

# Service Manual

## Repairs and maintenance

TP 30420/1 11.88

Section 2(20-23, 25-27)

Engine D 20, D 24

240 1979- 19 ..

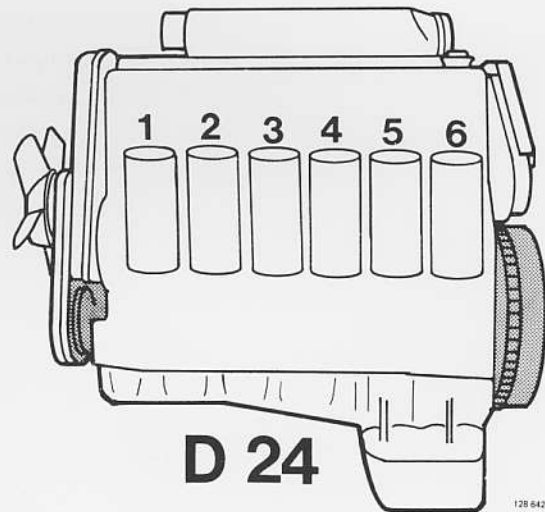
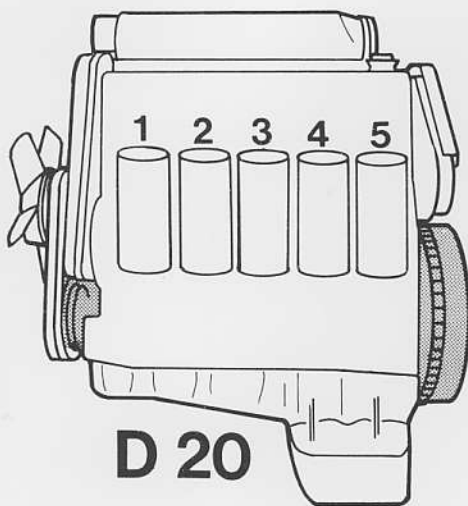
# VOLVO

## D 20, D 24

Both the D 20 and D 24 Diesel engines are dealt with in this manual.

The D 20 has five cylinders and the D 24 six. Otherwise the engines are similar in principle.

Note! Different flywheels and vibration dampers are fitted to the different engine types.



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Volvos are sold in versions adapted for different markets. These adaptations 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.

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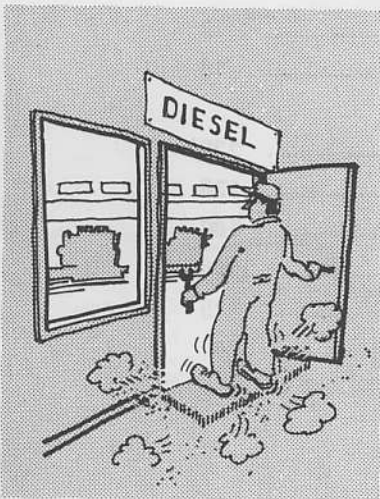
Order No.: TP 30420/1

We reserve the right to make alterations

Reprint of 1983 literature without change.

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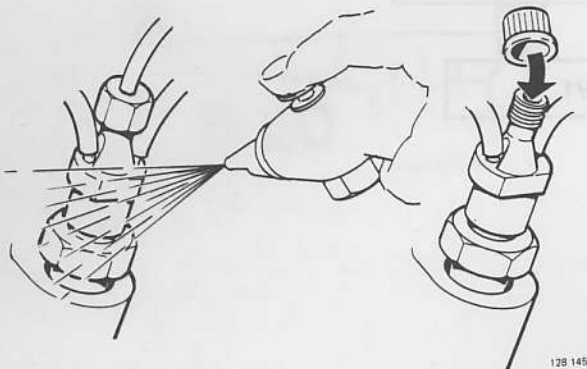
## Important information



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### CLEANLINESS

Diesel injection systems are extremely sensitive to dirt and foreign matter. A special workplace should therefore be used for inspection of components.

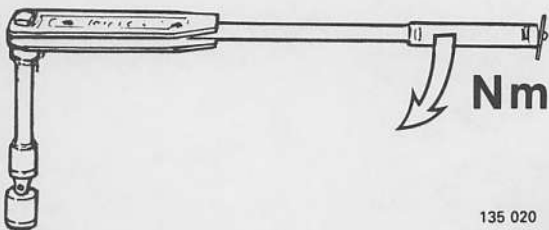


128 145

### PLUGS

Clean fuel line connections thoroughly before disconnecting pipes.

Plug ends of fuel lines etc as each component is removed. Do not remove these plugs until the component is reconnected.



135 020

### Tightening torques

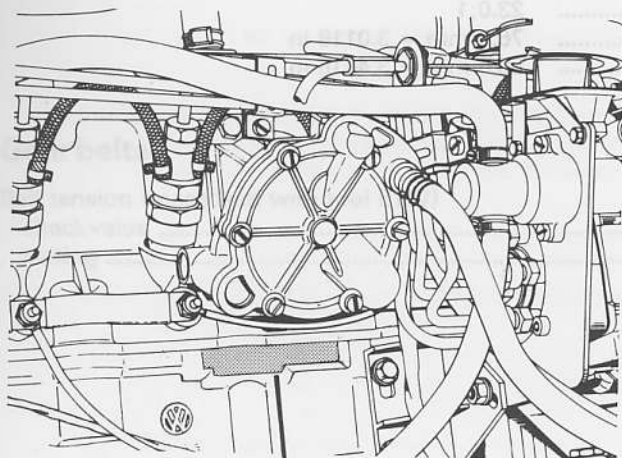
Two kinds of tightening torques will be found in this manual.

1. Tighten to **40 Nm** (30 ft lbs) indicates that a torque wrench must be used for tightening.
2. Tightening torque 40 Nm (30 ft lbs) indicates a guide value. Tightening need not be done with a torque wrench.



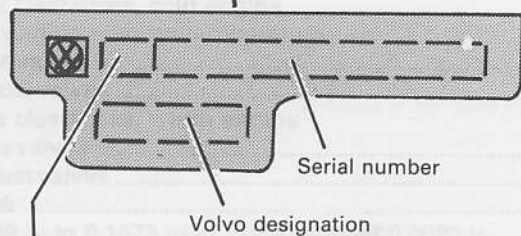
# Specifications

## Group 20 General



### Engine type designation and serial number

Stamped on left side of engine beneath vacuum pump



VW designation

Volvo designation

Serial number

133 757

### D 20 Engine

Output DIN .....	50 kW at 80 r/s	
Max torque DIN .....	68 hp at 4,800 r/min	
	120 Nm at 50 r/s	
	12.2 kpm at 3,000 r/min	
Number of cylinders .....	5	
Firing order .....	1-2-4-5-3	
Displacement .....	1.986 dm <sup>3</sup> (liter)	
Weight, approx. incl. engine mounts, alternator and starter motor .....	181 kg (405 lbs)	
Compression pressures:	<b>Mpa</b>	<b>psi</b>
New engine .....	3.2	455
Minimum .....	2.4	313
Max difference between cylinders .....	0.8	114
Compression ratio .....	23.0:1	
Cylinder bore .....	76.5 mm = 3.0118 in	
Stroke length .....	86.4 mm = 3.4016 in	

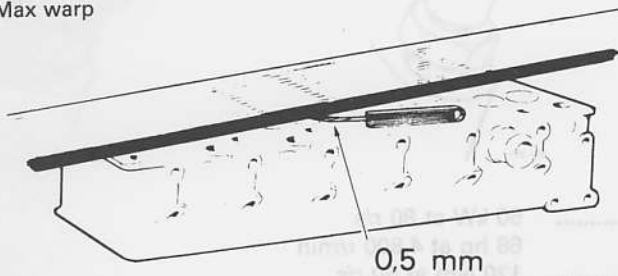
## D 24 Engine

Output DIN .....	60 kW at 80 r/s	
	82 hp at 4,800 r/min	
Max torque DIN .....	140 Nm at 47 r/s	
	14.3 kpm at 2,800 r/min	
Number of cylinders .....	6	
Firing order .....	1-5-3-6-2-4	
Displacement .....	2.383 dm <sup>3</sup> (liter)	
Weight, approx. incl. engine mounts, alternator and starter motor .....	198 (435 lbs)	
Compression pressures:	<b>MPa</b>	<b>psi</b>
New engine .....	3.2	455
Minimum .....	2.4	313
Max difference between cylinders .....	0,8	114
Compression ratio .....	23.0:1	
Cylinder bore .....	76.5 mm = 3.0118 in	
Stroke length .....	86.4 mm = 3.4016 in	

## Group 21 Engine assembly

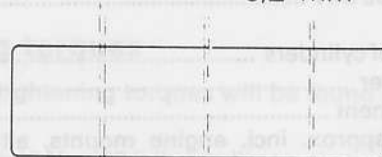
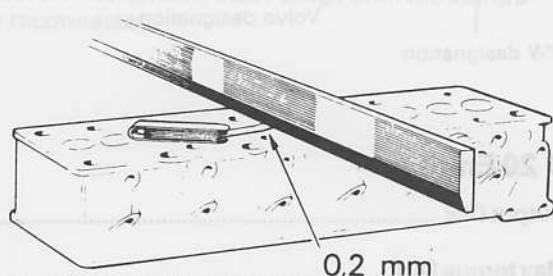
### CYLINDER HEAD

Max warp



Diagonally max 0.5 mm

128 146



Square max 0.2 mm

128 147

Replace cylinder head if warp exceeds specifications.  
Under no circumstances may cylinder head be machined.

**CYLINDER HEAD GASKET**

Three different gasket types are used depending on piston projection above cylinder block face.

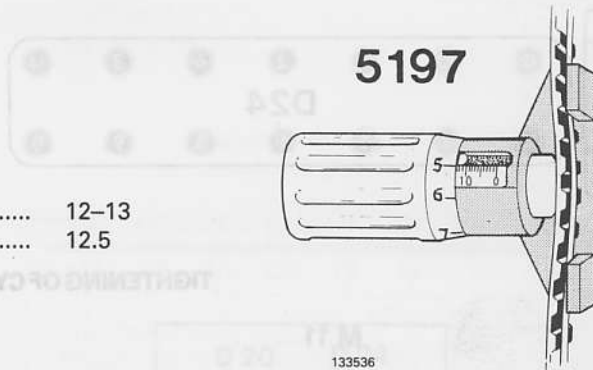


Piston projection mm (in)	Gasket notches	thickness mm (in)
0.67–0.80 (0.026–0.031)	1	1.4 (0.055)
0.81–0.90 (0.032–0.035)	2	1.5 (0.059)
0.91–1.02 (0.036–0.040)	3	1.6 (0.063)

**Gear belts**

Belt tension (measured with tool 5197)

check value	12–13
setting	12.5



**VALVE SYSTEM**

Valve clearances, cold engine

Cold engine = room temperature

intake valves

exhaust valves

Valve clearances, warm engine

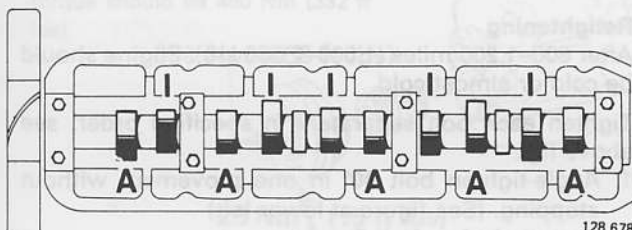
intake valves

exhaust valves

Shims

0.1299 in to 0.1673 in in increments of 0.0020 in

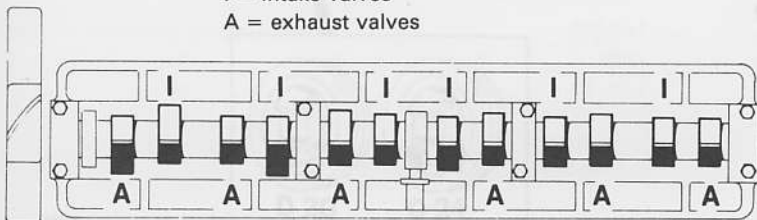
Check mm (in)	Setting mm (in)
0.15–0.25 (0.006–0.010)	0.20 (0.008)
0.35–0.45 (0.014–0.018)	0.40 (0.016)
0.20–0.30 (0.008–0.012)	0.25 (0.010)
0.40–0.50 (0.016–0.020)	0.45 (0.018)
3.00–4.25 mm in increments of 0.05 mm	



**D 20**

Check/adjust valves in following order:  
1-2-4-5-3

I = intake valves  
A = exhaust valves

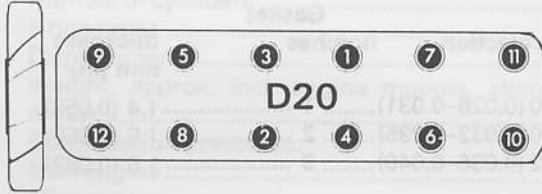


**D 24**

Check/adjust valves in following order:  
1-5-3-6-2-4

## TIGHTENING TORQUES

Tightening torques apply to oiled nuts and bolts. Degreased (washed) parts must be oiled prior to assembly.



### TIGHTENING SEQUENCE FOR CYLINDER HEAD BOLTS

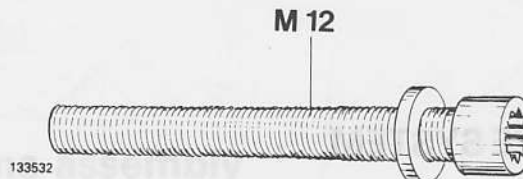
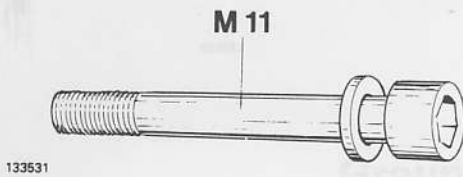
**Important!** slacken bolts in reverse order when removing cylinder head.

Remove oil and dirt from bolt holes. Oil left in holes will reduce pressure on cylinder head gasket.

Bolt threads and washers must however be oiled, otherwise frictional forces will be too great.

Two types of bolts are in use: An early type with M 11 threads and a later type with M 12 threads. (Later type is threaded along entire length.)

### TIGHTENING OF CYLINDER HEAD BOLTS



Use **new washers**, convex side upwards.  
Tighten in five stages:

- 1 **50 Nm** (37 ft lbs)
- 2 **70 Nm** (50 ft lbs)
- 3 **90 Nm** (65 ft lbs)
- 4 run engine until oil temperature is at least 50°C (122 °F)
- 5 **90 Nm** (65 ft lbs)

#### Retightening

– After 600–1,200 miles (1,000–2,000 km). Engine should be cold or almost cold. Tighten each bolt separately in specified order, see above fig.:

1. Slacken bolt 30°
2. Torque to **90 Nm** (65 ft lbs)

Use **new bolts**. Not necessary to replace washers.

Tighten in six stages:

- 1 **40 Nm** (30 ft lbs)
- 2 **60 Nm** (44 ft lbs)
- 3 **75 Nm** (55 ft lbs)
- 4 angle-tighten **180°** in one movement without stopping. (See figure at lower left)
- 5 run engine until oil temperature is at least 50°C (122 °F)
- 6 angle-tighten **90°** in one movement without stopping.

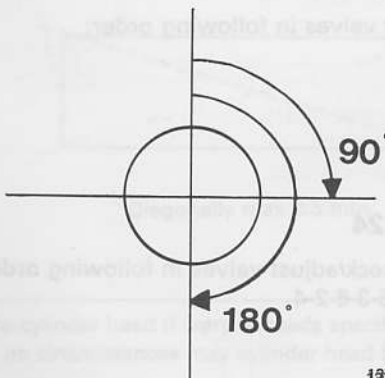
#### Retightening

After 600–1,200 miles (1,000–2,000 km). Engine should be cold or almost cold.

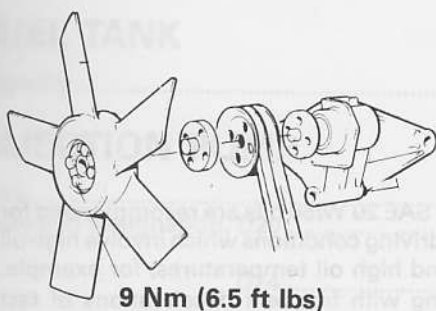
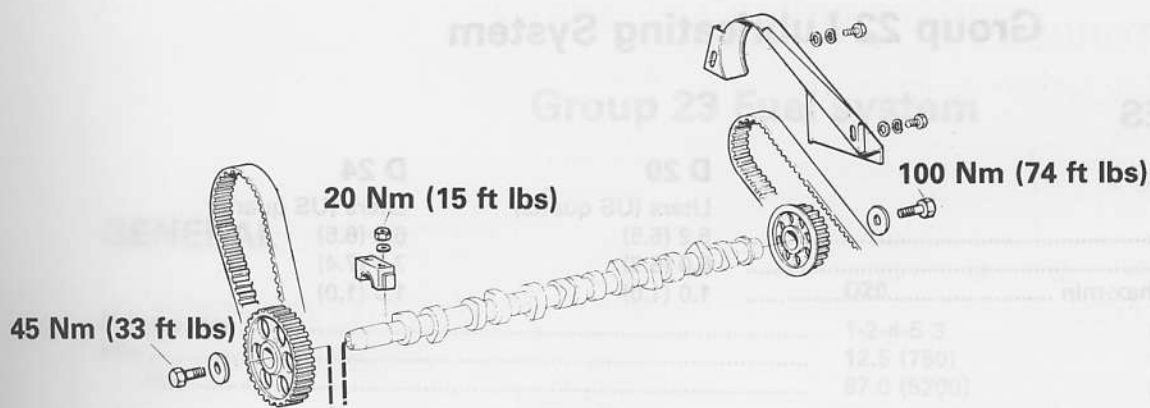
Tighten each bolt separately in specified order, see above fig.:

1. Angle-tighten bolt **90°** in one movement without stopping. (See figure at lower left)

**Do not slacken bolt first.**

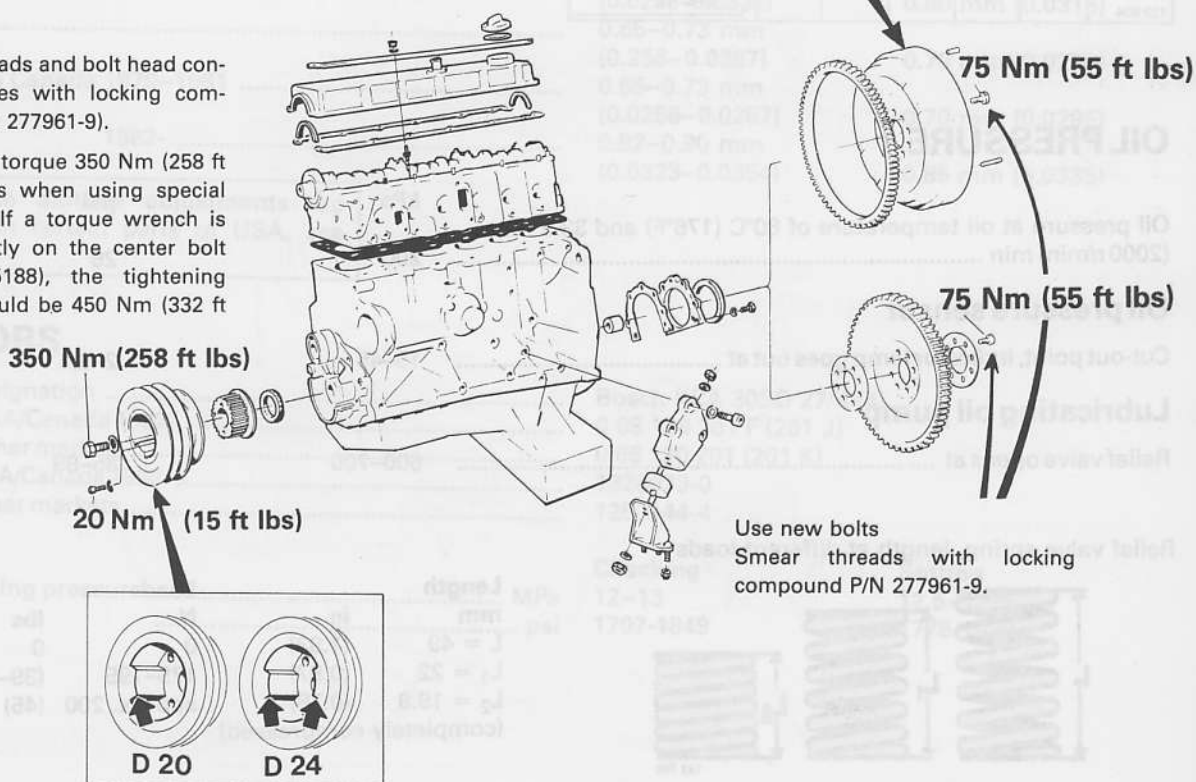


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Smear threads and bolt head contact surfaces with locking compound (P/N 277961-9).

Tightening torque 350 Nm (258 ft lbs) applies when using special tool 5188. If a torque wrench is used directly on the center bolt (without 5188), the tightening torque should be 450 Nm (332 ft lbs).





## Group 22 Lubricating System

### OIL CAPACITIES

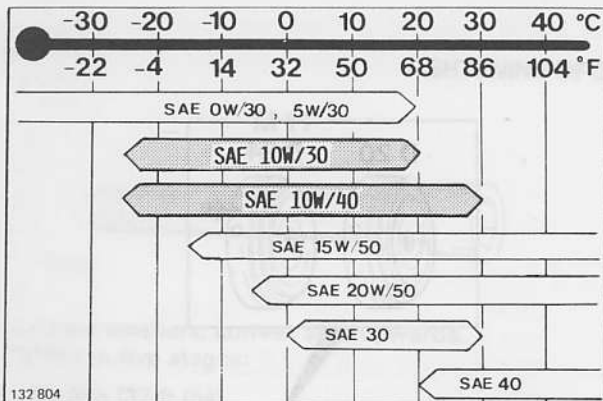
	D 20	D 24
Excl. oil filter .....	Liters (US quarts) 5.2 (5.5)	Liters (US quarts) 6.2 (6.5)
Incl. oil filter .....	6.0 (6.3)	7.0 (7.4)
Difference in volume, max-min .....	1.0 (1.0)	1.0 (1.0)

### ENGINE OIL

Quality .....	min CC
According to API .....	Oils with designations SE/CC, SE/CD, SF/CC and SF/CD meet this requirement

### Viscosity

Temperature range  
(stable ambient temperatures)

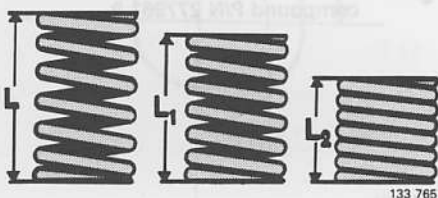


SAE 15 W/50 or SAE 20 W/50 oils are recommended for use in extreme driving conditions which involve high oil consumption and high oil temperatures, for example, mountain driving with frequent decelerations of fast motorway driving. (Note however the lower temperature limits.)

### OIL PRESSURE

	kPa	psi
Oil pressure at oil temperature of 80°C (176°F) and 33.3 r/s (2000 r/min) min .....	200	28
<b>Oil pressure sensor</b>		
Cut-out point, indicator lamp goes out at .....	15-45	2-6.4
<b>Lubricating oil pump</b>		
Relief valve opens at .....	600-700	85-99

Relief valve spring, length at different loads



Length mm	in.	Load N	lbs
L = 49	(1.93)	0	0
L <sub>1</sub> = 22	(0.87)	175-195	(39-44)
L <sub>2</sub> = 19.8	(0.78)	approx. 200	(45)

(completely compressed)



## Group 23 Fuel system

### GENERAL

	D20	D24
Firing order .....	1-2-4-5-3	1-5-3-6-2-4
Idle .....	12.5 (750)	12.5 (750) r/s (r/min)
fast .....	87.0 (5200)	87.0 (5200) r/s (r/min)

### FUEL

Standard .....	DIN 51601: CEC-ERF-DI, or ASTM-D 975-No. 2-D
Ignition response (cetane No.) min .....	45
Sulphur content, max. w.p. ....	0.5

### FUEL TANK

Capacity .....	60 litres (15.8 US galls.)
----------------	----------------------------

### INJECTION PUMP

Type .....	Distributor type pump	
Make and designation, D20 .....	Bosch VE5/10 F2400 L45 (L45-1 for auto vehicles)	
D24 .....	Bosch VE6/10 F2400 L32 (L32-1 for auto vehicles)	
Volvo P/N (exchange unit) D20 .....	5001716-9	
D24 .....	5001715-1	
Injection timing (pump plunger stroke at TDC)	<b>Checking mm (in)</b>	<b>Setting mm (in)</b>
D20 .....	0.75–0.83 mm (0.0295–0.0327)	0.80 mm (0.0315)
D24 .....	0.65–0.73 mm (0.256–0.0287)	0.70 mm (0.0276)
D24 USA and Canada 1979–1981 .....	0.65–0.73 mm (0.0256–0.0287)	0.70 mm (0.0295)
1982- .....	0.82–0.90 mm (0.0323–0.0354)	0.85 mm (0.0335)

**NOTE!** High altitude adjustments are necessary in certain parts of USA, see page 132.

### INJECTORS

Make and designation .....	Bosch KCA 30SD 27/ (44)	
Bosch No. USA/Canada 1982- .....	0 68 130 201 F (201 J)	
Other markets .....	0 68 130 201 (201 K)	
Volvo P/N USA/Canada 1982- .....	1328073-0	
Other markets .....	1257144-4	
Injector opening pressure .....	<b>Checking</b>	<b>Setting</b>
..... MPa	12–13	12.5–13.5
..... psi	1707–1849	1778–1920

Group 22 Lubricating System

Nozzles

Make .....	Bosch
Designation USA/Canada 1982- .....	DN O SD 193 0
Other markets .....	DN O SD 193
Volvo P/N USA/Canada 1982- .....	1328096-1
Other markets .....	1542303-1

0 68 130 201 F } USA/Canada 1982-

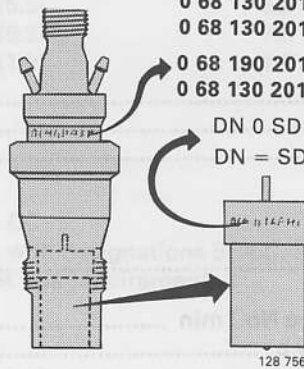
0 68 130 201 J } Other markets

0 68 190 201 } Other markets

0 68 130 201 K } Other markets

DN O SD 193 0 = USA/Canada 1982-

DN = SD 193 = other markets



Injector  
(complete)

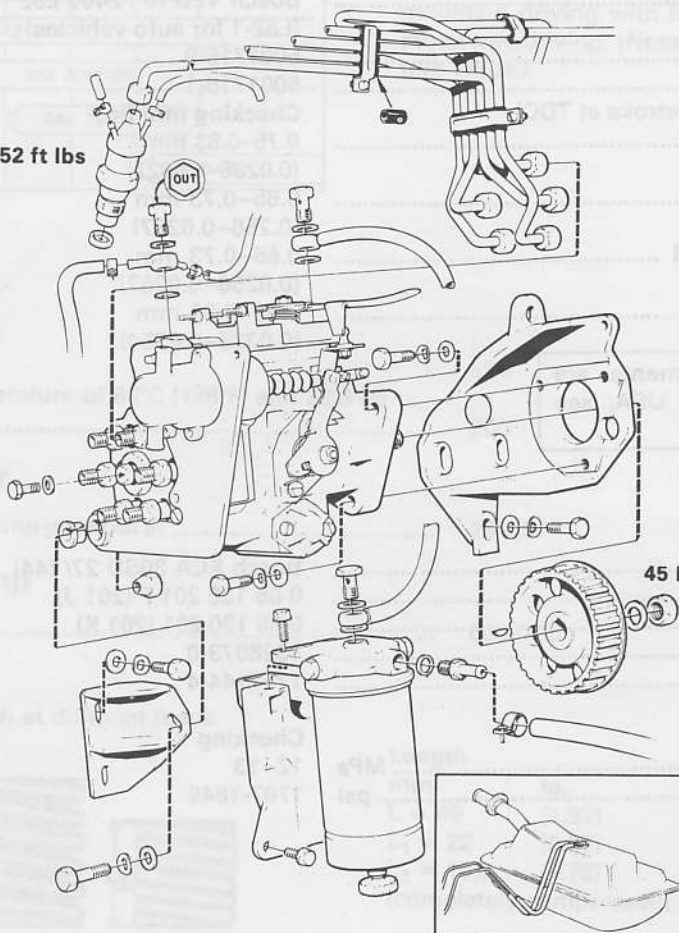
Nozzle

Identification of injectors and nozzles

TIGHTENING TORQUES

	Nm	ft. lbs
Injector, in cylinder head .....	70	52
upper - lower section .....	70	52
Injection pump, pump gear .....	45	33

70 Nm = 52 ft lbs

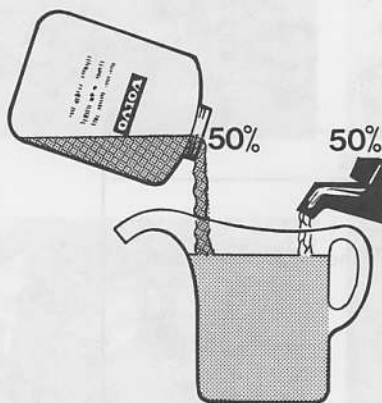


45 Nm = 33 ft lbs

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## Group 26 Cooling system

### GENERAL



128 187

#### Coolant

Since aluminium is used in the engines, active corrosion protection is necessary in the coolant to help prevent corrosion damage.

Use genuine Volvo blue-green coolant type C diluted with clean water in proportions of 50/50.

This mixture helps to prevent corrosion and frost damage.

- Never fill the cooling system with water alone.
- The coolant should be changed regularly since the corrosion protective additives in the coolant lose their effect in time.

	D 20 litres (US quarts)	D 24 litres (US quarts)
Capacity, with manual gearbox .....	8.2 (8.7)	9.4 (9.9)
with automatic transmission .....	8.0 (8.4)	9.2 (9.7)

### EXPANSION TANK

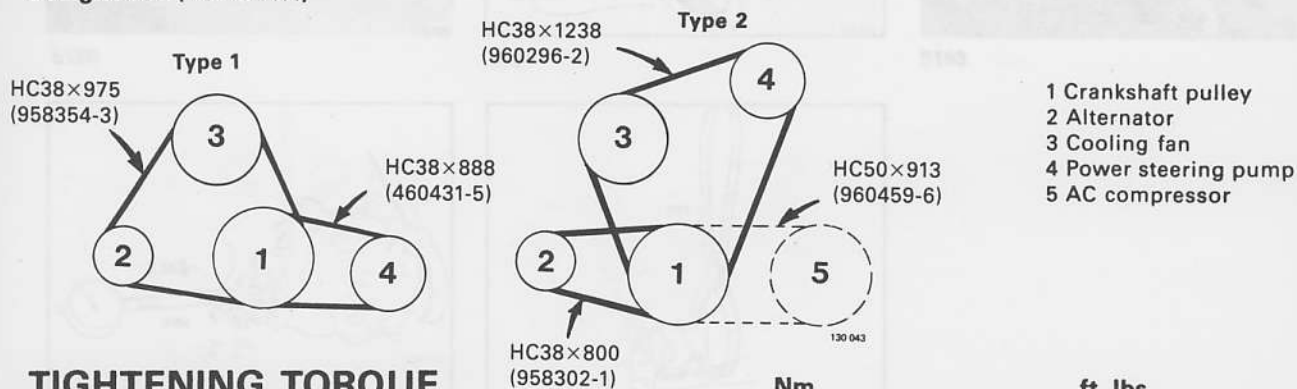
	Type 1 kPa (psi)	Type 2 kPa (psi)
Pressure valve in cap opens at .....	65-85 (9.2-12.1)	100 (14.2)
overpressure .....	7 (1.0)	7 (1.0)
underpressure .....		

### THERMOSTAT

Marking .....	87°C
Starts to open at .....	87°C (189°F)
Fully open at .....	102°C (216°F)
Opening gap, min .....	8 mm (0.3 in)

### DRIVE BELTS

Designation (Volvo P/N)



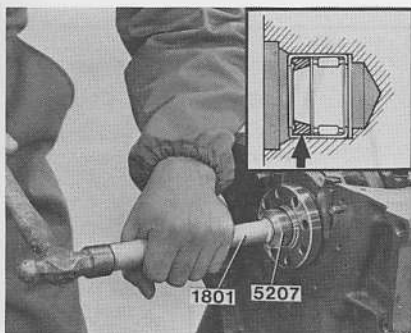
- 1 Crankshaft pulley
- 2 Alternator
- 3 Cooling fan
- 4 Power steering pump
- 5 AC compressor

### TIGHTENING TORQUE

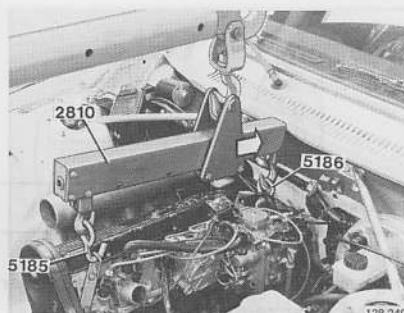
	Nm	ft. lbs.
Cooling fan .....	9	6.6

## Special tools

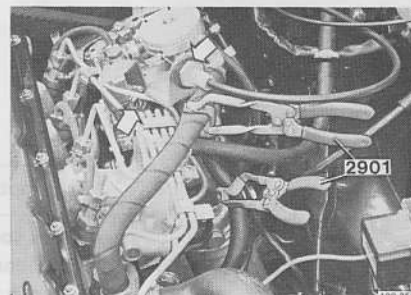
999	Description – Use
1801-3	<b>Standard handle:</b> used with drift 5207 and 5208
2810-3	<b>Lift beam:</b> removing/installing engine
2901-0	<b>Clamping pliers (2x):</b> clamping water hoses when removing injection pump
2903-6	<b>Oil filter wrench</b>
4090-0	<b>Puller:</b> removing pilot bearing
5006-5	<b>Lift bracket:</b> replacing front engine mounts
5033-9	<b>Support (2x):</b> for lift bracket 5006
5112-1	<b>Locking sector:</b> locking flywheel
5115-4	<b>Lift hook:</b> used with lift bracket 5006
5185-7	<b>Lift hook, front:</b> removing/installing engine
5186-5	<b>Lift hook, rear:</b> removing/installing engine
5187-3	<b>Wrench:</b> vibration damper
5188-1	<b>Wrench with extension arm:</b> for vibration damper center bolt
5190-7	<b>Gauge:</b> installing camshaft
5191-5	<b>Adapter:</b> connecting pressure gauge
5193-1	<b>Stop:</b> locking injection pump gear
5194-9	<b>Holder:</b> for dial indicator when adjusting injection pump
5195-6	<b>Pliers:</b> removing valve discs



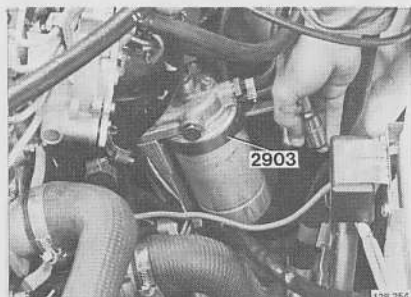
1801



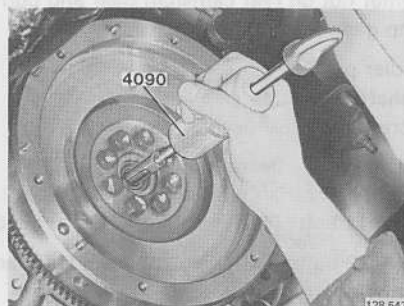
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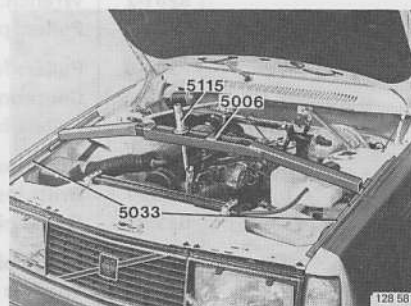
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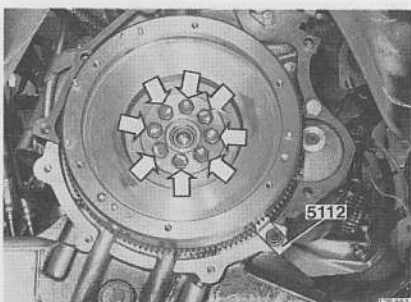
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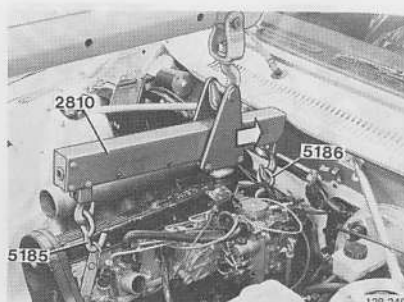
4090



5006, 5033, 5115



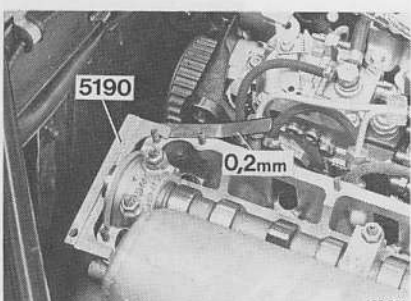
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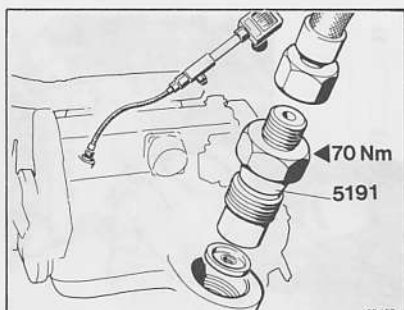
5185, 5186



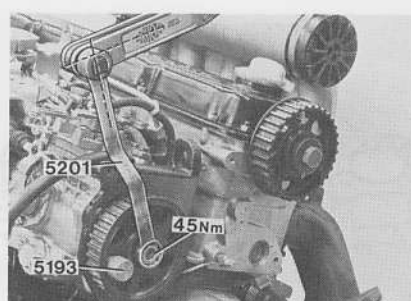
5187, 5188



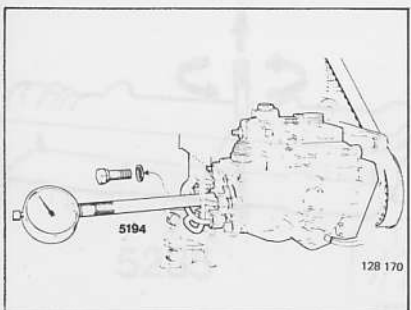
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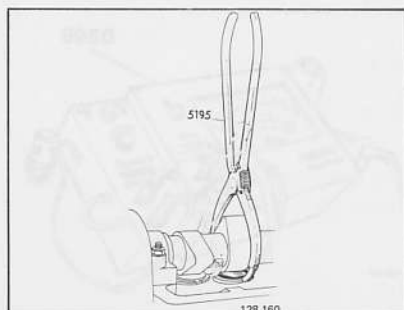
5191



5193



5194

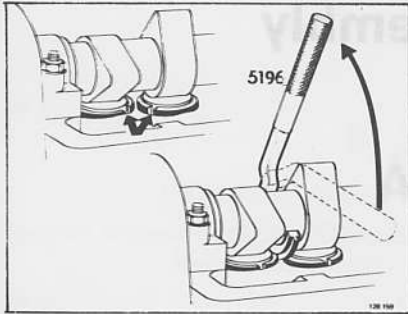


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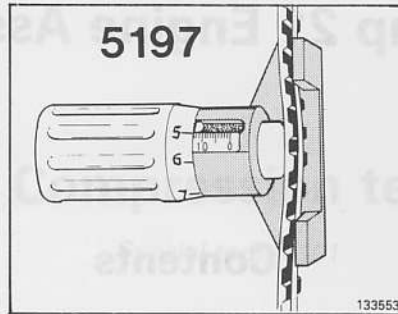


999	Description – Use
5196-4	<b>Press tool:</b> for valve tappets
5197-2	<b>Belt tension gauge:</b> timing gear belts and pump drive
5199-8	<b>Wrench:</b> front and rear camshaft gears
5200-4	<b>Adapter:</b> installing crankshaft front seal and camshaft seals
5201-2	<b>Wrench:</b> center nut on rear camshaft gear and pump gear
5204-6	<b>Puller:</b> pump gear, injection pump
5202-0	<b>Puller:</b> for idler pulley
5203-8	<b>Centering shaft:</b> for clutch disc
5205-3	<b>Puller:</b> for crankshaft front seal
5207-9	<b>Drift:</b> installing needle bearing in crankshaft
5208-7	<b>Drift:</b> installing crankshaft rear seal
5233-7	<b>Guide pins, M 11 bolts (4x):</b> installing cylinder head
5234-3	<b>Guide pins, M 12 bolts (4x):</b> installing cylinder head
5235-0	<b>Tool for removing guide pins</b>
9950-0	<b>Adapter:</b> engine rpm. Used with Volvo Monotester

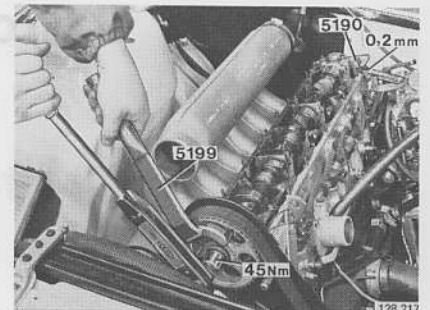




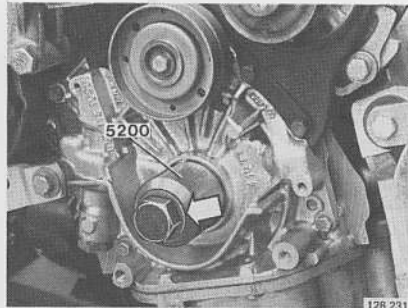
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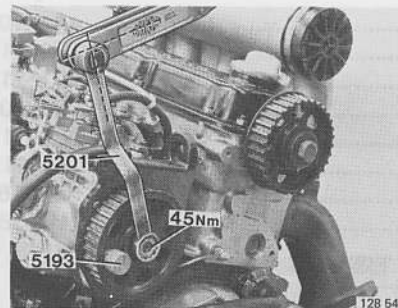
5197



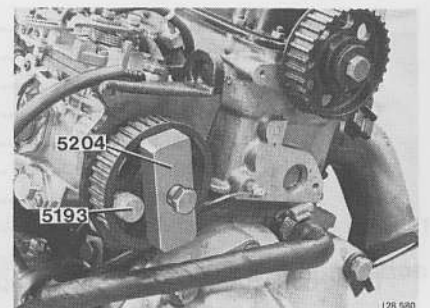
5199



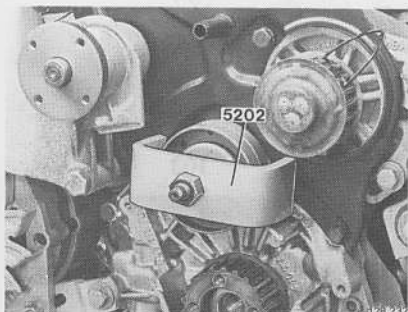
5200



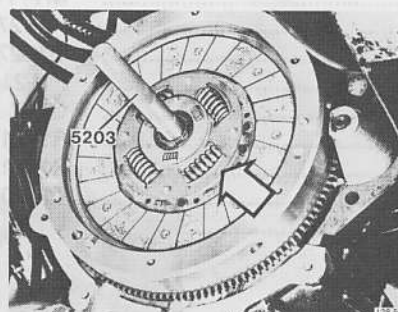
5201



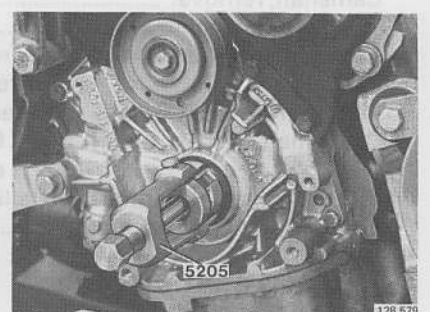
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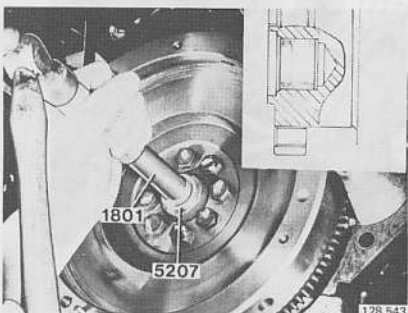
5202



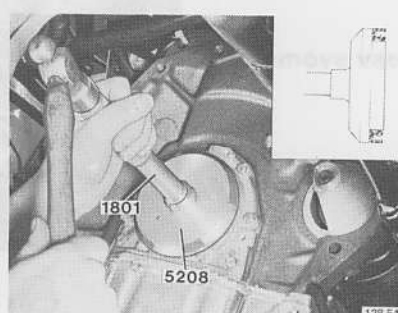
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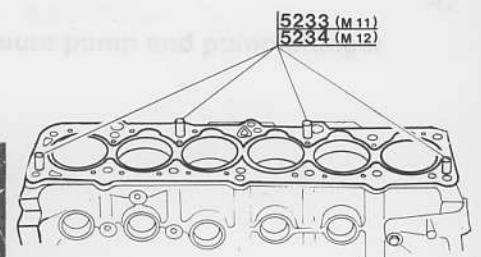
5205



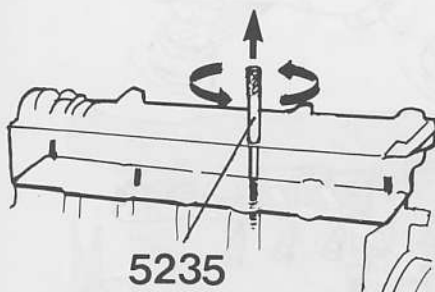
5207



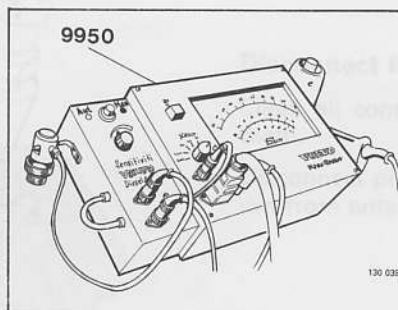
5208



5233, 5234



5235



9950

# Group 21 Engine Assembly

## Contents

### In-car

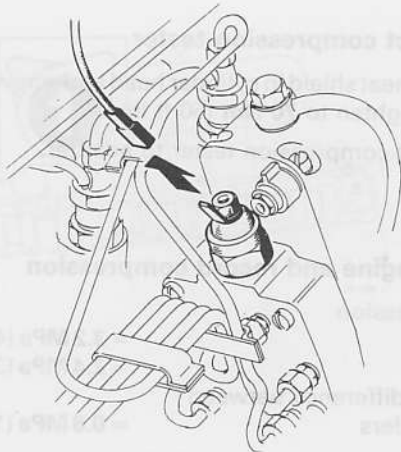
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## A. Compression test

Special tool: 5191

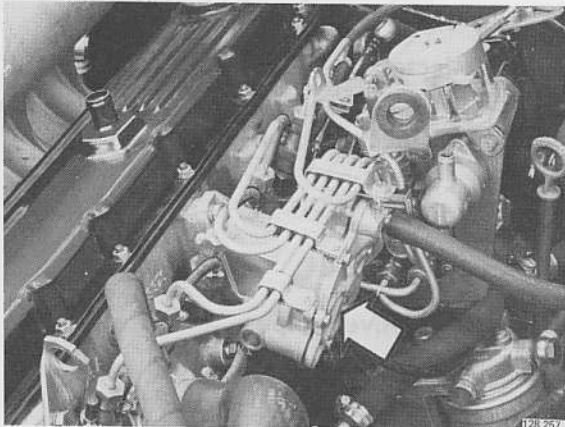


128150

A 1

**Disconnect wire from stop valve on injection pump**

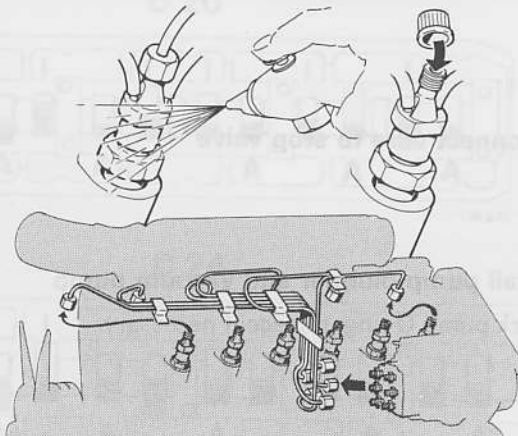
This stops flow of fuel and prevents unnecessary spillage.



