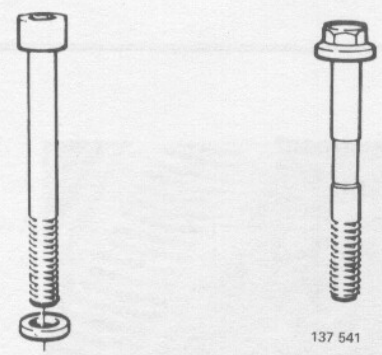
Check that:
- No. 1 piston at T.D.C.
- camshaft is at T.D.C. firing for No. 1 cylinder

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.

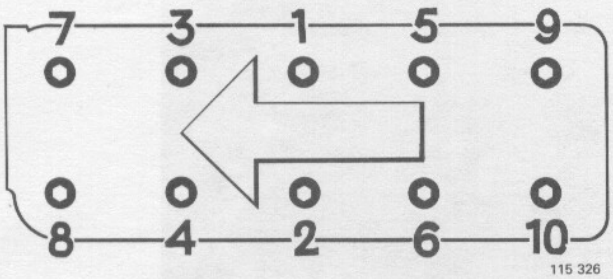
Do not interchange different types.

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.

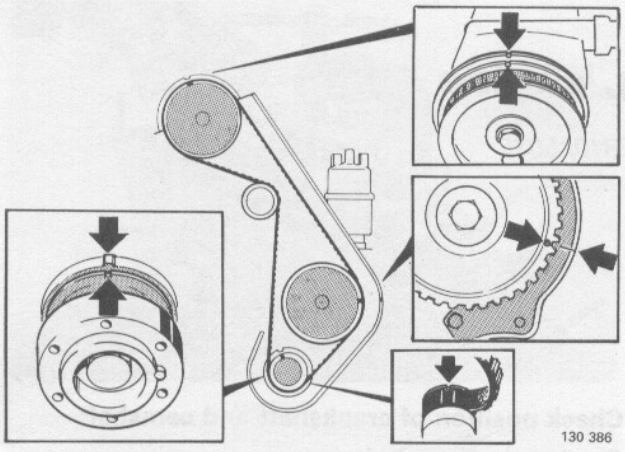
Oil bolts.

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°**

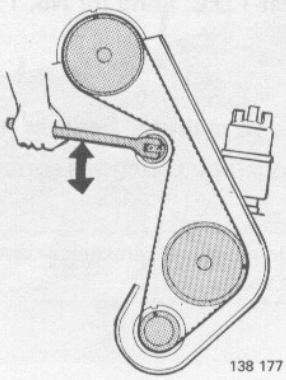

130 386

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

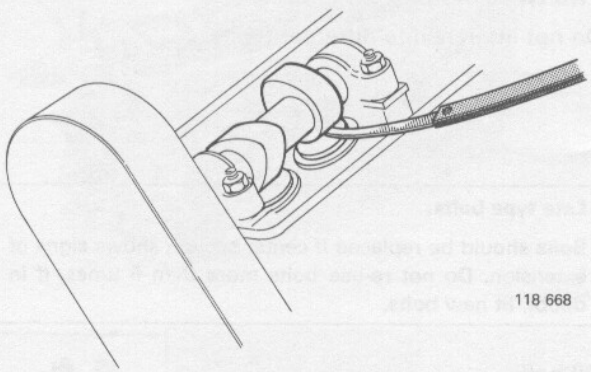
Slacken belt tensioner nut. Spring will now tension belt.

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.

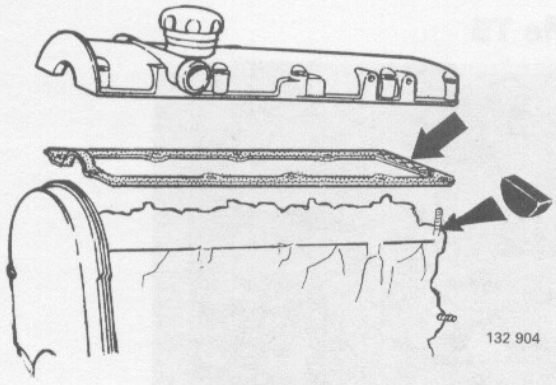

118 668

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:

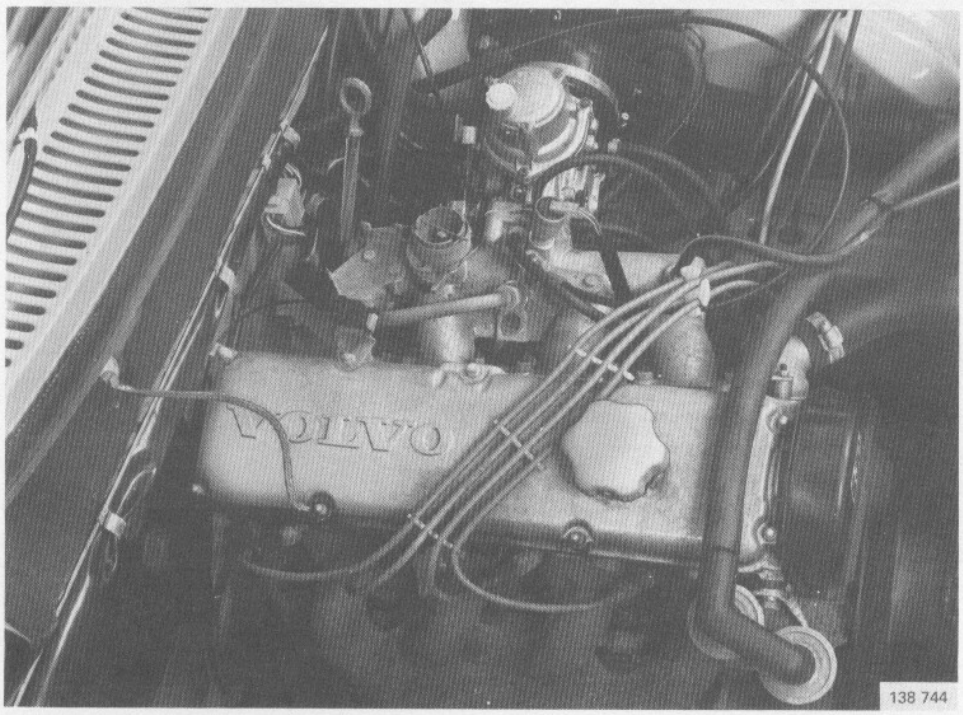
- valve cover
- ground cable
- electrical connection contact for timing advance
- nuts for valve cover, and tighten securely

C67

Install all other parts to cylinder head and intake manifold

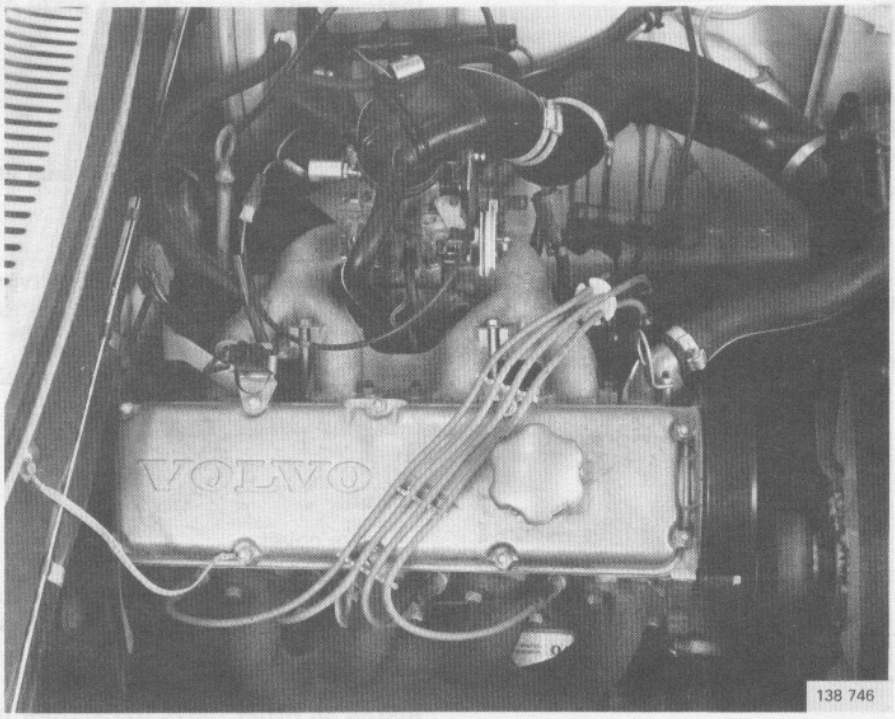
A engines see below
K engines see ..... page 52
E and F engines see ..... page 52
ET and FT engines see ..... page 53
F engines with LH-Jetronic fuel systems see ... page 53

A engines

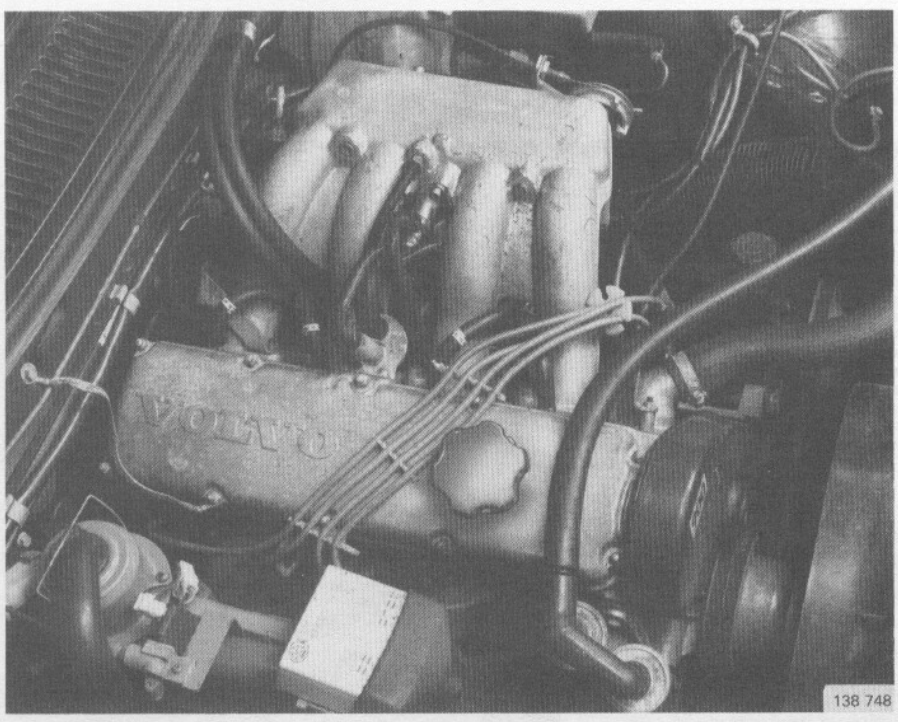


138 744

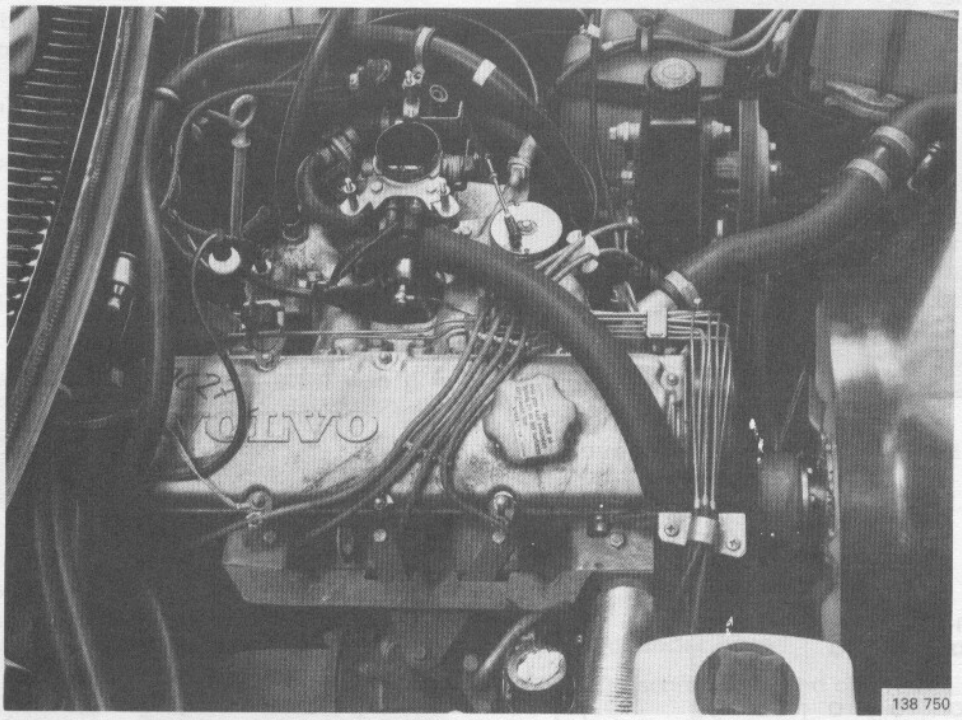
K engines



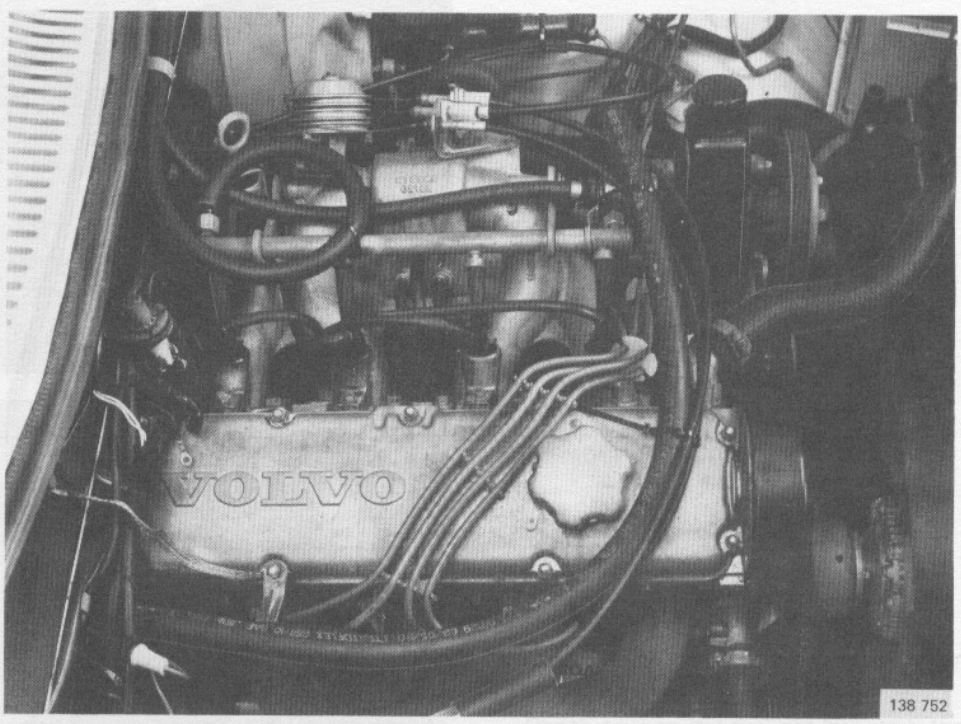
E and F engines

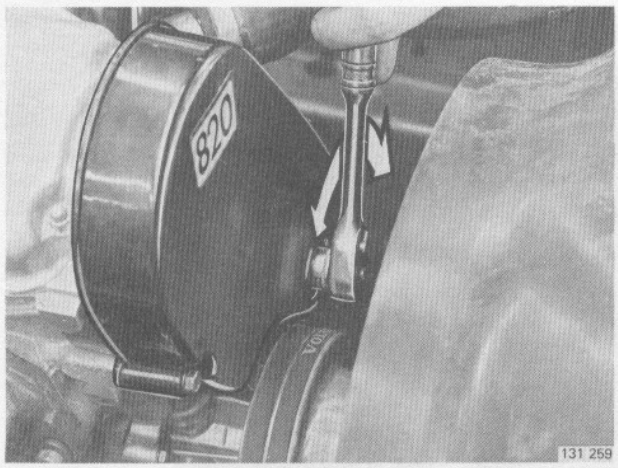


ET and FT engines



F engines with LH-Jetronic fuel systems





C68

Warm up engine

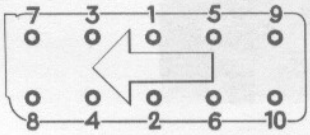
- Check/adjust ignition, idle speed and CO content.
- Check cooling system, and top up coolant if necessary.
- Adjust drive belt tension. Remove rubber plug in gear case.
  Slacken belt tensioner nut. Spring now extends belt.
  Retighten nut.

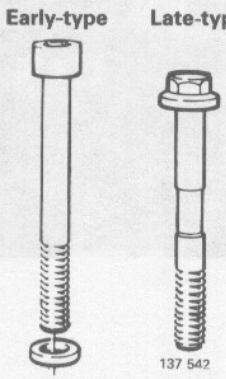
C69

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.





