Job No.

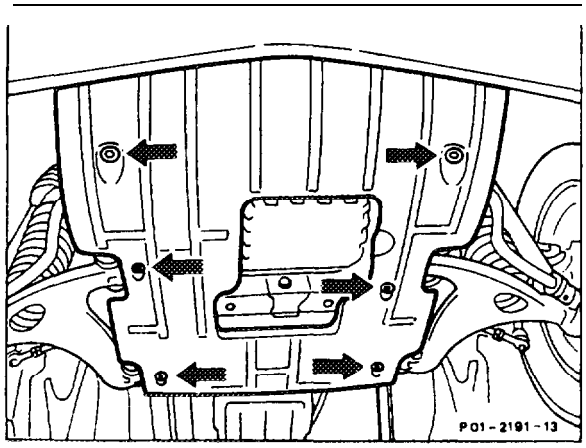
01-001 Engine and Model Survey

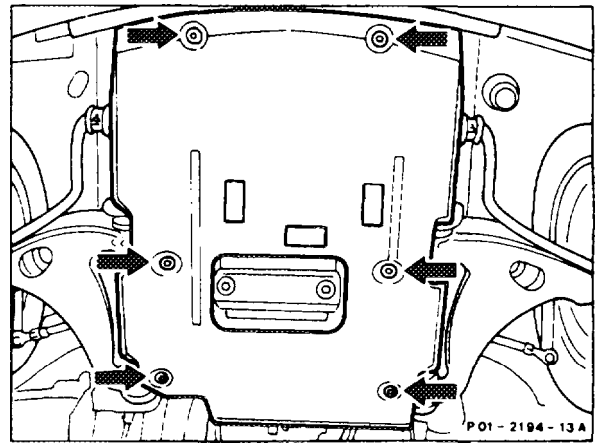
Engine	Model	Model Year	Sales designation	Power in kW at rprn	Compression ratio
102.961	201.024	1984	190 E 2.3	84/5000	8.0:1
102.985	201.024	1985 - 86	1190E2.3	90/5000	9.0:1
102.985	1201.028	1987 - 88 1991 - 93	119OE2.3	97/5100	9.0:1

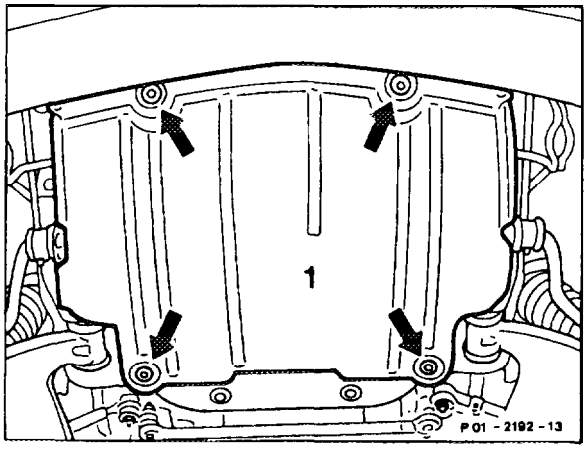
01-005 Overview – Engines, Models, Output and Compression Ratio

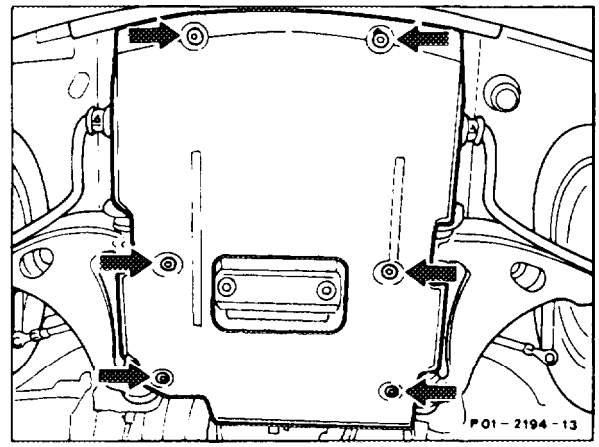
Engine	Model	Sales designation	Output in KW at rpm net bhpirpm	Compression ratio ε : 1
102.961 (USA) as of 1984	201.024	190 E 2.3	84/5000 113/5000	8.0
102.985 (USA) as of 1985	201.024	190 E 2.3	90/5000 12015000	8.0
102.985 (USA) as of 1987	201.028	190 E 2.3	97/5100 130/5100	9.0

01-006 Removal and installation of bottom engine compartment cover









Model 201

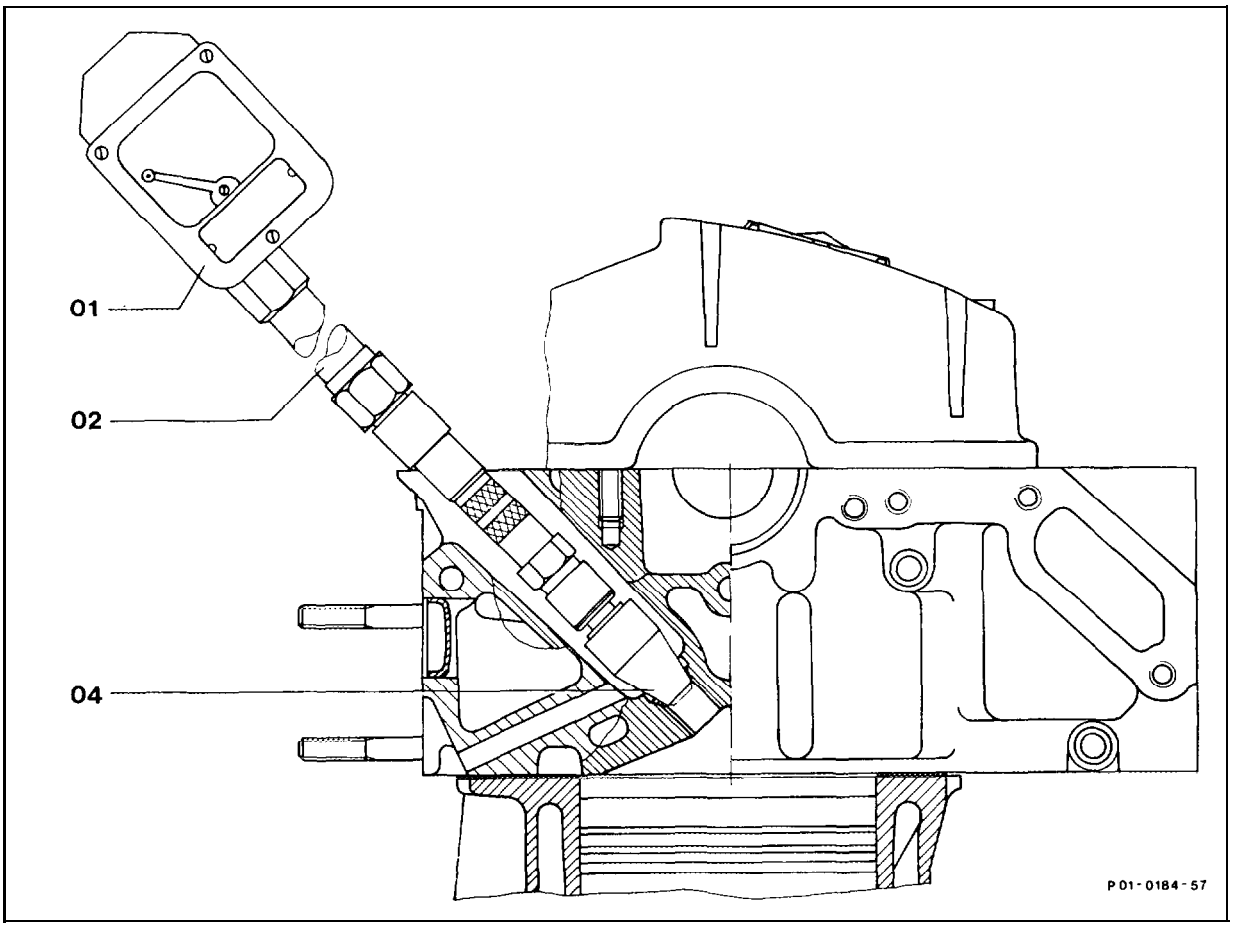
Self-tapping screws (arrows) . . . . . remove, screw in and remove, install engine compartment cover.

Note

On Model 201.028 (USA) install engine compartment cover so that the edge of the side parts grips above the bottom part.

01-010 Testing compression pressure

Preceding work:
Removing spark plug (15-018).

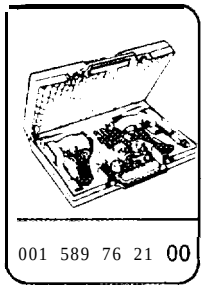


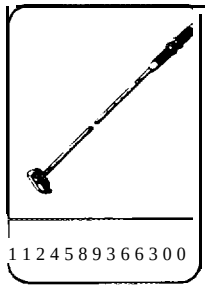
01 Compression pressure recorder, special tool 001 589 76 '21 00
02 Adapter piece
04 Sealing cone with check valve

Test data with engine at normal operating temperature (80°C) in bar

Subject		When new	Limit value
Compression ratio	ε = 9.0 – 9.4	10 – 12	approx. 8.5
	ε = 10.0	13.5 – 15.5	approx. 12
	ε = 7.5 – 8.3	9 - 10	approx. 7.5
	ε = 7.2 (102.92)	8 - 9	approx. 6.5
Permissible difference between individual cylinders max. 3			

Special tools





Notes

Test compression pressure at normal operating temperature.
If the minimum compression pressure is not reached, test cylinder leaktightness (01-015).

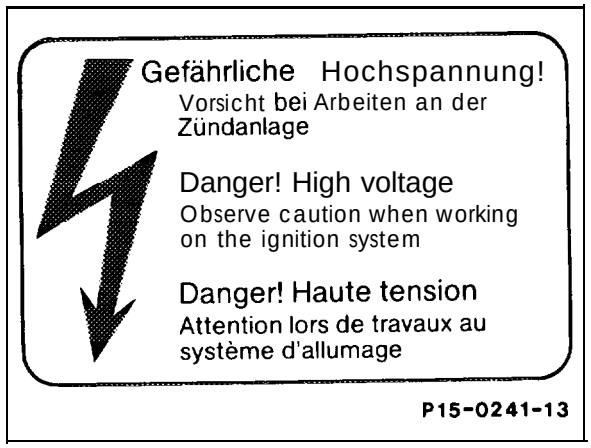
Unscrew all the spark plugs for testing.

Turn crankshaft with starter and compression pressure recorder.

Warning!

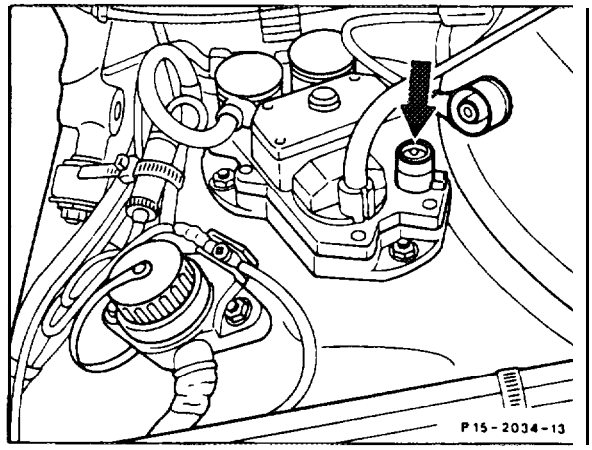
The engines are equipped with an ignition system with variable ignition characteristics (EZL).
Because of high ignition voltage, it is very dangerous to touch components of the ignition system (ignition coil, ignition cables, spark plug connector, plug-on unit) when

- the engine is running,
- the engine is started,
- the key in the steering lock is in position 2 and the engine is cranked by hand.

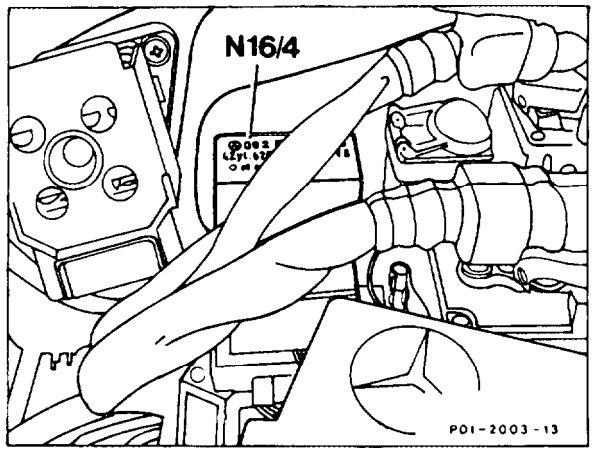


Testing

1 Switch off ignition. Detach connector from ignition distributor pickup (green cable on control module) (arrow).

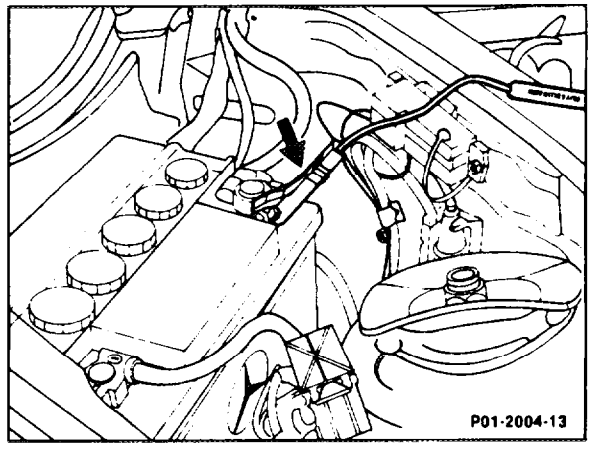


Caution!
On injection engines, detach the fuel pump relay module (N1614) before turning the crankshaft to ensure that no fuel is injected.



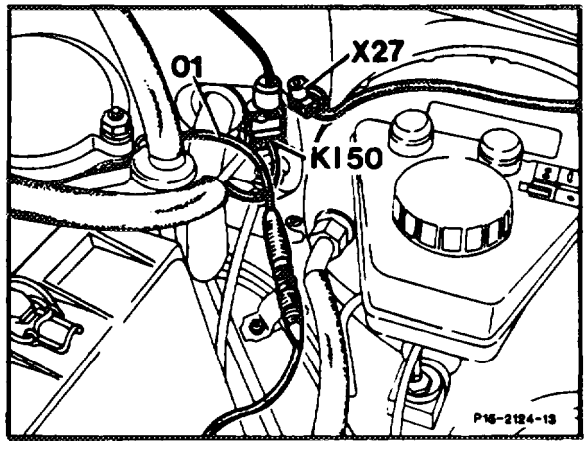
Model 201

2 Connect compression pressure recorder. This is done by clamping one of the two alligator clamps (arrow) of the compression pressure recorder, Part No. 001 589 76 21 00, to the positive terminal post of the battery.



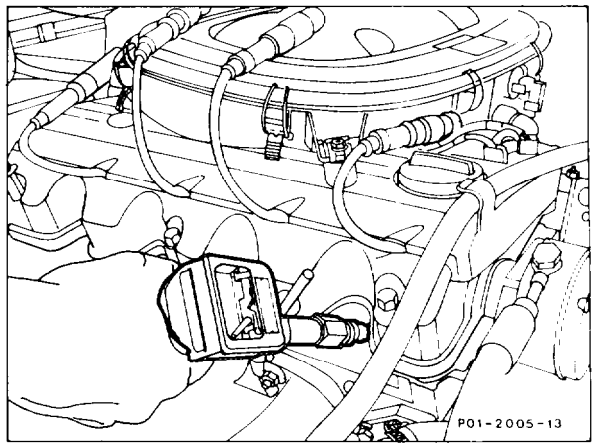
3 Detach connector (X27) from plug connection (terminal 50).

4 Plug in connector of adapter cable (01), Part No. 124 589 36 63 00.



Model 201

5 Crank engine several times with starter motor, in idle position, selector lever in position "P", and parking brake applied so that residues and soot are ejected.



6 To test each cylinder, press the compression pressure recorder into the spark plug hole of the particular cylinder and, with the throttle valve fully opened, crank engine approx. 8 revolutions. Test all the cylinders in this way.

7 Blow out spark plug recesses with compressed air. Remove any residues on the tapered sealing seat.

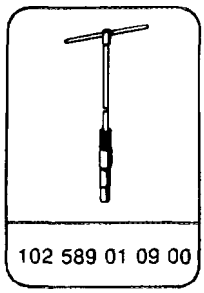
01-015 Testing cylinder leaktightness

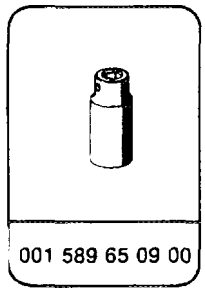
Data

Total pressure loss	max. 25%
At valves and cylinder head gasket	max. 10%
At pistons and piston rings	max. 20%

Tightening torque	Nm
Spark plugs	20

Special tools





Commercial tool

Cylinder leaktightness tester	e. g. Bosch, EFAW 210 A Sun, CLT 228

Testlng

1 Run engine until at normal operating temperature.

2 Blow out spark plug recesses with compressed air.

3 Remove spark plugs.

4 Top off coolant and leave filler opening at coolant expansion tank open.

5 Remove oil filler cap.

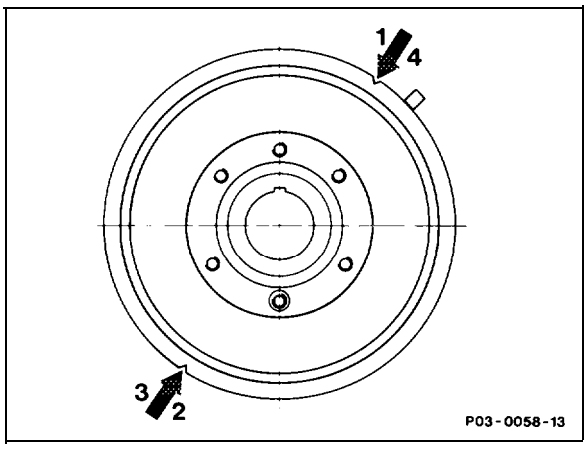
6 Remove air filter (09-400 or 09-410).

7 Connect cylinder leaktightness tester to a compressed air system and calibrate tester.

8 Position piston of No. 1 cylinder to ignition TDC. This is done by turning the crankshaft with a tool combination consisting of wrench socket (27 mm, 1/2" square) and reversible ratchet handle, at the central bolt (front of crankshaft).

Note

The respective pistons are in the TDC position when the markings shown in the drawing opposite on the vibration damper or on the belt pulley are below the TDC pointer.



9 Open throttle fully.

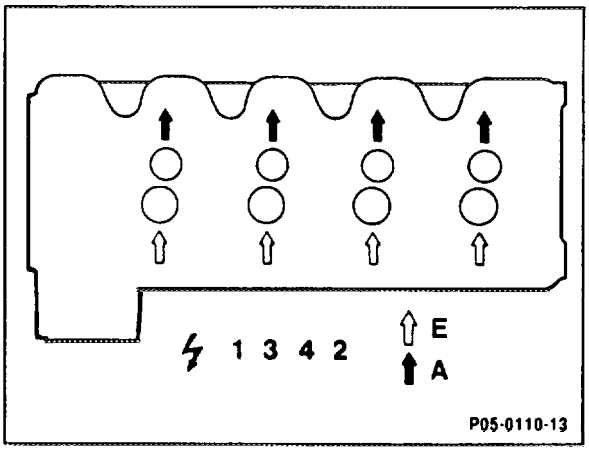
10 Screw connection hose into the 1 st spark plug bore and attach to the connecting hose of the tester.

The crankshaft must not turn when performing this step.

11 Read off pressure loss at tester.

12 Determine by listening whether the pressure escapes through intake manifold, exhaust, oil filler opening, spark plug bore of adjacent cylinder or coolant filler opening.

13 Test all the cylinders in the firing order.



Notes

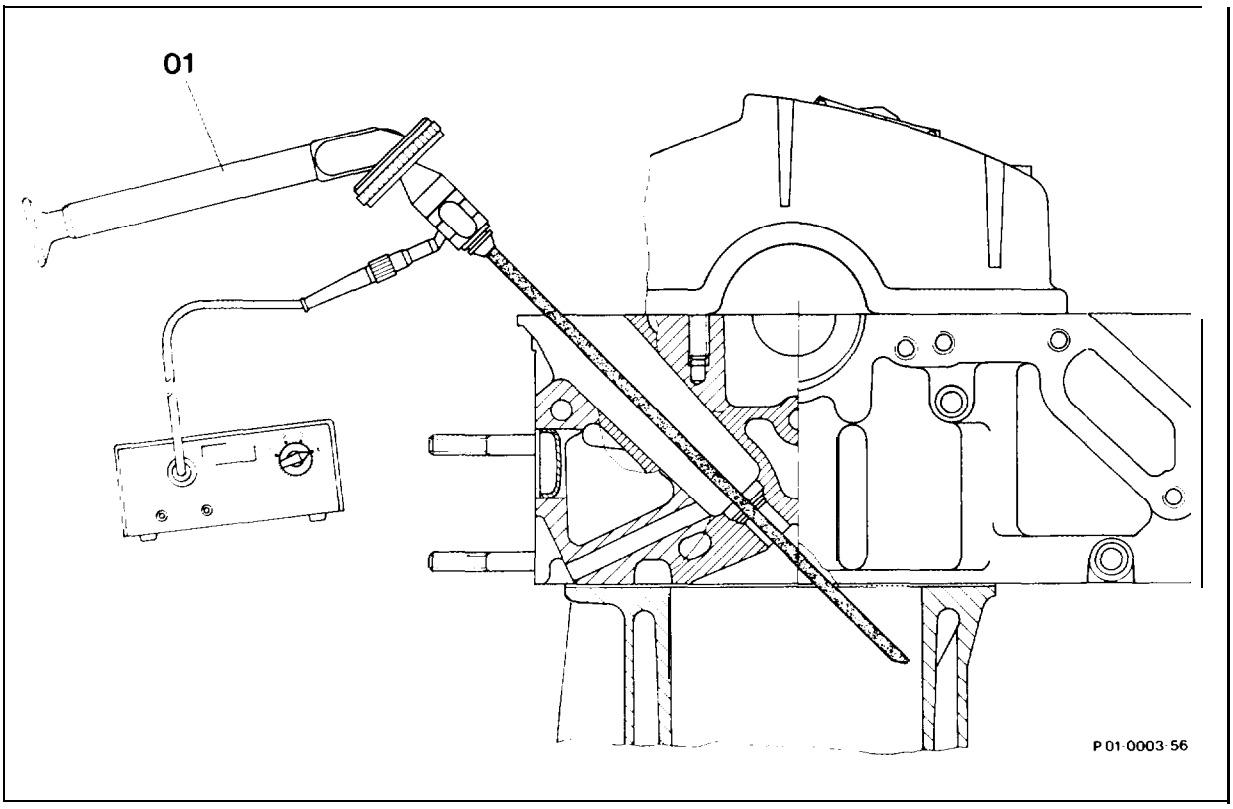
It is possible that the piston ring gaps of individual pistons are directly above each other which falsifies the test result.

In cases of doubt, allow vehicle to run and test cylinder leaktightness once again after some time.

After spraying oil onto the piston crown, it is possible to determine whether the leak exists at the piston rings or at the valves or the cylinder head gasket.

01-020 Illuminating cylinders

Preceding work:
Removing spark plugs (15-018).



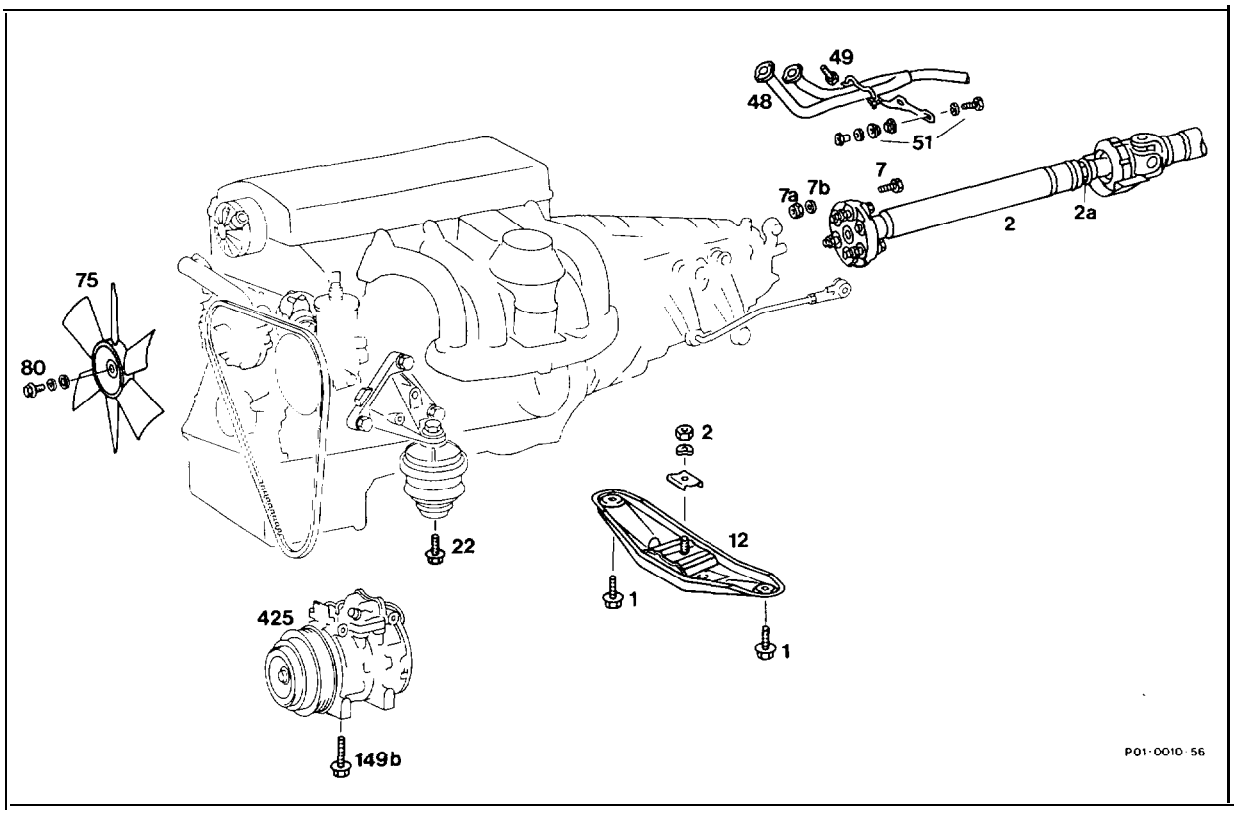
Cylinder (01)	illuminate with cylinder inspection lamp (01), distinguish between “optical rub marks and seizing rub marks”. “Optical rub marks” may result from the ring gap. Traces of honing are still visible, engine in order. “Seizing rub marks”; honing marks no longer visible, recondition engine.

Commercial tool

Cylinder inspection lamp	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)

01-030 Removal and installation of engine

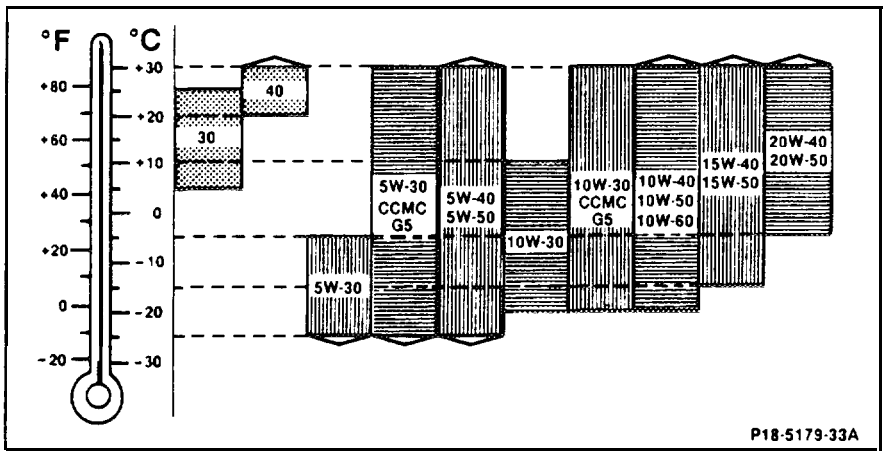
Preceding work:
Removal and installation of bottom engine compartment fairing (01-006).
Removal and installation of air filter (09-400 or 09-410).
Removal and installation of radiator (20-420).



Battery positive cable	disconnect, connect.
Fan (75)	remove, install, 25 Nm.
Alternator cable connector	detach (step 3).
Lines for pressure oil pump	detach, attach (step 4).
Cover for evaporator	insert (step 5).
Cover for engine wiring harness	remove at component partition wall (steps 6 and 7).
Starter wiring harness	remove, install (step 8).
Terminal block terminal 50	disconnect, connect (step 9).
Terminal 30	disconnect, connect at terminal block (step 10).
Engine wiring harness	disconnect, connect at the individual connections (steps 11 to 18).