128267

A 2

**Remove vacuum pump and pump plunger**



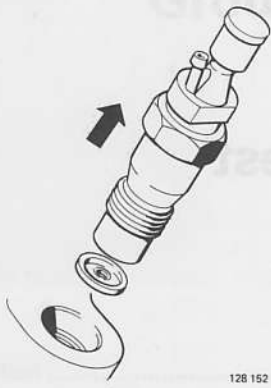
128151

A 3

**Disconnect fuel delivery pipes**

Clean all connections carefully before disconnecting them.

Disconnect pipes and plug all connections to prevent dirt from entering system.



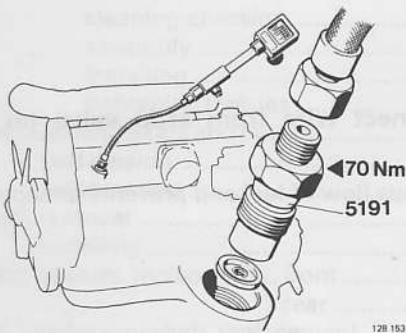
128 152

A4

**Remove injectors**

Use 27 mm socket (Volvo P/N 1158146).

Lift out heat shields under injectors otherwise they will be blown out during compression test.



128 153

A5

**Connect compression tester**

Place a heat shield in cylinder head and screw in adapter **5191**. Tighten to **70 Nm** (50 ft lbs).

Connect compression tester to adapter.

A6

**Run engine and record compression**

Compression

New = **3.2 MPa** (455 psi)

Min = **2.4 MPa** (341 psi)

Max difference between cylinders = **0.8 MPa** (114 psi)

A7

**Install injectors**

Place new heat shields in cylinder head, see fig. Install injectors. Torque to **70 Nm** (50 ft. lbs).

A8

**Reconnect delivery pipes**

Tightening torque 25 Nm (18 ft lbs).

A9

**Reconnect wire to stop valve**

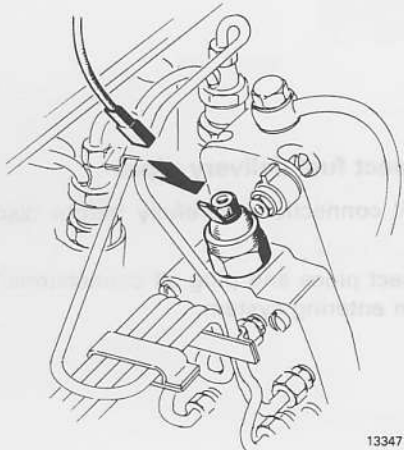
A10

**Install pump plunger and vacuum pump**

Check pump O-ring, replace if necessary.



128 154

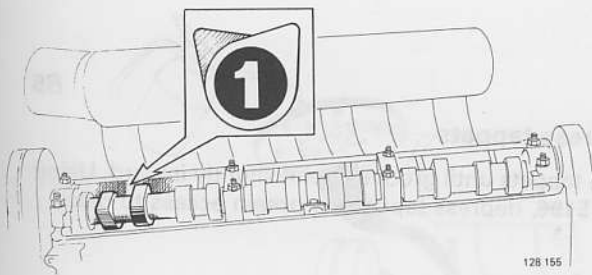


133471

## B. Valve adjustment

Special tools: 5195, 5196

Valve clearance must be checked/adjusted after completion of repairs such as grinding valves, crankshaft replacement etc., and also after 600–1,200 miles (1,000–2,000 km).



**Remove valve cover**

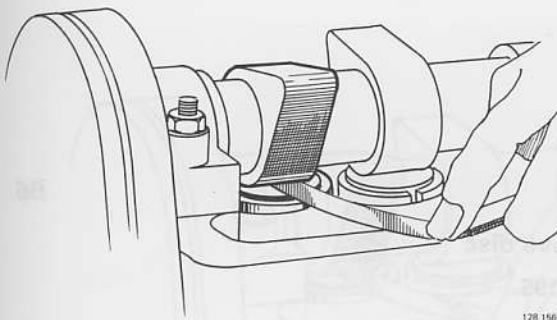
B1

**Turn engine until cyl. 1 is at TDC – injection**

B2

Always use the vibration damper center bolt to turn the engine. 27 mm socket or wrench 5188.

Both cylinder 1 cams should point obliquely upwards.

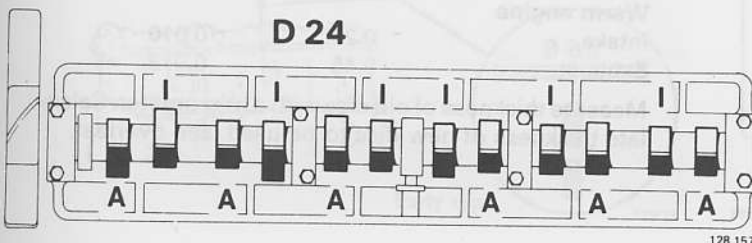
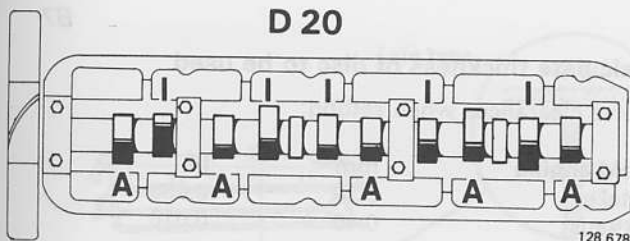


**Check valve clearance for cyl. 1**

B3

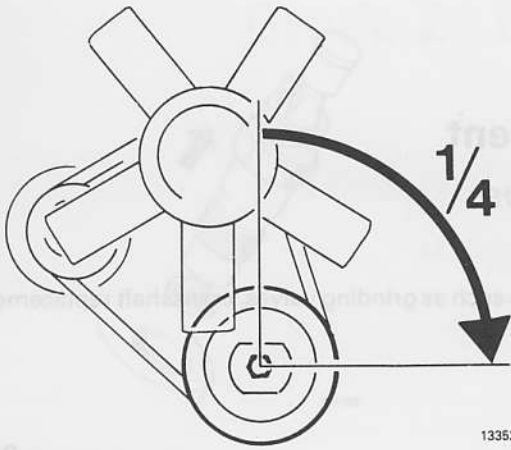
Checking values

	mm	in
<b>Cold engine</b>		
Intake	0.15–0.25	0.006–0.010
Exhaust	0.35–0.45	0.014–0.018
<b>Warm engine</b>		
Intake	0.20–0.30	0.008–0.012
Exhaust	0.40–0.50	0.016–0.020



Cold engine = room temperature  
I = intake valve  
A = exhaust valve





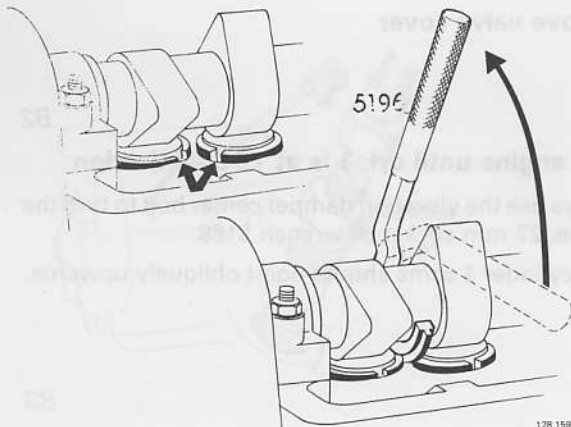
133522

*Incorrect clearance (B4–B8)*

B4

**Turn engine approx. 1/4 turn**

Piston must not be at top dead center when setting valve clearance, otherwise valves will contact piston when tappet is depressed.

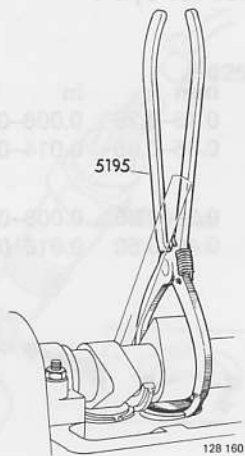


128 159

B5

**Depress tappets**

Turn tappets until grooves point slightly inward. Using tool 5196, depress tappets to obtain access to discs.

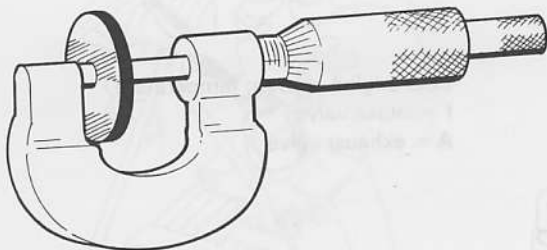


128 160

B6

**Remove disc**

Use 5195.



133478

B7

**Calculate thickness of disc to be used**

Valve clearances when setting:

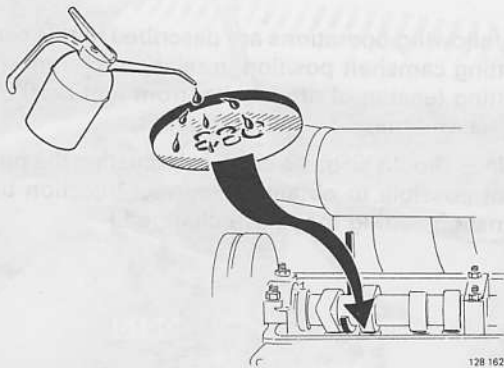
	mm	in
<b>Cold engine</b>		
Intake	0.20	0.008
Exhaust	0.40	0.016
<b>Warm engine</b>		
Intake	0.25	0.010
Exhaust	0.45	0.018

Measure thickness of old disc with a micrometer. Calculate thickness of new disc to be used, see overleaf.

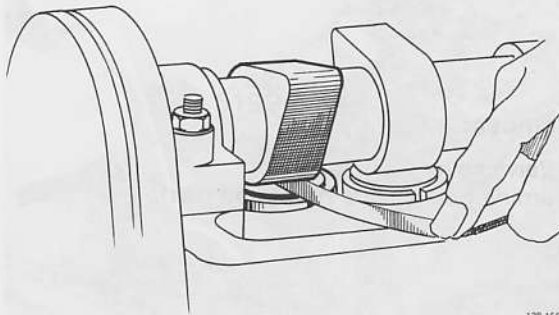


3,80

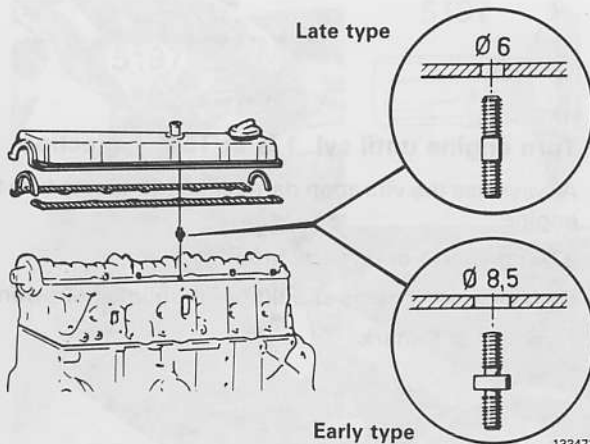
133479



128 162



128 156



133473

**Example:**

If clearance is 0.20 mm and specified clearance is 0.25 mm then replace existing disc with one which is 0.05 mm thinner.

Always use new discs.

Disc thicknesses available = 3.00–4.25 mm at intervals of 0.05 mm.

B8

**Position new disc and remove pliers**

Disc should be lubricated and installed with size marks facing down.

B9

**Check/adjust valve clearance for remaining cylinders**

Check/adjust in following order:

D 20, 1-2-4-5-3

D 24, 1-5-3-6-2-4

**Important!** Do not forget to rotate crankshaft 1/4 turn before check/adjusting valve clearance.

B10

**Recheck valve clearance for all cylinders**

Rotate engine several turns before rechecking.

B11

**Install valve cover**

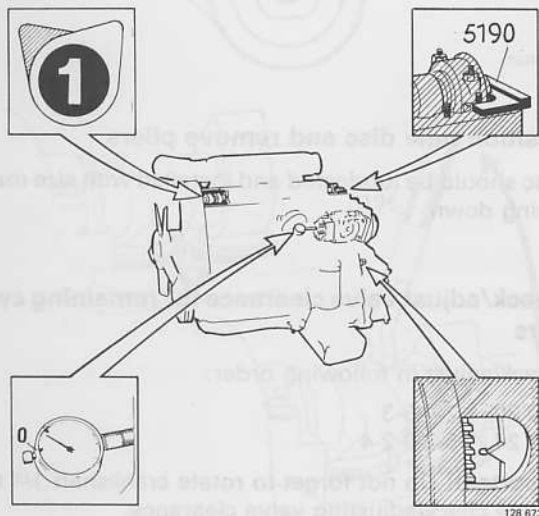
Use new gaskets if required.

Two types of pin studs are available see fig. Late types have a spacer, and hole in gasket is larger to prevent damage to gasket by overtightening.

Late and early type parts **must not** be interchanged.

## C. Basic setting of engine

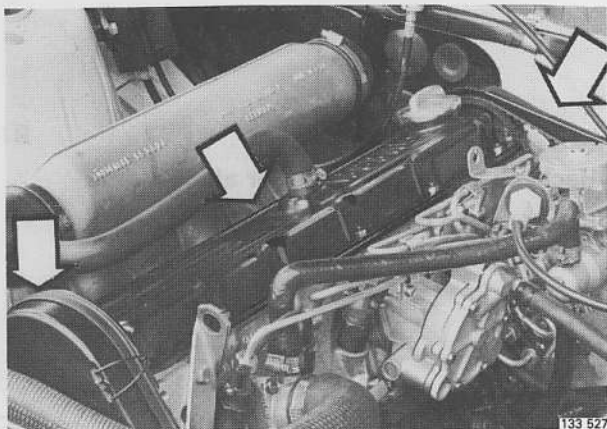
Special tools: 5190, 5193, 5194, 5197, 5199, 5201



The following operations are described in this section:

- setting camshaft position in relation to crankshaft
- setting tension of drive belts (front and rear)
- injection timing.

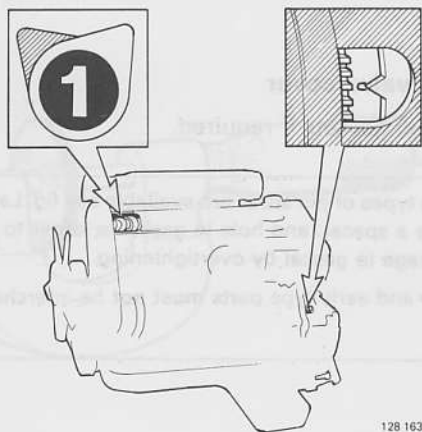
Engines should be basic-set if, by adjusting the pump, it is not possible to obtain the correct injection timing. (Camshaft setting may have changed.)



### Remove:

- Valve cover
- timing gear covers (front and rear).

C1



### Turn engine until cyl. 1 is at TDC – injection

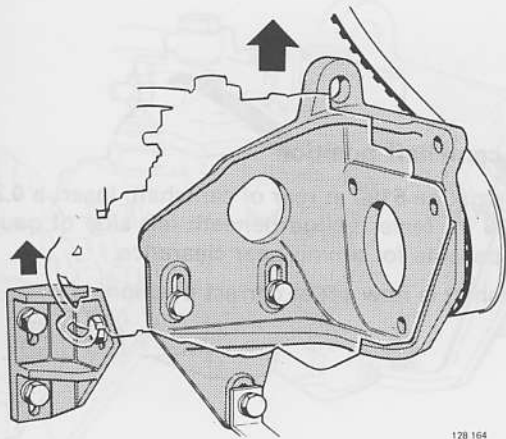
Always use the vibration damper center bolt to turn the engine.

27 mm socket or wrench 5188.

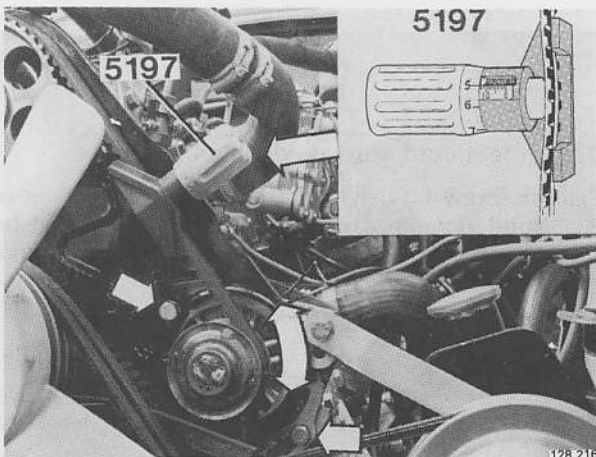
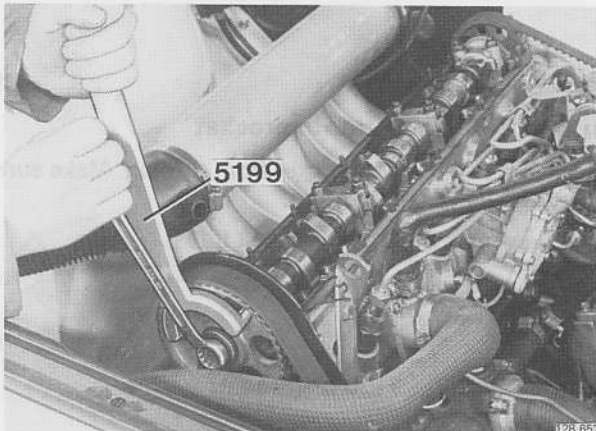
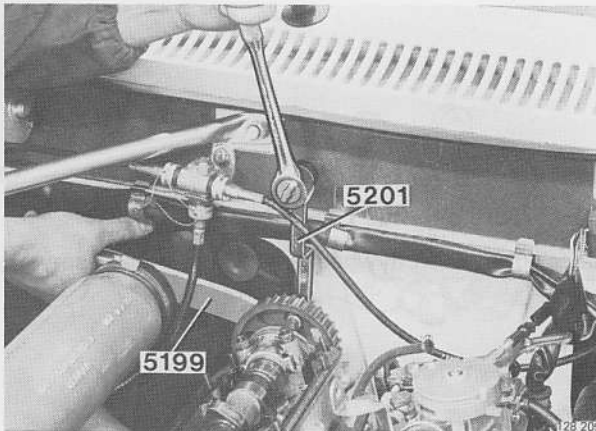
Both cylinder 1 cams should point obliquely upwards.

Flywheel at 0 mark.

C2



128 164



128 216

C3

**Lift off pump belt**

Slacken mounting bolts for injection pump bracket to release belt tension. Tighten one bolt so that pump remains in upper position.

Lift off belt.

C4

**Remove camshaft rear sprocket**

Hold sprocket in position with 5199 and unscrew nut with wrench 5201. Take care not to rotate camshaft.

C5

**Slacken camshaft front sprocket**

Use 5199 to hold sprocket in position when loosening bolt. Make sure that camshaft does not rotate.

Tap sprocket to free it from camshaft.

C6

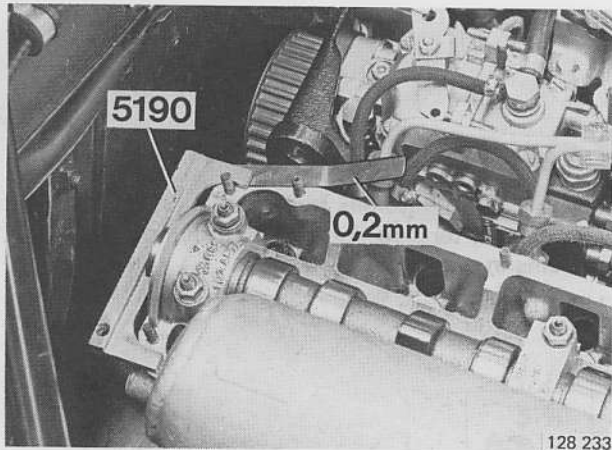
**Set belt tension**

Adjust tension by moving coolant pump.

Use gauge 5197 to check belt tension. Attach gauge to belt and set to 12.5 units.

Stretch belt until mark on gauge plunger is flush with sleeve.

Depress belt strongly with hand and recheck/adjust tension.

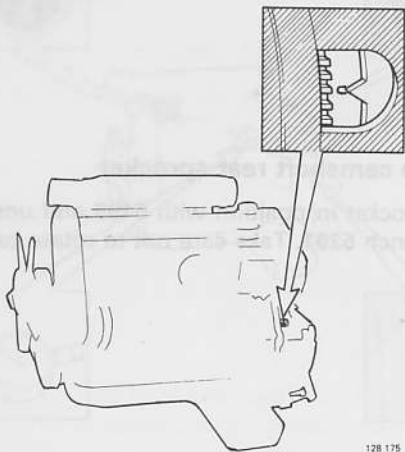


C7

**Set camshaft position**

Place gauge 5190 at rear of camshaft. Insert a 0.2 mm (0.008 in) feeler gauge beneath left side of gauge to compensate for timing gear clearance.

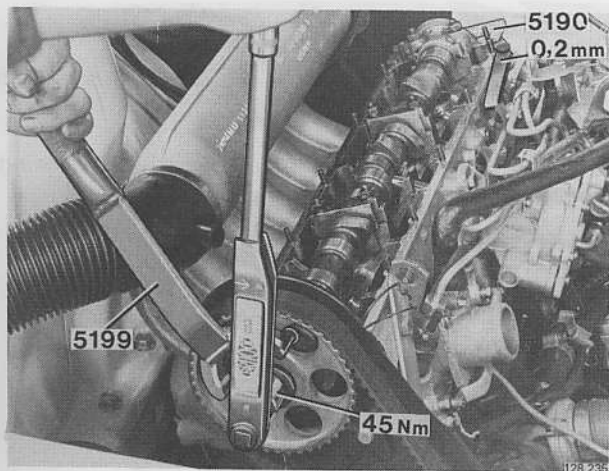
Camshaft is now set at correct position.



C8

**Make sure cyl. no. 1 is at top dead center**

Check 0 mark on flywheel and adjust if necessary.



C9

**Tighten camshaft front sprocket**

Use 5199 to prevent sprocket from turning. Make sure that camshaft does not turn.

Torque center bolt to 45 Nm (33 ft lbs).

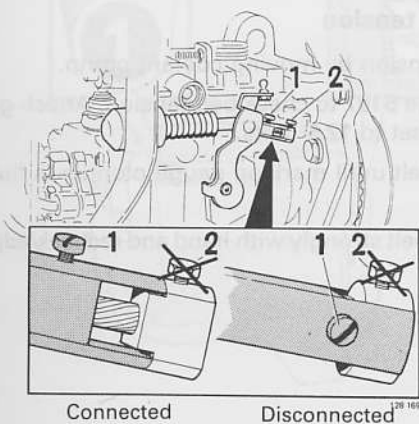
C10

**Remove gauge 5190 and feeler gauge**

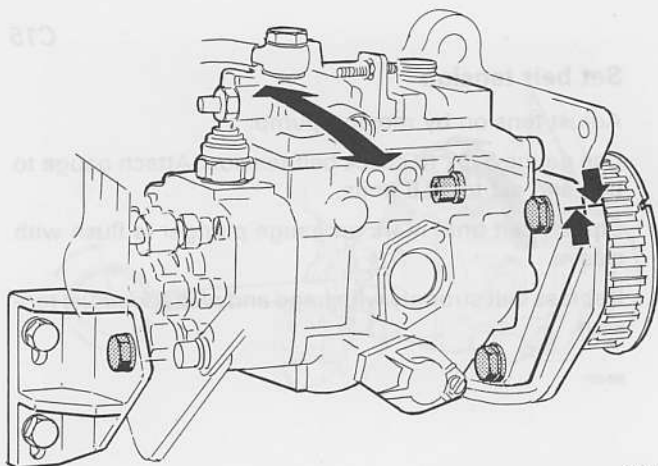
C11

**Disconnect cold start device**

Slacken screw 1. Push lever forward and rotate sleeve 90°. Note! Do not turn screw 2 otherwise it will be necessary to remove cold start device and reset it on a test bench.





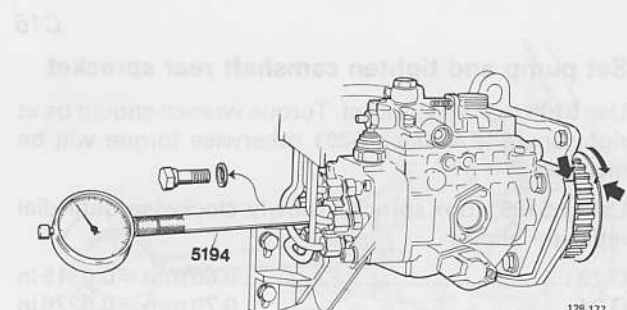


128 167

C12

**Basic-set injection pump**

Slacken pump mounting bolts (Allen key = 6 mm). Align marks in pump and mounting bracket by turning pump. Retighten mounting bolts.



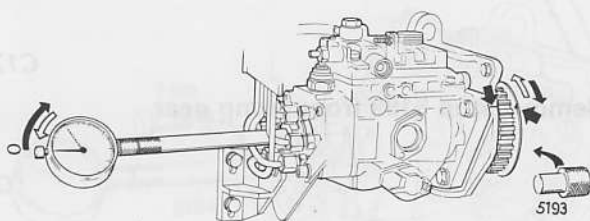
128 177

C13

**Set dial indicator zero. Lock pump gear at cyl. 1 injection using stop 5193**

Unscrew and remove plug from injection pump distributor. Install holder 5194 and dial indicator (range 0–3 mm). Set gauge to approx. 2 mm.

Turn pump gear clockwise until mark on gear and mounting bracket coincide.

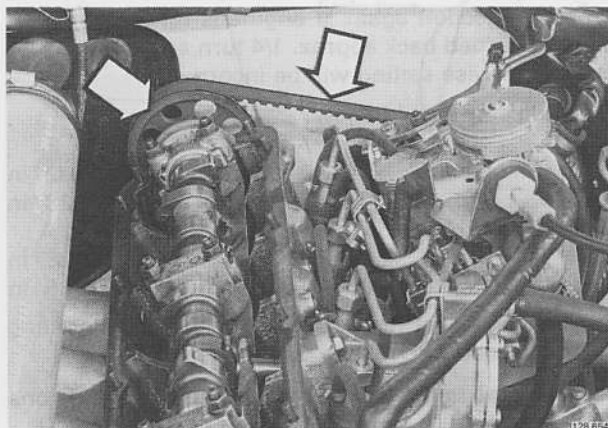


128 670

Then turn pump gear back slightly until min. reading registers on dial indicator.

Set indicator to zero.

Turn pump gear clockwise until mark on gear and pump mounting bracket coincide. Lock gear in this position with stop 5193. (Insert stop through pump gear into mounting bracket.)

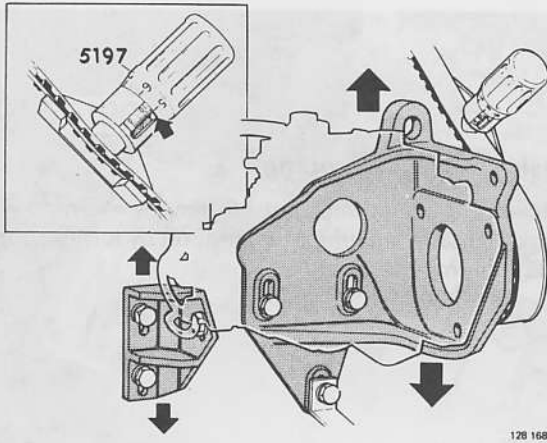


128 654

C14

**Install camshaft rear sprocket and belt**

Tighten center bolt by hand, but it should still be possible to turn sprocket on camshaft.



C15

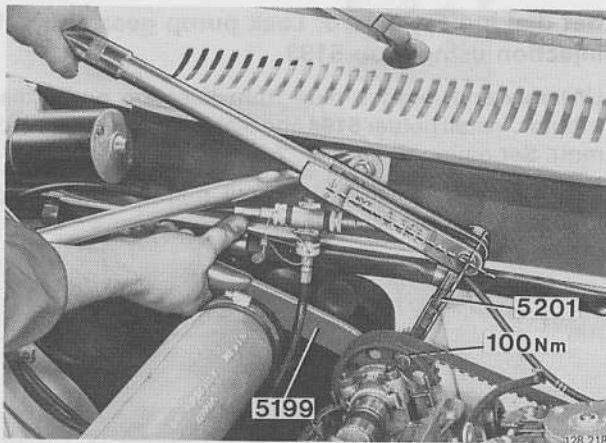
**Set belt tension**

Adjust tension by moving pump.

Use gauge **5197** to check belt tension. Attach gauge to belt and set to **12.5** units.

Stretch belt until mark on gauge plunger is flush with sleeve.

Depress belt strongly with hand and recheck/adjust tension.



C16

**Set pump and tighten camshaft rear sprocket**

Use **5199** to hold sprocket. Torque wrench should be at right angle to wrench **5201** otherwise torque will be incorrect.

Using **5199**, turn sprocket slowly clockwise until dial indicator shows:

D 20 .....	0.80 mm = 0.0315 in
D 24 .....	0.70 mm = 0.0276 in
D 24 USA/Canada 1979–1981 .....	0.70 mm = 0.0276 in
1982– .....	0.85 mm = 0.0335 in

Hold sprocket in this position and torque bolt to **100 Nm** (73 ft. lbs). Take care that camshaft and sprocket do not move.

C17

**Remove stop 5193 from pump gear**

C18

**Check pump setting**

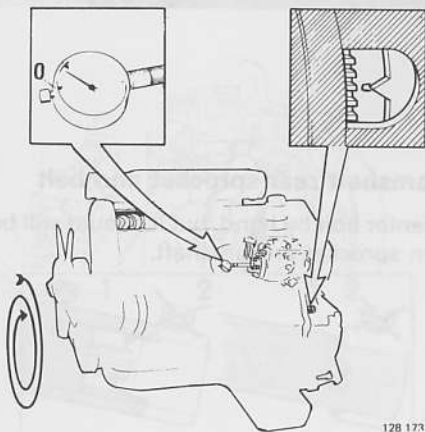
Turn engine two full turns until cyl. 1 is at top dead center – injection again. If engine is turned too far it must be turned back approx. 1/4 turn and then to zero mark otherwise setting will be incorrect.

Dial indicator should show:

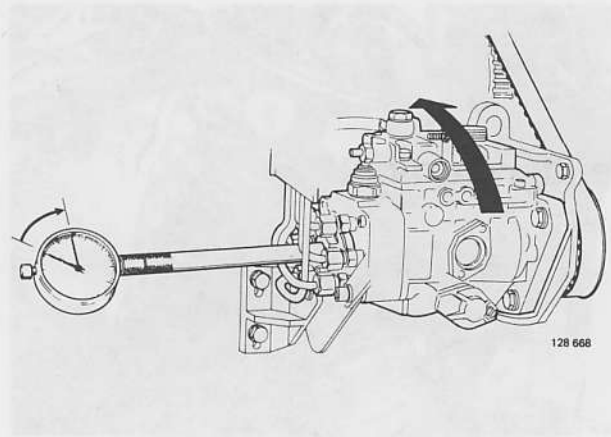
D 20 .....	0.75–0.83 mm = 0.0295–0.0327 in
D 24 .....	0.65–0.73 mm = 0.0256–0.0287 in
D 24 USA and Canada	
1979–81 .....	0.65–0.73 mm = 0.0256–0.0287 in
1982– .....	0.82–0.90 mm = 0.0323–0.0354 in

**Correct reading:** Tighten injection pump mounting bolts. Proceed to C19.

**Incorrect reading:** Readjust according to instructions on next page.







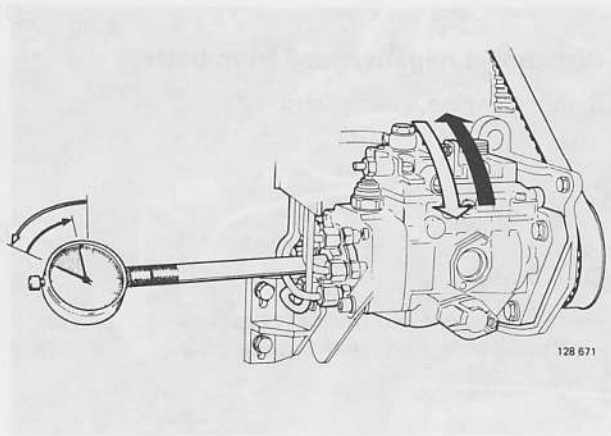
**Readjusting pump setting:**

Setting values:

D 20 .....	0.80 mm = 0.0315 in
D 24 .....	0.70 mm = 0.0276 in
D 24 USA and Canada 1979-81 .....	0.70 mm = 0.0276 in
1982- .....	0.85 mm = 0.0335 in

**Reading less than specified:**

Slacken pump mounting bolts and turn pump **inwards** to obtain correct value. Tighten mounting bolts and repeat check of pump setting.



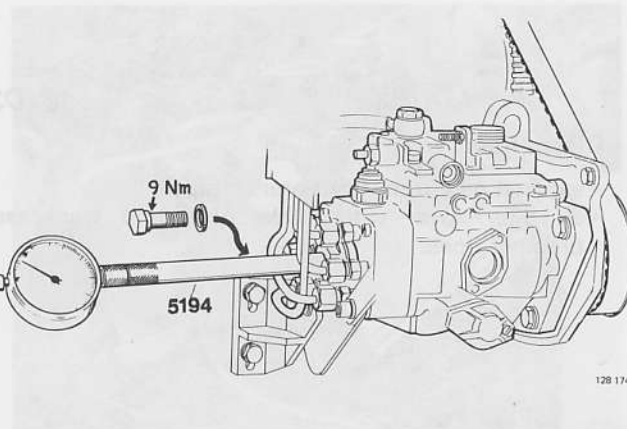
**Reading more than specified:**

Slacken pump mounting bolts and turn pump **outwards** until dial indicator shows **approx.**

D 20 .....	0.70 mm = 0.0276 in
D 24 .....	0.60 mm = 0.0236 in
D 24 USA/Canada 1979-81 .....	0.60 mm = 0.0236 in
1982- .....	0.75 mm = 0.0295 in

Then turn pump inwards until specified value is obtained. Tighten mounting bolts and recheck pump setting.

**Note!** Injection pump must not be tapped or knocked as this will alter setting.



C19

**Remove dial indicator and holder 5194. Install plug with new seal**

Tightening torque 9 Nm (6.5 ft lbs).

C20

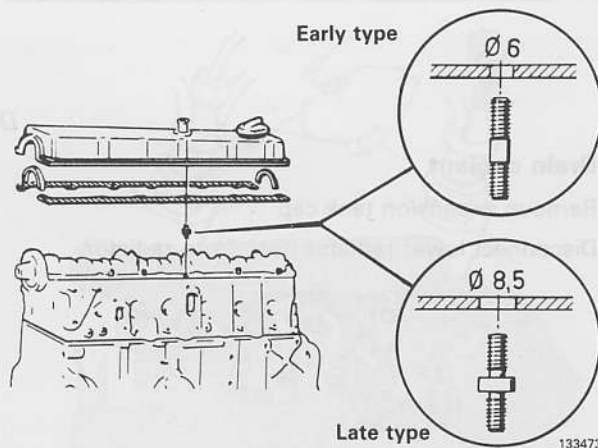
**Reconnect cold start device**

Press lever forwards and turn sleeve 90°. Retighten screw 1.

C21

**Install valve cover and timing gear covers**

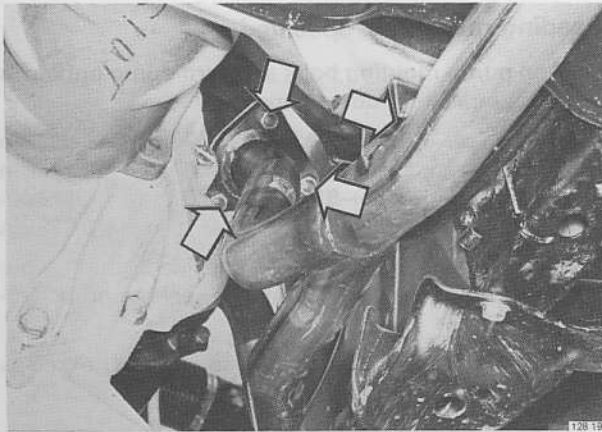
Use new gaskets if necessary.



Two types of pin studs are available, see fig. Late types have a spacer, and hole in gasket is larger to prevent damage to gasket by overtightening. Late and early type parts **must not** be interchanged.

## D. Cylinder head, removal

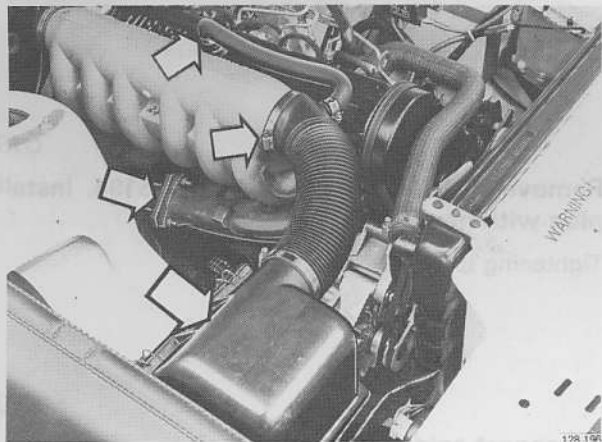
Special tools: 5199, 5201



D1

### Disconnect negative lead from battery

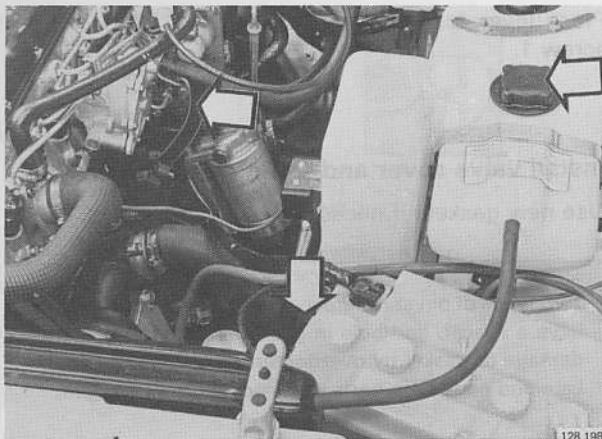
Remove engine splashguard.



D2

### Disconnect:

- exhaust pipe from gearbox bracket
- exhaust pipe from rear branch pipe.



D3

### Disconnect:

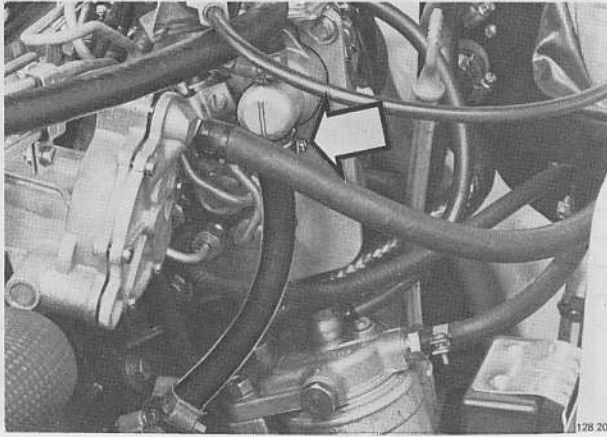
- exhaust pipe from front branch pipe
- air filter cover with intake hose and crankcase breather hose.

D4

### Drain coolant

Remove expansion tank cap

Disconnect lower radiator hose from radiator.

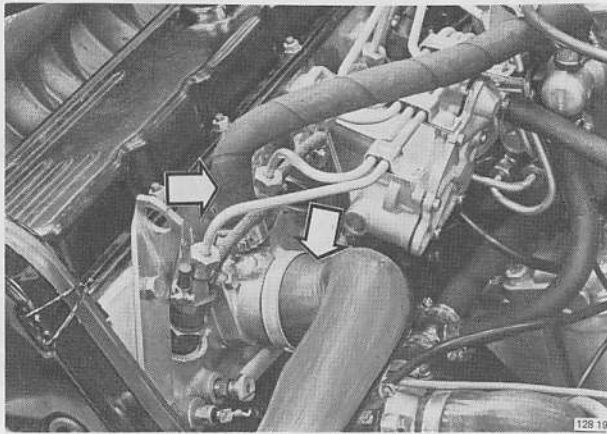


**Drain coolant from engine**

(Engine is without a drain cock.)

Disconnect lower hose from cold start device and drain coolant.

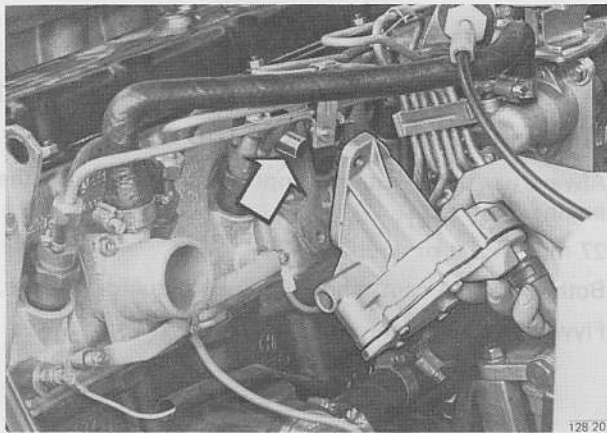
D5



**Disconnect from cylinder head:**

- upper radiator hose
- hose for cold start device.

