Mercedes-Benz

Service

Service Manual
Engine 103

Mercedes-Benz of North America Inc.

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Mercedes-Benz

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S-2421-103

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Introduction

This service manual is the product of existing technical publications. Special care has been taken to provide accurate information on removal, disassembly, inspection, Installation, and adjustment procedures, together with the necessary technical data for the particular job.

The material in this manual is divided according to the Mercedes-Benz Component Group System as outlined on the GROUP INDEX page. This page will quickly direct the reader to the Major Component Group. Each Major Component Group begins with a JOB INDEX listing all jobs within that group.

Mercedes-Benz of North America, Inc. recommends that repairs to, and maintenance of Mercedes-Benz automobiles be performed by trained Mercedes-Benz personnel at authorized Mercedes-Benz dealerships.

The information contained in this special publication is ordinarily issued by Mercedes-Benz of North America, Inc., in conjunction with supplementary service literature and special tools supplied only to its authorized dealers. The repair and maintenance procedures outlined herein are intended for use by trained Mercedes-Benz service and dealership personnel. This manual can also be useful for Mercedes-Benz owners in diagnosing vehicle systems and performing repairs. Supplementary service literature will not be provided with this publication, but may be contained in reprints of this service manual.

Please note that this manual has been compiled from various sources, some of which cover models other than the subject of this book. Always refer to the engine and vehicle identification table for model and component Information.

Special tools required in performing certain service jobs are identified in the manual and are recommended for use. Any part numbers given are only used for identification and easier differentiation between individual components, and are not intended for ordering purposes.

If your Mercedes-Benz model differs from the specifications contained in the manual you select, consult your authorized Mercedes-Benz dealer.

All procedures, illustrations and specifications contained in this manual were based on the latest information available at the time of publication. All rights are reserved to make production, design and specification changes at any time, without notice and without obligation to give notice. Any such changes will not be contained in this manual.

Caution!

The proper performance of service and repair procedures is essential for both the safety of the mechanic and the safe and efficient operation of the vehicle. The use of incorrect service procedures and tools may greatly increase the risk of personal injury and render the vehicle unsafe. The procedures in this manual are described in such a manner that the service may be performed safely and accurately.

However. it is a general assumption that the reader is familiar with basic automotive repair procedures and Mercedes-Benz vehicles. You should not attempt to use this manual if this is not the case.

Mercedes-Benz of North America. Inc. assumes no liability for any damage to person or property caused by the utilization of this publication to effect maintenance or repair work on Mercedes-Benz automobiles.

MERCEDES-BENZ OF NORTH AMERICA, INC.
Service and Parts Literature

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Crankcase and cylinder head	01
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Job No.

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Vehicle identification number locations . . . . . – 015
Technical data . . . . . – 020

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Complete Service Manual coverage for late model year Mercedes-Benz vehicles requires four individual manuals:

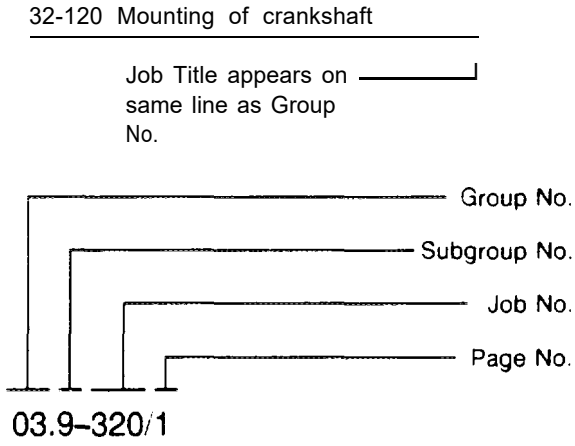
Service Manual, Engine
Service Manual, Chassis and body
Service Manual, Heating and air conditioning

Throughout these manuals. the vehicles are identified by their chassis and engine numbers. These numbers are made up of the first six digits of the respective serial number. For the actual location of chassis and engine numbers. see page 00–015/1. In case where the repair instructions apply to all versions, only the first three digits of the respective number are referenced.

For example, chassis 124 applies to all 124 models. However, chassis 124.050 would only apply to model 300 CE.

Location of specific repair instructions

First locate the **Group No. in** the Group Index. Individual groups are separated by an easily visible dividing page, which is followed by the job index page. Then check the job index for the exact job required. The first page of a typical job description looks like this:



Technical data. tightening torques and tools are listed at the beginning of each job.

All dimensions are in metric units. unless otherwise Indicated. Any part numbers given are only used for identification and easier differentiation between Individual components, and are not Intended for ordering purposes.

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Engine	Model	Sales designation	Power in kW at rpm	Compression ratio
103.940	124.026	260 E	11815800	9.2:1
103.942	201.029	190 E 2.6	118/5800	9.2:1
103.981	126.024	300 SE	132/5700	9.2:1
103.981	126.025	300 SEL	132/5700	9.2:1
103.982	107.041	300 SL	132/5700	9.2:1
103.983	124.030	300 E	132/5700	9.2:1
103.983	124.050	300 CE	132/5700	9.2:1
103.983	124.090	300 TE	132/5700	9.2:1
103.985	124.230	300 E 4MATIC	13215700	9.2:1
103.985	124.290	300 TE 4MATIC	132/5700	9.2:1

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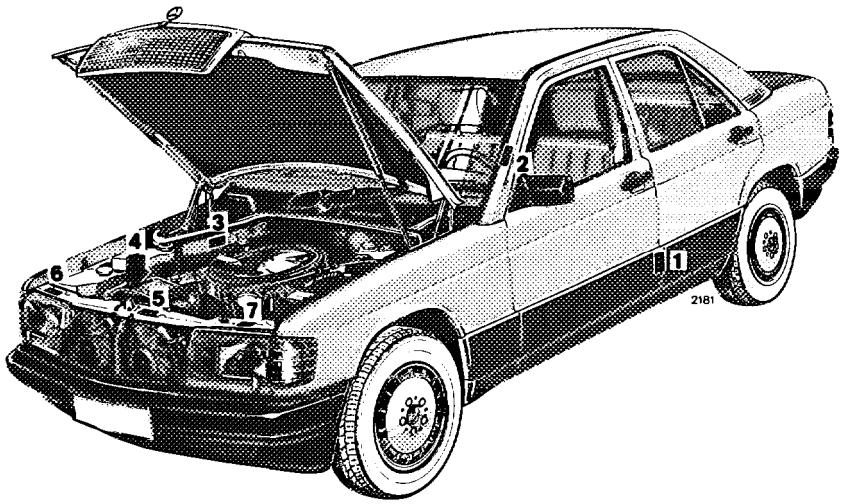
Model 201

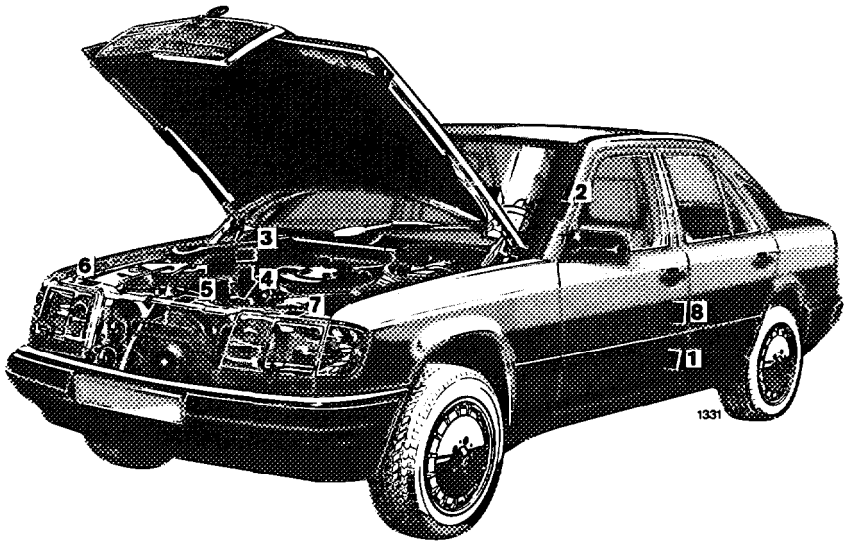
When ordering spare parts, please specify chassis and engine numbers.



1 Certification Tag (left door pillar)
2 Identification Tag (left windshield post)
3 Vehicle Identification No.
4 Engine No.
5 Body No. and Paintwork No.
6 Information Tag
California version
Vacuum line routing for emission control system
7 Emission Control Tag

Model 124 (4MATIC similar)

When ordering spare parts, please specify chassis and engine numbers.



1 Certification Tag (left door pillar)
2 Identification Tag (left window post)
3 Vehicle Identification No.
4 Engine No.
5 Body No. and Paintwork No.
6 Information Tag
California version
Vacuum line routing for emission control system
7 Emission Control Tag
8 Emission Control Tag
Catalyst Information

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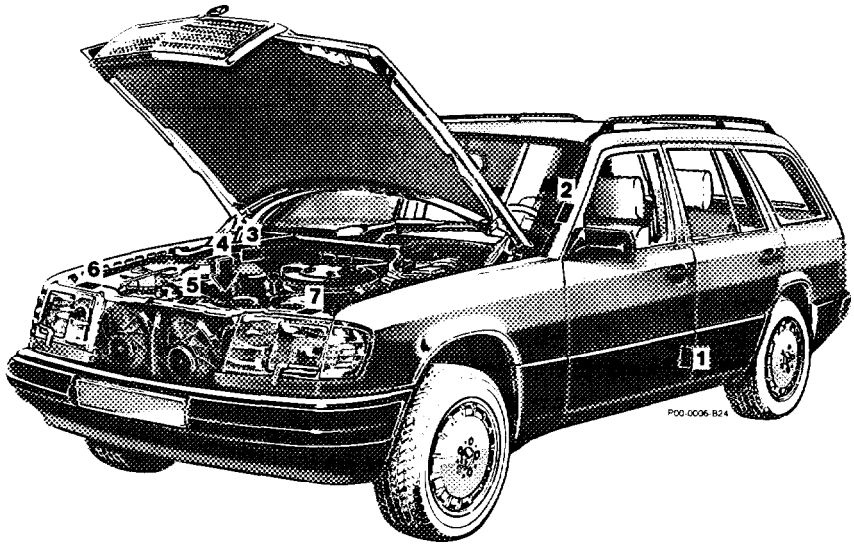
Model 124 TE (4MATIC similar)

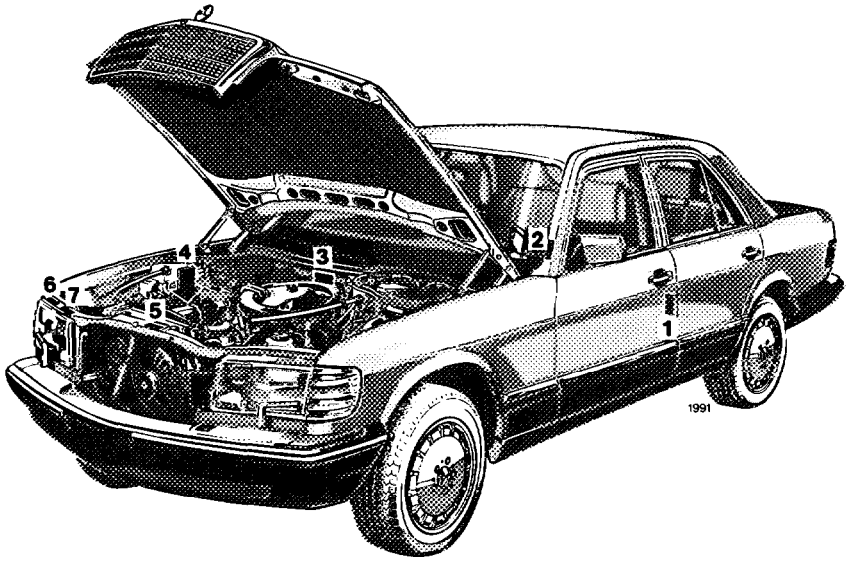
When ordering spare parts, please specify chassis and engine numbers.



1 Certification Tag (left door pillar)
2 Identification Tag (left windshield post)
3 Vehicle Identification No.
4 Engine No.
5 Body No. and Paintwork No.
6 Information Tag
California version
Vacuum line routing for emission control system
7 Emission Control Tag

Model 126 (SEL, SE similar)

When ordering spare parts, please specify chassis and engine numbers.



1 Certification Tag (left door pillar)
2 Identification Tag (left window post)
3 Vehicle Identification No.
4 Engine No.
5 Body No. and Paintwork No.
6 Emission Control Tag
7 information Tag
California version
Vacuum line routing
for emission control system

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Gasoline engines

Model	124.026	201.029	126.024	126.025
Sales designation	260 E	190 E 2.6	300 SE	300 SEL
Engine	103.940	103.942	103.981	103.961
Operation	4-cycle, electronic/ mechanical gasoline injection system with airflow sensor (CIS-E)	4-cycle, electronic/ mechanical gasoline injection system with airflow sensor (CIS-E)	4-cycle, electronic/ mechanical gasoline injection system with airflow sensor (CIS-E)	4-cycle, electronic, mechanical gasoline injection system with airflow sensor (CIS-E)
Number of cylinders	6	6	6	6
Cylinder arrangement	In-line 15° inclination	In-line 15° inclination	In-line 15° inclination	In-line 15° inclination
Bore/stroke mm	82.9/80.25	82.9/80.25	88.5/80.25	88.5/80.25
Total effective piston displacement cc	2599	2599	2962	2962
Compression ratio	9.2	9.2	9.2	9.2
Firma order	I-5-3-6-2-4	I-5-3-6-2-4	I-5-3-6-2-4	I-5-3-6-2-4
Maximum speed rpm	6550 ± 50	6550 ± 50	6350 ± 50	6350 ± 50
Engine output (SAE)kW/rpm net bhp/rpm	118/5800 158/5800	118/5800 158/5800	132/5700 177/5700	132/5700 177 5700
Maximum torque Nm/rpm net lb-ft./rpm	220/4600 1624400	220/4600 162/4400	255/4400 188/4400	2554400 1664400
Crankshaft bearings	7	7	7	7
Valve arrangement	Overhead	Overhead	Overhead	Overhead
Camshaft arrangment	1 overhead camshaft	1 overhead camshaft	1 overhead camshaft	1 overhead camshaft
Oil cooling	-	-	-	-
Cooling	Coolant circulating pump, thermostat with bypass line. fan with visco fan clutch. finned tube radiator	Coolant circulating pump, thermostat with bypass line. fan with visco fan clutch, finned tube radiator	Coolant circulating pump, thermostat with bypass line, fan with visco fan clutch, finned tube radiator	Coolant circulating pump, thermostat with bypass line fan with visco fan clutch. finned tube radiator
Lubrication	Pressure lubrication via gear type pump	Pressure lubrication via gear type pump	Pressure lubrication via gear type pump	Pressure lubrication via gear type pump
Oil filter	Full flow filter	Full flow filter	Full flow filter	Full flow filter
Air cleaner	Dry paper cartridge	Dry paper cartridge	Dry paper cartridge	Dry paper cartridge

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Gasoline engines

Model	124.030	124.050	124.090
Sales designation	300 E	300 CE	300 TE
Engine	103.983	103.983	103.983
Operation	4-cycle, electronic/ mechanical gasoline injection system with airflow sensor (CIS-E)	4-cycle, electronic/ mechanical gasoline injection system with airflow sensor (CIS-E)	4-cycle, electronic/ mechanical gasoline injection system with airflow sensor (CIS-E)
Number of cylinders	6	6	6
Cylinder arrangement	In-line 15° inclination	In-line 15° inclination	In-line 15° inclination
Boreistroke mm	88.5/80.25	88.5/80.25	88.5/80.25
Total effective piston displacement cc	2962	2962	2962
Compression ratio	9.2	9.2	9.2
Firing order	I-5-3-6-2-4	1-5-3-6-2-4	1-5-3-6-2-4
Maximum speed rpm	6350 ± 50	6350 ± 50	6350 ± 50
Engine output (SAE)kW/rpm net bhp/rpm	132/5700 177/5700	13215700 177/5700	13215700 17715700
Maximum torque Nm/rpm net lb-ft./rpm	255/4400 188/4400	25514400 188/4400	25514400 1 88/4400
Crankshaft bearings	7	7	7
Valve arrangement	Overhead	Overhead	Overhead
Camshaft arrangment	1 overhead camshaft	1 overhead camshaft	1 overhead camshaft
Oil cooling	-		-
Cooling	Coolant circulating pump, thermostat with bypass line, fan with visco fan clutch, finned tube radiator	Coolant circulating pump, thermostat with bypass line, fan with visco fan clutch, finned tube radiator	Coolant circulating pump, thermostat with bypass line, fan with visco fan clutch, finned tube radiator
Lubrication	Pressure lubrication via gear type pump	Pressure lubrication via gear type pump	Pressure lubrication via gear type pump
Oil filter	Full flow filter	Full flow filter	Full flow filter
Air cleaner	Dry paper cartridge	Dry paper cartridge	Dry paper cartridge

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Gasoline engines

Model	124.230	124.290
Sales designation	300 E 4MATIC	300 TE 4MATIC
Engine	103.985	103.985
Operation	4-cycle, electronic1 mechanical gasoline injection system with airflow sensor (CIS-E)	4-cycle, electronic/ mechanical gasoline injection system withairflow sensor (CIS-E)
Number of cylinders	6	6
Cylinder arrangement	In-line 15° inclination	In-line 15° inclination
Bore/stroke mm	88.5/80.25	88.5/80.25
Total effective prston displacement cc	2962	2962
Compressron ratro	9.2	9.2
Firing order	I-5-3-6-2-4	I-5-3-6-2-4
Maximum speed rpm	6350 ± 50	6350 ± 50
Engine output (SAE)kW/rpm net bhp/rpm	1325700 17715700	13215700 17715700
Maximum torque Nmirpm net lb-ft./rpm	25514400 188/4400	25514400 18814400
Crankshaft bearings	7	7
Valve arrangement	Overhead	Overhead
Camshaft arrangment	1 overhead camshaft	1 overhead camshaft
Oil cooling		
Cooling	Coolant circulating pump, thermostat with bypass line, fan with visco fan clutch, finned tube radiator	Coolant circulating pump, thermostat with bypass line, fan with visco fan clutch, finned tube radiator
Lubrication	Pressure lubrication via gear type pump	Pressure lubrication via gear type pump
Oil filter	Full flow filter	Full flow filter
Air cleaner	Dry paper cartridge	Dry paper cartridge

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00-020 Technical data

Electrical system

Model	124.026	201.029	126.024 126.025	124.030, 124.050 124.090	124.230 124.290
Sales designation	260 E	190 E 2.6	300 SE 300 SEL	300 E 300 CE 300 TE	300 E 4MATIC 300 TE 4MATIC
Engine	103.940	103.983	103.981	103.983	103.985
Battery Voltage Capacity	 12 v 62 Ah	 12 v 62 Ah	 12 V 62 Ah	 12 V 62 Ah	 12 V 62 Ah
Starter Bosch	12 v 1.7 kW	12 v 1.7 kW	12 v 1.7 kW	12 v 1.7 kW	12 v 1.7 kW
Alternator	14 V 80 A	14V 80A	14 V 80 A	14V 80A	14 V 80 A

Filling capacities

Model	124.026	201.029	126.024	126.025
Sales designation	260 E	190 E 2.6	300SE	300 SEL
Engine	103.940	103.942	103.981	103.981
Fuel tank/reserve approx. l	70/9.0	55/6.0	90/12.5	90/12.5
Engine oil initial filling approx. l	6.5	6.5	6.5	6.5
During oil and filter change approx. l	6.0	6.0	6.0	6.0
Marks on dipstick max./min. approx. l	5.7/3.7	5.7/3.7	5.7/3.7	5.7/3.7
Cooling system with heater approx. l	9.0 (MY1987) 10.0 (MY1988-up)	10.0	10.0	10.0

Filling capacities (continued)

Model	124.030	124.050	124.090	124.230	124.290
Sales designation	300 E	300 CE	300 TE	103.985	103.985
Engine	103.983	103.983	103.983	300 E 4MATIC	300 TE 4MATIC
Fuel tank/reserve approx. l	70/9.0	70/9.0	72/9.0	70/9.0	72/9.0
Engine oil initial filling approx. l	6.5	6.5	6.5	6.5	6.5
During oil and filter change approx. l	6.0	6.0	6.0	6.0	6.0
Marks on dipstick max./min. approx. l	5.7/3.7	5.7/3.7	5.7/3.7	5.7/3.7	5.7/3.7
Cooling system with heater approx. l	8.0 (MY1986) 9.0 (MY1987) 10.0 (MY1988-up)	10.0	10.0	10.0	10.0

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Job No.

Engine and model survey . . . . . 01 – 001
Opening hood, setting vertical warnings . . . . . 01 – 008
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Testing cylinders for leaks . . . . . – 015
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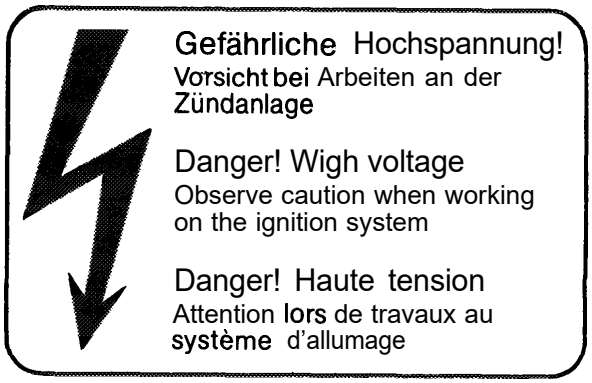
⚠

There is risk of injury whenever the engine is running and the hood is open.
The engine is equipped with an electronic ignition system. Because of the high voltage ignition, it is very dangerous to touch ignition system components (ignition coil, distributor, cables, spark plug connector, test socket) if

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

Observe these cautions when working on the breakerless, solid-state ignition system (15-505).

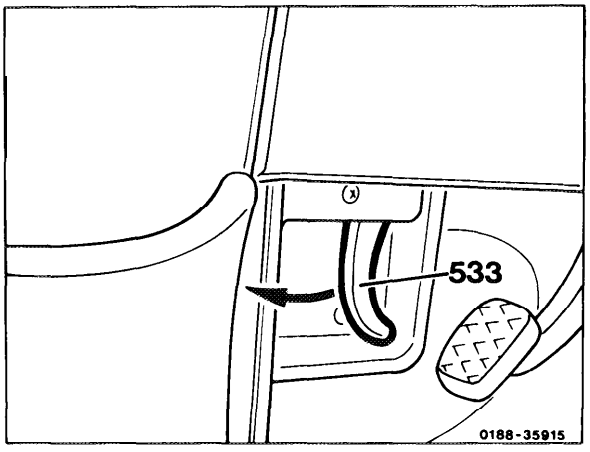


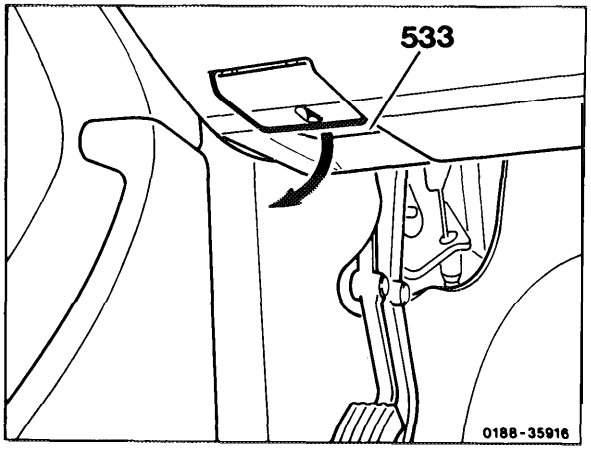
1154-9352

Opening hood

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

Model 107
Model 126





Model 124

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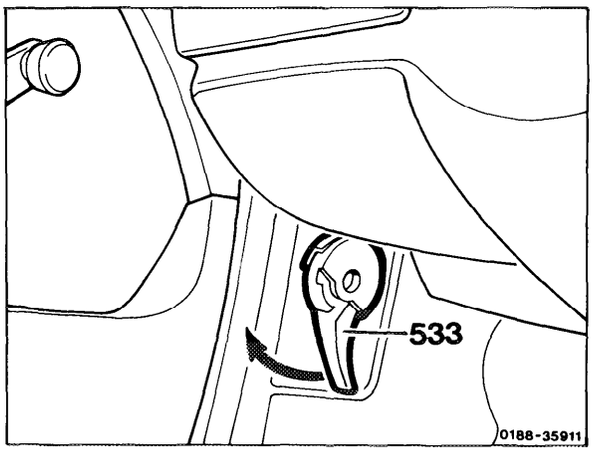
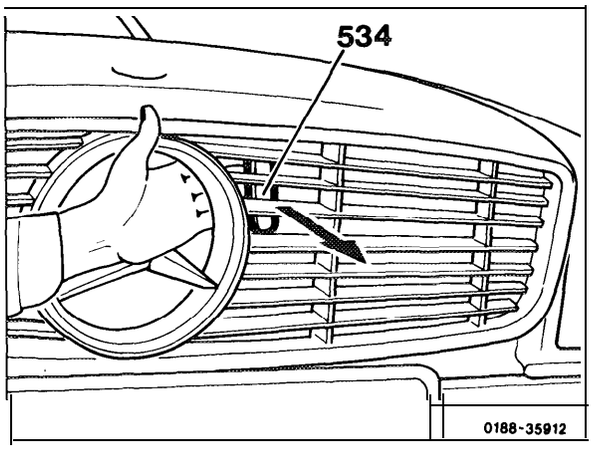


Model 201

Model 107

2 Reach through the opening in the grille star and push the lever (534) behind the grille in the direction of the arrow. Open the hood to the stop.



Note:

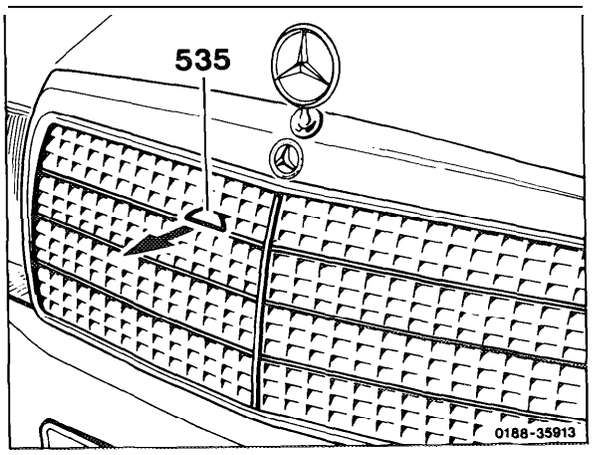
The windshield wiper arm must not be pivoted forward when the hood is lifted.

The **hood on this model cannot be moved into the vertical position.**

3 Close hood by pushing down forcibly.

Model 124, 126, 201

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



Note

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

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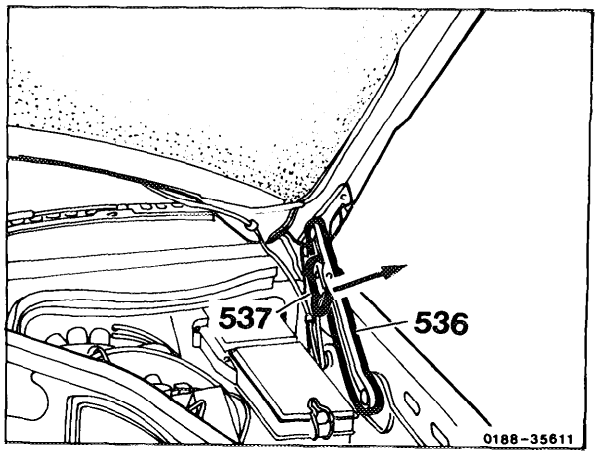
Moving hood into vertical position

Model 124 (production up to August 1968)

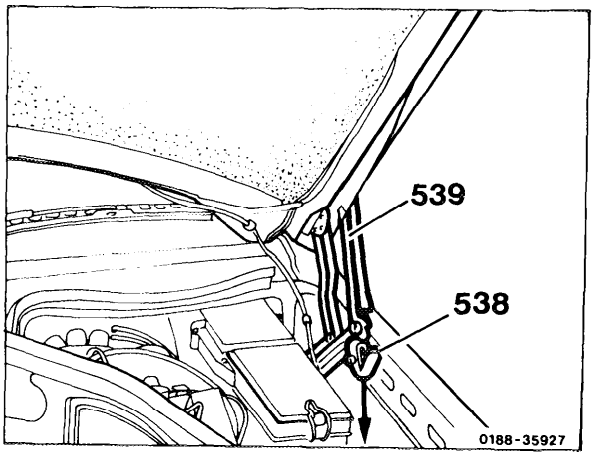
5 Push lock lever (537) on the left hood support (536) in direction of arrow. Lift hood slightly upward to keep the lock lever (537) from reengaging again.
Repeat the preceding at the right hood support and set the hood in a vertical position.



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

Model 126

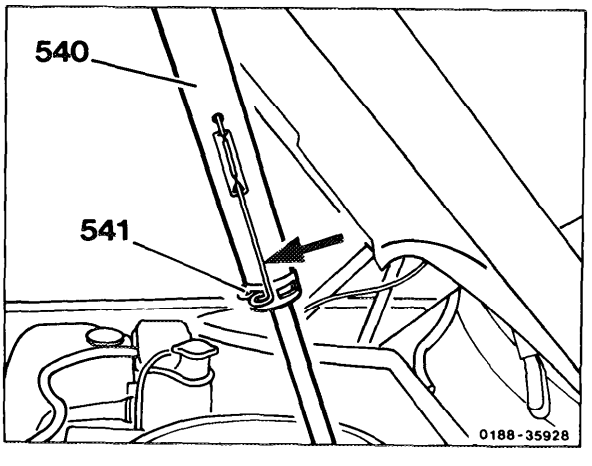
7 Push hood down slightly. Push lock lever (538) on the left hood support (539) down *in* the direction of the arrow. Push hood up slightly to keep the lock lever (538) from reengaging.
Repeat the preceding at the right hood support and set the hood in a vertical position.



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

Model 201

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



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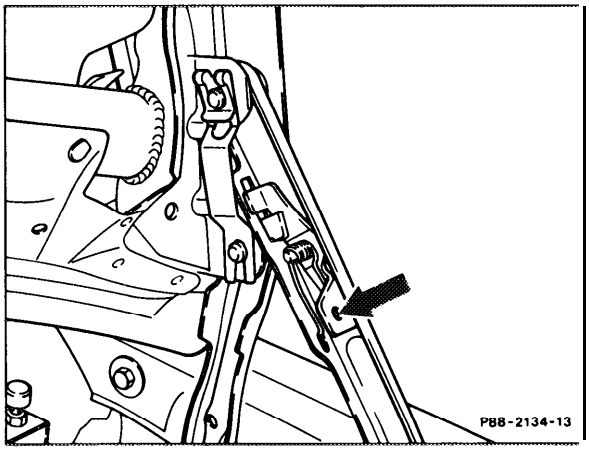
10 When the hood is set vertical, a lock engages on the left hood support.

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



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Job No. of job texts and job values or standard texts and fiat rates 01-1200

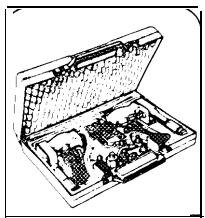
Model 124
Model 129

Test data for engine at normal operating temperature		Pressure
Minimum compression pressure at	Normal compression	approx. 12 bar
	Low compression	approx. 7.5 bar
Allowable difference between cylinders		max. 1.5 bar

Tightening torque

Spark plugs	20 Nm

Special tools



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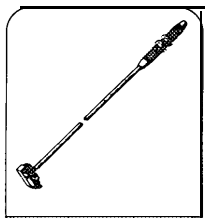

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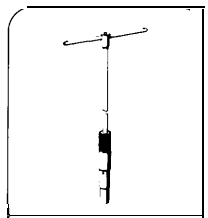

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Note
Test compression pressure at normal operating temperature.

If the pressure reading is below the minimum compression pressure, test cylinders for leaks (01-015).

During the test, have all spark plugs removed.

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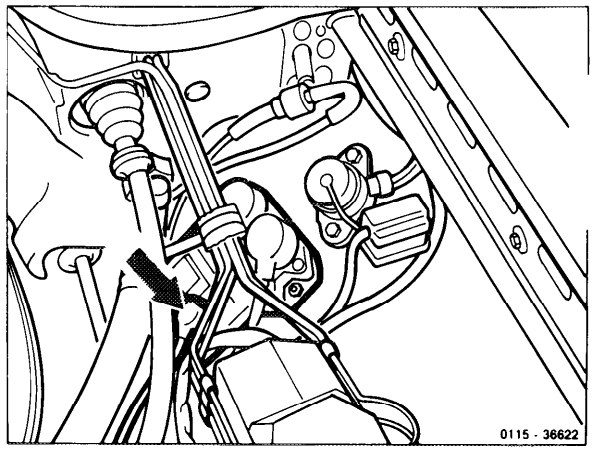
1 Set hood vertical (01-008).

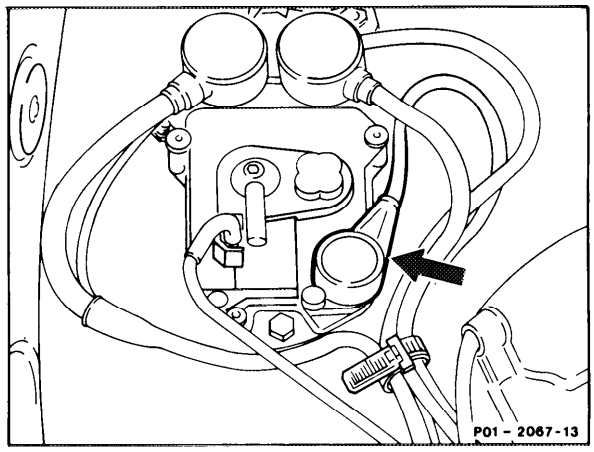
Model 124

2 Turn ignition off and unplug the connector (arrow) for the distributor inductive pickup (green cable) at the control unit.



Model 129

3 Turn ignition off and unplug the connector (arrow) for the distributor inductive pickup (green cable) at the control unit.



4 Unplug all spark plugs.

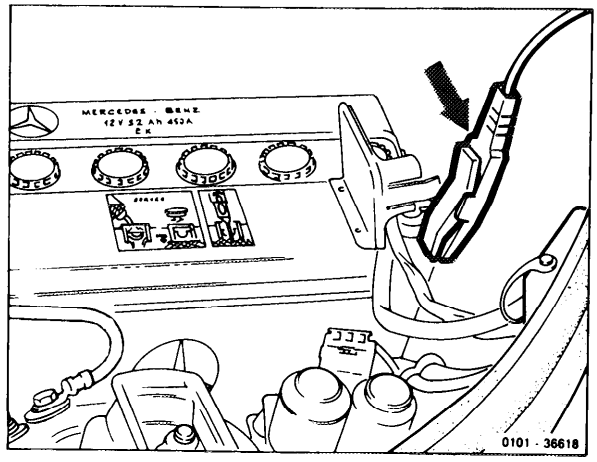
5 Blow out spark plug recesses with compressed air.

6 Remove spark plugs.

Connecting compression pressure recorder

Model 124

7 Connect an alligator clamp (arrow) from the compression pressure recorder (001 589 76 21 00) to the battery positive cable.



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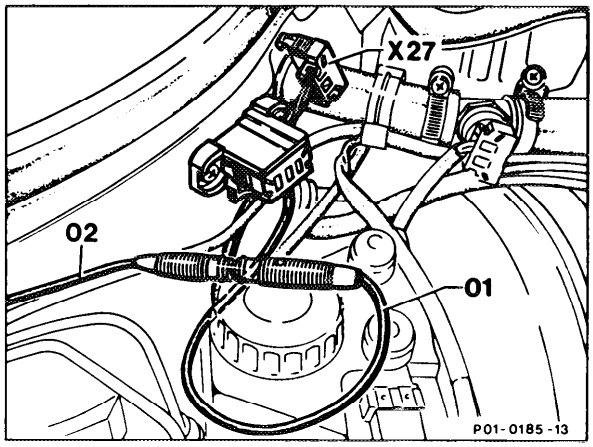
8 Unplug connector (X27) from connector (50).

9 Fit plug (63) of adapter cable
01 124 589 36 63 00 to connector (50).

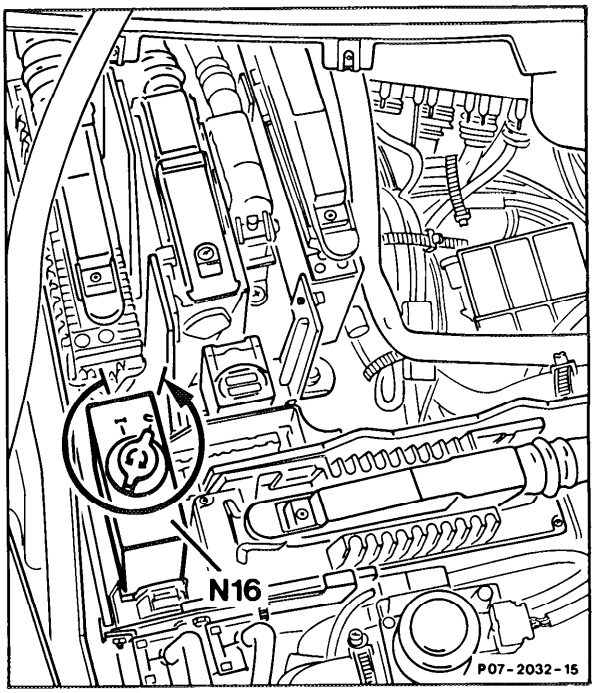
10 Connect adapter cable (01) to the compression pressure recorder cable (02).



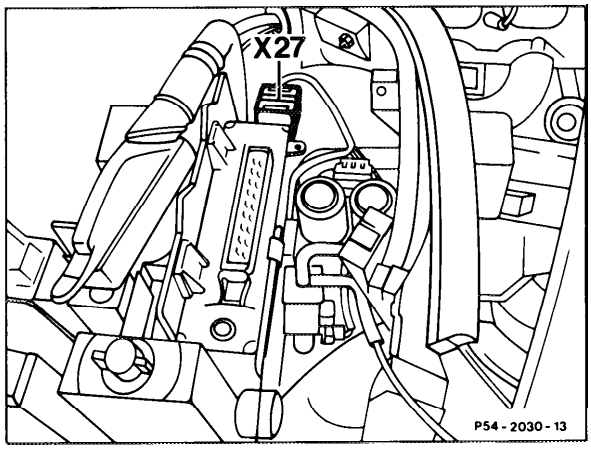
Model 129

11 Remove cover of component compartment.

12 Remove engine component control unit by turning the knob counterclockwise from position 1 to position 0, and remove the control unit upward.



13 Unplug connector (28) at connection (X27).



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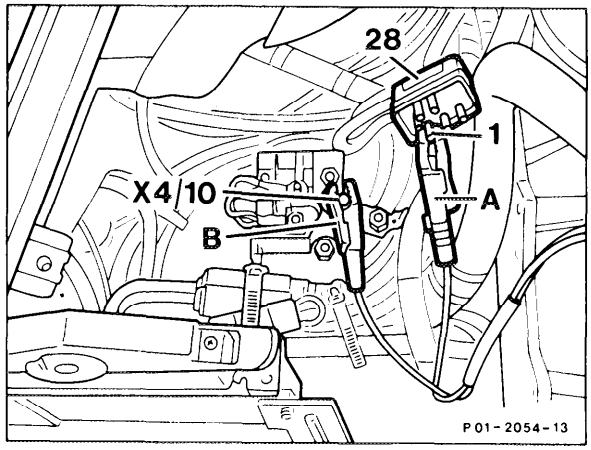
14 Connect terminal (A) to pin 1 on the connector (28).

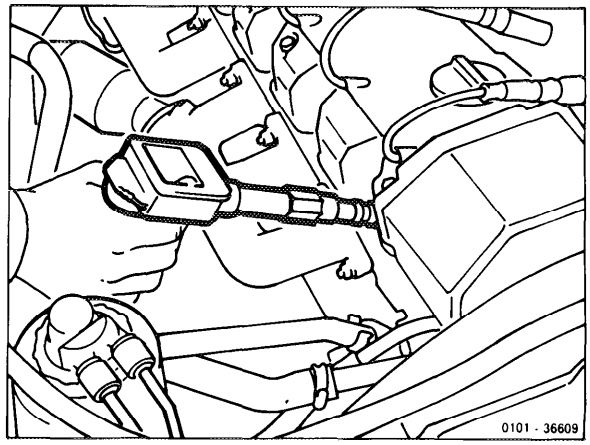
15 Connect terminal (B) to terminal block (X4/10).



Testing

16 With the throttle in the idle position and the parking brake applied, crank the engine with the starter several times to eject debris and soot.

17 Insert the diagram sheets in the compression pressure recorder and start with cylinder 1.



18 To test a specific cylinder, press the compression pressure recorder into the spark plug bore of the cylinder tested, and crank engine through approx. 8 compression strokes. Keep the throttle wide open during the test.

Test all the cylinders this way.

19 Blow out the spark plug recesses with compressed air. Remove residues on the tapered seat.

20 Thread in the spark plugs and tighten to 20 Nm.

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01-015 Testing cylinders for leaks

Job No. of job texts and job values or standard texts and fiat rates 01-1300

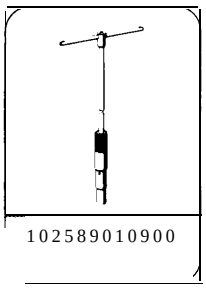
Data

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

Tightening torque

Spark plugs	20 Nm

Special tools



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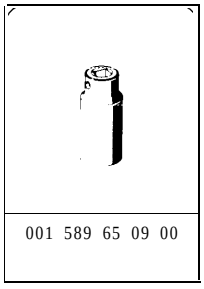

001 589 65 09 00

Commercial tool

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

Testing

1 Run engine until it is at normal operating temperature.

2 Blow out spark plug recesses with compressed air.

3 Remove spark plugs.

Reinstallation note:

Retighten spark plugs to 20 Nm at the completion of the test.

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4 Top up coolant and leave coolant expansion tank cap open.

5 Remove oil filler cap.

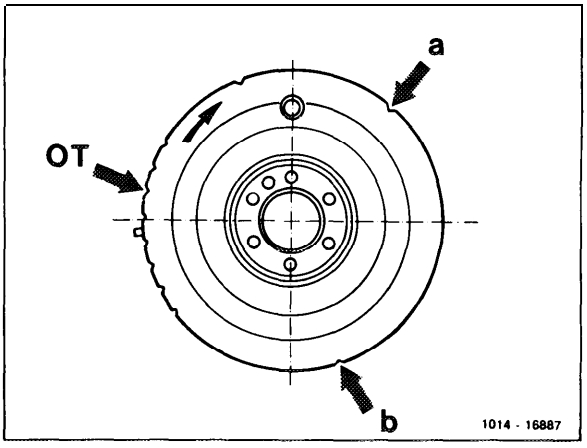
6 Remove air filter (09-400).

7 Connect cylinder leak tester to a compressed air source and calibrate tester.

8 Position the piston of cylinder No. 1 to compression stroke TDC.

A piston is at compression stroke TDC only if its mark (arrows) on the vibration damper, shown in the drawing, is aligned with the TDC pointer and if the distributor rotor points to that cylinder's electrode.

Marking	TDC	b = 120°	a = 240°
Piston in TDC Cylinder	1 or6	2 or 5	3 or 4



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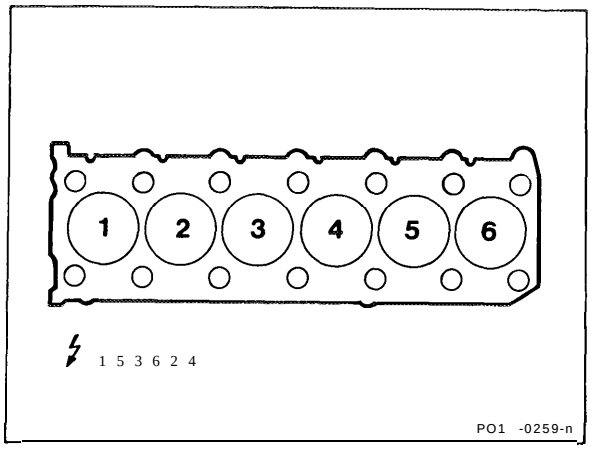
9 Thread the connector hose into spark plug hole # 1 and tighten, attach the connector hose of the tester.

Warning:

Keep hands and tools away from the radiator fan and all belts and pulleys during the next step. Pressurize that combustion chamber (approx. 5 bar applied air pressure). The crankshaft must not move during this step. If it does, the piston was not at TDC.



10 Read pressure loss on tester (in %).

11 Move throttle to wide open.

12 Listen to determine whether pressure escapes through the intake manifold, the exhaust, the oil filler opening, a spark plug hole of an adjacent cylinder or the coolant filler opening.

13 Continue test for each cylinder in the engine's firing order (l-5-3-6-2-4).

Note:

It is possible by spraying oil over the piston crown to determine whether the piston rings leak. The oil can temporarily seal the rings, but would have no sealing effect on valves or head gasket leaks.

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Job No. of job texts and job values or standard texts and flat rates. 01-2400, 01-2800

A. Models 124 and 124 4MATIC

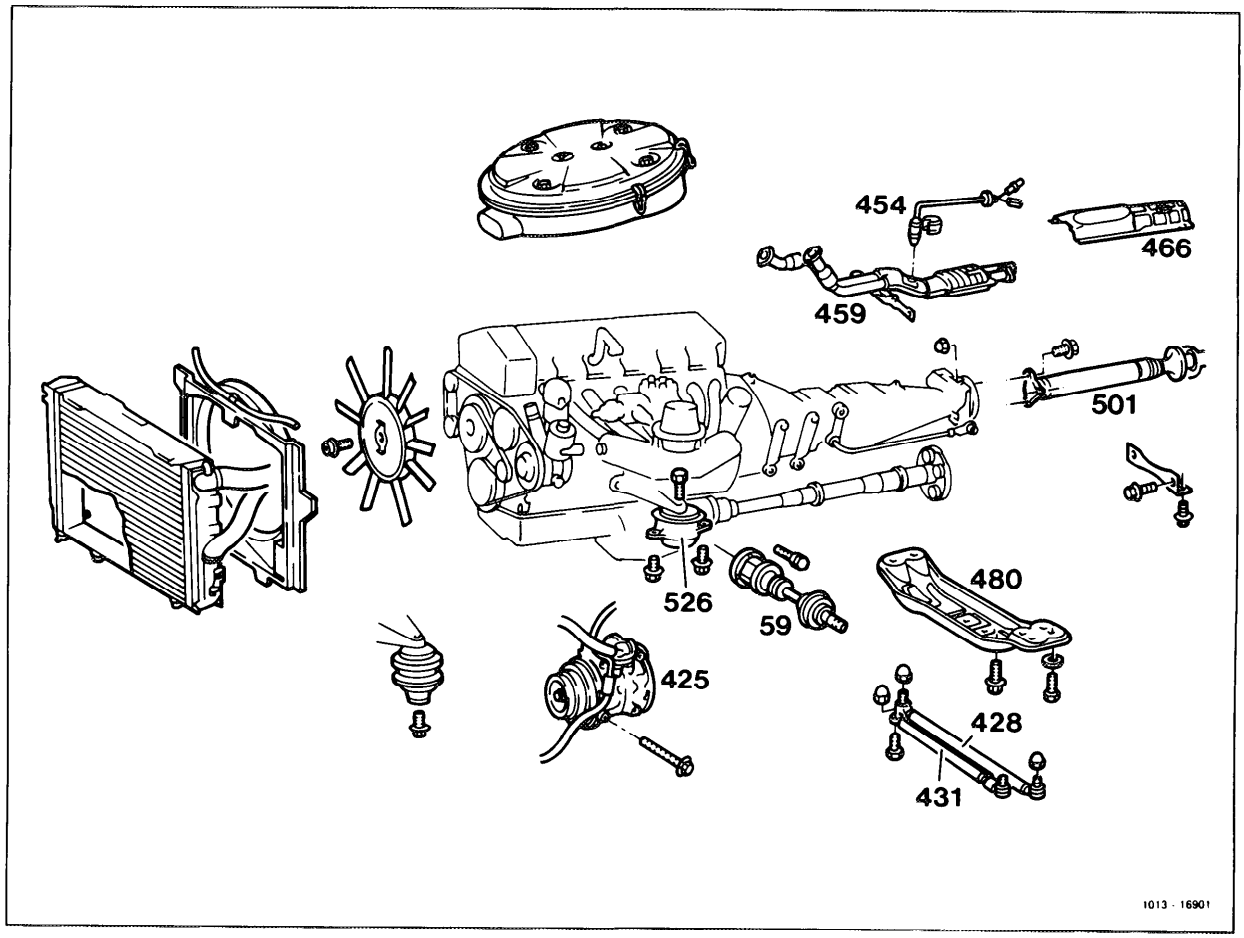

Illustration shows Model 124 4MATIC

Hood	set vertical (0 l-008).
Battery ground cable	disconnect, connect.
Lower engine compartment covering	remove, install (step 3).
Air filter	remove, clean and install (09-400) .
Radiator	remove, install (20-420).
With air conditioning	attach guard plate to condenser, remove and install poly V-belt (13-342).
Viscous fan clutch	remove, install (20-312).

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Power steering pump/tandem pump	extract oil from reservoir, top up oil to correct level (46-710).
Oil lines	detach, attach (step 13).
With air conditioning	detach refrigerant compressor (425) with manifold connected, set aside, attach (step 14).
Hydraulic system, high-pressure expansion hose (4MATIC)	vent pressure, move lever on service valve to test position, unbolt and bolt on.
Fuel lines	detach, connect and seal, open fuel filler cap briefly first (step 15).
Bowden cable (accelerator)	detach, attach (30-325) (step 16).
Electrical connections and engine wiring harness	detach, reconnect (steps 17 and 18).
Heating water return line	detach, reconnect.
Oxygen sensor (454)	remove, install (step 27).
Exhaust system and heat shield over exhaust system	remove, install (49-100).
Crossmember (4MATIC)	remove, install (step 29).
Flexible joint on propeller shaft (501)	detach, attach, replace self-locking nuts (step 30).
Clamping nut and center bearing support	slacken, tighten (steps 31 and 32).
Transmission linkage	detach, reconnect (steps 36 and 37).
Starter lockout switch (automatic transmission)	unlock, unplug and reconnect connector (step 37).
Clutch hydraulic line	unbolt, reconnect (step 38).
Center link (428) with steering damper (431)	remove, reinstall, replace self-locking nuts and bolts (46-550).
Front axle shafts (59) left, right (4MATIC)	detach, attach on inside and suspend joints with wire (step 40).
Engine hoist to suspension lugs	connect, disconnect (step 41).
Transmission	support.
Guard plate at component compartment wall	insert, remove.
Rear engine mount (480) without engine mounts	remove, install (steps 44 and 45).
Front engine mounts (526 or 522) left and right	unbolt, install from below (step 46).

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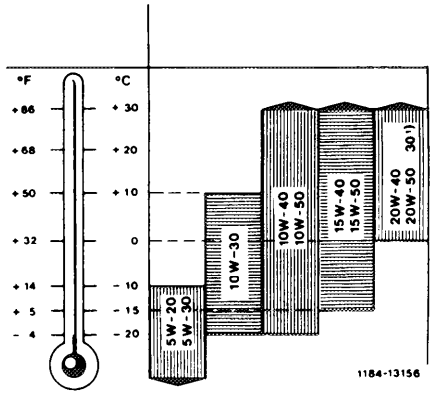
Engine with engine hoist	raise, lower (step 47).
Engine mounts, front and rear	check.
Coolant, oil and fuel hoses	check.
With automatic transmission	adjust control pressure cable (27-I 00).
Engine idle speed	check and adjust (017.3-I 00).
Oil drain plugs	check torque.
Oil level in engine and in transmission	adjust to correct level.
Coolant	top up, check anti-corrosion/antifreeze protection and correct (20-010).
Hydraulic system (4MATIC)	bleed (steps 56 to 60).

Specified viscosity classes according to SAE at extended outside temperatures



1) At extended outside temperature above + 30 °C SAE 40 may be used.
Precise use of the SAE classes according to the outside air temperatures would necessitate frequently changing engine oil. The temperature limits for the SAE classes should therefore be regarded as a guide which may be transgressed for brief periods.
In moderate climatic zones SAE 40 may be used from April onward for all engine versions.
The following oils may be used as an all-season oil for all gasoline engines

SAE 10 W-40 and SAE 10 W-50	
SAE 5 W-20	below + 10 °C
SAE 5 W-30, 10 W-30	all-year-round in moderate climatic zones, i.e. up to + 30 °C
SAE15 W-30	all-year-round in moderate climatic zones

Vehicle components and their respective lubricants must match. Therefore use only brands tested and recommended by us. Inquire at your authorized MERCEDES-BENZ dealer.

Oil capacities (refer to Service Product Specifications for approved engine oils)

Engine capacity at first filling or after overhaul	7.0 l
Engine capacity when changing oil and filter	6.5 l
Steering gear oil (automatic transmission fluid (ATF) or manual transmission oil)	approx. 0.6 l
Hydraulic oil for self-levelling suspension (refer to Service Product Specifications sheet 343)	approx. 2.0 l

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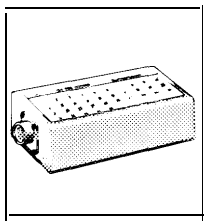
Tightening torques

Driveshaft center bearing to chassis	25 Nm
Air conditioning compressor to engine block	25 Nm
Crossmember to chassis, 4MATIC	25 Nm
Fiexible coupling to driveshaft	45 Nm
Steering damper to center link and chassis	50 Nm
Center link to Pitman arm	35 Nm
Front axle shafts to inboard flange, 4MATIC	70 Nm
I-ligh-pressure expansion hose to tandem pump	30 Nm
Return line to tandem pump	40 Nm
Clamping nut to driveshaft	35 Nm
Engine mount front to engine support	55 Nm
Engine mount front to body, 4MATIC	20 Nm
Engine mount rear to transmission	45 Nm
Engine mount rear to engine mount bow	45 Nm
Engine mount rear to engine support	20 Nm
Engine support rear to chassis	40 Nm

Special tools



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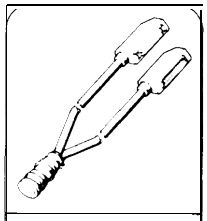

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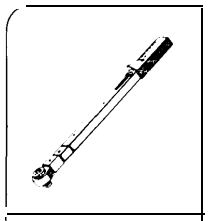

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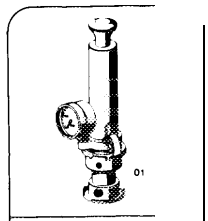

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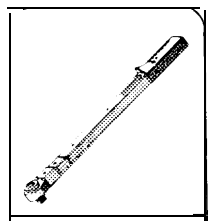

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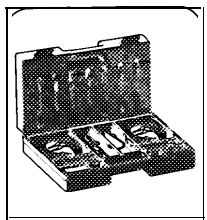

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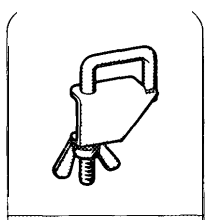

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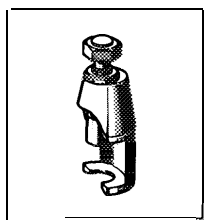
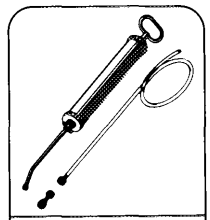
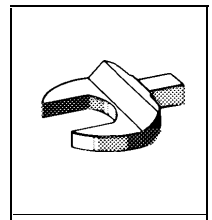


201 589 08 33 00



112 589 00 72 00



126 589 00 01 00

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Commercially available tools

Engine hoist No. 3188 self-locking	e. g. Backer Herder Str. D-5630 Remscheid
Anti-corrosion/antifreeze tester Preston-VU-Check	e. g. Philipp Gather D-4020 Mettmann 2

Shop-made tools

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

Note
Remove and install the engine with transmission attached, with 4MATIC with transfer case and front propeller shaft.
4MATIC reconditioned engines are supplied with an oil pan for shipping. This must be replaced with the original (01-310).

⚠
Do not strike or place a load on lube oil line at the transfer case when engine is positioned at an angle because this can cause it to leak.

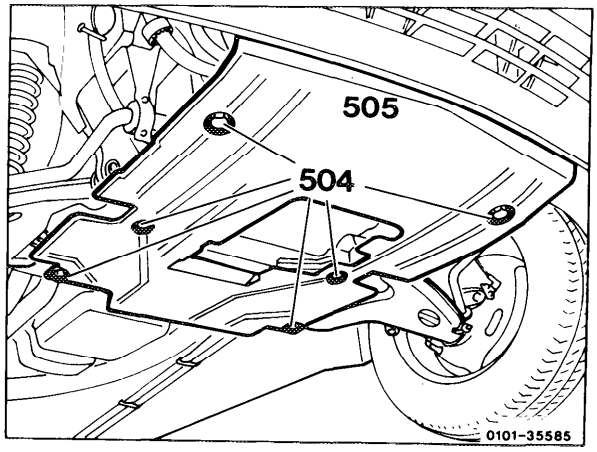
Removal, installation

1 Set the hood vertical (01-008).

2 Disconnect battery ground cable from the battery.

3 Unscrew bolts (504) and remove bottom engine compartment covering (505).

4 Remove air filter (09-400).



Reinstallation note:
Clean the air filter.

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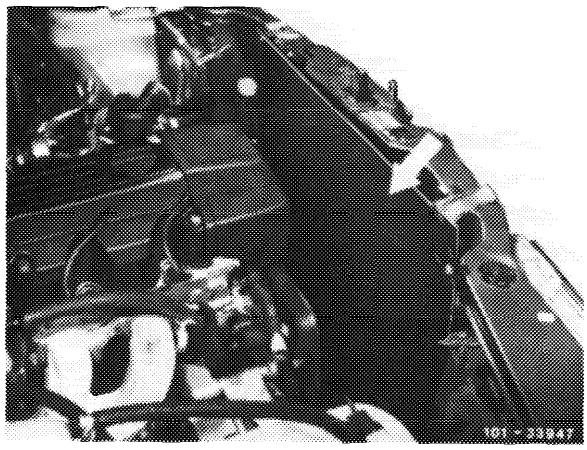
5 Remove radiator (20-420).

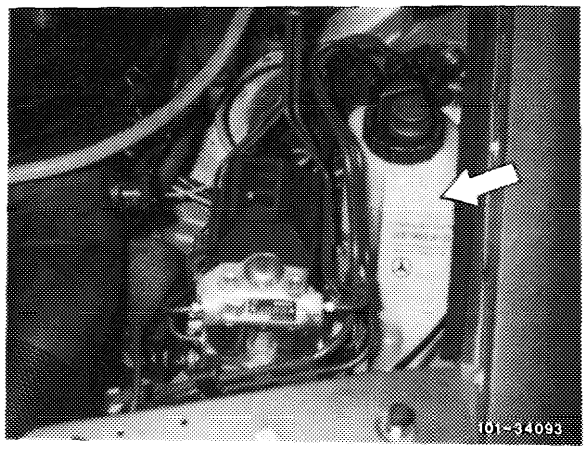
6 With air conditioning: Attach guard plate (arrow) to a/c condenser

7 With air conditioning: Remove poly-V-belt (13-342).

8 Remove viscous fan clutch (20-312).

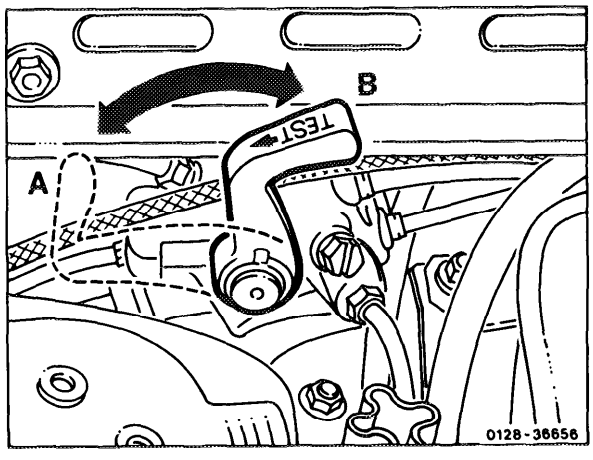


9 4MATIC: Unclip oil hose at bottom of hydraulic oil reservoir (arrow) and detach at tandem pump.

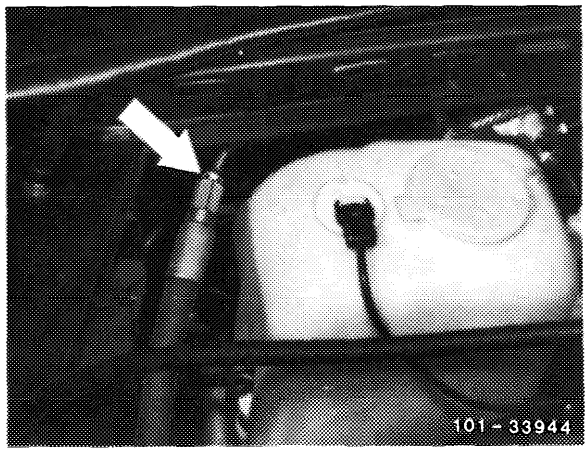


10 4MATIC: Release hydraulic system pressure by moving lever to test position on service valve.

A Test position
B Operate position



11 Detach threaded connector (arrow) at high-pressure expansion hose.



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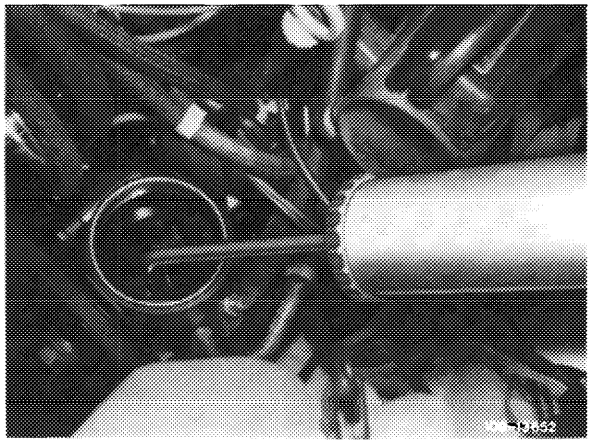
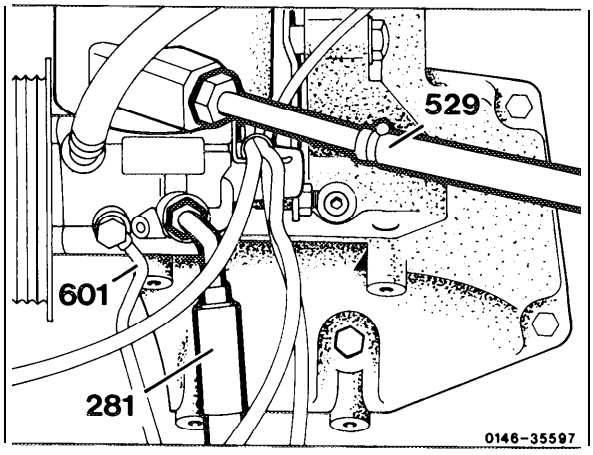
12 Draw oil from the reservoir of the tandem pump with a suction pump.



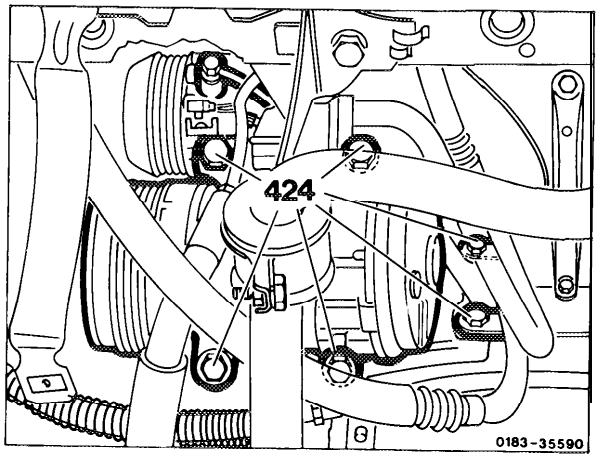
Installation note:
Check power steering oil level. Fill power steering system with the specified oil. With the engine running, top oil up to the mark. Turn steering several times from full lock to full lock. When the oil is at normal operating temperature, level is approx. 20 mm below the edge of reservoir, if the oil is cold it should be 6 – 8 mm below the mark (46-710).

13 Disconnect oil lines (281, 529) to steering gear and oil line (601) for self-levelling suspension at the tandem pump.



Installation note:
Replace seals.
High-pressure expansion hose (281) tightening torque 30 Nm.
Return line (529) tightening torque 40 Nm.

14 Detach air conditioning compressor from engine.
Remove bolts **(424),** tightening torque 25 Nm.
Secure air conditioning compressor with manifold connected at the bottom of the engine compartment to the side.



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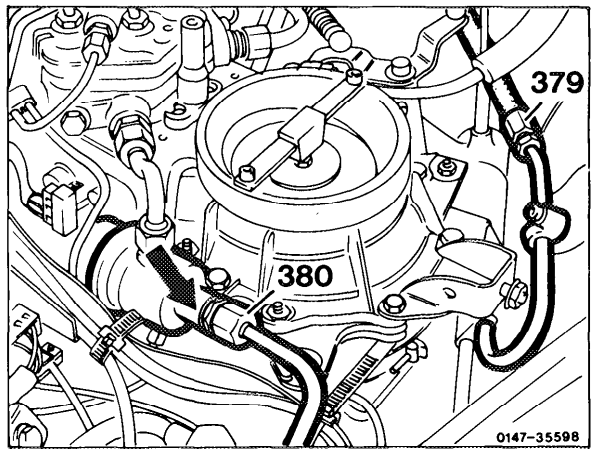
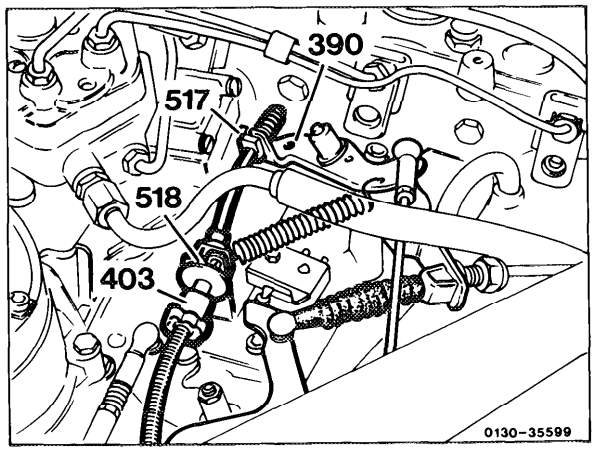
15 Briefly open the fuel filler cap to vent the fuel tank pressure.
Disconnect the fuel lines (380, 379).
Keep the connector fitting from turning (arrow) when detaching the fuel line (380).

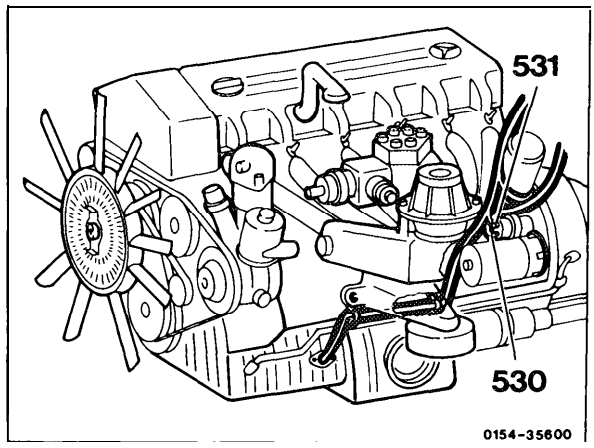


16 Detach the accelerator Bowden cable. Press plastic guide (517) out of its seat in the fulcrum lever (390) and withdraw Bowden cable (403) through the slot in the fulcrum lever.
Squeeze links of the plastic clip (518) together and push clip with the Bowden cable (403) through the bracket rearward.

Installation note:
Readjust Bowden cable (30-325).



17 Disconnect electric wires. Turn nut (531) downward. Unscrew cross-head screw (530).
Detach cable from the oil level gauge and from the oil pressure sensor.



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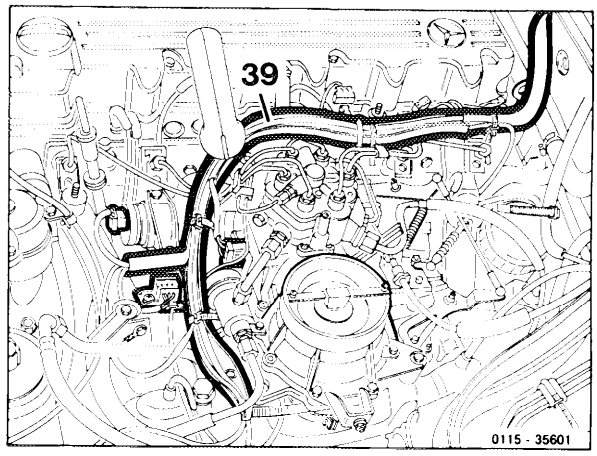
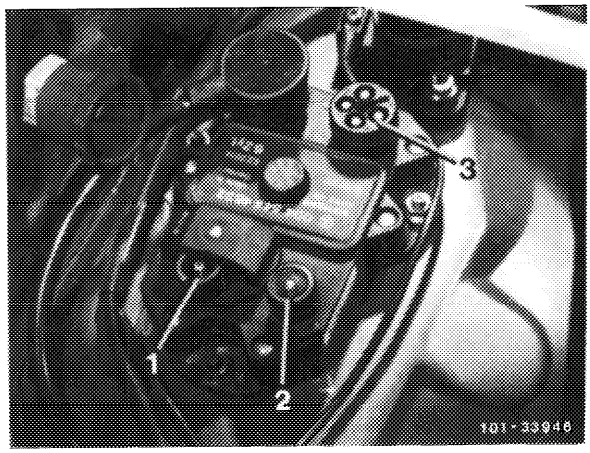
18 Release all cable straps of the engine wiring harness. Disconnect all the plug connectors along the engine wiring harness.
Remove engine wiring harness (39).



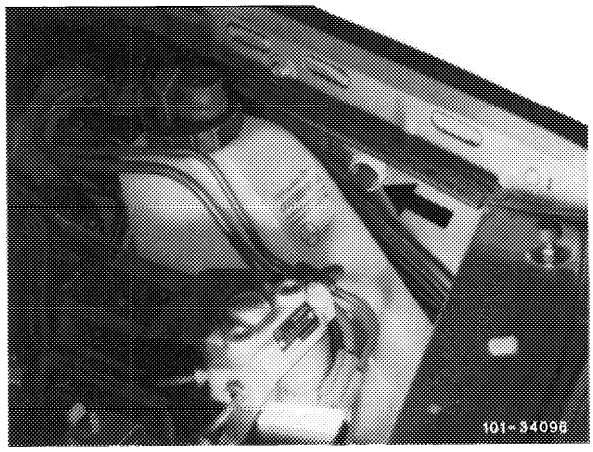
19 Detach heating hoses and vacuum lines in engine compartment.

20 Detach green control line from position sensor and vacuum line at ignition control unit connector - sensor.

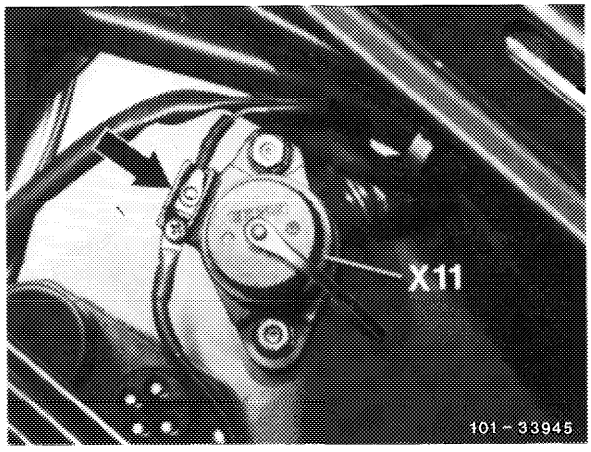


1 Vacuum connection
2 Control line connection
3 Connector - sensor connection

21 Detach vapor absorbtion line (arrow) of fuel evaporation control system from connector fitting on left wheelhouse.



22 Detach terminal block terminal TD (arrow) next to diagnostic socket (XI 1), unbolt diagnostic socket, detach grey cable from TDC sensor on back side of diagnostic socket.



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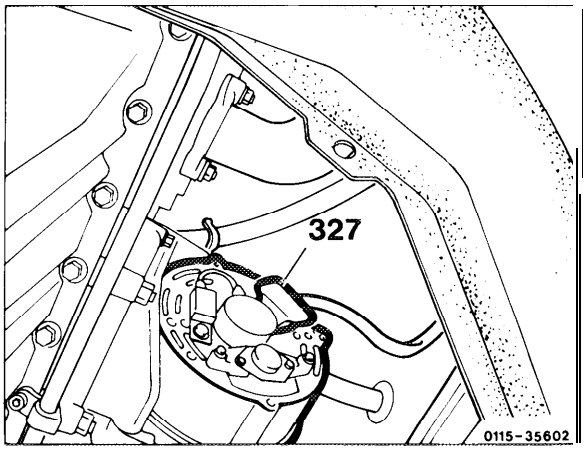
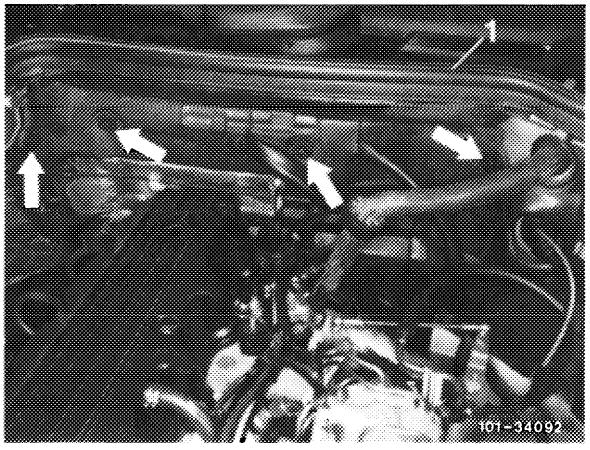
23 Detach wiring connector (327) at alternator.



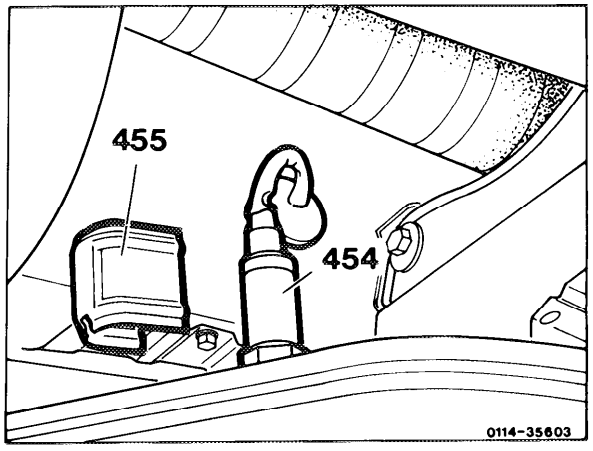
24 Remove rubber sealing strip (1) from component compartment wall.

25 Remove wiring harness cover by removing four plastic screws (arrows).

26 On vehicles with self-leveling suspension, unbolt wiring bracket at front of engine.

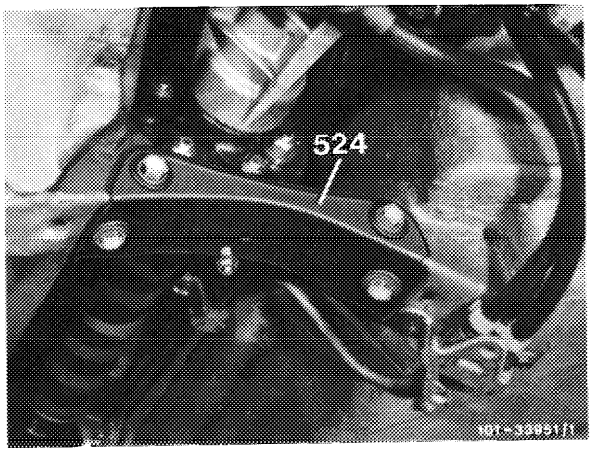


27 Remove protective cover (455), unscrew oxygen sensor (454).



28 4MATIC: Remove heat shields at transfer case and center tunnel.

29 Unbolt crossmember (524) in center tunnel, tightening torque 25 Nm.



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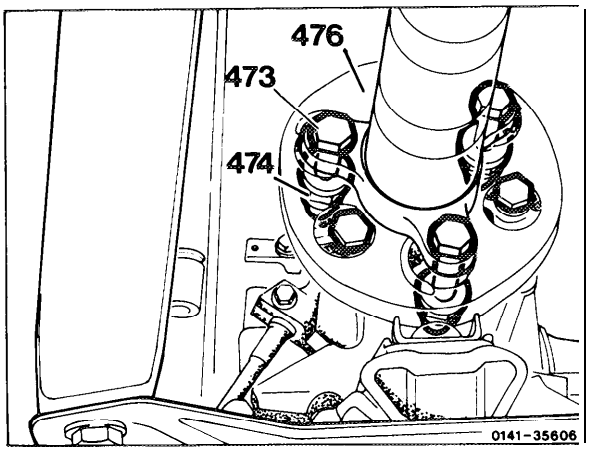
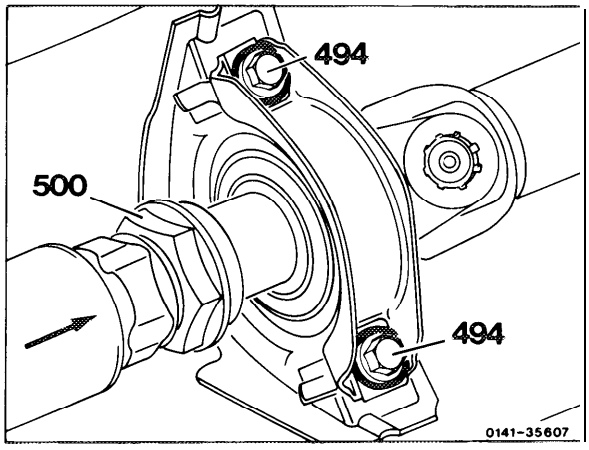
30 Remove driveshaft.
Unscrew nut (474), withdraw bolt (473), tightening torque 45 Nm. Flexible joint (476) remains on transmission.

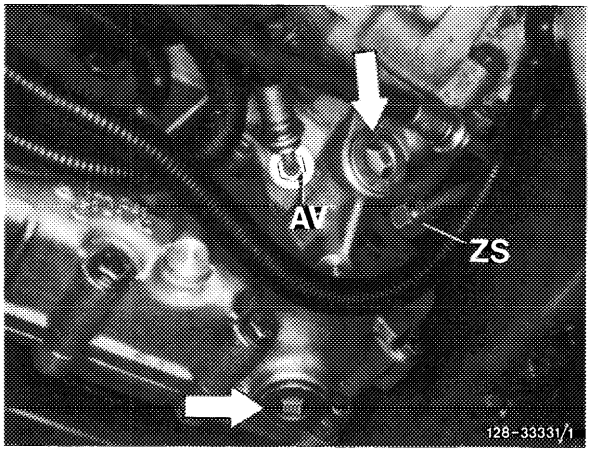


31 Loosen bolt (494) for propeller shaft intermediate bearing, but do not remove. Tightening torque 25 Nm.

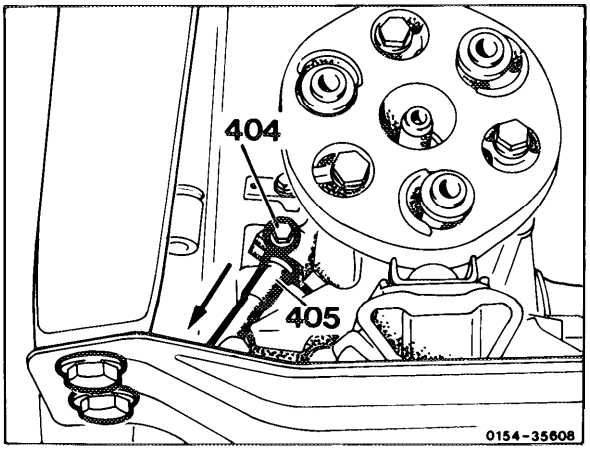
32 Loosen clamping nut (500) (wrench size 41/46 mm) on the driveshaft. Push driveshaft back as far as possible in direction of arrow, tightening torque 35 Nm.



33 4MATIC: Unscrew hydraulic lines (AV, ZS) at transfer case.



34 Unscrew bolt (404). Withdraw speedometer cable (405) in direction of arrow.



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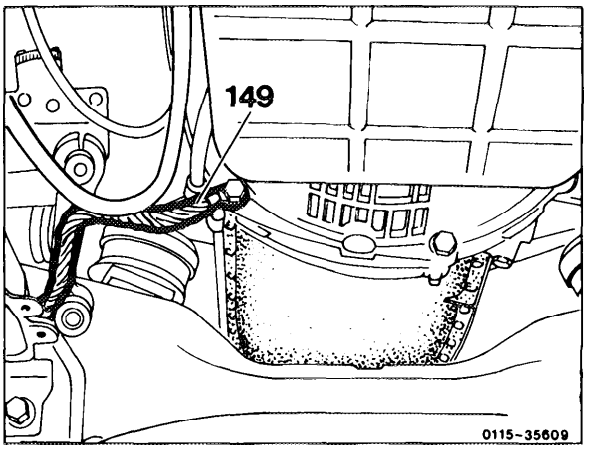
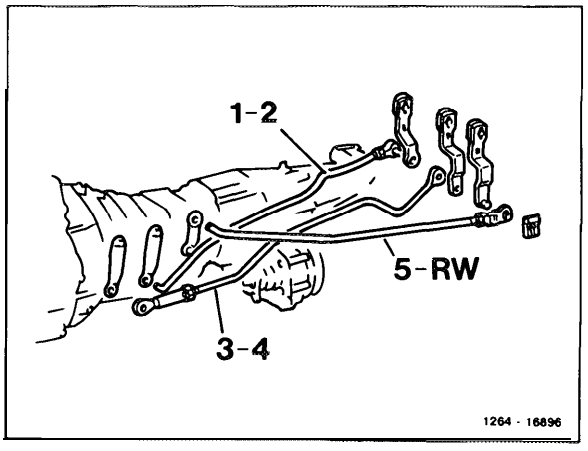
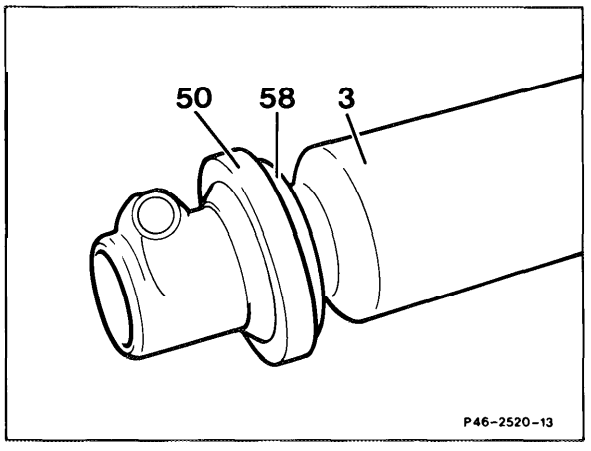
35 Unscrew ground cable (149) at transmission.



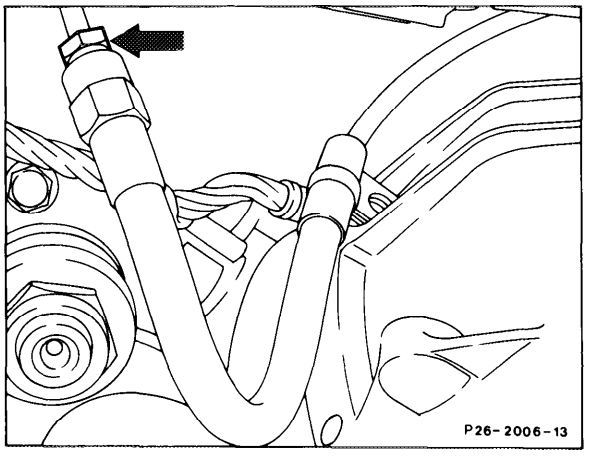
36 With manual transmission: Press the clip locks off first and then detach shift rods from the transmission shift levers.



37 With automatic transmission: Detach shift rod at center console. Turn white plastic lock on starter lockout, backup light switch (53) approx. 45° to the right and detach cable connector. Detach cable at kickdown solenoid valve.



38 With manual transmission: Disconnect hydraulic line (arrow) to slave cylinder at hose union.
Seal lines with plugs or draw fluid from the rear chamber of the combined reservoir with a suction gun.



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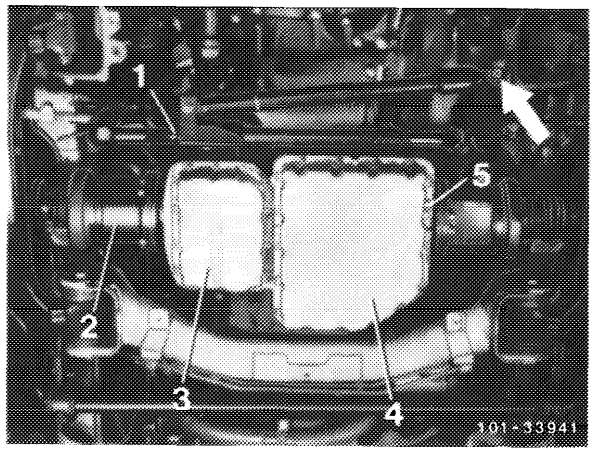
39 4MATIC: Remove center link together with steering damper (1). Unbolt steering damper (arrow) at the body.
Remove center link using the tapered stud remover, 201 589 08 33 00.

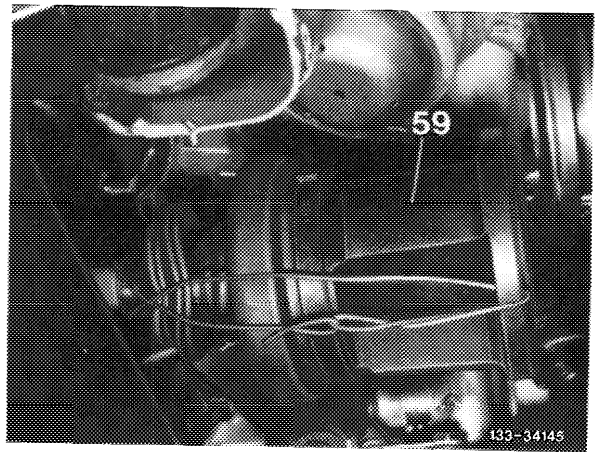
Note:
Replace self-locking nuts.
Tightening torques:

Steering damper	50 Nm
Center link	5 Nm

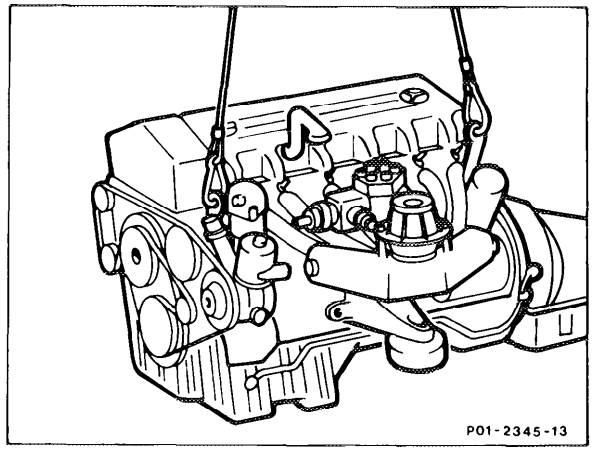


40 4MATIC: Remove front axle shafts (59).
Operate foot brake to slacken the six bolts (microencapsulated).
Compress front axle shafts as much as possible and hold in this position with wire.
Lay front axle shaft on crossmember, tightening torque 70 Nm.

Note
Do not pull inner joint too far apart and wire together to prevent the needle-bearing tripod joint rollers from dropping out of the journals at the tripod cross.



41 Attach engine hoist to the suspension lugs of the engine.
Adjust engine hoist so that the engine can be lifted horizontally.



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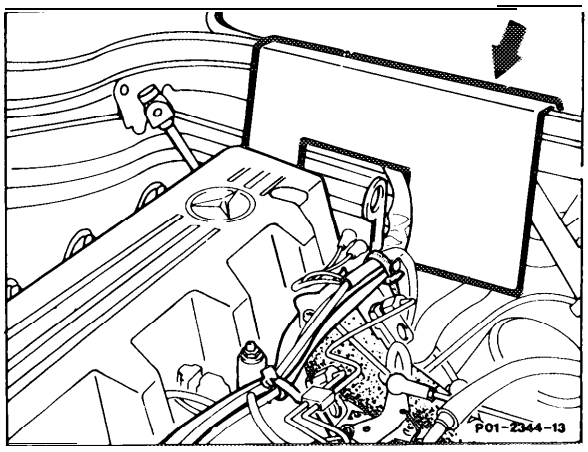
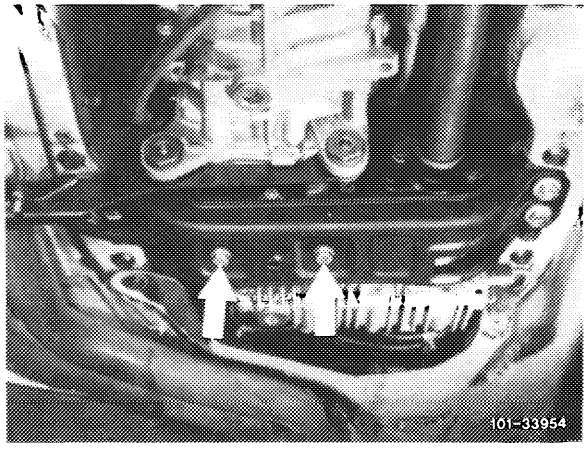
42 Insert guard plate (arrow) between the component compartment wall and the engine.

43 Support transmission with car jack or inspection pit lift.



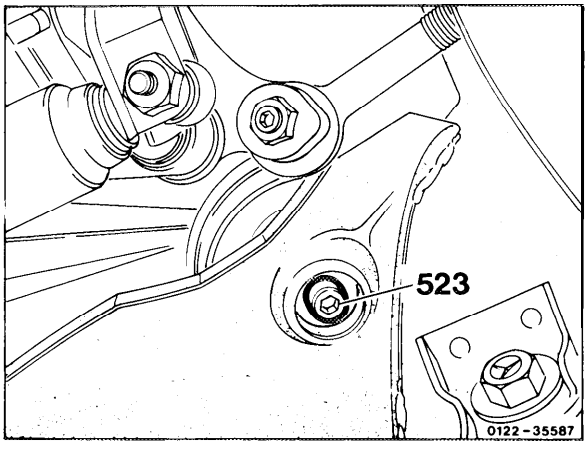
44 4MATIC: Unscrew bolts (arrows), tightening torque M8 20 Nm.