Fuel evaporation system	detach, attach (step 19).
Ground cable	unbolt, bolt on at intake manifold (step 20).
Accelerator control	disconnect, connect Bowden cable, adjust (step 21).
Fuel lines	detach, attach (step 22).
Coolant hose, heater supply line	detach, attach (step 23).
Vacuum line, brake booster	detach, attach (step 24).
Air conditioning compressor (425)	Note On vehicles with air conditioning, the A/C compressor can be unbolted with the lines connected and without draining the system (steps 25 to 34).
Engine hoist	attach to suspension lugs, detach (step 35).
Guard plate	insert between component compartment and engine, remove (step 37).
Exhaust system (48)	unbolt at exhaust manifold and transmission mount (51), bolt on (steps 38 and 39), 25 Nm.
Lambda sensor	remove, install (step 40).
Engine supporting bracket (12)	unbolt, bolt on (step 42). Tightening torques: Bolt (1) 25 Nm, Nut (2) 70 Nm.
Drive shaft to transmission (2)	detach, attach, replace self-locking nuts (7a) (step 44).
Clamping nut (2a)	loosen, tighten (step 45), 45 Nm.
Speedometer shaft	disconnect, connect to transmission (step 46).
Ground cable at transmission	disconnect, connect (step 47).
Shift rods at transmission	detach, attach (step 48).
Cable connector for starter lockout, backup light switch	unplug, plug in (step 49).
Cable for kickdown solenoid valve	disconnect, connect (step 50).
Front engine mounting (22)	unbolt, bolt on at bottom (step 51), 40 Nm.

Engine with transmission	lift out, insert (step 52).
Lines, hoses and engine mounts	examine for signs of wear, replace if necessary. Examine antifreeze protection, adjust to correct level if necessary. Test leaktightness.



Viscosity grades for engine oils according to SAE

Adhering to the SAE grades in accordance with ambient temperatures would result in frequent oil changes. Consequently, the temperature ranges are merely guidelines, which can be exceeded in the upper or lower limits for brief periods.

In moderate climatic zones SAE 30 may be used from the spring on for all engine models. SAE 10W-40 or SAE 10W-50 may be used as an all-seasons oil for all gasoline engines.

Refer to the most current “Factory Approved Service Products” for further information regarding specified viscosity grades and approved engine oils.

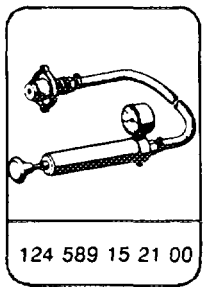
Oil capacity in liters

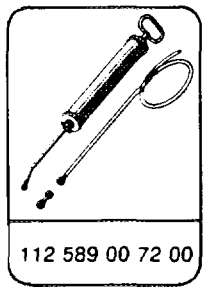
(refer to Factory Approved Service Products for approved engine oils)

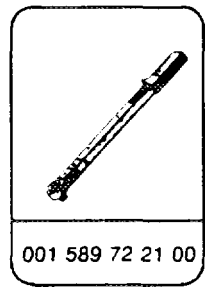
Engine (total capacity when refilling)	5.5
Engine capacity when changing oil and filter	5.0

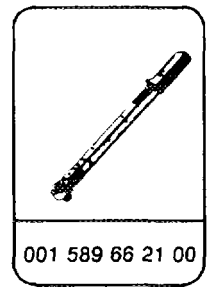
Tightening torques	Nm
Fan to engine coolant pump	**25**
Exhaust pipe to exhaust manifold	25
Exhaust bracket to transmission	25
Hexagon bolt of belt pulley to power steering pump	25
Bracket for A/C compressor to oil sump	10
Bracket for AC compressor to AC compressor	25
V bracket servo pump – engine supporting bracket – A/C compressor	25
Servo pump to supporting bracket	25
A/C compressor to supporting bracket	30
Propeller shaft to transmission	45
Clamping nut to spline end of propeller shaft	45
Ground cable to transmission	45
Engine mount to axle carrier	40

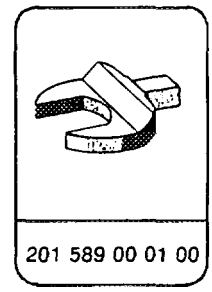
Special tools











Commercial tool

Engine hoist No. 3188 self-locking	e. g. Messrs. Backer Herderstraße D-5630 Remscheid

Shop-made tools

Guard plate for radiator/evaporator	Dimensions approx. 480 x 600 x 1
Metal panel for component compartment wall	Dimensions approx. 320 x 380 x 1

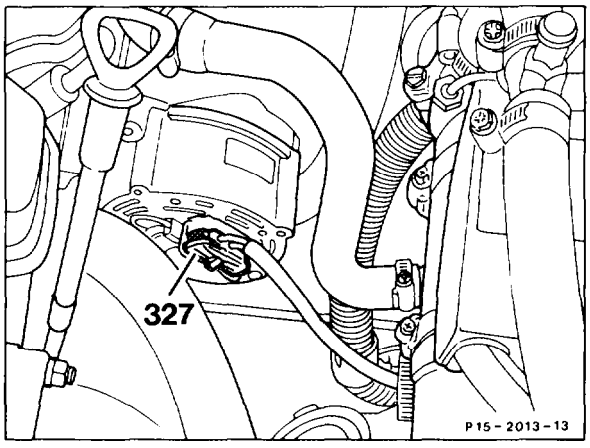
Note
Remove and install engine together with transmission.

Removal and installation

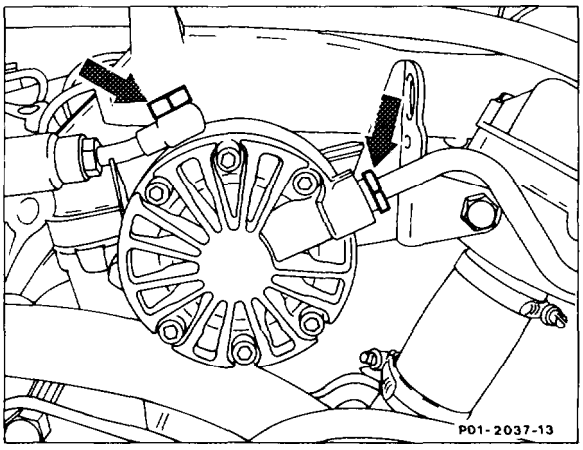
1 Disconnect battery negative terminal, connect.

2 Remove fan. install.

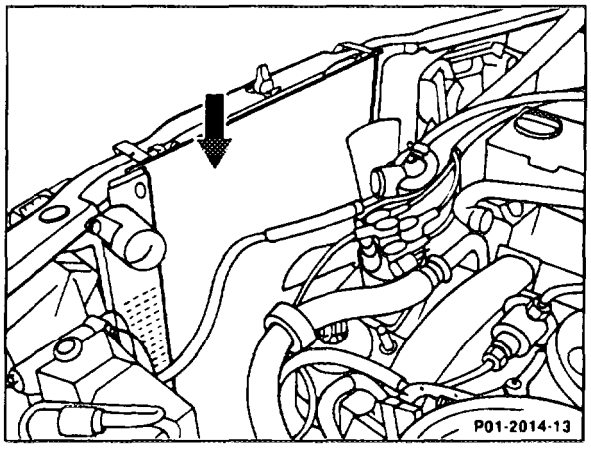
3 Unplug cable connector (327) at alternator, plug in.



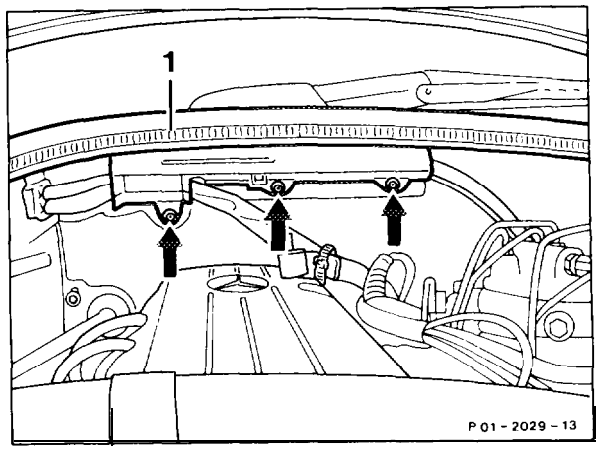
4 Detach lines for pressure oil pump at cylinder head, connect (arrows).



5 If equipped with air conditioning: install guard plate (arrow) to evaporator of air conditioning system.

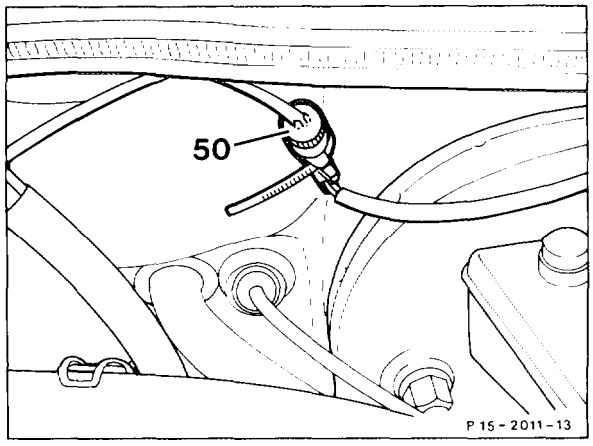


7 On Model 201, pull off rubber strip (1) above fire wall.
Take out clips (arrows), fold fixture upwards.



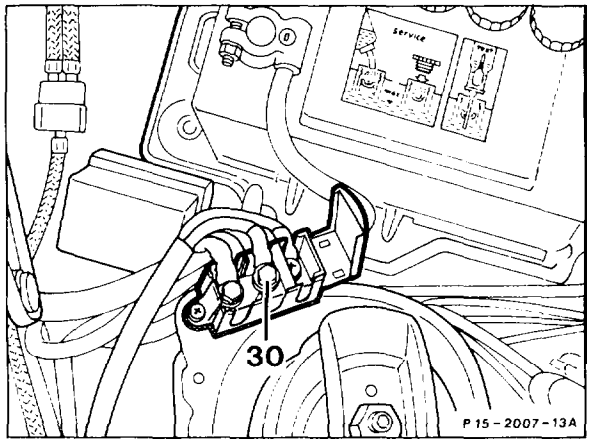
Model 201

9 On Model 201, unplug cable connector (50) at the plug connection, plug in.



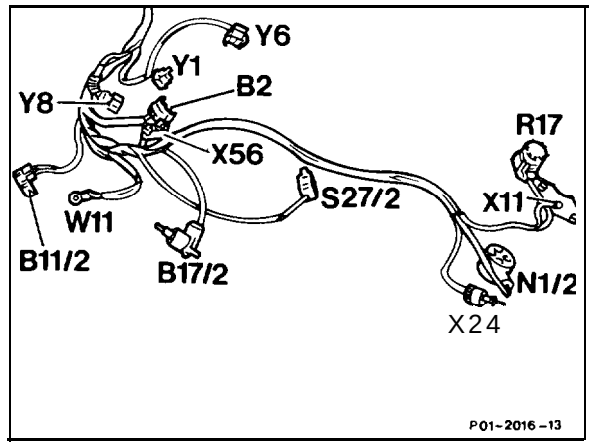
Model 201

10 Unbolt battery positive terminal. Disconnect terminal (30) at cable connector and pull cable through component compartment wall and place over engine.



Model 201 terminal 30

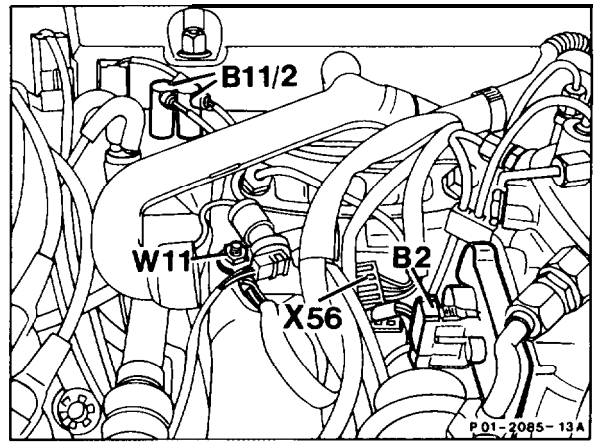
11 Disconnect engine wiring harness at the individual connections and place over the component compartment wall.



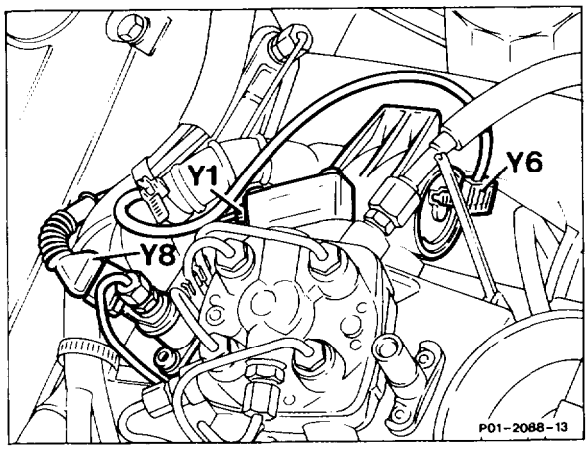
Engine wiring harness, shown on Model 201

B2	Volume air flow sensor position Indicator
B1 1/2	Engine coolant temperature sensor (CFI), 2-pin
B17/2	Intake air temperature sensor, CFI injection system
N1/2	Ignition control module
R17	Reference resistor, CFI injection system
S27/2	Deceleration shutoff microswitch
W11	Engine ground (electric lead bolted on)
x11	Diagnostic connector/terminal block terminal TD
X24	Connector, headlamp wiring harness
X56	Throttle body switch connector
Y1	Electrohydraulic actuator
Y6	Idle air control valve
Y8	Start valve

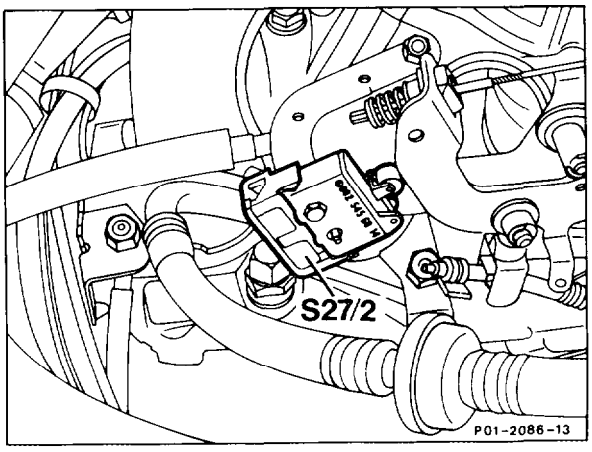
12 Detach twin connector (B1112) for engine coolant temperature sensor (CFI), plug in.
Unbolt engine ground (W11), bolt on.
Unplug throttle body switch connector (X56), plug in.
Unplug volume air flow sensor position indicator (B2), plug in.



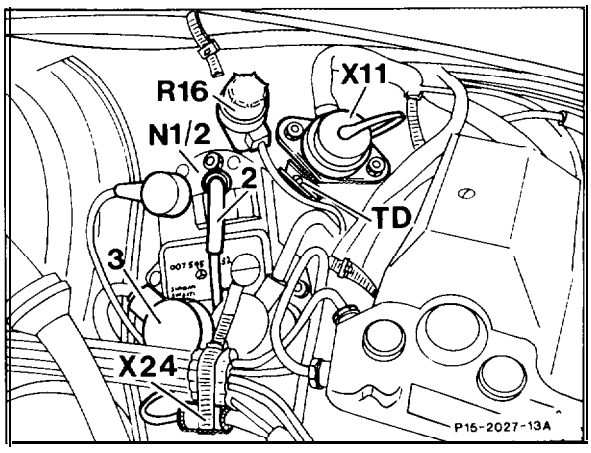
13 Unplug start valve (Y8), plug in.
Unplug electrohydraulic actuator (Y1), plug in.
Unplug idle air control valve (Y6), plug in.



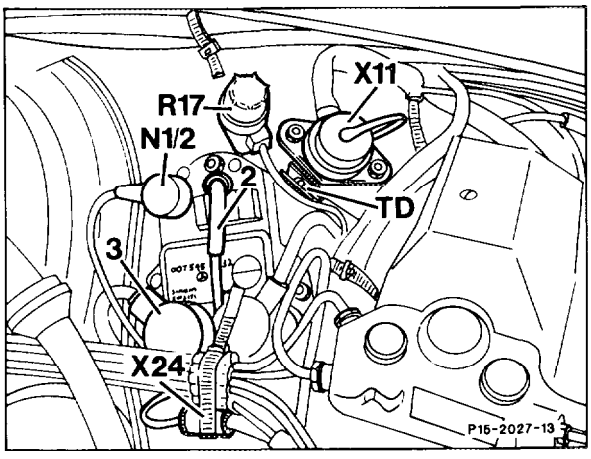
14 Unplug deceleration shutoff microswitch (S27/2), plug in.



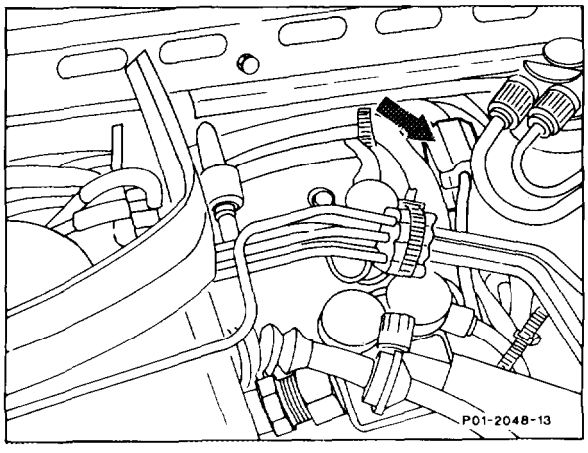
15 Unplug connector for crankshaft position sensor on ignition control module (N1/2), plug in.
Unplug vacuum line (2) and 4-pin connector (3), plug in.



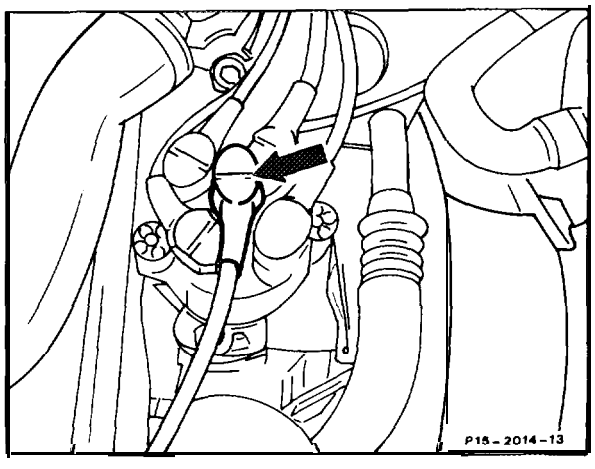
16 Unbolt terminal TD at terminal block of diagnostic connector (XI 1), bolt on. Unscrew diagnostic connector (XI 1) and unplug on the bottom the grey cable for TDC pulse generator, plug in.



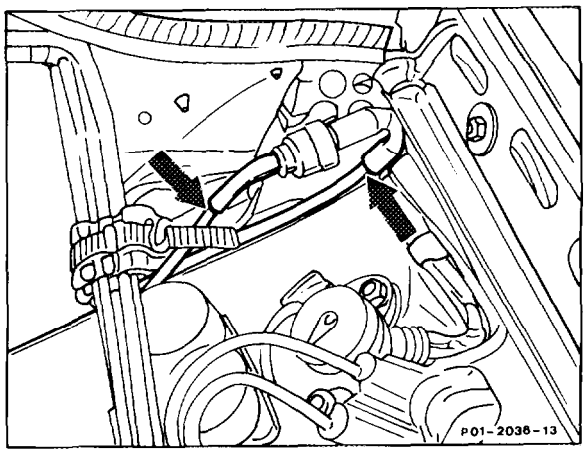
17 On models equipped with cruise control, unplug connector (arrow), plug in.



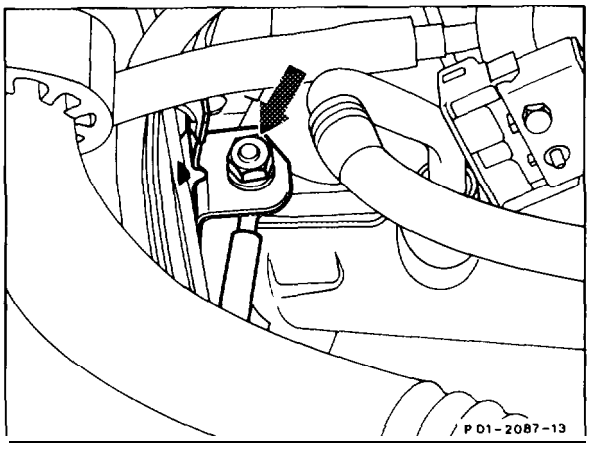
18 Unplug ignition cable 4 (arrow) at ignition distributor, plug in.



19 Detach vacuum lines (arrows) for fuel evaporative emission control system, attach.



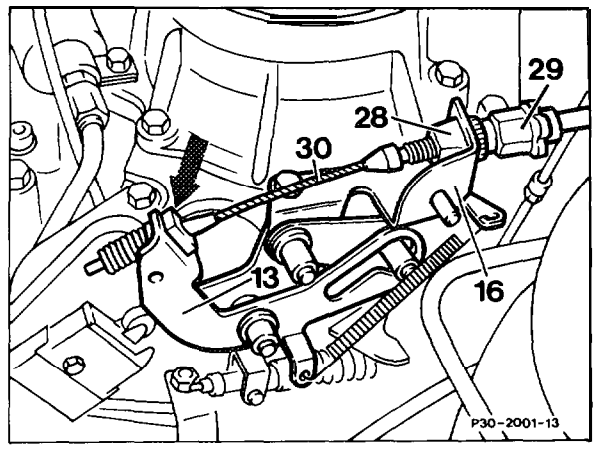
20 Unbolt ground cable at intake manifold, screw on (arrow).



21 Detach Bowden cable (30) for accelerator control, attach. Press plastic guide (arrow) out of its seat in the fulcrum lever (13) to perform this step, and take Bowden cable (30) out of the slot in the fulcrum lever.

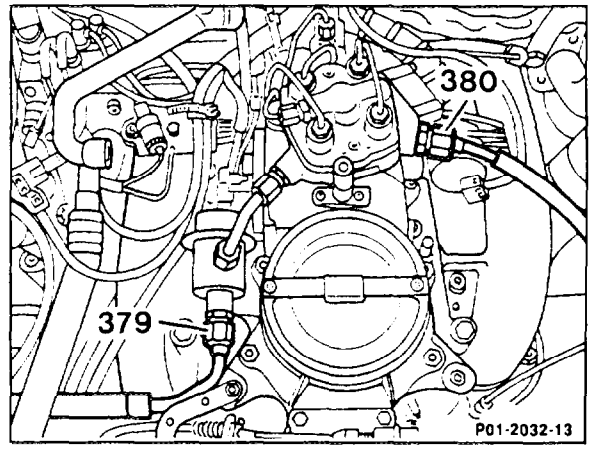
Installation instruction

Adjust Bowden cable (30) (30-325).



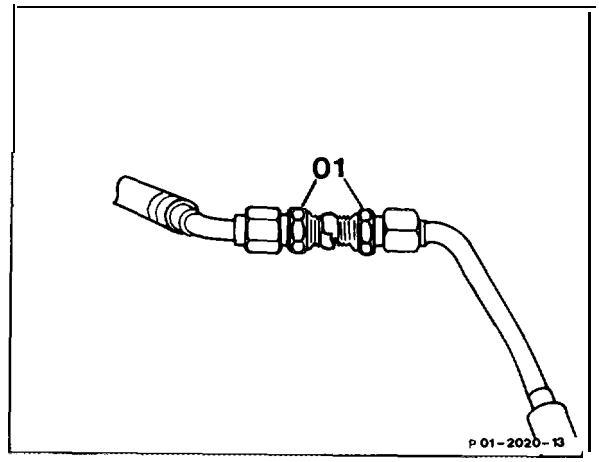
22 Reduce fuel pressure in the fuel lines by briefly opening fuel tank cap.

Unbolt fuel lines (379 and 380), bolt on.

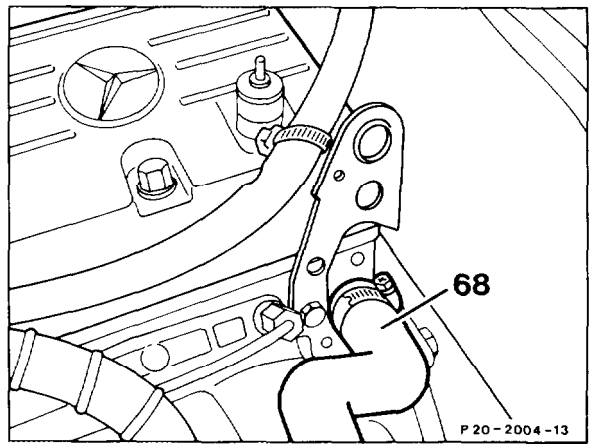


Note

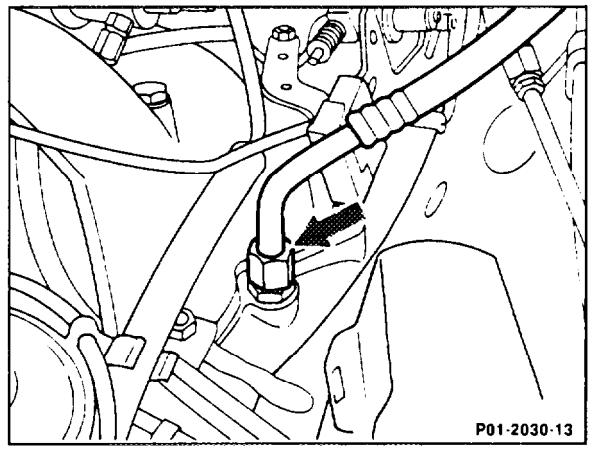
To prevent fuel flowing out of the disconnected fuel lines, both fuel lines can be plugged with a fitting (01, shop-made).



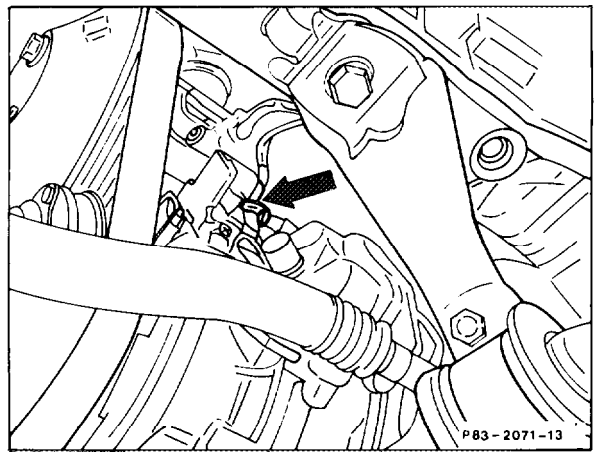
23 Disconnect engine coolant hose (68) for heater supply line at the cylinder head, connect.



24 Disconnect vacuum line for brake booster at intake manifold (arrow), connect.



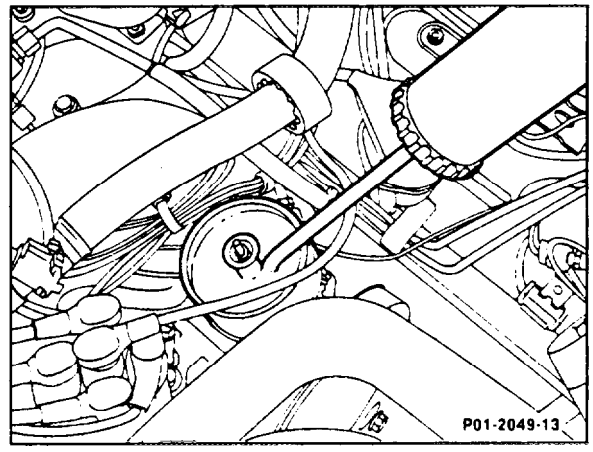
25 On models with A/C compressor, disconnect electric lead at A/C compressor, connect (arrow).



26 Disconnect piping group (170) at the cylinder head, connect (arrows).

27 Extract oil from the reservoir for power steering.

28 Disconnect oil lines at power steering pump, connect.



Installation instruction

Adjust oil level of power steering to correct level. When engine is running, top off oil to the marking. Turn steering several times from full left to full right lock.