D6

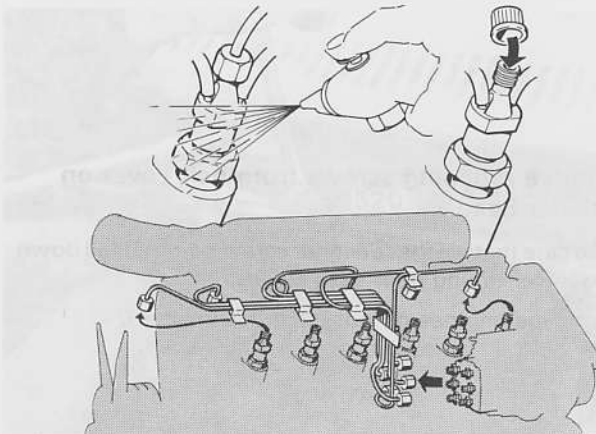


**Remove vacuum pump and pump plunger**

Remove pump retaining nuts and place pump on wheelarch.

Remove plunger from cylinder head.

D7

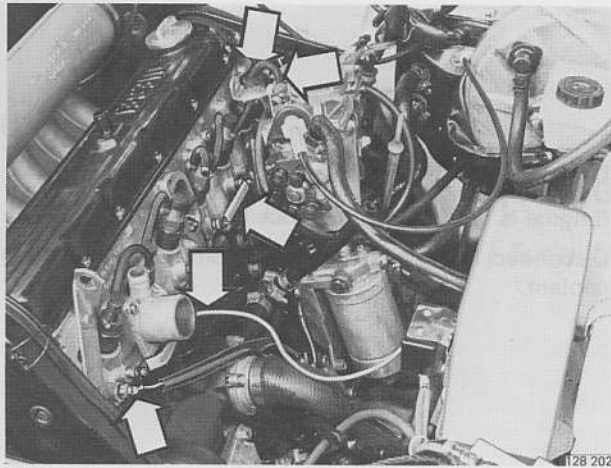


**Remove fuel delivery pipe**

Clean all connections thoroughly before disconnecting pipes.

Remove all pressure pipes and plug ends to prevent dirt from entering fuel system.

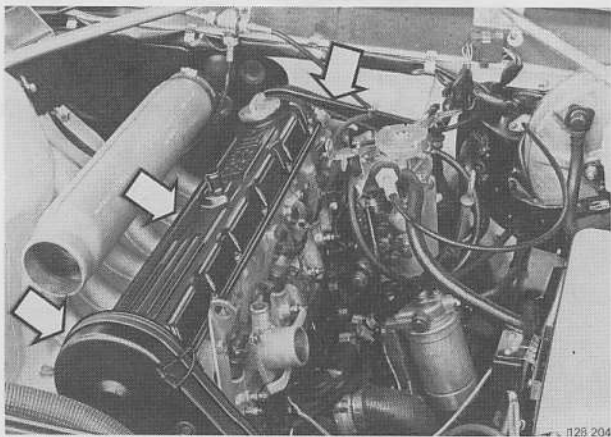
D8



D9

**Disconnect from cylinder head:**

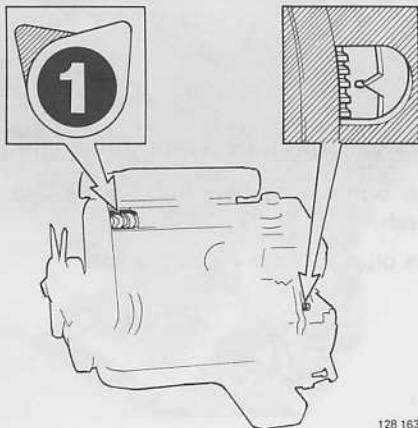
- wire for temperature gauge sender
- wire for glow plugs
- copper connecting strip for rear glow plug
- return hose from rear injector
- wire for temperature gauge sender at rear of cylinder head.



D10

**Remove:**

- valve cover
- timing gear covers (front + rear).



D11

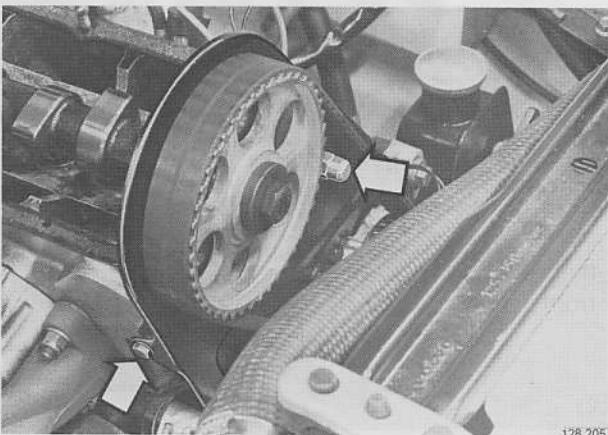
**Turn engine until cyl. 1 is at TDC – injection**

Always use the vibration damper center bolt to turn the engine.

27 mm socket or wrench 5188.

Both cylinder 1 cams should point obliquely upwards.

Flywheel at '0' mark.



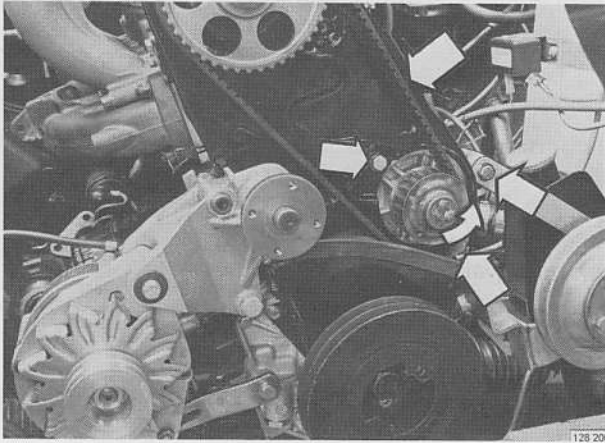
D12

**Remove retaining screws from belt cover on cylinder head**

Take care that washer on inner screw does not fall down into lower timing gear case cover.

(Late type engines do not have this washer).



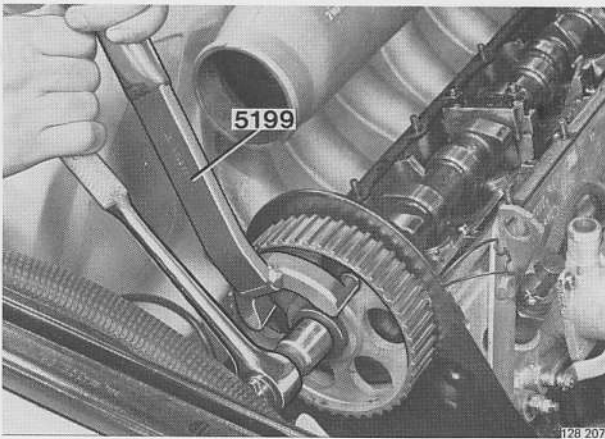


**Remove belt from camshaft sprocket**

Slacken coolant pump mounting bolts and belt tensioner.

Remove belt from sprocket.

D13

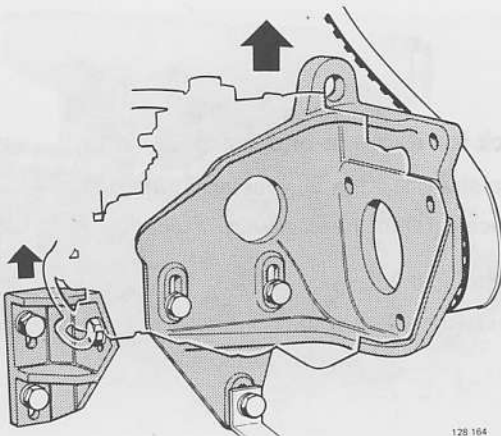


**Remove camshaft front sprocket**

Use **5199** to hold sprocket in position when loosening bolt. Make sure that camshaft does not rotate.

Tap sprocket to free it from camshaft.

D14

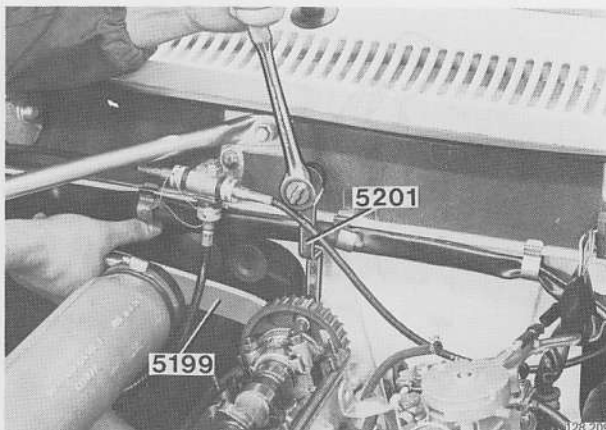


**Lift off pump belt**

Slacken mounting bolts for injection pump bracket to release belt tension. Tighten one bolt so that pump remains in upper position.

Lift off belt.

D15

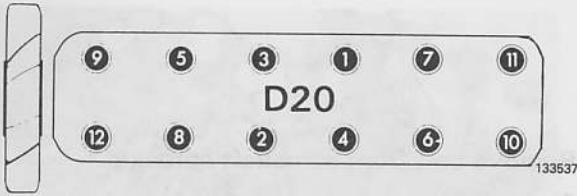


**Remove camshaft rear sprocket**

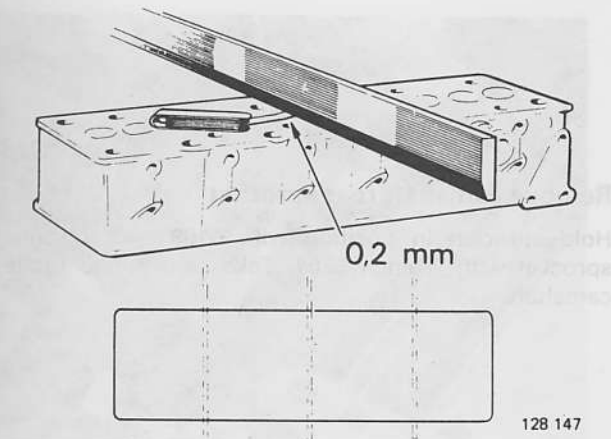
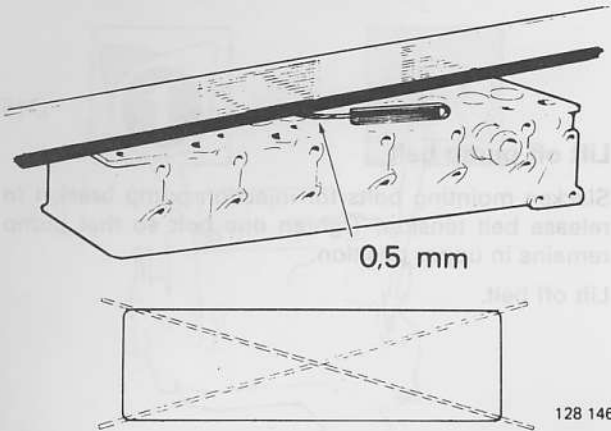
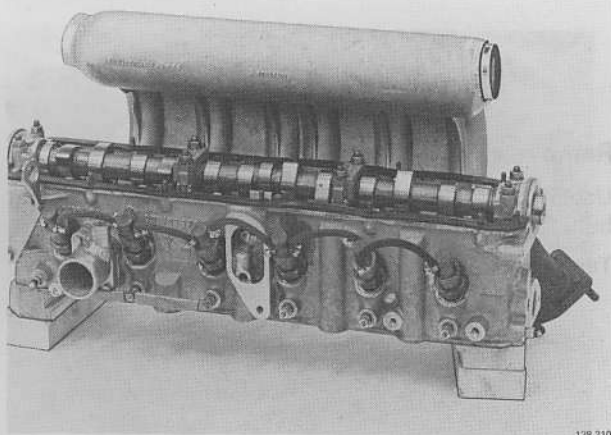
Hold sprocket in position with **5199** and unscrew sprocket with wrench **5201**. Take care not to rotate camshaft.

D16





Tightening sequence for cylinder head bolts.  
Bolts must be slackened in reverse sequence.



**Remove cylinder head**

**Important:** Slacken bolts in reverse sequence to tightening. (i.e. start at 12 (or 14) and finish at 1.)

Lift away cylinder head. Check that rear glow plug clears injection pump bracket and that valves do not contact cylinder walls.

D17

**Place cylinder head on wooden blocks**

Do not rest cylinder head on valves.

D18

**Clean gasket surfaces on cylinder head and cylinder block**

D19

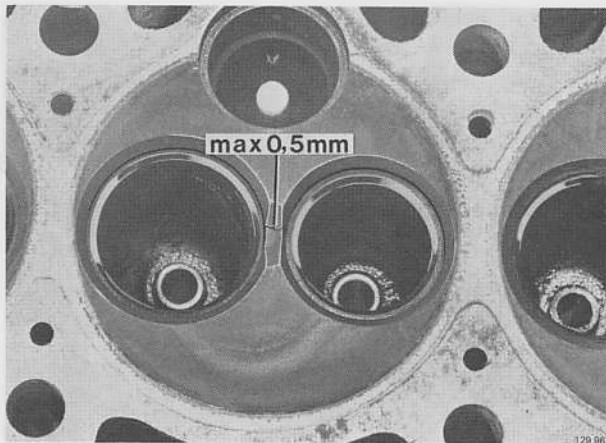
**Check for damage and warp**

Use a straight edge and feeler gauge.

Replace cylinder head if warp exceeds:

- lengthwise **0.5 mm** (0.02 in).
- crosswise **0.2 mm** (0.008 in).

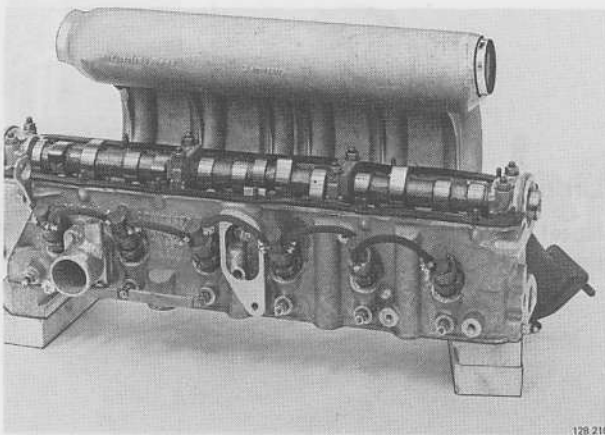
D20



**Note!** Small cracks (0.5 mm = 0.02 in) do not warrant replacement of cylinder head since they do not impair engine function.

For gasket replacement only see "Cylinder head installation" page 45.

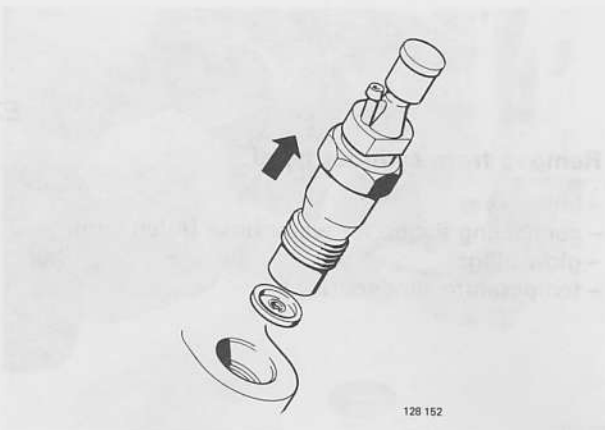
## E. Cylinder head, disassembly



E1

**Remove intake manifold, exhaust manifold and gasket**

Allen 6 mm.



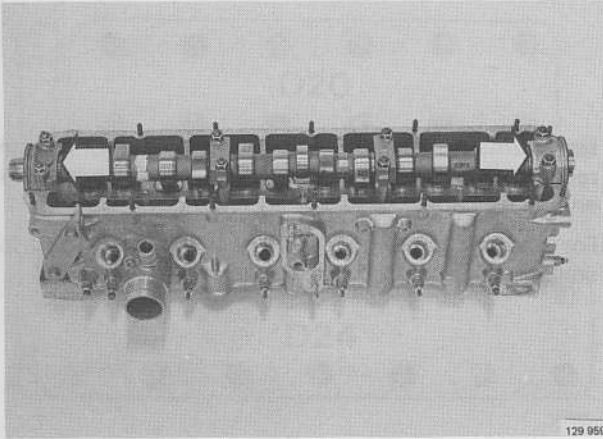
E2

**Remove injectors**

Remove dirt around injectors.

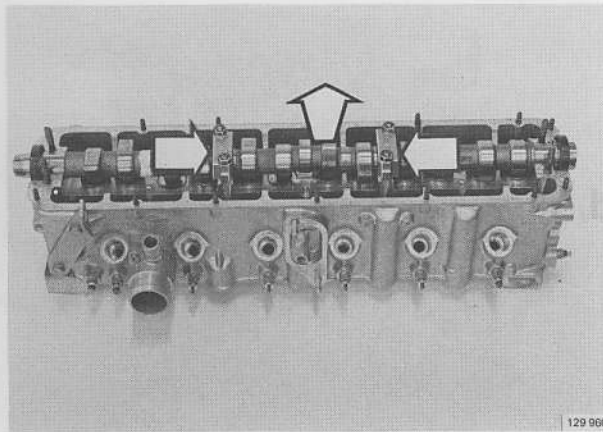
Disconnect fuel lines.

Remove injectors, 27 mm socket. Lift out heat shields from cylinder head.



**Remove camshaft bearing caps 1 and 4**

E3



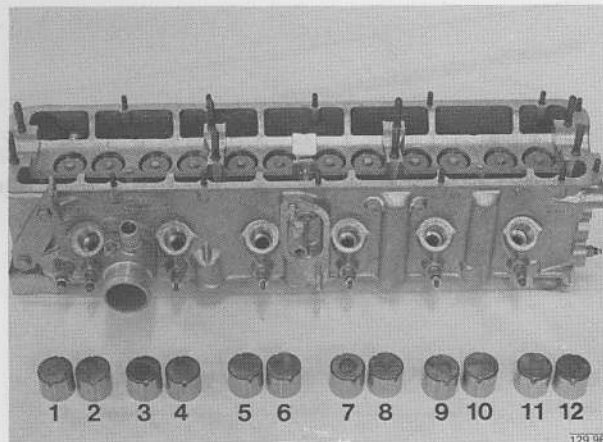
**Remove camshaft bearing caps 2 and 3**

Slacken nuts crosswise to avoid placing uneven load on camshaft.

E4

**Lift away camshaft and remove oil seals**

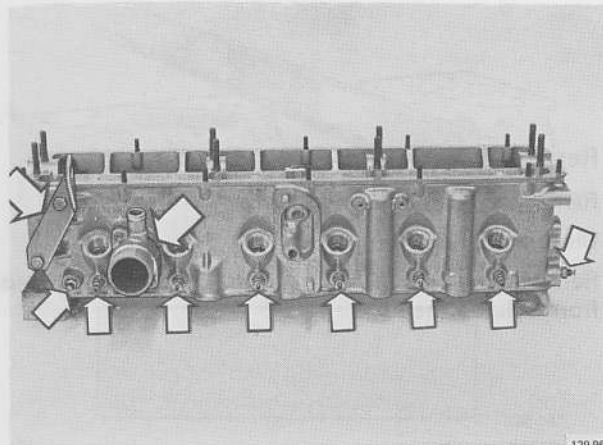
E5



**Lift out tappets**

**Note!** Do not interchange tappets. Mark tappets so that they can be installed in same position.

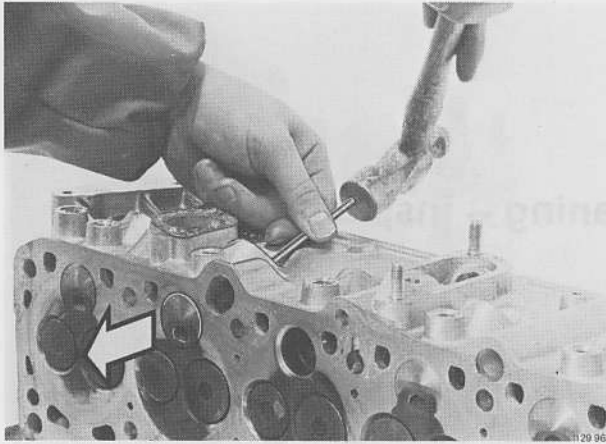
E6



**Remove from cylinder head:**

- lifting eyes
- connecting flange for water hose (Allen 5 mm)
- glow plugs
- temperature senders (2 X).

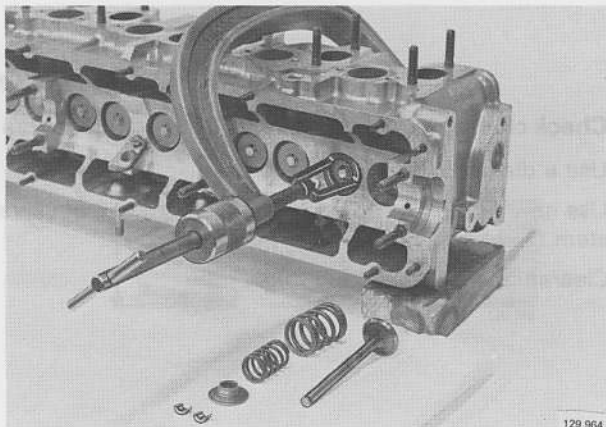
E7



**Tap out swirl chambers**

Use a long narrow punch (6 mm = 0.24 in diameter), length 150 mm (6 in).

E8



**Remove valve springs and valves**

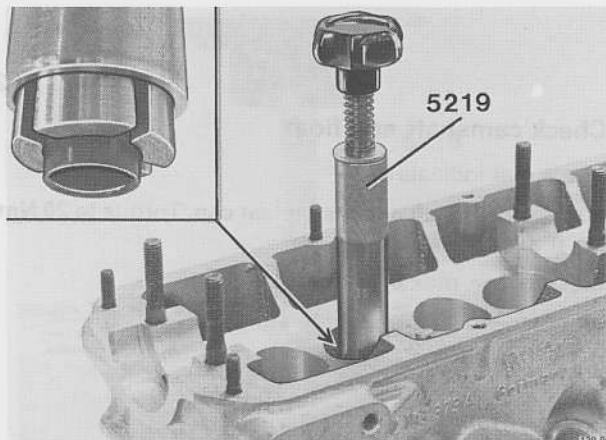
Important! Do not interchange parts.

Depress valve springs with a special compressor tool.

Remove:

- retainer (collet)
- upper spring seat
- springs
- valve.

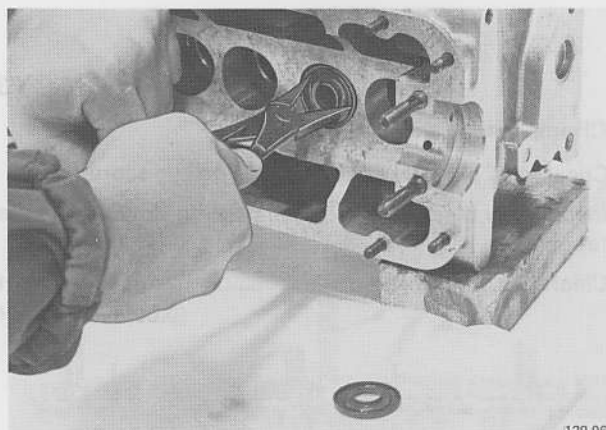
E9



**Remove seals from valve guides**

Use tool 5219.

E10

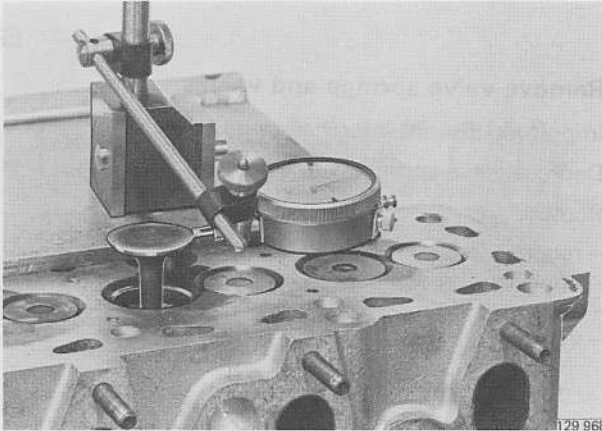


**Remove lower valve spring washers**

Use a pair of external lock ring pliers with flat jaws.

E11

## F. Cylinder head, cleaning – inspection



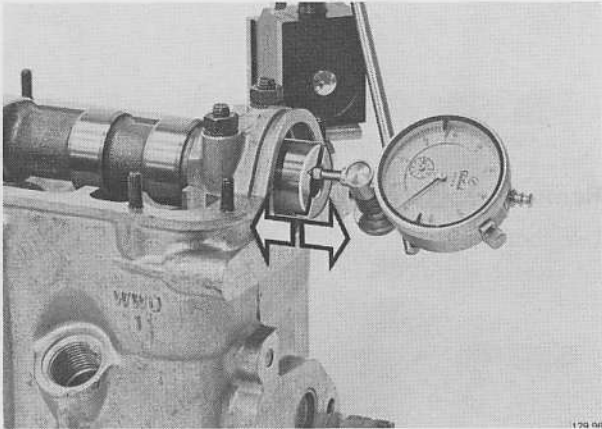
F1

### Check clearance between valve guides and valves

Use a dial indicator.

Use new valves (intake and exhaust) with end of valve stem flush with valve guide.

Clearance = **1.3 mm** (0.05 in).



F2

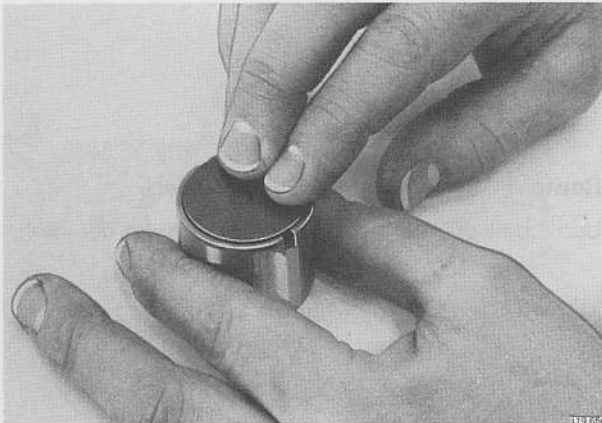
### Check camshaft end float

Use a dial indicator.

Position camshaft and install rear cap. Torque to **20 Nm** (15 ft lbs).

Clearance = max **0.15 mm** (0.006 in).

Remove cap and camshaft.



F3

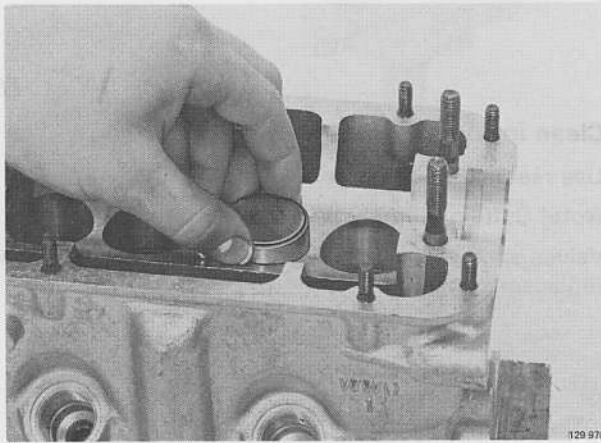
### Check discs

Check disc play. Replace disc if worn or scored.

Install new discs with numbers facing down, towards tappets.

Clearance, new parts ..... 0.016–0.046 mm  
(0.0006–0.0018 in)





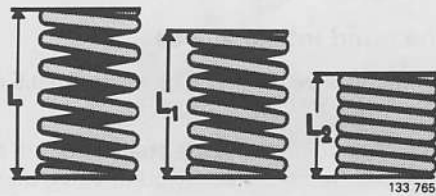
F4

**Check tappets**

Place tappets in cylinder head

Check fit and clearance.

Clearance, new parts 0.025–0.075 mm (0.001–0.003 in)



F5

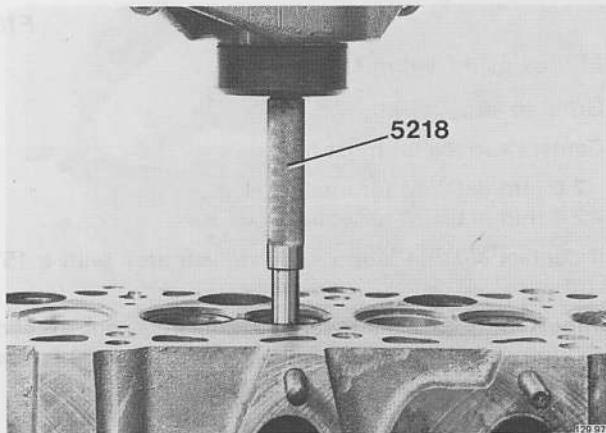
**Check valve springs**

**Inner springs**

Length		Load	
mm	(in)	N	(lbs)
33.9	(1.334)	0	(0)
28.6	(1.126)	67–77	(15–17.5)
18.3	(0.720)	209–231	(47–52.2)

**Outer springs**

Length		Load	
mm	(in)	N	(lbs)
40.2	(1.583)	0	(0)
32.6	(1.283)	167–185	(38–42)
22.3	(0.878)	433–479	(98–108.3)

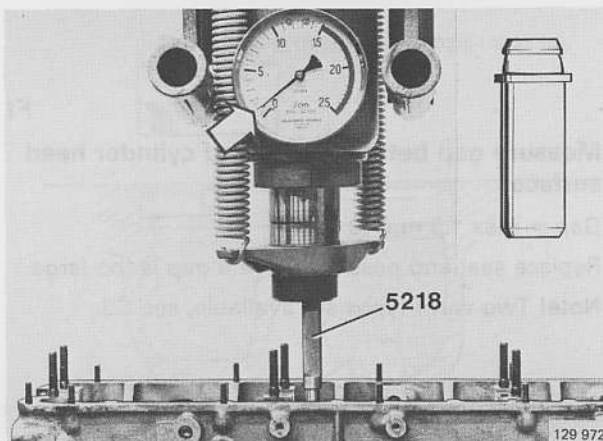


**Replacing valve guides**  
Operations F 6–8

F6

**Press out valve guide**

Use drift 5218. Press from combustion chamber side.



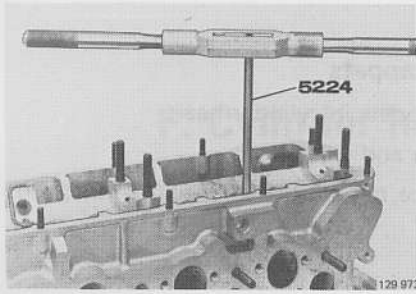
F7

**Press in new valve guide**

Lubricate valve guide.

Use drift 5218. Press in from camshaft side.

Press in guide until flange on guide contacts cylinder head. In this position press force must not exceed 1 ton since flange may break off.



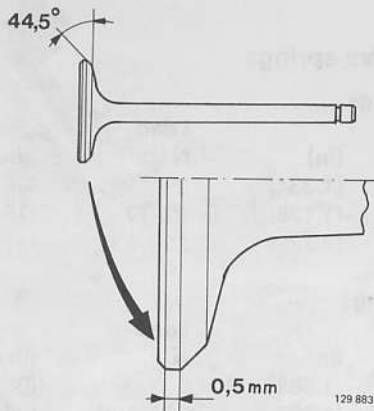
### Clean inside of valve guide

Use reamer 5224

**Note!** Cutting oil must be used when reaming.

Valves and seats must be ground-in after valve guide replacement.

F8



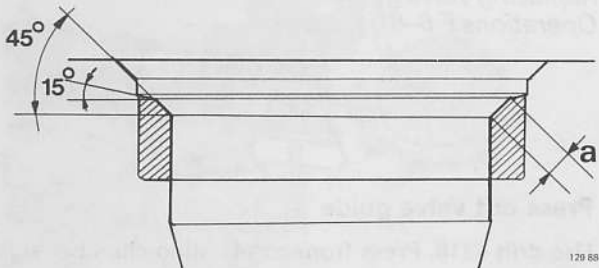
### Grinding-in valves and seats Operations F 9–12

#### Machine grind intake valves

Edge of intake valve must not be less than 0.5 mm (0.02 in).

**Important!** Exhaust valves are stellite coated and must not be ground by machine. Grind-in valve on seat with grinding paste.

F9



#### Mill or grind valve seats

Grind to 45°.

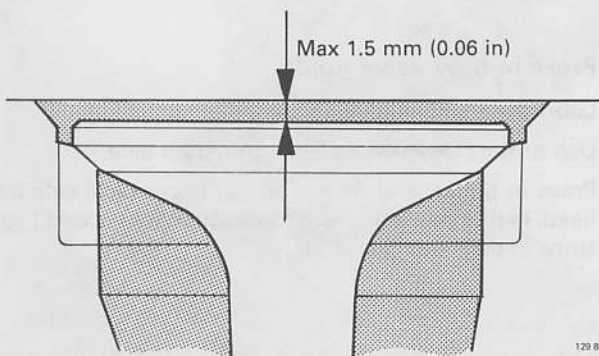
Contact surface (a) must be:

- 2.0 mm (0.08 in) for intake valve
- 2.4 mm (0.09 in) for exhaust valve.

If contact surface is too wide reduce area with a 15° cutter.

**Important!** Outer diameter of cutter must not exceed 35.2 mm (1.39 in) for intake valve seats and 33.2 mm (1.31 in) for exhaust valve seats.

F10



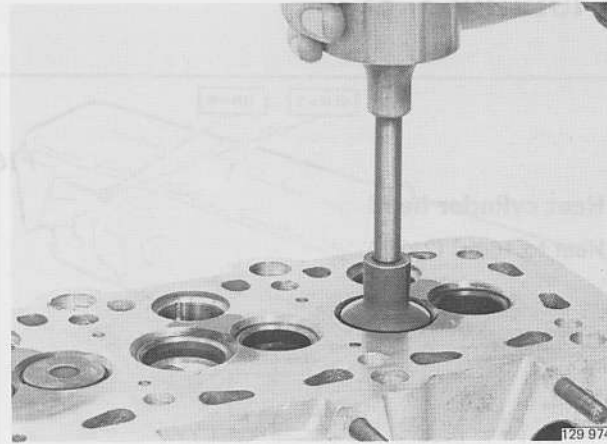
#### Measure gap between disc and cylinder head surface

Gap = max 1.5 mm (0.06 in).

Replace seat and possibly valve if gap is too large.

**Note!** Two valve types are available, see G3.

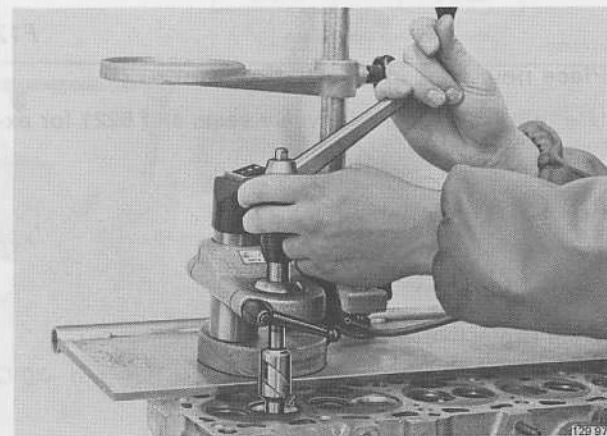
F11



F12

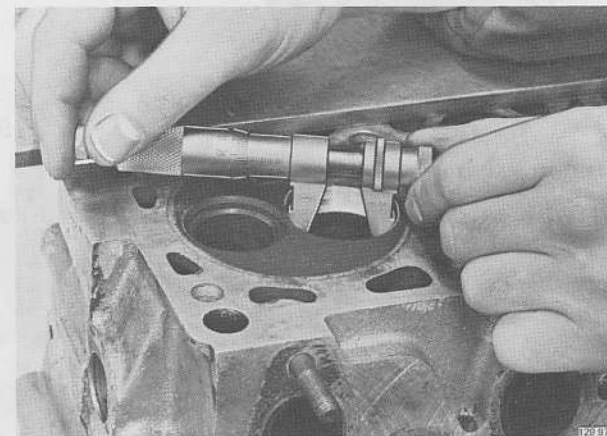
**Grind-in valves with paste**

Clean valves thoroughly.



**Replacing valve seats**  
Operations F 13–21

Valve guides must be replaced before replacing seats, see F6–8, page 37.



**Clean combustion chamber** F13

Edge of seat must be clearly visible after cleaning.

**Remove valve seat** F14

Mill valve seat, using cutters such as Mira (P/N 9986045). Refer to manufacturer's instructions. Make sure that seat in cylinder head is not damaged.

Clean surfaces thoroughly.

F15

**Measure diameter of seat recess in cylinder head and of valve seat**

Use an internal micrometer to measure seat recess.

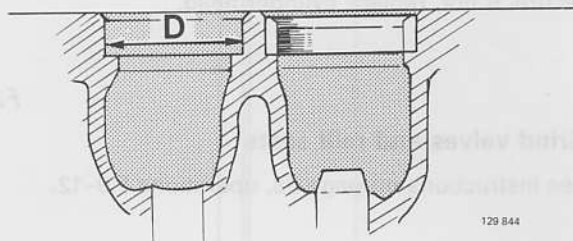
**Standard**  
(production version)

Diameter, seat recess, mm (in)		
intake .....	37.000–37.016	(1.4567–1.4573)
exhaust .....	33.000–33.016	(1.2992–1.2998)
Diameter, seat,		
intake .....	37.090–37.105	(1.4602–1.4608)
exhaust .....	33.090–33.105	(1.3028–1.3033)

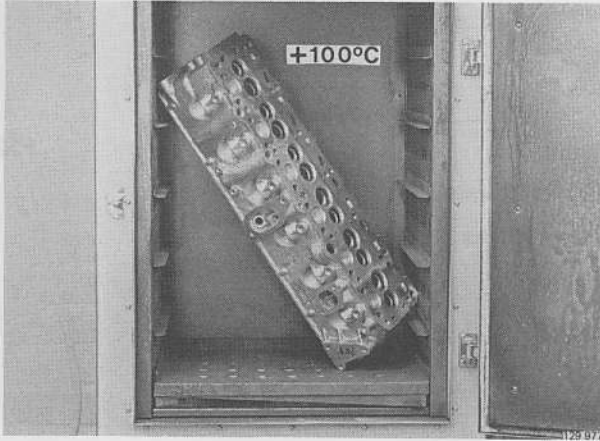
**Oversize**  
(replacement parts version)

Diameter, seat recess, mm (in)		
intake .....	37.200–37.216	(1.4646–1.4652)
exhaust .....	33.200–33.216	(1.3071–1.3077)
Diameter, seat,		
intake .....	37.290–37.305	(1.4681–1.4687)
exhaust .....	33.290–33.305	(1.3106–1.3112)

$D + (0.074 - 0.105 \text{ mm} = 0.0029 - 0.0041 \text{ in})$



When replacing valve seats: the interference between the valve seat and its bore in the cylinder head shall be **0.074–0.105 mm (0.0029–0.0041 in)** i.e. valve seat diameter must be 0.074–0.105 mm (0.0029–0.0041 in) greater than the diameter of the bore in the cylinder head. Replace cylinder head if clearance is too small. Mill seat recess if interference is too large.



**Heat cylinder head**  
Heat to 100°C (212°F).

F16

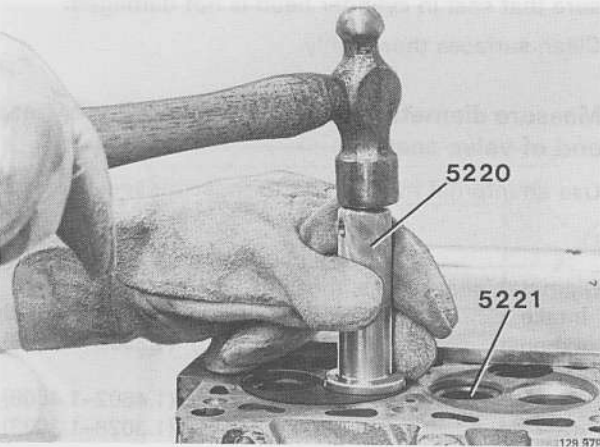


**Place new seat in installation tool**  
Use drift 5220 for intake valve seats and 5221 for exhaust valve seats.

F17

**Cool valve seat**  
Wear protective gloves and safety glasses.  
Use liquid carbon dioxide to cool seat down to -70°C (-94°F).

F18



**Tap-in valve seat**  
**Note!** This must be done quickly, within 3–4 seconds to avoid temperature loss.

F19

**Check fit of valve seat**  
Make sure that the seat has bottomed correctly and is secure. If not, replace cylinder head.

F20

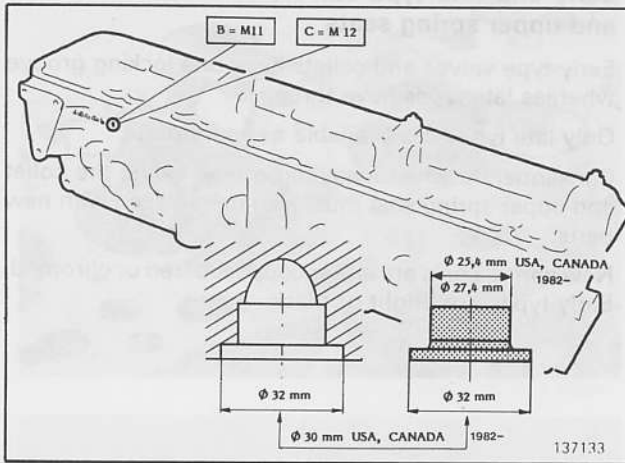
**Grind valves and mill seats**  
See instructions on page 38, operations F 9–12.

F21



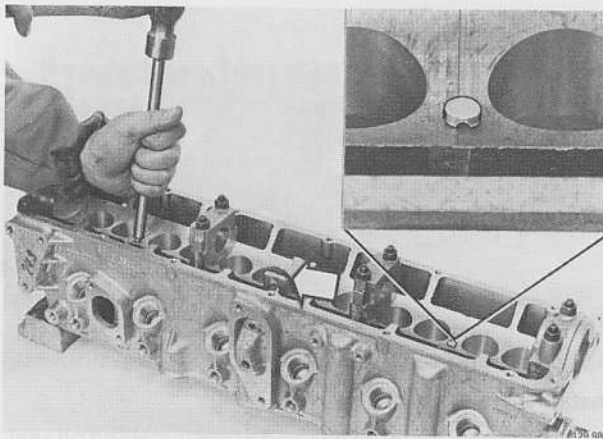
## G. Cylinder head, assembly

### New cylinder head



#### Important

- New cylinder head must be the same type as the old. Cylinder heads designed for use with M 12 bolts must not be used with M 11 bolts.  
Cylinder heads can be identified as follows (see illustration at left):
  - Number series followed by B = M 11
  - Number series followed by C = M 12
- USA/Canada 1982– has a different type of cylinder head and swirl chamber. Swirl chamber and its bore is 2 mm (0.080 in) smaller in diameter than other types.



### New cylinder head Operation G1

G1

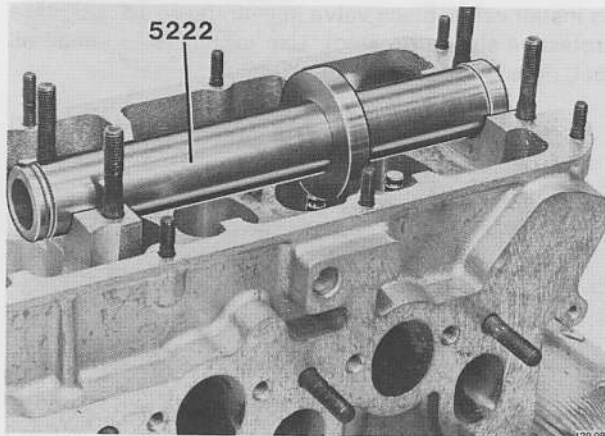
#### Install oil jets and pin studs in cylinder head

Carefully tap in oil jets using a brass punch.

**Note!** Turn outer jets to point across cylinder head, see fig.

**Important!** Check specification and type of cylinder head. M 12 bolts must not be used with M 11 bolts.

Different type cylinder heads are used for USA/Canada.