45 Remove rear engine support, tightening torque MI0 35 Nm.



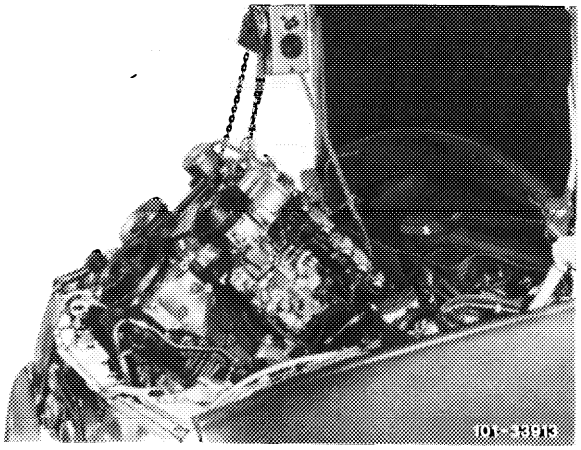
46 Unscrew bolt (523) on left and right front engine mount from below, tightening torque 40 Nm.

4MATIC: 2 bolts from below, tightening torque 20 Nm.



47 Angle engine and transmission and lift out of engine compartment, or install as appropriate, by readjusting engine hoist several times.

Note:
When tilting engine at the rear suspension lug, pay attention to oil filter.



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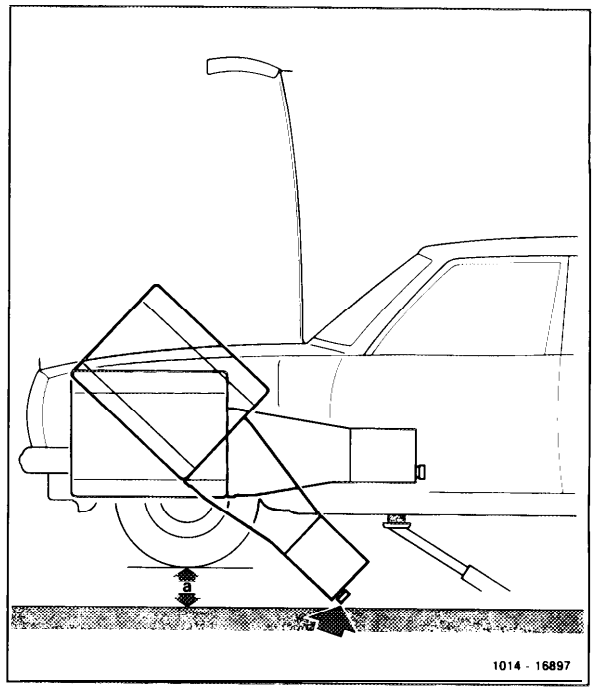
4MATIC: Do not place any load and do not strike lube oil line on transfer case (arrow) otherwise leaks may occur.

a = approx. 30 cm
t-look height at least approx. 260 cm.



48 Reverse sequence for reinstallation.

49 Check engine mounts at front and rear.

50 Check coolant, oil and fuel hoses.

51 With automatic transmission, adjust cable for control pressure (27-l 00).

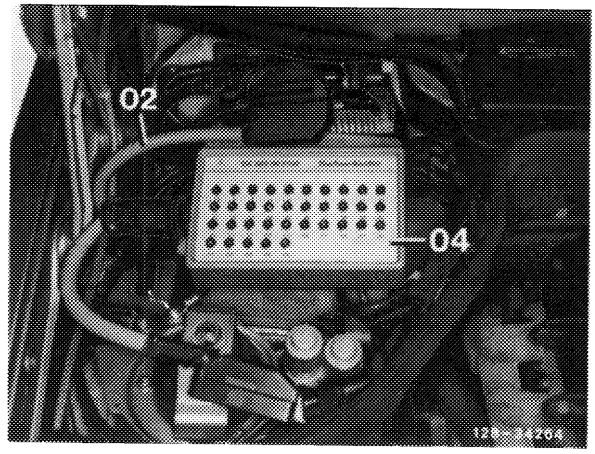
52 Check idle speed, adjust if necessary (07.3-l 00).

53 Check tightening torque of oil drain plugs.

54 Correct oil level in engine and transmission.

55 Top up coolant, check anti-corrosion/ antifreeze agent, correct freeze point (20-010).

56 4MATIC: Bleed hydraulic system. Connect socket box. Disconnect 4MATIC control unit and connect 25-pin connector to the socket box (04) with the Y cable (02). The control unit remains disconnected.



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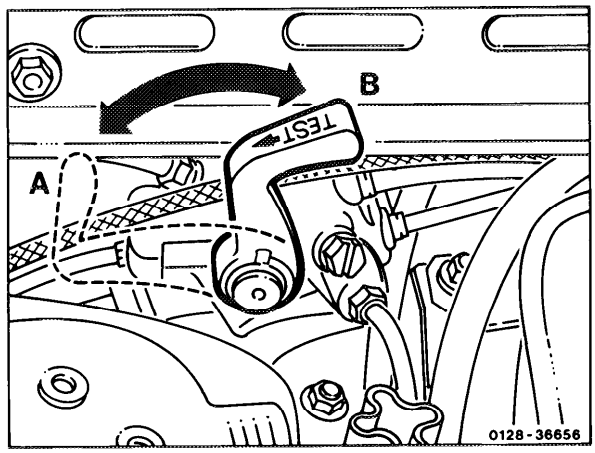
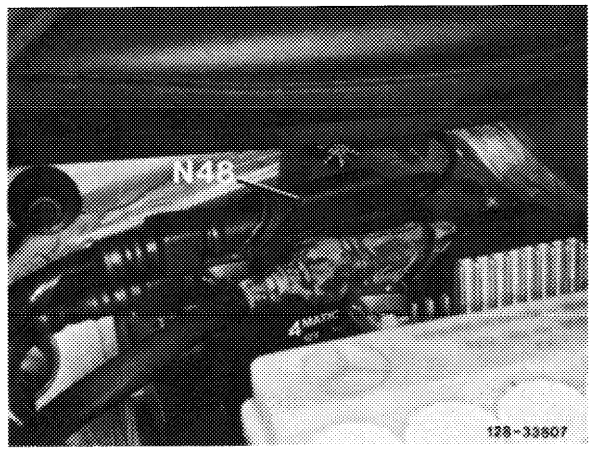
57 4MATIC: Bleed hydraulic oil pump. Check hydraulic oil level in reservoir. Put service valve in test position. Start engine for bleeding and run for approx. 30 seconds at 1000 - 2000 rpm. After bleeding, move service valve back to operating position.

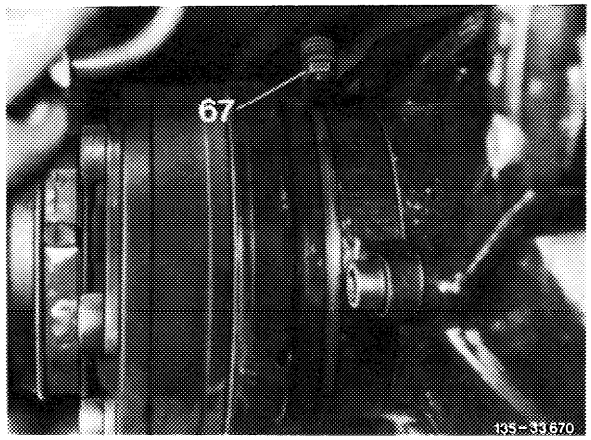


A Test position
B Operating position

58 4MATIC: Detach 25-pin connector from control unit (N 48) and connect socket box. Service valve in operating position. Apply parking brake. Start engine and run at idle speed.



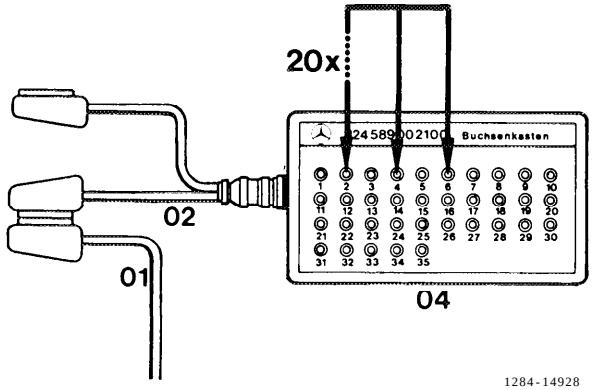
59 4MATIC: Bleed rear axle differential lock. Activate HS solenoid valve by jumpering contact 8 and contact 2 (ground) on socket box. Open bleeder (67) on rear axle center piece until the hydraulic oil flows out without bubbles (attach hose).



60 4MATIC: Bleed front and center differential multi-disk clutches. Activate front and center differential solenoid valves together 20 times by connecting contacts 4 and 6 on the socket box and jumpering to contact 2 (ground) 20 times.

Note

By actuating the front and center differential multi-disk clutches several times, the trapped air is removed with the hydraulic oil.



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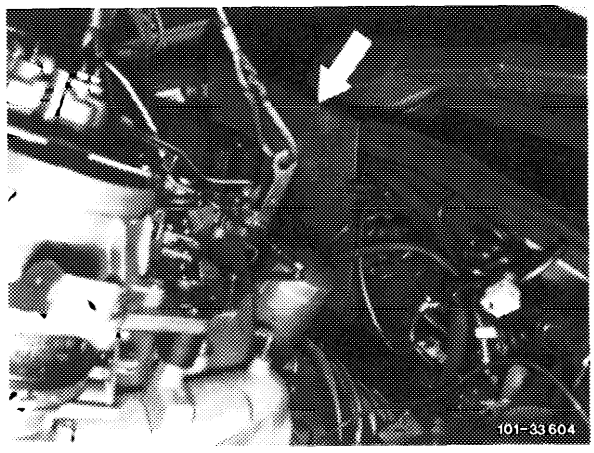
B. Model 201

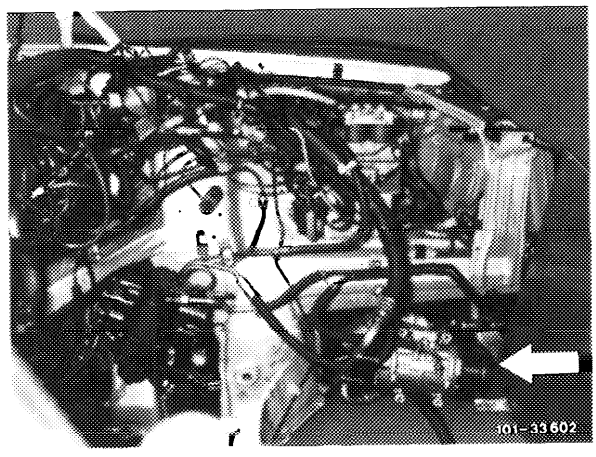
Removal, installation

1 Position suitable panel (arrow) between firewall and engine to prevent damage to to firewall.



2 Remove fan with visco clutch and radiator.

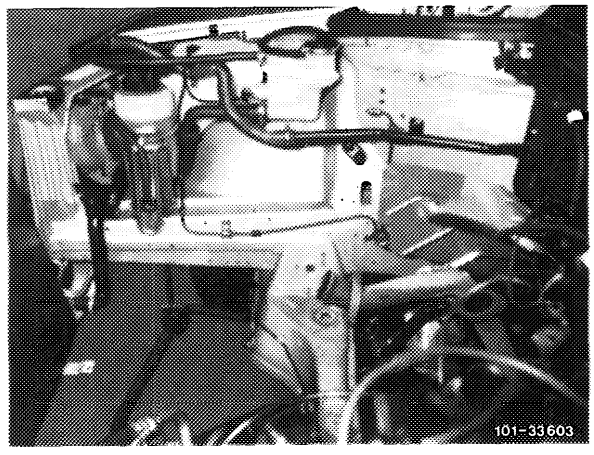
3 Protect condenser with suitable panel. Unbolt holder for refrigerant lines (2 bolts) and compressor (4 bolts). The compressor (arrow) remains in the vehicle with the refrigerant lines connected.



4 Disconnect steering linkage at left.

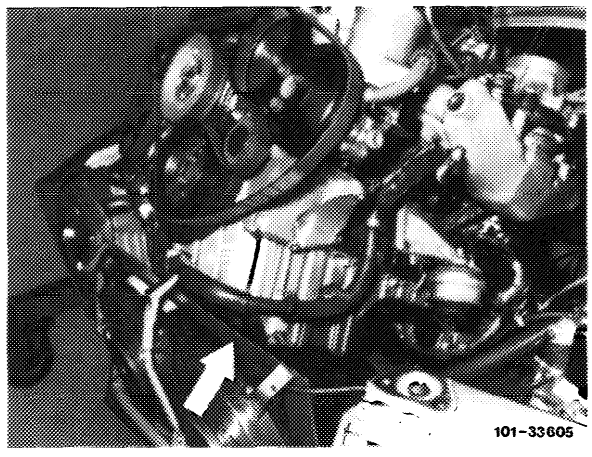
5 Engine mounts remain on engine.

6 Use new self-locking nut on steering linkage.



7 Lift engine out while altering angle of engine on hoist as necessary.

Install in the reverse order.



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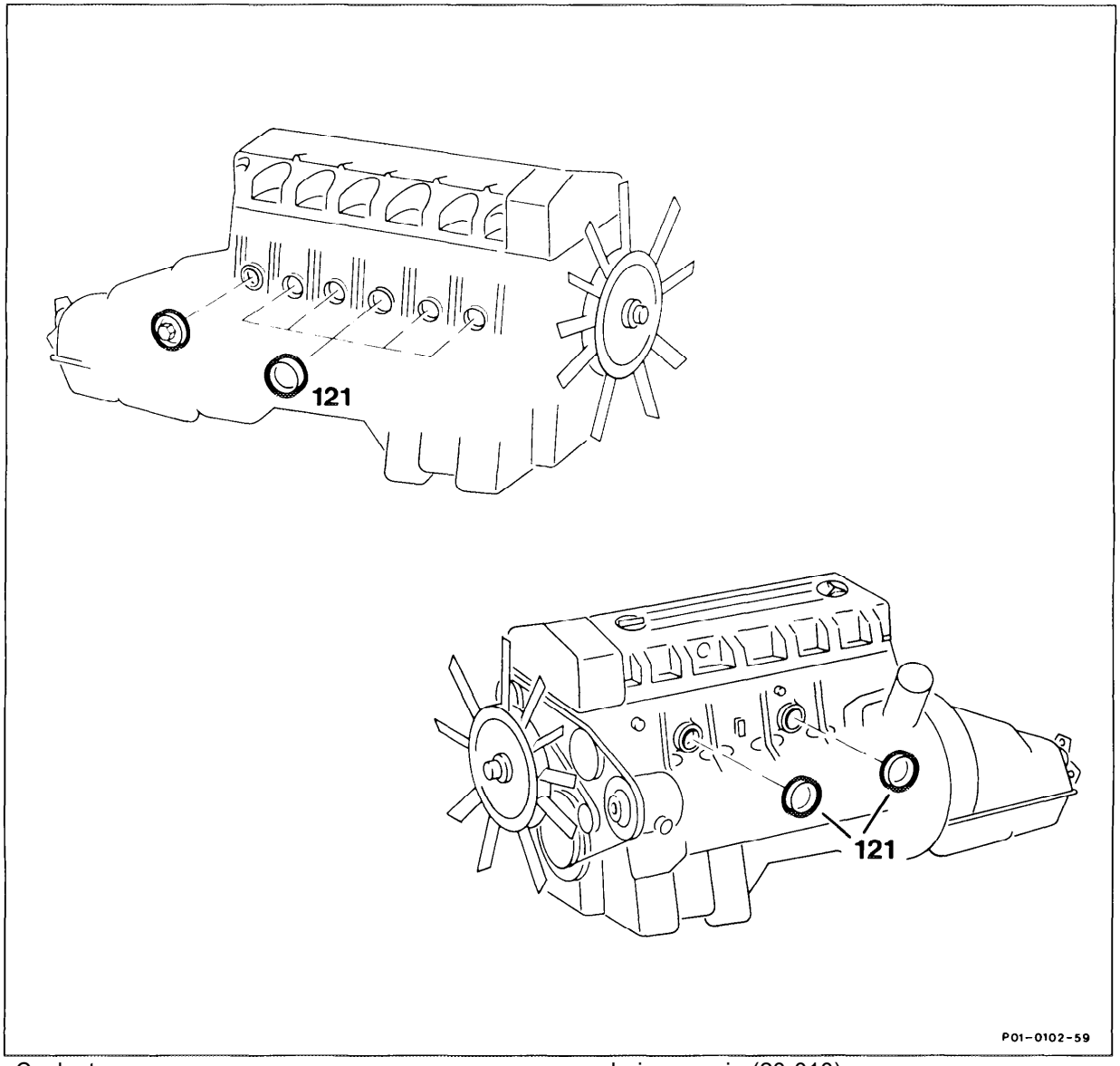
01-140 Replacing freeze plug in engine block

Preceding work:
Freeze plug to be replaced exposed.

Job No. of job texts and job values or standard texts and flat rates ..... 01-8501 -01-8741



Coolant	drain, pour in (20-010).
Freeze plug (121)	remove (steps 3 and 4).
Freeze plug hole	clean.
Freeze plug hole	coat with sealant 002 989 09 71.
Freeze plug (121)	drive in with drift. Special tool 102 589 00 15 00
Sealant	allow to cure.
Engine	check for leaks.

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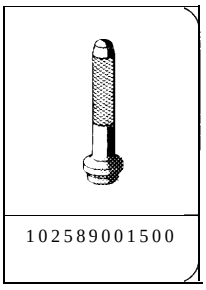
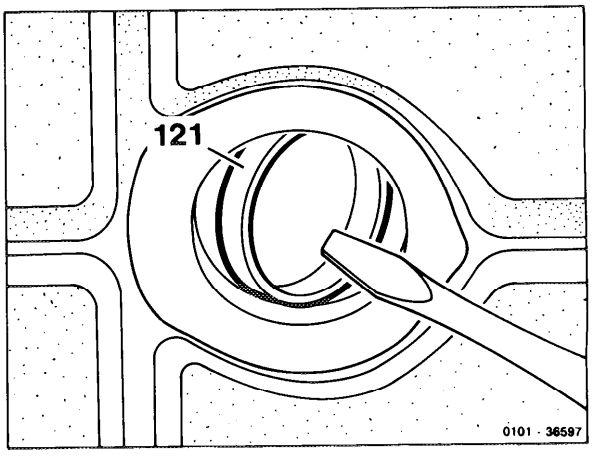
Special tool



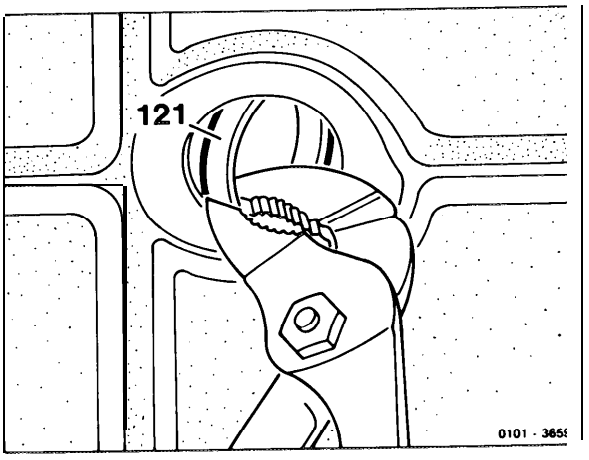
Replacement

1 Drain coolant (20-010).

2 Use a screwdriver to tap in freeze plug (121) on one side far enough to turn it.



3 Pull freeze plug (121) out with pliers.



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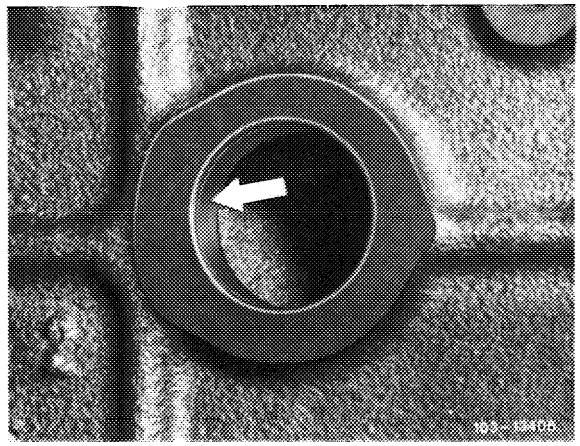
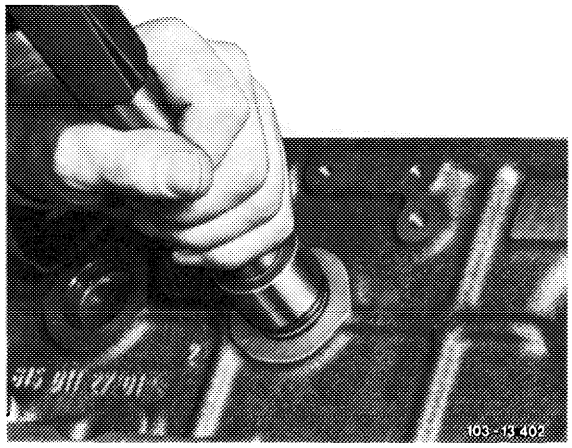
4 Thoroughly clean freeze plug hole. Spray the bore (arrow) with activator. It must be free of grease.



5 Coat freeze plug hole with sealant 002 989 09 71.

6 Drive in new freeze plug with drift 102 589 00 15 00 until flush.



Note:
The sealant must harden for approx. 45 minutes before the coolant is poured in.

7 Run engine until it is warm and check for leaks.

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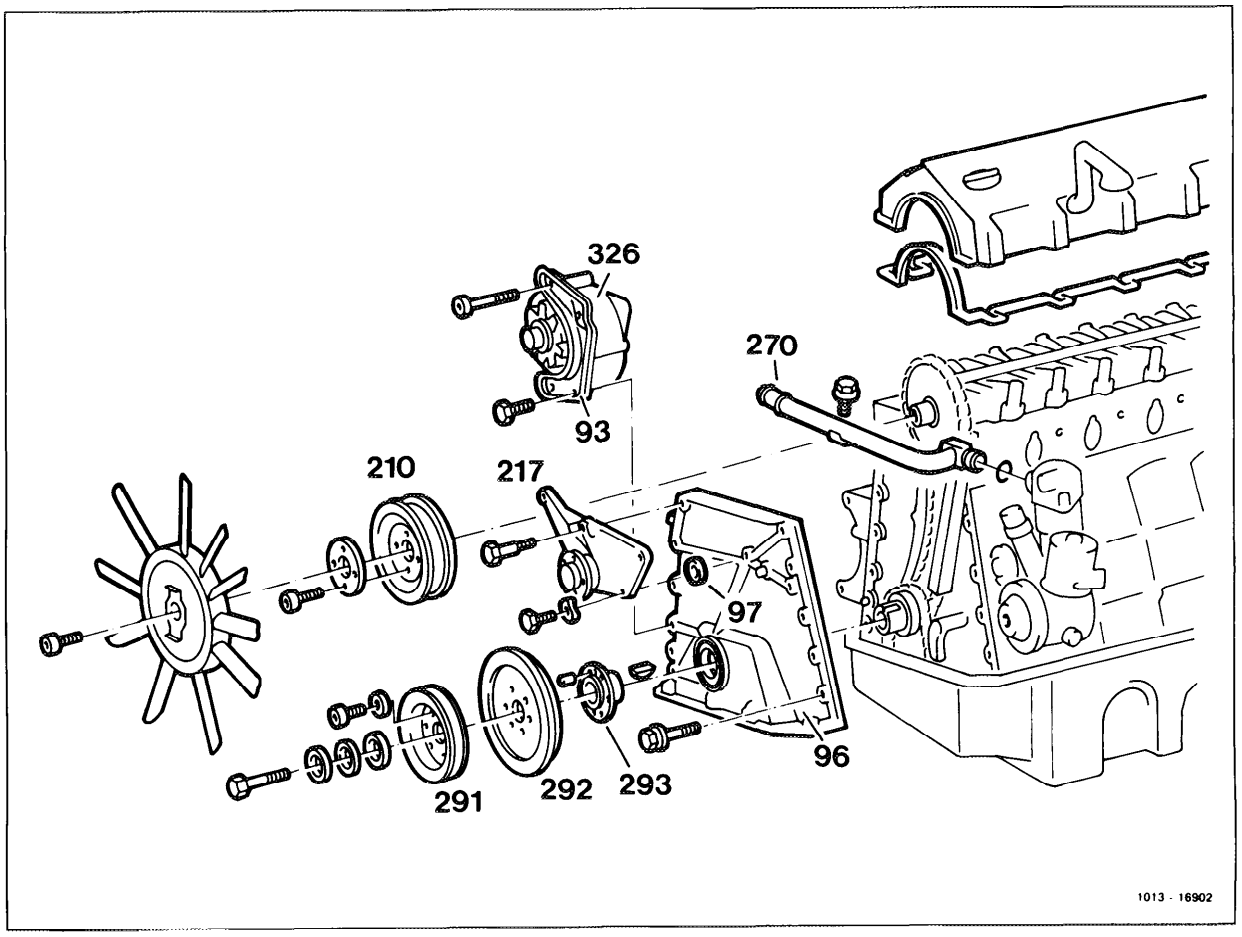
01-210 Removing, installing timing cover

Job No. of job texts and job values or standard texts and flat rates . . . . . 01-8000 - 01-8009

Model 124



Hood	set vertical (01-008).
Ground cable at battery	disconnect, reattach.
Air filter and air scoop	remove, install (09-400).
Engine compartment lower cover	remove, install (step 5).
Radiator	remove, install (20-420).
Viscous fan clutch	remove, install (20-312).
Fastening bolts of belt pulleys:	
Fan clutch, coolant pump, tandem pump	loosen, tighten, 10 Nm.
Poly V-belt	remove, install (13-342).
Belt pulley: fan clutch (210), coolant pump, tandem pump	take off, reinstall (step 10).

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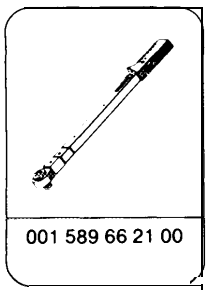
Belt pulley (291), vibration damper (292) and hub (293)	remove, install (03-342).
Heating water return line (270)	detach, attach and place to one side (step 12).
Level control line	detach, attach and place to the side (step 13).
Front top cover	remove, install (01-212).
Tensioner bracket	loosen, swivel, seal and secure (step 15).
Tandem pump	unbolt, bolt on(step 16).
Fan bearing support(217)	remove, install, 21 Nm (step 17).
Sealing ring (97)	replace (step 24).
Alternator (326) with bracket (93) and TDC sensor	remove, install (steps 18 and 19).
Chain tensioner	remove, install (05310).
Timing cover (96) front lower	unbolt, replace M6 10 Nm, M8 21 Nm (step 22).
Timing cover (96) with TDC sensor bracket	remove, seal and replace.

Tightening torques

Fastening bolts of oil pan		10 Nm
Timing case cover to crankcase	M6	9 Nm
	M8	21 Nm
Belt pulley to coolant pump shaft		10 Nm
Belt pulley to tandem pump		10 Nm

Special tool



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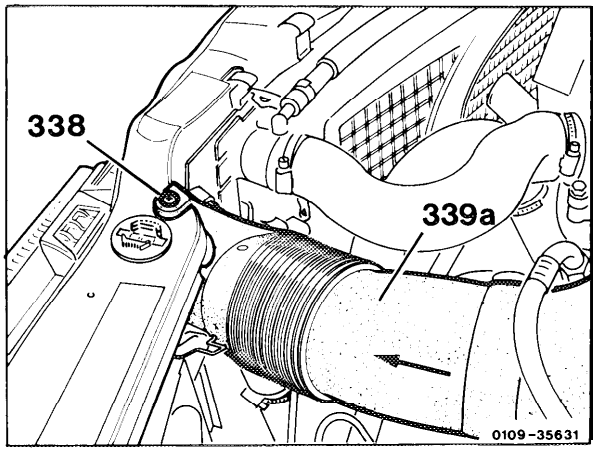
Removal, installation

1 Set hood vertical (01-008).

2 Disconnect battery ground cable.

3 Unscrew bolt (338). Pull air scoop (339a) from air filter in direction of arrow and remove.

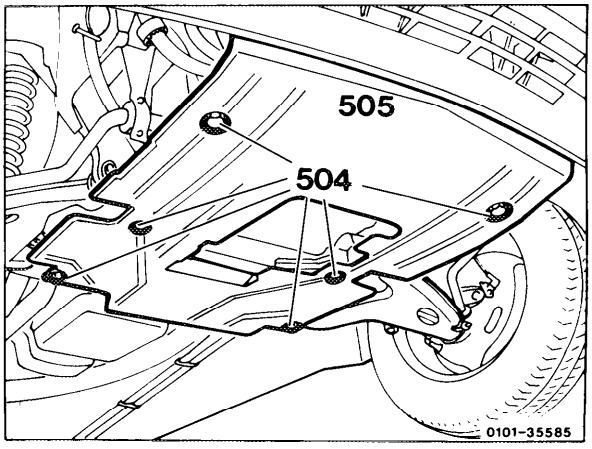
4 Remove, install air filter (09-400).



5 Unscrew bolts (504) and take off engine compartment covering (505).

6 Remove radiator (20-420).

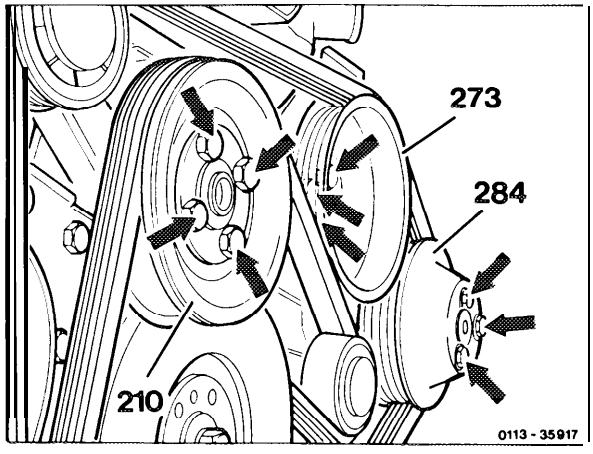
7 Remove viscous fan clutch (20-312).



8 Loosen bolts (arrows).

9 Remove poly V-belt (13-342).

10 Unscrew bolts (arrows), tightening torque 10 Nm.
Take off belt pulleys from fan clutch (210), coolant pump (273) and tandem pump (284).



11 Remove belt pulley, vibration damper and hub (03-342).

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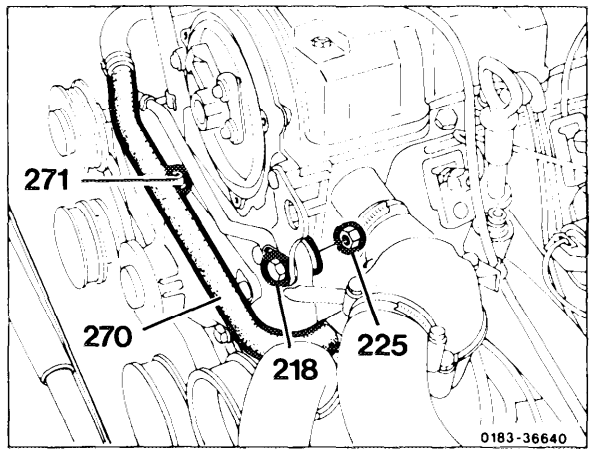
12 Loosen bolt (271). Withdraw heating water return line (270) from coolant pump and place to one side. Unscrew nut (225) and withdraw bolt (218) from the front.

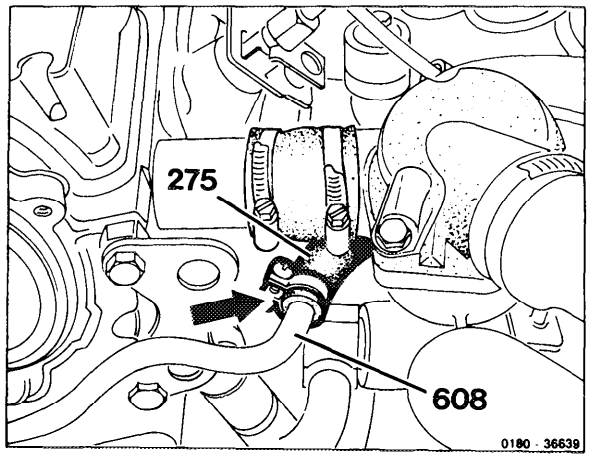
Note:
Effective 10/1987, the heating water return line is also bolted to the coolant pump.

Installation note:
Replace heating water return line seal (270).



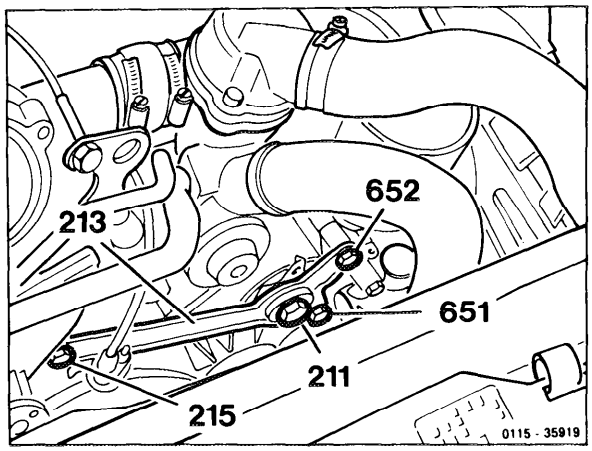
13 With self-levelling suspension, loosen clip (arrow). Detach hose (275) and plug line (608).

14 Remove front upper cover (01-212).



15 Loosen bolt (211) and remove bolts (215, 651, 652) together with spring washers. Swivel bracket (213).

Note:
Hold nut of bolt (651) to prevent it turning.



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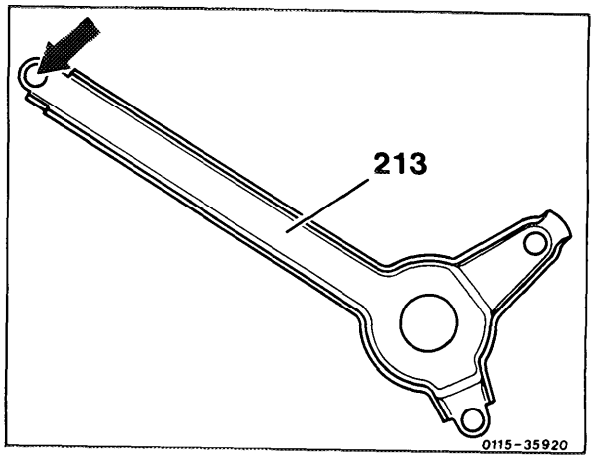
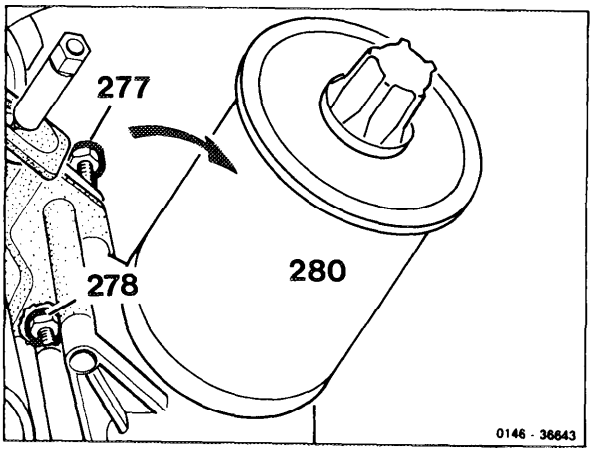
Installation note:
Apply sealant 001 989 29 20 to the front and rear sides of the attachment hole (arrow) of the bracket (213).

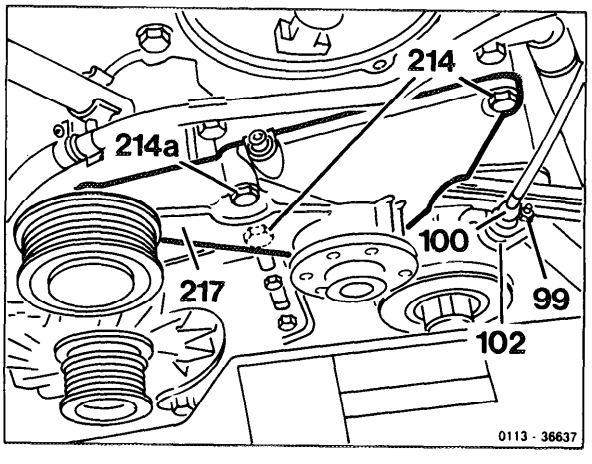


16 Unscrew bolts (277, 278). Swivel tandem pump (280) in direction of arrow.



17 Unscrew bolts (214), tightening torque 21 Nm, and remove fan bearing support (217). Unscrew nut (99). Take off TDC sensor (100) together with cable and place to one side.

Note
TDC sensor bracket (102) remains on timing case cover.
If replacing timing case cover, adjust TDC sensor.



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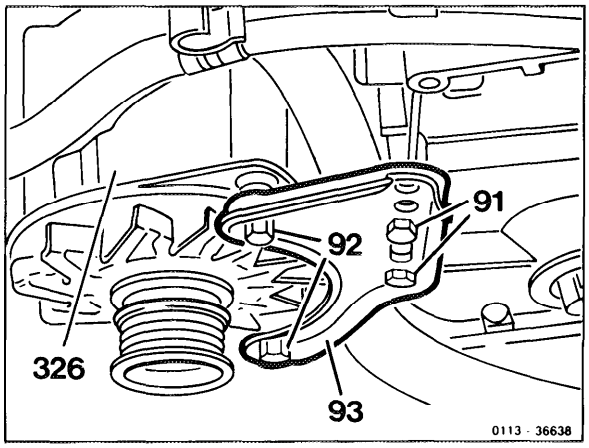
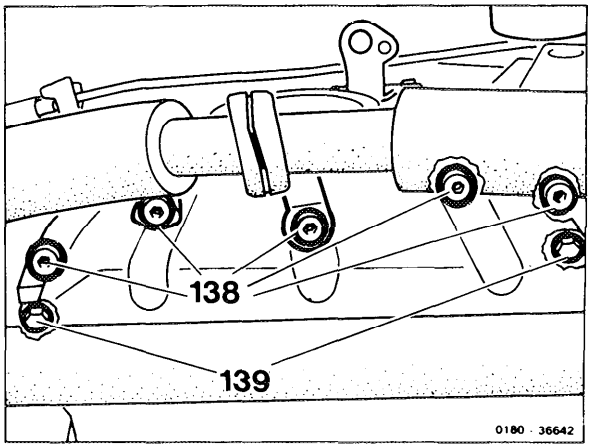
18 Disconnect wiring connector at the alternator (326).

19 Unscrew bolts (91, **92).** Remove bracket (93) and alternator (326).

20 Remove chain tensioner (05310).

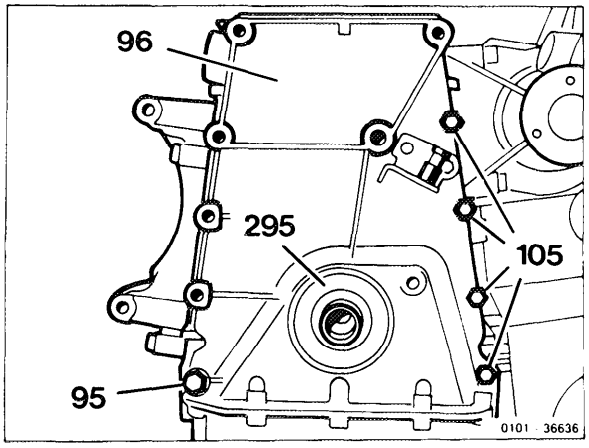


21 Unscrew bolts (138), tightening torque 10 Nm, and bolts (139), tightening torque 21 Nm, on the oil pan.
With self-levelling suspension: Place retaining clip with high-pressure hose to the side.



22 Unscrew bolts (95, 105) and remove timing case cover (96).

Note:
Do not damage oil pan gasket!
If necessary, replace oil pan gasket.
Check crankshaft front seal (295); renew if necessary.



23 Clean sealing surfaces on crankcase and on timing case cover.
Apply an even coat of sealant 001 989 45 20 to sealing surface of timing case cover.

4MATIC: Also, clean sealing surfaces of oil pan and coat with sealant 001 989 61 20 10.

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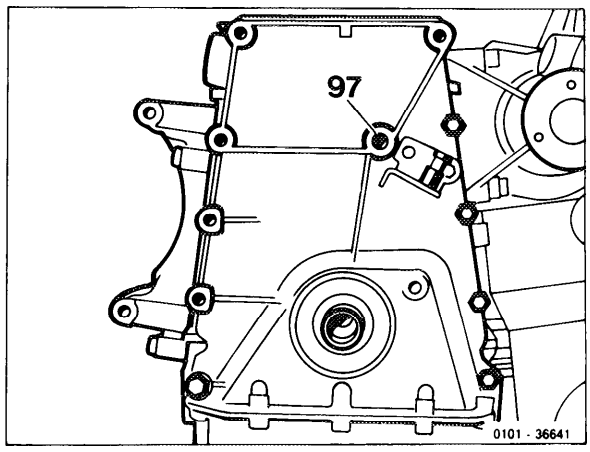
Note
The timing case cover is held in place by two roll pins in the engine block. Do not damage oil pan gasket.
Tightening torque 10 Nm.
Timing case cover to engine block:
M6 : 9 Nm
M8 : 21 Nm

24 Replace seal (97).

25 Install in reverse sequence.

26 Check engine oil level in and top up if needed.

27 Check engine for leaks with engine running.



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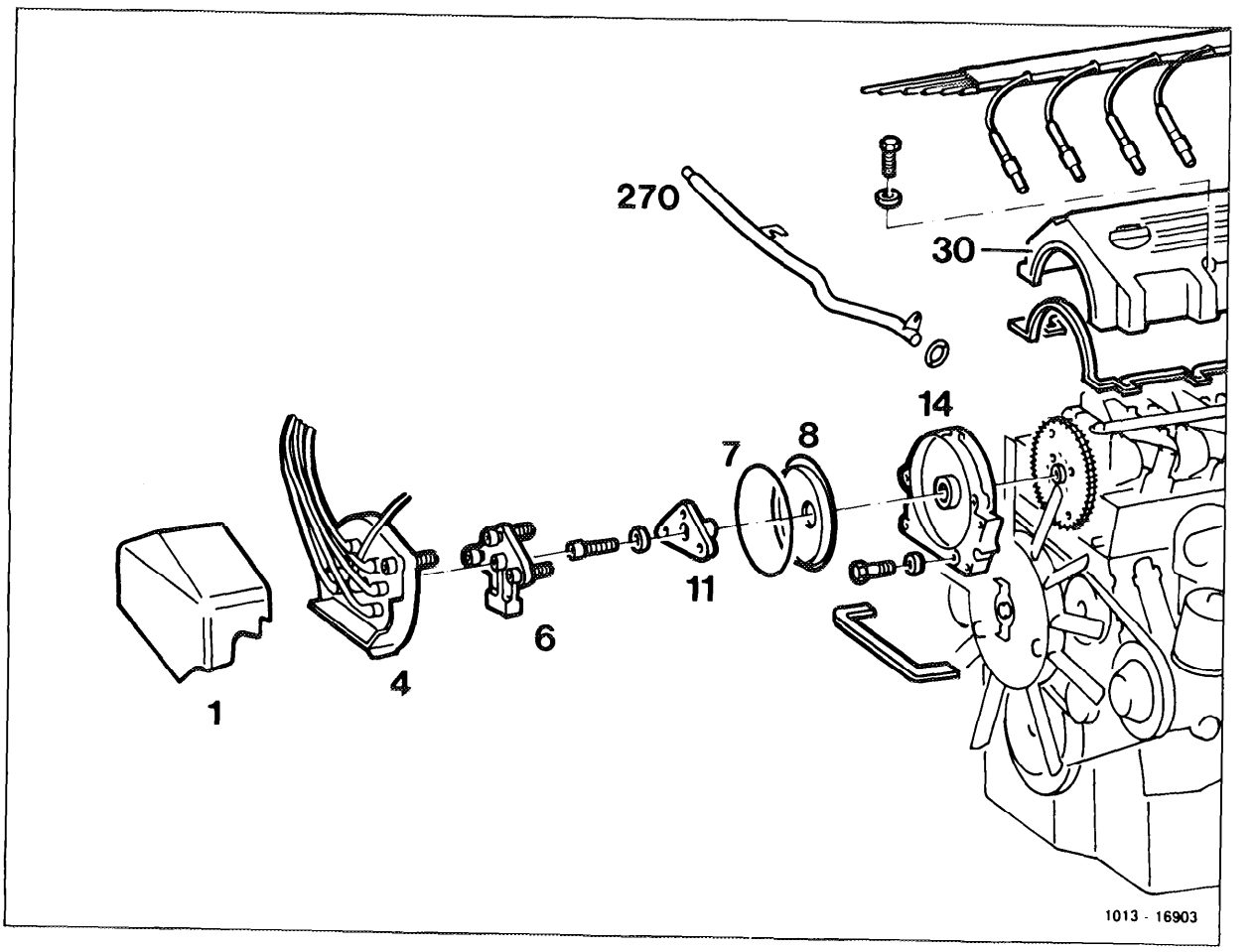
01-212 Removing, installing top front cover

Job No. of job texts and job values or standard texts and flat rates . 01-5700

Model 124
Model 129



Hood	set vertical (01-008).
High-voltage distributor (4) with protective cover (1)	remove, install (steps 2 and 3).
Cap of expansion tank	open, release pressure, close.
Heating water return line (270)	remove, install (step 5).
Missing coolant	top up.

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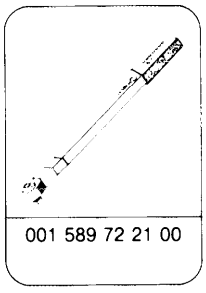
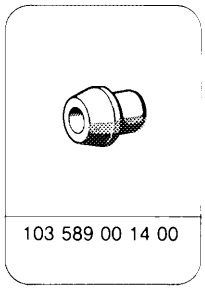
Valve cover (30) with ignition cables and high-voltage distributor (4)	remove, install (Caution: Observe steps 6 and 7).
Distributor rotor (6) and driver (11)	remove, Install (steps 8 and 9).
Guard cover (8) and seal (7)	take off, fit on (step 10).
Front cover at top (14)	remove, seal and install (steps 11 to 13).

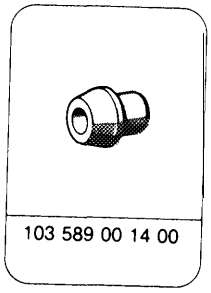
Tightening torques

Valve cover to cylinder head	8.5 Nm
Distributor rotor to driver (reference value)	2.5 Nm
Front cover at top to cylinder head	21 Nm
Distributor driver (1 st version, aluminum, diameter 21.5 mm) to camshaft M8	21 Nm
Distributor driver (2nd version, steel, diameter 20 mm) to camshaft M7	16 Nm

Special tools


001 589 72 21 00

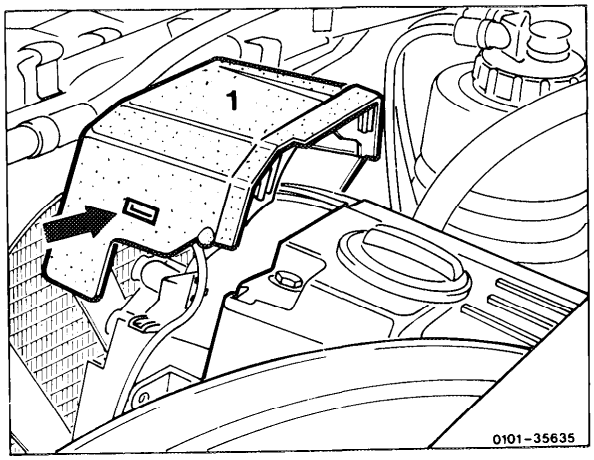

103 589 00 14 00


103 589 00 14 00

Removal, installation

1 Set hood vertical (01-008).

2 Remove protective cover (1) from high-voltage distributor. Unclip catches (arrow) and pull protective cover (1) upwards out of the guides.



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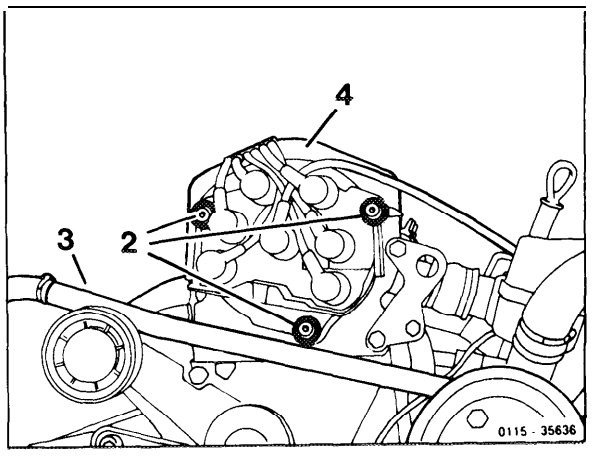
3 Remove distributor cap screws (2), take off distributor cap (4) and unplug spark plug cables.

4 Open expansion tank cap to release cooling system pressure.

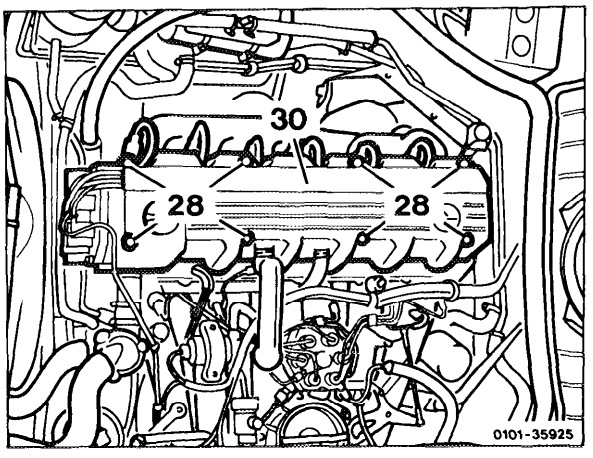
5 Remove heating water return line (3).

Installation note:
Replace seal.

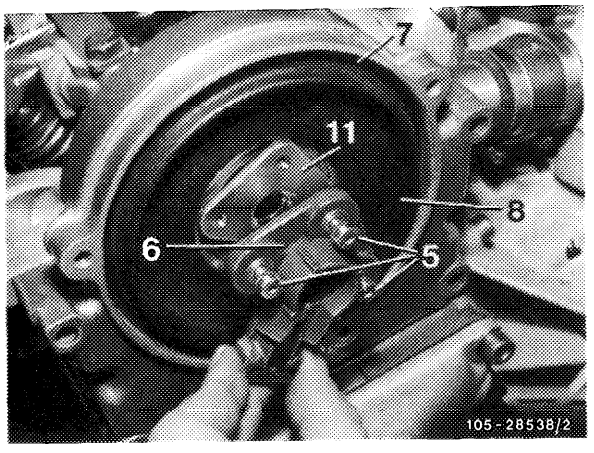


6 Unscrew bolts (28), tightening torque 8.5 Nm.
Take off valve cover (30) with ignition cables and distributor cap.

Caution!
If valve cover is difficult to remove, do not strike cover with a hammer (risk of cracking and fracturing).



7 Unscrew bolts (5), tightening torque 2.5 Nm. Remove distributor rotor (6).



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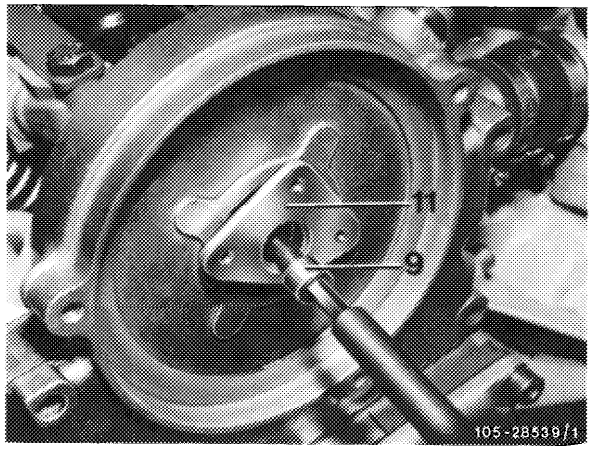
8 Unscrew bolt (9), tightening torque 21 Nm.
Pull driver (11) out by hand.

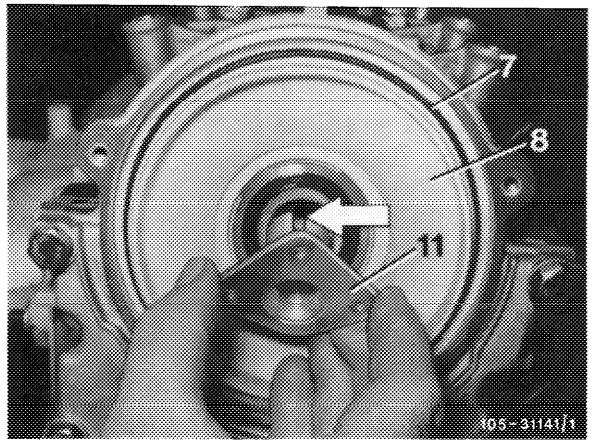


9 Take off guard cover with seal.

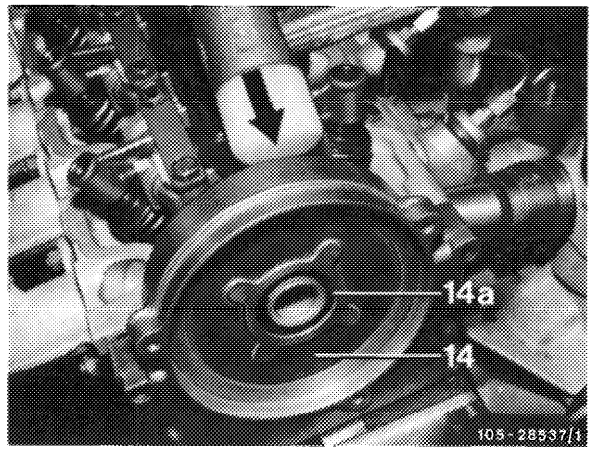
Installation note:
Steel driver with 20 mm diameter flange must be fitted with M7 x 26 mm bolt, and aluminium driver with 21.5 mm diameter flange with M8 x 29 mm bolt.

Installation note:
The groove (arrow) in the driver (11) must engage the pin in the camshaft.

Driver	1 st version	2nd version
Material	Aluminum	Steel
Bolt	M8 × 29	M7 × 26
Torque	21 Nm	16 Nm
Insertion sleeve collar diameter	103 589 00 14 00 21.5 mm	103 589 01 14 00 20 mm



10 Unscrew front cover bolts (14), tightening torque 21 Nm.
Tap off front cover (14) with a plastic hammer.
The front cover (14) is centered with two dowels.



Note
If the camshaft seal (14a) in the front cover (14) is replaced, it must be pressed in from the front until flush.

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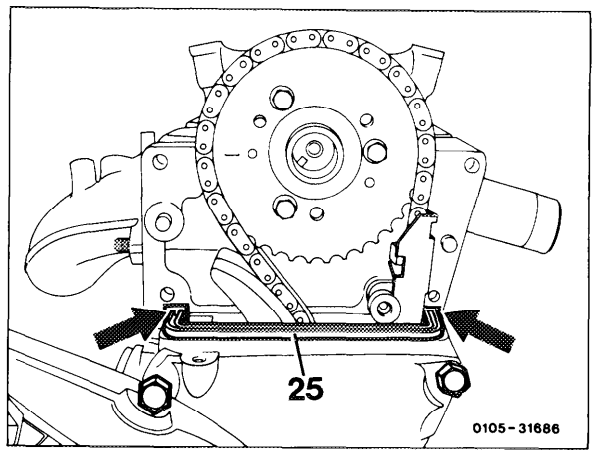
11 As a seal, apply sealant 001 989 61 20 10 at the points marked (arrows) on the left and right sides of the oil-free groove of the timing case cover (at joint to cylinder head).

Insert new seal (15) dry (without sealant) into the groove and push rearward.

12 Coat contact surfaces of front cover to cylinder head with sealant 002 989 00 20 10.

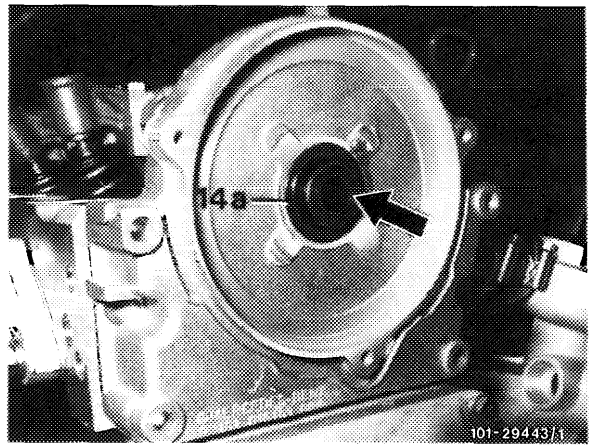


13 Insert guide sleeve (arrow) 103 589 00 14 00 (for camshaft diameter 21.6 mm), or 103 589 01 14 (diameter 20 mm) onto camshaft. Coat sealing lip of radial seal (14a) with engine oil. Install front cover (14).

14 Tighten the two bottom bolts first, tightening torque 21 Nm.

15 Install in reverse sequence.

16 Top up coolant.



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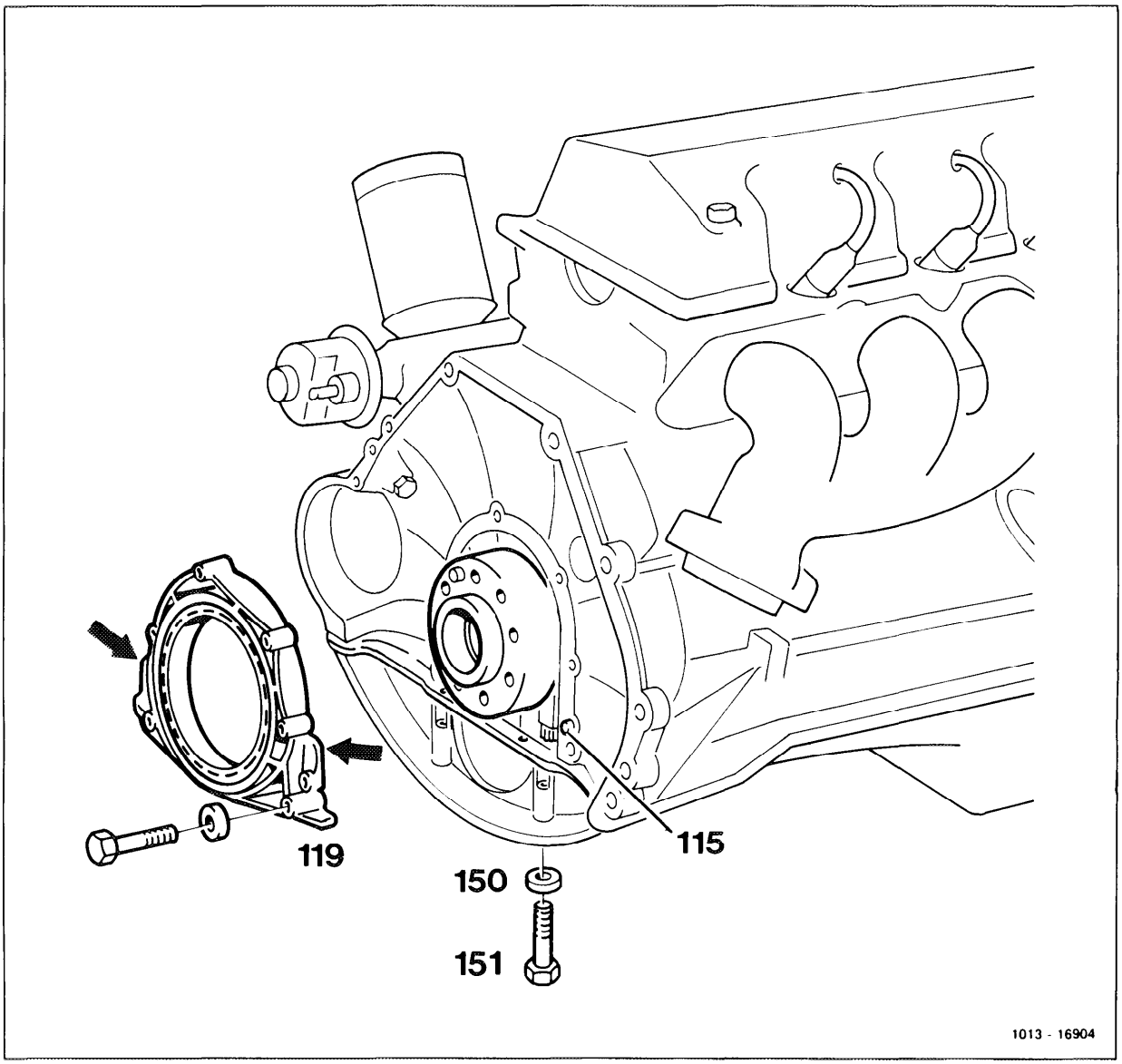
01-222 Removing, installing rear main seal cover

Transmission removed.

Job No. of job texts and job values or standard texts and flat rates 01-8913



Ground cable	detach, attach at battery.
Flywheel or flex plate	remove, install (03-410).
Bolts (151)	remove, install, 10 Nm. When installing, tighten these bolts first.
Washers (150)	note location

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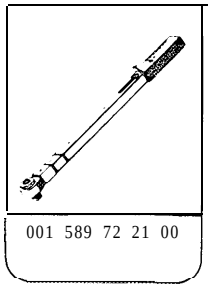
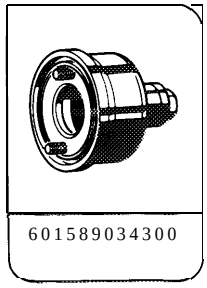
Rear main seal cover (119)	remove, install. Pry off at bosses (arrows) (steps 2 to 7). Sealant 001 989 45 20 10. Installation tool 601 589 03 43 00. Preserve oil pan gasket. On 4MATIC engines sealant on oil sump.
Sealing surfaces	clean.
Dowels (115)	note location.
Rear main crankshaft seal	check, replace if necessary. Coat sealing lip with engine oil.
Oil level in engine	check, top up.
Engine in installation position	support, secure.
Leaks once engine is running	check for.
Flywheel or driven plate	install.

Special tools



001 589 72 21 00



601589034300

Note

The rear main seal cover is sealed to the engine block with sealant and centered with 2 dowels. In addition, it is bolted to the oil pan and sealed on the bottom by the oil pan gasket, or on 4MATIC engines with sealant.

There must not be any scoring or unevennesses in the sealing surface of the rear main seal cover or of the engine block.

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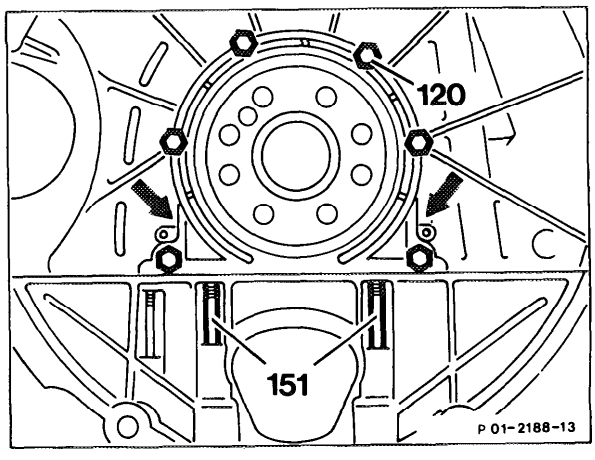
Removal, installation

1 Disconnect ground cable at battery.

2 Remove flywheel or flex plate (03-410).

3 Remove bolts (120, 151) and pry off closing cover at the two bosses (arrows) and remove.



⚠
Do not damage oil pan gasket. If necessary, replace oil pan gasket.

4 Clean sealing surface on crankcase, on closing cover and, on 4MATIC engines, also on oil sump.

5 Check radial seal, renew if necessary (03-327).

6 Apply an even coating of sealant 001 989 45 20 10 to the sealing surface of the closing cover and, on 4MATIC engines, also to the sealing surface of the oil sump.

7 Coat sealing lip of radial seal with engine oil.

⚠
Do not use grease. Grease prevents the inclined webs on the sealing lip transporting back the engine oil.

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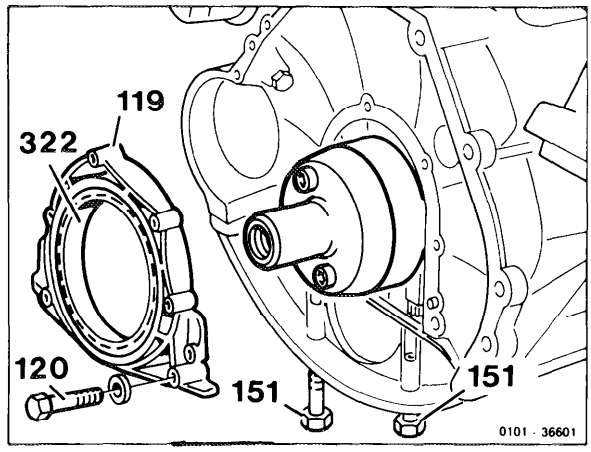
8 Press on closing cover (119) with radial seal (322) over the bolted-on insertion tool inner section 601 589 03 43 00 and over oil sump gasket and bolt on.



⚠
Do not damage oil sump gasket.

First of all tighten bolts (151) to 10 Nm, then tighten bolts (120) to 9 Nm.

9 Check oil level in engine and adjust to correct level.

⚠
Before starting engine, move into installation position and secure at the rear by supporting.

10 Attach ground cable.

11 Check for signs of leaks with engine running, prior to installing transmission.
12 Install in the reverse order.

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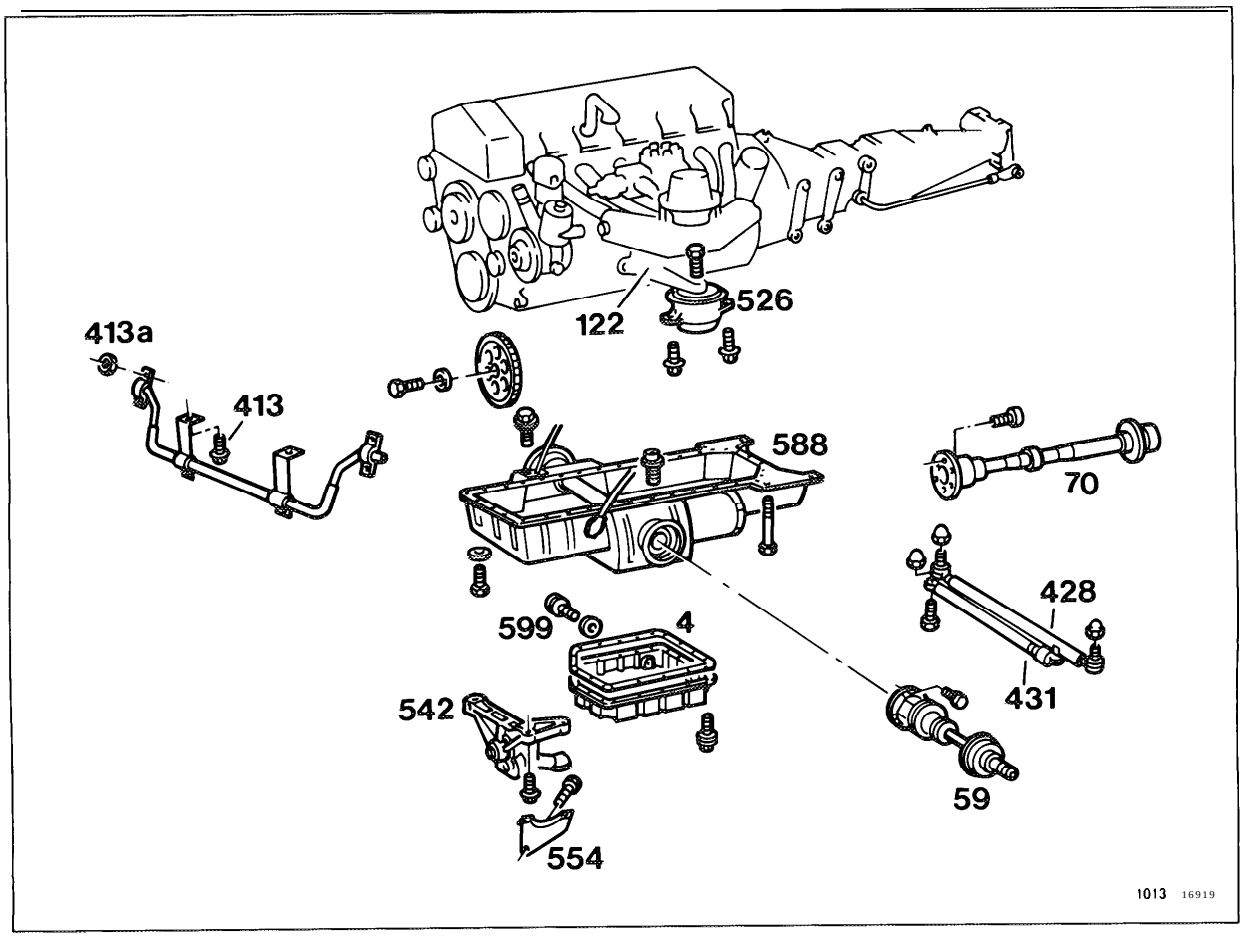
Job No. of job texts and job values or standard texts and flat rates 0 l-7500

A. Model 124 and 124 4MATIC



The Illustration shows Model 124 4MATIC

Hood	raise to vertical position (01-008).
Ground cable to battery	detach, attach.
Air filter (4MATIC)	remove, install (09-400).
Engine compartment covering below	remove, install (step 4).
Engine oil	drain, fill in, oil drain plug (599) 25 Nm.

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Both engine mounts (526) front	unscrew, screw on from below. Model 124 4MATIC M8 (527) 20 Nm Model 124 M10 40 Nm
Bolts (413) and nuts (413a) on both sides	unscrew, screw in, 60 Nm (step 7).
Fan cowl	detach, attach.
Dipstick guide tube (4MATIC)	remove, install, 10 Nm (step 9).
Drag link (428) with steering damper (431)	remove, install, tapered removal tool 201 589 08 33 00, (step 10). Drag link 35 Nm Steering damper 50 Nm
Self-locking bolts and nuts	renew.
Exhaust system	unscrew at flange of exhaust manifold (step 11).
Front propeller shaft (70, 4MATIC)	unscrew, screw on, 25 Nm (step 12).
Front axle shafts (59, 4MATIC)	unscrew, screw on, 70 Nm (step 13).
Plug connection, oil level switch	on oil sump or front axle housing, detach.
Bottom section of oil sump (4, 4MATIC)	remove, install, 10 Nm (step 15).
Support (554) for oil pump (542, 4MATIC)	remove, install (step 16).
Guard plate on component compartment wall	insert, remove (step 17).
Oil sump	on crankcase, unscrew, screw on, (step 18) M6 10 Nm, M8 22 Nm.
Packing	renew.
Sealant (4MATIC)	apply.
Engine	raise, lower (steps 19 and 20).
Piston of 3rd and 4th cylinder	set to TDC (step 21).
Lefthand engine support (122) at crankcase (4MATIC)	remove, install, M8 20 Nm (step 22).
Front axle housing (588, 4MATIC)	unscrew, screw on, (step 23) M6 10 Nm, M8 22 Nm.
Oil pump (542, 4MATIC)	remove, install, 25 Nm (step 24).
Oil sump or front axle housing (588)	remove, install.

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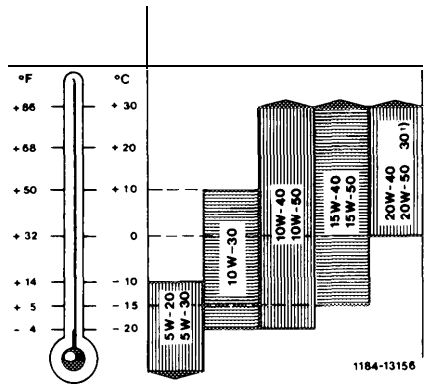
Specified viscosity classes according to SAE at prolonged outside temperatures

[1]) At prolonged outside temperature above + 30 °C SAE 40 may be used.
Precise use of the SAE classes according to the outside air temperatures would necessitate frequently changing engine oil. The temperature limits for the SAE classes should therefore be regarded as a guide which may be transgressed for brief periods.
In moderate climatic zones SAE 30 may be used from April onward for all engine versions.
The following oils may be used as an all-season oil for all gasoline engines
SAE 10 W–40 and SAE 10 W-50 below + 10 °C.
SAE 5 W-20
SAE 5 W-30, 10 W-30 all-year-round in moderate climatic zones, i.e. up to + 30 °C
SAE 15 W-30 all-year-round in moderate climatic zones



Oil capacities in liters (refer to Service Product Specifications for approved engine oils)

	124 4MATIC	124
Oil sump	6.25	5.7
Hypoid transmission oil SAE 90 for front axle differential	1.0	

Tightening torques		Nm
Dipstick guide tube to front axle housing		10
Oil drain plug to oil sump		25
Steering damper to body		50
Self-locking nut for drag link		35
Microencapsulated bolts for propeller shaft		25
Microencapsulated bolts for front axle shafts		70
Bottom section of oil sump to front axle housing		10
Engine mount to body MI0		40
Engine mount to body (4MATIC) M8		20
Engine mount front to engine support		55
Engine support to crankcase		20
Oil sump or front axle housing to crankcase		
	Hexagon bolts M6	10
	I-iexagon bolts M8	22

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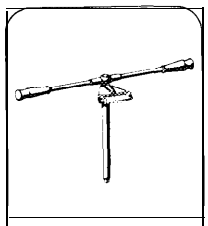
Bolts for oil pump	25
Sprocket wheel to oil pump	25
Torsion bar of fastening bolt	60

Special tools



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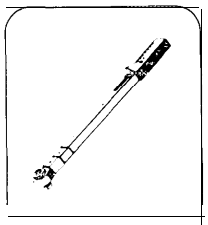

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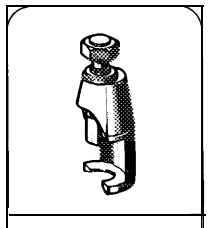


201 589 08 33 00

Shop-made tools

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

Note

Model 124: The oil sump is sealed to the crankcase with a gasket.

4MATIC: The oil sump is sealed to the crankcase with sealant 001 989 61 20 10.

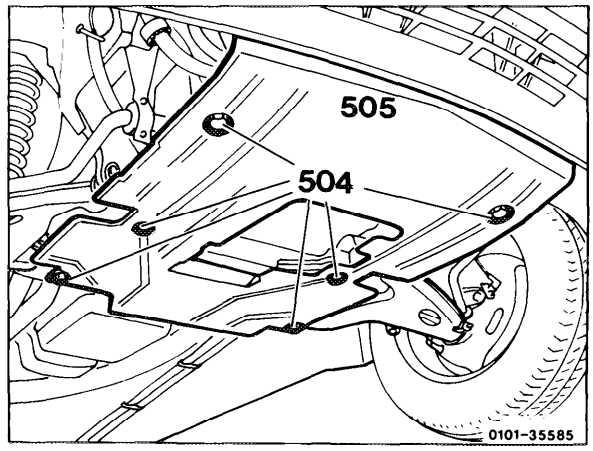
Removal, installation

1 Raise hood to vertical position (01-008).

2 Detach ground cable at battery.

3 4MATIC: Remove air filter (09-400).

4 Unscrew bolts (504) and remove bottom engine compartment covering (505).



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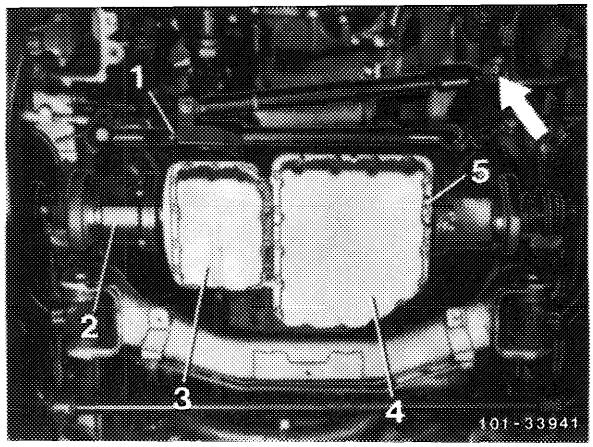
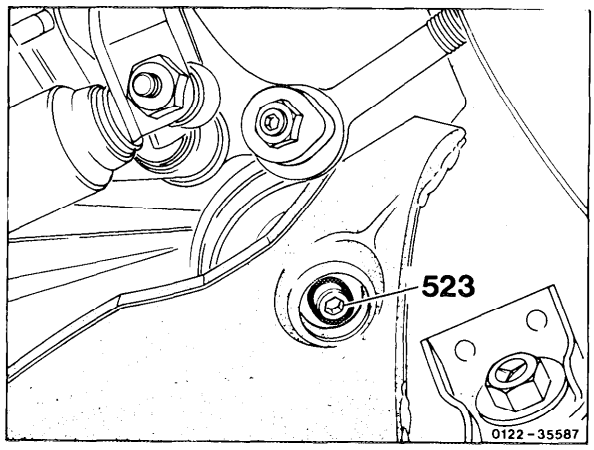
5 Drain engine oil (approx. 6.0 l) into a suitable vessel. Renew gasket. Oil drain plug tightening torque 25 Nm.

4MATIC: Unscrew oil drain plug (5).



6 Unscrew bolt (523) on left and right front engine mount from below. Tightening torque 40 Nm.

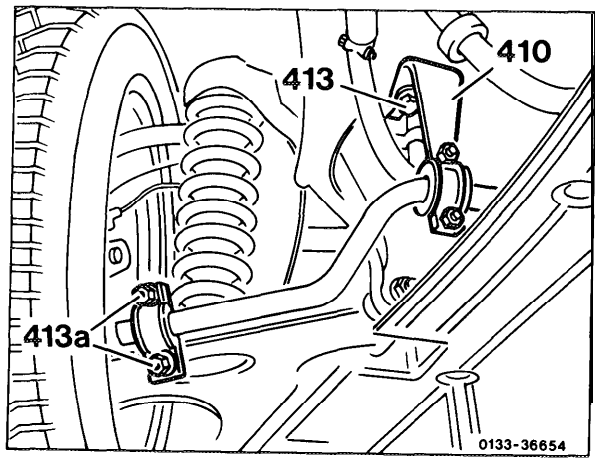
4MATIC: Unscrew 4 bolts from below. Tightening torque 20 Nm.



Model 124

7 Model 124: Unscrew bolt (413) for left and right spring leaf swing arm (410). Tightening torque 60 Nm.
Screw down nuts (413a).

8 Detach fan cowl.



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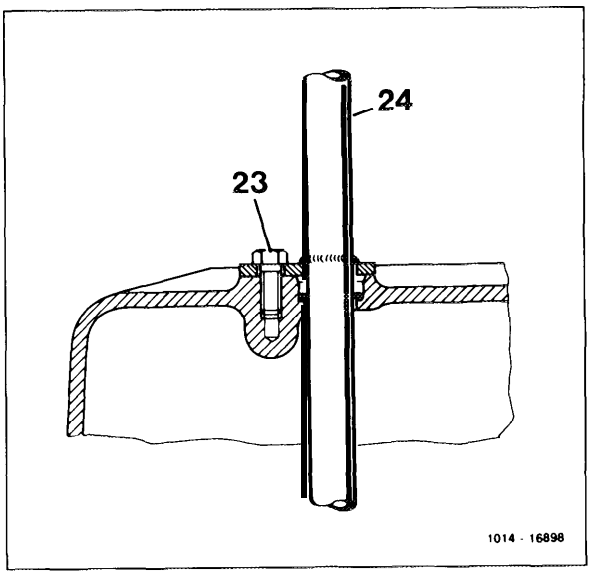
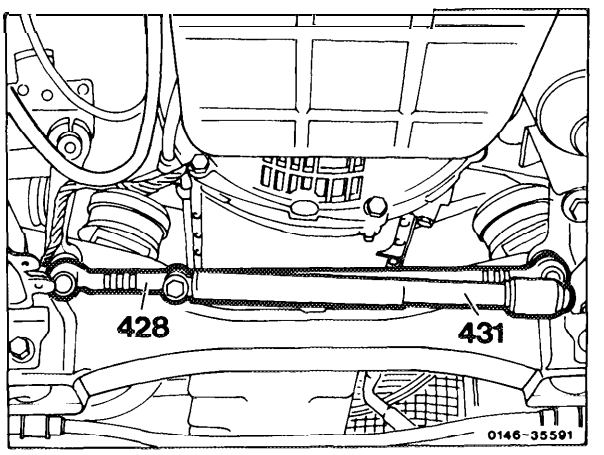
9 4MATIC: Unscrew bolt (23) and withdraw dipstick guide tube (24) from front axle housing, tightening torque 10 Nm.



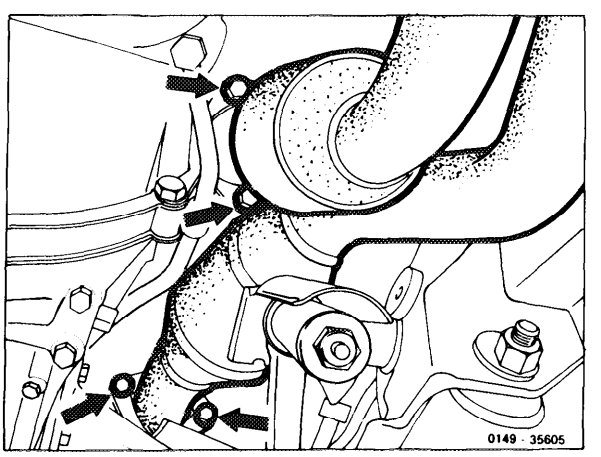
10 Remove drag link (428) with steering damper (431).
Unscrew steering damper (431) at body.
Remove drag link (428) using the tapered removal tool 201 589 08 33 00.

Note
Renew self-locking nuts.
Tightening torques:

Steering damper	50 Nm
Drag link	35 Nm



11 Unscrew bolts (arrows) for exhaust system on the flange of the exhaust manifold.



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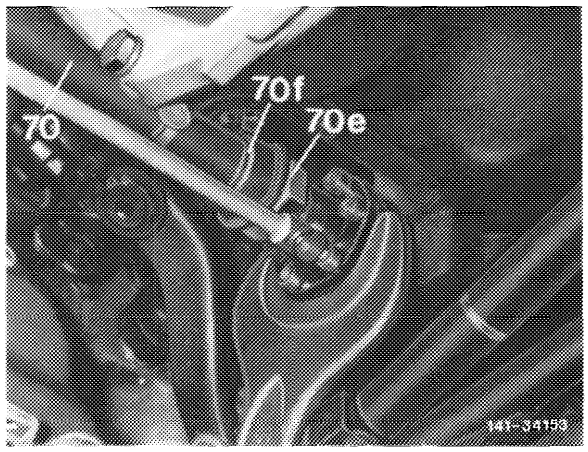
12 4MATIC: Unscrew propeller shaft (70) to the front axle at the front axle housing. When performing the step, hold the connecting flange with a 65 mm open-end wrench and unscrew six bolts (microencapsulated).



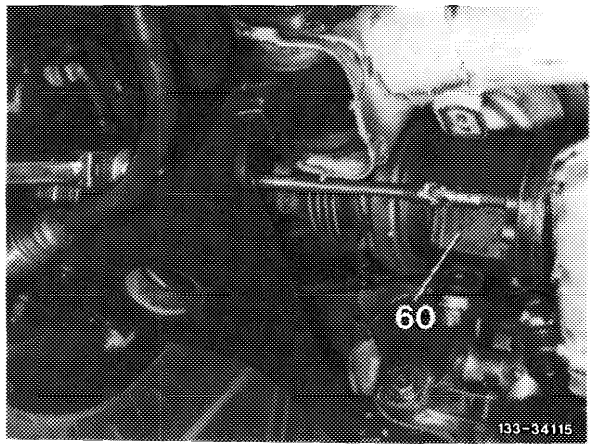
⚠

Do not hold the clamping nut (70e). Ensure that the connecting flange is not pushed out of the teeth.

Installation instruction

Renew microencapsulated bolts, tightening torque 25 Nm.

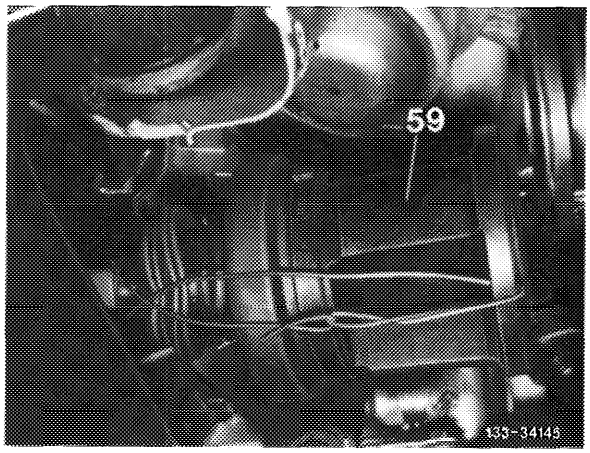
13 4MATIC: Unscrew front axle shafts (60). Operate foot brake to slacken the six bolts (microencapsulated).



Installation instruction

Renew microencapsulated bolts, tightening torque 70 Nm.

14 4MATIC: Push front axle shaft (59) together as far as possible and fix in this position with wire. Place front axle shafts on transverse link. Do not pull inner joint too far apart and angle in order to prevent the needle-bearing tripod joint rollers of the journals at the tripod cross from dropping out.



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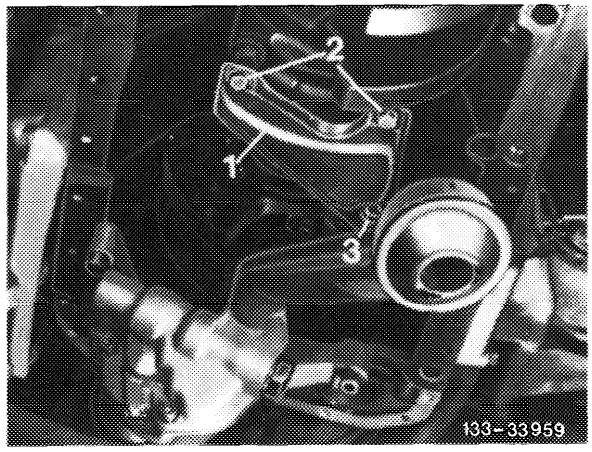
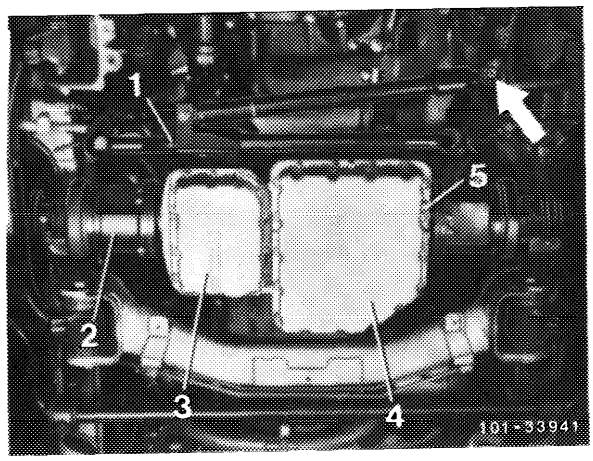
15 Detach plug connection of oil level switch on left of oil sump or front axle housing.

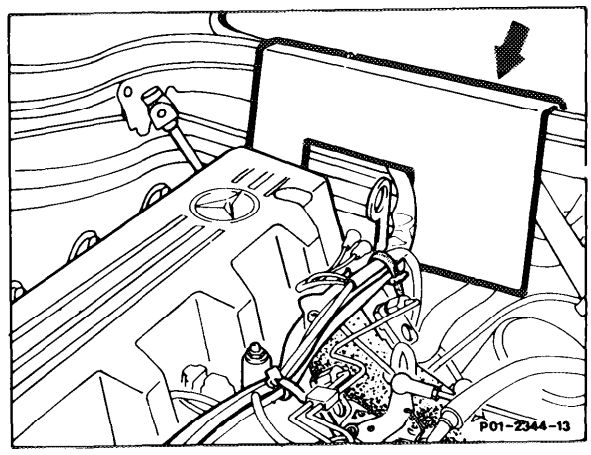
4MATIC: Unscrew bolts for bottom section of oil sump (4) and take off bottom section of sump (4), tightening torque 10 Nm.



16 4MATIC: Unscrew M6x12 bolts (2) and M6x18 bolt (3). Take off support (1) at intake snorkel of the oil pump.



17 Insert guard plate (arrow) between component compartment wall and engine.

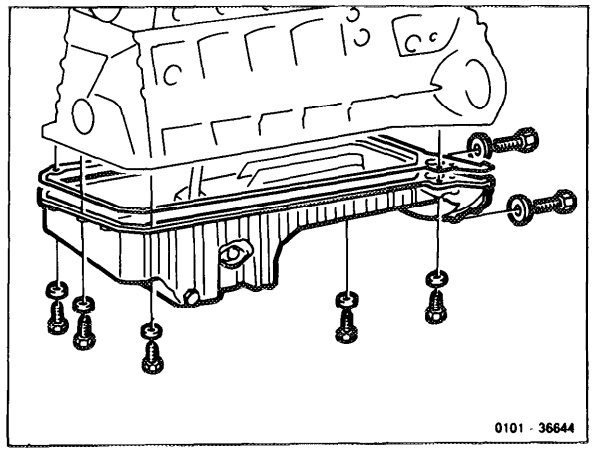


18 Model 124: Unscrew oil sump at the crankcase. Unscrew bolts.

Tightening torque: M6 : 10 Nm
M8 : 25 Nm

Installation instruction

Renew oil sump gasket. Before bolting the oil sump tight, the mating face must be aligned relative to the transmission.



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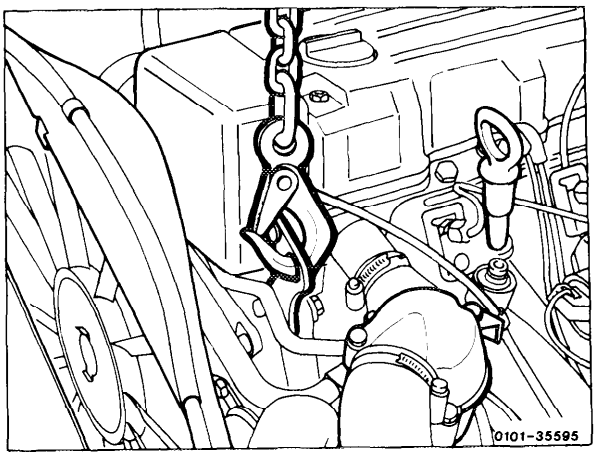
19 Attach engine hoist to the front suspension lug.