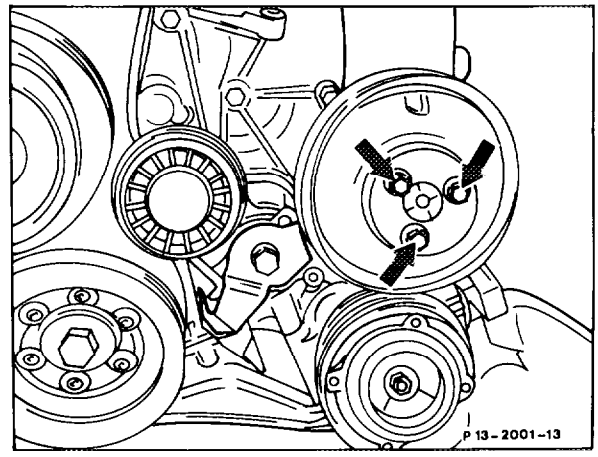
Oil level when oil at normal operating temperature (approx. 80 °C) 18 – 26 mm below the top edge of reservoir.

Oil level when oil cold (room temperature, approx. 20 “C) between Min. and Max. markings.

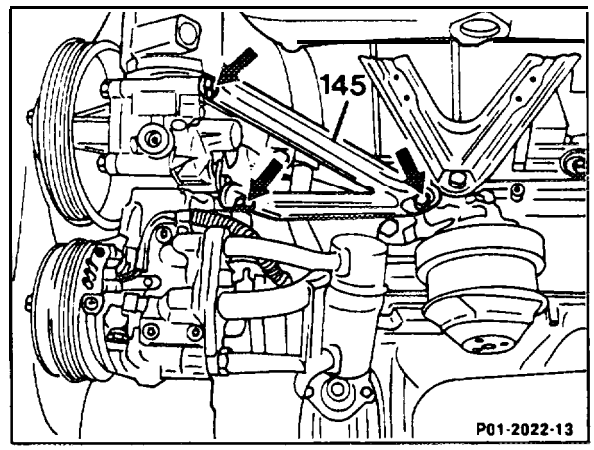
29 On models with AC compressor, remove poly V-belt, install (13-342).

30 Remove and install tensioning device for V-belt (13-345).

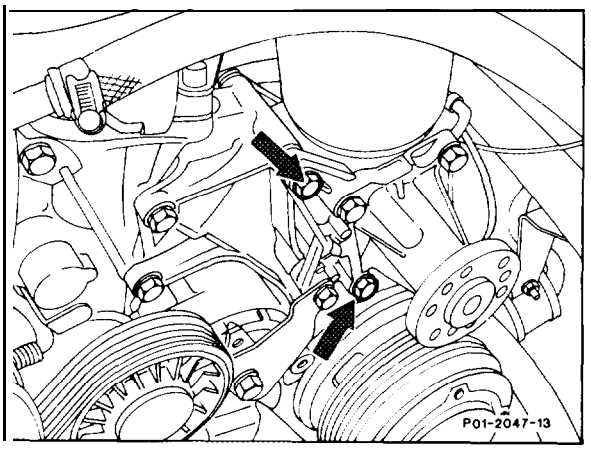
31 Unbolt belt pulley for high pressure pump of power steering, bolt on (arrows).



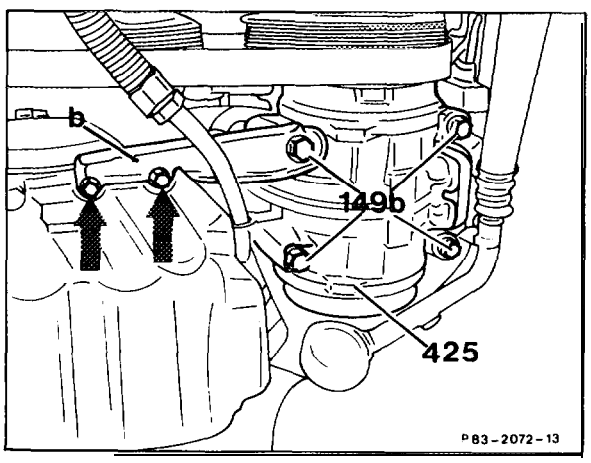
32 Unbolt strut (145) for high pressure oil pump and AC compressor (arrows), bolt on. Tightening torque 25 Nm.



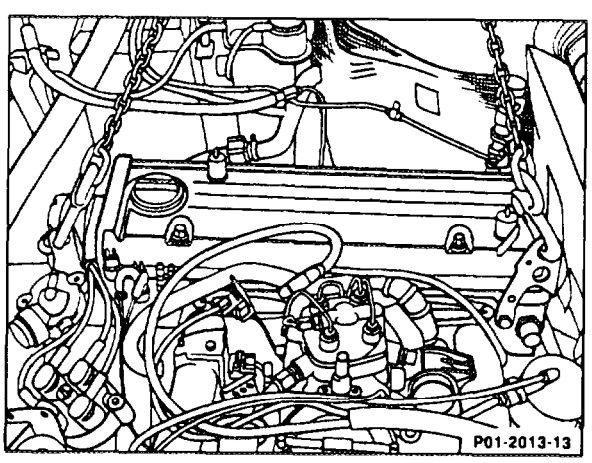
33 Unbolt high pressure oil pump, bolt on (arrows) and place to the side with the lines connected, tightening torque 25 Nm.



34 Unbolt AC compressor (425) at the supporting bracket, bolt on, and place to the side with lines connected. Bolts (149b), tightening torque 25 Nm.
Unbolt bracket (b), bolt on.

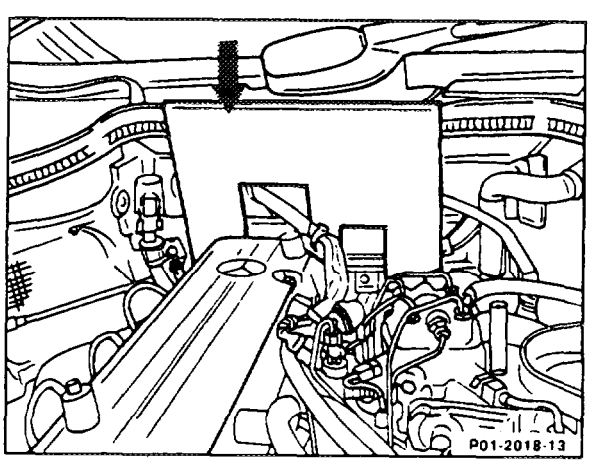


35 Attach engine hoist into the suspension lug of the engine.
Adjust engine hoist so that the engine can be raised horizontally.

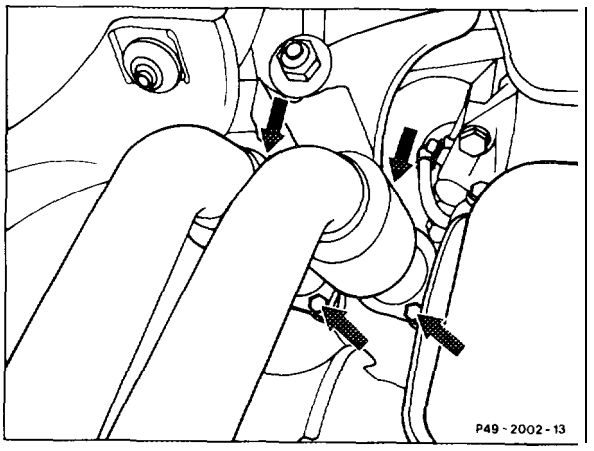


36 Disconnect all remaining lines, e. g. vacuum, oil, fuel lines and electric cables, running to the engine; connect.

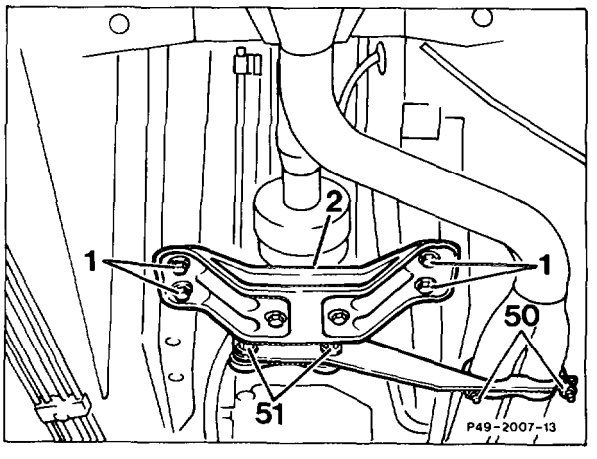
37 Insert guard plate (arrow) between component compartment and engine, remove.



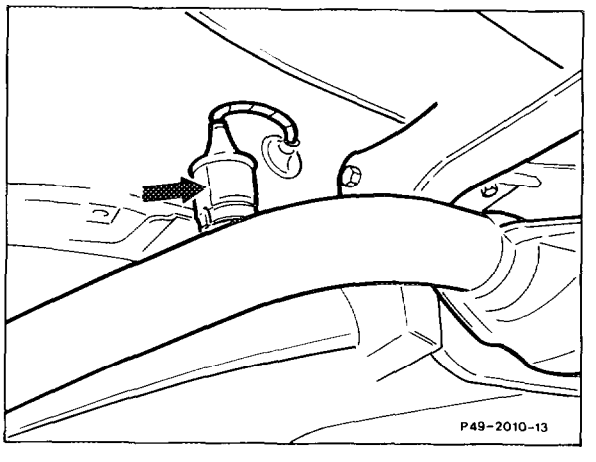
38 Unbolt exhaust at the exhaust manifold, bolt on (arrows), tightening torque 25 *Nm.*



39 Unbolt exhaust holder (50 and 51) at the exhaust and transmission, bolt on, tightening torque 25 Nm.

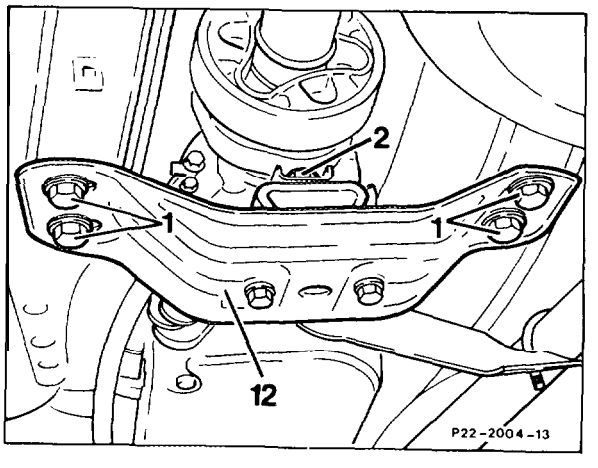


40 Remove lambda sensor at exhaust pipe, install. Remove cover (arrow) to perform this step.

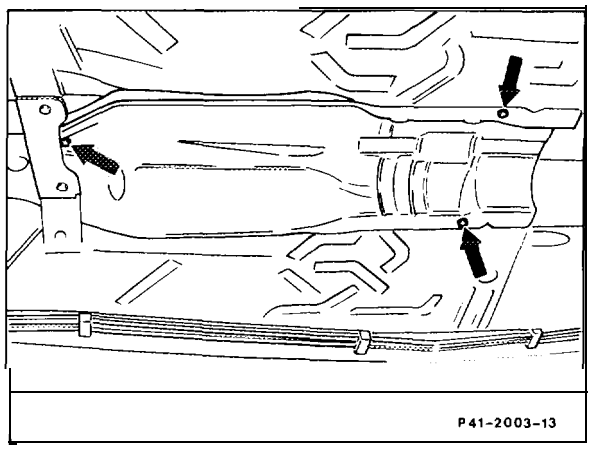


41 Remove and install exhaust system (49-100).

42 Unbolt engine supporting bracket (12), bolt on.
Tightening torques:
Bolt (1) 25 Nm,
Nut (2) 70 Nm.



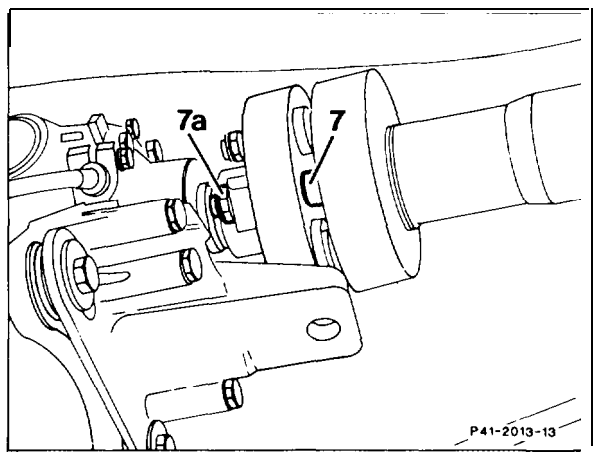
43 Unbolt shield, bolt on (arrows).



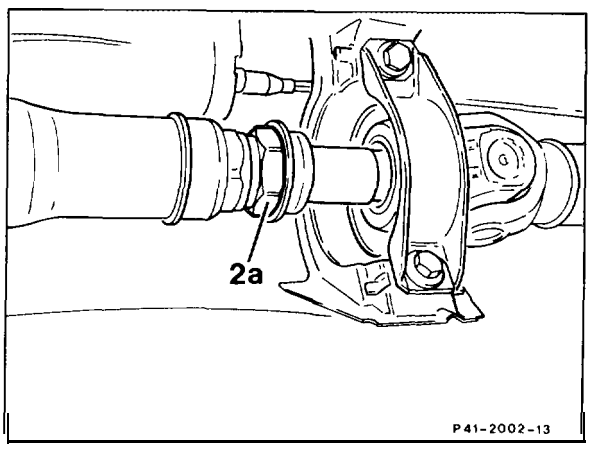
44 Unbolt drive shaft, bolt on. Loosen the bolts (7) and nut (7a) to perform this step. Tightening torque 45 Nm.

Note

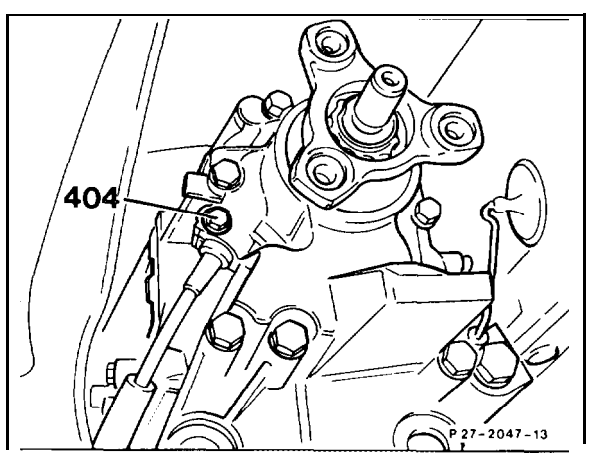
Flexible coupling remains on drive shaft.



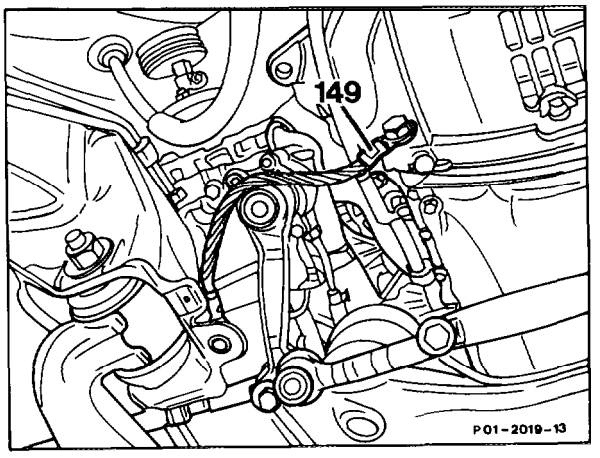
45 Loosen clamping nut (2a), tighten (wrench waf 41/46). Push drive shaft back as far as possible. Tightening torque 45 Nm.



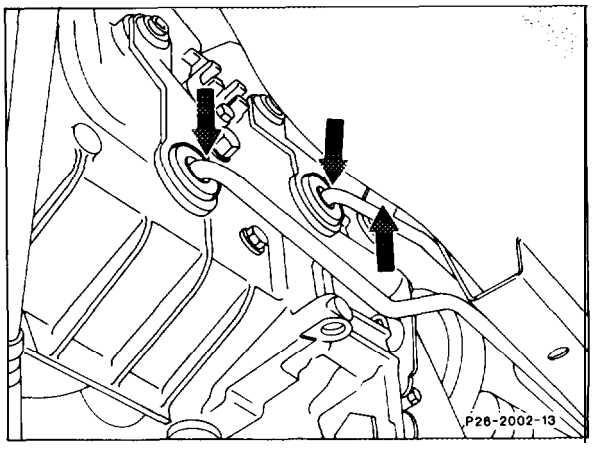
46 Detach speedometer shaft at transmission, attach. Remove bolt (404) to perform this step.



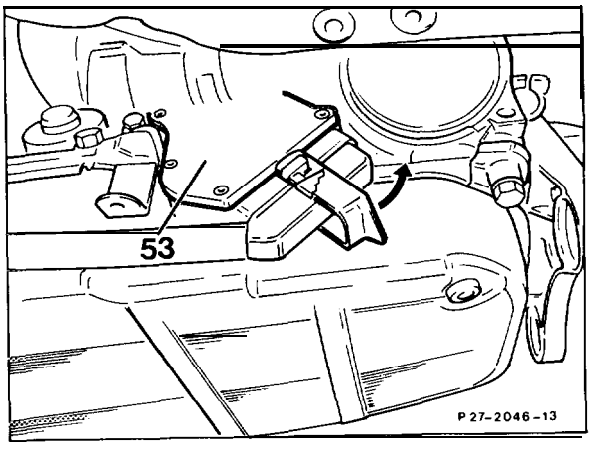
47 Unbolt ground cable (149) at transmission, bolt on. Tightening torque 45 Nm.



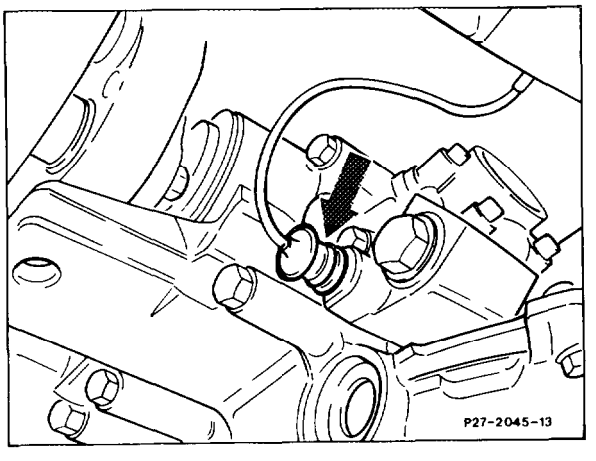
48 Detach shift rods at transmission, attach (arrows). Take the clip locks off the transmission shift levers to perform this step.



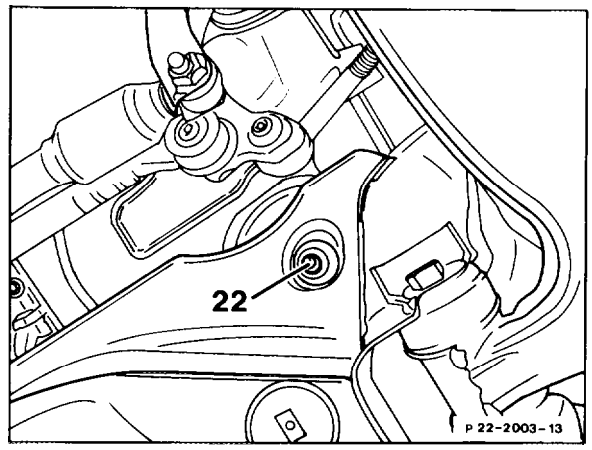
49 If equipped with automatic transmission, turn white plastic lock on starter lockout, backup light switch (53) approx. 45° to the right and unplug cable connector, plug in.



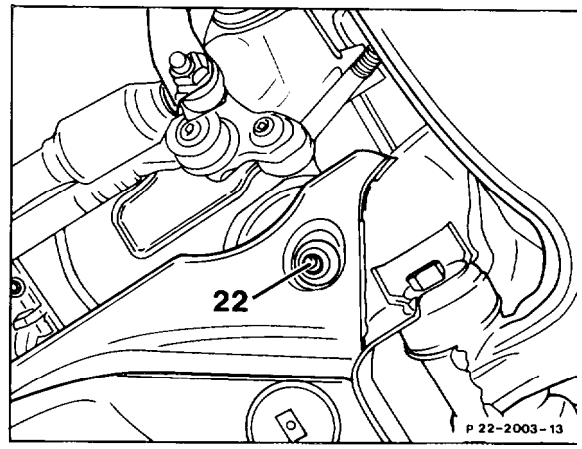
50 Unplug cable (arrow) at the kickdown solenoid valve, plug in.



51 Remove both bolts (22) for engine mounting. Tightening torque 40 Nm.



52 Lift out engine together with transmission at an angle of approx. 45°.

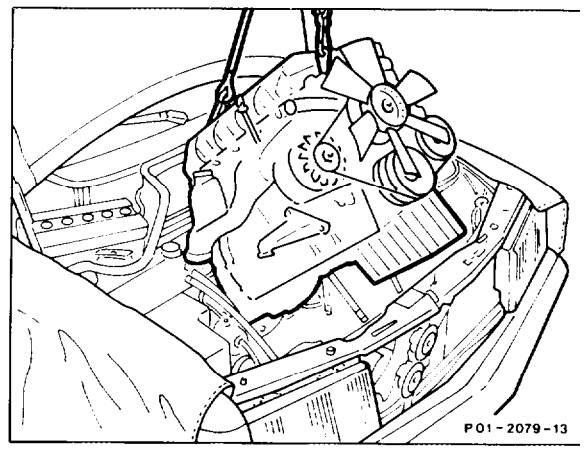


53 Install in the reverse order.

54 Check front and rear engine mounts.

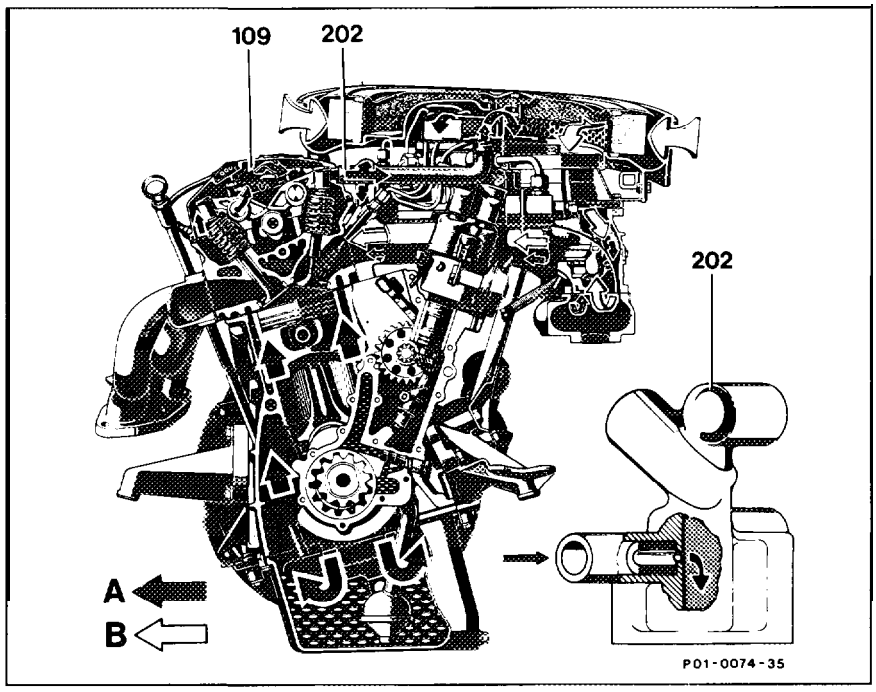
55 Check fluid levels, adjust to correct levels if necessary.

56 Check leaktightness with engine running.



01-040 Crankcase Ventilation – Function

Englne 102.985 (CFI system)



109 Oil separator
202 Idle air distributor (bypass passage dia. 1.5 mm)
A Fresh air
B Blowby gases

Function

The engine blowby gases flow through the oil separator (109) at the cylinder head cover and through a pipeline to the idle air distributor (202) or to the air filter (clean air side).

The oil separated out in the oil separator (109) flows back through a passage (dia. 3 mm) to the cylinder head.

At a high intake manifold vacuum, the blowby gases are drawn through the bypass passage (dia. 1.5 mm) in the idle air distributor (202) and the idle air passage in the intake manifold and flow to the combustion chambers. At the same time, a small quantity of clean air from the air filter is drawn in as well through the bypass passage.
At a low or no intake manifold vacuum. the blowby gases flow to the clean air side in the air filter and pass together with the intake air to the combustion chambers.

01-I 10 Measuring, boring and honing cylinders

Data

Engine	Gr. No.	1 st version 102.985	Gr. code letter	2nd version 102.985
Standard	0	95.498 – 95.508	A	195.500 – 95.506
	1	95.509 – 95.518	X	95.507 – 95.512
	2	95.519 – 95.528	B	95.513 – 95.518
1st repair size (+0.5)	0	95.998 – 96.008	A	96.000 – 96.006
	1	96.009 – 96.018	X	96.007 – 96.012
	2	95.519 – 96.028	B	96.013 – 96.018
2nd repair size (+1.0)	0	96.498 – 96.508	A	96.500 – 96.506
	1	96.509 – 96.518	X	96.507 – 96.512
	2	96.519 – 96.528	B	96.513 – 96.518

Wear limit in direction of travel or transverse direction		0.10
Permissible variation of cylinder shape	when new	0.007
	wear limit	0.05
Permissible variation from rectangularity related to cylinder height		0.05
Averaged peak-to-valley height (Rz) after ceramic finish honing		0.002 – 0.004
Permissible height of unevenness (Wt)		50 % of PTV height
Chamfer of cylinder bores		see instruction
Honing angle		50° ± 10°

Commercial tool

Snap gauge for internal measurements, Ø 80 – 100 mm	e. g. Hahn und Kolb Borsigstraße 50 D-7000 Stuttgart 30 Order No. G422K

Note
Since 04/88 the tolerance stages of piston and cylinder bore dia. have been identified with letters (hitherto figures, refer to data). As previously in the figures, the letters are also stamped in the mating face of the crankcase and in the piston crowns.

Identification of tolerance stages

previous	current
0	A
1	X
2	B

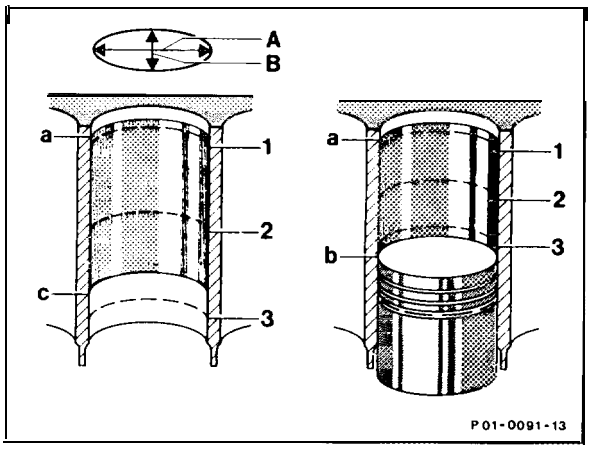
Standard **implementation:** 041'88

Model	Engine	Engine End No.	
		Manual transmission	Automatic transmission
201.028	102.985	024336	072359

When performing repairs, ensure that the tolerance stage identification of piston and cylinder bore agrees. It is possible to install pistons with a code letter identification in cylinder bores with a digit identification if this tolerance stage identification agrees according to the table. If, when performing repairs, no identical pairing is possible, reference can be made to the piston installation play of 0.016 – 0.040 mm to determine a suitable piston.

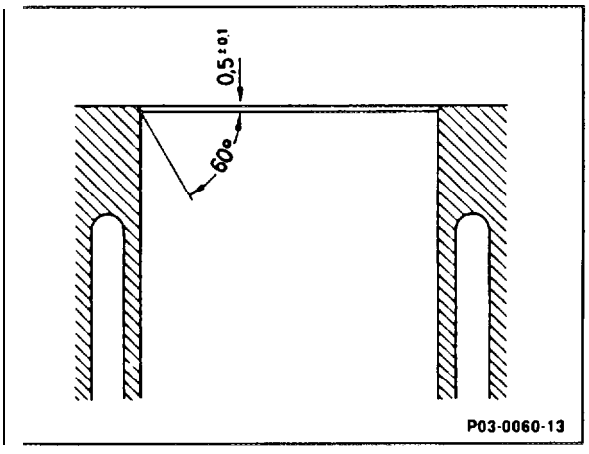
Measuring

Measure the cleaned cylinder bores with an internal measuring device at measuring points 1, 2 and 3 in longitudinal direction A (piston pin axis) and in transverse direction B.
With pistons installed, measuring point 3 is just above the piston, which must be at bottom dead center.

