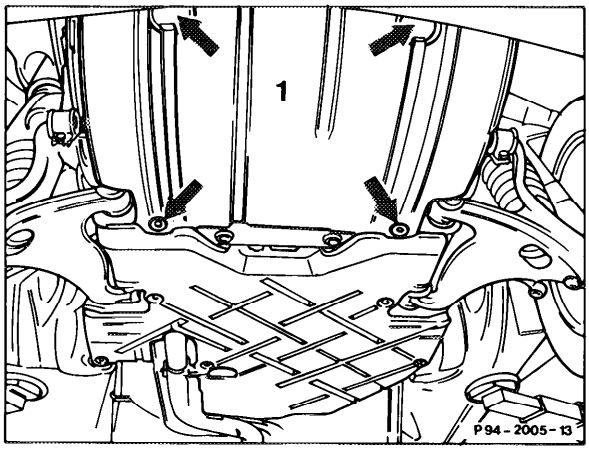
EXIT

Crankcase and Cylinder Head 01

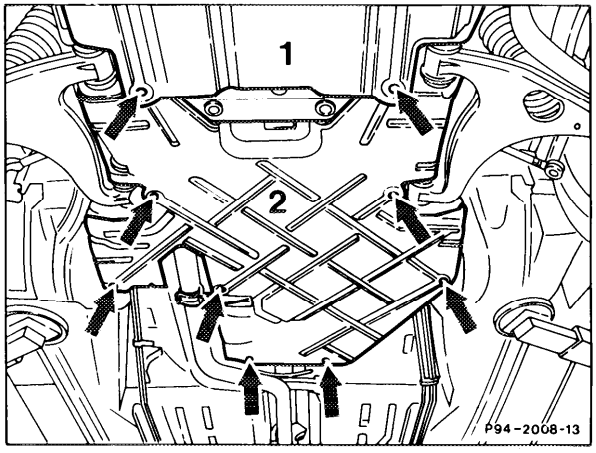
Job No.

01-001 Engine and model survey

Engine version	Vehicle model	Sales designation	ε	No. Cyl.	Displacement (cm^3)	Bore / Stroke	output (SAE) Kw(hp)/rpm	Torque (SAE) Nm/rpm (net lb.-ft/rpm)
602.911	201.126	190 D 2.5	22.0	5	2497	84.0 / 87.0	6914600 (93 / 4600)	165 / 2800 (12212800)
602.961 Federal	201.128	190 D 2.5 Turbo	22.0	5	2497	84.0 187.0	92 / 4600 (12314600)	22812400 (16812400)
602.962 Federal	124.128	300 D 2.5 Turbo	22.0	5	2497	84.0 187.0	90 14600 (120 / 4600)	223 / 2400 (164 / 2400)
603.960	124.133 124.193	300 D Turbo 300 TD Turbo	22.0	6	2996	84.0 187.0	107 / 4600 (14314600)	265 / 2400 (195 / 2400)
603.961 Federal	126.125	300 SDL Turbo	22.0	6	2996	87.0 / 84.0	110 / 4600 (148 / 4600)	273 / 2400 (201 / 2400)
603.961 California	126.125	300 SDL Turbo	22.0	6	2996	87.0 184.0	107 / 4600 (143 / 4600)	265 / 2400 (195 / 2400)
603.970 Federal	126.134 126.135	350 SD Turbo 350 SDL Turbo	22.0	6	3449	89.0 / 92.4	100 / 4000 (133 / 4000)	310 / 2000 (228 / 2000)



Noise capsule at bottom of engine compartment, front (1)



Noise capsule at bottom of engine compartment, rear (2)

Noise capsule, front and rear (1, 2) . . . . . Remove sheet metal screws (arrows), reinstall and remove capsule, install.

Note
Install engine compartment capsule so that edges of side part of capsule engage in bottom part of capsule.

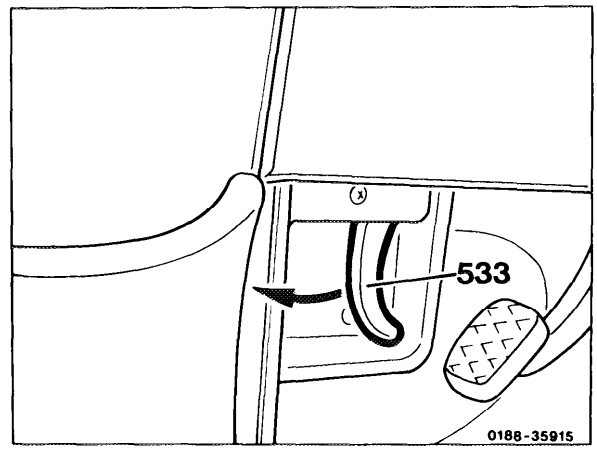
01-008 Opening hood, setting vertical, warnings

⚠Warning
There is risk of injury whenever the engine is running and the hood is open.

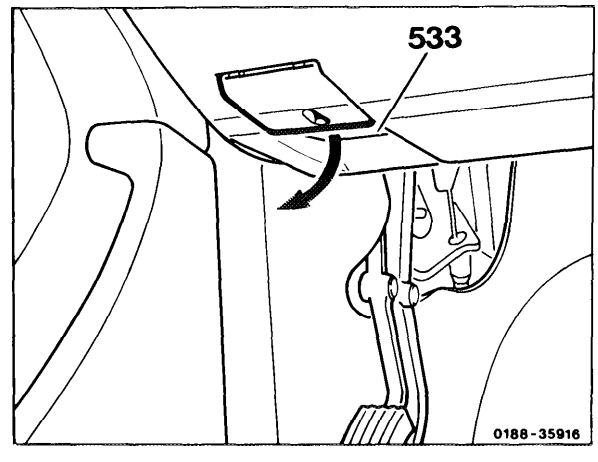
Opening hood

1 To unlock the hood, pull the lever (533) on the left below the instrument panel in the direction of the arrow. The hood opens to the safety hook stop.

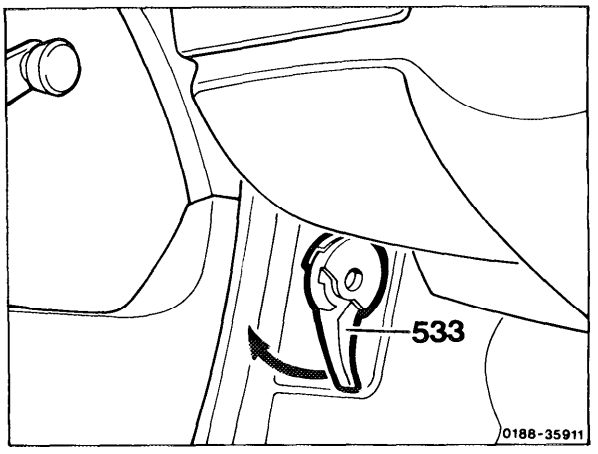
Model 126



Model 124



2 Close hood by pushing down forcibly.



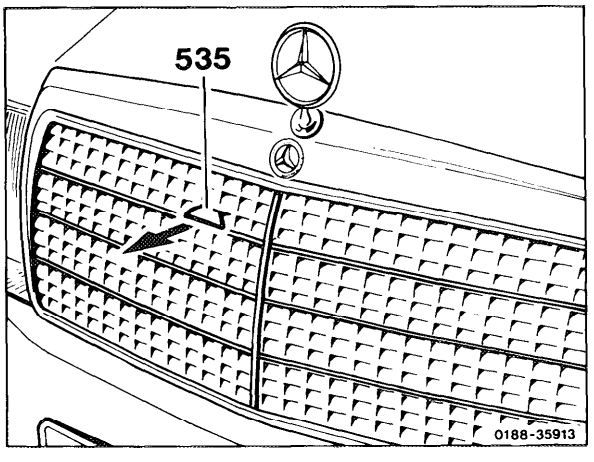
Model 201

Model 124, 126, 201

3 Pull the handle (535) extending from the grille as far as the stop and open hood (it may be necessary to lift the hood slightly to release the handle).

Note

Do not attempt to lift the hood with handle (535). The windshield wiper arm must not be pivoted forward when the hood is lifted.

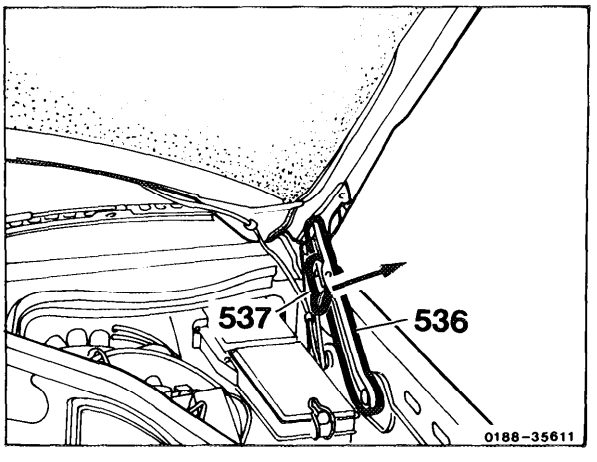


Moving hood into vertical position

Model 124 (production up to August 1988)

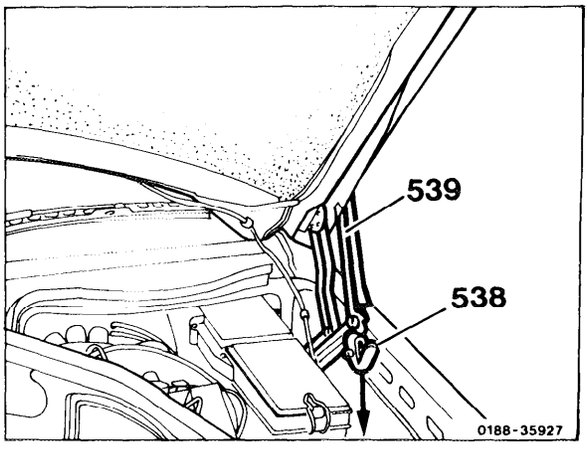
4 Push lock lever (537) on the left hood support (536) in direction of arrow. Lift hood slightly upward to keep the lock lever (537) from reengaging again.
Repeat the preceding at the right hood support and set the hood in a vertical position.

5 To close the hood, push in lock lever at the right hood support, and close the hood by pushing down forcibly.



Model 126

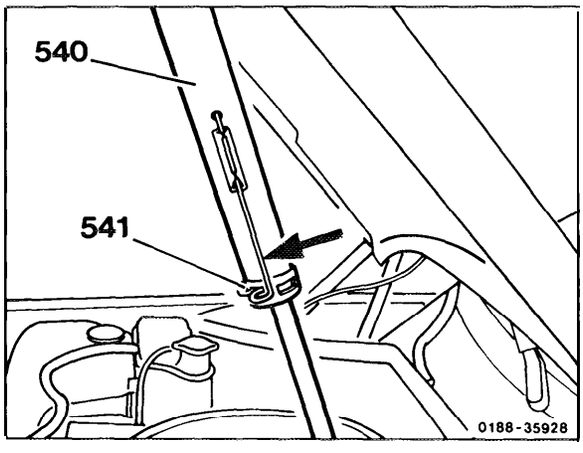
6 Push hood down slightly. Push lock lever (538) on the left hood support (539) down in the direction of the arrow. Push hood up slightly to keep the lock lever (538) from reengaging. Repeat the preceding at the right hood support and set the hood in a vertical position.



7 To close the hood, push the lock lever (538) at the left hood support in the direction of the arrow, and close the hood by pushing down forcibly.

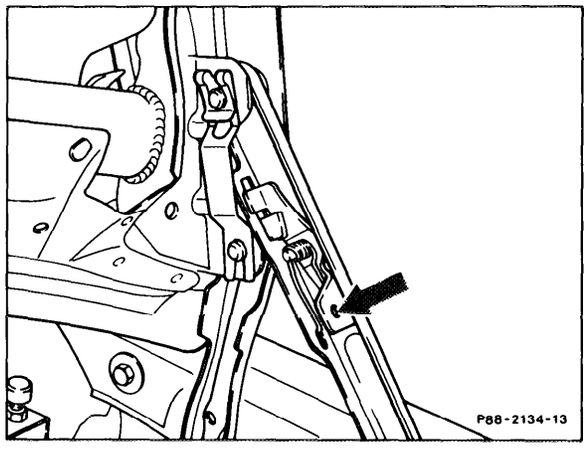
Model 201

8 Pull lock (541) on hood damper (540) in direction of arrow and set the hood in a vertical position.

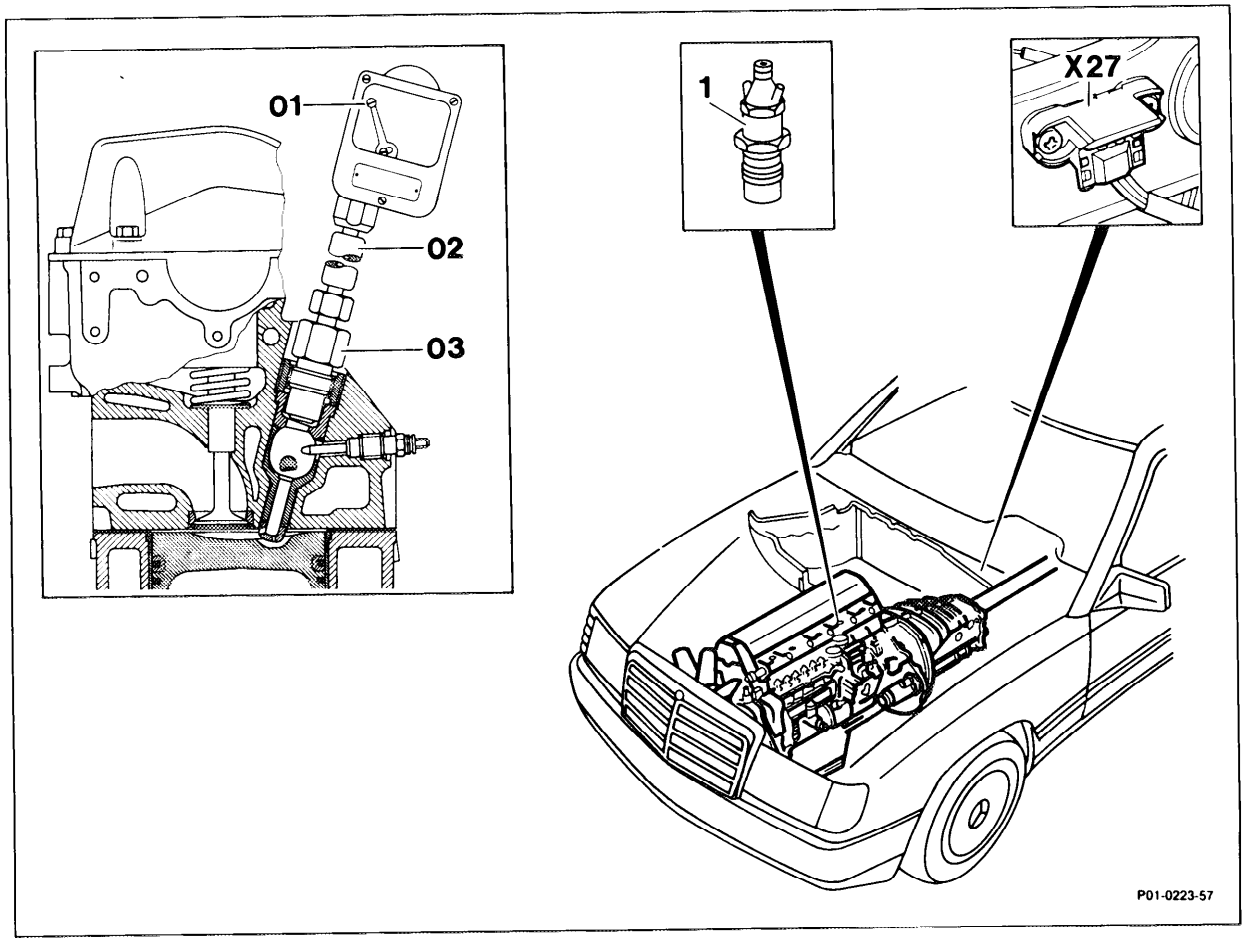


9 When the hood is set vertical, a lock engages on the left hood support.

10 Close hood. Push in the lock lever (arrow) and close the hood by pushing down forcibly.



EXIT



Engine	warm up to operating temperature (approx. 80 °C) (item 1).
	Note Check compression only with engine at operating temperature.
Nozzle holder (1)	remove, install (07-230).
Plug connector (X27)	for starter harness, disconnect, reconnect (items 3 – 4).
	Note The plug connector (X27) illustrated in the figure is installed on model 124. The installation point and version of the plug connector differs depending on the model.

Contact handle ..... for compression pressure recorder 001 589 78 21 00, connect, adapter line 124 589 36 63 00 (items 3 – 5).

Engine ..... turn over a number of times to clean out; the transmission must be in neutral and the shutoff lever on the injection pump pressed to “stop” (item 6).

Compression pressure recorder (01) ..... bolt appropriate adapter (03) and flexible connector (02) into precombustion chamber of cylinder to be checked (item 7).

Compression ..... check; shift transmission to neutral and turn engine over at least 9 revolutions with the shutoff lever on the injection pump pushed to “stop” (items 8 – 9).

Note

Check compression in remaining cylinders in same manner.

Measured compression values ..... compare with specified test values (item 10).

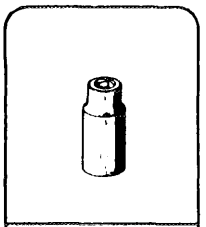
Note

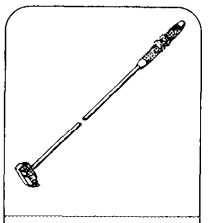
If one or more cylinders do not have the minimum compression, determine cause.

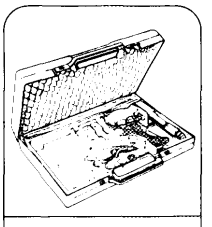
Test values with engine at operating temperature (approx. 80 °C)	bar
Compression pressure, normal	26 – 32
Minimum compression pressure	approx. 18
Permissible difference between individual cylinders	max. 3

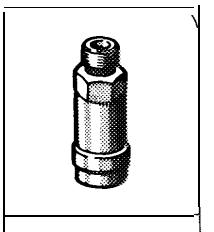
Tightening torques	Nm
Union nuts on injection lines (reference value)	10-20
Nozzle holders in prechambers	70 + 10
Nozzle holders for angular injection	30

Special tools


001 589 65 09 00


124 589 36 63 00
01


001 589 78 21 00
01


602 589 00 6300
ol

Testing

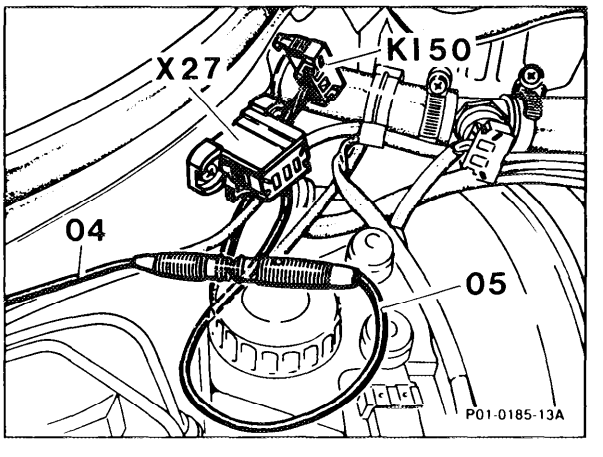
1 Warm engine up to operating temperature (approx. **80** °C).

Note
Check compression only with engine at operating temperature.

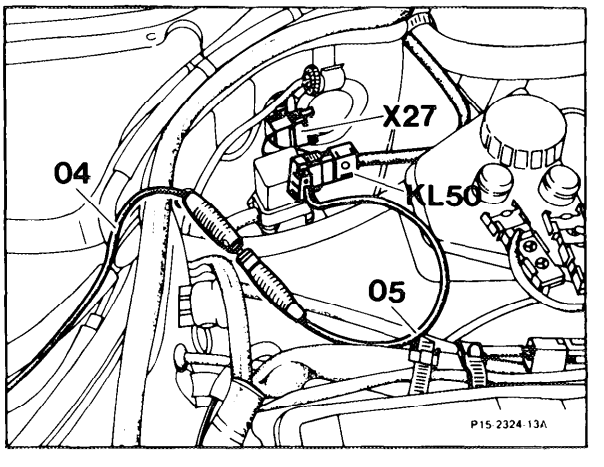
2 Remove all nozzle holders **(07-230).**

Models 124 and 126

3 Connect contact handle for compression pressure recorder 001 589 **78** 21 00; disconnect plug connector **(X27)** on left side of engine compartment and connect connection line **(04)** of contact handle to plug (Kl50) with adapter line (124 589 36 63 00 (05).



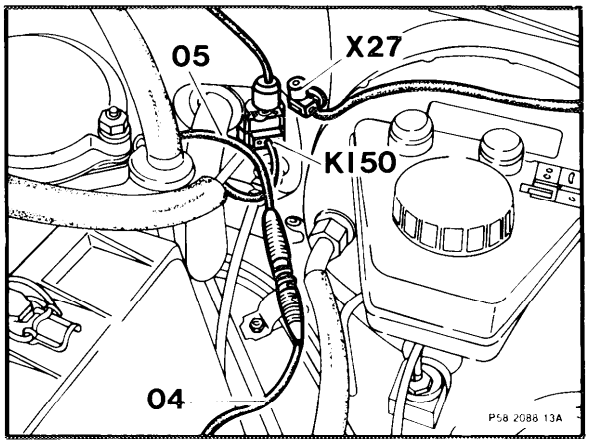
Model 124



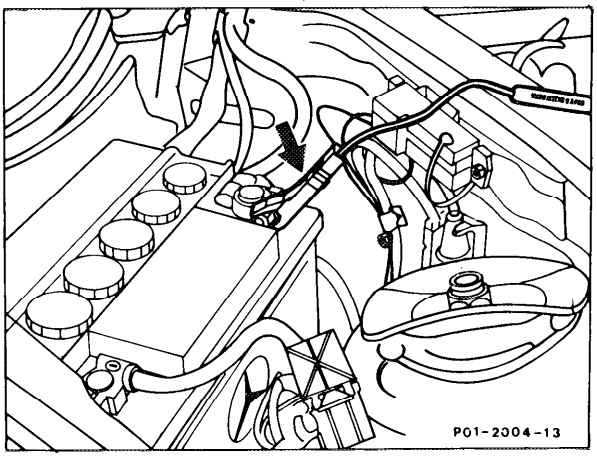
Model 126

Model 201

4 Connect contact handle of compression pressure recorder 001 589 78 21 00; disconnect plug connector (X27) on left side of firewall and connect connection line (04) of contact handle to plug (Kl50) with adapter line 124 589 36 63 00.



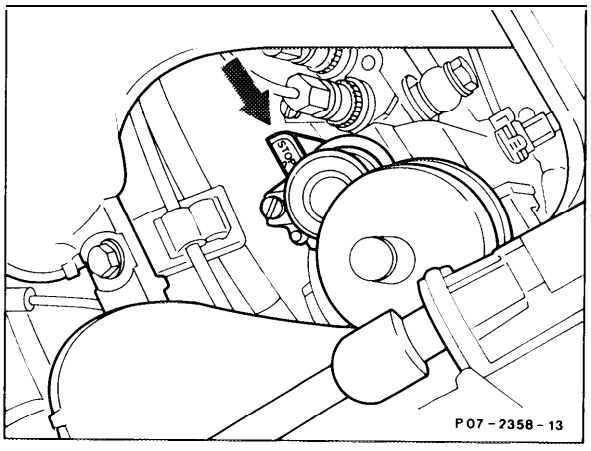
5 Connect second connection line from contact handle to positive pole (K130) on battery (arrow).



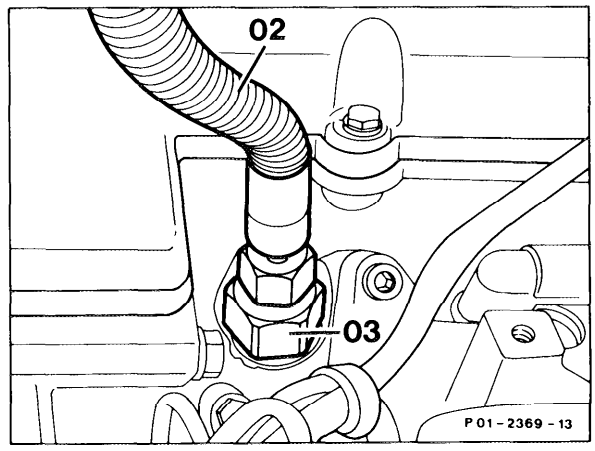
6 Crank engine a number of times with starter with transmission in neutral and shutoff lever on injection pump (arrow) pressed to “stop” to remove combustion residues in the precombustion chamber of the cylinder.

Note

Always hold shutoff lever on injection pump depressed when cranking engine. This prevents fuel from being pumped and therefore running out of the disconnected injection lines.



7 Bolt compression pressure recorder into pre-chamber of cylinder to be tested with appropriate adapter (03) and flexible connector (02).



Note
On engines with angular injection use adapter 602 589 00 63 00.

8 Crank engine at least 8 revolutions to test compression.

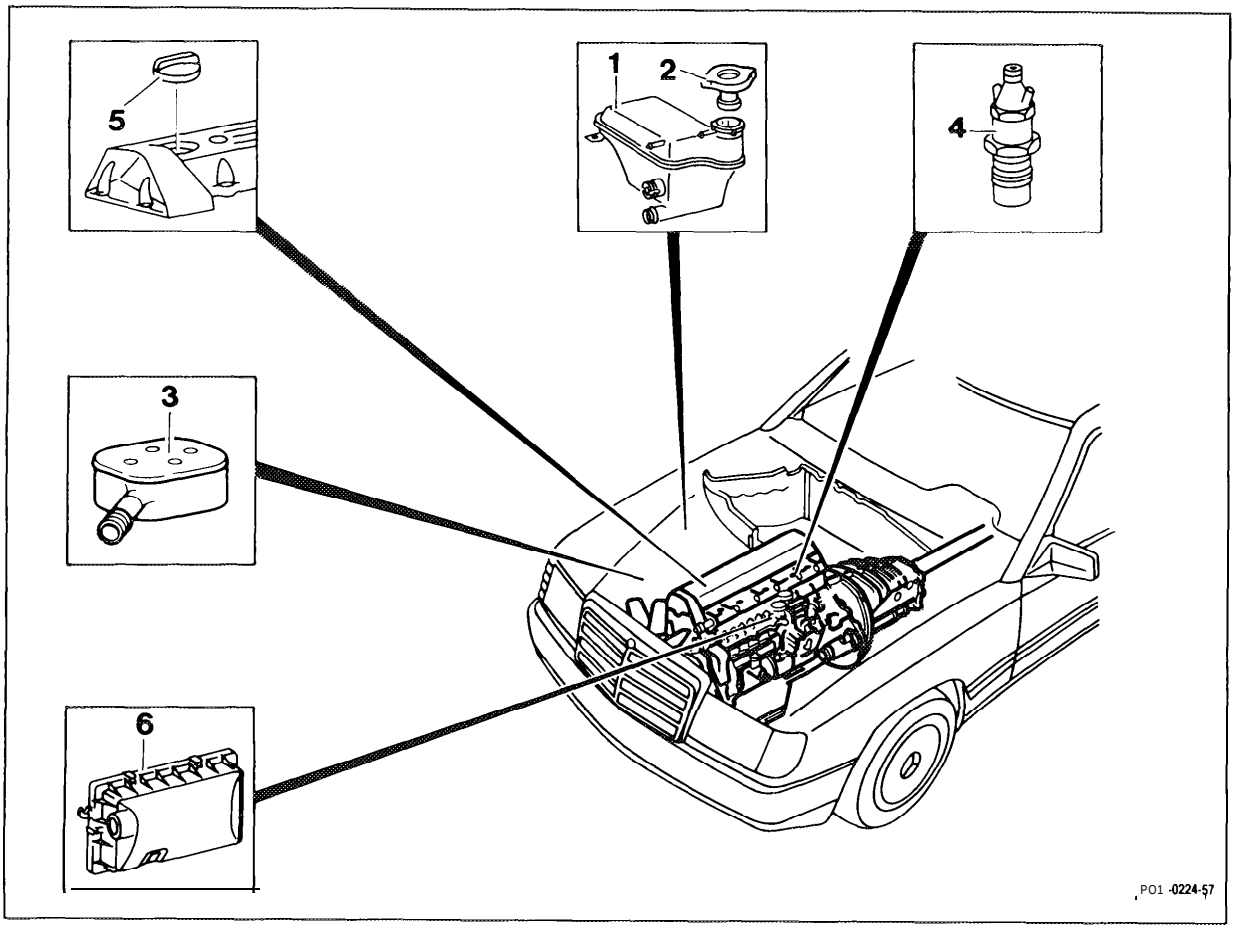
9 Perform test on remaining cylinders in same manner.

10 After completing the compression test compare pressures measured with specified values.

Note
If one or more cylinders do not have the minimum compression pressure, check cylinder for leakage (01-015) and determine cause.

11 Install in reverse order.

01-015 Checking cylinders for leaks



Engine	warm up to operating temperature (approx. 80 °C) (item 1).
Nozzle holders (4)	remove, install (07-230).
Coolant expansion tank (1)	⚠ **Warning** Open cap (2) on coolant expansion tank only at coolant temperatures below 90 °C. Remove cap (2), install. Add coolant, if necessary (items 3 – 4).
Air cleaner on naturally aspirated engines (6) and on Turbo-engines (3)	remove air cleaner cover, install (item 5).
Oil filler cap (5)	remove, install (item 6).

Engine	move piston of cylinder to be checked to TDC, ignition stroke, connect and calibrate cylinder leakage tester (items 7 – 9).
Cylinder	determine pressure loss (items 10 – 12).

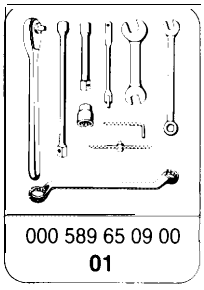
Note
Check other cylinders in firing order.

Permissible pressure loss

Total, engine	max. 25 %
Valves and cylinder head gasket	max. 10 %
Piston rings	max. **20** %

Tightening torques	Nm
Union nuts on injection lines (reference value)	10-20
Nozzle holders in prechambers	70 + 10
Nozzle holders for angular injection	30

Special tool



Commercially available tools

Cylinder leakage tester	e.g.	Bosch, EFAW 210 A Sun, CLT 228
Adapters and connectors	e.g.	Bosch Order no. 1 687 010 016

Testing

1 Warm engine up to operating temperature (approx. 80 °C).

2 Remove all nozzle holders (07-230).

⚠ Warning
Open cap on coolant expansion tank only at coolant temperatures below 90 °C.

3 Remove cap on coolant expansion tank.

4 Check coolant level in coolant expansion tank and add, if necessary.

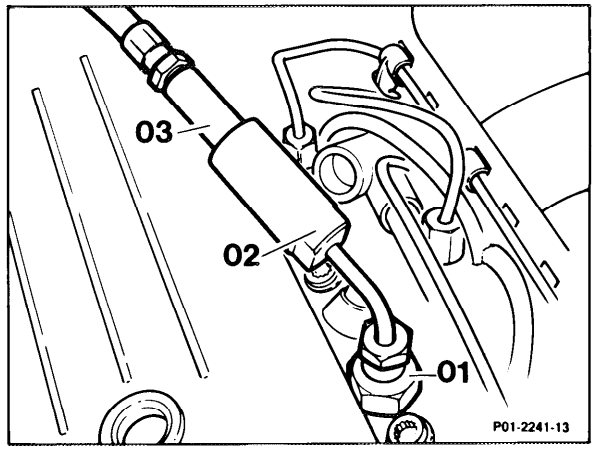
5 Open retaining strap on air cleaner cover on naturally aspirated engines or unscrew hex. head bolts on air cleaner cap on Turbo-engines, remove air cleaner cap and take out filter cartridge.

6 Remove oil filler cap.

7 Move piston in cylinder to be checked to TDC, ignition stroke.

8 Bolt appropriate adapter (01) with straight or angular connector (02) into precombustion chamber of cylinder to be checked.

9 Calibrate cylinder leakage tester and bolt connection hose (03) of tester onto connector (02).



10 Fill cylinder with compressed air and read off any pressure loss on tester.

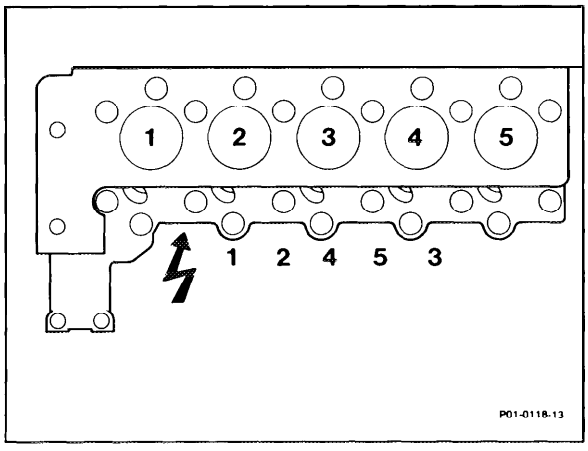
11 If pressure is lost, determine cause; check by listening whether pressure is exhausted through cylinder head gasket, intake manifold, exhaust, oil filler cap or prechambers of adjacent cylinder(s) and check for formation of air bubbles in coolant in coolant expansion tank.

Note

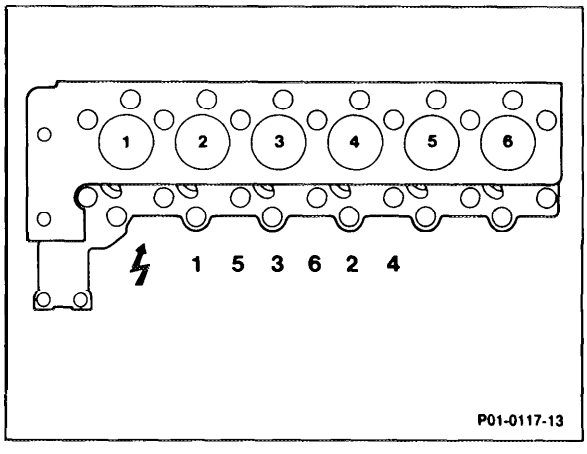
If pressure loss and air loss through the oil filler cap are present , the possible causes can be limited by spraying engine oil on the piston crown of the cylinder being tested. The oil seals the gap between the piston and cylinder. If pressure loss is no longer present for a short time, the cause is in all probability the piston, piston rings or cylinder running surface.

The position of the piston ring gaps can result in incorrect determination of the cause. If it is suspected that the pressure loss results from the piston ring gaps being positioned directly above one another, completely reassemble engine and repeat test after operating engine for a short time.

12 Perform test on other cylinders in engine ignition sequence.



Ignition sequence, engine 602



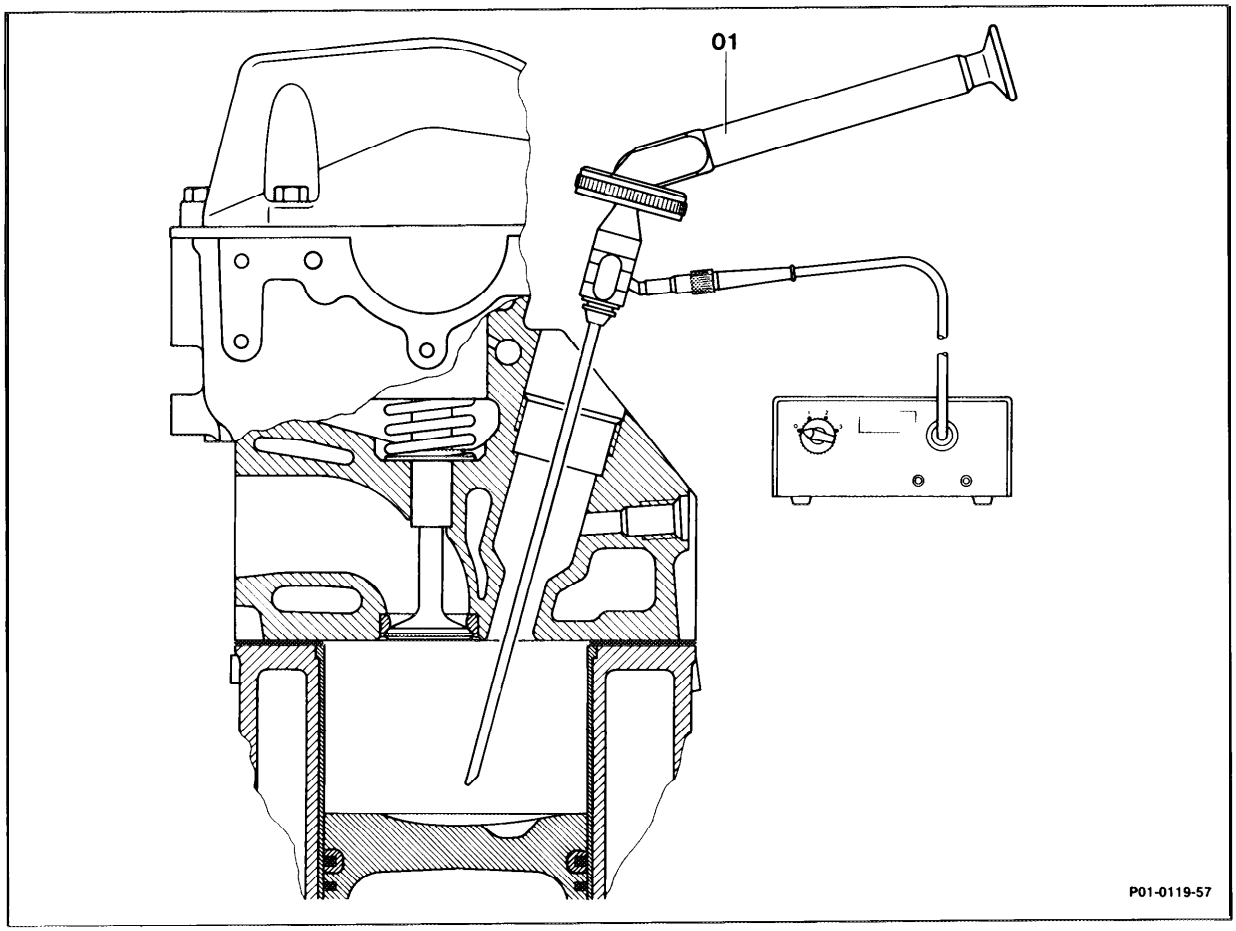
Ignition sequence, engine 603

13 Assemble in opposite order.

EXIT

01-020 Evaluating cylinder bores

Preliminary operations:
Prechambers removed



Piston . . . . . in cylinder to be tested, move to bottom dead center.

Cylinder . . . . . illuminate cylinder with illumination unit and check visually for damage; for this purpose insert the probe (01) of the illumination unit through the precombustion chamber bore into the cylinder.

Note

When inspecting differentiate between "Optical stripes" and "Scoring". **"Optical stripes"** can result from the ring gap. if honing marks are still visible, the engine is okay. **"Scoring marks"** honing marks no longer visible, repair engine.