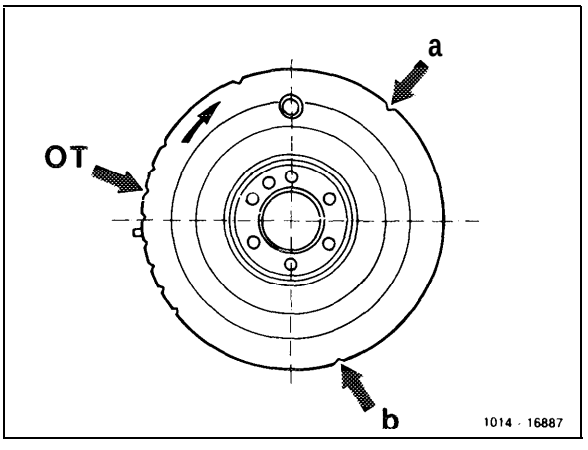


20 Model 124: Raise engine far enough to enable the oil sump to be removed to the front.

⚠

When raising the engine, ensure that the fan does not damage the radiator, and also pay attention to the rear suspension lug, oil filter and coolant hoses.

21 Set pistons of 3rd and 4th cylinder to TDC. The pistons of the 3rd and 4th cylinders are in the TDC position when the marking «a» on the vibration damper is aligned with the TDC pointer.



22 4MATIC: Unscrew lefthand engine support at the crankcase and take off together with engine mount.
Tightening torque 20 Nm.

23 4MATIC: Unscrew front axle housing from transmission and crankcase.
Support front axle housing.
If car is fitted with automatic transmission, unscrew the oil line from or to the transmission along the front axle housing.

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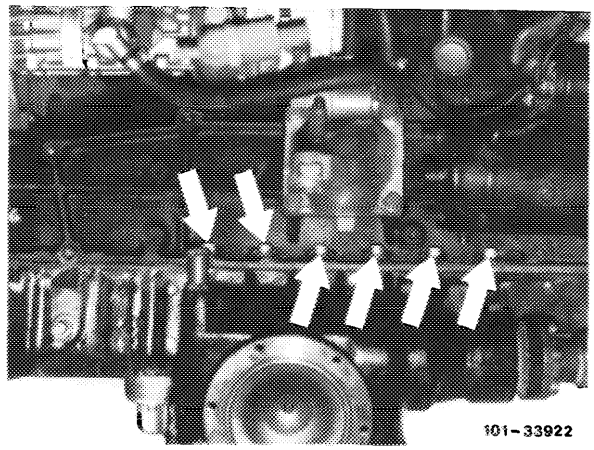
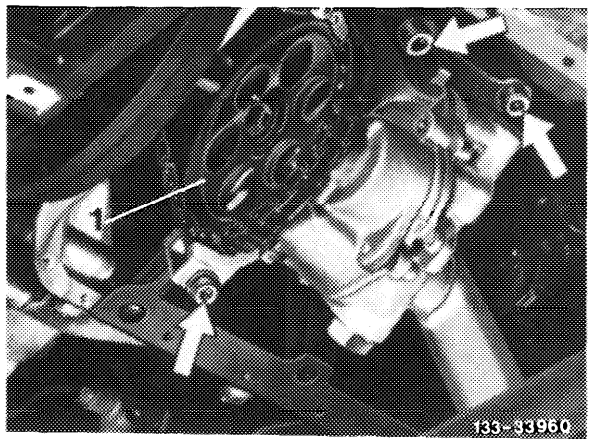
Note

The M8 bolts (arrows) on the lefthand side of t engine can be reached from above with the suitable tool combinations. In order to turn the two bolts below the starter, place screwdriver insert between starter and crankcase.



24 4MATIC: Lower front axle housing as far as possible. Unscrew bolt for sprocket wheel (1) and take off sprocket wheel (1), tightening torque 25 Nm.
Unscrew bolts (arrows) and take out oil pump down the way, tightening torque 25 Nm.
Take off front axle housing to the rear, paying attention to the drive chain of the oil pump.



25 4MATIC: Clean mating surfaces on front axle housing. Apply sealant 001 989 61 210 to the mating surface on the front axle housing
(a = silicone bead Ø 1.5 mm).
First of all mate front axle housing to the transmission then bolt to crankcase.

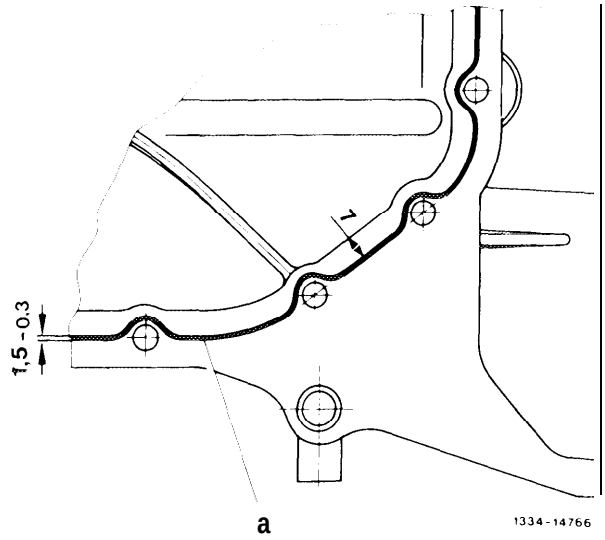
Installation instruction

Pay attention to different lengths of bolts.

Tightening torque M6 : 10 Nm
M8 : 22 Nm

Renew self-locking nut and microencapsulated bolts.

Install in the reverse order.



a= bead diameter of 1 5 mm

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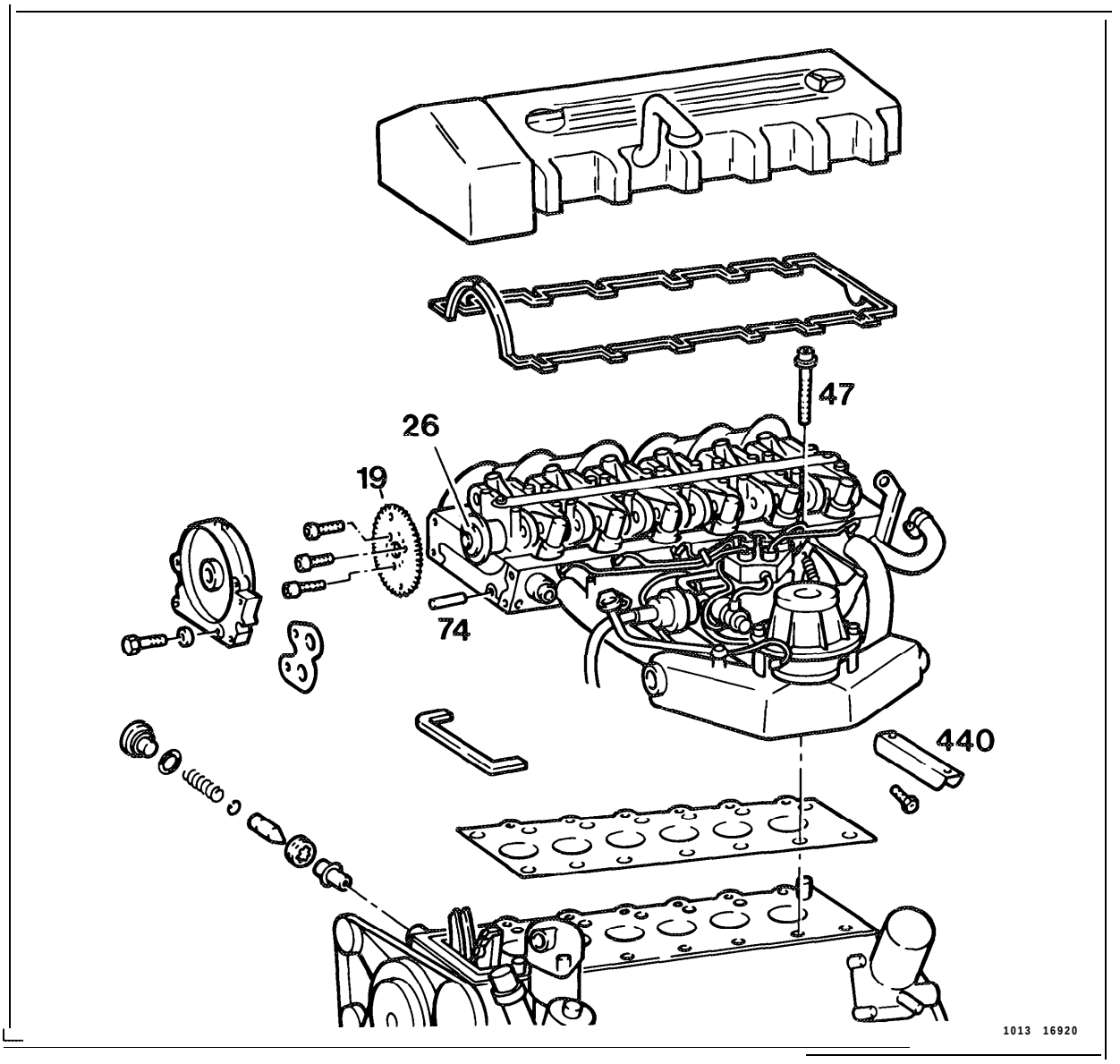
Job No. of job texts and job values or standard texts and flat rates 01-5800, 01-5855



Hood	raise to vertical position (01-008).
Coolant	drain, pour in (20-010).
Front cover at top	remove, install (01-212).
Camshaft gear (19)	mark relative to camshaft (26), detach and attach (steps 4 to 7).
Chain tensioner	remove, install (05310).
Sliding rail pin (74)	withdraw, knock in, impact extractor 116 589 20 33 00 (step 8).

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Bracket of dipstick guide tube and inlet pipe support (440)	unscrew, screw on (steps 9 and 10).
Fuel lines	detach, attach, briefly open fuel filler cap beforehand (step 14).
Bowden cable (accelerator control)	detach, attach (30-325).
Control pressure cable	detach, attach (step 16).
Coolant hoses and heating water return line	detach, attach (steps 11 and 12).
Engine wiring harness	detach, attach (steps 17 to 19).
If automatic transmission fitted, dipstick guide tube	unscrew, screw on (step 13).
Exhaust system at exhaust manifold	unscrew, screw on (step 20).
Cylinder head with intake manifold and exhaust manifold	take off, fit on (steps 21 to 23).
Camshaft (26)	set to marking (steps 24 and 25).
Piston of No. 1 cylinder	set to TDC (step 26).
Cylinder head bolts (47)	check, tighten (steps 27 to 29).

Tightening torques and angle of rotation torque		Nm
Cylinder head bolts when engine cold	1st stage	70
	2nd stage 90° angle of rotation	
	3rd stage 90° angle of rotation	
Bolts for cylinder head cover		8.5
Screw plug of chain tensioner		50
Threaded ring of chain tensioner		30
Camshaft gear to camshaft (hex. socket bolt M6, 1st version)		11
Camshaft gear to camshaft (Torx bolts M7, 2nd version)		16
Distributor rotor to follower (reference value)		2.5
Follower to camshaft		21
Front cover at top to cylinder head		21

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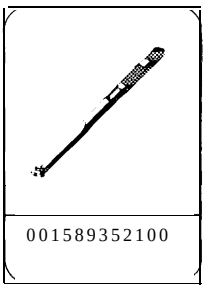
Special tools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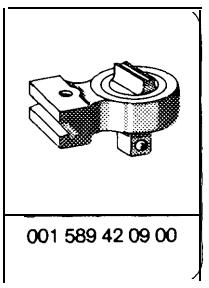
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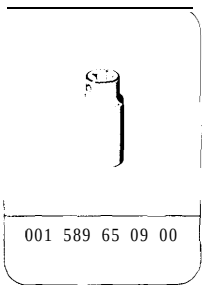
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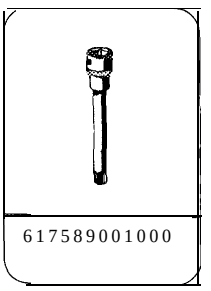
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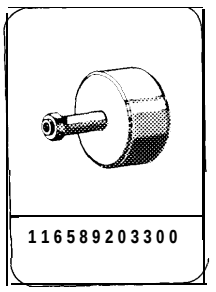
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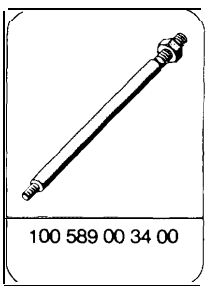

100 589 00 34 00

Note
Detach cylinder head together with camshaft, intake manifold and exhaust manifold after engine has cooled down.

Removal, installation

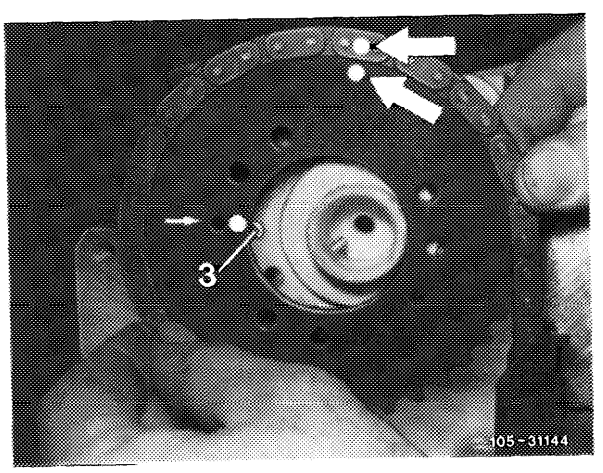
1 Raise hood to vertical position (01-008).

2 Drain coolant at crankcase (20-010).

3 Remove front cover at top (01-212).

4 Mark position of camshaft gear relative to camshaft. This is done by applying colored marking next to fixing pin (3) on the camshaft gear.

5 Remove chain tensioner (05310).



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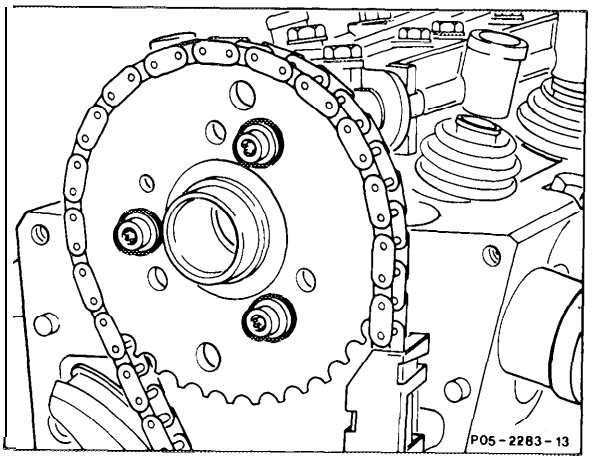
6 Unscrew bolts (16).

Tightening torque

Hex. socket bolts	M6:	11 Nm
Torx bolts	M7:	16 Nm

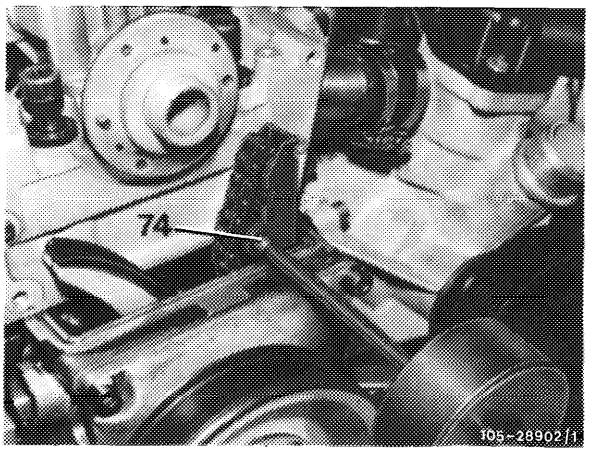
7 Pull off camshaft gear (19) by hand.



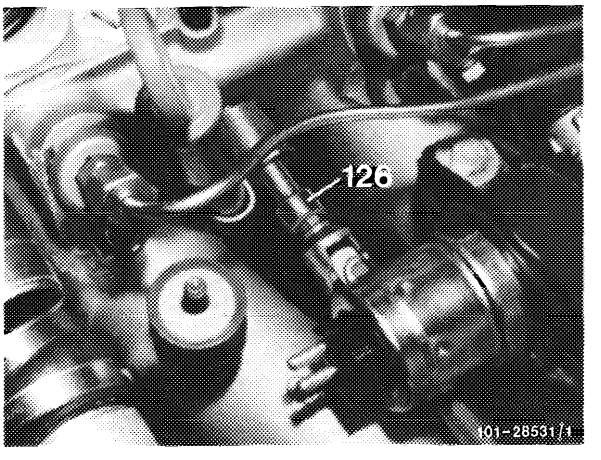
8 Use impact extractor 116 589 20 33 00 to withdraw slide rail pin (74).

Installation instruction

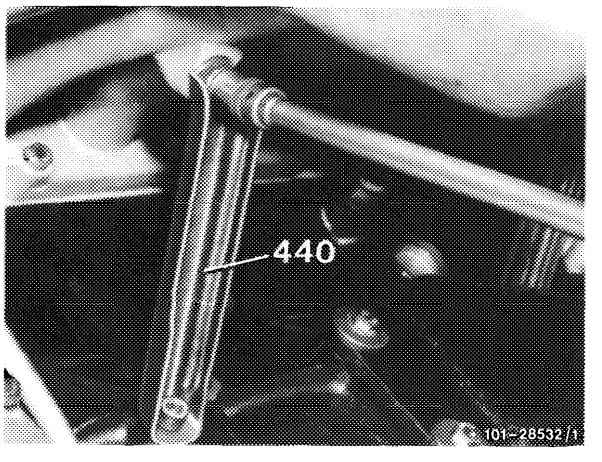
The thread in the slide rail pin (74) must be facing forward in direction of travel when it is knocked in.



9 Unscrew bracket (126) for dipstick guide tube.



10 Unscrew intake manifold support (440) at top, detach at bottom.



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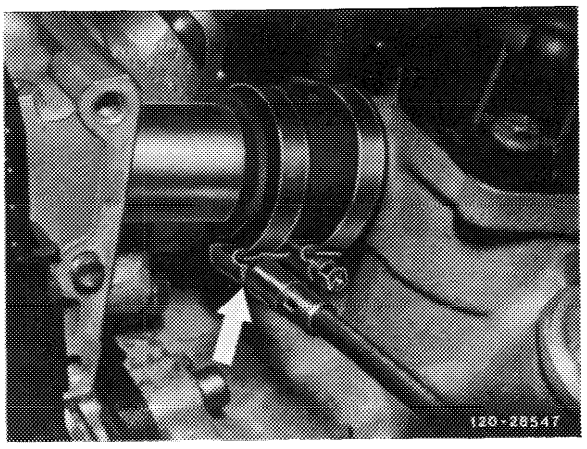
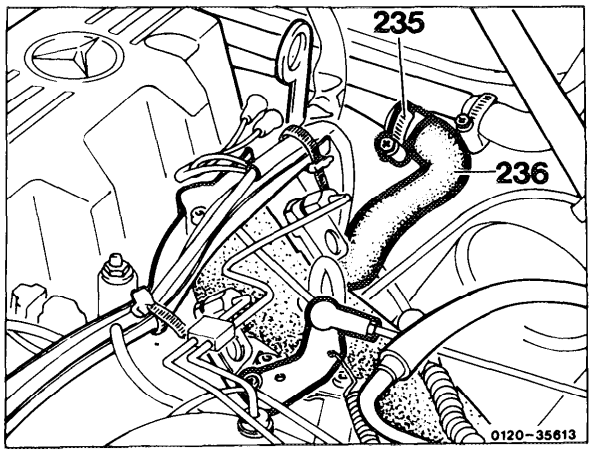
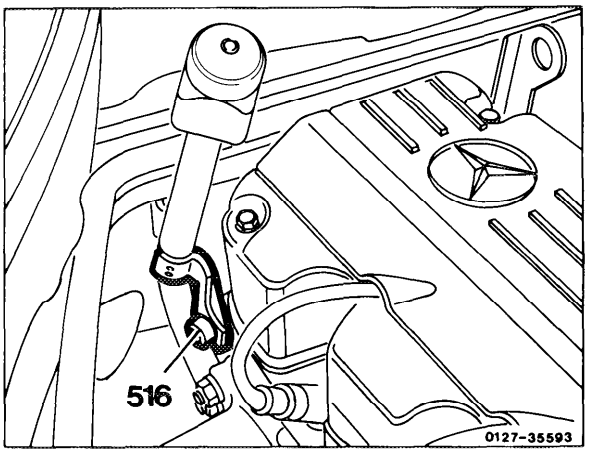
11 Slacken hose clips (arrow) on the coolant hose to the coolant pump.



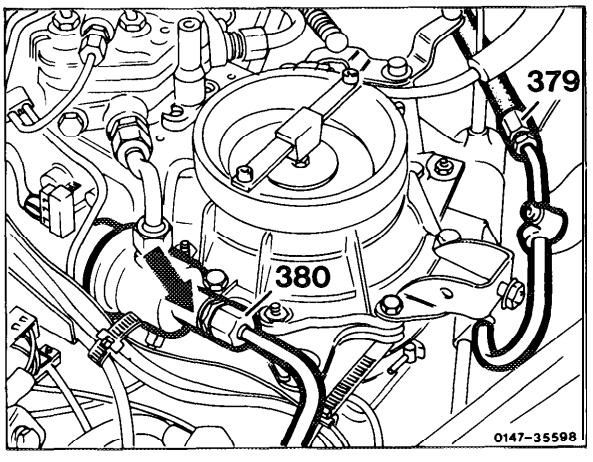
12 Slacken hose clip (235). Detach heating water return line (236).



13 If automatic transmission fitted: Unscrew bolt (516).



14 Briefly open fuel filler cap to release the pressure in the fuel tank.
Unscrew fuel lines (379, 380).
Hold the connection fitting (arrow) to prevent it moving when slackening the fuel line (380).



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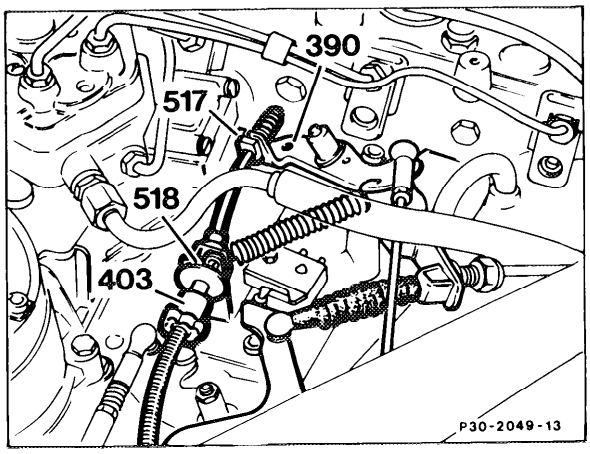
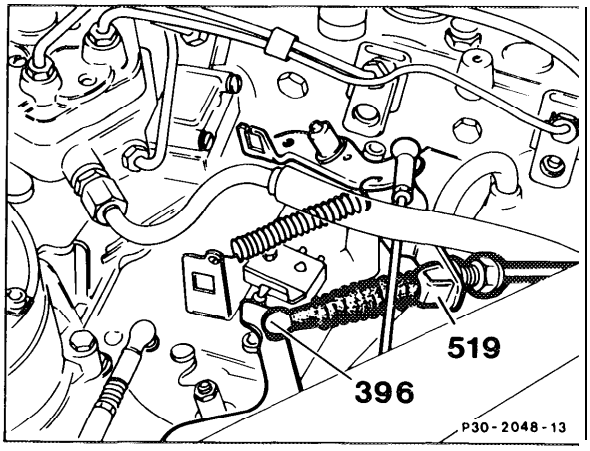
15 Detach Bowden cable (accelerator control). Press plastic guide (517) out of its seat in the fulcrum lever (390) and withdraw Bowden cable (403) through the slot in fulcrum lever (390). Compress the links of the plastic clip (518) and push plastic clip with the Bowden cable (403) to the rear through the bracket.

Installation instruction

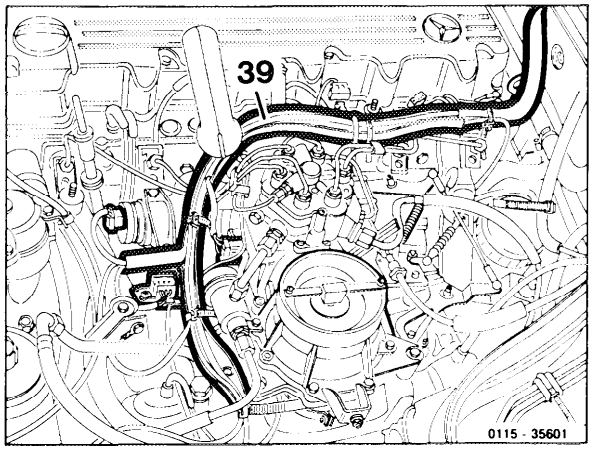
Adjust Bowden cable (403) (30-325).



16 Detach control pressure cable (396). Compress links (519) of the plastic clip and guide plastic clip with linkage through the bracket.



17 Detach engine wiring harness (39). Slacken all the cable straps of the engine wiring harness (39). Detach all the plug connections along the engine wiring harness (39).



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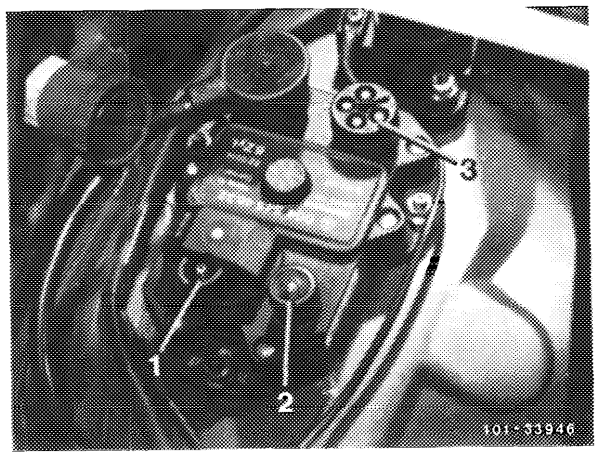
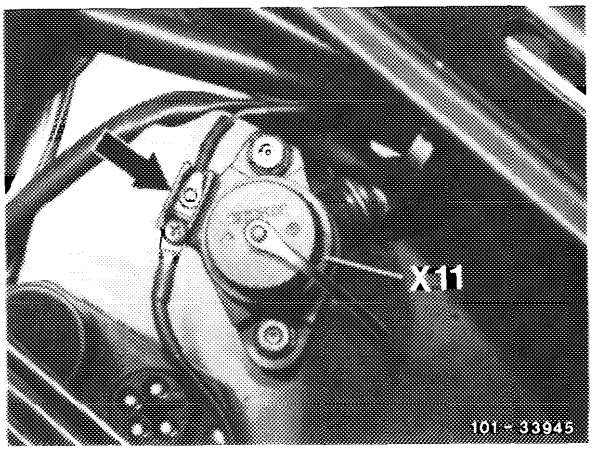
18 Detach green control cable and vacuum line at the connector-sensor ignition control unit.

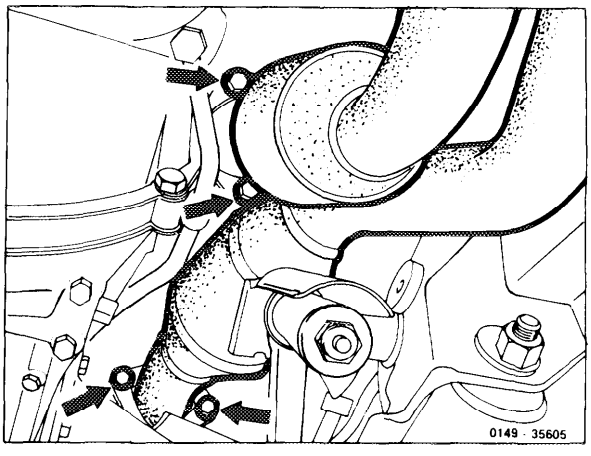


1 Vacuum connection
2 Control line-position sensor connection
3 Connector-sensor connection

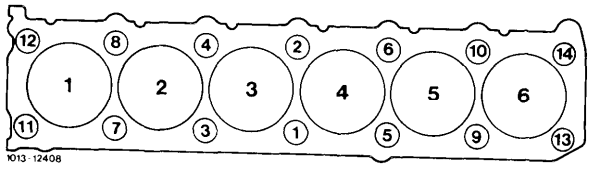
19 Detach terminal block terminal TD (arrow) next to diagnostic socket (Xl 1), unscrew diagnostic socket (Xl 1), detach grey cable from the TDC sensor on the rear of the diagnostic socket (Xl 1).



20 Unscrew bolts (arrows) for exhaust system on the flange of the exhaust manifold.



21 Slacken cylinder head bolts when engine cold in stages in the reverse order to the tightening diagram, starting with 14.



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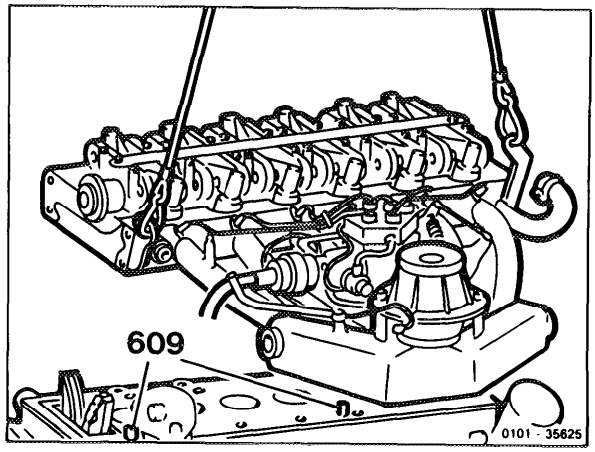
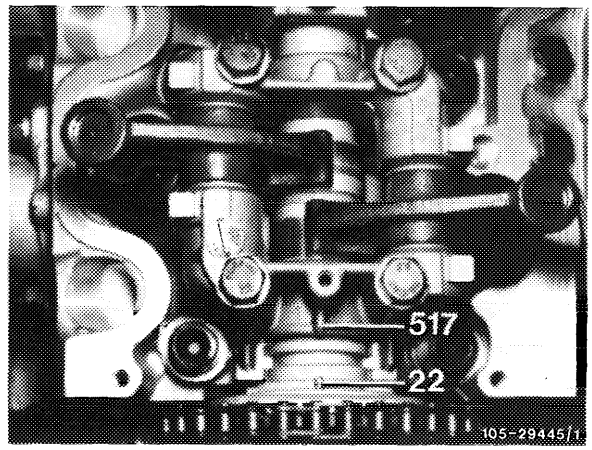
22 Attach engine hoist to the suspension lugs of the engine.
Take off cylinder head.



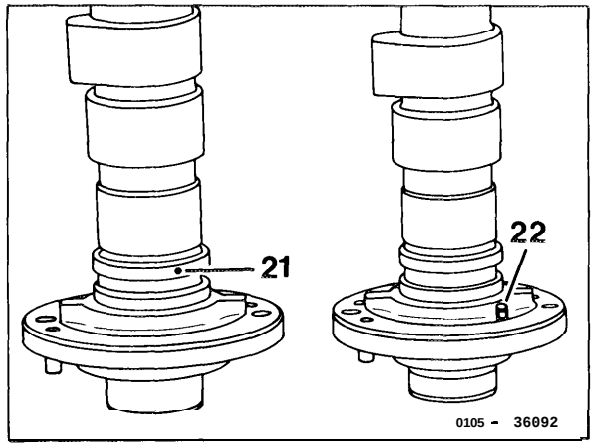
23 Renew cylinder head gasket.

Installation instruction
Pay attention to the 2 fit pins (609) for locating the cylinder head on the crankcase.

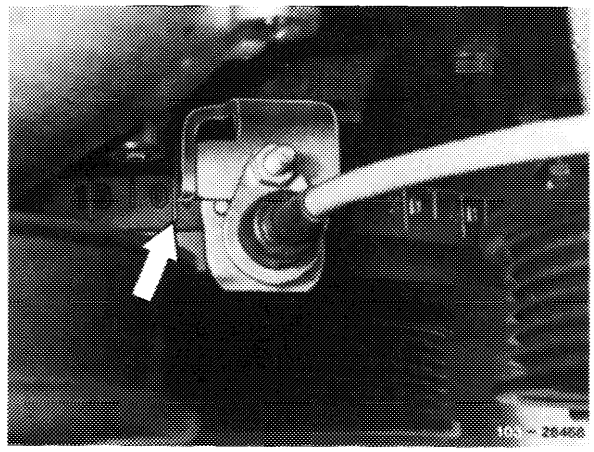
24 Turn crankshaft so that pin (22) or positioning bore of the camshaft is aligned with the marking (517) on the 1st camshaft bearing.



25 Effective 12/86 only the positioning bore (21) is provided in place of the pin (22).



26 Position piston of No. 1 cylinder to TDC (arrow).



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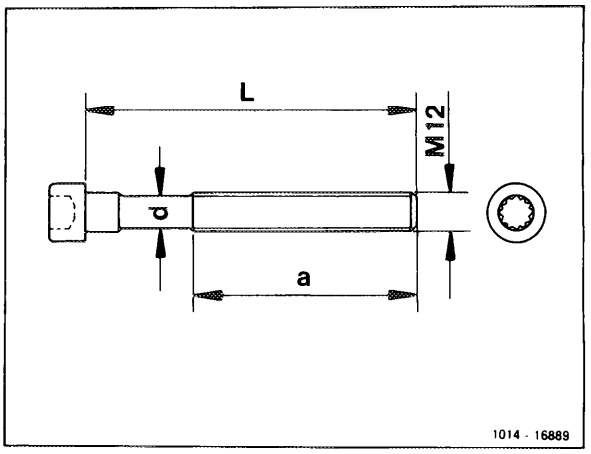
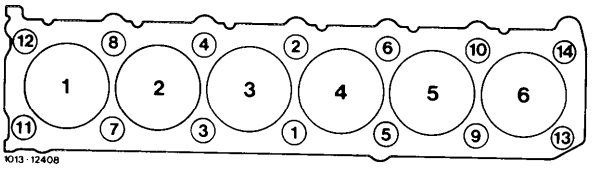
27 Check cylinder head bolts.
Each time the cylinder head bolts are tightened they are subject to a certain permanent stretch. If the maximum length (L) of 108.4 mm is exceeded, the bolts should be scrapped and replaced by new ones.



28 Oil the thread of the cylinder head bolts and also the contact surface of the bolt head and insert.

29 Tighten the cylinder head bolts in stages in the order shown in the tightening diagram, beginning with 1.
1st tightening stage 70 Nm
2nd tightening stage 90° angle of rotation
3rd tightening stage 90° angle of rotation



30 Install in the reverse order.

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Job No.

Checking, renewing and tightening conrod bolts . . . . . 03 – 310
Renewing front crankshaft radial seal . . . . . – 324
Renewing rear crankshaft radial seal . . . . . – 327
Removing, installing belt pulley, flywheel damper and hub . . . . . – 342
Removing, installing flywheel or driven plate . . . . . - 410
Machining flywheel . . . . . – 420

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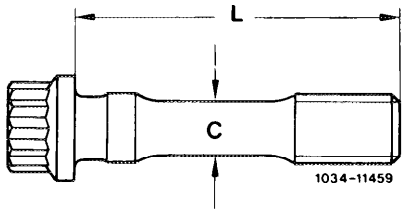
03-310 Checking, Renewing and Tightening Conrod Bolts

Job No. of job texts and job values or standard texts and fiat rates 03-4341, 03-4351

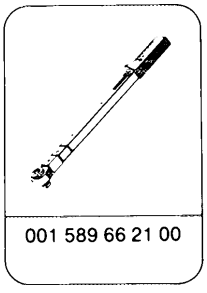
Conrod bolts

Part No.	102 038 00 71
Thread 0 (d)	M9 × 1
Stretch shaft 0 (c) when new	7.4 – 0.1
Minimum stretch shaft 0 (c)	7.1
Length (L) when new	52 – 0.3
Initial tightening torque	30 Nm
Angie of rotation torque	90 – 100"



Conrod bolts	measure minimum stretch shaft 0 (c). If the minimum stretch shaft 0 has been reached or no longer exists, renew conrod bolt.
Thread and contact surface of conrod bolts	oil before installing.
Conrod bolt initial and angle of rotation torque ...	initial torque 30 Nm. Angle of rotation torque 90 – 100°. Use special tool 001 589 66 21 00 (see Note).

Special tool



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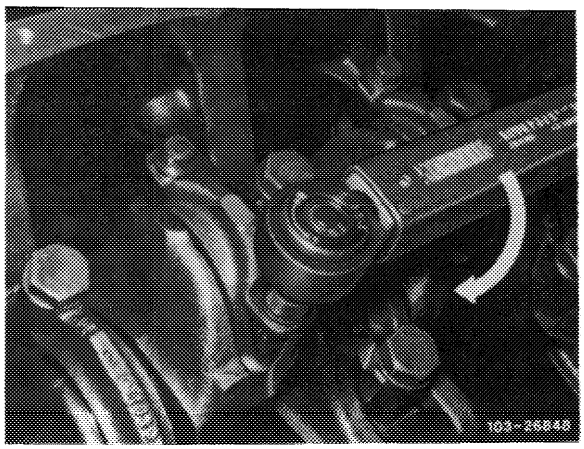
Note

If no torquing wrench is available, the conrod bolt can be torqued on by the specified angle with a socket wrench and tommy in a single step. To rule out any possible angle errors, do not use a bending rod torque wrench for tightening according to degrees of angle.



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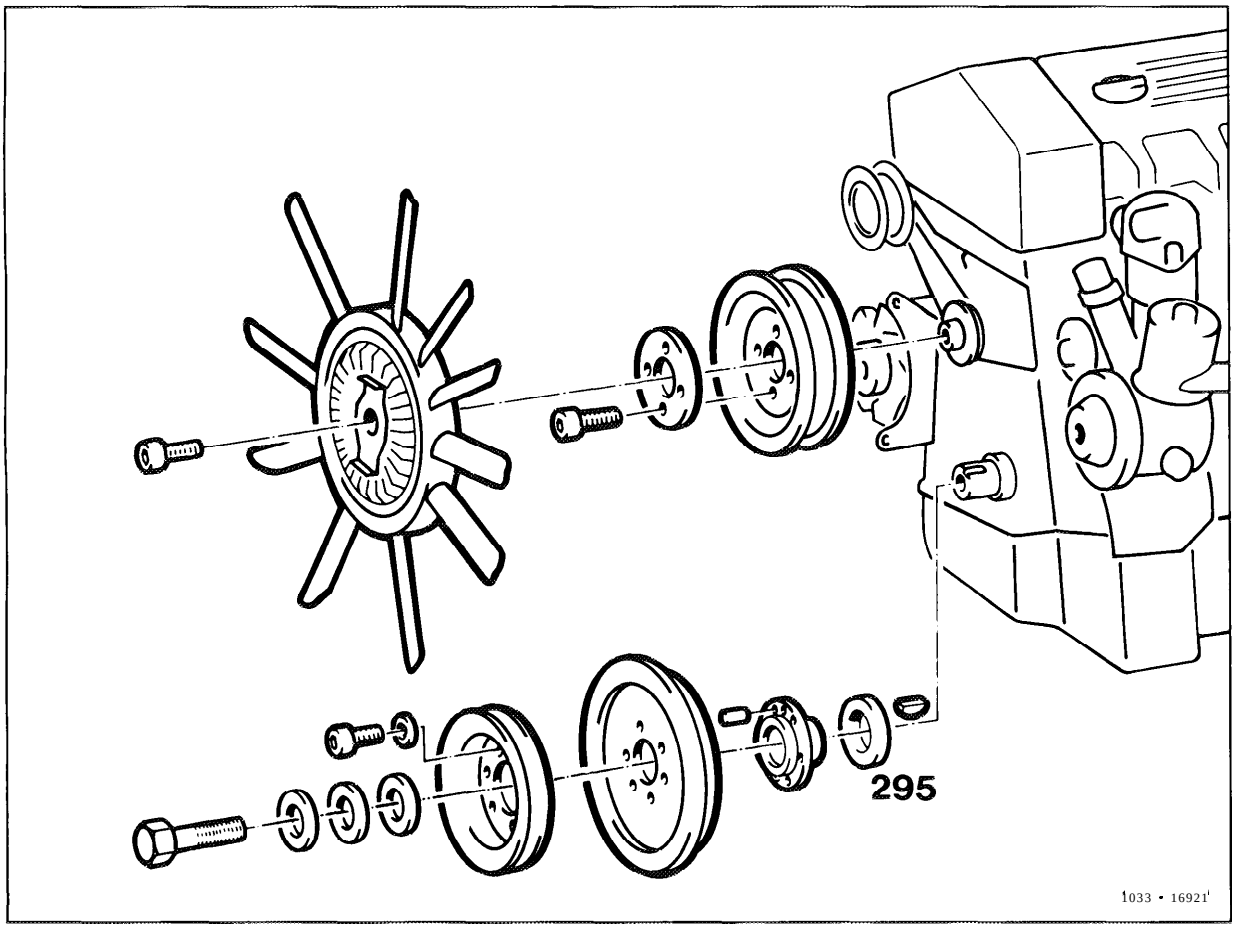
Job No. of job texts and job values or standard texts and flat rates ..... 03-3000 - 01-3112

Model 124



Belt pulley, vibration damper and hub	remove, install (03-342).
Radial seal (295)	remove, renew and install (step 2, use special tool 601 589 03 14 00).
Mounting hole	clean, check.
Sealing lip	oil (step 3).

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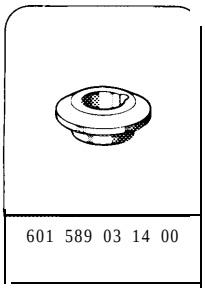
Special tool

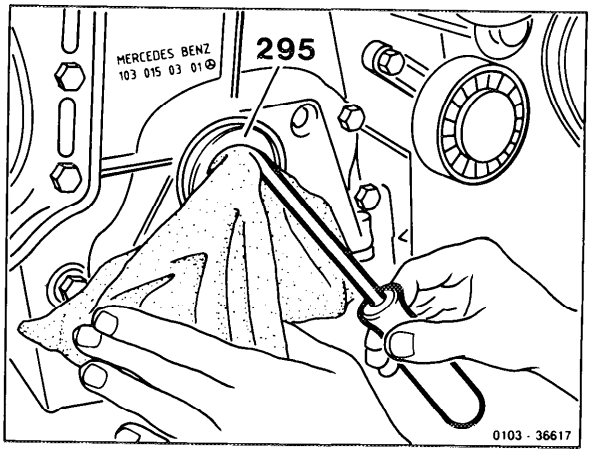


Note
An oil leak can be detected by spraying around the cleaned and dried area with Mercedes-Benz white contrast spray 000 989 03 59.

The radial seal has a sealing lip offset by 2 mm to the inside for the repair.

1 Remove belt pulley, vibration damper and hub (03-342).

2 Use a screwdriver to press radial seal (295) out of the timing case cover. Ensure that the crankshaft journal and the mounting hole in the timing case cover are not damaged.
Cover crankshaft journal with a cloth.
If necessary, deburr mounting hole.



3 Oil sealing lip of radial seal (295).

⚠
Do not use any grease. Grease prevents the inclined webs on the sealing lip from transporting back the engine oil.

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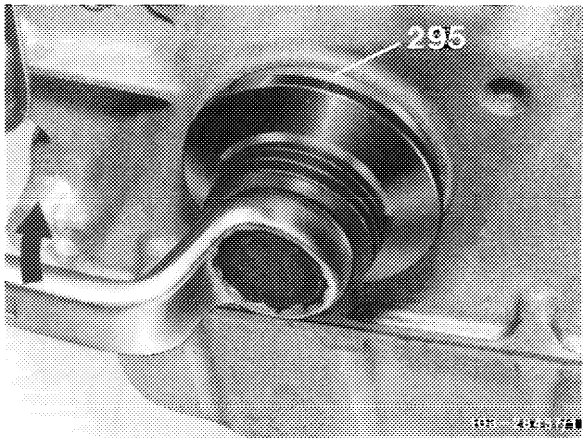
4 Press in radial seal (295) with the installation tool 601 589 03 14 00.



Note
The radial seal must be at right angles to the crankshaft journal otherwise it will not provide a proper seal.

Install in the reverse order.

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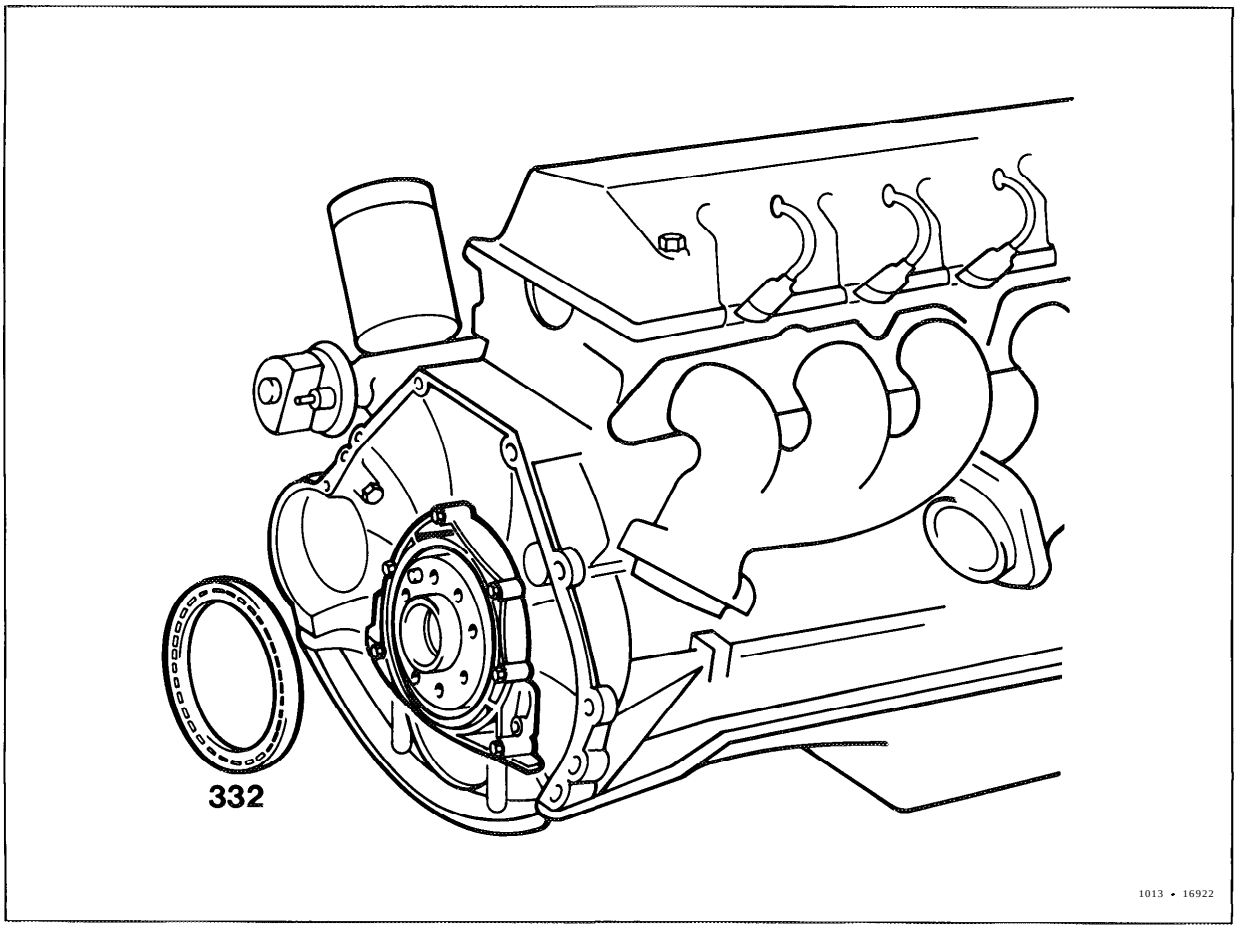
03-327 Renewing Rear Crankshaft Radial Seal

Transmission removed.

Job No. of job texts and job values or standard texts and flat rates . . . . . 03-3063 - 03-3301



Wood	raise to vertical position (01-008).
Ground cable to battery	detach, attach.
Flywheel or driven plate	remove (03-410).
Radial seal (322)	remove, renew and install.
Mounting hole	clean, check.
Sealing lip	coat with engine oil.
Oil level in engine	check, correct.
Engine in installation position	support, secure.
Leaktightness with engine running	check.
Flywheel or driven plate	install.

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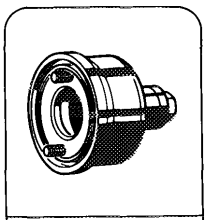
Special tool



601 589 03 43 00

Note

The radial seal is press-fitted flush in the closing cover without sealant. The closing cover is fixed to the crankcase with 2 fit pins and bolted on.

An oil leak can be detected after spraying the cleaned and dried area with Mercedes-Benz white contrast spray 000 989 03 59.

The radial seal has a sealing lip offset by 3 mm to the inside for the repair.

The mounting holes in the crankshaft are designed as blind holes.

1 Raise hood to vertical position (01-008).

2 Detach ground cable at battery.

3 Remove flywheel or driven plate (03-410).

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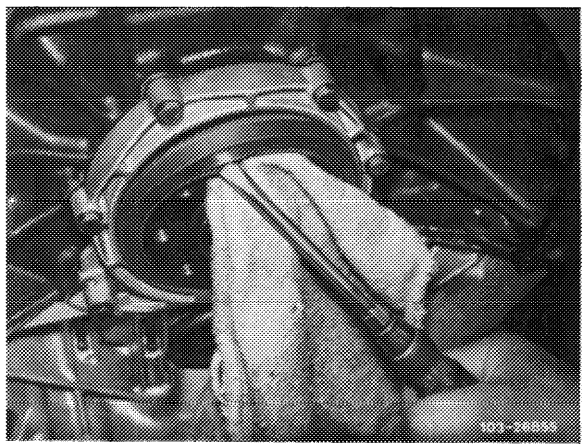
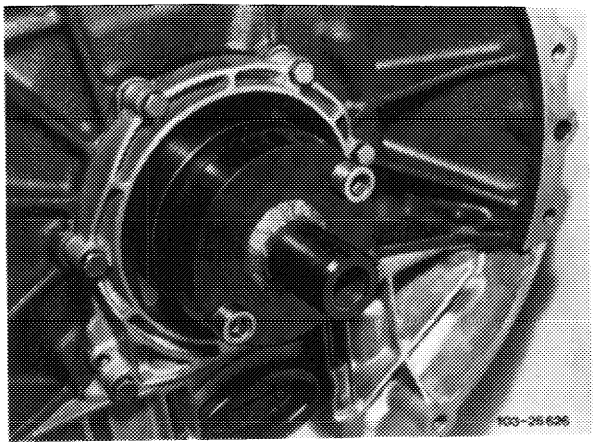
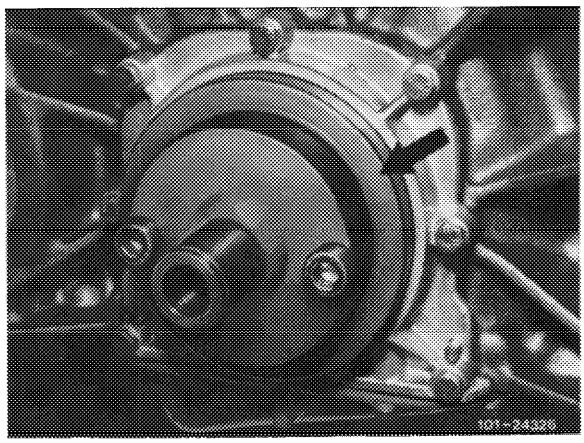
4 Use a screwdriver to press the radial seal out of the closing cover. Ensure that the crankshaft flange and the mounting hole in the closing cover are not damaged when performing this step.
Cover over crankshaft flange with a cloth.
If necessary, deburr mounting hole.



5 Bolt inner section of installation tool 601 589 03 43 02 to the crankshaft flange.

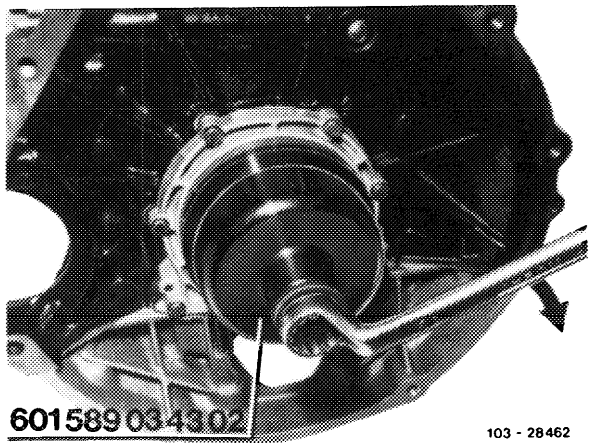


6 Push radial seal (arrow) over the inner section of the installation tool.



7 Press radial seal into the closing cover as far as the stop until flush using the outer section of the installation tool 601 589 03 43 02.

Note
The radial seal must be at right angles to the crankshaft flange otherwise it will not provide a proper seal.



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8 Coat sealing lip of radial seal with engine oil.

Do not use any grease. Grease prevents the inclined webs on the sealing lip from transporting back the engine oil.

9 Check oil level in engine and adjust to correct level.

Before starting engine, move into installation position and secure at the rear by supporting.

10 Attach ground cable to the battery.

11 With the engine running, check for signs of leaks before installing transmission.

12 Install flywheel or driven plate (03-410).

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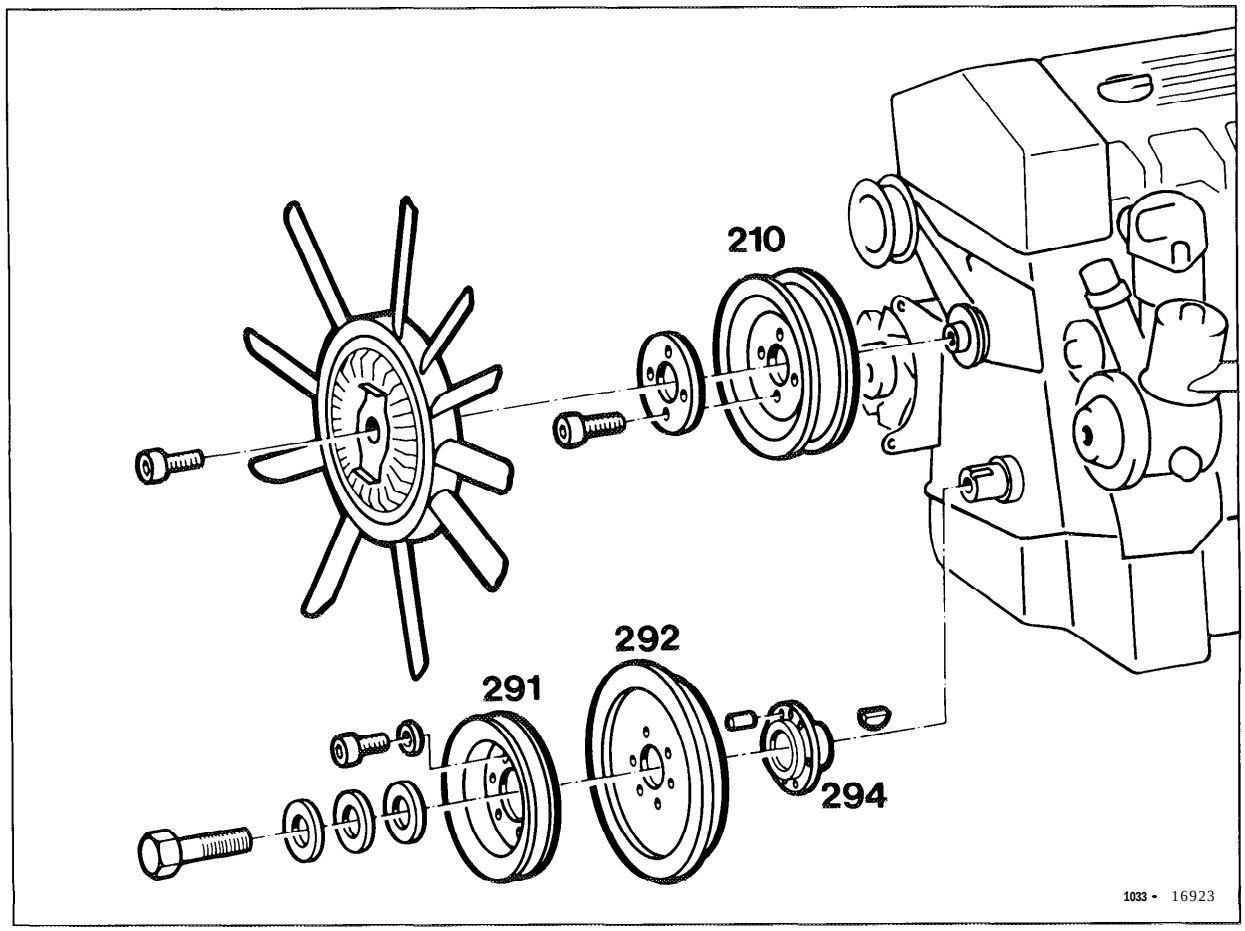
03-342 Removing, Installing Belt Pulley, Flywheel Damper and Hub

Job No. of job texts and job values or standard texts and flat rates ..... 03-I 320 - 03-I 911

Model 124



Hood	raise to vertical position (01-008).
Ground cable to battery	detach, attach.
Engine compartment covering below	remove, install.
Poly V-belt	remove, install (13-342).
Guard plate in front of radiator	attach (step 6).
Belt pulley (210)	remove, install, tightening torque 10 Nm.
Retaining lock	install, remove, special tool 601 589 02 40 00 (steps 8 and 9).
Vibration damper (292) and belt pulley (291)	remove, install (step 10), tightening torque 23 Nm.
Hub (294)	pull off, press on, tightening torque 300 Nm.

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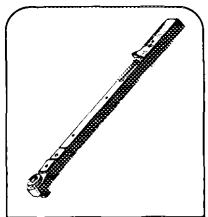
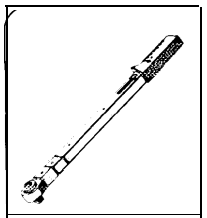
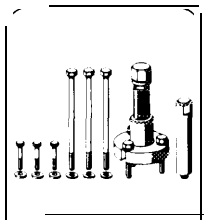
Special tools



000 589 10 99 01



001 589 72 21 00



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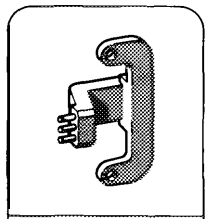


601 589 02 40 00

Shop-made tool

Guard plate for radiator/condenser	Dimensions approx. 600 × 480 × 1

Note

Belt pulley, vibration damper and hub can be renewed without balancing.

1 Raise hood to vertical position (01-008).

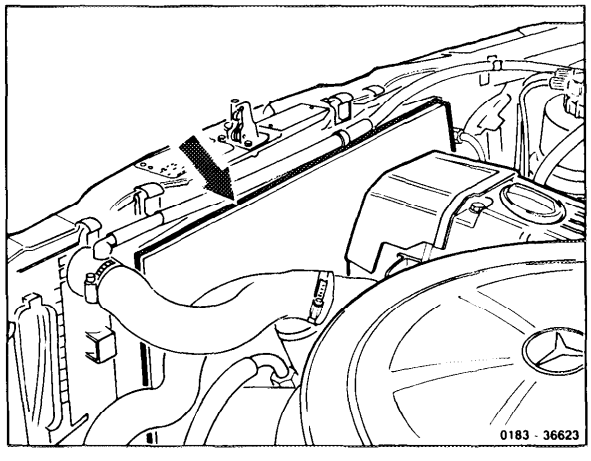
2 Detach ground cable at battery.

3 Remove engine compartment covering below.

4 Slacken bolts of the belt pulley-fan coupling.

5 Remove V-belt (13-342).

6 Fit guard plate (arrow) in front of radiator.



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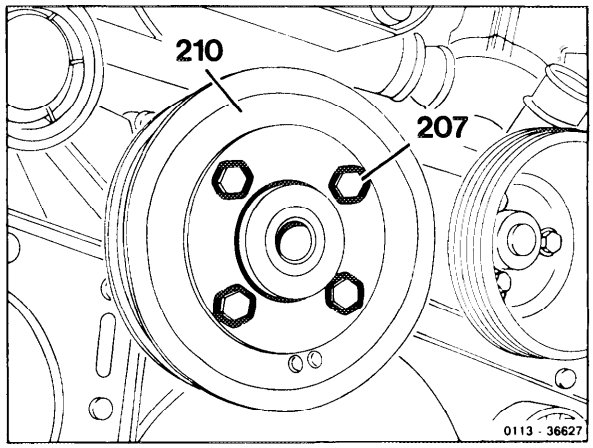
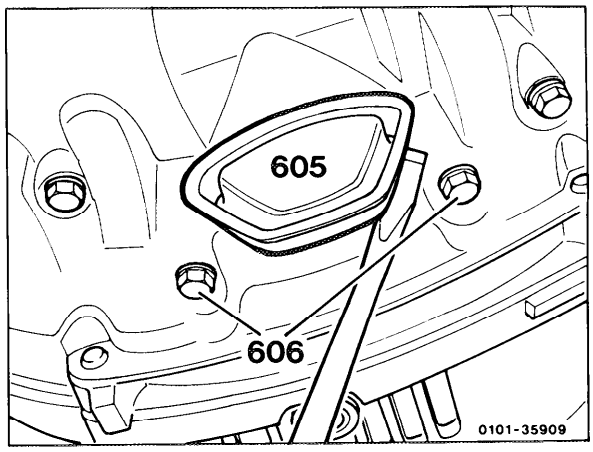
7 Unscrew bolts (207) and take off belt pulley-fan coupling (210), tightening torque 10 Nm.

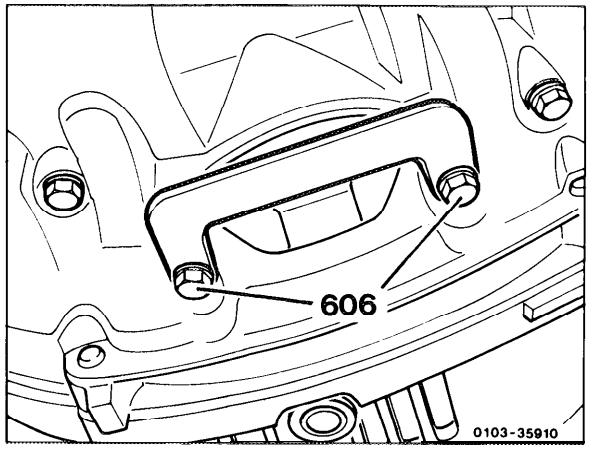


8 Take off plastic cap (605) on rear of oil sump. Unscrew bolts (606).



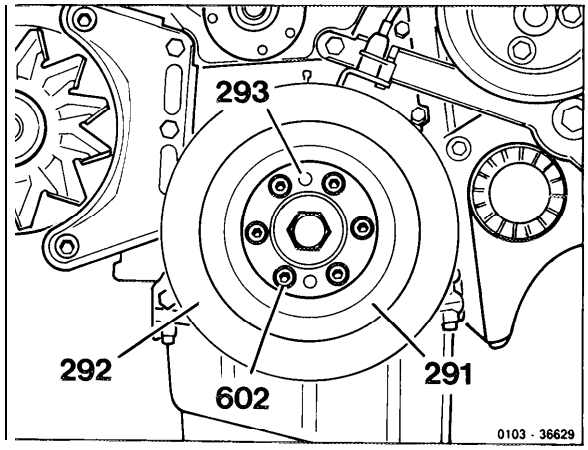
9 Attach retaining lock 601 589 02 40 00 with both bolts (606).

Note
Pins of the retaining lock must engage into the ring gear teeth.



10 Unscrew bolts (602). Take off belt pulley (291) and vibration damper (292).

Installation instruction
The vibration damper (292) is located with a fit pin (293).
Install bolts (602) with washers, tightening torque 23 Nm.



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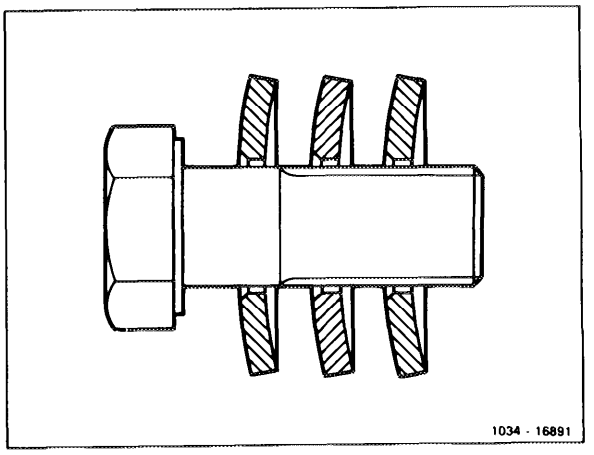
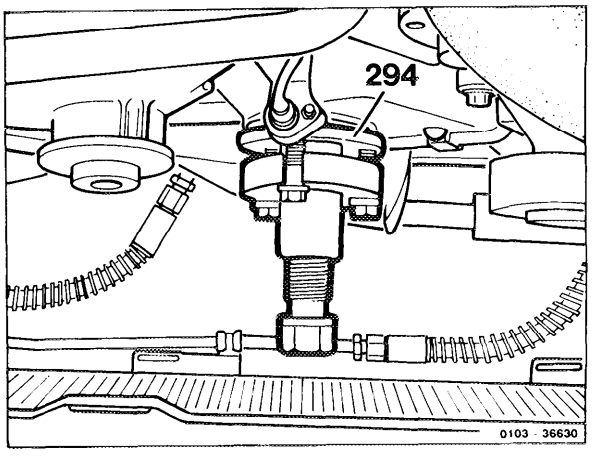
Installation instruction
Oil bolt threads and Belleville spring washers. Fit Belleville spring washers with the curved face pointing toward the bolt head.
Tighten bolt to 300 Nm.



11 Pull off hub (294) with puller 103 589 00 33 00.



Installation instruction
Heat hub (294) to approx. 50 °C so that it can be easily fitted onto the crankshaft. When fitting on, perform turning movements to determine whether the slot of the hub (294) is aligned with the Woodruff key in the crankshaft.

Install in the reverse order.

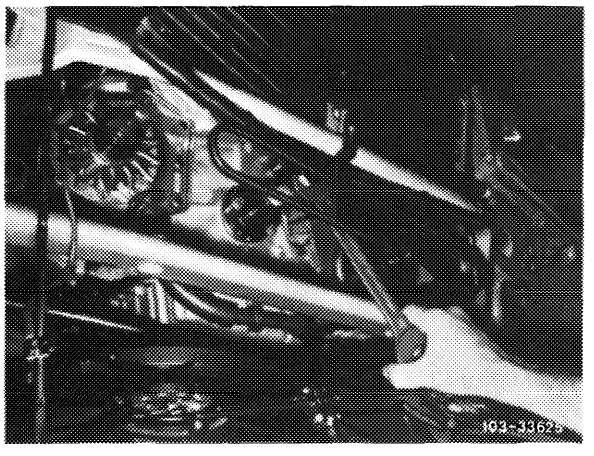
Model 201

1 Remove visco clutch, fan and radiator.

2 Disconnect steering oil cooler connections.

3 Disconnect both electric cooling fans.

Remaining procedure as on model 124.



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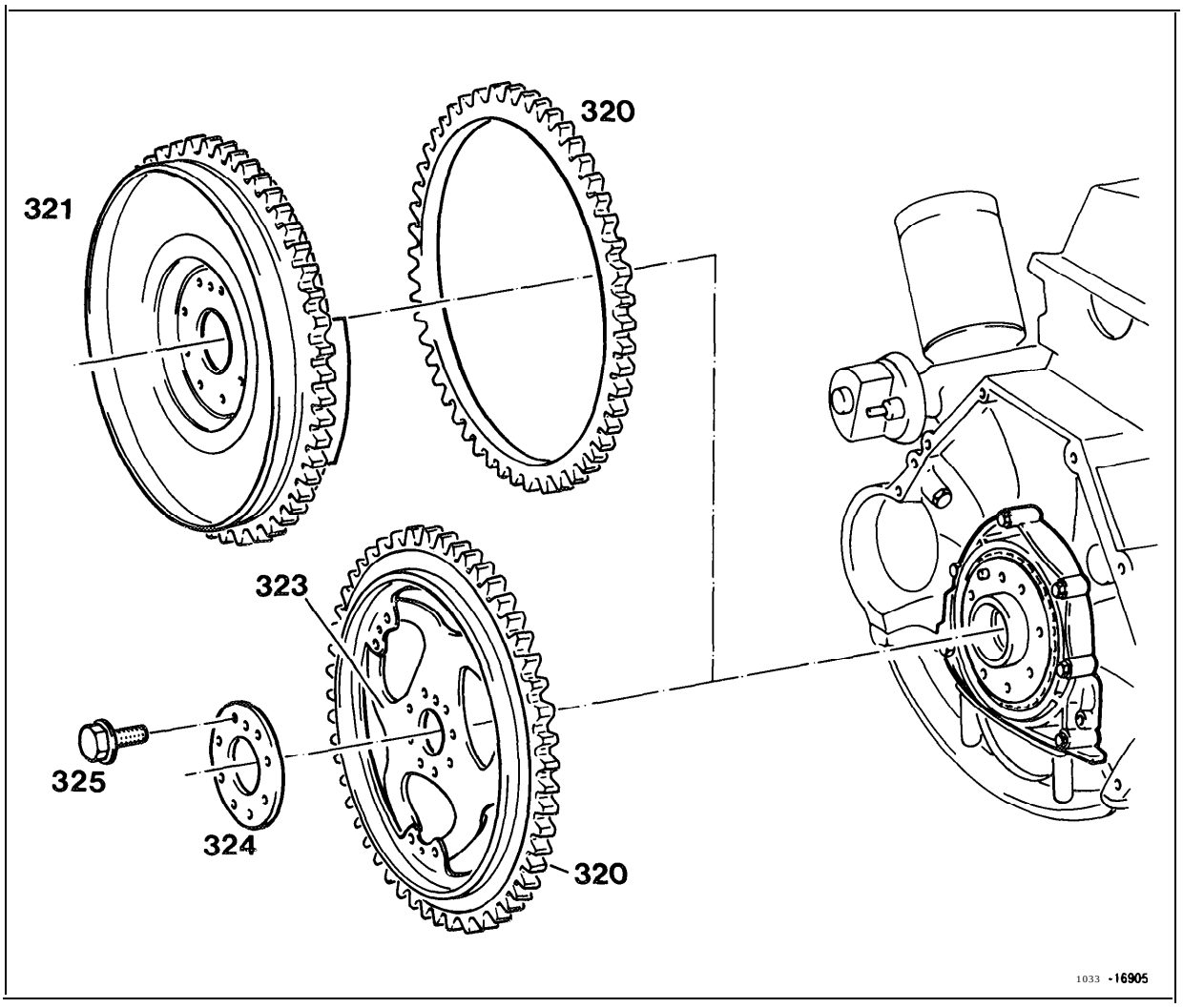
Job No. of job texts and job values or standard texts and flat rates 03-8001, 03-8201



Manual or automatic transmission	remove, install (26-020 or 27-600).
Clutch	remove, install (25050).
Retaining lock	install, remove. Special tool 601 589 02 40 00 (steps 1 and 2).
Stretch bolts (325, Ml0 x 22)	unscrew, check and screw in. Tightening torque: Initial torque 30 Nm. Angle of rotation torque 90° (step 4).

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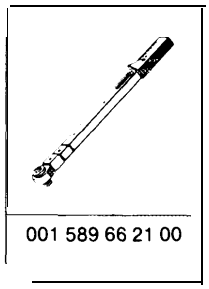
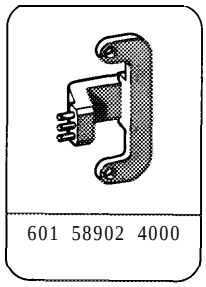
Stretch bolts (325)	check.
Flywheel (321) or driven plate (323) with ring gear (320)	detach, attach (steps 5 to 7).

Special tools



001 589 66 21 00



601 58902 4000

Note
The flywheels of the engines 103.94 and 103.98 differ in their dimensions and weights.

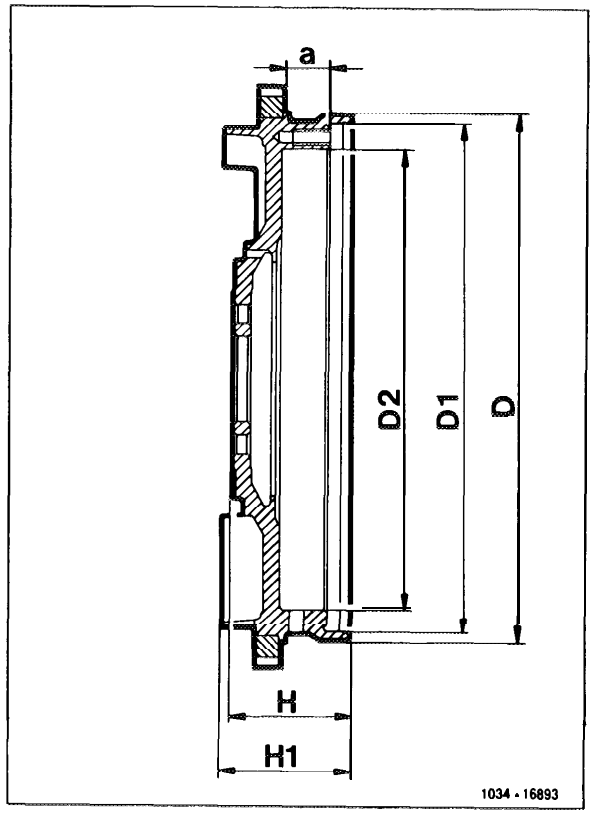
Distinguishing characteristics')

Engine	D	D2	H	H1	a
103.94	272.0	237	55.5	61.5	24.8
103.98	**277.5**	**244**	**60.2**	**66.2**	**27.5**

[1]) **except cars with** 4MATIC.

Flywheel and driven plate are guided on the crankshaft with fit holes and located each with a fit pin.

Flywheel or driven plate with ring gear are balanced individually and can be replaced without balancing.



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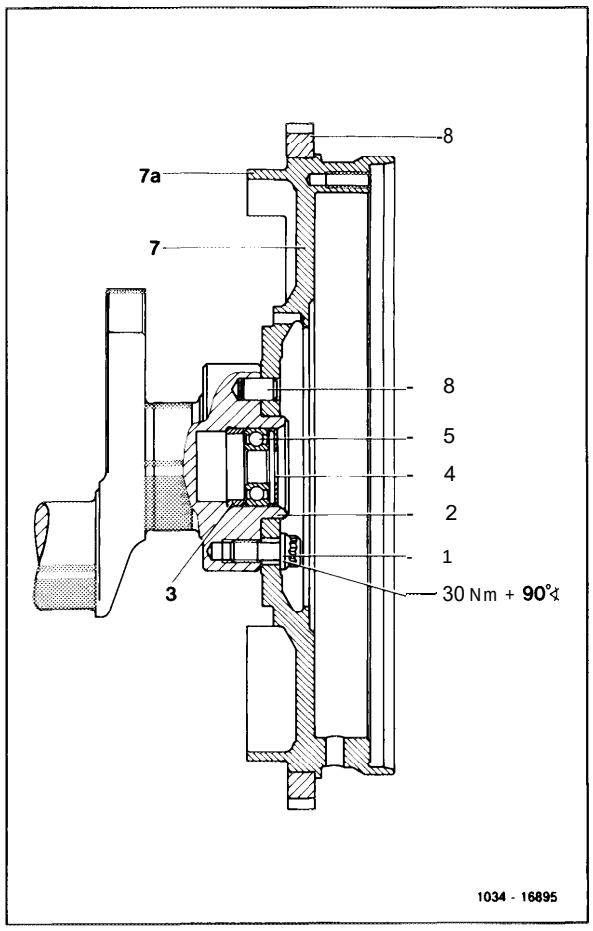
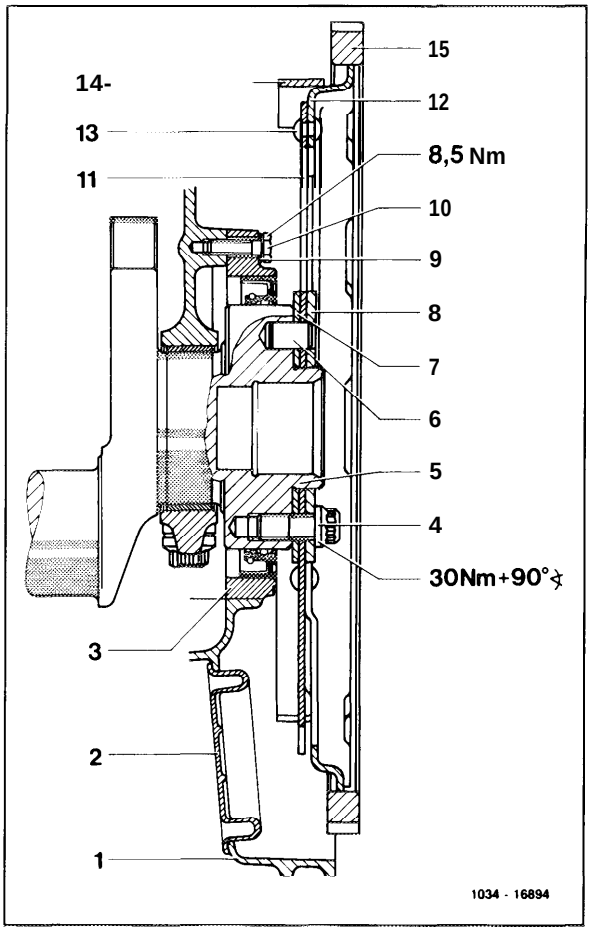


Arrangement on manual transmission

1 Stretch bolt MI 0 x 1 x 22
2 Crankshaft
3 Spacer ring
4 Closing cover
5 Grooved ball bearing
6 Fit pin
7 Flywheel
7a Segment
8 Ring gear



Arrangement on automatic transmission

1 Oil sump
2 Cover
3 Closing cover with radial seal
4 Stretch bolt M 10 x 1 x 22
5 Crankshaft
6 Fit pin
7 Disk 2.6 mm (stuck on)
8 Disk 3.5 mm
9 Washer
10 Bolt
11 Driven plate
12 Ring for ring gear
13 Rivet
14 Segment
15 Ring gear

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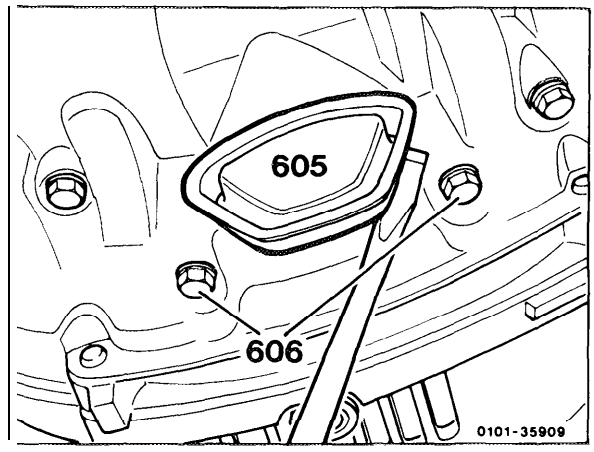
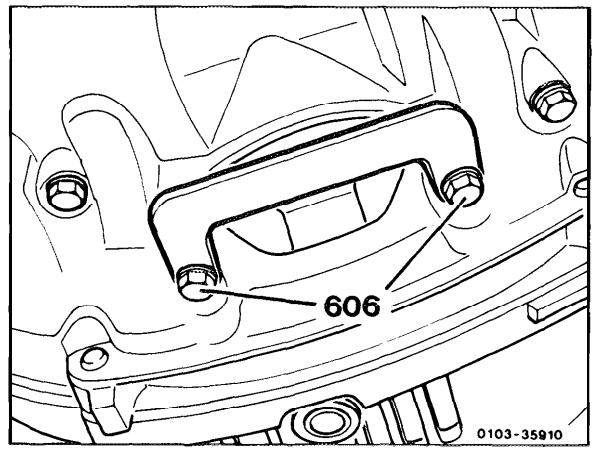
1 Take off plastic cap (605) on rear of oil sump. Unscrew bolts (606).

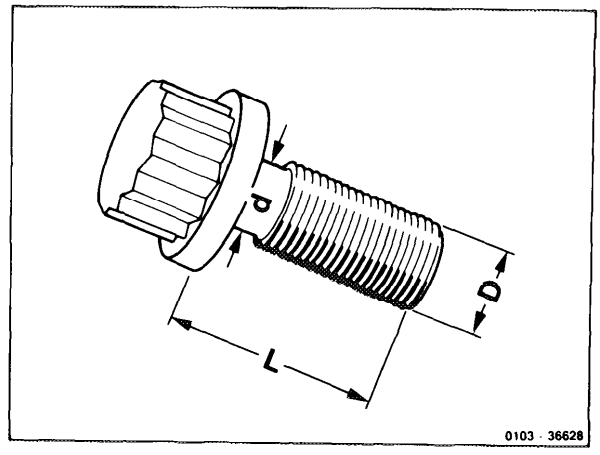


2 Fix retaining lock 601 589 02 40 00 with both bolts (606). Pins on the retaining lock must engage in the ring gear teeth.

3 Unscrew stretch bolts. Take off flywheel (321) or driven plate (320) with stuck-on disk and disk (324).



4 Check stretch bolts, measure diameter of stretch bolt shaft and length of bolts. If the specified minimum dia. «d» on the stretch shaft or if the maximum bolt length «L» is reached, the bolts must be renewed.



Thread	D		M10 × 1
Stretch shaft Ø	d	When new	8.5 – 0.2
		Minimum Ø	8.0
Bolt length	L	When new	22 ± 0.2
		Max. bolt length	22.5

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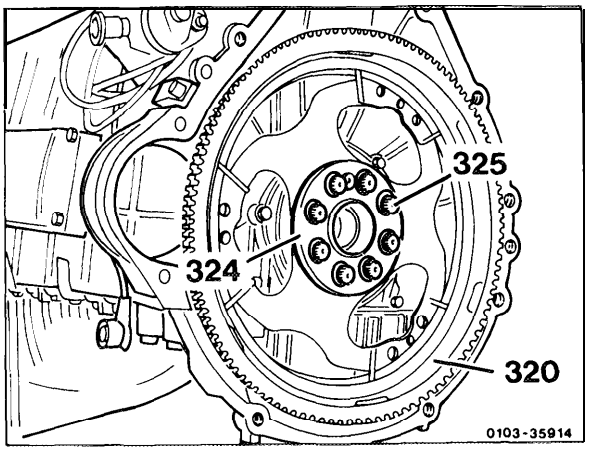
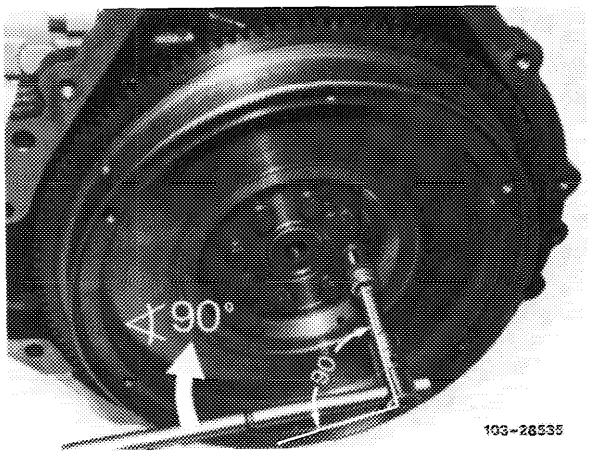
5 Attach flywheel or driven plate and ring gear (320) with stuck-on disk and disk (324).

6 Screw in stretch bolts (325) and tighten with initial tightening torque of 30 Nm.



7 Torque stretch bolts (325) on in a single step by the specified angle of rotation torque of 90°.
Do not use a torque wrench in order to rule out any possible angle error.



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03-420 Machining Flywheel

Job No. of job texts and job values or standard texts and flat rates 03-8022

Engine (except 103.984 and 103.985)		103.98	103.94
Distance a		25.4 + 0.2	19.4 ± 0.1
Distance b	when new	15.2 ± 0.4	16.6 ± 0.4
	for repairs up to	14.2 ± 0.4	15.6 ± 0.4
Permissible variation in concentricity on clutch face or clutch flange face		0.05	0.05

Note

Flywheels for manual transmission which have scorch points, scoring or cracking in the clutch face, should be machined by precision-turning.

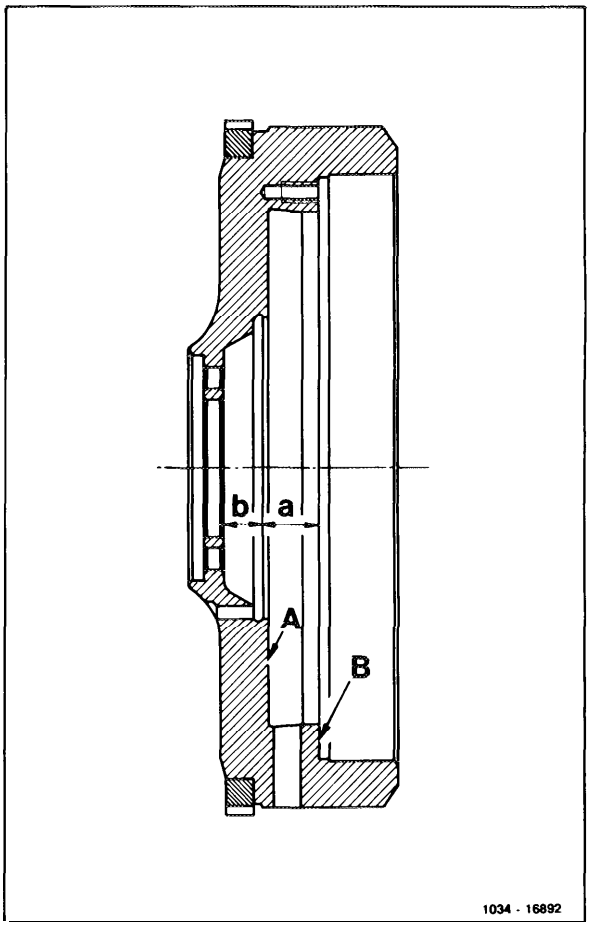
If the grooves or cracks are deeper than the maximum permissible stock removal, the flywheel must be renewed.

If the clutch face «A» is machined, the mounting face «B» must also be machined by the same amount in order to maintain the distance «a».

Size «b» must be maintained as a minimum size when performing repairs.

The flywheel must be properly clamped for machining to ensure that the permissible variation in concentricity of 0.05 mm is not exceeded.

Following machining, the clutch face must not have any shrinkholes or chatter marks.



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Job No.

Removing, installing camshaft . . . . . 05 – 220
Removing, installing valve springs . . . . . – 250
Renewing valve stem seals . . . . . – 270
Removing, installing chain tensioner . . . . . - 310
Renewing timing chain . . . . . – 320
Removing, installing tensioning rail . . . . . – 330
Removing, installing guide rail . . . . . – 335
Removing, installing crankshaft gear . . . . . – 460

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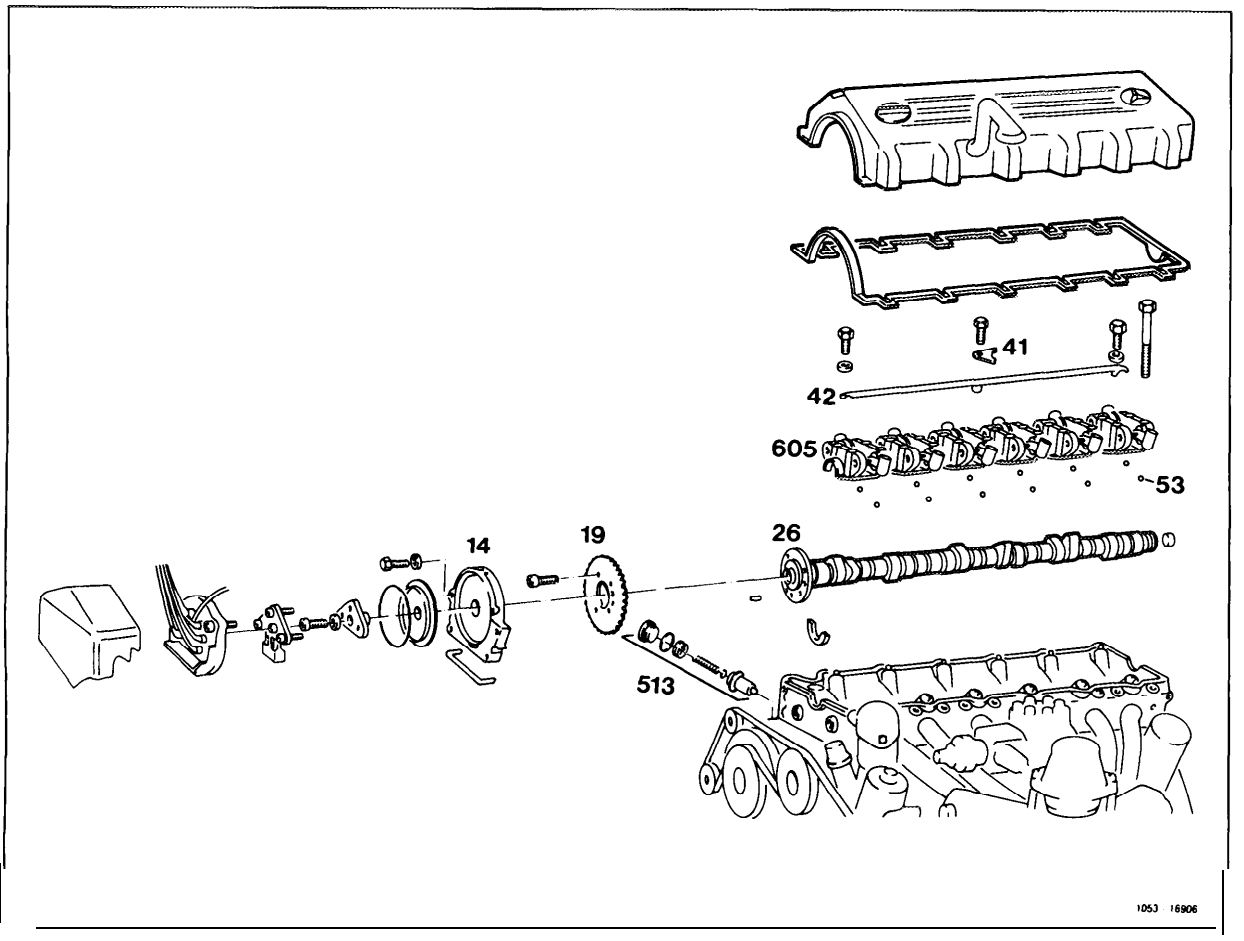
05-220 Removing, Installing Camshaft

Job No. of job texts and job values or standard texts and flat rates ..... 05-5521, 05-5541 05-6292 - 05-7050



Piston of No. 1 cylinder	set to TDC (step 1).
Front cover (14) at top	remove, install (01-212).
Chain tensioner (513)	remove, install (05-310).
Camshaft gear (19)	mark relative to camshaft (26), detach, attach. Tightening torque M6 - 11 Nm, M7 - 16 Nm (step 4).
Oil pipe (42)	remove, install. Pay attention to oil spray holes. Install only oil pipe 2nd version with retaining plate (41) (steps 7 and 8).
All rocker arm bearing brackets (605) with rocker arms	remove, install, 21 Nm (step 9).
Ball sockets (53)	take off, insert (step 10).
Cam and rocker arm sliding surfaces	oil.