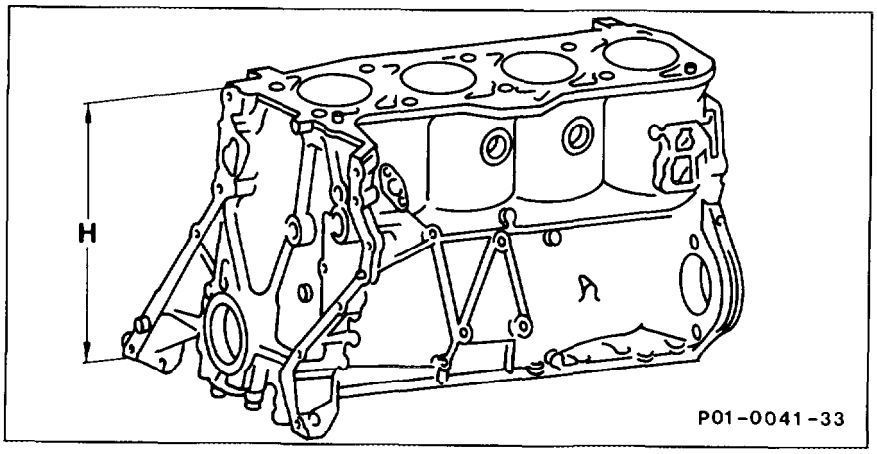


Measuring points 1 – 3
A Longitudinal direction
B Transverse direction
a Top reversal point of 1st piston ring
b Bottom dead center of piston
c Bottom reversal point of oil scraper ring

Chamfer the cylinder bores after boring.
The material allowance for honing should be not more than 0.05 mm.



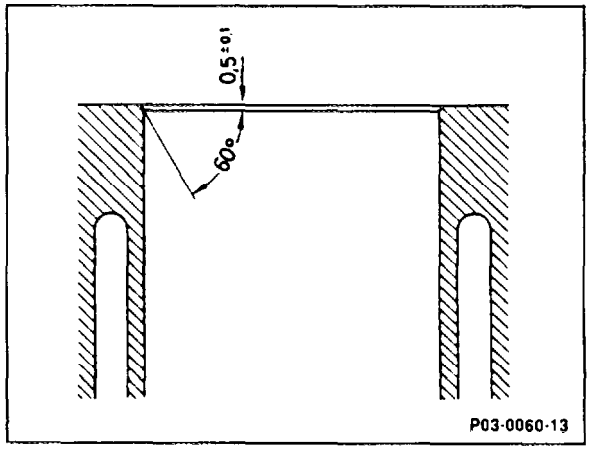
01-120 Facing crankcase parting surface



Data

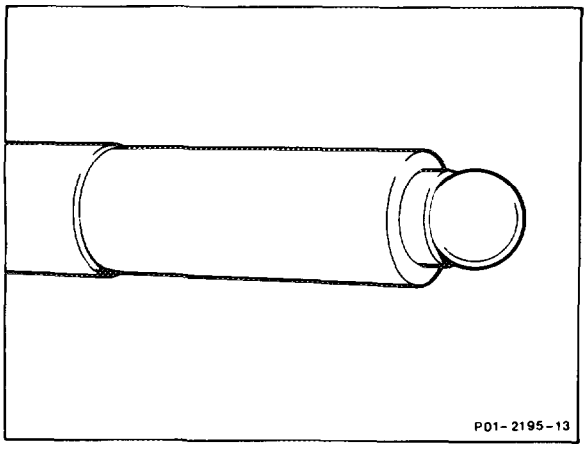
Height "H" of crankcase when new		292.45 ± 0.05
Minimum height after necessary stock removal		292.35
Permissible unevenness	top crankcase mating face	0.03
	bottom crankcase mating face	0.04
Permissible variation of parallelism of top to bottom crankcase mating face in longitudinal direction		0.1
Peak-to-valley height (Rz)	top crankcase mating face	0.005 – 0.020
	bottom crankcase mating face	0.025
Test pressure with air under water in bar gauge pressure		1.5
Chamfer of cylinder bores		0.5 ± 0.1 × 60°

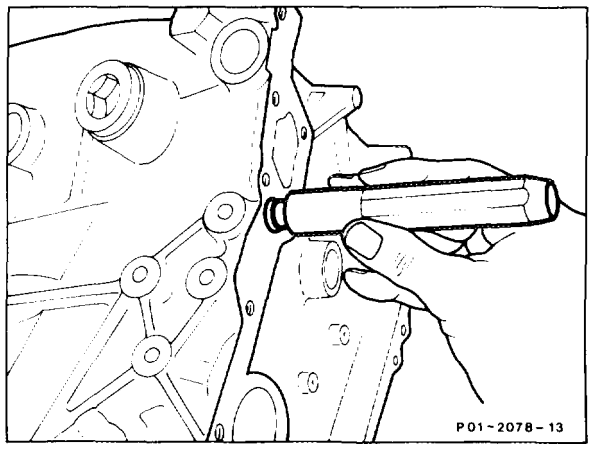
Note
Chamfer the cylinder bores after completing machine work.
If the crankcase mating face has been remachined, the timing must be reset (05215).
The timing case cover must be bolted tight to the crankcase and also be machined when machining the top or bottom crankcase mating faces.



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

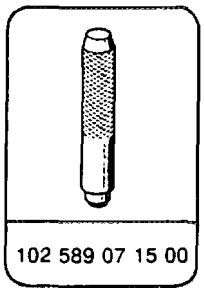
Preceding work:
Removal of engine coolant pump (20-210).
Removal of flywheel (03-410).





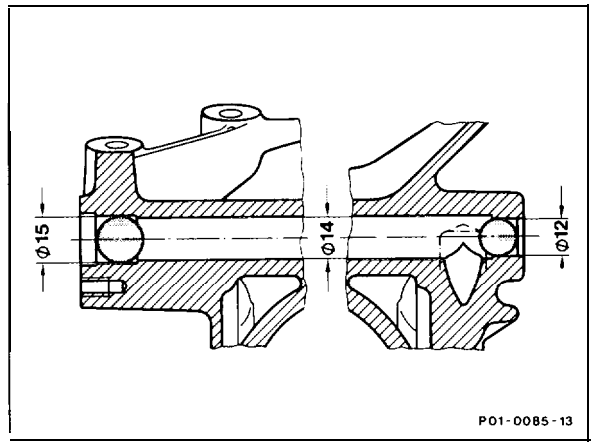
Both steel balls	knock out together from back to front with a round steel bar (dia. 11 mm, approx. 500 mm long). If the rear ball moves into the cross passage to the oil filter, remove the oil filter to enable the ball to be removed.
Bores	thoroughly clean in the area in which the steel balls are pressed in.
Cup on fitting mandrel	coat with grease and install steel ball into the cup.
Steel ball	position with the installation mandrel and knock in each at front and rear as far as the stop on the mandrel.

Special tool



Notes

The main oil gallery is closed with steel balls, dia. 15 mm at the front, dia. 12 mm at the rear.

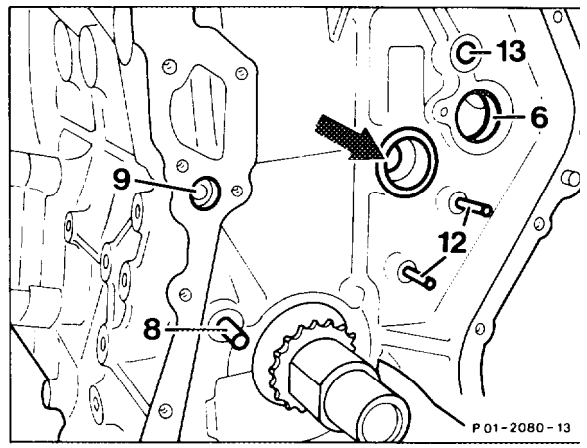


When reconditioning the engine, the steel bails must be knocked out from the rear in order to clean the main oil galleries.

Undamaged steel balls may be reused several times without machining the ball seat.

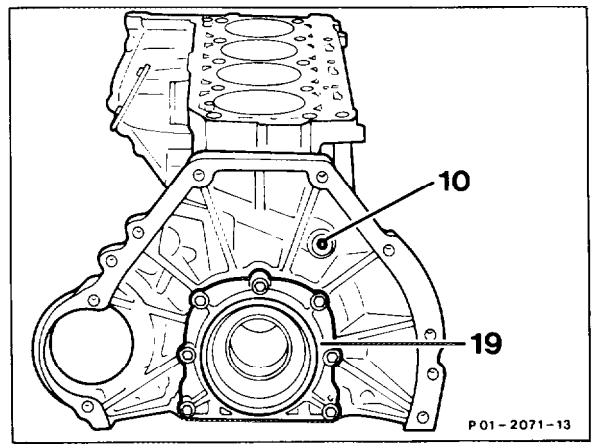
Replace damaged steel balls.

If a leak exists, reset steel balls approx. 1 mm (size is fixed on installation mandrel). Special tool 102 589 07 15 00.



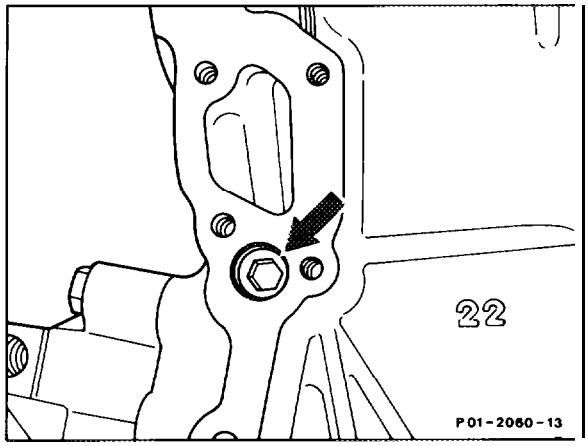
9 Front steel ball (Ø 15 mm)

Should the leaks not be repaired after this, knock out both steel balls and seal the main oil passage end in question with a screw plug.

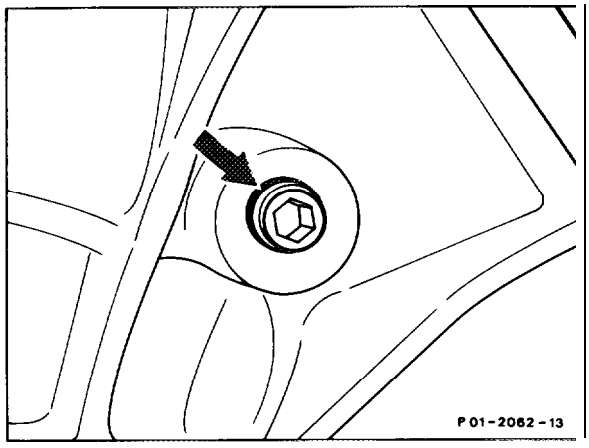


10 Rear steel ball (Ø 12 mm)

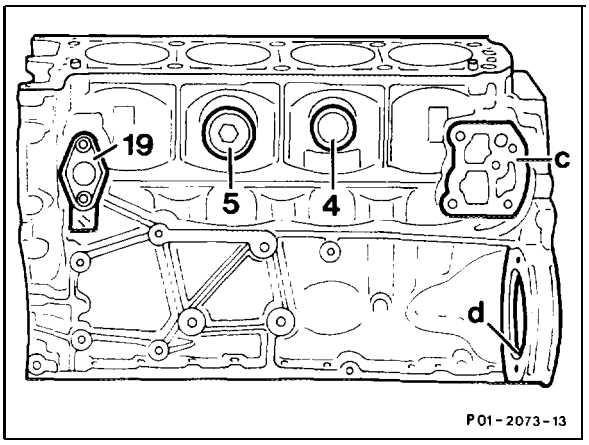
This is done by tapping an Ml 6 ✕ 1.5 thread approx. 10 mm deep at the front of the main oil gallery. Thoroughly remove chips from the oil gallery.
Coat Ml6 ✕ 1.5 screw plug Part No. 000 906 016 002 with sealing adhesive 002 989 94 71 and screw in (arrow).

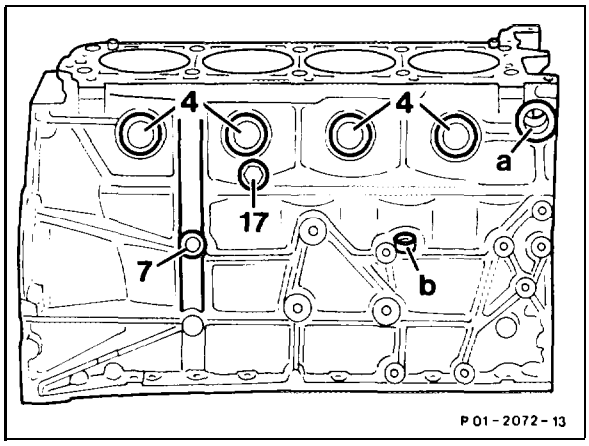


Tap an Ml 4 ✕ 1.5 thread approx. 12 mm deep into the rear of the main oil gallery. Thoroughly remove chips from the main oil gallery.
Coat Ml 4 x 1.5 screw plug, Part No. 000 906 014 000, with sealing adhesive 002 989 94 71 and screw in (arrow).



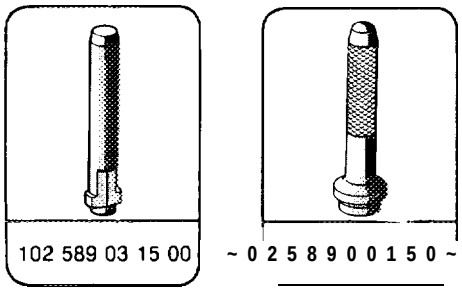
01-140 Replacing core plug in crankcase





Coolant	drain completely, pour in (20-010).
Components which restrict access	remove, install.
Core plug (4)	remove.
	Position a chisel with narrow blade or a screwdriver in the deep-drawn edge of the plug (step 3).
	Carefully knock in plug on one side far enough for it to turn through its own longitudinal axis (approx. 90°), and pull out with the pliers (step 4).
Sealing surface in crankcase	Thoroughly clean of residues. The sealing surface must be free of grease.
New core plug	install.
	Coat sealing surface with the sealant Loctite 241, 002 989 94 71. Note curing time of approx. 45 minutes (step 6).
	Knock in core plug with the matching mandrel (step 7).
Engine	run until warm and check leaktightness.

Special tools

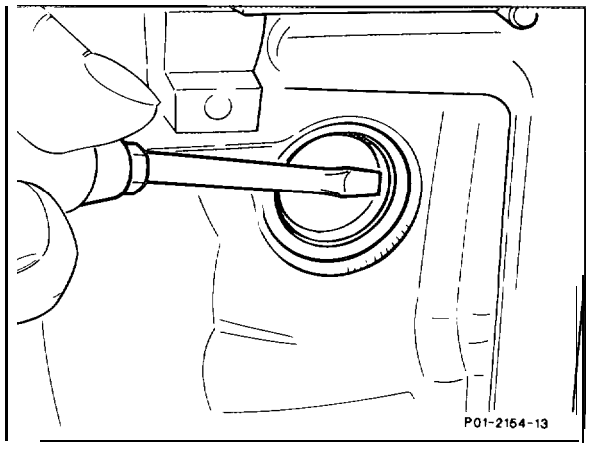


Replacement

1 Completely drain engine coolant (20-010).

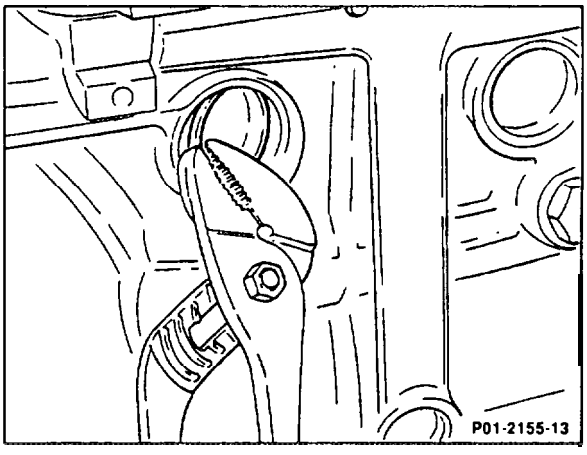
2 Remove components which restrict access.

3 Position a chisel with narrow blade or a screwdriver into the deep-drawn edge of the plug.



4 Carefully knock in plug on one side far enough for it to turn through its own longitudinal axis (approx. 90°) and withdraw with pliers.

5 Thoroughly clean sealing surface of residues. The sealing surface must be free of grease.

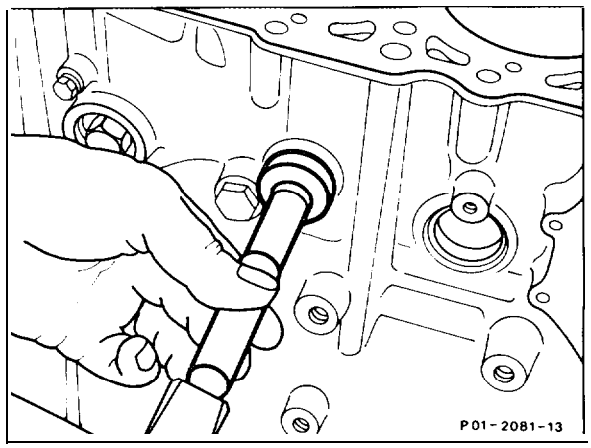


6 Coat sealing surface with sealant Loctite 241, 002 989 94 71.

Note

The sealant must cure for approx. 45 minutes before adding the engine coolant.

7 Knock in new core plug with the matching mandrel.



mm 0	Special tool
34	102 589 00 15 00
20	102 589 03 15 00

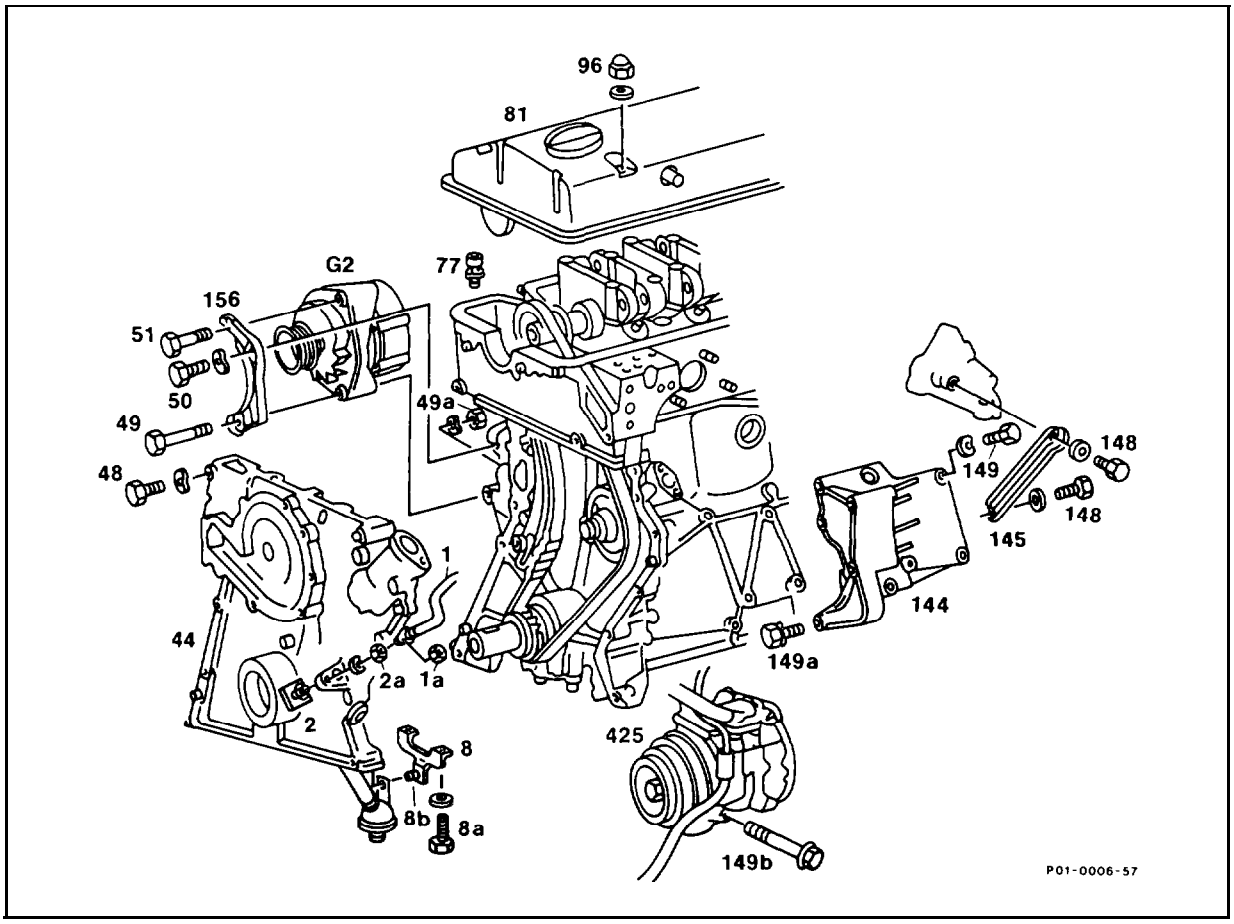
8 Install removed components.

9 Add engine coolant (20-010).

10 Run engine until warm and check leaktightness.

01-210 Removal and installation of timing case cover

Preceding work:
Removal of radiator (20-420).
Removal of power steering pump (46-710).
Removal of torsion bar (32-300).
Removal of oil sump (01-310).
Removal of V-belt tensioning device (13345).
Removal of vibration damper or hub and belt pulley (03-342)
Removal of engine coolant pump (20-210).
Removal of air filter (09-400, or 09-410).
Removal of ignition distributor (15-l 10).
Removal of pressure oil pump for level control (32640).

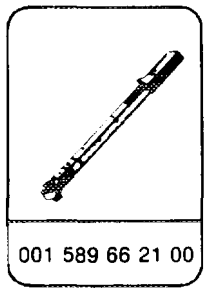


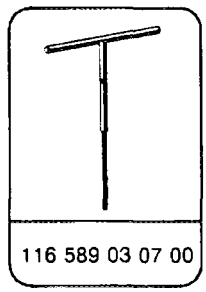
Cylinder head cover (81)	remove, install, together with ignition cable and distributor cover (01-406).
Hexagon socket bolts (77)	3 off, remove and install, 25 Nm (reference value, step 2).
Strut (145)	unbolt, bolt on, 25 Nm (step 3).
A/C compressor (425)	unscrew, screw on and place to the side with connected lines, 25 Nm. Unbolt, bolt on bracket (b), 10 Nm (step 4).

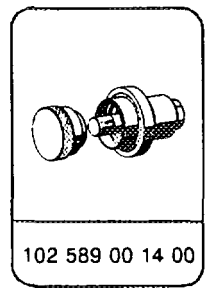
Connector (327)	unplug at alternator, plug in (step 5).
Alternator (G2)	unscrew, screw on, 30 Nm (step 6).
Bracket (156)	for alternator, unbolt, bolt on, 25 Nm (step 7).
TDC pulse generator cable (1)	unbolt, bolt on (step 8). If timing case cover has been replaced, the TDC pulse generator bracket must be adjusted (03345).
Bracket (8)	for oil pump strainer basket, unbolt, bolt on, 25 Nm, (step 9).
Timing case cover	remove remaining bolts, take off timing case cover (steps 10 and 11). Do not damage cylinder head gasket: replace cylinder head gasket if damaged.
Mating surfaces	clean (step 12).
Timing case cover	coat with sealant 001 989 25 20 and install timing case cover (steps 13 and 14). Use fitting tool 102 589 00 14 00 and spacer ring 102 589 01 14 00 for replacement of radial seal.

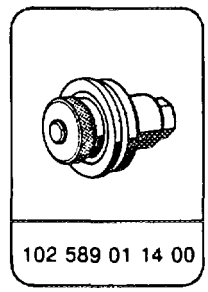
Special tools


001 589 72 21 00


001 589 66 21 00


116 589 03 07 00


102 589 00 14 00


102 589 01 14 00

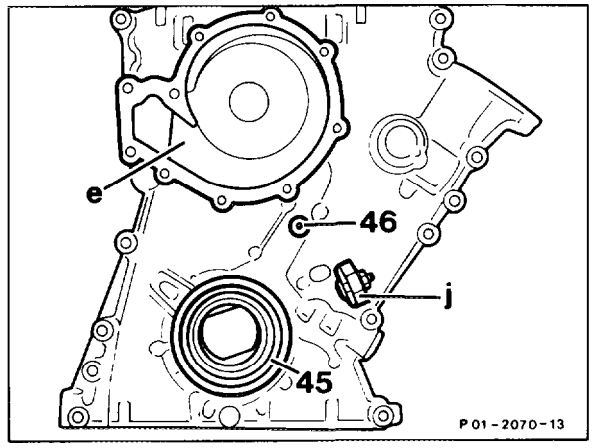
Notes

The timing case cover closes off the crankcase at the front. It is fixed in position with 2 straight pins 10 × 14 and attached to the crankcase with 15 hexagon bolts.

The timing case cover is sealed to the crankcase with the sealant Loctite 573, Part No. 001 989 25 20.

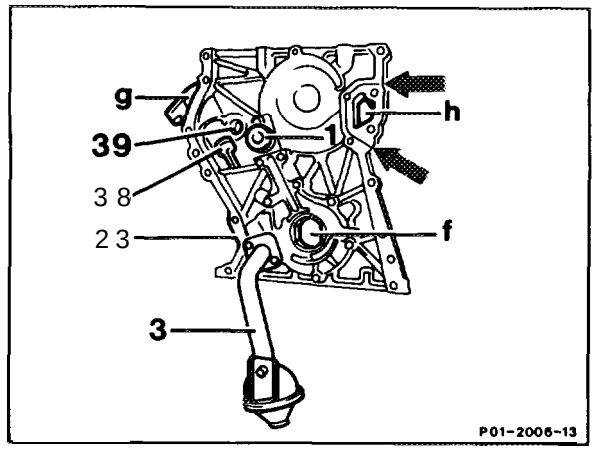
The timing case cover also acts as a support or housing for the following components or component parts:

Engine coolant pump
Ignition distributor
Oil pump
Oil overpressure valve
Radial seal for sealing crankshaft at front
Setting pointer
TDC pulse generator



Front side of timing case cover
45 Crankshaft radial seal
46 Setting pointer for TDC
e Coolant pump chamber with inlet
j Bracket for TDC pulse generator

To avoid any engine coolant mixing with the engine oil should a leak occur between crankcase and timing case cover, a groove (arrows) has been provided around the coolant inlet (h) to allow the coolant to flow to the outside.



Rear side of timing case cover
1 O-ring
23 Oil overpressure valve plug
38 Thrust piece
39 Bearing bush for Intermediate gear shaft
f Oil pump
g Mount for ignition distributor
h Coolant inlet

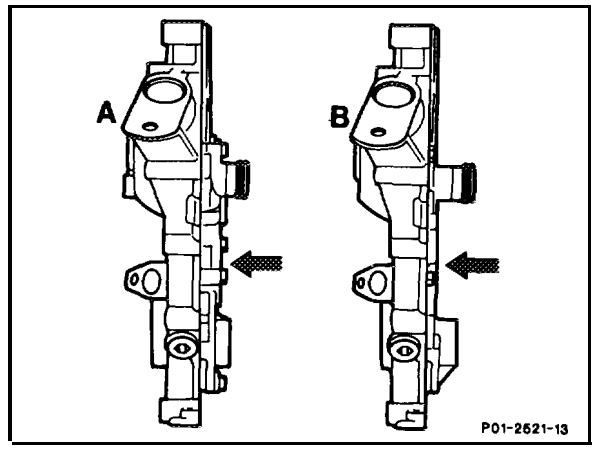
The timing case cover is always supplied as a replacement part with the oil pump installed, but without radial seal for the front of the crankshaft and without oil suction pipe with oil strainer.

Note

A gasket for sealing the timing case must not be installed on these engines (with single belt drive).

The timing case cover was modified effective 11/87.

The contours on the rear side have been lowered. This is detectible from the cast Part No. 102 015 11 01 on the front side of the cover. This timing case cover can also be installed on engines manufactured prior to this date.