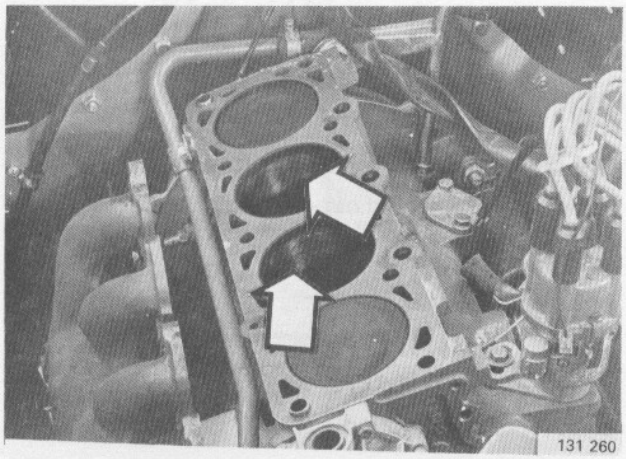
Retorquing cylinder head bolts

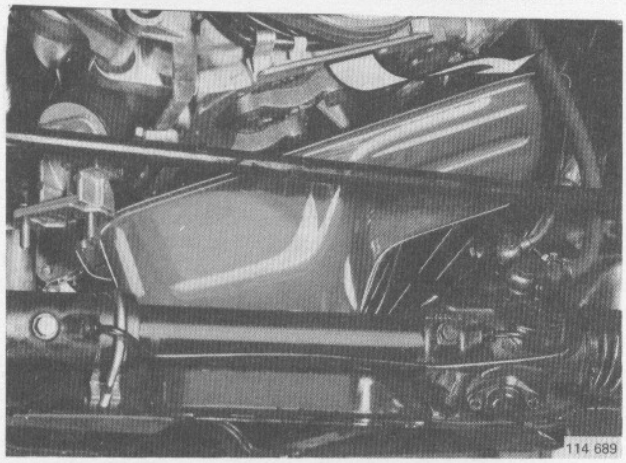
Applies only to early type bolts

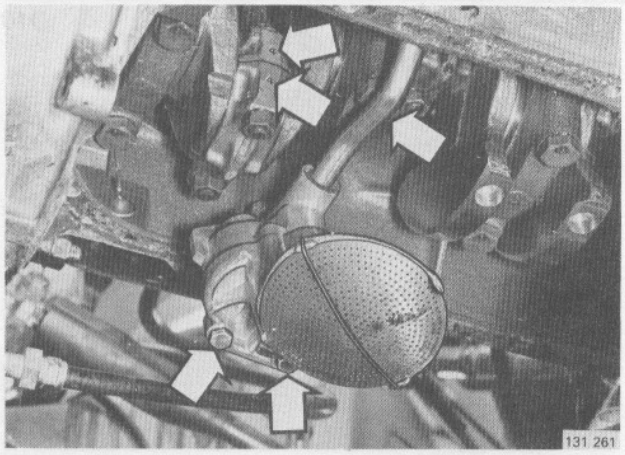
1. Warm-up engine. Leave to cool for 30 minutes.
2. Slacken bolt 1 approx. 30°.
   Retorque to **110 Nm** (80 ft lbs).
3. Repeat for remaining bolts in sequence shown in illustration.

D. Piston rings, replacement

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


131 260


114 689


131 261

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

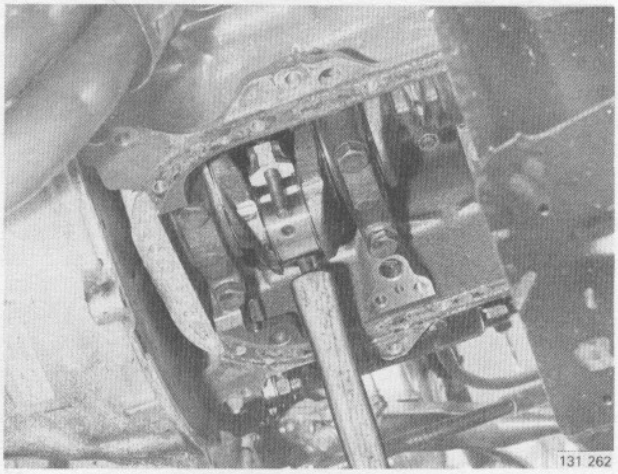
Remove oil pump and pipe

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

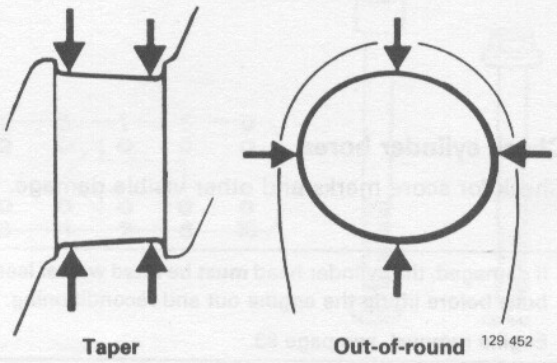
Remove connecting rod bearings and bearing shells

Check shells for score marks and other visible damage.

Do not mix up parts.

D7

Push out pistons with wooden handle of a hammer


Taper Out-of-round 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)

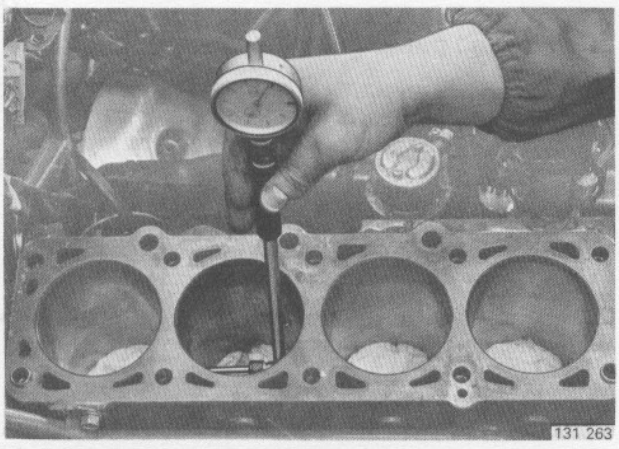
If journals are damaged or taper/out-of-round exceeds specifications, the engine must be lifted out and crankshaft replaced/reground.

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

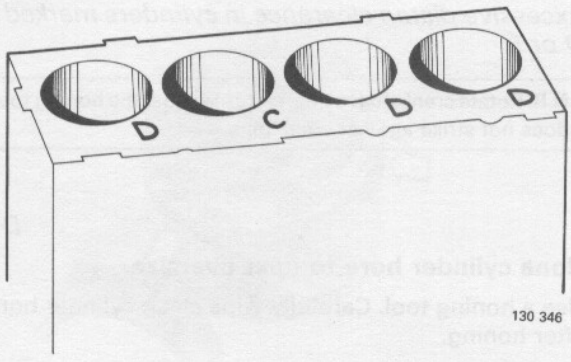
Measure cylinder bores

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

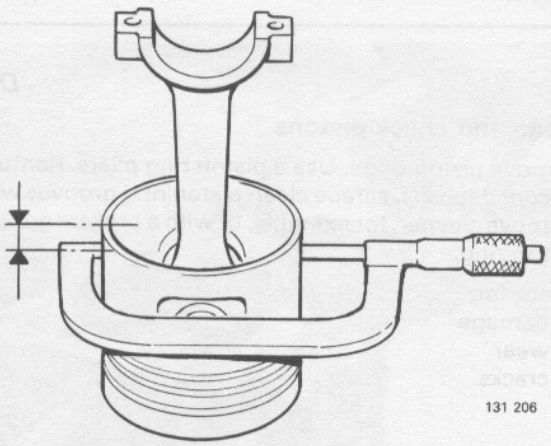
Measure for **maximum wear** in lateral direction of engine, just below top dead centre.

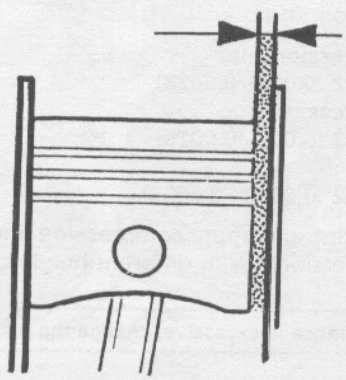
Measure for **minimum wear** in longitudinal direction of engine at bottom dead centre.

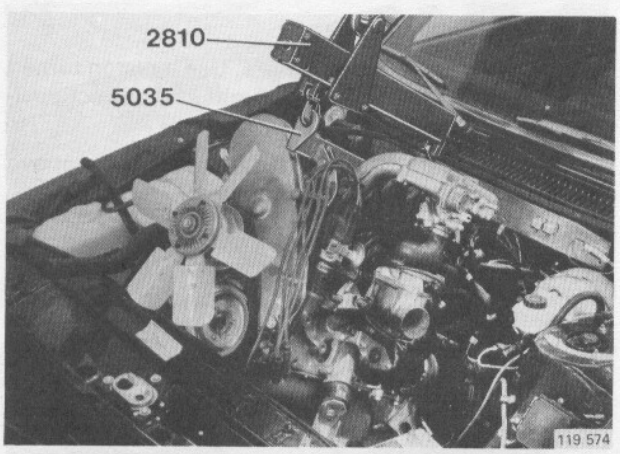
D11



130 346


131 206


131 370



119 574

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)

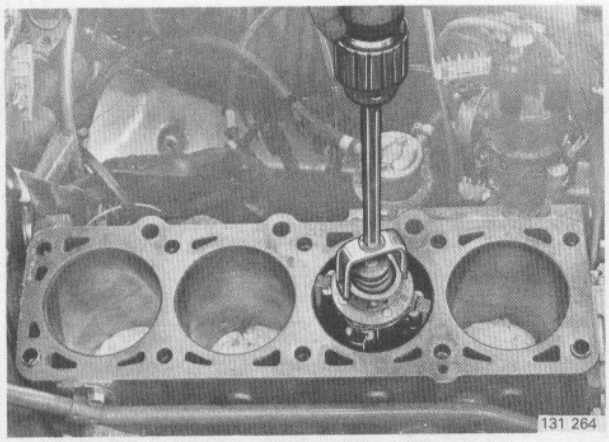
Too large piston clearance in cylinder marked G or oversize:

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.


131 264

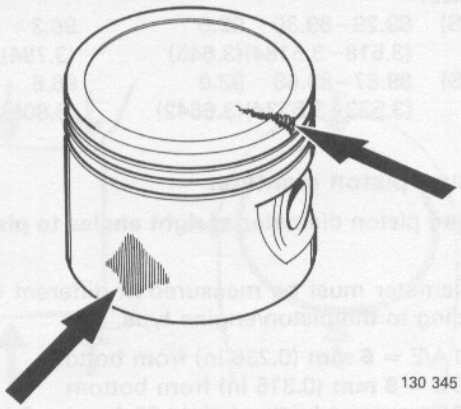
Excessive piston clearance in cylinders marked C, D or E

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.

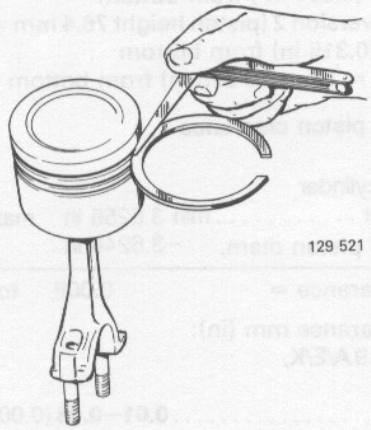

130 345

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.


129 521

D17

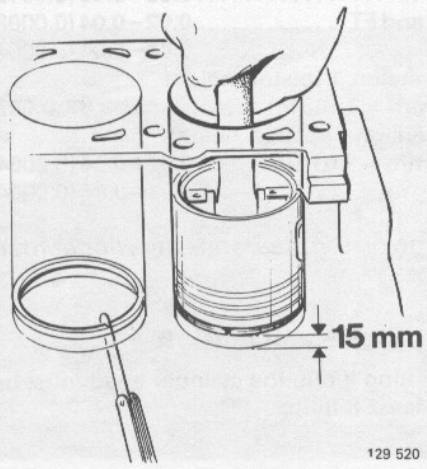
Check axial clearance of piston rings

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



129 520

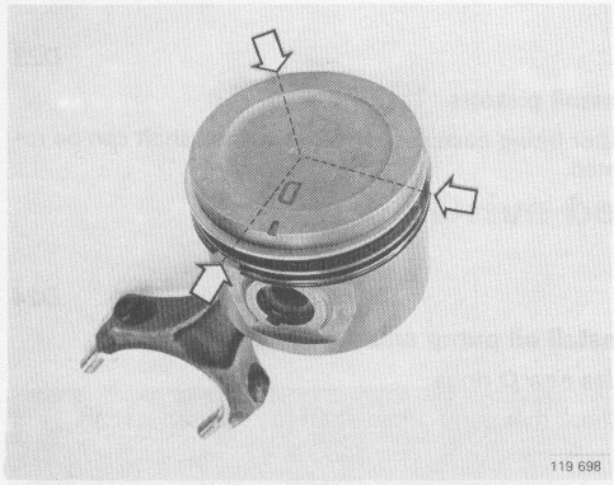
D18

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)

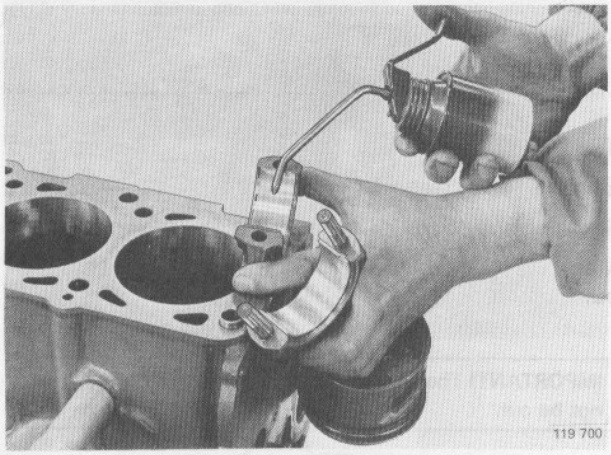

119 698

D19

Install new piston rings

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

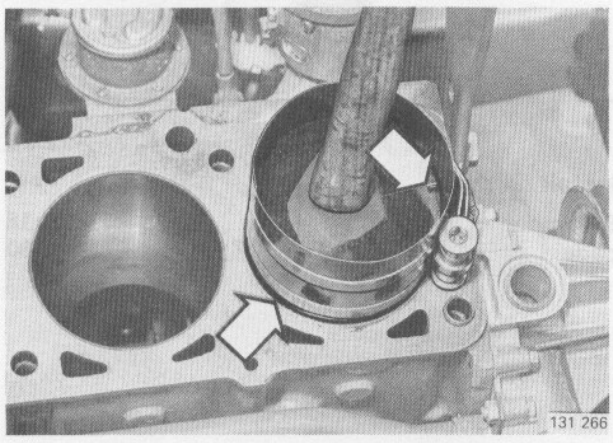
119 697


119 700

D20

Place bearing shells in connecting rods and in caps

Oil cylinder bores, pistons and bearing shells.


131 266

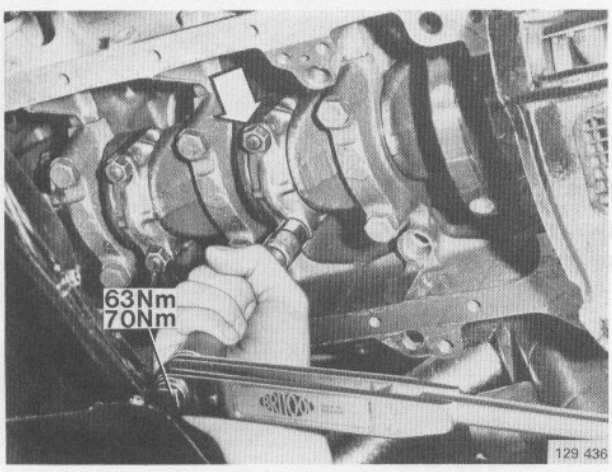
D21

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

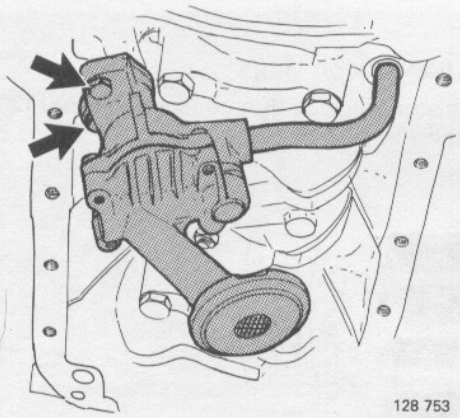
D22

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

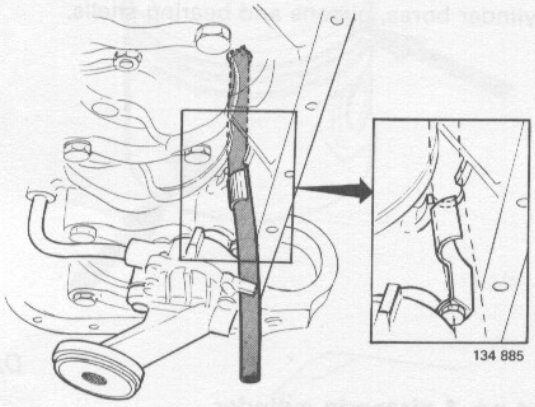
After fitting each cap, check that crankshaft can be rotated.