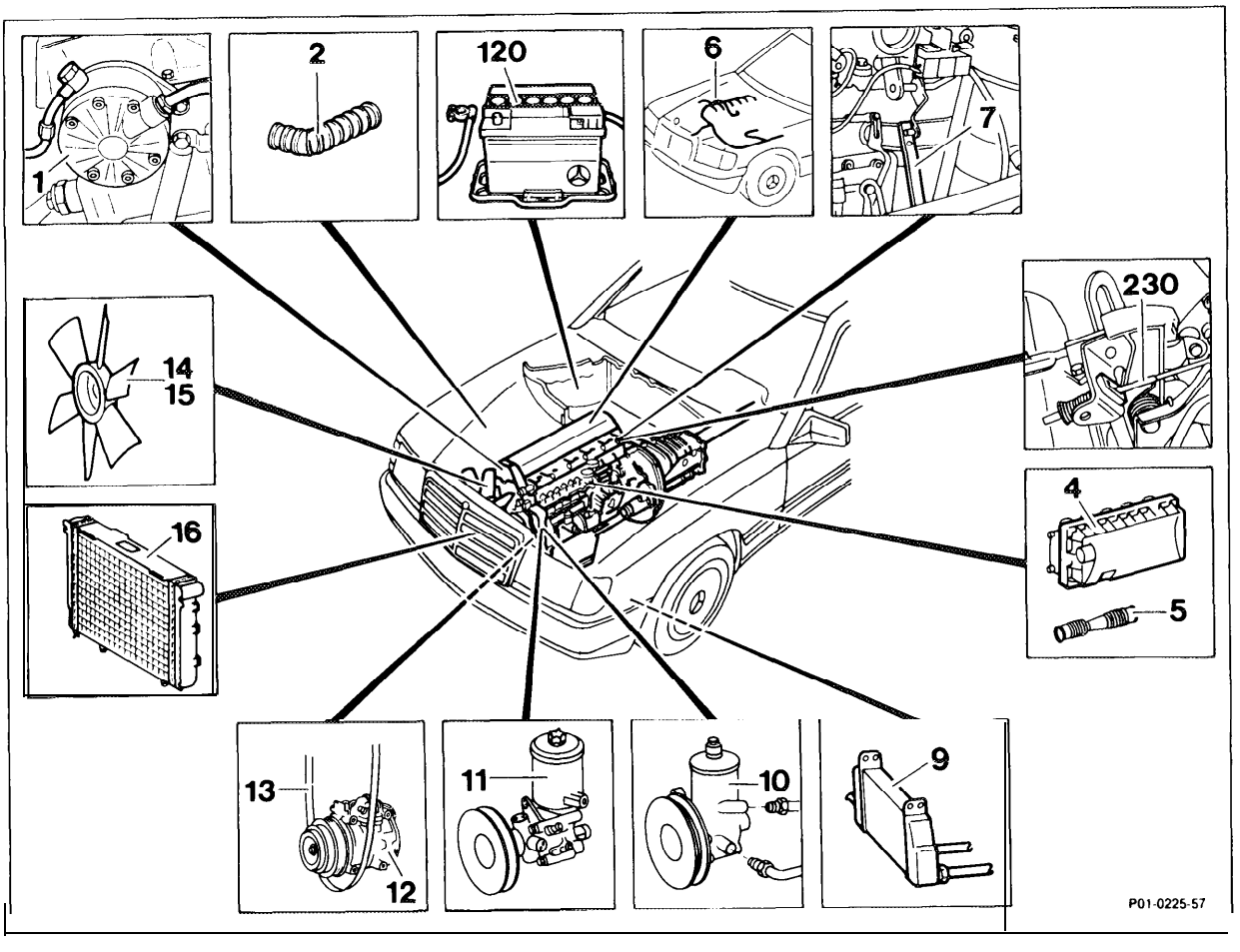
EXIT

Commercially available tool

Cylinder illumination unit	e. g.	Karl Storz GmbH, **D-7200** Tuttlingen Motoskop TW (cold light) with lens probes 103 26 CW **(570** mm) and 103 26 CT (210 mm)

Preliminary operations:
Noise capsule part at bottom of engine compartment removed (01-006).
Exhaust system removed (49-l 00).

A. Removal, installation, models 124, 126 and 201



Battery (120)	disconnect positive and negative terminals, reconnect (items 1 – 4).
Naturally aspirated engines:	
Air intake hose (5)	remove, attach (item 5).
Air cleaner cover (4)	remove together with filter cartridge, attach (item 5.1).
Turbo-engines:	
Intake hose (2)	to exhaust gas turbocharger, remove, attach (item 6).
Radiator (16)	remove, install (20-420).
Transmission oil lines	on vehicles with automatic transmission, unbolt, install and plug with clamps 000 589 40 37 00 (item 7).

Air conditioner:

Condenser	**Caution!** Attach protective plate immediately after removing radiator.
Coolant hoses	disconnect between engine and chassis, pull off, install (item 9).
Fan (14, 15)	remove, install, 25 Nm and 45 Nm (items 10 – 11). **Note** On vehicles with viscodrive fan clutch Use screwdriver socket 103 589 01 09 99, torque wrench 001 589 72 21 00 and holding tool 603 589 00 40 00.

Air conditioner:

Poly-V-belts (13)	remove, install (13-342).
Refrigerant compressor (12)	remove, install, 25 Nm (item 12). **Note** Do not unbolt the refrigerant lines on the compressor. Fasten compressor to chassis at side.
Vacuum hoses and fuel lines	remove between engine and chassis, disconnect, reinstall (item 13).

Models 124 and 126:

Control cable (230)	for engine control, unhook, hook in (item 14).

Model 201:

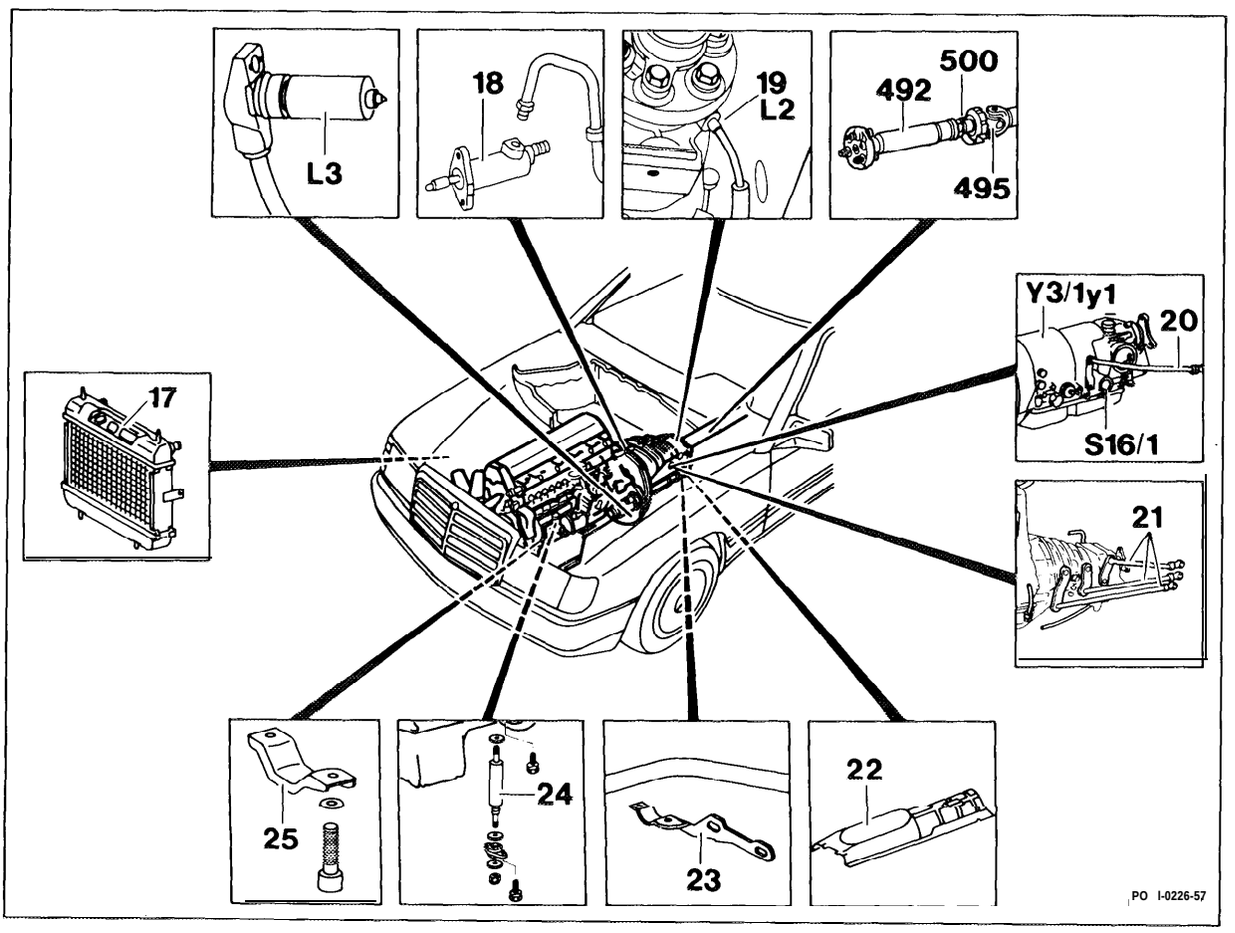
Engine control linkage (7)	unhook, hook in (item 15). **Note** Adjust control linkage (30-300).
Electrical connection lines	between engine and chassis, disconnect plug connectors and connections, reconnect (item 16).
Oil pressure switch and oil level sensor	disconnect plug connectors, reconnect (item 17).
Starter	unbolt connection lines, connect (item 18).
Alternator	disconnect plug connectors, reconnect (item 19).
Engine electrical harness (5)	remove, reattach (item 20).
Power steering pump (10)	evacuate oil out of power steering supply reservoir, use hand pump 112 589 00 72 00 and remove oil lines, reinstall, 30 Nm (items 21 – 22).

Vehicles with level control and/or ASD:

Oil pump (1) or tandem pump (11) . . . . . unbolt oil lines and hoses between engine and chassis, reinstall (item 23).

Turbo-engines or naturally aspirated engines with exhaust gas recirculation:

Air/oil cooler (9) . . . . . unbolt oil lines between cooler and engine, reinstall (item 24).



Turbo-engine with automatic transmission and trailer hitch in combination with air conditioner:

Transmission oil/air cooler (17) . . . . . oil lines and hoses between cooler and engine, remove, replace (item 25).

Model 201 (up to 03/85):

Mount for engine stop (25) . . . . . remove, install, 25 Nm (item 26).

Note

Check engine stop, adjust, 130 Nm (22-220), adjustment gauge 201 589 04 23 00.

Model 201 (up to 03/85):

Engine shock absorber (24), left	remove, install, 10 Nm (item 27).

Model 126:

Engine shock absorbers (24), left and right	remove, install, 10 Nm (item 28).

Manual transmissions:

Shift linkage (20)	unhook, hook in (item 29).
Clutch master cylinder (18)	remove hydraulic line, replace and bleed master cylinder (item 29.1).

Automatic transmissions:

Shift linkage (20)	unhook, hook in (30).
Starter lockout, back-up light switch (S16/1)	disconnect wires, reconnect (item 30).
Kickdown solenoid valve (Y3/1y1)	disconnect wire, reconnect (item 30.1).
Speedometer shaft (19) or inductive speedometer sensor (L2)	remove, reinstall (item 31).
Engine speed sensor (L3) and starter ground strap	remove, reinstall (item 32).
Lateral exhaust support (23)	remove, reinstall (item 33).
Heat baffle plates (22)	on center tunnel, remove, install (item 34).
Drive shaft (492)	remove, reinstall, 40 Nm and 60 Nm (item 35). **Note** Replace self-locking hex. nuts.
Drive shaft intermediate bearing (495)	loosen, tighten, 25 Nm (item 36).
Clamping nut (500)	on intermediate bearing, loosen, tighten, 30 – 40 Nm, open-end wrench 126 589 00 01 00 or 201 589 00 01 00 and torque wrench 001 589 66 21 00 (item 37).

Following installation:

Engine	check engine oil, add, if required or fill engine with new oil.
Cooling system	fill up and perform pressure test (20-017), pressure tester 124 589 15 21 00.
Engine	start and check engine oil and cooling system for leakage.

Engine oil capacities with oil dipstick code
(see "Service Product Specifications" for approved engine oils)

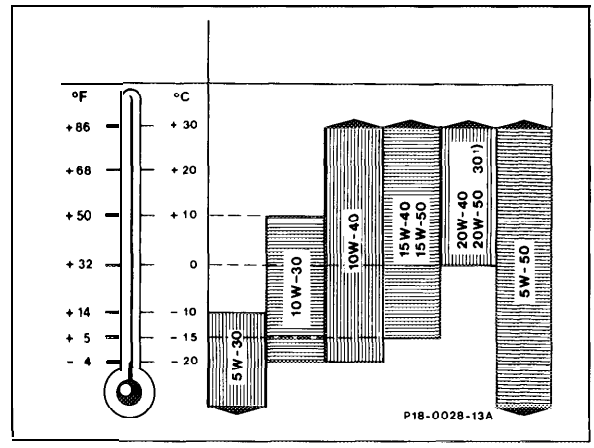
Engine	Model	Capacity for oil and filter change in liters	Color code, round handle	Color code, handle with bottle opener shape	Number code on handle
602.91	201	6.5 (6.9 U.S. qt.) 7 [2]) (7.4 U.S. qt.)	– –	– green[2])	602141)
602.96	124, 201	7.0 (7.4 U.S. qt.)	–	green[3])	–
603.96	124	7.5 (8.0 U.S. qt.)	–	black	
603.97	126	7.5 (8.0 U.S. qt.)	–	–	60316

[1]) 1st version, color code "red"
2nd version, color code "black"
3rd version, color code "brown"
[2]) Only for engines with exhaust gas recirculation and side part on oil pan
[3]) 1 st version, color code "black"

Specified viscosity classes for engine oil according to SAE for continuous ambient temperatures

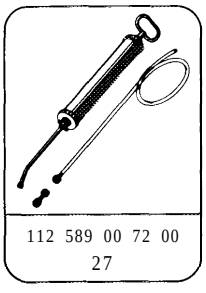
Exact adherence to the SAE class specified for the various ambient temperatures would result in frequent oil changes. The temperature limits for the SAE classes should therefore be regarded as guidelines which may be exceeded for short periods.

See " Service Product Specifications" for further information regarding specified viscosity classes and approved engine oils.

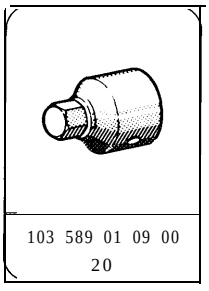


Tightening torques		Nm
Oil drain plug in oil pan	M 12×1.5×13	30
	M 14×1.5×22	25
Hex. head bolt, magnetic fan clutch		25
Allen bolt, viscodrive fan clutch		45
Hex. head bolts, refrigerant compressor		25
Oil lines, power steering pump		30
Allen bolts, mount, engine stop, front		10
Adjustment bolt, engine stop, front		130
Hex. nuts, engine shock absorber		10
Hex. head bolts, engine shock absorber mount		10
Hex. nuts, drive shaft on transmission flange		40
Hex. nuts, drive shaft on transmission flange, engine 603.96		60
Hex. head bolts, drive shaft intermediate bearing		25
Clamping nut, drive shaft intermediate bearing		30 – 40
Hex. head bolts, cross member center piece		45
Hex. head bolts, engine support, rear		45
Hex. head bolts, engine mount, rear		25
Hex. nut, engine mount, rear		70
Adjustment bolt, engine mount (rubber) rear		30
Allen bolt, engine mount, front		40
Allen bolt, engine mount, front, model 126		70

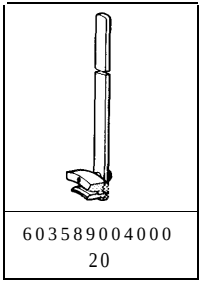
Special tools



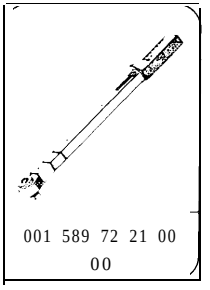
112 589 00 72 00
27



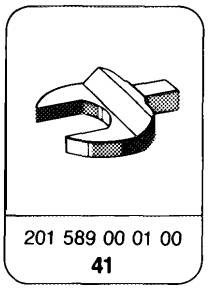
103 589 01 09 00
20



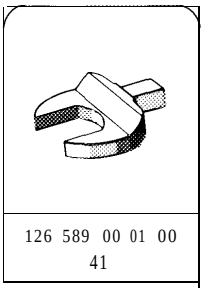
603589004000
20



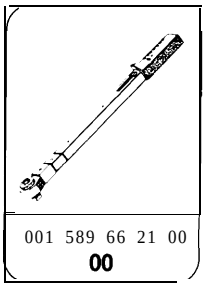
001 589 72 21 00
00



201 589 00 01 00
41



126 589 00 01 00
41



001 589 66 21 00
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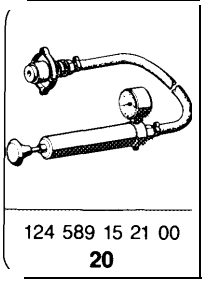
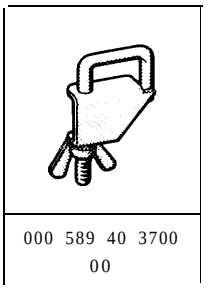
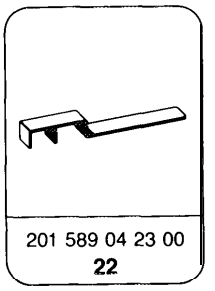


124 589 15 21 00
20



000 589 40 3700
00



201 589 04 23 00
22

Commercially available tools

7 mm socket on flexible shaft for hose clamps with worm drive	e. g.	Hazet, D-5630 Remscheid Order no. 426-7
Engine hoist no. 3188 (self-braking)	e. g.	Backer, D-5630 Remscheid, Herderstraße

Self-made tools

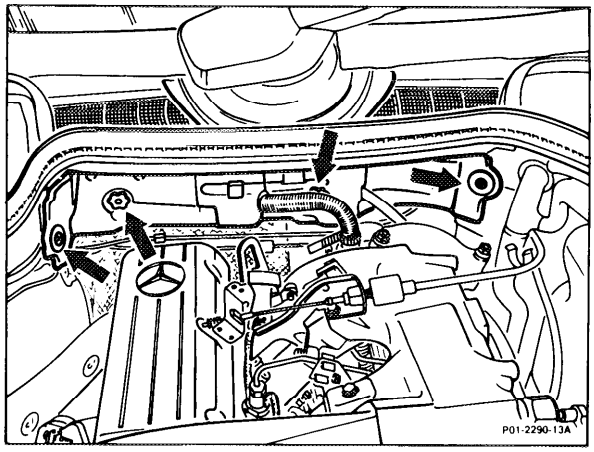
Guard plate for air conditioner condenser	Dimensions: approx. 480 × 600 × 1
Guard plate for unit compartment firewall	Dimensions: approx. 320 × 380 × 1

Removal, installation

1 Disconnect positive and negative cables on battery.

Models 124 and 126:

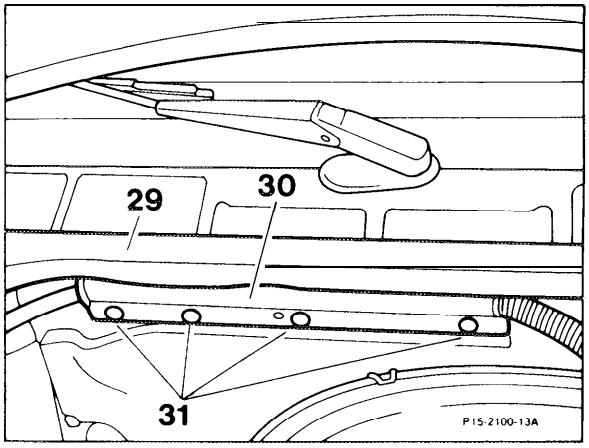
2 Remove cable cover on unit compartment firewall, for this purpose remove plastic screws (arrows) and remove cover.



Model 201:

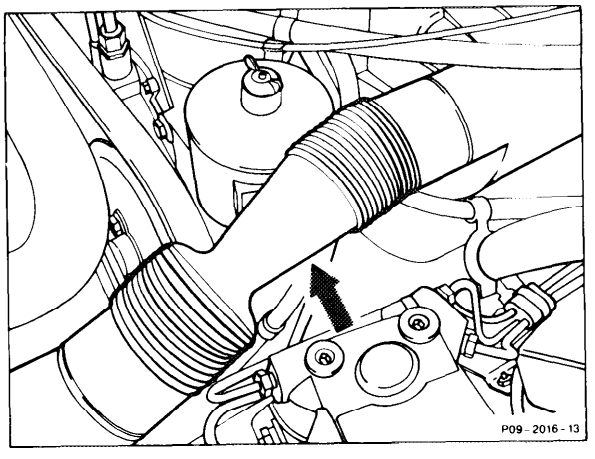
3 Remove cable cover on unit compartment firewall, for this purpose remove rubber sealing strip (29) over cable cover (30), disconnect clips (31) and fold cover upward.

4 Lay battery positive cable across engine.

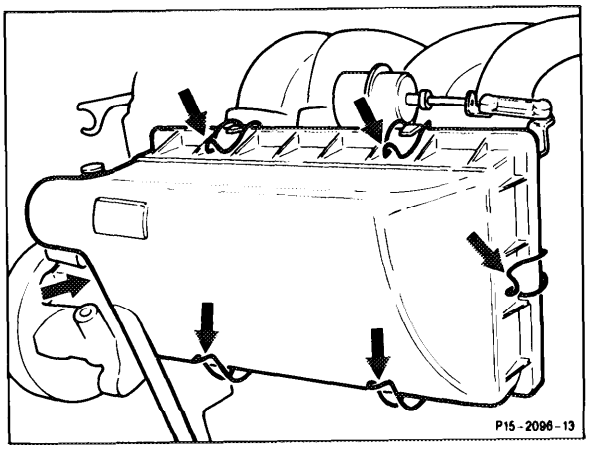


Naturally aspirated engines:

5 Remove air intake hose (arrow).



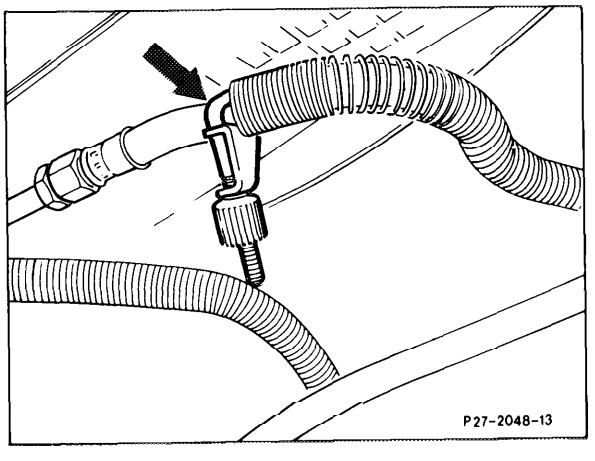
5.1 Open retaining clips on air cleaner cover and remove cleaner cover and filter cartridge.



Turbo-engines:

6 Remove intake hose to exhaust gas turbocharger.

7 On vehicles with automatic transmission plug oil cooler lines with clamps **000 589 40 37 00** (arrow).

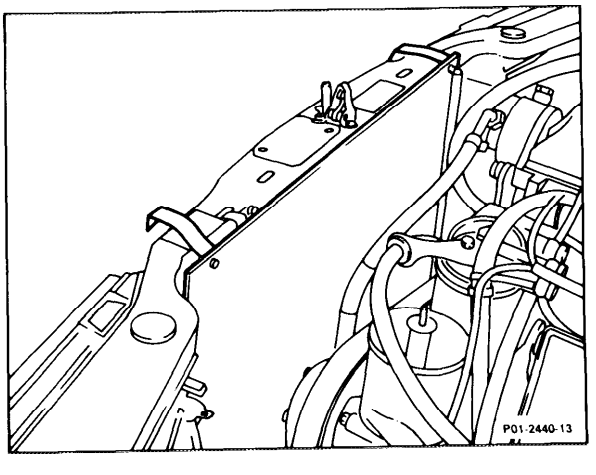


8 Remove radiator (20-420).

Caution!

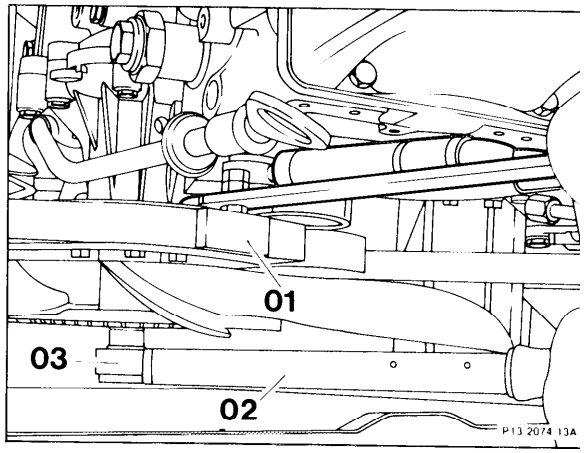
On vehicles with air conditioner attach guard plate to condenser immediately after removing radiator.

9 Loosen and remove all coolant hoses between engine and chassis.



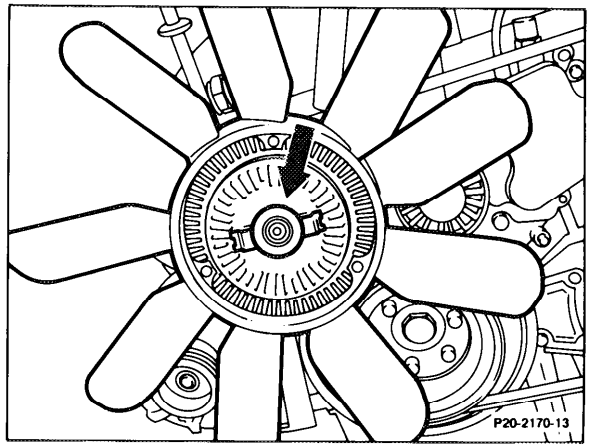
10 Remove fan with viscodrive fan clutch; hold V-belt pulley with counterholder (01) 603 589 00 40 00 and remove Allen bolt with socket (03) 103 589 01 09 00 and torque wrench (02) 001 589 72 21 00. Remove fan.

Installation note
Tightening torque 45 Nm.



Fans with magnetic fan clutch:
11 Remove fan; remove Allen bolt (arrow). Remove fan.

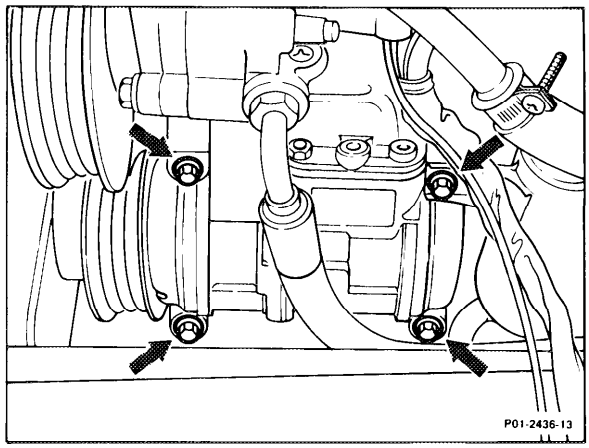
Installation note
Tightening torque 25 Nm.



Vehicles with air conditioning:
12 Remove poly V-belts (13-342), remove hex. head bolts (arrows) for refrigerant compressor and attach refrigerant compressor at side on chassis.

Note
Do not unbolt refrigerant lines on refrigerant compressor.

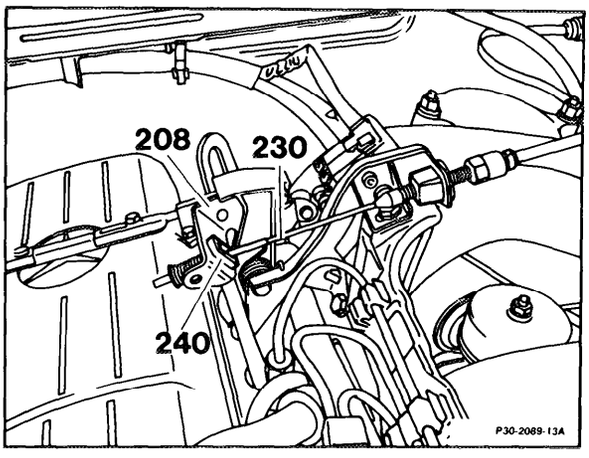
Installation note
Tightening torque for hex. head bolts on refrigerant compressor 25 Nm.



13 Loosen and disconnect all vacuum hoses and fuel lines between engine and chassis.

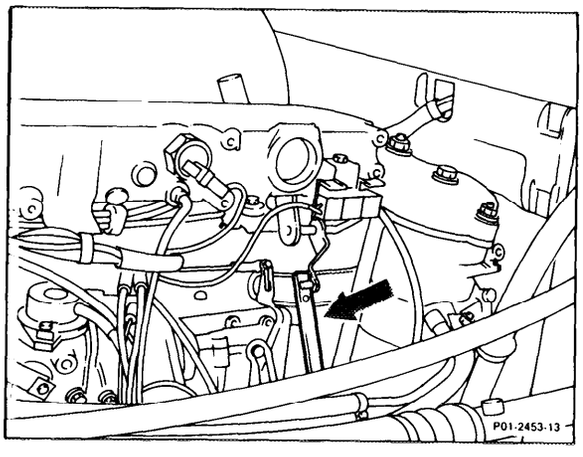
Models 124 and 201:

14 Unhook engine control; press out guide piece **(240)** on control lever **(208)** and remove control cable **(230).**



Model 126:

15 Unhook engine control linkage; unhook connecting rod (arrow) on control shaft.



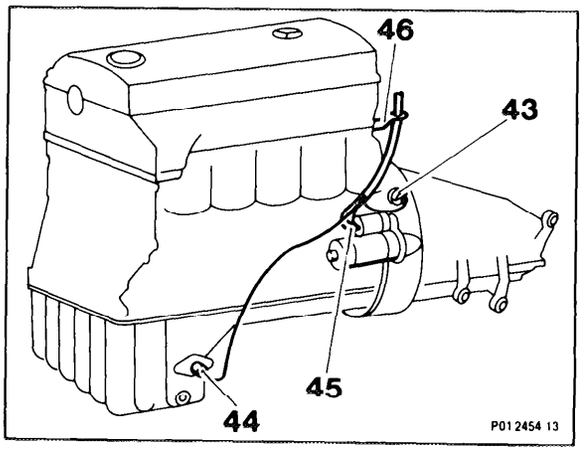
Installation note

Adjust control cable (30-300).

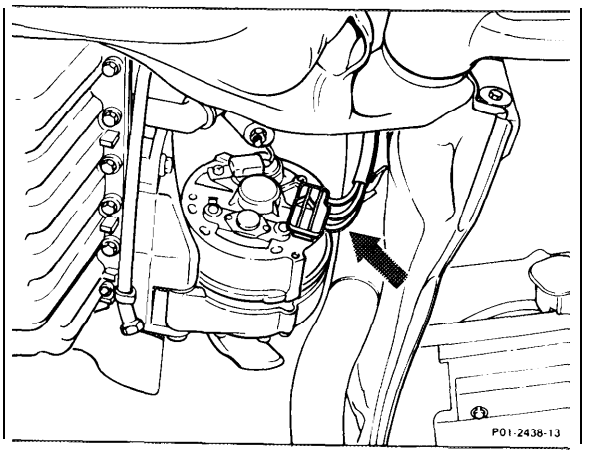
16 Disconnect all electrical lines between engine and chassis; for this purpose disconnect plug connectors and connections.

17 Disconnect plugs on oil pressure switch **(43)** and oil level sensor (44).

18 Remove connection cables on starter (45) and remove harness from holder (46) above starter.



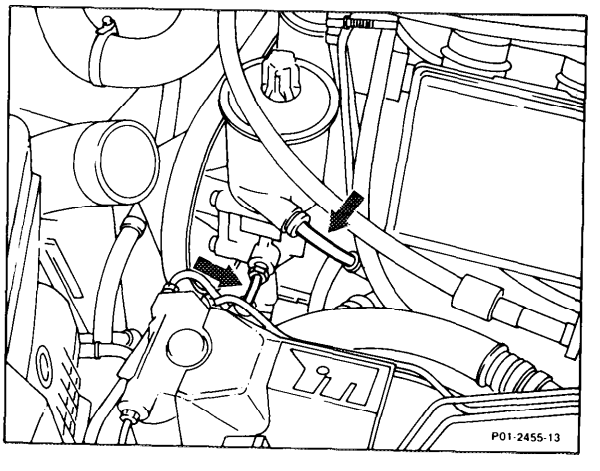
19 Disconnect plug connector (arrow) on alternator.



20 Completely remove engine wiring harness, for this purpose disconnect all clips and cable connectors.

21 Evacuate oil from supply reservoir for power steering pump or tandem pump using hand pump 112 589 00 72 00.

22 Unscrew oil lines for power steering on power steering pump (arrows) or on tandem pump.

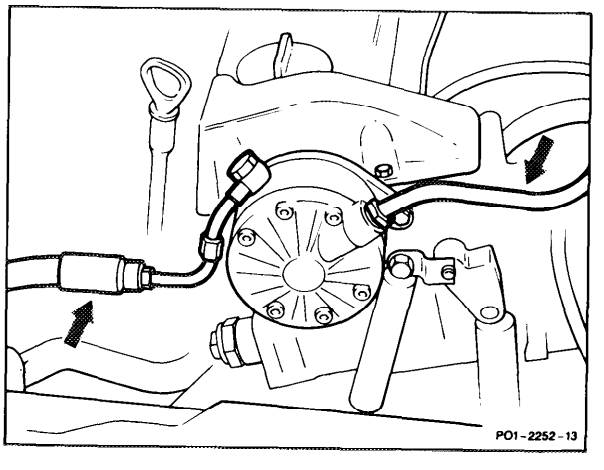


Power steering pump

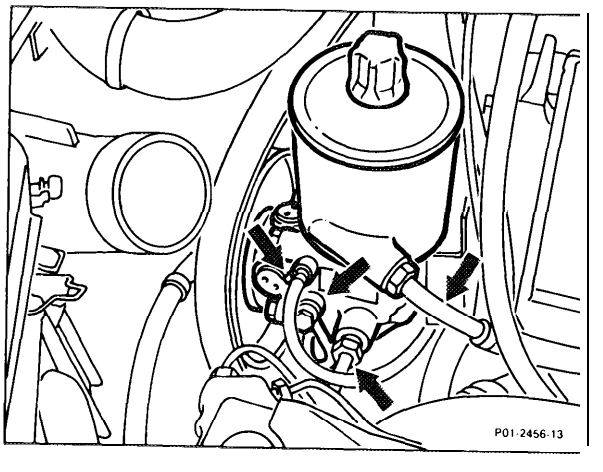
Installation note
Tightening torque 30 Nm.
Replace oil which has leaked out.

Vehicles with level control and/or ASD:

23 Remove oil lines and hoses (arrows) for hydraulic pump or tandem pump between engine and chassis.



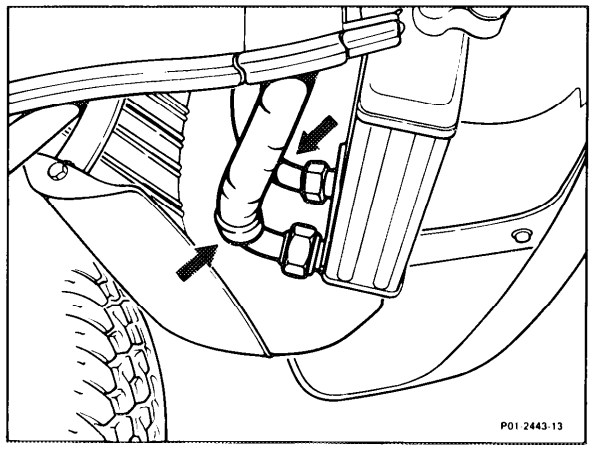
Hydraulic pump



Tandem pump

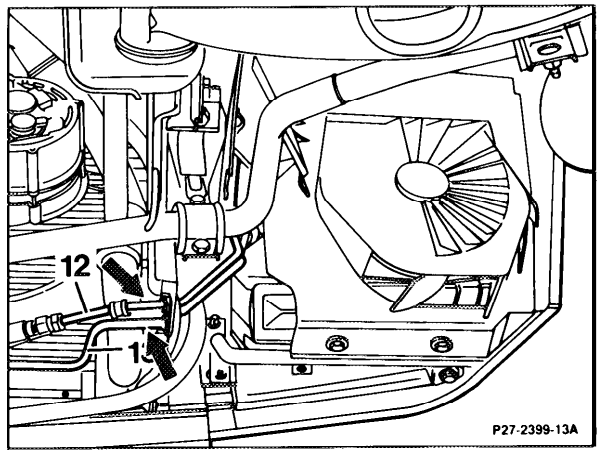
Turbo-engines or naturally aspirated engines with exhaust gas recirculation:

24 Unbolt oil lines and hoses (arrows) for air oil cooler in left wheelhouse between radiator and engine.



Turbo-engines with automatic transmission and trailer hitch in combination with air conditioning:

25 Unbolt oil lines and hoses (arrows) for transmission air oil cooler in right wheelhouse between radiator and engine.

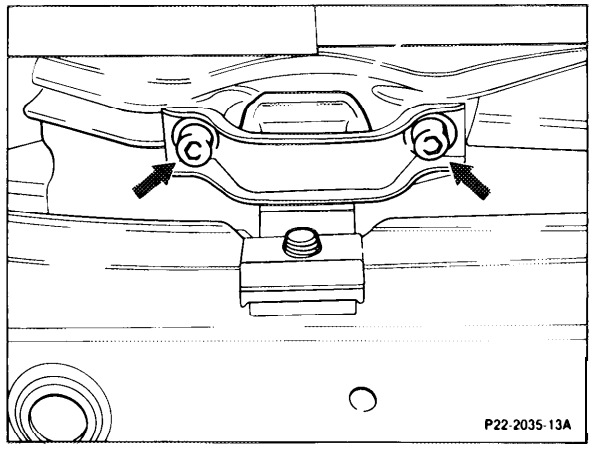


Model 201 (up to 03/85):

26 Remove Allen bolts (arrows) on mount for engine stop and remove mount.

Installation note

Tightening torque 25 Nm. Check engine stop with adjustment gauge 201 589 04 23 00 and adjust (22-220). Tightening torque for adjustment bolt 130 Nm.