A Previous version
B Present version

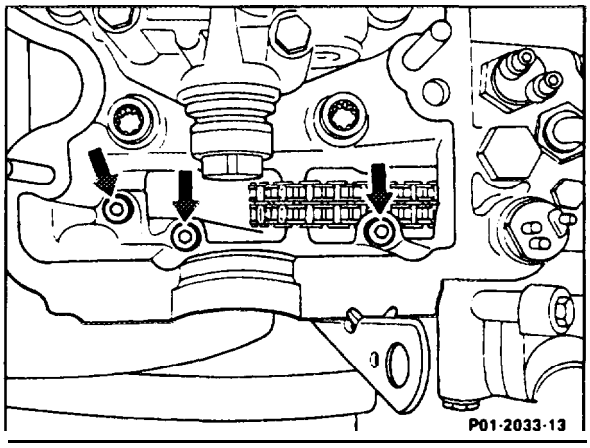
Standard implementation: 11/87

Model	Engine	Engine End No.	
		Manual transmission	Automatic transmission
201.028	102.985	020073	063591

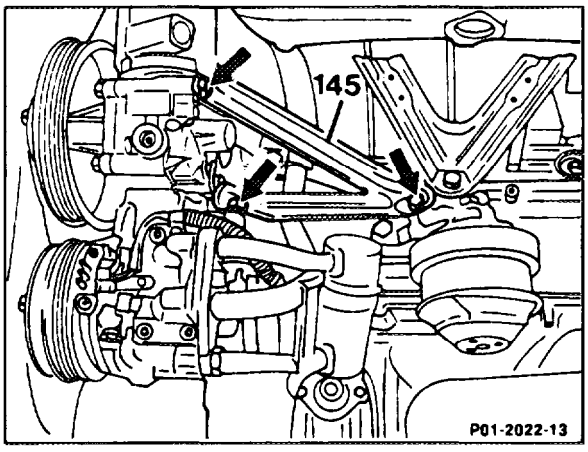
Removal

1 Remove cylinder head cover (01-406).

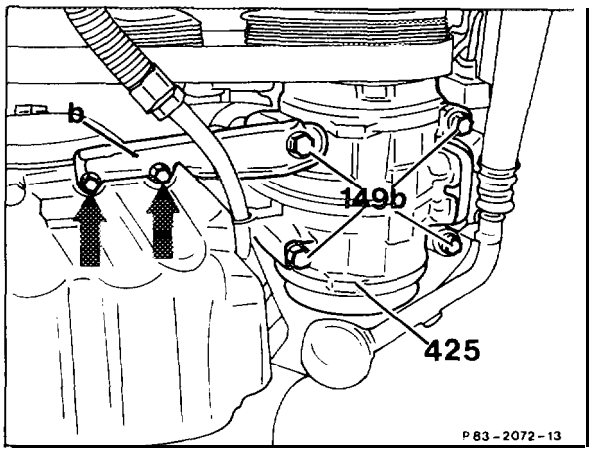
2 Remove hexagon socket bolts (3 off M8, arrows) in the chain box with a stud wrench 116 589 03 07 00. Tightening torque 25 Nm (reference value).



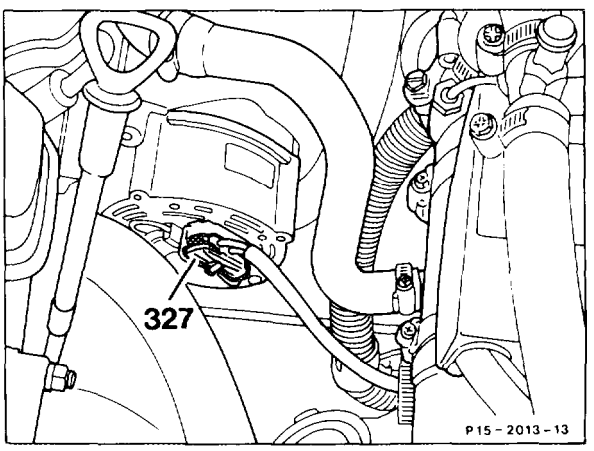
3 Remove strut (145) for power steering pump and A/C compressor (arrows). Tightening torque 45 Nm.



4 On models equipped with A/C compressor, unbolt compressor. Unbolt bracket (b) to perform this step.
Place A/C compressor to the side with the pipe group connected.

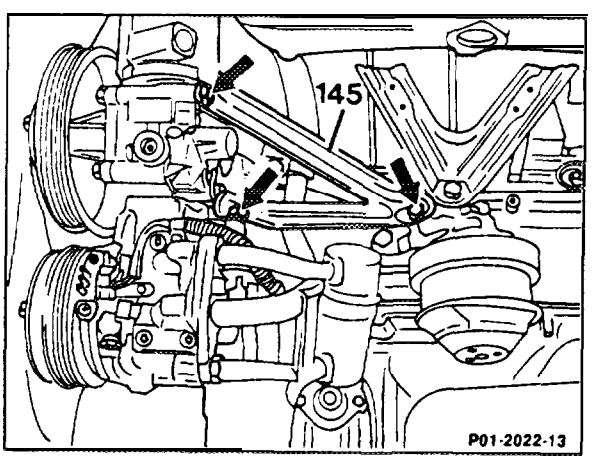


5 Unplug connector (327) at the alternator, plug in.

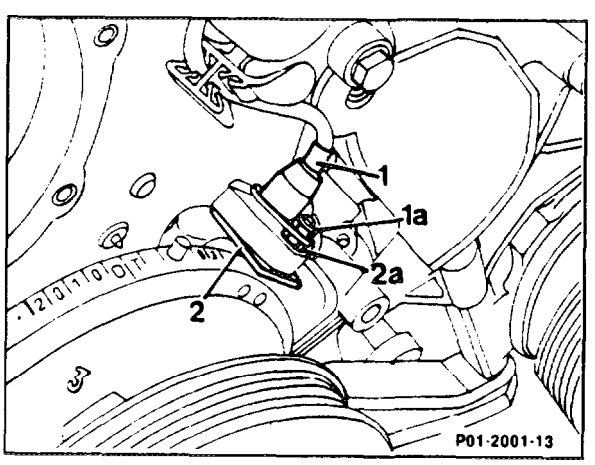


6 Remove bolts (49 and 51), bolt on; remove alternator, insert. Tightening torque 30 Nm.

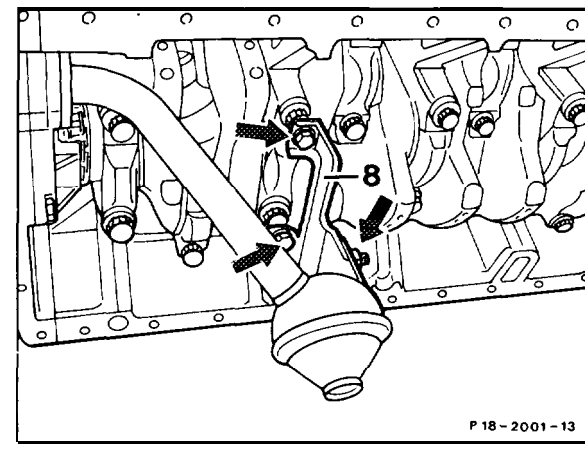
7 Unbolt bracket (156), bolt on. Tightening torque 25 Nm.



8 Unbolt TDC pulse generator cable (1) at the holder (2), screw on.



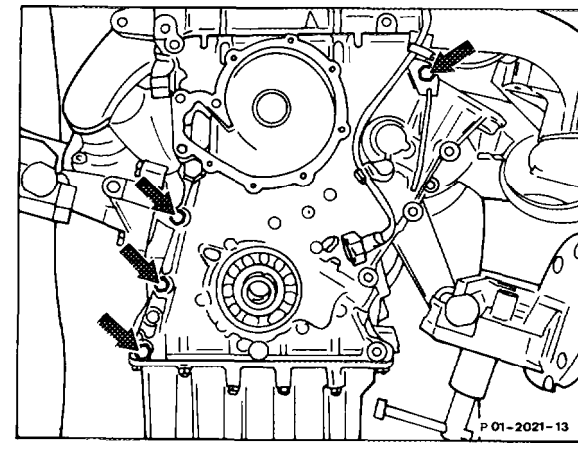
9 Unbolt bracket (8) for oil pump strainer basket, bolt on (arrows).



10 Remove remaining bolts (arrows) for timing case cover.

11 Remove timing case cover.

Caution!
Do not damage cylinder head gasket. Replace cylinder head gasket if damaged.



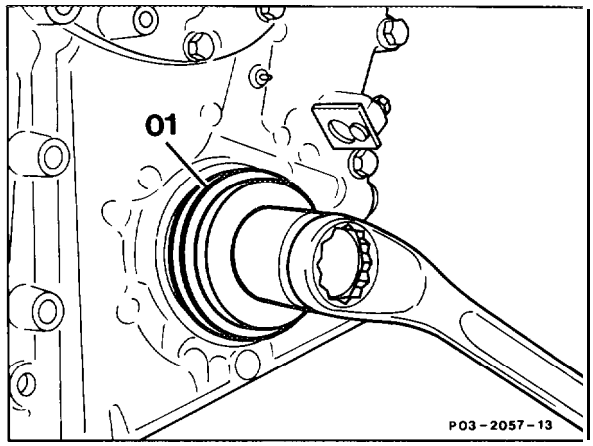
Installation

12 Clean mating faces.

13 Coat mating face of timing case cover with the sealant, Part No. 001 989 25 20.

14 Carefully install timing case cover, paying attention to the cylinder head gasket, and bolt tight.
Note bolt lengths.

15 If the radial seal has been removed, insert new radial seal with the sleeve 102 589 00 14 00.
Install spacer ring (01) 102 589 01 14 00 for the timing case cover with double roller chain.



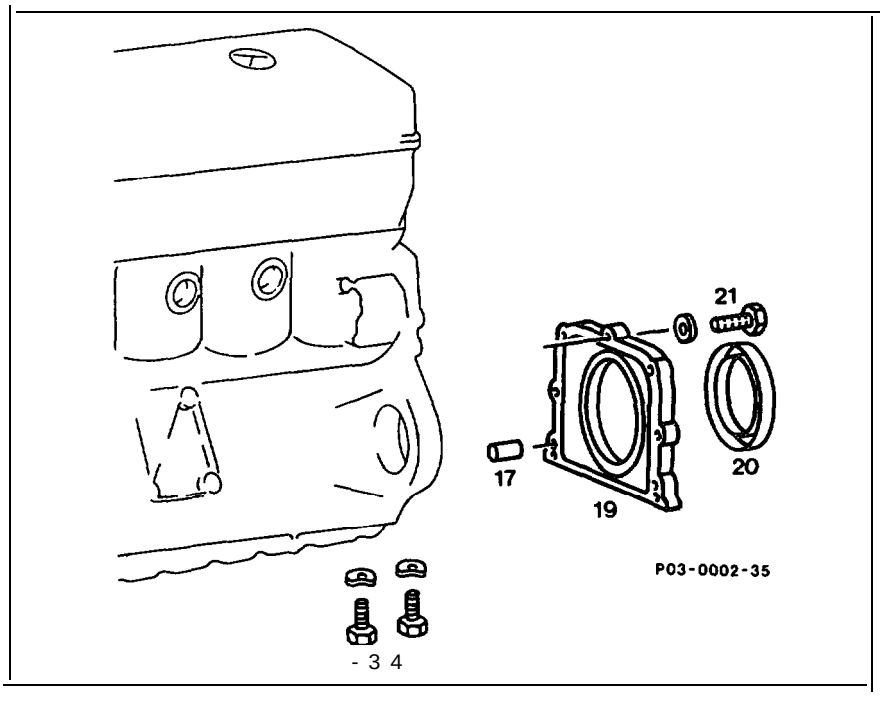
Note
If the timing case cover has been replaced, the TDC pulse generator holder must be adjusted (03-345).

16 The remaining parts are installed in the reverse order.

17 Run engine and check for leaks.

01-222 Removal and installation of end cover

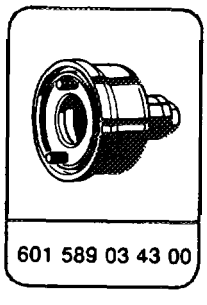
Preceding work:
Removal of transmission **(26-020** or **27-600).**
Removal of flywheel **(03-410).**

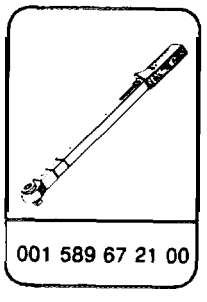


End cover (19) . . . . . remove, install (pay attention to instructions). Clean mating face, insert roll pins (17). Coat mating face and bolts (21 and 34) with sealant 001 989 45 20 10, 10 Nm.

Radial seal (20) . . . . . replace, use special tool 601 589 03 43 00.

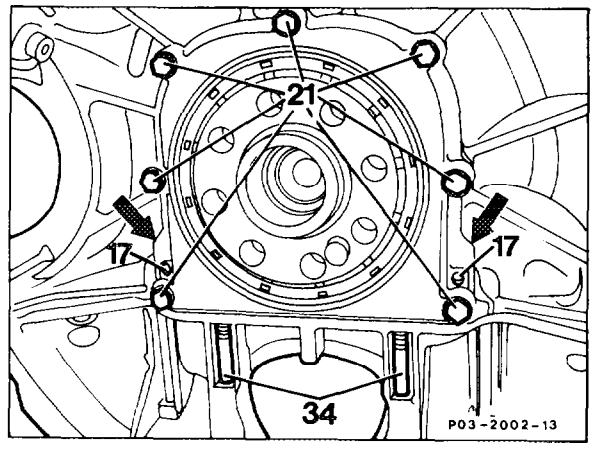
Special tools


601 589 03 43 00


001 589 67 21 00

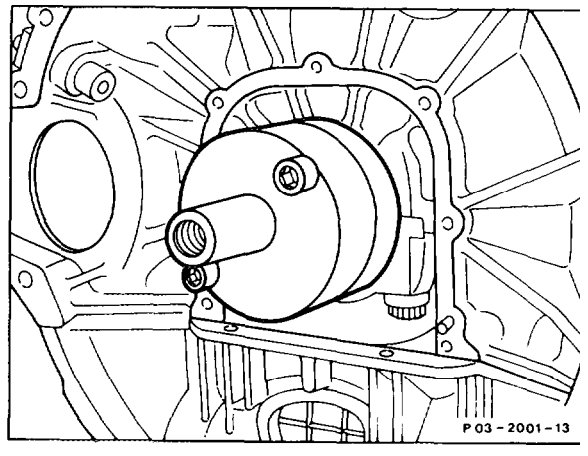
Notes

The center installation position relative to crankshaft center is fixed with two roll pins (17). Press end cover off at both side plates (arrows).



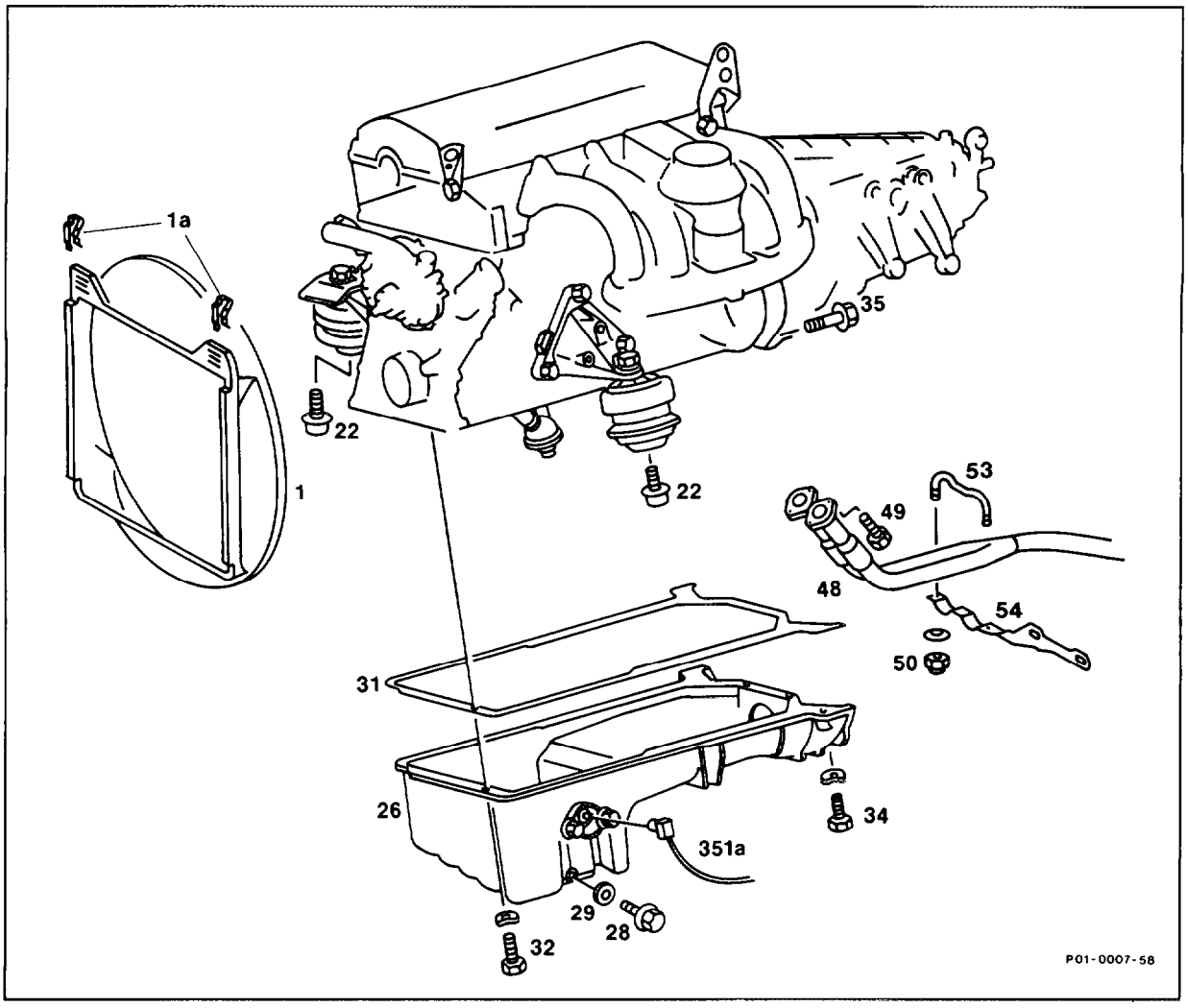
17 Roll pin
21 Bolt-washer assy (M6 x 22)
34 Bolt-washer assy (M6 x 65)

Push end cover with radial seal installed in place over the bolted-on assembly sleeve.



01-310 Removal and installation of oil pan

Preceding work:
Removal of air filter (09-400 or 09-410).
Removal of bottom engine compartment cover (01-006).
Removal of torsion bar (32-300).



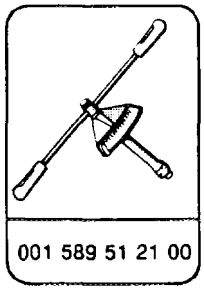
Engineoil	drain, add. Unscrew oil drain plug (28) to perform this step, screw in, 25 Nm. Replace sealing ring (29).
Cable (351a)	unplug, plug in.
Clips (la)	pull off, detach, attach fan shroud (1), place over fan.
Exhaust pipes (48)	unbolt at exhaust manifold, bolt on, 25 Nm (step 4).

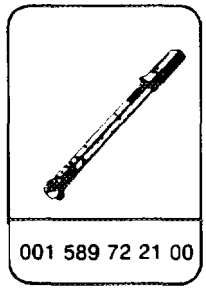
Pipe clip (53)	unbolt, bolt on, 25 Nm (step 5). Replace nuts (50).
Bolts (35)	2 off M10, unbolt, bolt on, 45 Nm (step 6).
Bolts (22)	unbolt, bolt on, 45 Nm, attach engine hoist to suspension lugs and raise (steps 7 and 8).
Oil pan (26)	remove, install. Remove bolts (32, 34) for this step, bolt on. Clean sealing surface. Replace gasket (31) (step 9). Tightening torque: M6 10 Nm, M8 25 Nm.

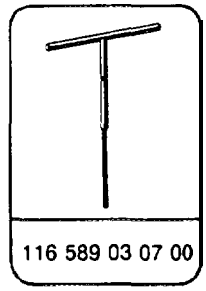
Oil capacity in litres

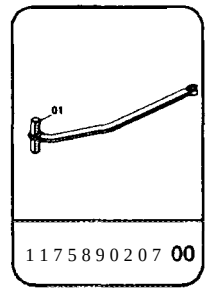
Total capacity for oil and filter change	5.5
Oil pan max. / min.	4.8 12.8

Special tools


001 589 51 21 00


001 589 72 21 00


116 589 03 07 00



1175890207 00

Commercial tool

Engine hoist No. 3180	e. g. Messrs. Backer Herderstraße D-5630 Remscheid

Shop-made tools

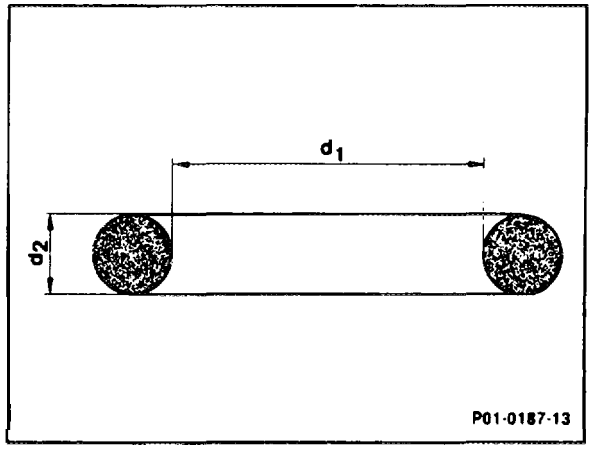
Metal panel for component compartment wall	Dimensions: approx.320 × 380 × 1
Guard plate for radiator/evaporator	Dimensions: approx. 480 × 600 × 1

Note
The O-ring for sealing the oil level pickup to the oil pan has been improved. In addition, the diameter has been increased from 3 mm to 3.15 mm. Color: green (previously black).

Standard implementation: 09/86

Model	Engine	Engine End No.	
		Manual transmission	Automatic transmission
201.024 (USA)	102.985	004381	040652

In June 1987 the O-ring of the oil level pickup was once again modified.



Modification

Size	Previous version mm	Present version mm
d_1	40.20	37.20
d_2	3.15	3.2

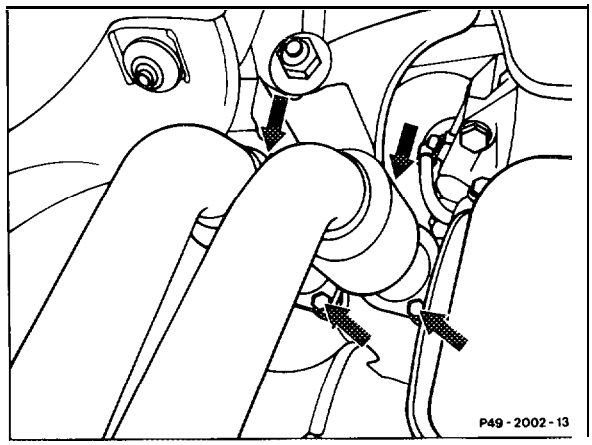
Removal and installation

1 Drain engine oil.

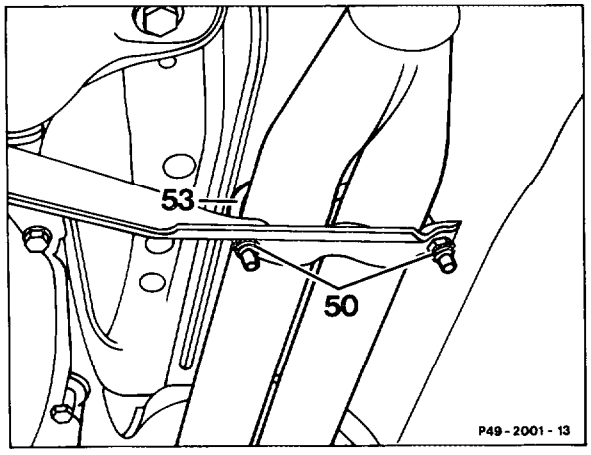
2 Unplug cable (351a) at the oil level pickup, plug in.

3 Detach clips (la) for fan shroud, detach, attach fan shroud (1), place over fan.

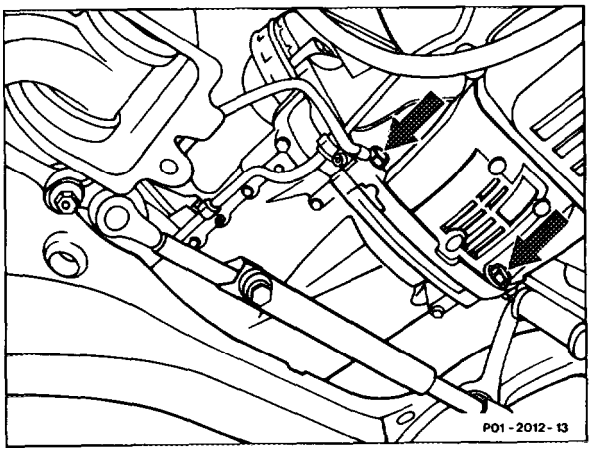
4 Unbolt exhaust pipes at exhaust manifold, bolt on (arrows).



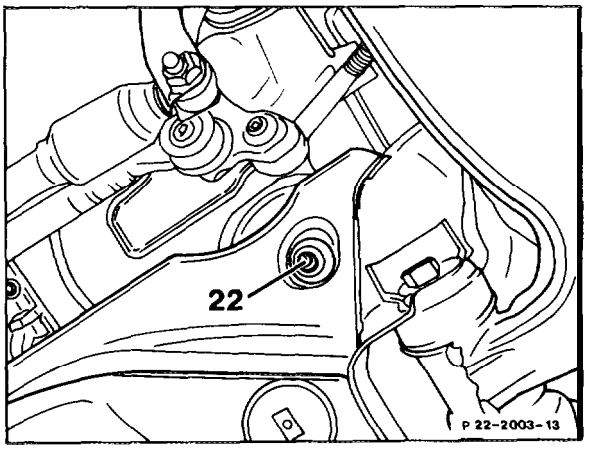
5 Unscrew pipe clip (53) at the front exhaust bracket to the transmission. Replace nuts (50). Tightening torque 25 Nm.



6 Remove two bolts at the transmission – engine joint (M10, arrows), bolt on. Tightening torque 45 Nm.



7 Remove both bottom bolts (22) for engine mounting fixture, bolt on. Tightening torque 45 Nm.

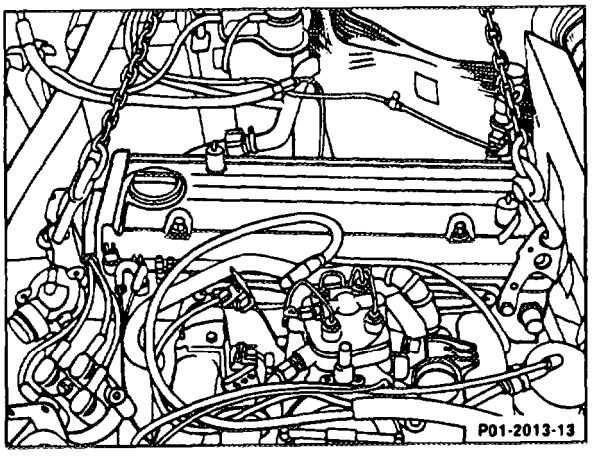


Len side shown

8 Raise engine with the engine hoist.

9 Remove remaining bolts (32, 34) for attaching oil pan, bolt on and remove oil pan. Tightening torque:
M6 10 Nm,
M8 25 Nm.

10 Carefully clean mating face at oil pan and on crankcase.



11 install oil pan with new gasket. Pay attention to bolt lengths and tightening torques.

12 Lower engine and attach engine mounts.

13 Add engine oil and adjust to correct level.

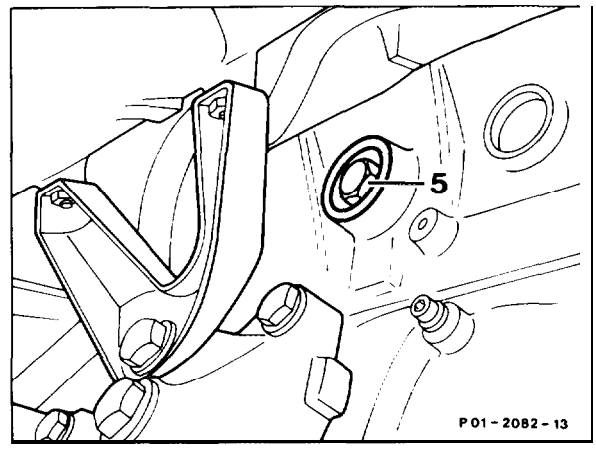
14 Check for leaks with engine running.

01-403 Repair instructions for crankcase, cylinder heads and cylinder head gaskets

Crankcase

The tapped hole for attaching the power steering pump carrier (compared to engines with multi-belt drive) have been converted from M8 to M10.

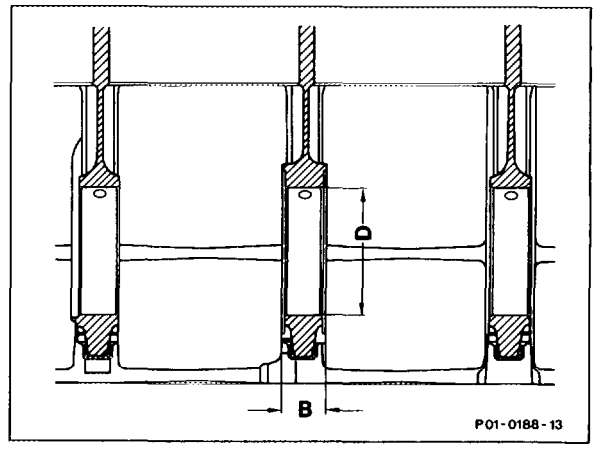
The M 38 × 1.5 tapped hole for mounting the coolant preheater on the left side is shorter. It is sealed with a screw plug (5) and an O-ring from engines 116/117 and 601.