D24

Install oil pump and pressure pipe

Use new O rings.

Check that pump input shaft fits into drive shaft.



134 885

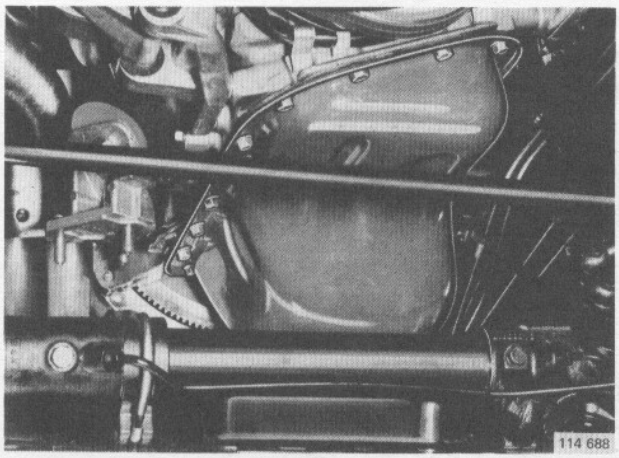
1981– *D25*

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.

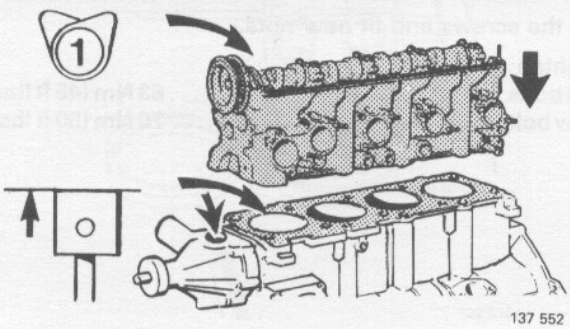


114 688

D26

Install oil sump

By method ..... K 11–18
page 80



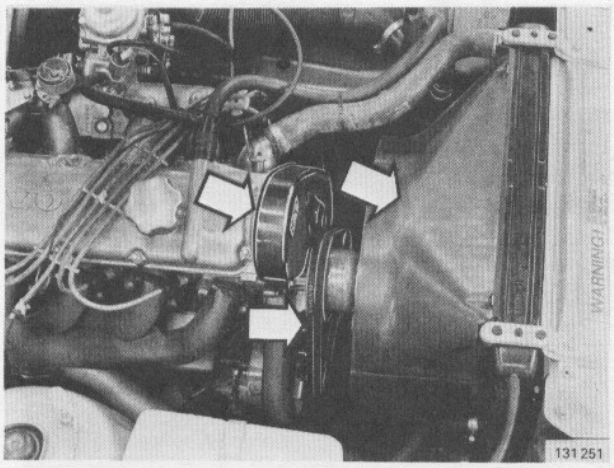
137 552

D27

Install cylinder head

By method ..... C 57–69
page 49

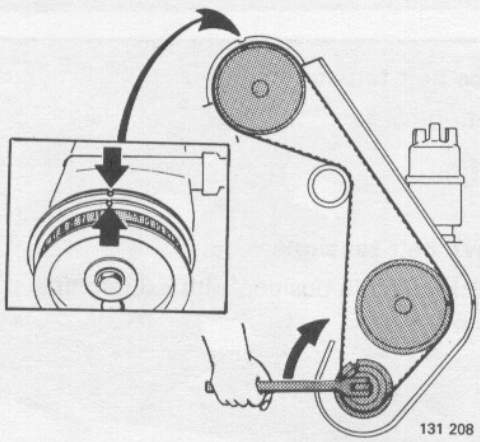
E. Drive belt, replacement



E1

Remove:

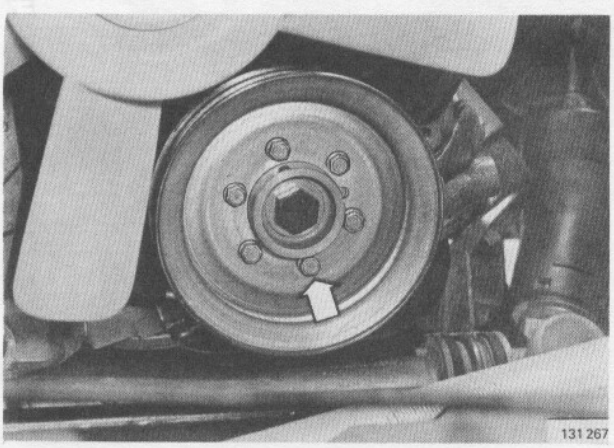
- battery ground connection
- fan cover
- all drive belts from crankshaft pulley
- gear case



E2

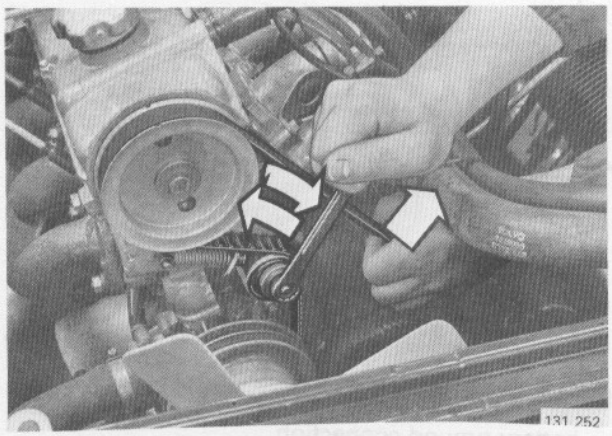
Basic engine adjustment

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

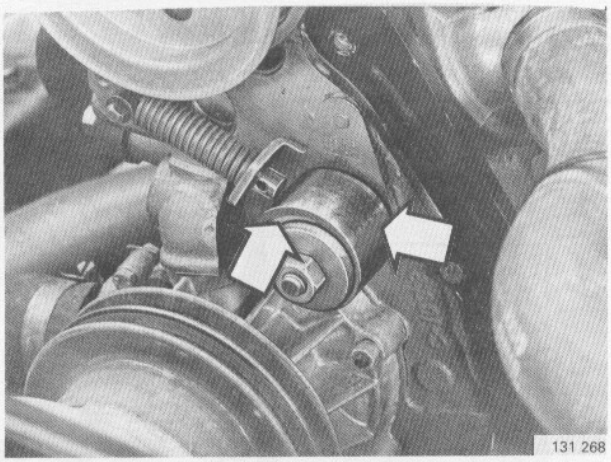
Slacken belt tensioner nut approx. 1 turn.

Pull out belt so that belt tensioner spring is compressed.

Retighten nut.

Remove belt.

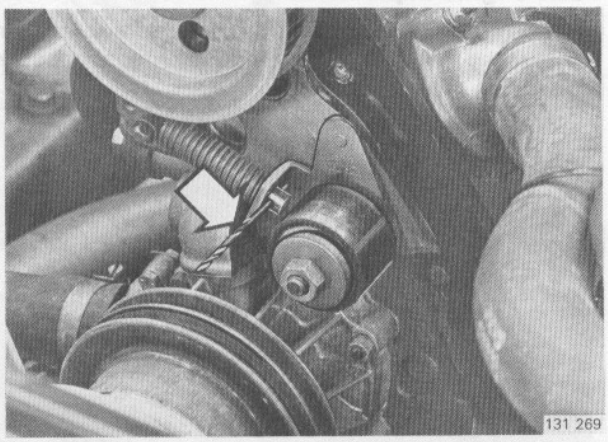
IMPORTANT! Do not rotate crankshaft or camshaft as pistons may strike against valves and cause damage.


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

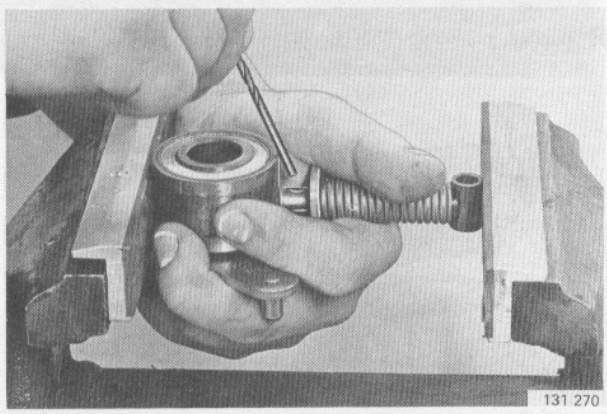
Replace belt tensioner

Operations E 6–7

E6

Remove belt tensioner

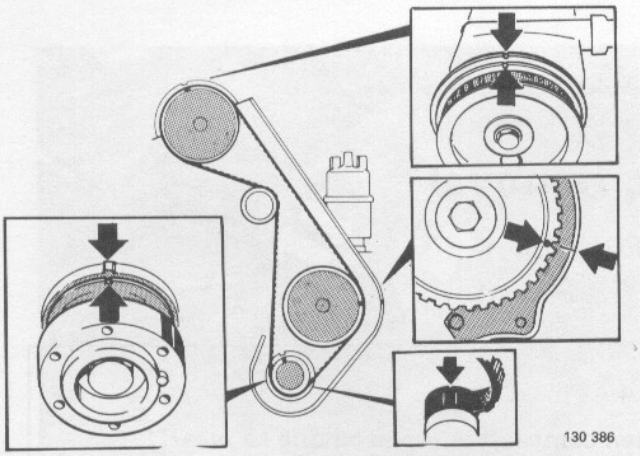
First lock spring in position with a 3 mm drill.


131 270

E7

Assemble and secure new belt tensioner

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

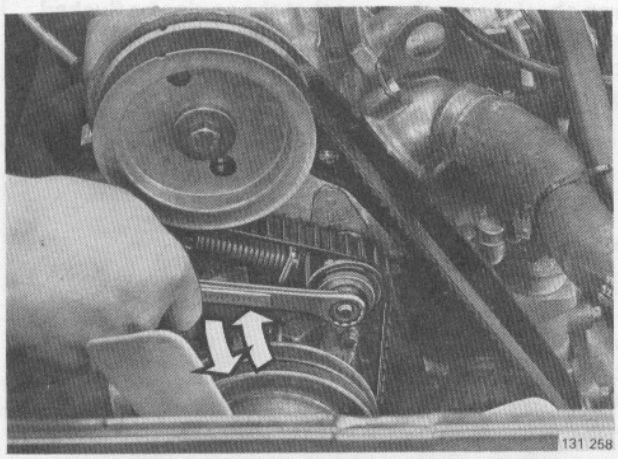

130 386

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

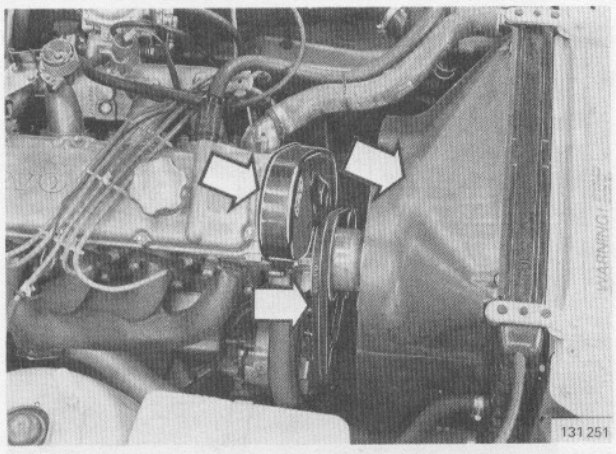
E9

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

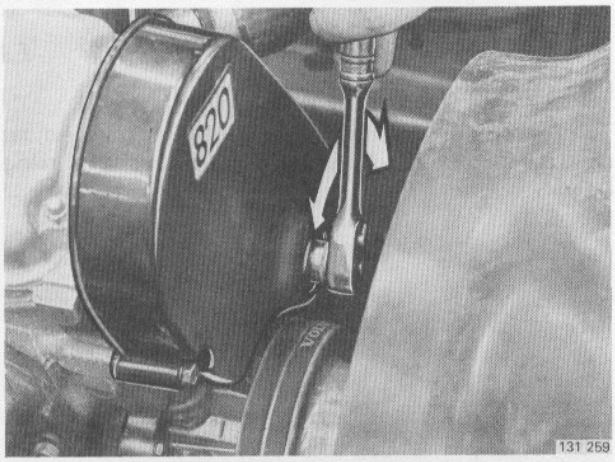
E11

Warm-up engine and check/adjust:

- ignition
- CO content
- idling.

E12

Switch off engine



131 259

E13

Tension drive belt

Remove rubber plug in gear case.

Slacken belt tensioner nut. Spring now extends belt.

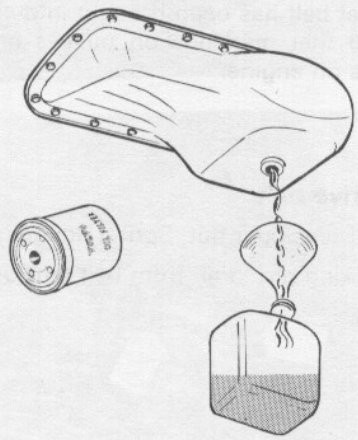
Retighten nut.

Fit rubber plug.

Recheck drive belts after 600 miles (1000 km).

F. Camshaft, removal

Special tools: 5021, 5034


137 504

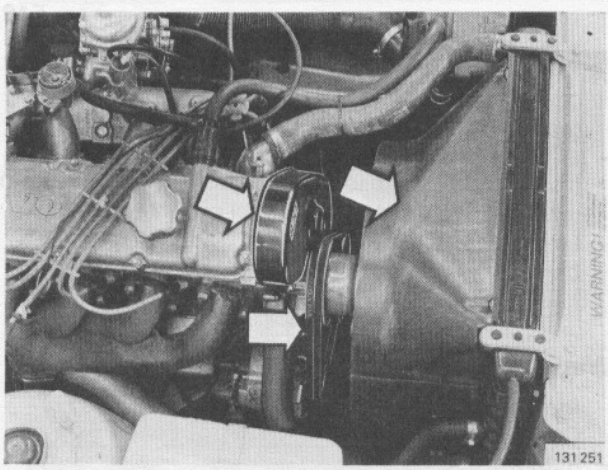
When camshaft is replaced due to wear

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

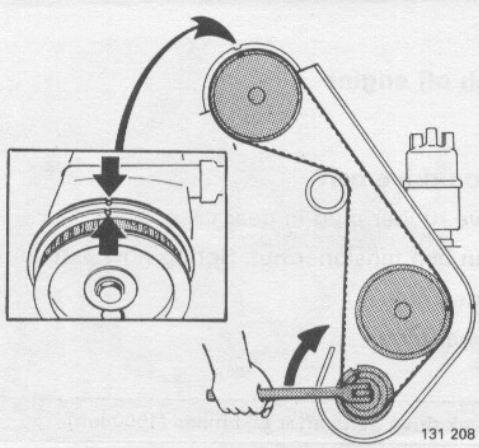
Change engine oil and oil filter.
Warm up engine for approx. 10 minutes.
Drain oil and remove oil filter.
Replace camshaft.
Install new oil filter and pour in oil.


131 251

F2

Remove:

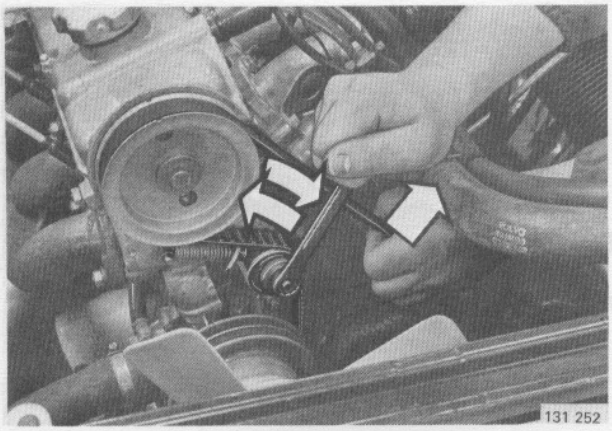
- battery ground connection
- fan cover
- fan belts
- gear case


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.

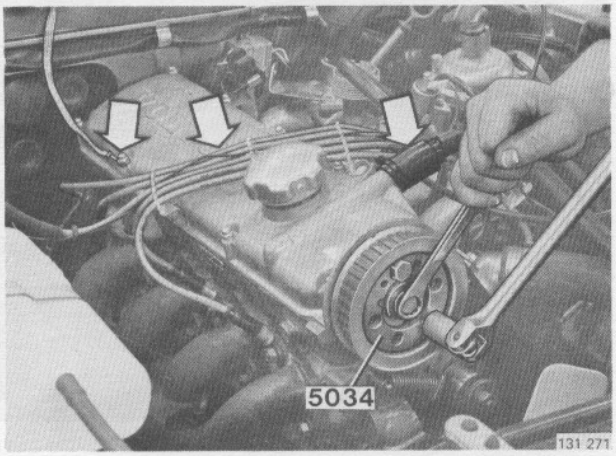


F4

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.