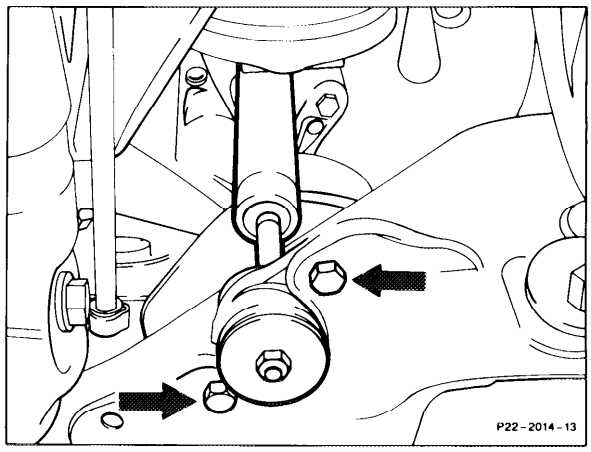


Model 201 (up to 03/85):

27 Remove engine shock absorber, left, for this purpose remove hex. head bolts (arrows) on mount and remove engine shock absorber from frame cross member.

Installation note

Tightening torque 10 Nm.

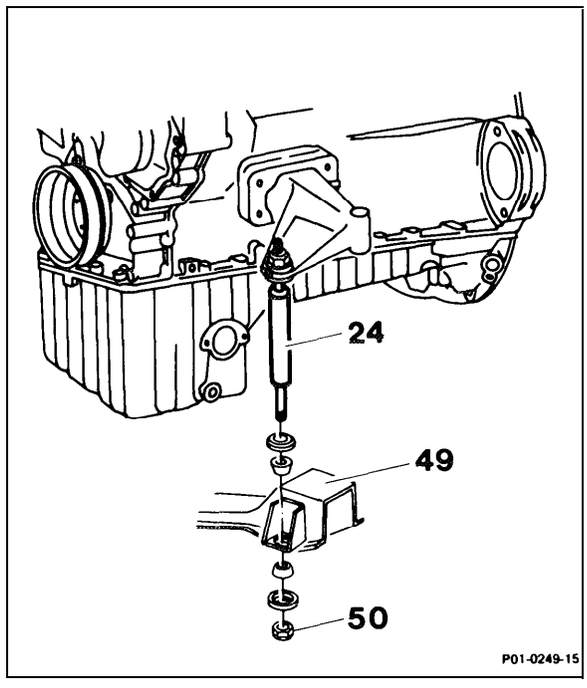


Model 126:

28 Unbolt engine shock absorbers (24) on left and right; for this purpose unscrew hex. nut (50) and press shock absorber upward out of mount on frame cross member (49).

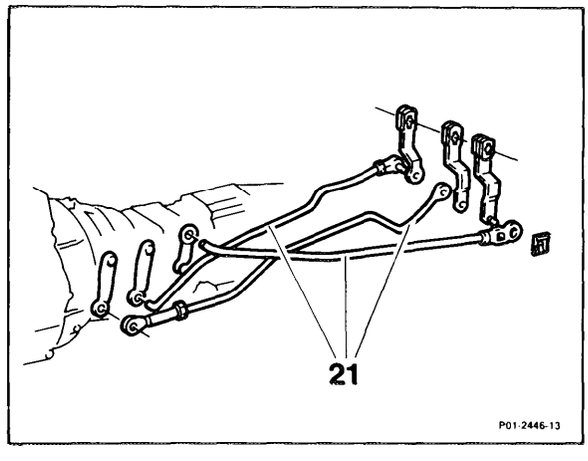
Installation note

Tightening torque 10 Nm.



Vehicles with manual transmission:

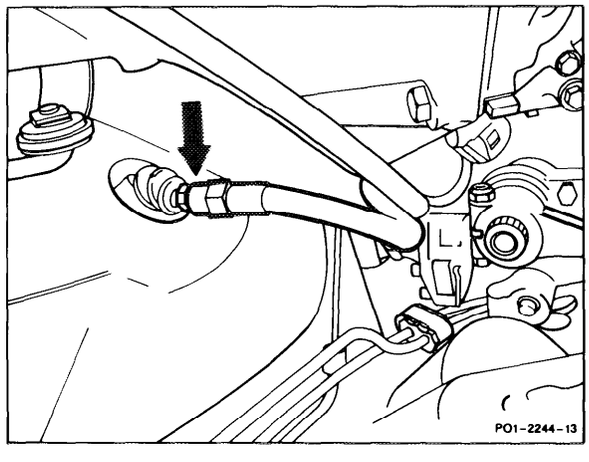
29 Unhook shift linkage (21) on transmission.



29.1 Unbolt hydraulic lines on clutch master cylinder (arrow).

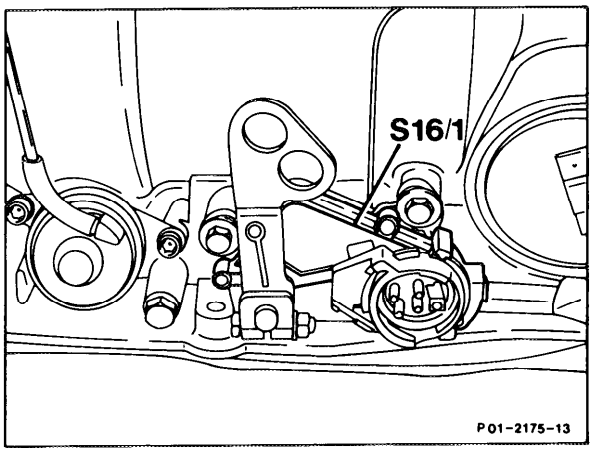
Installation note

Bleed clutch master cylinder.



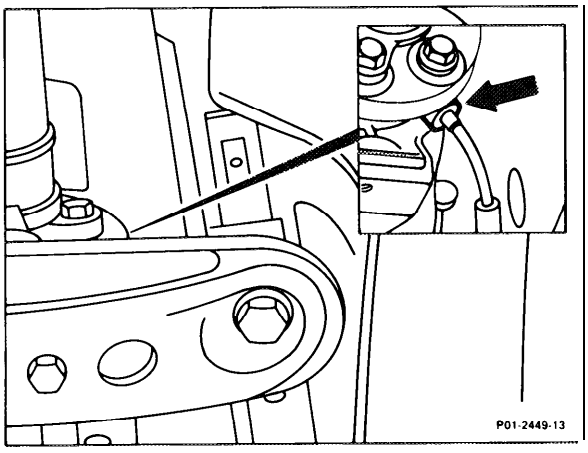
Vehicles with automatic transmission:

30 Unhook shift linkage on transmission and disconnect connector for starter lockout, back-up light switch (S16/1).

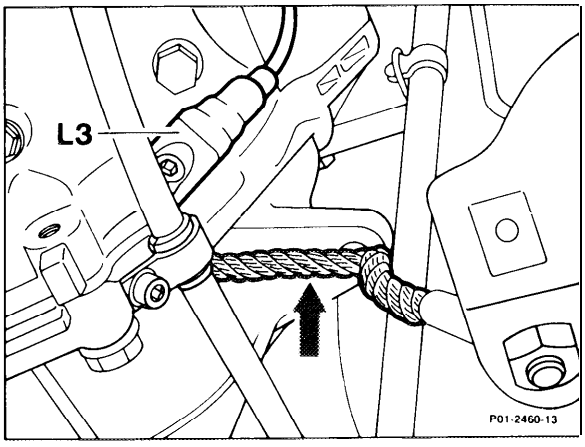


30.1 Disconnect connector for kickdown solenoid valve on right side of transmission.

31 Unbolt speedometer shaft or speedometer inductive sensor (arrow) and remove the two bottom hex. head bolts for the starter. Position speedometer shaft or connection wire to side.

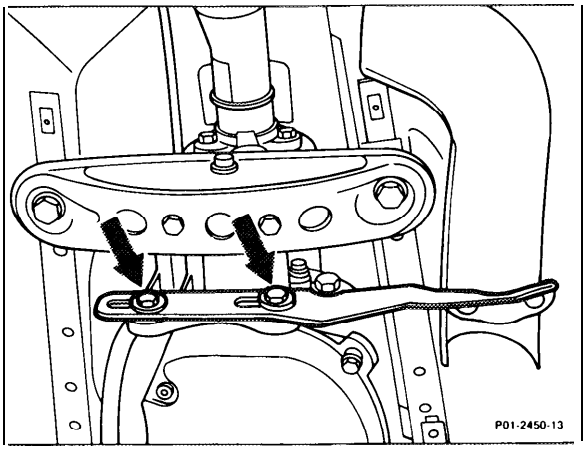


32 Unbolt engine speed sensor (L3) and starter ground strap (arrow) on chassis.

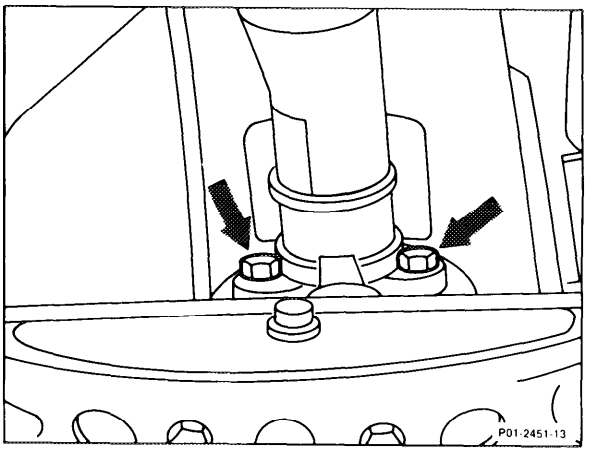


33 Remove hex. head bolts (arrows) for lateral exhaust support on transmission and remove support.

34 Unbolt heat baffle plates on center tunnel.



35 Remove hex. head bolts (arrows) for drive shaft on transmission flange and press drive shaft off of transmission flange.



Installation note

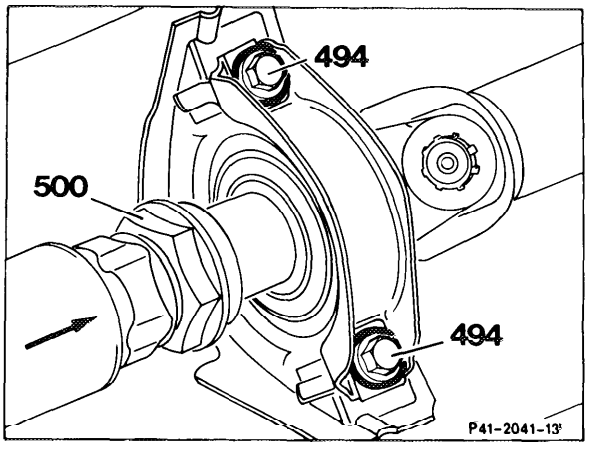
Replace self-locking hex. nuts.

Tightening torque

Engine 602, 603.91 40 Nm

Engine 603.96 60 Nm.

36 Loosen hex. head bolts (494) on drive shaft intermediate flange.



Installation note

Tightening torque 25 Nm.

37 Loosen clamping nut (500) with open-end wrench

126 589 00 01 00 (SW46) or

201 589 00 01 00 (SW41) and

torque wrench 001 589 66 21 00.

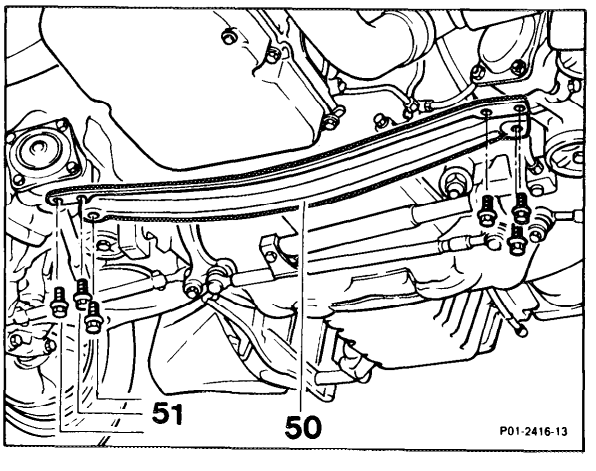
Push drive shaft back as far as possible (in direction of arrow).

Installation note

Tightening torque 30 – 40 Nm.

Model 126:

38 Unbolt hex. head bolts (51) on cross member center piece **(50)** and remove cross member center piece.

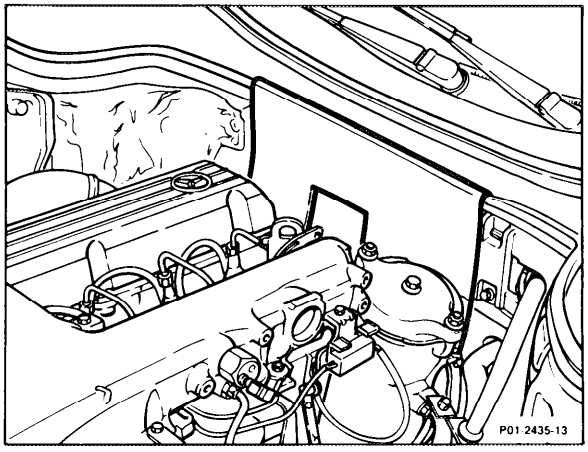


Installation note

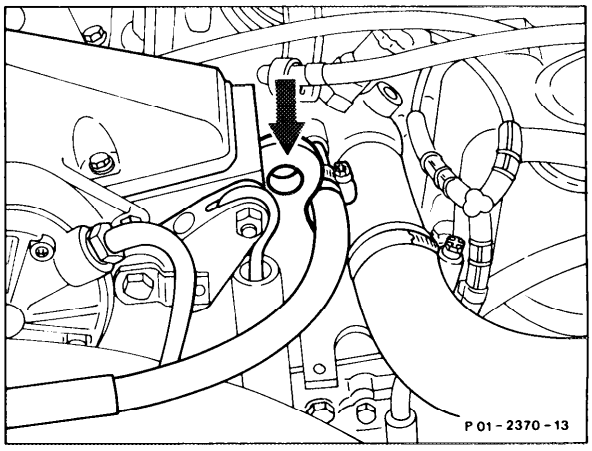
Replace self-locking hex. head bolts.

Tightening torque 45 Nm.

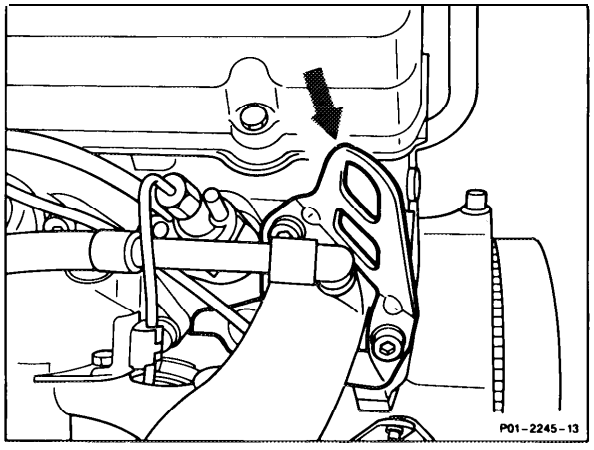
Caution!
Attach guard plate on unit compartment firewall.



39 Fasten engine hoist cables to front and rear suspension eyes on engine. Align engine hoist so that engine is positioned horizontally.

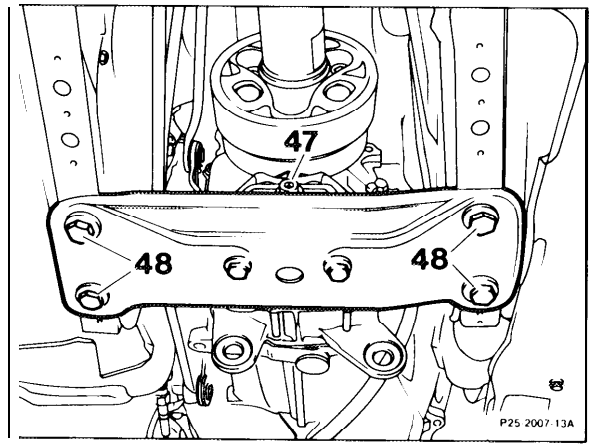


Suspension eye, front



Suspension eye, **fear**

40 Remove hex. head nuts (47) on mount for rear engine support. Remove hex. head bolts (48) and remove engine support with mount.



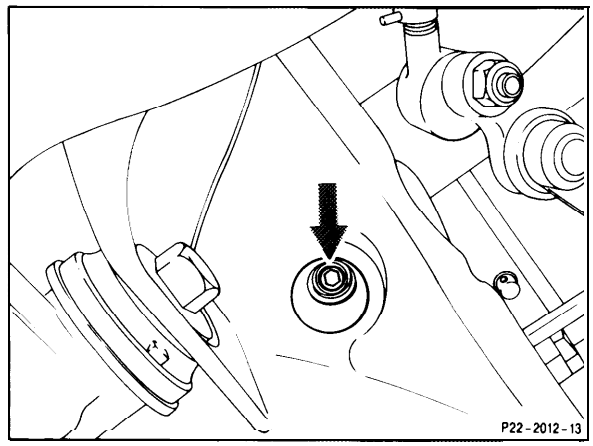
Installation note

Tightening torque

Hex. nuts	70 Nm
Hex. head bolts	45 Nm.

Check adjustment bolt on rubber mounts, tightening torque 30 Nm.

41 Remove Allen bolts for front engine mounts from frame cross member from bottom.

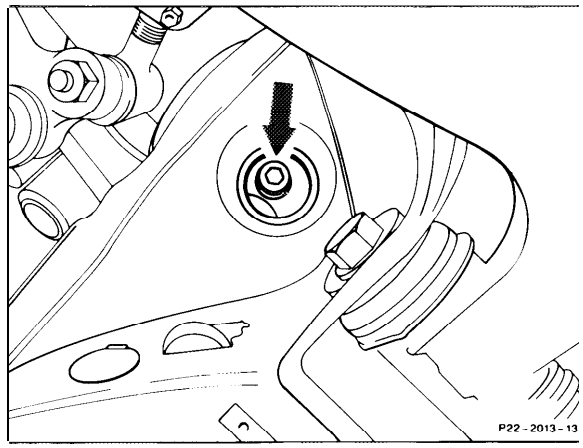


Allen bolt, engine mount, left

Installation note

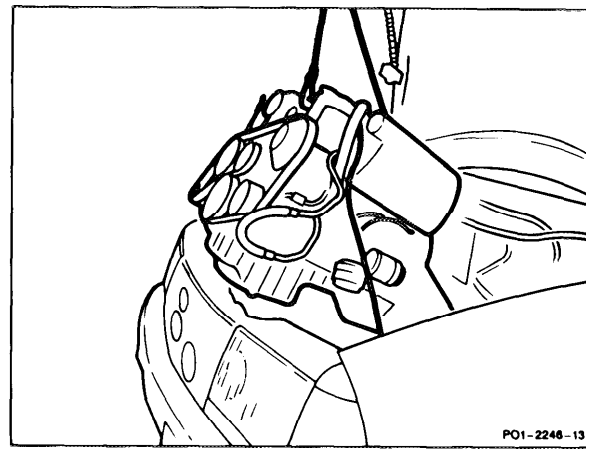
Tightening torque

Model 124 and 201	40 Nm
Model 126	70 Nm.



Allen bolt, engine mount, right

42 Lift engine with transmission at angle out of engine compartment, continuously correct angle with engine hoist, maximum angle approx. 45°.



⚠ Warning
When lifting engine pay attention to rear suspension eye on engine and engine oil filter.

43 Install in opposite order.

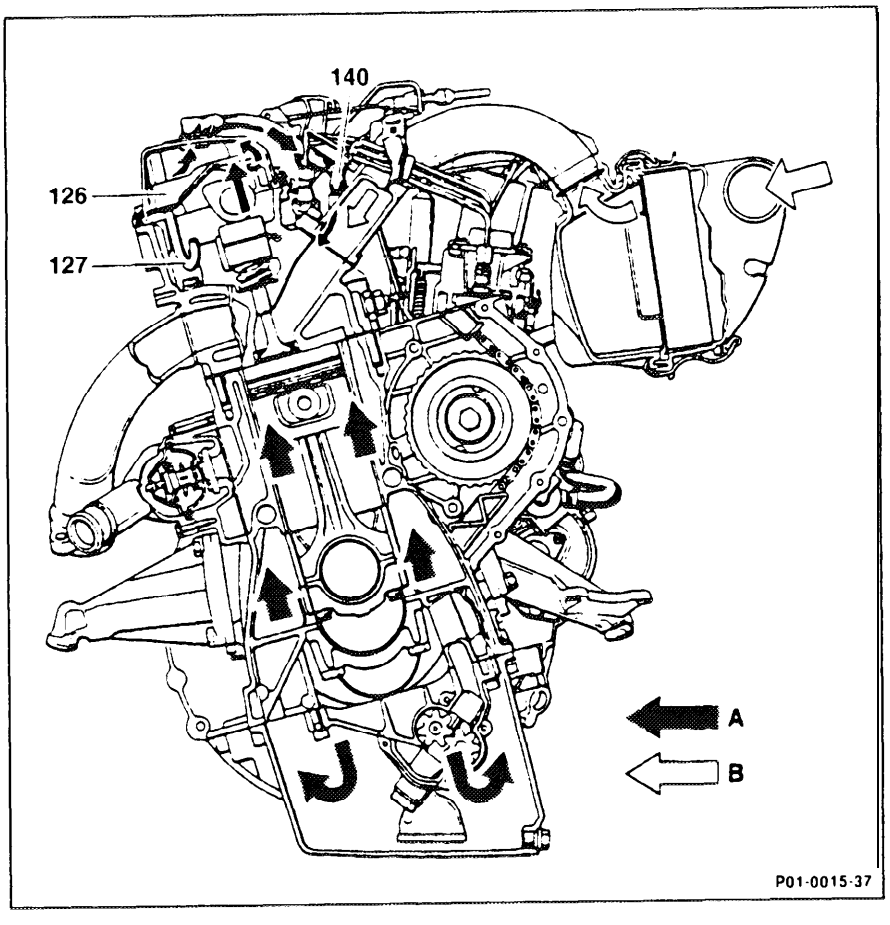
After installation:
44 Check engine oil, add, if required or refill engine oil and fill up cooling system.

44.1 Perform pressure test on cooling system (20-017), pressure tester 124 589 15 21 00.

44.2 Start engine and check engine oil and cooling systems for leakage.

01-040 Crankcase ventilation – Function

A. Standard version



Crankcase ventilation, naturally aspirated engine, standard version
Engine 602

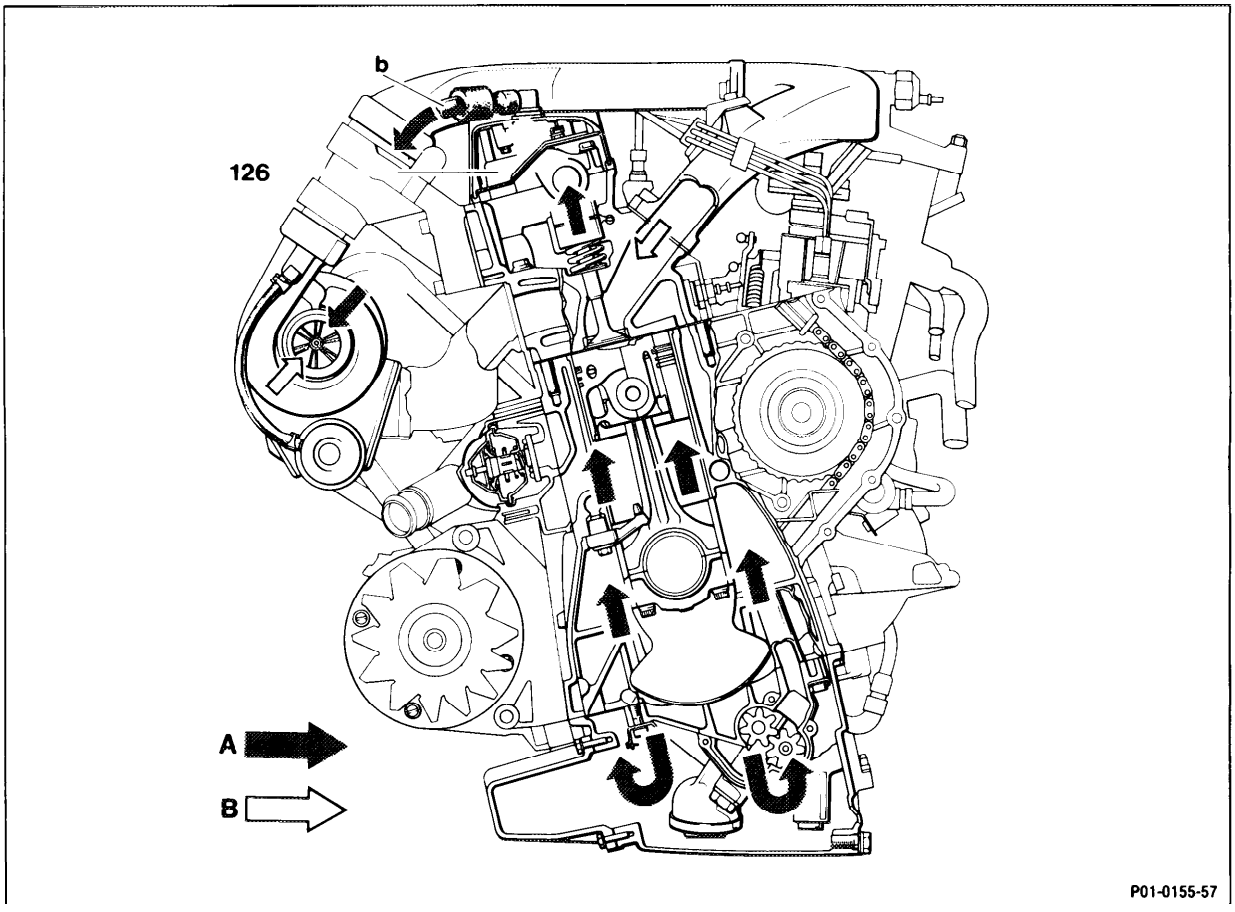
126	Oil separator
127	Return pipe
140	Distribution pipe
A	Blow-by gasses
B	Fresh air

The crankcase ventilation on standard version naturally aspirated engines is a closed, maintenance-free system.

The blow-by gasses from the crankcase flow through the oil separator (126) into the cylinder head cover and a hose to the distribution pipe (140) on the intake manifold depending on the intake manifold vacuum.

These gasses are distributed uniformly to all cylinders by the intake manifold and drawn into the combustion chambers together with the intake air.

The oil deposited in the oil separator runs back to the cylinder head through the return pipe (127).



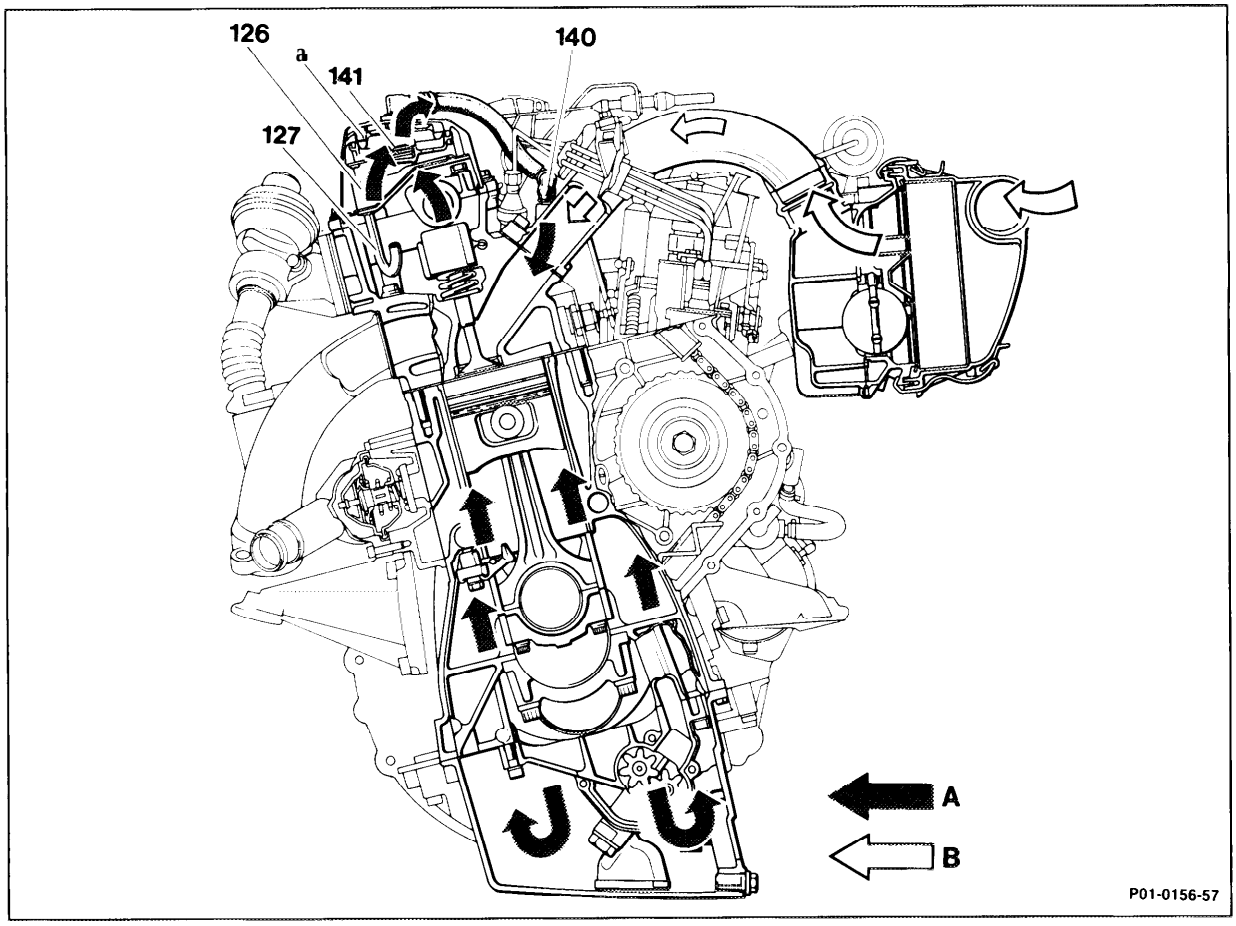
Crankcase ventilation, standard version turbo-engines
Engines 602.96, 603.96, 603.97

126	Oil separator
b	To arr cleaner housing
A	Blow-by gasses
B	Fresh air

The crankcase ventilation for the standard version turbo-engines corresponds to that of the naturally aspirated engine.

l-lowever on the turbo-engines, after removal of the engine oil, the blow-by gasses flow from the cylinder head cover to the intake hose.

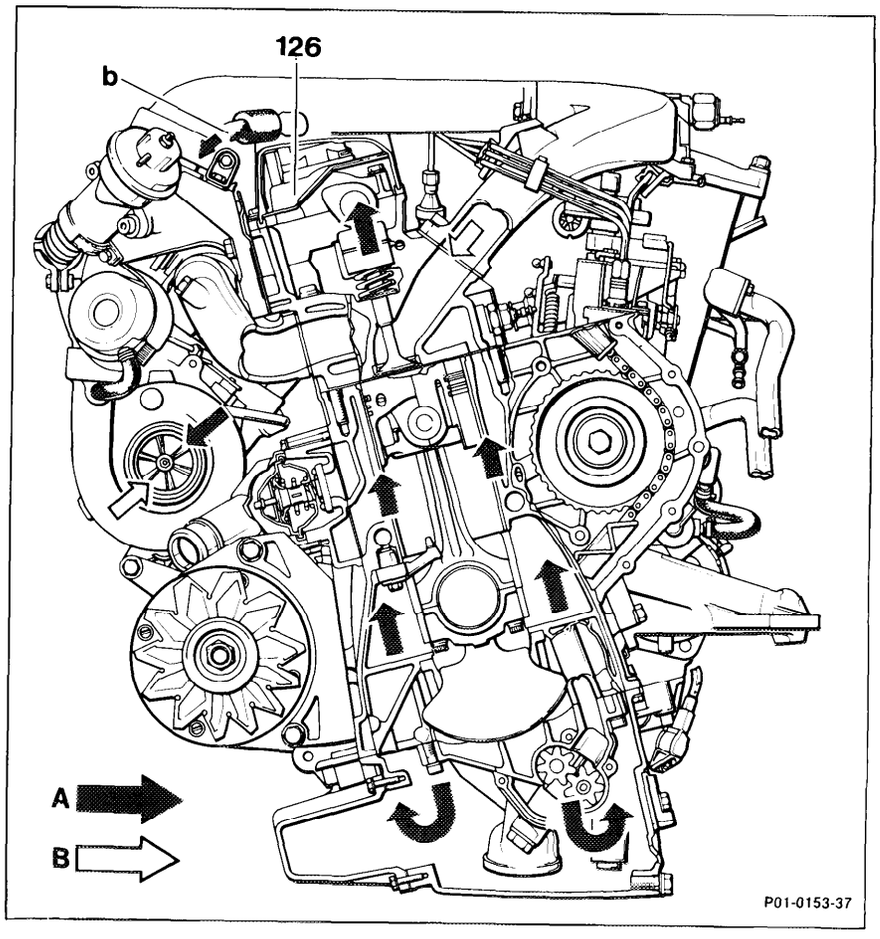
B. Naturally aspirated and turbo-engines with exhaust gas recirculation



Crankcase ventilation on engines with exhaust gas recirculation
Engine 602.91

126	Oil separator
127	Return pipe
140	Distribution pipe
141	Pressure control valve
a	Vent hole, dia. 3 mm
A	Blow-by gasses
B	Fresh air

Crankcase ventilation on engines with exhaust gas recirculation
Engines 602.96, 603.96, 97



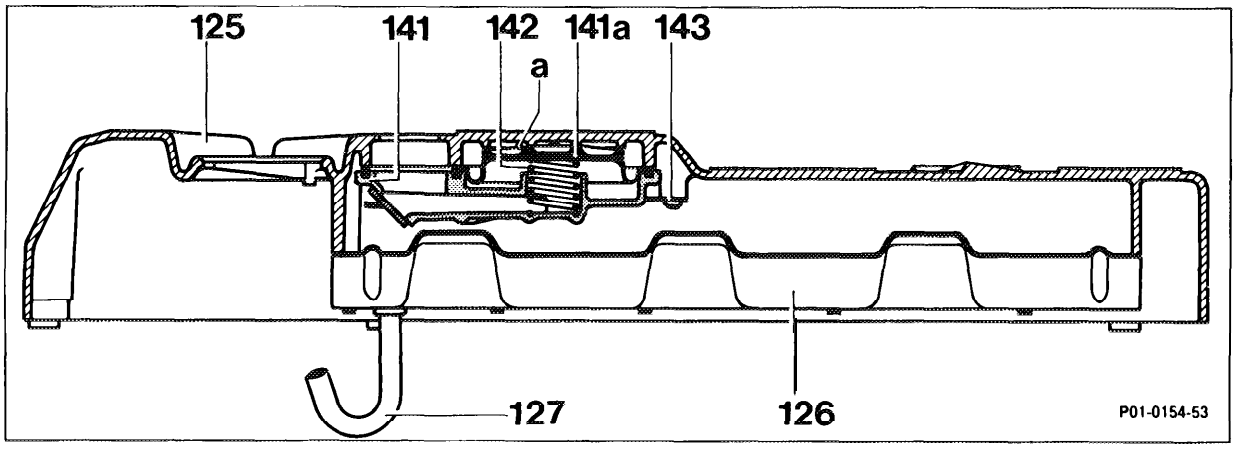
126 Oil separator
b To air cleaner housing
A Blow-by gasses
B Fresh air

The crankcase ventilation on naturally aspirated engines with exhaust gas recirculation differs from that of the standard version by addition of a built-in pressure control valve (141).

The pressure control valve is required because on engines with exhaust gas recirculation an additional throttle valve installed in the intake system results in significantly higher vacuums.

If the vacuum were too high, the engine oil would be sucked out of the crankcase.

The pressure control valve prevents this by keeping the vacuum constant above a certain value.

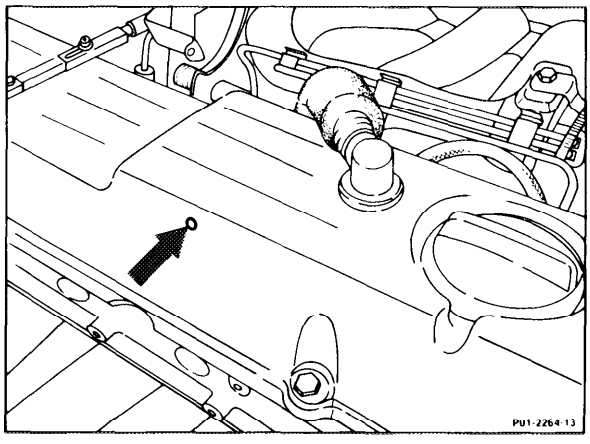


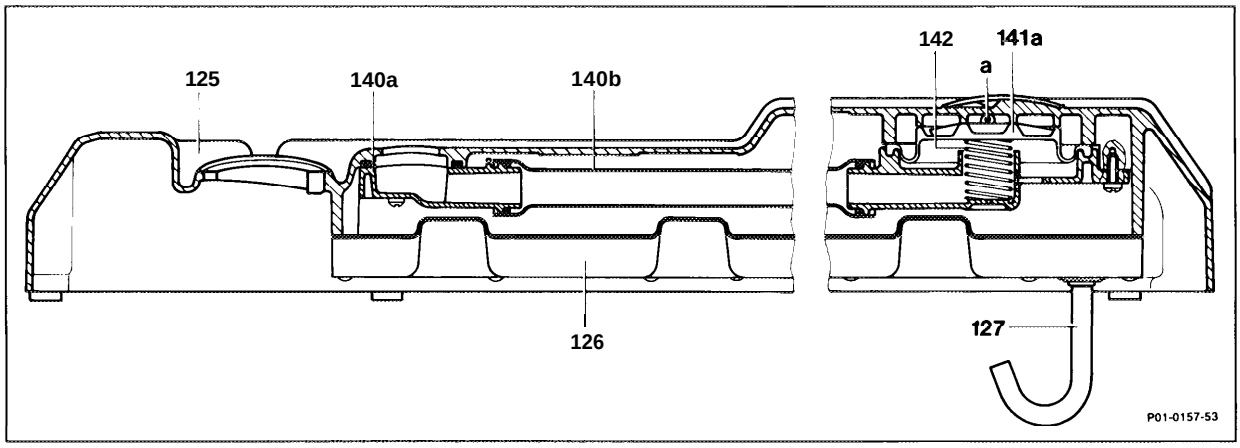
Pressure control valve
Engines 602.91, 603.91

125	Cylinder head cover	141a	Diaphragm
126	Oil separator	142	Spring
127	Return pipe	143	Holder
141	Pressure control valve	a	Vent hole

The pressure control valve is designed as a diaphragm-type valve and built into the oil separator in the cylinder head cover.

A hole is present in the cylinder head cover to vent the diaphragm chamber in the pressure control valve (arrow). This hole must not be plugged by dirt or preservation agents.





Pressure control valve, engines 602.96, 603.96

125	Cylinder head cover	140b	Intermediate section
126	Oil separator	141a	Pressure control valve
127	Return pipe	142	Spring
140a	Angle fitting	a	Vent hole

Turbo-engines with exhaust gas recirculation are also equipped with a pressure control valve (141 a). For space reasons this valve is installed in the rear section of the cylinder head cover.