G2

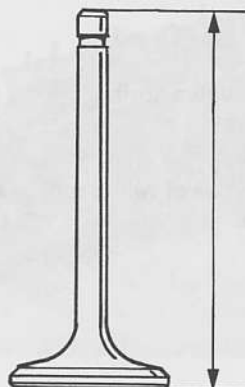
#### Check valve stem position in relation to camshaft

This measurement is carried out to ensure that there is sufficient adjustment latitude for valves.

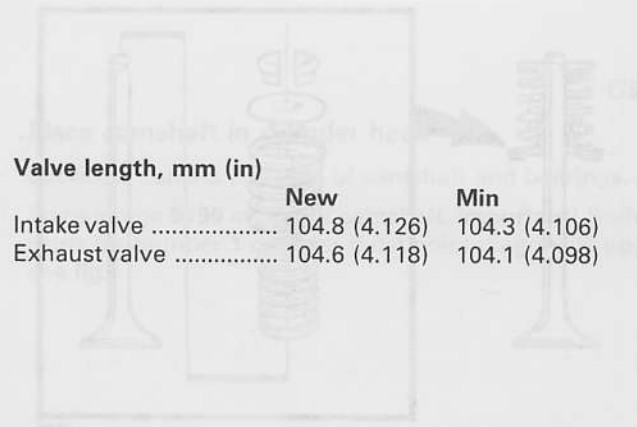
Place gauge **5222** with largest diameter ring, on cylinder head. (Small ring is for B 17–B 23 engines.)

**Note!** Front bearing recess diameter is larger than others. Make sure that gauge is positioned correctly.

Taking each valve in turn, check that stem does not contact gauge. If this happens, grind valve stem.



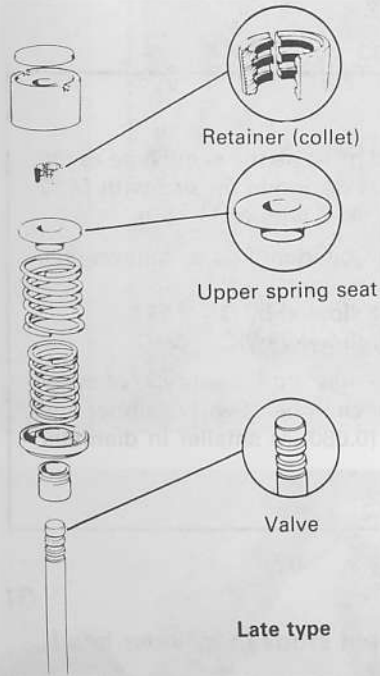
129 873



#### Valve length, mm (in)

	New	Min
Intake valve .....	104.8 (4.126)	104.3 (4.106)
Exhaust valve .....	104.6 (4.118)	104.1 (4.098)





135006

**Early and late type valves, valve collets (locks) and upper spring seats**

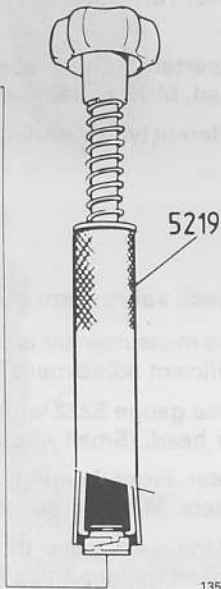
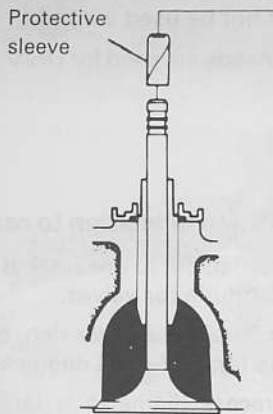
Early type valves and collets have one locking groove whereas late types have three.

Only late types are available as spare parts.

Consequently when installing a new valve, the collet and upper spring seat must also be replaced with new parts.

New spring seats are either copper coated or chromed. Early types are bright or black.

G3



135569

**Install:**

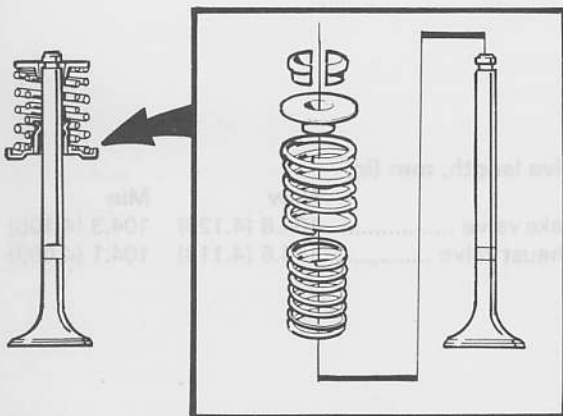
– upper spring seats, flanged side up.

Install valve stem oil seal.

Protective sleeves must be used when installing oil seal.

To install valve, place valve in cylinder head and place protective sleeve on stem. Use tool **5219** to install oil seal, note that tool should abut flange seal.

G4



129 886

**Install:**

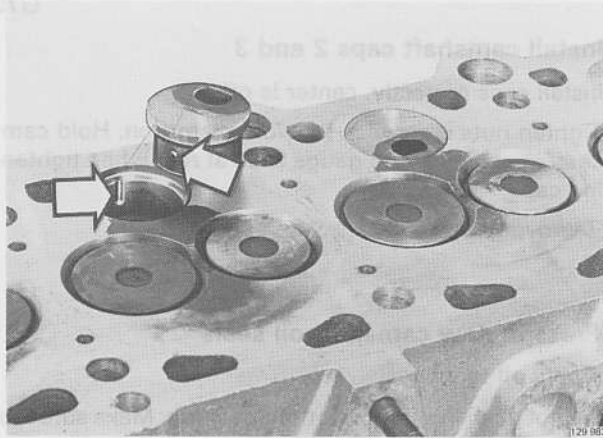
– inner and outer valve springs

– upper valve seat

– retainer (collet).

**Important!** Two types of valves, upper spring seats and collets are in use.

G5



### Install swirl chambers

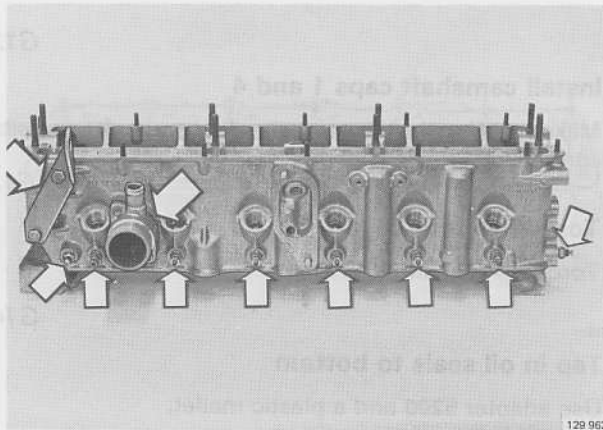
Check that steel ball is in chamber.

If not, install new swirl chamber.

Make sure that ball fits in slot in cylinder head. Tap down swirl chambers.

**Important!** Special swirl chambers (different diameter) for USA/Canada 1982-.

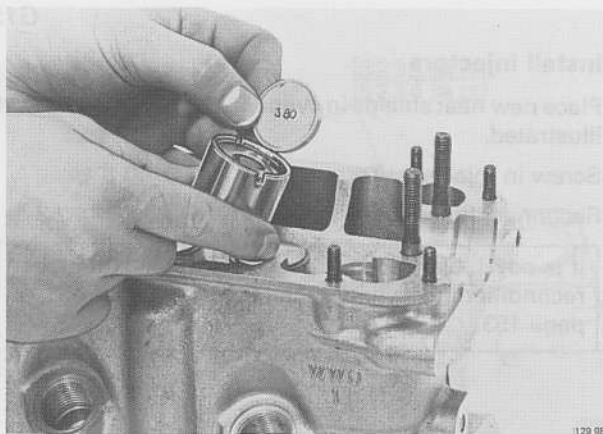
G6



### Install:

- glow plugs. Tightening torque 40 Nm (30 ft lbs)
- temperature senders (2X). Same type front and rear
- connecting flange for radiator hose (Allen 5 mm). Install new gasket. Tightening torque 10 Nm (7 ft lbs).
- lifting eyes.

G7



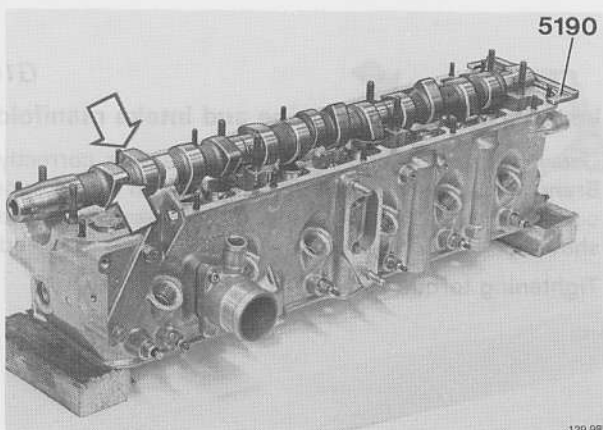
### Install tappets with shims

Smear tappets and shims with oil before installation.

Number on shims should face down.

Check that tappets slide easily without sticking.

G8

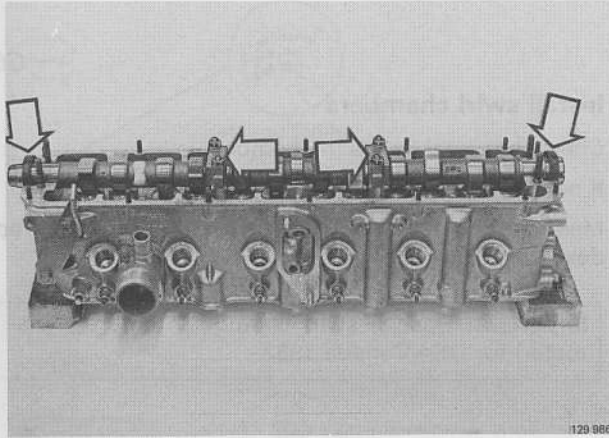


### Place camshaft in cylinder head

Lubricate contact surfaces of camshaft and bearings.

Place gauge 5190 at rear of camshaft. **Important!** Both cams for number 1 cylinder must point diagonally up, see fig.

G9



G10

**Install camshaft caps 2 and 3**

Install caps correctly, center is off-set.

Tighten nuts crosswise to avoid distortion. Hold camshaft in position with gauge 5190 at rear when tightening caps.

Remove gauge 5190.

G11

**Press in new camshaft oil seals**

Apply oil to oil seals.

Do not push in seals to bottom position. Make sure that seals are "square".

G12

**Install camshaft caps 1 and 4**

Make sure that the thrust washer for camshaft cap 4 sits correctly.

G13

**Torque all four caps**

Torque = 20 Nm (15 ft lbs).

G14

**Tap in oil seals to bottom**

Use adapter 5200 and a plastic mallet.

G15

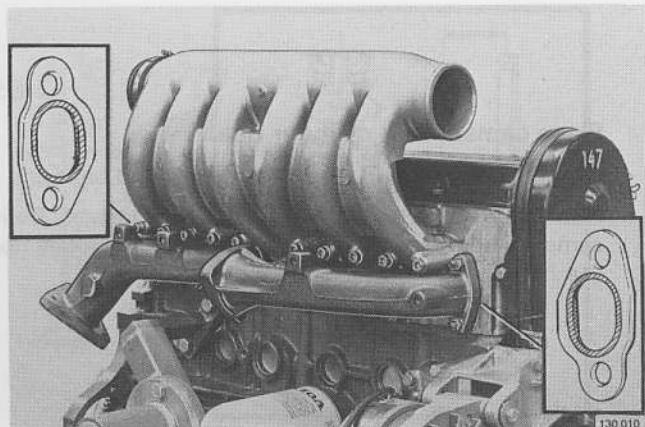
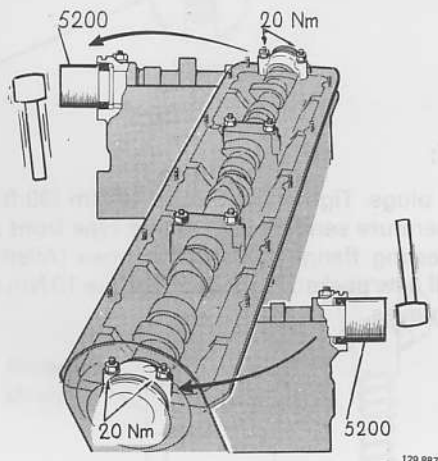
**Install injectors**

Place new heat shields in cylinder head. Turn shields as illustrated.

Screw in injectors. Torque to 70 Nm (50 ft lbs).

Reconnect fuel delivery lines between injectors.

It is advisable to check condition of injectors when reconditioning cylinder head. See instructions on page 153.



G16

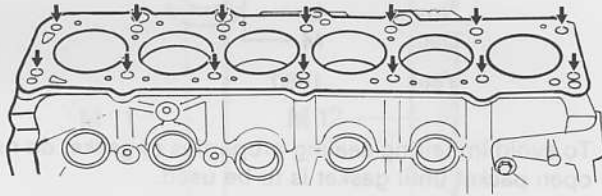
**Install exhaust branch pipe and intake manifold**

Use new gaskets and nuts. Install gaskets correctly. Branch pipe gasket should be turned with raised edge outwards, facing branch pipe. Intake manifold gasket should be turned with green side facing cylinder head.

Tightening torque 25 Nm (18 ft lbs).

## H. Cylinder head, installing

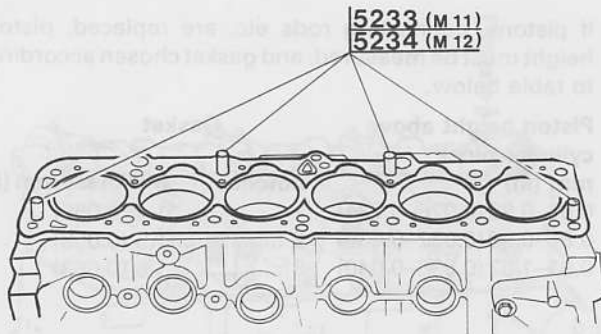
Special tools: 5190, 5193, 5194, 5197, 5199, 5201, 4 x 5233, 4 x 5234, 5235



133523

### H1 Clean holes for cylinder head bolts

Oil and dirt must be removed from holes otherwise gasket may leak as a result of insufficient tightening pressure.



133524

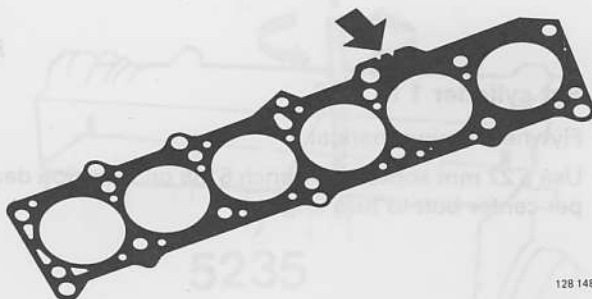
### H2 Install guide pins in cylinder block

5233 for blocks with M 11 bolts.

5234 for blocks with M 12 bolts.

Two outer pins hold gasket in position. Cylinder head is prevented from sliding and damaging gasket by two inner pins.

Important! Use all four pins, located as illustrated.



128.148

### H3 Install new cylinder head gasket

Three different types are available, and are marked with notches. Type to be fitted depends on piston height above cylinder block.

Use same gasket type (no. notches) as before, with OBEN facing up.

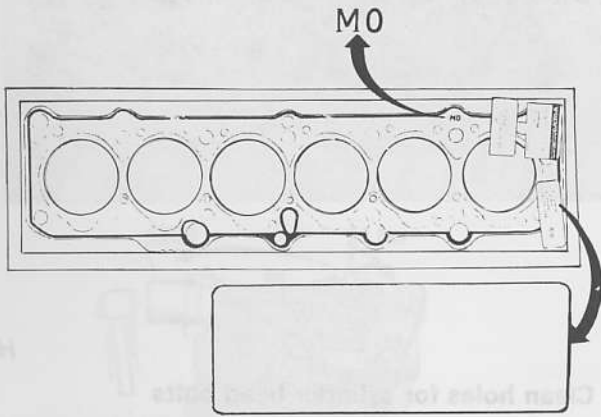
H1

H2

H3

Observe date code on gasket and packet. Gasket must be used before this date.

Only gaskets with code **MO** or later may be used on D 24 engines.



**Date code**

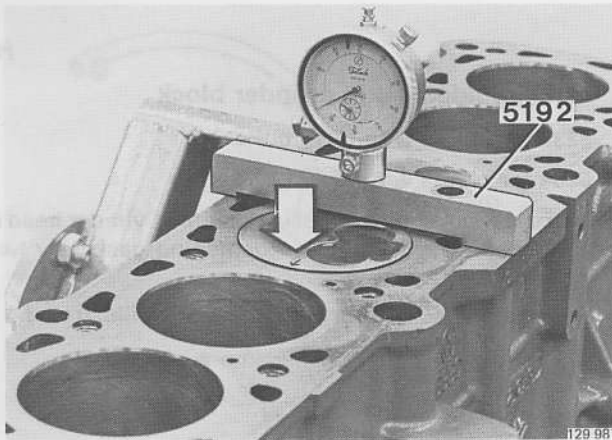
Month	Jan	A	0 = 1980 1 = 1981 2 = 1982 etc.
	Feb	B	
	Mar	C	
	Apr	D	
	May	E	
	June	F	
	July	G	
	Aug	H	
	Sept	J	
	Oct	K	
	Nov	L	
	Dec	M	
Year		1980	

To avoid impairing sealing properties of gasket do not open packet until gasket is to be used.

Take care not to damage packet and cause damage to gasket, (teflon strip, rubber seal).

132978

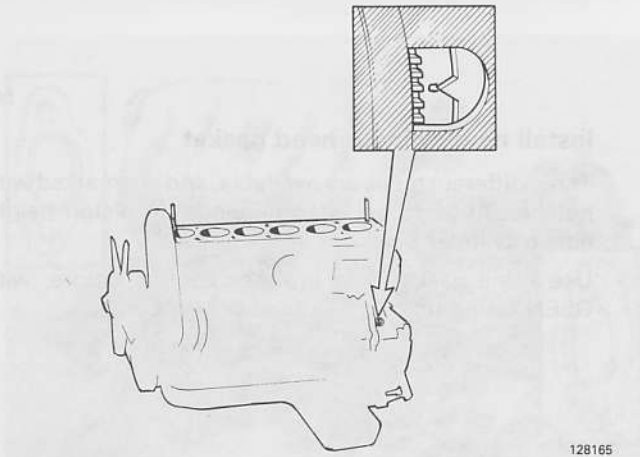
**H4**



If pistons, connecting rods etc. are replaced, piston height must be measured, and gasket chosen according to table below.

Piston height above cylinder block mm (in)	Gasket	
	notches	thickness mm (in)
0.67-0.80 (0.026-0.031)	1 .....	1.4 (0.055)
0.81-0.90 (0.032-0.035)	2 .....	1.5 (0.059)
0.91-1.02 (0.036-0.040)	3 .....	1.6 (0.063)

129 987



**H5**

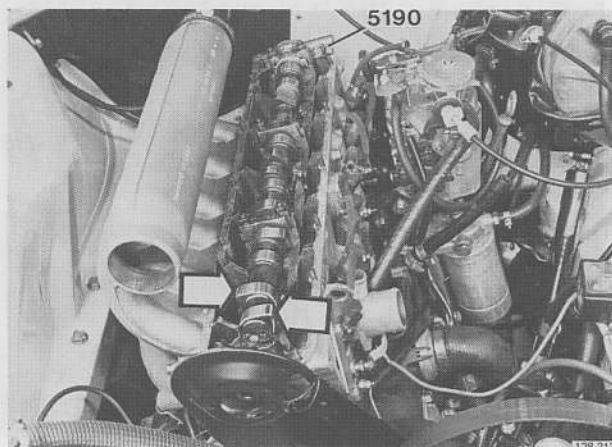
**Set cylinder 1 to TDC**

Flywheel timing mark at '0'

Use a **27 mm** socket or wrench **5188** on vibration damper center bolt to turn engine.

128165





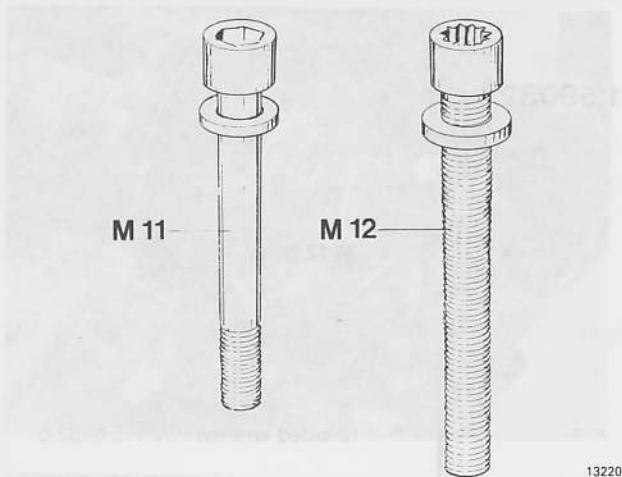
H6

### Position camshaft

Set camshaft so that number 1 cylinder is at injection (both cam lobes should point diagonally upwards).

Prevent camshaft from moving with stop **5190**.

**Important!** Camshaft must be locked otherwise valves may strike pistons.



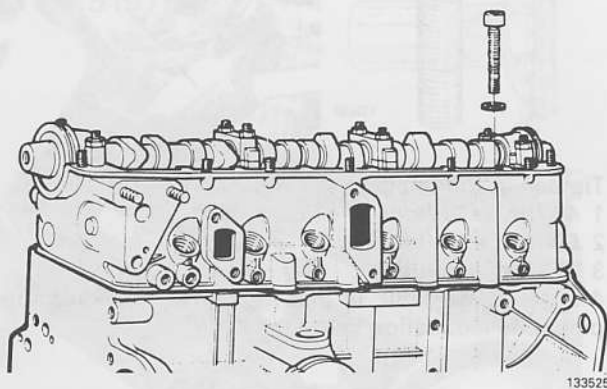
132202

### Cylinder head bolts

Two types of cylinder head bolts are in use.

Early type bolts have M 11 threads. These bolts can be reused with **new** washers. Fit washers with cup shape facing up.

Late type bolts have M 12 threads along entire length. These bolts **must not** be reused. Washers may however be reused.

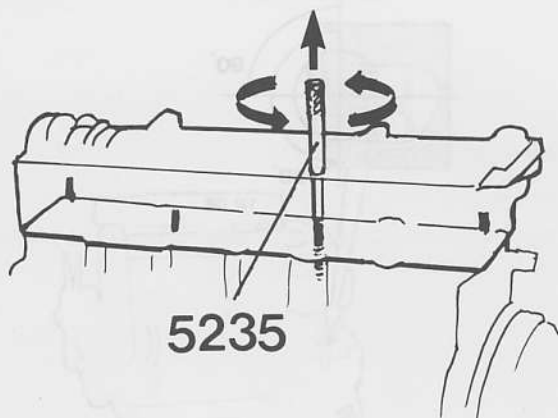


133525

H7

### Install cylinder head bolts

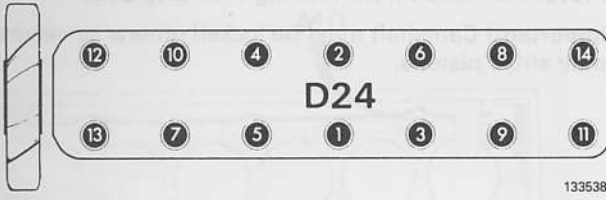
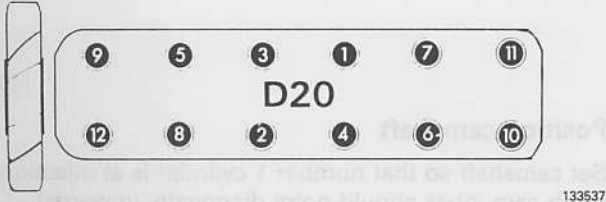
Lubricate threads and sliding surface of washers. Place bolts in holes without guide pins.



132203

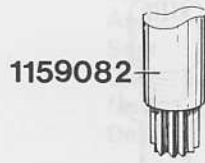
Remove guide pins. Use tool **5235**.

Install remaining bolts.



M 11 bolts

Allen key 10 mm



1159082



M 12 bolts

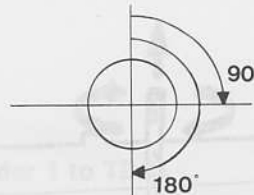
12-sided wrench P/N 115 9082-5

Tighten in three stages:

- 1 50 Nm = 37 ft lbs
- 2 70 Nm = 51 ft lbs
- 3 90 Nm = 66 ft lbs

Tighten in four stages:

- 1 40 Nm = 29 ft lbs
- 2 60 Nm = 44 ft lbs
- 3 75 Nm = 55 ft lbs
- 4 angle-tighten 180° in one movement without stopping. See illustration below:

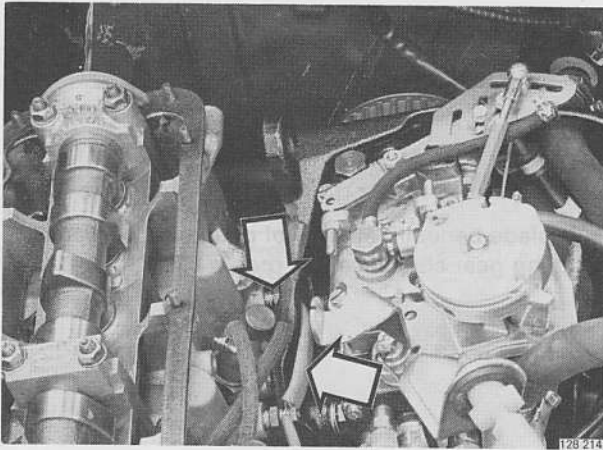


137 158

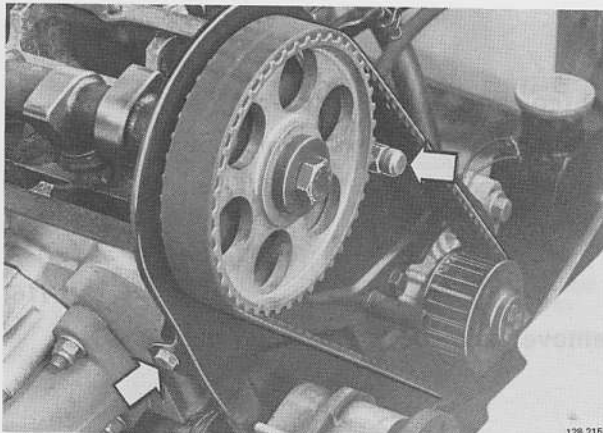
H8

**Torque cylinder head bolts**

Tighten all bolts one at a time in order specified adjacent before proceeding with next stage.

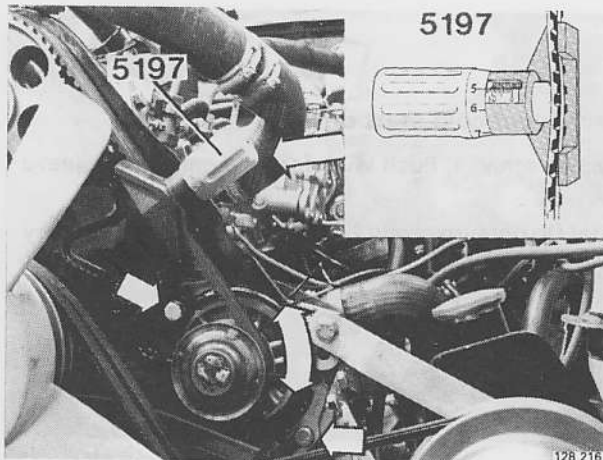


H9  
**Connect copper connecting strip for two rear glow plugs**

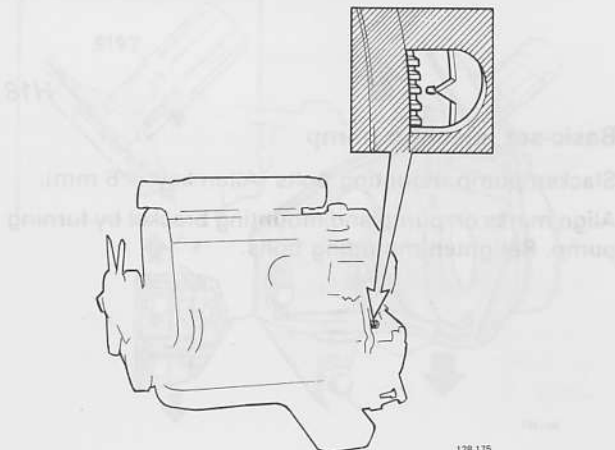


H10  
**Install bolts for cover**

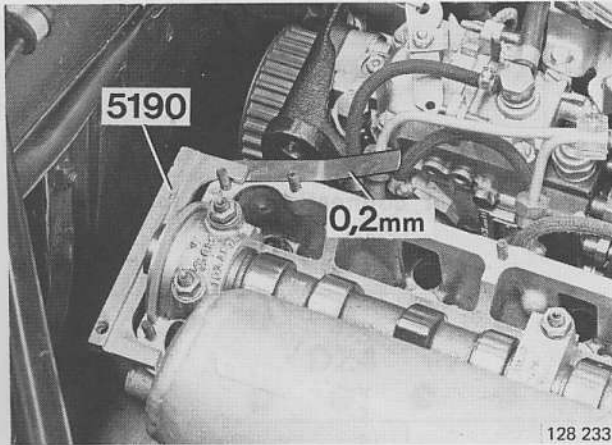
H11  
**Install camshaft sprocket and belt**  
Pull belt to ensure that it sits correctly on crankshaft gear.  
Place belt over camshaft sprocket and position sprocket and belt.  
Tighten center bolt by hand, but it should still be possible to turn sprocket on camshaft.



H12  
**Set belt tension**  
Adjust tension by moving cooling pump.  
Use gauge **5197** to check tension. Attach gauge to belt and set to 12.5 units.  
Stretch belt until mark on gauge plunger is flush with sleeves.  
Depress belt strongly with hand and recheck/adjust tension.



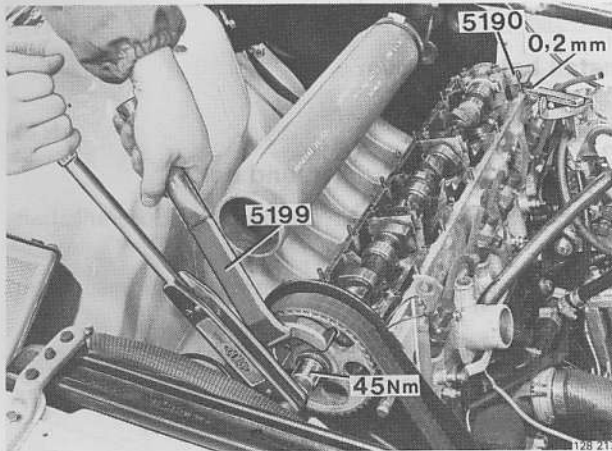
H13  
**Make sure cyl. 1 is at top dead center**  
Check '0' mark on flywheel and adjust if necessary.



H14

**Place a 0.2 mm feeler gauge beneath gauge 5190**

Insert blade beneath left side of gauge to compensate for timing gear clearance. 0.2 mm = 0.008 in.



H15

**Tighten camshaft front sprocket**

Use 5199 to prevent sprocket from turning.

Torque center bolt to 45 Nm (33 ft lbs).

H16

**Remove gauge 5190 and feeler gauge**

H17

**Disconnect cold start device**

Slacken screw 1. Push lever forward and rotate sleeve 90°.

**Note!** Do not turn screw 2 otherwise it will be necessary to remove cold start device and reset it on a test bench.

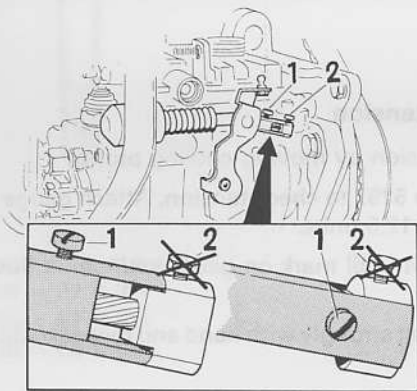
Press lever back against stop.

H18

**Basic-set injection pump**

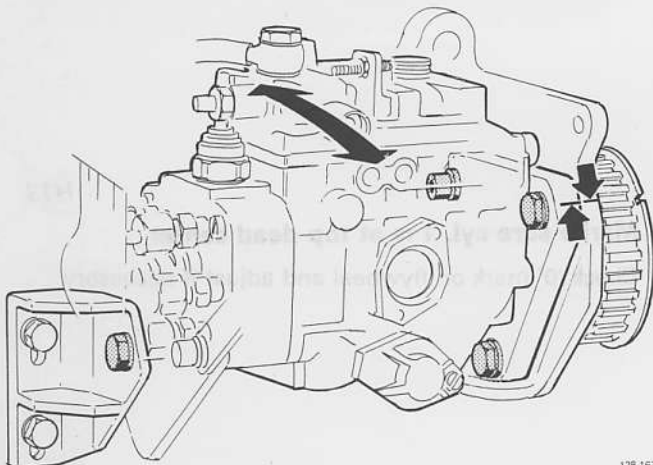
Slacken pump mounting bolts (Allen key = 6 mm).

Align marks on pump and mounting bracket by turning pump. Retighten mounting bolts.



Connected

Disconnected



128 167

H19

**Set dial indicator zero. Lock pump gear at cyl. 1 injection using stop 5193**

Unscrew and remove plug from injection pump distributor.

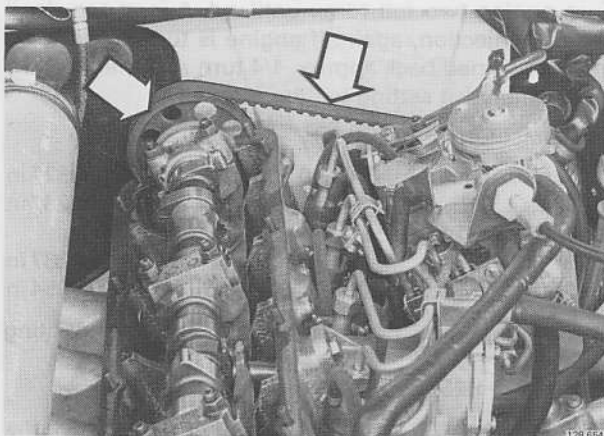
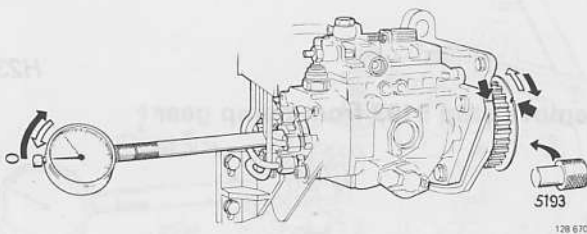
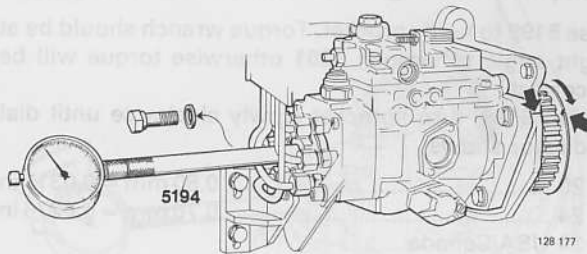
Install holder **5194** and dial indicator (range 0–3 mm). Set gauge to approx. 2 mm.

Turn pump gear clockwise until mark on gear and mounting bracket coincide.

Then turn pump gear back slightly until min reading registers on dial indicator.

Set indicator to zero.

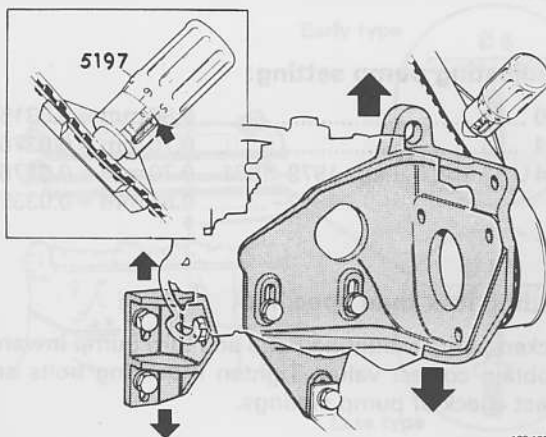
Turn pump gear clockwise until mark on gear and pump mounting bracket coincide. Lock gear in this position with stop **5193**. (Insert stop through pump gear into mounting bracket.)



H20

**Install camshaft rear sprocket and belt**

Tighten center bolt by hand, but it should still be possible to turn sprocket on camshaft.



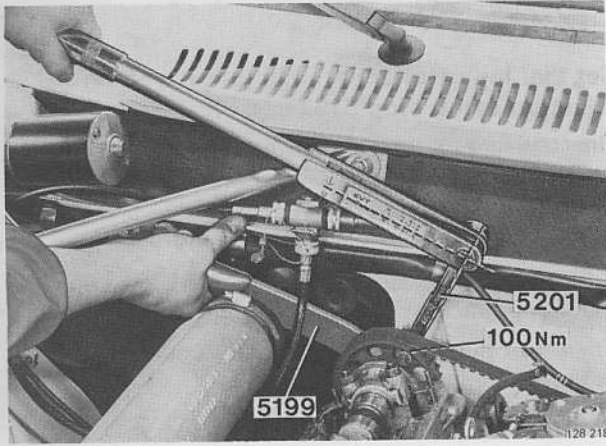
H21

**Set belt tension**

Adjust tension by moving pump.

Use gauge **5197** to check tension. Attach gauge to belt and set to **12.5** units. Stretch belt until mark on gauge plunger is flush with sleeve. Depress belt strongly with hand and recheck/adjust tension.





H22

**Set pump and tighten camshaft rear sprocket**

Use **5199** to hold sprocket. Torque wrench should be at right angle to wrench **5201** otherwise torque will be incorrect.

Using **5199**, turn sprocket slowly clockwise until dial indicator shows:

D 20 .....	0.80 mm = 0.0315 in
D 24 .....	0.70 mm = 0.0276 in
D 24 USA/Canada	
1979-81 .....	0.70 mm = 0.0276 in
1982- .....	0.85 mm = 0.0335 in

Hold sprocket in this position and torque bolt to **100 Nm** (73 ft lbs). Take care that camshaft and sprocket do not move.

Tighten camshaft front sprocket

Use 5199 to hold sprocket

Torque 49 Nm (36 ft lbs)

H23

**Remove stop 5193 from pump gear**

Remove gauge 5190 and torque gauge

H24

**Check pump setting**

Turn engine two full turns until cyl. 1 is at top dead center – injection, again. If engine is turned too far it must be turned back approx. 1/4 turn and then to zero mark otherwise setting will be incorrect.

Dial indicator should show:

D 20 .....	0.75-0.83 mm = 0.0295-0.0327 in
D 24 .....	0.65-0.73 mm = 0.0256-0.0287 in
D 24 USA and Canada	
1979-1981 .....	0.65-0.73 mm = 0.0256-0.0287 in
1982- .....	0.82-0.90 mm = 0.0323-0.0354 in

**Correct reading:** Tighten injection pump mounting bolts.

Proceed to H25.

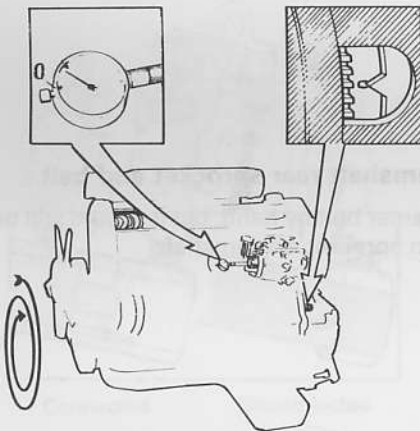
**Incorrect reading:** Readjust according to instructions below.

**Readjusting pump setting:**

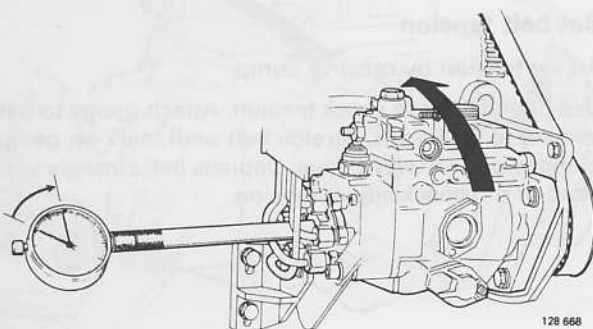
D 20 .....	0.80 mm = 0.0315 in
D 24 .....	0.70 mm = 0.0276 in
D 24 USA and Canada 1979-1981	0.70 mm = 0.0276 in
1982- .....	0.85 mm = 0.0335 in

**Reading less than specified:**

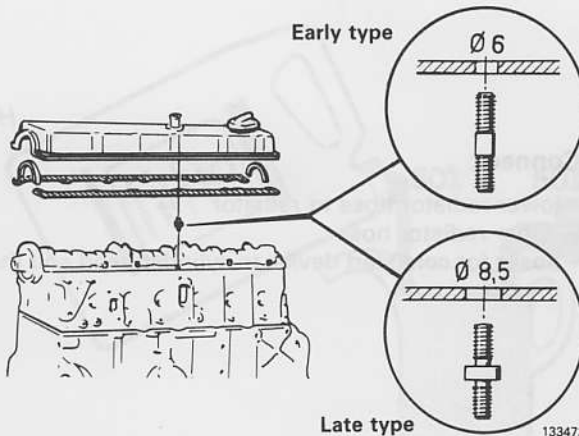
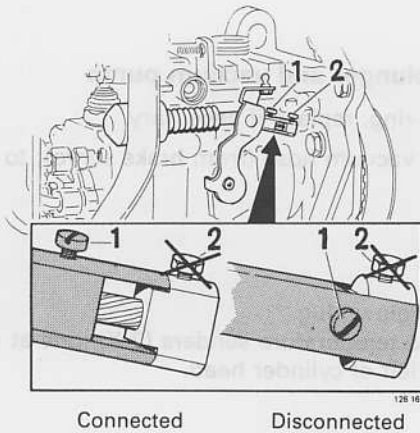
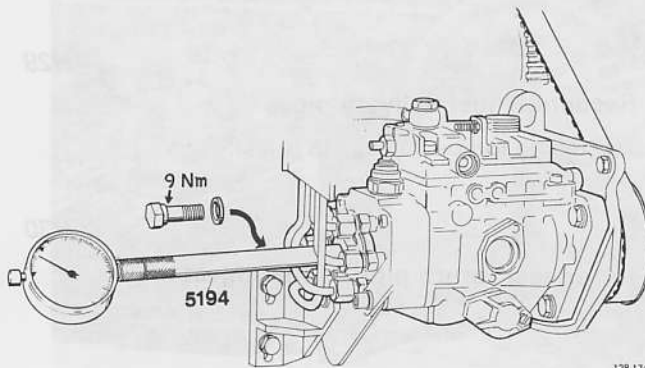
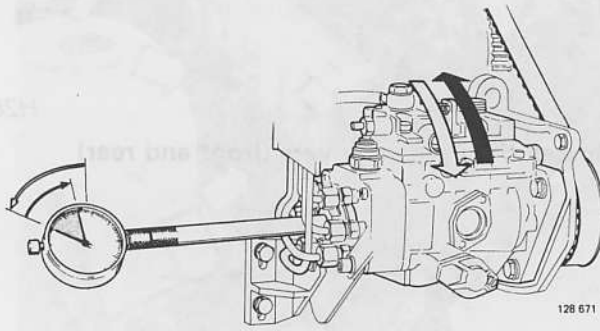
Slacken pump mounting bolts and turn pump **inwards** to obtain correct value. Tighten mounting bolts and repeat check of pump settings.



128 173



128 666



**Reading more than specified:**

Slacken pump mounting bolts and turn pump outwards until dial indicator shows approx:

D 20 .....	0.70 mm = 0.0276 in
D 24 .....	0.60 mm = 0.0236 in
D 24 USA/Canada 1979-1981 .....	0.60 mm = 0.0236 in
1982- .....	0.75 mm = 0.0295 in

Then turn pump inwards until specified value is obtained. Tighten mounting bolts and recheck pump setting.

**Note!** Injection pump must not be tapped or knocked as this will alter its setting.

H25

**Remove dial indicator and holder 5194. Install plug with new seal**

Tightening torque 9 Nm (6.5 ft lbs).

H26

**Reconnect cold start device**

Press lever forwards and turn sleeve 90°. Retighten screw 1.