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In the reverse order	install.
Setting of camshaft (26)	check (steps 16 and 17).
Camshaft lubrication when engine running	check (step 18).

Permissible test data

		When new	Wear limit
Camshaft bearing Ø	Normal size	30.934 – 30.950 mm	–
	Repair size	31.434 – 31.450 mm	–
Permissible variation in concentricity of middle bearing points and of camshaft gear seat when mounted in outer bearing points	Camshaft gear seat	**0.025** mm	–
	Bearing point 2, 3, 4	0.030 mm	
Camshaft bearing play	radial	0.050 – 0.091 mm	0.11 mm
	axial	0.030 – 0.110 mm	0.15 mm
Scleroscopic hardness of cams		70 – 82	63

Timing in °CA at 2 mm valve lift

Code number of camshaft stamped on front of camshaft flange	Inlet valve		Exhaust valve	
	opens after TDC	closes after BDC	opens before BDC	closes before TDC
18, 36[2]) 19[1]), 37[1])[2])	11.5” (12”)	17.0”	18.5”	13.5”
22[3]), 42[4]), 49[5]) 23[1]),[3])43[1])[4]), 50[1])[5])	11.5” (12°)	19.5”	21.5”	13.5”
20 Belgium 115 kW (power-reduced) 21’)	16° (16.5”)	0.5”	19.0”	14.5”
30[3]), 44[4]), 56[5]) 31 [1])[3]),45[1])[4]),57[1]),[5])	**6.5”** (7°)	14.0”	26.5”	18.5”
53[6]) 54’)“)	**16.5”** (17”)	**24”**	21.5”	13.5”

[1]) Repair camshaft with 0.5 mm larger bearing diameter.
[2]) USA 1986.
[3]) Installed since May 1986 (M7 thread) for mounting camshaft gear.
[4]) Camshaft tin-coated, cam 1 mm wider, standard as from October 1986.
[5]) Chilled cast camshaft, as from February 1989 (follower mounting Ø 20 mm).
[6]) 103.984 as from March 1989 (follower mounting Ø 20 mm).
Settings for used timing chains in parentheses.

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Note

If the camshaft is renewed, the rocker arms must also be renewed.

Inductively hardened camshafts must only be used with hard chrome-plated rocker arms (standard up to February 1989).

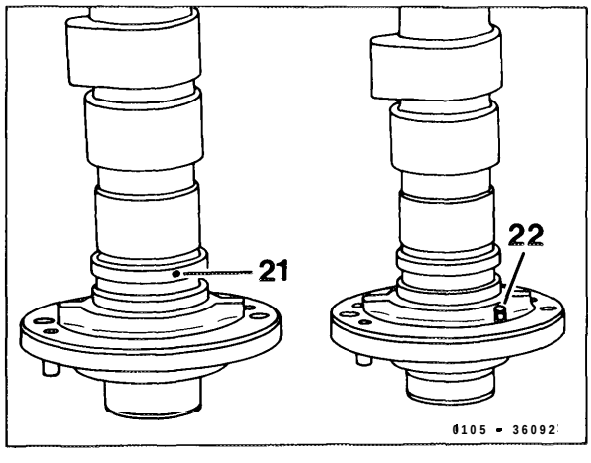
Chilled cast camshafts may only be used with rocker arms with carbide metal coating (standard as from March 1989).

If bearing fretting or severe scoring exists, the camshaft bearings can be drilled open by 0.5 mm in the cylinder head or in the rocker arm bearing brackets and a camshaft with oversized bearing journals installed.

After damage to a cam (e. g. worn cams), all the affected timing parts (hydraulic elements, valves, valve springs, valve plates and valve wedges) should be checked for signs of damage.

If individual rocker arm bearing brackets are renewed, all the bearing brackets must be tightened to specification and the camshaft checked to ensure that it moves freely.

A positioning hole (21) is provided in place of the pin (22) as from December 1986.



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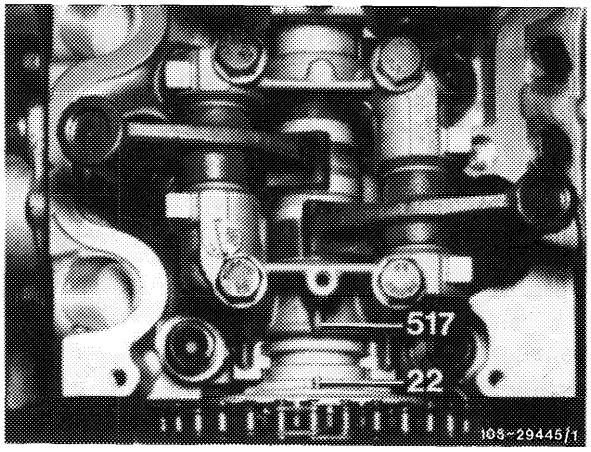
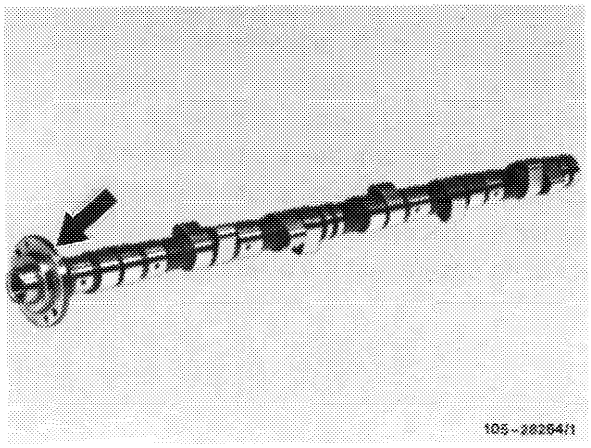
Basic setting

With No. 1 cylinder in TDC position, the pin (22) or the positioning hole (21) in the camshaft flange must be opposite the cast marking (517) on the 1st bearing bracket.



The camshaft code number is stamped in the flange (arrow).

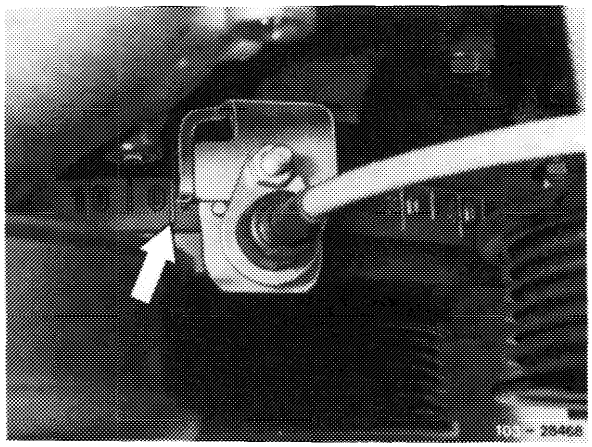


Removal, installation

1 Set piston of No. 1 cylinder to TDC (arrow).

2 Remove front cover at the top (01-212).

3 Remove chain tensioner (05310).



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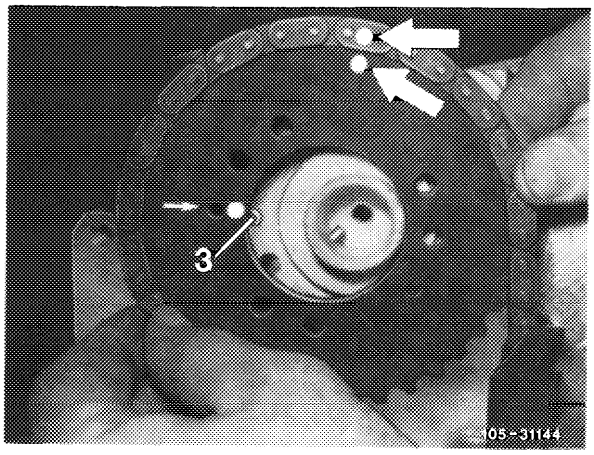
4 Mark position of camshaft gear relative to camshaft. This is done by applying colored marking next to the locating pin (3) on the camshaft gear.



Note
If the camshaft gear is renewed, the colored marking must be applied to the corresponding point on the new camshaft gear.

The camshaft gear with 3 oblong holes (1st version) should be renewed if performing repairs with the camshaft gear 2nd version with 3 holes 0 6 m m .

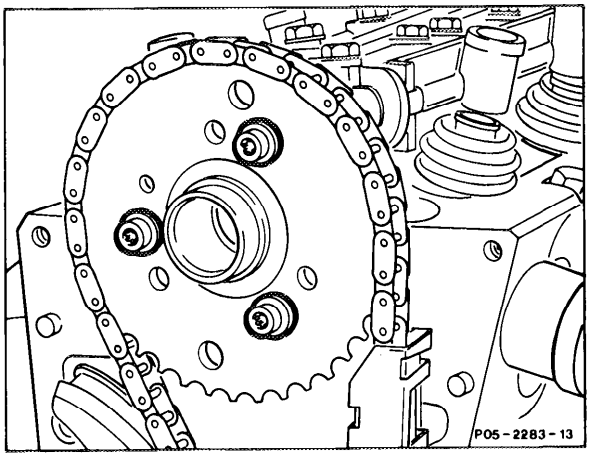
The camshaft gear 2nd version can be used when performing repairs in place of the camshaft gear 3rd version with 3 holes Ø 7 mm. In this case the 3 holes should be widened from Ø 6 mm to Ø 7 mm.

The timing can be set by turning or changing the side of the camshaft gear on the camshaft (05215).

5 Unscrew bolts (16).

Tightening torque:

I-lex. socket bolts	M6 11 Nm
Tom bolts	M7 16Nm



6 Pull off camshaft gear (19) by hand.

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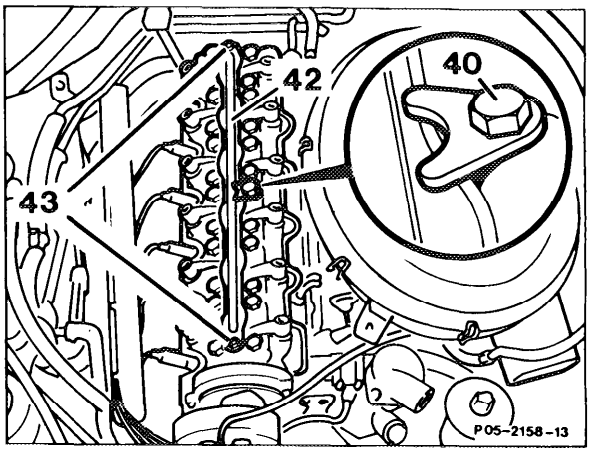
7 Unscrew bolts (40, 43). Take off oil pipe (42).



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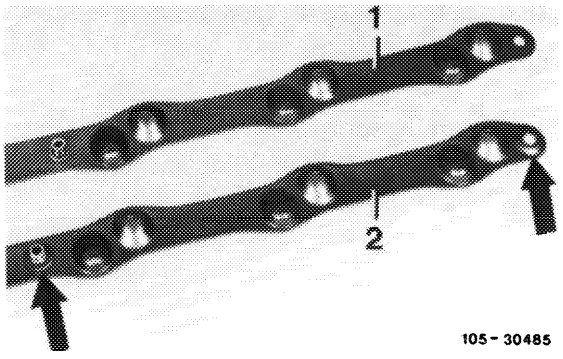
The shaped edge of the oil spray holes on the oil pipe must not be misshaped otherwise this will affect the spray direction.

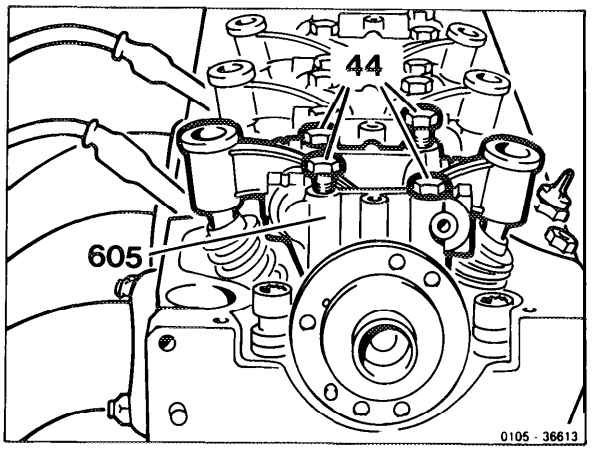
The oil pipe (42) for lubricating the camshaft is attached additionally with a retaining plate (41) and a bolt (40) without washer on the 3rd rocker arm bearing bracket at the rear hole (inlet manifold side) since October 1986.

8 Check whether 1st or 2nd version of the oil pipe is installed.



The 1 st version (1) must be replaced with the 2nd version (2), standard as from October 1986, and bolted on additionally to the 3rd rocker arm bearing bracket with a retaining plate (41).

9 Unscrew bolts (44) in such a way that the rocker arm bearing bracket (605) is not tensioned, tightening torque 21 Nm.



Note
The rocker arm bearing brackets must be installed again at the same point and at the same attitude.

Use rocker arm 1st version with 3 mm wide reinforcing rib only with camshafts which are not chill cast.

Use rocker arm 2nd version with 1.5 mm wide reinforcing rib only with chilled cast camshaft. The 2nd version of rocker arms have soldered-on carbide metal running surfaces.

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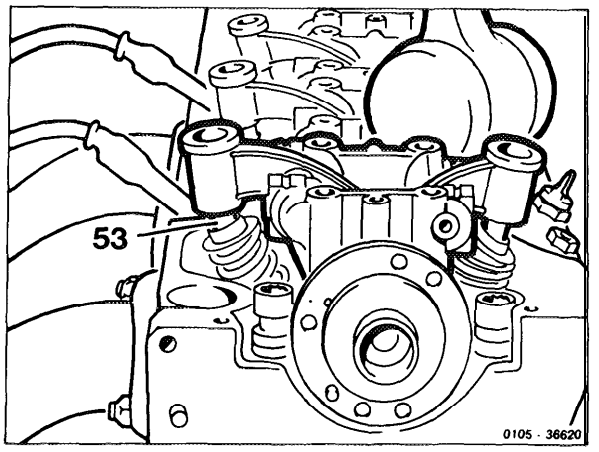
10 Remove all rocker arm bearing brackets. (Slacken tight rocker arm bearing brackets with light blows from a plastic-headed hammer).



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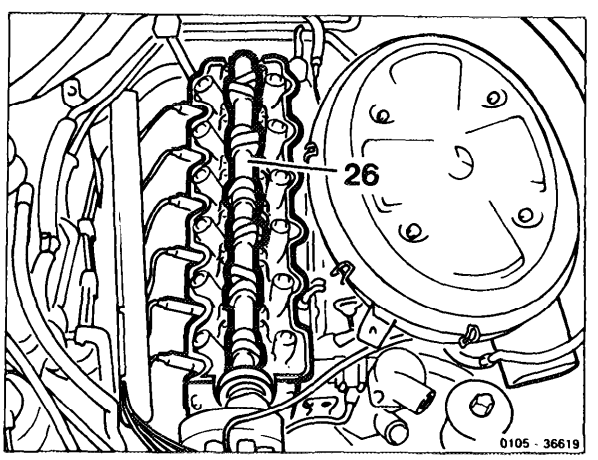
When taking off the rocker arm bearing brackets, the ball sockets (53) may catch on the hydraulic valve clearance compensating elements.

Installation instruction

The ball sockets must be installed again at the same point.

11 Take off ball sockets (53).

12 Lift out camshaft (26).



Note

When lifting out, pay attention to the thrust washer at the front (axial mounting).

13 Oil camshaft bearing journals.

14 With No. 1 cylinder in TDC position, insert camshaft so that the pin (22) or the positioning hole (21) is facing up the way.

15 Oil cam and rocker arm sliding surfaces.

16 Fit on all rocker arm bearing brackets. Screw in all bolts by hand and tighten evenly, tightening torque 21 Nm.

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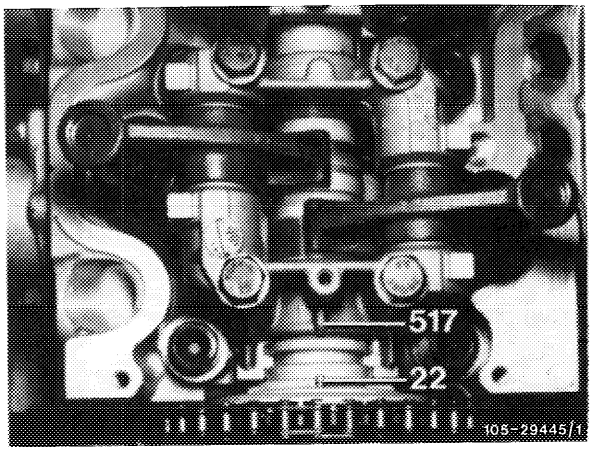
17 Pin (22) or positioning hole on 1st camshaft flange must be aligned with the marking (517) when No. 1 cylinder is in the TDC position.



18 Check the oil supply (spray direction) of the camshaft at idling speed.

Note
If damage to a camshaft has been caused by a lack of oil resulting from a loose oil nozzle return lock without stop collar, an oil nozzle return lock with stop collar must be installed (standard as from December 1986) (18-415).

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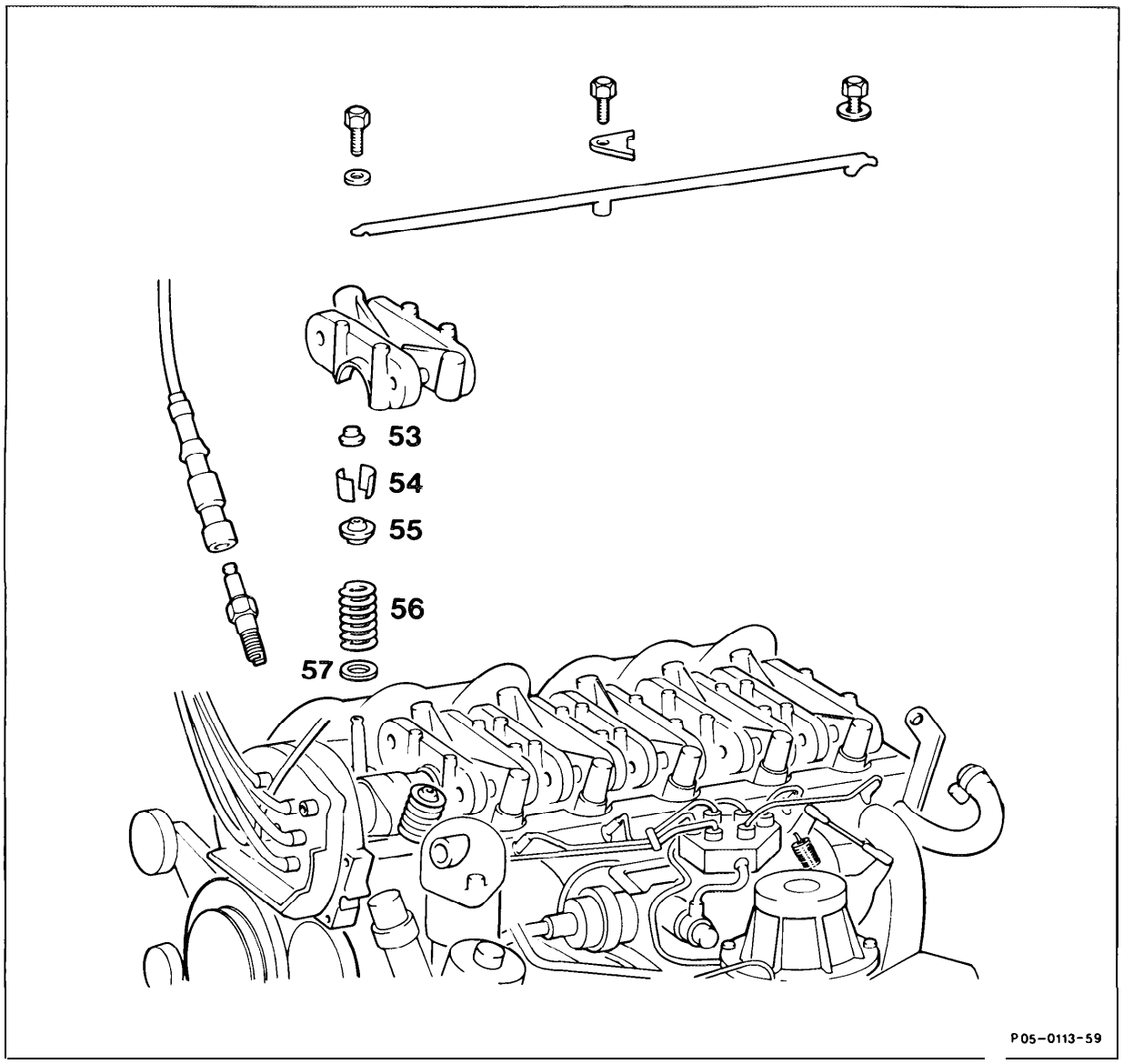
Job No. of job texts and job values or standard texts and flat rates 05-3510



Rocker arm bearing bracket of respective cylinder	remove, install.
Ball sockets (53)	take off, insert, use magnetic finger 116 589 06 63 00 (step 2).
Piston of respective cylinder	set to TDC (step 3).
Supporting bracket 103 589 00 61 00	install (step 4).
Respective cylinder	pressurize (steps 5 to 7).

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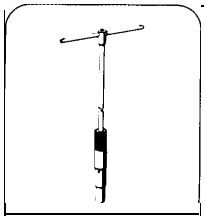
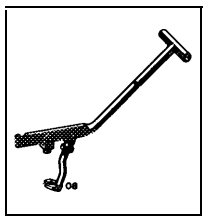
Valve collet halves (54), valve spring plate at top (55), and valve springs (56) ..... remove, install, use lever pusher 601 589 02 61 00 (steps 8 to 10).

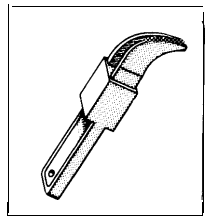
Special tools



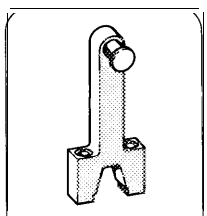
10258901 0900



601 589 02 61 00



116589066300



103 589 00 61 00

Note

Valve springs, top and bottom valve spring plates with scoring on the contact surfaces must be replaced.

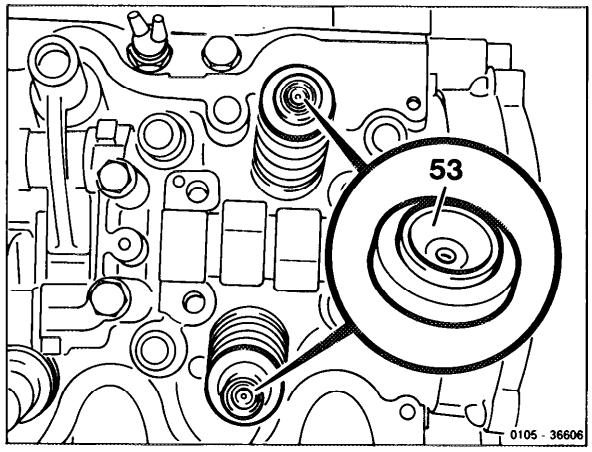
Commercial tool

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

Removal, installation

1 Remove rocker arm bearing bracket of the respective cylinder (05-235).

2 Take out ball sockets (53) using magnetic finger 116 589 06 63 00.



Installation instruction

Ball sockets must be re-installed again at the same point.

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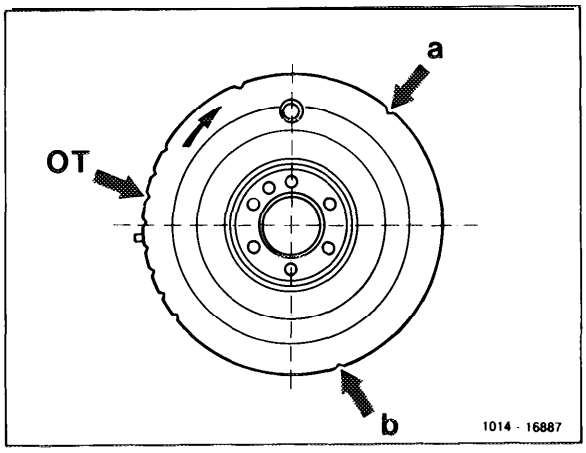
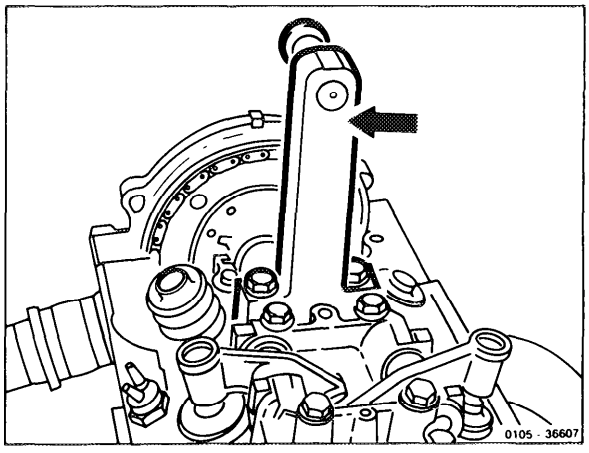
3 The respective pistons are in ignition TDC position when the marking shown in the drawing opposite (arrows) on the flywheel damper are aligned with the TDC pointer and the cams of the respective cylinder are facing up the way.

Marking	TDC	b = 120	a = 2 4 0
Piston in TDC Cylinder	1 and 6	2 and 5	3 and 4



4 Screw supporting bracket (arrow) 103 589 00 61 00 onto cylinder head.



5 Detach spark plug connector of the respective cylinder. Blow out spark plug recesses with compressed air.

6 Unscrew spark plug.

Installation instruction
Tighten spark plugs to 20 Nm.

7 Screw connection hose of cylinder leaktightness tester into the spark plug hole and pressurize compression chamber (approx. 5 bar).

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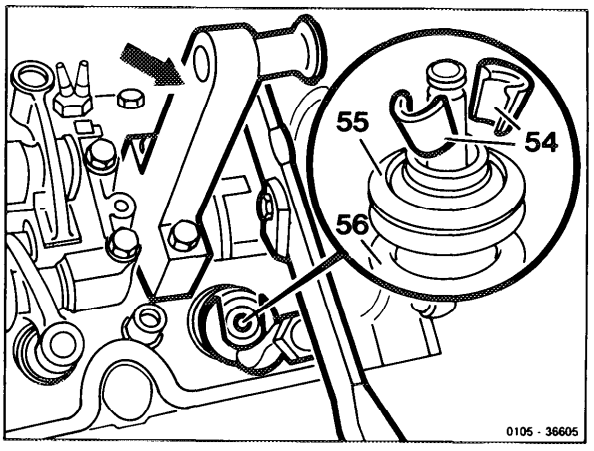
8 Attach lever presser 601 589 02 61 00 to the supporting bracket (arrow) and place against valve spring plate (55).
Detach the valve collet halves (54) with light blows to the valve spring plate (55).



9 Compress valve spring and remove valve collet halves (54) with magnetic finger 116 589 06 63 00.

10 Take out valve spring plate (55), valve spring (56).

Note
The valve spring plates and valve springs of the exhaust and inlet valves are identical.

Install in the reverse order.

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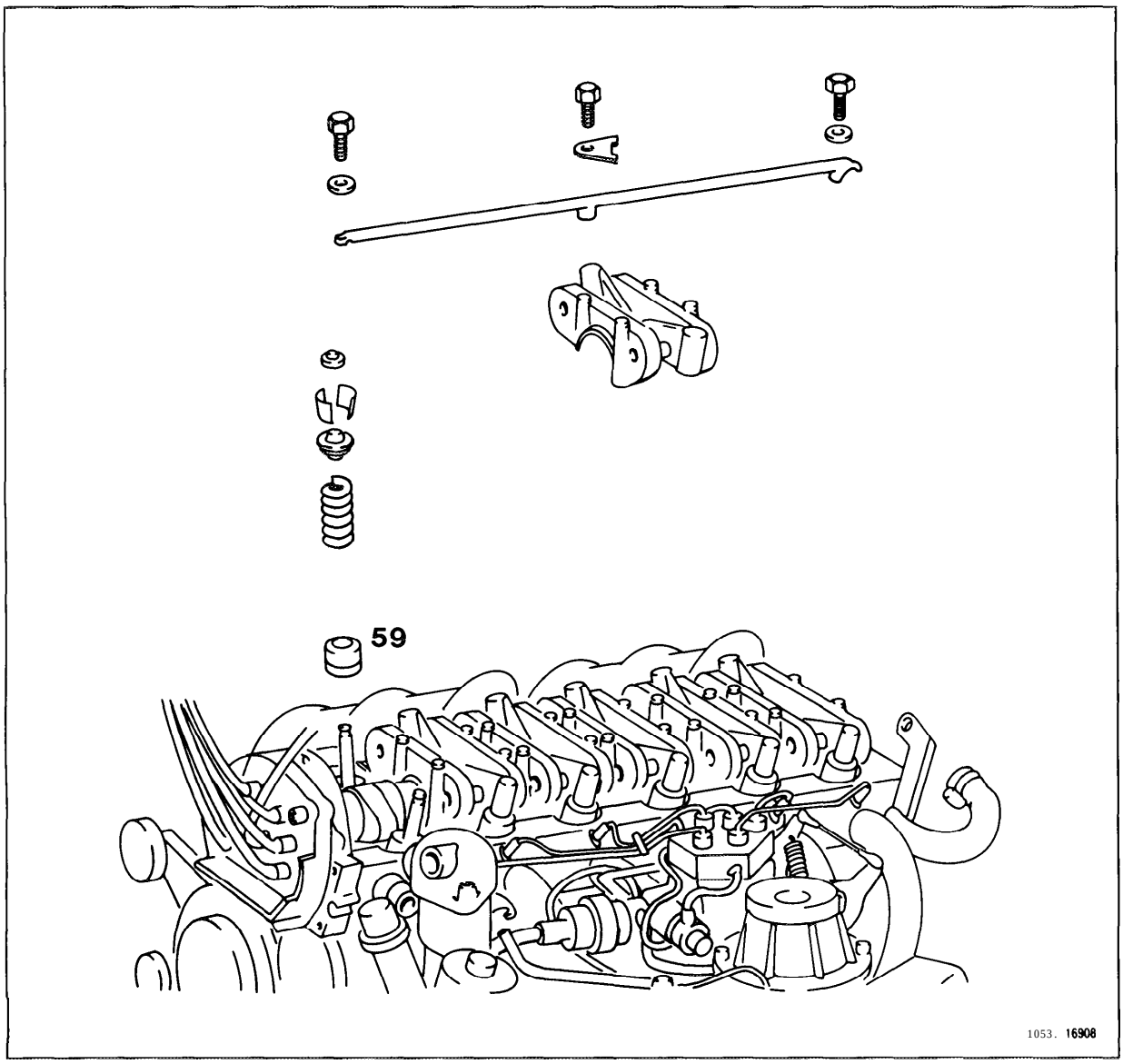
05-270 Renewing Valve Stem Seals

Job No. of job texts and job values or standard texts and **flat rates** **05-3510**



Valve springs	.....	remove, install **(05-250).**
Valve stem seals (59)	.....	remove, install.
Valve stem	.....	deburr, if necessary.

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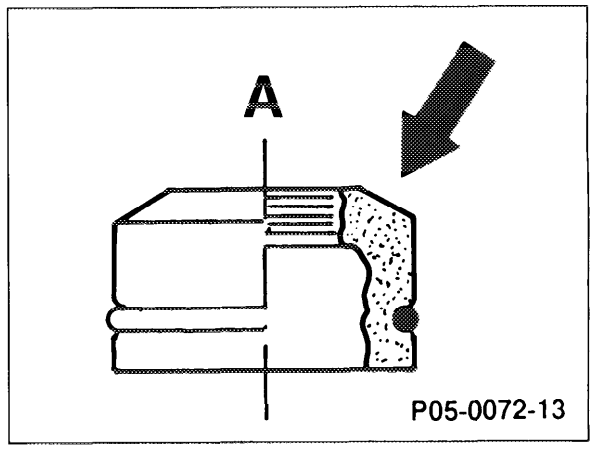
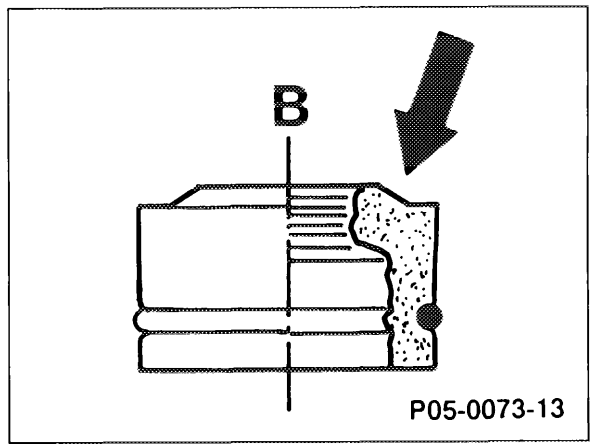
Valve stem seal identification	Part No.	Color	
Repair kit Exhaust 0 9 m m	102 053 03 58	bright zinc-coated (yellow)	
Repair kit Inlet 0 8 mm	103 053 16 58	phosphatized (black)	

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Note
Exhaust and inlet valve stem seals and assembly sleeves are supplied as a repair kit.
The assembly sleeves must be used to prevent the valve stem seals from being damaged.

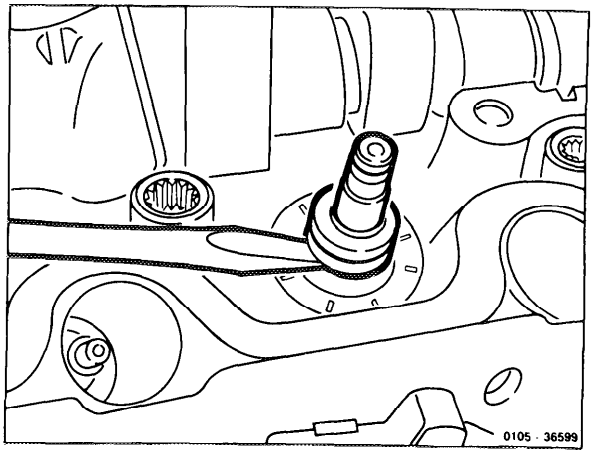
Valve guides which are worn at the retaining slot for the valve stem seals and valves with damaged valve ends or valve stem must be renewed.

Renewal

1 Remove valve springs (05250).

2 Use a screwdriver to press off valve stem seal or pull off with pliers.

Do not damage cylinder head, valve stem and valve guide.



3 Fit assembly sleeve onto the valve stem on the inlet valve.

4 Oil valve stem seal and press on by hand.

Pay attention to matching of different valve stem seals as shown in table.

Install in the reverse order.

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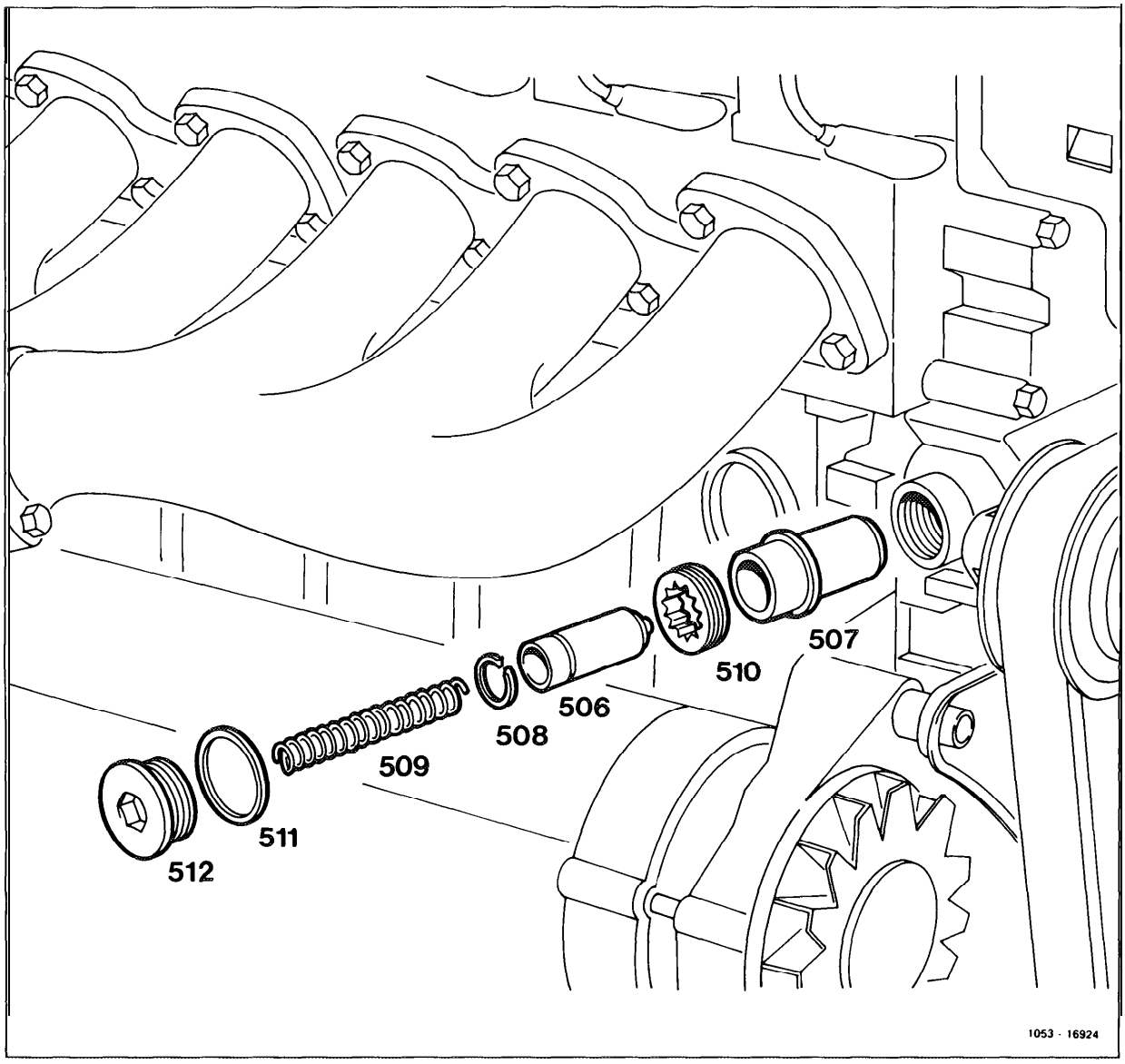
05-310 Removing, Installing Chain Tensioner

Job No. of job texts and job values or standard texts and flat rates **05-7800, 05-7801**



Hood	raise to vertical position (01-008).
Screw plug (512) with seal (511) and compression spring (509)	unscrew, take out (step 1).
Threaded ring (510)	unscrew (step 2).
Chain tensioner housing (507) with pressure pin (506)	withdraw (step 3).
Pressure pin (506) with detent spring (508)	press out of chain tensioner housing (507) in direction of pressure (step 4).

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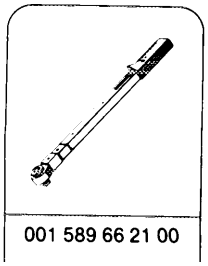
Chain tensioner housing (507) into mounting hole	insert (step 5).
Threaded ring (510)	screw in, tighten, 30 Nm (step 6).
Pressure pin (506) with detent spring (508) and compression spring (509)	insert (step 7).
Screw plug (512) with seal (511)	screw in, tighten, 50 Nm (step 8).
Leaktightness	check.

Special tool



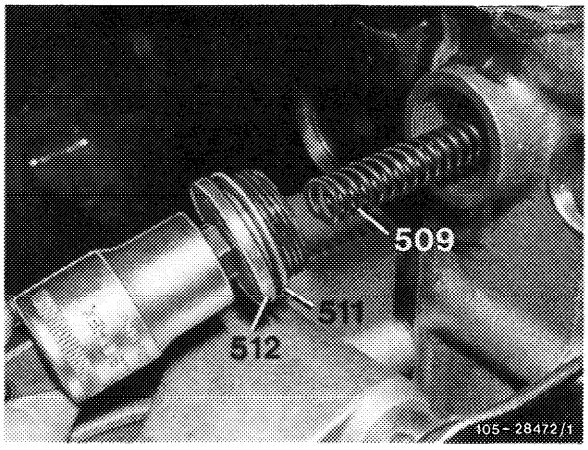
Commercial tools

Pin wrench insert 17 mm, 1/2" square	e. g. Hazet, D-5630 Wemscheid Order No. 985/17
Pin wrench insert 12 mm, 1/2" square	e. g. Hazet, D-5630 Wemscheid Order No. 985/12

Removal, installation

1 Unscrew plug (512) with seal (511). Take out compression spring (509).

⚠ The screw plug is pressurized by the compression spring.



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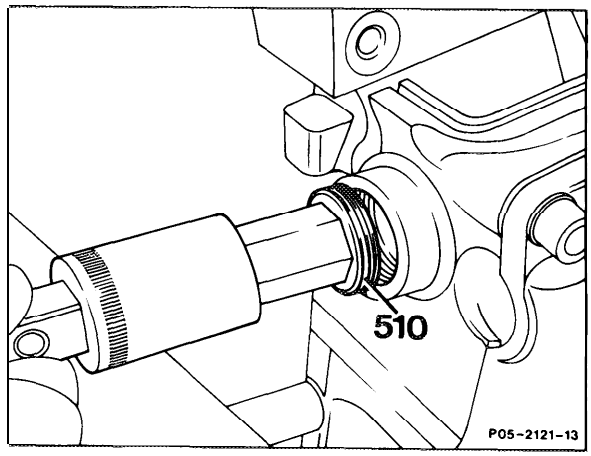
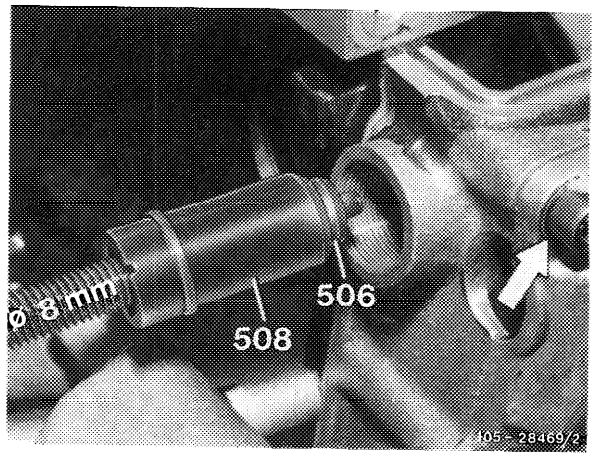
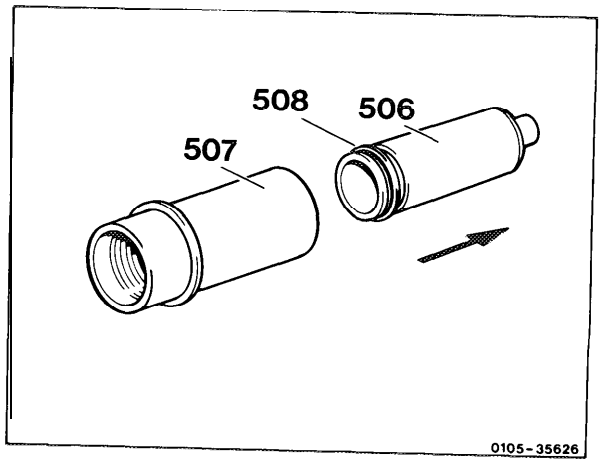
2 Unscrew threaded ring (510).



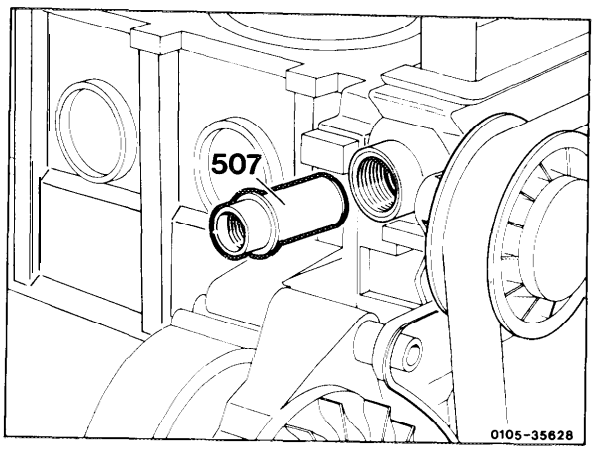
3 Withdraw chain tensioner with the aid of an M8 bolt.
The M8 bolt cannot be screwed in but should only be angled.
If it is not possible to withdraw the chain tensioner, slacken hex. socket bolt (arrow).
With the cylinder head cover removed, press with the handle of a hammer on the tensioning rail.



4 Chain tensioner must be disassembled before installing. This is done by pressing the pressure pin (506) with detent spring (508) out of the chain tensioner housing (507) in direction of arrow.
Thoroughly clean all parts.



5 Insert chain tensioner housing (507) into mounting bore.



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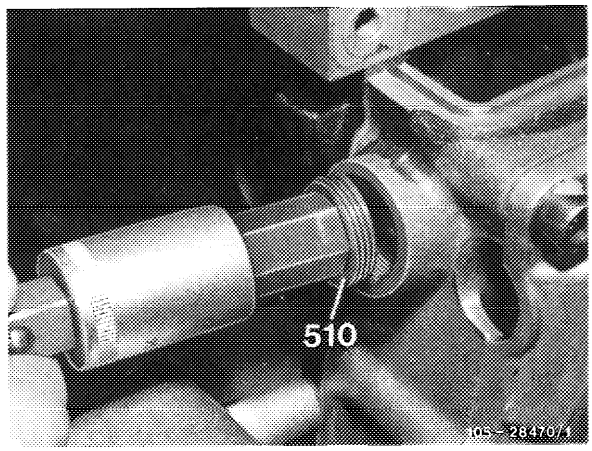
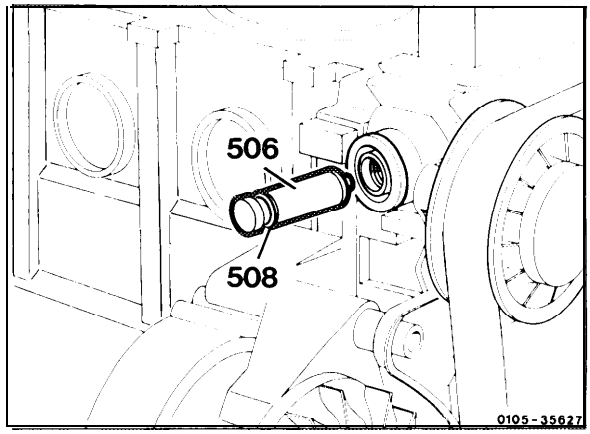
6 Screw in threaded ring (510), tightening torque 30 Nm.

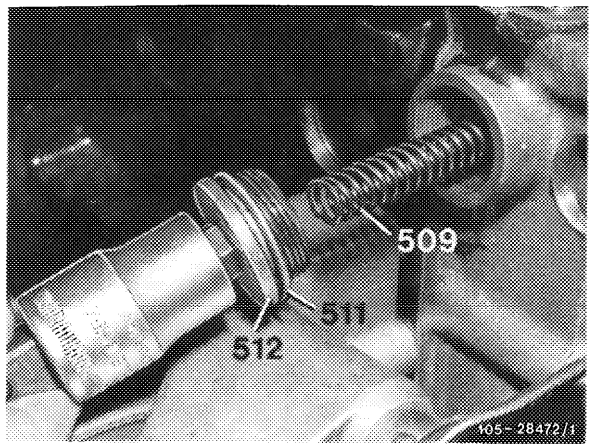


7 insert pressure pin (506) with detent spring (508) into the assembled chain tensioner housing.



8 Install compression spring (509) and screw plug (512) with new seal (511). Tighten screw plug (512) to 50 Nm.

9 Run engine and check for signs of leaks.



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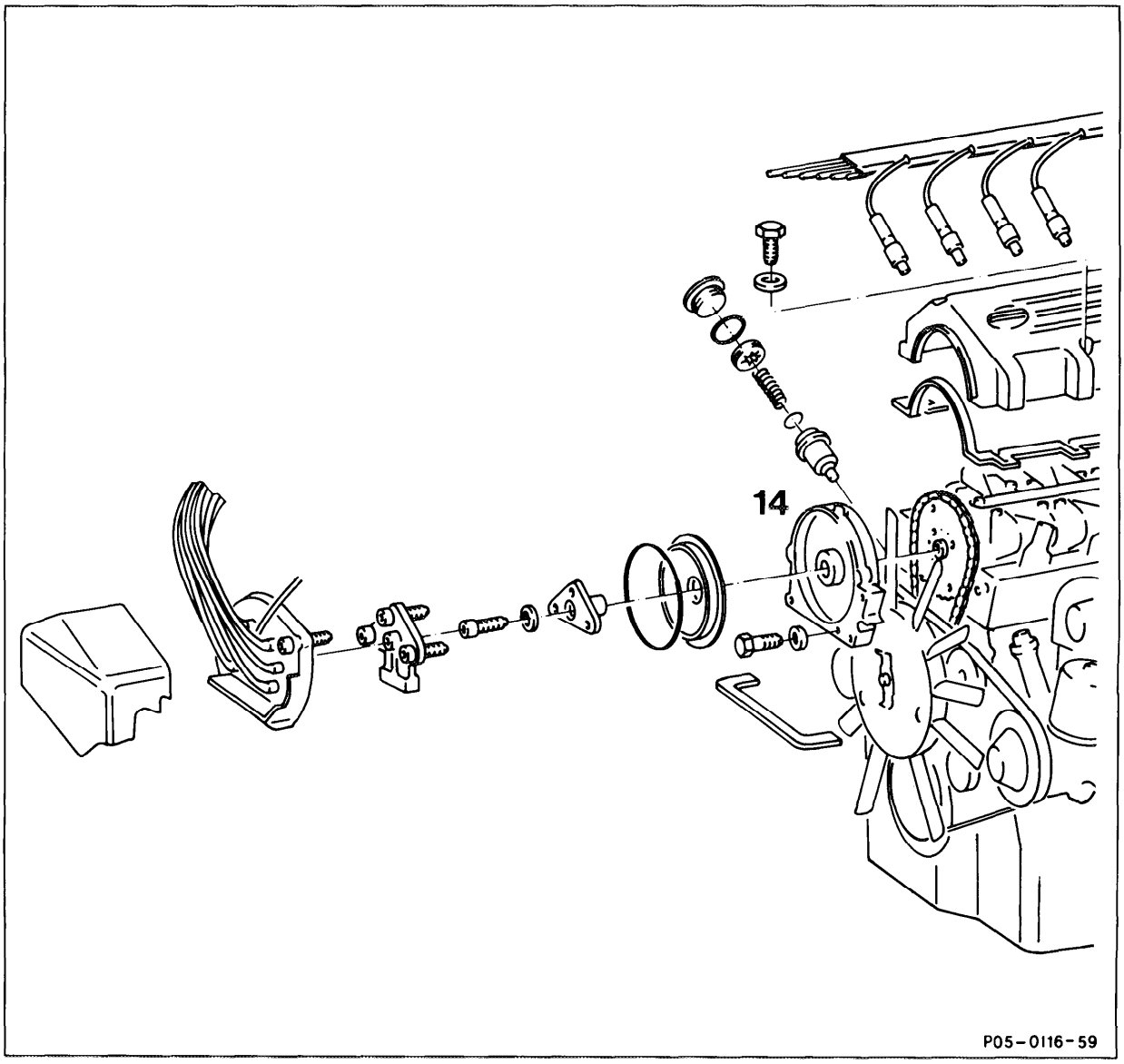
05-320 Renewing Timing Chain

Job No. of job texts and job values or standard texts and flat rates 05-7601



Front cover at top (14)	remove, install (01-212).
Chain tensioner	remove, install (05310).
All spark plugs	remove, install, 20 Nm (steps 3 to 5).
Chain pin	grind open (step 6).
New timing chain to old timing chain	connect, draw in (step 7 to 9).
New timing chain with rivet link	connect (step 10).
Plate	103 589 01 63 00, insert in rivet tool 000 589 58 43 00, press on (steps 13 to 15).

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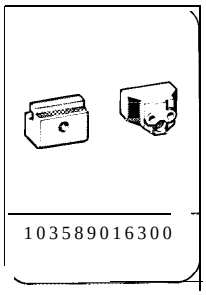
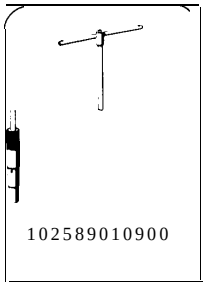
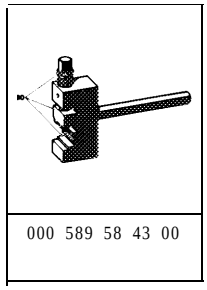
Rivet tool ..... take off, change over (step 16).
Individual pins of rivet link rivet, 30 Nm (steps 17 and 18).

Special tools







1 Remove front cover (14) at top (01-212).

2 Remove chain tensioner (14) (05310).

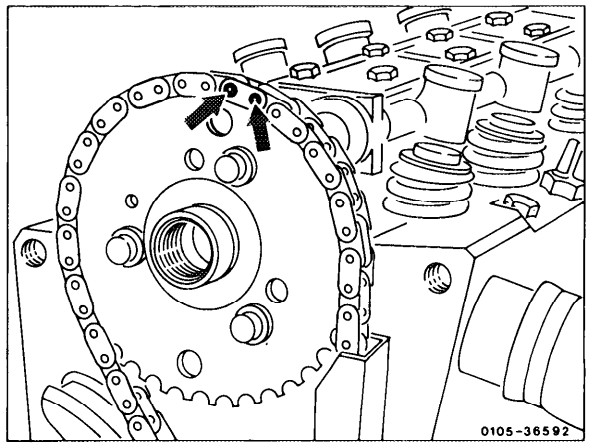
3 Detach all spark plug connections.

4 Blow out spark plug recesses with compressed air.

5 Unscrew all spark plugs, tightening torque 20 Nm.

6 Cover over the exposed part of the chain box with a clean cloth and grind open both chain pins (arrows) **at a double link** of the timing chain.

7 Attach new timing chain with the rivet link to the old timing chain.
This is done by pressing out the ground open double link.



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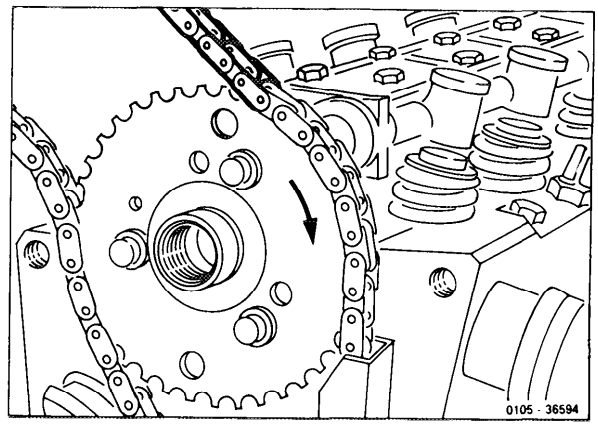
8 Fit new timing chain connected to old timing chain onto the camshaft gear. Slowly turn crankshaft in direction of rotation of engine.

⚠

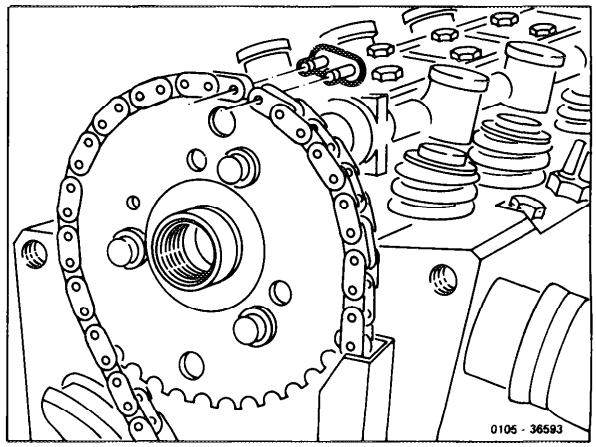
The timing chain must remain meshed when turning the camshaft gear.



9 Pull out the exposed end of the old timing chain evenly corresponding to the new timing chain being drawn in.

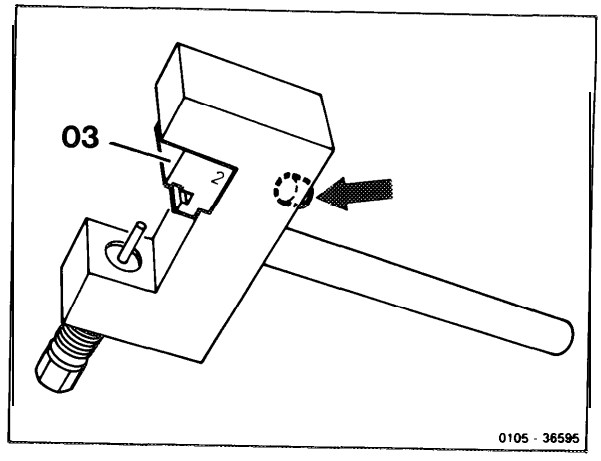
10 Turn crankshaft long enough for it to be possible to connect the ends of the new timing chain to the rivet link.

Note
Rivet link must be inserted from behind.



11 Insert thrust piece (03) as shown in drawing into the rivet tool and tighten with the screw (arrow).

Note
The figure 2 is stamped on the side of the thrust piece (03).



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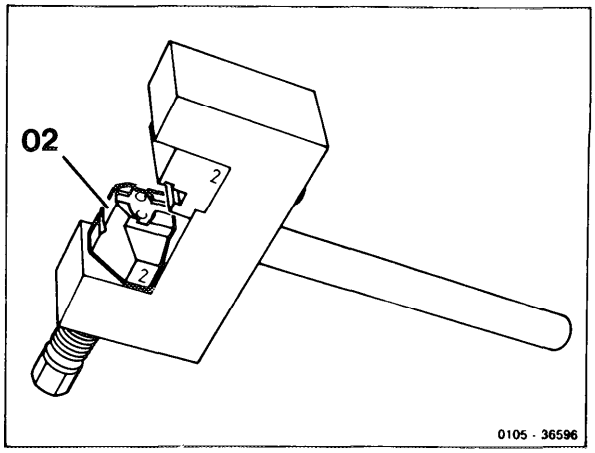
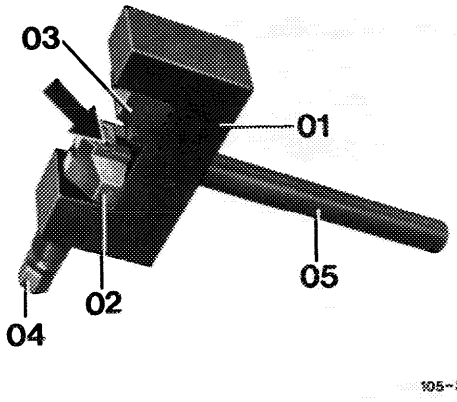
12 Insert moving jaw (02) with the figure 2 into the rivet tool as shown in the drawing.

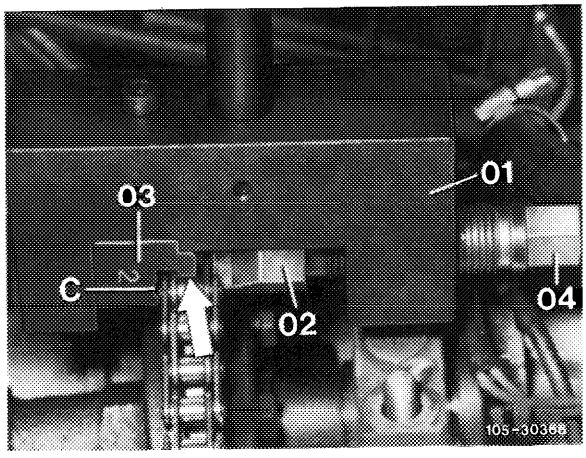


13 Insert plate (arrow) into the moving jaw (02).



14 Fit web (arrow) onto both rollers on the rivet link.

Note
Rivet heads of the rivet link pins must be guided in the slot (C).



15 Screw in spindle (04) until a firm resistance is felt.

Note
When screwing in, ensure that the pins of the rivet link can be guided into the holes of the plate.

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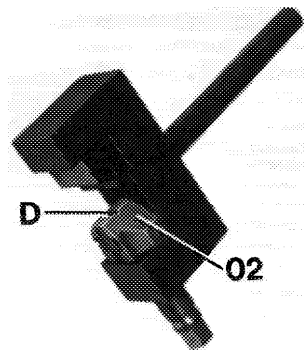
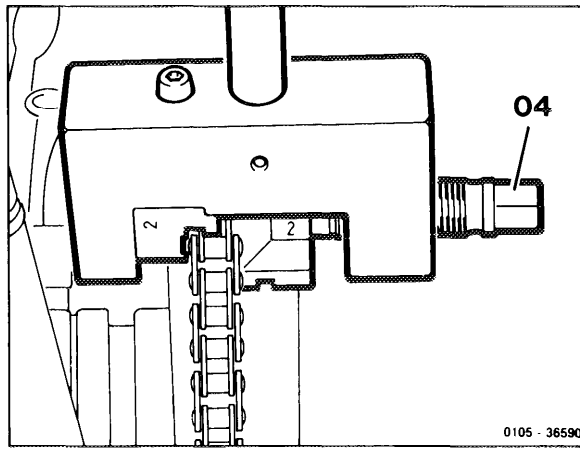
16 Take off rivet tool and change over the moving jaw (02) to the rivet profile (D).



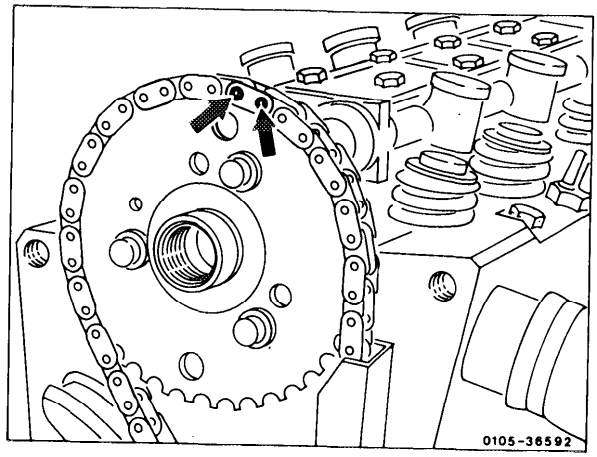
105-30367

17 Position rivet tool exactly over center of pin. Rivet pins of the rivet link individually by tightening the spindle (04) to approx. 30 Nm.



18 Check riveting (arrows), re-rivet if necessary.

19 Install in the reverse order.



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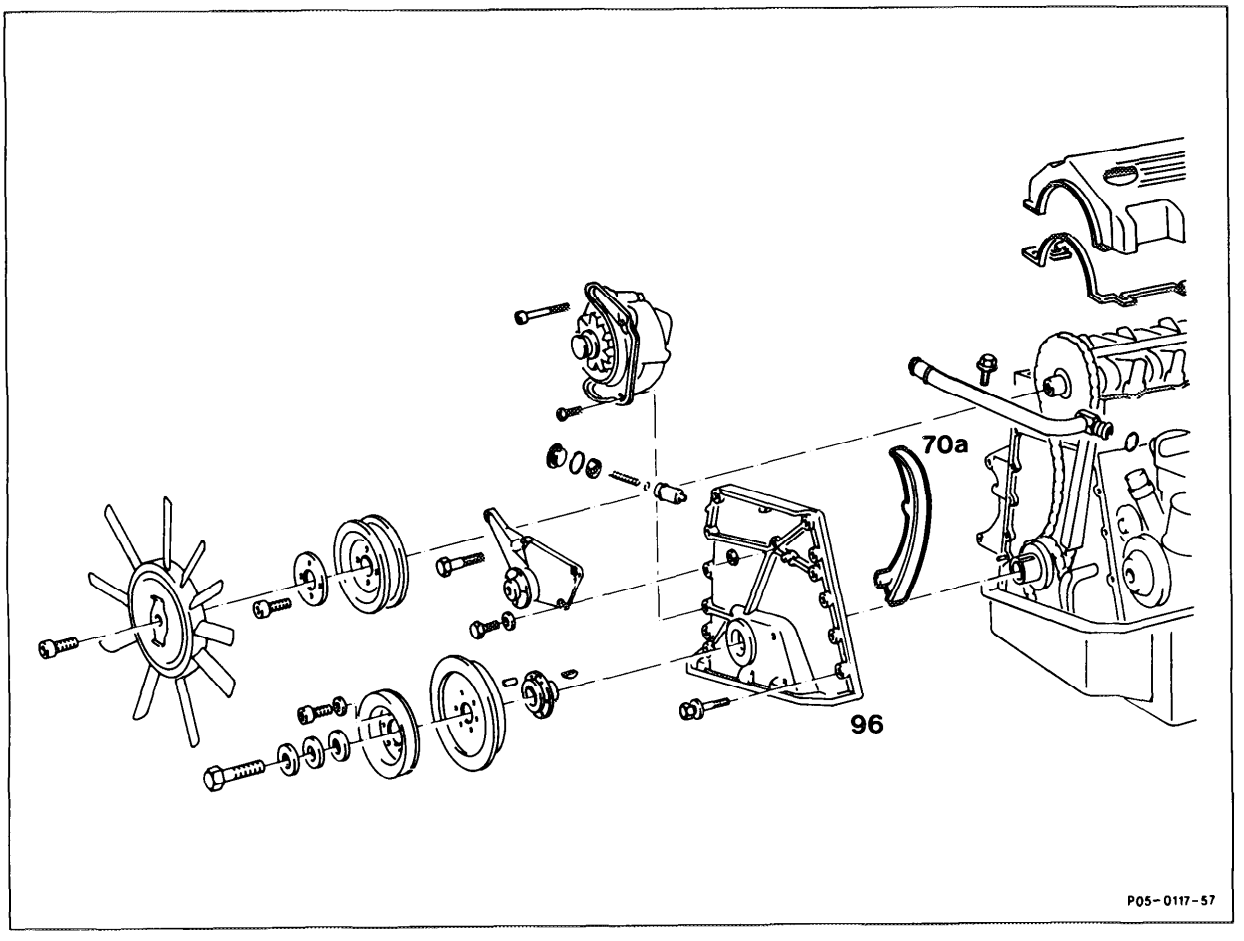
05-330 Removing, Installing Tensioning Rail

Job No. of job texts and job values or standard texts and flat rates OS-81 21



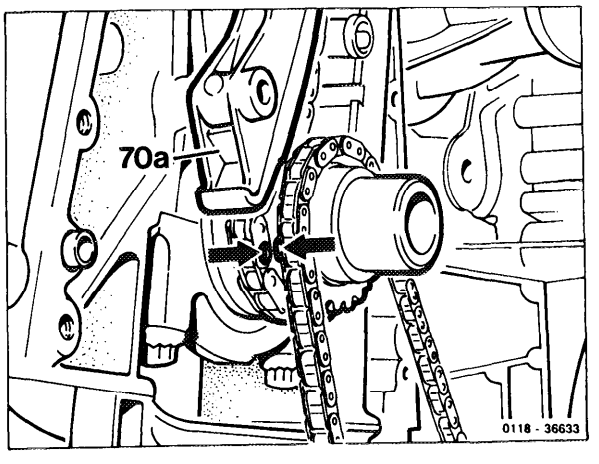
Timing case cover (96)	remove, install (01-210).
Timing chain with crankshaft gear	mark (step 2).
Tensioning rail (70a)	remove, install.
Setting of camshaft	check.

Removal, installation

1 Remove timing case cover (96) (01-210).

2 Mark timing chain with crankshaft gear (arrows).

3 Take off tensioning rail (70a).



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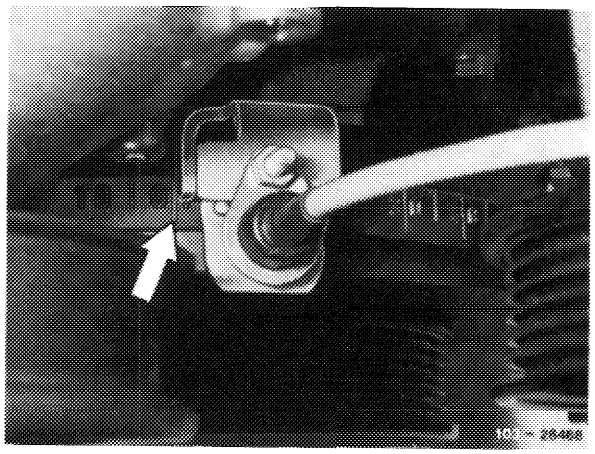
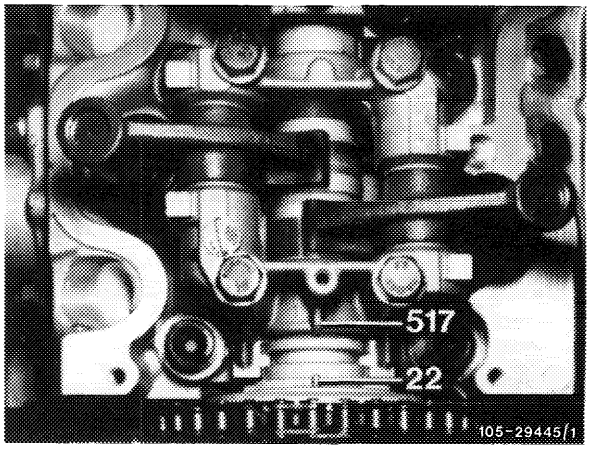
Installation instruction

Position piston of No. 1 cylinder to TDC (arrow).

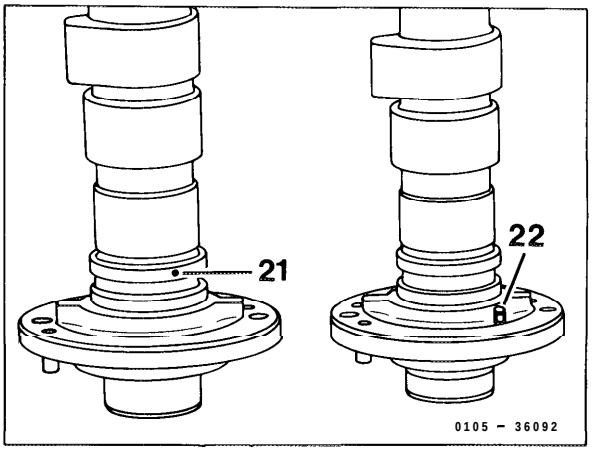


Positioning marking (22) or positioning hole of camshaft must be aligned with the marking (517) on 1st camshaft bearing.



Only the positioning hole (21) is provided in place of the pin (22) as from 12/86.

Install in the reverse order.



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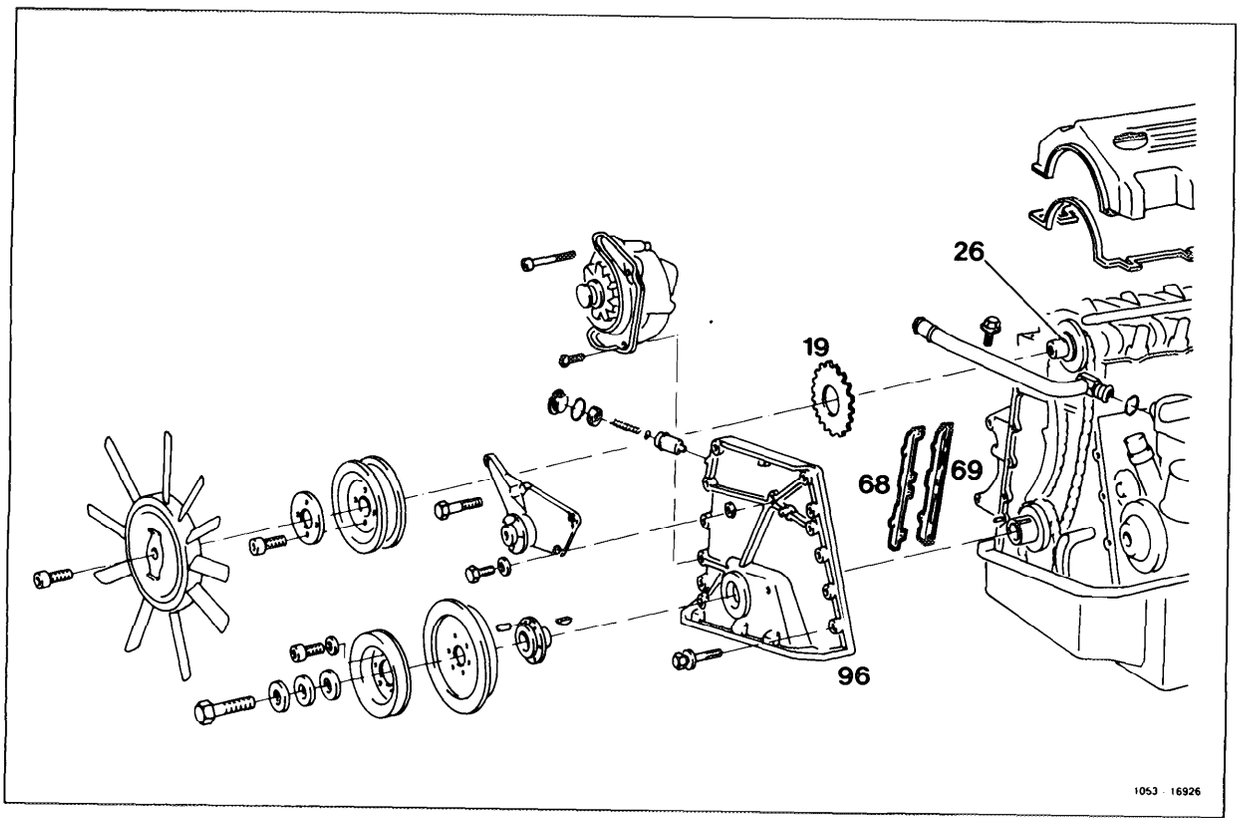
05-335 Removing, Installing Guide Rail

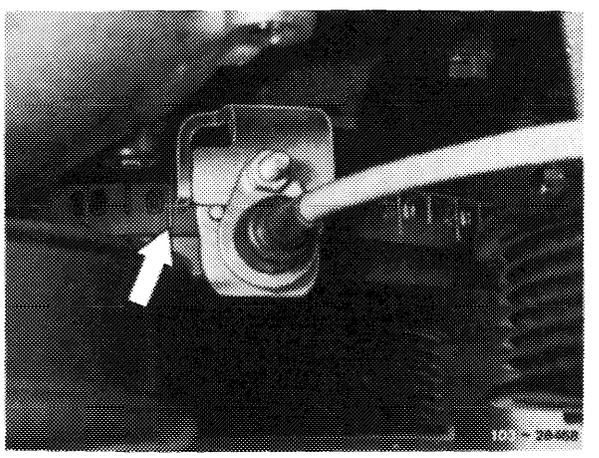
Job No. of job texts and job values or standard texts and flat rates .....



Piston of No. 1 cylinder	set to TDC (step 1).	
Timing case cover (96)	remove, install (01-210).	
Camshaft gear (19) to camshaft (26)	mark, detach and attach,	
	tightening torque	M6 11 Nm
		M7 16Nm
	(steps 4 and 5).	
Guide rail (68, 69)	remove, install (step 6).	

1 Set piston of No. 1 cylinder to TDC (arrow).

2 Remove timing case cover (01-210).



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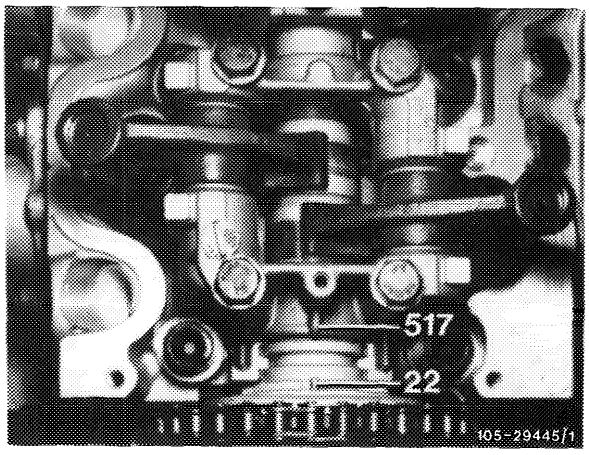
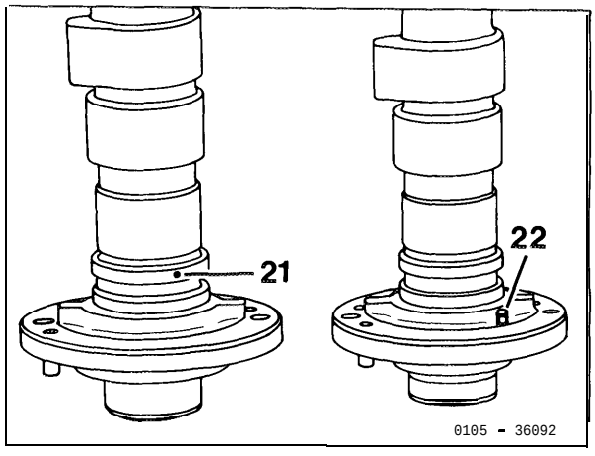
3 Positioning marking (22) or positioning hole of camshaft must be aligned with the marking (517) on 1st camshaft bearing.



Only the positioning hole (21) is provided in place of the pin (22) as from 12/86.

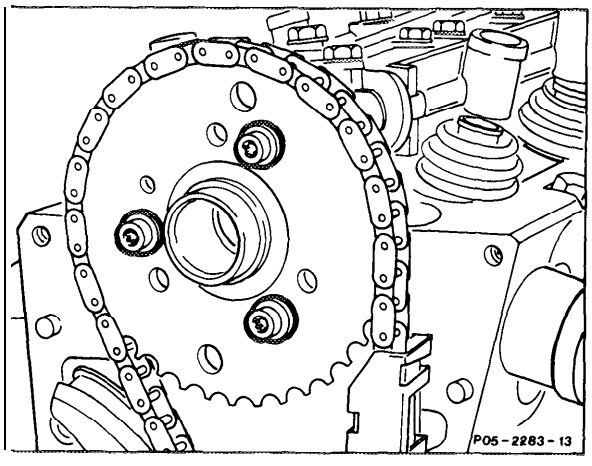


4 Unscrew bolts, (16).

Tightening torque:

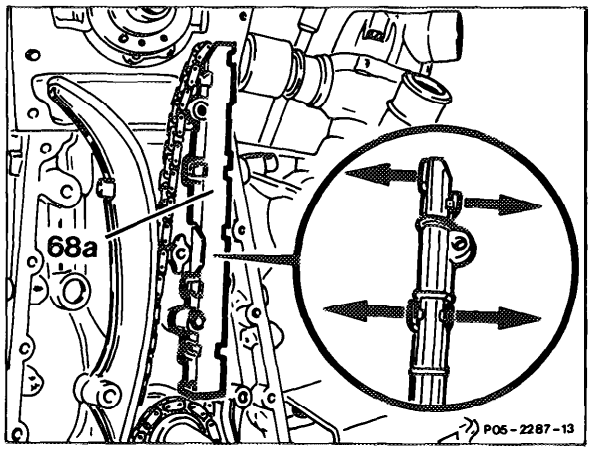
Hex. socket bolts	M 6 :	11 Nm
Torx bolts	M 7 :	16 Nm

5 Pull off camshaft gear (19) by hand.



6 Unclip retaining lugs in direction of arrow and remove guide rail (68a).

7 Install in the reverse order.



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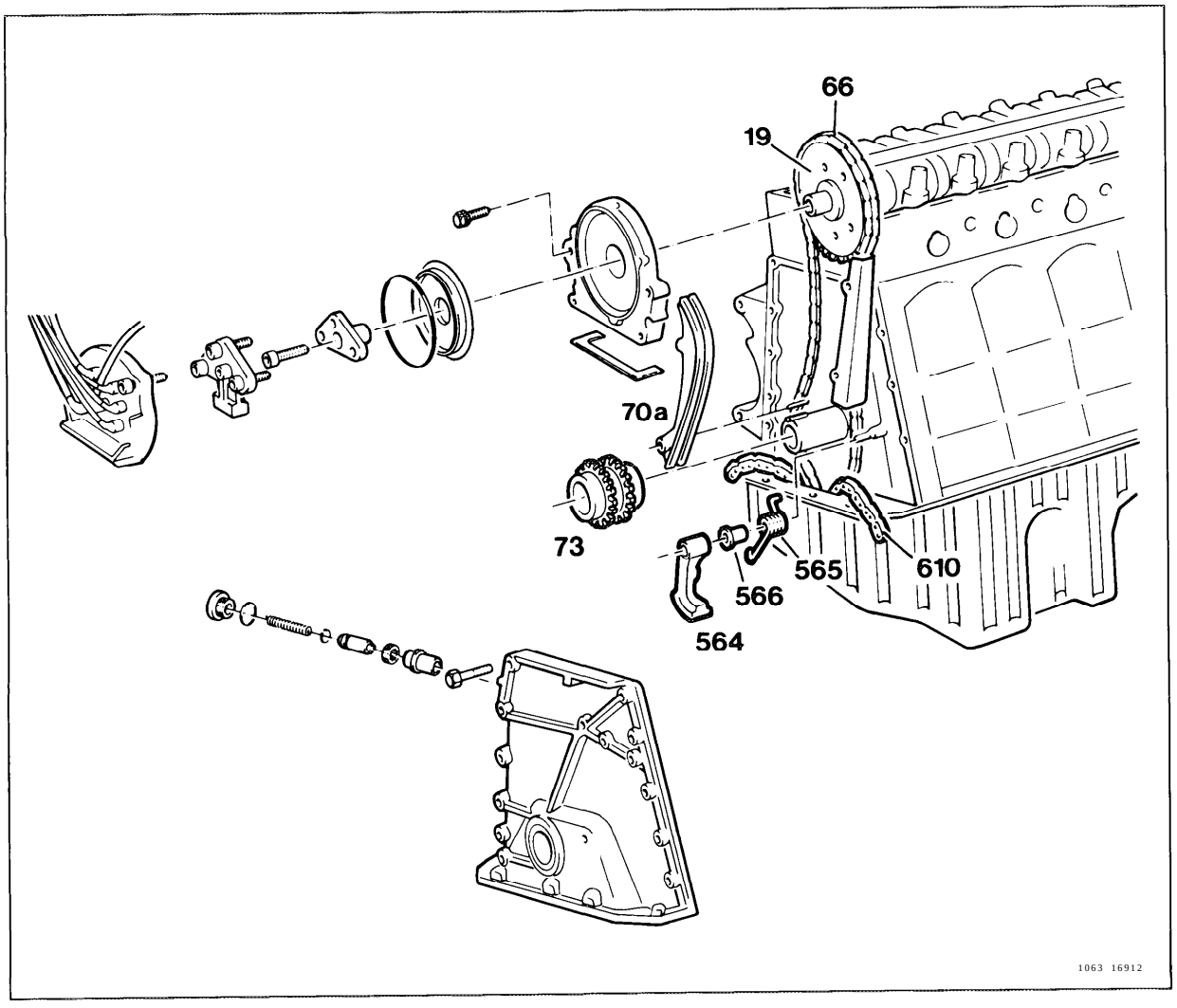
05-460 Removing, Installing Crankshaft Gear

Job No. of job texts and job values or standard texts and flat rates .....



Hood	raise to vertical position (01-008).
Piston of No. 1 cylinder	set to TDC (step 2).
Tensioning rail (70a)	remove (05-330).
Tensioning bracket (564), spring (565) with bush (566)	pull off (step 6).
Oil pump chain (610)	grind open rivet link pins (step 7).
Timing chain (66) to camshaft gear (19)	mark, take off (step 8).
Crankshaft gear (73) with puller 615 589 01 33 00	pull off (step 9).
Crankshaft gear (73)	heat, fit on (step 10).

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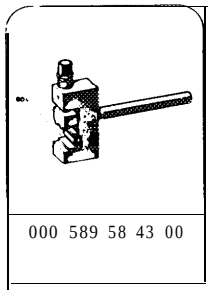
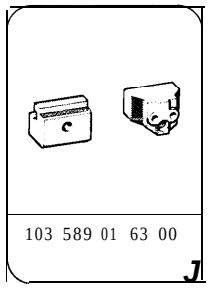
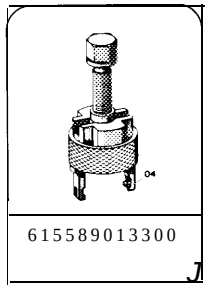
Timing chain (66)	fit onto camshaft gear (19).
Oil pump chain (610)	fit onto crankshaft gear (73).
Rivet link	insert from rear into oil pump chain.
Plate	insert in rivet tool, press on (steps 14 to 16).
Individual rivet link pins of oil pump chain	rivet (steps 17 to 19), 30 Nm.
Spring (565), bush (566) and tensioning bracket (564)	install.
Tensioning rail (70a)	install (05-330).

Tightening torques	Nm
Camshaft gear to camshaft (hex. socket bolt M6)	11
Camshaft gear to camshaft (Torx bolt M7)	16

Special tools







Note
When renewing a worn crankshaft gear, timing chain and camshaft gear must also be renewed.

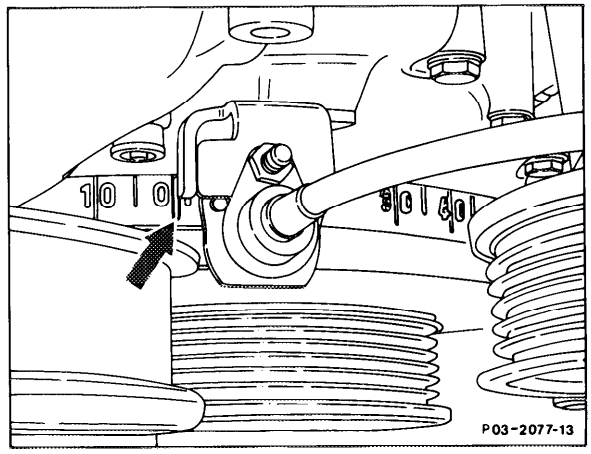
Removal

1 Raise hood to vertical position (01-008).

2 Position piston of No. 1 cylinder to TDC.

3 Remove tensioning rail (05-330).

4 Cover over oil sump with clean cloth.



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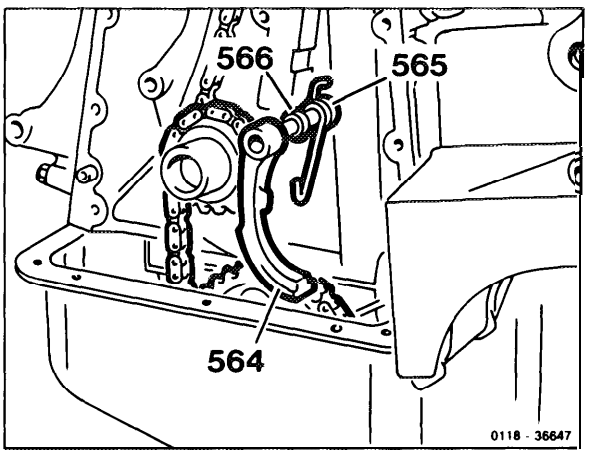
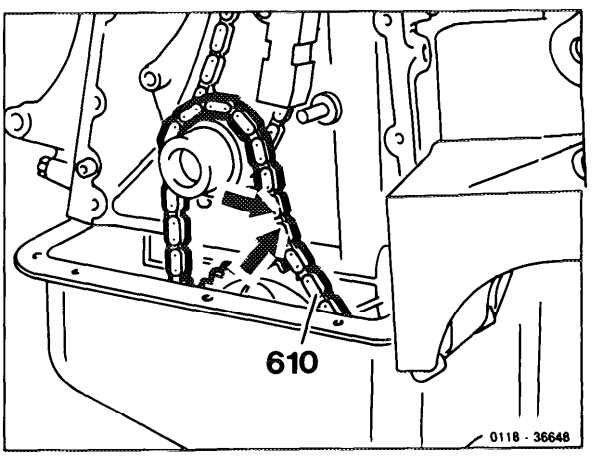
5 Pull off tensioning bracket (564), spring (565) with bush (566).



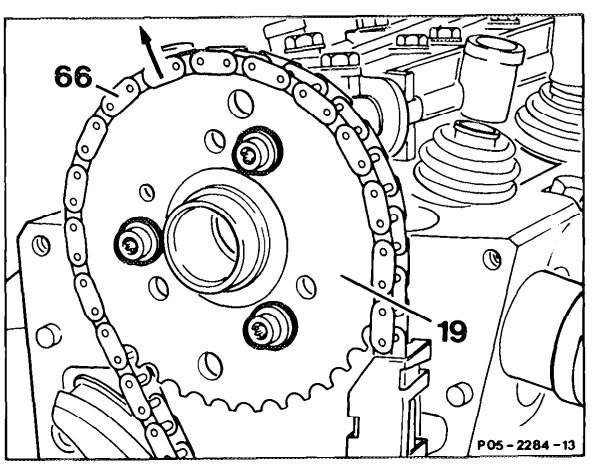
6 Grind open both rivet link pins (arrows) on a double link of the oil pump chain (610). Press out ground open double link.

Note

Do not take oil pump chain off the oil pump drive gear, tie on left and right with wire.



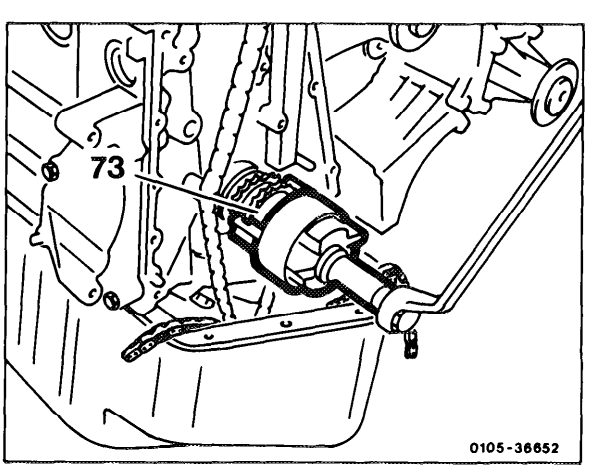
7 Mark position of timing chain (66) relative to camshaft gear (19) with a colored pen. Take timing chain off camshaft gear (19) in direction of arrow.