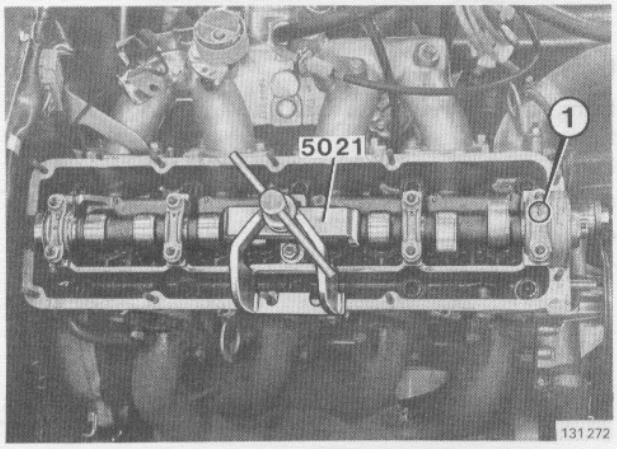
F5

Remove pulley from camshaft

Use dolly 5034.

F6

Remove valve cover



F7

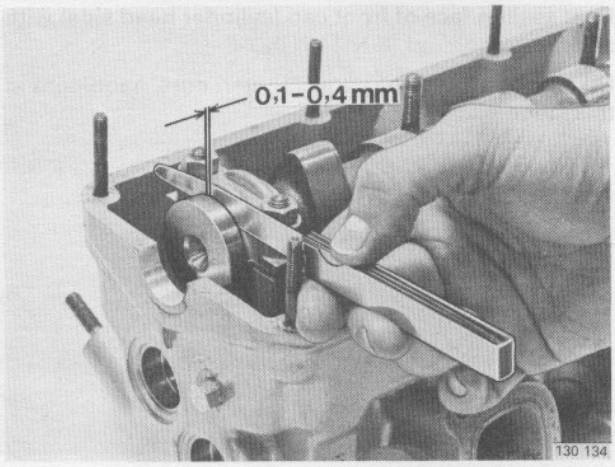
Check marking on camshaft caps. Remove centre cap

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.



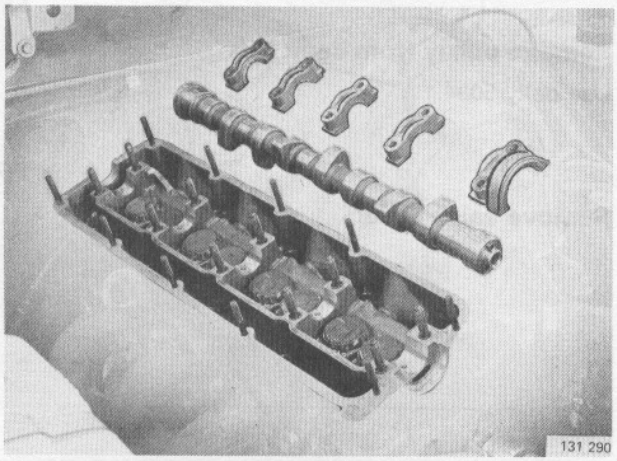
F9

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

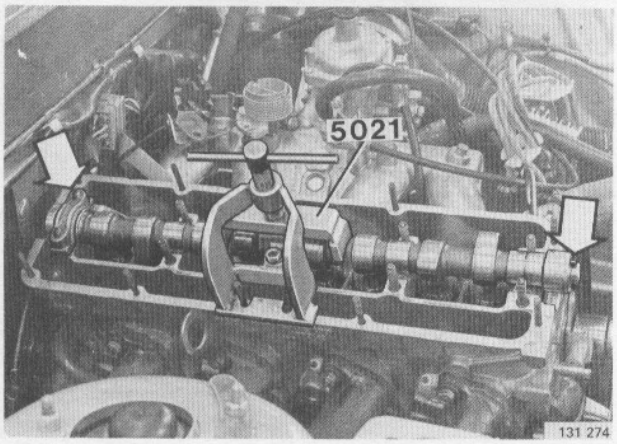
Special tools: 5021, 5026, 5034



F10

Oil:

- bearing shells
- cams
- adjustment washers on tappets.



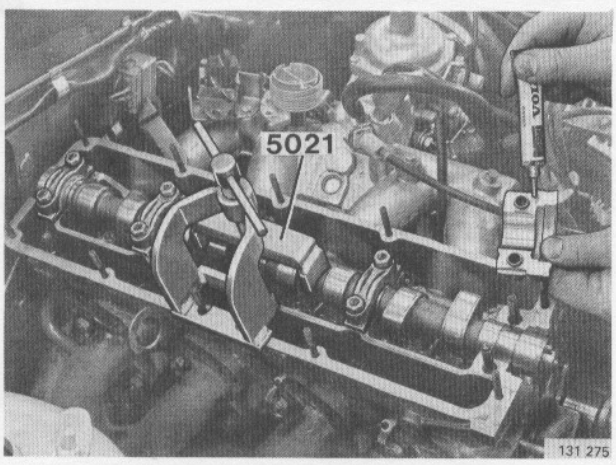
F11

Install camshaft and caps

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

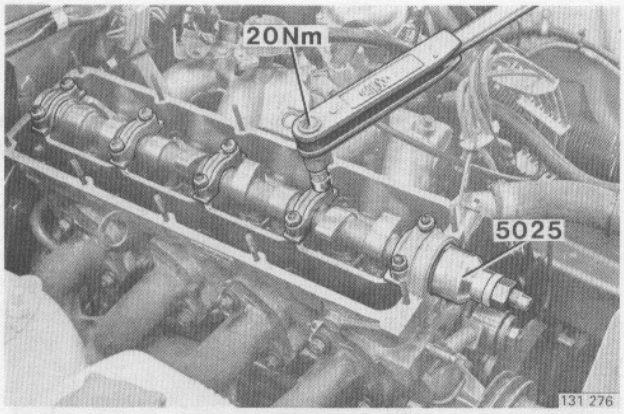
Press down camshaft with pressing tool **5021**. Use rear cap as a guide.

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.

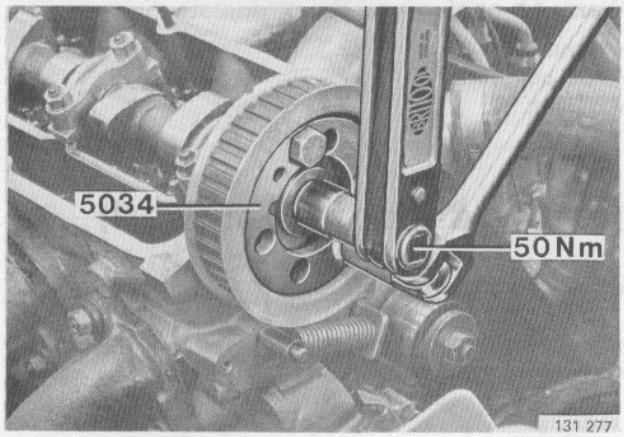
Tighten nuts **20 Nm** (14 ft lbs).

F12

Install front sealing ring

Use sleeve **5025**.

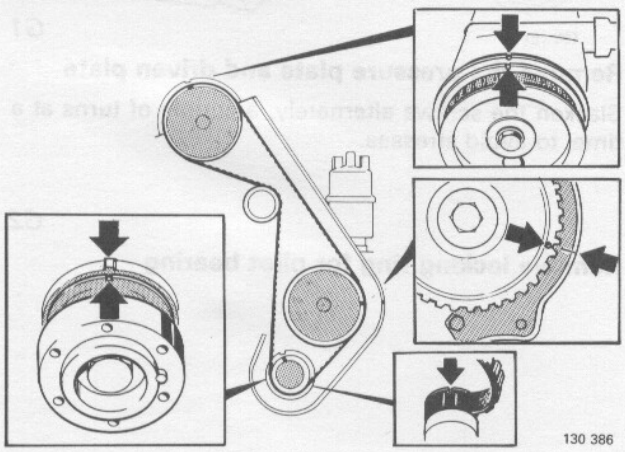
Grease the seal and shaft. Check that rubber lip on seal is not damaged.



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**.

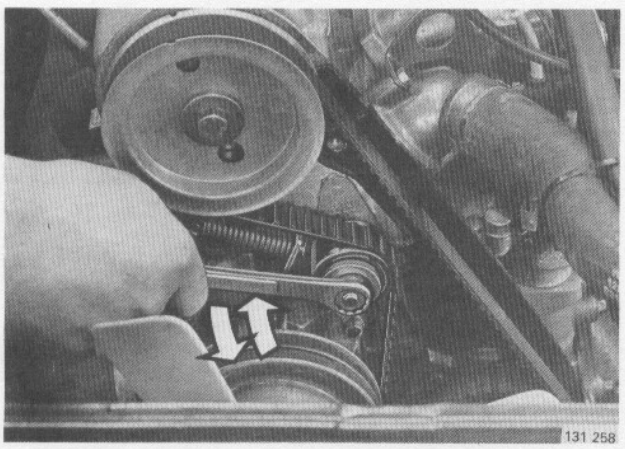


F14

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.

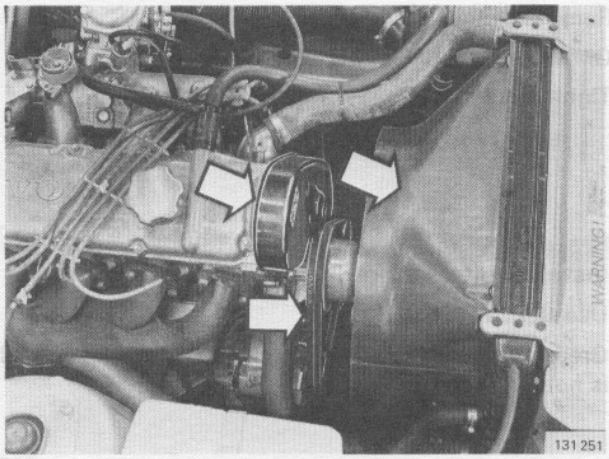


F15

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.

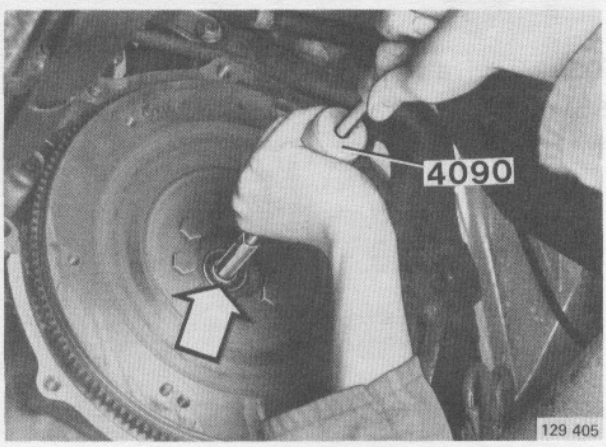
G1

Remove the pressure plate and driven plate

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

G2

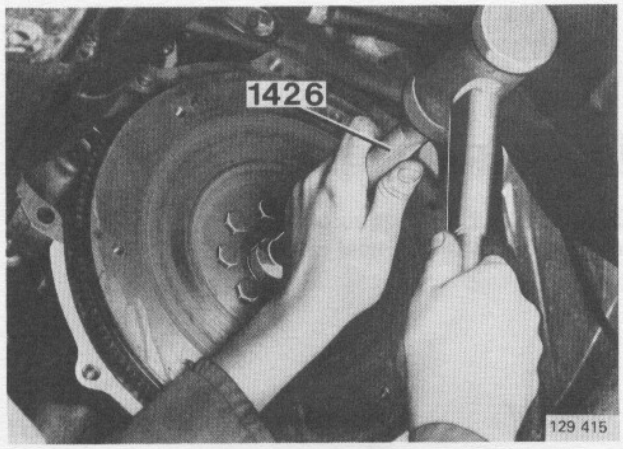
Remove locking ring for pilot bearing



G3

Pull bearing out of crankshaft

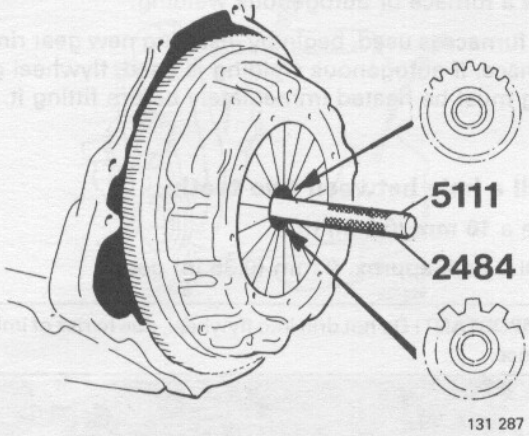
Use extractor **4090.**



G4

Install:

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



G5

Install driven plate and pressure plate

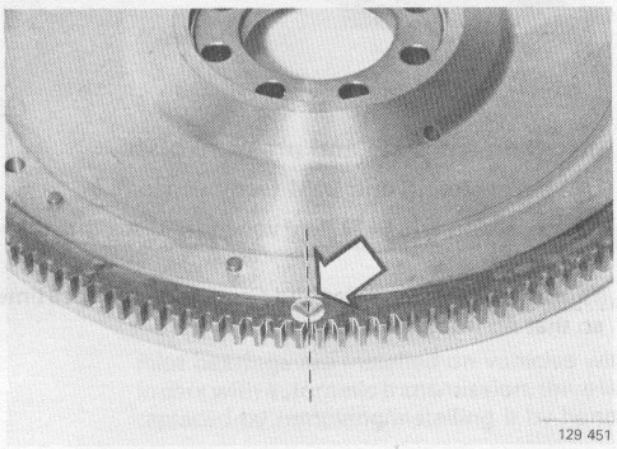
Use the centering drift **2484** (early version).

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.

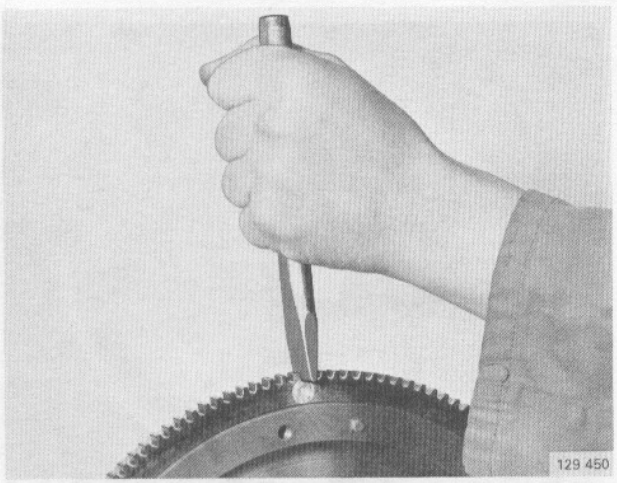
H2

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

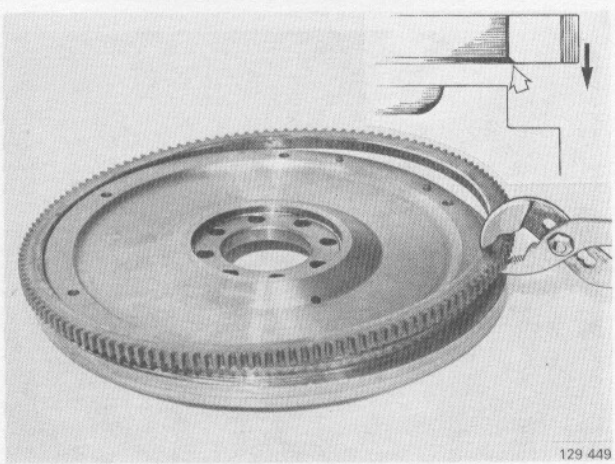
Clamp flywheel in a vice with soft jaws.

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.

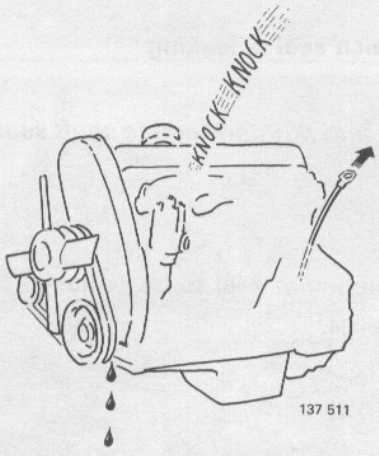
If necessary, knock gear ring down to bottom. Use a brass drift.

Allow it to cool.

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

Special tools: 5024, 5025, 5034

11

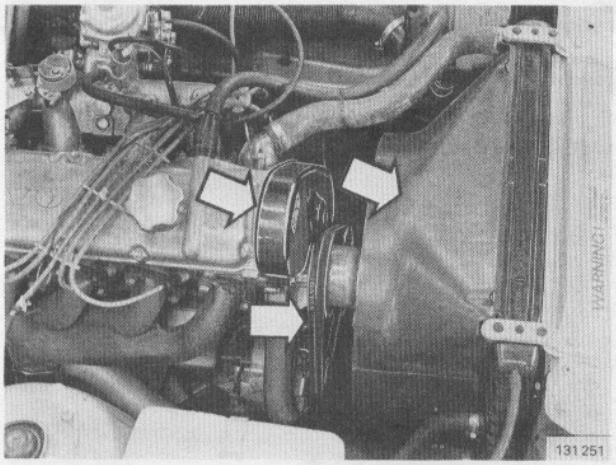


Check that flame guard is not blocked

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.