**Note!** Do not turn screw 2 otherwise it will be necessary to reset cold start device on a test bench.

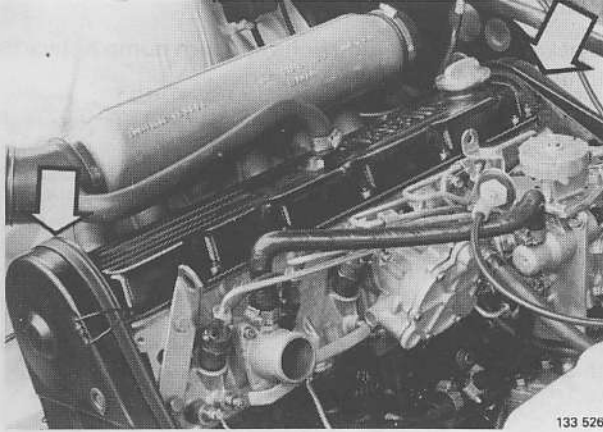
H27

**Install valve cover**

Use new gaskets if necessary.

Two types of pin studs are available, see fig. Late types have a spacer, and hole in gasket is larger to prevent damage to gasket by overtightening. Late and early type parts **must not** be interchanged.

**Note!** Only install a few nuts since cover is to be removed later on when tightening cylinder head bolts.



Set pump and tighten camshaft rear sprocket.

Use 27mm hex socket. Torque wrench should be used.

5001 camshaft torque will be 10 Nm (7.4 ft lbs).

H28

**Install timing gear covers (front and rear)**

Hold sprocket in this position and torque bolt to 10 Nm (7.4 ft lbs). Take care that camshaft and sprocket do not move.

0.80 mm (0.031 in)

0.70 mm (0.028 in)

0.30 mm (0.012 in)

Hold sprocket in this position and torque bolt to 10 Nm (7.4 ft lbs). Take care that camshaft and sprocket do not move.

0.80 mm (0.031 in)

0.70 mm (0.028 in)

0.30 mm (0.012 in)

Hold sprocket in this position and torque bolt to 10 Nm (7.4 ft lbs). Take care that camshaft and sprocket do not move.

0.80 mm (0.031 in)

0.70 mm (0.028 in)

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Hold sprocket in this position and torque bolt to 10 Nm (7.4 ft lbs). Take care that camshaft and sprocket do not move.

0.80 mm (0.031 in)

0.70 mm (0.028 in)

0.30 mm (0.012 in)

Hold sprocket in this position and torque bolt to 10 Nm (7.4 ft lbs). Take care that camshaft and sprocket do not move.

0.80 mm (0.031 in)

0.70 mm (0.028 in)

0.30 mm (0.012 in)

Hold sprocket in this position and torque bolt to 10 Nm (7.4 ft lbs). Take care that camshaft and sprocket do not move.

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0.70 mm (0.028 in)

0.30 mm (0.012 in)

Hold sprocket in this position and torque bolt to 10 Nm (7.4 ft lbs). Take care that camshaft and sprocket do not move.

0.80 mm (0.031 in)

0.70 mm (0.028 in)

0.30 mm (0.012 in)

Hold sprocket in this position and torque bolt to 10 Nm (7.4 ft lbs). Take care that camshaft and sprocket do not move.

0.80 mm (0.031 in)

0.70 mm (0.028 in)

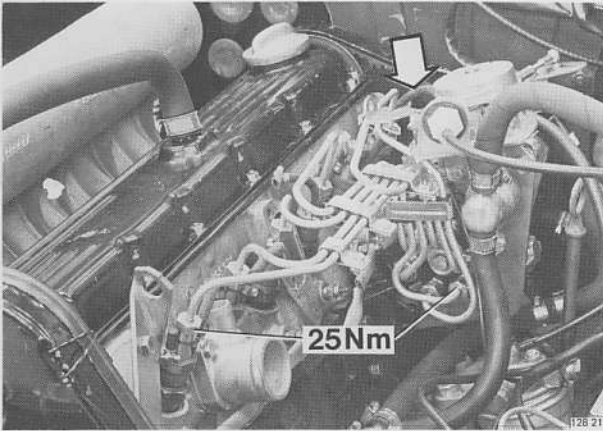
0.30 mm (0.012 in)

Hold sprocket in this position and torque bolt to 10 Nm (7.4 ft lbs). Take care that camshaft and sprocket do not move.

0.80 mm (0.031 in)

0.70 mm (0.028 in)

0.30 mm (0.012 in)



**Reconnect fuel delivery pipes**

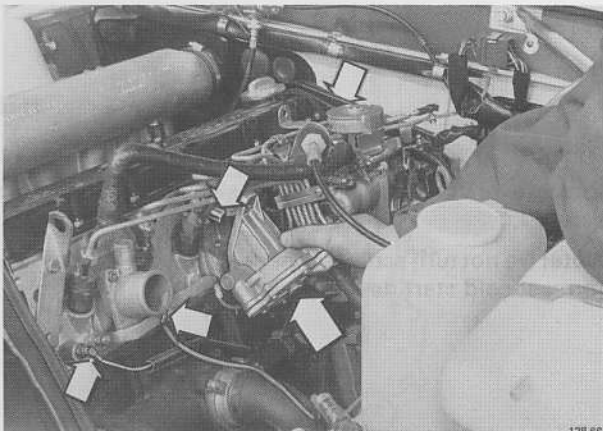
Tightening torque 25 Nm (18 ft lbs).

H29

**Reconnect return pipe to rear injector**

Tightening torque 25 Nm (18 ft lbs).

H30



**Install plunger and vacuum pump**

Check O-ring, replace if necessary.

Connect vacuum hose (from brake servo); to pump.

H31

**Install:**

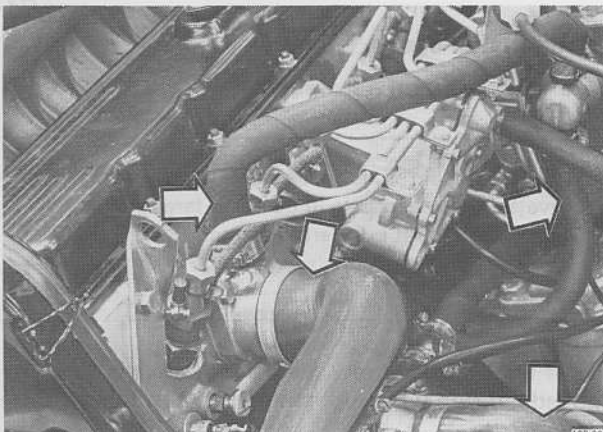
- wire to glow plug
- wires to temperature senders (2 X), one at rear and one to left of cylinder head.

H32

**Connect:**

- lower radiator hose to radiator
- upper radiator hose
- hoses for cold start device to cylinder head and thermostat.

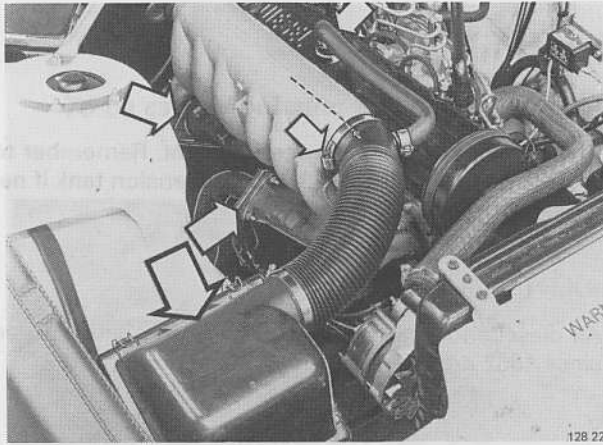
H33



H34

### Install air filter and connect hoses

Arrow on inlet hose must point towards inlet manifold otherwise the crankcase breather hose may contact bonnet (hood).



H35

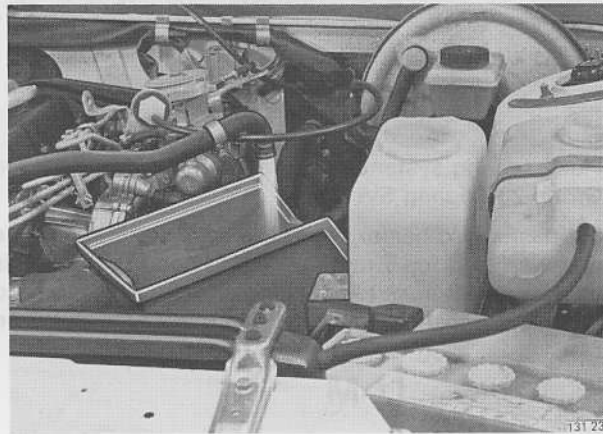
### Connect:

- exhaust pipe to branch pipe. Use new gaskets.
- exhaust pipe to gearbox mounting
- splashguard
- battery.

H36

### Bleeding of cooling system

Disconnect upper hose from cold start device. Place drip pan beneath hose and hold hose level with top edge of expansion tank.



### Coolant

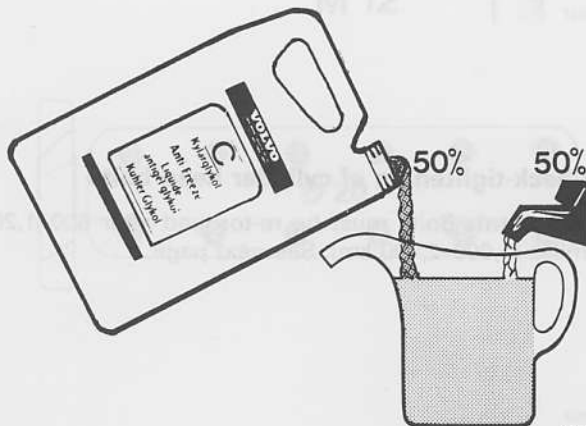
Since aluminium is used in the engines, active corrosion protection is necessary in the coolant help prevent corrosion damage.

Use genuine Volvo blue-green coolant type C, dilute with **clean** water in proportions of 50/50.

This mixture helps to prevent corrosion and frost damage.

- Never fill the cooling system with water alone.
- The coolant should be changed regularly since the corrosion protective additives in the coolant lose their effect in time.

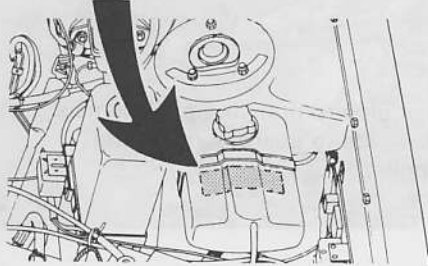
**Note!** Do not run engine when level of coolant is low. High local temperatures can result which may cause the cylinder head to crack.



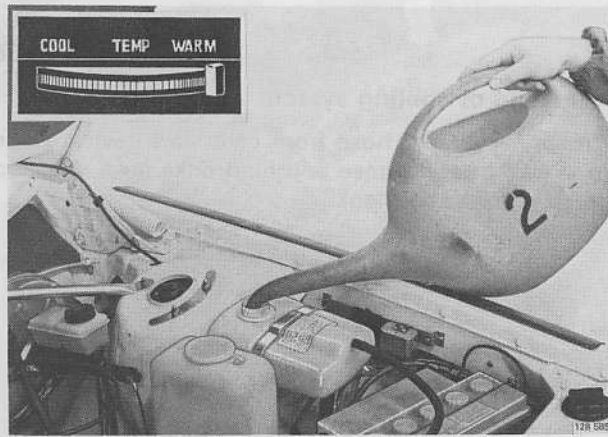
133542



**VOLVO** ORIGINAL KYLVÄTSKA TYP C ÄR PÅFYLLD. KYLSYSTEMET ÄR FROSTSKYDDAT TILL -30°C. EFTERFYLL ÅRET RUNT MED EN DEL VATTEN OCH EN DEL VOLVO KYLVÄTSKA TYP C.  
 FILLED WITH GENUINE **VOLVO** COOLANT TYPE C. COOLING SYSTEM IS PROTECTED TO -22°F. TOP UP YEAR ROUND WITH HALF WATER AND HALF VOLVO COOLANT TYPE C.  
 REMPLI DE LIQUIDE ANTIGEL **VOLVO** TYPE C VALABLE JUSQU'À -22°F / -30°C. REMPLIR EN TOUTE SAISON AVEC MOITIÉ EAU MOITIÉ ANTIGEL TYPE C.  
 1297524



133477



128 585

### Replacing coolant

Always use **type C** blue-green coolant. Remember to replace decal (P/N 1331473-7) on expansion tank if necessary.

### Type C blue-green coolant

All diesel and petrol (gasoline) engines manufactured since 1982 are filled with type C coolant.

H37

### Fill coolant

Capacity: D 20 = 8.1 liters (8.6 US quarts)  
 D 24 = 9.3 liters (9.8 US quarts).

Flush cooling system before adding new coolant, see Group 26 Cooling System.

Set dashboard heater control to max. Turn on engine and warm-up for 5 minutes. Add coolant during this time. Connect hose to cold start device. Fill coolant to mouth of expansion tank (above max) and screw on cap.

H38

### Tighten cylinder head bolts

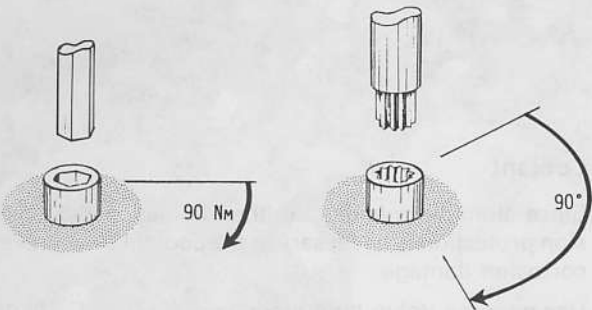
Warm-up engine until oil temperature is at least 50°C (122°F).

Remove vacuum pump with plunger and valve cover.

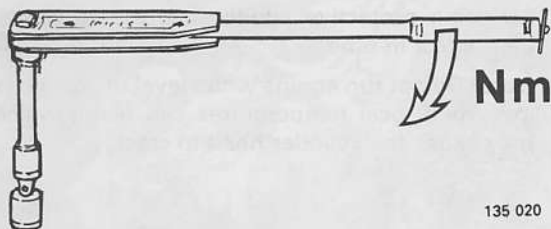
**M 11 bolts:** torque to 90 Nm (65 ft lbs)

**M 12 bolts:** angle-tighten 90° in one movement with out stopping. Install valve cover, pump plunger and vacuum pump.

Uninstall all cylinder heads.



133499



135 020

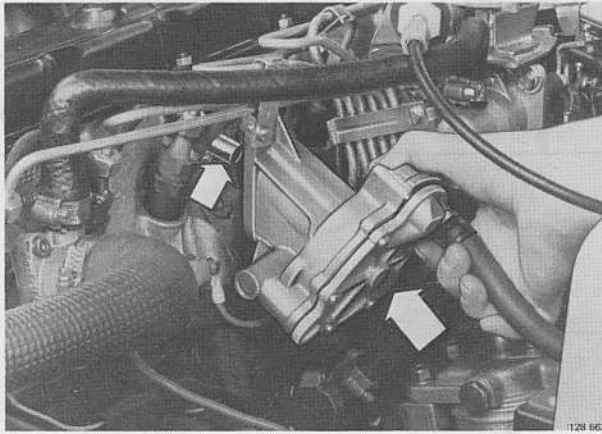
### Check-tightening of cylinder head bolts

**Important:** Bolts must be re-torqued after 600–1,200 miles (1,000–2,000 km). See next page.



## J. Cylinder head, retorquing

To be carried out after 600–1,200 miles (1,000–2,000 km) on cold or nearly cold engine.

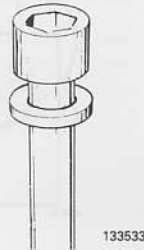


### J1 Remove valve cover, vacuum pump and plunger

Access to one of cylinder head bolts is restricted by pump plunger.

M 11 bolts = 10 mm Allen key

**M 11**



### M 11 bolts:

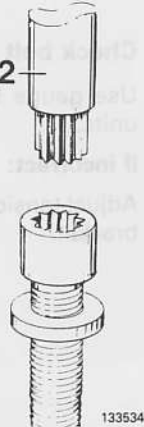
Tighten each bolt in turn as indicated according to below:

1. Slacken bolt 30°
2. Torque to 90 Nm (65 ft lbs).

M 12 bolts = 12 sided socket  
P/N 115 9082-5.

**1159082**

**M 12**



### M 12 bolts:

Tighten each bolt in turn as indicated according to below:

1. Angle-tighten bolt 90° in one movement without stopping. Do not slacken bolt first. See illustration in operation H38.



### J3 Install valve cover, plunger and vacuum pump

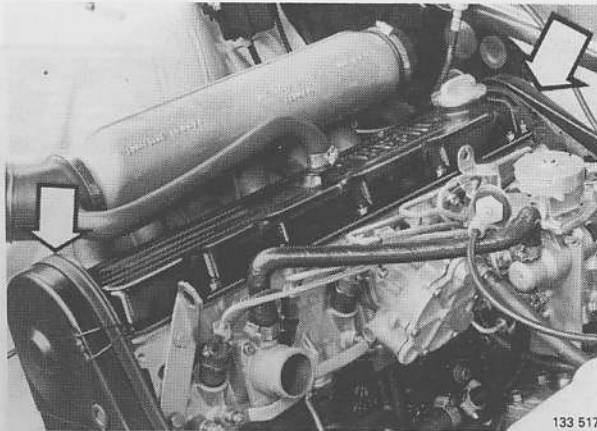
Check O-ring, replace if necessary.

133537

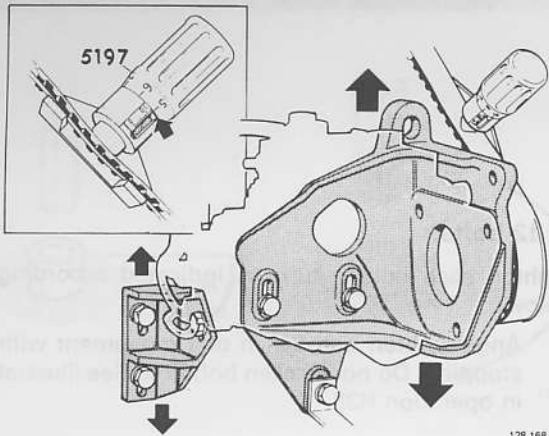
## K. Timing gear belt tension, checking/adjusting

Special tool: 5197

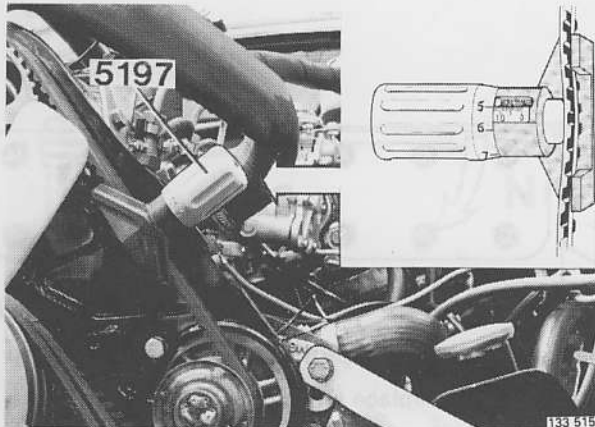
Belt tension affects injection timing. Follow below instructions carefully. Overtight belts cause pulley to squeak.



133 517



128 168



133 515

K1

**Remove timing gear covers (front and rear)**

K2

**Check belt tension**

Use gauge 5197. Tension should be between 12–13 units.

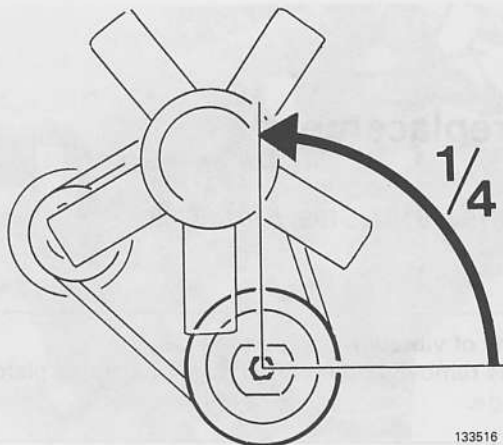
**If incorrect:**

Adjust tension to 12.5 units by moving pump mounting bracket.

K3

**Check timing gear belt tension**

Use gauge 5197. Tension should be between 12–13 units.



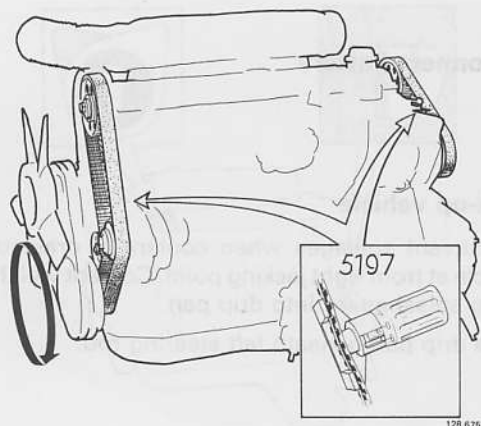
**Incorrect belt tension**

Unscrew expansion tank cap to release overpressure from cooling system.

Turn engine approx. 1/4 turn anticlockwise to obtain slack part of belt on driving side. If this is not done injection pump setting will be incorrect.

Turn crankshaft with **27 mm** socket or **5188**.

Adjust belt tension to **12.5** units on gauge **5197** by moving coolant pump mounting bracket.



**If gear belt tension has been adjusted**

Turn engine at least one turn clockwise and check that belt tension is **12–13** units on tool **5197**. Adjust if necessary according to operations K2–3 and recheck tension.

K4

K5

**Install timing gear covers**

## L. Timing gear belts, replacement

Special tools: 5187, 5188, 5190, 5193, 5194, 5197, 5199, 5201, 5202

Engine may only be turned by means of vibration damper.  
Do not rotate crankshaft or camshaft when timing gear belt is removed otherwise valves may strike pistons and cause damage.



### Disconnect battery

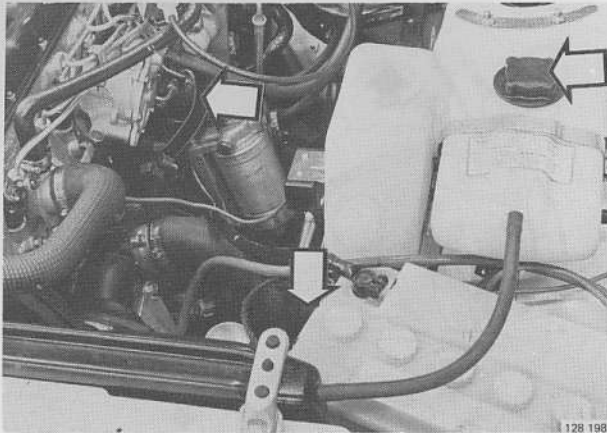
L1

### Jack-up vehicle

L2

To prevent spillages when coolant is drained, raise vehicle at front right jacking point. Coolant will then run along splashguard into drip pan.

Place drip pan beneath left steering rod.



### Drain coolant

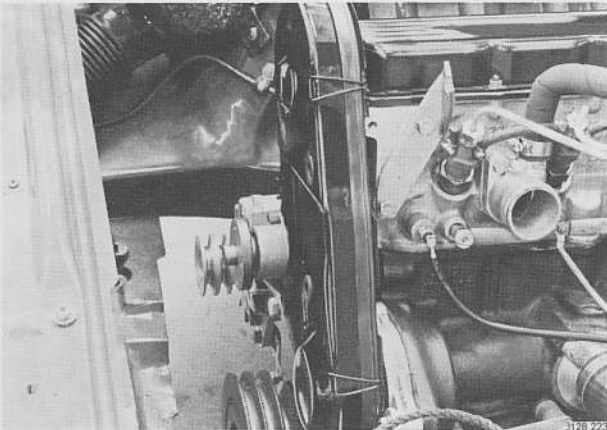
L3

Unscrew expansion tank cap.

Disconnect lower radiator hose from radiator.

Disconnect lower hose from thermostat for cold start device and drain coolant. (Engine is without drain taps).

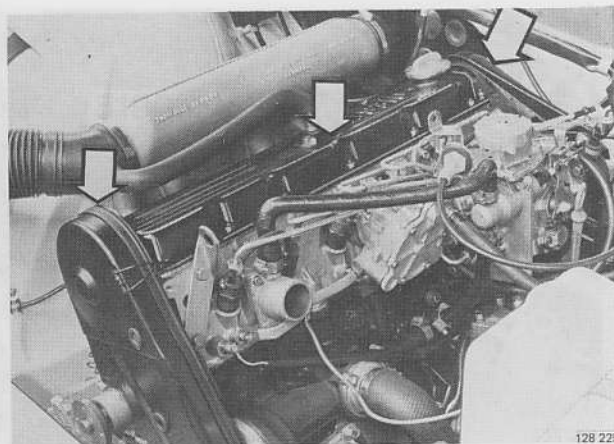
Lower vehicle.



### Remove

L4

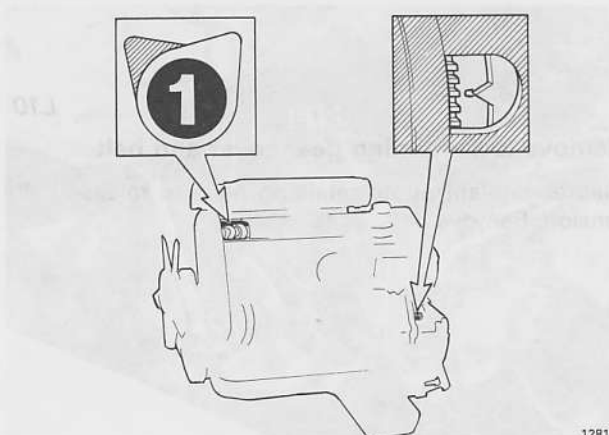
- radiator
- cooling fan with spacer and pulley
- fan belts and power steering pump belt
- splashguard.



L5

**Remove:**

- valve cover
- timing gear covers (front and rear).

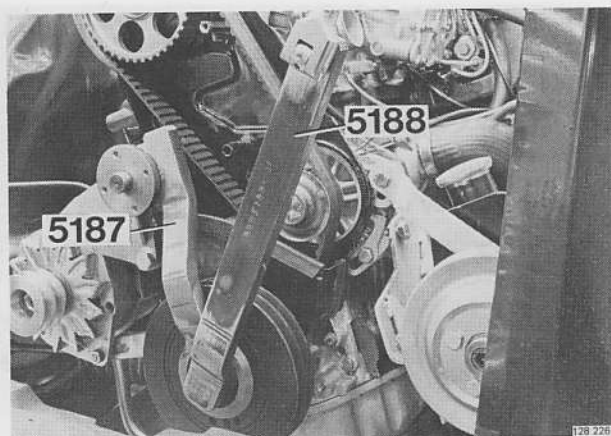


L6

**Turn engine until cyl. 1 is at TDC – injection**

Always use vibration damper center bolt to turn engine. **27 mm** socket or wrench **5188**.

Both cylinder 1 cams should point obliquely upwards. Flywheel at '0'.

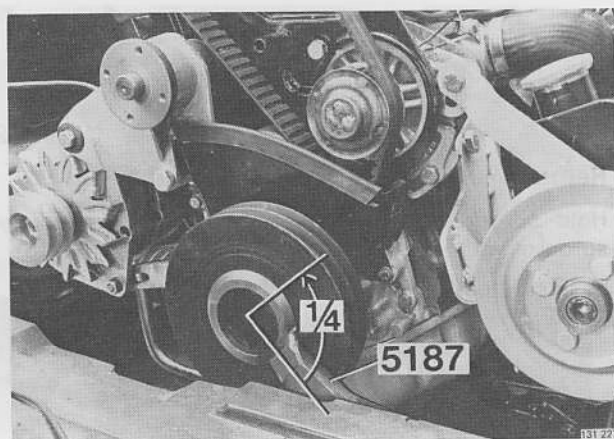


L7

**Remove vibration damper center bolt**

Use **5187** to prevent pulley from rotating, and socket **5188** to unscrew bolt.

It may be necessary to turn engine slightly so that **5187** rests on fan bearing.



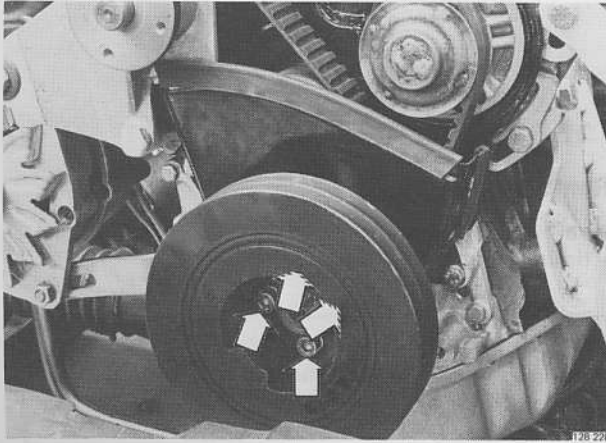
L8

**Check that cyl. 1 is at TDC – injection**

Check '0' mark on flywheel.

Adjust if necessary, use **5187** to turn engine.



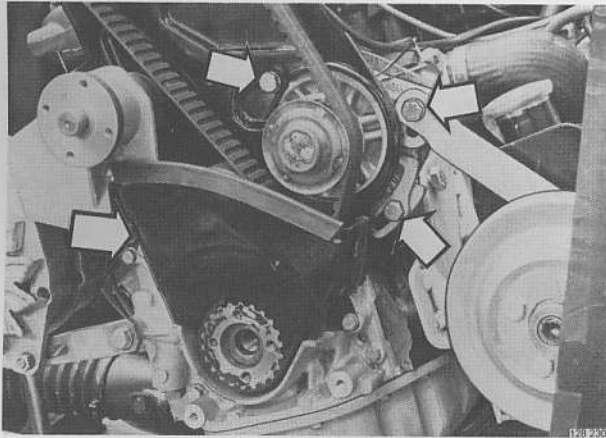


L9

**Remove vibration damper**

Remove four Allen screws (6 mm).

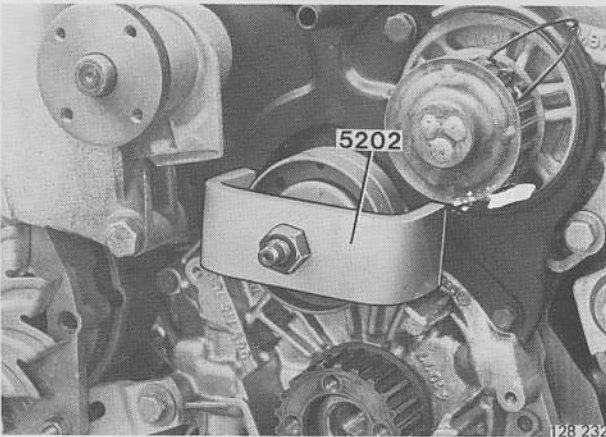
Pull off vibration damper. **Note!** Crankshaft gear may sometimes stick to vibration damper.



L10

**Remove lower timing gear cover and belt**

Slacken coolant pump retaining bolts to release belt tension. Remove belt.



L11

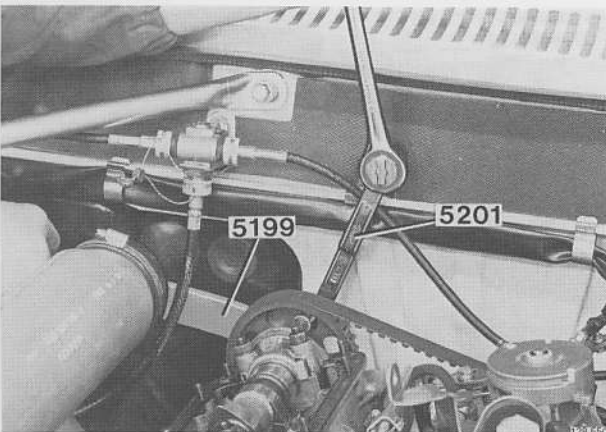
**Replace idler pulley**

Always replace pulley when fitting new belt.

Remove center bolt.

Withdraw pulley using 5202.

Tap on new pulley and install center bolt.

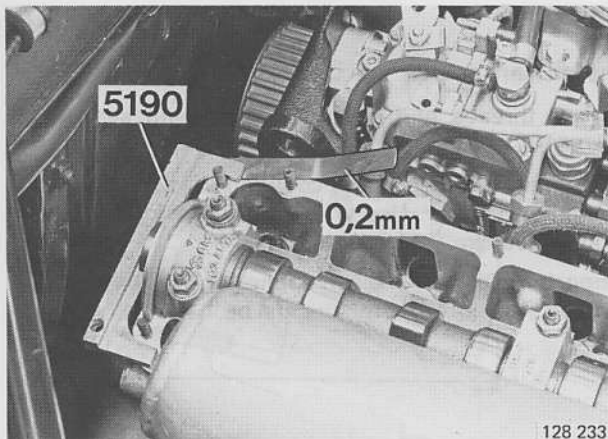


L12

**Remove camshaft rear sprocket and belt**

Hold sprocket in position with 5199 and unscrew sprocket with wrench 5201.

Take care not to rotate camshaft.



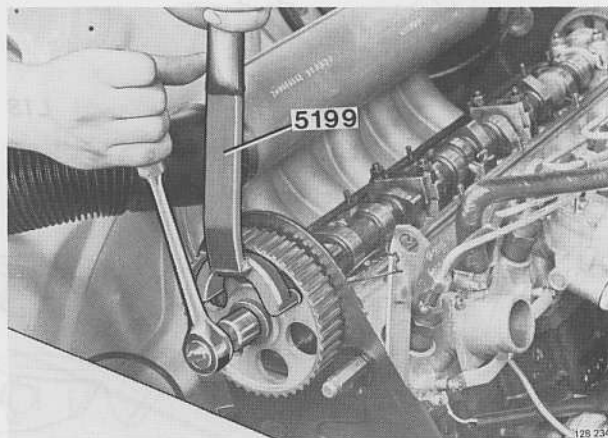
**Lock camshaft in position**

Lift valve cover gasket

Place gauge **5190** at rear of camshaft. Insert a **0.2 mm** feeler gauge beneath left side of gauge to compensate for timing gear clearance.

Camshaft is now set at correct position.

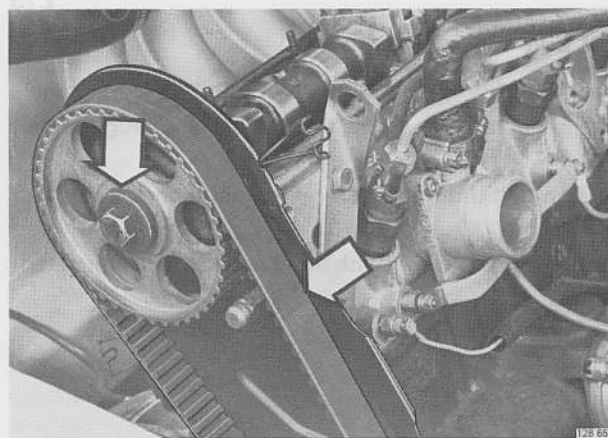
L13



**Remove camshaft front sprocket**

Use **5199** to hold sprocket in position when loosening bolts. Tap sprocket to free it from camshaft.

L14

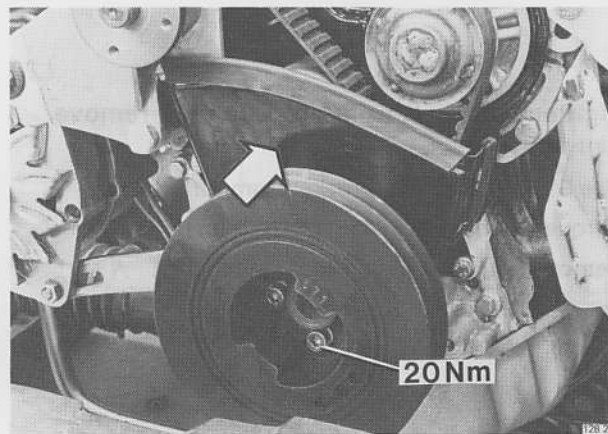


**Install gear belt and camshaft front sprocket**

Make sure that belt fits securely on all gears.

Install center bolt, hand tight. It should be possible to turn sprocket on camshaft without camshaft rotating.

L15

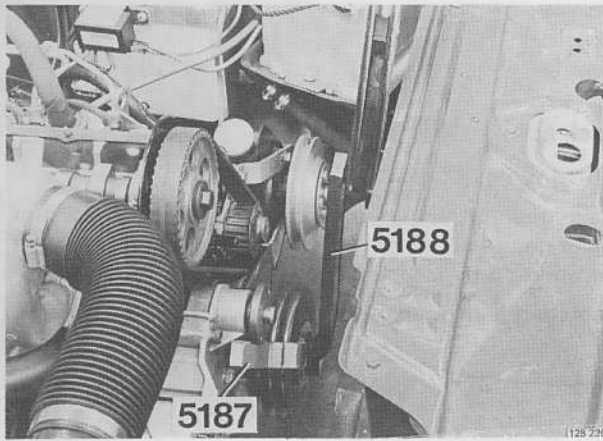


**Install lower timing gear cover and vibration damper**

Damper can only be fitted in one way. Pin on crankshaft gear must fit in vibration damper.

Torque in-hex bolts to **20 Nm** (15 ft lbs).

L16



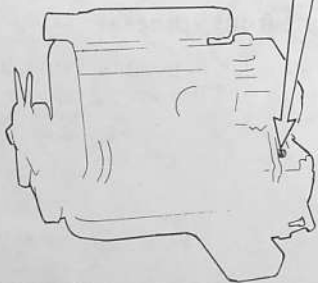
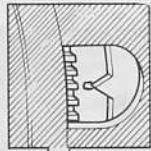
L17

**Install center bolt**

Smear threads and mating surface with sealer P/N 277961-9.

Use wrench **5187** (rest on cooling fan journal) to hold vibration damper. Use wrench **5188** to torque center bolt to **350 Nm** (255 ft lbs).

**Important:** Torque 350 Nm applies only if wrench 5188 is used. Also torque wrench must be in line with wrench 5188.

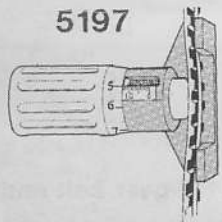
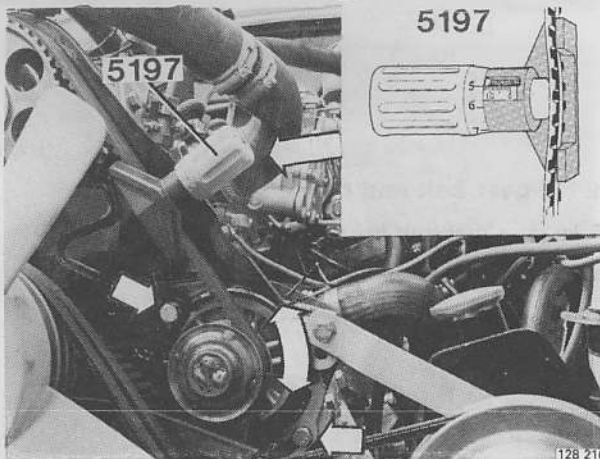


128 175

L18

**Make sure cyl. 1 is at TDC – injection**

Check '0' mark on flywheel and adjust if necessary.



L19

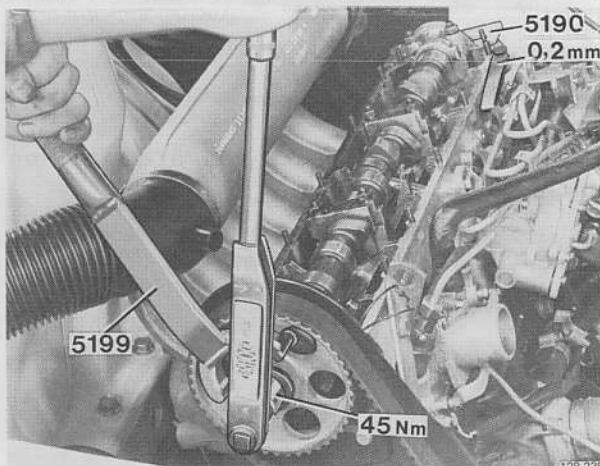
**Set belt tension**

Adjust tension by moving coolant pump

Use gauge **5197** to check tension. Attach gauge to belt and set to **12.5** units.

Stretch belt until mark on gauge plunger is flush with sleeve.

Depress belt strongly with hand and recheck/adjust tension.



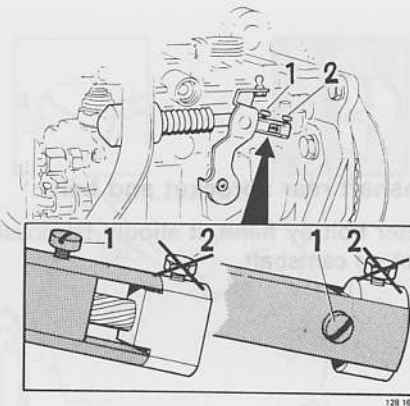
L20

**Tighten camshaft front sprocket and remove gauge 5190**

Use **5199** to prevent sprocket from turning.

Torque center bolt to **45 Nm** (33 ft lbs).

Remove gauge 5190 and feeler gauge.



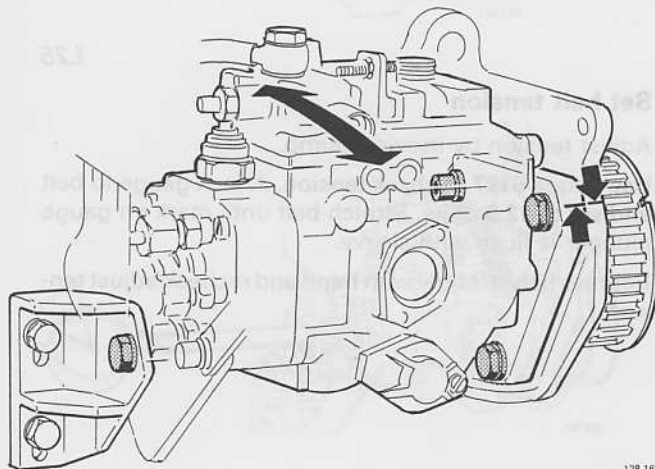
L21

**Disconnect cold start device**

Slacken screw 1. Push lever forward and rotate sleeve 90°.

**Note!** Do not turn screw 2 otherwise it will be necessary to remove cold start device and reset it on a test bench.

Press back lever against stop.

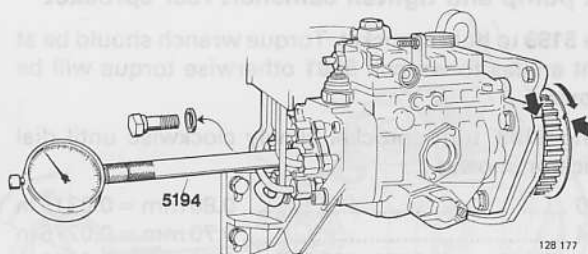


L22

**Basic-set injection pump**

Slacken pump mounting bolts (Allen key = 6 mm).

Align marks on pump and mounting bracket by turning pump. Retighten mounting bolts.



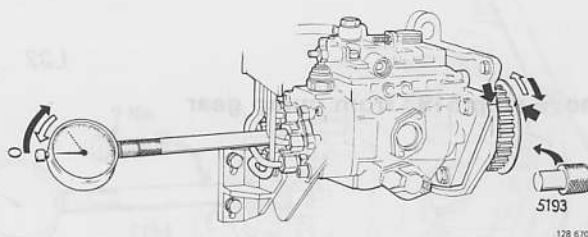
L23

**Set dial indicator zero. Lock pump gear at cyl. 1 injection using stop 5193**

Unscrew and remove plug from injection pump distributor.

Install holder 5194 and dial indicator (range 0–3 mm). Set gauge to approx. 2 mm.

Turn pump gear clockwise until mark on gear and mounting bracket coincide.