8 Pull off crankshaft gear (73) with puller 615 589 01 33 00.

Installation

9 Heat crankshaft gear to approx. 50 °C and fit onto the crankshaft.
Pay attention to the Woodruff keys.



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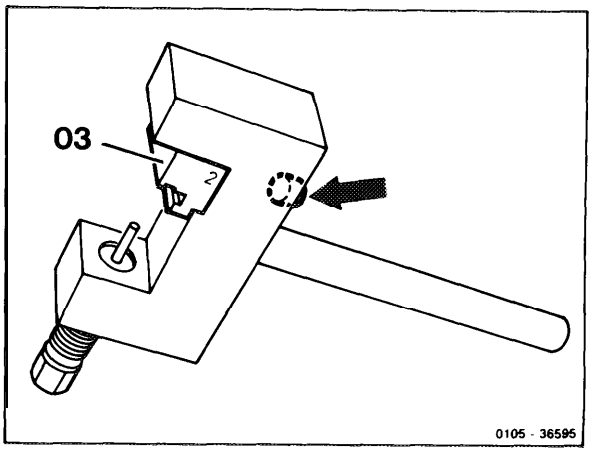
10 Fit timing chain onto the camshaft gear.

Note
Pay attention to colored marking.

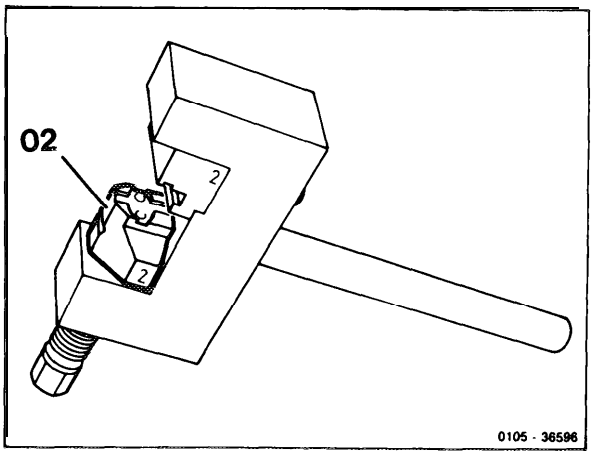
11 Fit oil pump chain onto the crankshaft gear. Insert rivet link from behind into the oil pump chain.

12 Insert thrust piece (03) into the rivet tool as shown in the drawing and tighten with the screw (arrow).

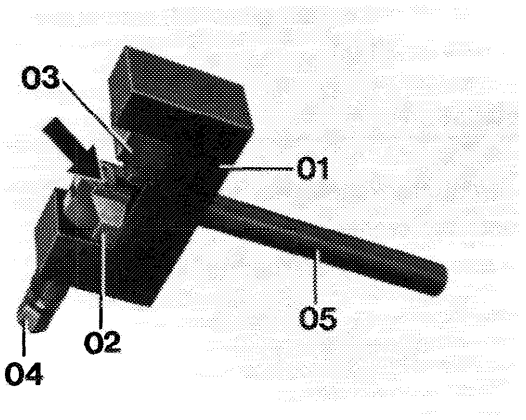
Note
The figure 2 is stamped on the side of the thrust piece (03).



13 Insert moving jaw (02) with the figure 2 into the rivet tool as shown in the drawing.



14 Insert plate (arrow) into the moving jaw (02) (magnetic surface).



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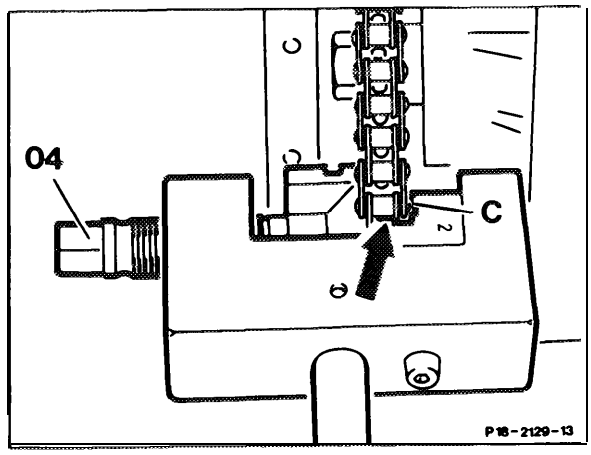
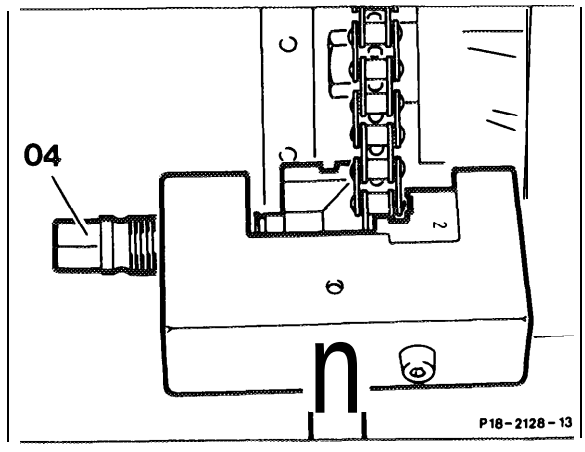
15 Fit web (arrow) onto both rollers on the link.

Note
Rivet heads of rivet link pins must be guided in the slot (C).

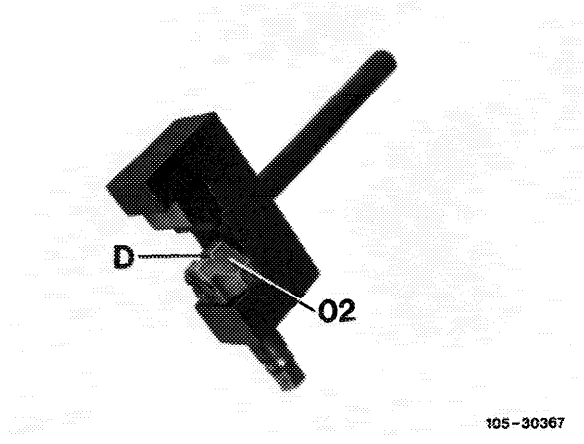


16 Screw in spindle (04) until a firm resistance is felt.

Note
When screwing in, ensure that the pins of the link are inserted into the holes of the plate.

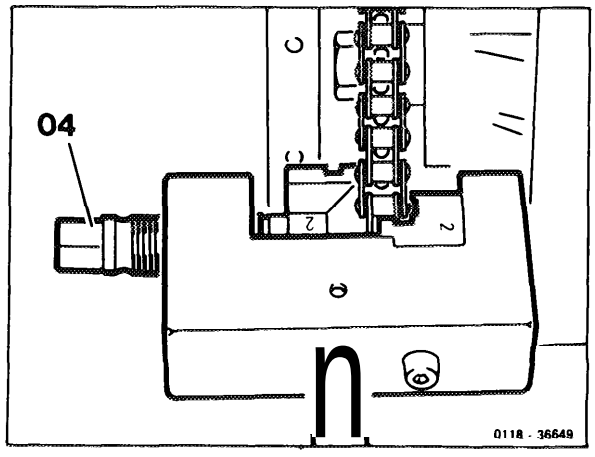


17 Take off rivet tool and change over the moving jaw (02) to the rivet profile (D).



18 Fit on rivet tool.
Rivet pins of the rivet link individually, by tightening the spindle (04) to 30 Nm.

19 Check riveting; re-rivet if necessary.



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20 Install spring, bush and tensioning bracket.

21 Install tensioning rail (05330).

22 Install in the reverse order.

Check leaktightness with engine running.

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Mechanically/electronically controlled gasoline injection system (CIS-E) 07.3

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Job No.

Testing and adjusting jobs

Checking idling speed, readjusting or special emission test (ASU) ..... 07.3 - 100
Testing, regulating engine ..... -110
Performing cylinder comparison test with engine tester SUN 2110 ..... -111
Testing electronic idling speed control ..... -112
Testing engine output and emissions on drum dynamometer ..... -115
Determining fuel consumption by driving on road ..... - 117
Checking fuel pressures and for internal leaks ..... - 120
Testing electrical components of CIS - E injection system ..... -121
A. Without trouble diagnosis by means of on-off ratio .....
B. With trouble diagnosis by means of on-off ratio .....
Testing throttle (orifice) in fuel distributor for unobstructed passage ..... - 122
Testing starting unit ..... -125
Testing starting valve activation ..... -126
Performing cold start ..... -127
Electric wiring diagrams ..... -128
Testing fuel pump ..... - 130
A. Delivery capacity .....
B. Fuel pressure .....
Testing injection valves ..... - 135
Testing, replacing throttle valve switch ..... - 152
Performing fuel quantity comparison measurement ..... - 160
Testing relay fuel pump ..... -165

Assembly jobs

Removal and installation of mixture control unit ..... - 200
Replacing fuel distributor ..... -205
Replacing sealing ring for control piston ..... -207
Removal and installation of injection valves ..... - 215
Replacing air volume meter ..... -220
Removal and installation of mixture control unit with air guide housing ..... -225
Removal and installation of throttle valve housing ..... -230
Replacing, centering air flow sensor plate,
testing and adjusting zero position of air flow sensor plate ..... - 245
Removal and installation of control unit ..... - 250
Replacing electrohydraulic actuator (EHA) ..... - 255
Replacing rubber ring or rubber buffers for fuel pump package ..... -268
Removal and installation of fuel pump package ..... -269
Removal and installation of fuel accumulator ..... -270
Removal and installation of fuel filter ..... -275
Removal and installation of fuel pump ..... -280

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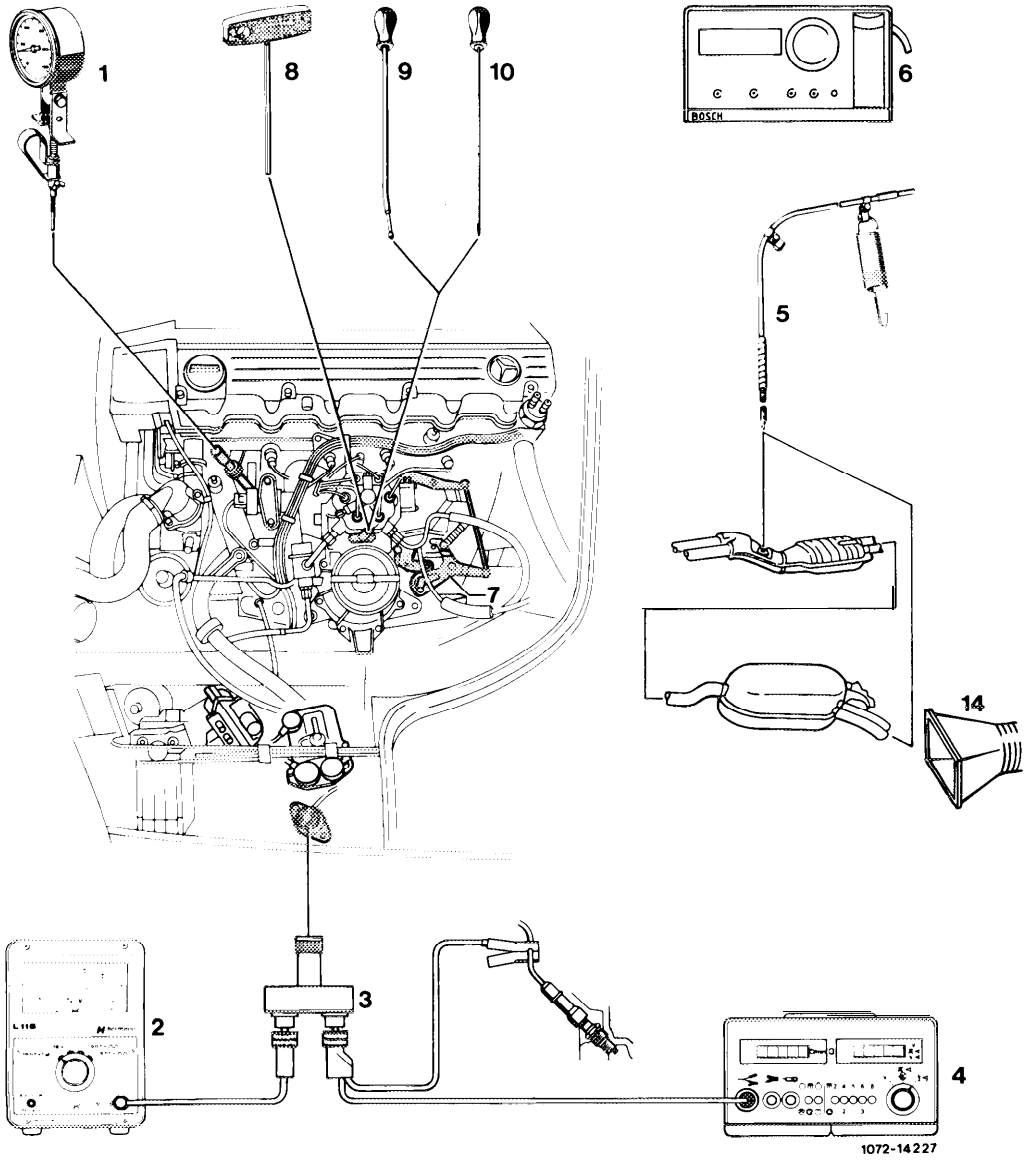
Job No. of work unit or standard texts and fiat rates data 07-2053, special emission test (ASU) 00-7600.

Basic and national versions starting 1986



Testers (1, 2, 3, 4, 5, 6).	Connect
Ignition timing (firing point)	Check (refer to Table)
Throttle control (7)	Check for easy operation and condition
Engine oil temperature	60 — 80 °C
Idling speed, idling speed emission value,	
lambda control	Check, readjust (refer to Table)
	For readjustment, use special tools (8, 9, 10)
Testing engine running performance	Engage all supplementary units for this purpose

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Basic versions and (CH) KAY

Engine	Version	Idling speed rpm	Idling speed Control range	Idling speed emission value % CO	Lambda control Control range %
103.94	RÜF	650-750	35-45 % 21–27°	1 ± 0.5	–
	NV				
	KAT (CH) KAT			≤ 0.5[1]	[2]
103.980	Std.	600-700		1 ± 0.5	–
	Std. KAT			2 ± 0.5	
103.981 103.982 103.983	RÜF			1 ± 0.5	
	NV				
	KAT (CH) KAT			≤ 0.5[1]	[2]

[1]) With special emission test (ASU).
[2]) Test lambda control at 2500 rpm and read mean value. Compare this value with idling speed value and readjust, if required. The medium value at idling speed should not deviate from value measured at 2500 rpm by more than ± 10. For test, pull off purge line and close.

National versions

Engine	Version	Model year	Idling speed rpm	Idling speed Control range	Idling speed emission value % CO	Lambda control Control range %
103.981 103.983	(AUS) (J) (USA)	as of 1986	650 ± 50	35–45 % 21–27°	–	[1]
	(CH) (S)		780 ± 50		0.6 ± 0.3	–

[1]) Test lambda control at 2500 rpm and read mean value. Compare this value with idling speed value and readjust, if required. The medium value at idling speed should not deviate from value measured at 2500 rpm by more than ± 10. For test, pull off purge line and close.

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Ignition timing (EZL)

Engine	Version or type of fuel	Engine rpm rpm	Ignition timing[1] in 'crank angle before TDC Adjustment plug position	Vacuum without	 with
Basic version and (CH) KAT					
103.94	RÜF/KAT (CH) KAT	3200	S	25–29	40–44
			N	19–23	
		Idling	S and N	7–11	
103.980	Premium grade leaded	3200	1	23–27	39–43
		Idling		8–13	
	Premium grade unleaded	3200	3	19–23	39–43
		Idling		8–13	
103.981 103.982 103.983	RÜF/KAT (CH) KAT	3200	S	27–31	40–44
			N	21–25	
		Idling	S and N	7–11	
(AUS) starting 1986 (single adjustment plug: 220 Ω)					
103.982 103.983	–	3200	–	21–25	40–44
		Idling		7–11	
(CH) starting 1986 (for (CH) KAT same values as basic version) **(S) starting 1986**					
103.981 103.983	–	3200	S	29–33	40–44
			N	23–27	
		Idling	S and N	TDC ± 2	
(J) (USA) starting 1986 (single adjustment plug: 750 Ω)					
103.94	–	3200	–	25–29	40–44
103.982 103.983				27–31	
		Idling	–	7–11	

[1]) In the event of deviations, check ignition system (15-563).

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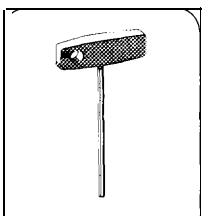
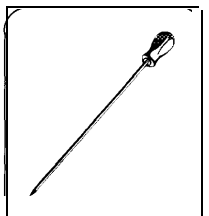
Special tools



000 589 14 11 00



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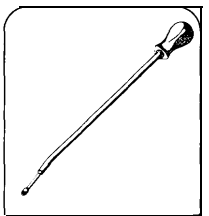
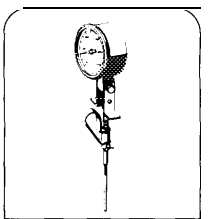
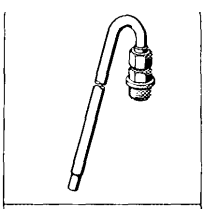


123 58900 1500

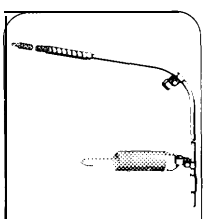


116 589 27 21 00

201 589 00 99 00



1035890091 00



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Conventional testers

Tachometer	
Digital tester (t-pm, dwell angle, ignition angle)	**e.g. Bosch, MOT 001.03**
Lambda control tester	**e.g. Hermann, L 115**

Note

Test or adjust lambda control with a lambda control tester. If no lambda control tester is available, a dwell angle tester may be used.

Idling speed should not be adjusted when the engine is too hot, e.g. after a fast drive or after measuring output on an output dynamometer.

Testing, adjusting

1 **Switch off air conditioning system or automatic climate control. Move selector lever into position ,,P''.**

2 Connect testers.

3 Test ignition timing (firing point) (refer to Table).

4 Check throttle control for easy operation and condition.

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5 Run engine to 60-80 °C oil temperature.

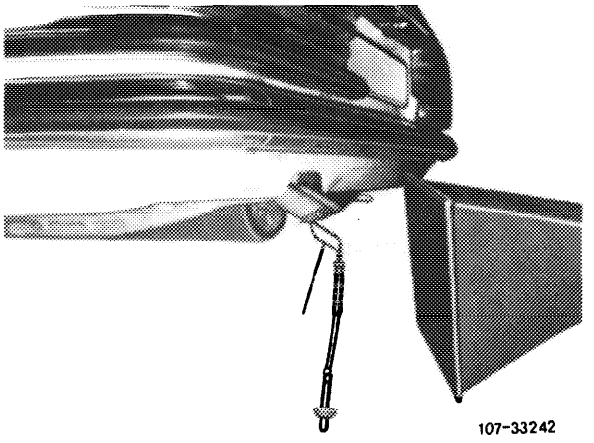
6 Check idling speed (refer to Table).

Attention!
The idling speed can no longer be adjusted on engines with electronic idling speed control. Perform test program if idling speed deviates (07.3-I 12).

7 Test idling speed emission value (refer to Table).

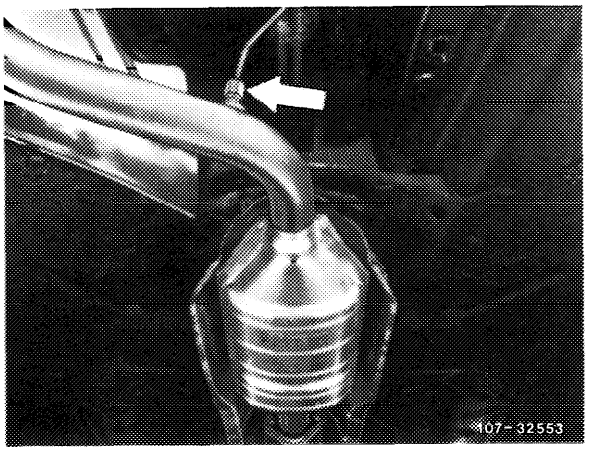
Measuring point at exhaust end pipe.

Measuring point (arrow) for open loop KAT, prior to catalytic converter.



8 Test lambda control.

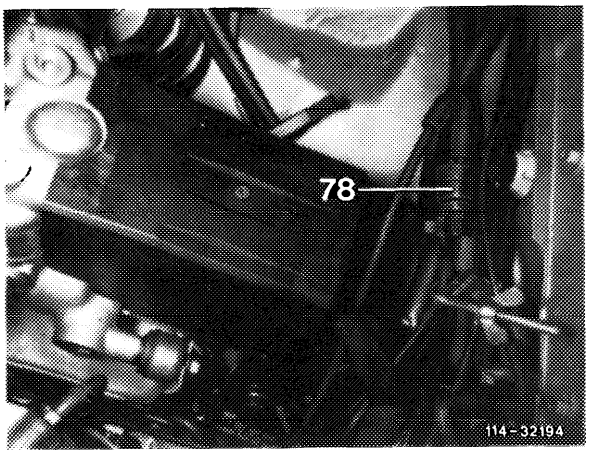
Attention!
While measuring, the indicated value should oscillate. If a constant value is shown, a fault on lambda control is indicated, e.g. O_2 sensor pulled off.



With lambda control tester, pull purge line to throttle valve housing from purge valve (78) and close.

Connect tester to diagnosis socket.
Push button 100 % ⎍⎍⎍.

Test on-off ratio at 2500 rpm and read mean value. Compare this value with idling speed value. The mean value at idling speed should not deviate from value measured at 2500 rpm for more than ± 10.



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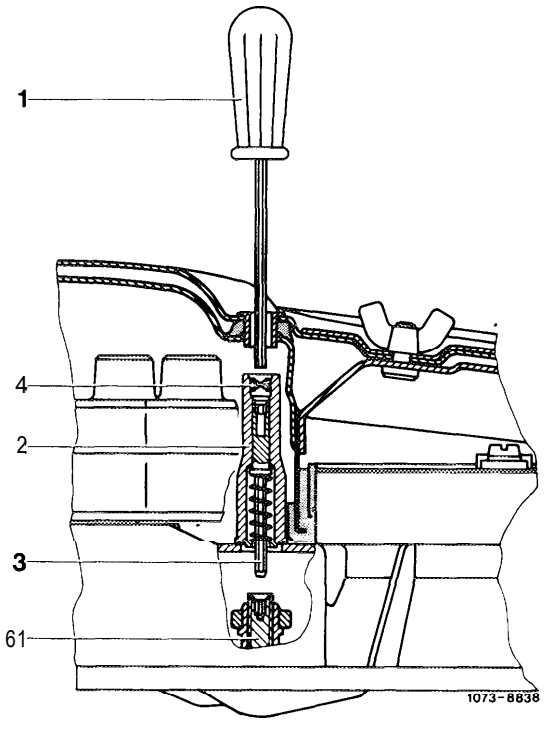
9 Set idling speed emission value or lambda control.

Pull out safety plug (4) with puller.

Push with screwdriver (1) through recess on air filter top against adjusting device (2). Push adjusting device downwards by means of screwdriver against spring force of adjusting device, turn slightly until hex. head (3) engages in mixture control screw.

Turning counterclockwise = leaner — voltage increases

Turning clockwise = richer — voltage drops



1 Screwdriver
2 Adjusting device
3 Hex. head
4 Safety plug
61 Mixture control screw

Accelerate for a short moment and test idling speed emission value or lambda control, adjust if required.

Upon adjustment, insert a blue safety plug (4), part No. 000 997 59 86, by means of installer.

10 (USA)

Attention!
The adjusting device (2) is provided with a protective steel plug.

If upon completion of engine repairs or after exchanging a part of the CIS-E injection system an adjustment of the on-off ratio is required, proceed as follows:

Remove air cleaner.

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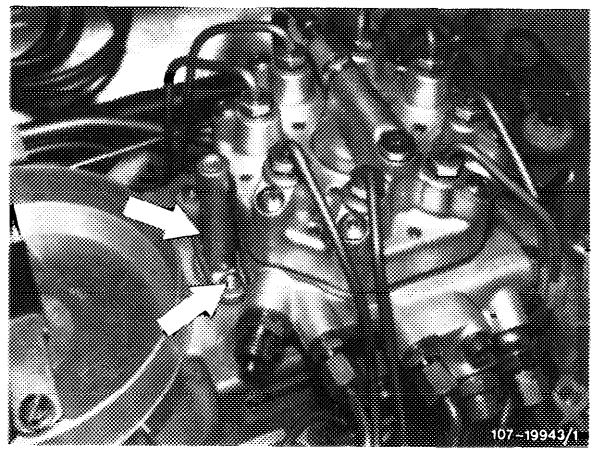
Punch-mark breakaway safety screw (arrow) in center and drill with a 2.5 mm twist drill to a depth of approx. 6-8 mm.



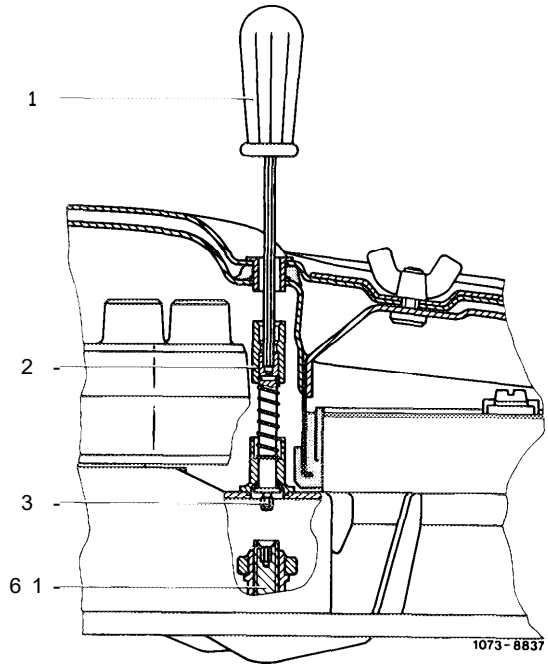
Attention!
Do not drill completely through screws, since engine damage may be caused by the resulting chips. Thoroughly remove metal chips with a rag.

Unscrew breakaway safety screws with a lefthand twist drill.

Install new repair set, part No. 102 589 02 07, while tightening screws until breakaway head breaks off.

Mount air cleaner.

Push with a screwdriver (1) through recess in air cleaner top against adjusting device (2).



1 Allen wrench
2 Adjusting device
3 Hex. head
61 Mixture control screw

Push adjusting device down with screwdriver against spring force, rotate slightly until hex. head (3) engages in mixture control screw (61).

Turning counterclockwise = leaner -voltage increases

Turning clockwise = richer -voltage drops

Accelerate for a short moment and test idling speed emission volue or lambda control, readjust if required.

Remove air cleaner.

Push down steel safety plug (contained in repair kit).

Mount air cleaner.

11 Reconnect purge line.

12 Check engine running performance. For this purpose, engage selector lever in driving position. Switch on air conditioning/automatic climate control. Turn power steering to full lock; engine should continue running.

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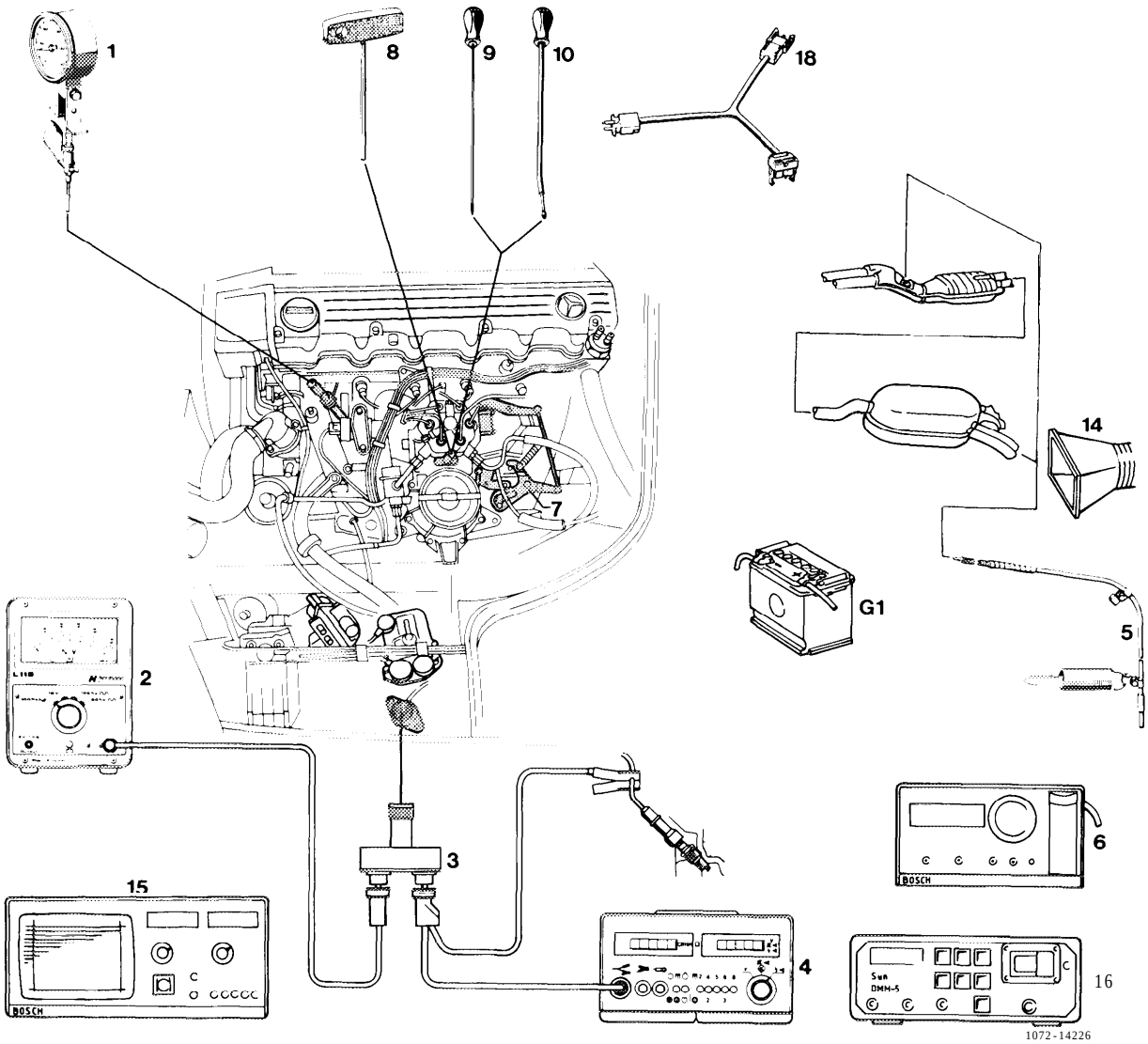
Job No. of work unit or standard texts and flat rates data 07-I 100.

Basic and national versions starting 1986



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Testers (1, 2, 3, 4, 5, 6, 15, 16)	Connect
Test cable (18)	Connect
Coolant level	Check, correct
Engine oil level	Check, while paying attention to oil condition (visual checkup)
Oil level in automatic transmission	Check, correct
Air cleaner	Remove and install
Regulating linkage (7)	Check throttle valve for easy operation and condition. Lubricate bearings, guide lever, ball sockets.
Slotted lever	Check, adjust
Full throttle stop	Check from direction of accelerator pedal, adjust
Voltages	Test battery start ignition coil terminal 1 and 15
Current on actuator	Test with ignition switched on
Ignition timing (firing point)	Test, adjust (refer to Table)
Vacuum adjustment	Check (refer to Table)
Engine oil temperature	60-80 °c
Oscilloscope pattern	Evaluate
Intake system	Spray-test for leaks
Decel shutoff	Check function
Function checkup of electric components	Test
Idle speed stop	Check
Idle speed, idle speed emission value, lambda control	Check, readjust (refer to Table) For readjustment, use special tools (8, 9, 10)
Check engine running performance	For this purpose, engage all auxiliary units

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Basic versions and (CH) KAT

Engine	Version	Idling speed rpm	Idling speed Control range	Idling speed emission value % co	Lambda control Control range %	Current on actuator with ignition switched on mA
103.94	RÜF	650-750	35-45 % 21–27°	1 ± 0.5	–	10
	NV					–
	KAT (CH) KAT			≤ 0.5[1]	[2]	20
103.980	Std.	600–700		1 ± 0.5	–	–
	Std. KAT			2 ± 0.5		
103.981 103.982 103.983	RÜF			1 ± 0.5		10
	NV					–
	KAT (CH) KAT			≤ 0.5[1]	[2]	20

National versions

Engine	Version	Model year	Idling speed rpm	Idling speed Control range	Idling speed emission value % CO	Lambda control Control range %
103.981 103.983	(AUS) (J) (USA)	as of 1986	650 ± 50	35-45 % 21–27°	–	[2]
	(CH) (S)		780 ± 50		0.6 ± 0.3	–

[1] With special emission test (ASU).
[2] Test lambda control at 2500 rpm and read mean value. Compare this value with idling speed value and readjust, if required. The medium value at idling speed should not deviate from value measured at 2500 rpm by more than ± 10. For test, pull off purge line and close.

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Ignition timing (EZL)

Engine	Version or type of fuel	Engine rpm rpm	Ignition timing[1]) in °crank angle before TDC Adjustment plug position	Vacuum without	 with
Basic versions and (CH) KAT					
103.94	RÜF/KAT (CH) KAT	3200	S	25–29	40–44
			N	19–23	
		Idling	S and N	7–11	
103.980	Premium grade leaded	3200	1	23–27	39–43
		Idling		8–13	
	Premium grade unleaded	3200	3	19–23	39–43
		Idling		8–13	
103.981 103.982 103.983	RÜF/KAT (CH) KAT	3200	S	27–31	40–44
			N	21–25	
		Idling	Sand N	7-11	
(AUS) starting 1986 (single adjustment plug: 220 Ω)					
103.982 103.983	–	3200	–	21–25	40–44
		Idling		7–11	
(CH) starting 1986 (for (CH) KAP same values as basic version) **(S) starting 1986**					
103.981 103.983	–	3200	S	29–33	40–44
			N	23–27	
		Idling	S and N	TDC ± 2	
(J) (USA) starting 1986 (single adjustment plug: 750 Ω)					
103.94	–	3200	–	25–29	40–44
103.982 103.983				27–31	
		Idling	–	7–11	

[1]) In the event of deviations, check ignition system (15–563).

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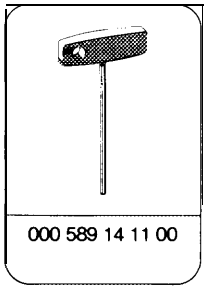
Battery voltages

No-voltage current	12.2 volts
Starting current min.	10 volts

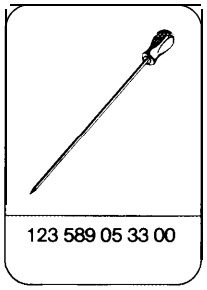
Voltages on ignition coil (with engine stopped and ignition switched on)

Terminal 15 to ground	Battery voltage
Terminal 1 and terminal 15	0 volt

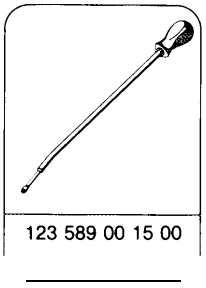
Special tools



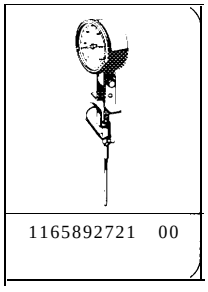
000 589 14 11 00



123 589 05 33 00



123 589 00 15 00



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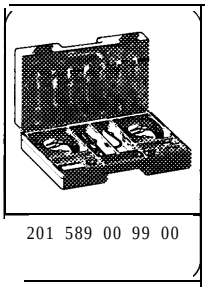
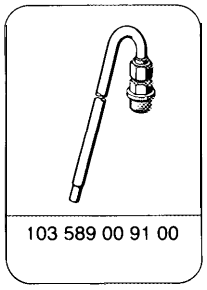
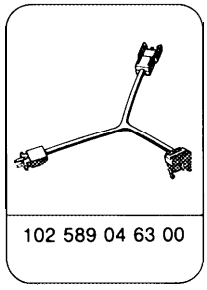


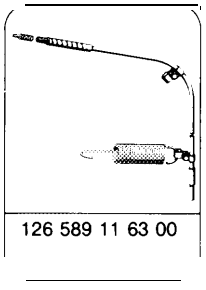
201 589 00 99 00



103 589 00 91 00



102 589 04 63 00



126 589 11 63 00

Conventional testers

Speedometer	
Digital tester (rpm, dwell angle, ignition angle)	e.g. Bosch, MOT 002.02 Sun, 1019
Lambda control tester	e.g. Hermann, L 115
Multimeter	e.g. Sun, DMM-5

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Note

Test or adjust lambda control with a lambda control tester. If no lambda control tester is available, a dwell angle tester may be used.

Idling speed should not be adjusted when the engine is too hot, e.g. after a fast drive or after measuring output on an output dynamometer.

Testing, regulating

1 Complete data sheet.

2 Check coolant level, correct.

3 Check engine oil level, while paying attention to oil condition (visual checkup).

4 Check oil level in automatic transmission.

5 Switch off air conditioning system or automatic climate control. Move selector lever into position „P".

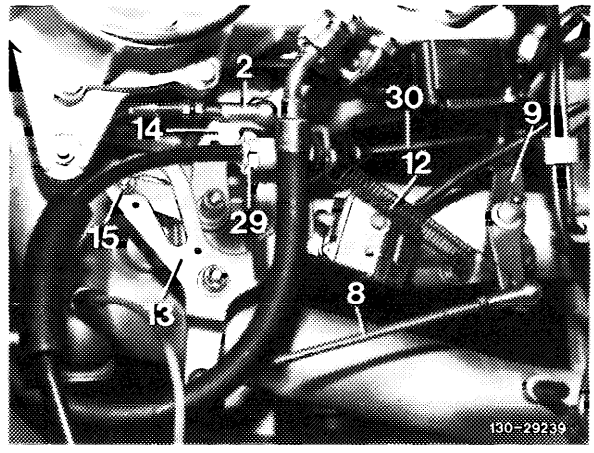
6 Remove air cleaner.

7 Check regulating linkage and throttle valve for easy operation and condition. Lubricate all bearing points and ball sockets.

8 Check slotted lever, adjust. Check whether roller (15) in slotted lever (13) rests free of tension against end stop. If required, adjust slotted lever (13) with connecting rod (2) in such a manner that roller (15) rests free of tension against end stop.

9 Check full throttle stop from direction of accelerator pedal, adjust (30–300).

10 Connect testers.



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11 Test voltages (battery, start and ignition coil).

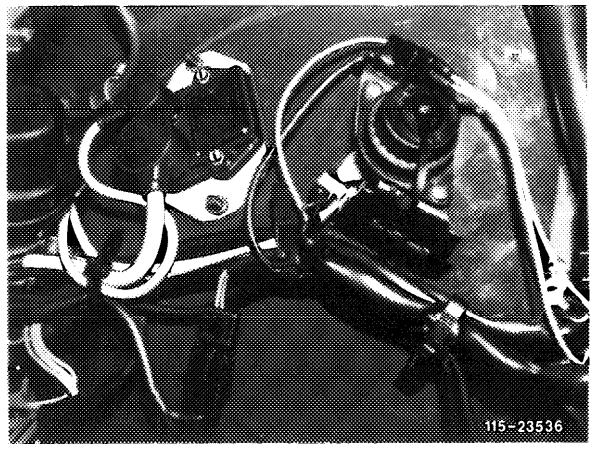
a) No-voltage current

Connect voltmeter while paying attention to polarity on battery and read voltages. Nominal value 12.2 volts.

b) Starting voltage

Pull off plug for ignition distributor sensor on switching unit (green cable) or connect protective plug, part No. 102 589 02 21 00 to diagnosis socket.

Test starting voltage.
Operate starter for a short moment while reading voltage.
Nominal value min. 10 volts.



c) Ignition coil

Switch on ignition with engine stopped. On jack 5 of diagnosis socket, test voltage, terminal 15 to ground.

Nominal value: battery voltage.

On jack 5 and 4 of diagnosis socket, check voltage difference between terminal 15and terminal 1.

Nominal value: 0 volt.

If nominal values are not attained, check ignition system (15–563).

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12 Test current on actuator with ignition switched on. For this purpose, pull plug from actuator, make intermediate contact with test cable 102 589 04 63 00. Connect multimeter, set to mA.

Nominal value: refer to Table.
If not ok (07.3-121, refer to section ,,k'').

13 Test ignition timing (firing point) and vacuum adjustment. For test values refer to Table.

14 Run engine to 60-80 °C oil temperature.

15 Evaluate oscilloscope pattern (15–508).

16 Check intake system for leaks. For this purpose, spray-test all leak points with Iso octane DIN 51756 or benzine.

Attention!
For spray-testing, do not use conventional fuel (vapors detrimental to health). Pay attention to fire hazard and do not spray on glowing parts or parts of ignition system.

17 Check decel shutoff. For this purpose, keep engine speed constant > 2500 rpm.

Actuate microswitch manually, engine should be hunting.

Check fuel pressures and for internal leaks, if required (07.3-I 20 section ,,C'').

18 Function checkup of electrical components RÜF/KAT

a) Faulty diagnosis by measuring on-off ratio.

Engine at idling speed.

Nominal value: RÜF 50 % readout constant.
KAT readout oscillating.

If the values are not attained, perform test program (07.3-I 21).

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b) Function test of idling speed and full load contact.

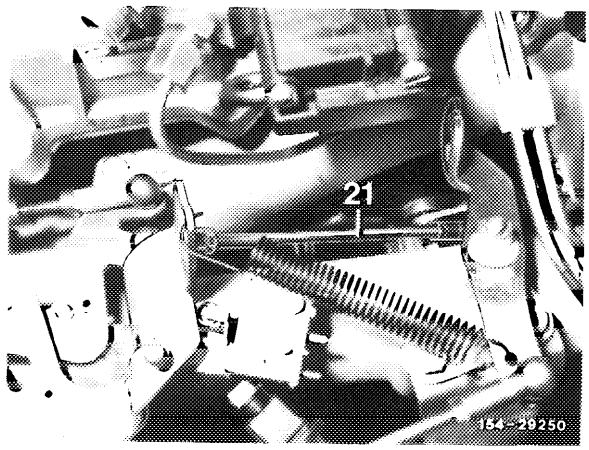
Engine stopped. Switch on ignition 70 %.

Deflect air flow sensor plate 10 %.
At 70 %, check throttle valve switch (07.3-I 21, section ,,e'').

Air flow sensor plate zero position 70 %.

Fully open throttle valve 20 %.
At 40 %, check throttle valve switch (07.3-I 21, section ,,e'').

19 Check whether throttle valve rests against idle speed stop. Disengage connecting rod for this purpose.



20 Vehicles with cruise control/Tempomat.

Check whether actuator rests against idle speed stop of cruise control/Tempomat. For this purpose, push lever of actuator clockwise to idling speed stop on cruise control/Tempomat. When engaging pull rod (21), make sure that the lever of the actuator is raised by the idle speed stop on cruise control/Tempomat by approx. 1 mm. Adjust pull rod, if required.

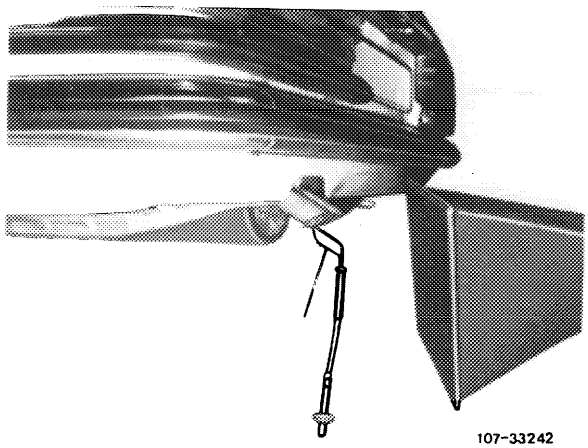
21 Mount air cleaner.

22 Check idling speed (refer to Table).

Attention!
On engines with electronic idle speed control, the idling speed can no longer be adjusted. Perform test program, if idling speed deviates (07.3-I 12).

23 Check idling speed emission value (refer to Table).

Measuring point at exhaust end pipe.



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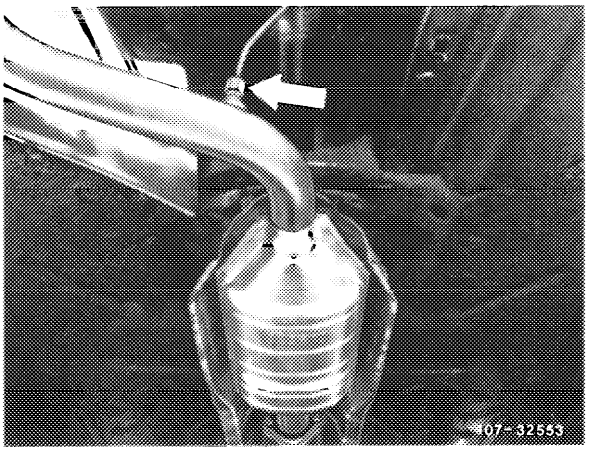
Measuring point (arrow) for open loop KAT in front of catalytic converter.



24 Test lambda control (refer to Table).

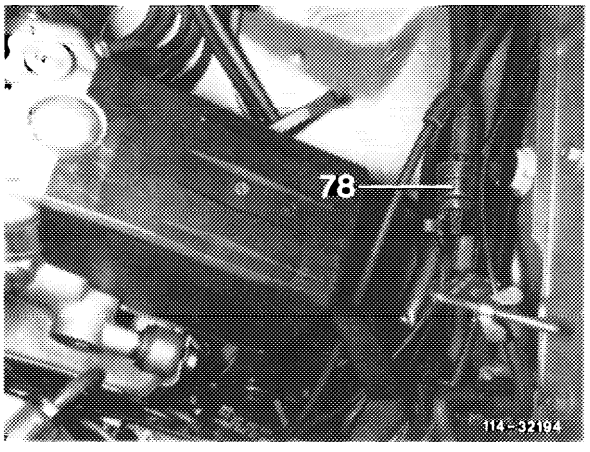
Attention!
While measuring, the indicated value should oscillate. If a constant value is shown, a fault on lambda control is indicated, e.g. O_2 sensor pulled off.

With lambda control tester

Pull off purge line toward throttle valve housing on purge valve (78) and close.

Connect tester to diagnosis socket.
Push button 100 % ⎍⎍⎍.

Check on-off ratio at 2500 rpm and read mean value. Compare this value with idling speed value. The mean value at idling speed should not deviate by more than ± 10 from value measured at 2500 rpm.



25 Adjust idling speed emission value or lambda control.

Pull out safety plug (4) by means of puller.

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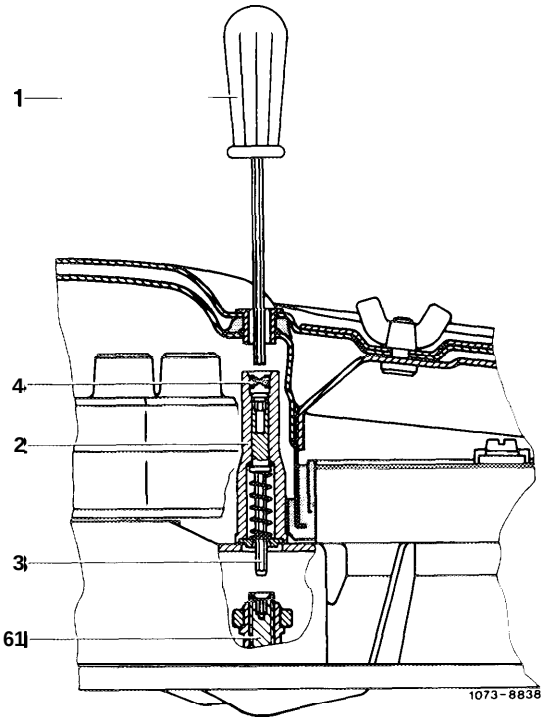
Push with screwdriver (1) through recess on air cleaner top against adjusting device (2). Push adjusting device down with screwdriver against spring force of adjusting device until hex. head (3) engages in mixture control screw (61).

Turning counterclockwise = leaner — voltage increases
Turning clockwise = richer — voltage drops

Accelerate for a short moment and test idle speed emission value or lambda control and adjust, if required.

Following adjustment, insert a blue safety plug (4), part No. 000 997 59 86, by means of installer.



1 Screwdriver
2 Adjusting device
3 Hexagon head
4 Safety plug
61 Mixture control screw

(USA)

Attention!
A protective steel plug is installed in adjusting device (2).

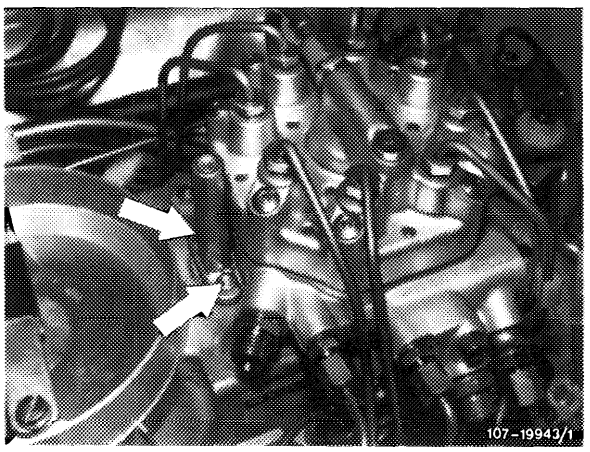
If upon completion of engine repairs or replacement of a part of the CIS-E injection system an adjustment of the on-off ratio is required, proceed as follows:

Remove air cleaner.

Center-punch breakaway screws (arrow) and drill with a 2.5 mm twist drill to a depth of approx. 6-8 mm.

Attention!
Do not drill through screws, since engine damage may be caused by the metal chips. Thoroughly remove metal chips with a rag.

Unscrew breakaway screws with lefthand twist drill.



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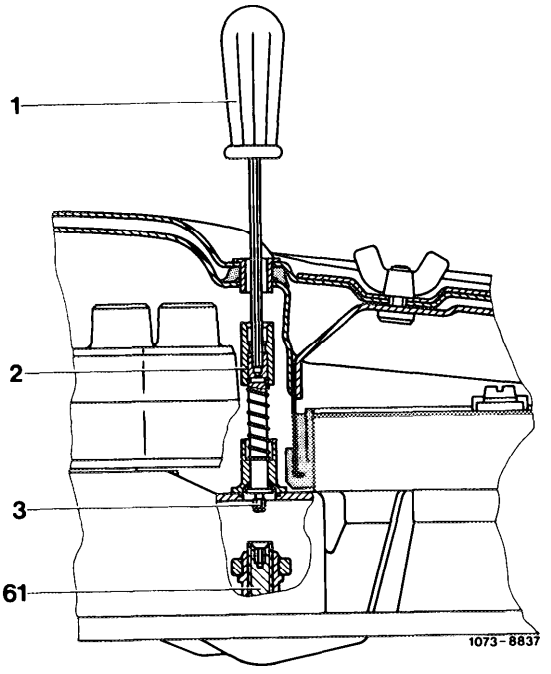
Install new **repair kit, part No. 102 586 02 07, while tightening screws until breakaway head is breaking off.**

Mount air cleaner.

Push with screwdriver (1) through recess in air cleaner top against adjusting device (2).

Push adjusting device down with screwdriver against spring force, slightly rotate until hex. head (3) engages in mixture control screw (61).

Turning counterclockwise = leaner -voltage increases
Turning clockwise = richer -voltage drops



1 Allen wrench
2 Adjusting device
3 Hex. head
61 Mixture control screw

Accelerate for a short moment and test mean control rod travel, readjust if required.

Remove air cleaner.

Push down steel safety plug (contained in repair kit).

Mount air cleaner.

26 Reconnect purge line.

27 Check engine running performance. For this purpose, engage selector lever in driving position, switch on air conditioning/automatic climate control, turn power steering to full lock; engine should continue running. Check rpm stabilization, if required (07.3-I 12).

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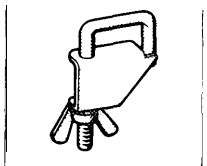
07.3-I 11 Performing cylinder comparison test with engine tester SUN 2110

Job No. of work unit or standard texts and flat rates data 07 - 1150

Special tools



000 589 40 37 00

Conventional tester

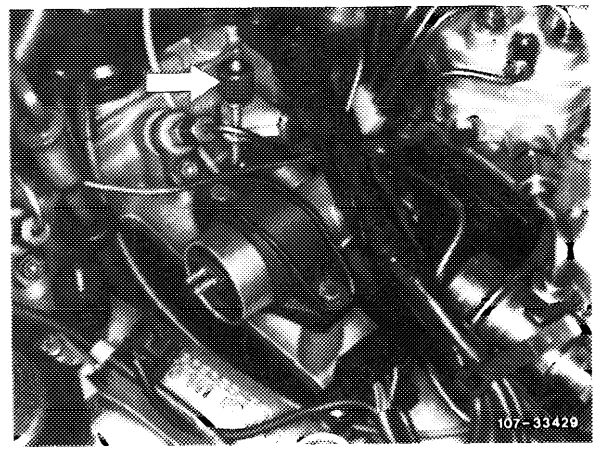
Engine tester	SUN, 2110

Testing

1 Run engine to 60-80 °C oil temperature.

2 Connect engine tester SUN 2110.

3 Pull connecting cable from idle speed adjuster (idle speed air valve). Adjust previously measured idling speed with clamp (arrow). Also adjust idling speed emission value.



4 Select illustrated page ,,Engine starting, measuring" with button # illustrated page.

5 Push button ,,Engine stop". Start engine (not running) until lettering ,,Data in memory" shows up.

6 Push button ,,Engine stop" again, engine will be running.

7 Select illustrated page ,,Cylinder comparison" with button #. Run engine at idling speed until HC value is constant.

Perform cylinder comparison test and evaluate.

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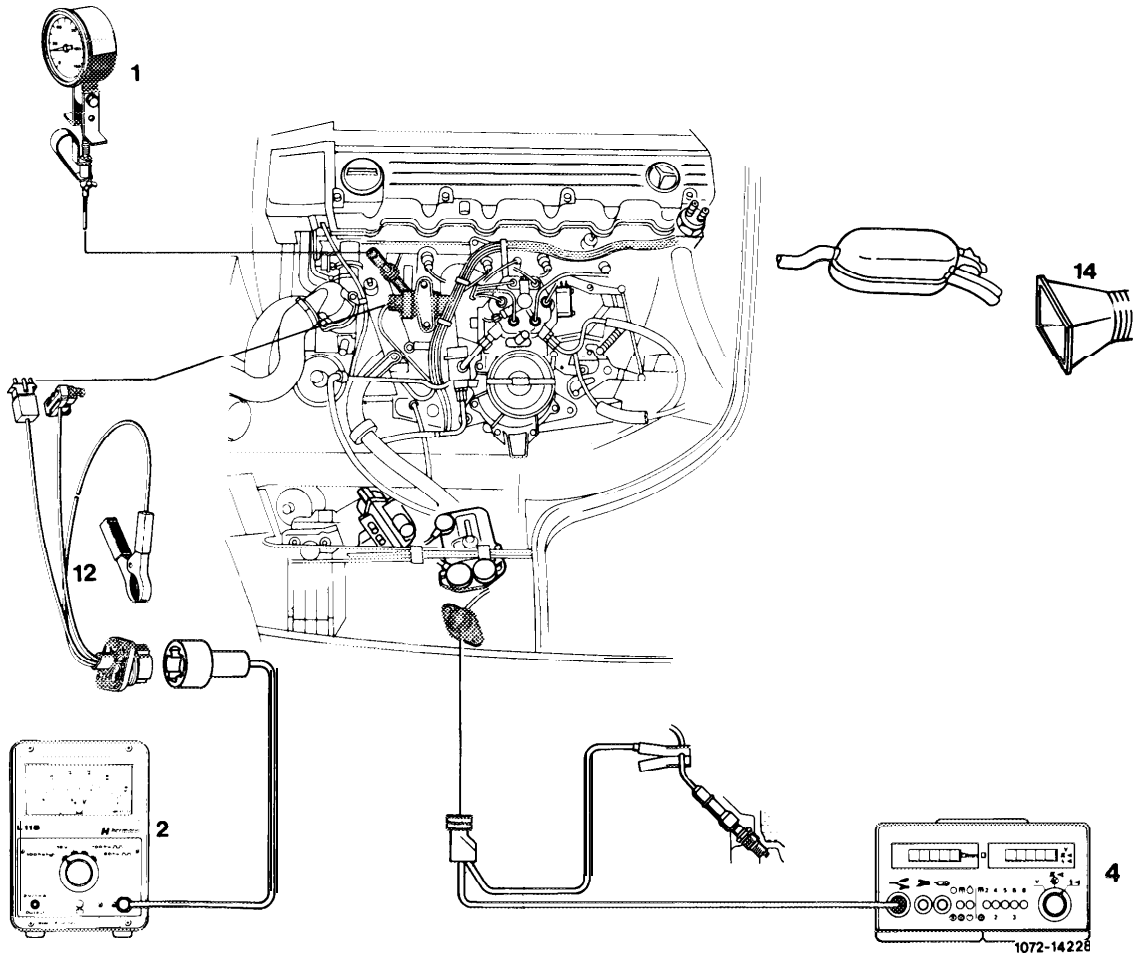
07.3-I 12 Testing electronic idling speed control

Job No. of work unit or standard texts and flat rates data 07-2006.



Testers (1, 2, 4)	Connect
Test cable (12)	Connect
Engine oil temperature	60-80 °C
Electronic idling speed control	Check (refer to Table)
Control range	Check (refer to Table)
Function idling speed adjuster (air valve)	Check. For this purpose, connect battery voltage for a short moment, valve should switch audibly.
Voltage supply	Check according to wiring diagram
Rpm stabilization	Check. On vehicles with automatic transmission and/or A/C compressor

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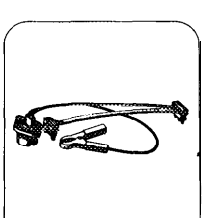
Basic versions and (CH) KAT

Engine	Version	Idling speed rpm	Control range %	Control range ° ∡	Model year
103.94	RÜF NV KAT (CH) KAT	650-750	35-45	21-27	–
103.980	Std. Std. KAT	600-700			
103.981 103.982 103.983	RÜF NV KAT (CH) KAT				

National versions

103.981 103.983	(AUS) (J) (USA)	650 ± 50	35–45	21–27	starting 1986
	(CH) (S)	780 ± 50			

Special tools



103 589 00 63 00

201 589 00 99 00

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Conventional testers	e.g. make
Multimeter	Sun, DMM-5
Engine tester	Bosch, MOT 002.02
Lambda control tester	Hermann L 115

Note

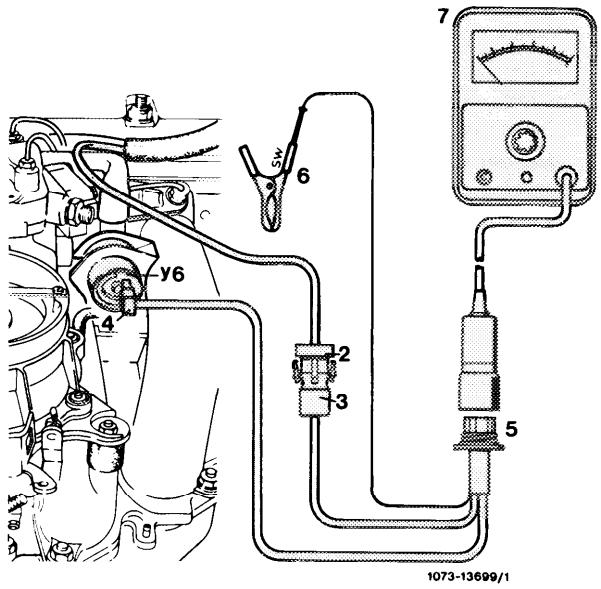
Electric wiring diagrams 07.3-I 28.

On analog measuring instruments the voltage may drop down to 0 volt.

Speed increases when plug is pulled from micro-switch.

Connecting testers

Connect test cable 103 589 00 63 00 to idling speed adjuster (air valve) and to lambda control tester or engine tester.



2 Plug, engine harness
3 Plug connection, test cable
4 Plug, idling speed air valve
5 Test cable
6 Ground terminal
7 Lambda control tester
Y6 Idling speed air valve

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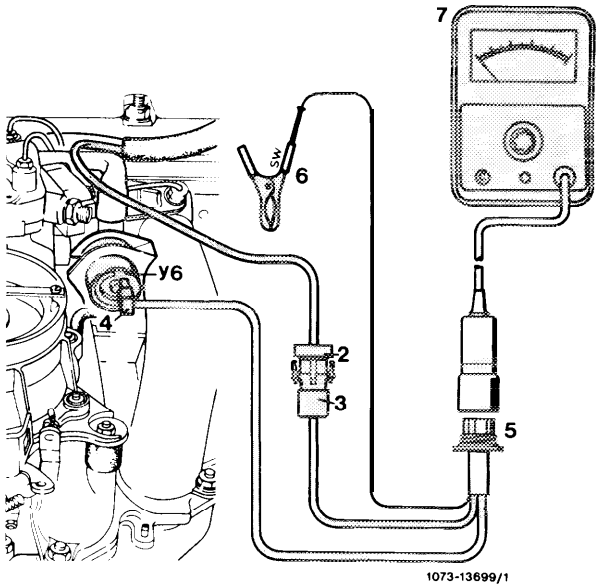
Connect test cable to idle speed air valve and to lambda control tester or engine tester.
A. Lambda control tester = % readout
B. Engine tester = °4 readout
Engine at idling (operating temperature).

Nominal value: 35-45 % at idling speed
21-27 °4

Ok	Not ok

End of test



Readout 0 % or 100 %
0 °4 or 90 °4

Pull plug from idling speed air valve.
Connect battery voltage and ground briefly to idling speed air valve.

Idling speed air valve is audibly switching.

Ok	Not ok

Replace idling speed air valve.

Check voltage supply according to wiring diagram.

Switch on ignition. Voltage on red/blue line approx. 12 volts.
Check red/white line for continuity.

Ok	Not ok

Check input signals or contour hoses for continuity.
Replace control unit.

Repair interruption.

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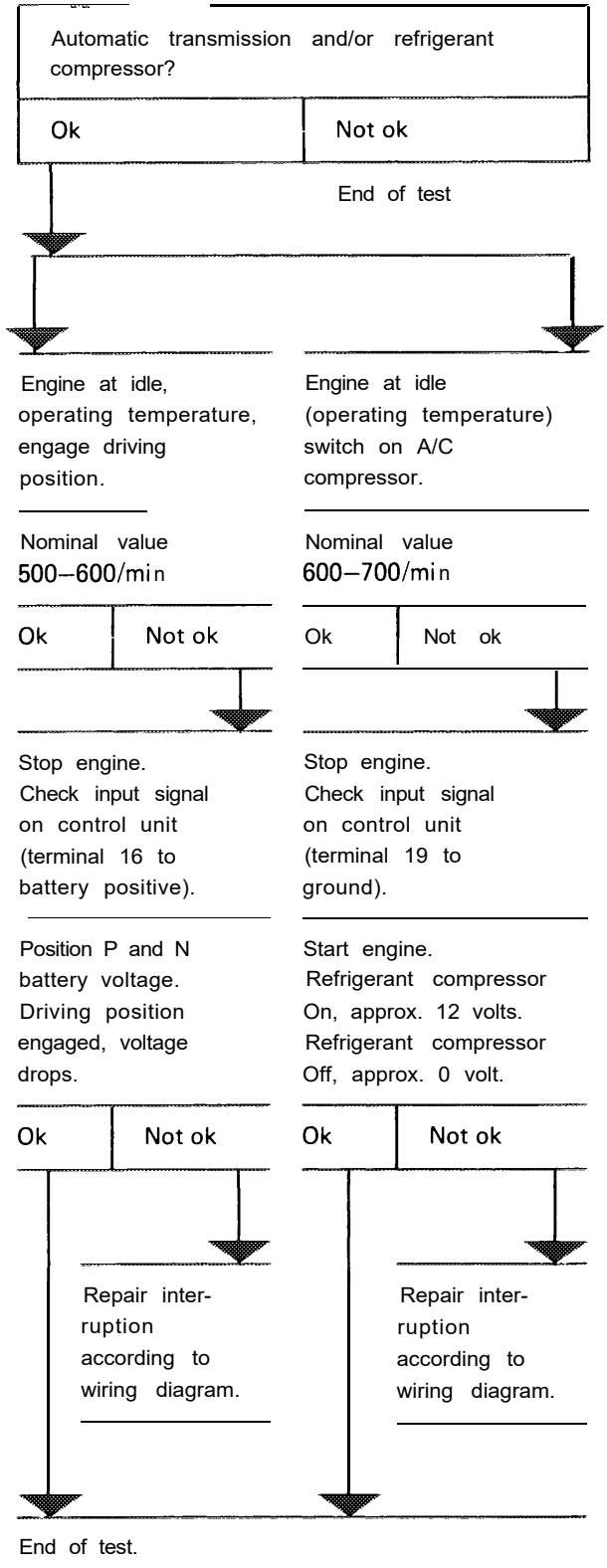

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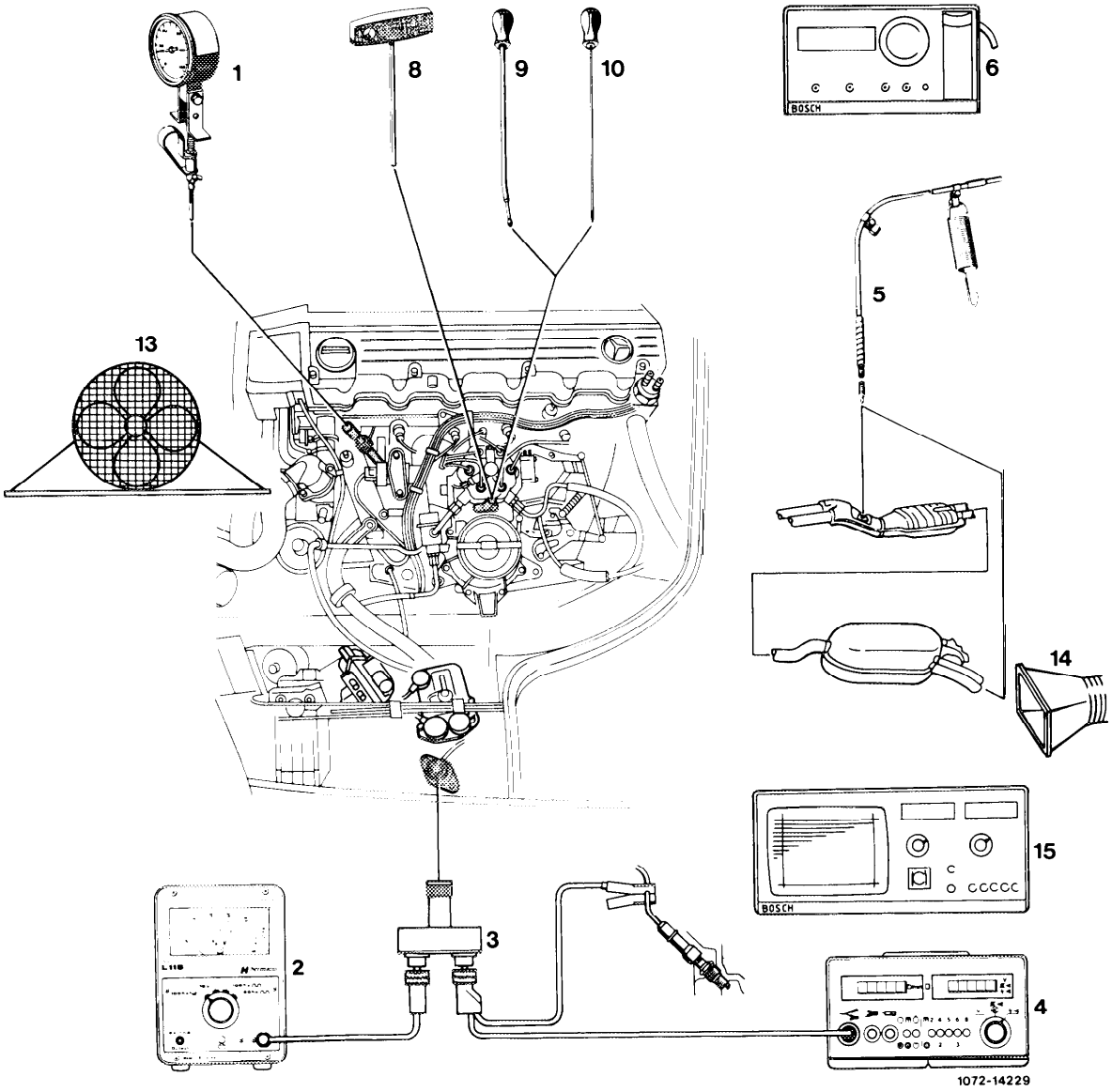
07.3-I 15 Testing engine output and emissions on drum dynamometer

Job No. of work unit or standard texts and flat rates data 07-1203 or 07-1206.

Basic and national version (CH)



Data sheet	Complete
Fluid levels (engine oil, automatic transmission fluid, coolant)	Check, correct
Testers (1, 2, 3, 4, 5, 6, 15)	Connect
Trunk contents	Check. Remove heat-sensitive and heavy items.
Front wheels.	Secure. Place holding wedges at approx. 100 **mm distance in front of front wheels.**
Tire pressure of rear wheels	**Check, set to specified pressure.**
Suction device (14)	**Set up behind exhaust pipe**
Engine oil temperature	**Run under partial load to 60-80 °C while checking speedometer.**
Blower (13)	**Cool engine, do not exceed 120 °C engine oil temperature.**
Oscilloscope pattern	**Evaluate under load (15-508).**
Full load output	**Check (refer to table). Pay attention to notes concerning output and emission test. Attention! Run at full load output only as long as required for reading instruments.**

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Emission values	**Check under load. If emission values are not attained, replace fuel distributor; check lambda control (07.3-I 00)**

Test and adjustment values

Engine output and emission test

Engine			103.940/941/942	
Version			RÜF	**KAT** (CH) **KAT**
Engine output test				
output test, full load')		rpm	**5500**	
	Manual transmission 3rd speed	kW	92	89
	Automatic transmission driving pos. ,,3''	kW	89	86
Emission test				
Idling speed		rpm	**650-750**	
		% CO	1 ± 0.5	≦ 0.5[2])
	Lambda control	%	–	Readout oscillating
Full load	**3rd speed driving position ,,3''**	% CO[3])	1.5–5	
		rpm	3500	
Upper partial load	**4th speed driving pos. „D" 120 km/h 24 kW**	% CO	**0.1-0.8**	**Readout oscillating**
Lower partial load	**4th speed driving pos. „D" 50 km/h 7 kW**	% CO	**0.1-0.8**	**Readout oscillating**

[1]) Test values are minimum outputs.
[2]) With special emission test (ASU).
[3]) On vehicles with lambda control, lambda control will move to control operation during full load test.

Note: When measuring output, be sure to take the various influencing factors into consideration.

Output correction factor

Notes for output test.

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Engine	103.980		103.981/982/983	
Version	Std.	Std. KAT	RÜF	KAT (CH) KAT

Engine output test

output test full load[1])		rpm	5500			
	Manual transmission 3rd speed	kW	105	–	104	100
	Automatic transmission driving pos. ,,3''	kW	102	–	101	97

Emission test

Idling speed		rpm	**600-700**			
		% co	**1 ± 0.5**	**2 ± 0.5**	1 ± **0.5**	≦ 0.5[2])
	Lambda control	%	–	**Readout oscillating**	–	**Readout oscillating**
Full **load**	3rd **speed driving position** ,,3''	**% CO**[3])	1.5-5			
		rpm	3500			
Upper partial load	**4th speed** driving pos. ,,D'' 120 km/h 24 kW	% co	0.1–0.8	Readout oscillating	0.1–0.8	Readout oscillating
Lower partial load	4th **speed driving pos. „D" 50 km/h 7.0** kW	**% co**	0.1–0.8	Readout oscillating	0.1–0.8	Readout oscillating

[1]) **Test values are minimum output values.**
[2]) **With special emission test (ASU).**
[3]) **On vehicles with lambda control, lambda control will move to control operation during full load test.**

Note: When measuring output, be sure to take the various influencing factors into consideration.

Output correction factor
Notes for output test.

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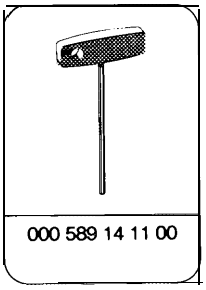
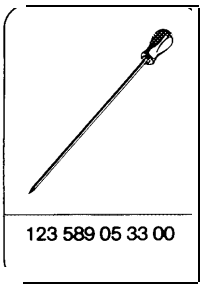
Special tools


000 589 14 11 00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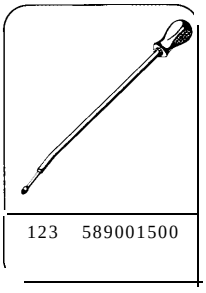
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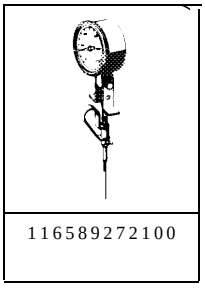
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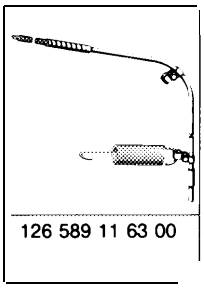
126 589 11 63 00

Conventional testers

CO measuring instrument		
Engine tester	(rpm, dwell angle, ignition angle, oscilloscope, voltmeter)	e.g. Bosch, MOT 002.02
		e.g. SUN, 1019
Lambda control tester		e.g. Hermann, L 115

Notes concerning output and emission test on drum dynamometer, as well as output corrections, driving rules and operating notes

Output test

This test is required only in the event of a complaint about output. The valid output reference values are minimum values and apply to vehicles with power steering. Take barometer reading and intake air temperature into account (refer to enclosure).

On vehicles where the firing point has been changed owing to a changeover from leaded to unleaded fuel, the output values may be slightly reduced.

Note: Vehicles with electronic ignition timing (EZL).

When a coolant temperature of approx. 95 °C on these vehicles is exceeded, the ignition timing (firing point) is put back in direction of ,,retard". This will reduce the output by approx. 2-5 %.

If during output test the specified minimum output is not attained, repeat output test with a simulated coolant temperature of 80 °C.

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The coolant temperature can be simulated with the Ω-decade (special tool 124 589 09 63 00), 80 °C = 300 Ω.
For this purpose, pull green/black plug from temperature **sensor and connect to ground via a-decade.**

Emission tests

The emission tests at idle, partial load and full load are serving to evaluate the mixture composition in combustion chamber. They must be made in the event of complaints about engine performance, fuel consumption and engine output. A statement on absolute consumption is not possible. For emission tests, use measuring instruments in accordance with infrared absorption method.

Output correction on drum dynamometer

To determine the engine output, uniform directives according to 80/1 269 EEC were set up for the European Economic Community. They differ from DIN 70020 part 6, valid up to now e.g. by the atmospheric reference conditions named (air temperature now 25 °C, air pressure 990 hPa (mbar) instead of 1013 hPa(mbar).

The formulas for determining correction factors were also revised. Humidity conditions were not included.

Driving regulations, operating notes

To keep tire strain within permissible limits the following regulations should be observed:

1 Do not drive on drum dynamometers with winter tires. Mount shop-owned test bench tires. Only warming up under partial load is permitted (refer to item 8).

2 Check tire pressure of drive wheels, but do not increase beyond the pressure specified for road driving.

3 High axle load of drive wheels is **not permitted.**

4 Restrict duration of driving to the absolutely necessary time for reading the instruments (approx. 5 seconds **for emission test).**

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5 Driving speed max. 130 km/h (with SR tires 120 km/h) on dynamometers with a drum diameter of min. 318 mm with original tires.

At a drum diameter of 220-318 mm and vehicles with SR tires for speeds above 100 km/h, shop-owned test bench tires must be mounted. Function and output tests at max. 100 km/h (e.g. diesel) can also be made with original tires.

6 Maintain test regulations and the following sequence:

Warming up — output test — emission test full load, upper partial load, lower partial load — idling speed — emission test idling speed.

The full load tests (output, emissions) must be made immediately after warming up, as long as the tire temperature is still low, since the temperature rises the most during these measurements. Two repeat measurements following adjusting jobs are permitted. Prior to additional measurements, be sure to wait for about 45 minutes for cooling the tires.

7 Cool vehicle with blower (minimum output 15 000 m^3/h). Direct air flow to radiator and underbody of vehicle (oil pan, exhaust, tires). Maintain a distance of approx. 1 m between blower and vehicle.

8 Warming up under partial load (driving position 3 or 3rd speed, approx. 60 km/h, approx. 25 kW) up to an oil temperature of 75 °C.

9 Insert emission probe (special tool 126 589 11 63 00) for at least 300 mm into exhaust pipe.

10 During output test drive in specified gear step at engine speed named, with the engine fully loaded. Read instruments. Decelerate. Compare indicated output with reference value. Take vehicle equipment, barometer reading and intake temperature into account (for output corrections, refer to enclosure and Data Manual).

11 During emission test drive in specified gear step at full load or partial load at specified engine speed or driving speed and test bench adjustment named. Do not drive longer than required for reading the instruments. Pull off engine vent. Air cleaner must be mounted. Perform emission test at partial load at an oil temperature between 75 and 85 °C. If required, cool engine after driving under full load.

12 During emission test at idling speed an oil temperature of 60-80 °C is required. The cooling blower must be switched off. Run engine for 5 minutes at idle for stabilization.

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Use of correction table

All output data refer to normal operating conditions:

a) Reference pressure: 990 hPa = 990 mbar
b) Reference intake air temperature: +25 °C

The output measured on dynamometer must be corrected if test conditions are different, so that they can be compared with the output data in technical records.

Air pressure measuring system of weather station

The barometer of the weather station shows the air pressure with reference to height above sea level. Prior to operating station, the barometer must be set to the air pressure according to data from local weather service.

In addition to barometer reading the altitude and intake air temperature should also be included.

Output correction formula $Ne_o = Ne \times K_H$

Ne_o = Output with reference to normal operating conditions in kW (HP).

Ne = Measured output on dynamometer in kW (HP).

K_H = Correction for intake air temperature, barometer reading and altitude of respective test location.

The output correction factors are shown on correction table.

Example
(Looking up of values for this example is indicated).

Determined output: Ne = 100 kW
Barometer reading (with reference to height above sea level): p = 955 hPa (955 mbar)
Altitude of test location: 400 m above sea level
Intake air temperature: t = +20 °C

Result:

p test location = p barometer − p altitude

p test location = 955 hPa -46 hPa
= 909 hPa ≈ 910 hPa

K_H = 1.0787 (from correction table 910 hPa, +20 °C)

Ne_o = measured output Ne x correction KH

therefore Ne_o = 100 kW x 1.0787 = 108 kW

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Output corrections on dynamometer for gasoline engines according to 80/1269 EEC

Air pressure	hPa (mbar)	Correction factor										
	1040	0,9111	0,9194	0,9277	0,9358	0,9439	0,9519	0,9599	0,9678	0,9756	0,9833	0,9910
	1035	0,9155	0,9239	0,9321	0,9403	0,9485	0,9565	0,9645	0.9724	0,9803	0,9881	0,9958
	1030	0,9200	0,9284	0,9367	0,9449	0,9531	0,9612	0,9692	0,9772	0.9851	0,9929	1,0007
	1025	0,9245	0.9329	0,9412	0,9495	0,9577	0,9659	0.9739	0,9819	0,9899	0,9977	1,0056
	1020	0,9290	0.9375	0,9458	0,9542	0,9624	0,9706	0,9787	0.9867	0,9947	1.0026	1,0105
	1015	0,9336	0,9421	0.9505	0,9589	0.9672	0,9754	0.9835	0,9916	0,9996	1.0076	1,0155
	1010	0,9382	0,9467	0,9552	0,9636	0,9719	0,9802	0,9884	0,9965	1,0046	1,0126	1,0205
	1005	0,9428	0,9514	0,9600	0,9684	0.9768	0.9851	0.9933	1,0015	1.0096	1,0176	1,0256
	1000	0,9476	0,9562	0,9648	0,9732	0,9817	0,9900	0,9983	1,0065	1,0146	1,0227	1,0307
	995	0,9523	0,9610	0,9696	0,9781	0.9866	0.9950	1,0033	1,0115	1,0197	1.0278	1,0359
	990	0,9571	0,9659	0,9745	0,9831	0,9916	1,oooo	1,0084	1,0166	1.0249	1.0330	1,0411
	985	0.9620	0,9708	0,9795	0,9881	0,9966	1,0051	1,0135	1.0218	1,0301	1,0383	1,0464
	980	0,9669	0,9757	0,9845	0,9931	1,0017	1,0102	1,0186	1,0270	1,0353	1,0436	1,0517
a	975	0,9719	0,9807	0,9895	0,9982	1,0068	1,0154	1,0239	1,0323	1,0406	1,0489	1,0571
ir ressre	970	0,9769	0.9858	0,9946	1,0033	1,0120	1,0206	1,0291	1,0376	1.0460	1,0543	1.0626
	965	0,9819	0,9909	0,9998	1,0085	1,0173	1,0259	1,0345	1,0430	1,0514	1,0598	1,0681
a	960	0,9870	0,9960	1,0050	1,0138	1.0226	1,0313	1,0399	1,0484	1,0589	1,0653	1,0736
	955	0,9922	1,0013	1,0102	1,0191	1,0279	1,0366	1,0453	1,0539	1,0624	1,0709	1,0793
	950	0,9974	1,0065	1,0155	1,0245	1,0333	1,0421	1,0508	1,0594	1,0680	1,0765	1,0849
	945	1,0027	1,0119	1,0209	1,0299	1,0388	1,0476	1.0564	1,0651	1,0737	1,0822	1,0907
	940	1,0080	1,0172	1,0263	1.0354	1,0443	1,0532	1.0620	1,0707	1,0794	1,0880	1,0965
	935	1,0134	1,0227	1,0318	1,0409	1,0499	1,0588	1,0677	1.0764	1,0851	1,0938	1,1023
	930	1,0189	1,0282	1,0374	1,0465	1,0555	1,0645	1,0734	1,0822	1,0910	1,0997	1,1083
	925	1,0244	1,0337	1,0430	1,0522	1,0613	1,0703	1,0792	1,0881	1,0969	1,1056	1,1143
	920	1,0300	1,0393	1,0487	1,0579	1,0670	1,0761	1.0851	1,0940	1,1028	1,1116	1,1203
	915	1,0356	1,0450	1,0544	1,0637	1,0729	1,0820	1.0910	1,1000	1,1089	1,1177	1,1264
	910	1.0413	1,0508	1,0602	1,0695	**1,0787**	1,0879	1,0970	1,1060	1,1150	1,1238	1,1326
	905	1,0570	1,0566	1.0660	1,0754	1,0847	1,0939	1,1031	1,1121	1,1211	1,1300	1.1389
	900	1,0528	1,0624	1,0720	1,0814	1,0907	1,1000	1,1092	1,1183	1,1273	1,1363	1,1452
	895	1,0587	1,0684	1,0779	1,0874	1,0968	1,1061	1,1154	1,1246	1,1336	1,1427	1,1516
	890	1.0647	1,0744	1,0840	1,0935	1,1030	1,1124	1,1217	1,1309	1,1400	1,1491	1,1581
	885	1,0707	1,0805	1,9901	1,0997	1,1092	1,1186	1,1280	1,1373	1.1465	1.1556	1,1646
	880	1,0768	1,0866	1,0963	1,1060	1,1155	1,1250	1,1344	1,1437	1,1530	1,1621	1,1712
	875	1,0829	1,0928	1,1026	1,1123	1,1219	1,1314	1,1409	1,1503	1,1596	1,1688	1.1779
	870	1,0892	1,0991	1,1089	1,1187	1,1283	1,1379	1,1474	1,1569	1,1662	1,1755	1,1847
	865	1,0954	1,1054	1,1153	1,1251	1,1349	1,1445	1,1541	1,1636	1,1730	1,1823	1,1915
	860	1,1018	1,1119	1,1218	1,1317	1,1415	1,1512	1,1608	1,1703	1,1798	1,1892	1,1985
	855	1,1083	1,1184	1,1284	1,1383	1,1481	1,1579	1,1676	1,1772	1.1867	1,1961	1.2055
	850	1,1148	1,1294	1,1350	1,1450	1,1549	1,1647	1,1744	1,1841	1,1937	1,2032	1,2126
p	845	1,1214	1,1316	1,1417	1,1518	1,1617	1,1716	1,1814	1,1911	1,2007	1,2103	1.2198
sure	840	1,1281	1,1383	1,1485	1,1586	1,1686	1,1786	1,1884	1,1982	1,2079	1,2117	1,2270
	835	1,1348	1,1452	1,1554	1,1656	1,1756	1,1856	1,1955	1,2054	1,2151	1.2248	1,2344
	830	1,1416	1,1521	1,1624	1.1726	1,1827	1,1928	1,2077	1,2126	1,2224	1,2321	1,2418
	825	1,1486	1,1590	1,1694	1,1797	1,1899	1,2000	1,2100	1,2200	1,2298	1.2396	1,2493
	820	1,1556	1,1661	1,1765	1,1869	1,1971	1,2073	1,2174	1,2274	1,2372	1,2472	1,2569
	815	1,1627	1,1733	1,1838	1,1942	1,2045	1,2147	1,2249	1,2349	1,2449	1,2548	1.2647
	810	1,1698	1,1805	1,1911	1,2015	1,2119	1,2222	1,2324	1,1426	1,2526	1,2626	1,2725
	805	1,1771	1,1878	1,1985	1,2090	1,2195	1,2298	1,2401	1,2503	1,2604	1.2704	1.2804
	800	1,1845	1.1953	1,2060	1,2166	1,2271	1,2375	1,2478	1,2581	1,2683	1,2784	1,2884
	795	1,1920	1,2028	1,2135	1,2242	1,2348	1,2453	1,2557	1,2660	1,2762	1,2864	1,2965
	790	1,1994	1,2104	1,2212	1,2320	1,2426	1,2532	1,2636	1,2740	1,2843	1,2945	1,2047
	785	1,2071	1,2181	1,2290	1,2398	1,2505	1,2611	1,2717	1,2821	1,2925	1,3028	1,3130
	780	1,2148	1,2259	1,2369	1,2478	1,2585	1,2692	1,2798	1,2904	1,3008	1,3111	1,3214
		0	5	10	15	20	25	30	35	40	45	50

Intake airtemperaturet+ °C

Altitude correction

If the air pressure is read with reference to height above sea level (weather station), the following air pressure must be deducted from correction table.

m	hPa(mbar)	m	hPa(mbar)	m	hPa(mbar)	m	hPa(mbar)	m	hPa(mbar)	m	hPa(mbar)
0	0	300	36	600	69	900	145	1400	159	2000	221
50	6	350	41	650	75	950	109	1500	170	2100	230
100	12	400	46	700	81	1000	115	1600	181	2200	239
150	18	350	52	750	86	1100	126	1700	192	2300	250
200	24	500	58	800	92	1200	137	1800	201	2400	259
250	30	550	63	850	98	1300	148	1900	210	2500	268

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07.3-I 17 Determining fuel consumption by driving on road

Job No. of work unit or standard texts and flat rates data 07-1333.

1 **Completely fill up vehicle on level ground in the presence of customer.**

2 Driving distance approx. 100 km, of which approx. 40 km on express road and approx. 60 km on high-way and in city traffic.

3 After driving, fill up again and calculate fuel consumption.

Example:
Fuel consumption in liters/l00 km

$$= \frac{\text{Fuel quantity consumed in liters}}{\text{Driven km}} \times 100$$

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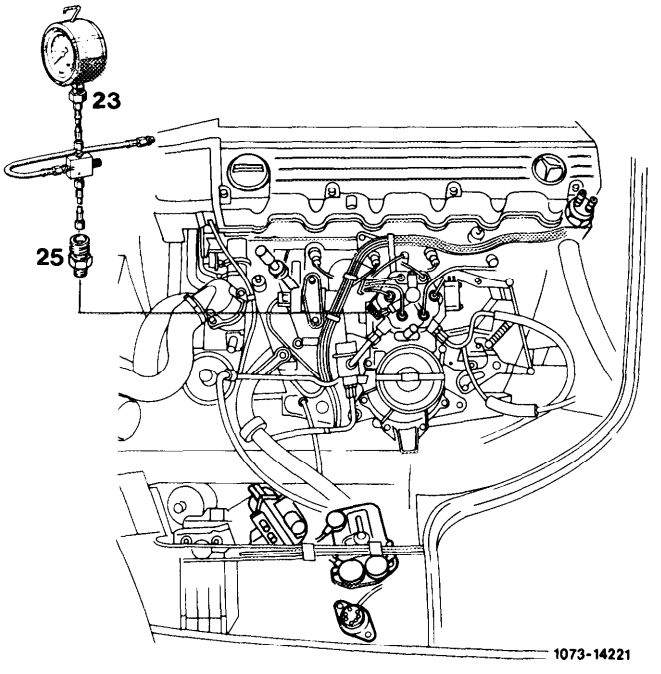
Job No. of work unit or standard texts and flat rates data 07–1603.

Basic and national versions



All fuel connections	Check for leaks
Easy operation of air flow sensor plate and control piston	Check
Control piston for leaks	Check
Pressure measuring device (23)	Connect. Special tool 103 589 00 21 00
System pressure.	Check
Lower chamber pressure	Check
Decel shutoff	Check
Full load enrichment	Check
Acceleration enrichment	Check
Fuel distributor and fuel pump for leaks	Check

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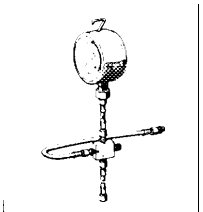
Test and adjustment values

Fuel pressures in bar gauge pressure

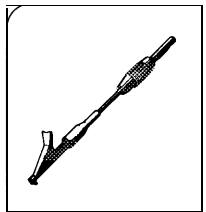
Engine				103.980	103 (except 103.980)
System pressure with engine cold or at operating temperature				5.3–5.5	
Lower chamber pressure	engine at operating temperature		approx.	0.4[1])	
	with plug pulled from coolant temperature sensor			–	
	at coolant temperature of +20 °C	stationary or at idle	approx.	0.5[1])	
		and acceleration enrichment		⩾3.8	–
	at full load enrichment with engine at operating temperature		approx.	–	
	at decel shutoff			5.3–5.5[2])	

[1]) **Below previously measured system pressure**
[2]) **Lower chamber pressure equals system pressure**

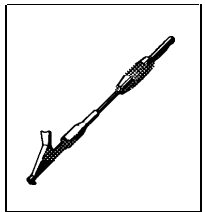
Special tools



103 589 00 21 00



102 589 05 63 00



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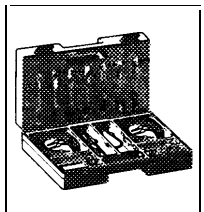

201 589 00 99 00

Note

Perform leak test only in the event of hot start complaints.