Note

Because of increased pressure difference between the intake manifold and the crankcase, a stronger compression spring (142) with a higher spring rate was used. The following table indicates the vehicle and engine models in which the modified springs were first installed.in addition to engines 602.962 and 603.970 beginning model year 1990.

Production breakpoint: 01/88

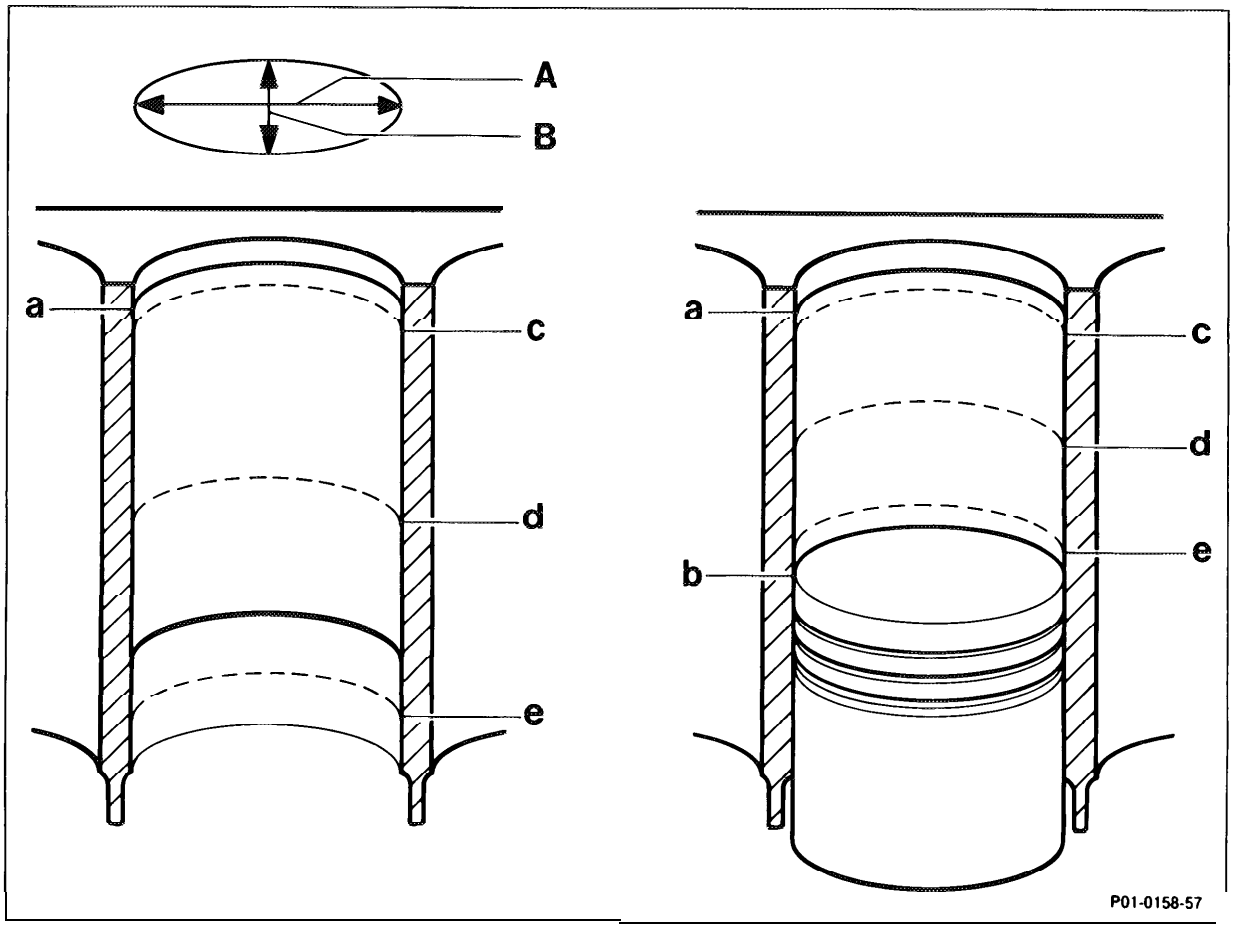
Model	Engine	Engine end no.		Vehicle ident. end no.	
		manual transmission	automatic transmission	A	F
124.133 124.193	603.960	–	0 17932	*	*
124.128	602.962	From Model Year 1990		*	*
126.134 126.135	603.970	From Model Year 1990		*	*
201.126	602.911	073017	014820	*	*

* not avarlable

01-110 Measuring, boring and honing cylinder bores

Preliminary operations:
Pistons removed (03-316).

A. Measuring
Engines with and without cylinder sleeves



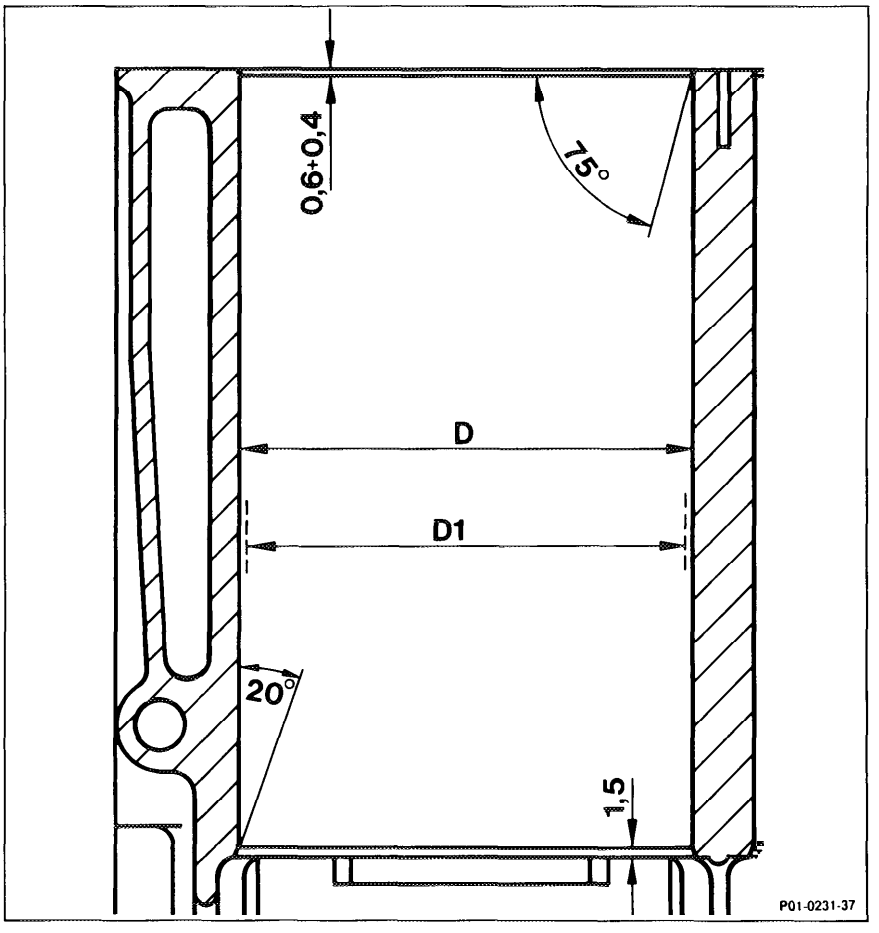
Cylinder bores ..... clean thoroughly.

Cylinder bore ..... Measure cylinder bore diameter with internal measuring instrument at 3 measuring points (c, d, e) in longitudinal direction (A) and transverse direction (B).

Note
Compare measured cylinder bore diameters with standard or repair stage specifications for engine (except for engines with cylinder sleeves).

Observe group ident. letters A, X or B stamped on the crankcase or piston crown. On used engines the difference between the diameter measured at point (c) and the original diameter is equal to the wear (max. permissible wear 0.2 mm).
The original diameter can be measured at the piston top land after it has been cleaned thoroughly (the top land is the area between the piston crown and the top surface of the block in the TDC position on ignition stroke).

B. Boring and honing
Engines without cylinder sleeves



Cylinder bore diameter (D) . . . . . measure.

Bore diameter	(D_1)	determine and adjust boring tool. **Note** The bore diameter "D1" is the cylinder bore diameter "D" minus the material which will be removed by honing. The material removed by honing should not exceed max. 0.05 mm. Select repair stage diameter "D" according to engine model and group code letter A, X, B" (stamped in block).
Boring operation	.....	perform according to operating instructions for boring tool used.
Cylinder bore ..	.....	bevel at upper and lower edges of cylinder (see drawing for dimensions).
Honing operation	.....	perform according to specified data.

Maximum permissible wear for cylinder bores

Measuring range “a” (upper reversal point of 1st piston ring) in longitudinal and/or transverse direction	0.2 mm

Standard and repair stage diameter "D" for cyl nder bores

Engine			602, 603	603.970
Version	Cylinder	Group code letter	Cylinder dia. D in mm	Cylinder dia. D in mm
Standard	1 – 4, 5, 6	A	**87.000 – 87.006**	**89.000 – 89.006**
		X	**over 87.006 – 87.012**	**over 89.006 – 89.012**
		B	over **87.012 – 87.018**	over 89.012 – 89.018
Repair stage [1] (+0,7 mm)		A	**87.700 – 87.706**	**89.700 – 89.706**
		X	**87.706 – 87.712**	**89.706 – 89.712**
		B	**87.712 – 87.718**	**89.712 – 89.718**

[1]) Does not apply for engines with cylinder sleeves. Cylinder sleeves must be replaced when the wear limit is reached.

Machining tolerances

Permissible out-of-round and conicity of cylinder bore	0.07 mm
Permissible roughness of cylinder bore (R3Z)	0.003 – 0.006 mm
Permissible waviness of cylinder bore	50 % of roughness
l-ioning angle	45”
Roughness of block parting surface	0.006 – 0.016 mm
Chamfer of cylinder bores	refer to figure

Introduction of engines without cylinder sleeves

Note

Beginning in 1987 the cylinder sleeves were eliminated partially on engines 602/603. The following tables show exactly when and on which model or engine the new version was introduced. Engine 603.970 was introduced into production without cylinder sleeves.
Installation of cylinder sleeves is not permissible.

Production breakpoint: 08/89

Model	Engine	Engine end no.		Vehicle ident. end no.	
		manual transmission	automatic transmission	A	F
201.126	602.911	081638	016218	*	*

Production breakpoint:

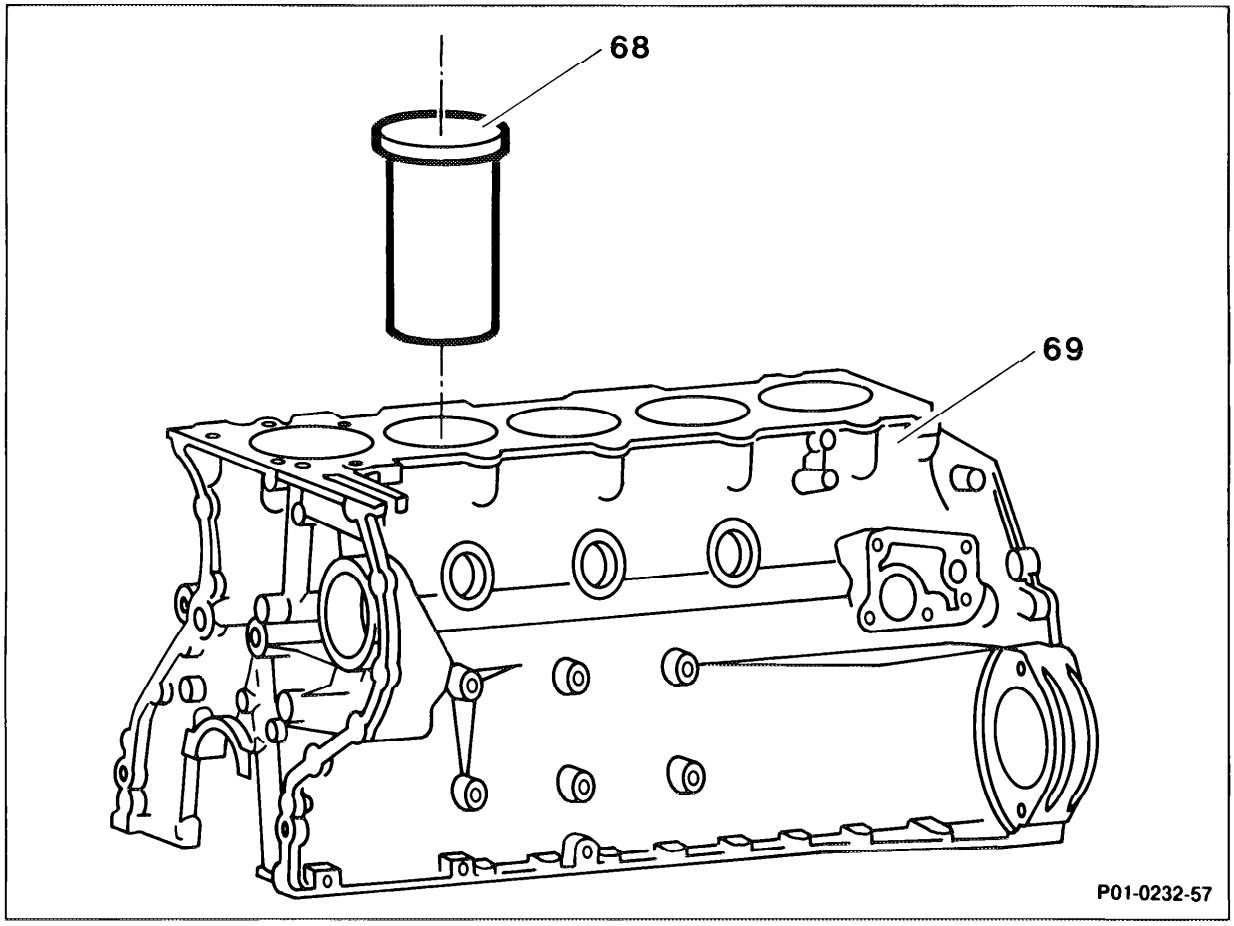
Model	Engine	Engine end no.		Vehicle ident. end no.	
		manual transmission	automatic transmission	A	F
201.126	602.911	083630	016502	*	*

Commercially available tool

Internal measuring instrument for 50 – 150 mm dia., with 0.01 mm increments and measuring point pressure relief	e.g.	Hommel Handel D-5000 Köln 71 Sunnen Grm-2125

01-115 Boring, honing and replacement of cylinder sleeves

Preliminary operations:
Pistons removed (03-316).



Cylinder bore	measure (01-l 10).
Cylinder sleeves (68)	press out, punch 603 589 00 15 00 (item 1).
Block (69)	clean basic bores for sleeves and check diameter (see table) with internal measuring instrument (items 2 and 3). **Note** If the permissible values are exceeded, replace block.
Cylinder sleeves	press in and maintain pressure for approx. 7 seconds to seat sleeve, punch 603 589 00 15 00 (item 4).

Cylinder bores	bore out to standard diameter "D" and hone, see Note in (01-l 10). Observe group code letters (A, X, B) (items 5 – 9).

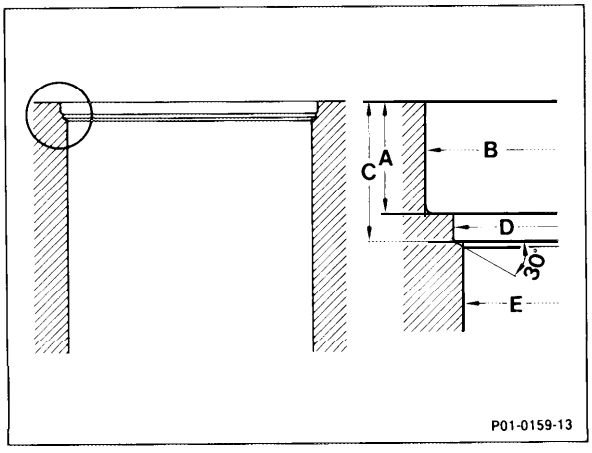
Diameter "D" for cylinder sleeves

Engine			**602, 603**
Version	Cylinder	Group code letter	Cylinder dia. D in mm
Standard [1]	1 – 4, 5, 6	A	87.000 – 87.006
		X	over 87.006 – 87.012
		B	over 87.012 – 87.018

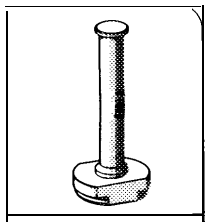
[1] There are no repair stages for engines with cylinder sleeves.

Dimensions for basic bore in block

Bore dia. "B"	92.650 – 92.750 mm
Bore dia. "D"	90.550 – 90.650 mm
Bore dia. "E"	90.000 – 90.935 mm
Depth "A" sleeve seat	3.8 – 4.0 mm
Depth "C" sleeve seat	4.77 – 5.23 mm
Permissible out-of-round of basic bore in block	0.01 mm
Permissible out-of-round and conicity of cylinder bore	0.07 mm
Permissible roughness of cylinder bore (R3Z)	0.003 – 0.006 mm
Permissible waviness of cylinder bore	50 % of roughness
l-loning angle	45"
Roughness of block parting surface	0.006 – 0.016 mm
Chamfer of cylinder bores	30"



Special tool

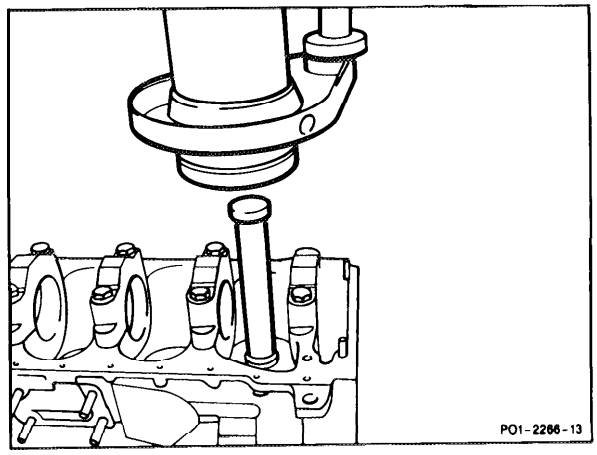


603 589 00 15 00
01

Commercially available tool

Internal measuring instrument for 50 – 100 mm dia., with 0.01 mm increments and measuring point pressure relief	e.g.	Hommel Handel D-5000 Köln 71 Sunnen Grm -2125

Replacement



1 Press out cylinder sleeves.

2 Thoroughly clean basic bore.

3 Measure basic bore (D) in block.

If the limits are exceeded (see table) the block cannot be reused.

4 Position new cylinder sleeves and press in with press.

After pressing in cylinder sleeves maintain pressure for approx. 7 seconds with press (setting pressure).

Boring and honing

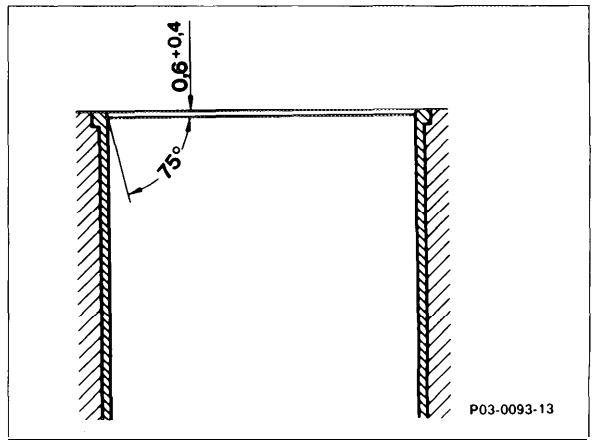
5 Mill or grind off projecting collar on sleeve. Remove as little material as possible from the block parting surface. Guide milling cutter or grinding wheel carefully over cylinder bores.

6 Bore out cylinder sleeves in two steps. Leave at least 0.03 mm additional material in the bores for honing.

7 Chamfer cylinder sleeves.

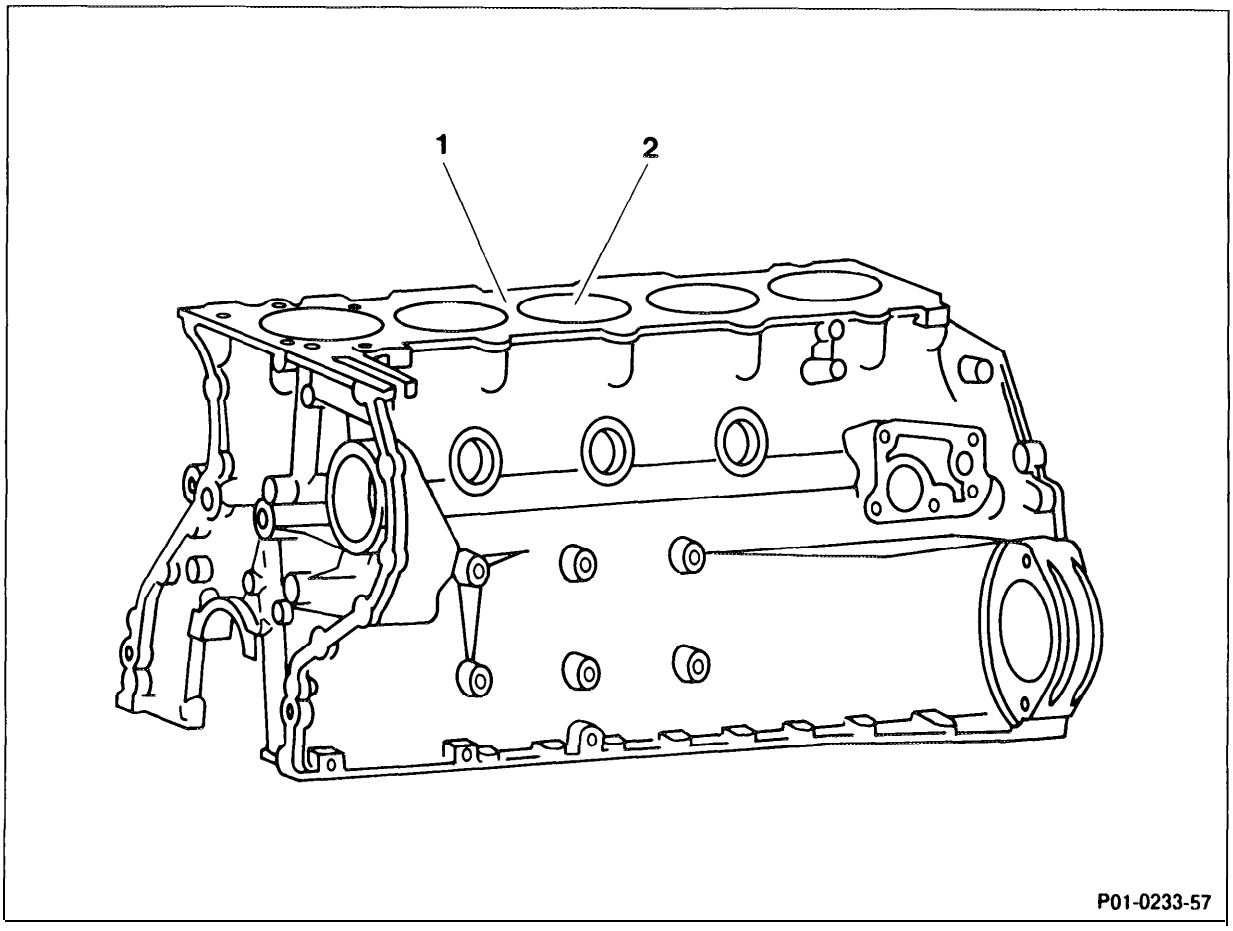
8 Hone cylinder bores.

9 Measure cylinder bores and select matching pistons (01410).



01-120 Planing crankcase parting surface

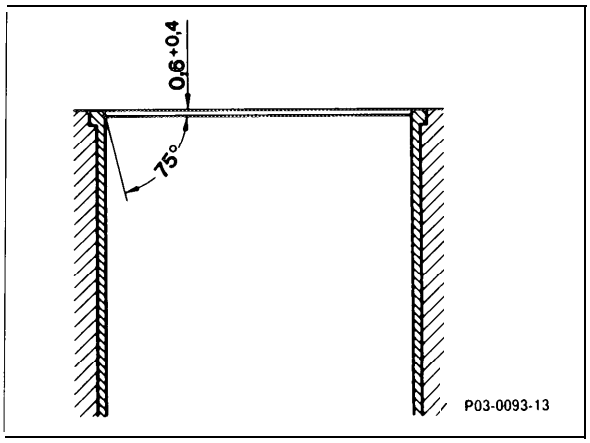
Preliminary operations:
Piston extension checked and pistons removed (03-316).



Parting surface (1)	plane according to operating instructions for planing tool used.
	Note Observe specified dimensions and machining data!
Cylinder bores (2)	chamfer at top of cylinder.
After reassembly	check engine timing (05-215).

Data

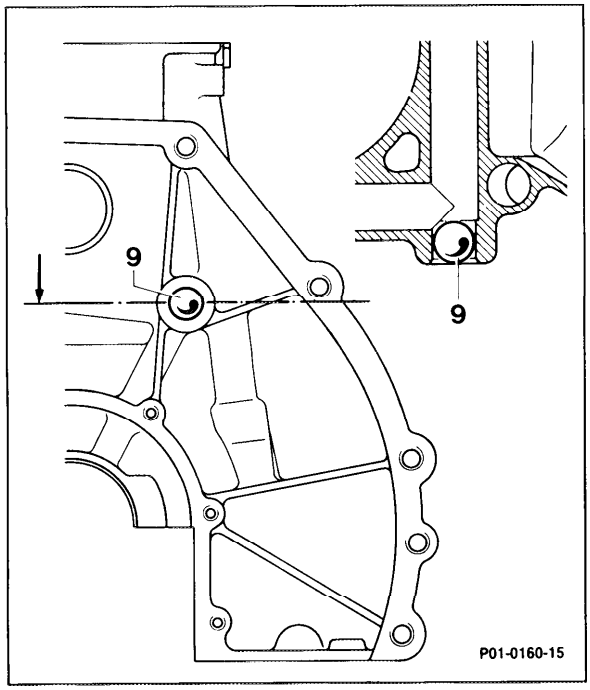
Height of block in new state from center of main bearing bore		234.97 – 235.03
Minimum height after required material removal from center of main bearing bore		234.60
Permissible unevenness of parting surface	in longitudial direction	0.06
	in transverse direction	0.06
Permissible roughness of upper parting surface		0.006 – 0.016
Permissible deviation in parallel between upper parting surface and lower parting surface in longitudinal direction		0.05
Chamfer of cylinder bores		see figure
Distance between piston crown and block parting surface		Projection max. 0.965 Projection min. 0.735



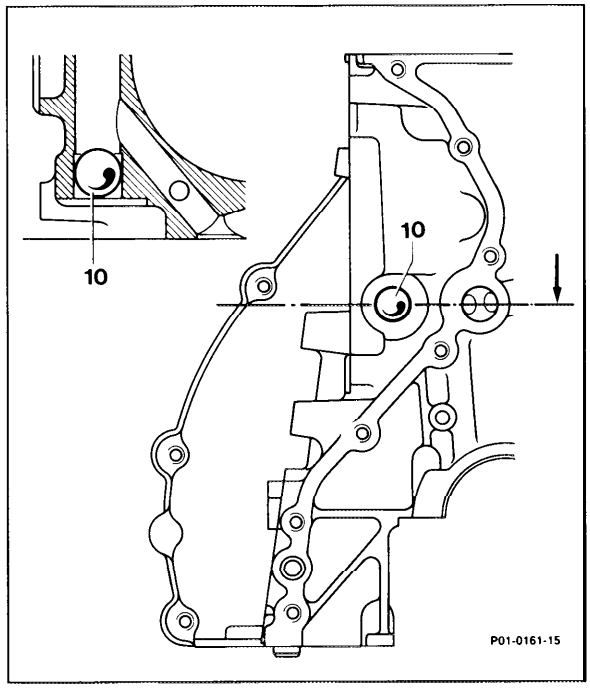
Cylinder bore chamfer

01-130 Removal and installation of steel balls in main oil duct

Preliminary operations:
Coolant pump removed with housing (20-230).
Flywheel removed (03-410).



Steel ball, rear, 15 mm dia. (9)



Steel ball, front, 17 mm dia. (10)

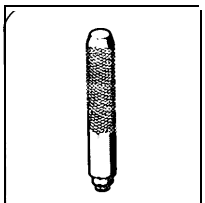
Steel balls (9, 10)	knock out, insert. Punch 601 589 08 15 00 (items 1 – 6).
	Note If not damaged the steel balls can be reinstalled a number of times. In the event of leakage reseat steel balls approx. 1 mm deeper (dimension marked on punch).
Leaky steel balls	replace with plug, remedy measures (items 7 – 9).
After reassembling engine	warm up engine and check for leakage in area of steel balls.

Tightening torque	Nm
Plug as replacement for steel balls	50

Replacement parts for steel balls	Part no.
Plug M 18 x 1.5 (front)	000 908 018 002
Plug M 16 x 1.5 (rear)	000 906 016 002
Gasket A 18	007 603 018 103

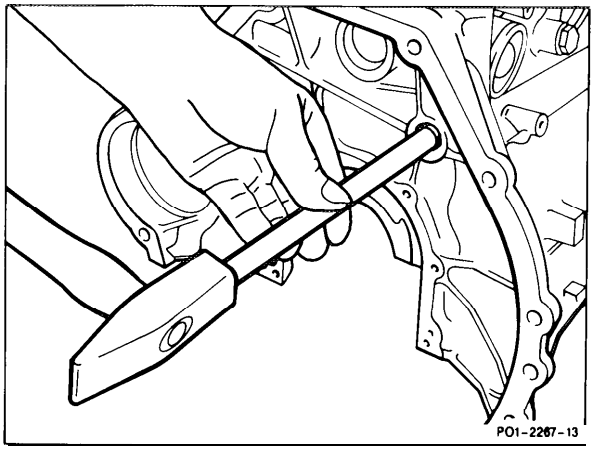
Sealant for replacement of rear steel ball	
Loctite 241	002 989 94 71

Special tool



601 589 08 15 00
01

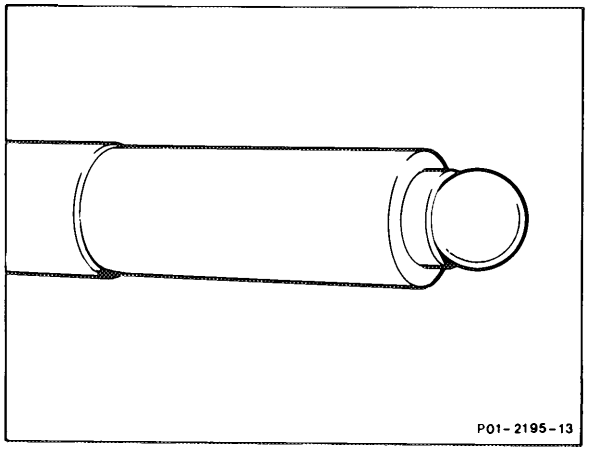
Knocking out



1 Knock out both steel balls from rear toward front with suitable steel rod.

Note
The steel balls can be reused a number of times. Replace damaged balls under all circumstances.

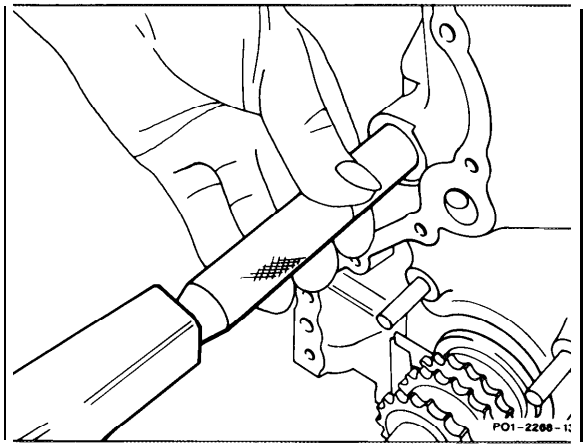
Inserting



2 Thoroughly clean seat for steel ball in engine block.

3 Insert steel ball with slight quantity of grease on punch 601 589 08 15 00.

4 Position steel balls on hole and drive in to specified stop on punch.



5 After reassembling engine, warm up engine and check for leakage in area of steel balls.

Note
If one of the steel balls does not seal sufficiently after inserting or if leakage is present following leakage test, replace steel ball with plug.

Replacing steel ball with plug

6 Knock steel ball out again.

7 Cut thread in hole for leaky ball.

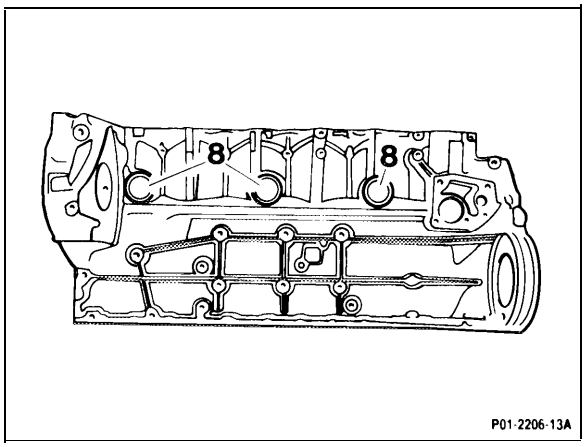
Note

Front bore M 18 × 1.5	10 mm deep
Rear bore M 16 × 1.5	14 mm deep

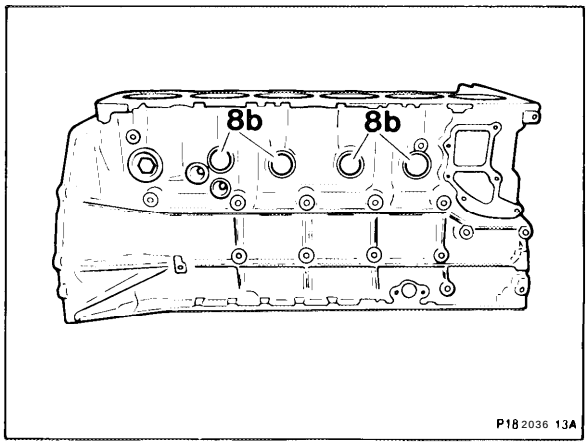
8 Thoroughly clean oil duct, screw in front plug with gasket and rear plug with sealant 002 989 94 71, tightening torque 50 Nm.

01-140 Replacement of freeze plugs in crankcase

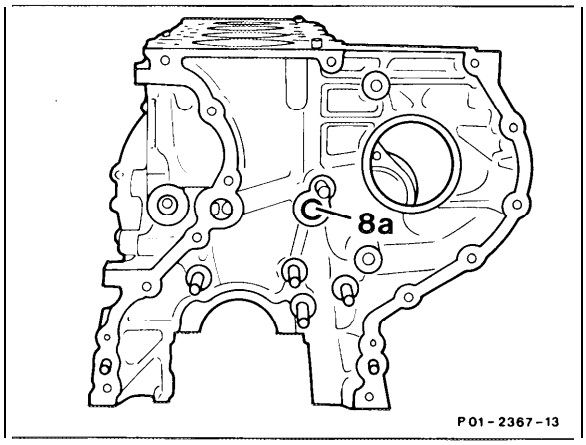
Preliminary operations:
Coolant drained (20-010).
Attachment parts in area of freeze plug removed.



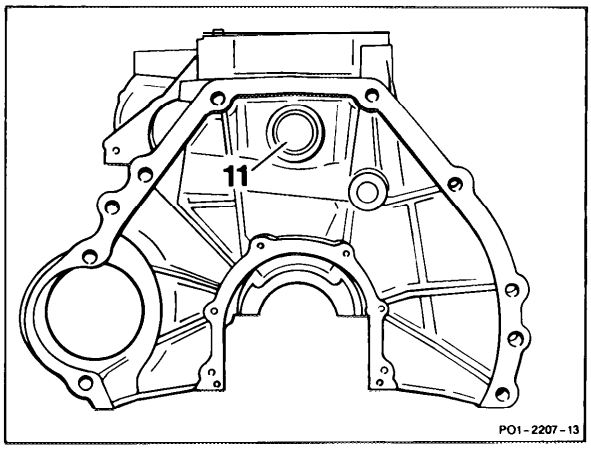
Freeze plug, left, 34 mm dia. (8)



Freeze plug, right, 34 mm dia. (8b)



Freeze plug, front, 17 mm dia. (8a)



Freeze plug, rear, 34 mm dia. (11)

Freeze plugs (8, 8a, 8b, 11) . . . . . remove, knock in. Installation punch
102 589 12 15 00, 17 mm dia. or punch
102 589 00 15 00, 34 mm dia. (items 1 – 6).

Note
Seal freeze plugs with sealant
002 989 94 71. Allow sealant to harden
for approx. 45 minutes.

After reassembling engine ..... allow engine to warm up and check for leakage at newly installed freeze plug .

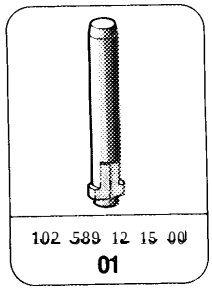
Note
The number of freeze plugs differs on the individual engine models. The figure shows engine model 603 as an example.

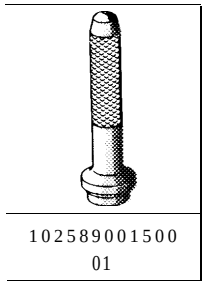
Engine	left, 34 mm dia.	right, 34 mm dia.	front, 17 mm dia.	rear, 34 mm dia.
602	3	3	1	1
603	3	4	1	1

Sealant

Loctite 241	002 989 94 71

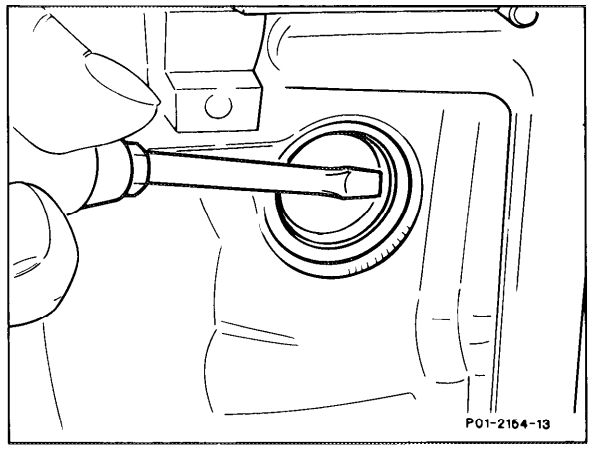
Special tools





Removal

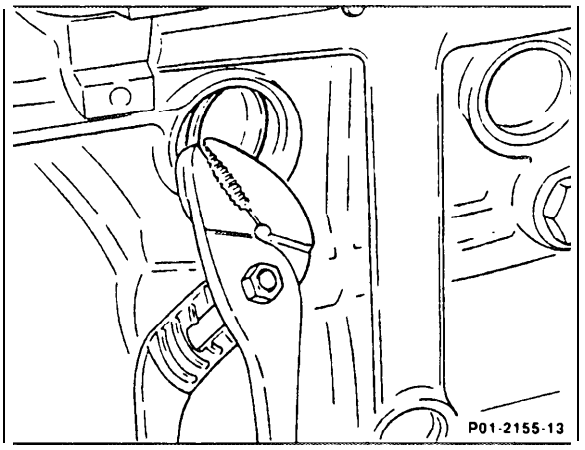
1 Position chisel with small blade or screw-driver in deep-drawn edge of freeze plug.