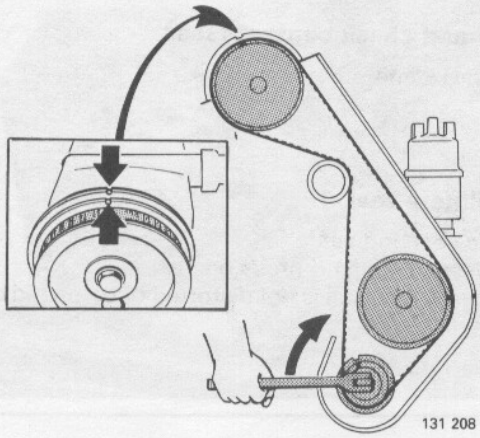
12



Remove:

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

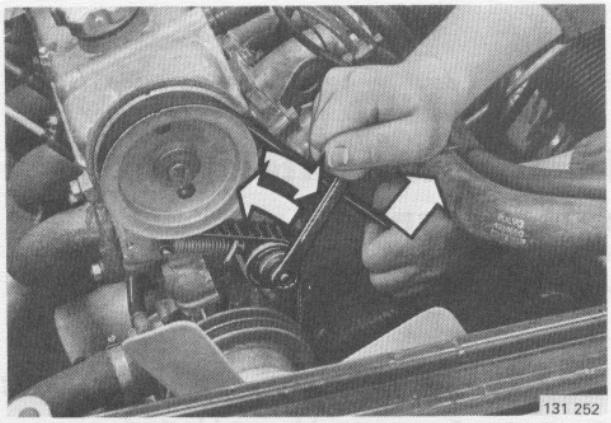
13



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

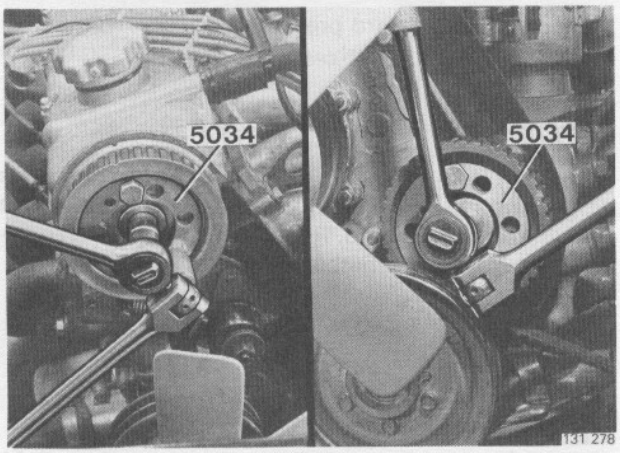
Slacken belt tensioner nut approx. 1 turn.
Pull out belt so that tensioner spring is compressed.
Tighten belt tensioner nut.
Remove belt.

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

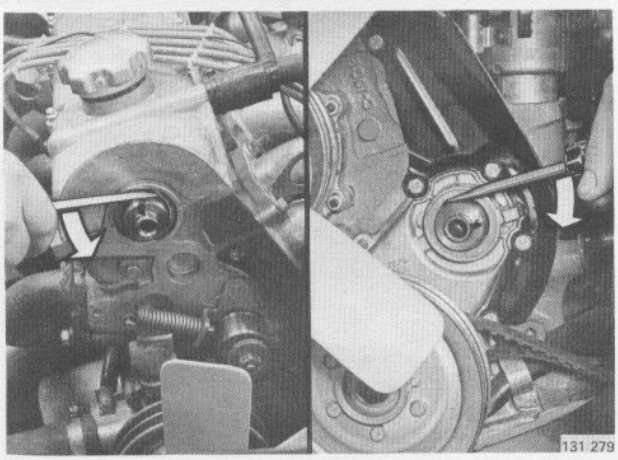
Camshaft and/or intermediate shaft seal, replacement



16

Remove pulley at seal to be replaced

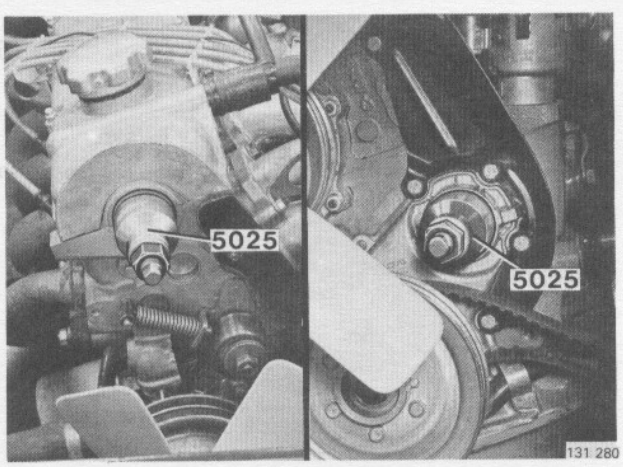
Use dolly **5034**.



17

Remove seal to be replaced

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



18

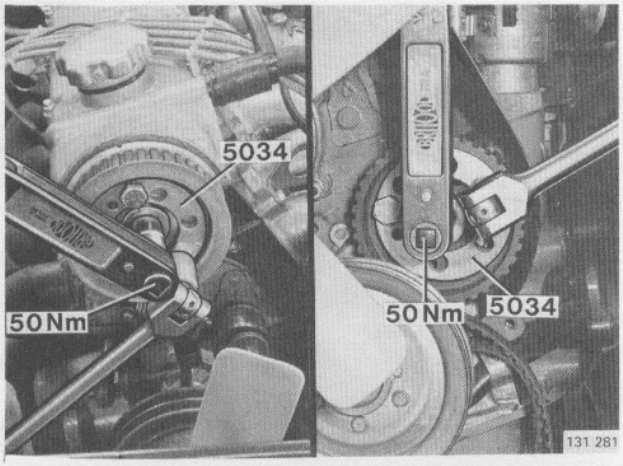
Clean and check contact faces

(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.



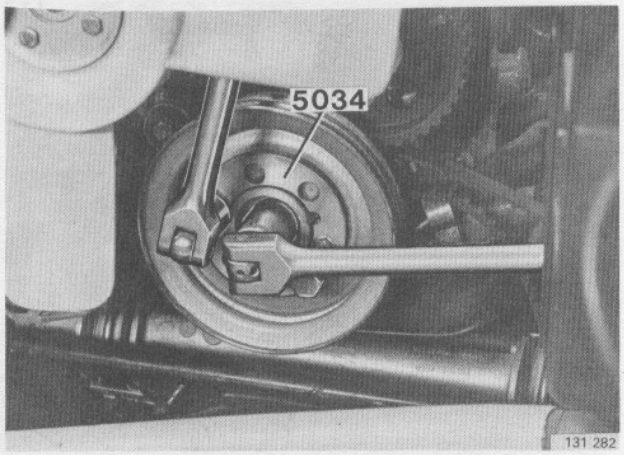
I 10

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

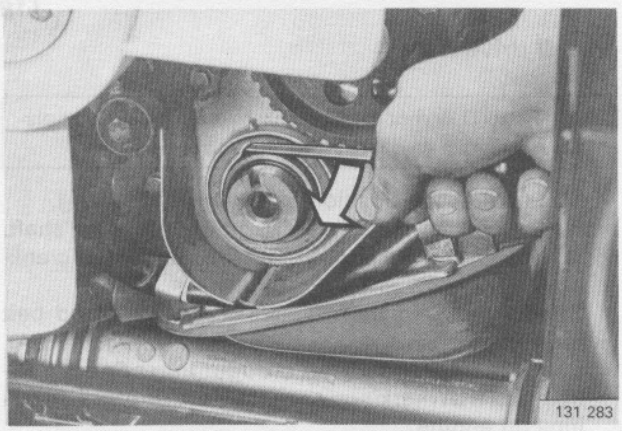
Turn intermediate shaft wheel with marking (a cavity) outwards. Tighten to **50 Nm** (36 ft lbs). Use dolly **5034**.



Crankshaft seal, replacement *I 12*

Remove:

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



I 13

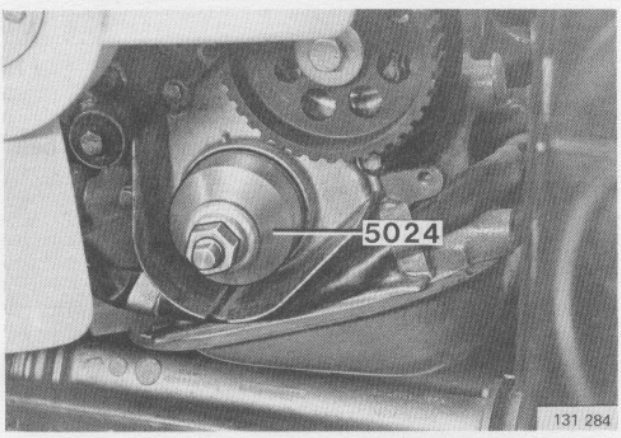
Remove seal

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.

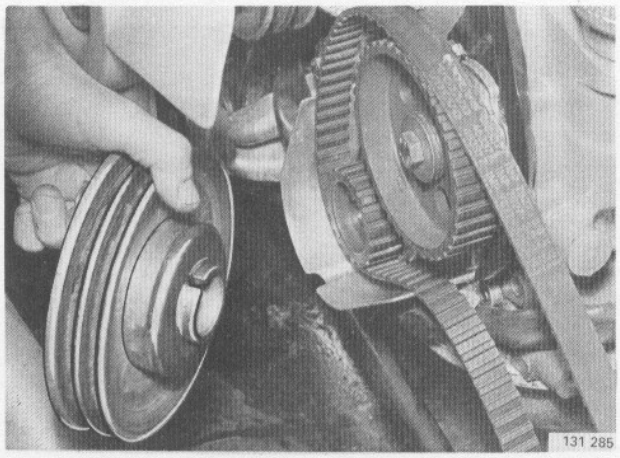


I 15

Install new seal

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

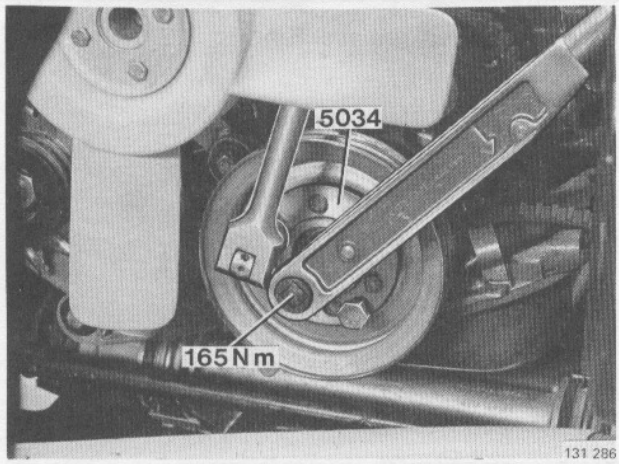
N.B. Check that seal is not distorted or damaged during fitting.



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

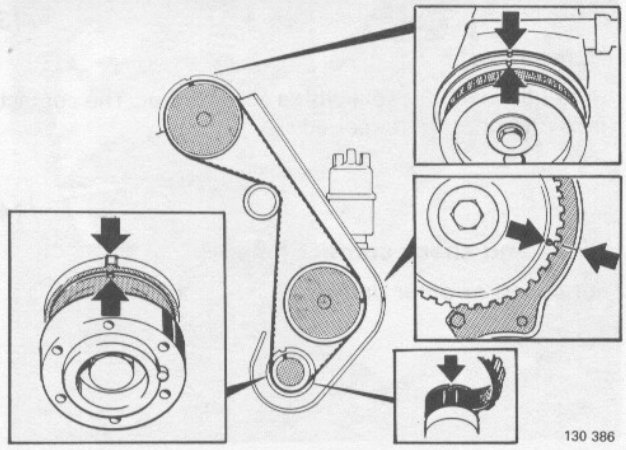


I 17

Torque crankshaft centre screw

Use dolly **5034.**

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

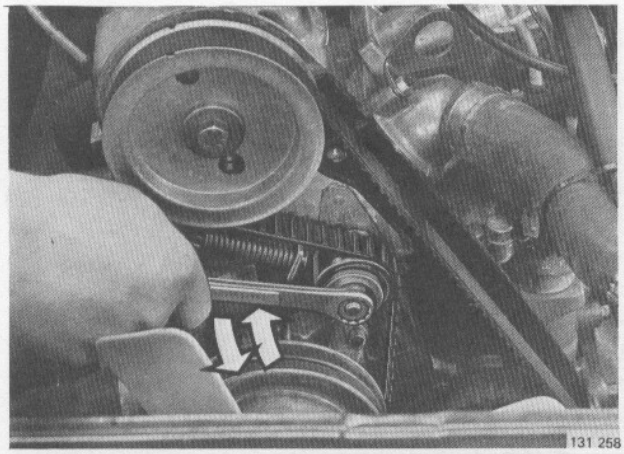


I 18

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.

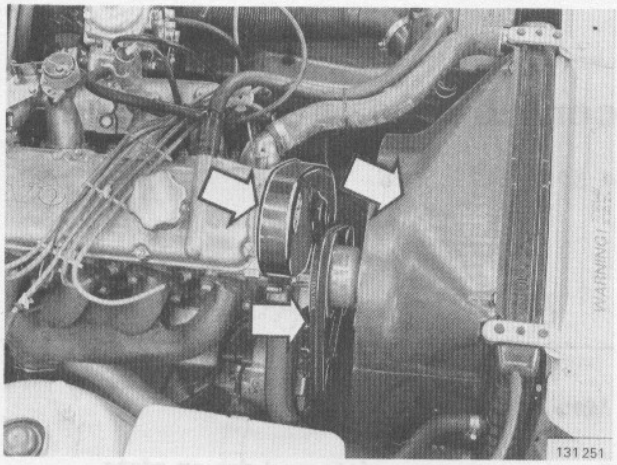


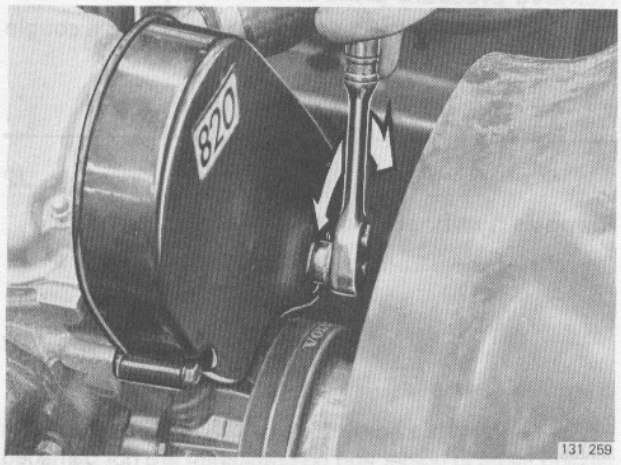
I 19

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

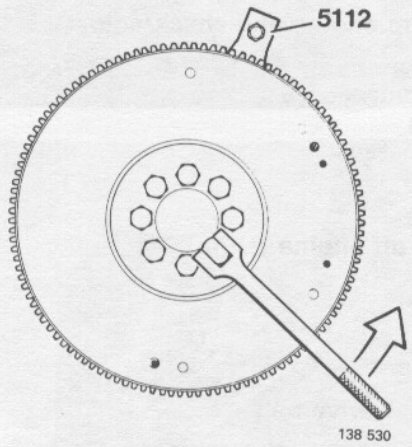
123

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

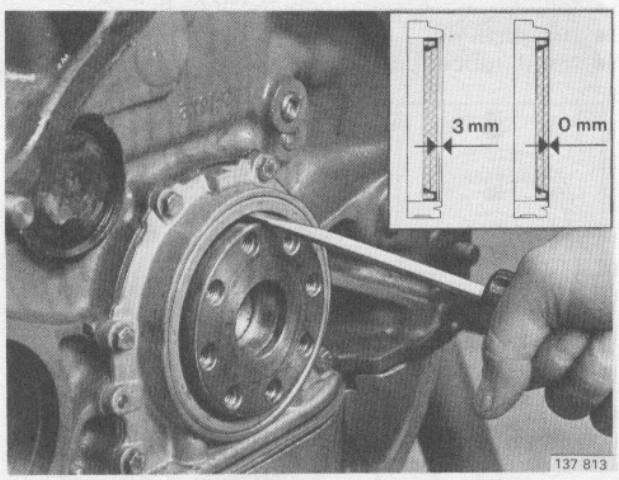
Remove pressure plate and driven plate

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**.