After stopping engine the fuel pressure should still amount to 2.5 bar gauge pressure after 30 minutes.

If there is no reaction whatsoever during pressure test of auxiliary functions, check overvoltage protection (07.3-I 21 section ,,a").

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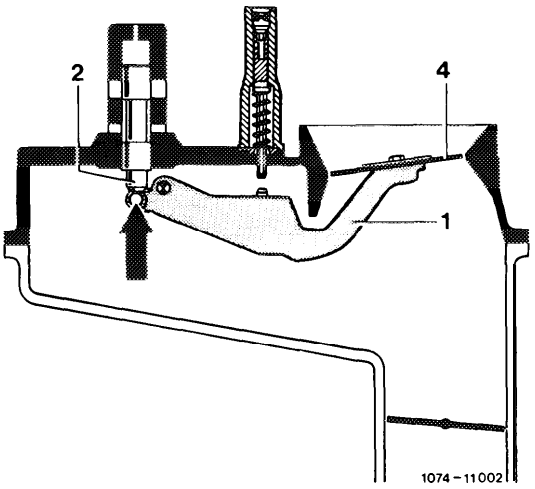
Visual checkup



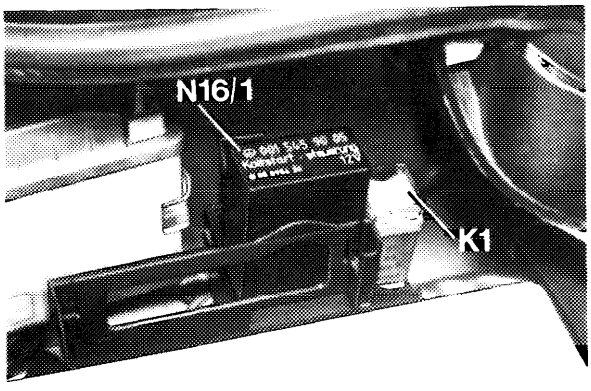
1 Remove air cleaner.

2 Check all fuel connections for leaks.

3 Check for easy operation of adjusting lever (1) in air volume sensor and of control piston (2) in fuel distributor. For this purpose, pull off fuel pump relay (N16/1) and bridge the two jacks 7 and 8 for a short moment to establish pressure. Push air flow sensor plate (4) manually down. Uniform resistance should be felt along entire distance. No resistance should be felt during fast upward movement, since the slowly following control piston lifts off from adjusting lever. During slow upward movement the control piston should closely follow.

4 Check control piston in fuel distributor for leaks.

Push air flow sensor plate for a short moment completely down and hold in this position, slight leaking is permitted.



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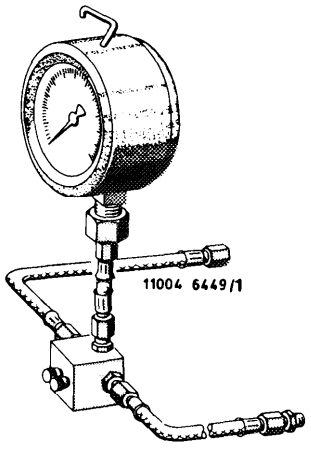
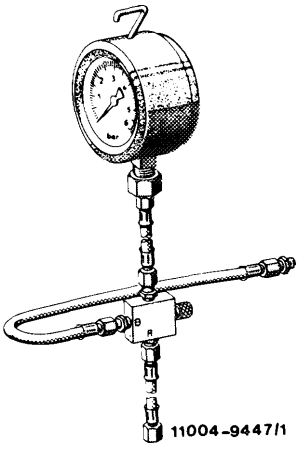
Connecting pressure measuring device



Pressure measuring device 1st version

Connection 1 = Hose line to fuel distributor — lower chamber
Connection 2 = Hose line to pressure gauge
Connection 3 = Hose line to fuel distributor — upper chamber (connection cold start valve)



Pressure measuring device 2nd version

Connection A = Hose line to fuel distributor — lower chamber
Connection B = Hose line to fuel distributor — upper chamber on cold start valve

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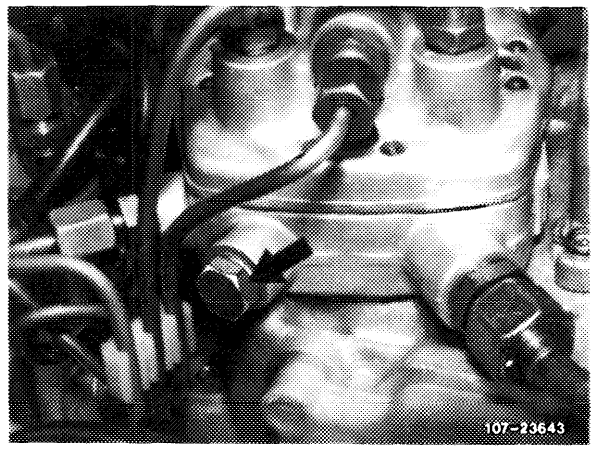
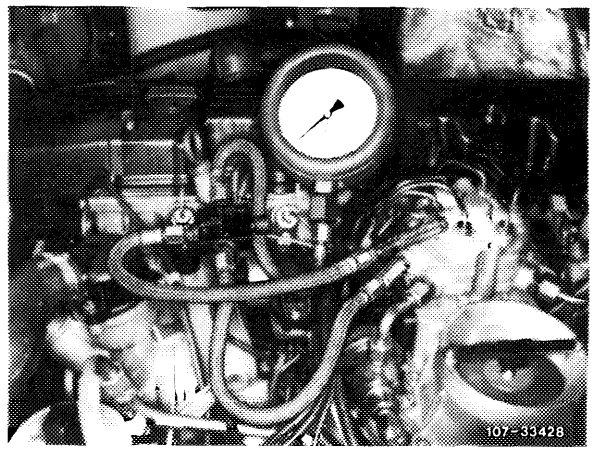
To relieve the sealing rings, keep valve screw or valve screws always open. Connections of three-way valve are numbered.



5 Unscrew closing plug (arrow) on lower chamber of fuel distributor.

When loosening closing plug, make sure that the open-end wrench is not pressing against sensor of air flow meter. The result would be damage to that sensor.

6 Connect hose line of connection ,,A" or ,,1'' to lower chamber. for this purpose, use M 8 x 1 /m 12 x 1.5, special tool part No. 102 589 06 63 00.



7 Unscrew fuel line on cold start valve on fuel distributor.

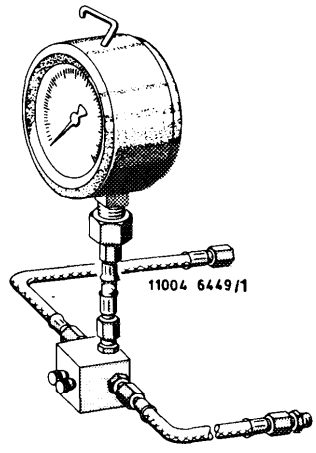
8 Connect hose line of connection ,,B'' or ,,3'' to fuel distributor.

9 Position of valve screws:

a) System pressure

Close pressure device 1st version = valve screw connection 1, open valve screw connection 3.

Open pressure measuring device 2nd version = open valve screw.



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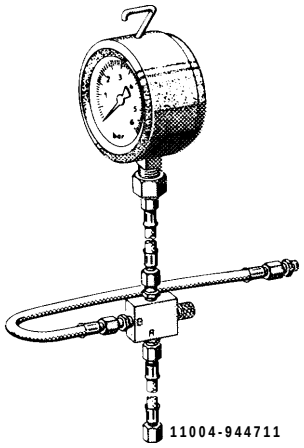
b) Lower chamber pressure, decel shutoff, acceleration enrichment

Pressure measuring device 1st version = open valve screw connection 1, **close** valve screw connection 3.

Pressure measuring device 2nd version = close valve screw.



Checking

Check system and lower chamber pressure with engine stopped.

Checking of acceleration enrichment as well as of decel shutoff must be **done with engine running.**

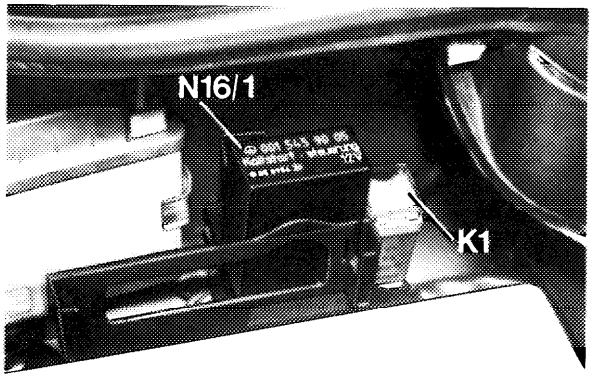
Place pressure measuring device on cylinder head cover.

a) System pressure with engine cold or at operating temperature

10 Pull off fuel pump relay (N16/1) and bridge the two jacks 7 and 8.

Pay attention to position of valve screws, read system pressure.

Nominal value:
5.3-5.5 bar gauge pressure.



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11 **If the nominal value is not attained or exceeded:**

Check fuel pump (07.3–130).

Replace diaphragm pressure regulator.

Check fuel return line for unobstructed passage.

12 Re-open valve screw on connection 1.

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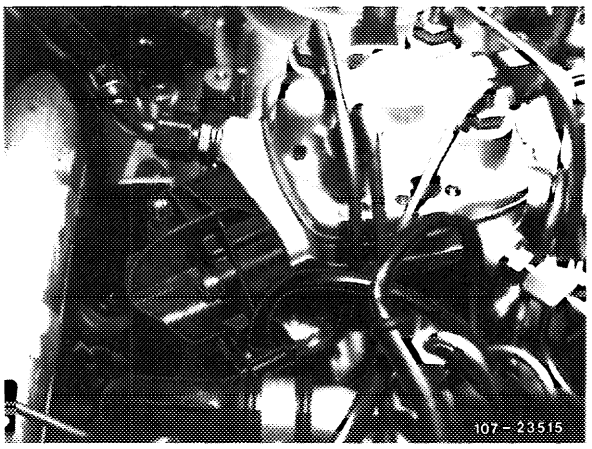
b) Lower chamber pressure



13 Pull off fuel pump relay and bridge the two jacks 7 and 8. Switch on ignition.

14 With engine at operating temperature, pull electric connection from electrohydraulic actuator.

Pay attention to position of valve screws.

Read lower chamber pressure.

Nominal value at operating temperature approx. 0.4 bar below system pressure.

When plugging on electric connection, there should be no pressure change.

Note: During warm-up stage the actuator is energized by a given voltage, which is determined by the coolant temperature sensor and the control unit.

If the nominal value is not attained:
Check coolant temperature sensor (07.3-I 21, section ,,b'').

Test control unit (07.3-I 21, section ,,b'').

Test electrohydraulic actuator (07.3-I 21, section ,,b''),

If pressure in lower chamber is above nominal value, check throttle (orifice) in fuel distributor for unobstructed passage (07.3-I 22).

15 Put back fuel pump relay.

c) Decel shutoff

16 Run engine to operating temperature.

17 Pay attention to position of valve screws.

18 Run engine at idle. Increase speed for a short period to approx. 2500 rpm. When the speed drops, pressure in lower chamber should increase to system pressure.

Combustion starts again at approx. 1300 rpm.

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If the nominal value is not attained:

Check microswitch (07.3-I 21, section ,,d'').

Check control current on actuator (07.3-I 21, section ,,d'').

Test control unit (07.3-I 21, section ,,d'').

Test TD signal (07.3-I 21, section ,,d'').

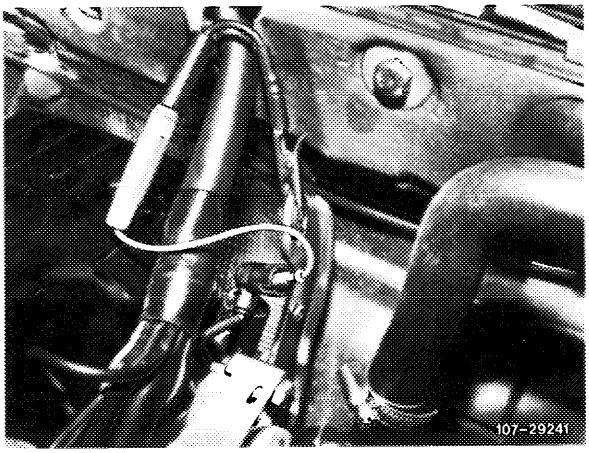
On vehicles with cruise control/Tempomat, check relay for cruise control/Tempomat (Group 54).

d) Acceleration enrichment (engine 103.980 only)

To check acceleration enrichment, simulate ,,engine cold".

19 Pay attention to position of valve screws,

20 Simulate ,,engine cold". For this purpose, connect resistor (arrow) at 2.5 kΩ,= approx. +20 °C, between connecting cable coolant temperature sensor and vehicle ground.



21 Start engine, increase rpm suddenly to approx. 2500 rpm. During increase of rpm, the lower chamber pressure shou ld drop.

If the nominal value is not attained:

Check sensor air volume meter (07.3-I 21, section ,,f'').

Check control current on actuator (07.3-I 21, section ,,f'').

Check control unit (07.3-I 21, section ,,f'').

Checking fuel distributor and **fuel pump for leaks**

22 Stop engine. Pressure in system will then drop below opening pressure of injection valves (approx. 2.8 bar gauge pressure).

23 If the pressure drops immediately to 0 bar gauge pressure, replace check valve on fuel pump.

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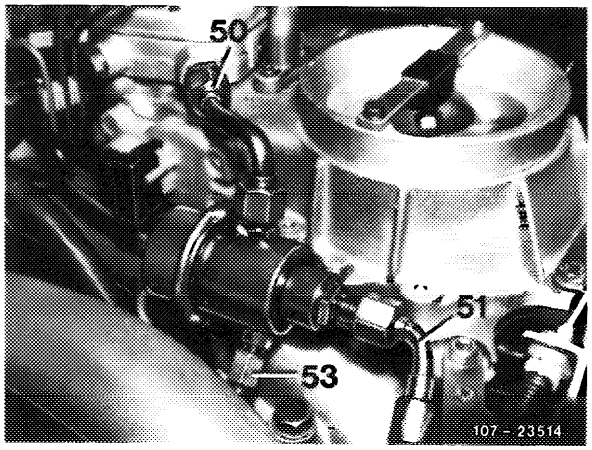
24 If the pressure drops slowly, unscrew fuel return line (51) on diaphragm pressure regulator. No fuel should follow (slight quantity of leak fuel is permitted).

Attention!
If fuel flows out of fuel return line (51), de-activate line.

25 Pinch off leak line on fuel accumulator. If the pressure does not drop immediately, replace fuel accumulator (07.3–270).



26 If upon leak test no leaks are showing up, test starting valve for leaks. For this purpose, remove starting valve (07.3-l 25, section ,,Checking for leaks").

27 Disconnect pressure measuring device, while catching fuel with a rag.

28 Connect fuel lines, run engine once again and check all fuel connections for leaks.

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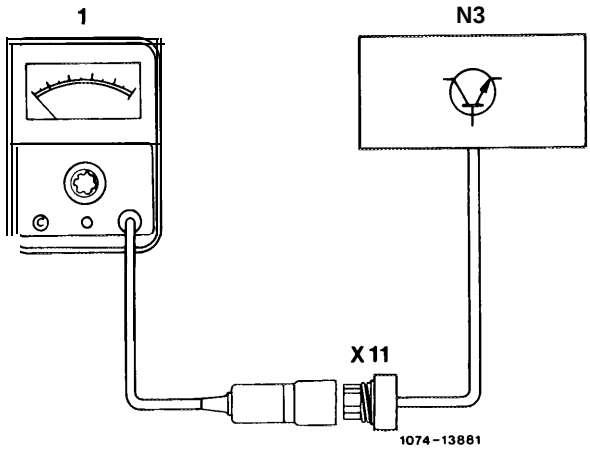
Basic and national versions

A. Without trouble diagnosis by means of on-off ratio

Up to March 1986 no fault detection is integrated in CIS-E control unit.

B. With trouble diagnosis by means of on-off ratio

Starting March 1986, faulty input signals are detected by CIS-E control unit (N3) and transmitted to lambda measuring output. Faults are picked up by means of lambda control tester (1) at diagnosis socket (XI 1).



Fault detection permits testing different components of CIS-E injection system by means of measuring the on-off ratio.

Fault detection of control units:

On-off ratio indication	Control unit
70 %	with fault detection
100%	without fault detection

Electrical wiring diagrams 07.3-l 28.

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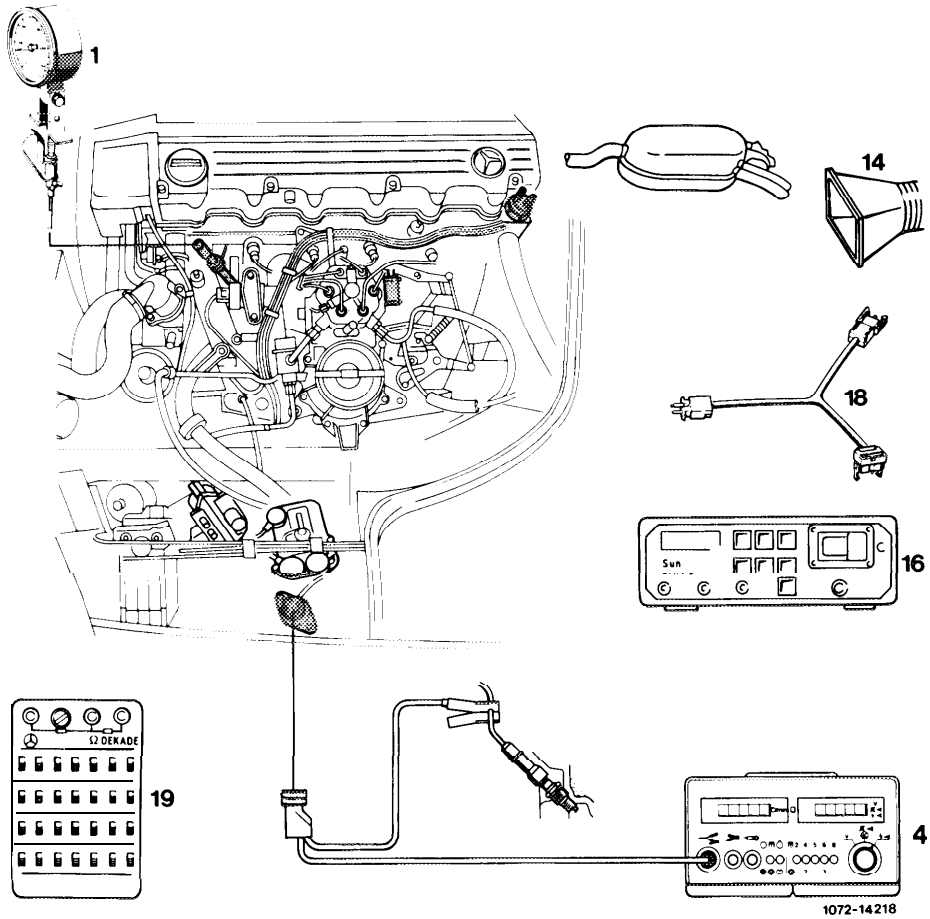
A. Without trouble diagnosis by means of on-off ratio



Testers	Connect: oil telethermometer (1) 116 589 27 21 00. Engine tester (4). Multimeter (16). Test cable (18) 102 589 04 63 00. Ohm decade (19) 124 589 09 63 00.
Suction device (14)	Set up at exhaust end pipe.
Engine oil temperature	60-80 °C.
Overvoltage protection (“07-I 627)	Battery voltage.
Coolant temperature sensor (“07-I 613)	Refer to table.
Intake air temperature sensor (“07-1614)	Refer to diagram.
Decel shutoff (*07–1618)	Refer to table.
Throttle valve switch (*07–1622)	Idle speed contact approx. 0 Ω, full load contact approx. 0 Ω.
Acceleration enrichment or sensor for air volume meter (“07-1631)	Refer to table.
Partial load mixture adaptation RÜF only (“07-I 623)	Refer to table.
O_2 sensor (“07-I 610)	Readout oscillating.
Speed signal engine 103.942 only (“07-I 635)	O-I 2 V.
Current at actuator (*07–1634)	Without lambda control 10 mA, with lambda control 20 mA.
Altitude correction	approx. 5 V.

. Job No. of work unit or standard texts and fiat rates data.

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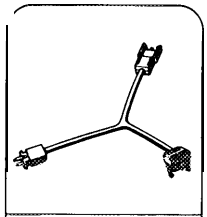
Test values

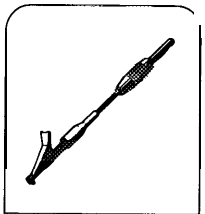
Engine			103.94	
Version			RÜF	KAT
Coolant temperature sensor	Coolant temperature +20 °C (warm-up basic value)	Resistance kΩ	2.2–2.8	
		Current at actuator mA	16–22	2–6
	Coolant temperature +80 °C	Resistance Ω	290–370	
		Current at actuator mA	1–2	Readout oscillating
After-start enrichment	After-start at +20°C	Current at actuator mA	25-31	3-9
Acceleration enrichment		Current at actuator at +20 °C and sudden acceleration mA	> 15	
Partial load mixture adaptation		Current at actuator mA	–7 to +4	Readout oscillating
Decel shutoff		Current at actuator mA	approx. –60	

Engine			103.98	
Version			Std./RÜF	KAT
Coolant temperature sensor	Coolant temperature +20 °C (warm-up basic value)	Resistance kΩ	2.2–2.8	
		Current at actuator mA	15–22	2–6
	Coolant temperature +80 °C	Resistance Ω	290–370	
		Current at actuator mA	1–2	Readout oscillating
After-start enrichment	After-start at +20°C	Current at actuator mA	21-27	8-12
Acceleration enrichment		Current at actuator mA at +20 °C and sudden acceleration	> 15	
Partial load mixture adaptation		Current at actuator mA	–7 to 4	Readout oscillating
Decel shutoff		Current at actuator mA	approx. -60	

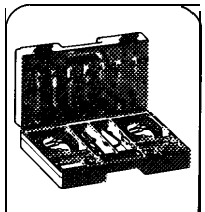
Special tools



102 589 04 63 00



102 589 05 63 00



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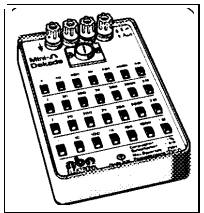

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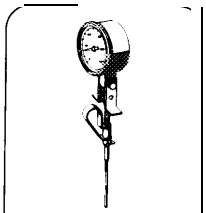

1165892721 00

Conventional testers

Multimeter	e.g. Sun, DMM-5
Engine tester	e.g. Bosch, MOT 002.02
Twin capsule	e.g. Hermann, ECD 53

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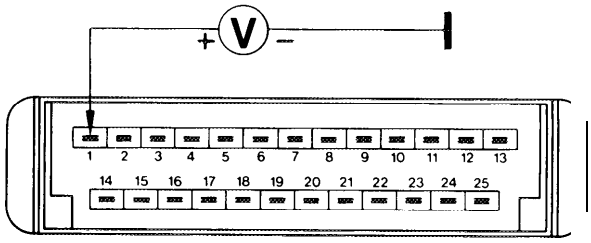
a) Testing overvoltage protection

Test fuse on overvoltage protection.

Fuse ok.	Fuse defective.

Replace fuse.



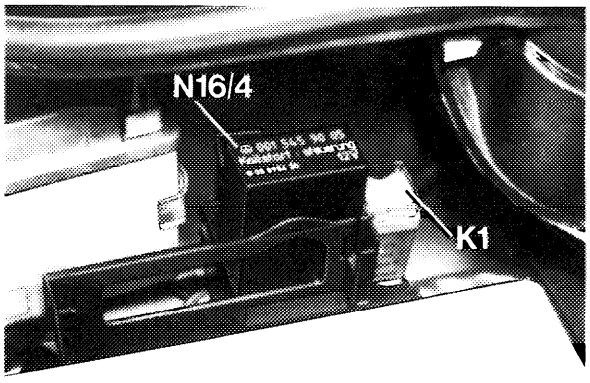
1074-11132

Pull off overvoltage protection. Bridge jack 1 and 2. Voltage on CIS-E control unit, test terminal 1 to ground.

Voltage approx. 12 volts.

Ok	Not ok

Check voltage according to wiring diagram.



107-29244/1

Check voltage on jack 5 and 6 on overvoltage protection.

Voltage approx. 12 volts.

Ok	Not ok
Replace overvoltage protection.	Check voltage supply according to wiring diagram.

End of test

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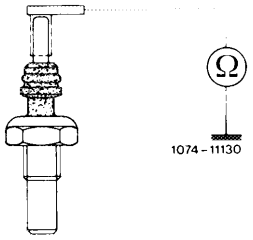
b) Testing coolant temperature sensor

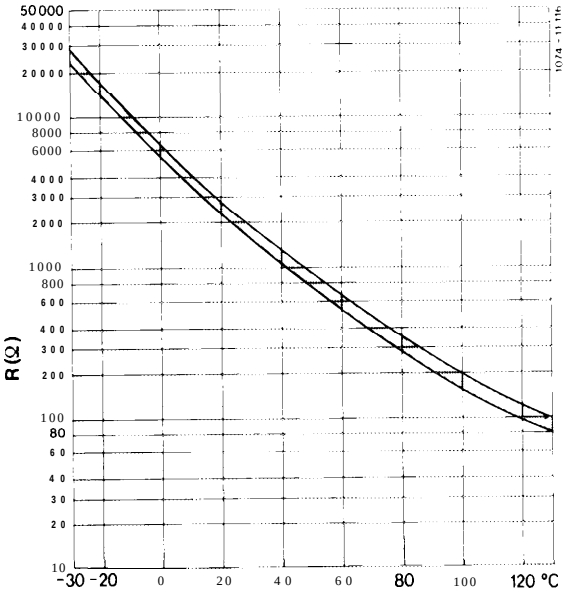
Pull **plug** from coolant temperature sensor.
Test resistance to ground.

For nominal value refer to diagram.
Test resistance at two temperature measuring points.

Example:
+ 20 °C = 2.2 – 2.8 kΩ
+ 80 °C = 290 – 370 kΩ

Ok	Not ok



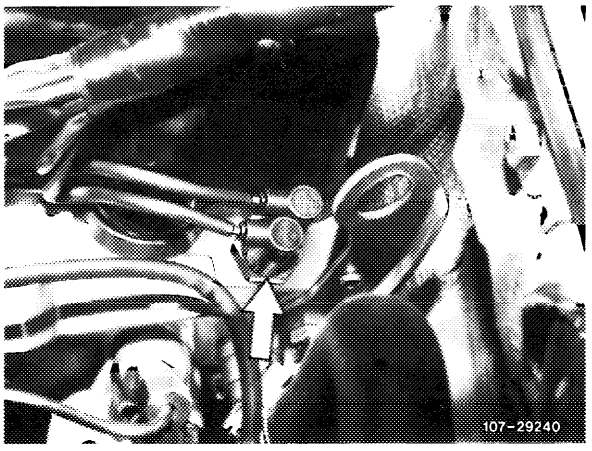


Replace coolant temperature sensor.

Connect test cable to actuator. Set measuring unit to mA. Pull off plug O_2 sensor. Switch on ignition. Read current value.

Coolant temperature + 80 °C
Std., RÜF 1–2 mA
KAT ± 3 mA
Coolant temperature + 20 °C
Engine 103.94 RÜF 16-22 mA
Engine 103.98 Std., RÜF 15-22 mA
Engine 103 KAT 2–6 mA

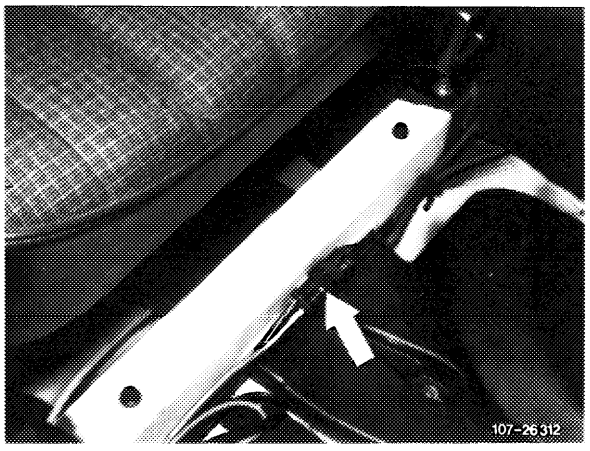
Ok	Not ok



With engine stopped.
Pull plug from actuator.
Test resistance of actuator.

Resistance 18-21 Ω

Ok	Not ok



Replace actuator.

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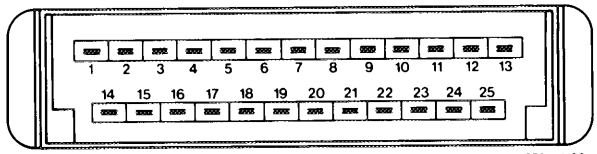
Check green/red line from terminal 21 plug control unit to plug coolant temperature sensor for continuity.

Resistance approx. 0 Ω

Ok	Not ok

Repair interruption according to wiring diagram.



1074-11129

Except RÜF/KAT, check brown/black line (terminal 12) between control unit and actuator for continuity.

Resistance approx. 0 Ω

Ok	Not ok

Replace control unit.

Repair interruption according to wiring diagram.

End of test

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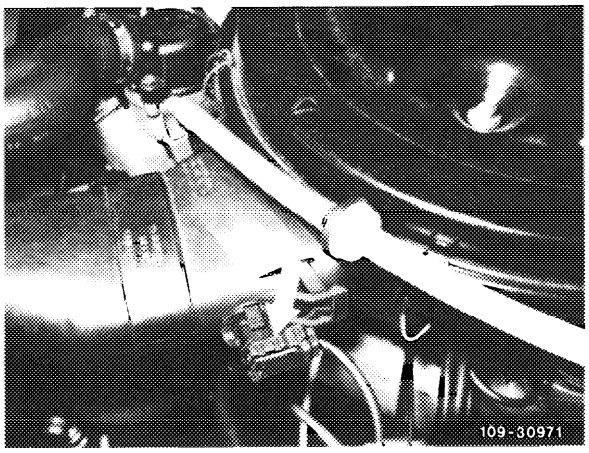
c) Check temperature sensor intake air



Pull plug from temperature sensor intake air (arrow). Test resistance.

For nominal value refer to diagram.

Example:
+ 20 °C = 2.2-2.8 kΩ
0 °C = 5.5-6.1 kΩ

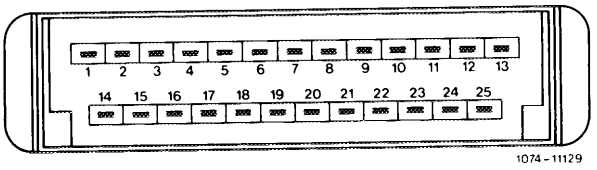
Ok	Not ok

Replace temperature sensor external air.

Check lines between temperature sensor intake air and ground or control unit injection system terminal 11 for continuity.

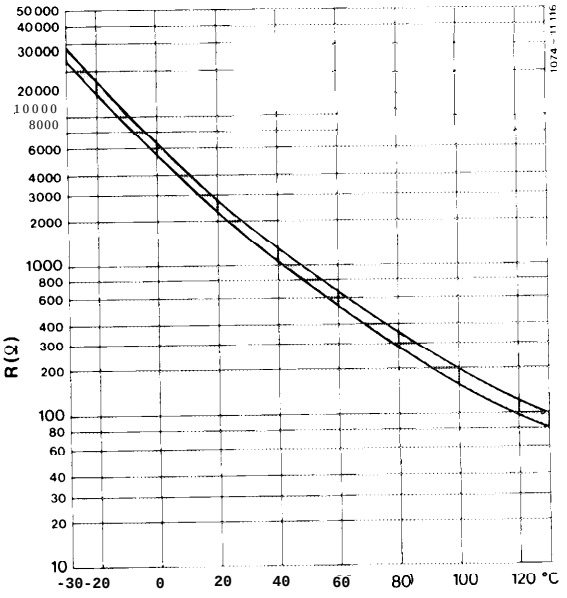
Resistance approx. 0 Ω

Ok	Not ok



Repair interruption according to wiring diagram.

End of test



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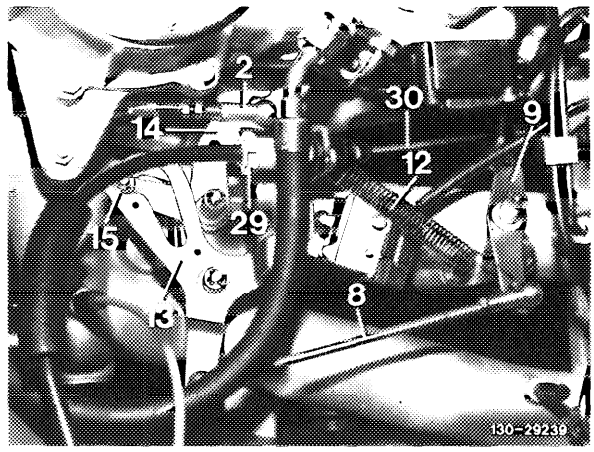
d) Testing decel shutoff



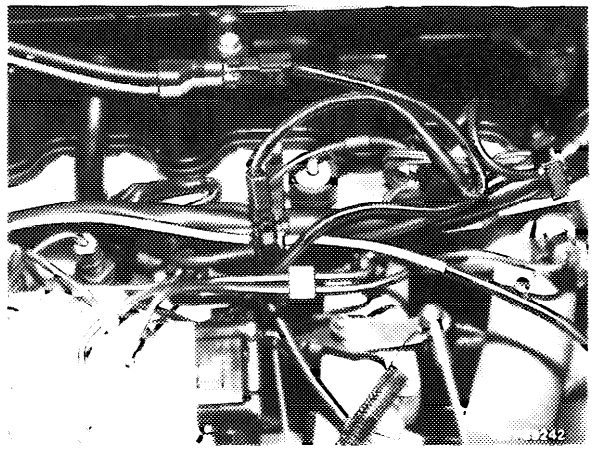
Engine at operating temperature. Pull off throttle valve switch and bridge jacks 1 and 2. Engine speed > 2500 rpm. Keep engine speed constant and actuate microswitch manually.

Engine hunting.

Ok	Not ok

1. Check adjustment of slotted lever. Roller (15) should rest free of tension against end stop.

2. Check throttle valve switch, section ,,e''.



1. Check resistance of microswitch.

2. Check throttle valve switch, section ,,e".

Idle speed position approx. 0 Ω
Idle travel cancelled ∞ Ω

Ok	Not ok

Replace switch.

Connect test cable to actuator. Measuring unit to mA. Increase engine speed to approx. 2500 rpm and release throttle control.

Up to attaining restarting speed at approx. 1300 rpm, the current value should amount to approx. -60 mA. Direction of current negative-positive.

Ok	Not ok

End of test

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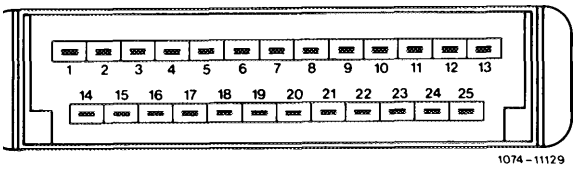
Test rpm signal (TD) on plug of control unit terminal 25 (green/yellow line). Measuring unit to volts. Start engine.

Voltage 6-I 2 V

Ok	Not ok

Repair interruption according to wiring diagram.



Except RÜF/KAT, test brown/black line (terminal 10) and black line (terminal 12) between control unit and actuator for continuity.

Resistance approx. 0 Ω

Ok	Not ok
Replace control unit.	Repair interruption according to wiring diagram.

End of test

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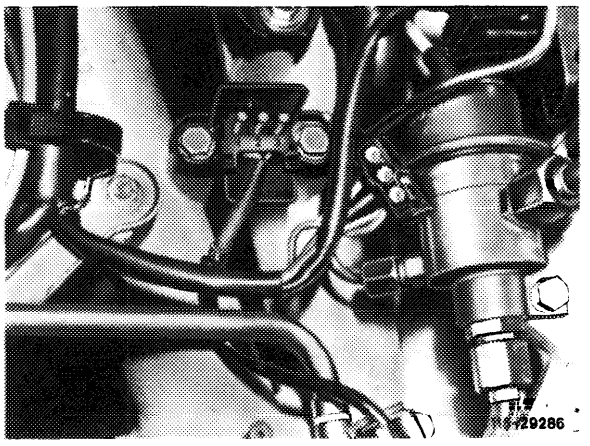
e) Testing throttle valve switch

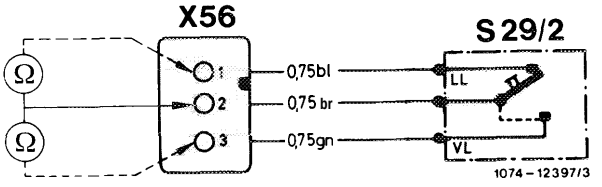


Stop engine.
Separate plug connection between throttle valve switch and control unit. Test resistance of throttle valve switch.

Idle speed contact: Idle speed position approx. 0 Ω
Full load position approx. ∞ Ω
Full load contact: Idle speed position approx. ∞ Ω
Full load position approx. 0 Ω
Partial load pos. approx. ∞ Ω

Ok	Not ok

Adjust or renew throttle valve switch, or wrong pole connection.



S29/2 **Throttle valve switch full load/idle detection**
X56 **Plug connection, throttle valve switch**

Test lines from throttle valve switch plug to CIS-E control unit and ground for continuity.

Resistance approx. 0 Ω

Ok	Not ok

Repair interruption according to wiring diagram.

End of test

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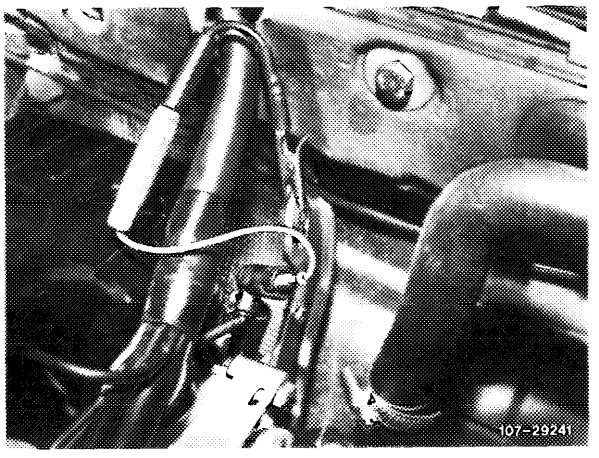
f) Checking acceleration enrichment or sensor of air volume meter



Connect test cable to electrohydraulic actuator. Set measuring unit to mA. With test resistor (on plug coolant temperature sensor and ground) simulate coolant temperature +20°C. With KAT, pull off O_2 sensor. Start engine (increased idling speed).

Current at actuator:
Engine 103.94 RÜF 16-22 mA
Engine 103.98 Std., RÜF 15-22 mA
Engine 103 KAT 2-6 mA

Ok	Not ok

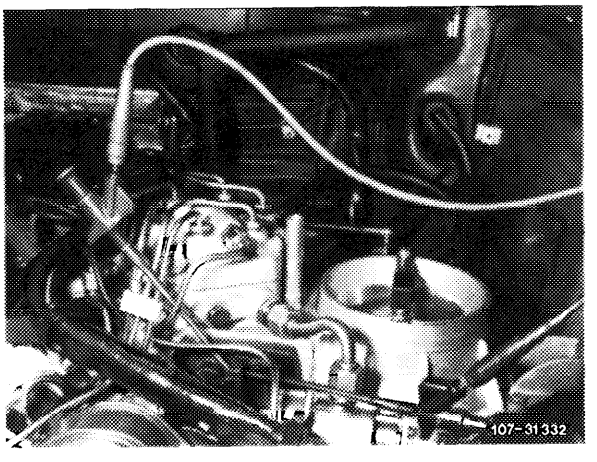
Connect coolant temperature sensor and O_2 sensor.

Pull off plug connection for sensor of air volume meter to the extent that voltage can be measured. Start engine. Check voltage between terminal 1 and 3.

Voltage 4.6–5.1 V

Ok	Not ok

Repair interruption according to wiring diagram.

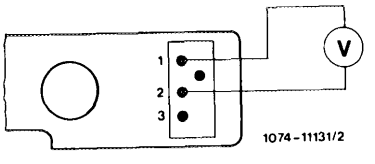


Measure voltage between terminal 1 and 2. Run engine at idling speed.

If idling speed deviates, pull plug from idling speed adjuster (air valve) and adjust idling speed with a clamp on air hose to mean value of tolerance data.

Worldwide	**0.57 – 0.81 V**
(CH) (S)	0.75 – 1.05 V

Ok	Not ok



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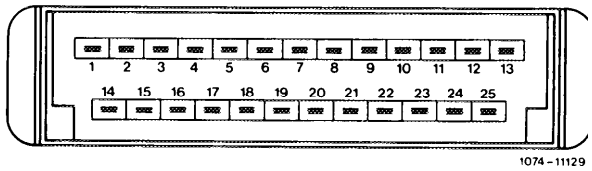
Voltage „0" volt: repair interruption. Voltage higher or lower: replace air volume meter.

Test rpm signal (TD) on control unit plug terminal 25 (green/yellow).

Voltage 6–12 volts

Ok	Not ok
Replace control unit (CIS-E).	**Repair interruption according to wiring diagram.**

End of test



1074-11129

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g) Testing partial load mixture adaptation, RÜF only

Connect test cable to actuator. Set measuring unit to mA. Engine at idle (operating temperature).

Current on actuator 0 mA. Increase engine speed to approx. 2500 rpm. Current on actuator: — 7 to + 4 mA.

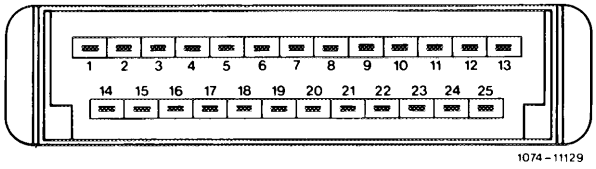
Ok	Not ok

Test rpm signal (TD) on plug of control unit terminal 25 green/yellow.

Voltage 6-l 2 volts

Ok	Not ok
Replace control unit (CIS-E).	Repair interruption according to wiring diagram.

End of test



1074-11129

Note: If the test values on throttle valve switch are attained during adaptation of partial load mixture, full load enrichment is also effective.

h) Testing lambda control
refer to 07.3-100

i) Testing O_2 sensor

Note

Test O_2 sensor with engine at operating temperature.

Function test: Slightly deflect air flow sensor plate manually with engine running, control range on tester should go back to lean stop. If not, perform test program.

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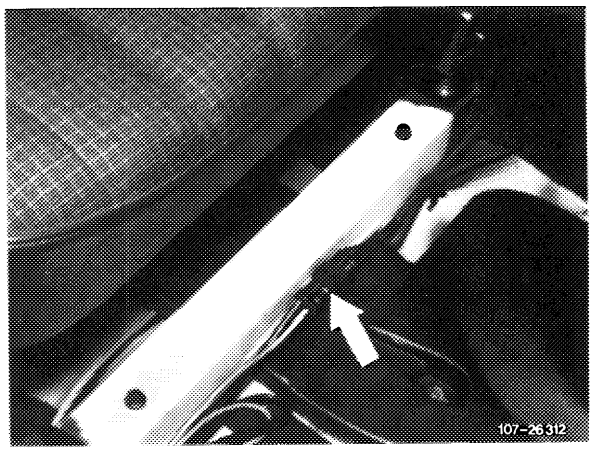
Disconnect plug O_2 sensor signal. Plug to CIS-E control unit to ground. Start engine. Test voltage to ground at plug connection of O_2 sensor l ine.

Voltage 450 – 1000 mV

Ok	Not ok

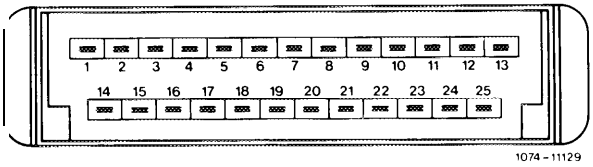


Stop engine. Test line to CIS-E control unit jack 8 for continuity.

Resistance approx. 0 Ω

Ok	Not ok

Repair interruptionaccording to wiring diagram.



Pull off plug of O_2 sensor heater (two-pole) to the extent that the voltage can be tested. (Attention! short-circuit danger). Pull off fuel pump relay and bridge jack 7 and 8. Switch on ignition.

Readout approx. 12 volts (battery voltage)

Ok	Not ok

Repair interruption according to wiring diagram.

Disconnect plug of O_2 sensor heater. Check current input.

Nominal value 0.5-l .3 A

Ok	Not ok

Replace O_2 sensor.

End of test

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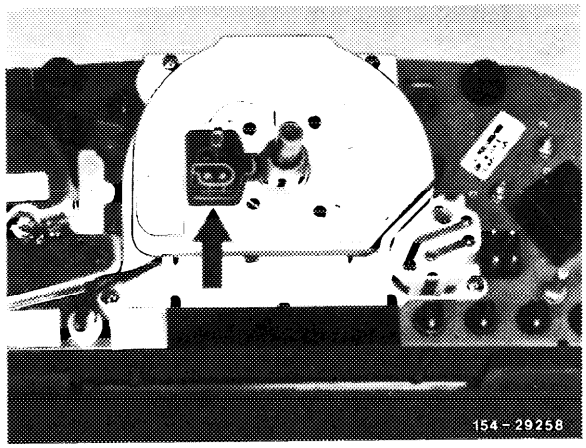
j) Testing speed signal, engine 103.942 only



Function

For idle speed control, the Hall sensor (arrow) transmits a speed signal to control unit.

This signal will switch the idling speed rpm control off as from a speed of approx. 1.4 km/h. This will improve driving performance during deceleration. The idling speed rpm control is again operational below 1.4 km/h.

Note

In the event of replacements, the control unit cannot be interchanged with control units of engines 103.940/941 and 103.98.

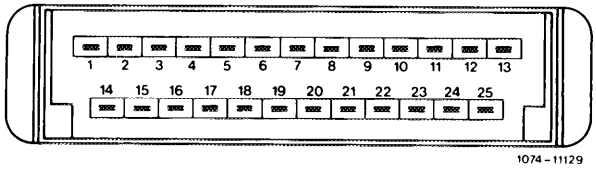
Ignition off. Pull plug from CIS-E control unit. Ignition on. Test voltage on plug of CIS-E control unit, jack 1 and 6, with multimeter (volt position).

Roll vehicle for approx. 1 m.

Readout osci l lates between O-l 2 volts.

Ok	Not ok

Test interruption according to wiring diagram and replace Hall sensor, if required.



1074-11129

Connect lambda control tester to diagnosis socket. Drive vehicle in 2nd speed or driving position 2 on dynamometer or on road.

Fully accelerate vehicle at approx. 2000 rpm (for approx. 6 seconds). Read on-off ratio.

On-off ratio readout 60 % (constant).

Ok	Not ok

Replace control unit.

End of test

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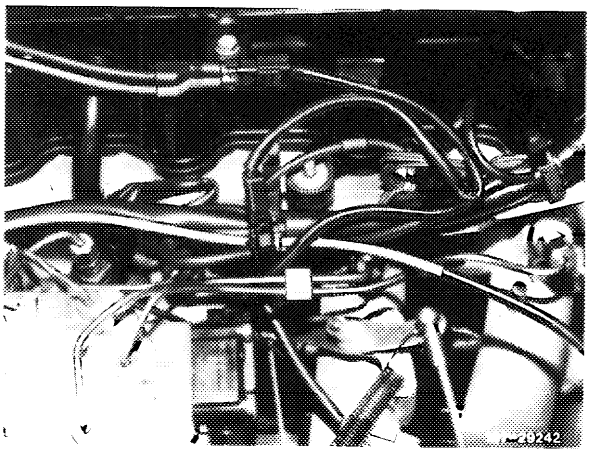
k) Testing current on actuator



Connect test cable to actuator.
Set measuring instrument to mA.
Switch on ignition.
Read voltage.

Current	Readout
without lambda control	10 mA
with lambda control	20 mA

Ok	Not ok

Start engine. Engine oil temperature 60-80 °C and idling speed.
Read voltage.

	Readout
without lambda control	1-2 mA
with lambda control	Readout oscillating

Ok	Not ok

Testing adjustment plug.

Designation without lambda control	ECE
Designation with lambda control	KAT

Ok	Not ok

Correct adjustment plug.

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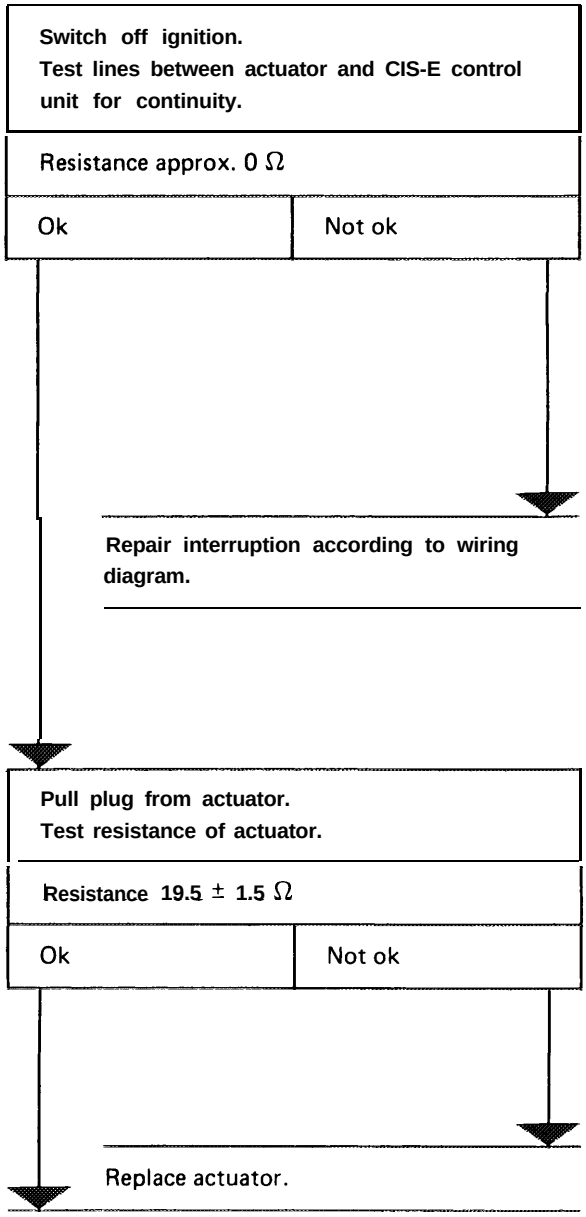

End of test

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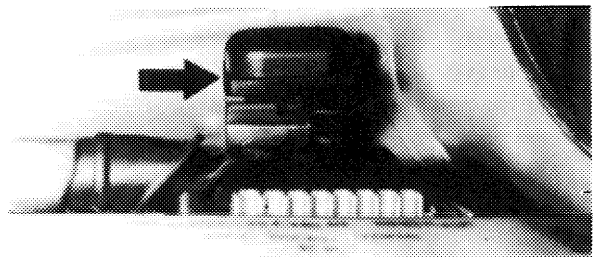
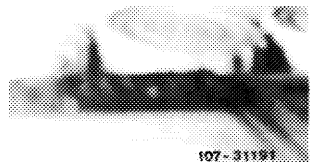
l) Testing sensor, altitude correction (arrow)
(AUS) (J) (USA)





107-311191

Pull plug from sensor, altitude correction.
Switch on ignition.
Test voltage on jack 2 against jack 3.

Voltage approx. 5 volts

Ok	Not ok

Test voltage supply and ground according to wiring diagram.

Switch off ignition. Test line between plug sensor, altitude correction, jack 1 and plug CIS-E control unit, jack 11 for continuity.

Resistance approx. 0 Ω

Ok	Not ok

Repair interruption according to wiring diagram.

Start engine. Idling speed and engine at operating temperature.

On-off ratio	Readout oscillating

Ok	Not ok

Replace sensor, altitude correction.

End of test

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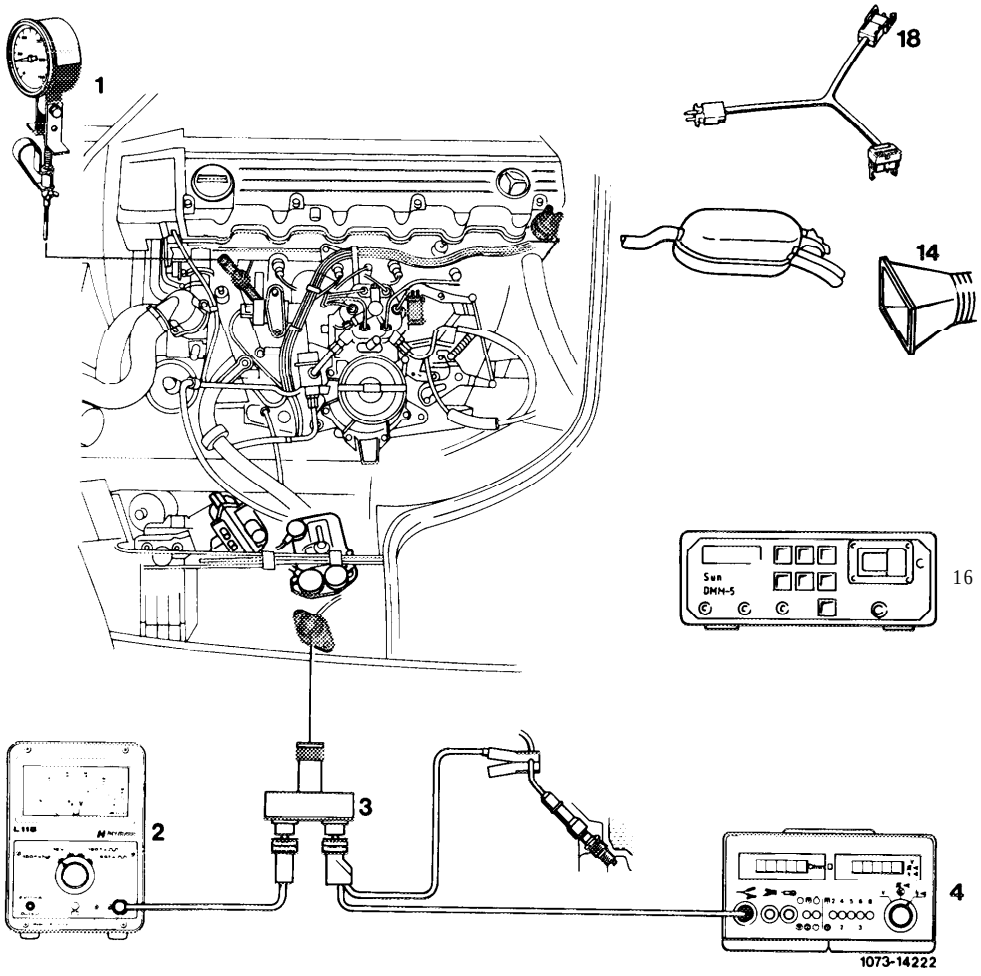
B. With trouble diagnosis by means of on-off ratio



Testers . . . . . Connect: oil telethermometer (1) 116 589 27 21 00.
Lambda control tester (2).
Twin capsule (3).
Engine tester (4).
Multimeter (16).
Test cable (18) 102 589 04 63 00.

Suction unit (14) . . . . . Set up at exhaust end pipe.
Engine oil temperature . . . . . 60-80 °C.
Test procedure . . . . . Refer to on-off ratio in %.
Voltage supply CIS-E control unit (*07–1625) 0
Sensor, air volume meter (“07-l 633) 10
Throttle valve switch (“07-l 622) 20
Coolant temperature sensor (“07-l 613) 30
Acceleration enrichment or sensor,
air volume meter (“07-1631). 40
O_2 sensor (*07–5206) 50
TD signal (*07–1626) 70
Temperature sensor intake air (“07-l 614) 80
O_2 sensor (*07–5206) 100

*Job No. of work unit or standard texts and flat rates data.

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Test sequence

On-off ratio in %	Possible causes of faults	Test scope
0	Without lambda control: On-off ratio is not displayed or measuring instrument is defective. Line diagnosis socket jack 3 defective.	Voltage supply. Check ground and diagnosis socket line. Control unit defective.
	With lambda control: No voltage on CIS-E control unit or defective. Line diagnosis socket jack 3 defective or measuring unit defective. Mixture adjustment too rich, sensor signal of +12 volts.	Check voltage supply, ground and line diagnosis socket. Check lambda adjustment. Check 02 sensor signal.
10	Sensor air volume meter wrong pole connection or defective. Speed approx. 2000 rpm.	Check sensor air volume meter measuring signal and line routing.
	Wire routing of plug, idling speed and full load contact, wrong pole connection or short circuit. (Full load contact closed at insufficient rate of air flow).	Check throttle valve switch and routing of plug throttle valve switch (idle speed contact defective, firing point approx. 10° higher).
	No idle speed contact on throttle valve switch.	Check throttle valve switch.
20	Full load contact with wrong pole connection or defective. Readout 20 % with microswitch actuated only.	Test full load contact.
30	Short circuit or line interruption between CIS-E control unit and coolant temperature sensor or coolant temperature sensor defective.	Test coolant temperature sensor.
40	Line interruption or short circuit to sensor, air volume meter or defective. Temporarily increased idling speed.	Test sensor, air volume meter
50	Without lambda control	No fault in range of monitored signals.
	With lambda control: O_2 sensor not operational, line interrupted or defective.	Test operating temperature. Test O_2 sensor.
70	No TD signal (line interruption) on CIS-E control unit.	Test TD signal.
80	Line interruption or short to ground at temperature sensor, intake air, or defective.	Test temperature sensor, intake air.
90	Unused, no fault associated.	–
100	Without lambda control: On-off ratio not displayed or measuring unit defective. Overvoltage protection defective. Increased idling speed.	Test overvoltage protection.
	With lambda control: Lambda adjustment too lean. O_2 sensor defective (short to ground). Control unit or measuring instruments defective. No current on actuator. Increased idling speed.	Test adjustment of lambda control and O_2 sensor signal. Test lines between CIS-E control unit and electrohydraulic actuator for continuity.
Readout oscillating	With lambda control: No fault in range of monitored signals during control.	–

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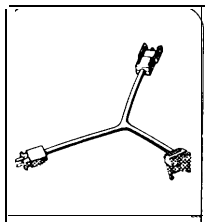
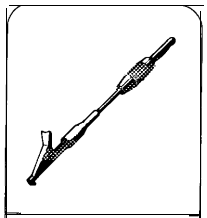
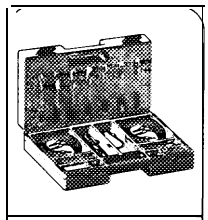
Special tools



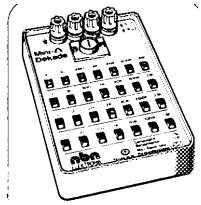
102 589 04 63 00



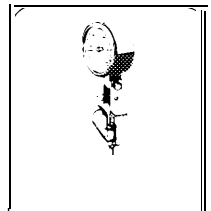
102 589 05 63 00



201 589 00 99 00



124 589 09 63 00



116 589 27 21 00

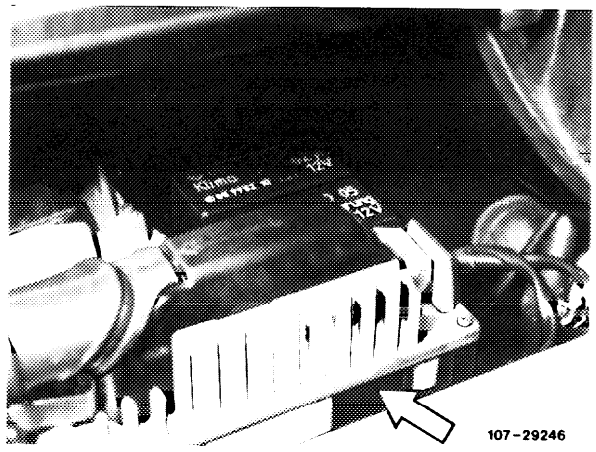
Conventional testers

Multimeter	e.g. Sun, DMM-5
Engine tester	e.g. Bosch, MOT 002.02
Twin capsule	e.g. Hermann, ECD 53
Lambda control tester	e.g. Hermann, L 115

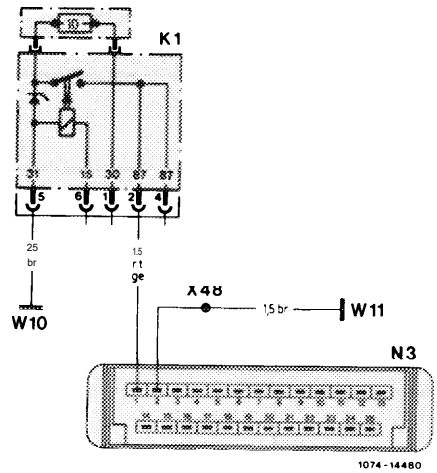
On-off ratio 0 %

Note: On vehicles with lambda control, test lambda control first and adjust, if required (07.3-100).

Testing voltage supply, CIS-E control unit	
Pull plug from CIS-E control unit. Switch on ignition, test voltage on jack 1 against jack 2.	
Voltage approx. 12 volts	
Ok	Not ok



107-29246



1074-14480

K1 **Overvoltage protection CIS-E**
N3 **Control unit CIS-E**
W10 **Ground, battery**
W11 **Ground, engine (electric cable screwed on)**

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Test voltage on jack 1 against ground (battery).

Voltage approx. 12 volts

Ok | Not ok

Not ok → Test voltage supply according to wiring diagram.

Test line from jack 2 and ground, engine (W1 1) for continuity.

Resistance approx. 0 Ω

Ok | Not ok

Not ok → Repair interruption according to wiring diagram.

Test line between diagnosis socket jack 3 and control unit jack 23 for continuity.

Resistance approx. 0 Ω

Ok | Not ok

Not ok → Repair interruption according to wiring diagram.

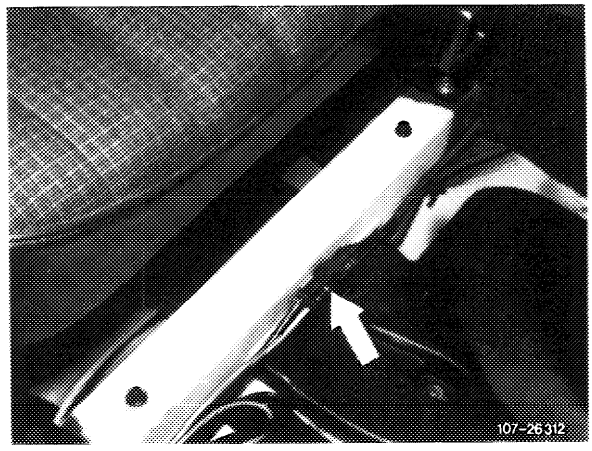
Disconnect plug O_2 sensor signal. Plug to CIS-E control unit to ground. Start engine. On plug connection of O_2 sensor line, check voltage to ground.

Voltage 450 – 1000 mV

Ok | Not ok

Not ok → Replace O_2 sensor.

End of test



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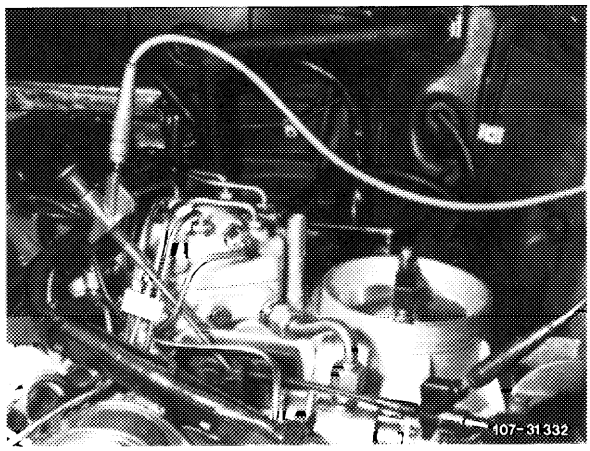
On-off ratio 10 %



Testing sensor, air volume meter

Pull off plug of sensor air volume meter to the extent that voltage can be measured. Start engine.

Terminal 1 to 3 4.6-5.1 volts
Pay attention to wire routing.

Ok	Not ok

Repair interruption according to wiring diagram.

Test voltage between terminal 1 and 2 at idling speed.

Terminal 1 to 2 0.57–0.81 V

Ok	Not ok

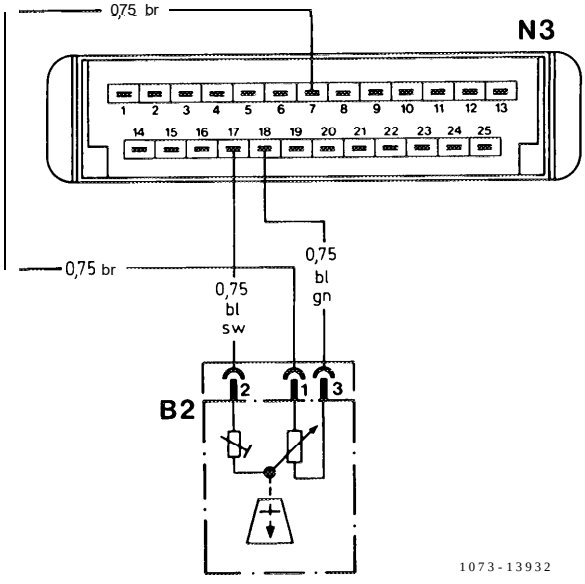
Voltage higher or lower, replace air volume meter.

Voltage 0 volt.
Stop engine. Test lines between sensor, air volume meter (B2) and plug, CIS-E control unit (N3) for continuity. Pay attention to wire routing.

Resistance approx. 0 Ω

Ok	Not ok

Repair interruption according to wiring diagram.



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Stop engine. Pull off plug to throttle valve switch. Test resistance at terminal 1 to 2.

Idle speed contact:

Idle speed position	approx. 0 Ω
Full load position	∞ Ω
Partial load position	∞ Ω

Ok	Not ok

Adjust or replace throttle valve switch.

Test lines from plug, throttle valve switch to CIS-E control unit and ground for continuity.

Resistance approx. 0 Ω

Ok	Not ok

Repair interruption according to wiring diagram

Start engine (idle speed and engine oil temperature 60-80 °C). Check on-off ratio on diagnosis socket.

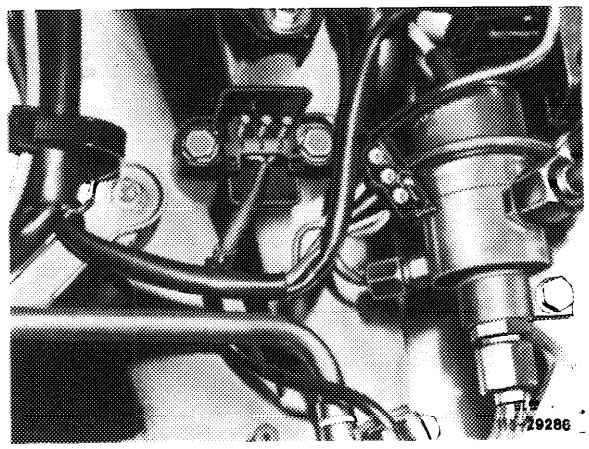
On-off ratio:

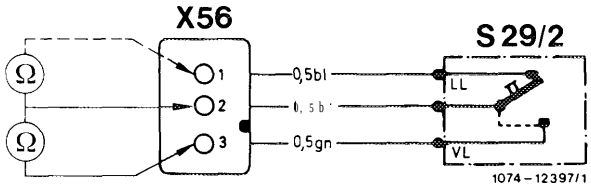
With lambda control:	Readout oscillating
Without lambda control:	Readout 50 %

Ok	**Not** ok

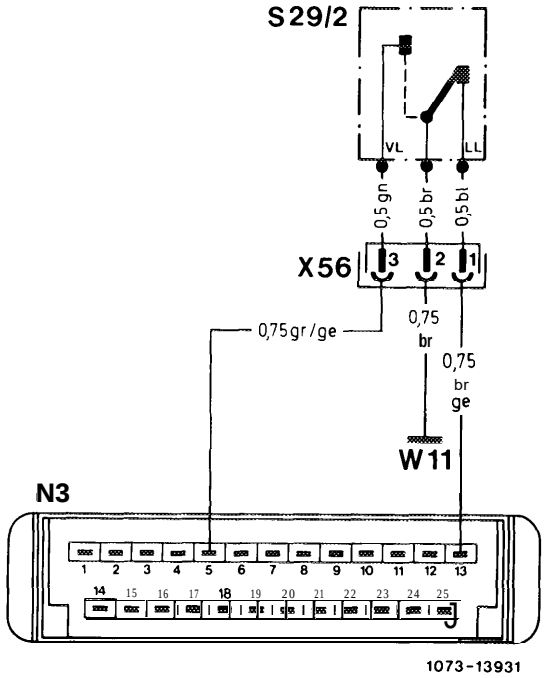
For other on-off ratio refer to test diagram.

End of test





S29/2 **Throttle valve switch full load/idle detection**
X56 **Plug connection throttle valve switch**



N3 **Control unit CIS-E**
S29/2 **Throttle valve switch full load/idle detection**
W11 **Ground, engine (electric cable screwed on)**
X56 **Plug connection throttle valve switch**

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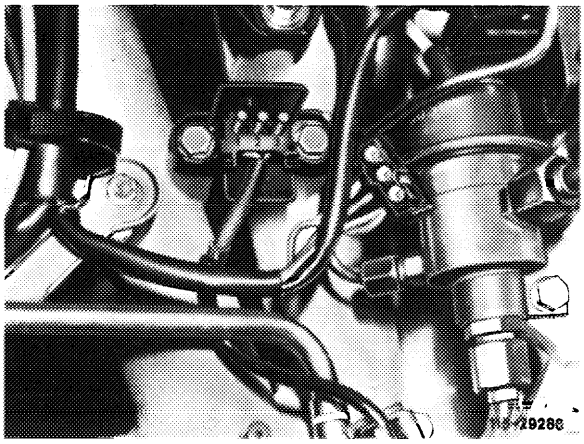
On-off ratio 20 %



Testing throttle valve switch (full load contact)

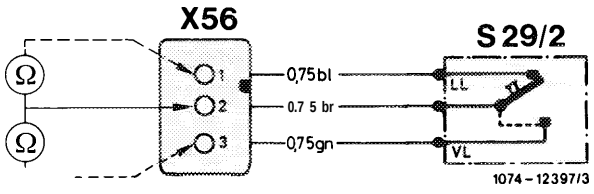
Stop engine, disconnect plug, throttle valve switch. Check resistance on terminal 2 to 3.

Full load contact:

Idle speed position	∞ Ω
Full load position	approx. 0 Ω
Partial load position	∞ Ω

Ok	Not ok

Adjust or replace throttle valve switch or wrong pole connection.



S29/2 **Throttle valve switch full load/idle detection**
X56 **Plug connection throttle valve switch**

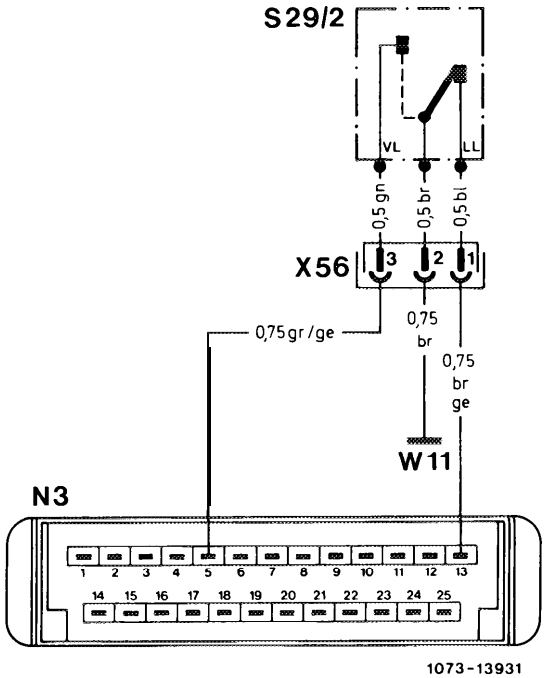
Test lines from plug, throttle valve switch to CIS-E control unit and ground for continuity.

Resistance approx. 0 Ω

Ok	Not ok

Repair interruption according to wiring diagram.

End of test



N3 **Control unit CIS-E**
S29/2 **Throttle valve switch full load/idle detection**
W11 **Ground, engine (electric cable screwed on)**
X56 **Plug connection throttle valve switch**

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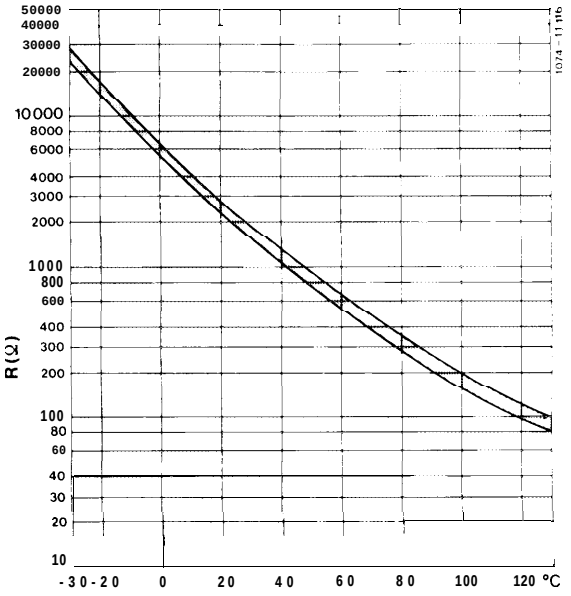
On-off ratio 30 %



Testing coolant temperature sensor

Pull plug from coolant temperature sensor. Test resistance to ground. (idling speed in order during short to ground or too high during interruption.)

For nominal value refer to diagram.
Test resistance at two temperature measuring points.

Example: +20 °C ≙ **2.2 -2.8** kΩ
+80 °C ≙ 290-370 Ω

Ok	Not ok

Replace coolant temperature sensor.

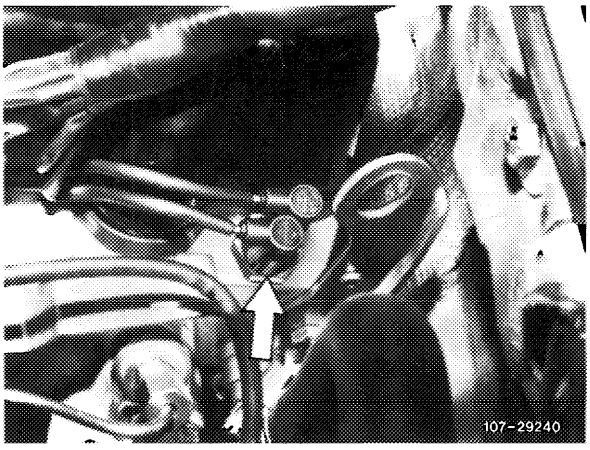
Test green/red line from terminal 21 plug, control unit (N3) to plug, coolant temperature sensor (B11/2) for continuity.

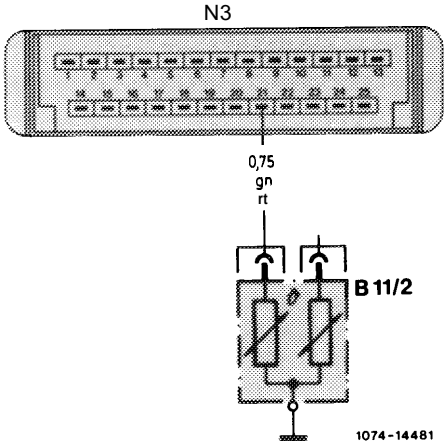
Resistance approx. 0 Ω

Ok	Not ok

Repair interruption according to wiring diagram.

End of test





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On-off ratio 40 %

Testing acceleration enrichment or sensor, air volume meter

Connect test cable 102 589 04 63 00 to electrohydraulic actuator and multimeter. Set multimeter to mA. Pull off plug, coolant temperature sensor and connect to 2.5 kΩ test resistor (special tool) or to ground with ohm decade (special tool) (simulate +20 °C).

With KAT, pull off O_2 sensor.
Start engine (increased idling speed).

Current at actuator

without lambda control	16-22 mA
with lambda control	2– 6 mA

Suddenly increase engine speed, voltage shou ld increase.

Ok	Not ok

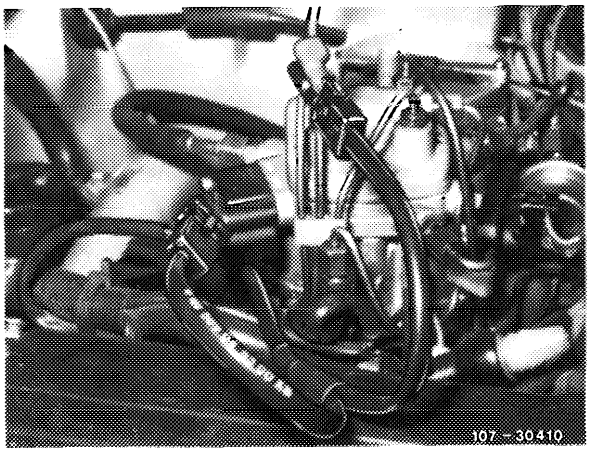
Reconnect coolant temperature sensor and O_2 sensor.

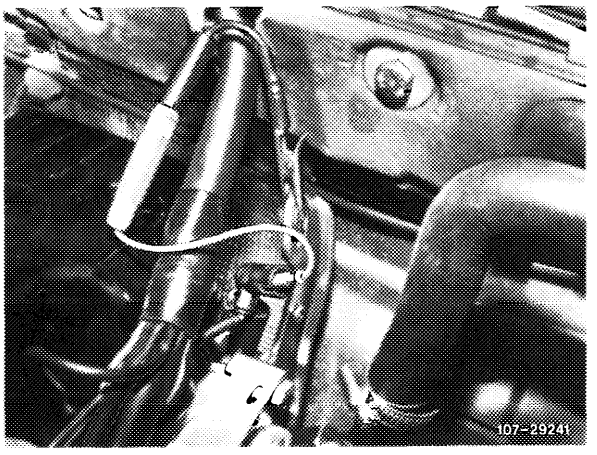
Pull off plug, sensor air volume meter to the extent that voltage can be measured. Start engine. Test voltage between terminal 1 and 3.

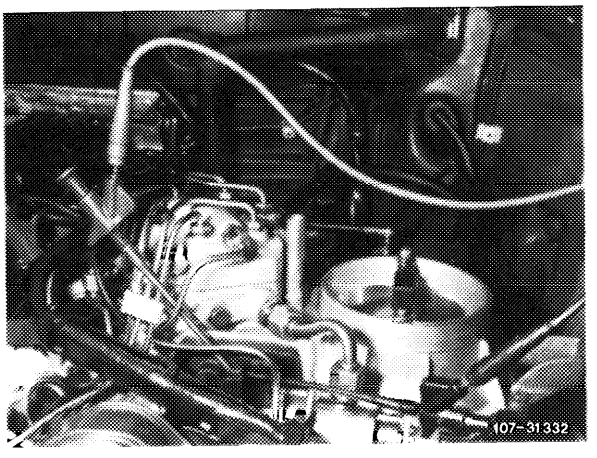
Voltage	4.6-5.1 V

Ok	Not ok

Repair interruption according to wiring diagram.







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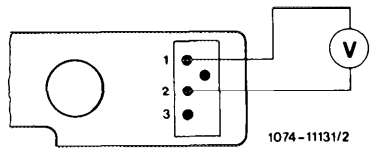
Measure voltage between terminal 1 and 2, run engine at idling speed.
If idling speed deviates, pull plug from idle speed adjuster (air valve) and set idle speed with a clamp on air hose to mean value of tolerance data.

Terminal 1 to terminal 2
0.57-0.81 V

Ok	Not ok



Engine off, ignition on. Slowly deflect air flow sensor plate. Test voltage between terminal 1 and terminal 2.

Voltage should continuously increase to 4.6-5.1 V.

Ok	Not ok

Replace air volume meter.

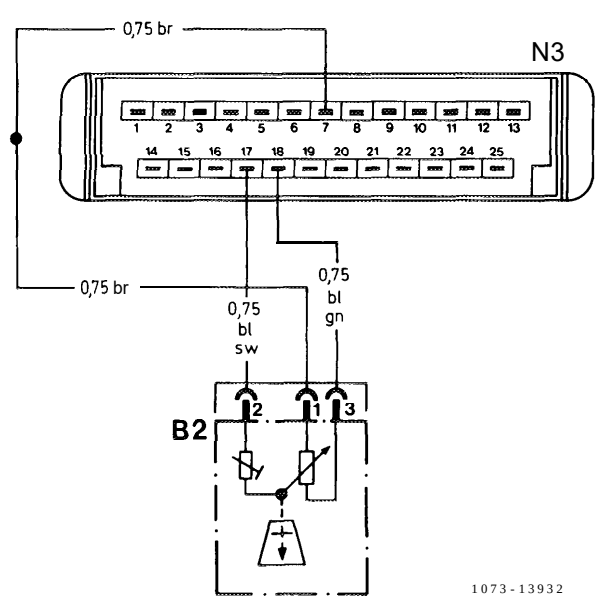
Voltage higher or lower, replace air volume meter.

Voltage 0 V.
Stop engine, test lines between sensor, air volume meter and plug, CIS-E control unit for continuity. Pay attention to wire routing.

Resistance approx. 0 Ω

Ok	Not ok

Repair interruption according to wiring diagram.



B2 Sensor, air volume meter
N3 Control unit CIS-E

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Start engine (idling speed and engine oil temperature 60-80 °C). Test on-off ratio on diagnosis socket.

On-off ratio:
with lambda control — Readout oscillating
without lambda control — Readout 50 %

Ok	Not ok

For different on-off ratio, refer to test program.

End of test

On-off ratio 50 %

Note: Without lambda control: No fault in range of monitored signals.

Testing O_2 sensor

Separate plug, O_2 sensor signal. Plug to CIS-E control unit to ground. Start engine. On plug connection of O_2 sensor line, test voltage against ground.

Voltage 450-1 000 mV

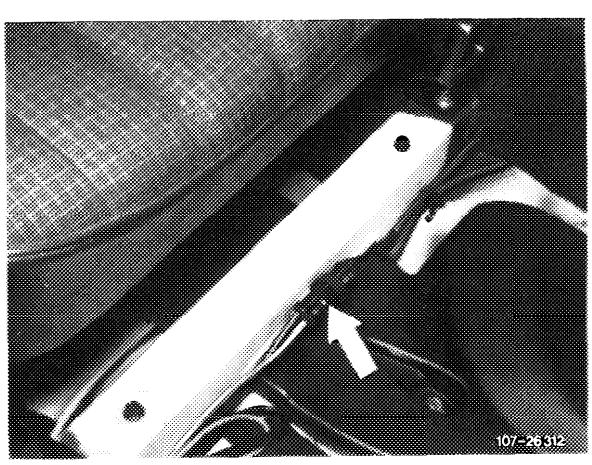
Ok	Not ok

Stop engine. Test line to CIS-E control unit, jack 8, for continuity.

Resistance approx. 0 Ω

Ok	Not ok

Repair interruption according to wiring diagram.



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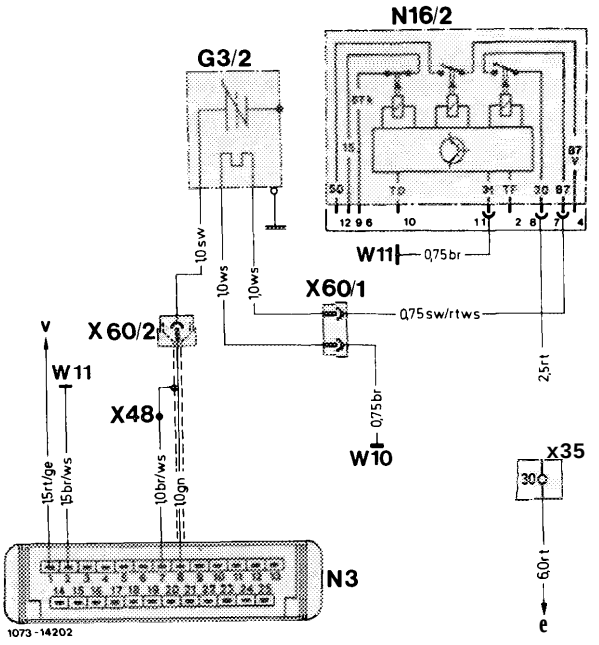


G3/2 O_2 sensor, heated
N3 Control unit CIS-E
N16/1 Relay, fuel pump
W10 Ground, battery
X60/1 Plug connection heater coil O_2 sensor
X60/2 Plug connection signal O_2 sensor

Pull off plug of O_2 sensor heater to the extent that voltage can be tested (Attention! short-circuit danger).

Pull off relay, fuel pump and bridge jack 7 and 8.

Readout approx. 12 volts (battery voltage).

Ok	Not ok

Repair interruption according to wiring diagram.

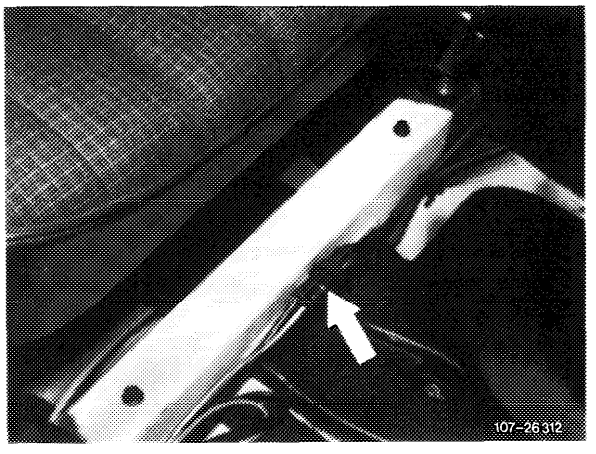
Disconnect plug, O_2 sensor heater.
Test current input.

Nominal value 0.5-l .3 A

Ok	Not ok

Replace O_2 sensor.

End of test



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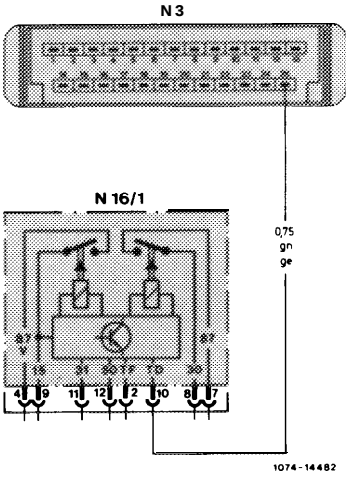
On-off ratio 70 %



Testing TD signal

Pull plug from CIS-E control unit.
Start engine.
Test voltage on jack 25 to ground.

Voltage 6–12 volts

Ok	Not ok

Pull off relay, fuel pump (N16/1). Test line between jack 10 on relay, fuel pump and jack 25 on CIS-E control unit (N3) for continuity (pay attention to tie lug).

Resistance approx. 0 Ω

Ok	Not ok

Repair interruption according to wiring diagram.

Test line between jack 10 (relay fuel pump) and diagnosis socket/line connector TD for continuity.

Resistance approx. 0 Ω

Ok	Not ok

Test line between diagnosis socket/line connector TD and ignition switching unit terminal TD for continuity.

Resistance approx. 0 Ω

Ok	Not ok

Repair interruption according to wiring diagram.

End of test

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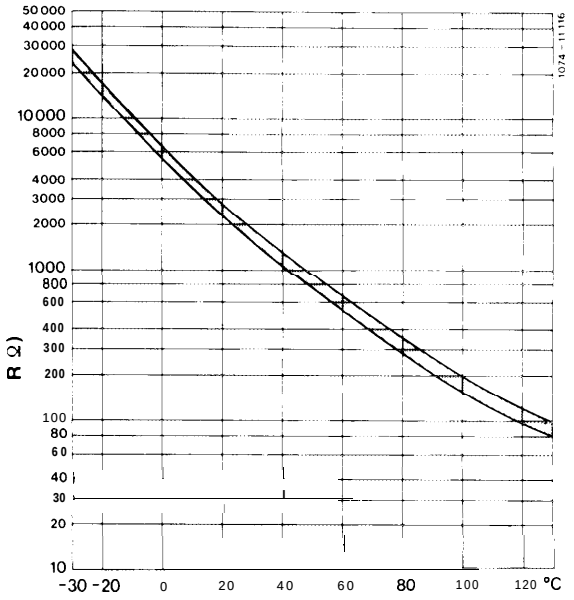
On-off ratio 80 %



Testing temperature sensor, intake air

Pull plug (arrow) from temperature sensor, intake air. Test resistance to ground.

For nominal value, refer to diagram.
Example: +20 °C = **2.2-2.8** kΩ
0 °C = 5.5-6.1 kΩ

Ok	Not ok

Replace temperature sensor, intake air.

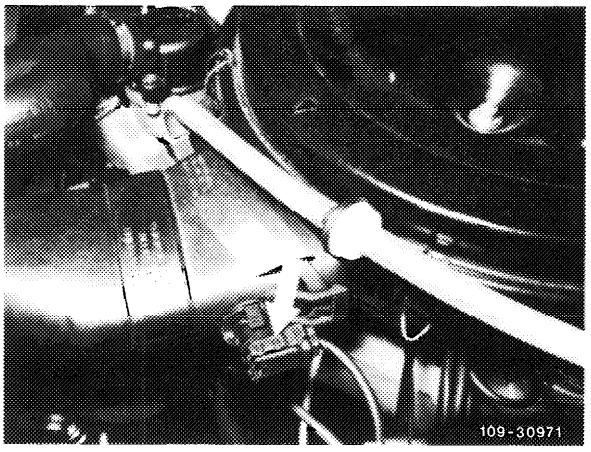
Check lines between temperature sensor, intake air and ground or control unit, injection system terminal 11 for continuity.

Resistance approx. 0 Ω

Ok	Not ok

Repair interruption according to wiring diagram.