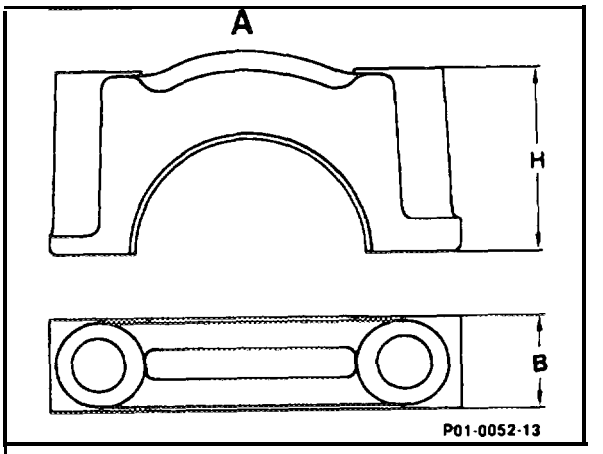
The crankshaft bearings in the crankcase have been modified (size "B").

Multi-belt drive = 24 mm

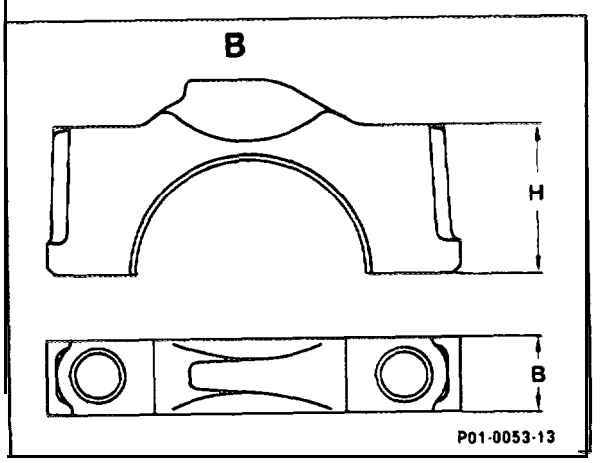
Single-belt drive = 20 mm



At the same time, the crankshaft bearing covers are 8 mm lower (H = 40 mm).

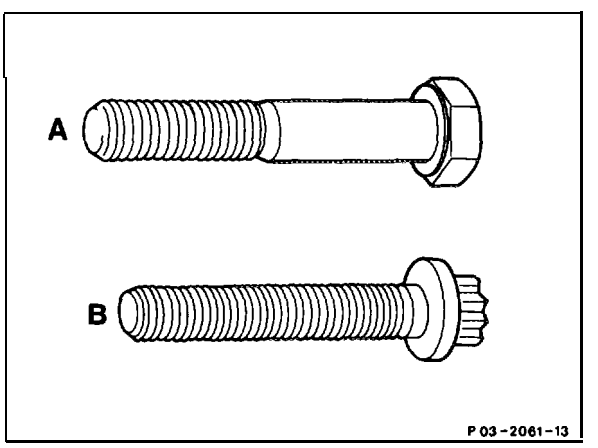


Engines with multi-belt drive (102.985)
H = 48 mm



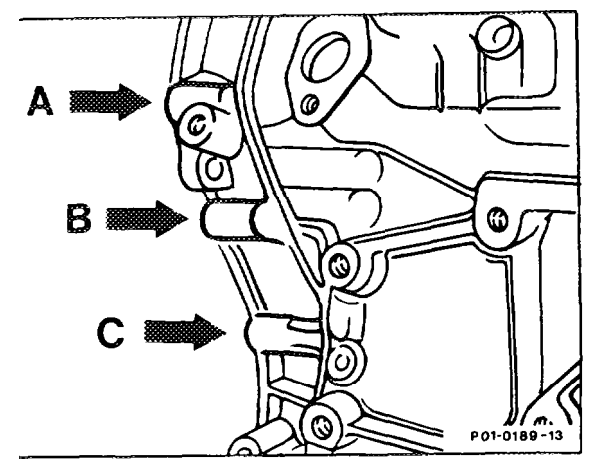
Engines with single-belt drive (102.961)
H = 40 mm

Fastening bolts of the crankshaft bearing covers converted to Ml 1 x 62 twelve-side stretch bolts with collar. Previously, Ml 2 x 70 hexagon bolts.

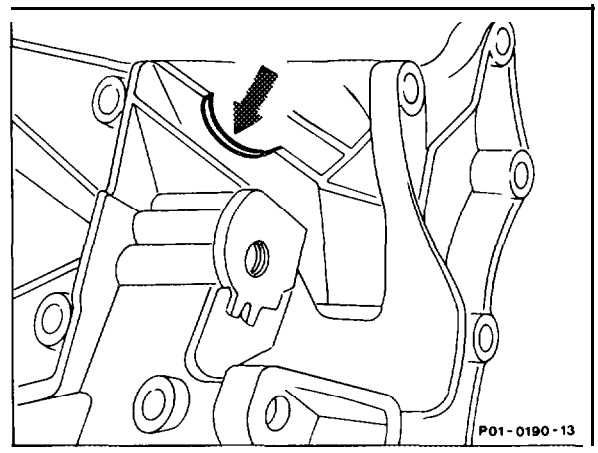


A M 12 x 70 hexagon bolts
B Mt 1 x 62 twelve-side stretch bolt

Bolt projections (A, 6, C) on crankcase for fastening bolts of timing case cover lengthened.



Because of the lengthened bolt extensions, the power steering pump carrier has been provided with a semi-circular cutout at the second reinforcing rib (arrow).



Standard Implementation: 06186

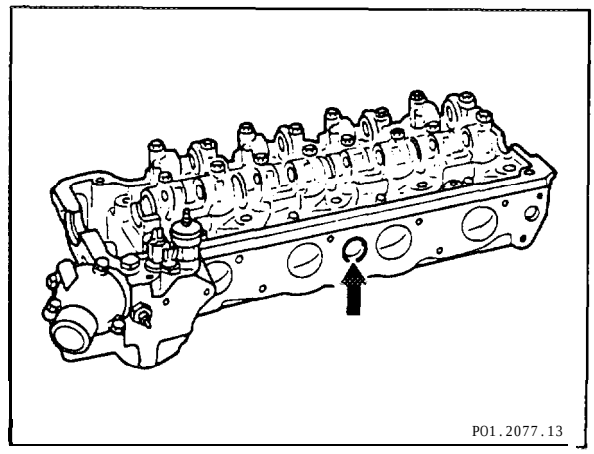
Model	Engine	Engine End No.		Vehicle Ident End No.	
		Manual transmission	Automatic transmission	A	F
201.024 (USA)	102.985	003938	036445	313424	246820

Cylinder head

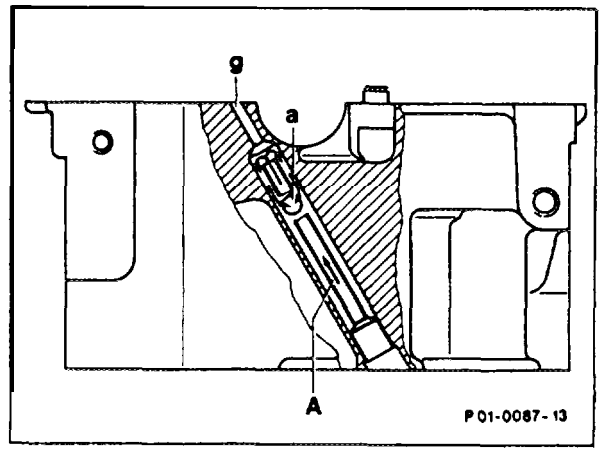
The same cylinder head is installed on engines 102.9221924 as on engines 102.962/982/985.
Only one cylinder head version is supplied as a replacement part.
This cylinder head must not be installed on the previous engine 102.961.

A core plug, Part No. 000 443 025 003 should be inserted with MB sealant 002 989 94 71 and the installation mandrel 102 589 02 15 00 for engine 102.985.

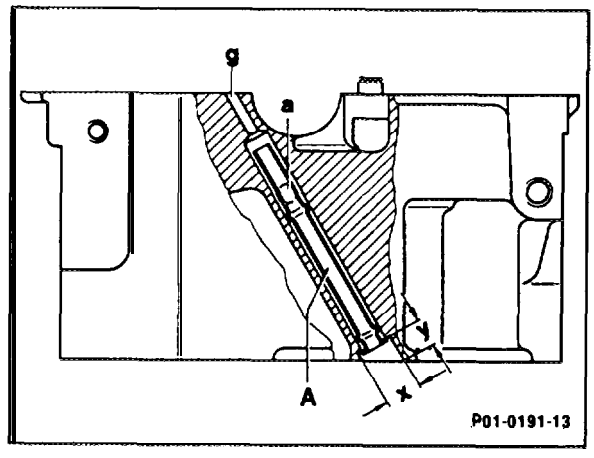
Caution!
If the core hole is not closed (arrow), coolant may get into the cylinders on engine 102.985.



An oil pipe (A) is inserted in the oil feed passage at the rear of the cylinder head to prevent the oil passages running empty when the engine is off.

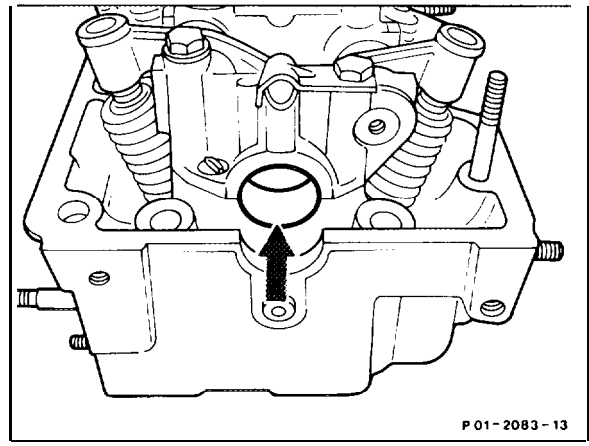


Since 071'87 the oil pipe (A) has a stop collar (arrow). This prevents the oil pipe "migrating upward" in the cylinder head. At the same time, the recess in the cylinder head has been modified.



Dimension	Previous version	Present version
X	9.0 mm	9.5 mm
Y	7.0 mm	7.0 mm

No oil passage is provided at the 4th bearing point for camshaft lubrication (arrow).



Cylinder head gasket

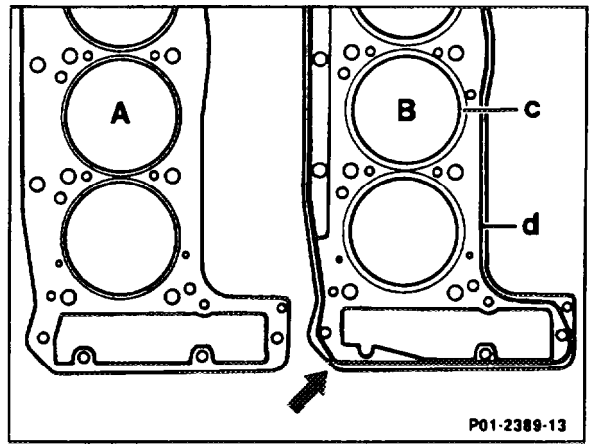
Cylinder head gaskets of asbestos-free material were installed for a certain period on engines 102.985.

Standard implementation: February – March 1988 (manufacturer Elring)

Model	Engine	Engine End No.		Vehicle Ident End No.	
		Manual transmission	Automatic transmission	A	F
201.028	102.985	022847 – 023481	068903 – 070235	437591 – 441023	*

* not covered

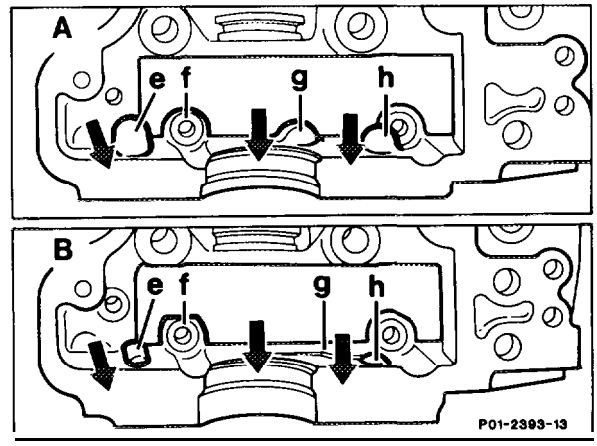
The cylinder head gasket in the chain box area was modified with implementation of the double roller chain (B, arrow).
In addition, sealing surfaces with modified coating and widened combustion chamber chamfered faces (c) as well as silicone strips (d) running all round the outer edge.



Standard implementation: 01/88

Model	Engine	Engine End No.	
		Manual transmission	Automatic transmission
201.028	102.985	021822	066697

To achieve greater clearance for the double roller chain, the front wall at the cylinder head was lengthened. In addition, the bolt extensions were flattened off at the radius (f).



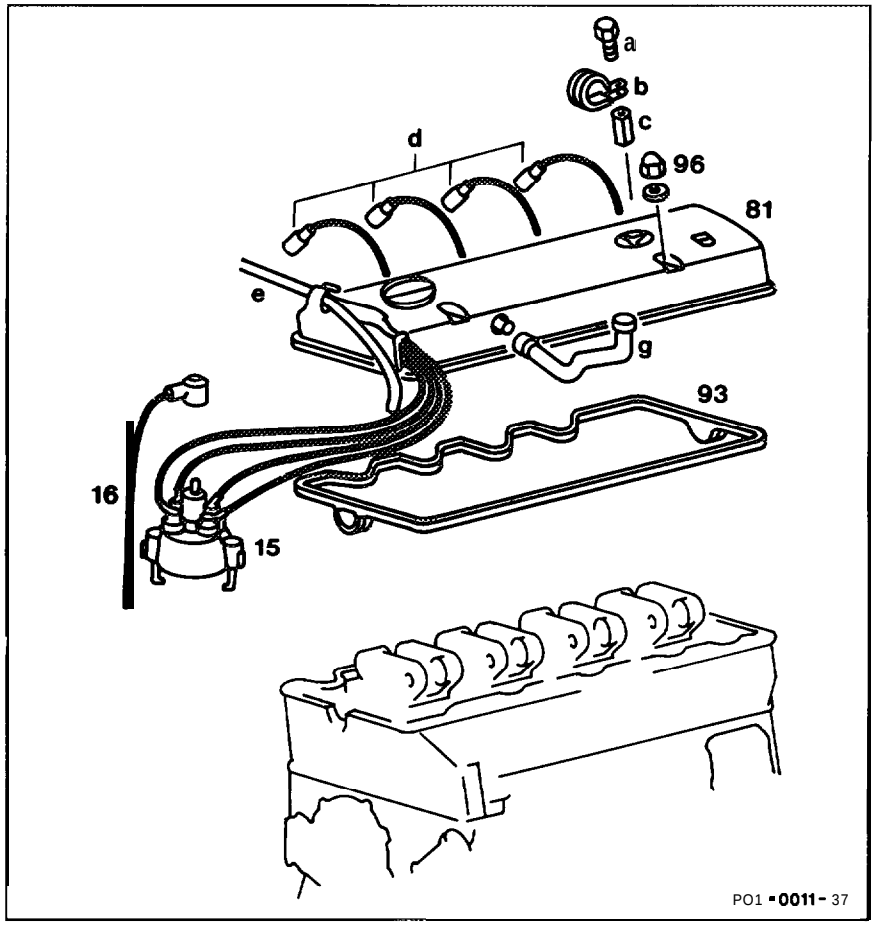
A Single roller chain
B Double roller chain

Standard implementation: 01188

Model	Engine	Engine End No.	
		Manual transmission	Automatic transmission
201.028	102.985	022013	067143

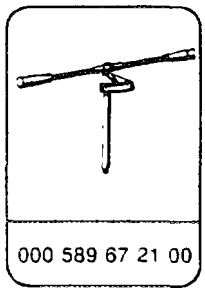
01-406 Removal and installation of cylinder head cover

Preceding work:
Removing air filter (09-400 or 09-410).



Ignition cable (16)	unplug at distributor cover, plug in.
Ignition distributor cover (15)	unbolt at distributor, bolt on.
Spark plug connector (d)	detach from spark plugs, fit on.
Vent line (e)	detach, attach.
Holder (b)	unbolt, bolt on if equipped with automatic transmission.
Cap nut (96) or hexagon nut (c)	unbolt, bolt on, 15 Nm.
Cylinder head cover (81)	remove with ignition cables, refit. Pay attention to instructions.
Gasket (93)	check, replace if necessary.

Special tool

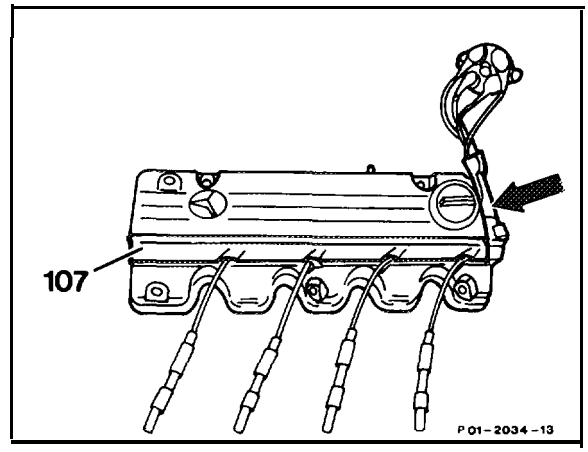


Notes

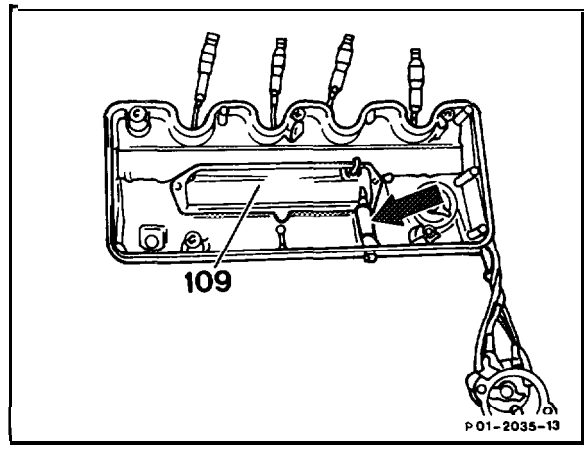
The cylinder head cover is manufactured from a magnesium alloy and is coated on the outside with a black colored plastic.

A two-part, glass fibre reinforced polyamide rectangular tube (107) in which the ignition cables run is inserted in a longitudinal groove of the cylinder head cover.

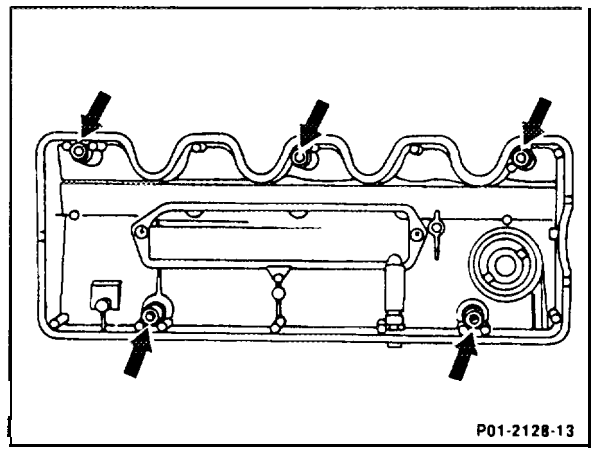
In addition, the ignition cables and the vent line at the face end of the cylinder head cover run through a plastic holder (arrow).



On the inside, the oil separator (109) and the related outlet pipe are fixed in place with the hose piece (arrow) of the crankcase ventilation (function description 01-140).



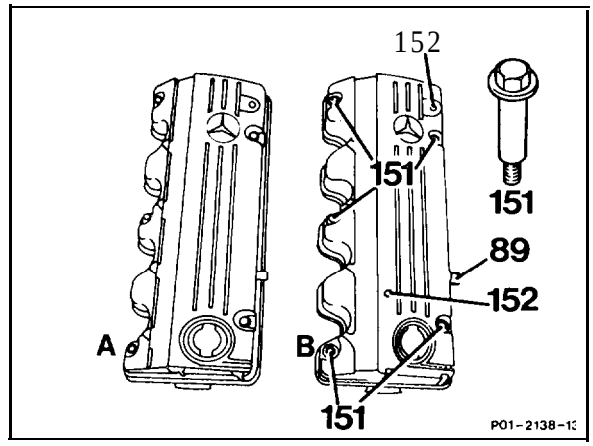
The spacer sleeves (arrows) prevent the gasket being squeezed when tightened.



In January 1986 a cylinder head cover made of plastic was fitted (on engines without pressure oil pump for level control).

Distinguishing features:

- Collar bolt (151)
- Hose connection for crankcase ventilation with larger OD.

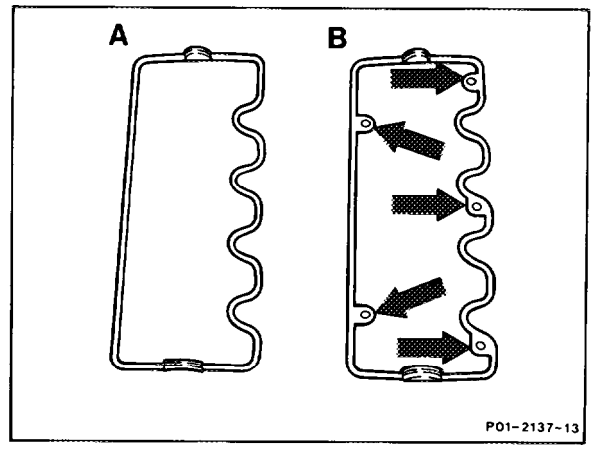


A Cylinder head cover (magnesium)
B Plastic cylinder head cover

The cylinder head gasket has wider plates (arrows) for sealing the bolt guides.

Caution!

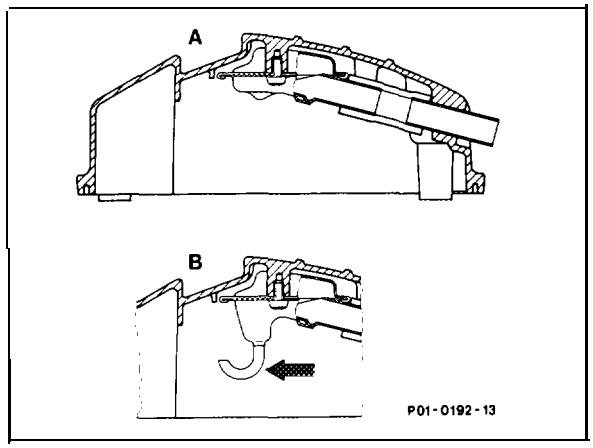
If the cylinder head cover has to be replaced, e. g. because of cracking, install the previous magnesium cylinder head cover.



Model affected

Model	Vehicle Ident End No.	
	from	to
201.024	A 277147 F 159163	280307 192314

As of February/March 1985 the oil separator is installed in the cylinder head cover with a vent pipe.



A 1 st version
B 2nd version

Standard implementation: 02/85

On models with level control

Model	Engine	Engine End No.		Chassis End No.
		Manual transmission	Automatic transmission	
201.024 (USA)	102.985	001321	011371	A 198009 / F 084320

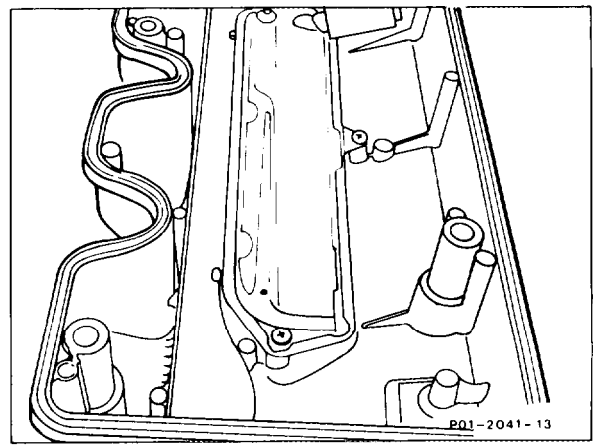
Standard implementation: 03/815

Model	Engine	Engine End No.		Chassis End No.
		Manual transmission	Automatic transmission	
201.024 (USA)	102.985	001460	012597	

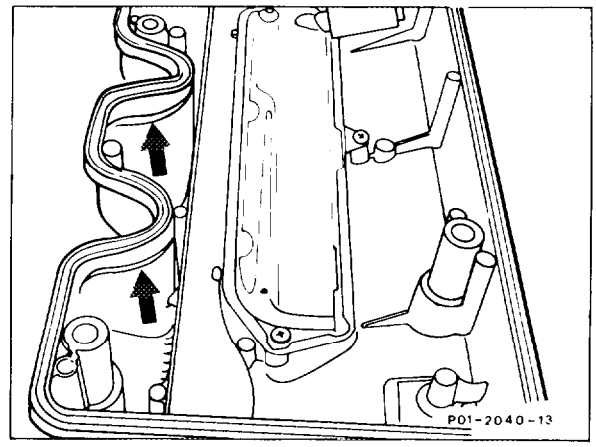
Since 12/88 **a** cylinder head cover has been installed which has a recessed wall (arrows) in the area of the spark plug recesses.

This prevents the valve spring or the valve spring plate rubbing the cylinder head cover and causing noises.

The modified cylinder head cover can also be installed on previous engines in the event of complaints.



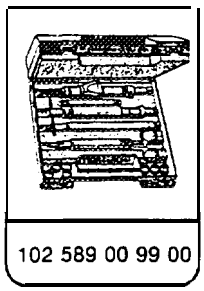
Cylinder head cover **1st** version



Cylinder head cover 2nd version

01-407 Reconditioning spark plug thread In cylinder head

Special tool

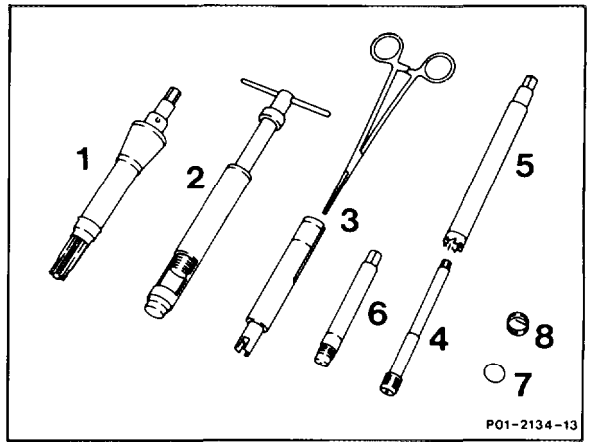


102 589 00 99 00

Note

The spark plug threads in the cylinder head can be reconditioned on all gasoline engines with the HELI-COIL repair set.

The cylinder head should only be removed for reconditioning the spark plug thread if the spark plug bore in question is not accessible for the tool.

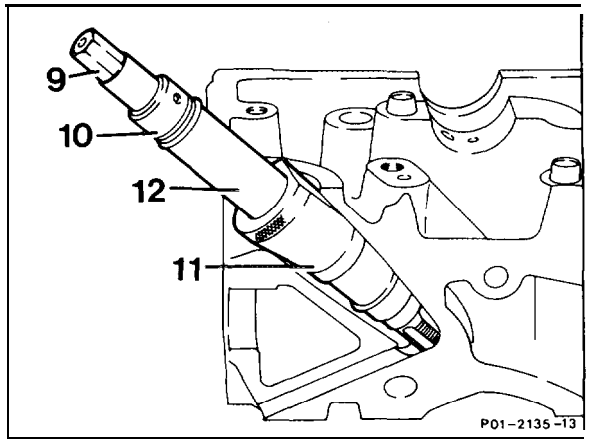


Recondltionina

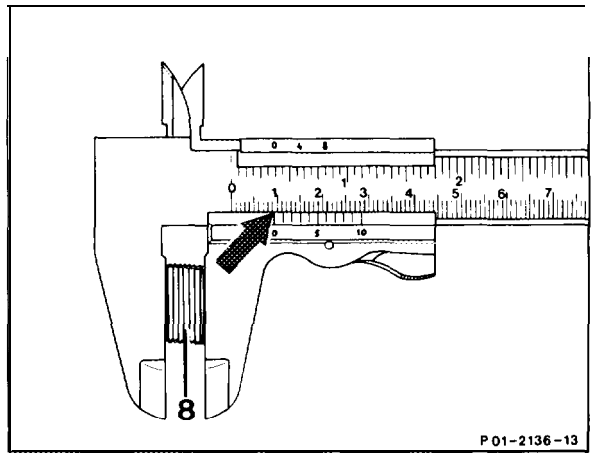
1 Set piston at the cylinder in question to 20° – 30° before TDC.