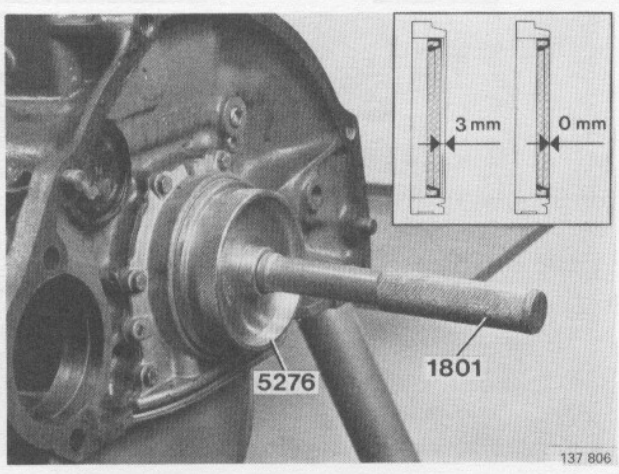


J3

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.

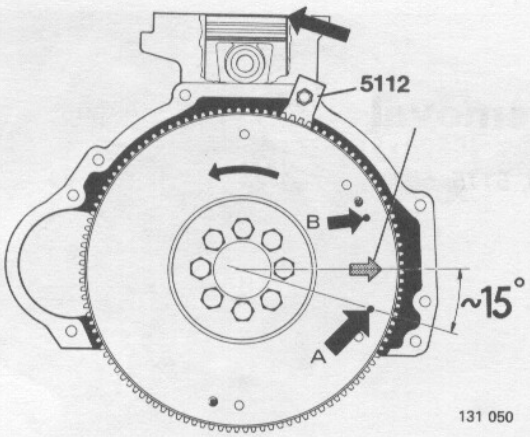
If there is a wearing surface on crankshaft, press seal further into flange than before.

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

J6

Install flywheel (manual) or carrier plate (automatic)

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

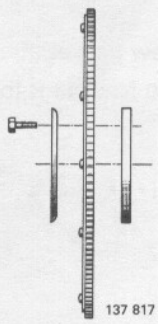
Place flywheel/carrier plate on crankshaft so that pin A is 15° below horizontal position, see diagram.

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

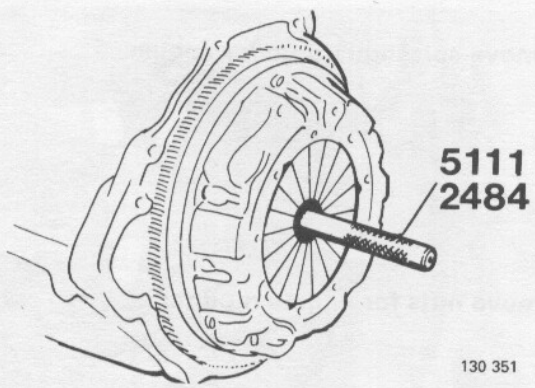
An etched arrow is also provided on flywheels of later version. The arrow must point straight to right.

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.


137 817

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).

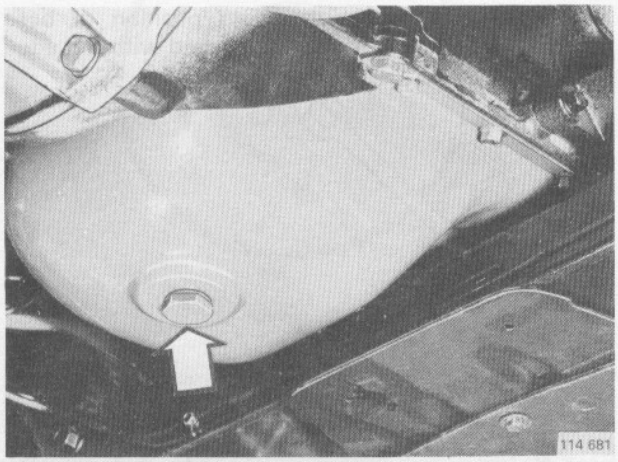
Tighten screws crosswise and a couple of turns at a time, so that no fractures occur.

J8

Remove toothed sector 5112

K. Oil sump, removal

Special tools: 5006, 5033, 5115, 5871

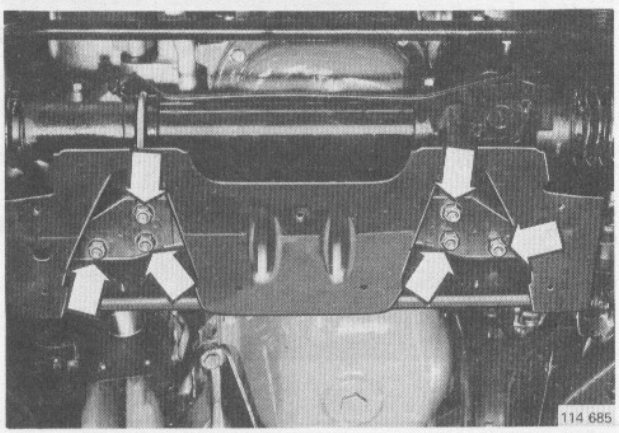


K1

Drain engine oil

Install plug and a new gasket after draining.

Tightening torque 60 Nm (43 ft lbs).

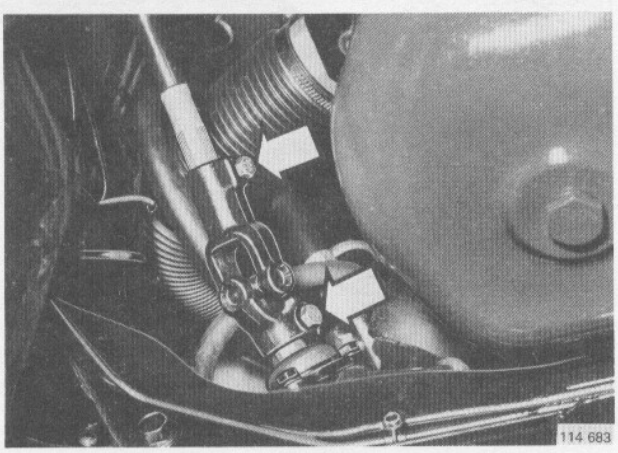


K2

Remove splashguard under engine

K3

Remove nuts for engine mounts

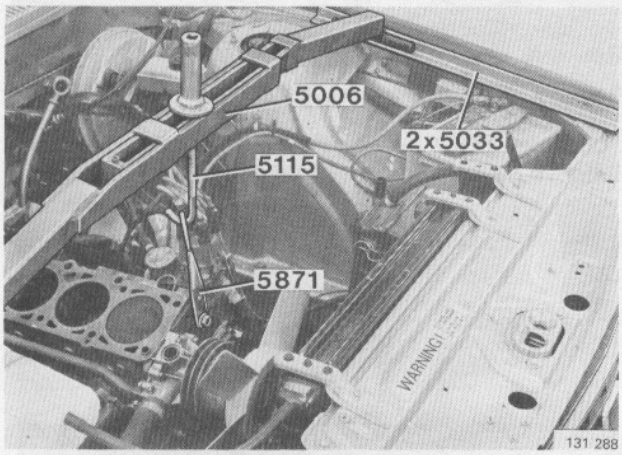


K4

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.

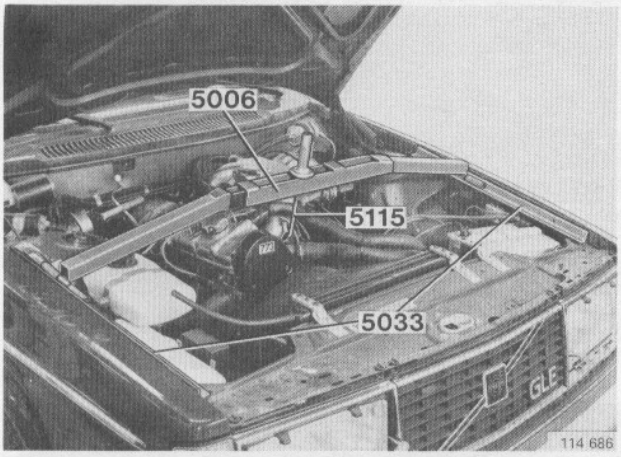


Engine without cylinder head

K5

Lift engine slightly

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

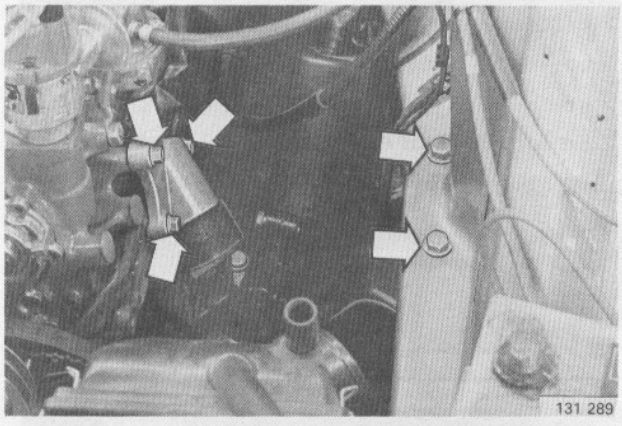


Engine with cylinder head

K6

Lift engine slightly

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



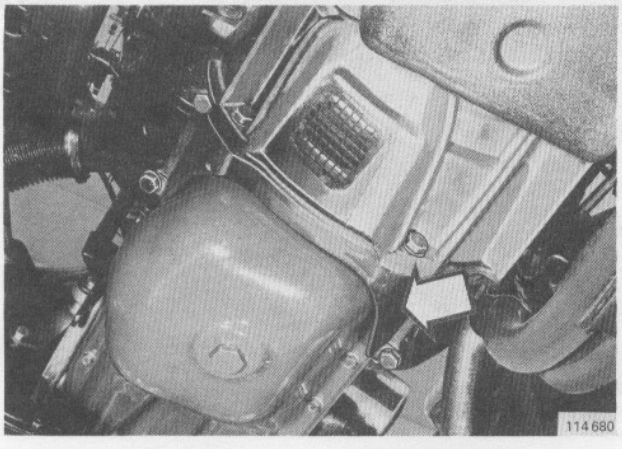
K7

Remove left engine mount

K8

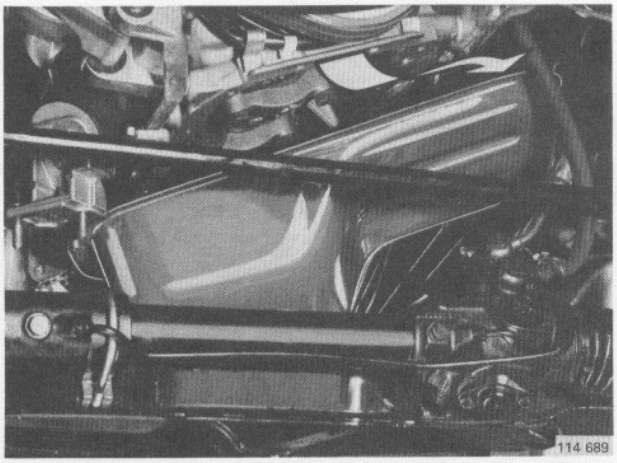
Remove screws which retain front axle cross member. Pull down cross member

Remove left and right side screws.



K9

Remove reinforcing bracket



K10

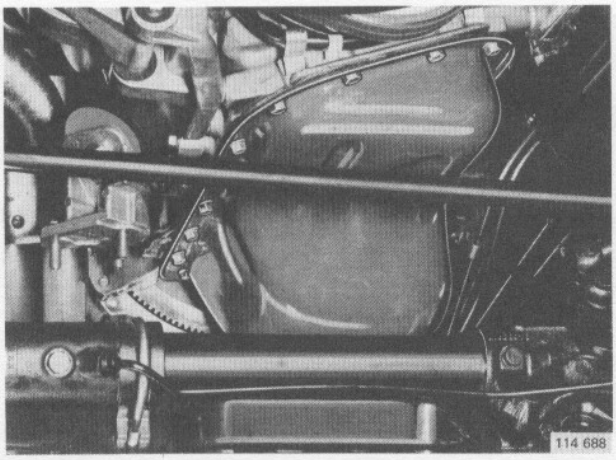
Remove oil sump

Remove all retaining screws for sump.

Loosen, rotate and pull down sump.

Remove gasket and clean contact faces.

Install oil sump



K11

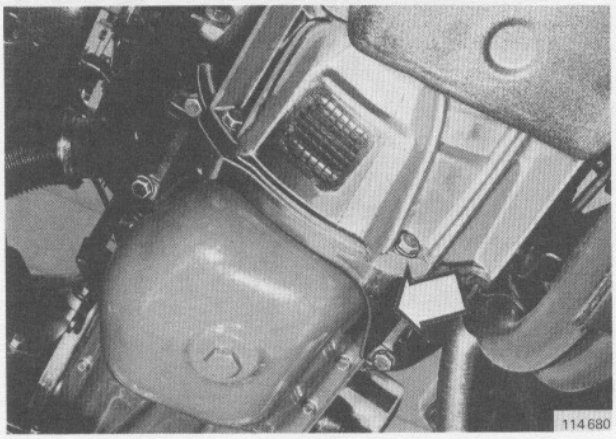
Fit the oil sump

Place a new gasket on sump.

Turn lug on gasket towards starter motor support.

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

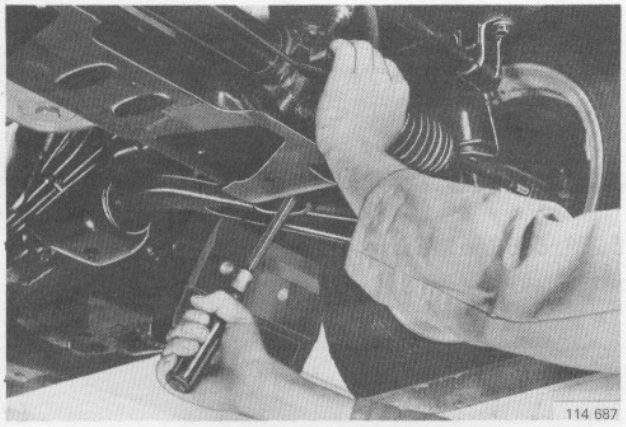
Install all the screws. Tightening torque 11 Nm (8 ft lbs).



K12

Install reinforcing bracket

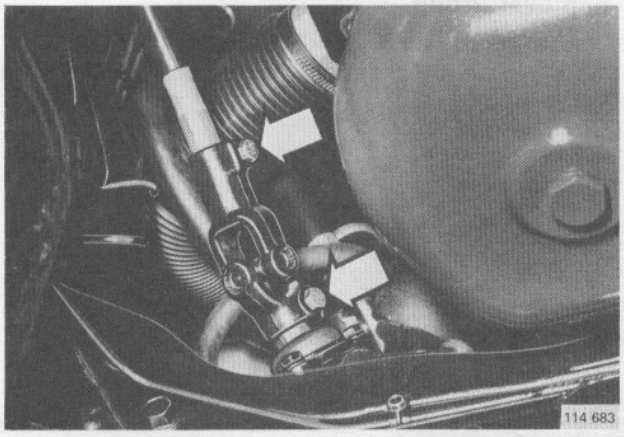
Tighten bracket retaining screws in stages so that no stresses arise.



K13

Install front axle cross member

Push up cross member, install bolts and tighten them.