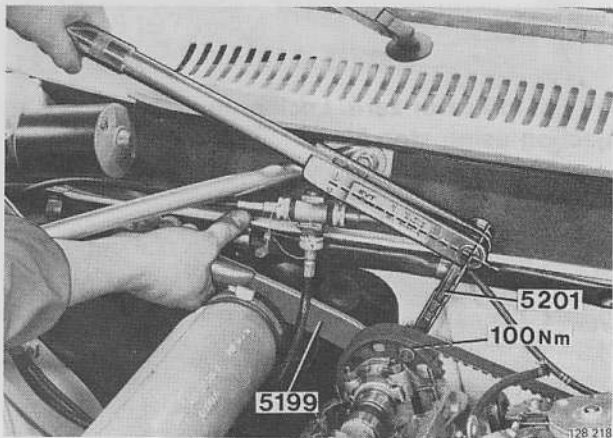
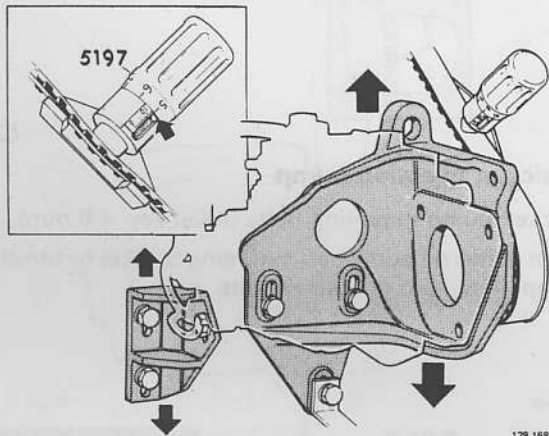
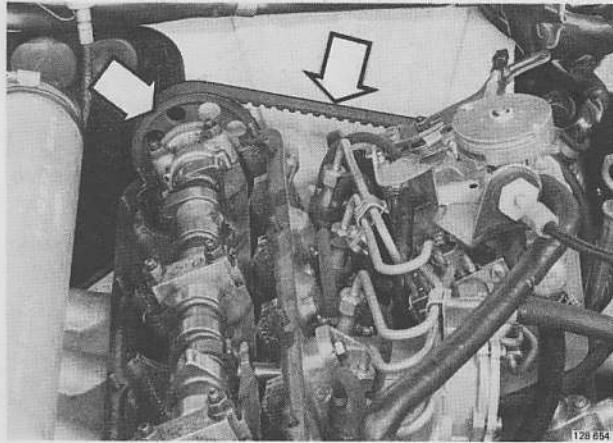


Then turn back pump gear slightly until min reading registers on dial indicator.

Set indicator to zero.

Turn pump gear clockwise until mark on gear and pump mounting bracket coincide. Lock gear in this position with stop 5193. (Insert stop through pump gear into mounting bracket.)





Install center bolt  
 Tighten center bolt by hand, it should be possible to turn sprocket on camshaft.

L24

**Install camshaft rear sprocket and belt**

Tighten center bolt by hand, it should be possible to turn sprocket on camshaft.

**Set belt tension**

Adjust tension by moving pump.

Use gauge 5197 to check tension. Attach gauge to belt and set to 12.5 units. Stretch belt until mark on gauge plunger is flush with sleeve.

Depress belt strongly with hand and recheck/adjust tension.

L25

**Set pump and tighten camshaft rear sprocket**

Use 5199 to hold sprocket. Torque wrench should be at right angles to wrench 5201 otherwise torque will be incorrect.

Using 5199, turn sprocket slowly clockwise until dial indicator shows:

D 20 .....	0.80 mm = 0.0315 in
D 24 .....	0.70 mm = 0.0276 in
D 24 USA/Canada 1979-1981 .....	0.70 mm = 0.0276 in
1982- .....	0.85 mm = 0.0335 in

Hold sprocket in this position and torque bolt to 100 Nm (73 ft lbs). Take care that camshaft and sprocket do not move.

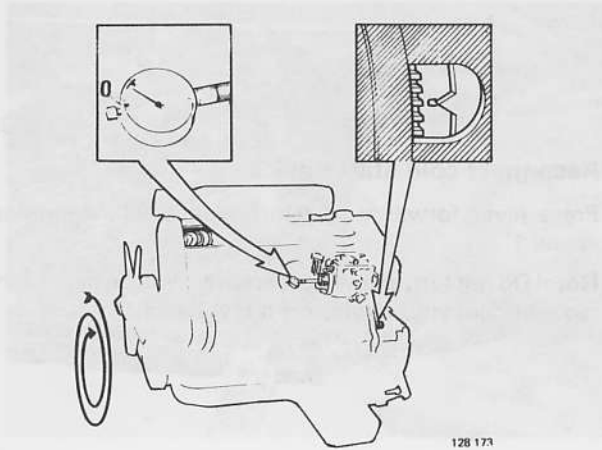
L26

**Remove stop 5193 from pump gear**

L27



L28



128 173

**Check pump setting**

Turn engine two full turns until cyl. 1 is at top dead center – injection, again. If engine is turned too far it must be turned back approx. 1/4 turn and then to zero mark otherwise setting will be incorrect.

Dial indicator should show:

D 20 .....	0.75–0.83 mm = 0.0295–0.0327 in
D 24 .....	0.65–0.73 mm = 0.0256–0.0287 in
D 24 USA/Canada	
1979–1981 .....	0.65–0.73 mm = 0.0256–0.0282 in
1982– .....	0.82–0.90 mm = 0.0323–0.0354 in

**Correct reading:** Tighten injection mounting bolts. Proceed to L29.

**Incorrect reading:** Readjust according to instructions below.

**Radjusting pump setting:**

D 20 .....	<b>0.80 mm = 0.0315 in</b>
D 24 .....	<b>0.70 mm = 0.0276 in</b>
D 24 USA/Canada	
1979–1981 .....	<b>0.70 mm = 0.0276 in</b>
1982– .....	<b>0.85 mm = 0.0335 in</b>

**Reading less than specified:**

Slacken pump mounting bolts and turn pump **inwards** to obtain correct value. Tighten mounting bolts and repeat check of pump settings.

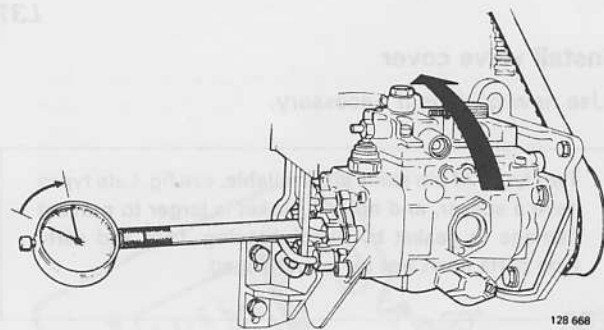
**Reading more than specified:**

Slacken pump mounting bolts and turn pump **outwards** until dial indicator shows approx:

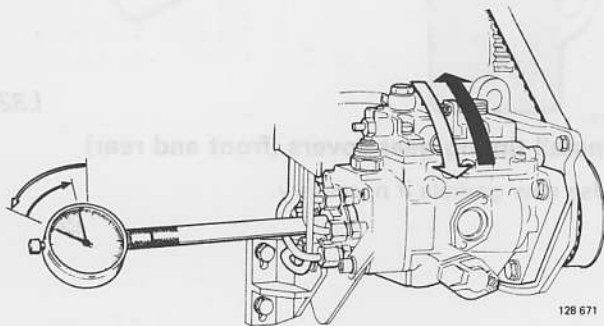
D 20 .....	0.70 mm = 0.0276 in
D 24 .....	0.60 mm = 0.0236 in
D 24 USA/Canada 1979–1981 .....	0.60 mm = 0.0236 in
1982– .....	0.75 mm = 0.0295 in

Then turn pump inwards until specified value is obtained. Tighten mounting bolts and recheck pump setting.

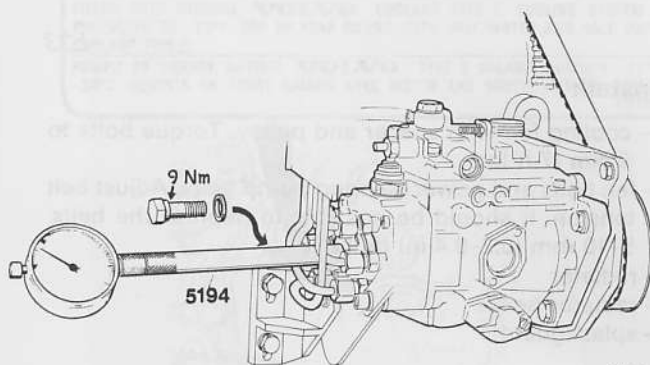
**Note!** Injection pump must not be tapped or knocked as this will alter its setting.



128 668



128 671

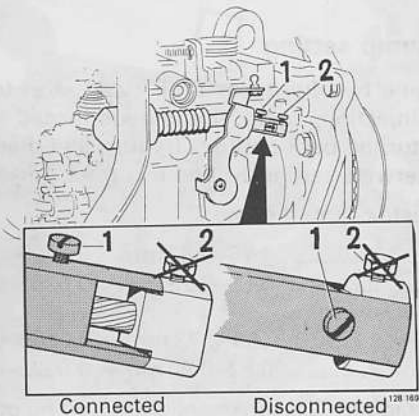


128 174

**Remove dial indicator and holder 5194. Install plug with new seal**

Tightening torque 9 Nm (6.5 ft lbs).

L29

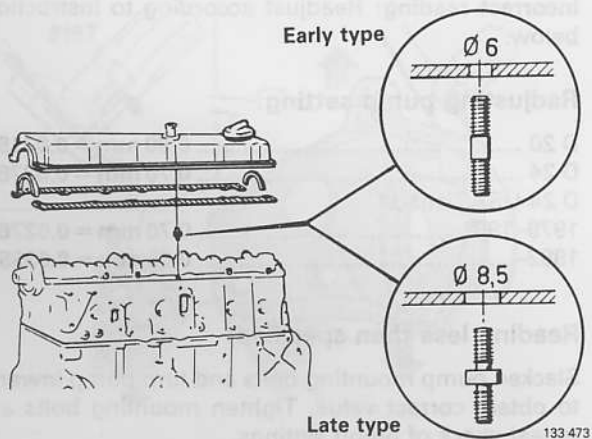


L30

**Reconnect cold start device**

Press lever forwards and turn sleeve 90°. Retighten screw 1.

**Note!** Do not turn screw 2 otherwise it will be necessary to reset cold start device on a test bench.

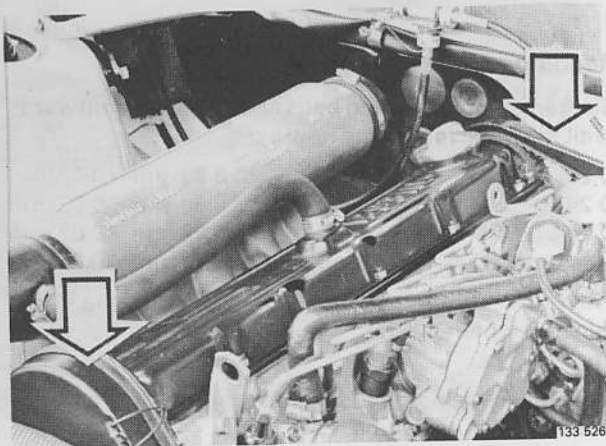


L31

**Install valve cover**

Use new gaskets if necessary.

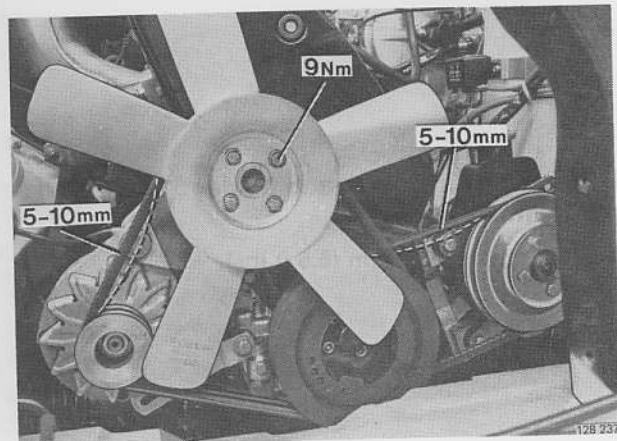
Two types of pin studs are available, see fig. Late types have a spacer, and hole in gasket is larger to prevent damage to gasket by overtightening. Late and early type parts **must not** be interchanged.



L32

**Install timing gear covers (front and rear)**

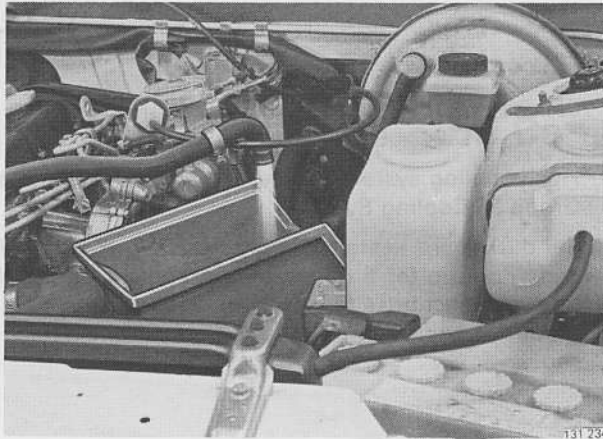
Use new gaskets if necessary.



L33

**Install:**

- cooling fan with spacer and pulley. Torque bolts to **9 Nm** (7 ft lbs)
- fan belts and power steering pump belts. Adjust belt tension. It should be possible to depress the belts 5-10 mm (0.2-0.4 in) by hand.
- radiator
- radiator hoses
- splashguard.

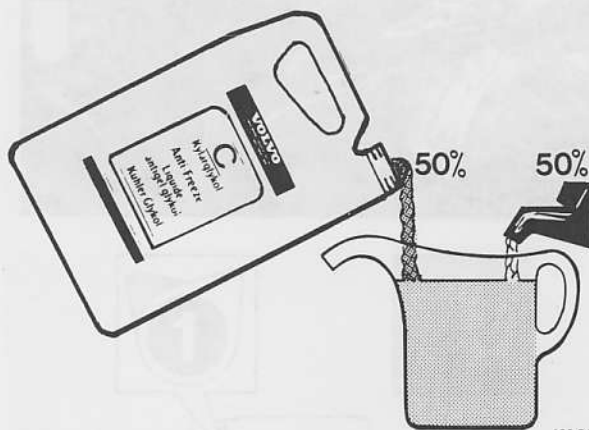


131 234

L34

### Bleeding of cooling system

Disconnect upper hose from cold start device. Place drip pan beneath hose and hold hose level with top edge of expansion tank.



133 542

### Coolant

Since aluminium is used in the engines, active corrosion protection is necessary in the coolant to help prevent corrosion damage.

Use genuine Volvo blue-green coolant type C, diluted with **clean** water in proportions of 50/50.

This mixture helps to prevent corrosion and frost damage.

Never fill the cooling system with water alone.

The coolant should be changed regularly since the corrosion protective additives in the coolant lose their effect in time.

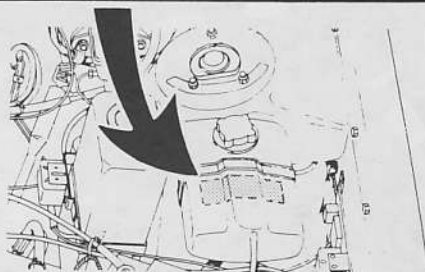
**Note!** Do not run engine when level of coolant is low since high local temperatures can result which may cause the cylinder head to crack.

**VOLVO** ORIGINAL KYLVÄTSKA TYP C AR PÅFYLLED. KYLSYSTEMET AR FROSTSKYDDAT TILL -30°C. EFTERFYLL ÅRET RUNT MED EN DEL VATTEN OCH EN DEL VOLVO KYLVÄTSKA TYP C.

FILLED WITH GENUINE **VOLVO** COOLANT TYPE C. COOLING SYSTEM IS PROTECTED TO -22°F. TOP UP YEAR ROUND WITH HALF WATER AND HALF VOLVO COOLANT TYPE C.

REPLI DE LIQUIDE ANTIGEL **VOLVO** TYPE C VALABLE JUSQU'À -22°F/-30°C. REMPLIR EN TOUTE SAISON AVEC MOITIÉ EAU MOITIÉ ANTIGEL TYPE C.

1297524



133 477

### Replacing coolant

**Always** use **type C** blue-green coolant. Remember to replace decal (P/N 1331473-7) on expansion tank if necessary.

### Type C blue-green coolant

All diesel and petrol (gasoline) engines manufactured since 1982 are filled with type C coolant.



### Fill coolant

Capacity: D 20 = 8.1 liters (8.6 US quarts)  
D 24 = 9.3 liters (9.8 US quarts).

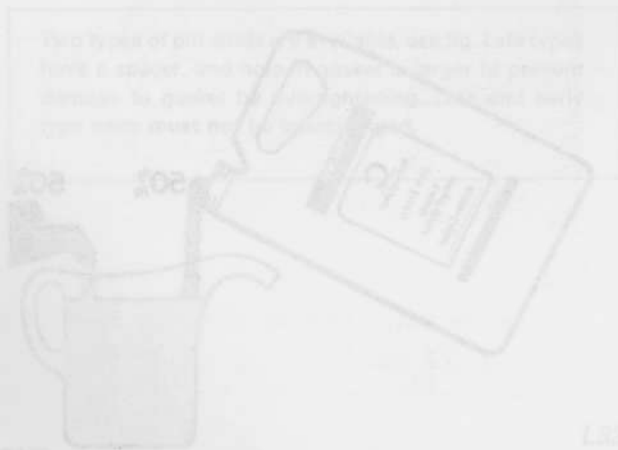
Flush cooling system before adding new coolant, see Group 26 Cooling System.

Set dashboard heater control to max. Turn on engine and warm-up for 5 minutes. Add coolant during this time. Connect hose to cold start device. Fill coolant to mouth of expansion tank (above max) and screw on cap.

L35

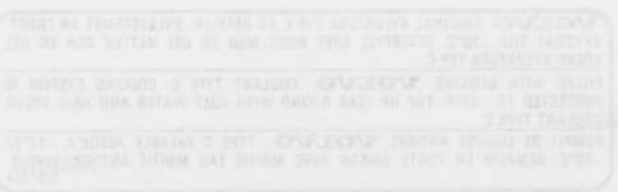
### Install valve cover

Use new gaskets if necessary.



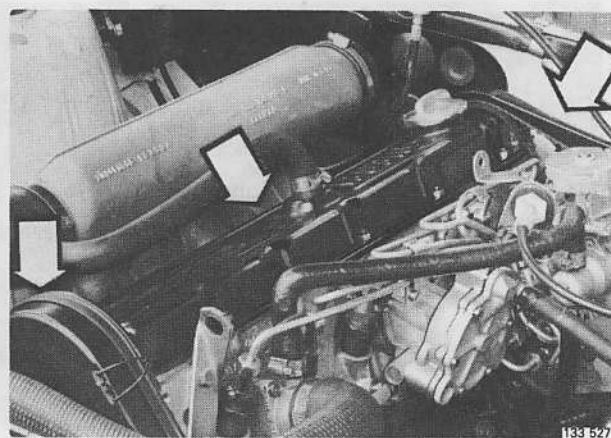
### Install timing gear covers (front and rear)

Use new gaskets if necessary.

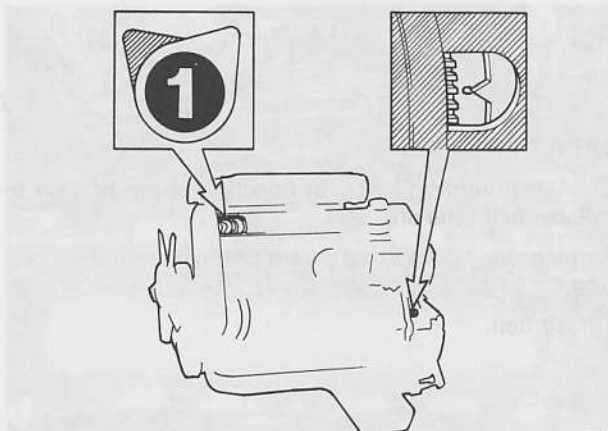


## M. Camshaft, removal

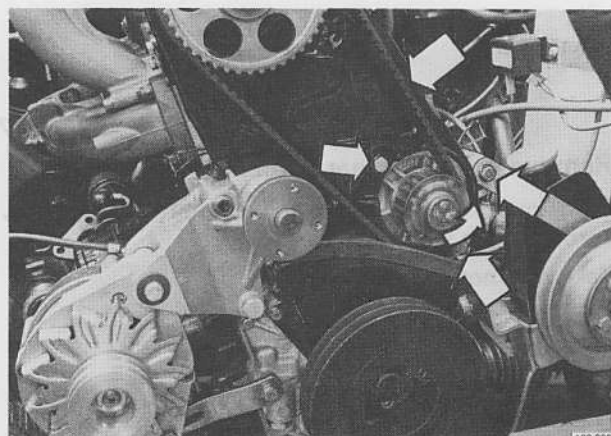
Special tools: 5199, 5201



133 527



128 163



128 206

M1

### Remove:

- valve cover
- timing gear covers (front and rear).

M2

### Turn engine until cyl. 1 is at TDC – injection

Always use the vibration damper center bolt to turn the engine. **27 mm** socket or wrench **5188**.

Both cylinder 1 cams should point obliquely upwards.  
Flywheel at '0'.

M3

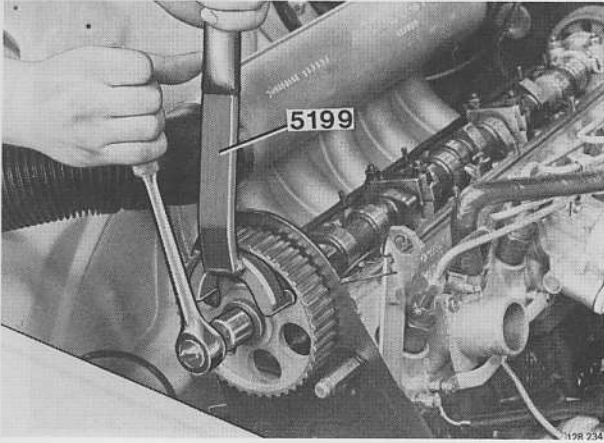
### Remove belt from camshaft sprocket

Unscrew expansion tank cap to release overpressure from cooling system.

Slacken coolant pump mounting bolts and belt tensioner. Tighten two lower mounting bolts to avoid unnecessary loss of coolant.

Remove belt from camshaft sprocket.



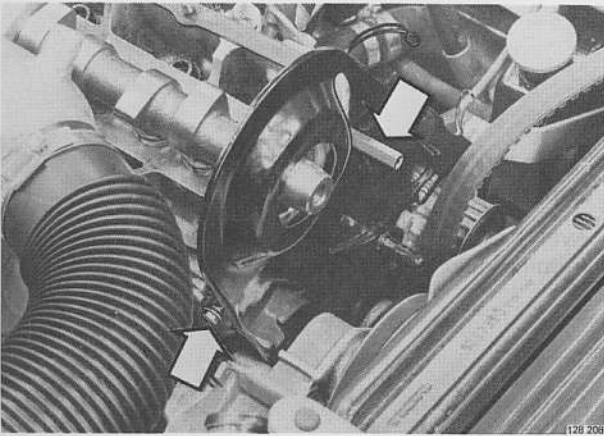


M4

**Remove camshaft front sprocket**

Use **5199** to hold sprocket in position when loosening bolt. Make sure that camshaft does not rotate.

Tap sprocket to free it from camshaft.



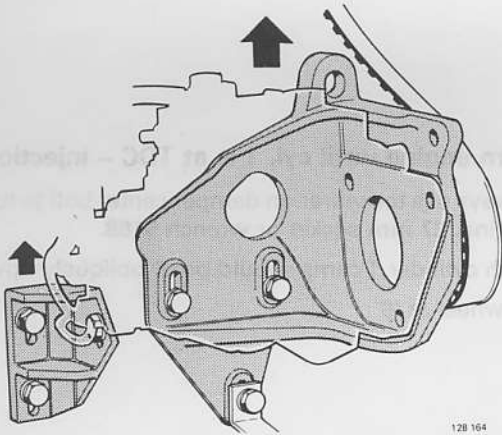
M5

**Detach belt shield from cylinder head**

Remove two upper retaining bolts.

Bend out shield to free it from camshaft. If necessary slacken coolant pump upper bolt.

Keep shield in outer position with a piece of wood.



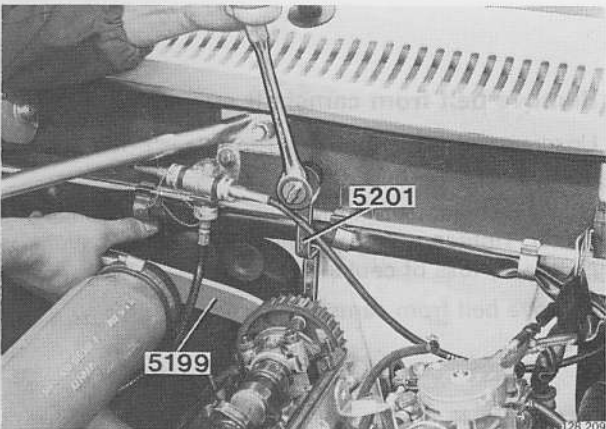
M6

**Lift off pump belt**

Slacken mounting bolts for injection pump bracket to release belt tension.

Tighten one bolt so that pump remains in upper position.

Lift off belt.

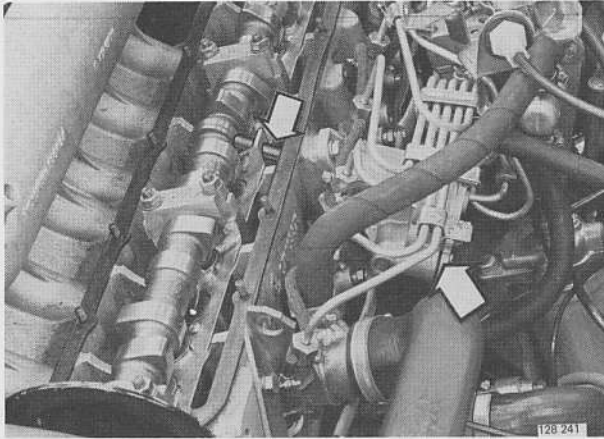


M7

**Remove camshaft rear sprocket**

Hold sprocket in position with **5199** and unscrew sprocket with wrench **5201**.

Take care not to rotate camshaft.

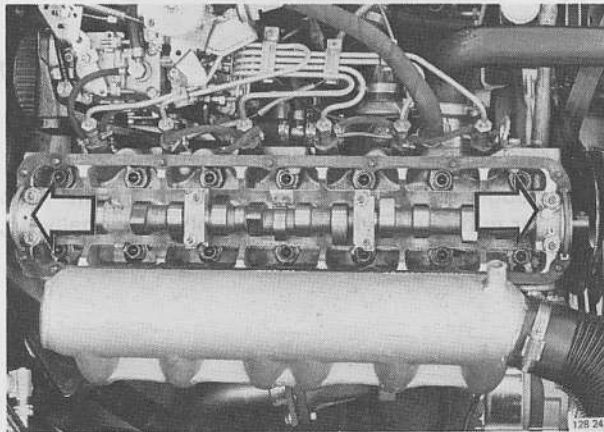


M8

**Remove vacuum pump and pump plunger**

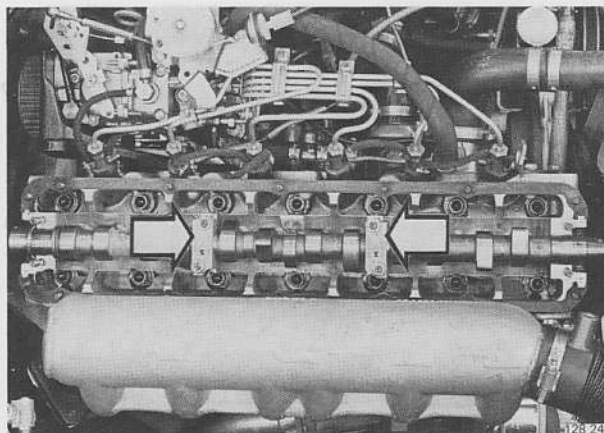
Remove pump retaining nuts and place pump on wheelarch.

Withdraw plunger from cylinder head.



M9

**Remove camshaft bearing caps 1 and 4**



M10

**Remove camshaft bearing caps 2 and 3**

Slacken nuts crosswise to avoid placing uneven load on camshaft.

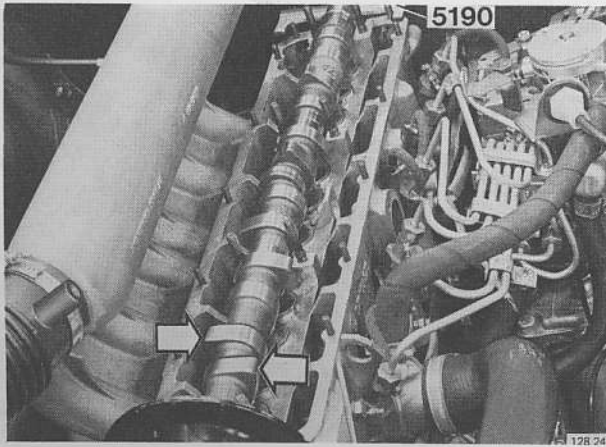


M11

**Lift away camshaft and remove oil seals**

## N. Camshaft, installing

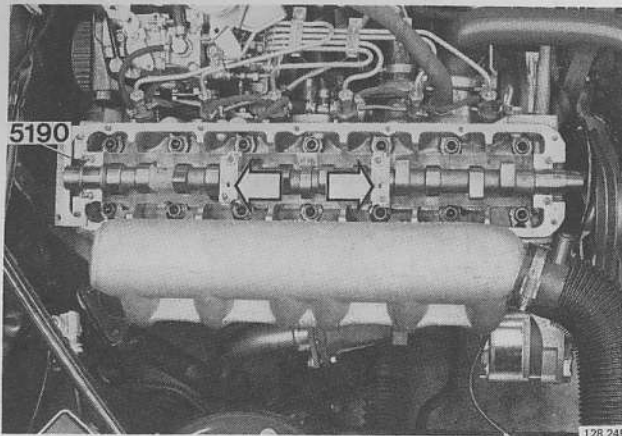
Special tools: 5190, 5193, 5194, 5195, 5196, 5197, 5199, 5200, 5201



N1

### Place camshaft in cylinder head

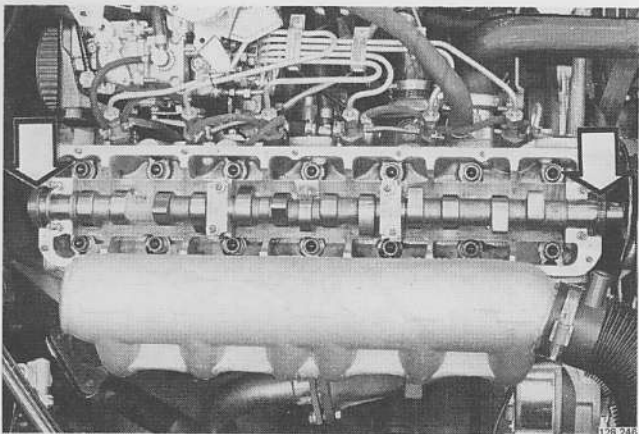
Lubricate contact surfaces of camshaft and bearings.  
Place gauge **5190** at rear of camshaft. **Important!** Both cams for number 1 cylinder must point diagonally up, see fig.



N2

### Install camshaft caps 2 and 3

Install caps correctly, center is off-set.  
Tighten nuts crosswise to avoid warp. Keep camshaft in position with gauge **5190** at rear when tightening caps.



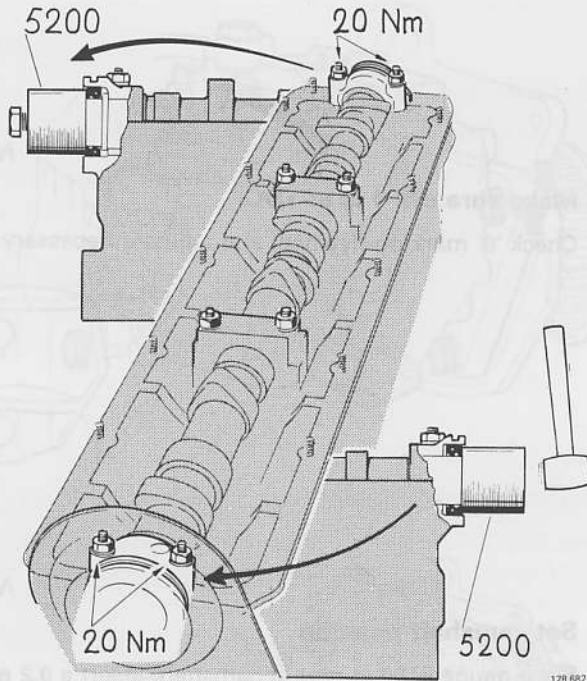
N3

### Remove gauge 5190

N4

### Press in new camshaft oil seals

Oil seals.  
Do not push in seals to bottom position. Make sure that seals are "square".



N5

**Install camshaft caps 1 and 4**

Make sure that the thrust washer for camshaft cap 4 sits correctly.

N6

**Torque all four caps**

Torque = 20 Nm (15 ft lbs).

N7

**Tap in oil seals to bottom**

**Rear oil seal:** Use adapter 5200 and bolt for camshaft rear sprocket.

**Front oil seal:** Use adapter 5200 and tap seal into position.

N8

**Install bolts for belt cover**

N9

**Install gear belt and camshaft front sprocket**

Pull belt to ensure that it is seated correctly on crankshaft gear.

Place belt over camshaft sprocket and install sprocket and belt.

Install center bolt hand tight. It should be possible for sprocket to turn on camshaft without camshaft rotating.

N10

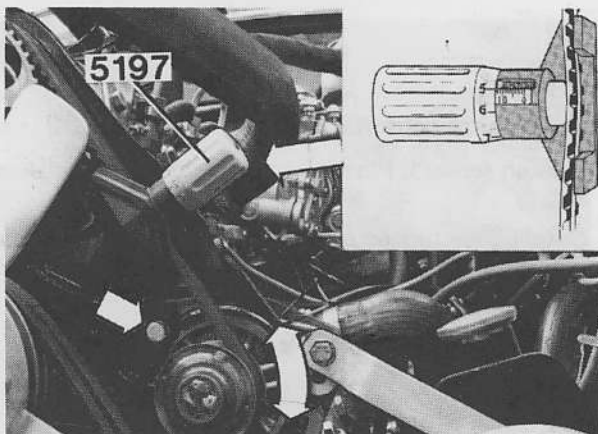
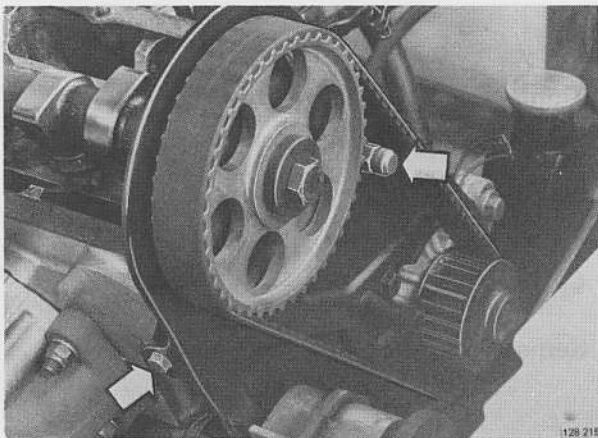
**Set belt tension**

Adjust tension by moving cooling pump.

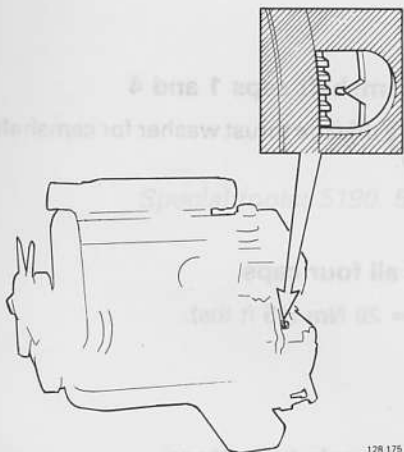
Use gauge 5197 to check tension. Attach gauge to belt and set to 12.5 units.

Stretch belt until mark on gauge plunger is flush with sleeves.

Depress belt strongly with hand and recheck/adjust tension.



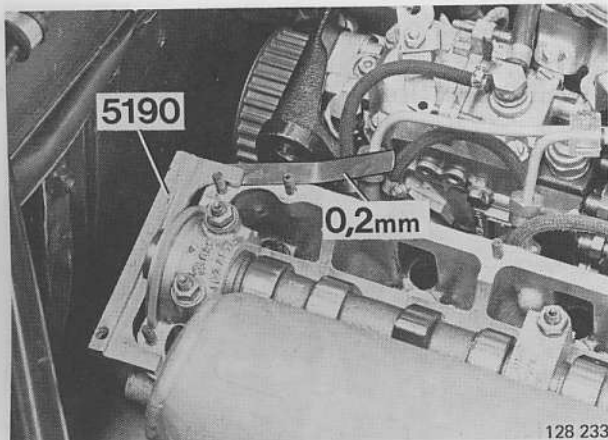




N11

**Make sure cyl. 1 is at TDC**

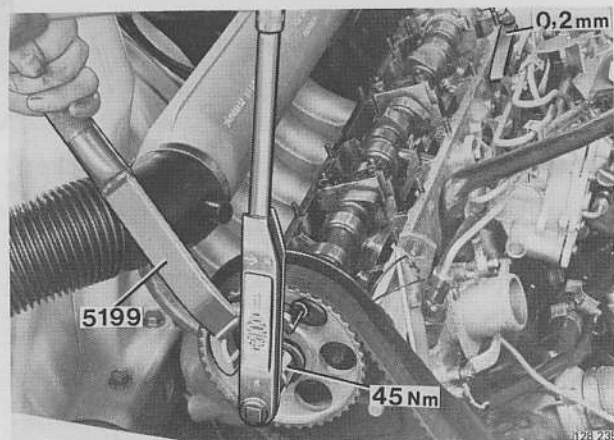
Check '0' mark on flywheel and adjust if necessary.



N12

**Set camshaft position**

Place gauge 5190 at rear of camshaft. Insert a 0.2 mm feeler gauge beneath left side of gauge to compensate for timing gear clearance.



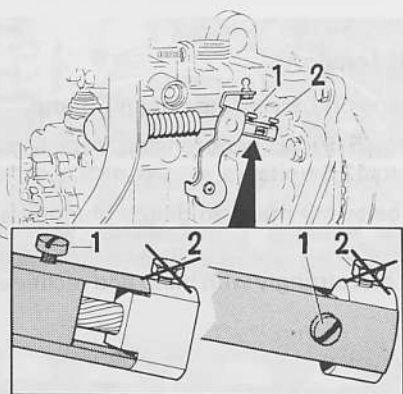
N13

**Tighten camshaft front sprocket**

Use 5199 to prevent sprocket from turning. Torque center bolt to 45 Nm (33 ft lbs).

N14

**Remove gauge 5190 and feeler gauge**



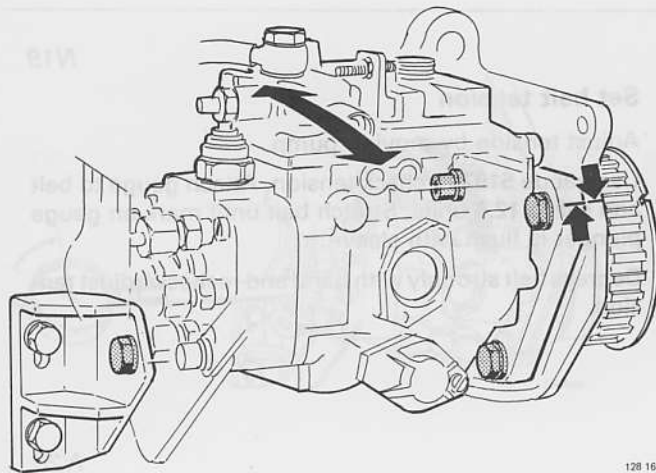
N15

**Disconnect cold start device**

Slacken screw 1. Push lever forward and rotate sleeve 90°.

**Note!** Do not turn screw 2 otherwise it will be necessary to remove cold start device and reset it on a test bench. Press back lever against stop.

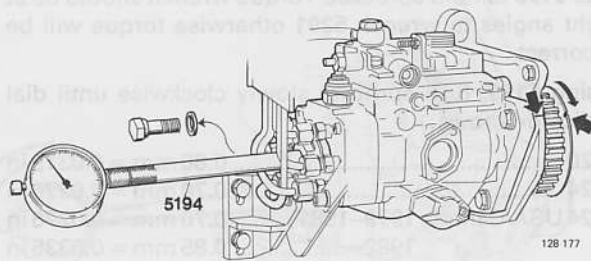




N16

### Basic-set injection pump

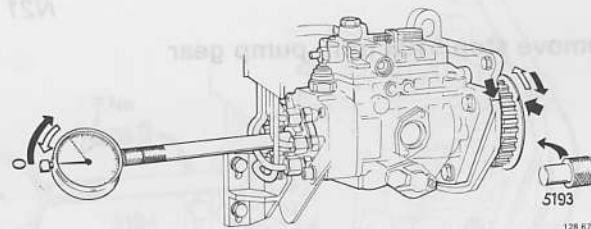
Slacken pump mounting bolts (Allen key = 6 mm).  
Align marks on pump and mounting bracket by turning pump. Retighten mounting bolts.



N17

### Set dial indicator zero. Lock pump gear at cyl. 1 injection using stop 5193

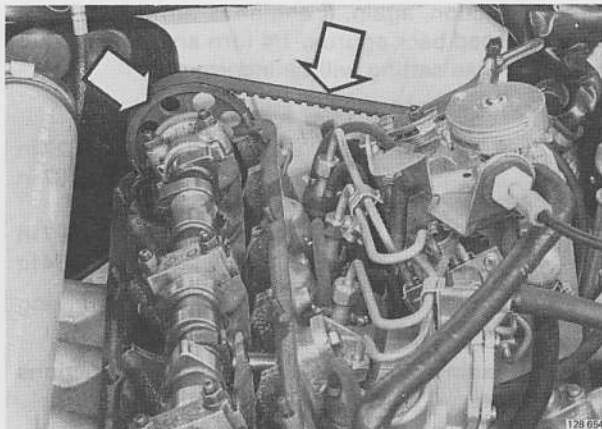
Unscrew and remove plug from injection pump distributor.  
Install holder 5194 and dial indicator (range 0–3 mm). Set gauge to approx. 2 mm.  
Turn pump gear clockwise until mark on gear and mounting bracket coincide.



Then turn pump gear back slightly until min reading registers on dial indicator.

Set indicator to zero.

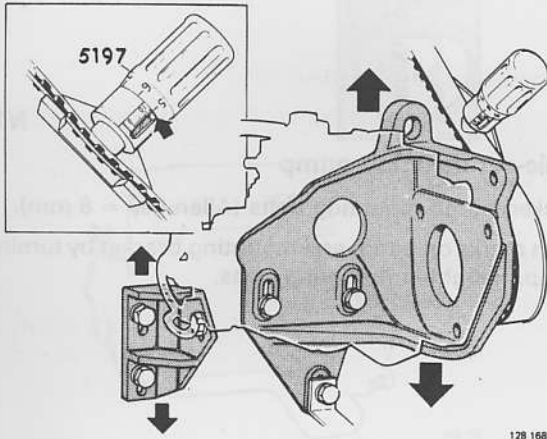
Turn pump gear clockwise until mark on gear and pump mounting bracket coincide. Lock gear in this position with stop 5193. (Insert stop through pump gear into mounting bracket.)



N18

### Install camshaft rear sprocket and belt

Tighten center bolts by hand, it should be possible to turn sprocket on camshaft.



128 168

N19

**Set belt tension**

Adjust tension by moving pump.

Use gauge **5197** to check tension. Attach gauge to belt and set to **12.5** units. Stretch belt until mark on gauge plunger is flush with sleeve.

Depress belt strongly with hand and recheck/adjust tension.

N20

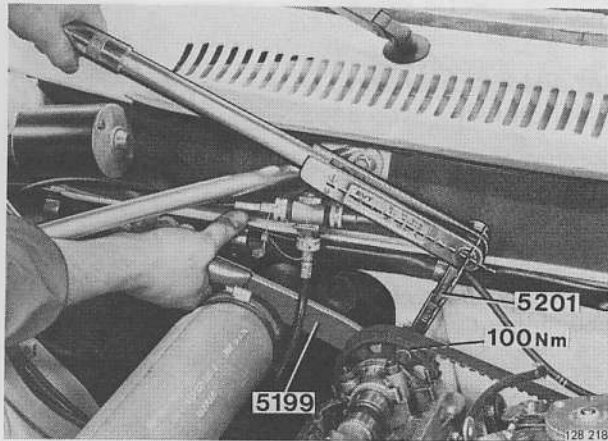
**Set pump and tighten camshaft rear sprocket**

Use **5199** to hold sprocket. Torque wrench should be at right angles to wrench **5201** otherwise torque will be incorrect.

Using **5199**, turn sprocket slowly clockwise until dial indicator shows:

D 20 .....	0.80 mm = 0.0315 in
D 24 .....	0.70 mm = 0.0276 in
D 24 USA/Canada 1979-1981 .....	0.70 mm = 0.0276 in
1982- .....	0.85 mm = 0.0335 in

Hold sprocket in this position and torque bolt to **100 Nm** (73 ft lbs). Take care that camshaft and sprocket do not move.