2 Pack grooves of the combination tap (9) of the tapping unit (1, ill. note) with grease and screw combination tap into the damaged thread. At the same time, press the guide bush (11) into the spark plug recess. Screw in combination tap far enough for the guide tube (12) to move up and be touching the stop ring (10).

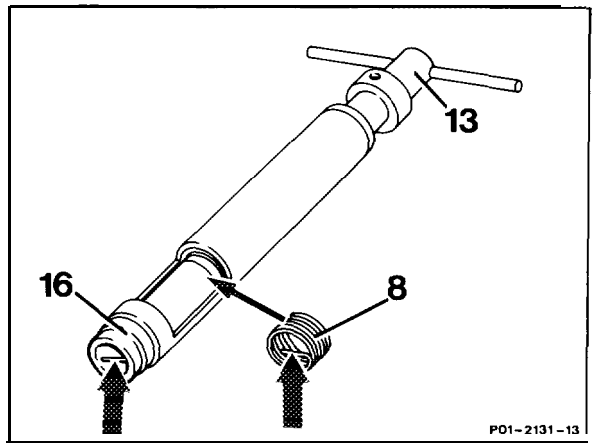
Caution!
If the cylinder head is installed, unbolt combination tap after approx. each five turns, clean grooves of swarf and grease and again pack with grease.



3 Check length of the HELI-COIL thread insert (8).
Use only the HELI-COIL inset-t with 9.1 mm block length.



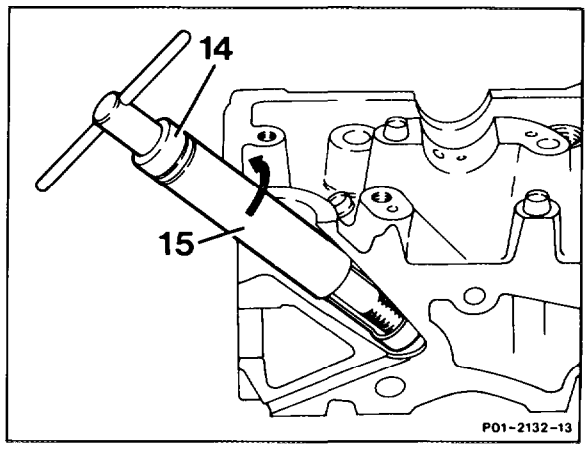
4 Install HELI-COIL thread insert. To perform this step, insert HELI-COIL insert (8) into the tool (2, ill. note) so that the bar (arrow) of the insert is facing the preload cartridge (16).
Turn HELI-COIL insert with the turning spindle (13) far enough through the preload cartridge until the bar (arrow) is flush with the face of the preload cartridge.



Install installation tool onto the tapped hole, hold jacket sleeve (15) tight and turn spindle for long enough until the stop ring (14) is touching the jacket sleeve.

Note

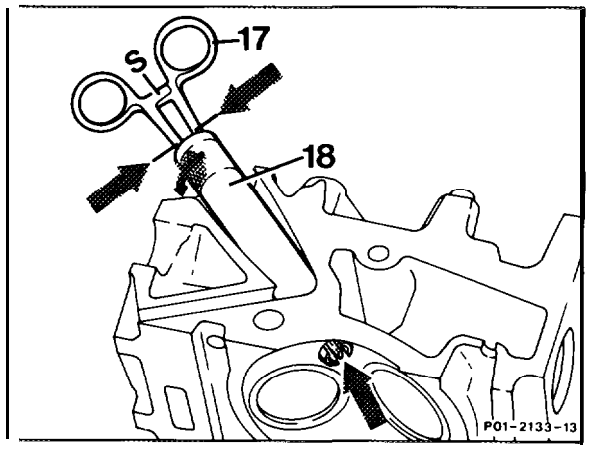
When installing the HELI-COIL thread insert, turn back jacket sleeve slightly (15) if it is jamming.



5 Break off bar (arrow) of the HELI-COIL thread insert.

This is done by installing the sleeve (18) of the bar breaking unit (3, ill. note) over the bar, introducing the opened pliers (17) as far as the mark (arrow) into the sleeve and closing pliers. The serrated tooth lock (s) must engage.

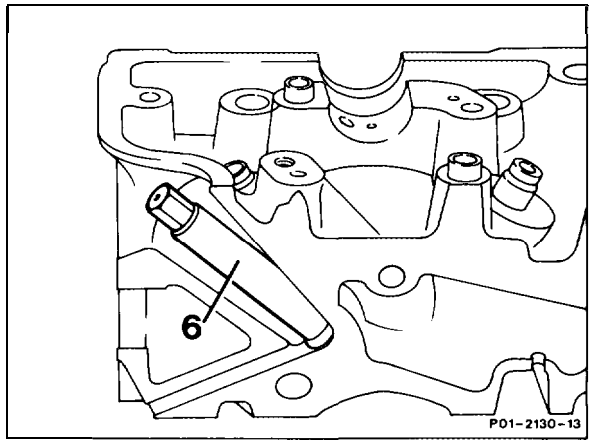
Turn sleeve to the left as far as the stop and hold tight. Move pliers slightly up and down and break off bar.



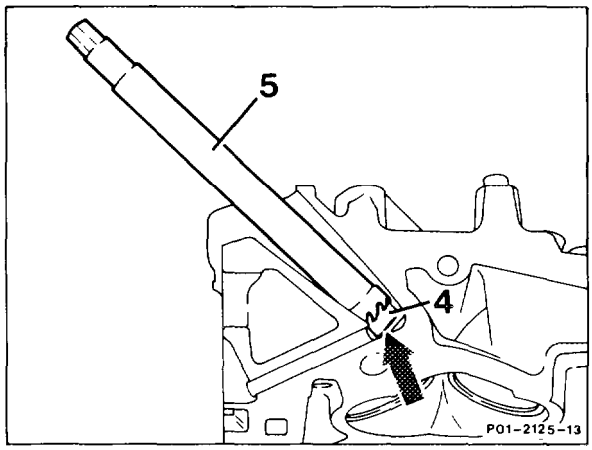
Caution!

It is essential to remove a bar which may have dropped on the piston crown with a magnet.

6 Caulk HELI-COIL thread insert. This is done by greasing the conical thread of the caulking tool (6), screwing caulking tool into the fitted HELI-COIL insert, tightening to 25 Nm and removing the caulking tool.



7 Mill mounting seat for the copper seal (7). This is done by screwing in the guide mandrel (4) far enough for the stop collar (arrow) to be touching the tapped hole.
Push milling cutter (5) over guide mandrel and mill the seat for the sealing ring. Always blow out the chips from time to time.
Once the milling cutter is seated on the stop collar of the guide mandrel, the required milling depth is reached (no further cutting resistance).

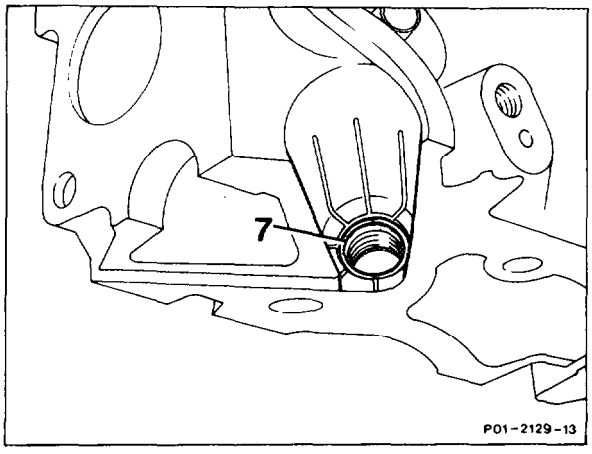


Once again thoroughly blow out spark plug recess before then removing the guide mandrel. Turn crankshaft several times with starter motor and contact handle in order to remove any chips which may have dropped onto the piston crown.

8 Place copper seal (7) into the milled mounting seat, screw in spark plug and tighten to 30 Nm.

Note

When performing this step, the tapered seat of the spark plug is pressed into the copper seal.

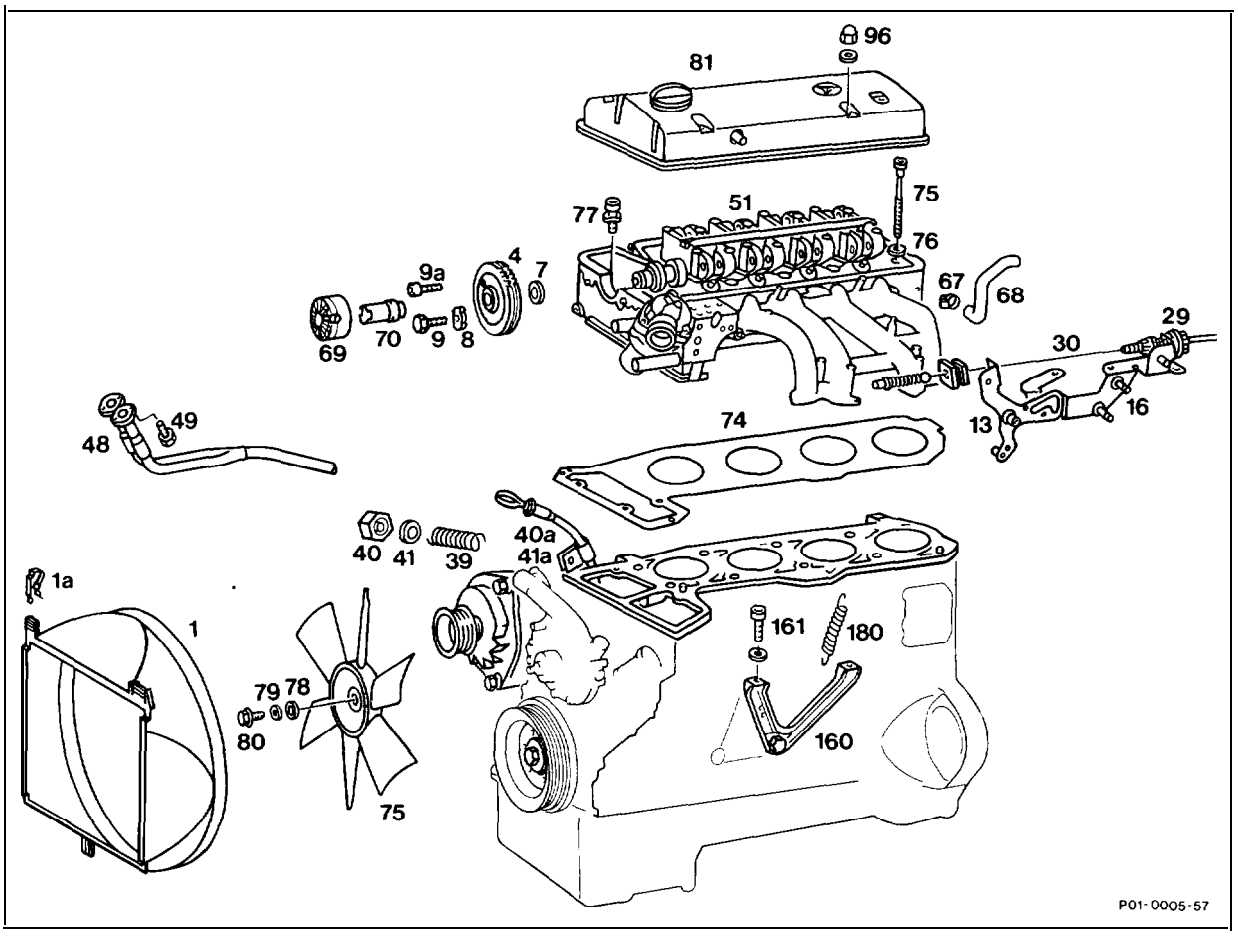


9 Loosen spark plug fully and tighten to 15 Nm.

EXIT

01-415 Removal and installation of cylinder head

Preceding work:
Removal of air filter (09-400).
Draining engine coolant (20-010).
Removal of guide rail in cylinder head (05-340).
Removing poly V-belt (13-342).



Fan shroud (1) and fan (75)	remove, install, 25 Nm (steps 1 and 2).
Cylinder head cover (81)	remove, install, with ignition cable and distributor cover (01-406).
Exhaust pipes (48)	unbolt at exhaust manifold, bolt on, 25 Nm (step 4).
Dipstick guide tube (40a)	unbolt, bolt on (step 5).
Bowden cable (30)	detach, attach, adjust (30-325, step 6).
Intake manifold strut (160) and return spring (180)	at intake manifold, unbolt, bolt on, return spring, detach, attach (steps 7 and 8).

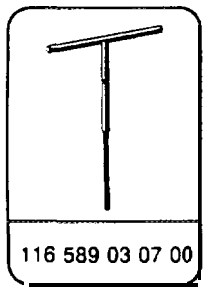
Engine coolant hose (68) supply line for heater	disconnect, connect (step 9).
Engine wiring harness	disconnect, connect (steps 10 to 14).
Brake booster vacuum line	disconnect, connect (step 15).
Fuel lines	disconnect, connect, dump overpressure (step 16).
Air conditioning pipe group holder	disconnect, connect (step 17).
Piston of No. 1 cylinder	set to ignition TDC (step 18).
Alternator	swing away to the outside (steps 19 and 20).
Closing nut (40)	for chain tensioner, remove and install, replace sealing ring (41) (05310, step 21).
Camshaft gear (4)	mark relative to timing chain (step 22).
Pressure oil pump (69)	unbolt, bolt on, place to the side with lines connected (step 23).
Camshaft gear (4)	unbolt, bolt on, 80 Nm, check TDC marking (steps 24 and 25).
Hexagon socket bolts (77)	unbolt, bolt on with pin wrench 116 589 03 07 00, 25 Nm (reference value), (step 26).
Cylinder head bolts (75)	unbolt, bolt in, check, tighten (steps 27, 31 to 33). Refer to table for tightening torques.
Cylinder head (51)	remove, refit, clean mating surfaces, replace cylinder head gasket (74) (steps 28 to 30).

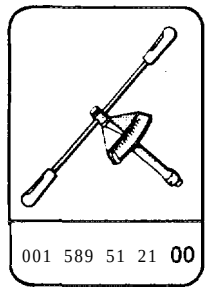
Tightening torques in Nm and angle of rotation torque
Diagram for step-by-step tightening: refer to step 31 for order:

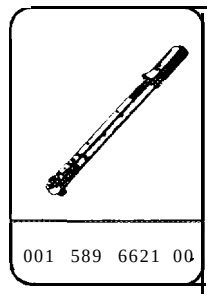
Step-by-step tightening **angle of rotatlon torque** when engine cold

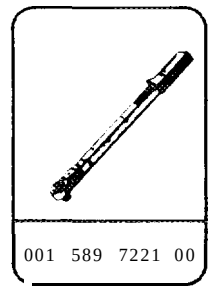
	1st stage	2nd stage	3rd stage
M12 cylinder head bolts	55 Nm	90°	90°
Hexagon socket bolts	25 Nm (reference value)	–	

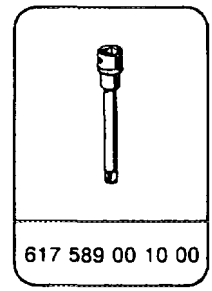
Special tools











Note

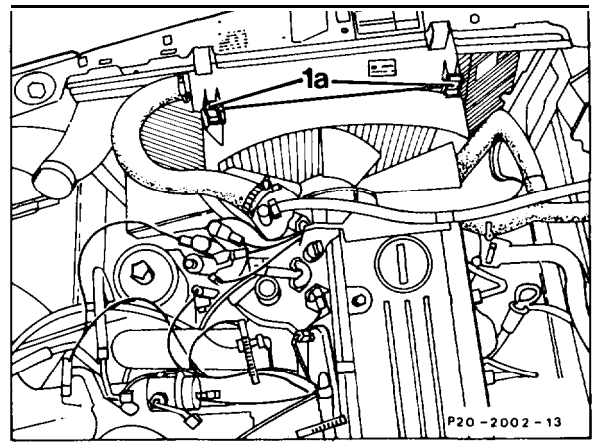
Remove cylinder head together with camshaft, intake manifold and exhaust manifold once engine has cooled down.

Removal and installation

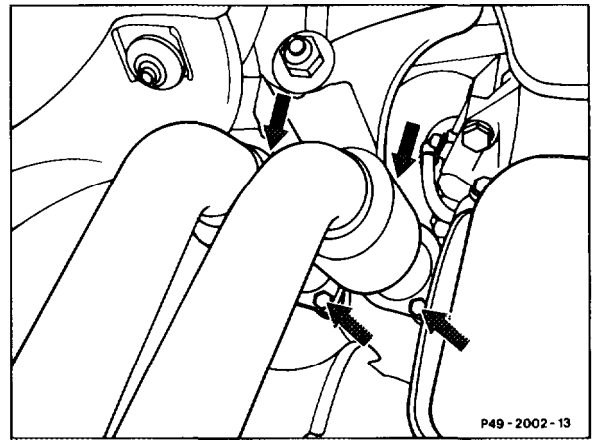
1 Detach fan shroud (1) and place over fan. When installing, ensure clearance to fan.

2 Unbolt fan (75), remove together with fan shroud, bolt on.

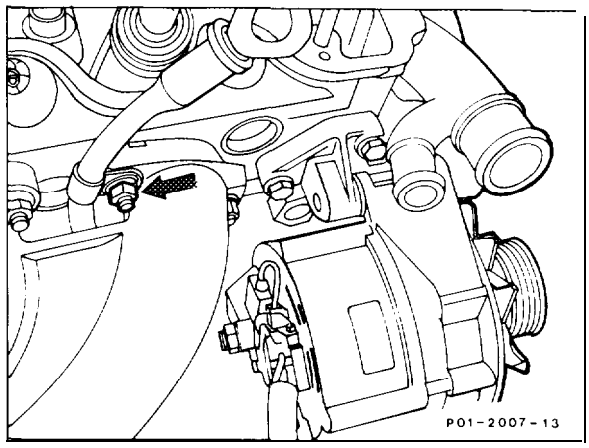
3 Remove cylinder head cover together with spark plug connector and distributor cover (01-406).



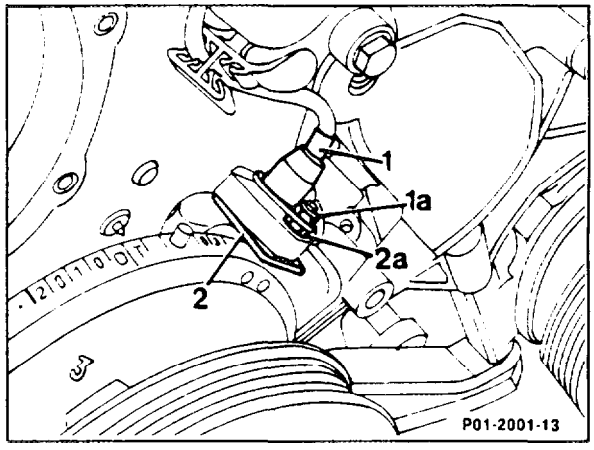
4 Unbolt exhaust pipes at exhaust manifold, bolt on.



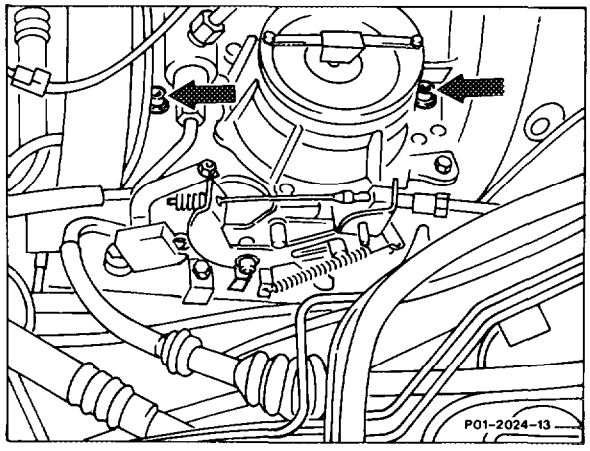
5 Unscrew dipstick guide tube at exhaust manifold, screw in (arrow).



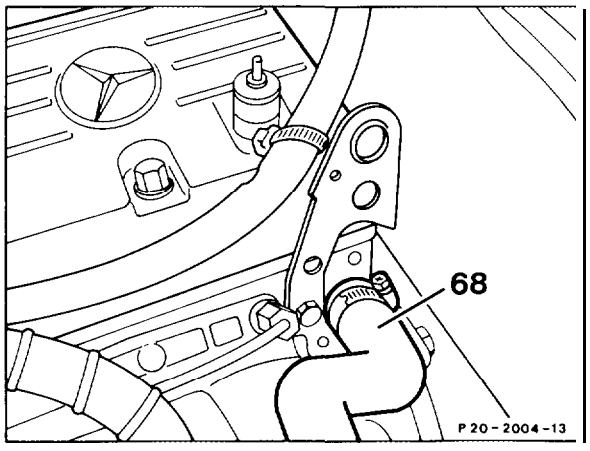
6 Detach Bowden cable (30) for accelerator control, attach, press plastic guide (arrow) out of its seat in the fulcrum lever (13) to perform this step, and take Bowden cable (30) out of the slot in the fulcrum lever.
Compress plastic clip (28) and push clip together with Bowden cable to the rear through the holder (16).
Adjust Bowden cable (30) (30-325).



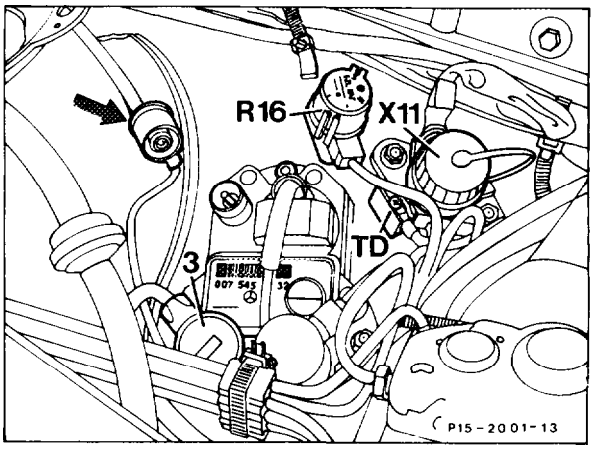
7 Unbolt strut at intake manifold. To perform this step, unbolt 2 hexagon socket bolts (arrows) on injection engine, bolt on.
Detach return spring for throttle body assembly (below intake manifold), attach.



8 Detach coolant hose (68) of supply line for heater, attach.



9 Detach connector pickup of control cable (arrow) and 4-pin connector pickup (3) at ignition control module, plug in.



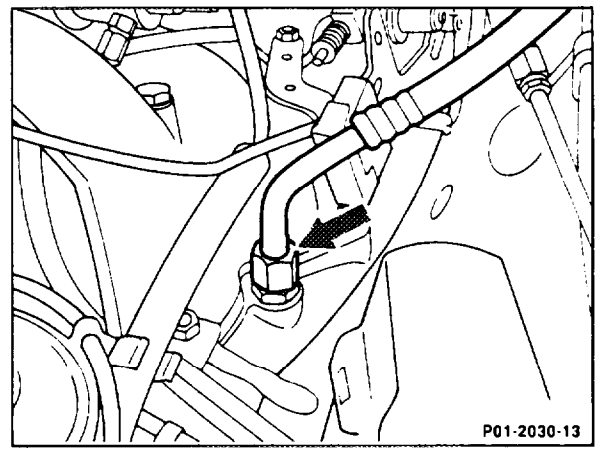
10 Detach cable from reference resistor (R16) (Model 201 only).

11 Unbolt terminal TD at the diagnostic connector (Xl 1), bolt on.

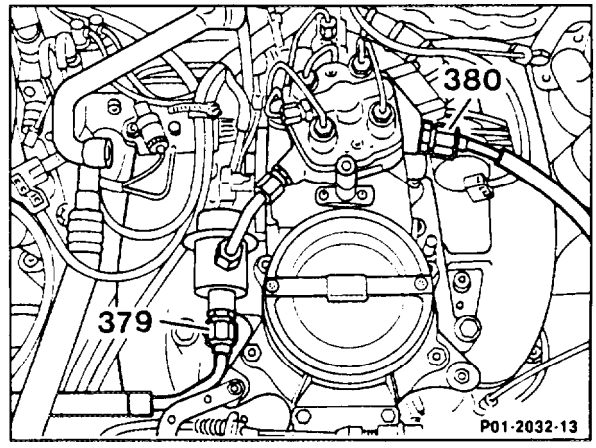
12 Unbolt diagnostic connector (Xl 1), unplug grey cable from the TDC pulse generator at the rear of the diagnostic connector, plug in.

13 Unplug all connectors and vacuum lines at thermo valves and temperature switches, plug in.

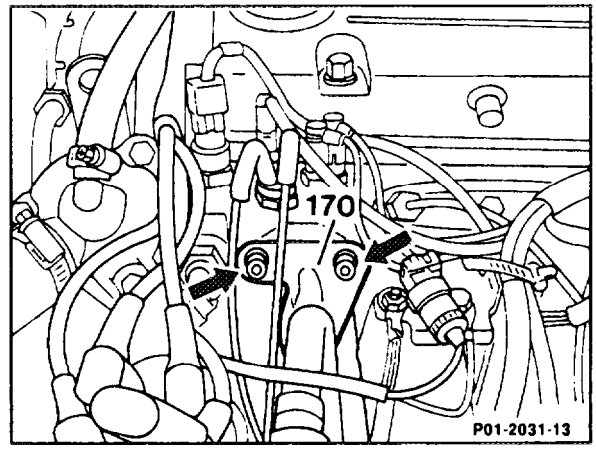
14 Disconnect vacuum line for brake booster, connect (arrow).



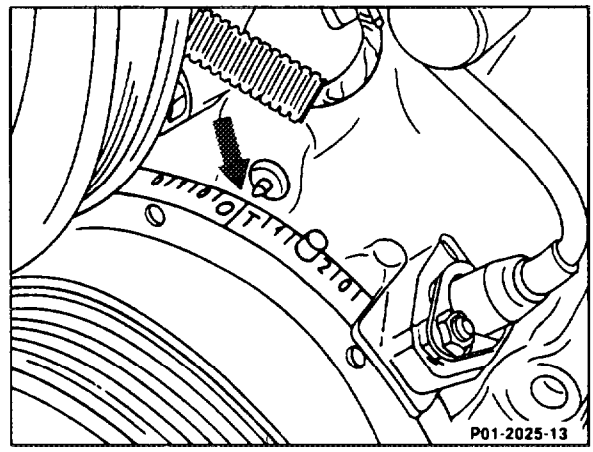
15 Lower fuel pressure in the fuel lines by briefly opening fuel filler cap.
Unbolt fuel lines (379, 380), bolt on. When detaching the fuel line (380), hold connection to prevent it from turning.



16 On models equipped with air conditioning, unbolt bracket for pipe group (170) of A/C compressor at cylinder head, bolt on.

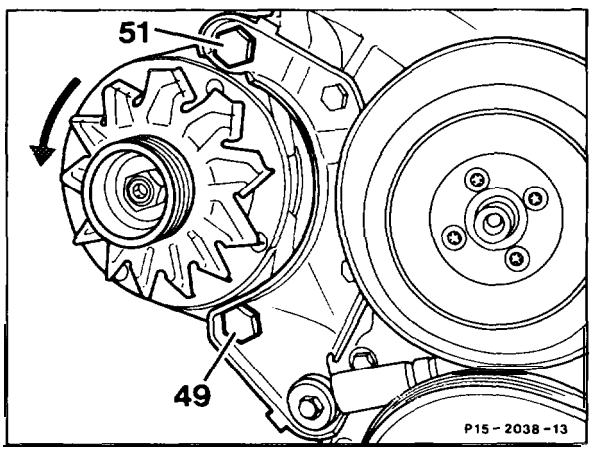


17 Set engine to ignition TDC of No. 1 cylinder.

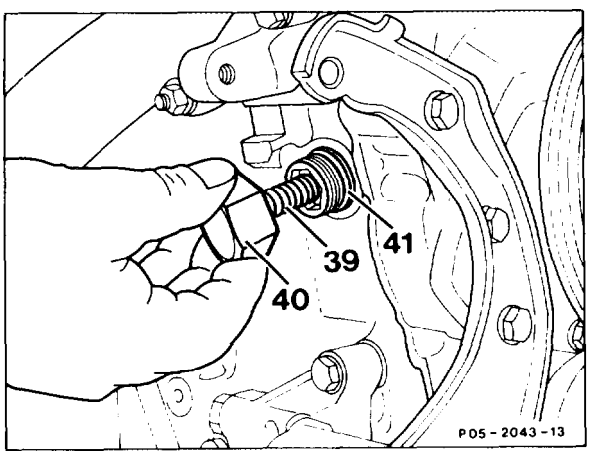


18 Loosen bottom bolt (49) for alternator fixture, tighten.

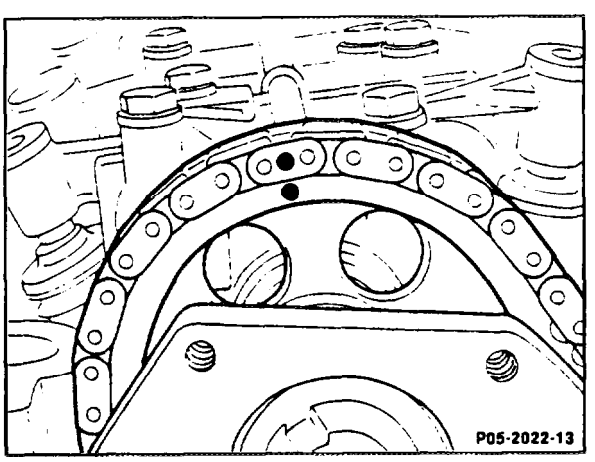
19 Remove top bolt (51), swivel alternator out of the way to the outside (arrow).