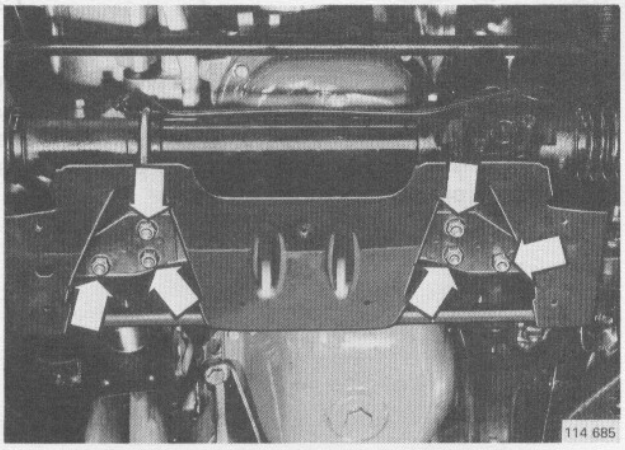
K14

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

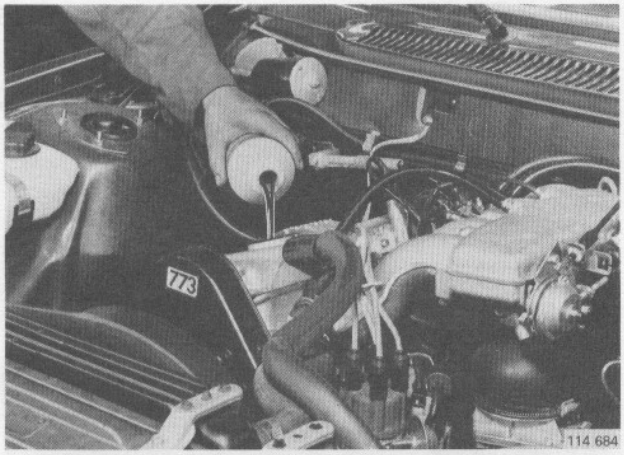
Lower engine

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

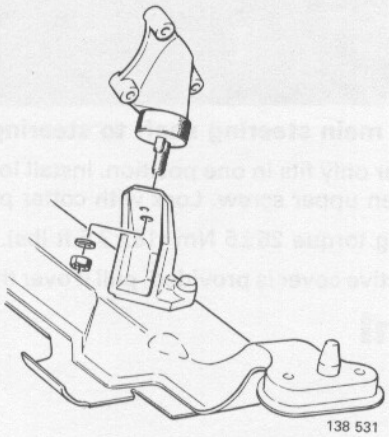
Fill with engine oil

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

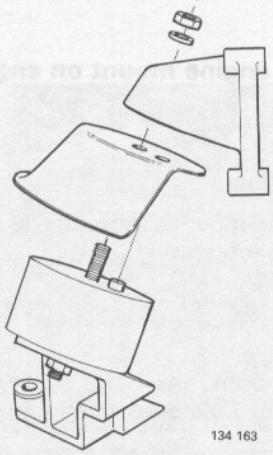
Special tools: 2903, 5006, 5033, 5115


138 531

L1

Removal/fitting

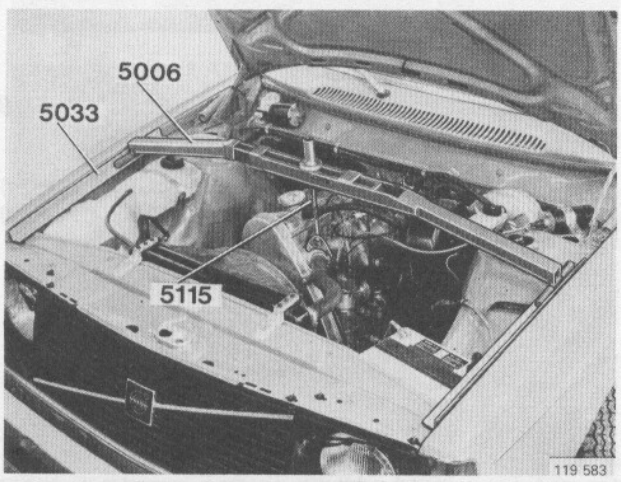
Disconnect battery.
When replacing right engine mount, the oil filter must also be removed.
Use tool **2903.**


134 163

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.



119 583

L3

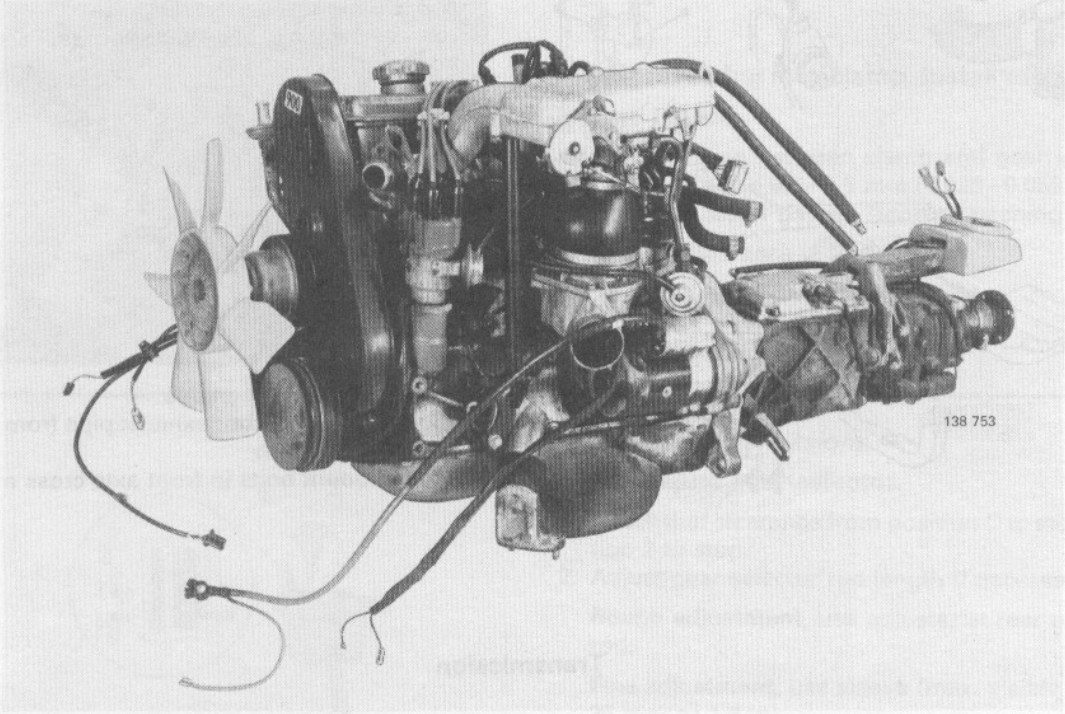
Lifting tool

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

M. Engine, replacement

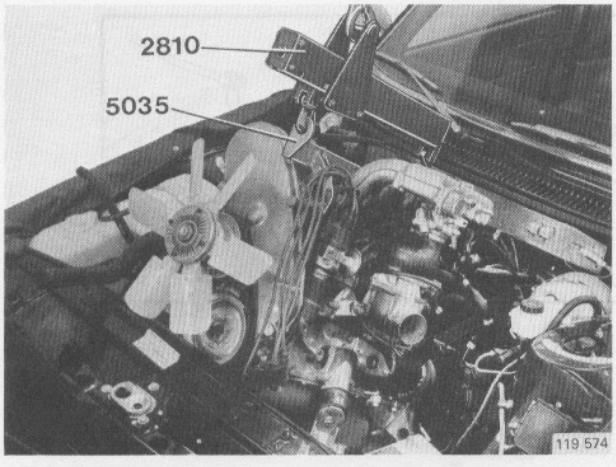
Operations M 1–5
Special tools: 2810, 5035

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



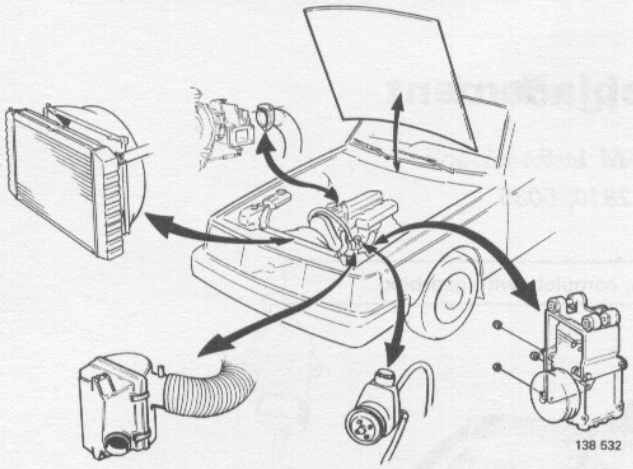
Engine replacement

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

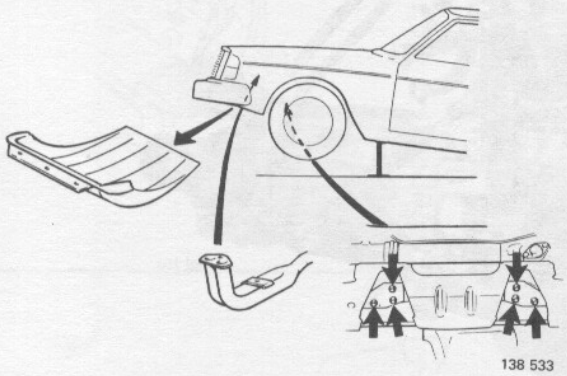
Remove/install

- 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

M3

Underneath engine

Jack up car under jack supports.


138 533

M4

Remove/install

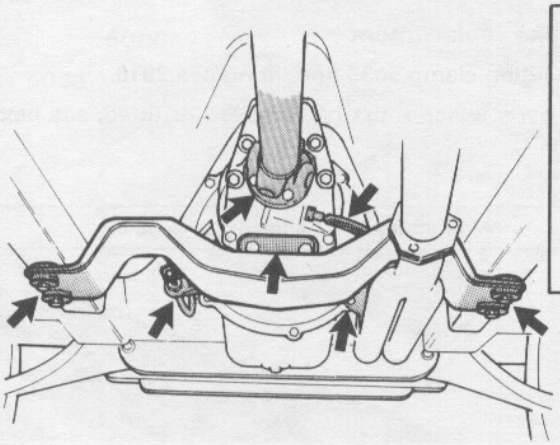
- splashguard under engine
- engine without turbo: exhaust pipe from intake and exhaust manifolds
- engine mount bolts in front axle cross member

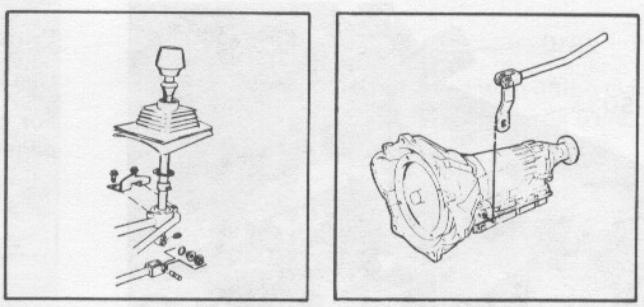
Transmission

M5

Remove/install

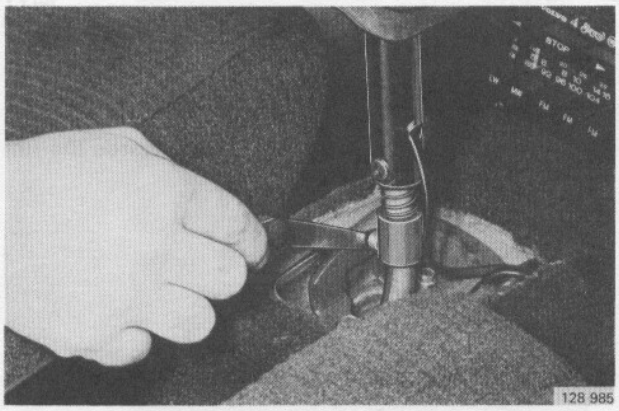
- front support for exhaust pipe
- (manual transmission) clutch cable and the gear lever
- (automatic transmission): selector linkage from transmission
- speedometer cable
- propeller shaft
- transmission cross member. Support transmission with a jack
- detach electric cables




138 534

Work to be carried out after lifting in the engine

Operations M6–14



Manual transmission

M6

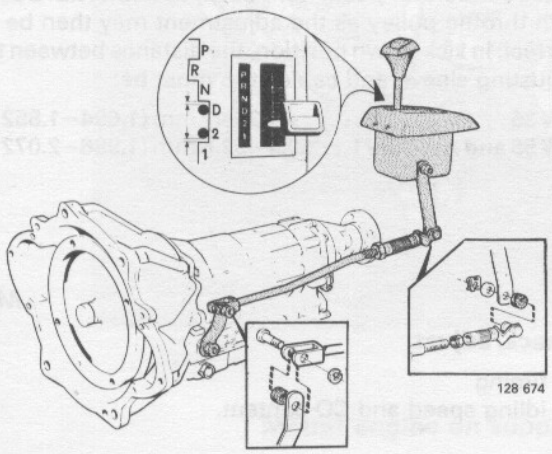
Adjust reversing lock clamp. Install rubber gaiter

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

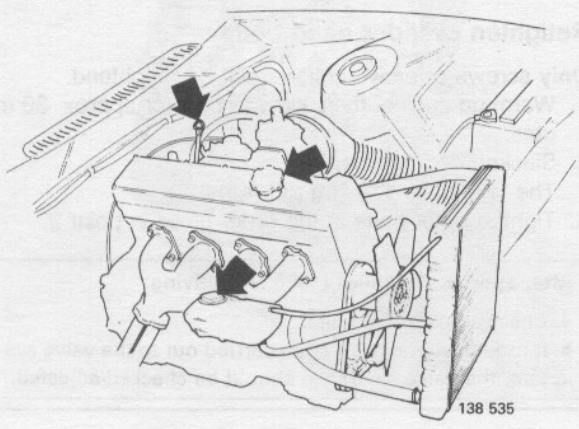
1. Check that clearance from position D to stop = position 2 to stop.
2. Adjust gear selector rod length if necessary.

   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.

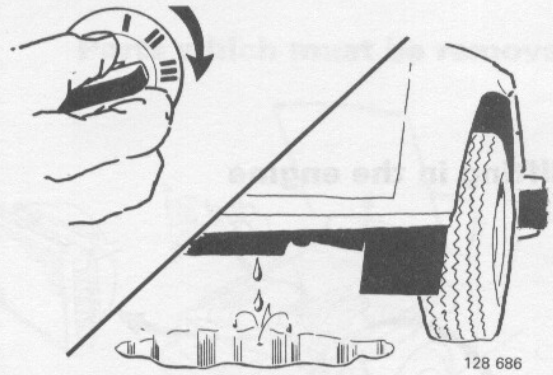
The cooling system holds 9.5 litres (10.0 US qts) (manual transmission) and 9.3 litres (9.8 US qts) (automatic transmission). Set heater control to MAX when adding coolant.

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.

Engine, replacement



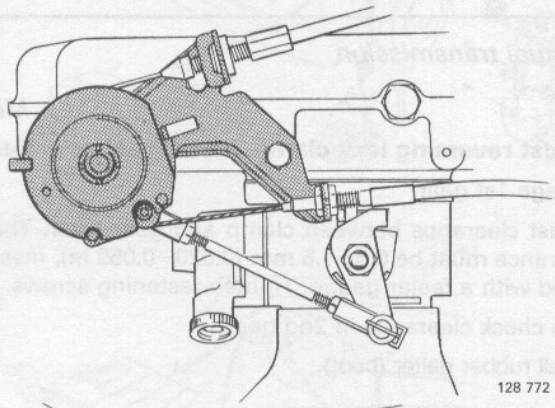
128 686

Carry out an operational check

Start engine and warm it up.

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

M11



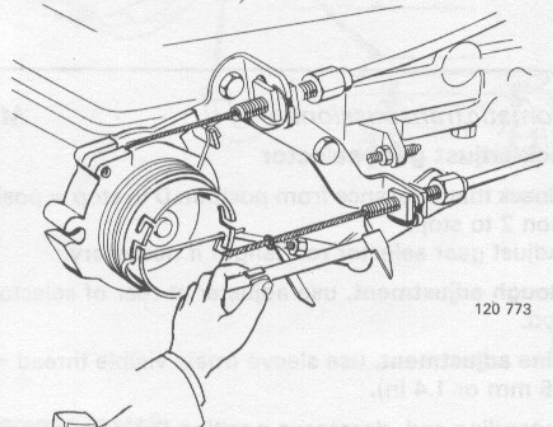
128 772

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.

Automatic transmission *M12*



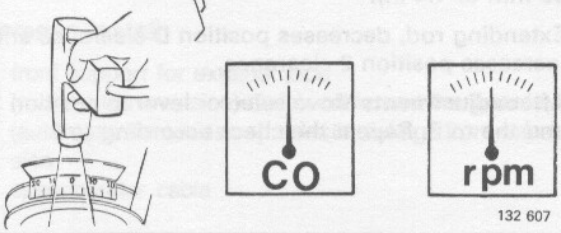
120 773

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



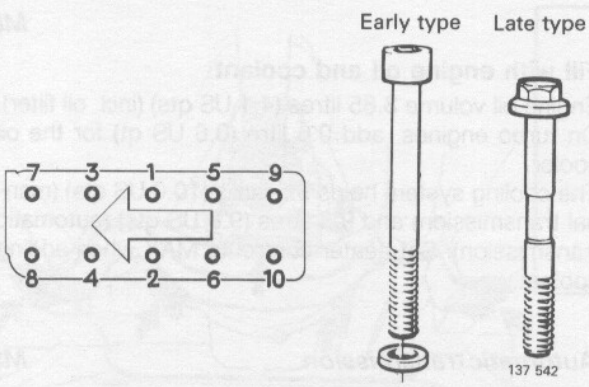
132 607

Check/adjust:

- timing
- idling speed and CO content.

If engine has been dismantled

M14



137 542

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.