2 Carefully knock in freeze plug at one side until it rotates around its own longitudinal axis and can be gripped with a pair of pliers.

3 Pull out freeze plug.

4 Clean sealing surface; surface must be free of grease.

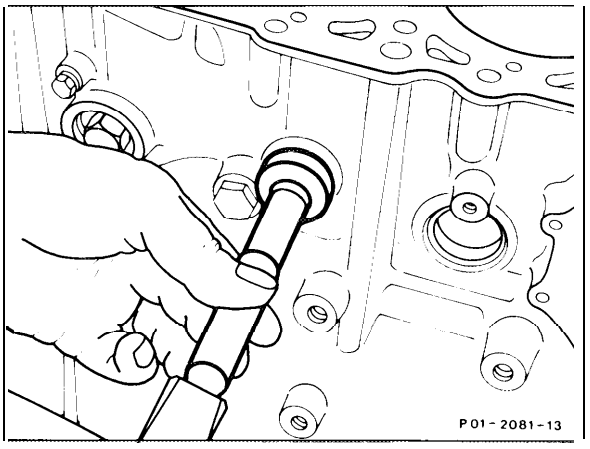


Installation

5 Coat sealing surface with sealant 002 989 94 71.

6 Knock in new freeze plug with install-ation punch 102 589 12 15 00 (17 mm dia.) or 102 589 00 15 00 (34 mm dia.).

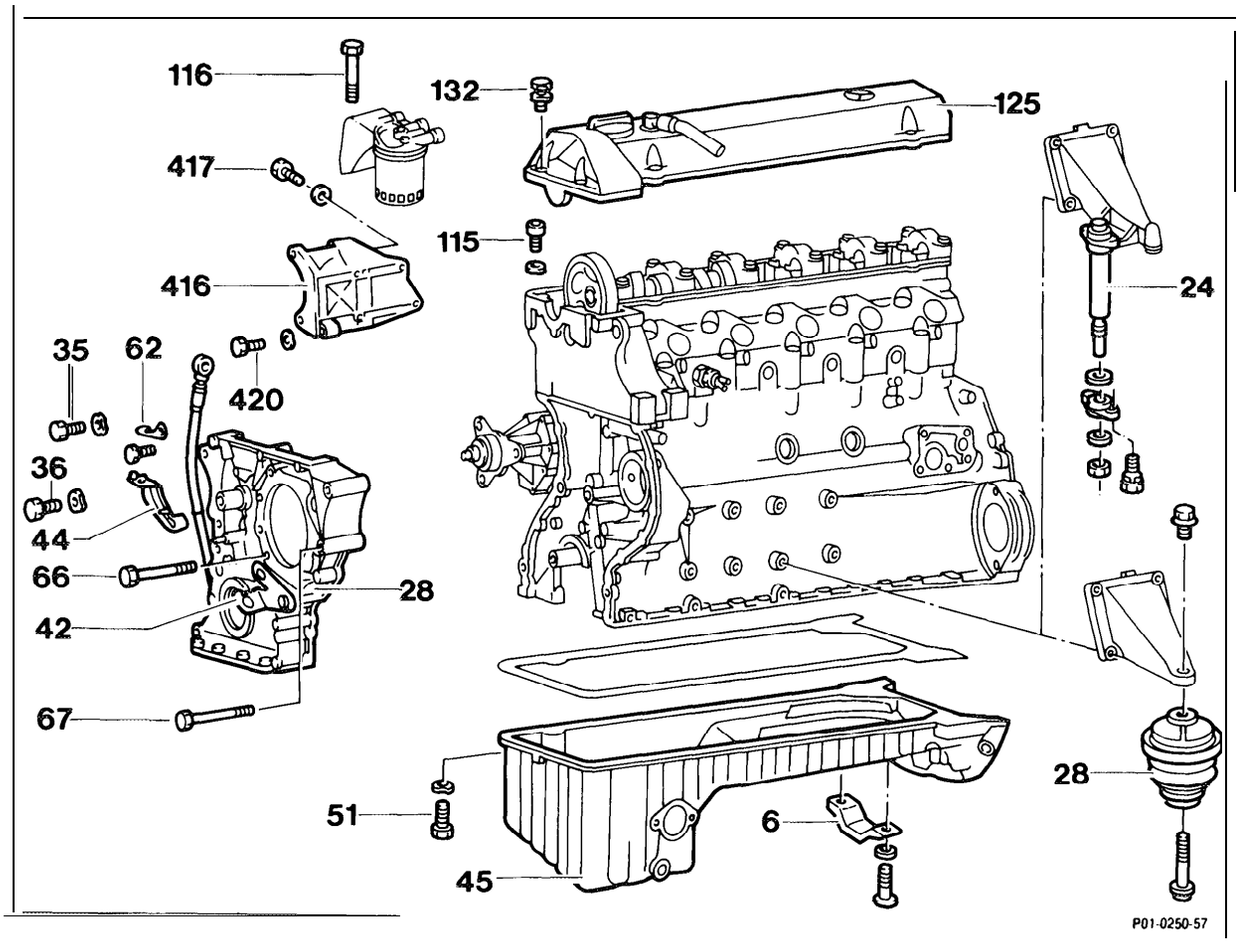
Caution!
Allow sealant to harden for approx. 45 minutes before filling coolant.



7 After reassembling engine, allow engine to warm up and check for leakage at new freeze plug installed.

01-210 Removal and installation of timing cover

Preliminary operations:
Engine compartment capsule, bottom section removed (01-006).
Radiator removed (20-420).
Magnetic or viscodrive fan clutch removed (20-335, 20-312).
Crankshaft pulley and hub removed (03-341).
Poly-V-belt tensioning device removed (13-345).
Piston vacuum pump removed (43-618).
Power steering pump or tandem pump removed (46-710).
Hydraulic pump on cylinder head removed (05437).
Alternator removed (15-510).
Engine oil drained.



Air conditioning:

Condenser .....

Caution!
Attach guard plate.

Cylinder head cover (125) .....

remove if not yet removed, install, 10 Nm (item 1).

Note
On turbo-engines the charge air pipe must be removed before removing the cylinder head cover.

Front hex. head bolt (116)	for fuel filter, remove, reinstall, 25 Nm (item 2).
Holder (62)	for oil dipstick tube, remove, reinstall, 25 Nm (item 3).
Hex. head bolts (417)	on mount (416) for alternator, remove, reinstall and remove mount, install, 45 or 25 Nm (item 4).
Holder for TDC sensor (42 or 44)	mark position and unbolt, reinstall (item 5).
	Note Check TDC sensor adjustment, readjust if required **(03-345).**
Model 201 (up to 03/85):	
Mount (6) for engine stop	remove, reinstall, 25 Nm (item 6).
Model 201 (up to 03/85):	
Engine shock absorber (24), left	remove, install, 10 Nm (item 7).
	Note Check engine stop, adjust, 130 Nm (22-220), adjustment gauge 201 589 04 23 00.
Model 126:	
Engine shock absorbers (24), left and right	remove, install, 10 Nm (item 8).
Front suspension eye on engine	hook in engine hoist (item 9).
Engine mounts (28), front, left and right	remove Allen bolts at bottom, reinstall, 40 and 70 Nm (item 10).

Engine	lower back on engine mounts with engine hoist (item 14).
Hex. head bolts (66, 67)	for mounting injection pump, remove, reinstall, 25 Nm (item 15).
Allen bolts (1 15)	in timing chain housing, remove, reinstall, 25 Nm (item 16).
Hex. head bolts (35, 36)	in timing case cover, remove, reinstall, 25 Nm (item 17).
Timing case cover (28)	remove, install (item 17).

Caution!
When removing timing case cover pay attention to cylinder head gasket and oil pan gasket. Avoid damaging. Replace damaged cylinder head gasket.

Note
Clean parting surface on timing case cover, seal cover with sealant 001 989 95 20.

Check crankshaft radial seal in timing case cover, remove if required, install, sleeve 601 589 03 14 00 (item 17).

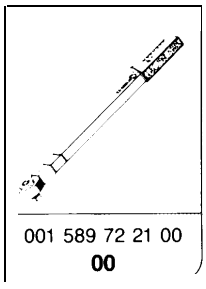
After installation	warm up engine and check for leakage (item 19).

Sealant

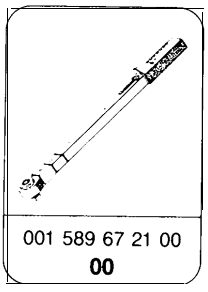
Hvlomar	001 989 25 20

Tightening torques		Nm
Allen bolts, mount, engine stop, front		10
Adjustment screw, engine stop, front		130
Allen bolt, engine mount, front		40
Allen bolt, engine mount, front, model 126		70
Hex. head bolts, cylinder head cover		10
Cylinder head bolts in timing chain case		25
Hex. head bolts, mount, alternator		45
Hex. head bolts, oil pan	M6	10
	M8	25
Hex. head bolts for mounting injection pump		25
Hex. head bolts for mounting timing case cover		25
Hex. head bolts for engine shock absorber mount		10
Hex. nuts, engine shock absorber		10

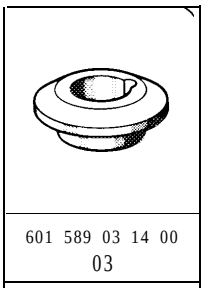
Special tools



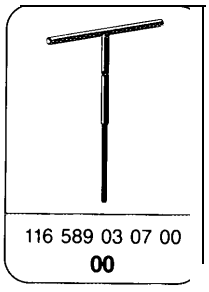
001 589 72 21 00
00



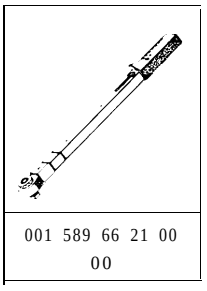
001 589 67 21 00
00



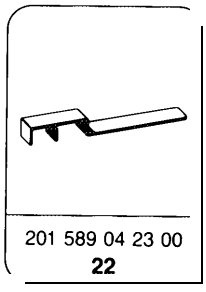
601 589 03 14 00
03



116 589 03 07 00
00



001 589 66 21 00
00



201 589 04 23 00
22

Commercially available tools

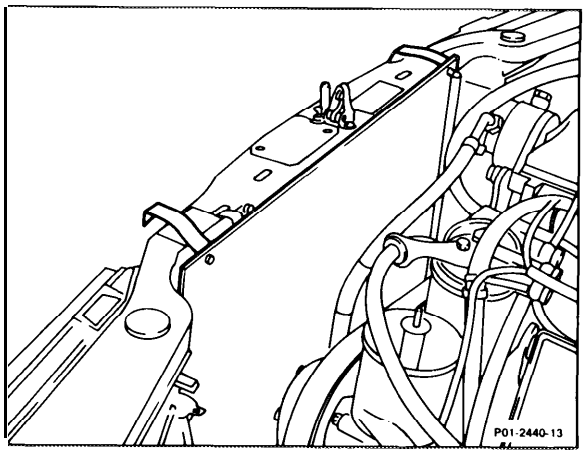
Connection 3/4" square ratchet to 1/2" square head	e.g.	Hazet, D-5630 Remscheid Order no. 1058 R. 1
Engine hoist no. 3188 (self-braking)	e.g.	Backer, D-5630 Remscheid, Herderstraße
7 mm socket on flexible shaft for hose clamps with worm drive	e.g.	Hazet, D-5630 Remscheid Order no. 426-7

Self-made tool

Guard plate for air conditioner condenser	Dimensions: approx. 480 x 600 x 1

Removal, installation

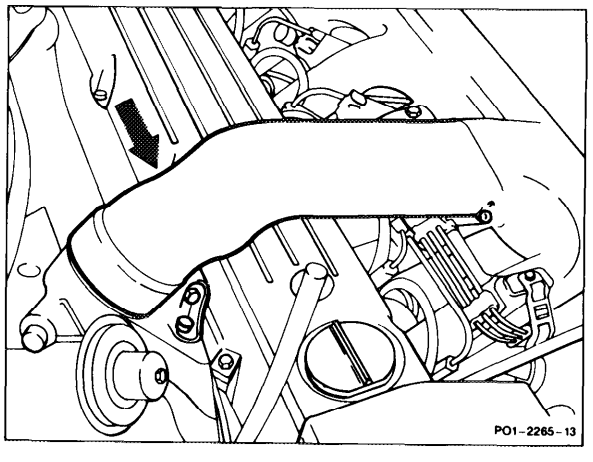
Caution!
On vehicles with air conditioning attach guard plate to condenser before starting work.



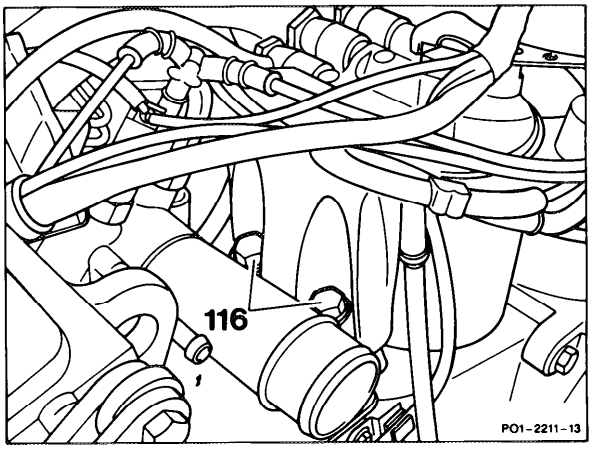
1 Remove cylinder head cover, if not already removed.

Installation note
Tightening torque 10 Nm.

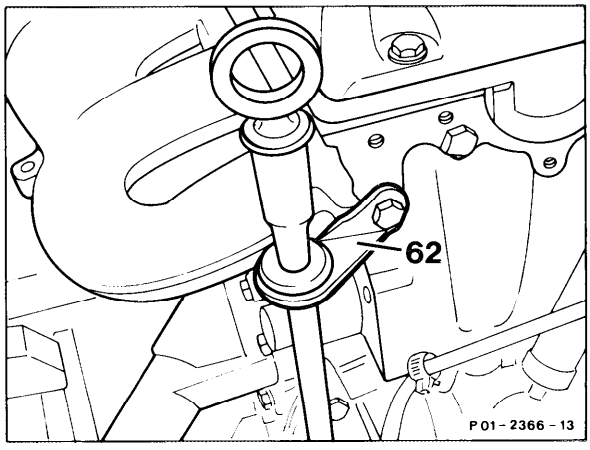
Note
On turbo-engines the charge air pipe (arrow) must be removed before removing the cylinder head cover.



2 Remove hex. head bolts (116) at front of fuel filter.



3 Unbolt holder (62) for oil dipstick tube, 25 Nm.

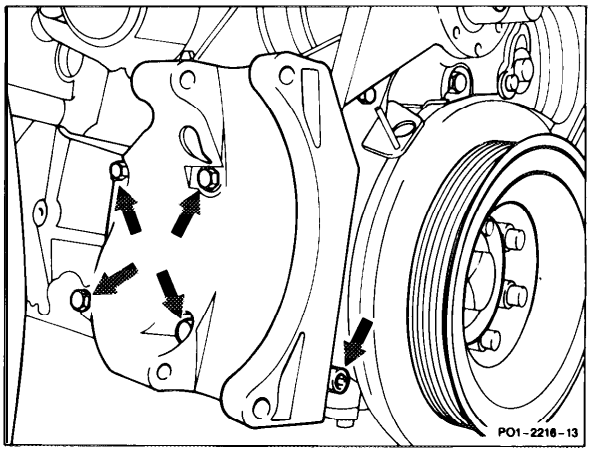


4 Remove hex. head bolts (arrows) on mount for alternator and remove mount.

Installation note

Tightening torques

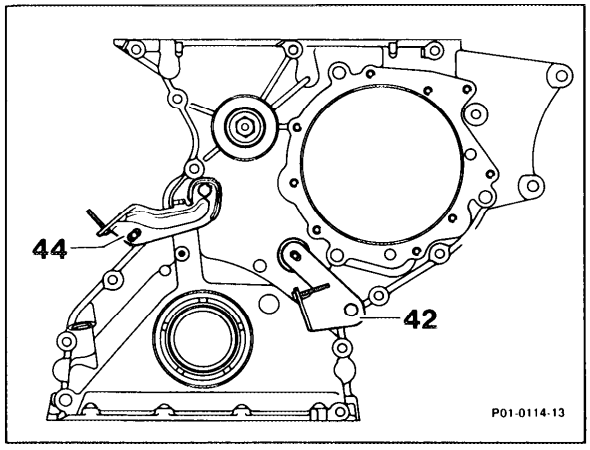
Mounting bolts for mount	45 Nm
Mounting bolt on timing case cover	25 Nm.



5 Mark position of mount for TDC sensor (42 or 44) and unbolt mount.

Installation note

Check TDC sensor and adjust if required (03-345).



Model 201 (up to 03/85):

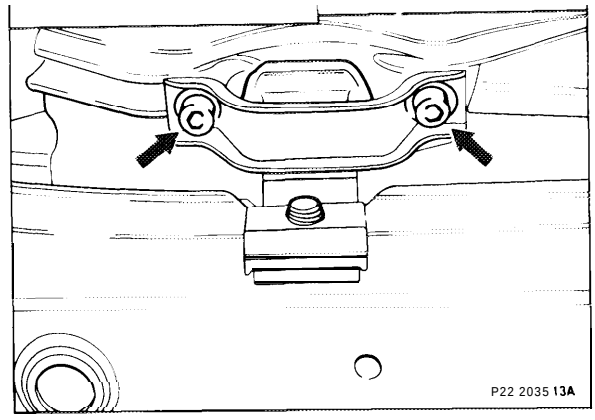
6 Remove Allen bolts (arrows) on mount for engine stop at front and remove mount.

Installation note

Tightening torque 25 Nm.

Check engine stop with adjustment gauge 201 589 04 23 00 and adjust (22-220).

Tightening torque for adjustment bolt 130 Nm.

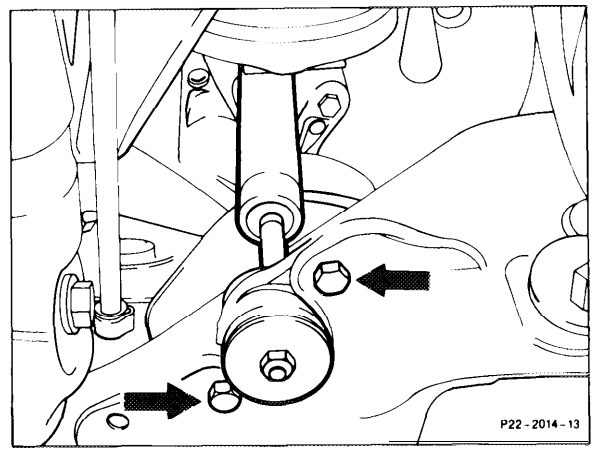


Model 201 (up to 03/85):

7 Remove engine shock absorber on left; remove hex. head bolts (arrows) on mount and remove engine shock absorber from frame cross member.

Installation note

Tightening torque 10 Nm.

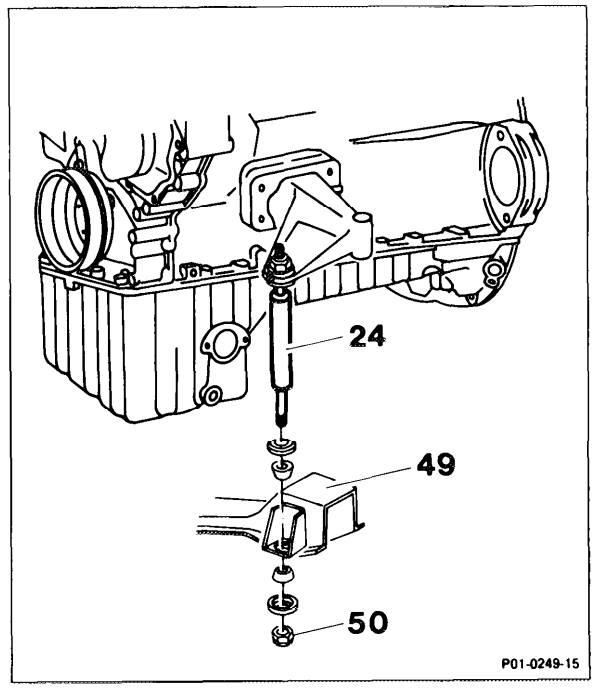


Model 126:

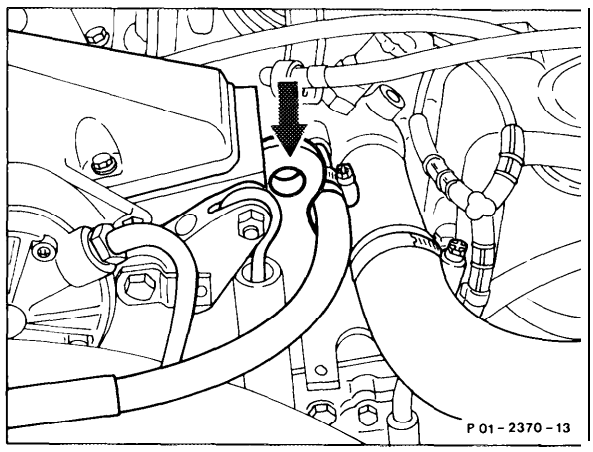
8 Remove engine shock absorbers (24) on left and right; unscrew hex. nuts (50) and press shock absorber upward out of mount on frame cross member (49).

Installation note

Tightening torque 10 Nm.



9 Attach engine hoist cable to front suspension eye (arrow).

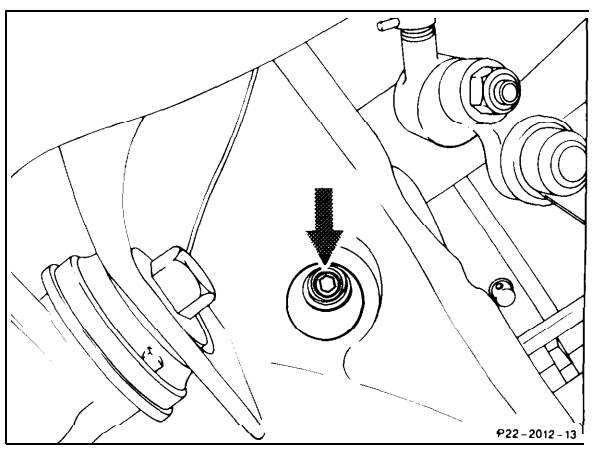


10 Remove Allen bolts for front engine mount from frame cross member from bottom.

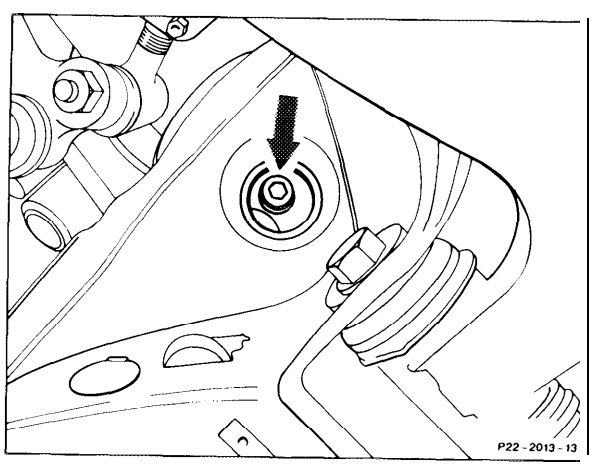
Installation note

Tightening torque

Model 124 and 201	40 Nm
Model 126	70 Nm



Allen bolt, engine mount, left



Allen bolt, engine mount, right

12 Hoist engine with engine hoist until hex. head bolts in oil pan are accessible in area of timing case cover.

13 Remove hex. head bolts in oil pan in area of timing case cover and loosen remaining bolts.

Installation note

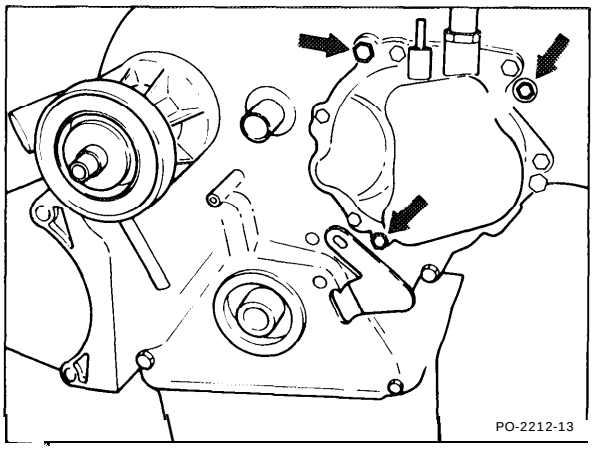
Tightening torque M6 10 Nm,
M8 25 Nm.

14 Lower engine back onto front engine mounts.

15 Remove hex. head bolts (arrows) for mounting injection pump. Remove square nuts on injection pump flange.

Installation note

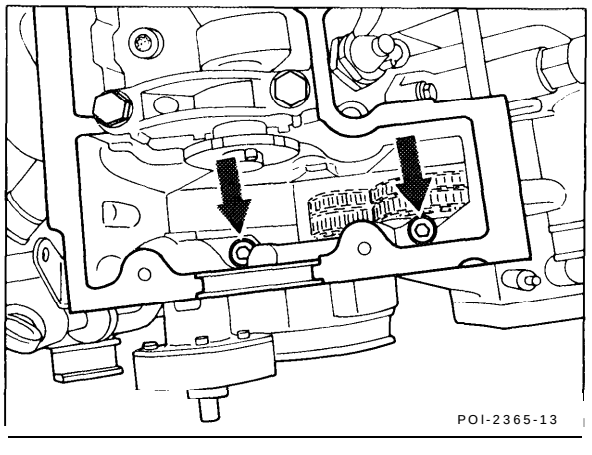
Tightening torque 25 Nm.



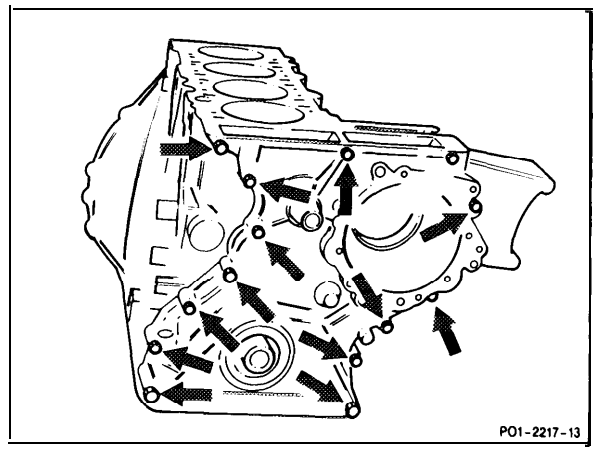
16 Remove Allen bolts (arrows) in timing chain case.

Installation note

Tightening torque 25 Nm.

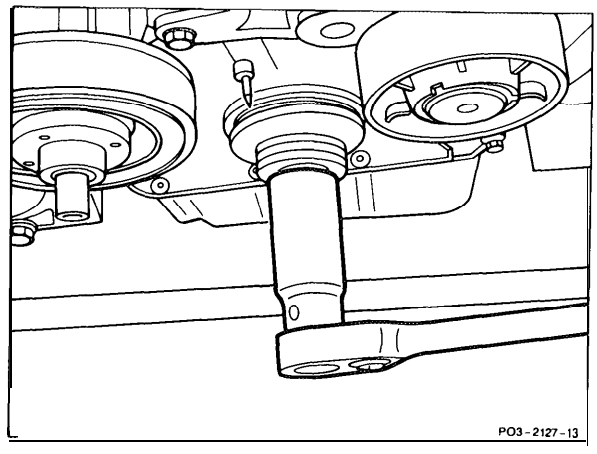


17 Remove all remaining hex. head bolts (arrows) in timing case cover and remove timing case cover.



Caution!
When removing timing case cover be careful of cylinder head gasket and oil pan gasket. Avoid damaging. Replace damaged gaskets.

Installation note
Clean gasket residues off of parting surface on timing case cover.
Check crankshaft radial seal in timing case cover and replace, if required, installation sleeve 601 589 03 14 00.
Coat parting surface of timing case cover with sealant 001 989 25 20. Tightening torque 25 Nm.

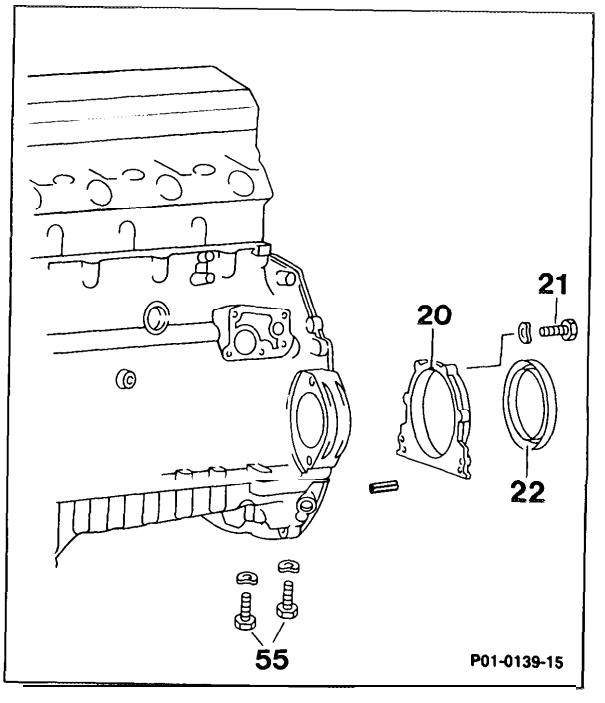


18 Assemble in opposite order.

19 After installation warm up engine and check timing case cover for leakage.

01-222 Removal and installation of end cover

Preliminary operations:
Flywheel removed (03-410).



Hex. head bolts (55)	in oil pan, remove, reinstall, 25 Nm (item 1).
Hex. head bolts (21)	Hex. head bolts (21) in end cover (20), remove, reinstall, 10 Nm (item 2).

Note
Coat threads of hex. head bolts with sealant 002 989 20 10.

End cover (20) ..... press out together with crankshaft radial seal (22), press in, installation sleeve 601 589 03 43 00 (item 3).

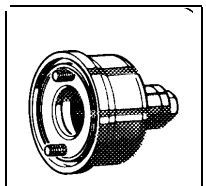
Note
Avoid damaging oil pan gasket.

Note
Clean gasket residues off of parting surface on end cover and coat parting surface of cap with sealant 002 989 00 20 10. Check crankshaft radial seal and remove if required, install, installation sleeve 601 589 03 43 00.

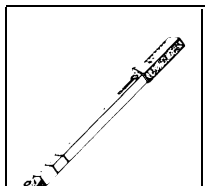
Sealant	
Omnifit	002 989 00 20 10

Tightening torques	Nm
Hex. head bolts, end cover	10
Hex. head bolts, oil pan	25

Special tools



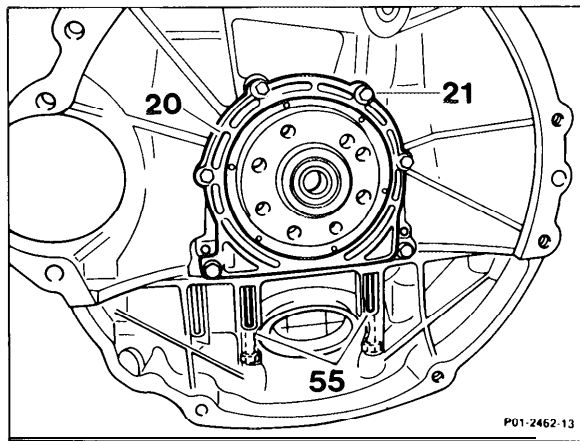
601 589 03 43 00
03



001 589 72 21 00
00

Removal, installation

1 Remove the two hex. head bolts (55) in the oil pan.

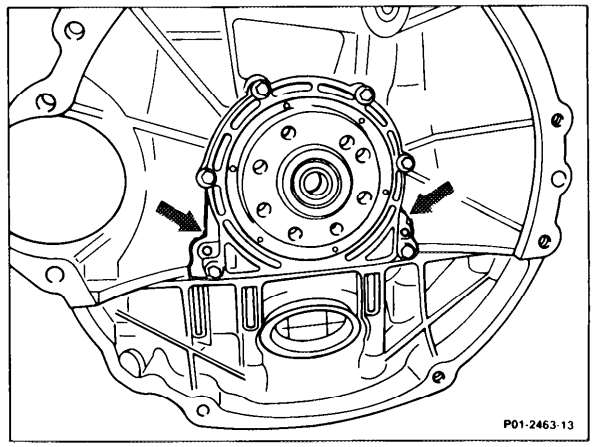


Installation note
Tightening torque 25 Nm.

2 Remove hex. head bolts (21) in end cover (20).

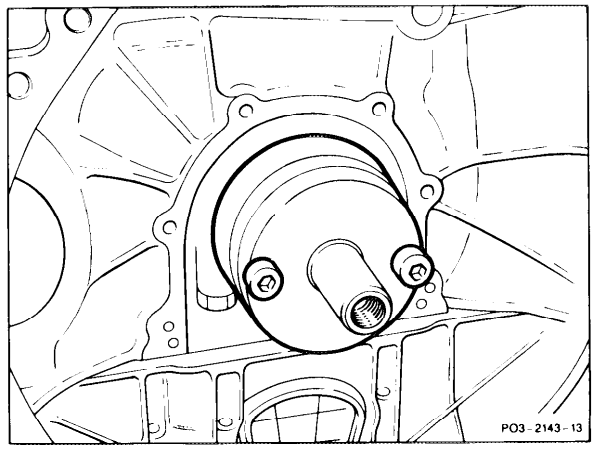
Installation note
Coat threads on hex. head bolts with sealant 002 989 00 20 10.
Tightening torque 10 Nm.

3 Press end cover off of crankcase at tabs (arrows) and remove crankshaft radial seal from crankshaft journal.



Note
When pressing the end cover on and off avoid damagingthe oil pan gasket. .

Installation note
Clean gasket residues off of parting surface on end cover. Check crankshaft radial seal and replace if required. Coat parting surface on end cover with sealant 002 989 00 20 10 and slide end cover together with radial seal over attached installation sleeve 601 589 03 43 00.

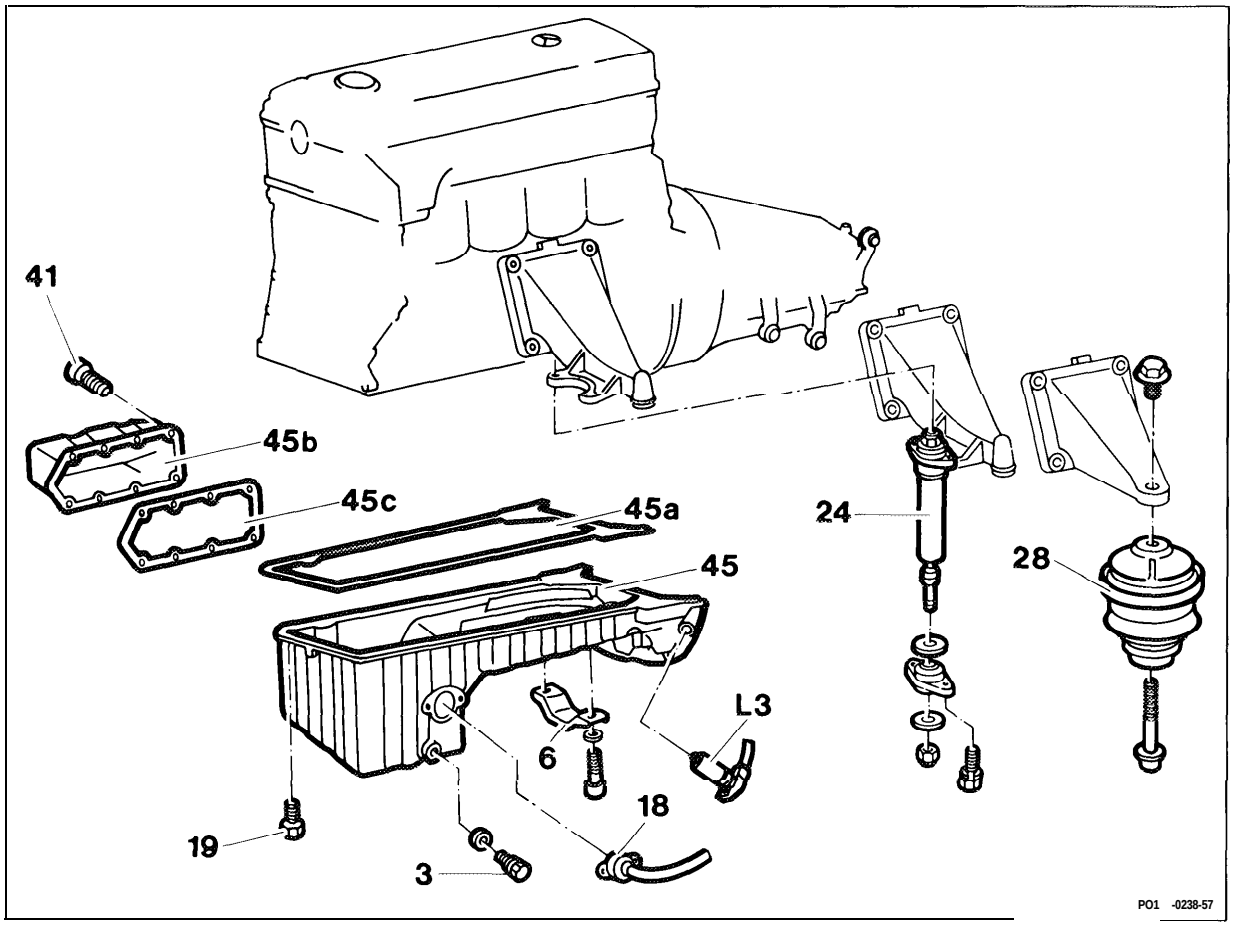


EXIT

01-310 Removal and installation of oil pan

A. Model 124, 126 and 201

Preliminary operations:
Bottom section of engine compartment noise capsule removed (01-006).
Model 124 and 201:
Torsion bar on front axle removed .
Models 124, 201 .126 and 201 .128:
Steer. rod, left and steer. shock absorber, right rem..
Fan cowl loosened.



Battery	disconnect negative cable, reconnect (item 1) .
Engineoil	drain, fill (item 2).

Note
Tightening torque for oil drain plug (3) 25 or 30 Nm. Observe specified oil capacity.

Model 201 (up to 03/85):

Mount, engine stop (6)	remove, install, 25 Nm (item 3). **Note** Check engine stop, adjust, 130 Nm (22-220), adjustment gauge 201 589 04 23 00.

Model 201 (up to 03/85):

Engine shock absorber (24), left	remove, install, 10 Nm (item 4).