128 218

N21

**Remove stop 5193 from pump gear**

N22

**Check pump setting**

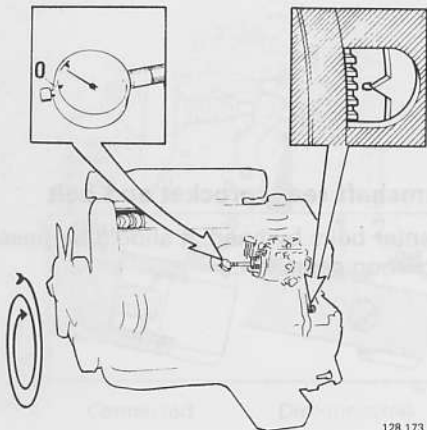
Turn engine two full turns until cyl. 1 is at top dead center - injection, again. If engine is turned too far it must be turned back approx. 1/4 turn and then to zero mark otherwise setting will be incorrect.

Dial indicator should show:

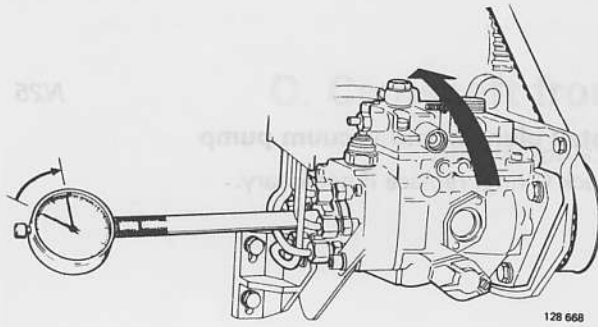
D 20 .....	0.75-0.83 mm = 0.0295-0.0327 in
D 24 .....	0.65-0.73 mm = 0.0256-0.0287 in
D 24 USA/Canada	
1979-1981 .....	0.65-0.73 mm = 0.0256-0.0287 in
1982- .....	0.82-0.90 mm = 0.0323-0.0354 in

**Correct reading:** Tighten injection pump mounting bolts. Proceed to N23.

**Incorrect reading:** Readjust according to instructions on next page.



128 173

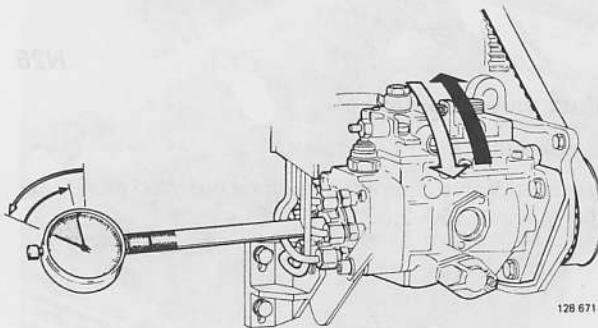


**Readjusting pump setting:**

D 20 .....	0.80 mm = 0.0315 in
D 24 .....	0.70 mm = 0.0276 in
D 24 USA/Canada 1979-1981 .....	0.70 mm = 0.0276 in
1982- .....	0.85 mm = 0.0335 in

**Reading less than specified:**

Slacken pump mounting bolts and turn pump **inwards** to obtain correct value. Tighten mounting bolts and repeat check of pump settings.



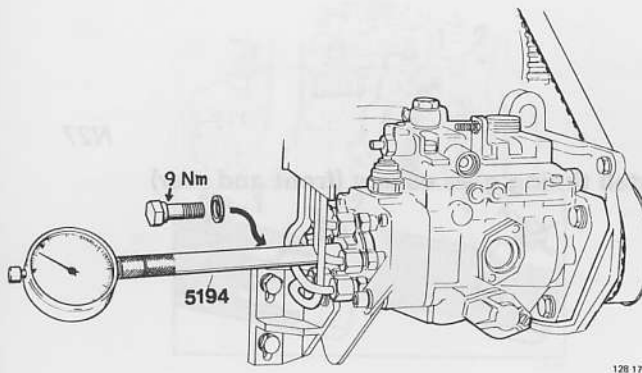
**Reading less than specified:**

Slacken pump mounting bolts and turn pump **outwards** until dial indicator shows approx:

D 20 .....	0.70 mm = 0.0276 in
D 24 .....	0.60 mm = 0.0236 in
D 24 USA/Canada 1979-1981 .....	0.60 mm = 0.0236 in
1982- .....	0.75 mm = 0.0295 in

Then turn pump **inwards** until specified value is obtained. Tighten mounting bolts and recheck pump setting.

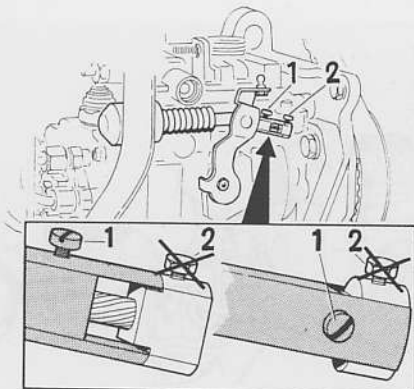
**Note!** Injection pump must not be tapped or knocked as this will alter its setting.



N23

**Remove dial indicator and holder 5194. Install plug with new seal**

Tightening torque 9 Nm (6.5 ft lbs).



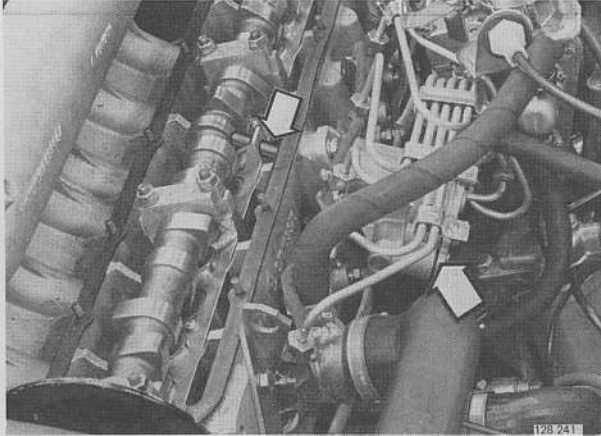
N24

**Reconnect cold start device**

Press lever forwards and turn sleeve 90°. Retighten screw 1.

**Note!** Do not turn screw 2 otherwise it will be necessary to reset cold start device on a test bench.

Connected      Disconnected

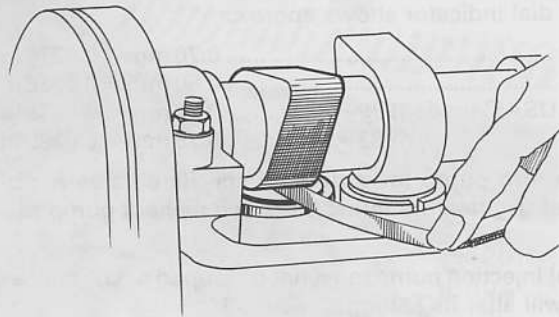


128 241

**Install plunger and vacuum pump**

Check O-ring, replace if necessary.

N25



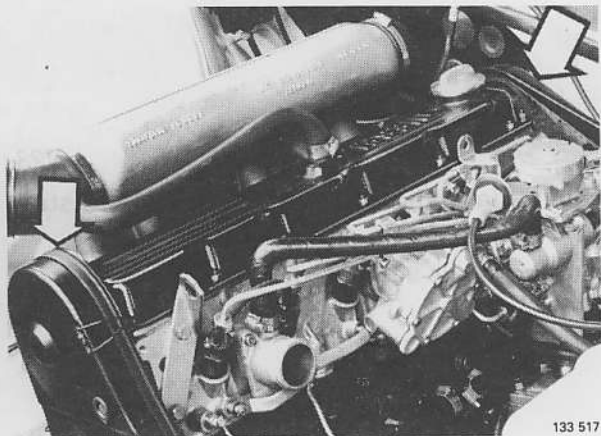
128 156

**Adjust valve clearance:**

See operation B1-11, page 19.

**Important!** Valve clearance must be checked after 600-1,200 miles (1,000-2,000 km).

N26



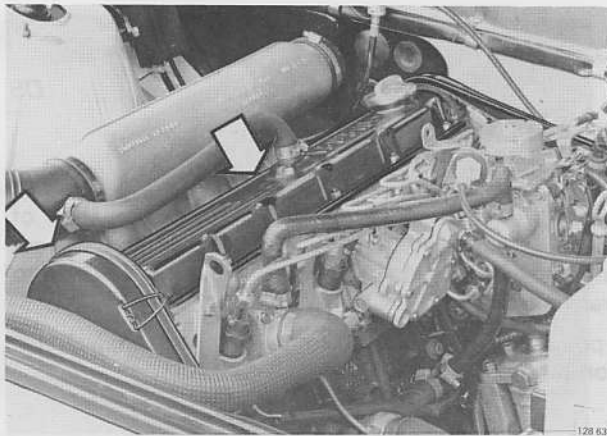
133 517

**Install timing gear covers (front and rear)**

N27

## O. Camshaft front seal, replacement

Special tools: 5194, 5197, 5199, 5200

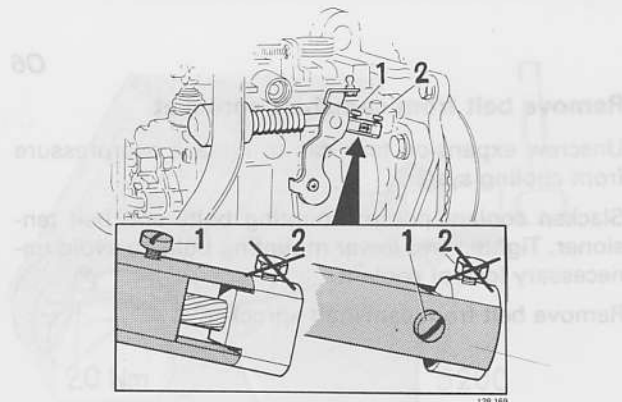


Remove valve cover 1 and oil seal

O1

### Remove:

- valve cover
- front timing gear cover.



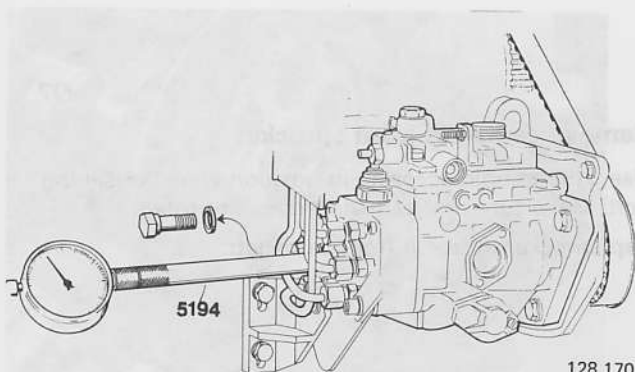
### Disconnect cold start device

Slacken screw 1. Push lever forward and rotate sleeve 90°.

**Note!** Do not turn screw 2 otherwise it will be necessary to remove cold start device and reset it on a test bench.

Press back lever against stop.

O2



### Install dial indicator

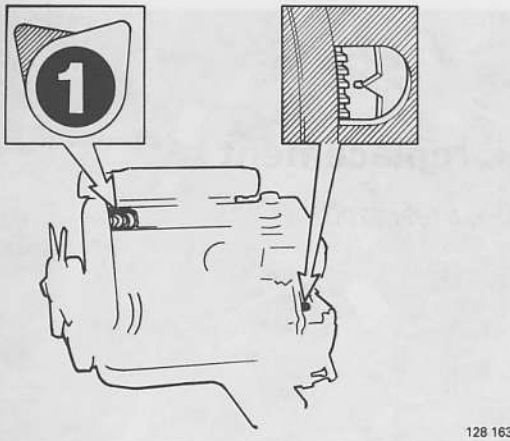
Unscrew and remove plug from injection pump distributor.

Install holder 5194 and dial indicator (range 0-3 mm). Set gauge to approx. 2 mm.

O3



04



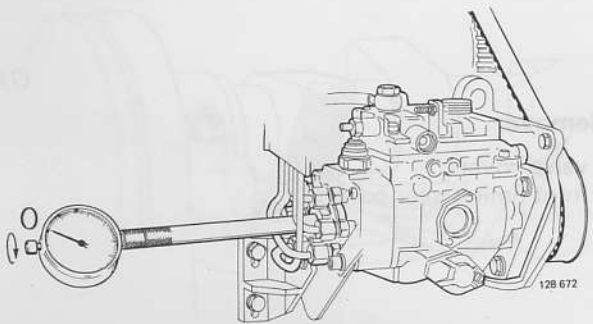
**Turn engine until cyl. 1 is at TDC – injection**

Always use the vibration damper center bolt to turn the engine. **27 mm** socket or wrench **5188**.

Both cylinder 1 cams should point obliquely upwards.

Turn engine approx. 1/4 turn clockwise past '0' and then back to '0' again, to obtain slack part of belt on driving side. If this is not done injection pump setting will be incorrect.

05



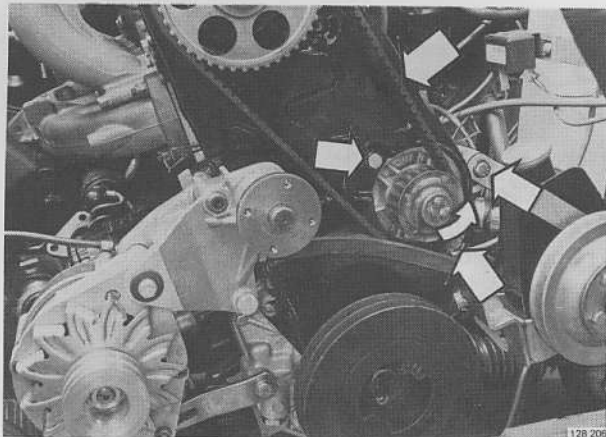
**Set dial indicator zero**

**Important!**

Gauge pointer must not move during installation of new oil seal otherwise it will be necessary to basic-set engine since camshaft will have moved in relation to crankshaft.

If pointer does not move it suffices to check/adjust injection pump setting.

06



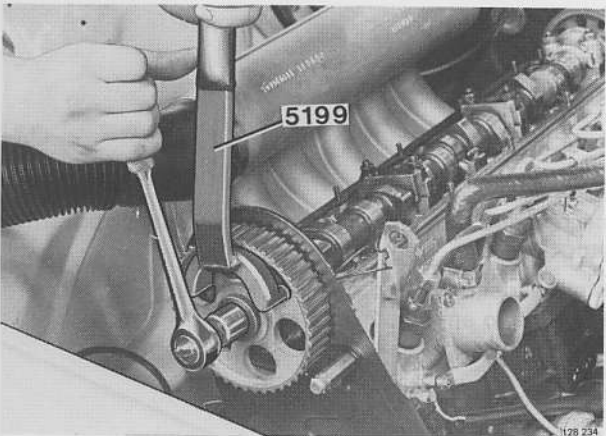
**Remove belt from camshaft sprocket**

Unscrew expansion tank cap to release overpressure from cooling system.

Slacken coolant pump mounting bolts and belt tensioner. Tighten two lower mounting bolts to avoid unnecessary loss of coolant.

Remove belt from camshaft sprocket.

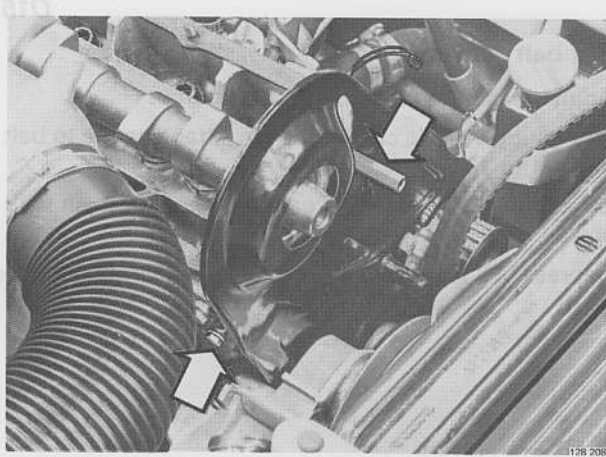
07



**Remove camshaft front sprocket**

Use **5199** to hold sprocket in position when loosening bolt. Make sure that camshaft does not rotate.

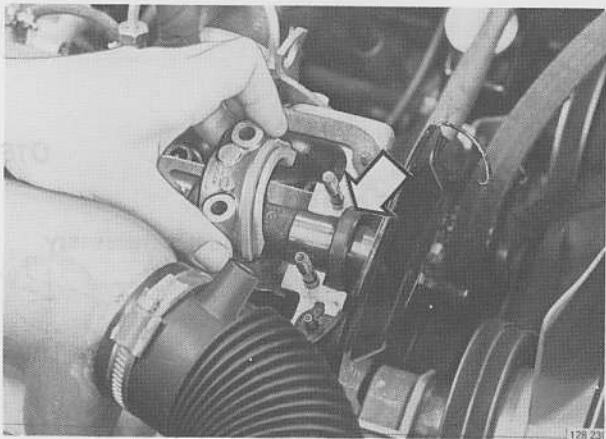
Tap sprocket to free it from camshaft.



**Detach belt shield from cylinder head**

Remove two upper retaining bolts.  
Bend out shield to free it from camshaft. If necessary slacken coolant pump upper bolt.  
Keep shield in outer position with a piece of wood.

08



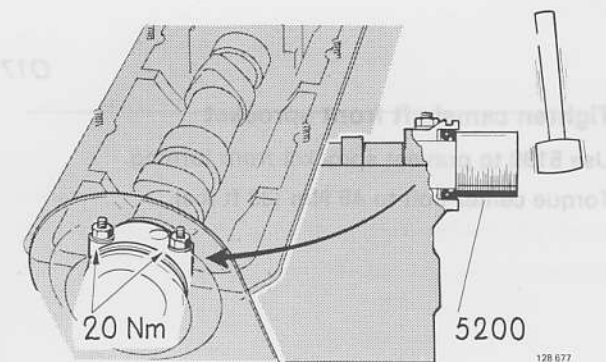
**Remove camshaft cap 1 and oil seal**

**Press in new camshaft oil seal**

Oil seal.  
Do not push in seal to bottom position. Make sure that seal is "square".

09

010



**Install camshaft cap 1**

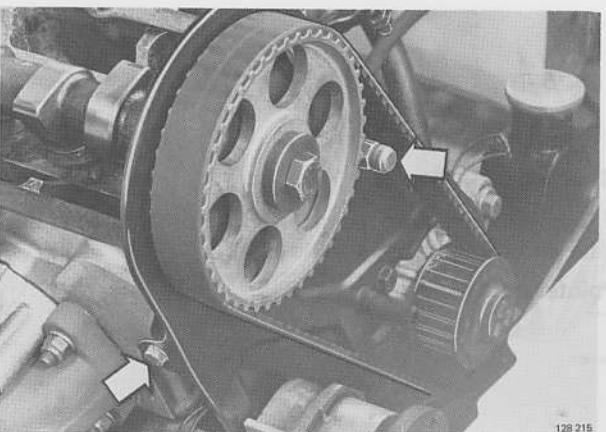
Torque to 20 Nm (15 ft lbs).

**Press in seal to bottom position**

Release cover. Use adapter 5200 to tap in oil seal.

011

012



**Install bolts for belt cover**

**Install gear belt and camshaft front sprocket**

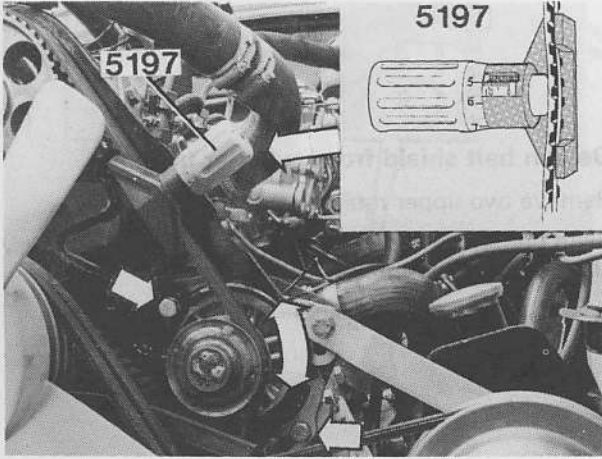
Pull belt to ensure that it is seated correctly on crankshaft gear.

Place belt over camshaft sprocket and install sprocket and belt.

Install center bolt and tighten. It should be possible for sprocket to turn on camshaft without camshaft rotating.

013

014



O15

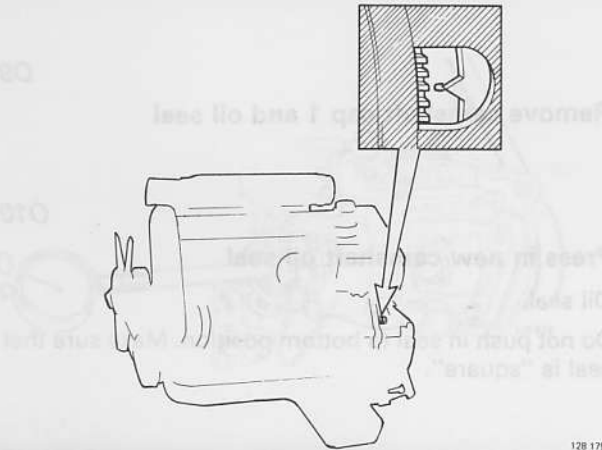
**Set belt tension**

Adjust tension by moving cooling pump.

Use gauge **5197** to check tension. Attach gauge to belt and set to **12.5** units.

Stretch belt until mark on gauge plunger is flush with sleeve.

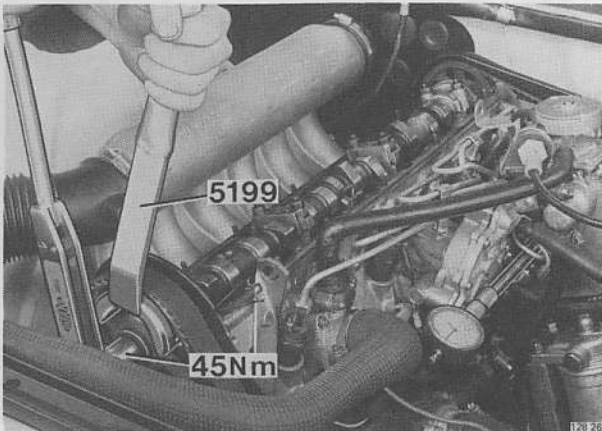
Depress belt strongly with hand and recheck/adjust tension.



O16

**Make sure cyl. 1 is at TDC**

Check '0' mark on flywheel and adjust if necessary.

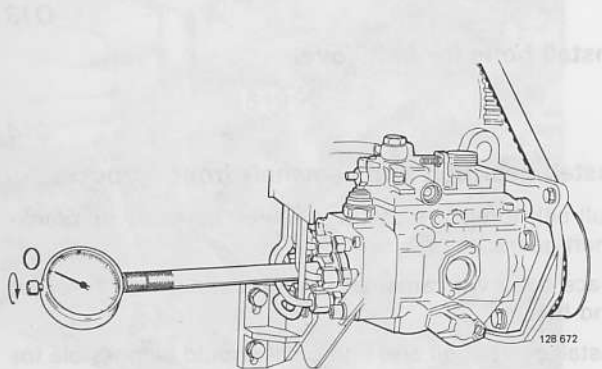


O17

**Tighten camshaft front sprocket**

Use **5199** to prevent sprocket from turning.

Torque center bolt to **45 Nm** (33 ft lbs).

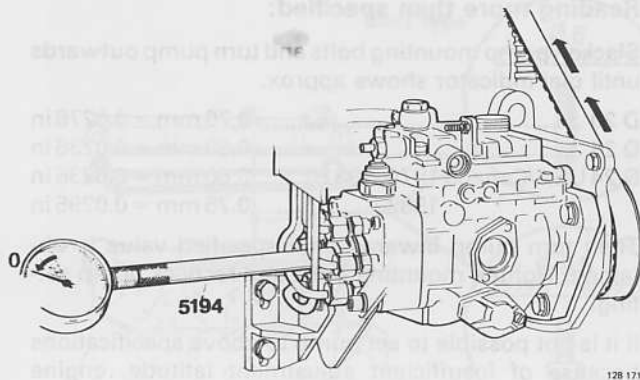


O18

**Check dial indicator**

If pointer has moved from zero position: basic-set engine according to operations C1-21.

**Pointer at zero:** Proceed to O19.

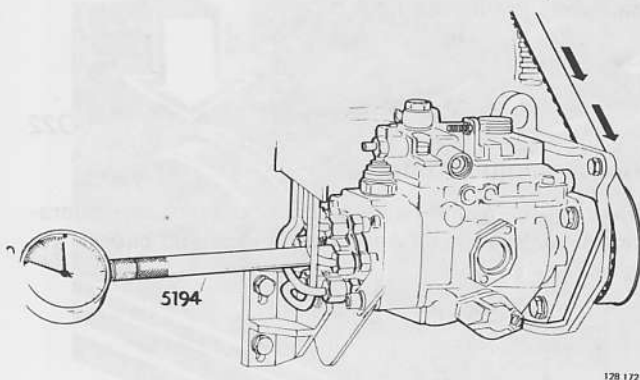


O19

**Zero injection pump and dial indicator**

Slowly turn engine anticlockwise until min reading is reached on dial indicator.

Set zero.



O20

**Check pump setting**

Slowly turn engine clockwise until flywheel reaches '0' mark.

If engine is turned too far it must be turned back approx. 1/4 and then to '0' mark otherwise setting will be incorrect.

Dial indicator should show:

D 20 .....	0.75–0.83 mm = 0.0295–0.0327 in
D 24 .....	0.65–0.73 mm = 0.0256–0.0287 in
D 24 USA/Canada	
1979–1981 .....	0.65–0.73 mm = 0.0256–0.0287 in
1982– .....	0.82–0.90 mm = 0.0323–0.0354 in

**Correct reading:** Tighten injection pump mounting bolts. Proceed to O23.

**Incorrect reading:** Readjust according to below.

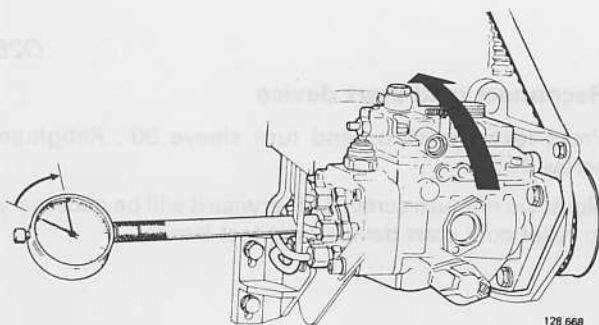
O23

Remove dial indicator and holder

O24

install plug with new seal  
tightening torque 8 Nm (5.8 ft.lbf)

O25



O21

**Check/adjust pump setting**

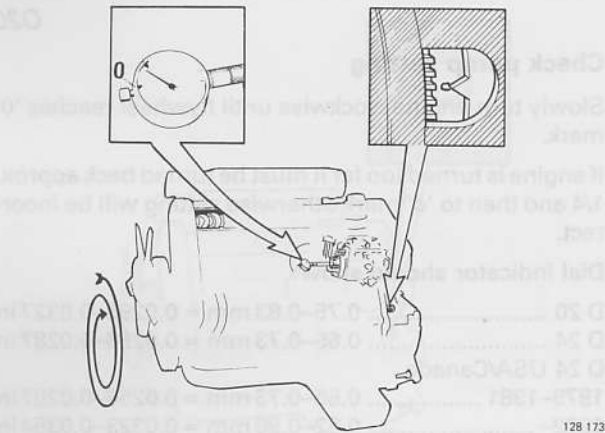
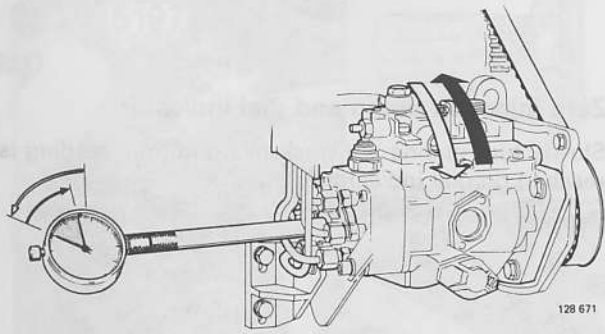
D 20 .....	0.80 mm = 0.0315 in
D 24 .....	0.70 mm = 0.0276 in
D 24 USA/Canada 1979–1981 .....	0.70 mm = 0.0276 in
1982– .....	0.85 mm = 0.0335 in

**Reading less than specified:**

Slacken pump mounting bolts and turn pump **inwards** to obtain correct value. Tighten mounting bolts and repeat check of pump setting.

betamodell Connected





**Reading more than specified:**

Slacken pump mounting bolts and turn pump **outwards** until dial indicator shows approx.

D 20 .....	0.70 mm = 0.0276 in
D 24 .....	0.60 mm = 0.0236 in
D 24 USA/Canada 1979–1981 .....	0.60 mm = 0.0236 in
1982– .....	0.75 mm = 0.0295 in

Then turn pump **inwards** until specified value is obtained. Tighten mounting bolts and recheck pump setting.

If it is not possible to set pump to above specifications because of insufficient adjustment latitude, engine must be basic-set again, since camshaft and crankshaft are probably out-of-line.

**Note!** Injection pump must not be tapped or knocked as this will alter its setting.

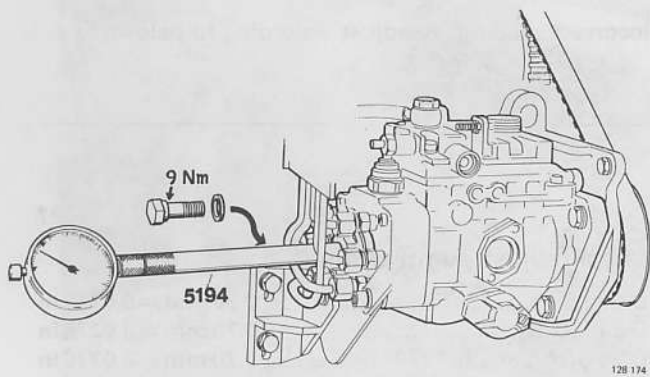
O22

**Check pump setting**

Turn engine round twice and check setting, see operation O20. Readjust if necessary and repeat check.

O23

**Remove dial indicator and holder**



O24

**Install plug with new seal**

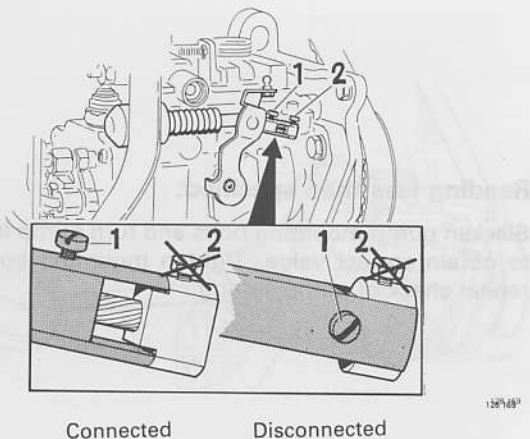
Tightening torque 9 Nm (6.5 ft lbs).

O25

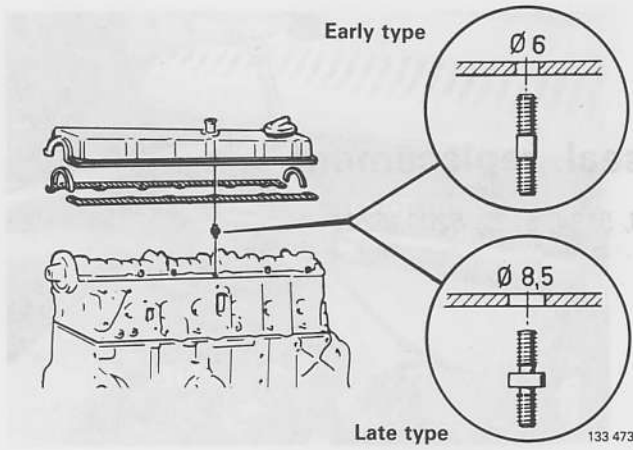
**Reconnect cold start device**

Press lever forwards and turn sleeve 90°. Retighten screw 1.

**Note!** Do not turn screw 2 otherwise it will be necessary to reset cold start device on a test bench.





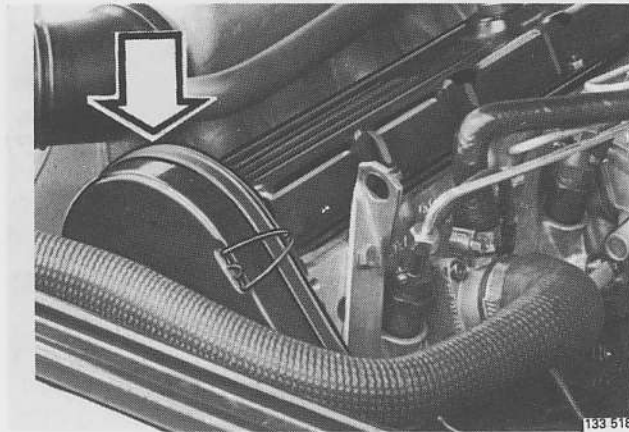


**install valve cover**

Use new gaskets if necessary.

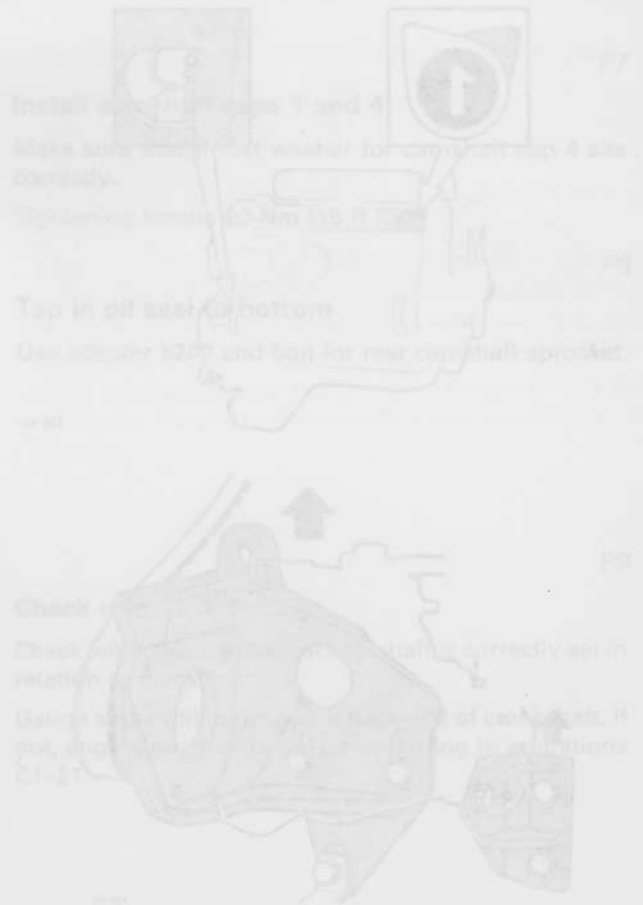
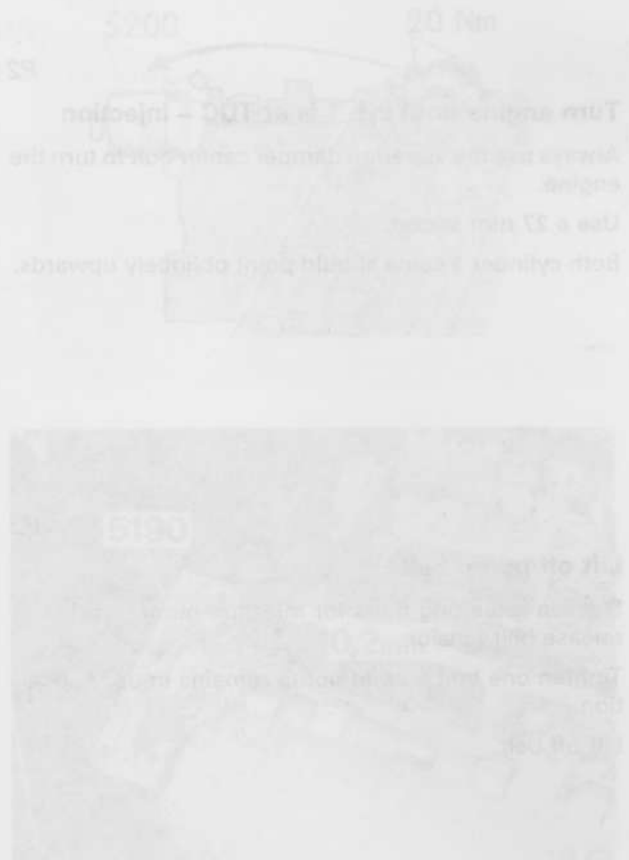
Two types of pin studs are available, see fig. Late types have a spacer, and hole in gasket is larger to prevent damage to gasket by overtightening. Late and early type parts **must not** be interchanged.

O26



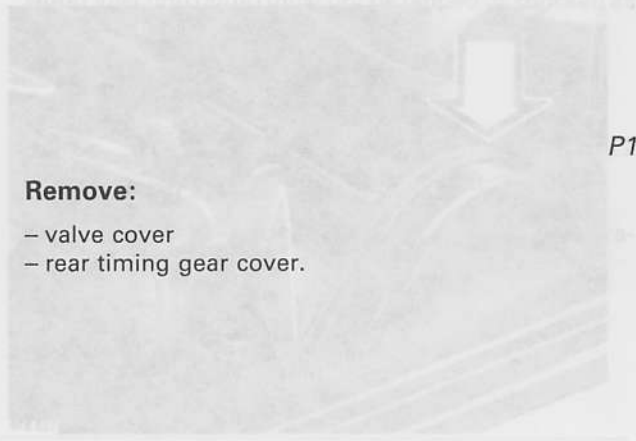
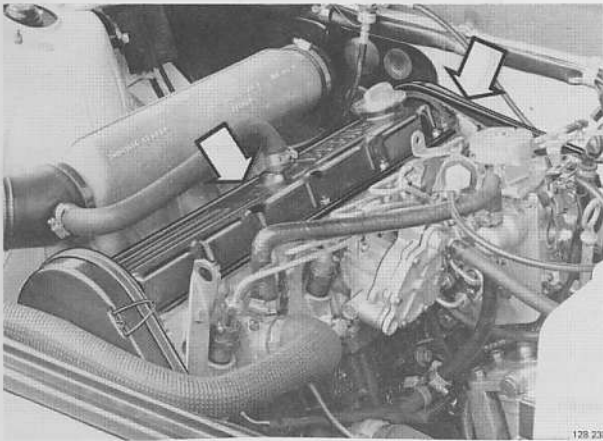
**Install front timing gear cover**

O27



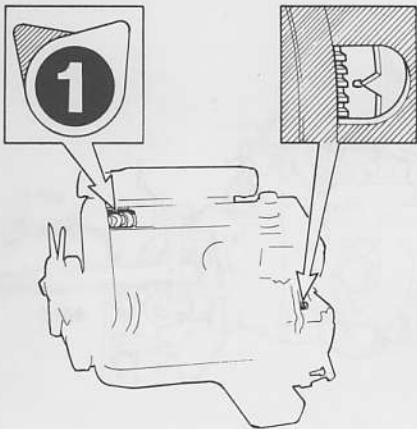
## P. Camshaft rear seal, replacement

Special tools: 5190, 5193, 5194, 5199, 5200, 5201



### Remove:

- valve cover
- rear timing gear cover.

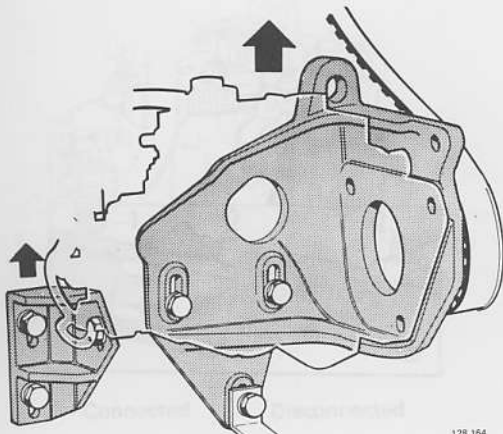


### Turn engine until cyl. 1 is at TDC – injection

Always use the vibration damper center bolt to turn the engine.

Use a 27 mm socket.

Both cylinder 1 cams should point obliquely upwards.

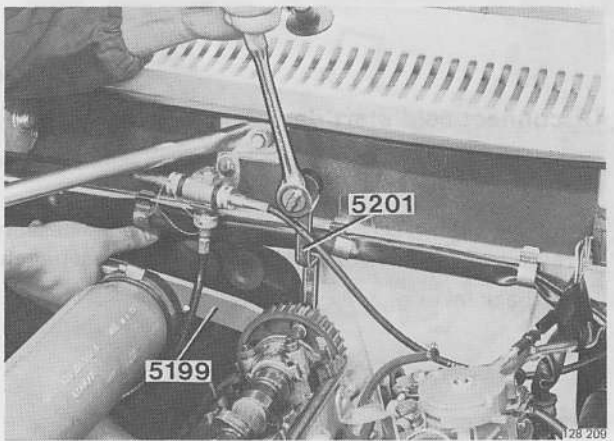


### Lift off pump belt

Slacken mounting bolts for injection pump bracket to release belt tension.

Tighten one bolt so that pump remains in upper position.

Lift off belt.

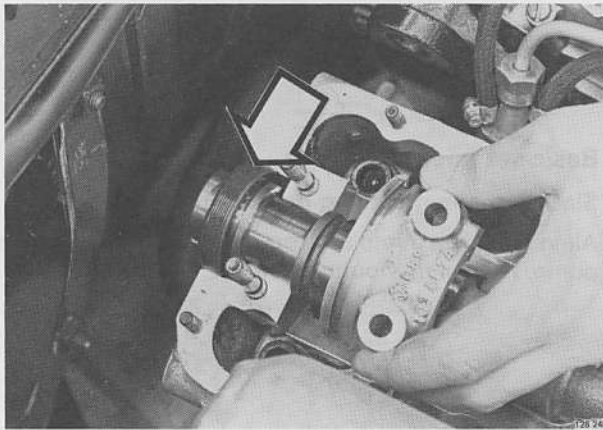


P4

**Remove camshaft rear sprocket**

Hold sprocket in position with 5199 and unscrew sprocket with wrench 5201.

**Note!** Take care not to rotate camshaft.



P5

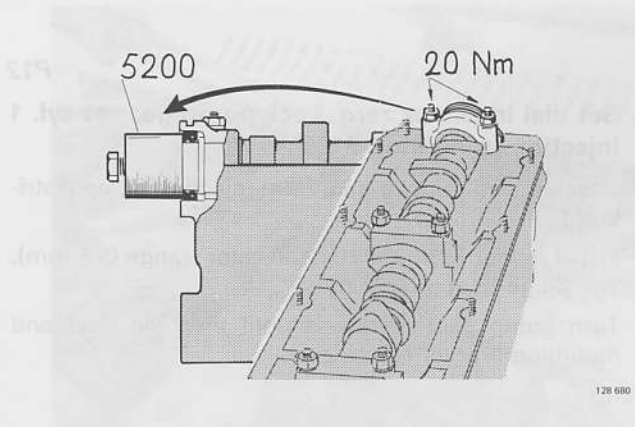
**Remove camshaft cap 4 and old oil seal**

P6

**Press in new oil seal**

Oil seal.

Do not push in seal to bottom position. make sure that seal is "square".



P7

**Install camshaft caps 1 and 4**

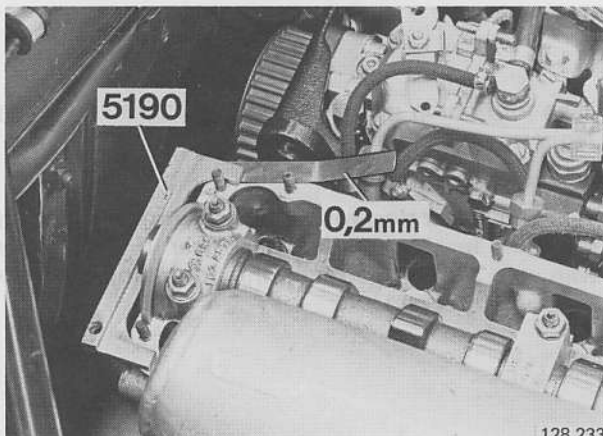
Make sure that thrust washer for camshaft cap 4 sits correctly.

Tightening torque 20 Nm (15 ft lbs).

P8

**Tap in oil seal to bottom**

Use adapter 5200 and bolt for rear camshaft sprocket.

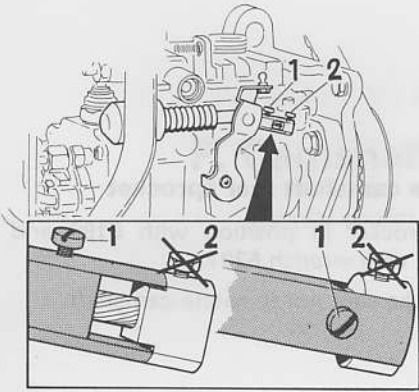


P9

**Check camshaft setting**

Check with gauge 5190 that camshaft is correctly set in relation to crankshaft.