End of test



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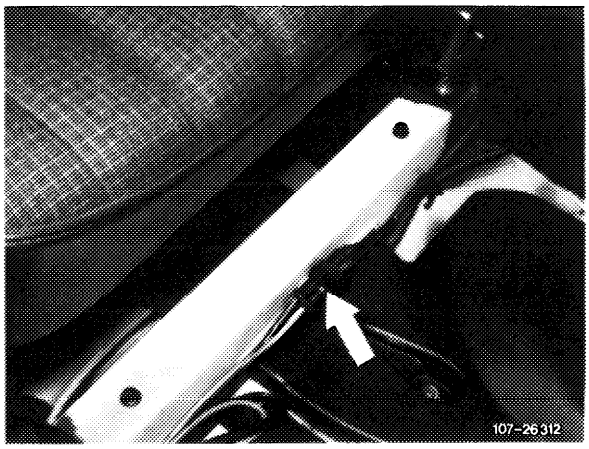
On-off ratio 100 %

Note: With and without lambda control: At on-off ratio 100 % and idling speed too high, test fuse on overvoltage protection or voltage supply and ground (refer to section ,,a").

Testing O_2 sensor	
Test adjustment of lambda control (07.3-I 00).	
On-off ratio can be regulated. Readout oscillating.	
Ok	Not ok

Disconnect plug, O_2 sensor signal. Plug to CIS-E control unit to ground. Start engine. On plug connection of O_2 sensor line, test voltage to ground.	
Voltage 450-I 000 mV	
Ok	Not ok



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Stop **engine.**
Test line to CIS-E control unit jack 8 for continuity.

Resistance approx. 0 Ω

Ok	Not ok

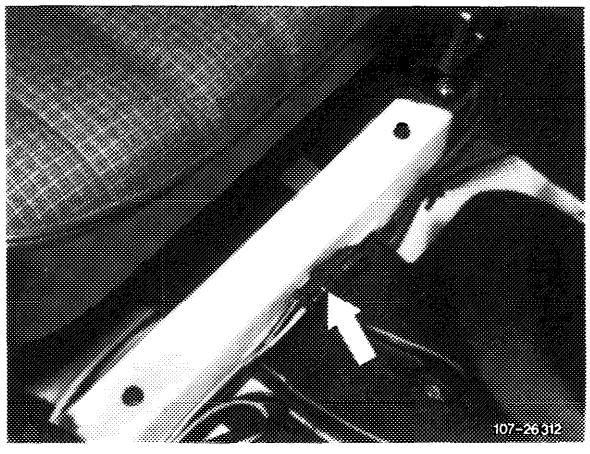
Repair interruption according to wiring diagram.

Pull off plug of O_2 sensor heater to the extent that the voltage can be tested **(Attention!** short-circuit danger). Pull off relay, fuel pump and bridge jack 7 and 8.

Readout approx. 12 volts (battery voltage).

Ok	Not ok

Repair interruption according to wiring diagram.



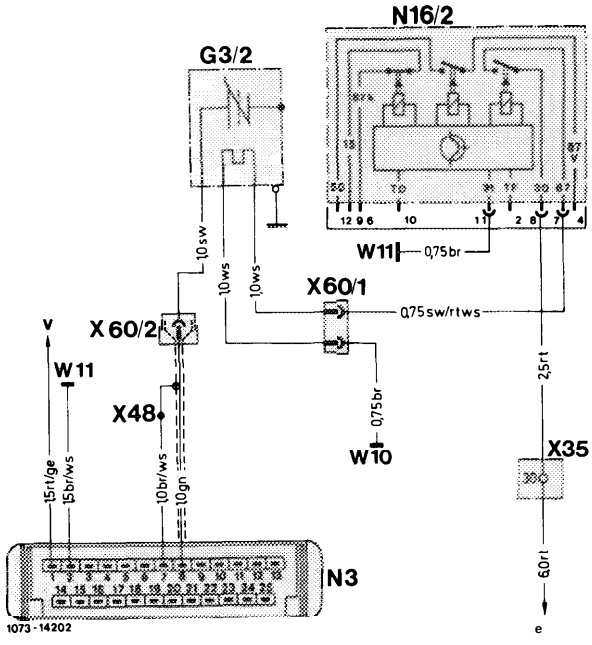
Disconnect plug, O_2 sensor heater.
Test current input.

Nominal value 0.5-1 .3 A

Ok	Not ok

Replace O_2 sensor.

End of test



G3/2 O_2 sensor heated
N3 Control unit CIS-E
N16/1 Relay, fuel pump with starting valve activation
W10 Ground, battery
X60/1 Plug connection heater coil O_2 sensor
X60/2 Plug connection signal O_2 sensor

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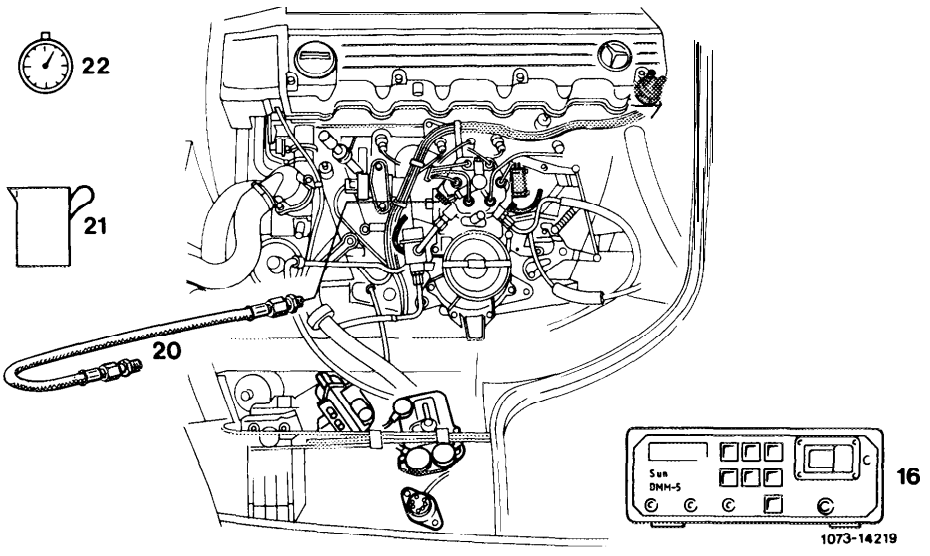
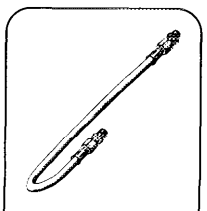
07.3-I 22 Testing throttle (orifice) in fuel distributor for unobstructed passage

Job No. of work unit or standard texts and flat rates data 07-1604.

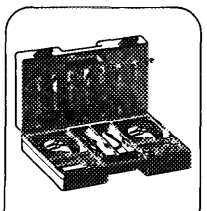


Plug on actuator		Pull off.
		With lambda control, switch on ignition. Disconnect plug of O_2 sensor in vehicle interior.
Fuel line		Unscrew on fuel distributor and close with closing plug M 10 x 1.
Pressure hose	(20)	Connect to fuel distributor and hold into measuring glass or measuring cup.
		Special tool 102 589 00 21 00
Fuel pump relay		Pull off and bridge jacks 7 and 8 (fuel pump running).
		Special tool 201 589 00 99 00
Throttle (orifice)		Check for unobstructed passage.
		Nominal: 130 — 150 cc/min at minimum voltage of 11.5 V on fuel pump.
		If nominal value is not attained, replace fuel distributor.

Special tools



102 589 00 21 05



201 589 00 99 00

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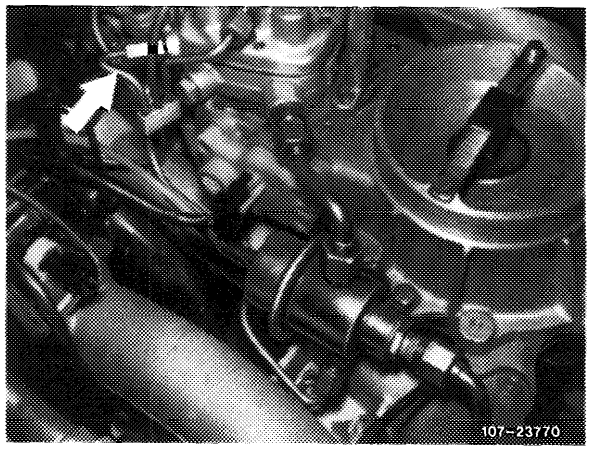
Voltmeter, measuring glass or measuring cup, stop watch

Testing

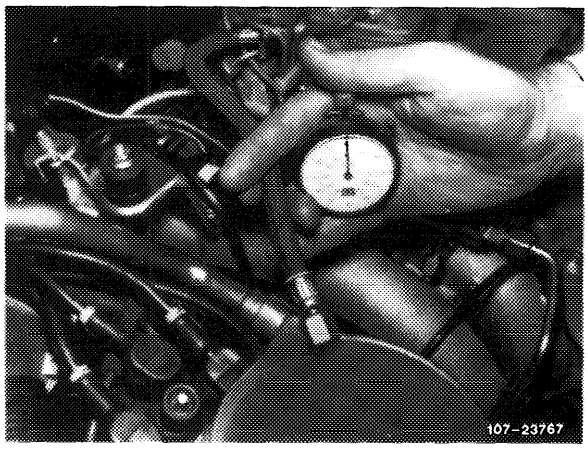
1 Pull plug from actuator.

With lambda control, switch on ignition. Disconnect plug of O_2 sensor in vehicle interior.

2 Unscrew fuel connecting line (arrow) between fuel distributor and diaphragm pressure regulator on fuel distributor. Close unscrewed connecting line with closing plug M 10 x 1, so that no fuel will run out.



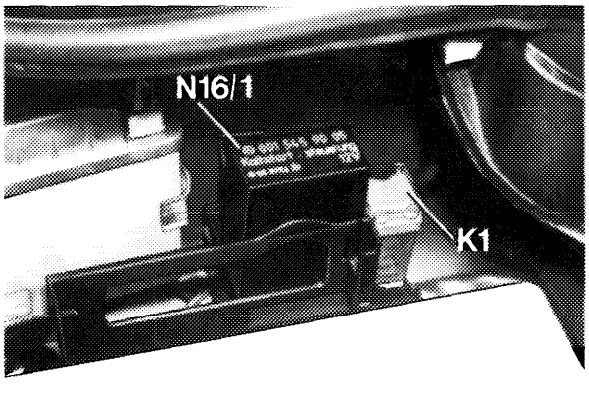
3 Connect fuel hose to fuel distributor and hold into measuring glass or measuring cup.



4 Pull off fuel pump relay and bridge the two jacks 7 and 8. This will energize the fuel pump.

Pull off contact bridge after 1 minute.

If the nominal value of 130-l 50 cc/minute at a minimum voltage of 11.5 V on fuel pump is not attained, replace fuel distributor.



107-29244

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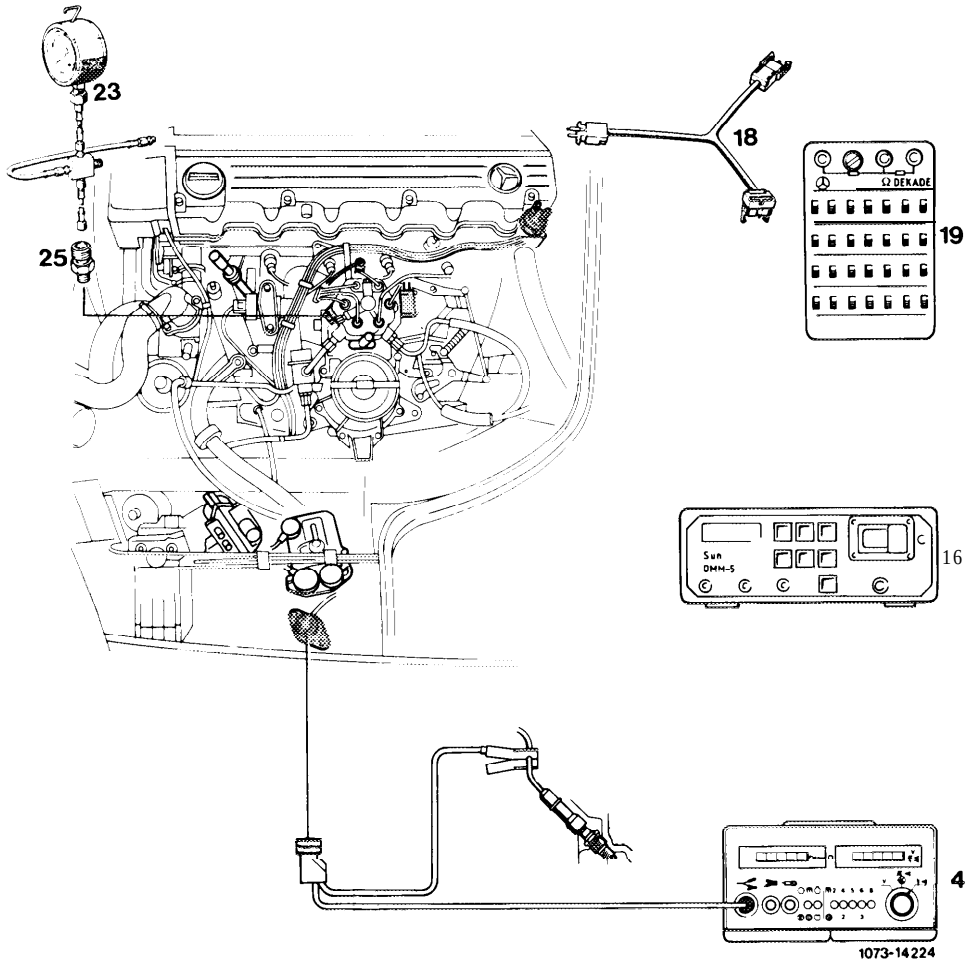
Job No. of work unit or standard texts and flat rates data 07-2353.



Fuel pressures and internal leaks	**Test (07.3-I 20).**
Starting valve	**Check for function and leaks.**
After-start enrichment	**Check.**

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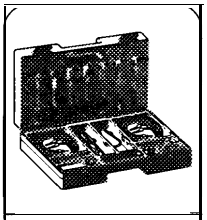
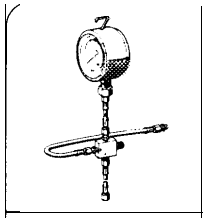
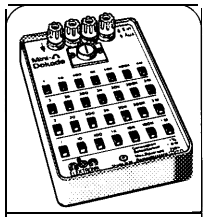
Special tools



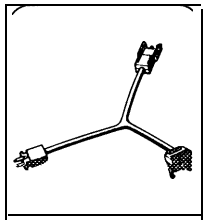
201 589 00 99 00



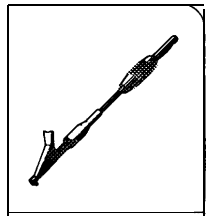
103 589 00 21 00



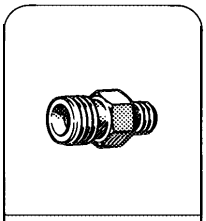
124589096300



102 589 04 63 00



102 589 05 63 00



102 589 06 63 00

Conventional testers

Multimeter	**e.g. Sun, DMM-5**
Digital tester (rpm, dwell angle, ignition angle)	**e.g. Bosch, MOT 002.02** **e.g. Sun, 1019**

Note

Electric wiring diagrams 07.3-I 28.

Testing fuel pressures and for internal leaks (07.3-I 20).

Test lower chamber pressure at + 20 °C coolant temperature.

Nominal value: 4.8-5.0 bar.

Ok	**Not ok**

Test coolant temperature sensor (07.3-I 21, section ,,b'').

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Checking starting valve for function and leaks

Disconnect fuel line on starting valve (arrow).
Remove starting valve and reconnect fuel line.
Simulate 10 kΩ on coolant temperature sensor with ohm decade.
Hold starting valve into a container.

Check function.
Start engine, starting valve should eject.

Ok	Not ok

Test starting valve or activation (07.3–126).

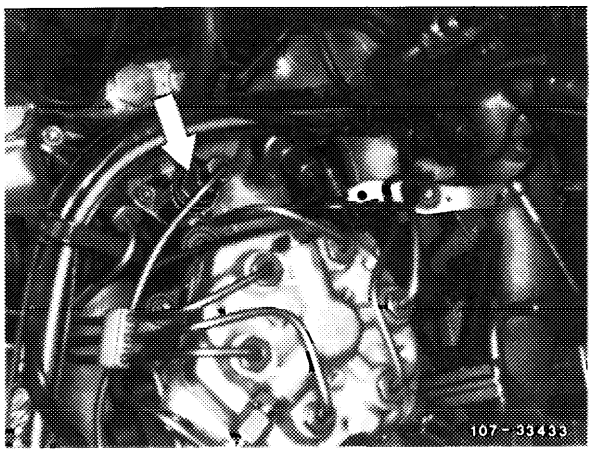
Check for leaks.
Dry starting valve on nozzle.

Formation of drops

Ok	Not ok

Replace starting valve.

End of test



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Testing after-start enrichment

Test values

Engine		103.94		103.98	
Version		RÜF	KAT	Std./RÜF	KAT
After-start at +20 °C	mA	25–31	3–9	21–27	8–12
End of start	approx. seconds	20	60	20	60
Warm-up basic value	mA	16–22	2–6	15–22	2–6

Connect test cable to actuator. Set measuring instrument to mA. With test resistor 2.5 kΩ simulate coolant temperature + 20 °C or with ohm decade 2.5 kΩ. With lambda control, pull off O_2 sensor. Start engine. Increase idling speed.

Voltage increase:
Refer to Table.

Following end of start approx. ... seconds constant. Refer to Table.

Dropping to warm-up basic value:
Refer to Table.

Ok | Not ok

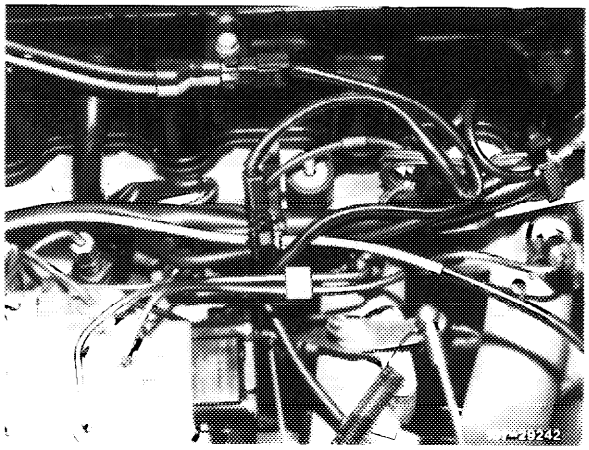
Test rpm signal (TD) on plug, control unit terminal 25 (green/yellow).
Start engine.

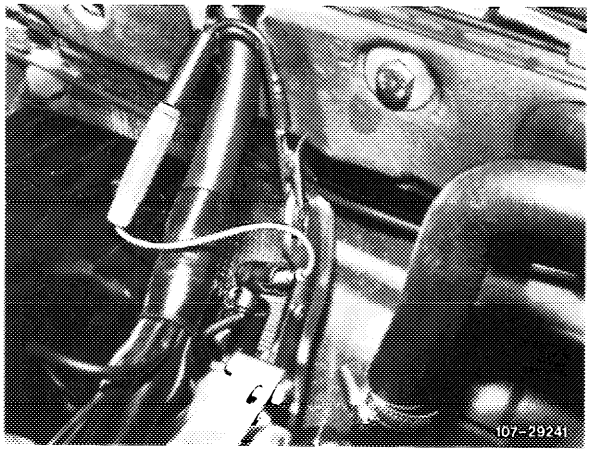
Voltage 6–12 volts.

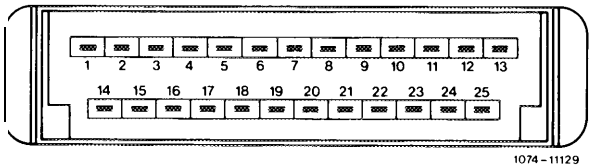
Ok | Not ok

Repair interruption according to wiring diagram.

End of test







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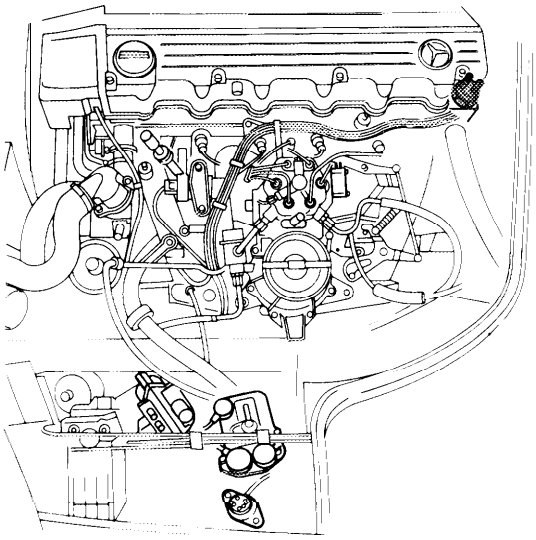
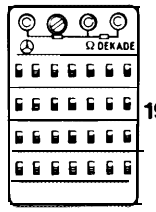
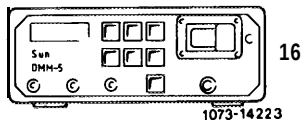
Job No. of work unit or standard texts and flat rates data 07-1607.

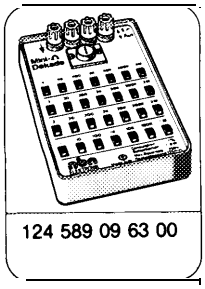






Testers.	Connect: multimeter (16). Ohm decade (19) 124 589 09 63 00.
Starting voltage	Check. Min. 10 V in approx. 5 seconds.
Electric lines between starting valve and fuel pump relay for continuity	Test. Resistance approx. 0 Ω.
Voltage on fuel pump relay	Test. Jack 12 (terminal 50) min. 10 V, jack 2 (terminal TF) 3-5 V, simulated at 10 kΩ.

Special tool



124 589 09 63 00

Conventional tester

Multimeter	e.g. Sun, DMM-5

Activation via fuel pump relay.

The starting valve is activated via fuel pump relay in accordance with coolant temperature.

Example: -20 °C = approx. 10 seconds.
No more activation above +15 or +60 °C.

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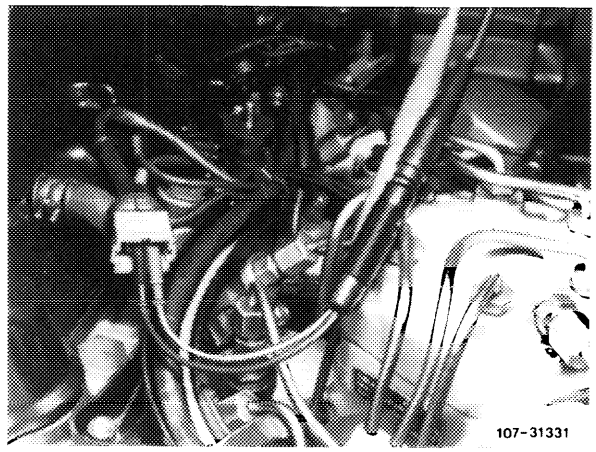
Simulate 10 kΩ with ohm decade on coolant temperature sensor. Pull off green cable on switching unit or plug protective plug, part No. 102 589 02 21 00 to diagnosis socket. Actuate starter, while testing voltage on plug, starting valve to ground.

Voltage at least 10 volts
Time: approx. 5 seconds

Ok	Not ok



Test lines between starting valve and fuel pump relay, jack 4 (terminal 87V) or test ground, engine for continuity.

Resistance approx. 0 Ω

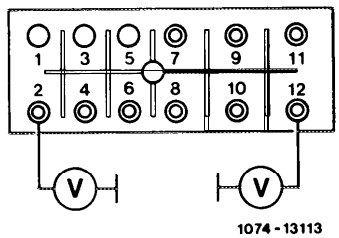
Ok	Not ok

Repair interruption according to wiring diagram.

Test voltage on fuel pump relay, jack 12 (terminal 50) as well as jack 2 (terminal TF) to ground, engine. Start engine.

Voltage, jack 12 min. 10 volts,
voltage jack 2 = 3-5 volts at 10 kΩ, simulated.

Ok	Not ok



1074-13113

Replace fuel pump relay.	Repair interruption according to wiring diagram.

End of test

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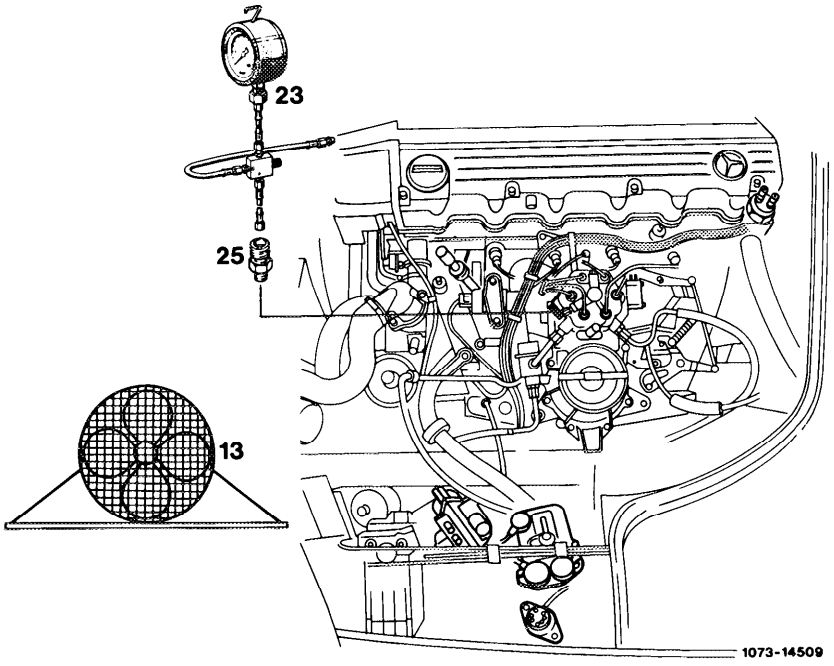
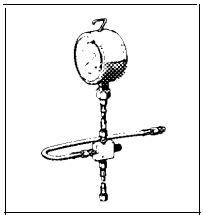
Job No. of work unit or standard texts and flat rates data 07-2320.



Pressure measuring device (23)	Connect (07.3-120) special tool 103 589 00 21 00. Run engine to establish pressure.
Blower (13)	Cool engine (or leave overnight).
Cold start	Perform, paying attention to pressure gauge: If required, test fuel pressures 07.3-I 20 or electronic components of CIS-E injection system 07.3-I 21.

Special tool



103 589 00 21 00

Test values

Fuel pressures in bar gauge pressure		
System pressure with engine cold or at operating temperature		**5.3-5.5**
Lower chamber pressure	**with engine at operating temperature**	**approx. 0.4[1])**
	stationary or idling at coolant temperature +20 °C	**approx. 0.5[1])**
	with decel shutoff	**5.3-5.5**

[1]) **Below previously measured system pressure.**

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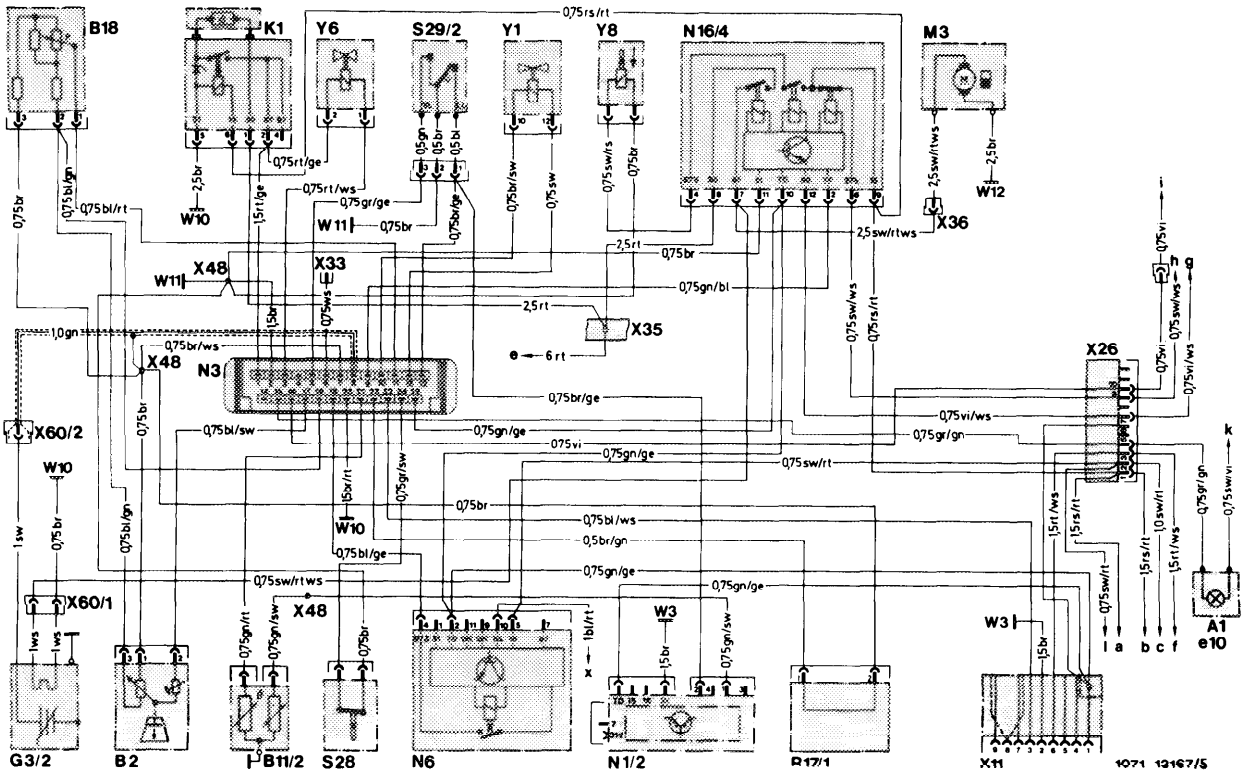

Wiring diagram mechanically/electronically controlled gasoline injection system

A1e10	O_2 sensor failure indicator
B2	Sensor, air volume meter
B11/2	Temperature sensor, coolant (2-pole)
B18	Sensor, altitude correction
G3/2	O_2 sensor heated
K1	Relay, overvoltage protection
M3	Fuel pump
N1/2	Switching unit, electronic ignition system
N3	Control unit CIS-E (25-pole plug)
N6	Control unit, compressor cutout
N16/3	Relay, fuel pump (manual transmission)
N16/4	Relay, fuel pump (automatic transmission)
R17/1	Single adjustment plug, injection system
S28	Microswitch, decel shutoff
S29/2	Throttle valve switch, full load/idle detection
w3	Ground, wheelhouse front left (ignition coil)
W9	Ground, front left (near lamp unit)
W10	Ground, battery
W11	Ground, engine (electric cable screwed on)
w12	Ground, center console
x11	Diagnosis socket/cable connector, terminal TD
X26	Plug connection, engine compartment harness (12-pole)
x33	Plug connection, injection system, cruise control/ Tempomat (1-pole)
x35	Cable connector, terminal 30/terminal 61 (battery)
X36	Plug connection, fuel pump harness
X48	End sleeve (soldered connector in cable connector)
X56	Plug connection, throttle valve switch
X60/1	Plug connection, heater coil O_2 sensor
X60/2	Plug connection, signal O_2 sensor
Y1	Electrohydraulic actuator (EHA)
Y6	Idle speed adjuster (air valve)
Y8	Starting valve
a	Ignition coil, terminal 15
b	Fuse 7
c	Fuse 7, terminal 15
e	Cable connector terminal 30 (fuse and relay box)
f	Fuse 9, terminal 30
g	Plug connection, starter lockout switch, jack 4
h	Switch, kickdown, jack 1 Automatic transmission, plug starter lockout switch, jack 3, terminal 50 Manual transmission, ground, engine (via starter coil)
k	Fuse 6, terminal 15 (fused) Relay, auxiliary fan, terminal 86
x	Pushbutton switch A/C compressor

Note: Unidentified grounding points to ground, engine or ground, body.

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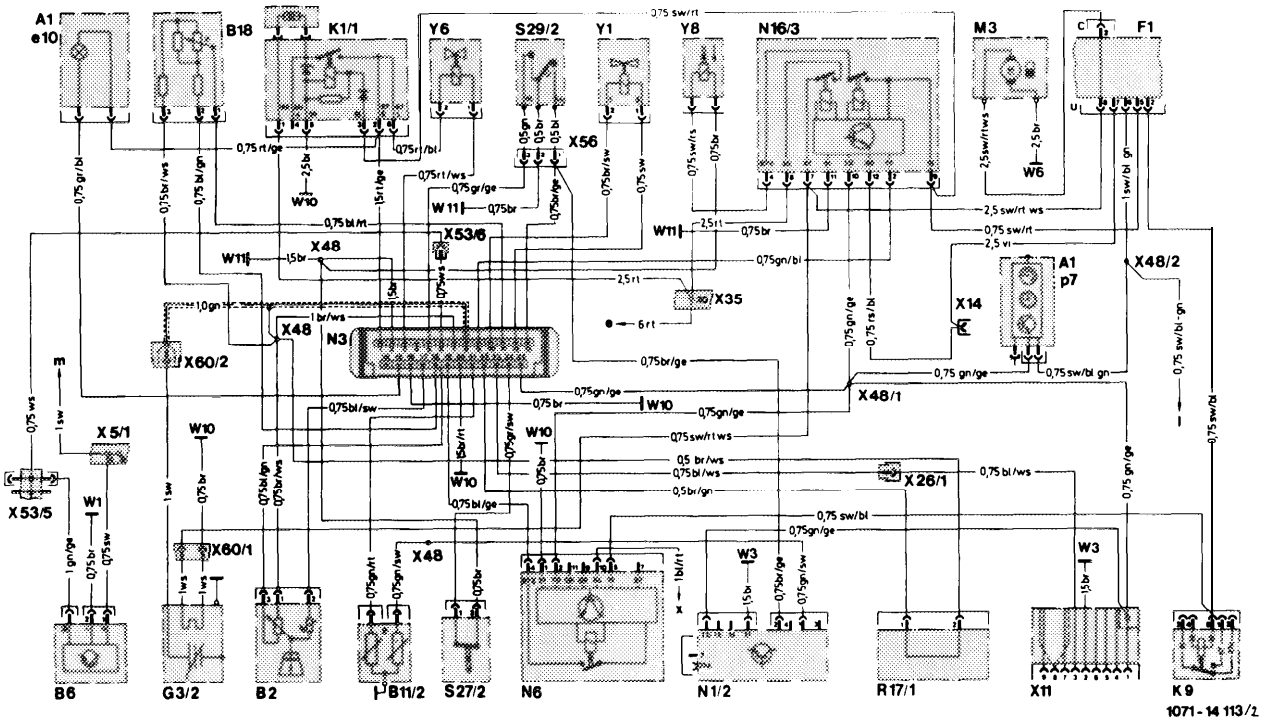

Wiring diagram, mechanically/electronically controlled gasoline injection system with manual transmission

A1e10	Failure indicator lamp, O_2 sensor
A1p7	Electronic clock/tachometer
B2	Sensor, air volume meter
B6	Hall sensor, road speed
B11/2	Temperature sensor, coolant (EZL/CIS-E)
B18	Sensor, altitude correction
F1	Central electrical system
G3/2	O_2 sensor heated
K1/1	Relay, overvoltage protection 87E/87L
K9	Relay, auxiliary fan
M3	Fuel pump
N1/2	Switching unit, transistorized ignition (EZL)
N3	Control unit, CIS-E injection system
N6	Control unit, compressor cutout
N16/3	Relay, fuel pump with starting valve activation and engine speed limiter
R17/1	Single adjustment plug (CIS-E)
S27/2	Microswitch, decel shutoff
S29/2	Throttle valve switch, full load/idle detection
w3	Ground, wheelhouse front left (ignition coil)
W6	Ground, trunk, wheelhouse left
W10	Ground, battery
W11	Ground, engine (electric cable screwed on)
X5/1	Cable connector, interior
X11	Diagnosis socket/cable connector terminal TD
x14	Plug connection, terminal 50
X26/1	Plug connection, engine harness/headlamp harness, 1 -pole, diagnosis socket
x35	Cable connector, terminal 30/terminal 61 (battery)
X48	End sleeve (soldered connector in harness)
x4811	End sleeve TD (soldered connector in harness)
X48/2	End sleeve, terminal 15 (soldered connector in harness)
x53/5	Multiple plug connection/Hall sensor
X56	Plug connection, throttle valve switch
X60/1	Plug connection, heater coil O_2 sensor
X60/2	Plug connection, signal O_2 sensor
Y1	Electrohydraulic actuator (EHA)
Y6	Idle speed adjuster (air valve)
Y8	Starting valve
e	Cable connector terminal 30 (fuse and relay box)
l	Washing nozzle heater, left (R2/2)
m	Central electrical system, plug L, fuse 10
x	Pushbutton switch A/C compressor

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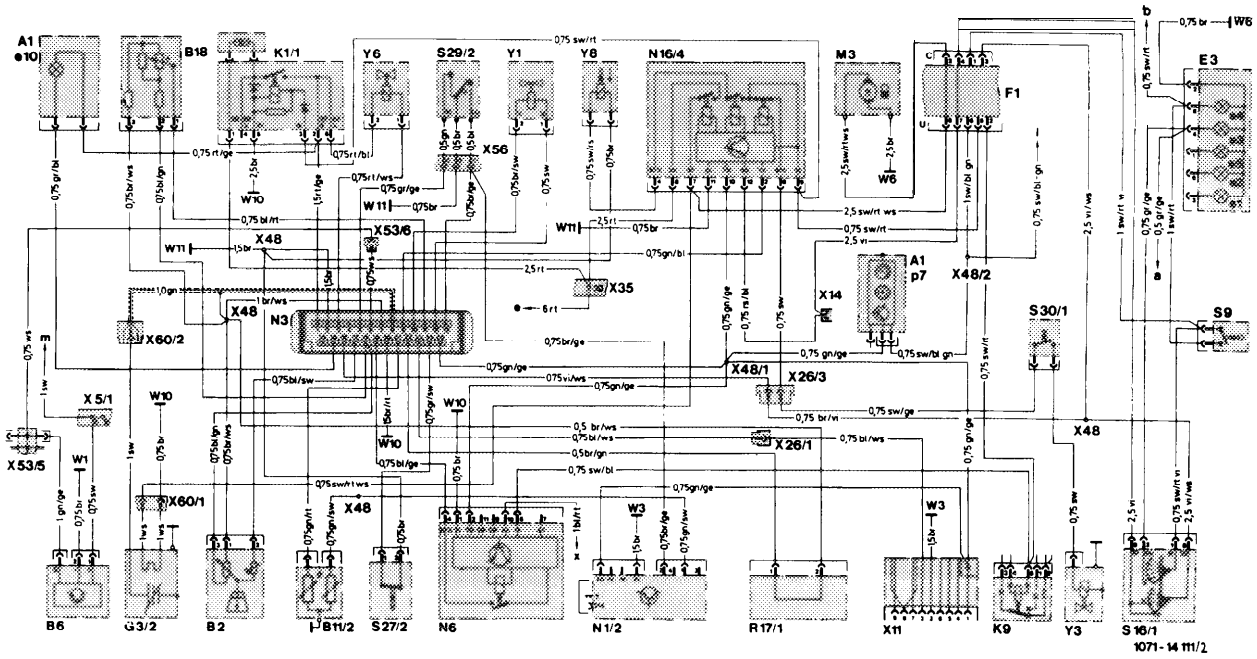

Wiring diagram, mechanically/electronically controlled gasoline injection system with automatic transmission

A1e10	Failure indicator lamp, O_2 sensor
A1p7	Electronic clock/tachometer
B2	Sensor, air volume meter
B6	Hall sensor, road speed
B11/2	Temperature sensor, coolant (EZL/CIS-E)
B18	Sensor, altitude correction
E3	Tail lamp unit, left
F1	Central electrical system
G3/2	O_2 sensor heated
K1/1	Relay, overvoltage protection 87E/87L
K9	Relay, auxiliary fan
M3	Fuel pump
N1/2	Switching unit, transistorized ignition (EZL)
N3	Control unit, CIS-E injection system
N6	Control unit, compressor cutout
N16/4	Relay, fuel pump with starting valve activation, kickdown cutout and engine speed limiter
R17/1	Single adjustment plug (CIS-E)
S9	Stop lamp switch
S16/1	Starter lockout and backup lamp switch
S27/2	Microswitch, decel shutoff
S29/2	Throttle valve switch, full load/idle detection
S30/1	Kickdown switch
W3	Ground, wheelhouse front left (ignition coil)
W6	Ground, trunk, wheelhouse left
W10	Ground, battery
W11	Ground, engine (electric cable screwed on)
X5/1	Cable connector, interior
X11	Diagnosis socket/cable connector terminal TD
x14	Plug connection, terminal 50
X26/1	Plug connection, engine harness/headlamp harness, 1 -pole, diagnosis socket
X26/3	Plug connection engine harness/tail lamp harness, 2-pole
x33	Plug connection, CIS-E, cruise control/ Tempomat, 1 -pole
x35	Cable connector, terminal 30/terminal 61 (battery)
X48	End sleeve (soldered connector in harness)
X4811	End sleeve TD (soldered connector in harness)
X48/2	End sleeve, terminal 25 (soldered connector in harness)
x53/5	Multiple plug connection/Hall sensor
X56	Plug connection, throttle valve switch
X60/1	Plug connection, heater coil O_2 sensor
X60/2	Plug connection, signal O_2 sensor
Y1	Electrohydraulic actuator (EHA)
Y3	Switchover valve, automatic transmission
Y6	Idle speed adjuster (air valve)
Y8	Starting valve
a	Tail lamp, right, jack 4 (E4)
b	Tail lamp, right, jack 5 (E4)
e	Cable connector terminal 30 (fuse and relay box) Washing nozzle heater, left (R2/2)
m	Central electrical system, plug L, fuse 10
x	Pushbutton switch A/C compressor

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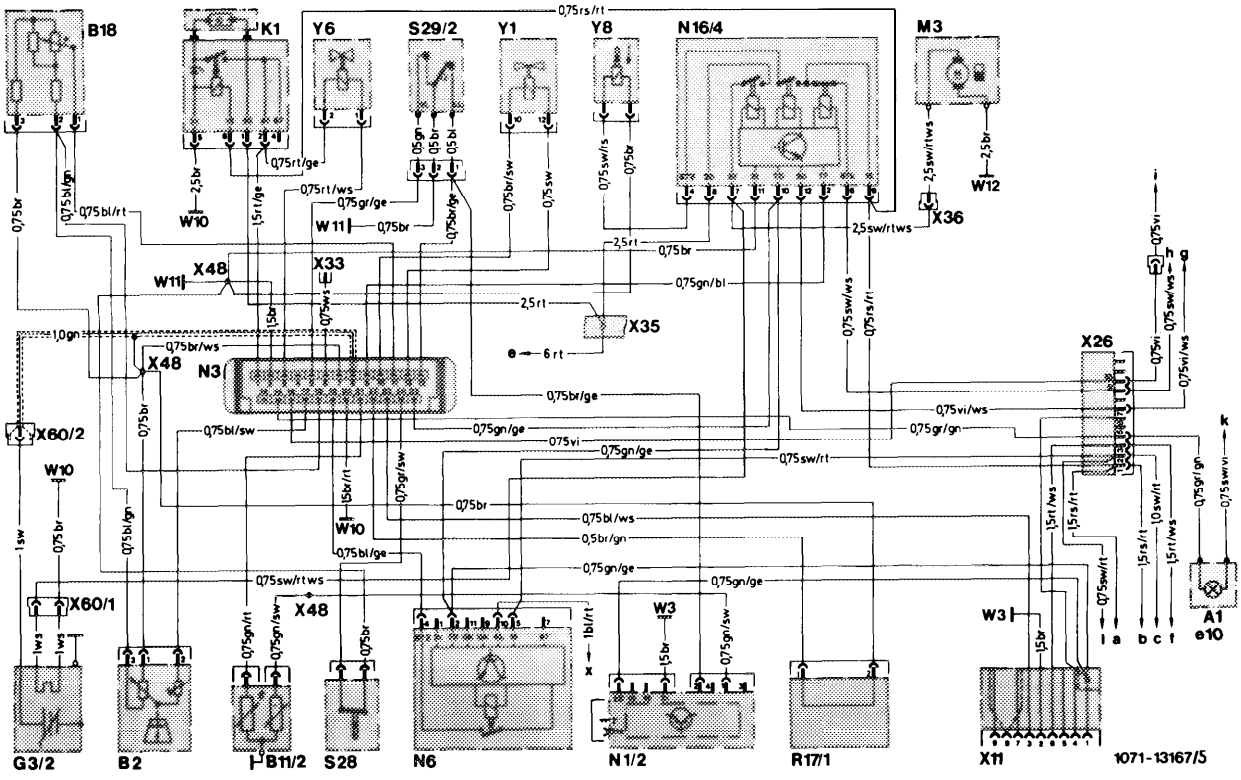

Wiring diagram, mechanically/electronically controlled gasoline injection system

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B18	Sensor, altitude correction
G3/2	O_2 sensor heated
K1	Relay, overvoltage protection
M3	Fuel pump
N1/2	Switching unit, electronic ignition system
N3	Control unit CIS-E (25-pole plug)
N6	Control unit, compressor cutout
N16/3	Relay, fuel pump (manual transmission)
N16/4	Relay, fuel pump (automatic transmission)
R17/1	Single adjustment plug CIS-E
S28	Microswitch, decel shutoff
S29/2	Throttle valve switch, full load/idle detection
w3	Ground, wheelhouse front left (ignition coil)
W9	Ground, front left (near lamp unit)
W10	Ground, battery
W11	Ground, engine (electric cable screwed on)
w12	Ground, center console
X11	Diagnosis socket/cable connector, terminal TD
X26	Plug connection, engine compartment harness (12-pole)
x33	Plug connection, injection system, cruise control/ Tempomat (1-pole)
x35	Cable connector, terminal 30/terminal 61 (battery)
X36	Plug connection, fuel pump, harness
X48	End sleeve (soldered connector in harness)
X56	Plug connection, throttle valve switch
X60/1	Plug connection, heater coil O_2 sensor
X60/2	Plug connection, signal O_2 sensor
Y1	Electrohydraulic actuator (EHA)
Y6	Idle speed adjuster (air valve)
Y8	Starting valve
a	Ignition coil, terminal 15
b	Fuse 7
c	Fuse 7, terminal 15
e	Cable connector terminal 30 (fuse and relay box) Fuse 9, terminal 30
g	Plug connection, starter lockout switch, jack 4
h	Switch, kickdown, jack 1 Automatic transmission, plug starter lockout switch, jack 3, terminal 50 Manual transmission, ground, engine (via starter coil)
k	Fuse 6, terminal 15 Relay, auxiliary fan, terminal 86
x	Pushbutton switch A/C compressor

Note: Unidentified grounding points to ground, engine or ground, body.

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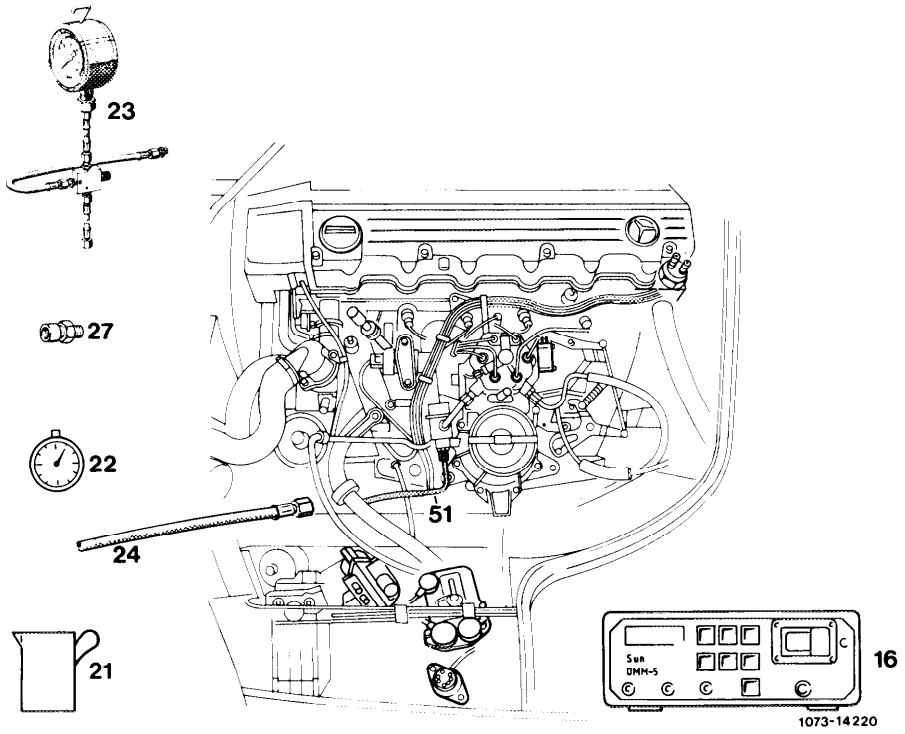
Job No. of work unit or standard texts and flat rates data 07-5700.



Fuel return line (51).	Unscrew
Fuel hose (24).	Self-made and connected to diaphragm pressure regulator
Del ivery capacity	Check. Nominal value 1 liter in max. 40 seconds. Use testers (16, 21, 22) for this purpose.
Current input	Check. Nominal value 7-10 amps Use tester (16) for this purpose.
Fuel hose	Check. Nominal value 2-4 bar gauge pressure. Use testers (23, 27) for this purpose. Special tool 103 589 00 21 00

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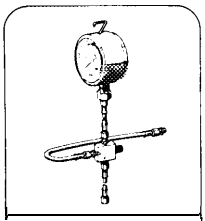
Test values

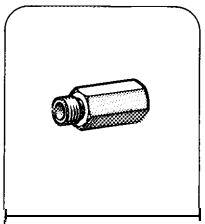
Fuel pump (each)		1	2
Designation		EKP4	EKP6
MB part No.		002 091 97 01	002 091 59 01[1])
Bosch No.		0580 254 942	0580 254 951
Measuring instructions		with engine stopped and a voltage of min. 11.5 volts at delivery pump	
Delivery capacity[2])	Measuring point	Fuel return line following diaphragm pressure regulator	
	min. 1 liter in	40 seconds	
Current input		7-10 amps	

[1]) Spare part No. 002 091 88 01
[2]) For measuring delivery capacity, the fuel tank must be at least filled by half.

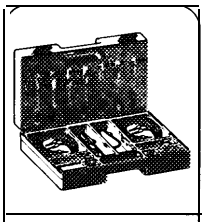
Special tools



103 589 00 21 00



103 589 02 63 00



201 589 00 99 00

Conventional testers

Measuring glass or measuring cup (min. 1 liter), stop watch	
Multimeter	e.g. Sun, DMM-5

Self-made tool

Fuel hose approx.	500 mm long
Pipe with sealing cone	
Coupling nut	M 14 x 1.5

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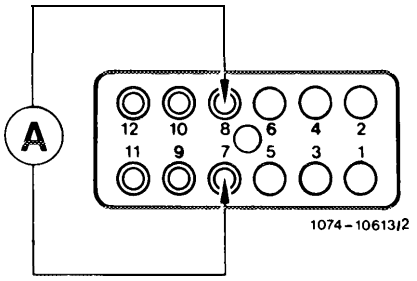
A. Delivery capacity

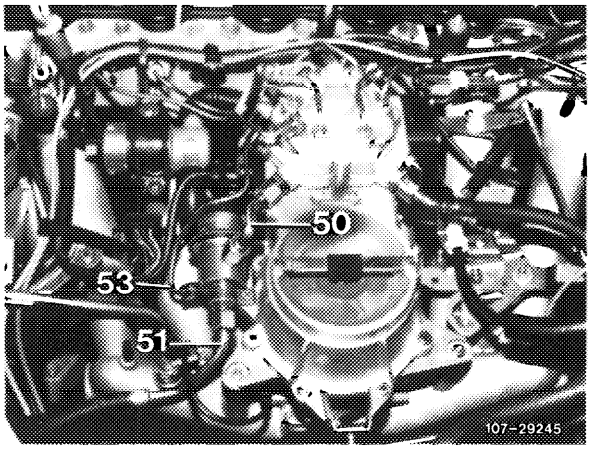
1 Check current input at jack 7 (terminal 87) and jack 8 (terminal 30).

Current input: 7-I 0 amps

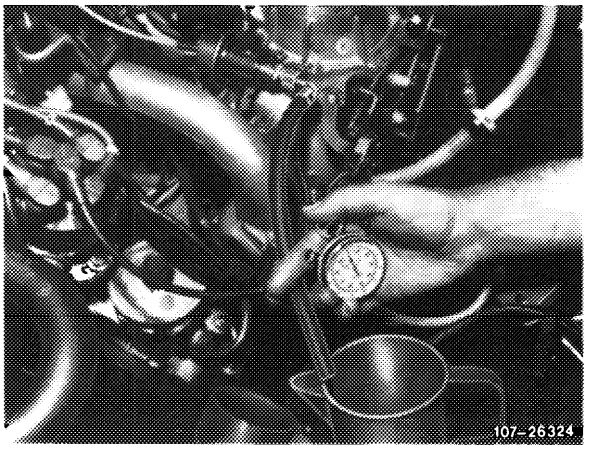
If more than 10 amps are measured, replace fuel pump.



2 Pull electric lines from multimeter. Check delivery capacity of fuel pump in fuel return line. For this purpose, unscrew fuel return line (51) at diaphragm pressure regulator.



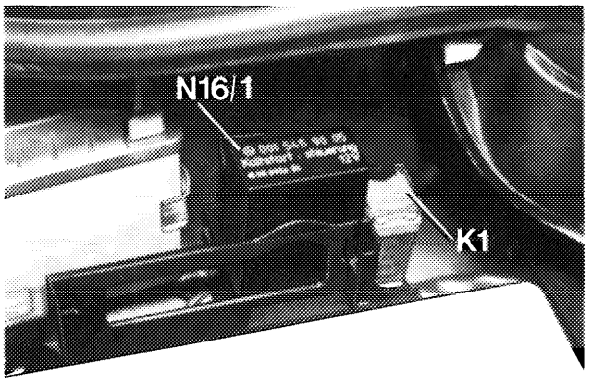
3 Screw self-made fuel hose to diaphragm pressure regulator and hold into measuring glass or measuring cup.



4 Bridge jacks 7 and 8. This will energize the fuel pump.

Pull off contact bridge after 40 seconds or before measuring glass/measuring cup starts overflowing.

Nominal value: 1 liter in max. 40 seconds at a minimum voltage of 11.5 volts on fuel pump.



107-29244

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5 If the delivered quantity is less than 1 liter in 40 seconds, check the following items:

a) Test voltage on fuel pump.
Nominal value min. 11.5 volts.

b) Check strainer in feed connection of fuel distributor for unobstructed passage.

c) Check fuel lines for pinched spots (squeezed lines).

d) Pinch off leak line between fuel accumulator and suction damper. Check delivered quantity once again. If the specified quantity is attained, replace fuel accumulator.

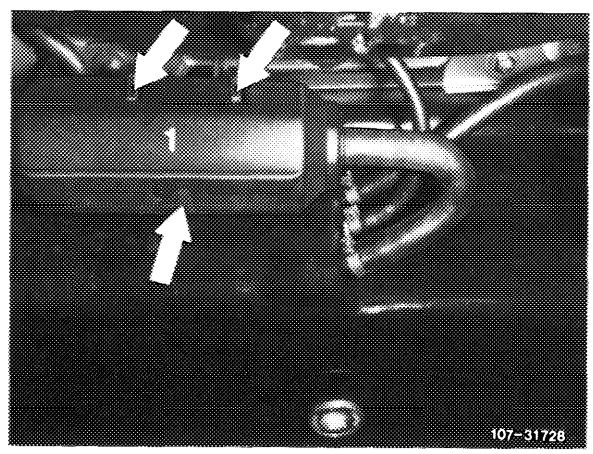
e) Replace fuel filter.

6 If the delivered quantity is still too low, replace fuel pump.

On vehicles with double pump version, find defective fuel pump by measuring fuel pressure (section „B").

7 Connect fuel return hose. Mount relay.

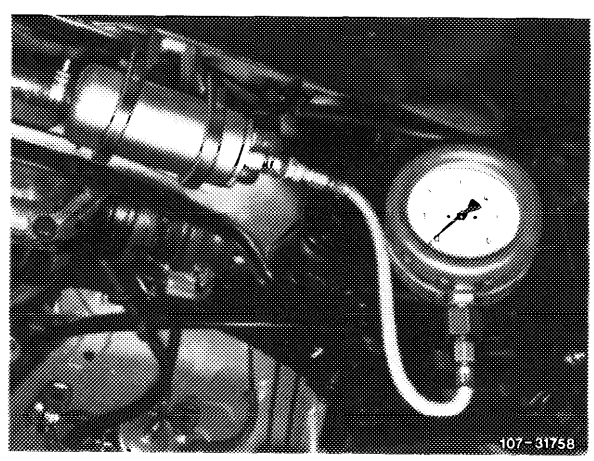
B. Fuel pressure



1 Disengage protective box (1) at rubber straps (arrows) and remove.

2 Unscrew cap nut on fuel pump 1, connect pipe connection part No. 103 589 02 63 00 and pressure gauge O-10 bar, part No. 103 589 00 21 00.

3 Pull off fuel pump relay and bridge the two jacks 7 and 8 (terminal 30 and 87).



4 Read pressure on pressure gauge. Pressure should be between 2-4 bar. If pressure is below 2 bar, the fuel pump 1 (between rear axle and fuel tank) is defective. If the pressure is above 4 bar, fuel pump 2 (mounted in fuel pump package) is defective.

5 Disconnect pressure gauge, connect cap nut and check for leaks.

6 Engage protective box.

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Testing injection valves

Job No. of work unit or standard texts and flat rates data 07-6500.

Test values

Opening pressure of injection valves	with new injection valves	3.5-4.1 bar gauge pressure
	with used injection valves	min. 3.0 bar gauge pressure

Tightening torques	Nm
Injection lines on fuel distributor (reference value)	10-12
Injection lines on injection valves (reference value)	10-15

Conventional testers and accessories

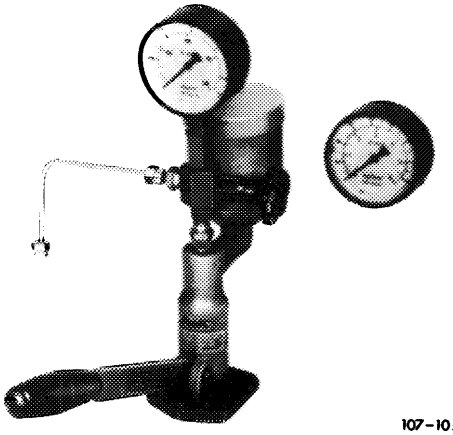
Valve tester Bosch KDJE-P 400	Bosch order designation KDJE-P 400
Nozzle tester EFEP 60 H[1])	Bosch No. 0 684 200 700
Pressure gauge O-6 bar gauge pressure housing dia. 100 mm Quality class 1 .O	Bosch No. 1 687 231 000
Pipe line	Bosch No. 1 680 750 001

[1]) Similar to previous nozzle tester. Testing of injection valves requires the named pressure gauge or the pressure gauge of the pressure measuring device 100 589 13 21 00.

Note

The nozzle or valve tester serves to test the opening pressure, buzzing, the jet and the absence of leaks of injection valves.

Prior to starting injection valve test, fill reservoir of tester and vent the unit. For testing, use kerosene exclusively.



107-10592

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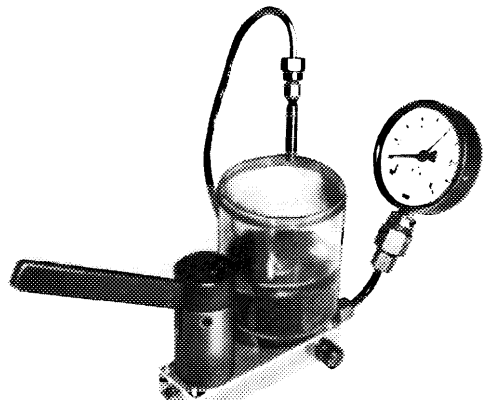
Replace injection valves beyond tolerance. Injection valves can be individually replaced within a set.



107-14212

Testing

Remove injection valves for testing (07.3–215).

1 Coarse leak test:

a) Connect removed injection valves to tester. Vent pressure line with shutoff valve opened and coupling nut released. Then tighten coupling nut.

b) **Open shutoff** valve, slowly actuate hand lever (4 s/stroke) and establish pressure up to max. 1.5 bar gauge pressure. If a leak on injection valve shows up, replace injection valve.

2 Check opening pressure.

With new injection valves 3.5-4.1 bar gauge pressure
With used injection valves min. 3.0 bar gauge pressure

Close shutoff valve. Flush injection valve by actuating hand lever several times fast.

Open shutoff valve and test opening pressure by means of slow movements of hand lever.

3 Precision leak test:

Close shutoff valve. Flush injection valve by a number of fast movements of hand lever. Open shutoff valve and increase pressure slowly up to 0.5 bar gauge pressure below the previously determined opening pressure and hold. No drops should show up on injection valve within 15 seconds.

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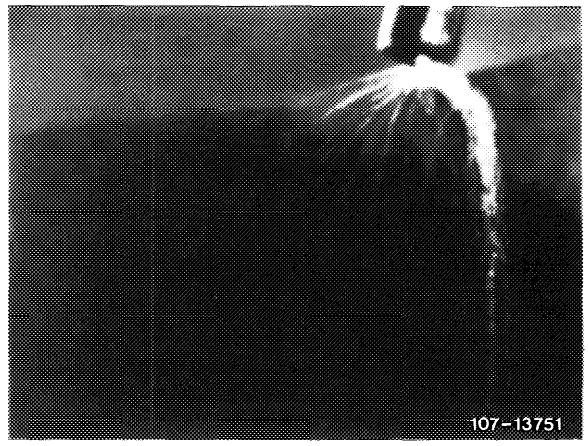
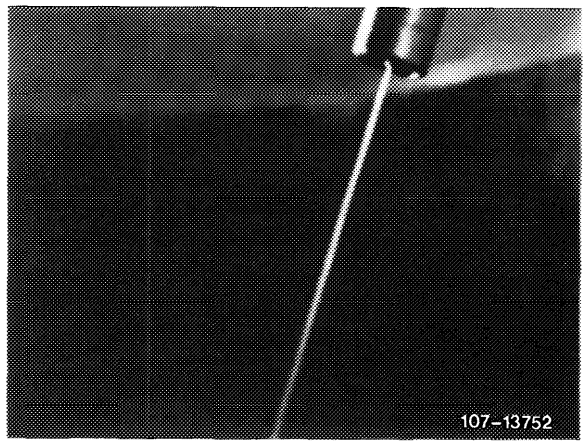
4 Buzzing test, evaluation of jet

Close shutoff valve and flush valve by actuating lever several times (0.5 s/stroke). Then reduce speed of lever actuation to approx. 1 s/stroke. Valve should be buzzing. No drops should show up at mouth of valve. There should be no cord-type jet. One-sided, atomized jet formation within a total jet angle (injection angle) of approx. 35^{o} is permitted.

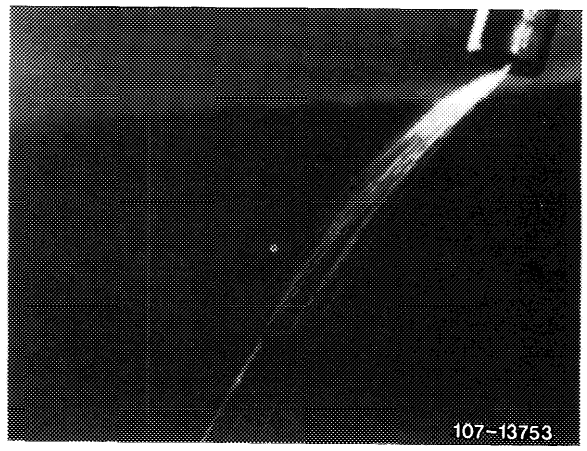
faulty injection valves



Formation of drops



Cord-type jet



Spreading jet

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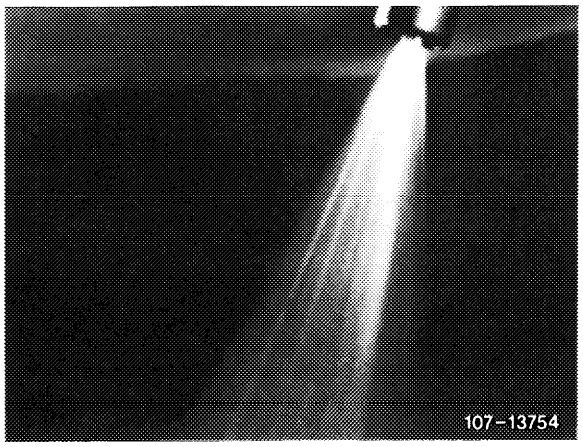
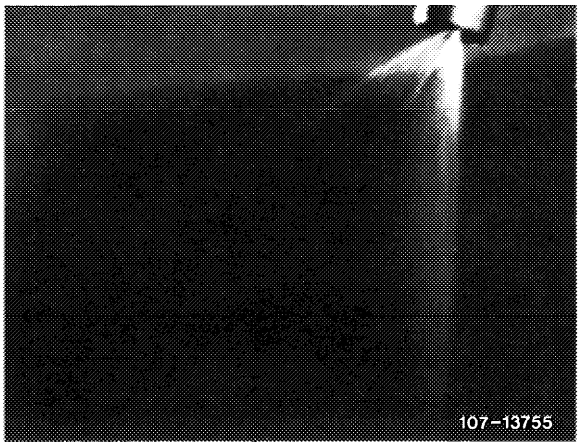
Good injection valves



Well-proportioned jet



Slightly one-sided atomization

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07.3-I 52 Testing, replacing throttle valve switch

Job No. of work unit or standard texts and flat rates data 07-1689.

Conventional tool

Ohmmeter

Note

Remove throttle valve housing to replace throttle valve switch (07.3-230).

Checking

1 **Set ohmmeter to measuring range of 0—∞ Ω.**

2 Check full throttle stop. Push throttle valve to full throttle stop for this purpose. The readout will then be 0 Ω.

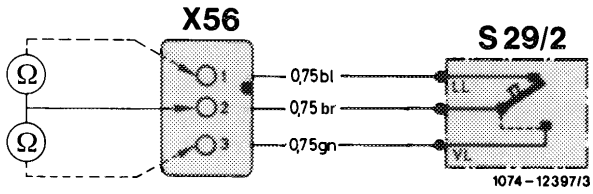
3 Turn throttle valve slightly in direction of idling, readout should move to ∞ Ω.

4 Check idle speed stop.

Push throttle valve to idle speed stop. Turn throttle valve until the readout shows 0 Ω.

Lift throttle valve by 0.2 mm, readout should move to ∞ Ω.

Idle speed contact:	**Idle speed position approx. 0 Ω**
	Full load position approx. ∞ Ω
Full load contact:	**Idle speed position approx. ∞ Ω**
	Full load position approx. 0 Ω
	Partial load position approx. ∞ Ω



S29/2 Throttle valve switch full load/idle speed detection
X56 Plug connection throttle valve switch

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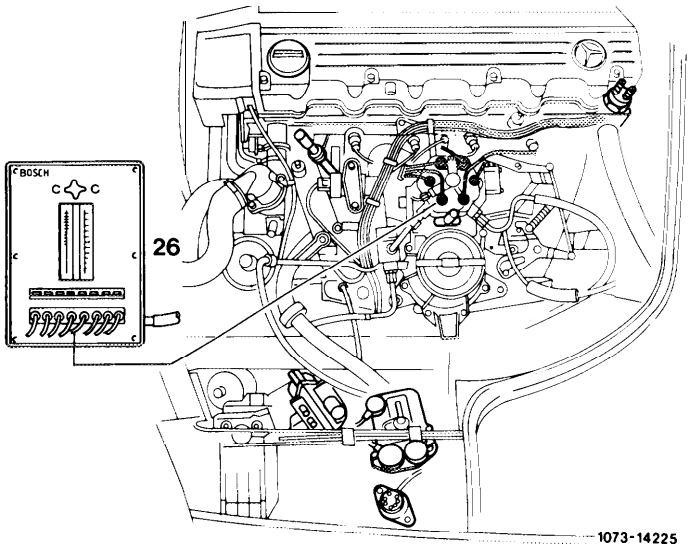
07.3-160 Perform fuel quantity comparison measurement

Job No. of work unit or standard texts and flat rates data 07-1609.



Injection lines	Unscrew
Quantity comparison measuring unit (26)	Connect
Fuel pump relay	Pull off. Bridge jacks 7 and 8. Special tool 201 589 00 99 00
Air flow sensor plate	Deflect and vent quantity comparison measuring unit
Air flow sensor plate	Locate
Test sheet.	Complete. Compute difference between smallest and largest flow quantity (for nominal values refer to Table)
Injection lines	Connect
Fuel pump relay	Plug on. Run engine and check all fuel connections for leaks
Idling speed	Adjust (07.3-100)

Test values

Simulated operating mode	Flow rate (minimum quantity) per connection in cc/min	Max. dispersion in cc/min
Idling speed	4	0.4
Partial load	30	4.0
Full load	100	10.0

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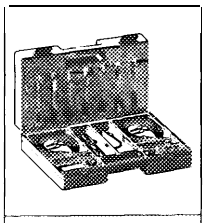
Special tool



201 589 00 99 00

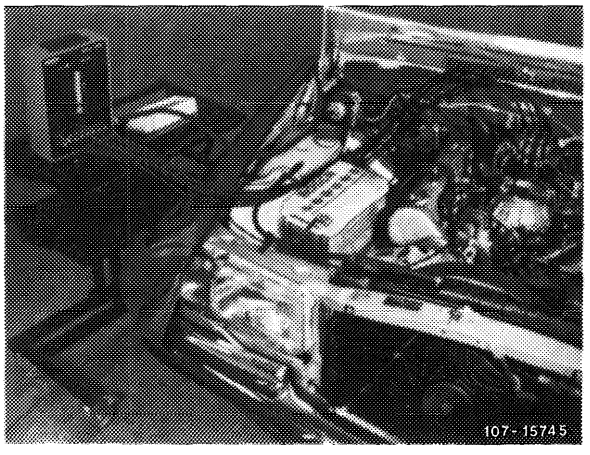
Conventional Bosch testers and accessories

Designation	Order designation
Quantity comparison unit	KDJE-P 300
Tester carriage[1]	M 200/2 or KDJE-W 100

[1]) If the tester carriage is used for the quantity comparison measuring unit, an additional angle plate is required. The plate can be self-made or acquired from a Bosch agency.

Note

A quantity comparison measuring unit is available to check the fuel distributor in vehicle. The unit serves to measure the individual fuel quantities which the fuel distributor distributes to the injection valves. The measuring proceeds with the engine stopped. The operating mode (idling speed, partial or full load) is simulated and adjusted on air flow sensor plate by means of an adjusting device.

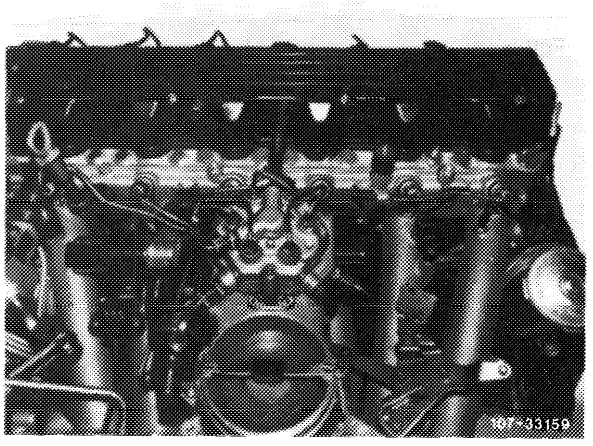


Testing

1 Place quantity comparison measuring unit horizontally adjacent to vehicle (tool or tester carriage).

2 Remove air cleaner.

3 Unscrew injection lines on fuel distributor and release at injection valves, unscrew if required.



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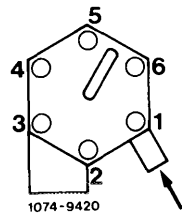
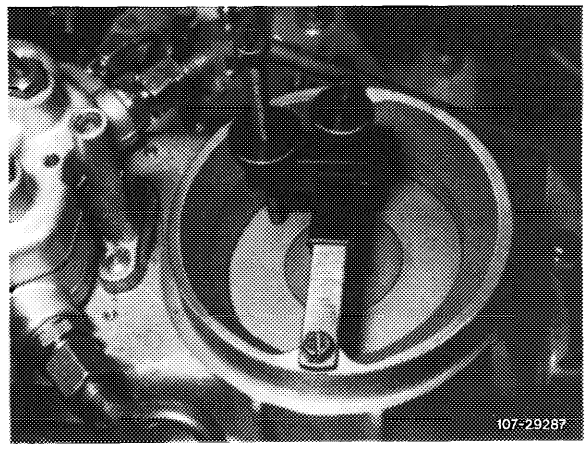
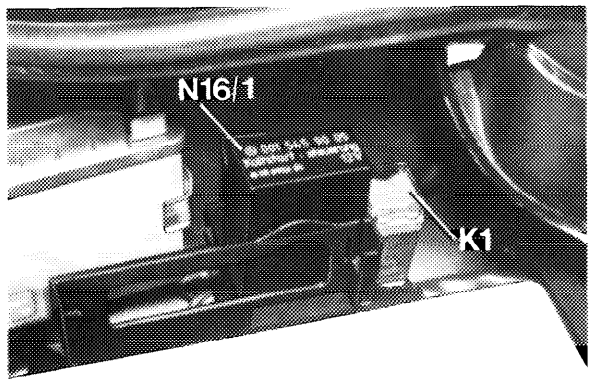
4 Attach connecting lines of quantity comparison measuring unit to fuel distributor (sequence according to Fig.) and insert fuel return line into filler neck of fuel tank.



5 Clamp adjusting device for fixing air flow sensor plate to stop bracket of air funnel.



6 Pull off fuel pump relay and bridge the two jacks 7 and 8. This will energize the fuel pump.



7 Deflect air flow sensor plate and quickly push buttons 1 to 6 individually for venting the equipment.

8 Keep one button pushed, deflect air flow sensor plate by means of adjusting device and fix an air flow rate of 4 cc/min (idling speed).

9 Push the remaining buttons, read the individual flow quantities and enter on test sheet.

Max. dispersion:
Idling speed 0.4 cc/min

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Note: Orders for test sheets, print No. 800.99.472.00 should be directed by branches and general agencies in the Federal Republic of Germany on punched cards to the ,,Drucksachen-Zentrallager in Stuttgart-Untertiirkheim" and by the general representatives in export countries to ZKD/MI 2, Stuttgart-Unterttirkheim. The data sheets are available in blocks of 50 sheets each.

10 Compute the difference between the smallest and the largest flow quantity and compare with tolerance value.

11 For partial and full load, fix air flow sensor plate as described under item 8 at a flow rate of 30 cc/min or 100 cc/min. Then also compute the difference between the smallest and the largest flow rate and compare with tolerance value.

Max. dispersion:
Partial load 4.0 cc/min
Full load 10.0 cc/min

12 If the dispersion is beyond tolerance, exchange fuel distributor.

13 Run engine and check all fuel connections for leaks.

14 Adjust idling speed (07.3–100).

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07.3-165 Testing relay fuel pump

Job No. of work unit or standard texts and flat rates data 07-5792

Function

The fuel pump relay for energizing the fuel pump has the following functions:

1. Activation of fuel pump when starting and with the engine running.
2. Rpm limitation after attaining engine max. speed.
3. Switching off fuel pump as soon as there are no more impulses via terminal TD of switching unit.
4. Kickdown cutout.
5. Starting valve activation.

Conventional tester

Multimeter	e.g. Sun, DMM-5

Test condition

Battery charged to min. 60 %.

If the engine is not regulated (breakaway speed) when the engine max. speed is attained, replace fuel pump relay.

The respective breakaway speed is stamped on fuel pump relay.

For starting valve activation, refer to 07.3-l 26.

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Testing relay, fuel pump

Pull off relay, fuel pump. Bridge jack 7 (terminal 87) and jack 8 (terminal 30). Fuel pump will be audibly running.

Ok	Not ok

Switch on ignition. Set multimeter to volts. Test voltage on jack 9 (terminal 15) against jack 11 (terminal 31).

Voltage approx. 12 volts

Ok	Not ok

Repair interruption according to wiring diagram.

Bridge jack 7 and 8. Set multimeter to volts.
Test voltage on jack 10 (terminal TD) against jack 11 (terminal 31), start engine for this purpose.

Voltage 6-l 2 volts

Ok	Not ok

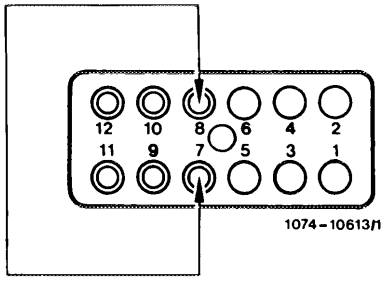
Repair interruption according to wiring diagram or test ignition switching unit.

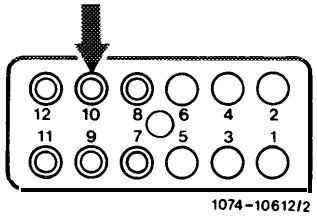
Stop engine. Install relay, fuel pump. Switch on ignition. Fuel pump will temporarily start.

Ok	Not ok

Replace relay, fuel pump.

End of test





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Test voltage on jack 8 (terminal 30) against jack 11 (terminal 31).
Set multimeter to volts.

Voltage approx. 12 volts

Ok	Not ok

Repair interruption according to wiring diagram.

Bridge jack 7 and 8.
Test voltage at fuel pump.

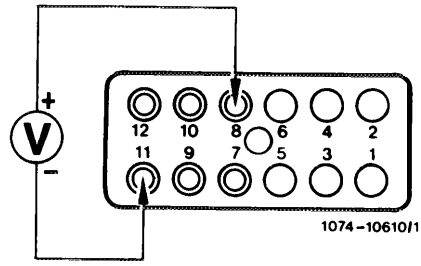
Voltage approx. 12 volts

Ok	Not ok

Replace fuel pump.

Repair interruption according to wiring diagram.

End of test



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Testing kickdown cutout

Pull plug from kickdown switch.
Set multimeter to volts. Start engine and test voltage.
With selector program
jack 2 to ground.
Without selector program (AUS) (J) (USA)
jack 1 to ground.

Voltage approx. 12 volts

Ok	Not ok

Repair interruption according to wiring diagram.

Test voltage on plug, kickdown switch.
With selector program
jack 2 and 4.
Without selector program (AUS) (J) (USA)
jack 1 and 2.

Voltage approx. 12 volts

Ok	Not ok

Increase engine speed.
Voltage should drop at a speed approx. 200 rpm prior to attaining breakaway speed.

Ok	Not ok

Replace relay, fuel pump.

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Stop engine. Set multimeter to ohms.
Test kickdown switch for continuity.

With selector program
jack 2 and 4.
Without selector program (AUS) (J) (USA)
jack 1 and 2.

Kickdown switch
actuated 0 Ω
not actuated ∞ Ω

Ok	Not ok

Replace kickdown switch.

End of test

Pull plug from solenoid valve (Y3). Set multimeter to volts. Test voltage to ground, while actuating kickdown switch manually (not with accelerator pedal).

Voltage approx. 12 volts.

Ok	Not ok
Replace solenoid valve.	Repair interruption according to wiring diagram.

End of test

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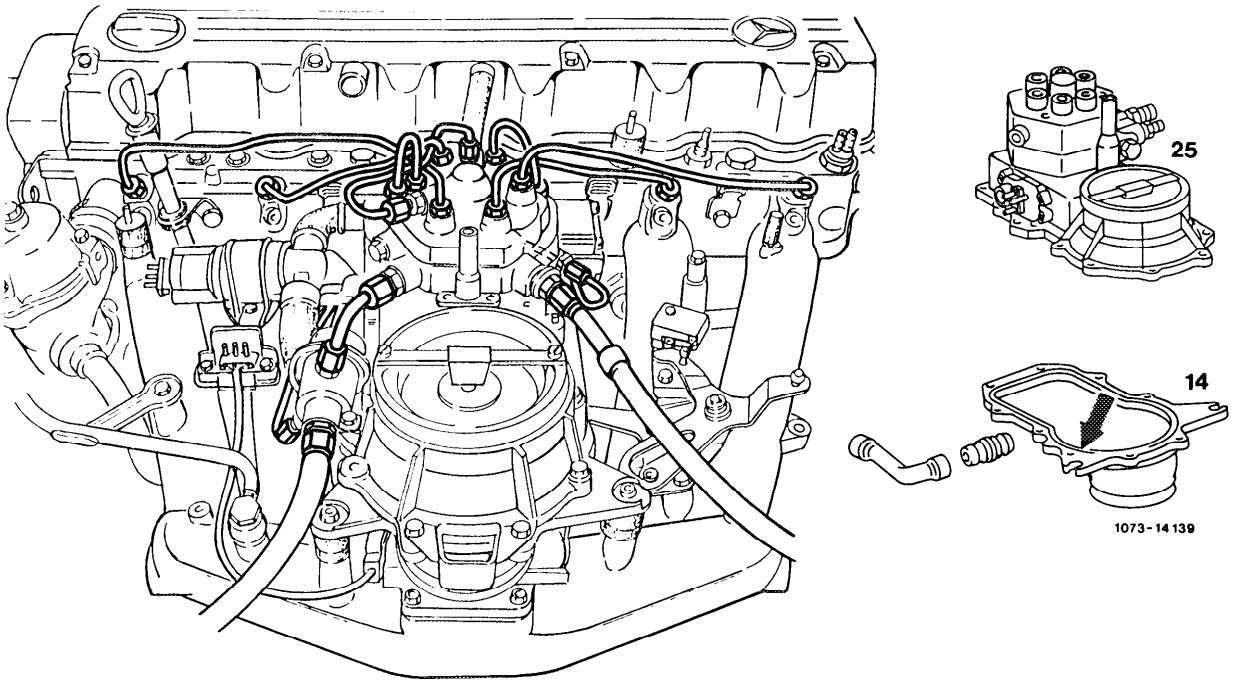
07.3-200 Removal and installation of mixture control unit

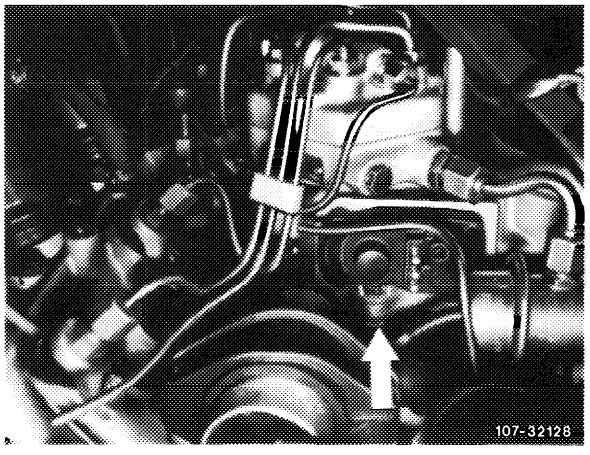
Job No. of work unit or standard texts and flat rates data 07-1668



Mixture control unit (25)	Remove and install together with air guide housing (14) (07.3-225)
Air guide housing (14)	Unscrew from mixture control unit (25). Replace damaged parts. Do not use sealing compound during assembly. Sealing is performed by sealing lip (arrow). The air guide housing is made of rubber. It is fastened to light-alloy frame by means of buttons.

Note

Screws of different length are used for fastening air guide housing to air volume meter (air flow sensor). For this reason, make sure that the removed screw below sensor, air volume meter (arrow) is again installed there. Using a longer screw will damage sensor of air volume meter.



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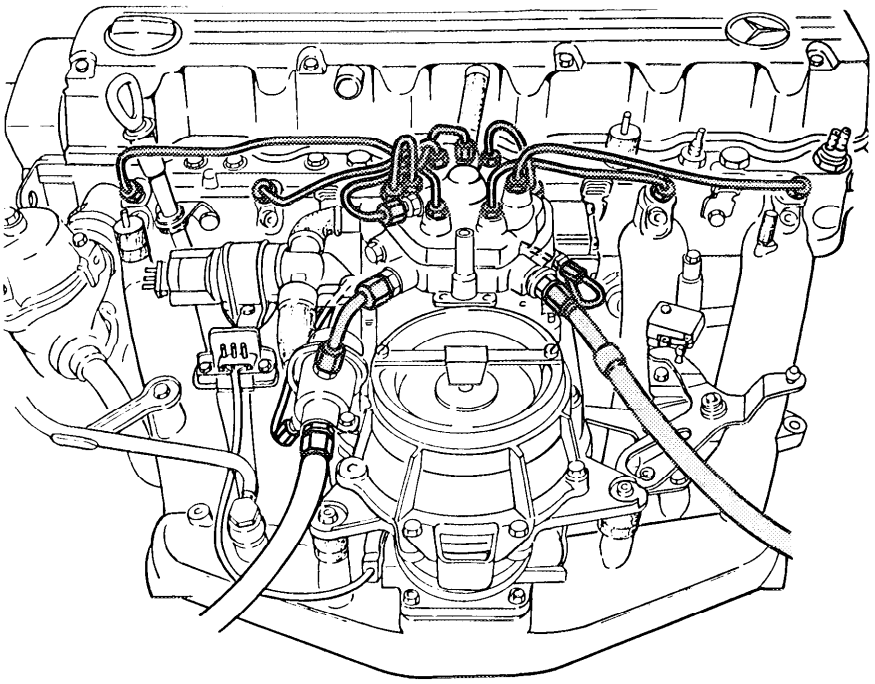
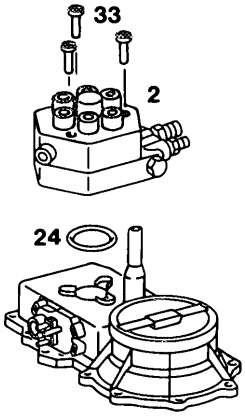
07.3-205 Replacing fuel distributor

Job No. of work unit or standard texts and flat rates data 07-1674





1073-14141

Fuel and injection lines.	Screw off and on, 10-l 5 Nm (reference value)
Fastening screws (33)	Screw off and on
Fuel distributor (2)	Remove by turning to and fro
Rubber sealing ring (24)	Replace, lubricate slightly, carefully mount fuel distributor
Test coordination of control piston in relation to air flow sensor plate and adjust, if required	For this purpose, pull off fuel pump relay and bridge jacks 7 and 8. The fuel should now just stop or start to flow at outlet connection for injection lines, adjust coordination by means of idle speed mixture control screw, if required.
Adjust idling speed (07.3–100)	Check all fuel connections, as well as rubber ring on fuel distributor for leaks by means of spray test.

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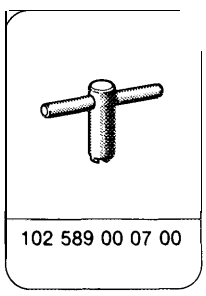
07.3-207 Replacing sealing ring for control piston

Job No. of work unit or standard texts and flat rates data 07-1660

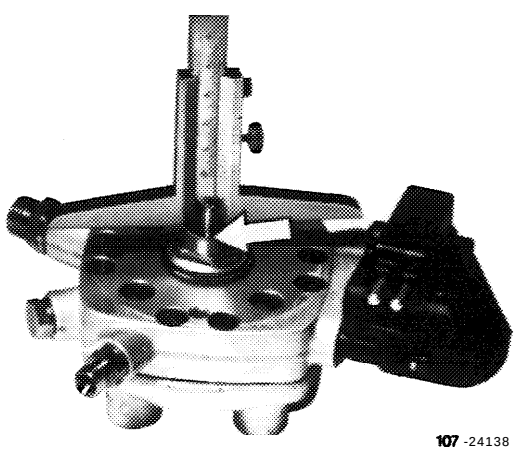
Special tool



Replacing

1 Unscrew fuel distributor (07.3–205).

2 Measure position of closing plug with depth gauge (arrow) and mark position with scriber.

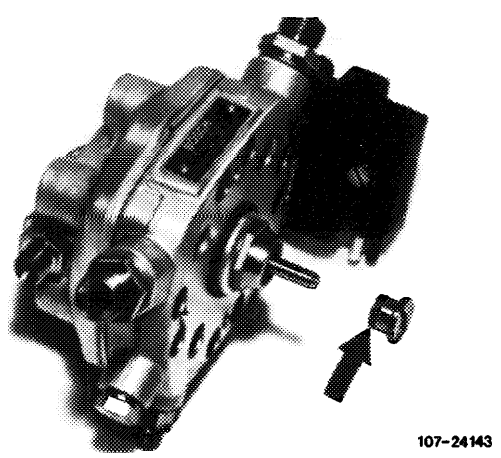


3 Unscrew closing plug and replace contour ring (arrow).

4 Screw in closing plug to previous input value and mark.

Attention!
Be sure to maintain previous input value.

If not, basic adjustment of control piston will be wrong.