Model 126:

Engine shock absorbers (24), left and right	remove, install, 10 Nm (item 5).
Engine speed sensor (L3) and ground strap	remove, reinstall (item 6).
Oil level sensor (18)	disconnect plug, reconnect (item 7).

Automatic transmission

Oil lines	between transmission and oil cooler or transmission air/oil cooler, unbolt at oil pan, install and remove at radiator, reinstall (item 8). **Note** Plug oil lines before removal, clamp 000 589 40 37 00.

Oil pan with attached side sections:

Oil pan side section (45b)	remove, install (item 9). **Note** Replace gasket (45c) for oil pan side section. Tightening torque for hex. head bolts (41) 10 Nm.
Front suspension eye on engine	hook in engine hoist, unhook (item 10).
Front engine mounts (28), left and right	remove Allen bolts from bottom, reinstall, 40 and 70 Nm (item 11).
Engine	hoist with engine hoist, lower back on engine mounts (item 12).
Hex. head bolts (19)	remove from oil pan (45), reinstall (item 13). M6 bolts 10 Nm, M8 bolts 25 Nm. **Note** Observe different lengths of hex. head bolts.

Oil pan (45) . . . . . remove from crankcase together with oil pan gasket (45a), install (item 14).

Note

Remove oil pan toward front of vehicle while turning crankshaft slightly if required. Clean gasket residues from parting surface of oil pan. Replace oil pan gasket (45a).

After installation . . . . . warm up engine and check for leakage (item 16).

Oil capacities with oil dipstick code

(see "Service Product Specifications" for approved engine oils)

Engine	Model	Oil quantity for oil and filter change in liters	Color code Round handle	Color code Handle with bottle opener shape	Number code on handle (color red)
602.91	201	6,5 7 [2])	– –	– green[2])	60214[1]) –
602.96	124, 201	7	–	green[3])	–
603.96	124	7,5	–	black	–
603.97	126	7,5	–	–	60316

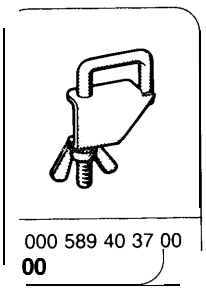
[1]) 1 st version color code "red"
2nd version color code "black"
3rd version color code "brown"

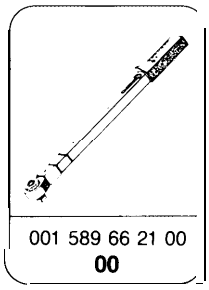
[2]) Only for engines with exhaust gas recirculation and side section on oil pan

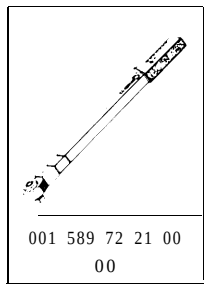
[3]) 1st version color code "black"

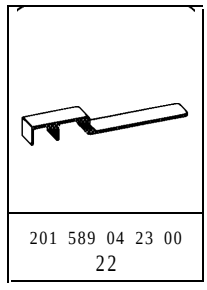
Tightening torques		Nm
Oil drain plug on oil pan	M 12×1,5×13	30
	M 14×1,5×22	25
Allen bolts, mount, engine stop, front		10
Adjustment bolt, engine stop, front		130
Hex. nuts, engine shock absorber		10
t-tex. head bolts, engine shock absorber mount		10
Hex. head bolts, oil pan side section		10
Hex. head bolts, oil pan	M 6	10
	M 8	25
Allen bolt, engine mount, front		40
Allen bolt, engine mount, front, model 126		70

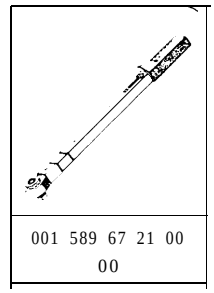
Special tools











Commercially available tool

Engine hoist no. 3188 (self-braking)	e.g.	Backer D-5630 Remscheid Herderstraße

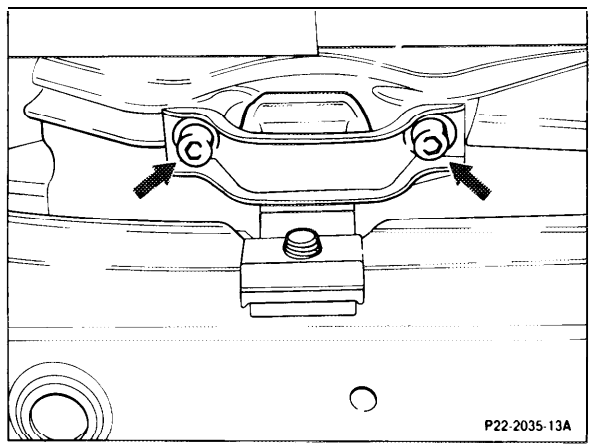
Removal, installation

1 Disconnect negative cable from battery.

2 Drain engine oil.

Installation note
Tightening torque for oil drain plug
M 12×1.5×13 30 Nm
M 14×1.5×22 25 Nm.
Observe specified oil capacity when filling engine.

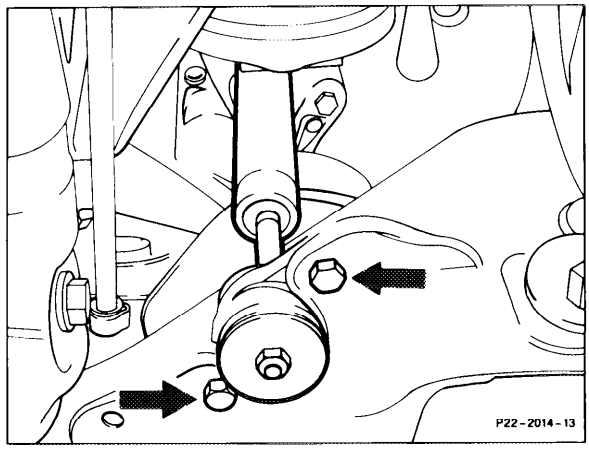
Model 201 (up to 03/85):
3 Remove Allen bolts (arrows) on mount for front engine stop and remove mount.



Installation note
Tightening torque 25 Nm.
Check engine stop with adjustment gauge 201 589 04 23 00 and adjust (22-220).
Tightening torque for adjustment bolt 130 Nm.

Model 201 (up to 03/85):

4 Remove engine shock absorber, left; remove hex. head bolts (arrow) on mount and remove engine shock absorber from frame cross member.

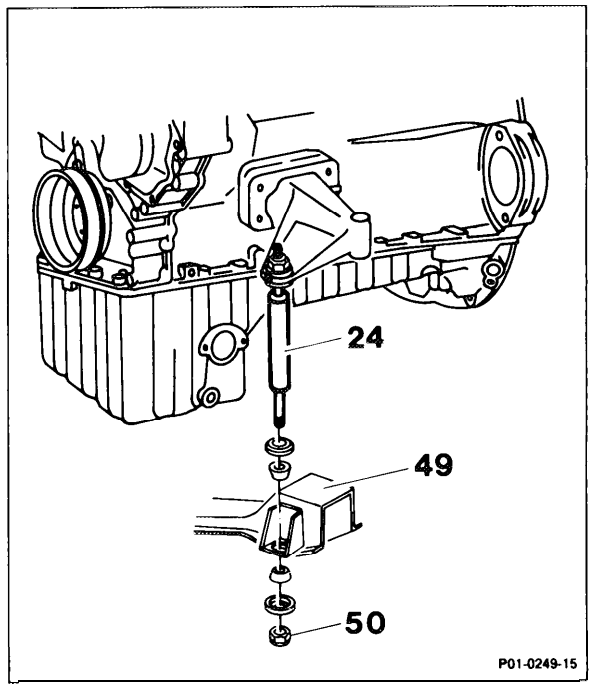


Installation note

Tightening torque 10 Nm.

Model 126:

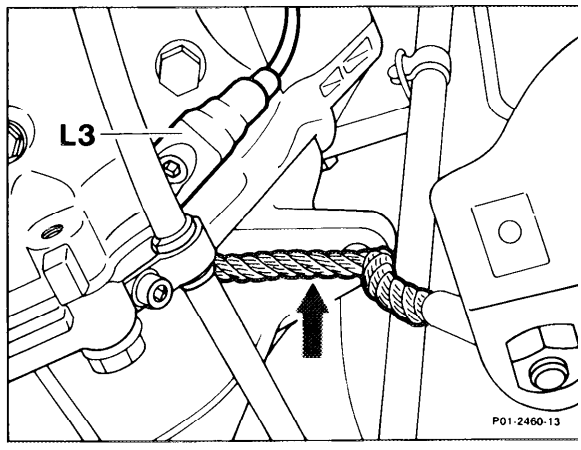
Remove engine shock absorbers (24), left and right; unscrew hex. nut (50) and press shock absorber upward out of mount on frame cross member (49).



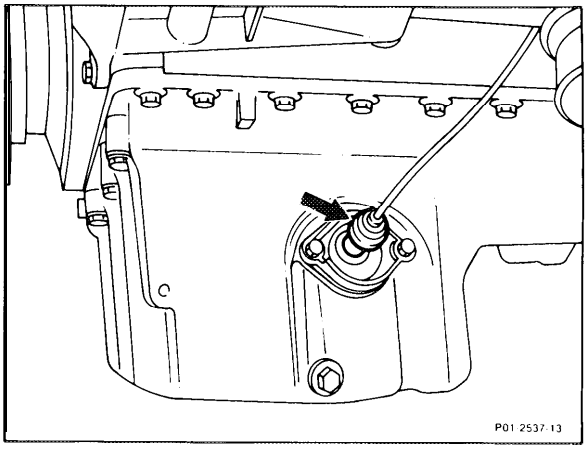
Installation note

Tightening torque 10 Nm.

6 Unbolt engine speed sensor (L3) and ground strap for starter (arrow) on chassis.

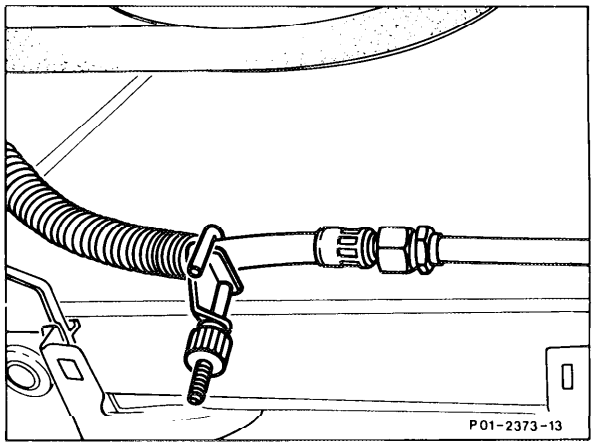


7 Disconnect plug from oil level sensor (arrow).



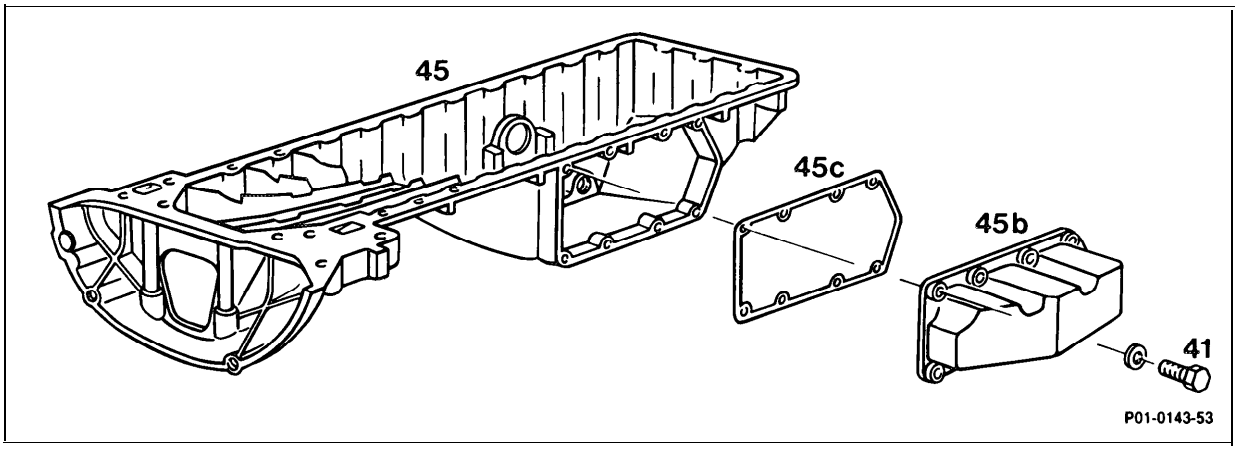
Vehicles with automatic transmission:

8 Clamp oil lines between transmission and oil cooler or transmission air/oil cooler, clamp 000 589 40 37 00, screw oil lines off of oil pan and radiator.



Installation note

Check transmission oil level, add if required.



Oil pan with attached side section:

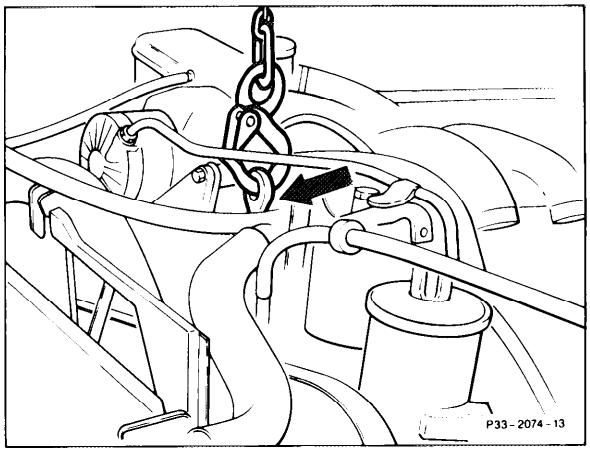
9 Remove hex. head bolts (41) and remove oil pan side section (45b) together with gasket (45c).

Installation note

Replace gasket (45c).

Tightening torque 10 Nm.

10 Attach engine hoist cable to front suspension eye on engine (arrow).

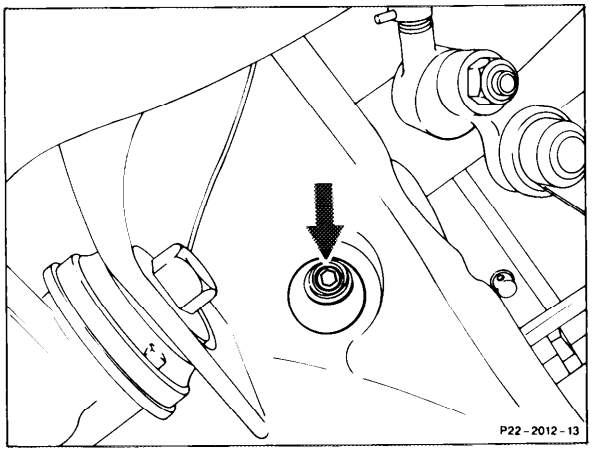


11 Remove Allen bolts for front engine mount from frame cross member from below.

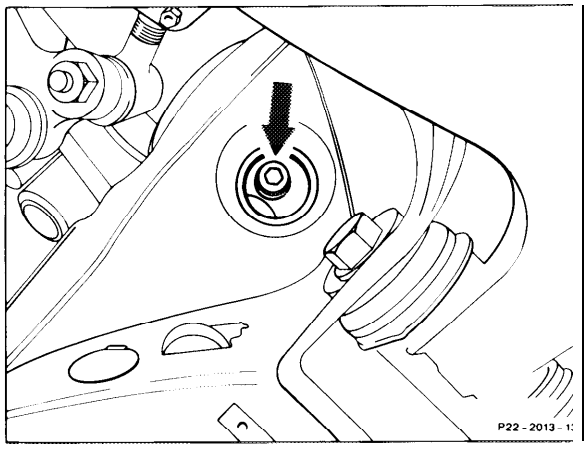
Installation note

Tightening torque

Model 124 and 201	40 Nm
Model 126	70 Nm.



Allen bolt, engine mount, left



Allen bolt, engine mount, right

12 Lift engine at front with engine hoist as far as possible.

13 Remove hex. head bolts (19) of oil pan (45).

Installation note

Observe different lengths of hex. head bolts.

Tightening torque M6 10 Nm,
M 8 25 Nm.

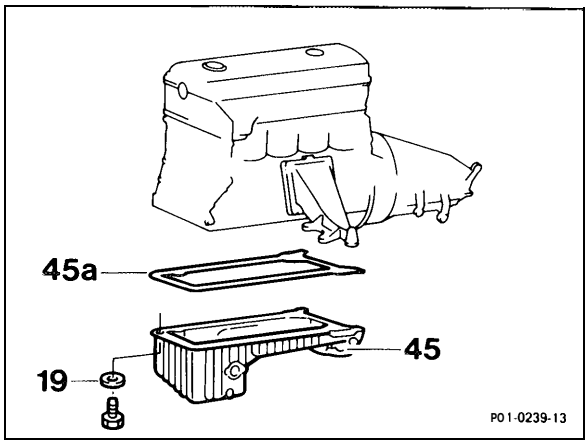
14 Remove oil pan (45) from crankcase together with oil pan gasket (45a); remove oil pan toward front of vehicle, turn crankshaft slightly if required.

Installation note

Clean gasket residues off of parting surface on oil pan. Replace oil pan gasket.

15 Assemble in opposite order.

16 After assembly warm up engine and check oil pan for leakage.



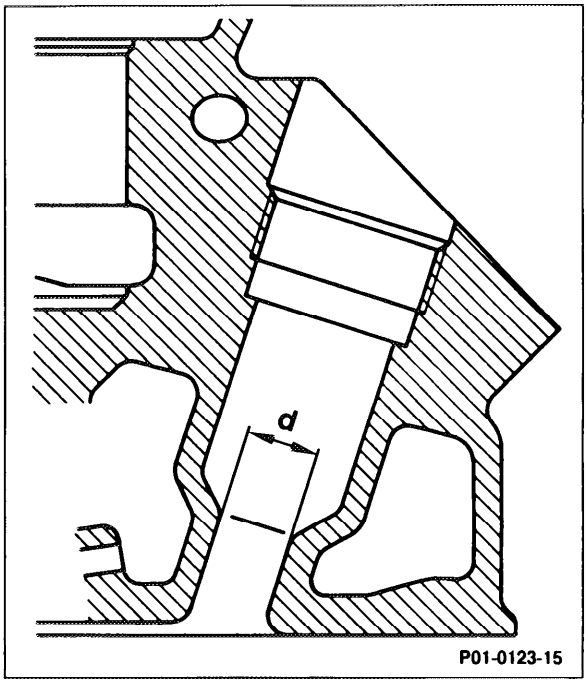
01400 Repair notes for cylinder heads and cylinder head gaskets

A. Engine 602, 603

Differentiation of cylinder heads for naturally aspirated and turbo-engines

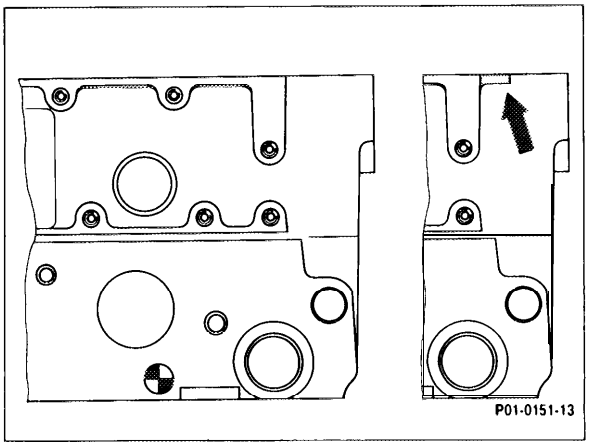
The cylinder heads for turbo-engines 602.96, 603.96 and 603.97 are reinforced at the water jacket due to the higher combustion pressures.

On turbo-engines the diameter (d) of the pre-combustion chamber bore is 15 mm, on naturally aspirated engines 14 mm.



The cylinder heads on turbo-engines are provided with an identification strip. This identification strip (arrow) is located on the parting surface for the cylinder head cover at the front right.

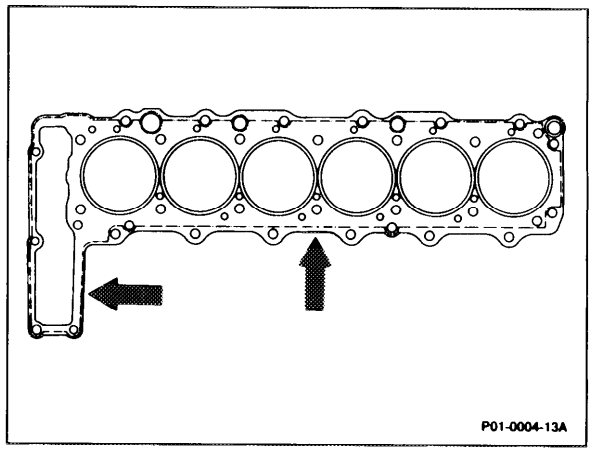
Caution!
Do not mix up cylinder heads for turbo-engines and naturally aspirated engines.



The cylinder head gasket for the turbo-engines has stainless steel inserts around the combustion chambers (arrow).

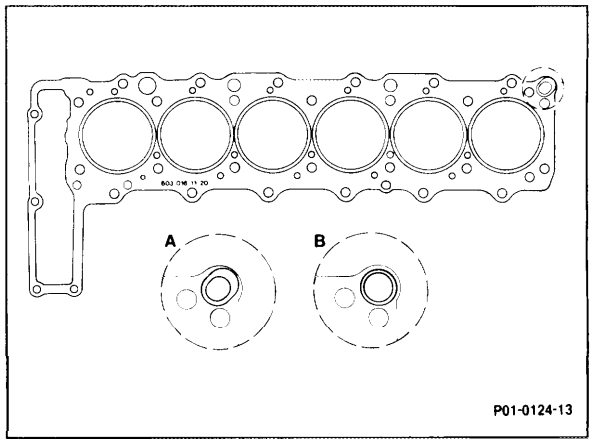
The combustion chamber inserts on the standard gaskets installed on naturally aspirated engines consist of normal sheet steel.

Only the cylinder head gaskets with stainless steel inserts are available as replacement parts for both the naturally aspirated and turbo-engines.



Cylinder head gasket with Viton sealing ring

A Viton sealing ring is inserted at the rear oil return passage to prevent oil leakage.



A 1st version with sheet metal jacket
B 2nd version with Viton sealing ring

Production breakpoint: 03/87

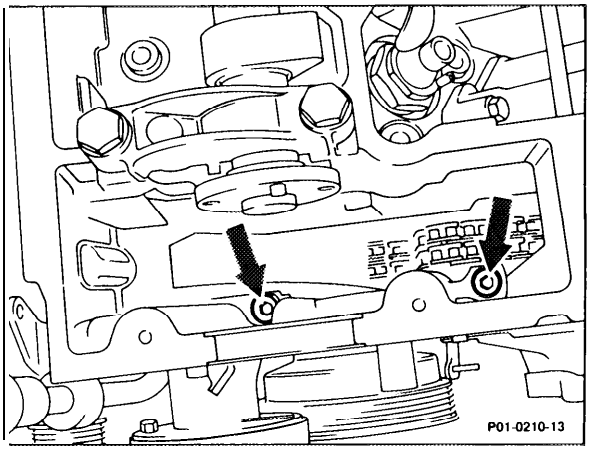
Model	Engine	Engine end no.		Vehicle ident. end no.	
		manual transmission	automatic transmission	A	F
124.133 124.193	603.960	–	011489	*	*
126.125	603.961	–	010966	*	*

* not available

Modifications in area of timing chain case

For production reasons the height of the bridge in the cylinder head in the area of the timing chain case was increased to 32 mm (previously 12 mm).

This modification made it necessary to change the dimensions of the two cylinder head bolts (arrow). The new bolt length is M 8 x 50 (previously M 8 x 30).



Production breakpoint: 09/87

Model	Engine	Engine end no.		Vehicle ident. end no.	
		manual transmission	automatic transmission	A	F
201.126	1602.911	1052292	011264	*	*

* not available

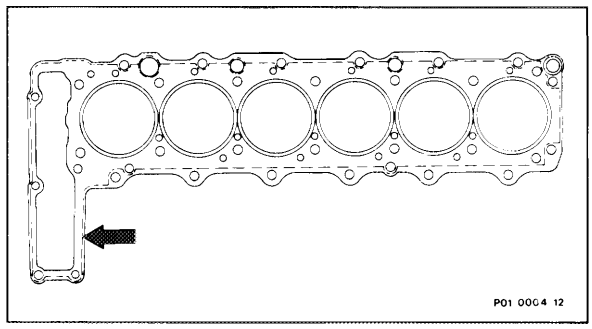
Production change for protection against cracks in water jacket

The bolt flutes on the exhaust side have been reinforced and the recesses (hollows) between the coolant ducts on the outlet side filled to prevent cracks in the cylinder head water jacket.

The baseplate on the intake side was reinforced from previously 11 mm to 14 mm.

Cylinder head gasket for improved sealing

The cylinder head gasket has been equipped with circumferential silicone sealing strips (arrow) on both sides and a Viton sealing ring at the oil return passage at the rear right to better prevent water and oil leakage.



Production breakpoint: 10/88

Model	Engine	Engine end no.		Vehicle ident. end no.	
		manual transmission	automatic transmission	A	F
124.133 124.193	603.960	–	019043	*	*

* not available

Production breakpoint: 05/89

Model	Engine	Engine end no.		Vehicle ident. end no.	
		manual transmission	automatic transmission	A	F
124.128	602.962	–	002254	*	*
201.128	602.961	–	006028	*	*

* not available

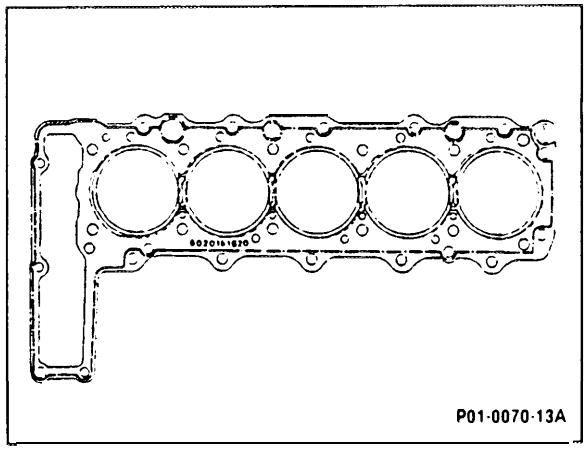
Production breakpoint: 09/89

Model	Engine	Engine end no.		Vehicle ident. end no.	
		manual transmission	automatic transmission	A	F
201.126	602.911	1083460	016487	*	*

* not available

Cylinder head gasket, engines 602, 603 (except for engine 603.970)

The combustion chamber insert (dotted line) has been modified at the 1st cylinder on the cylinder block side.



Production breakpoint: 01/90

Model	Engine	Engine end no.		Vehicle ident. end no.	
		manual transmission	automatic transmission	A	F
124.128	602.962	-	004055	*	*
201.126	602.911	087394	017068	*	*
201.128	602.961	-	007574		

* not avadable

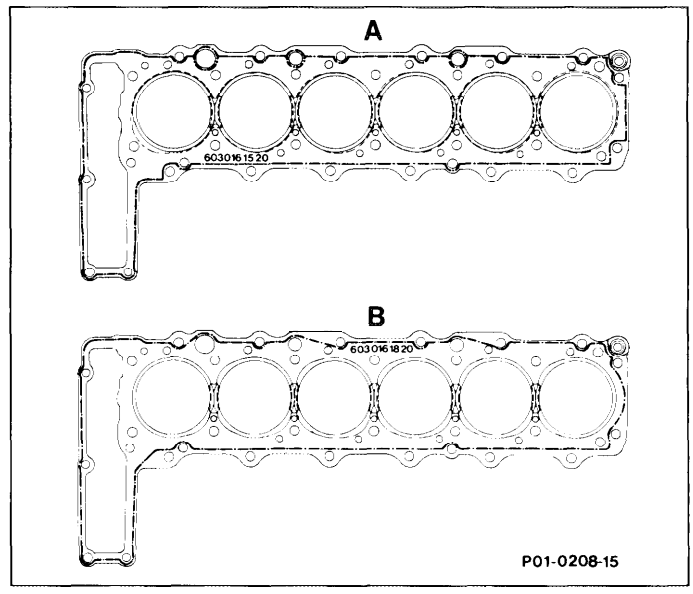
Production breakpoint: 02/90

Model	Engine	Engine end no.		Vehicle ident. end no.	
		manual transmission	automatic transmission	A	F
124.133	603.960	–	025726	*	*
124.193	603.963	-			

* not avadable

Cylinder head gasket, engine 603.970

Combustion chamber insert modified.
Silicone sealing strip position changed on both sides.



A. 1st version (Gotze)
B. 2nd version (Elring)

Production breakpoint: 01/90

Model	Engine	Engine end no.		Vehicle ident. end no.	
		manual transmission	automatic transmission	A	F
126.135	603.970	–	000047	*	*

* not available

Improvement to passage supports in water jacket

The passage supports in the cylinder head water jacket were improved on the turbo-engines.

Production breakpoint: 12/88

Model	Engine	Engine end no.		Vehicle ident. end no.	
		manual transmission	automatic transmission	A	F
124.128	602.962	–	000753	*	*
201.128	602.961	–	004872	*	*

not available

Reinforcements at valve tappet guides and exhaust passages

The reinforcements at the valve tappet guides and exhaust passages have been reinforced. Modified cylinder heads can be recognized by the cast no. on the intake side, see table.

Engine	previous cast no.	new cast no.
602	602 016 03 01	602 016 07 01
602 Turbo	602 016 06 01	602 016 08 01
603 Turbo	603 016 15 01	603 016 17 01

Production breakpoint: 07/89

Model	Engine	Engine end no.		Vehicle ident. end no.	
		manual transmission	automatic transmission	A	F
124.133 124.193	603.960	–	022706	*	*

* not available

Production breakpoint: 09/89

Model	Engine	Engine end no.		Vehicle ident. end no.	
		manual transmission	automatic transmission	A	F
201.126	602.911	083167	016457	*	*

* not available

Combustion chamber recess

The size of the combustion chamber recess (d) was increased to reduce the thermal load in the cylinder head.

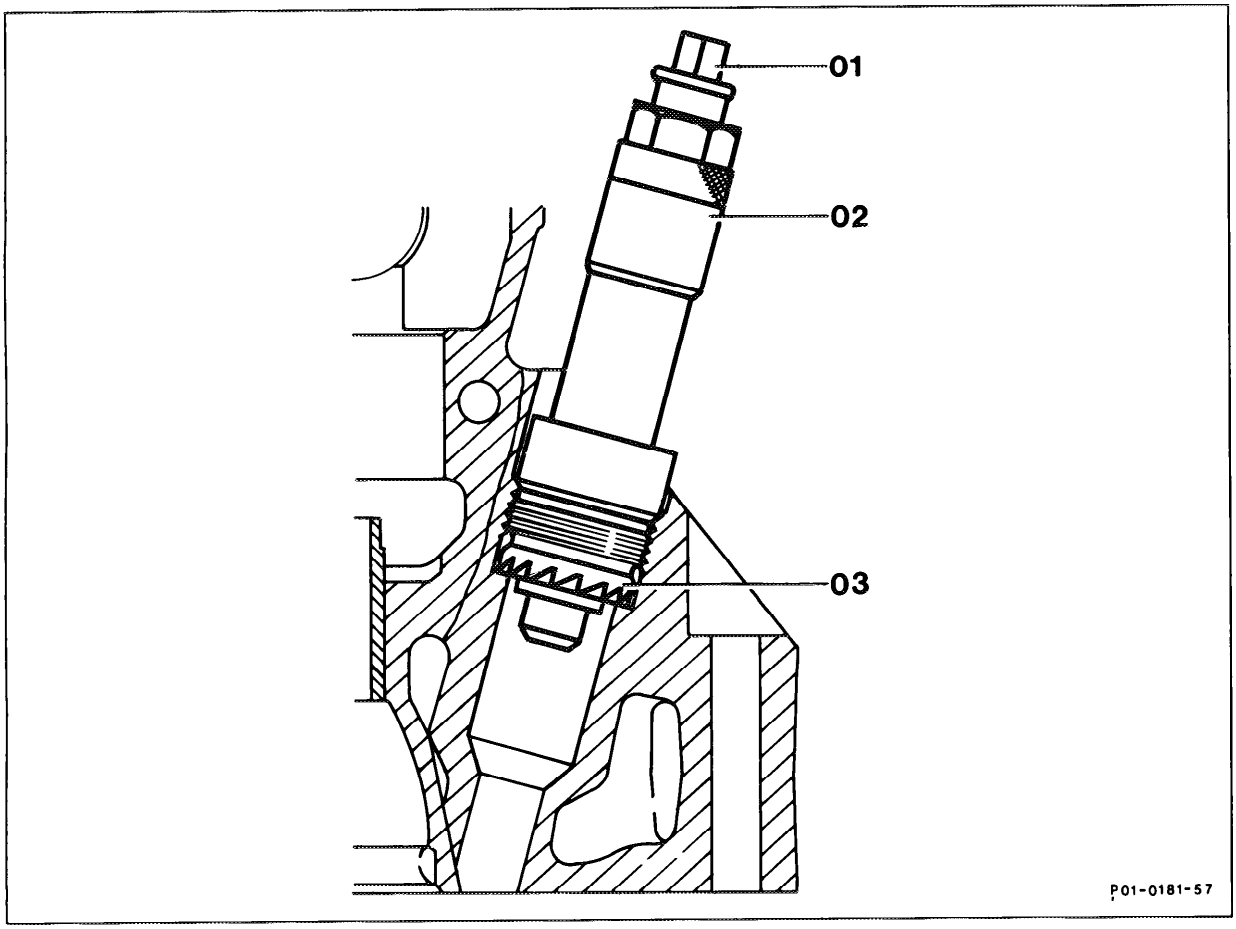
Production breakpoint: 06/88

Model	Engine	Engine end no. manual transmission	Engine end no. automatic transmission	Vehicle ident. end no. A	Vehicle ident. end no. F
126.1	1603.970	from start of production		*	*
201.126	1602.911	(065342	013489	*	*
201.128	602.961	–	003172	*	*

* not available

01410 Refinishing prechamber sealing surface

Preliminary operations:
Nozzle holder removed (01-417).
Prechamber removed (01-417).



Prechamber mounting bores	plug or seal off toward combustion chamber (item 2).
Countersinking tool 601 589 00 66 00 (01, 02, 03)	bolt into precombustion chamber mounting bore to be refinished down to stop (items 3 – 4).
Interval "X"	measure between top of shaft (01) and top of sleeve (02) (item 5). **Note** When the cylinder head is installed, measuring interval "X" replaces measuring the projection dimension "C".

Prechamber sealing surface	refinish, use countersinking tool 601 589 00 66 00 with tap wrench, turn clockwise approx. 5 revolutions while exerting slight pressure (item 6). **Caution!** Do not lift countersinking tool while refinishing.
Interval "X"	measure again (item 7). **Note** The difference between the 1st and 2nd measurements corresponds to the material removed and therefore the thickness of the required spacer ring.
Countersinking tool	unscrew and clean chips out of mounting bore (item 8).
Engine	turn over with starter to throw out any chips which may have got into the combustion chamber (item 9).
Spacer ring	select according to difference in measurements and install (item 10). **Note** **See** table for thicknesses of available spacer rings.
Refinished precombustion chamber	mark with punch in area of mounting bore (item 1 1).

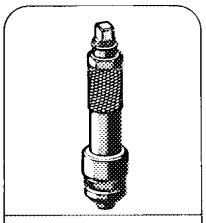
Data

Precombustion chamber projection dimension "C"	7.6 – 8.1 mm

Parts

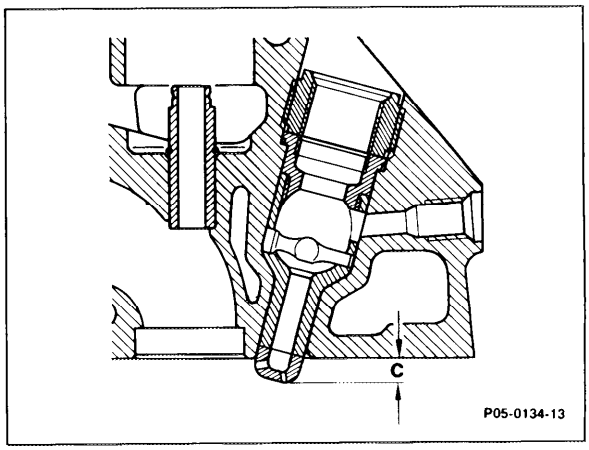
Designation		Part no.
Spacer ring	0.3 mm	601 017 04 60
	0.6 mm	601 017 02 60
	1.0 mm	601 017 03 60

Special tool



601 589 00 66 00
01

Refinishing



Note

Refinish prechamber sealing surface when damaged or leaking. The first refinishing operation on the prechamber sealing surface can be performed with the cylinder head removed or installed. If the sealing surfaces have already been refinished once before, this can be recognized by the markings (punch marks) in the area of the prechamber mounting bores or on the spacers installed. In this case it is necessary to remove the cylinder head to refinish again. The prechamber projection dimension "C" (7.6 – 8.1 mm) can only be measured precisely with the cylinder head removed. Maintenance of this projection dimension ensures that the necessary distance between the prechamber and piston crown is present when the piston is in the TDC position.

Cylinder head removed:

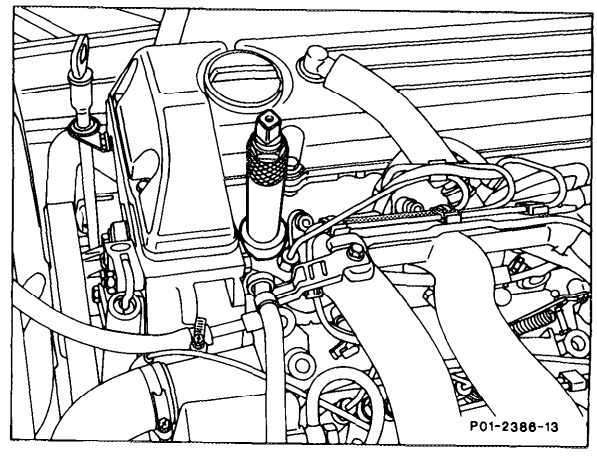
1 When the cylinder head is removed the scope of work for refinishing is the same except for items 5 and 7. Instead of items 5 and 7 measure the projection dimension (c).

Cylinder head installed:

2 Plug or seal off prechamber mounting bores toward combustion chamber (e.g. with rag), so that chips cannot get into the combustion chamber.

3 Remove protective sleeve from countersinking tool 601 589 00 66 00.

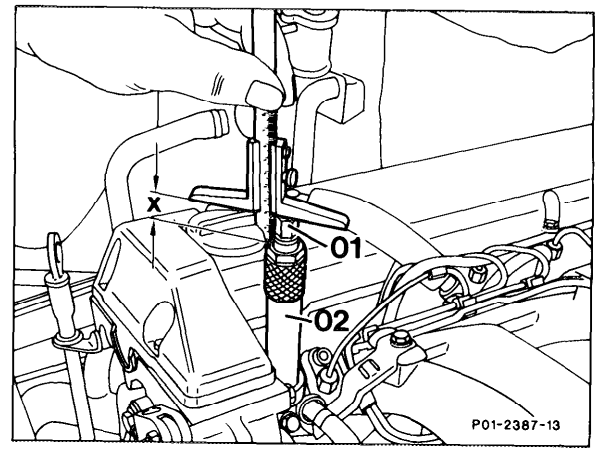
4 Install countersinking tool 601 589 00 66 00 into the prechamber mounting bore to be refinished down to the stop.