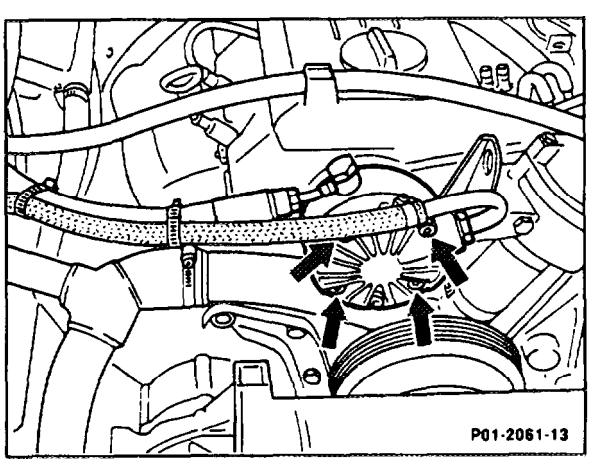
20 Unscrew locking nut (40) of the chain tensioner, bolt on. Replace seal (41). Tightening torque 70 Nm.



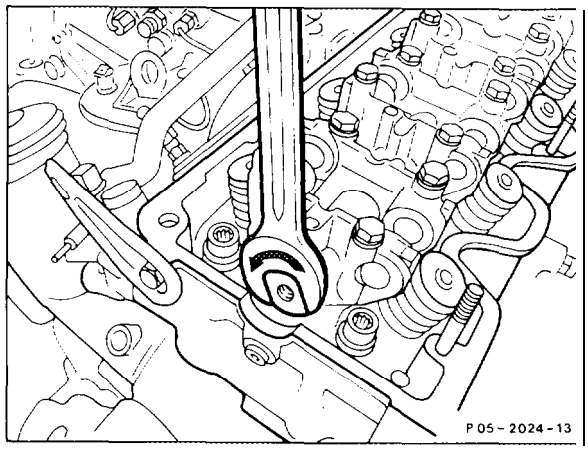
21 Mark camshaft gear and timing chain relative to each other.



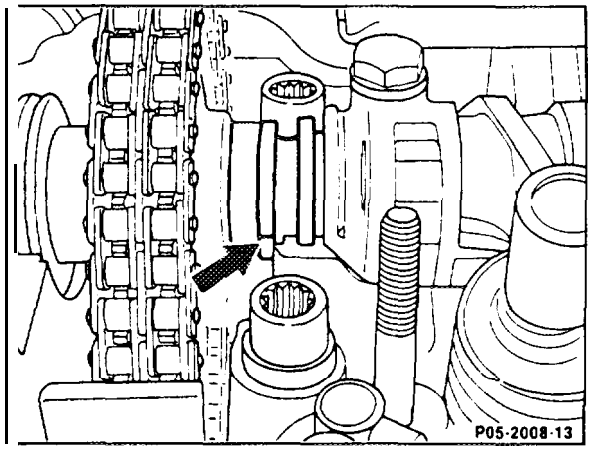
22 Unbolt pressure oil pump, place to the side with lines connected, bolt on (arrows).



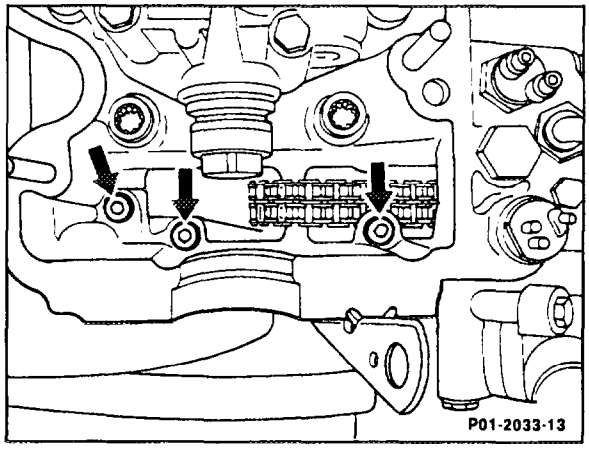
23 Unbolt camshaft gear, remove and bolt on. Place timing chain in chain box. Tightening torque 80 Nm.
Hold camshaft gear tight with an open-end wrench (waf 24 mm) for loosening or tightening the camshaft bolt.



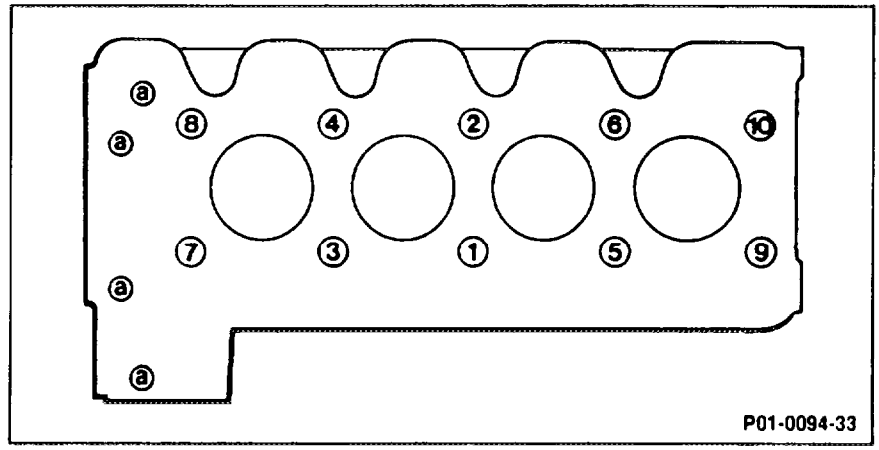
24 Check setting marking on camshaft (arrow).



25 Unscrew hexagon socket bolts (arrows) with the pin wrench 116 589 03 07 00, screw on. Tightening torque 25 Nm (reference value).



26 Remove cylinder head bolts in stages in the reverse order of the tightening diagram with the torque wrench insert 617 589 00 10 00 with engine cold.



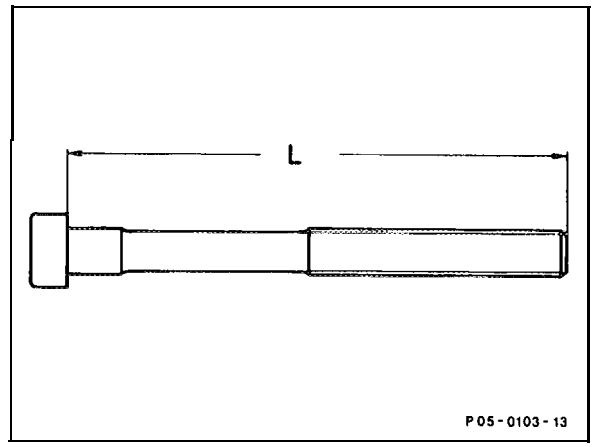
27 Remove cylinder head (51).

28 Clean mating faces on cylinder head and crankcase.

29 Replace cylinder head gasket.

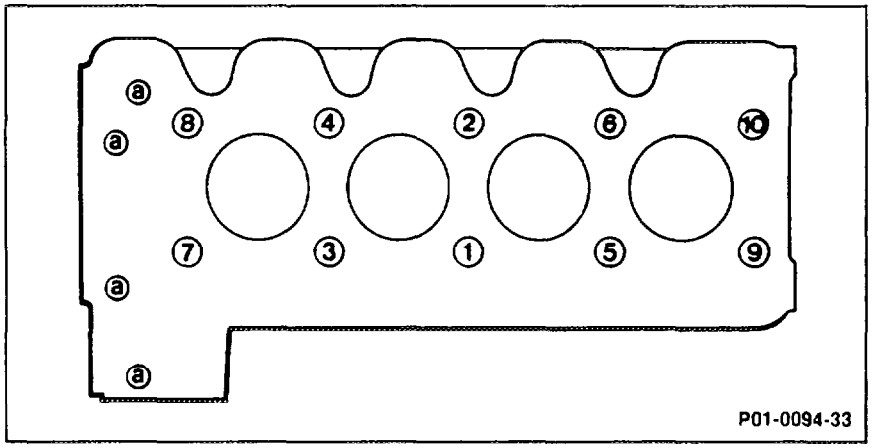
30 Check the shaft length of the cylinder head bolts.
If the maximum length (L) of 122 mm is exceeded, the bolts should be replaced with new ones.

31 Oil thread and head contact face of cylinder head bolts and insert.



32 Tighten cylinder head bolts in stages in the order of the tightening diagram, beginning with 1.

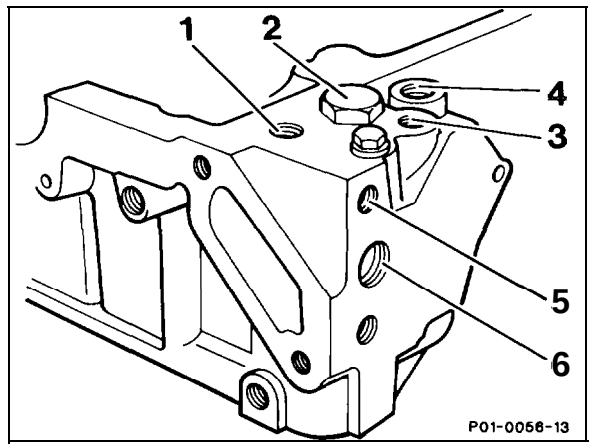
1st tightening stage 55 Nm
2nd tightening stage 90° angle of rotation
3rd tightening stage 90° angle of rotation
Hexagon socket bolts (a), 25 Nm.



33 Check for leaks with engine running.

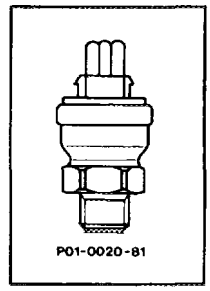
01-416 Matching measuring sensors to cylinder head

Note
Different temperature switches, thermo-time switches or thermovalves are installed in the measuring sensor box on the cylinder head depending on the engine version.

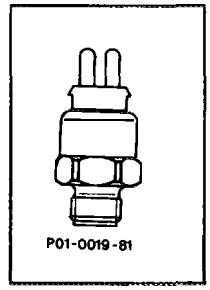


Items on cylinder head

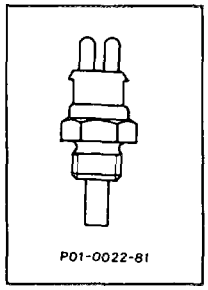
Item 1
Temperature switch for magnetic fan coupling and 2nd stage auxiliary fan red 100 °C.



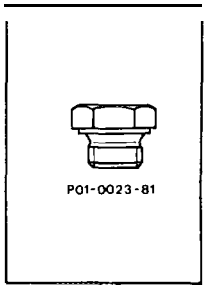
Temperature switch for magnetic fan coupling red 100 °C.



Item 2
Temperature sensor for A/C compressor blue.

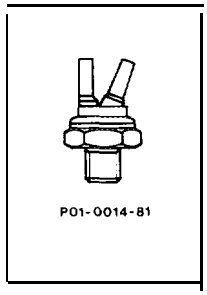


Item 2 **and 5**
Screw plug Ml4 x 1.5

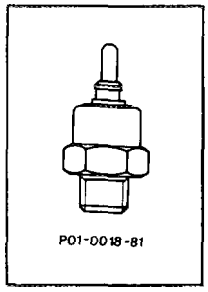


Item 3
Thermovalve for:

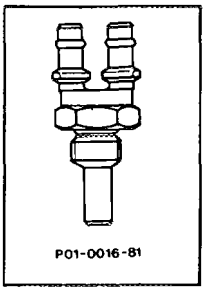
Ignition switchover	white	60 °C
Purge	red	50 °C
	black	40 °C



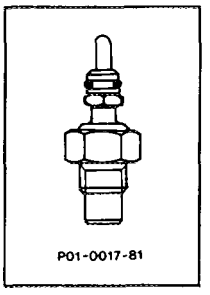
Item 4
Temperature switch for intake manifold heater black 110 °C.



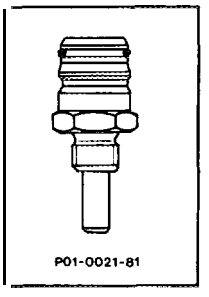
Temperature sensor for:
CFI control black
Ignition control and CFI control module green



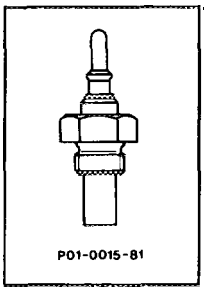
Temperature sensor for CFI injection system black.



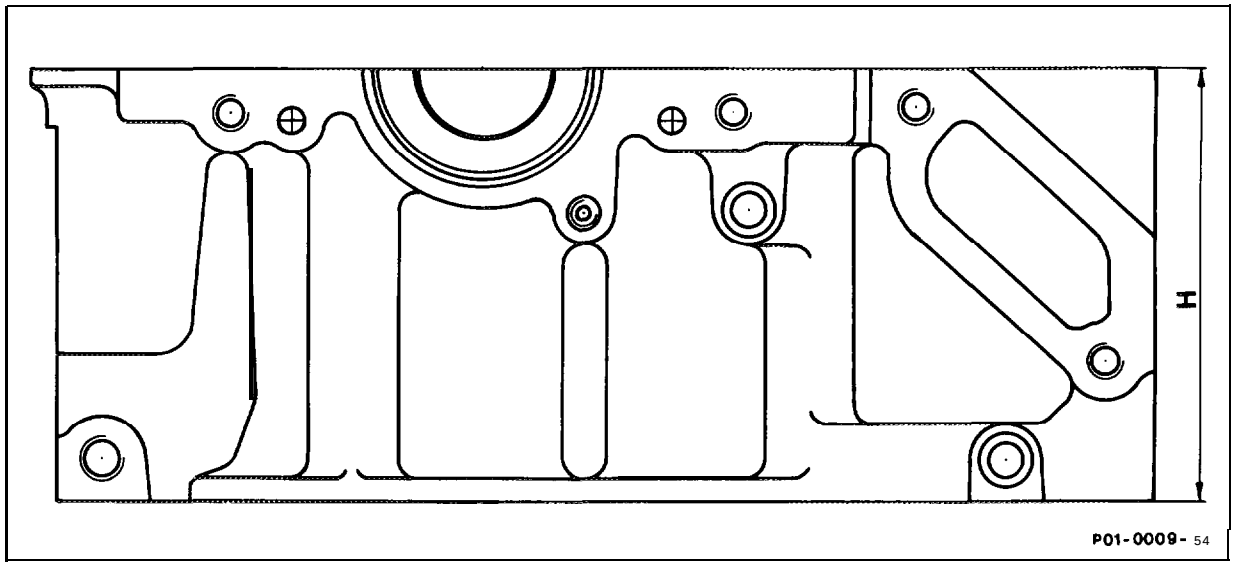
Double temperature sensor for ON board, CFI control and ignition control black.



Item 6
Temperature sensor for instrument cluster.



01-418 Facing cylinder head mating face



Data

Total height "H" of cylinder head		98.4 – 98.5
Minimum height after machining		97.8
Permissible variation of evenness of mating face	in longitudinal direction	0.15
	in transverse direction	0.05
Permissible variation of parallelism of top to bottom mating face in longitudinal direction		0.1
Peak-to-valley height		0.003 – 0.010
Test pressure with air under water in bar gauge pressure		2

Valve clearance to cylinder head mating face

Engines		102.961 (USA) as of 1984
Minimum clearance “A” with new valve seats and valves	Inlet (172)	1.2
	Exhaust (173)	0.5
Maximum clearance “A” with machined valve seats and reground valves	Inlet (172)	2.1
	Exhaust (173)	1.4

Commercial tools

Surface grinding machine with milling device for light alloy surfaces.	e. g. Sceledum, Type RTY Messrs. Roaro u. Fi. Schioiltaly
Knife-edge straightedge approx. 500 mm long	e. g. Messrs. Roaro u. Fi. Schioiltaly

Note
Only machine cylinder head mating face if there are porous or damaged areas.

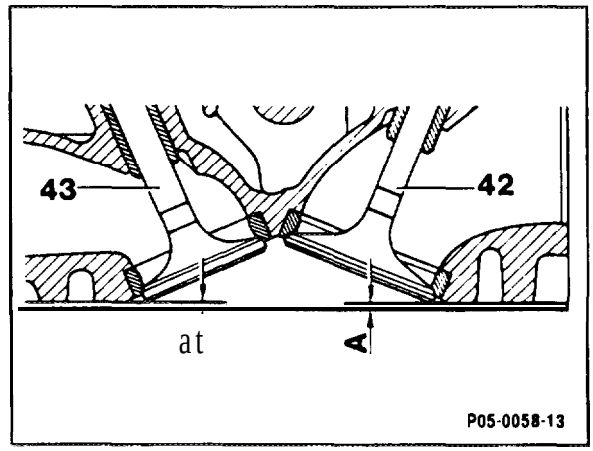
Caution!
Clamp cylinder head absolutely flat for facing. Failure to observe this instruction may result in the camshaft jamming when the cylinder head is reinstalled. In this case, the cylinder head must be replaced.

Facing

1 Face cylinder head mating face.

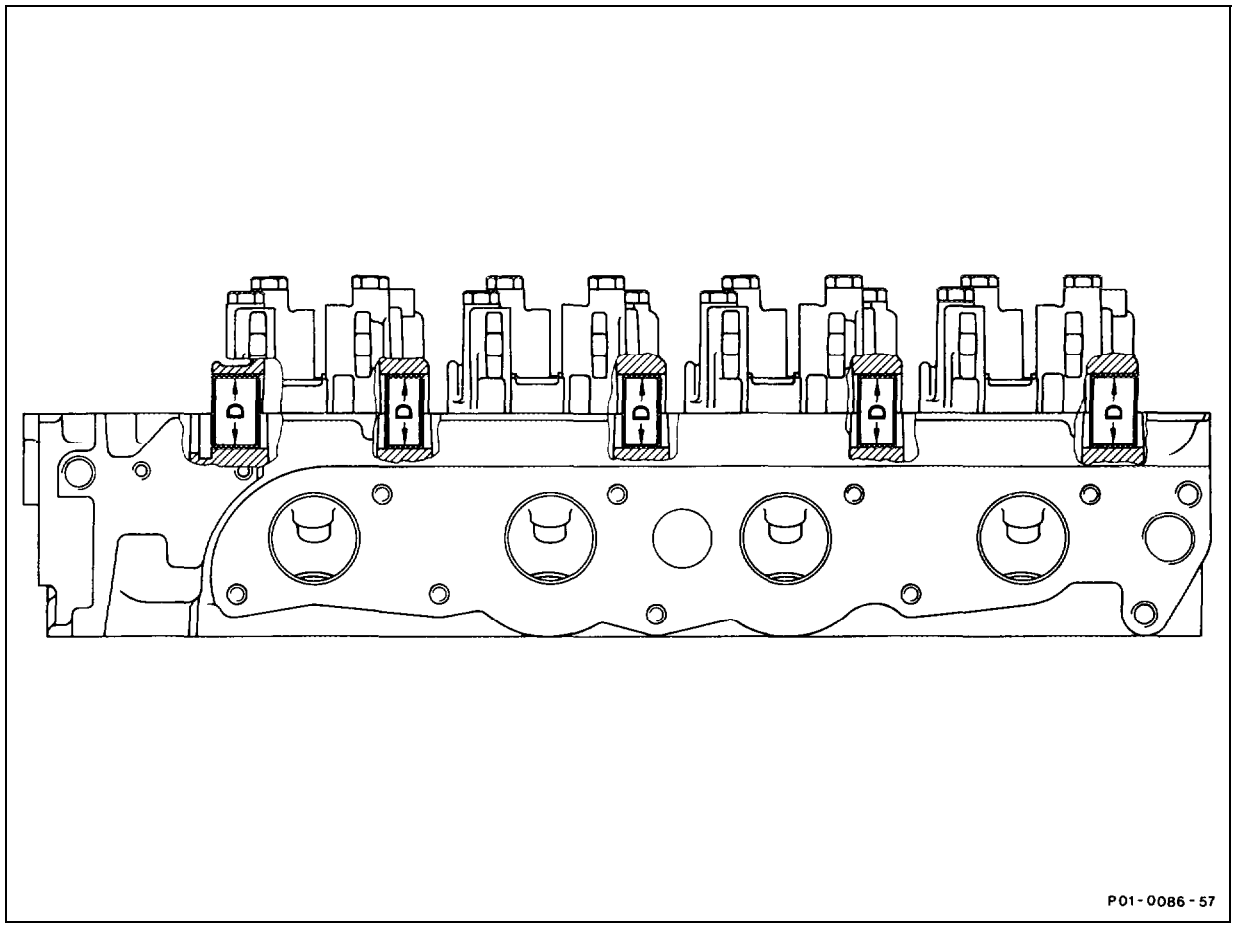
2 Remachine valve seats far enough for the minimum distance “A” to be achieved (05-291).

3 Check timing (05-215).



01-419 Enlarging camshaft bearing bores (repalr size)

Preceding work:
Removal and installation of cylinder head (01-415).
Removal and installation of camshaft (05-220).
Disassembling cylinder head.

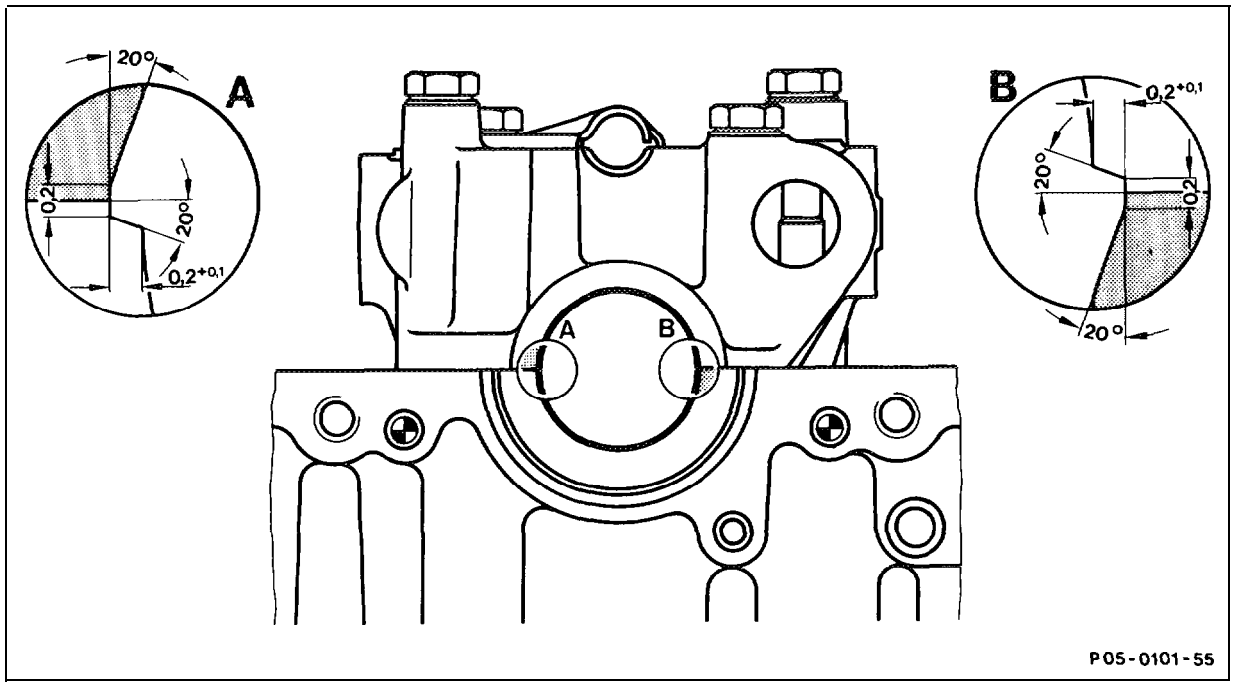


Camshaft bearing data

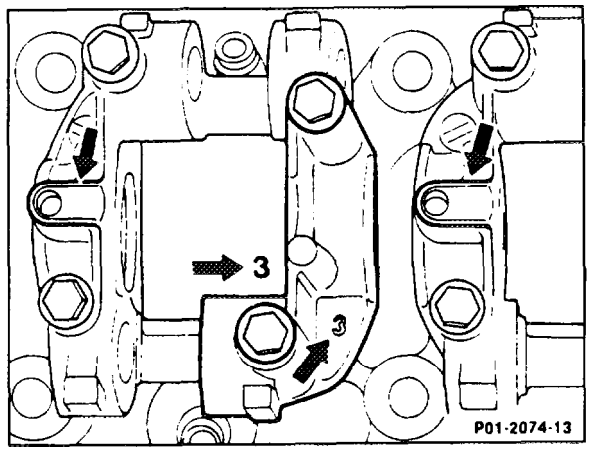
Normal size	Camshaft bearing dia. D	32.000 32.025
	Journal dia. D1	31.934 31.950
Repair size	Camshaft bearing dia. D	32.500 32.525
	Journal dia. D1	32.434 32.450
Camshaft bearing bores	Peak-to-valley height	0.003 – 0.006
	Permissible variation from cylindrical shape	0.012

		When new	Wear limit
Bearing play	radial	0.050 – 0.091	0.11
	axial	0.07 – 0.15	0.18

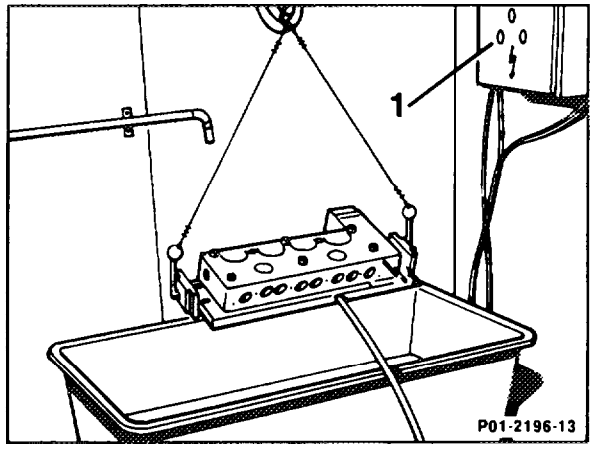
Note
If bearing seizure or severe scoring is present, the camshaft bearings in the cylinder head can be enlarged by 0.5 mm and camshafts with oversize bearing journals installed.
These camshafts have different code numbers (05-215 and 220).
If the rocker arm bearing brackets are equipped for enlarging without the rocker arm shafts, the fastening bolts of the bearing brackets must be tightened to max. 15 Nm otherwise the bores for the rocker arm shafts will be distorted. When machining the basic bores, ensure that the half-bores for mounting the cylinder head cover gasket or the sealing disc at front and rear on the cylinder head are not widened. After widening the basic bores, the edges at the mating face of the cylinder head bracket (A) or at the mating face of the cylinder head (B) on the camshaft bearings 1 to 4 must be machined in accordance with the specified dimensions. If the edges are not machined, the lubrication film will tear at these points, causing damage (seizure) to the camshaft bearings.



The bearing brackets differ. Each bearing bracket has a number stamped to identify it. This number must agree with the number stamped on the cylinder head (arrows). If correctly installed, the contact faces for the oil pump are facing to the rear and the code numbers are on the righthand side (direction of travel) (arrows).

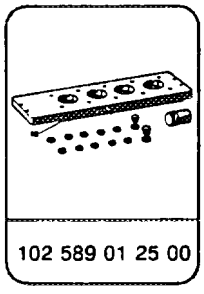


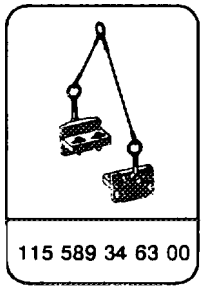
01-420 Pressure-testing cylinder head



Pressure-testing plate	bolt onto cleaned cylinder head.
Bores and connections	plug.
Compressed air hose	connect and adjust compressed air to 2 bar gauge pressure.
Cylinder head	Attach to suspension device and immerse into the heated water (approx. 80 “C). If air bubbles rise up, determine leak point and mark.

Special tools





Commercial tool

Electrically heated water bath	e. g. Messrs. Otto Dürr D-71 23 Sachsenheim-Ochsenbach