Gauge should fit in groove in back end of crankshaft. If not, engine must be basic-set according to operations C1-21.



Connected

Disconnected

128 169

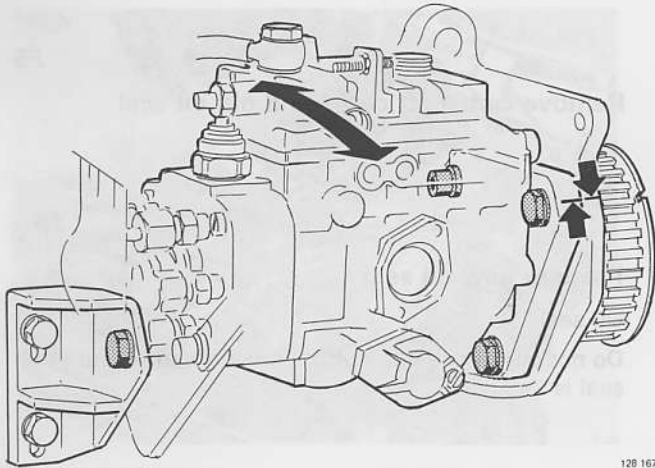
P10

### Disconnect cold start device

Slacken screw 1. Push lever forward and rotate sleeve 90°.

**Note!** Do not turn screw 2 otherwise it will be necessary to remove cold start device and reset it on a test bench.

Press back lever against stop.



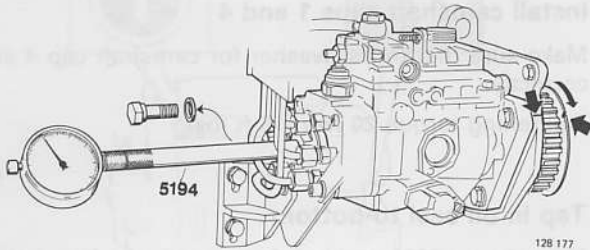
128 167

P11

### Basic-set injection pump

Slacken pump mounting bolts (Allen key = 6 mm).

Align marks on pump and mounting bracket by turning pump. Retighten mounting bolts.



128 177

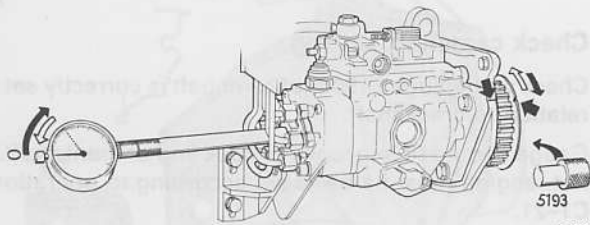
P12

### Set dial indicator zero. Lock pump gear at cyl. 1 injection using stop 5193

Unscrew and remove plug from injection pump distributor.

Install holder 5194 and dial indicator (range 0–3 mm). Set gauge to approx. 2 mm.

Turn pump gear clockwise until mark on gear and mounting bracket coincide.

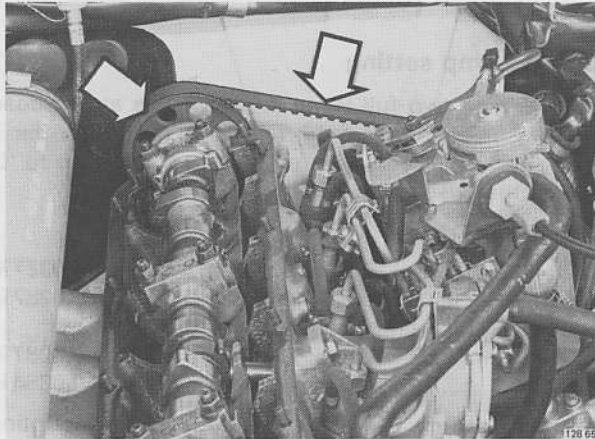


128 670

Then turn pump gear back slightly until min reading registers on dial indicator.

Set indicator to zero.

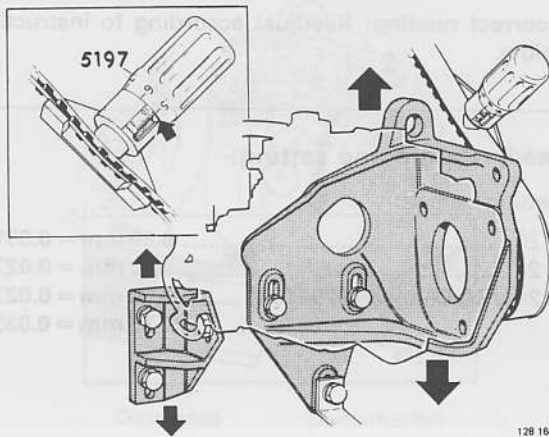
Turn pump gear clockwise until mark on gear and pump mounting bracket coincide. Lock gear in this position with stop 5193. (Insert stop through pump gear into mounting bracket.)



P13

**Install camshaft rear sprocket and belt**

Tighten center bolt by hand, it should be possible to turn sprocket on camshaft.



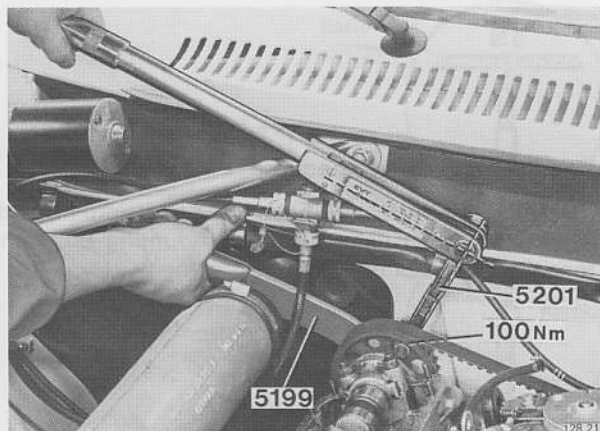
P14

**Set belt tension**

Adjust tension by moving pump.

Use gauge **5197** to check tension. Attach gauge to belt and set to **12.5** units. Stretch belt until mark on gauge plunger is flush with sleeve.

Depress belt strongly with hand and recheck/adjust tension.



P15

**Set pump and tighten camshaft rear sprocket**

Use **5199** to hold sprocket. Torque wrench should be at right angles to wrench **5201** otherwise torque will be incorrect.

Using **5199**, turn sprocket slowly until dial indicator shows:

D 20 .....	<b>0.80 mm = 0.0315 in</b>
D 24 .....	<b>0.70 mm = 0.0276 in</b>
D 24 USA/Canada 1979–1981 .....	<b>0.70 mm = 0.0276 in</b>
1982– .....	<b>0.85 mm = 0.0335 in</b>

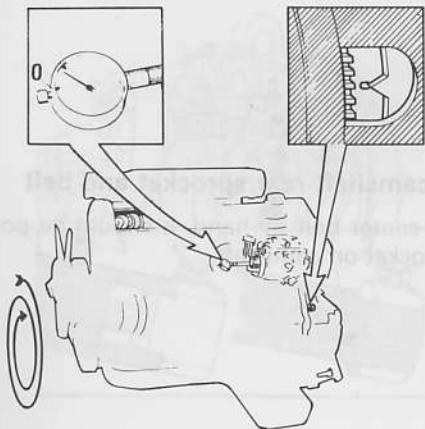
Hold sprocket in this position and torque to **100 Nm** (73 ft lbs). Take care that camshaft and sprocket do not move.

P16

**Remove stop 5193 from pump gear**



P17



128 171

**Check pump setting**

Turn engine two full turns until cyl. 1 is at top dead center – injection, again. If engine is turned too far it must be turned back approx. 1/4 turn and then to '0' mark otherwise setting will be incorrect.

Dial indicator should show:

D 20 .....	0.75–0.83 mm = 0.0295–0.0327 in
D 24 .....	0.65–0.73 mm = 0.0256–0.0287 in
D 24 USA/Canada	
1979–1981 .....	0.65–0.73 mm = 0.0256–0.0287 in
1982– .....	0.82–0.90 mm = 0.0323–0.0354 in

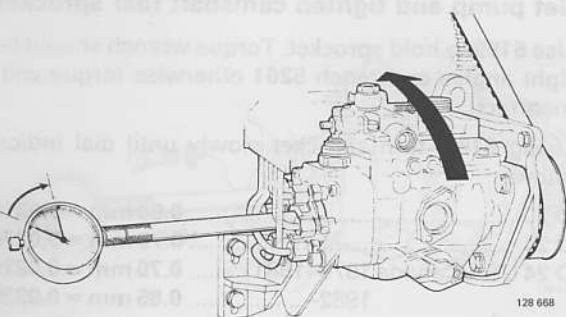
**Correct reading:** Tighten injection pump mounting bolts. Proceed to P18.

**Incorrect reading:** Readjust according to instructions below.

**Readjusting pump setting:**

Setting values:

D 20 .....	<b>0.80 mm = 0.0315 in</b>
D 24 .....	<b>0.70 mm = 0.0276 in</b>
D 24 USA/Canada 1979–1981 .....	<b>0.70 mm = 0.0276 in</b>
1982– .....	<b>0.85 mm = 0.035 in</b>



128 668

**Reading less than specified:**

Slacken pump mounting bolts and turn pump **inwards** to obtain correct value. Tighten mounting bolts and repeat check of pump setting.

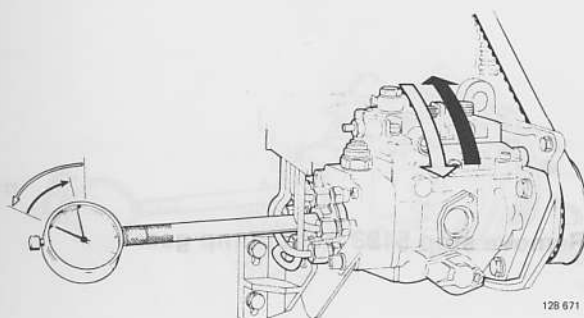
**Reading more than specified:**

Slacken pump mounting bolts and turn pump **outwards** until dial indicator shows approx.

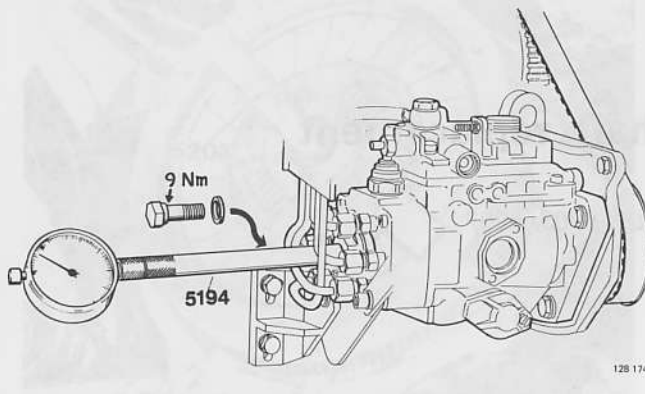
D 20 .....	0.70 mm = 0.0276 in
D 24 .....	0.60 mm = 0.0236 in
D 24 USA/Canada 1979–1981 .....	0.60 mm = 0.0236 in
1982– .....	0.75 mm = 0.0295 in

Then turn pump **inwards** until specified value is obtained. Tighten mounting bolts and recheck pump setting.

**Note!** Injection pump must not be tapped or knocked as this will alter its setting.



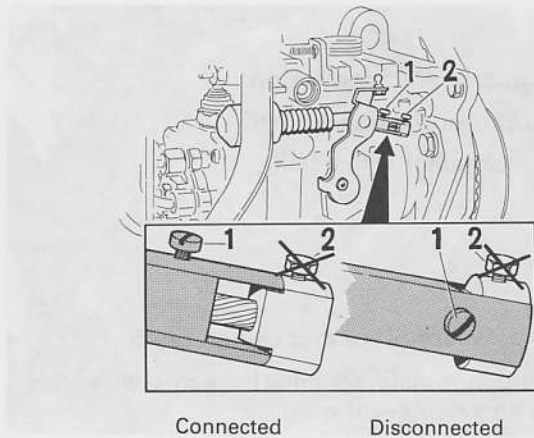
128 671



P18

**Remove dial indicator and holder 5194. Install plug with new seal**

Tightening torque 9 Nm (6.5 ft lbs).

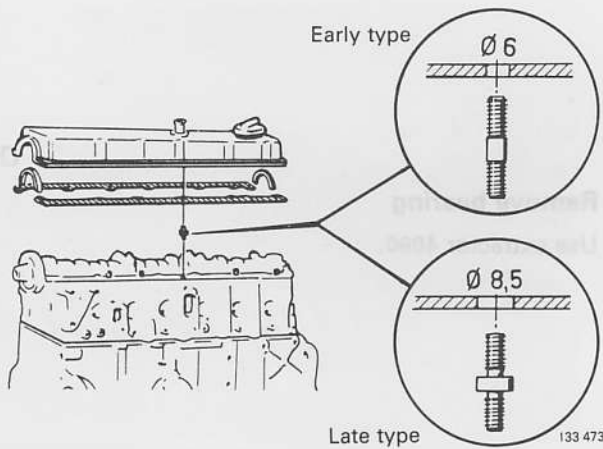


P19

**Reconnect cold start device**

Press lever forwards and turn sleeve 90°. Retighten screw 1.

Note! Do not turn screw 2 otherwise it will be necessary to reset cold start device on a test bench.

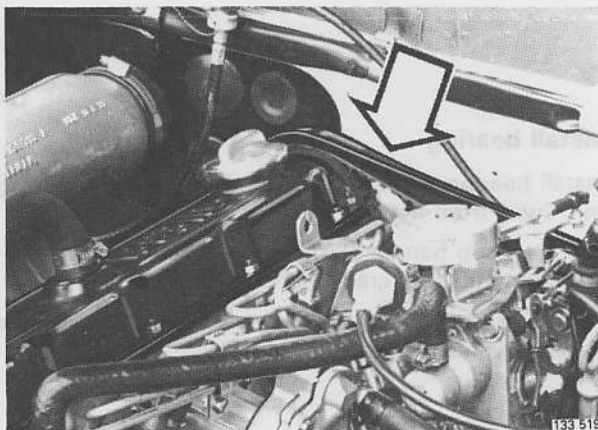


P20

**Install valve cover**

Use new gaskets if necessary.

Two types of pin studs are available, see fig. Late types have a spacer, and hole in gasket is larger to prevent damage to gasket by overtightening. Late and early type parts **must not** be interchanged.

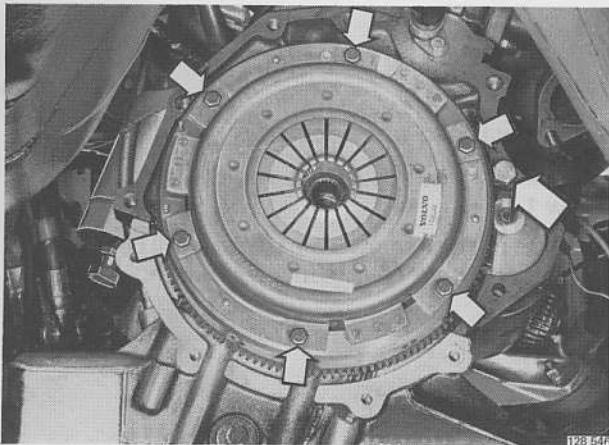


P21

**Install rear timing gear cover**

## Q. Pilot bearing in crankshaft, replacement

Special tools: 1801, 4090, 5203, 5207



### Remove gearbox/transmission

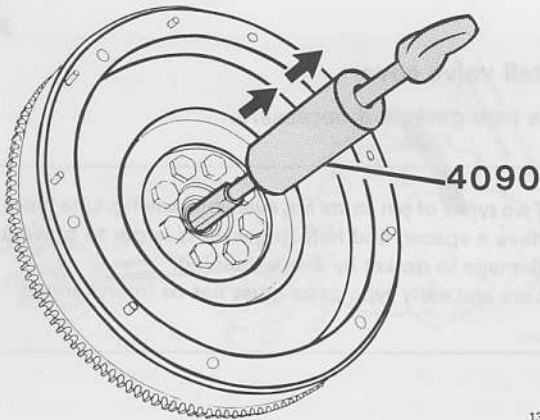
See Service manual section 4 (43).  
Secure starter motor with a bolt.

Q1

### Remove pressure plate and driven plate

Unscrew pressure plate mounting bolts crosswise a few turns at a time to prevent warp.

Q2



### Remove bearing

Use extractor 4090.

Q3

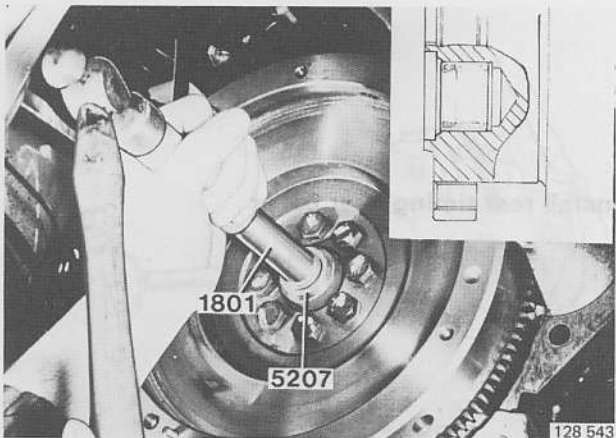
### Install bearing

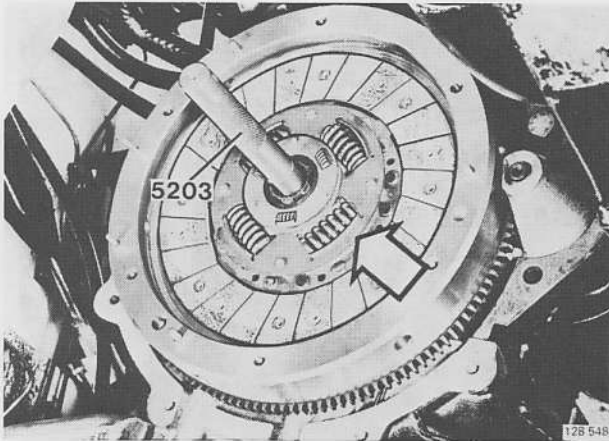
Install bearing and seal with text on outer ring facing out, away from flywheel.

Use standard handle 1801 and drift 5207 to tap in bearing until it abuts crankshaft.

Press in a small amount of grease (1.3–1.5 gram) in the space beyond the bearing.

Q4



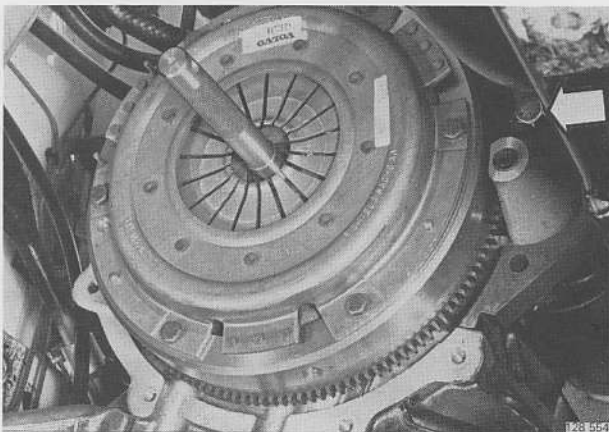


**Install driven plate**

Use centering shaft 5203.

Turn driven plate with hub facing out, away from fly-wheel.

Q5



**Install pressure plate**

Tighten bolts crosswise a few turns at a time to avoid warp.

Q6

**Install gearbox**

Do not forget to remove bolts securing starter motor.

Q7

## R. Crankshaft front seal, replacement

Special tools: 5187, 5188, 5197, 5200, 5205



### R1 Disconnect battery

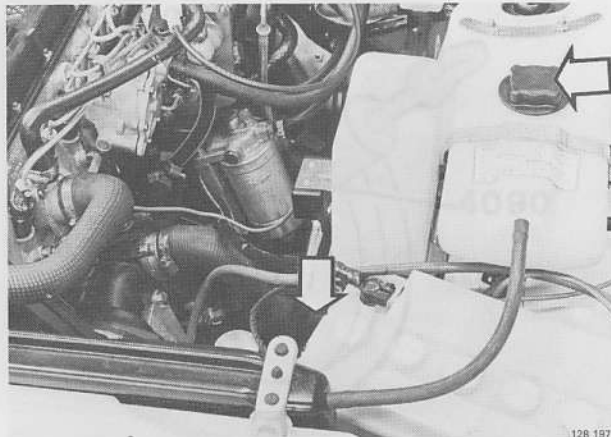
R1

### R2 Jack-up vehicle

R2

To prevent spillages when coolant is drained, raise vehicle at front right jacking point. Coolant will then run along splashguard into drip pan.

Place drip pan beneath left steering rod.



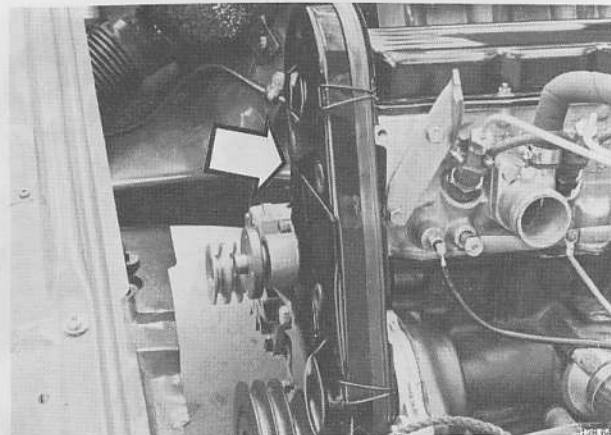
### R3 Drain coolant

R3

Unscrew expansion tank cap.

Disconnect lower radiator hose from radiator and drain coolant. (Engine is without drain taps).

Lower vehicle.

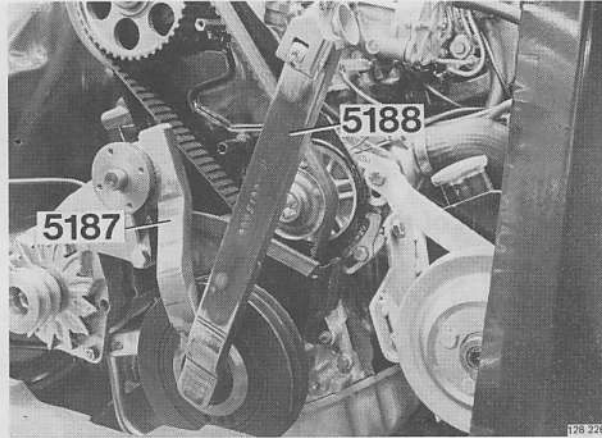


### R4 Remove:

R4

- radiator
- cooling fan with spacer and pulley
- fan belts and power steering pump belt
- front timing gear cover.



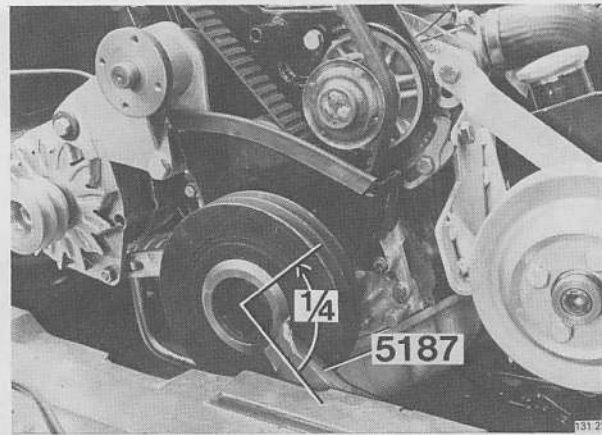


R5

**Remove vibration damper center bolt**

Use **5187** to prevent pulley from rotating, and socket **5188** to unscrew bolt.

It may be necessary to turn engine slightly so that **5187** rests on fan bearing.

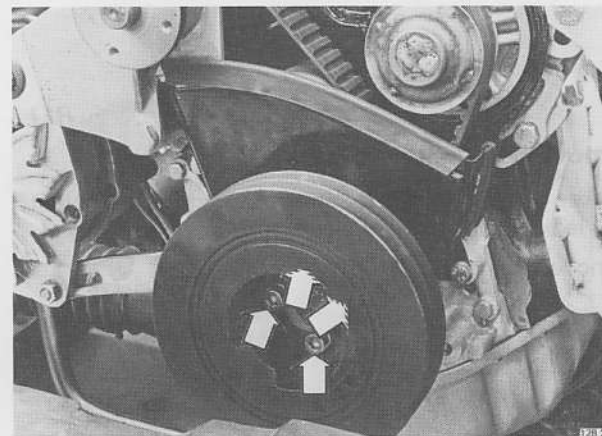


R6

**Turn engine approx. 1/4 turn anticlockwise**

Use wrench **5187**.

By turning engine anticlockwise, slack in belt will move to driving side, making it easier to remove and install belt.



R7

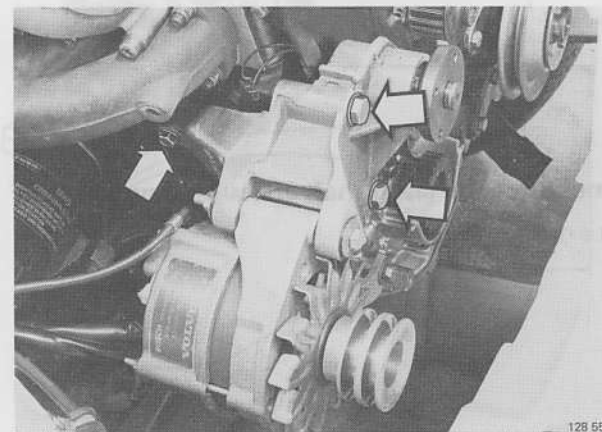
**Remove vibration damper**

Remove four inhex bolts (6 mm).

Pull off vibration damper. **Note!** Crankshaft gear may sometimes stick to vibration damper.

R8

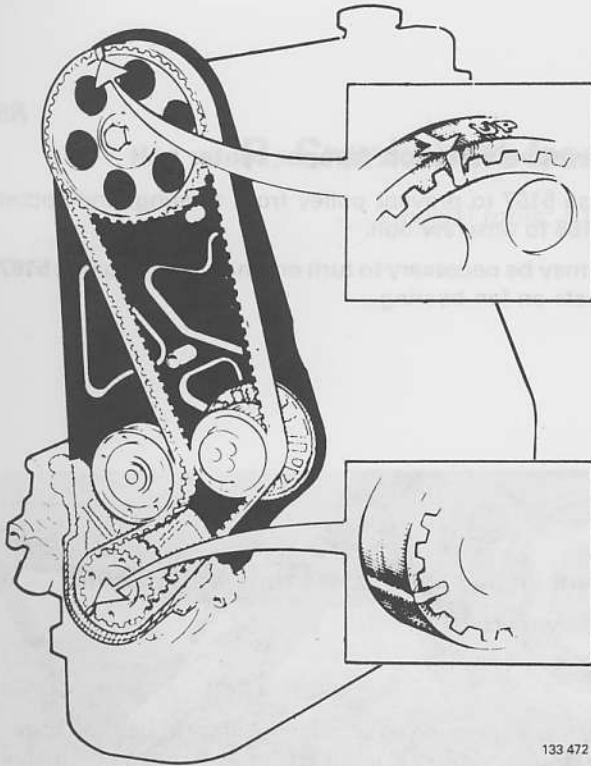
**Remove lower timing gear cover**



R9

**Detach cooling fan mounting bracket and alternator and place on one side**

Remove mounting bolts (arrowed) and press bracket outward.



R10

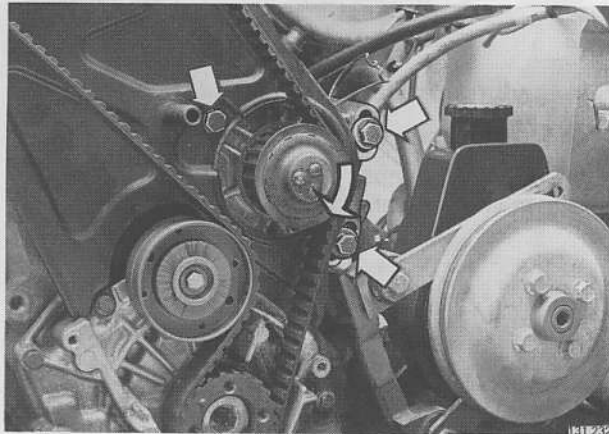
**Mark position of timing gear belt**

Mark belt, camshaft sprocket and crankshaft gear. Mark in front of a cog.

Also identify outside and topside of gear belt.

**Important**

Belt must be fitted in **exactly** same position as before otherwise valves may contact pistons and cause serious damage.

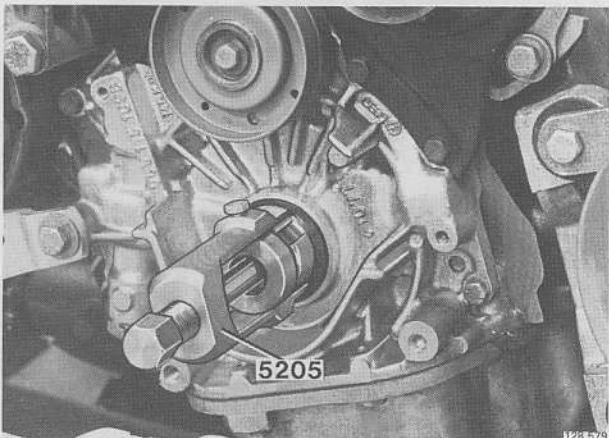


R11

**Remove gear belt**

Slacken coolant pump mounting bolts and belt. Coolant may leak when bolts are slackened.

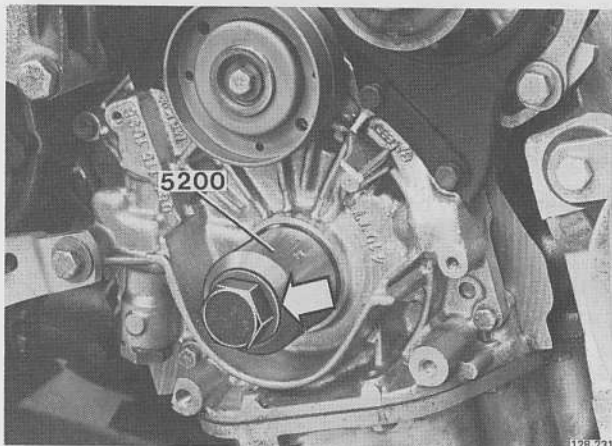
Remove belt.



R12

**Remove gear on crankshaft and withdraw oil seal**

Use extractor 5205.



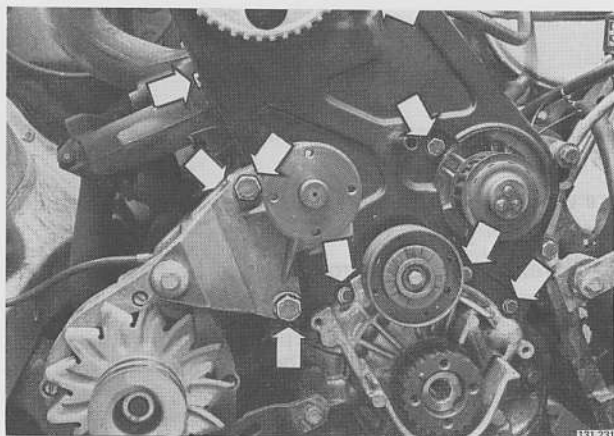
R13

**Install new oil seal and gear on crankshaft**

Pack space between sealing lips with grease.

Press in new seal. Use adapter 5200, vibration damper center bolt and a thick washer.

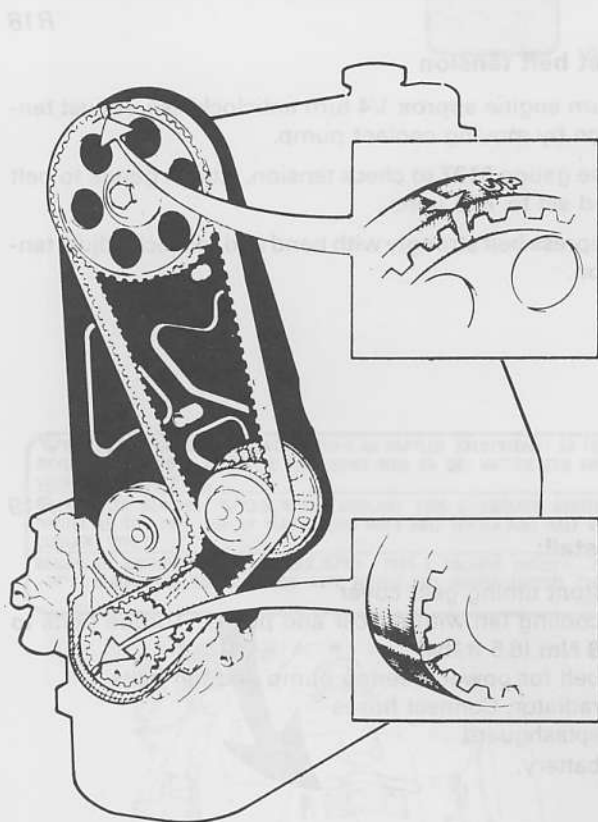
Install gear on crankshaft.



R14

**Install:**

- retaining bolts for cover
- mounting bracket for cooling fan/alternator.



R15

**Install camshaft gear belt**

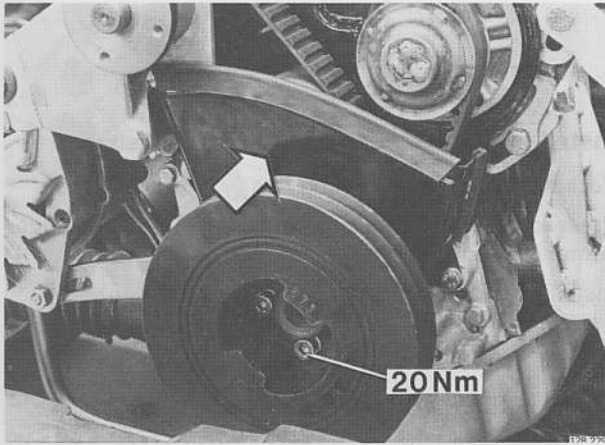
Make sure that belt is fitted in **exactly same position as before.**

Align identification marks on belt, camshaft sprocket and crankshaft gear.

**It is extremely important that belt is fitted in exactly same position as before.**

Tension belt by moving coolant pump (by hand).

Tighten pump mounting bolts.

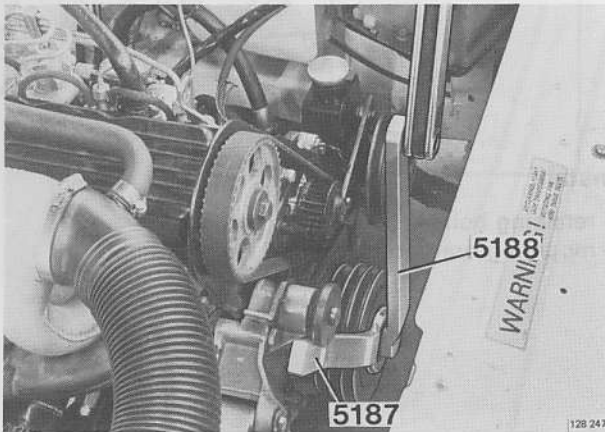


R16

**Install lower timing gear cover and vibration damper**

Damper can only be fitted in one way. Pin on crankshaft gear must fit in vibration damper.

Torque inhex bolts to **20 Nm** (15 ft lbs).



R17

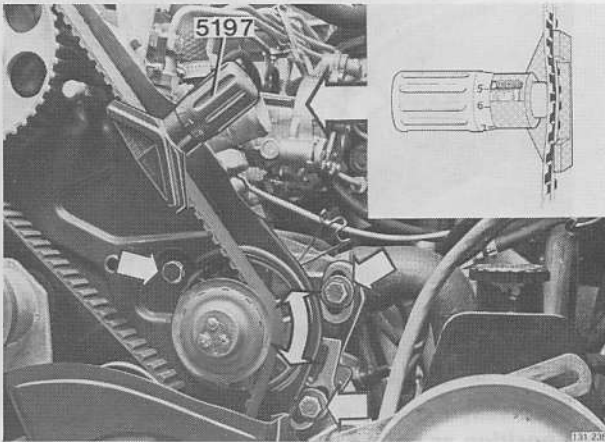
**Install center bolt**

Smear threads and mating surface with sealer P/N 277961-9.

Use wrench **5187** (rest on cooling fan bearing) to hold vibration damper.

Use wrench **5188** to torque center bolt to 350 Nm (255 ft lbs).

**Important:** Torque 350 Nm applies only if wrench 5188 is used. Also torque wrench must be in line with wrench 5188.



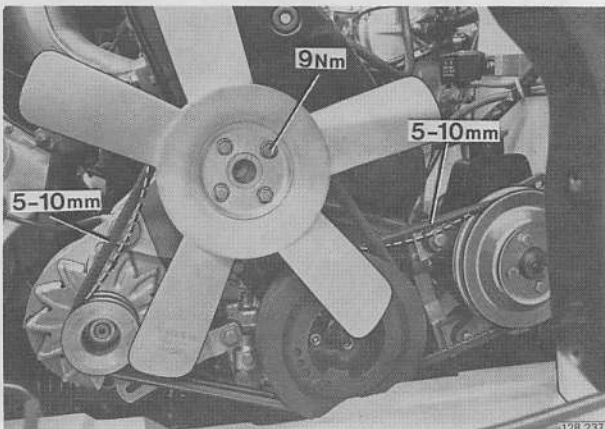
R18

**Set belt tension**

Turn engine approx 1/4 turn anticlockwise. Adjust tension by moving coolant pump.

Use gauge **5197** to check tension. Attach gauge to belt and set to **12.5** units.

Depress belt strongly with hand and recheck/adjust tension.

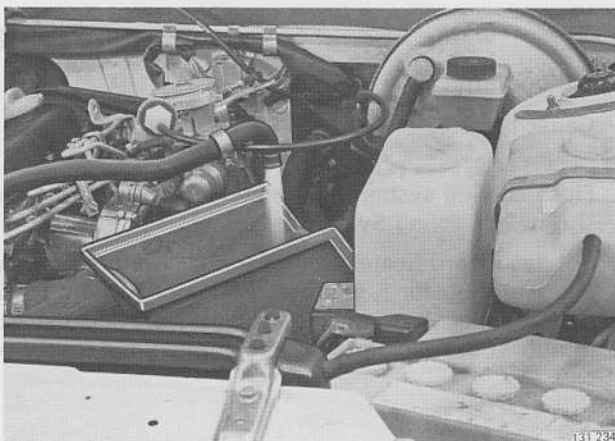


R19

**Install:**

- front timing gear cover
- cooling fan with spacer and pulley: Torque bolts to **9 Nm** (6.5 ft lbs)
- belt for power steering pump and fan belts
- radiator. Connect hoses
- splashguard
- battery.

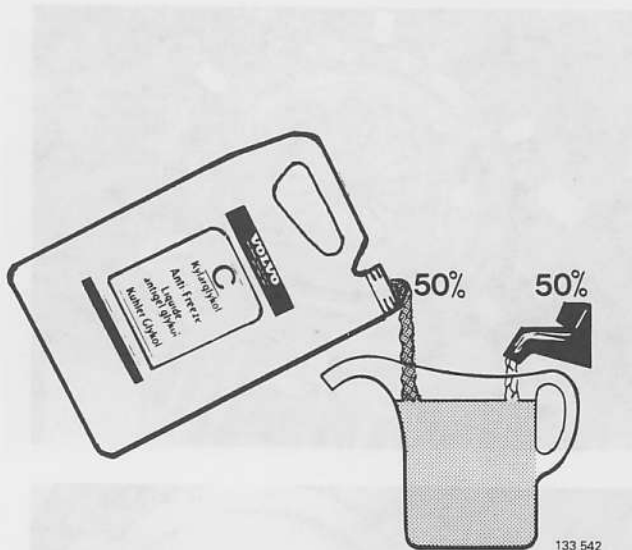




R20

**Bleeding of cooling system**

Disconnect upper hose from cold start device. Place drip pan beneath hose and hold hose level with top edge of expansion tank.



**Coolant**

Since aluminium is used in the engines, active corrosion protection is necessary in the coolant to help prevent corrosion damage.

Use genuine Volvo blue-green coolant type C, diluted with clean water in proportions of 50/50.

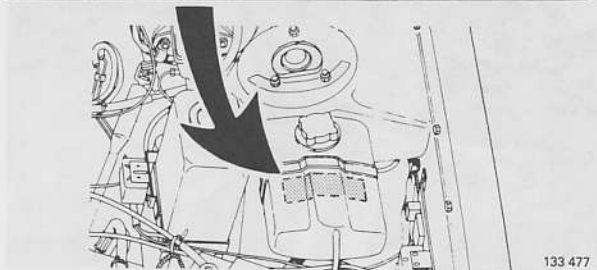
This mixture helps to prevent corrosion and frost damage.

Never fill the cooling system with water alone.

The coolant should be changed regularly since the corrosion protective additives in the coolant lose their effect in time.

**Note!** Do not run engine when level of coolant is low, since high local temperatures can result which may cause the cylinder head to crack.

**VOLVO** ORIGINAL KYLVÄTSKA TYP C ÄR PÅFYLLD. KYLSYSTEMET ÄR FROSTSKYDDAT TILL -30°C. EFTERFYLL ÅRET RUNT MED EN DEL VATTEN OCH EN DEL VOLVO KYLVÄTSKA TYP C.  
 FILLED WITH GENUINE **VOLVO** COOLANT TYPE C. COOLING SYSTEM IS PROTECTED TO -22°F. TOP UP YEAR ROUND WITH HALF WATER AND HALF VOLVO COOLANT TYPE C.  
 REMPLI DE LIQUIDE ANTIGEL **VOLVO** TYPE C VALABLE JUSQU'À -22°F/-30°C. REMPLIR EN TOUTE SAISON AVEC MOITIÉ EAU MOITIÉ ANTIGEL TYPE C. 1297524



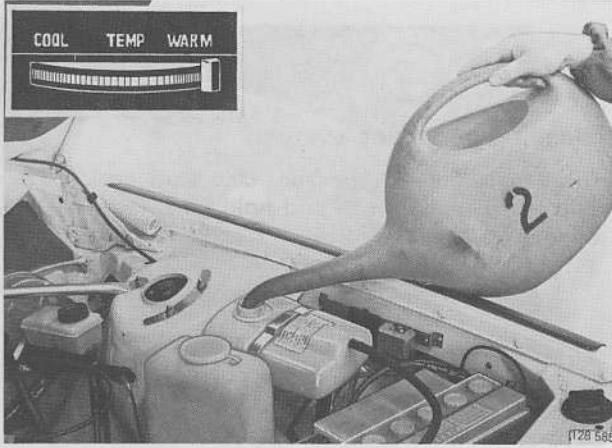
**Replacing coolant**

**Always** use **type C** blue-green coolant. Remember to replace decal (P/N 1331473-7) on expansion tank if necessary.

**Type C blue-green coolant**

All diesel and petrol (gasoline) engines manufactured since 1982 are filled with type C coolant.





R21

**Fill coolant**

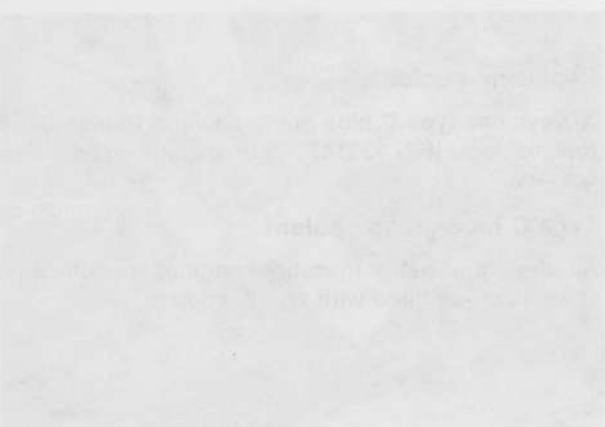
Capacity: D 20 = 8.1 liters (8.6 US quarts)  
D 24 = 9.1 liters (9.8 US quarts)

Flush cooling system before adding new coolant, see Group 26 Cooling System.

Set dashboard heater control to max. Turn on engine and warm-up for 5 minutes. Add coolant during this time. Connect hose to cold start device. Fill coolant to mouth of expansion tank (above max) and screw on cap.

COOLANT

Since summer months are the most common time for coolant replacement, it is important to check the coolant level regularly. The coolant level should be checked when the engine is cold. Never fill the coolant reservoir when the engine is hot. The coolant should be checked when the engine is cold. The coolant level should be checked when the engine is cold. The coolant level should be checked when the engine is cold.



Turn engine speed to 1400 rpm. Adjust tension by moving coolant pump. Use gauge 5187 to check tension. Adjust gauge to 120 and set to 12.5 units. Depress belt strongly with hand and observe deflection.