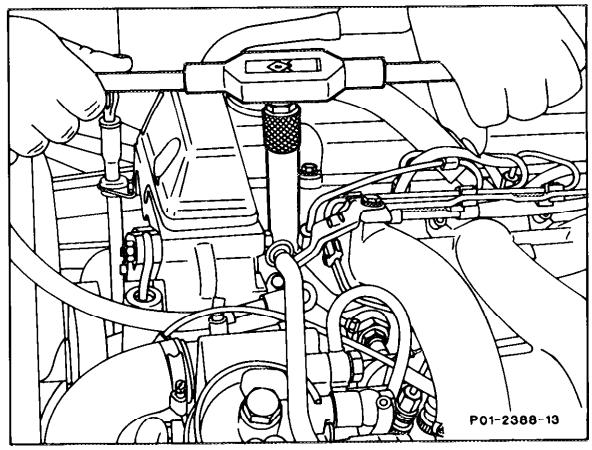
5 Measure interval "X" between top of shaft (01) and top of sleeve (02) and note value.

Note

When the cylinder head is installed, measuring the interval "X" replaces measuring the projection dimension “C”.



6 Attach tap wrench to countersinking tool 601 589 00 66 00 and turn countersinking tool clockwise approx. 5 rotations while exerting light pressure.



Caution!
Do not lift countersinking tool while refinishing.

7 Measure dimension "X" again. The difference between the first and second measurements corresponds to the material removed.

Determine thickness of spacer ring:

Example:

Calculate material removed	
Dimension before refinishing	= 25.7 mm
Dimension after refinishing	= 25.5 mm
Material removed	= 0.2 mm

Note
In this example the thickness of the spacer ring to be installed is 0.3 mm. Select the spacer ring so that it is at least 0.1 mm thicker and max. 0.3 mm thicker than the amount of material removed.

8 Remove countersinking tool 601 589 00 66 00 and remove chips.

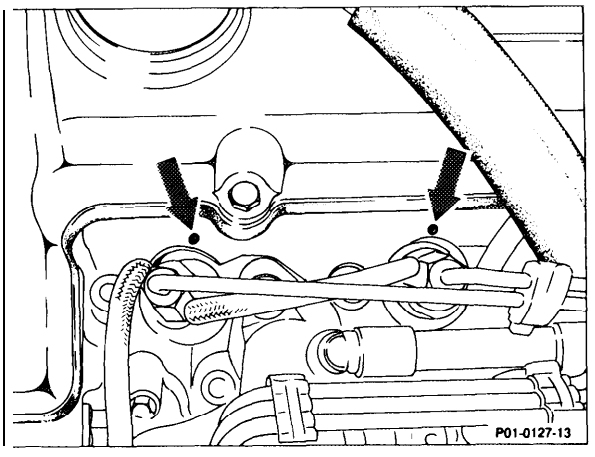
Note
If sealing surface is not completely flat, install countersinking tool again and refinish sealing surface again. Then repeat measurement, items 5 and 7.

9 Remove rag from precombustion chamber bore and turn over engine with starter to throw out any chips which may have got into the combustion chamber.

10 Insert proper spacer ring.

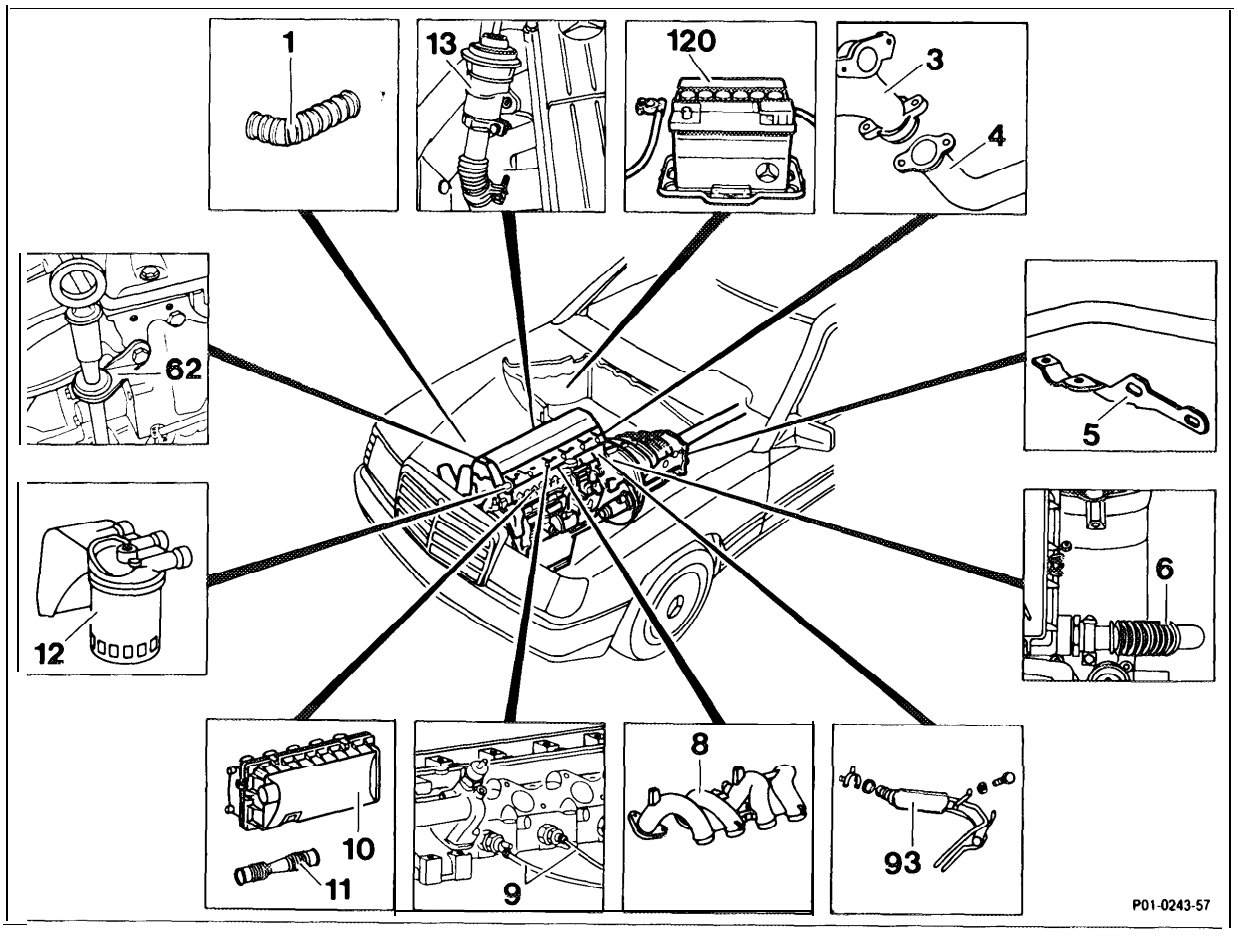
11 Mark cylinder head with punch mark above each prechamber seat refinished (arrows).

12 Install in reverse order.



01415 Removal and installation of cylinder head

Preliminary operations:
Camshaft removed (05220).
Nozzle holders removed (01-417).
Radiator removed (20-420).
Poly-V-belt tensioning device removed (13-345).



⚠Warning
Remove cylinder head only after engine has cooled off.

Battery (120) . . . . . disconnect negative cable, if not already disconnected (item 1).

Naturally aspirated engines:

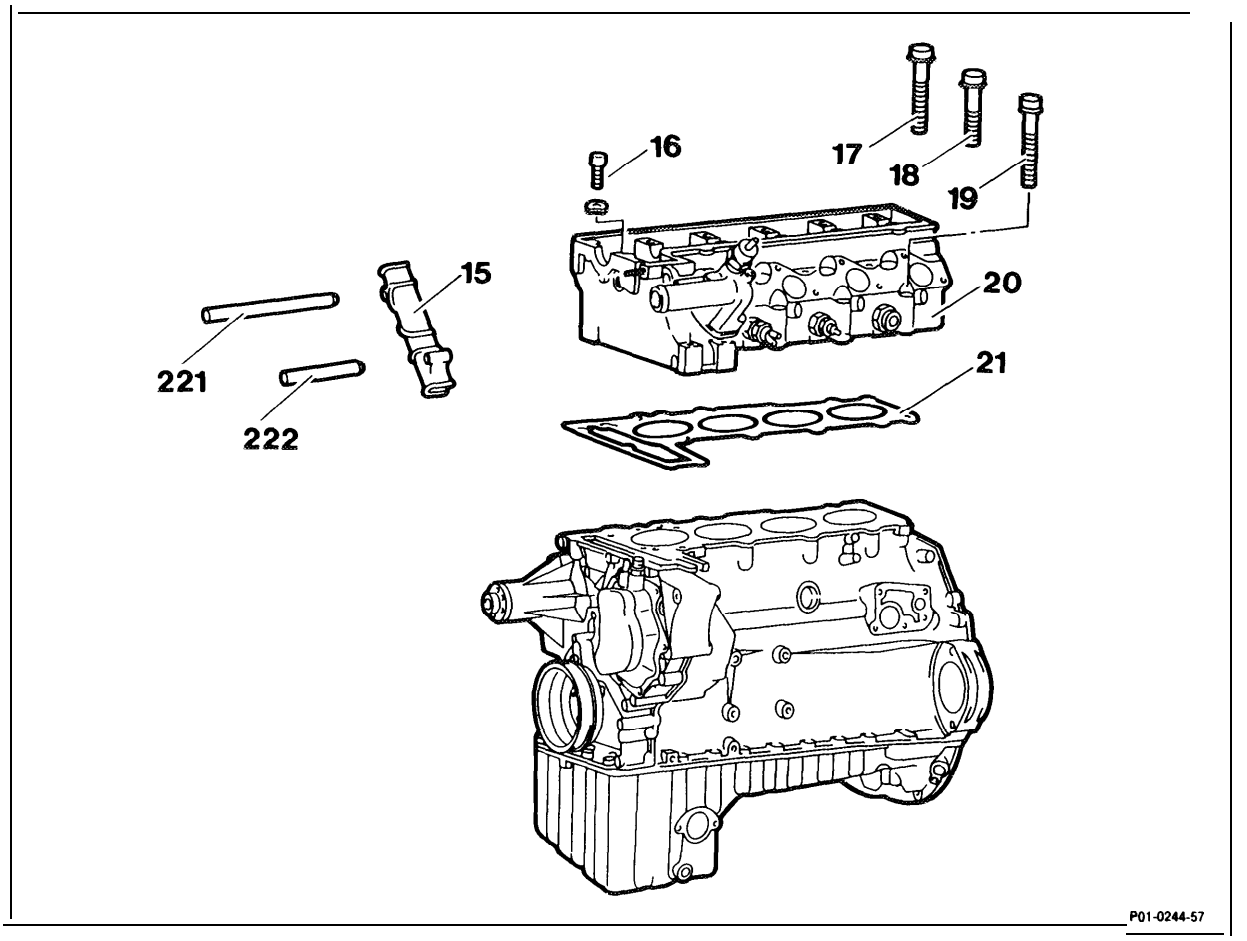
Air intake hose (11) and air cleaner cover (10) . . . . . if not already removed, remove together with filter cartridge, install (item 2).

Turbo-engines:

Intake hose (1) . . . . . to exhaust gas turbocharger, remove, install (item 3).

Fuel filter (12) . . . . . remove, install (items 4, 5, 35, 36).

Holder (62)	for oil dipstick tube, remove, reinstall (items 6, 34).
Engines with exhaust gas recirculation:	
Pipe (6)	between exhaust gas recirculation valve (13) and intake manifold or charging air manifold, remove, install (item 7).
Exhaust gas recirculation valve (13)	remove line to air guide housing, install (items 7, **33).**
Side exhaust support (5)	on transmission, unbolt, bolt on, 25 Nm (items 8, 32).
Exhaust pipe (4)	unbolt from exhaust manifold (3), bolt on, 25 Nm (items 9, 31).
Pipe elbow (7)	for heater feed, remove, install (items 10, 11, 29).
	Note Replace O-ring.
Glow plugs	unbolt connection lines (9), bolt on (items 12, 37).
Intake manifold (8) on naturally aspirated engines or charging air manifold on turbo-engines	remove, install, 25 Nm (14-180).



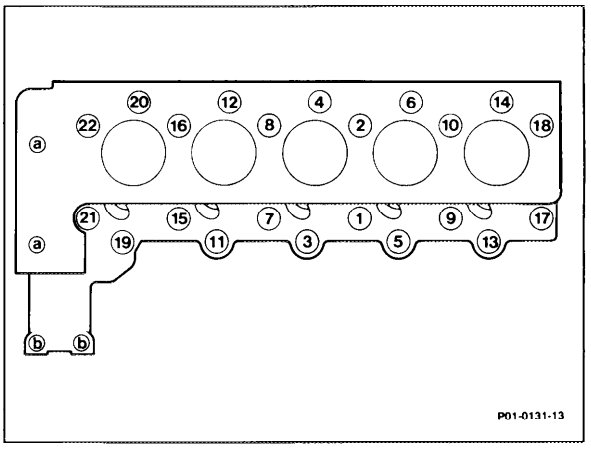
Slide rail bolts (221, 222)	on cylinder head, knock out, knock in, impact puller 116 589 20 33 00, threaded rod 116 589 02 34 00 and threaded insert 123 589 00 34 00 (items 14, 30).
	Note When installing coat collar on slide rail bolts with sealant.
Slide rail (15)	for timing chain, remove from timing chain case, install (items 15, 28).
Allen bolts (16)	in area of timing chain case, unbolt, bolt on, 25 Nm (items 16, 27).

Cylinder head bolts (17, 18, 19)	unbolt in opposite order of torquing diagram, check length of cylinder head bolts and replace if necessary. Bolt on according to torquing diagram, socket 601 589 00 10 00 (items 17, 20, 23 – 28).
	Note Observe different lengths of bolts and tightening specifications.
Cylinder head (20)	remove together with cylinder head gasket (21), install (items 18, 19, 21, 22).
	Note Clean parting surfaces on cylinder head and check for cracks. Install cylinder head with new gasket.
After assembling engine	check cooling and engine oil systems for leakage (item 38).

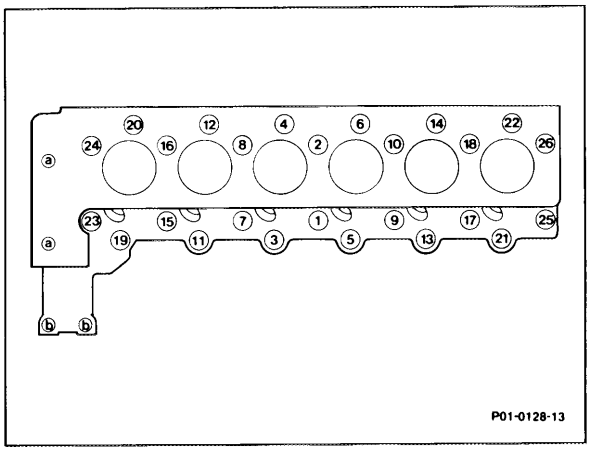
Tightening torques and rotation angles (tightening in stages)			Nm
Cylinder head bolts with 12-point Allen head (engine cold)	Initial tightening torque	Stage 1 Stage 2	15 35
	Rotation angle	Stage 3	90°
	Interval for setting	10 min	
	Rotation angle	Stage 4	90°
M 8 Allen bolts in area of timing chain case (reference value)			25
Exhaust pipe on exhaust manifold			25
Side exhaust support			25

Cylinder head bolt dimensions and maximum permissible lengths (L)

New state	Max. permissible length (L) in mm
M 10x80	83,6
M 10 × 102	1056
M 10 × 115	118,6

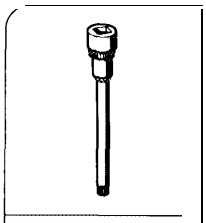


Tightening sequence, engine 602

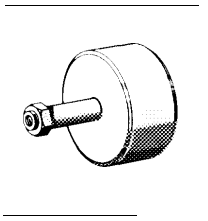


Tightening sequence, engine 603

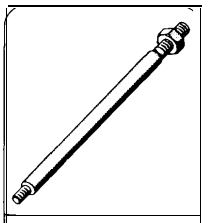
Special tools



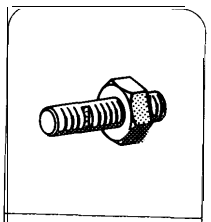
601 589 00 10 00
01



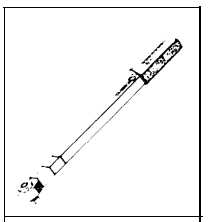
116589203300
05



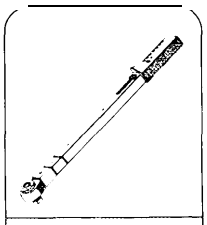
116589023400
05



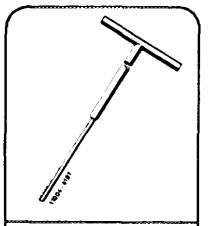
123 589 00 34 00
05



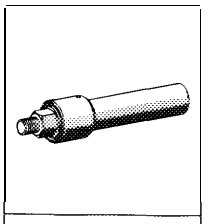
001 589 72 21 00
00



001 589 66 21 00
00



116 589 03 07 00



115 589 20 33 00
05

Commercially available tool

7 mm hex. socket on flexible shaft for hose clamps with worm drive	e.g.	Hazet, D-5630 Remscheid Order no. 426-7

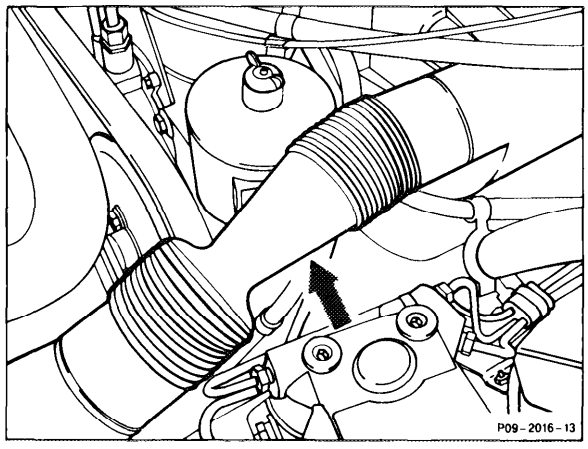
Removal

⚠ Warning
Remove cylinder head only when engine is cool.

1 Disconnect negative cable on battery.

Naturally aspirated engines:

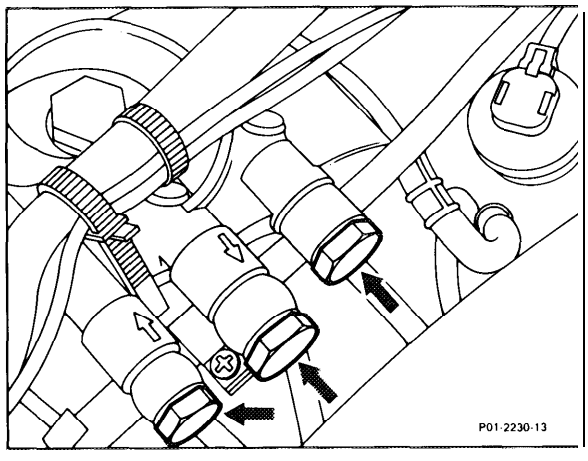
2 Remove air intake hose (arrow) and air cleaner cover together with filter cartridge, if not already removed.



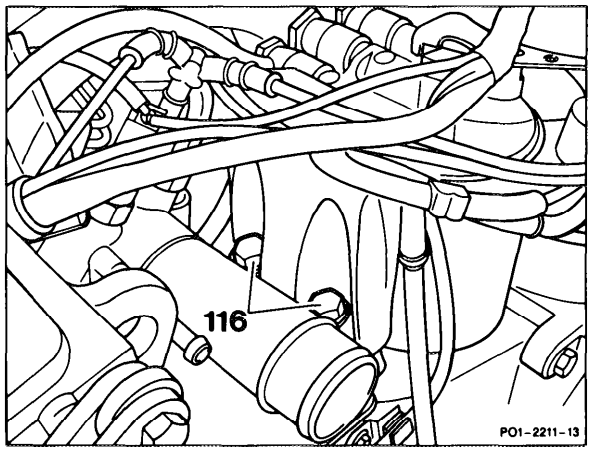
Turbo-engines:

3 Remove intake hose to exhaust gas turbocharger.

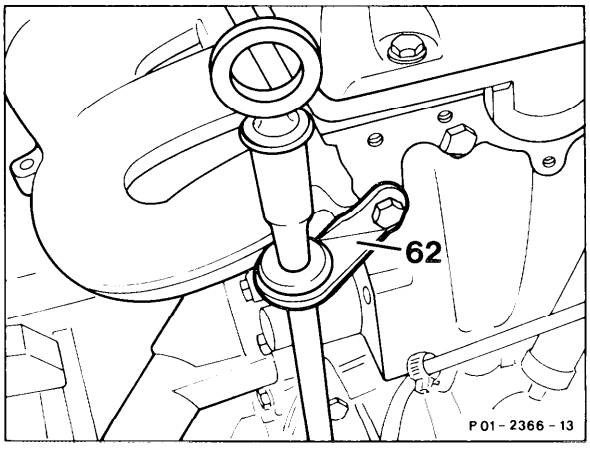
4 Disconnect fuel lines (arrows) from fuel filter and remove lines from fuel filter.



5 Unbolt hex. head bolts (116) from fuel filter and remove fuel filter from cylinder head.

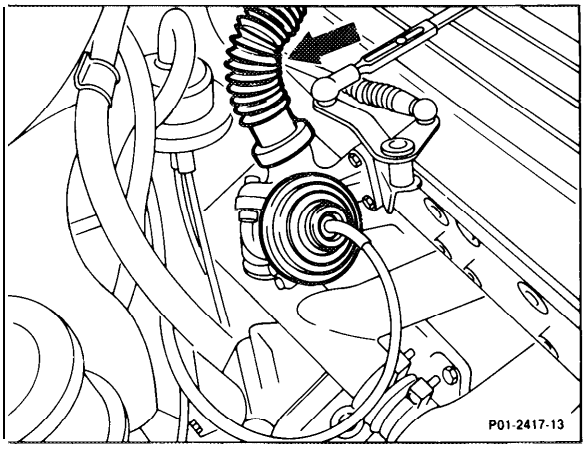


6 Unbolt holder (62) for oil dipstick tube from cylinder head.



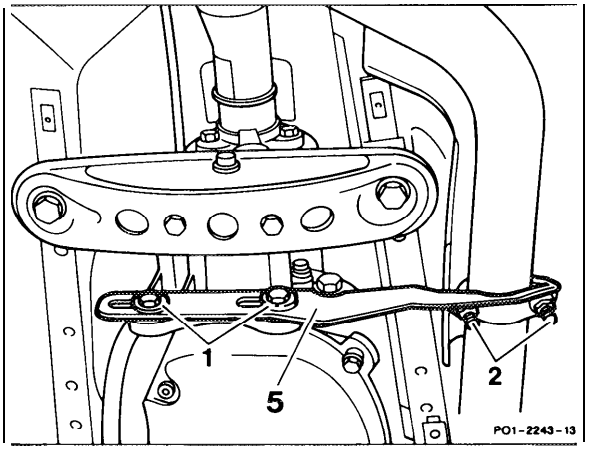
Engines with exhaust gas recirculation (naturally aspirated engines):

7 Remove line (arrow) from exhaust gas recirculation valve to air guide housing.

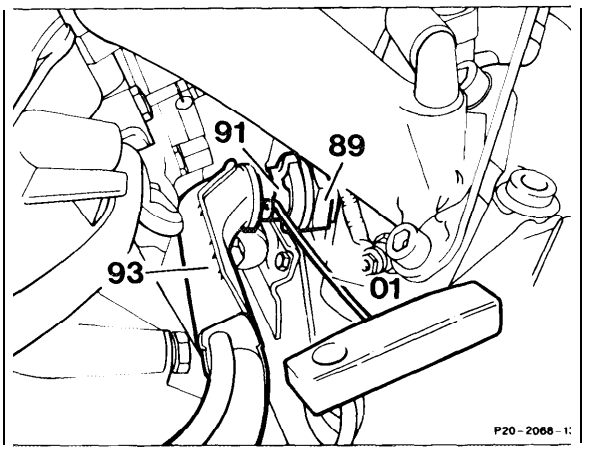


8 Unbolt hex. head bolts (1) for side exhaust support (5) from transmission. Loosen hex. nuts (2) on exhaust pipe.

9 Unbolt exhaust pipe at exhaust manifold.



10 Pull off retainer (91) for heater feed line with hook (01).



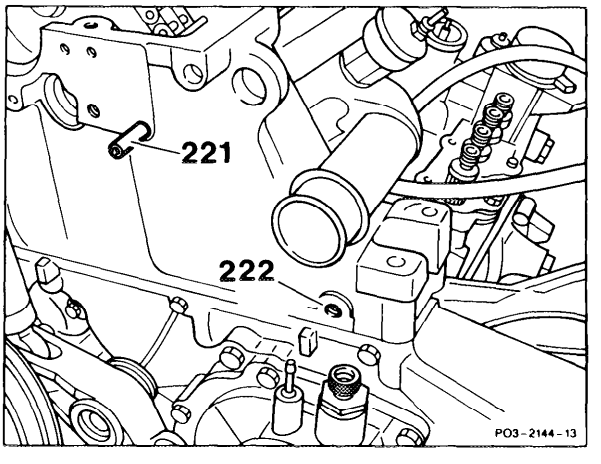
11 Unbolt pipe elbow (93) from oil filter and pull pipe elbow off of connection fitting (89).

12 Unbolt connection lines from glow plugs.

13 Remove intake manifold (naturally aspirated engines) or charge air manifold (turbo-engines) (14-180).

Note
Leave exhaust manifold mounted on cylinder head.

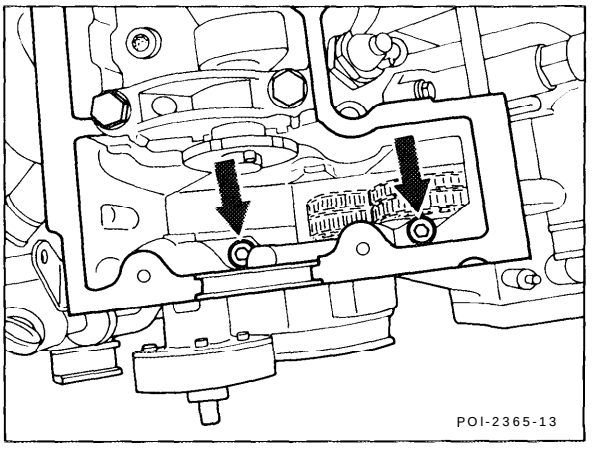
14 Knock slide rail bolts (221, 222) out of cylinder head with impact puller
116 589 20 30 00, threaded rod
116 589 02 34 00 and threaded insert
123 589 00 34 00.



Note
If the slide rail bolts are too tight, puller 115 589 20 33 00 can also be used.

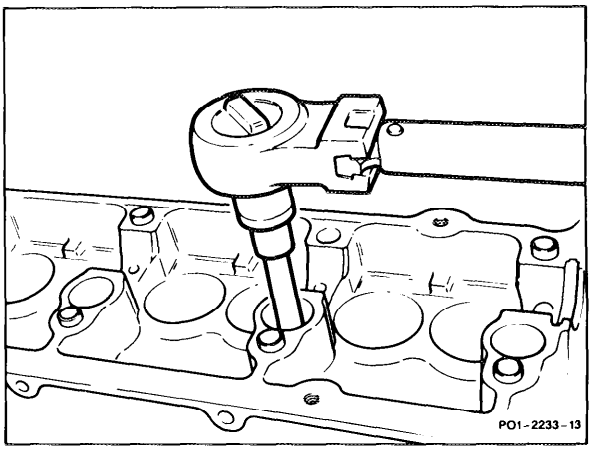
15 Remove slide rail for timing chain from timing chain case.

16 Remove M 8 x 30 Allen bolts (arrows) from the area of timing chain case.



Note
Longer bolts (M 8 x 50) are used in the area of the timing chain case on engine model 602.91 starting 09/87 or 10 87 respectively.

17 Unbolt cylinder head bolts in opposite order of torquing sequence using socket 601 589 00 10 00.

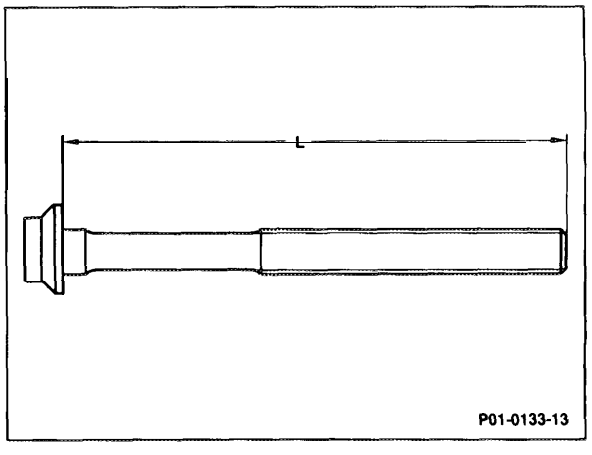


18 Remove cylinder head from cylinder block together with cylinder head gasket.

19 Clean parting surface on cylinder head and check for cracks.

20 Check length (L) of cylinder head bolts.

Note
If the length (L) exceeds the maximum dimension, use new cylinder head bolts for installation.



Installation

21 Position new cylinder head gasket on cylinder block.

22 Position cylinder head.

Note
When positioning the cylinder head use fitted sleeves for locating cylinder head.

23 Oil threads and head contact surface of cylinder head bolts.

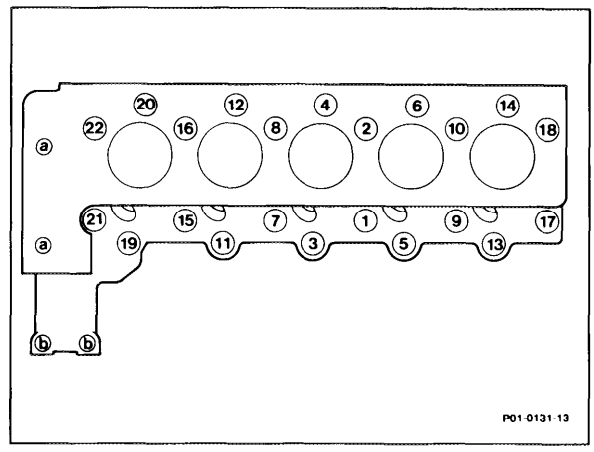
24 Install cylinder head bolts by hand making note of different bolt lengths and sizes, see tables below.

Note
Oil bolt head contact area.

Engine **602**

Bolt diagram

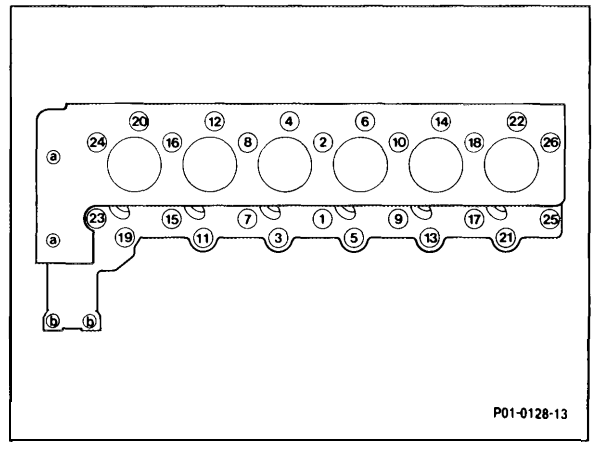
Hole	Bolt size
3,5, 11, 13, 19	M 10×80
2,4,6,8,10, 12, 14, 16, 18, 20, 22	M 10x102
1, 7, 9, 15, 17, 21	M 10x115
a (Timing case area)	M 8×30 or M 8×50
b (Fuel filter)	M 8×80



Engine 603

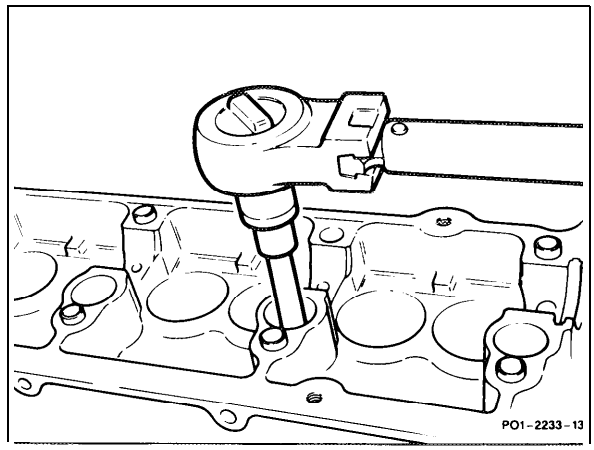
Bolt diagram

Hole	Bolt size
3,5, 11, 13, 19, 21	M 10x80
2,4,6,8,10, 12, 14, 16, 18, 20, 22, 24, 26	M 10×102
1, 7, 9, 15, 17, 23, 25	M 10×115
a (Timing case area)	M 8×30 or M 8×50
b (Fuel filter)	M 8×80



25 Tighten cylinder head bolts in stages in specified in the torquing sequence, use socket 601 589 00 10 00.

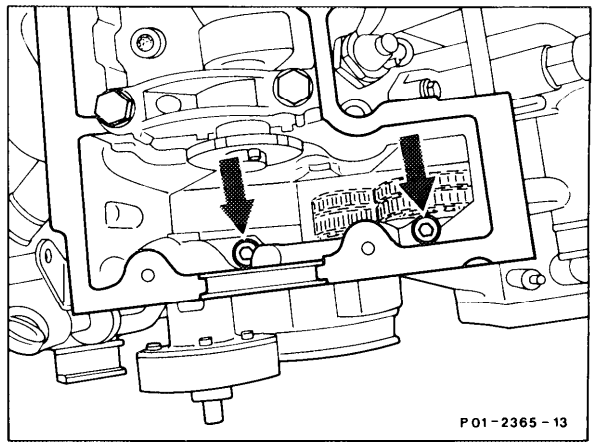
26 Torque cylinder head bolts in specified tightening sequence.



Tightening torques and rotation angles for cylinder head bolts

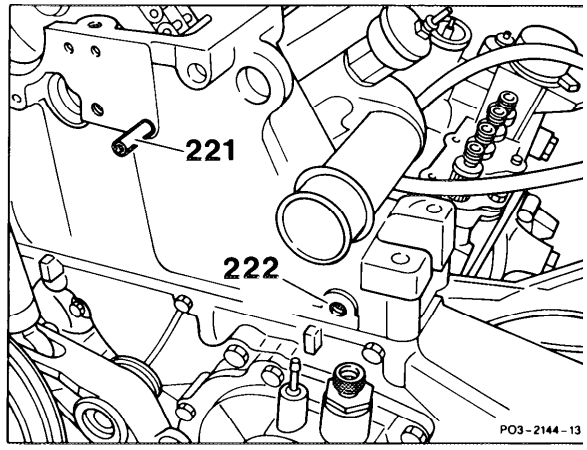
Stage 1	15 Nm
Stage 2	35 Nm
Stage 3	90”
Setting time	10 min
Stage 4	90”

27 Tighten Allen bolts (arrows) in area of timing chain case, tighten in specified sequence, tightening torque 25 Nm.



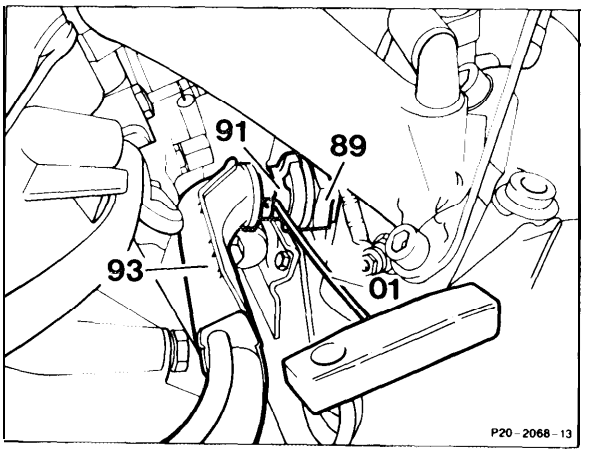
28 Install slide rail for timing chain in timing chain case and knock in slide rail bolts (221) 222).

Note
Coat collar on slide rail bolts with sealant.



29 Install pipe elbow (93) for heater feed line using new O-ring and slide onto connection fitting (89). Attach retainer (91) with hook (01).

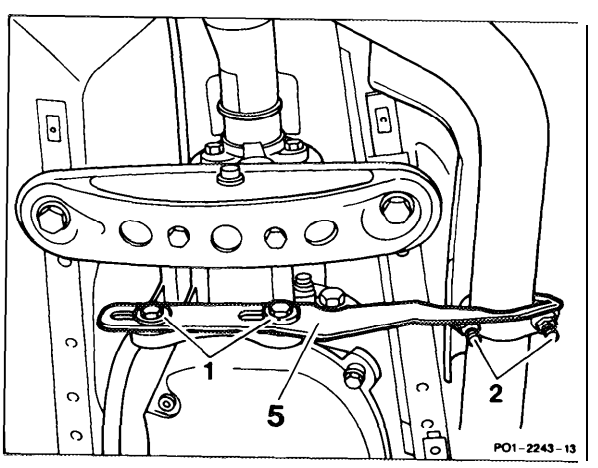
Note
Dip O-ring in coolant to facilitate installation.
Do not use grease or oil.



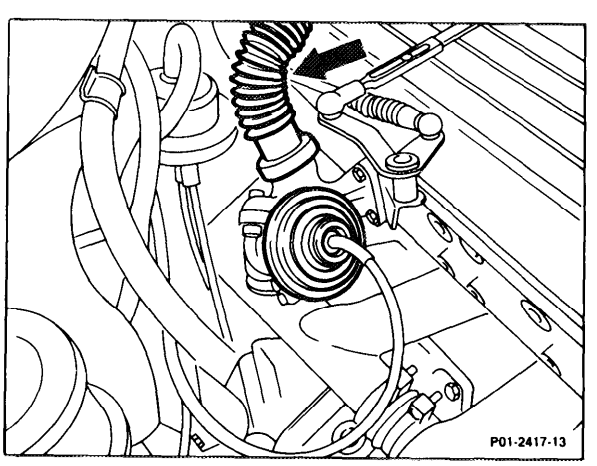
30 Install intake manifold (naturally aspirated engines) or charge air manifold (turbo-engines) (14-180).