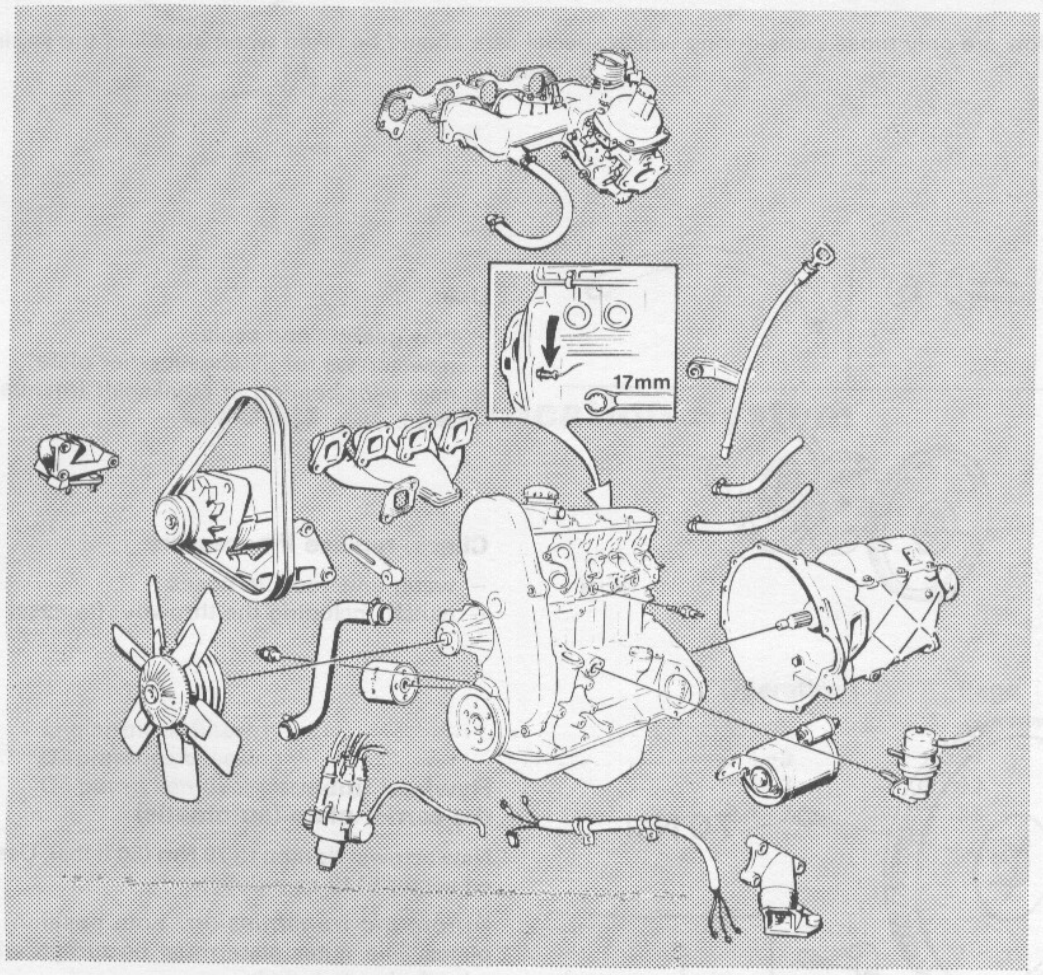
Removal of parts from engine body

Operations M 15–16

Special tools: 1426, 2520, 5023, 5112

M15

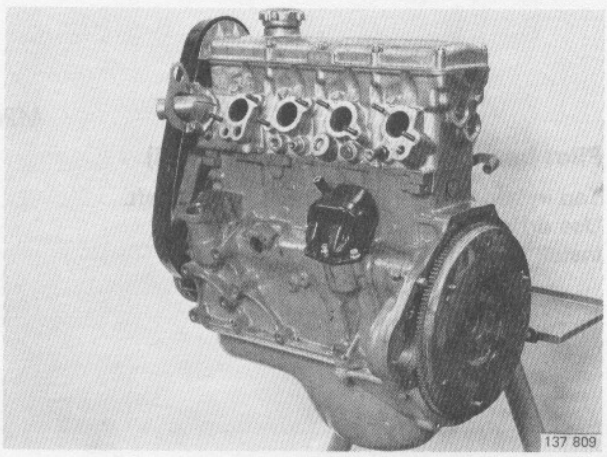
Uncover engine body by removing parts shown in diagram



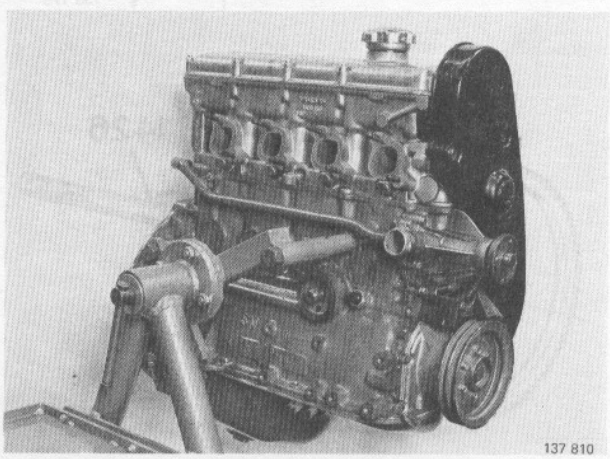
137 555

M16

Mount engine on support stand 2520 with fixture 5023



137 809

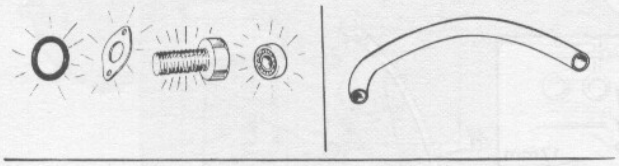


137 810

Installing parts in engine body

Operations M 17–21
Special tools: 1425, 5112

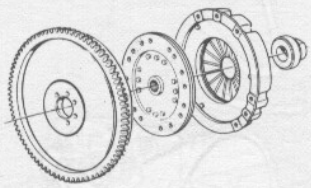
Included below are only those steps during which special care should be taken when installing the engine components.



M17

Use:

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

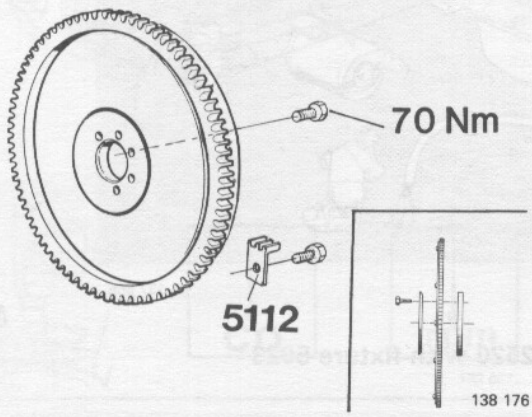


138 174

M18

Check, replace if necessary

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



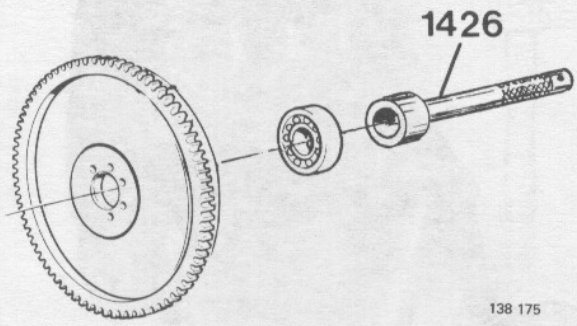
138 176

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.

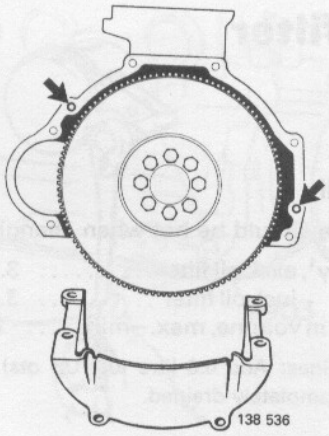


138 175

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.

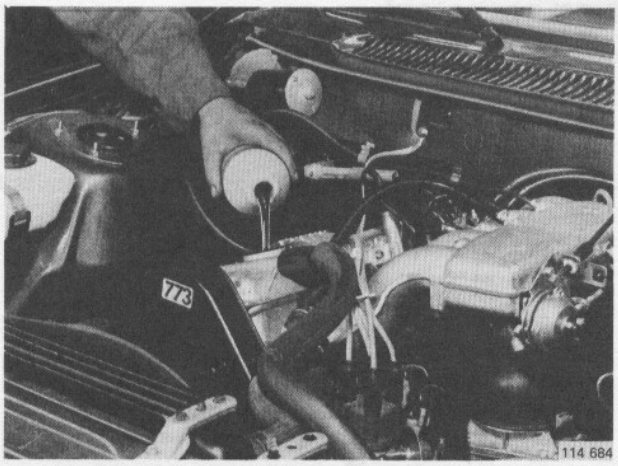
Tighten reinforcing bracket in stages so that no fractures occur.

Group 22 Lubrication System

	Operations	Page
Engine oil, oil filter	N 1–2	90
Oil pressure, checking	O 1–3	91
Oil pump, removal/installing	P 1–2	92
repair	Q 1–7	93

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

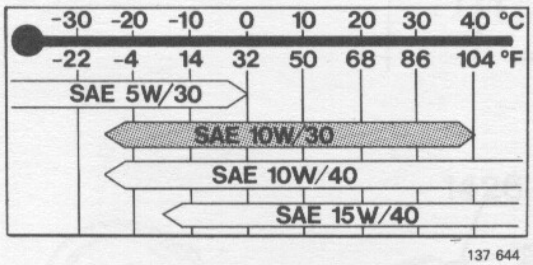
Oil quality

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

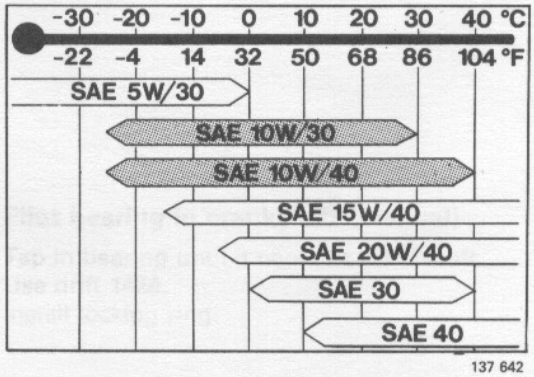
Oil quality

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

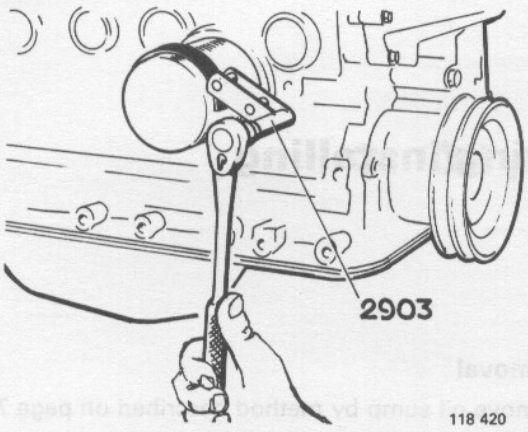
*Oils with designations SE, SF, SE/CC, SF/CC and SF/CD fulfil this requirement. **Note that SE/CD oils must not be used.**
**Oils with designations SF/CC and SF/CD fulfil this requirement.

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

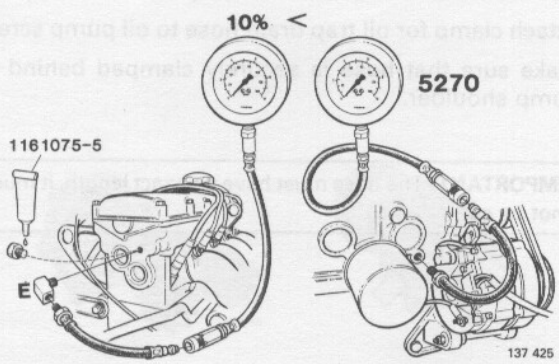
Use strap wrench **2903** to remove filter. See instructions on filter. If only the oil filter is changed, add **0.5 l** (0.5 US qt) of engine oil.

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:

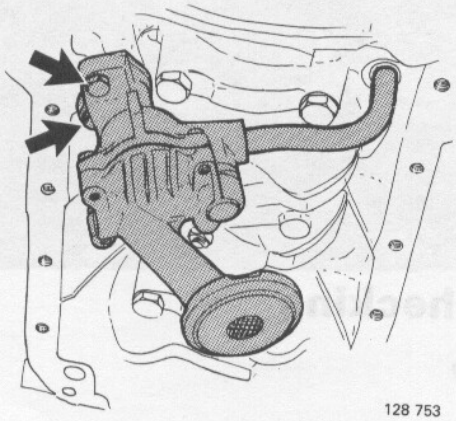
33 r/s (2000 rpm) ..... at least **250 kPa** (35.5 psi)

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).

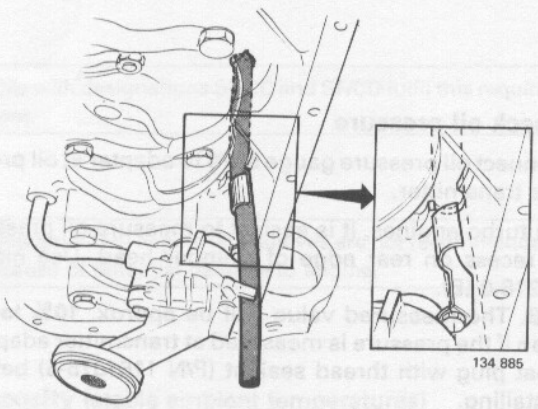
P2

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*

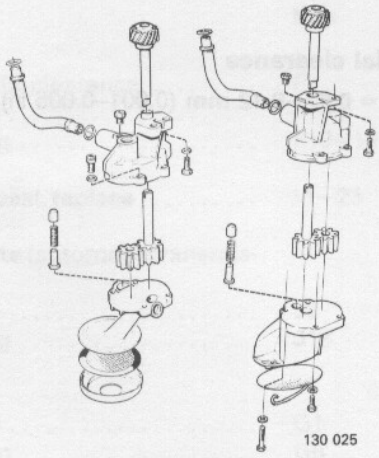
Secure drain hose from oil trap

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.

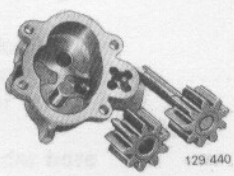
Q. Oil pump, overhaul

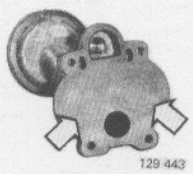

130 025

Q1

Dismantel oil pump

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

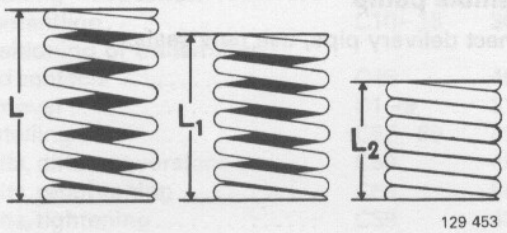

129 440


129 443

Q2

Clean pump

Check gearwheel, housing and cover for wear and damage.

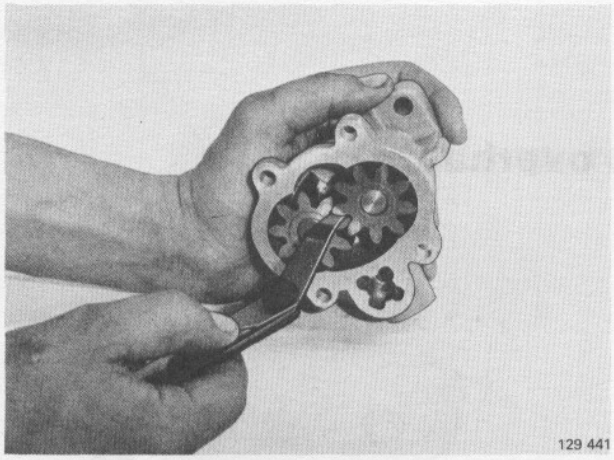


129 453

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)



Q4

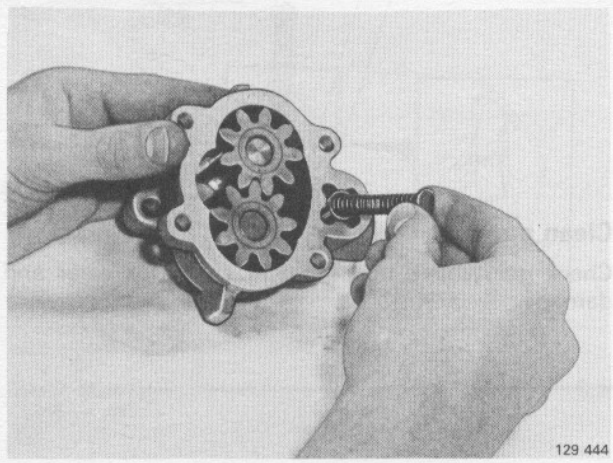
Check tooth flank clearance

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

Q5

Check axial clearance

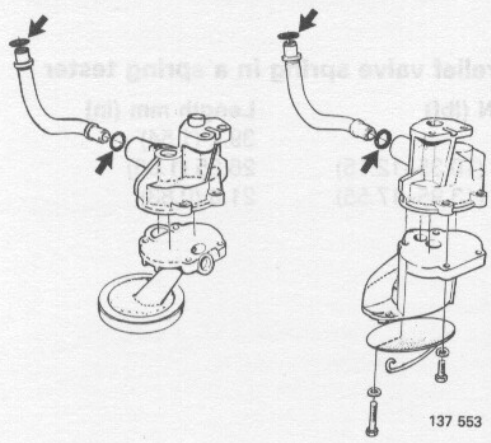
Clearance = **0.02–0.12 mm** (0.001–0.005 in).



Q6

Install piston and spring

Early version has a ball and spring.



Q7

Assemble pump

Connect delivery pipe, use new seals.

Index

	Operation	Page
Camshaft		
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