31 Bolt exhaust pipe onto exhaust manifold, tightening torque 25 Nm.

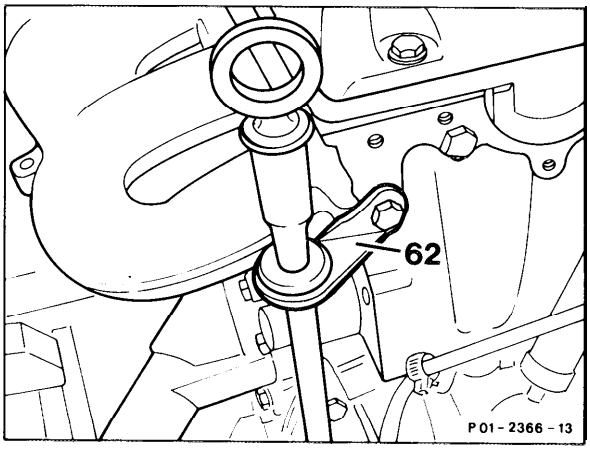
32 Bolt side exhaust support (5) onto transmission. Tighten hex. head bolts (1) and hex. nuts (2), tightening torque 25 Nm.



Engines with exhaust gas recirculation (naturally aspirated engines):
33 Attach line (arrow) from exhaust gas recirculation valve to air guide housing.



34 Bolt oil dipstick tube with holder (62) into cylinder head.



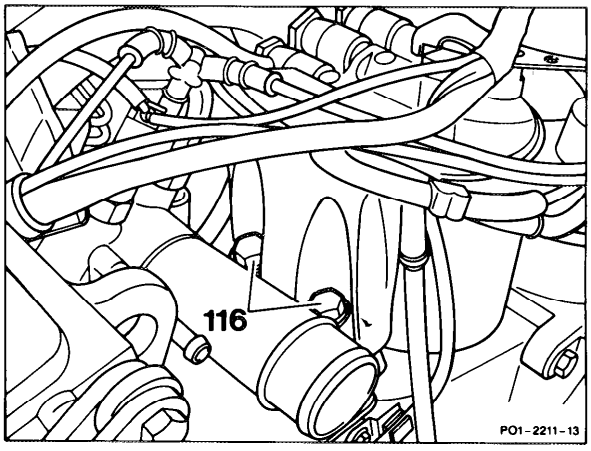
35 Install fuel filter, tighten hex. head bolts (116).

36 Connect fuel lines.

37 Bolt connection lines onto glow plugs.

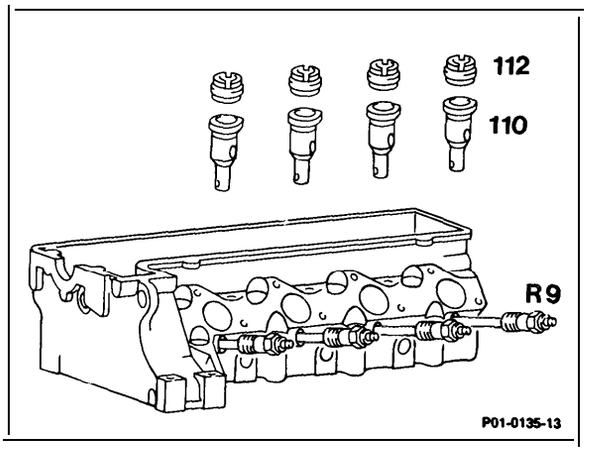
38 After assembling engine check cooling and oil system for leakage after warming up engine.

Note
It is not necessary to retorque the cylinder head bolts.

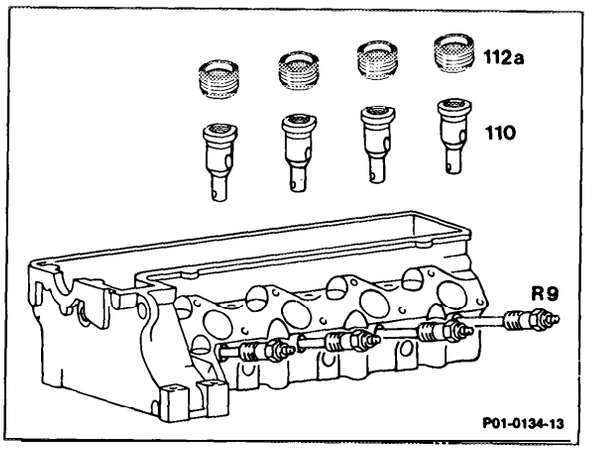


01-417 Removal and installation of prechambers

Preliminary operations:
Mount for engine control removed (30-300)
Nozzle holders removed (07.1-230).



Vertical injection
(example engine 601)



Angular Injection
(example engine 601)

Glow plugs (R9) ..... remove, reinstall, 20 + 2 Nm (item 1).

Vertical injection:

Threaded ring (112) ..... remove, reinstall, 90 -110 Nm, pin wrench 615 589 00 07 00 (item 2).

⚠ Warning
When screwing in or out assure that the pin wrench is seated in the grooves in the threaded ring.

Angular injection:

Threaded ring (112a) . . . . . remove, reinstall, 70 Nm, splined wrench 603 589 00 09 00 (item 3).

Prechamber (110) . . . . . knock out, install, impact puller 602 589 00 33 00 and check (items 4, 6).

Note
Install prechamber so that the lug on the collar of the prechamber is located in the recess in the cylinder head.

Prechamber mounting bore . . . . . in cylinder head, clean, check and cover (item 5).

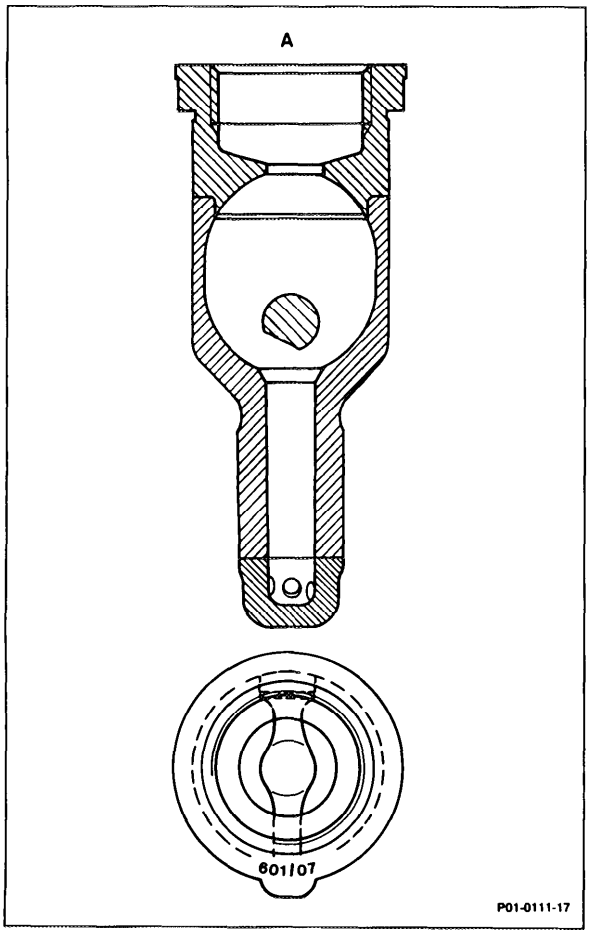
Note
Refinish prechamber sealing surface if required (01-410).

Prechamber survey

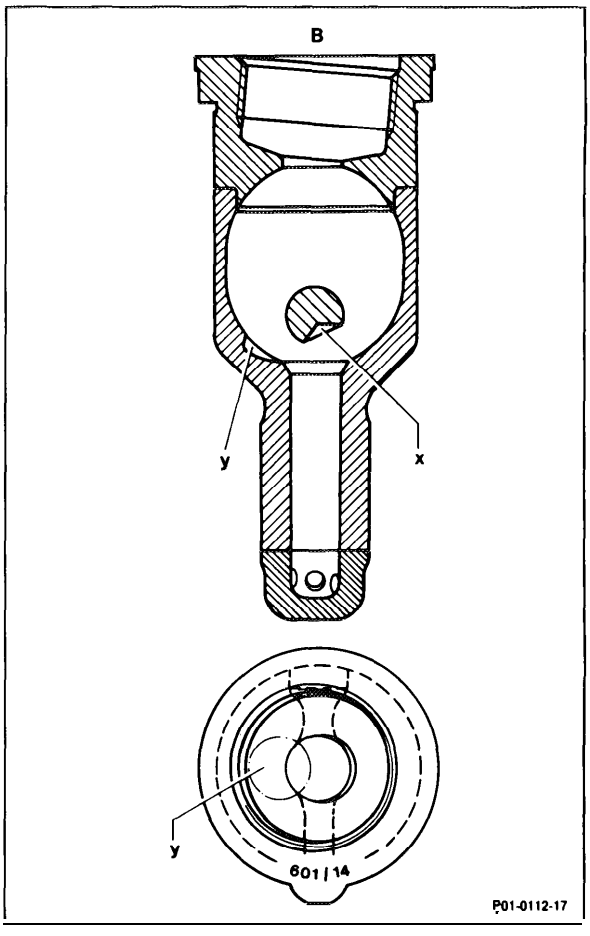
Engine	602.91[1])	603.96 up to 09/88	602.91[2]) 603.91[2]) starting 09/88	602.961 starting 09/88 602.962 Standard	603. 962[2]) 603.970[2]) starting 09/88
Code	601/07 or 17	601/09 or 23	601/25	601/26	601/30
Version	A[1])	A[1])	C[2])	C[2])	C[2])
Combustion neck OD (mm)	14	15	14	15	15

[1]) Without exhaust gas recirculation
[2]) With exhaust gas recirculation starting 02/89

Differentiation, vertical and angular injection

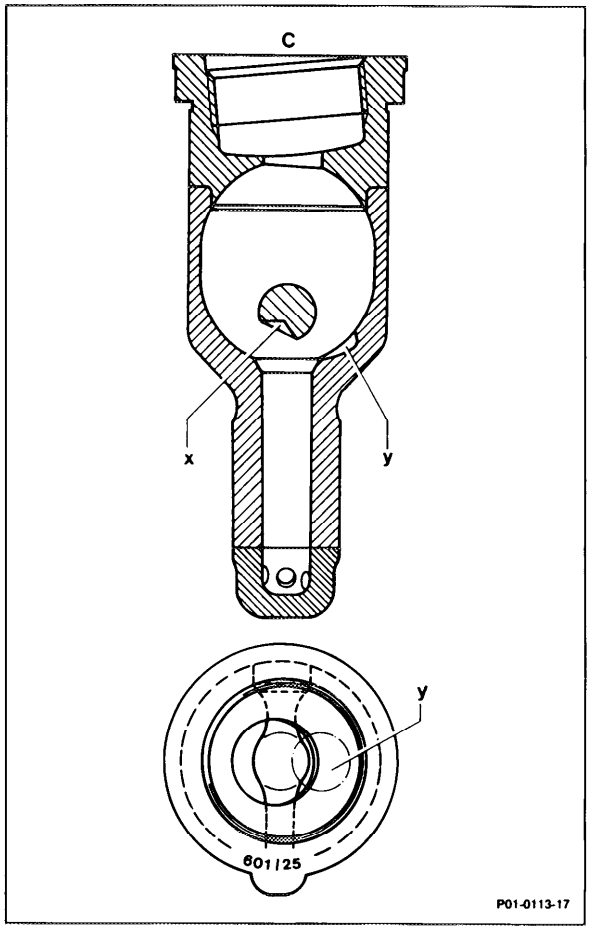


A Prechamber, vertical injection
Code 601107, 601117, 601/09, 601123



B Prechamber angular injection, inclined 5°
Code 601/14, 601 /15

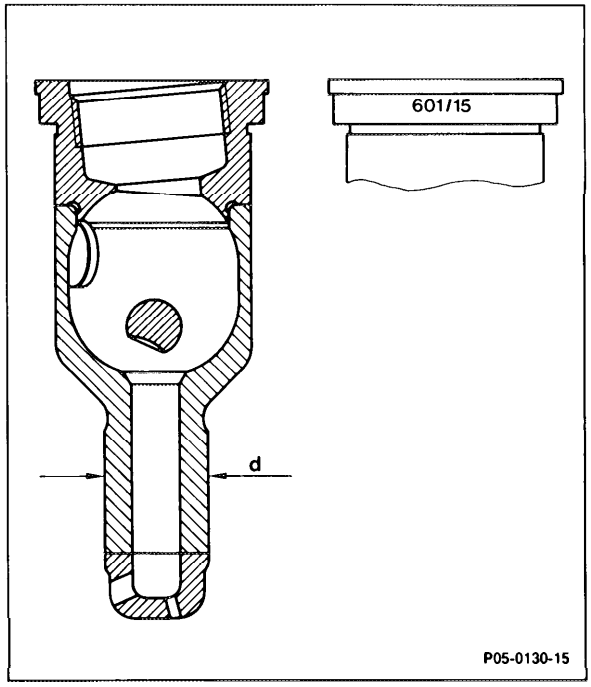
X Cone
y Recess



C Prechamber, angular injection
Inclined 5°, turned 180"
Code 601/25, 601 26, 601130

x Cone
y Recess

Differentiation, combustion neck diameter
The individual combustion neck diameters (d) differ on naturally aspirated engines and turbo-engines.

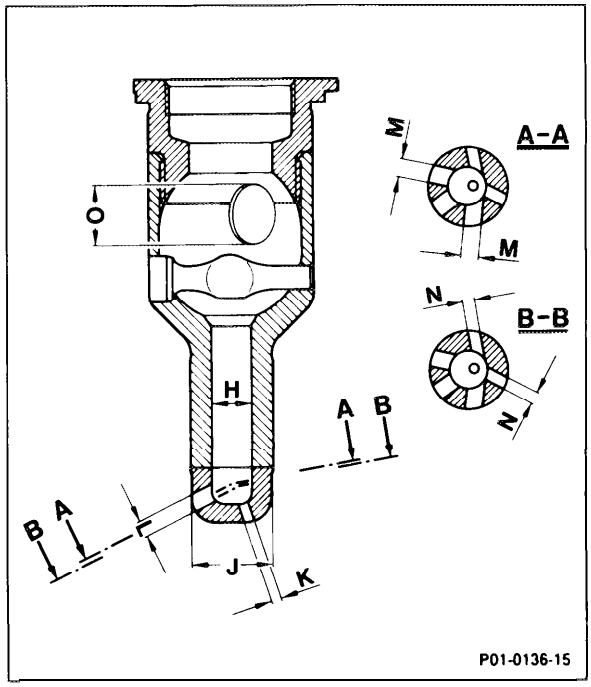


d = 14 mm naturally aspirated engines
d = 15 mm turbo-engines

Differentiation, combustion bores

6 combustion bores with different diameters are located in different planes and at different angles in the bottom section of the prechamber (combustion neck).

The injection angle is always 180°.

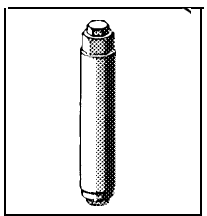


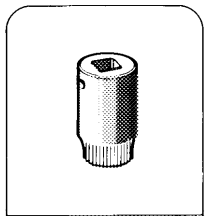
Combustion bore diameters (dia. in mm)

Prechamber code	601107 or 17	601/09 or 23	601/14/25	601/15/26	601/30
H Firing duct	7,0	7,0	7,0	7,0	7,0
J Combustion neck	14,0	15,0	14,0	15,0	15,0
K Combustion bore	1,5	1,5	1,8	1,8	1,8
L Combustion bore	3,2	3,2	3,0	3,0	3,0
M Combustion bore	3,0	3,0	3,0	3,0	3,0
N Combustion bore	2,0	2,0	2,5	2,5	2,5
0 Bore for glow plug	10,0	10,0	10,0	10,0	10,0

Tightening torques	Nm
Glow plugs	20 + 2
Threaded ring, vertical injection	90 – 110
Threaded ring, angular injection	70

Special tools


615 589 00 07 00
01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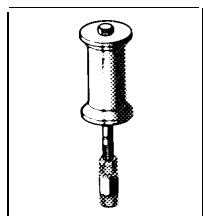
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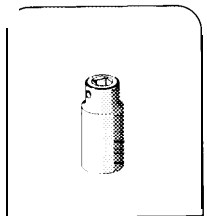
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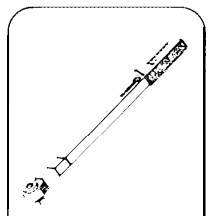
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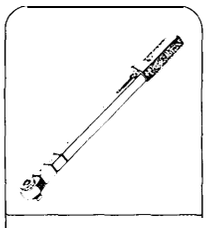
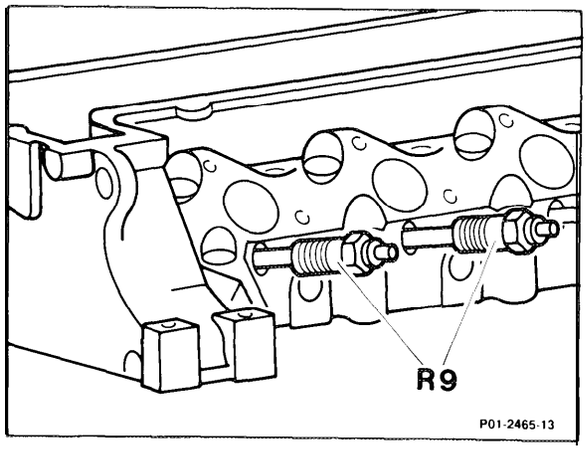


001 589 06 21 00

Removal, installation

1 Remove glow plugs (R9).

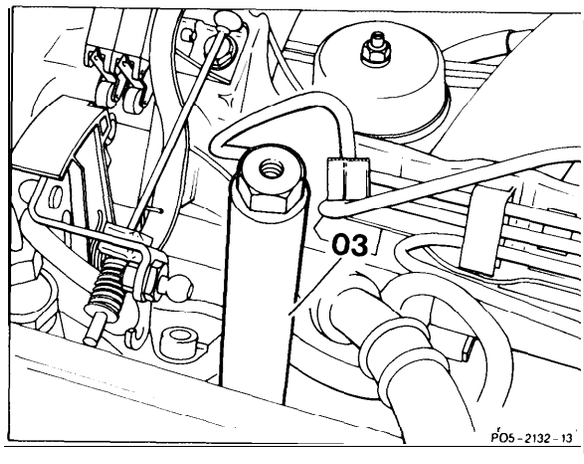


Installation note

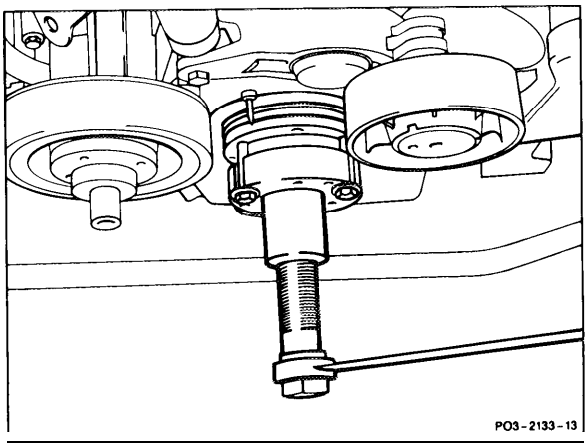
Tightening torque 20 + 2 Nm.

Vertical injection:

2 Bolt threaded end (03) of pin wrench 615 589 00 07 00 into threaded ring of prechamber.



2.1 Slide sleeve (02) of pin wrench over threaded end and insert into grooves in threaded ring.



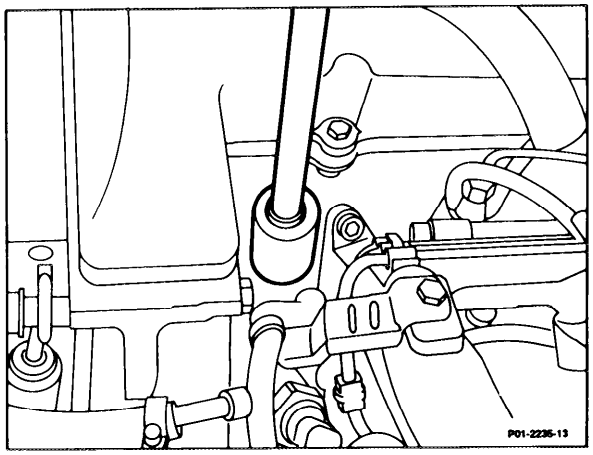
Caution!
The sleeve must be seated tightly in the grooves of the threaded ring.

2.2 Counter sleeve (02) with hex. head bolt (01).

2.3 Remove threaded ring with open-end wrench on hex. end of sleeve (02).

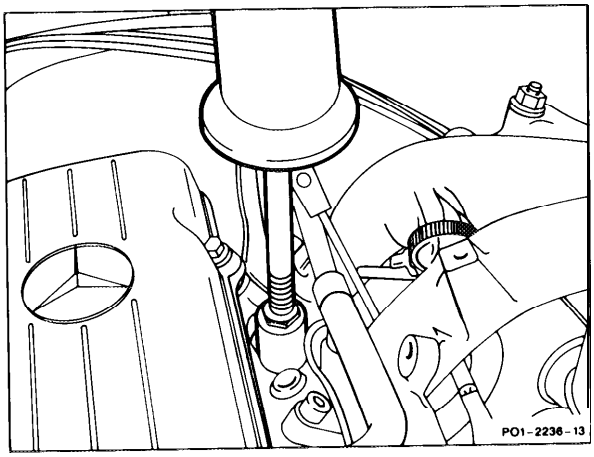
Installation note
Oil threaded ring.
Tightening torque 90 - 110 Nm.

Angular injection:
3 Remove threaded ring with splined wrench 603 589 00 09 00.



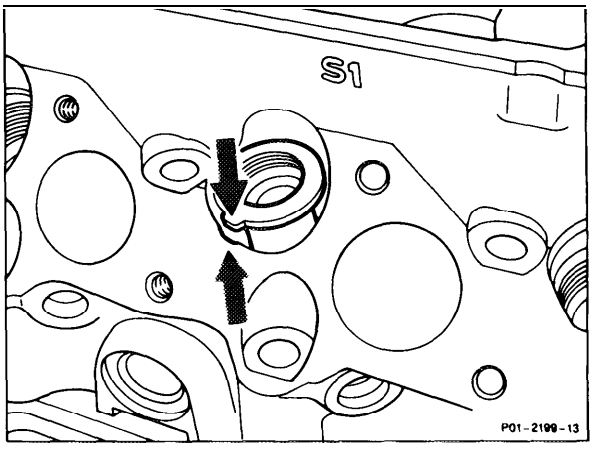
Installation note
Oil threaded ring.
Tightening torque 70 Nm.

4 Bolt impact puller 602 589 00 33 00 into prechamber and knock out prechamber.



Installation note

Insert prechamber into mounting bore so that lug on collar of prechamber fits in recess in cylinder head (arrows).



5 Clean mounting bore for prechamber in cylinder head, check and cover.

Note

Refinish prechamber sealing surface if required (01-410).

6 Check prechambers.

Note

The spherical pin must not be burned or scaly. If the combustion tips are burned or cracked in the bottom section of the prechamber, check the following:

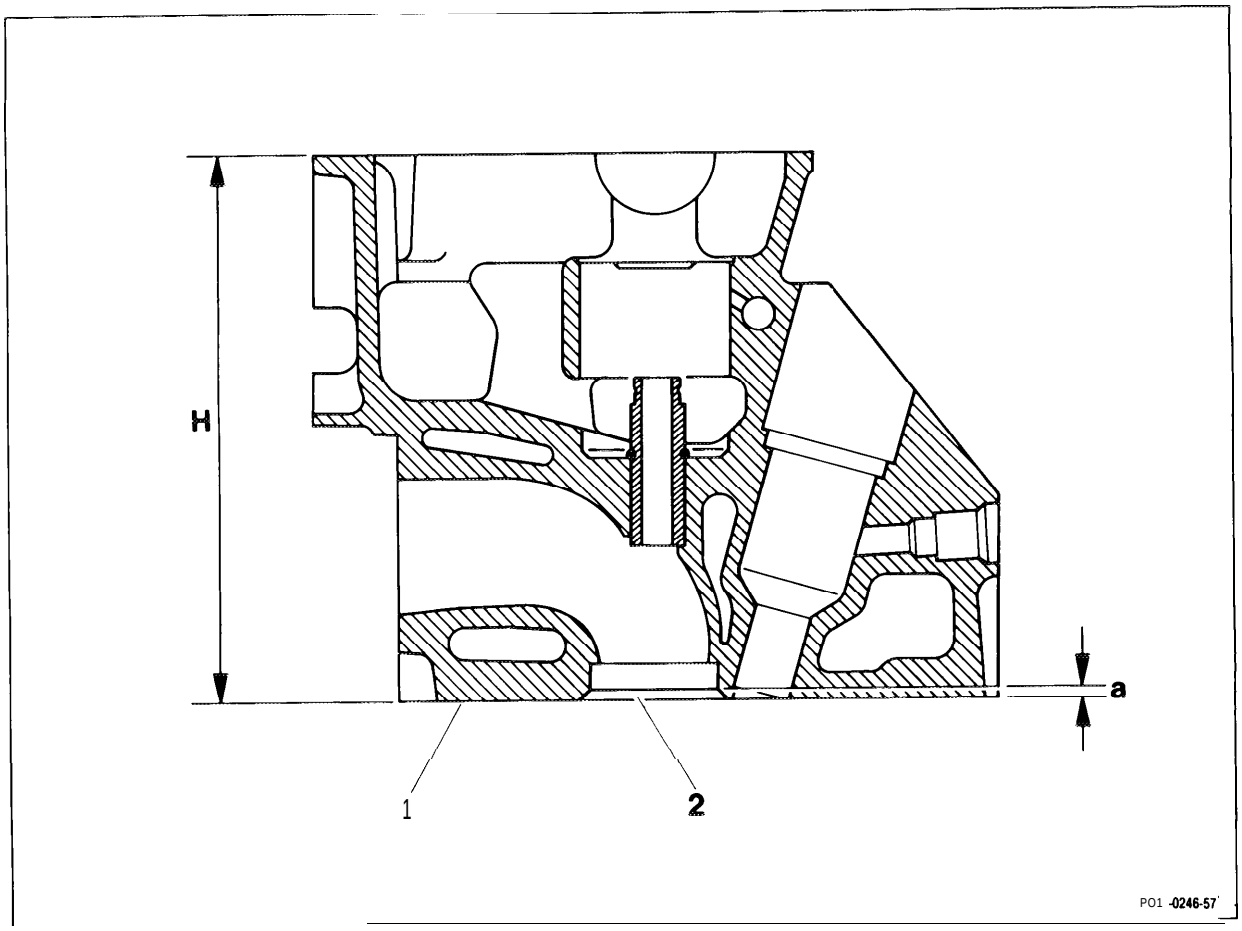
1. Oil level at oil temperature of approx. 80 °C. If the quantity of oil in the oil pan is too high, correct oil level.
2. Check piston vacuum pump for damage or replace vacuum box on injection pump.

To determine wich component is unfit for use, check vacuum lines (blackened with oil).

7 Install in opposite order.

01418 Facing **cylinder head mating surface**

Preliminary operations:
Valves removed.
Valve guides checked (05285).
Prechambers removed (01-417).
Cylinder head pressure-tested (01-420).



Mating surface (1)	plane according to operating instructions of tool manufacturer.
	Note Observe permissible minimum height (H) and machining data.
Valve seats (2)	refinish until minimum interval (a) is reached (05291).
After assembly	check engine timing (05215).

Data

Total height of cylinder head in mm [1])		142.9 – 143.1
Minimum height (H) after machining in mm		142.4
Material removal per facing operation in mm		0.5
Permissible unevenness of mating surface in mm	in longitudinal direction	0.08
	in transverse direction	0.0
Permissible deviation in parallel of upper mating surface in relation to lower surface in longitudinal direction in mm		0.1
Roughness in mm		0.004
Test pressure with air under water in bars gauge pressure in mm		2
Minimum distance (a) (recess) with new valves and new valve seats in mm	Intake	– 0.1 to – 1.0
	Exhaust	
Max. distance (a) (recess) with new valves and machined valve seats in mm	Intake	– 1.0
	Exhaust	

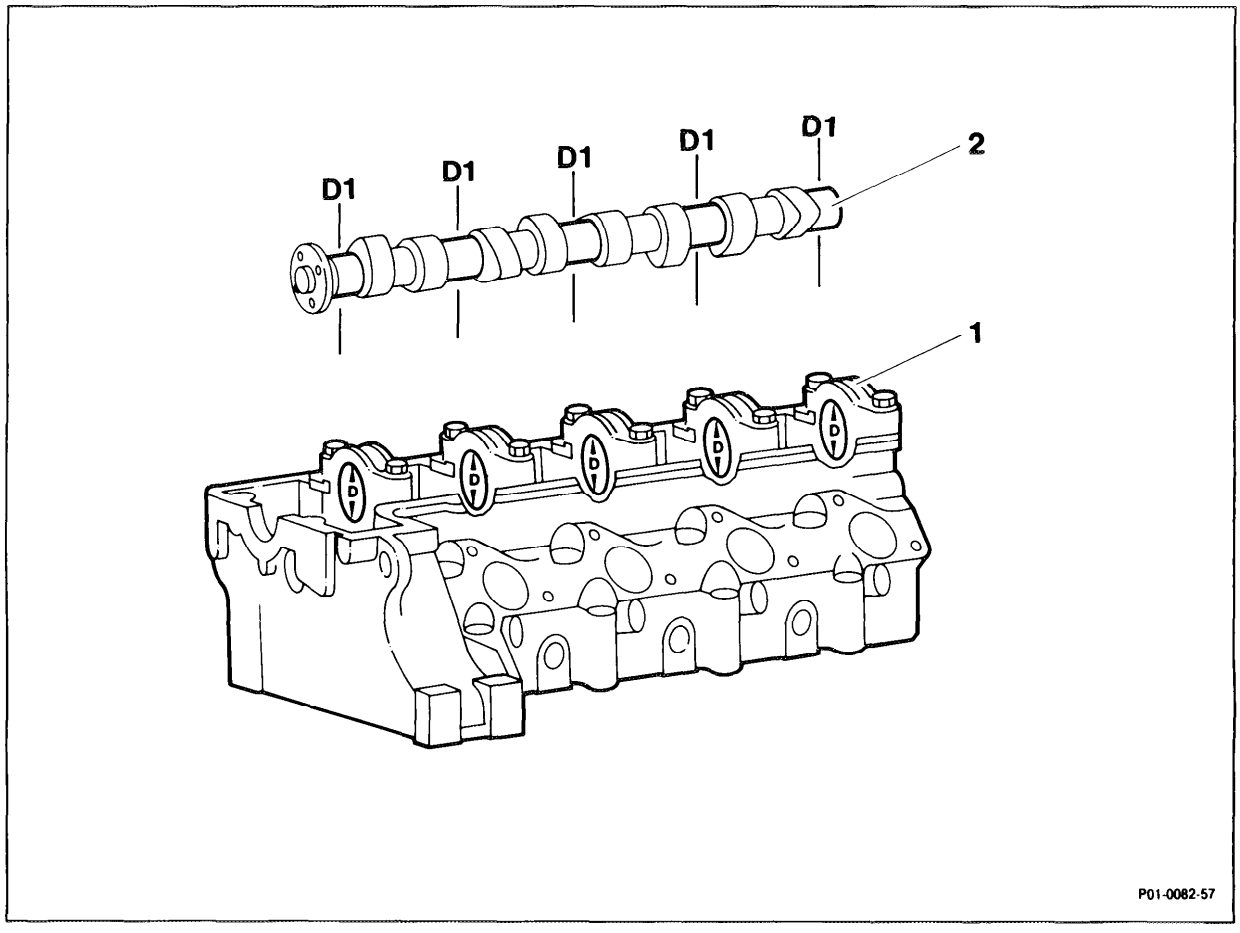
1) It is not permissible to machine the upper mating surface of the cylinder head.

Commercially available tools

Cylinder head clamping fixture	e.g.	Hunger, D-8000 München 70 Order No. 211.60.000
Valve seat machining tool, model VDSNL 1/45/30	e.g.	Hunger, D-8000 München 70 Order No.
Testing set for valve seats	e.g.	Hunger, D-8000 München 70 Order No. 216.93.300
65° correction blade No. 13 for bottom correction angle	e.g.	Hunger, D-8000 München 70 Order No. 216.64.622

01-419 Boring out camshaft bearing bores (repair stage)

Preliminary operations:
Cylinder head removed (01-415).
Camshaft removed (05220).
Valves removed.



Camshaft bearing caps (1)	remove, install, 25 Nm.
Camshaft bearing basic bores (D)	measure.

Note
It is only possible to rebore the camshaft bearing bores once to max. 0.5 mm oversize. Observe repair stage dimensions.

Camshaft bearing basic bores (D)	bore out according to operating instructions for tool used.

Caution!
When boring ensure that the mating surface at the rear of the cylinder head cover and the mount for the sealing plate at the front are not damaged.

After boring . . . . . remove burrs on mating surfaces of camshaft bearing caps (1) and mating surfaces on cylinder head.

Note
Edges with burrs can lead to poor lubrication during engine operation resulting in bearing damage.

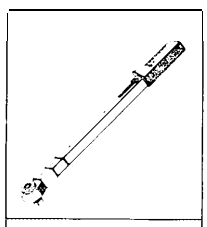
Install new camshaft (2) . . . . . with oversize bearing journals (D1), code for oversize camshaft (05-215 or 05220).

Data, camshaft bearings

Standard dimension	Camshaft bearing diameter D		30.95 – 31.04
	Journal diameter D1		29.934 – 30.95
Repair stage	Camshaft bearing diameter D		31.45 – 31.54
	Journal diameter D1		31.434 – 31.45
Camshaft bearing bores	Roughness		0.003 – 0.006
	Permissible out-of-round		0,012
		New value	Wear limit
Bearing play	radial	0.050, – 0.091	0.15
	axial	0.030 – 0.100	0.15

Note
If bearings have seized or are scored deeply, the camshaft bearings in the cylinder head can only be rebored once to a maximum of 0.5 mm oversize. After reboring replace damaged camshaft with new camshaft with oversize bearing journals.

Special tool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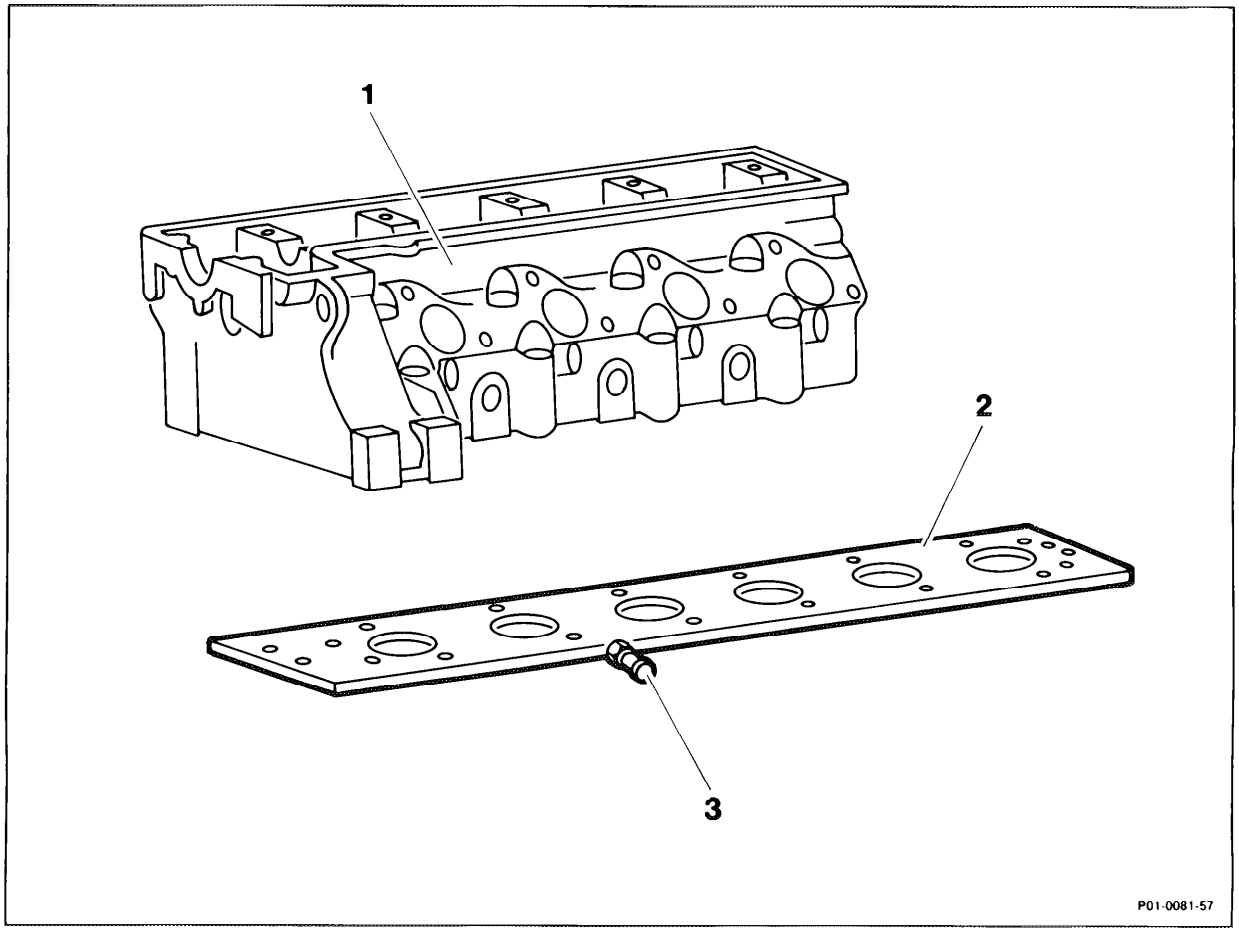
01-420 Pressure-testing cylinder head

Preliminary operations:
Cylinder head removed (01-415).
Camshaft removed (05-220).
Valves removed.
Valve shaft seals removed (05-270).
Cooling water return fitting removed.



Cylinder head (1)	clean.
Pressure plate (2)	bolt onto cylinder head with rubber sealing plate 601 589 00 25 00, unbolt.
Connection for cooling water return fitting and heater feed line	on cylinder head, plug tightly.
Compressed air	connect to fitting (3) on pressure plate and allow compressed air to flow into cylinder head at pressure of 2 bars.
Cylinder head (1) with pressure plate (2)	fasten to suspension device 115 589 34 63 00 and immerse in water preheated to approx. 80 °C.

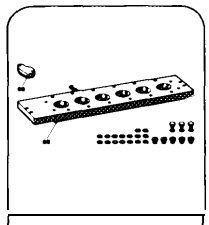
Cylinder head (1)	. . . . .	check for air bubbles exiting.

Note
Air bubbles indicate a leak, locate exit point for air bubbles more precisely if possible.

Data

Test pressure with air under water	2 bar

Special tools



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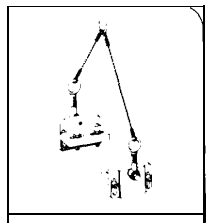

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Commercially available tool

Electrically heated water basin	e.g.	Otto Dürr, D-7123 Sachsenheim- Ochsenbach