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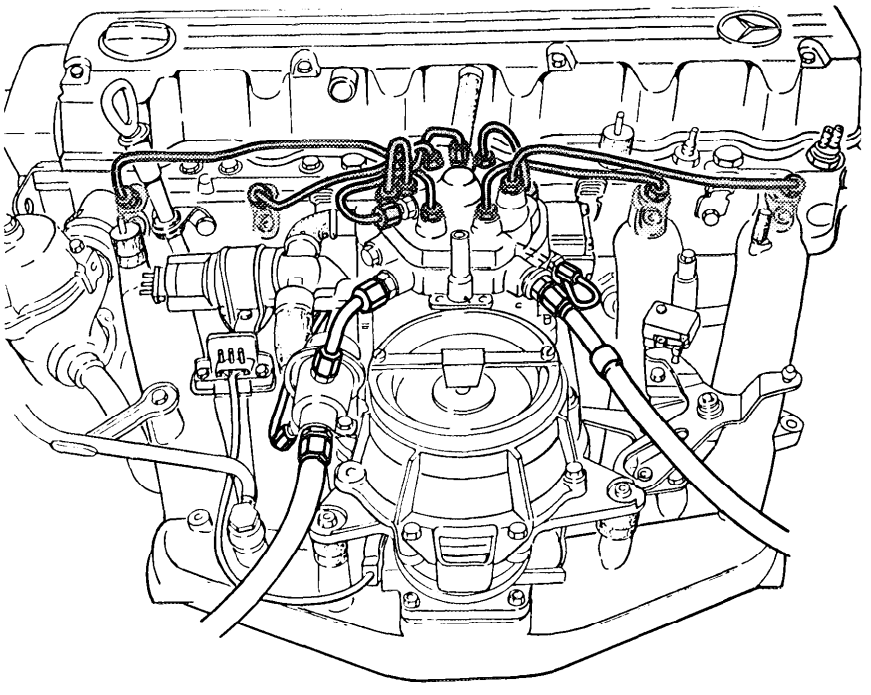
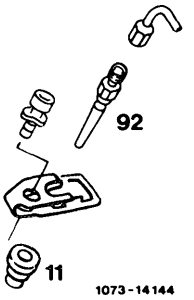
Job No. of work unit or standard texts and flat rates data 07-6520





Injection lines	Remove and install, apply counterhold to injection valves. 1 O-l 5 Nm (reference value)
Holder.	Unscrew
Injection valves (92)	Pull out
Rubber sealing ring (11)	Replace

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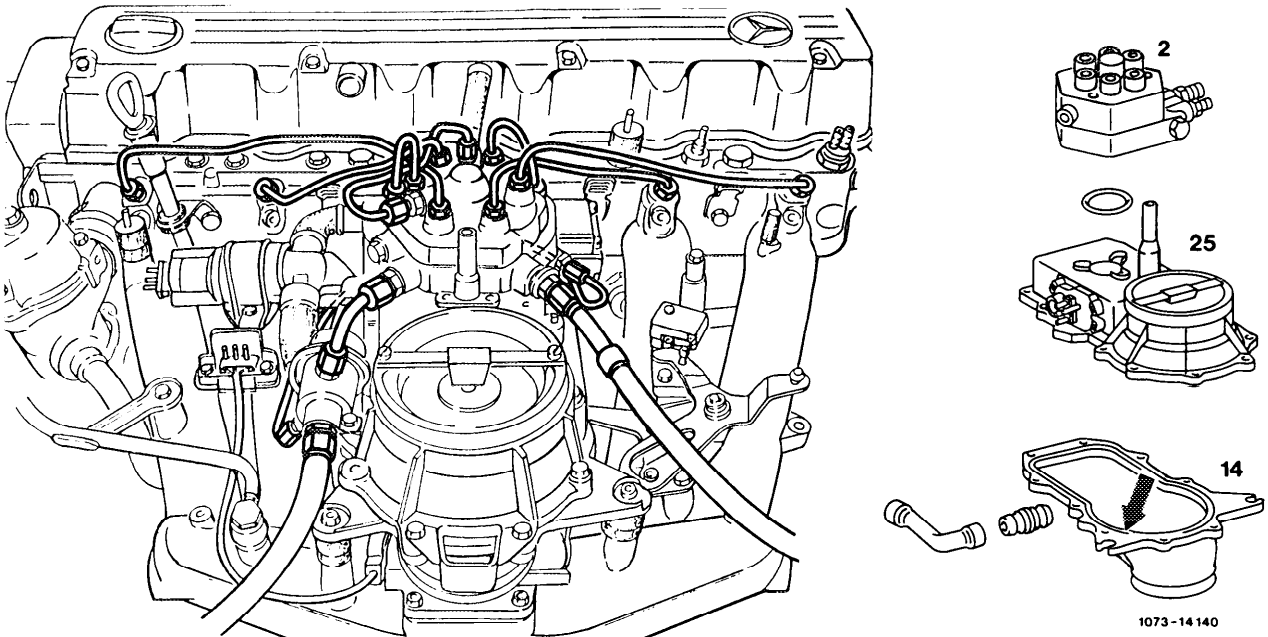
07.3-220 Replacing air volume meter

Job No. of work unit or standard texts and flat rates data 07-1686

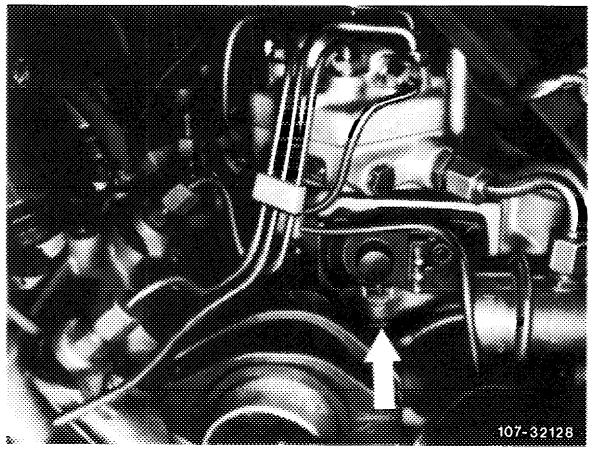


Mixture control unit (25)	Remove and install together with air guide housing (07.3–225)
Air guide housing (14).	Unscrew from mixture control unit (25). Replace damaged parts. Do not use sealing compound during installation. Sealing is performed by sealing lip (arrow). The air guide housing is made of rubber. It is fastened to light-alloy frame by means of buttons.
Fuel distributor (2)	Remove and install (07.3–205)

Note

Screws of different length are used for fastening air guide housing to air volume meter (air flow sensor). For this reason, make sure that during disassembly the removed screw below sensor of air volume meter (arrow) is again installed there.

Using a longer screw will damage sensor of air volume meter.



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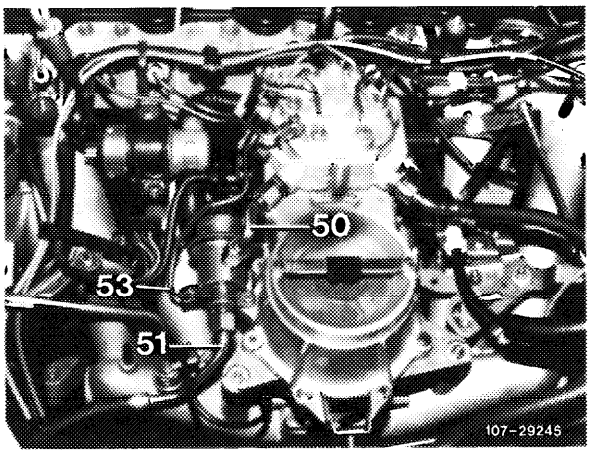
When loosening fuel line (50), fuel distributor to diaphragm pressure regulator make sure that the open-end wrench is not pressing against sensor for air volume meter and will damage the latter.



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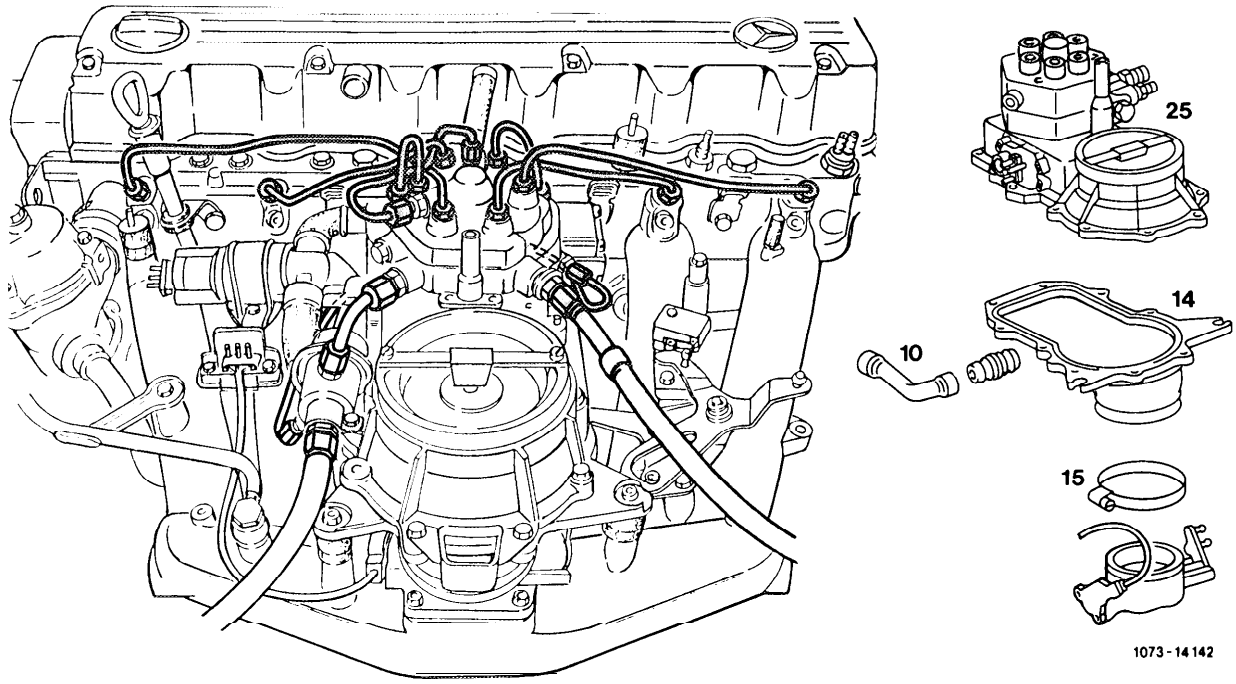
07.3-225 Removal and installation of mixture control unit with air guide housing

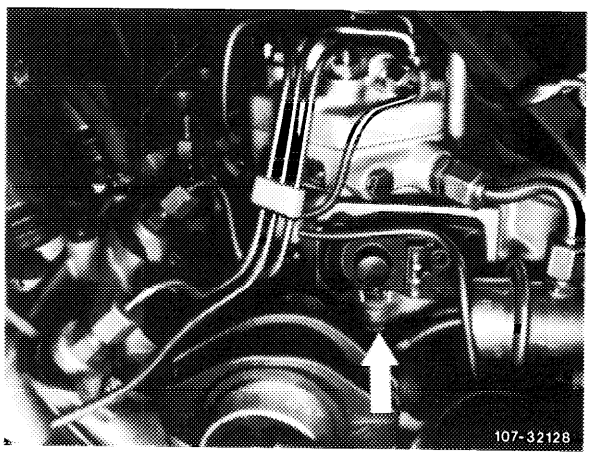
Job No. of work unit or standard texts and flat rates data 07-1668



Fuel and injection lines.	Screw **off and** on. 10—15 Nm (reference value)
Electric lines	Disconnect and connect
Diaphragm pressure regulator	Screw off and on
Fastening nuts on rubber buffer	Screw off and on, 9-10 Nm (reference value)
Hose clamp (15)	Loosen, tighten
Mixture control unit (25)	Lift with air guide housing (14), while pulling off idle speed air hose (10)
Engine	Run engine and check all fuel connections for leaks
Idling speed	Adjust (07.3-100)

Note

Screws of different length are used for fastening air guide housing to air volume meter (air flow sensor). For this reason, make sure that during disassembly the removed screw below sensor of air volume meter (arrow) is again installed there. Using a longer screw will damage sensor of air volume meter.



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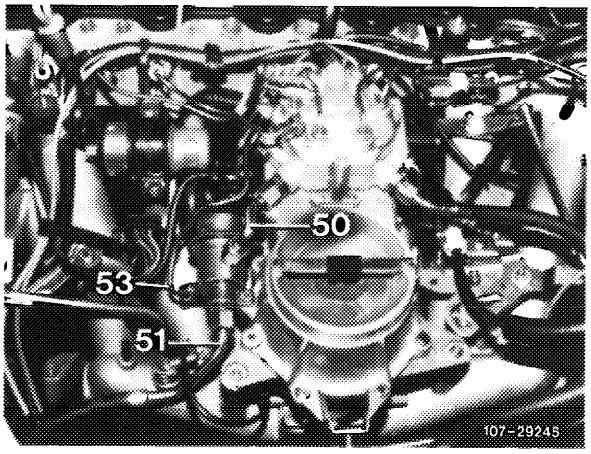
When loosening fuel line (50), fuel distributor to diaphragm pressure regulator make sure that the open-end wrench is not pressing against sensor for air volume meter and will damage the latter.



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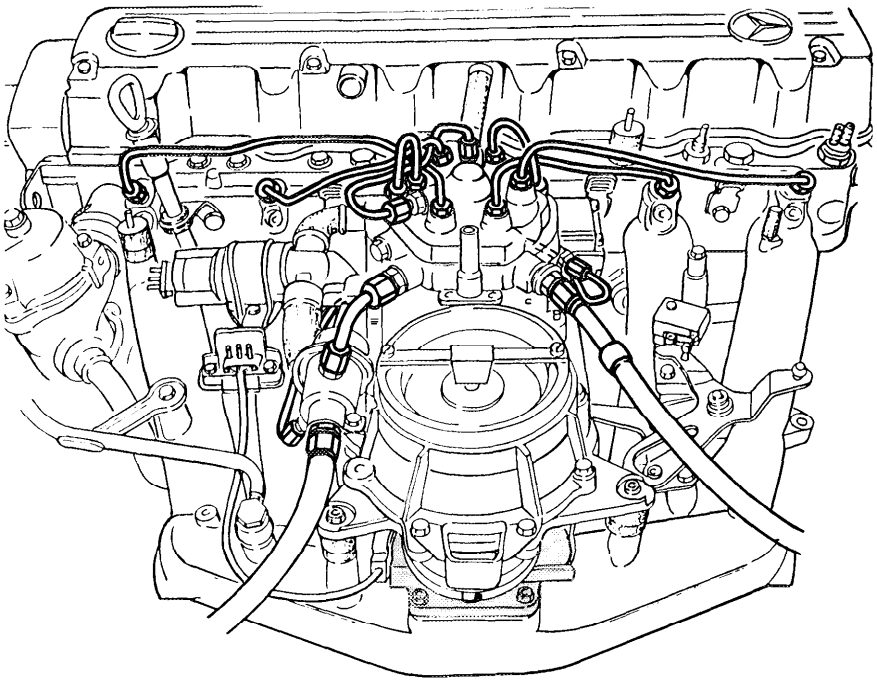
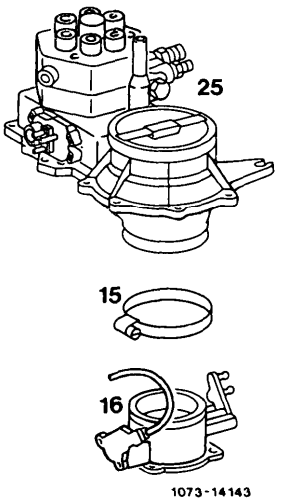
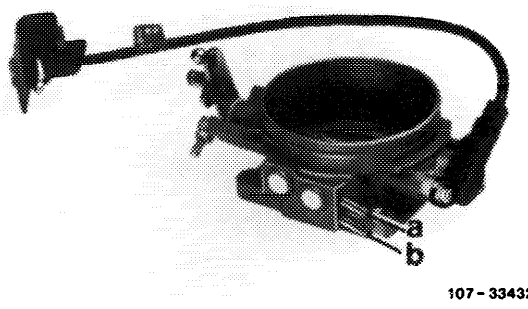
07.3430 Removal and installation of thrdttle valve housing

Job No. of work unit or standard texts and flat rates data 07-6210





Hose clamp (15)	Loosen, tighten
Mixture control unit (25)	Unscrew fastening nuts on front vibration dampers and pull out mixture control unit in upward direction
Return spring and regulating rod on throttle valve housing	Disengage, engage
Throttle valve housing (16)	Unscrew and remove. Use new gasket during installation
Vacuum lines and electrical connection for throttle valve switch	Disconnect, connect
Slotted lever	Adjust (30-300)
Idling speed	Adjust (07.3-l 00)



a To thermovalve
b Connection suction line to purge valve for fuel evaporation control system

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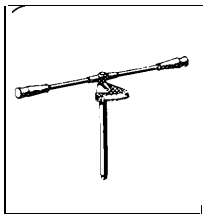
07.3-245 Replacing, centering air flow sensor plate, testing and adjusting zero position of air flow sensor plate

Adjusting job No. of work unit or standard texts and flat rates data 07-1612, replacing 07-1665.

Special tool



0005696721 00

Conventional units and tools

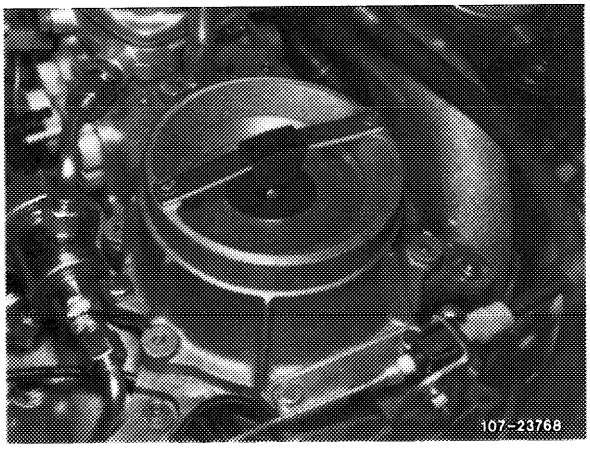
Hot air blower, tap M 6

Tightening torque	Nm
Fastening screw for air flow sensor plate	5.0-5.5

Removal

1 Remove air cleaner.

2 Unscrew stop bracket.



3 Heat fastening screw for air flow sensor plate with a hot air blower and carefully unscrew (avoid breaking off screw).

Attention!
The fastening screw is micro-encapsulated.

4 Clean bore for fastening air flow sensor plate with tap M 6.

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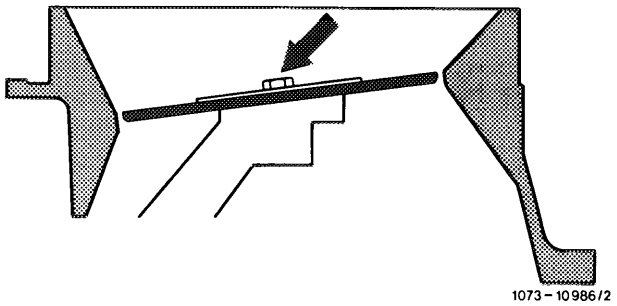
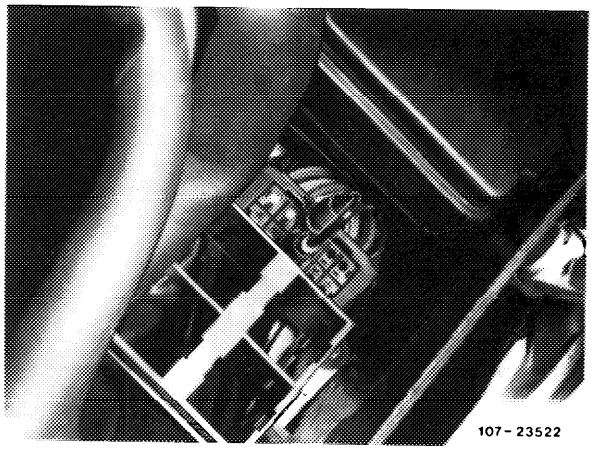
Installation

5 Install parts of repair set. Insert air flow sensor plate and washer. Slightly attach micro-encapsulated fastening screws (arrow, self-locking).

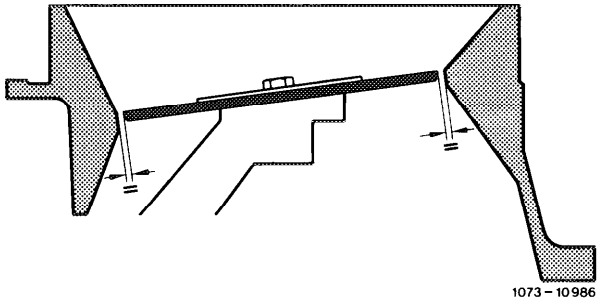


6 Center air flow sensor pla te. For this purpose, pull off fuel pump relay and bridge the two jacks 7 and 8 for a short period so that pressure will be established.



Use a slip gauge of approx. 0.05 mm to make sure that the air flow sensor plate is accurately centered. The air flow sensor plate should not bind even under slight, lateral pressure (bearing play cancelled).

7 Tighten fastening screw to 5.0-5.5 Nm and mount stop bracket.



8 Check air flow sensor plate for easy operation. For this purpose, push air flow sensor plate manually slightly down. Sensor plate should not bind. Release sensor plate, when moving back the sensor plate should also not bind and should audibly abut against resilient stop. Center air flow sensor plate once again, if required.

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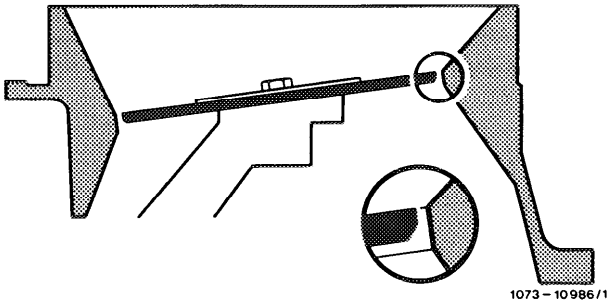
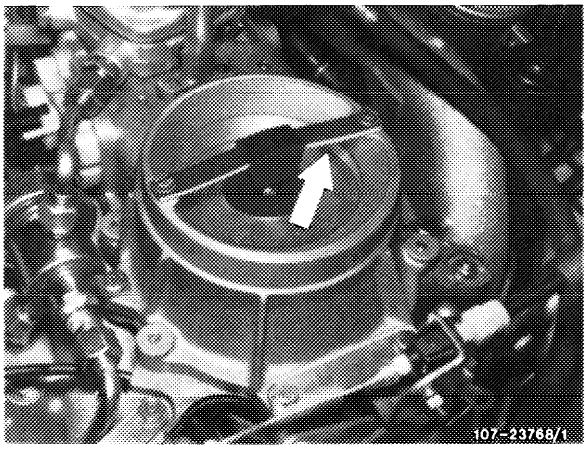
9 Test zero position (rest position) of air flow sensor plate. Upper edge of air flow sensor plate should be flush with upper edge of cylindrical part on air funnel.



The measuring point is directly underneath spring bracket (arrow).

A higher location up to max. 0.2 mm is permitted.

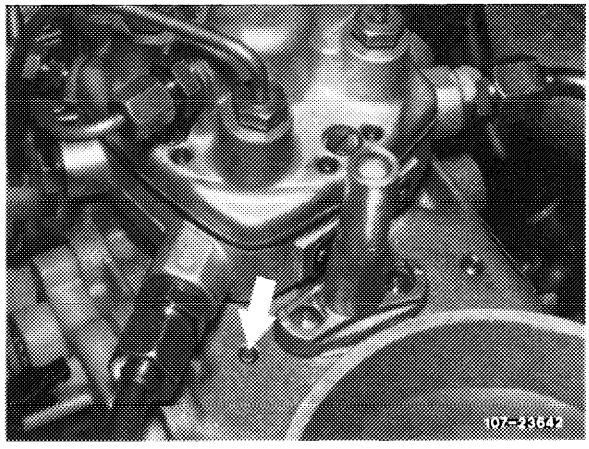
In this position, the clearance should be l-2 mm up to control piston when the air flow sensor plate is pushed.



10 Adjust to zero position of air flow sensor plate.

a) If sensor plate is located too high, knock guide pin (arrow) down as required by means of a mandrel.

b) If too low, remove mixture control unit and knock out guide pin from below (07.3-200).



Attention!
Displace guide pin very carefully, so that it is not displaced too far.

Avoid repeatedly displacing pin in both directions, since press-fit of pin will then be not tight enough.

11 Mount fuel pump relay.

12 Adjust idling speed (07.3-100).

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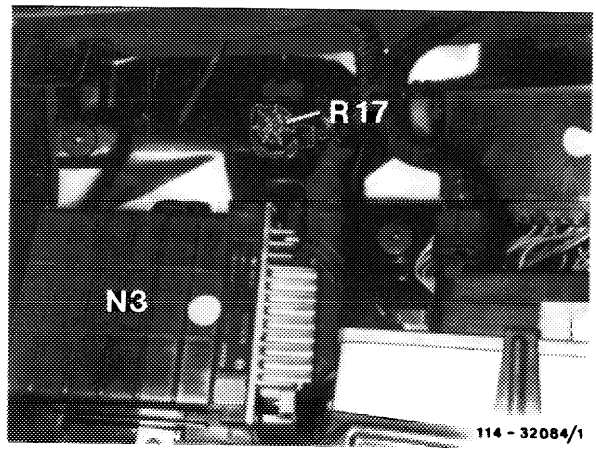
Job No. of work unit or standard texts and flat rates data 07-1698

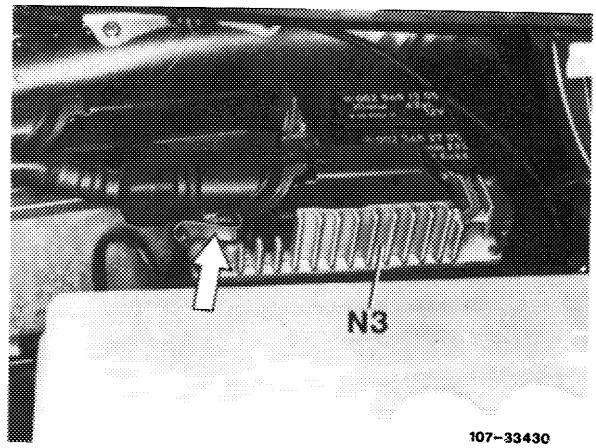
Layout CIS-E control unit (N3)

Model 107
At front right under leg support.

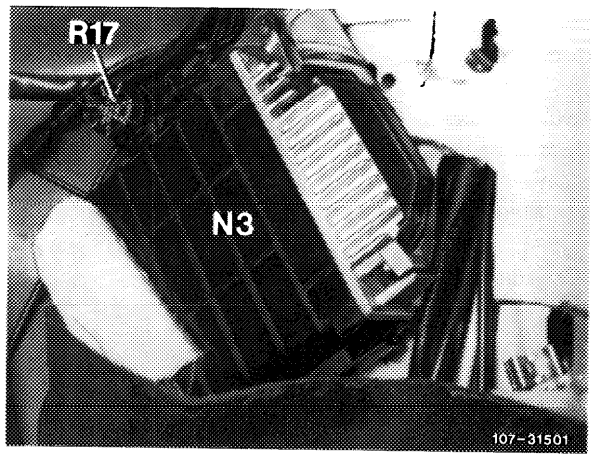


N3 Control unit
R 17 Adjustment plug CIS-E

Model 124
In unit compartment, right.



Model 126
In legroom, right, behind side panelling.



N3 Control unit
R 17 Adjustment plug CIS-E

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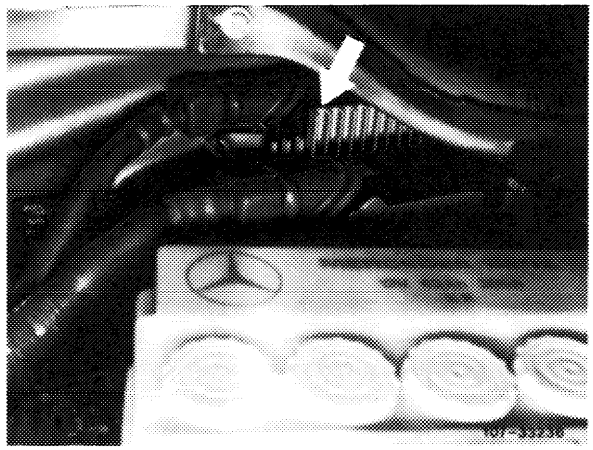
Model 201
In unit compartment, right (arrow).



Removal, installation

1 **Pull plug from control unit. For this purpose, push sheet metal clip (arrow) down.**

2 Pull out control unit (N3) in upward direction.

Note: Model 124 and 201 remove 66 Ah batteries.

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07.3–255 Replacing electrohydraulic actuator (EHA)

Job No. of work unit or standard texts and flat rates data 07-1692

Conventional tool

Screwdriver 2115-T 27	e.g. Hazet, D-5630 Remscheid

Tightening torque (reference value)

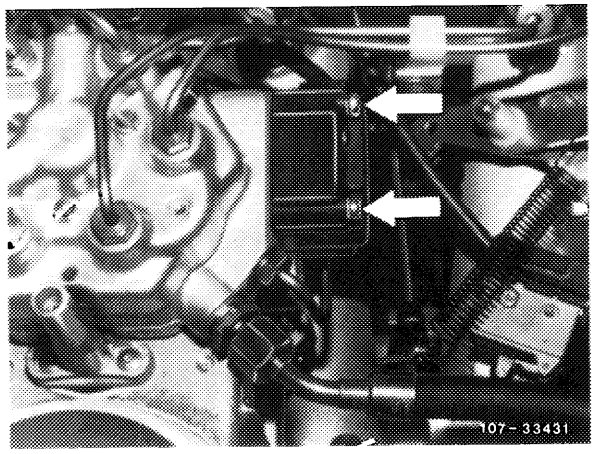
Fastening screws	3.0 + 0.5 Nm

Replacing

1 Pull off electric plug connection.

2 Reduce fuel pressure. For this purpose, loosen fuel line between fuel distributor and starting valve. Catch emerging fuel with a rag.

3 Unscrew both fastening screws (arrows).



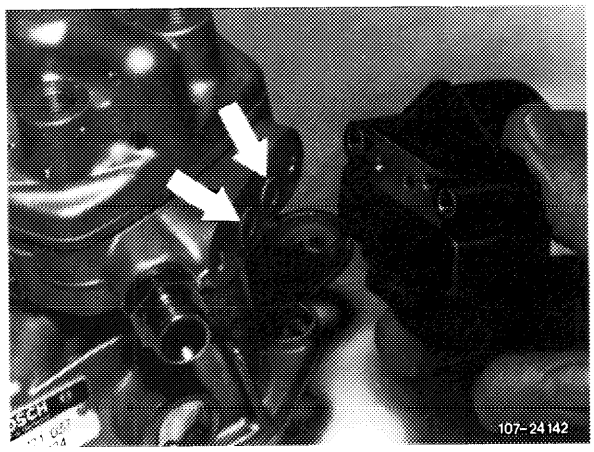
4 For installation, use 2 new O-rings (arrows) in reverse sequence.

Pay attention to special cleanliness of sealing surfaces. Clean with benzine and a non-fibrous rag.

5 Tighten fastening screws uniformly.
Pay attention to tightening torque.

6 Check fuel pressures once again.

7 Check for leaks.



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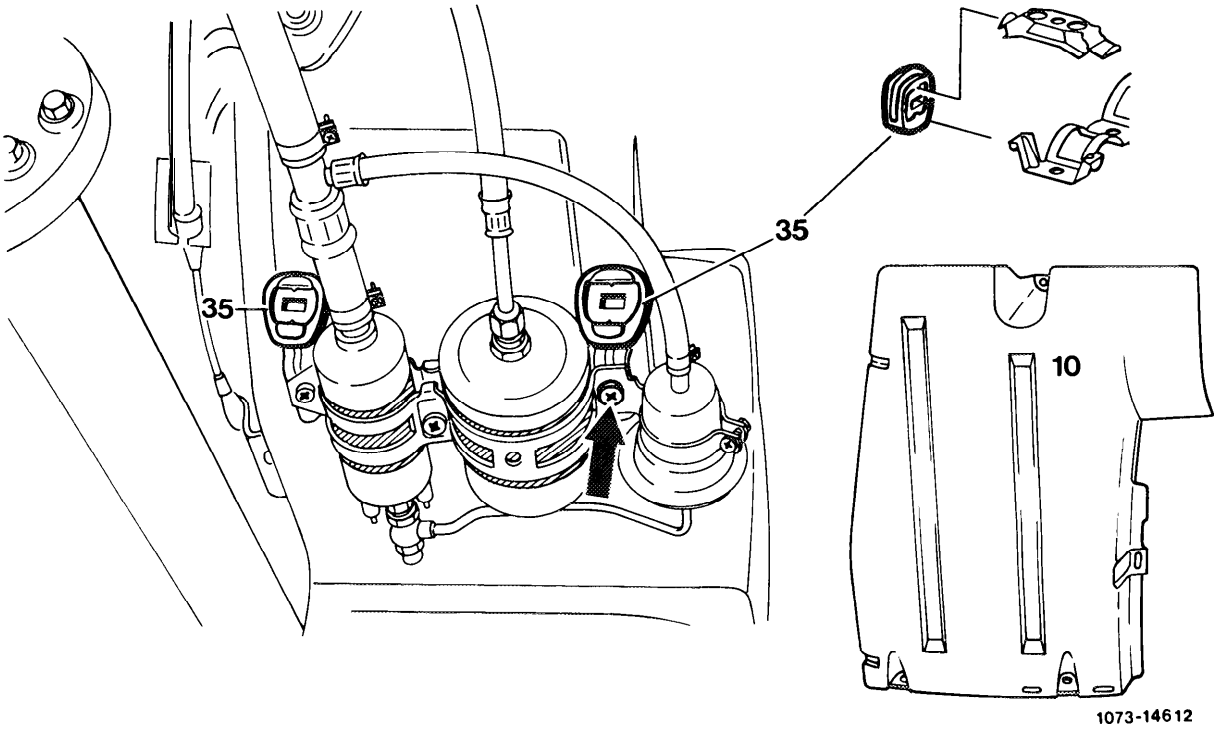
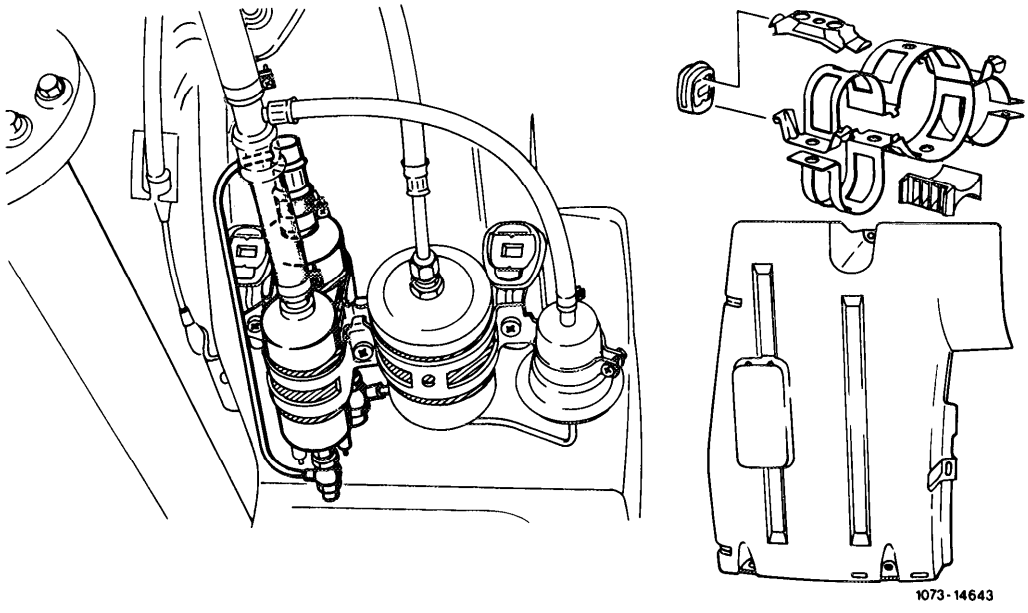
07.34268 Replacing rubber rings or rubber buffers for fuel pump package

Job No. of work unit or standard texts and flat rates data 07–5860/5862

Model 124
Fuel pump package with 1 fuel pump



Model 124
Fuel pump package with 2 fuel pumps



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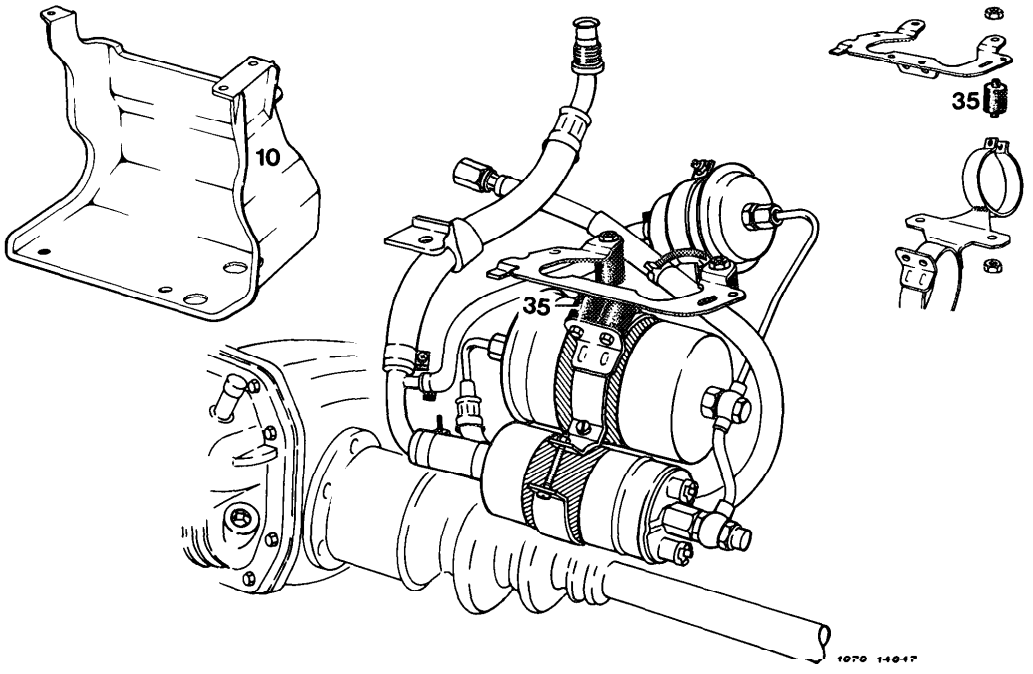
Model 107,126



Protective box.	Screw off and on
Rubber rings or rubber buffer (35)	Remove and install, while paying attention to plastic clip for electric line (risk of breaking)
Fastening screw (arrow, model 124).....	Loosen for holder, fuel accumulator, pull slightly forward so that rubber strap will come out

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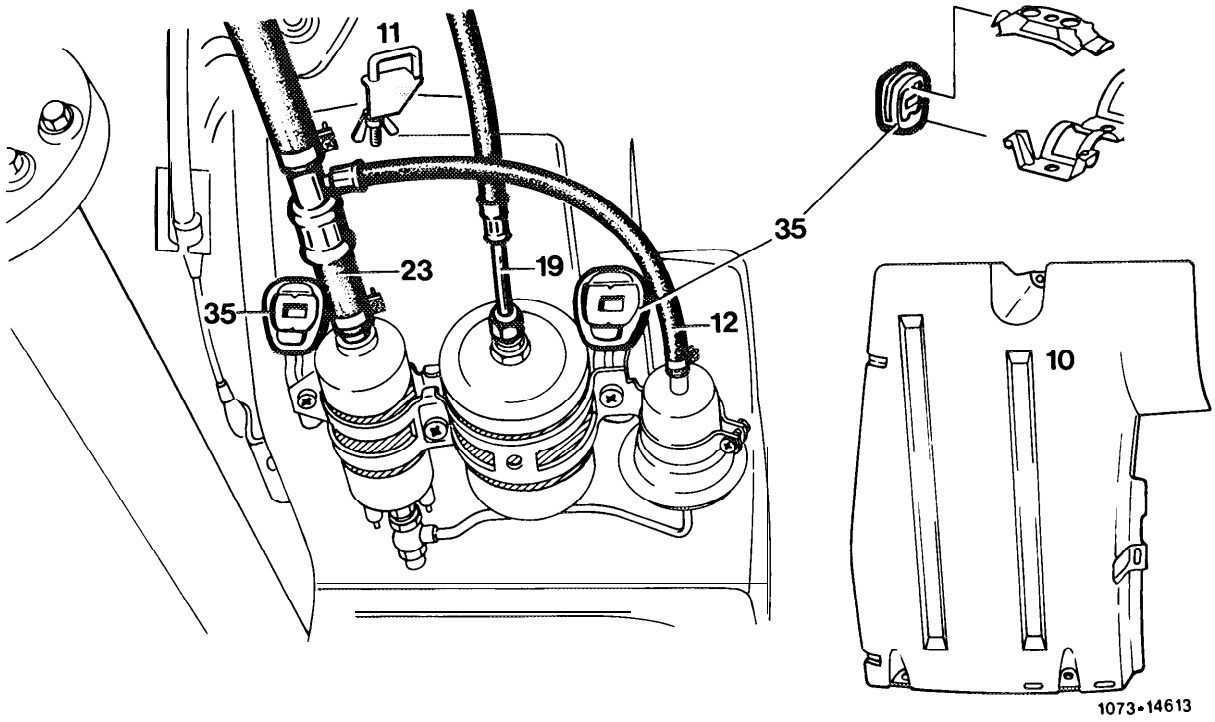
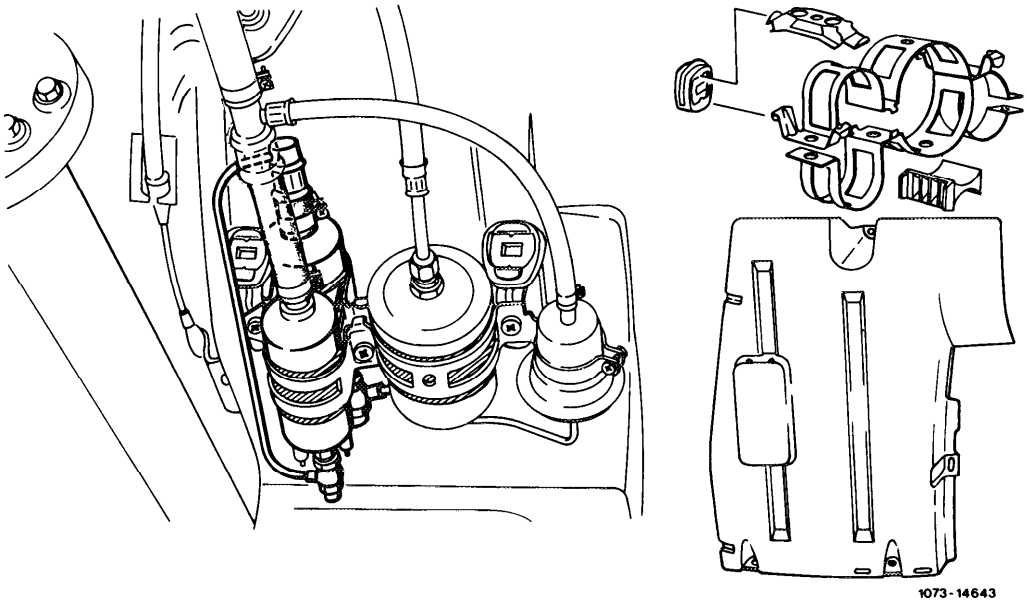
Model 124
Fuel pump package with 1 fuel pump



Model 124
Fuel pump package with 2 fuel pumps



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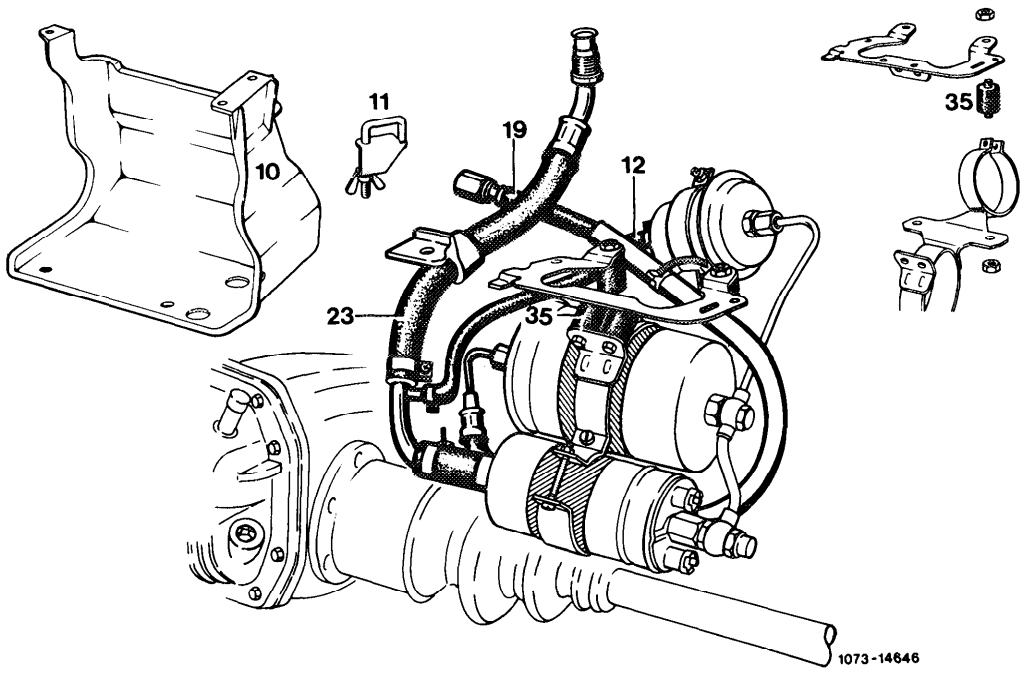
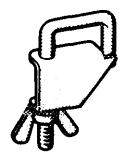


Battery	Disconnect and connect
Protective box (10)	Screw off and on
Electric lines	Disconnect and connect
Fuel suction, pressure hose (19, 23)	Pinch with clamp (11) and remove Special tool 000 589 40 37 00 Attention! On model 124.090, pay attention to Note (07.3–280)
Fuel suction leak and pressure hose (12, 19, 23)	Screw off and on
Rubber rings or rubber buffer (35)	Remove and install

Special tool



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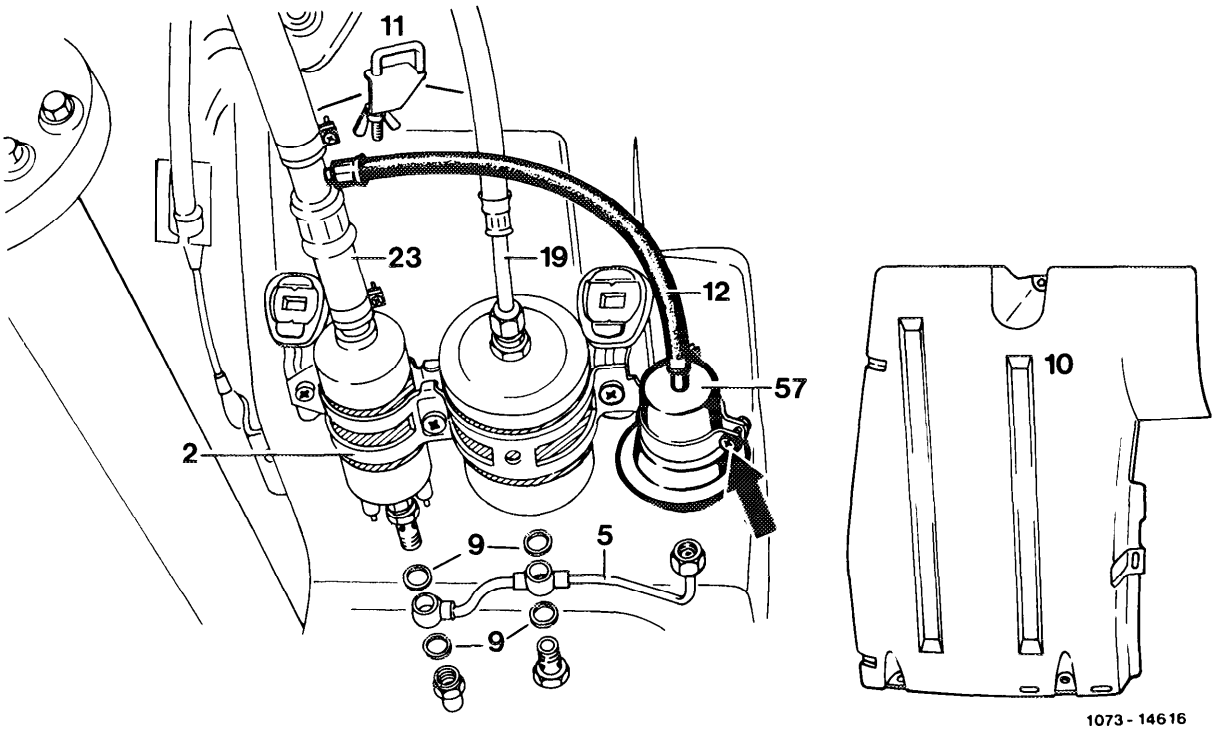
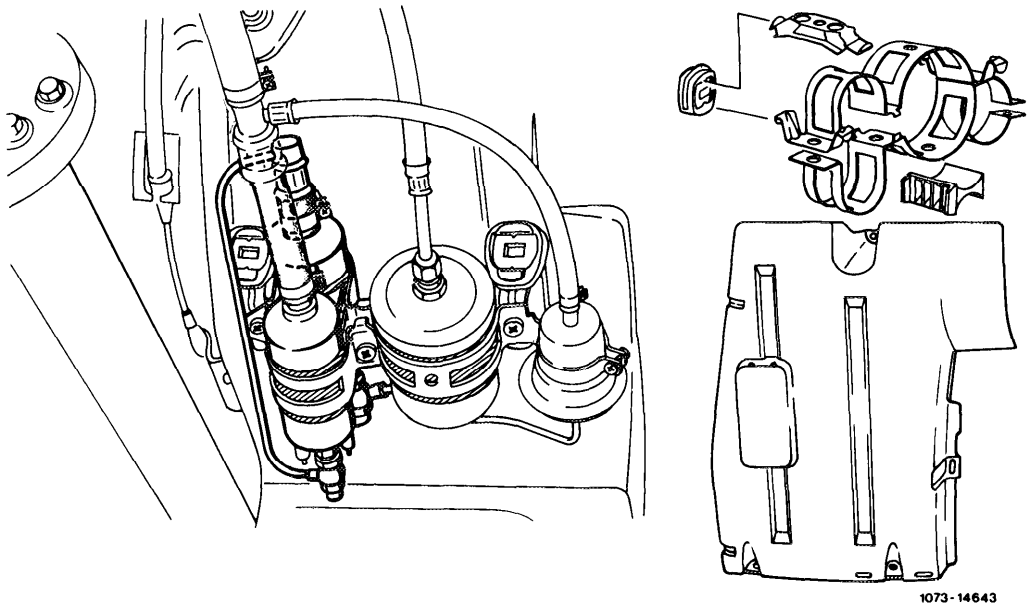
Job No. of work unit or standard texts and flat rates data 07-1683

Model 124
Fuel pump package with 1 fuel pump



Model 124
Fuel pump package with 2 fuel pumps



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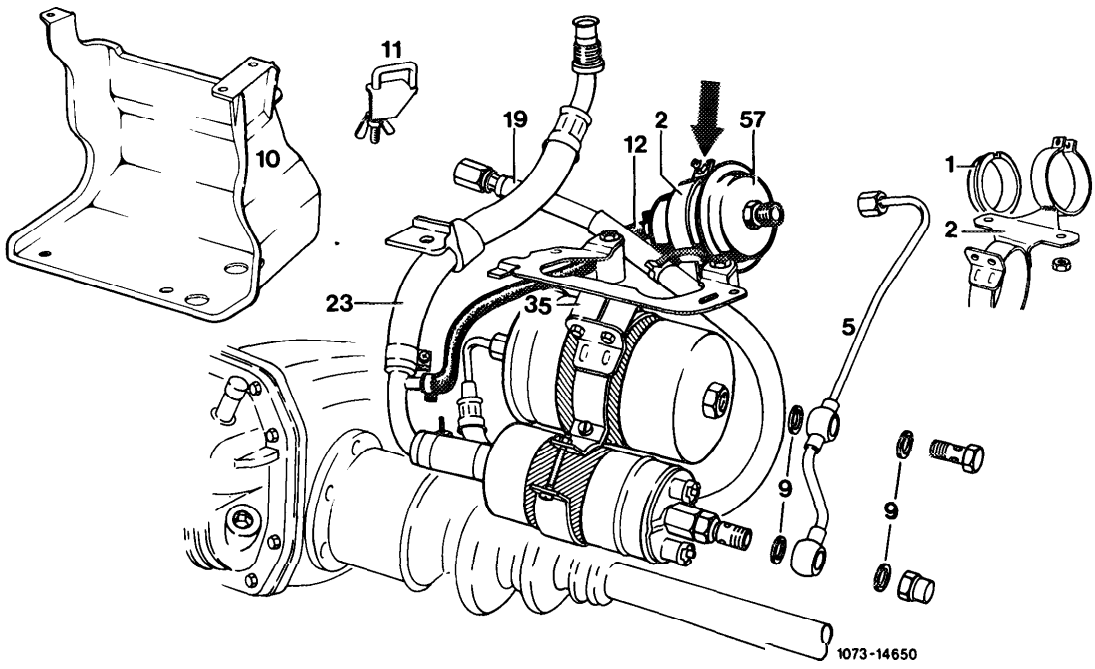
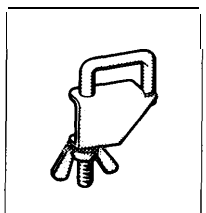
Model 107, 126



Gauge pressure in fuel tank	Exhaust gauge pressure, open closing cap for this purpose
Battery	Disconnect and connect
Protective box (10)	**Screw off and on**
Fuel suction (23) and pressure hose (19)	Pinch with clamp (11) and remove Special tool 000 589 40 37 00 **Attention!** On model 124.090, pay attention to Note (07.3–280)
Fuel line (5)	Unscrew on fuel accumulator, fuel pump and fuel filter
Leak hose (12)	Loosen and pull off
Fastening screw (arrow)	Remove on holder (2) and fuel accumulator (57). On model 107, 126 pay attention to spacing ring (1) in holder (2)
Sealing rings (9)	Replace
Run engine.	Check for leaks

Special tool



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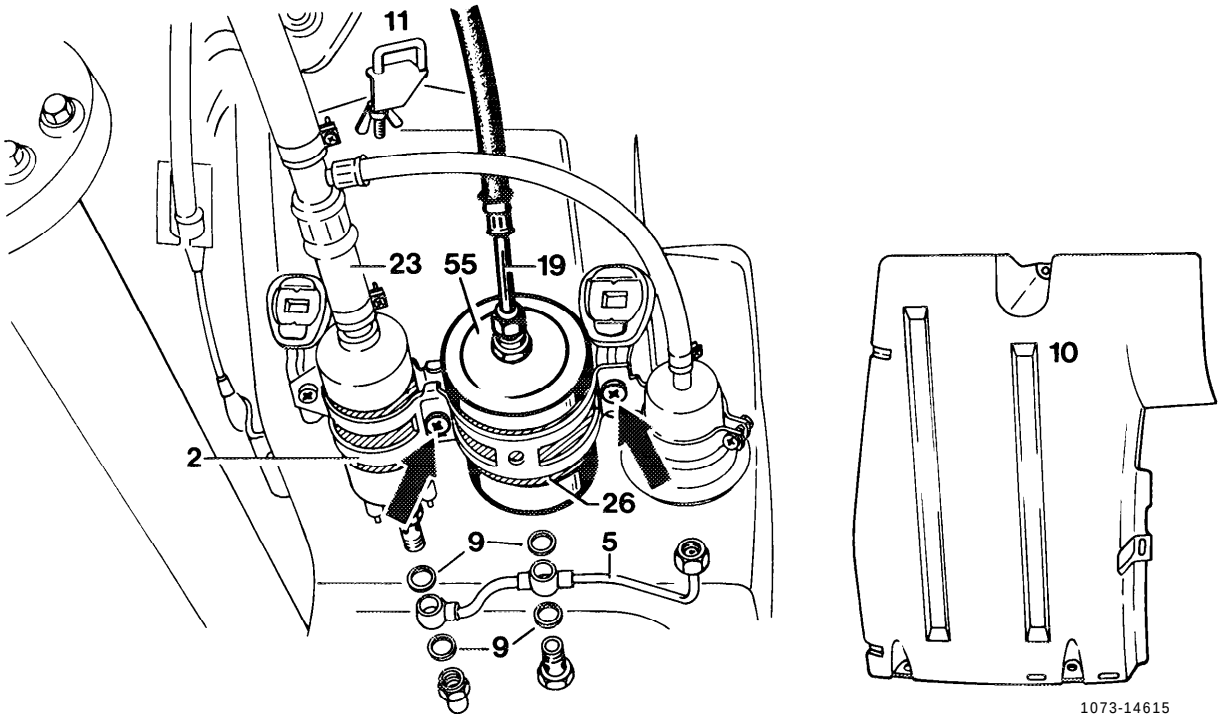
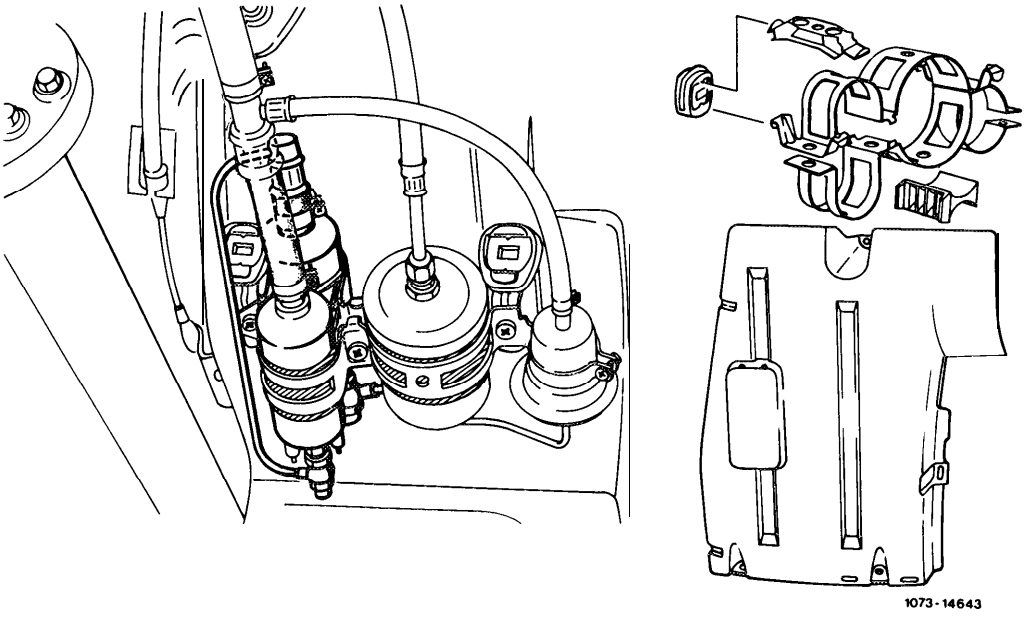
Job No. of work unit or standard texts and flat rates data 07-5563

Model 124
Fuel pump package with 1 fuel pump



Model 124
Fuel pump package with 2 fuel pumps



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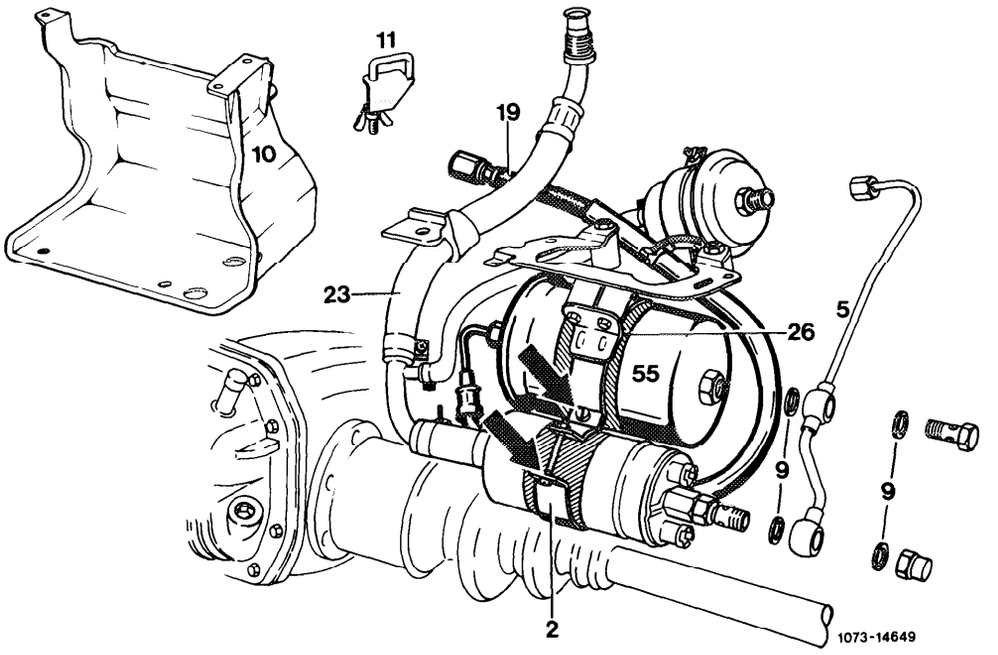

Gauge pressure in fuel tank	Reduce gauge pressure, open closing cap for this purpose
Battery	Disconnect and connect
Protective box (10).	Screw off and on
Fuel suction (23) and pressure hose (19).	Pinch with clamp (11) and remove Special tool 000 589 40 37 00 Attention! On model 124.090 pay attention to Note (07.3-280)
Fuel line (5)	On fuel accumulator, fuel pump and fuel filter, screw off and on
Fuel pressure hose (19)	Screw off and on
Fastening screws (arrows)	Loosen on holder (2) and remove fuel filter (55)
Plastic sleeve (26).	Mount. (Pay attention to Note)
Sealing rings (9)	Replace
Run engine	Check for leaks

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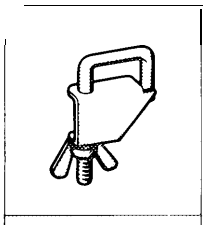
Special tool



000 589 40 37 00

Note

To avoid contact corrosion the fuel filter is provided with a plastic jacket or a plastic sleeve.

When replacing fuel filter, make sure that the plastic sleeve is mounted between fuel filter (55) and holder (2). The sleeve should project on both sides of holder, since direct contact of fuel filter with holder may lead to contact corrosion.

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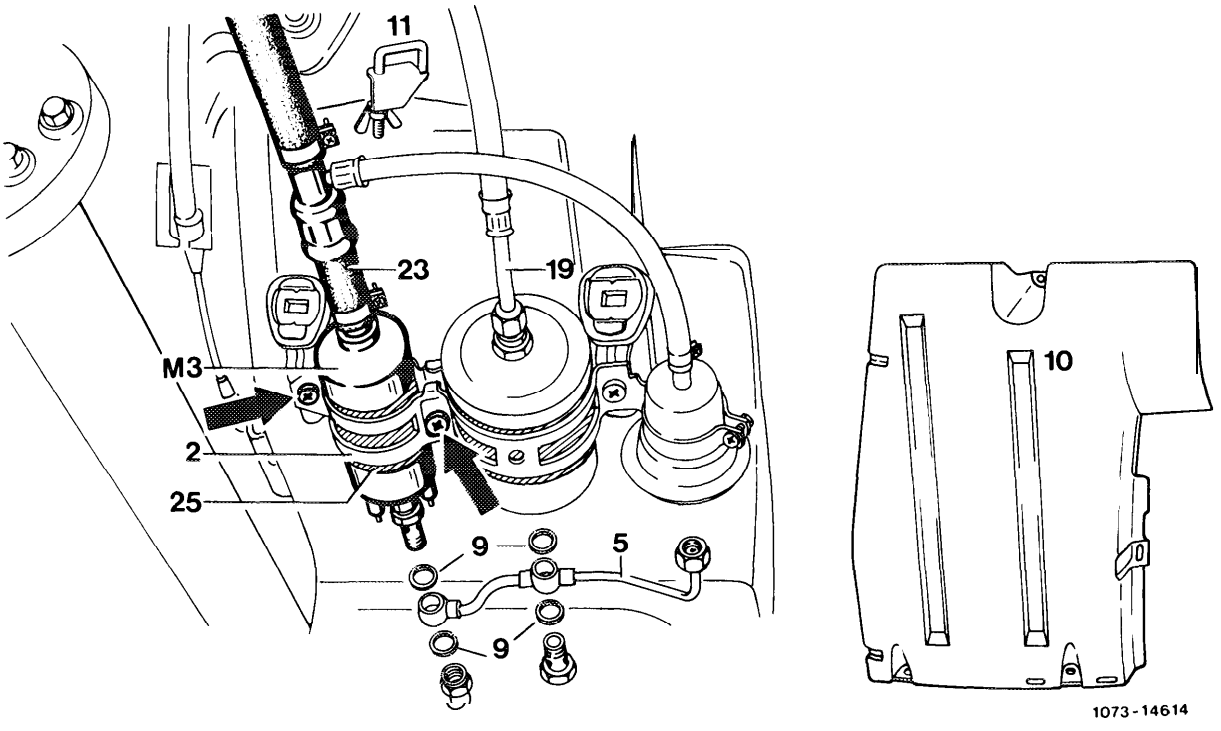
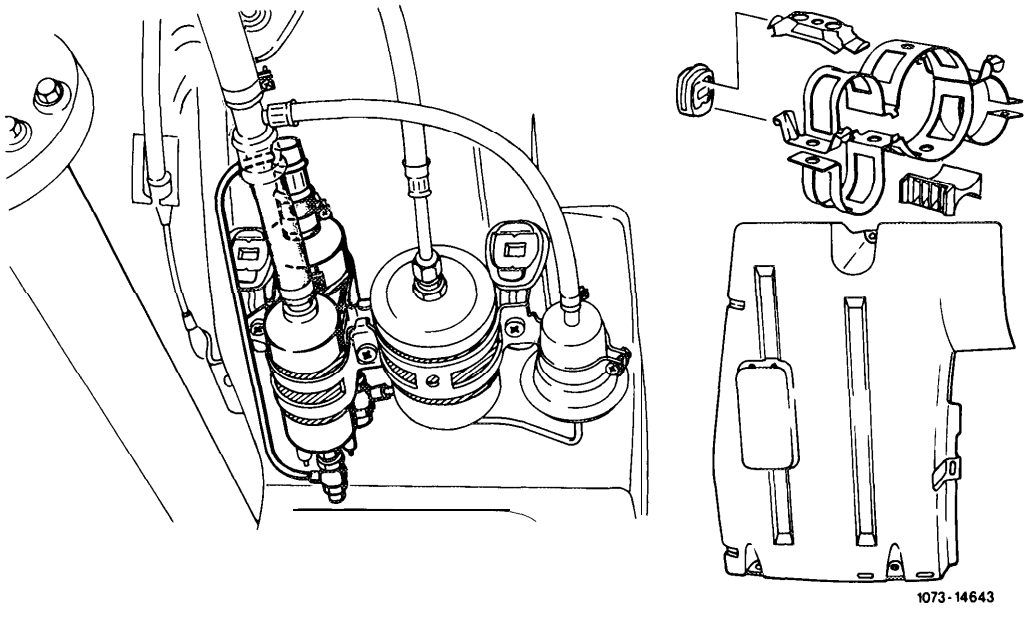
Job No. of work unit or standard texts and flat rates data 07-5710

Model 124
Fuel pump package with 1 fuel pump



Model 124
Fuel pump package with 2 fuel pumps



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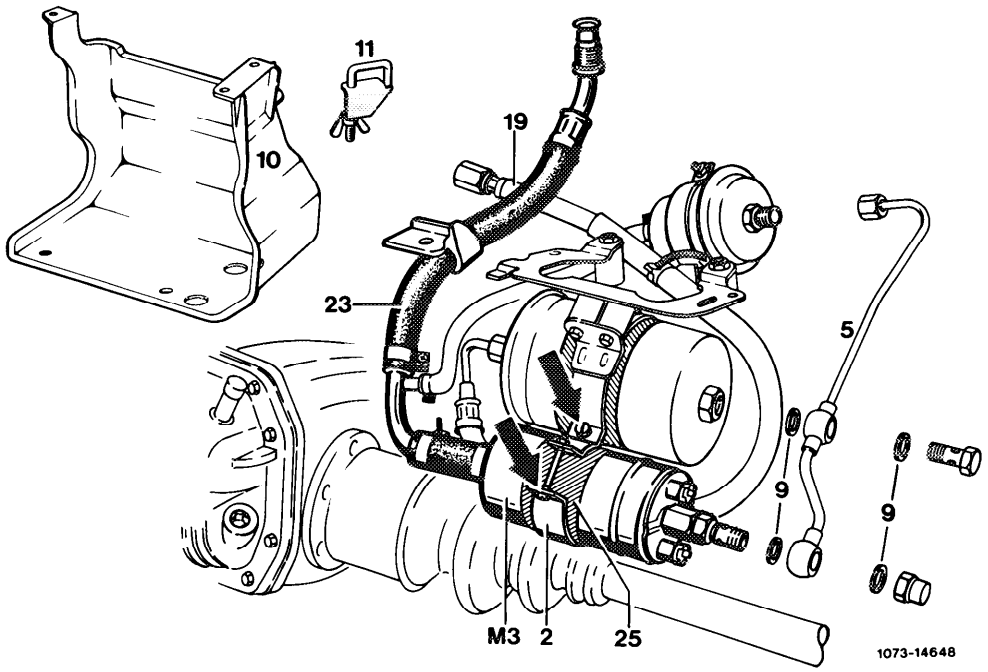
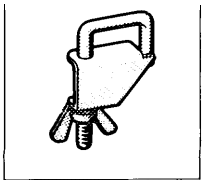
Model 107,126



Gauge pressure in fuel tank	Exhaust pressure, open closing cover for this purpose
Battery	Disconnect and connect
Protective box (10)	Screw off and on
Fuel suction (23) and pressure hose (19)	Pinch with clamp (11) and remove Special tool 000 589 40 37 00 Attention! On model 124.090, pay attention to Note
Fuel line (5)	On fuel accumulator, fuel pump and fuel filter, screw off and on
Fuel suction hose (23)	Loosen, pull off, mount
Electric lines	Disconnect and connect
Fastening screws (arrows)	Loosen on holder (2) and remove fuel pump (M3)
Plastic sleeve (25)	Mount, pay attention to Note
Sealing rings (9)	Replace
Run engine	Check for leaks

Special tool



000 589 40 37 00

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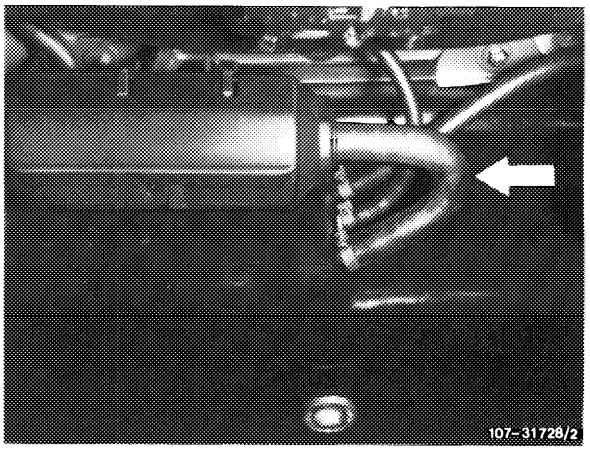
Note

When replacing fuel filter, make sure that the plastic sleeve (25) is mounted between fuel pump (M3) and holder (2). The sleeve should project on both sides of holder, since direct contact of fuel pump with holder may lead to contact corrosion.

The fuel pump is activated via relay, fuel pump (07.3-I 65).

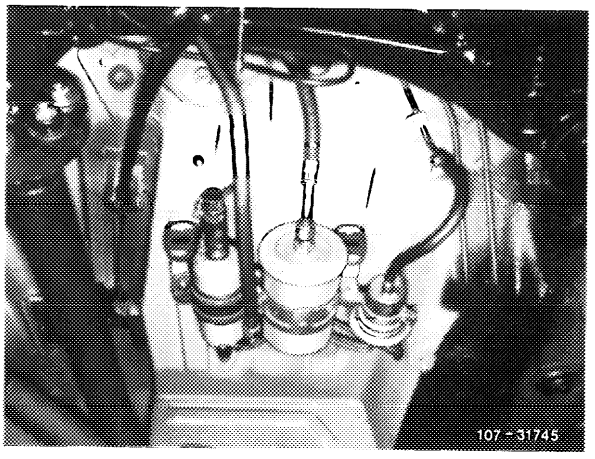
On model 124.090, do not pinch fuel suction hose at radius (arrow).

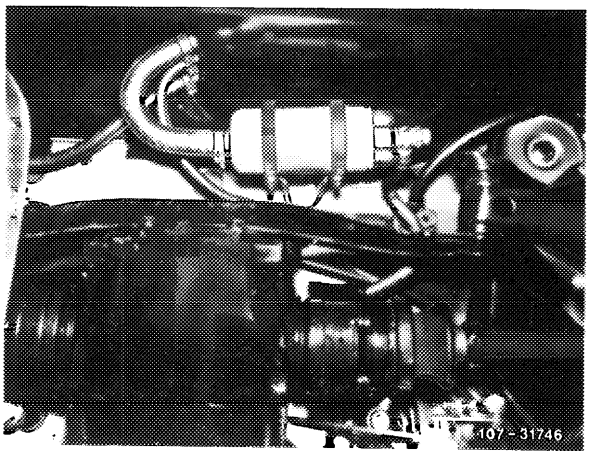


Engine 103.983, model 124.090

On this model, two fuel pumps are arranged in line.

To obtain short suction distances, a fuel pump is suspended between rear axle and fuel tank on rubber rings, and the other is housed in fuel pump package.





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Job No.

Removal and installation of air cleaner . . . . . 09 – 400
Renewing of intake scoop . . . . . – 402

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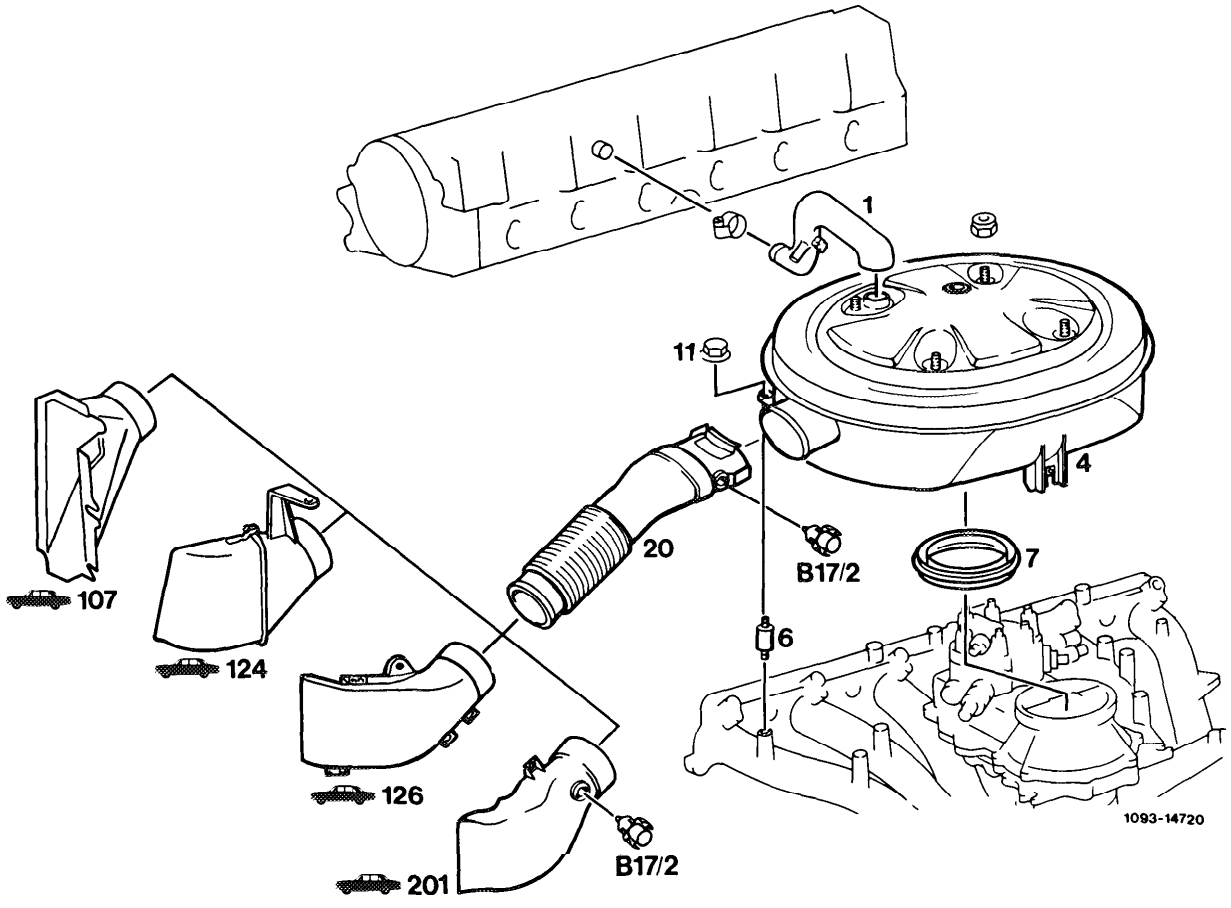
Job number of the job text and work units and standard texts and flat rates respectively 09-0015



Intake air temperature sensor (B17/2)	dismount, mount.
Fastening nuts (11)	on anti-vibration mounts (6) and holder on mixture controller, unscrew and screw on.
Shaped hose (1)	for crankcase ventilation, dismount, mount.
Air cleaner (4)	dismount, mount. when doing so, ensure proper seating of the sealing ring (7) between air flow meter and air cleaner.

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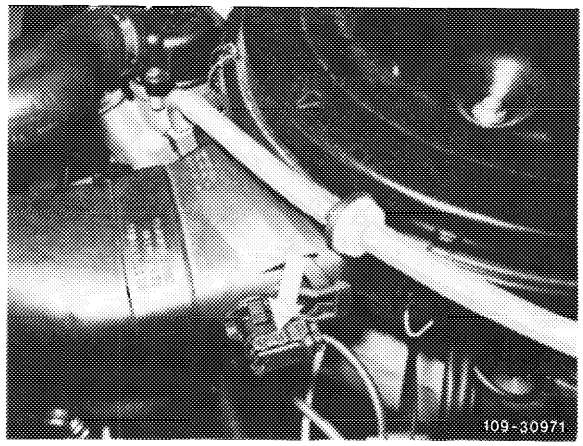
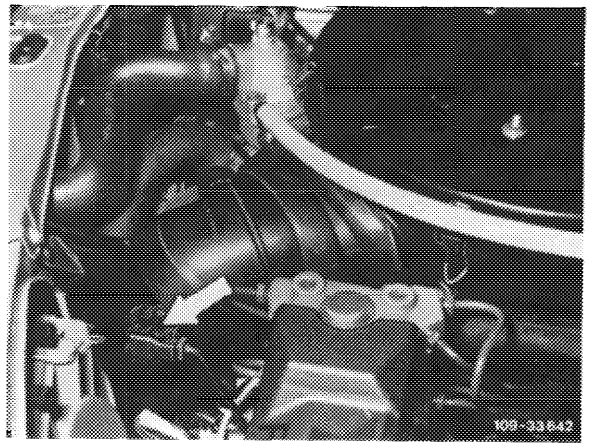
Note

The air cleaner top is provided with a recess for adjusting the idle speed mixture. On vehicles with RÜF/CAT version, an intake air temperature sensor is Installed.

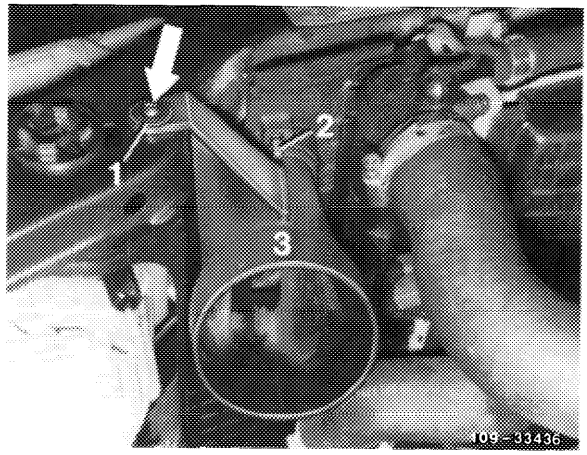
Intake air temperature sensor arrangement (arrow). Engine 103 (except 103.942) in the intake snorkel.



Engine 103.942 in the intake scoop.



The intake scoop is attached with a spreader clip (1) and locked twice.



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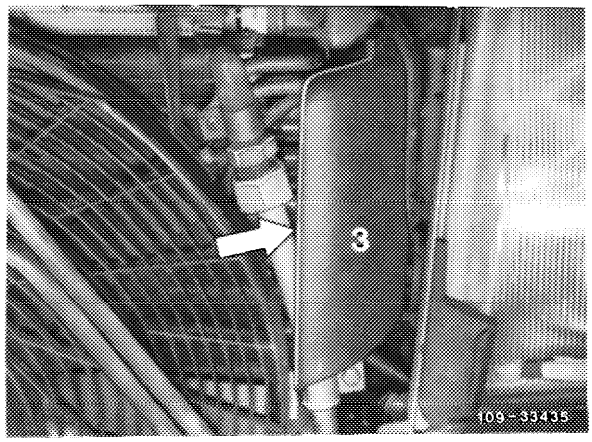
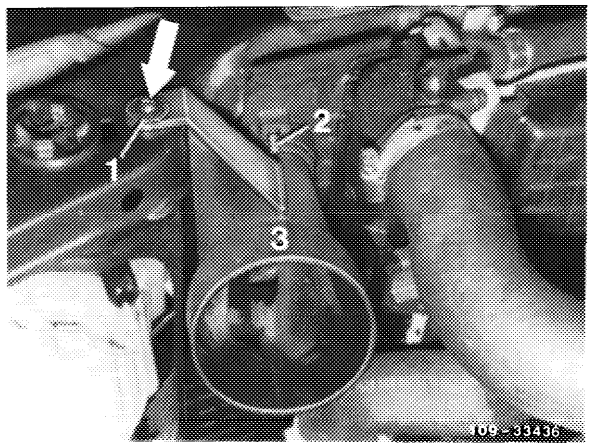
Note
The air is drawn in from outside the engine compartment (arrow) via the plastic scoop (3).



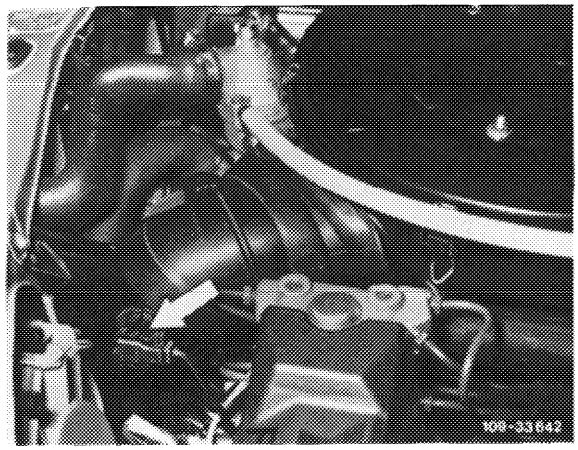
Renewal

1 Unscrew fastening screw (arrow) and force out spreader clips (1).

2 Force plastic clip(2) downwards and remove intake scoop (3).



On engine 103.942 the intake air temperature sensor (arrow) is installed in the intake scoop (3).



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Job No.

Checking condition of poly V – belt and renewing . . . . . 13 – 342
Removing, installing tensioning device . . . . . - 345

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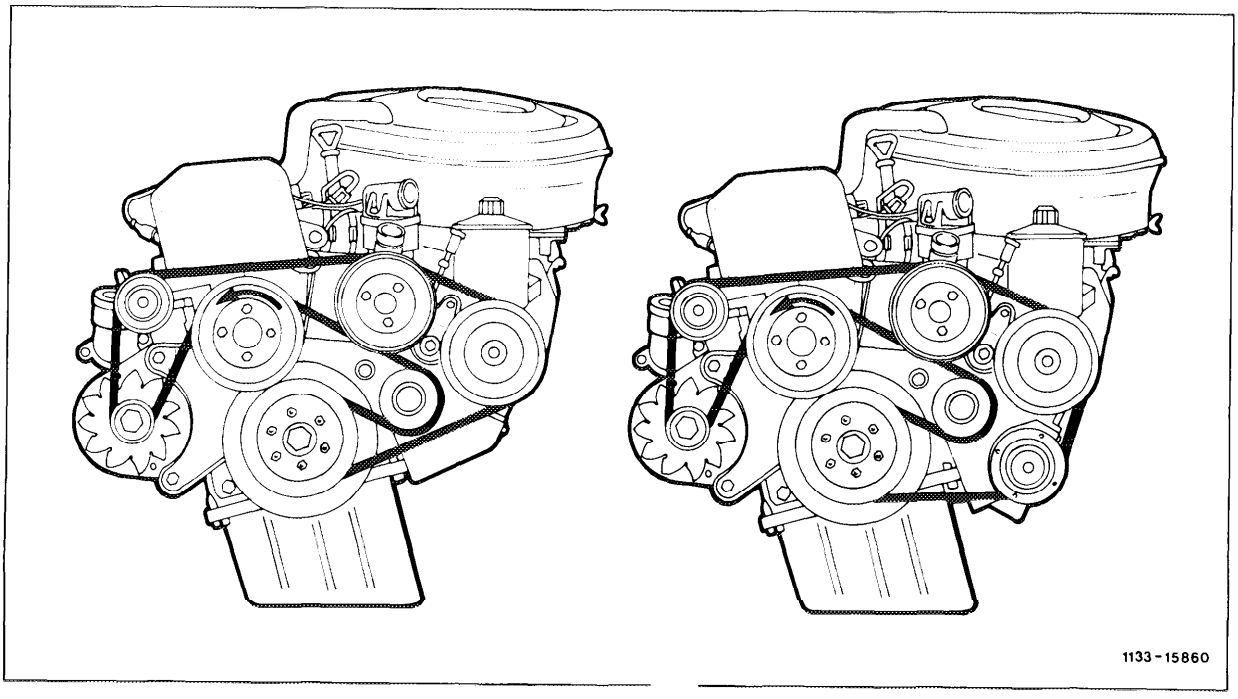
13-342 Checking condition of poly V-belt and renewing

Job No. of job texts and job values or standard texts and flat rates . . . . . 13-1202 - 13-4001



Checking

Hood	raise to vertical position (01-008).
Engine	crank (01-010).

Renewing

Viscous fan clutch	remove, install (20-312).
Poly V-belt	remove, install (steps 5 to 11).

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Checking

1 Raise hood to vertical position (01-008).

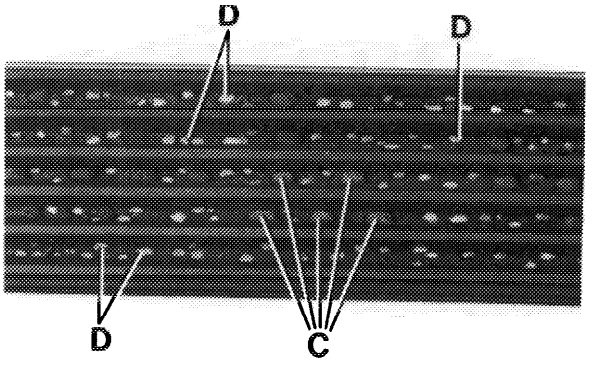
2 Check V-belt. Mark V-belt with chalk at a clearly visible point.

3 Crank engine in stages (01-010), at the same time checking V- belt for signs of damage.

4 This operation is completed once the marking is again visible (one complete revolution of belt).

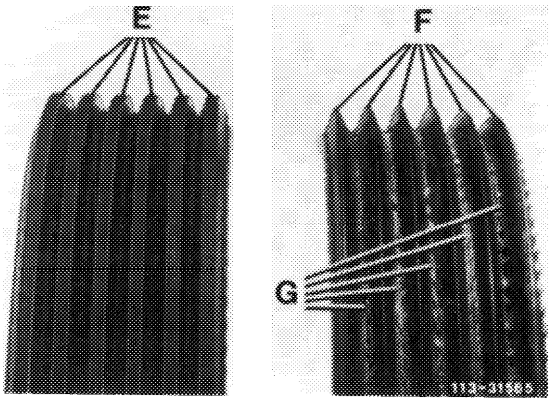
Patterns of damage

5 The V-belt must be renewed (to separate order) if the following patterns of damage exist:
Rubber knobs in base of belt (C),
dirt or grit embedded in belt (D).



113-31547

Wear to flank (F),
ribs are pointed - trapezoidal in shape when new (E) and strands visible in base of belt (G, brighter points).



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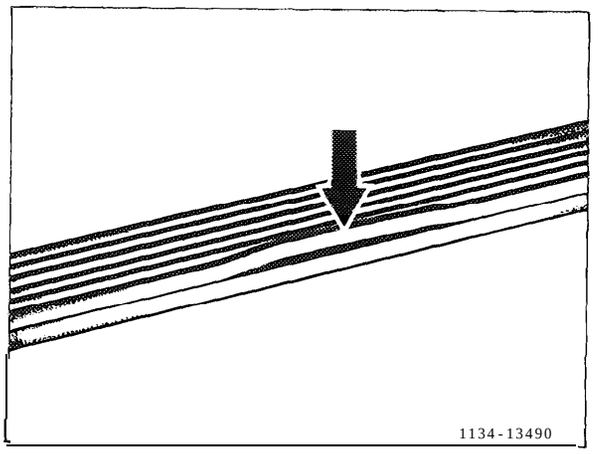
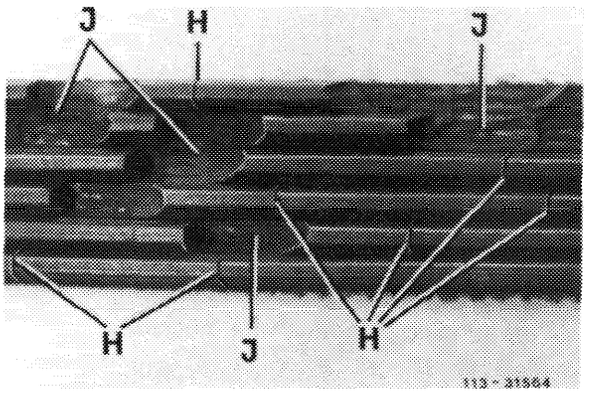
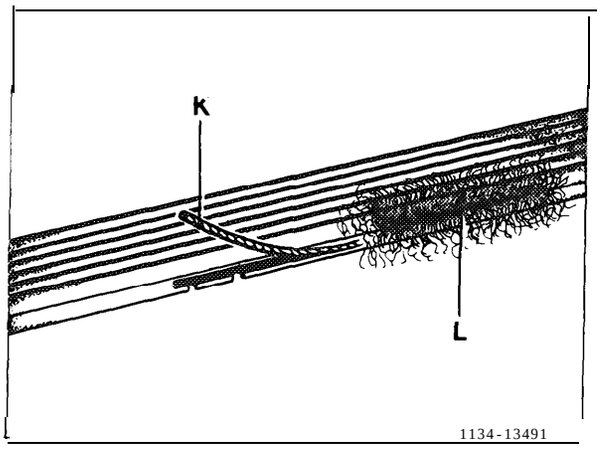


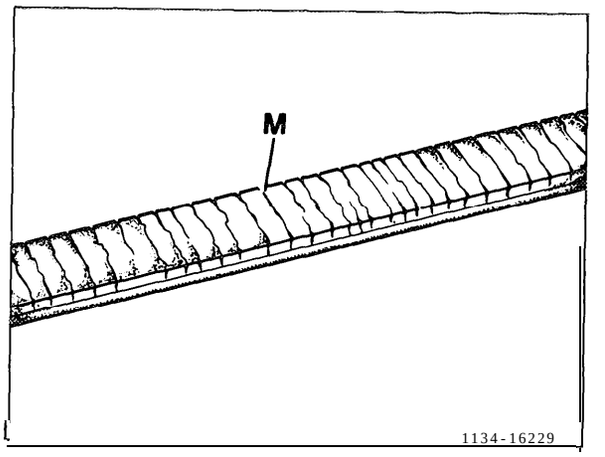
Cracks across the ribs (H) and/or sections of ribs broken off (J).



Strand torn at the side (K) or outer strands frayed (L).



Cracks (M) across the back.



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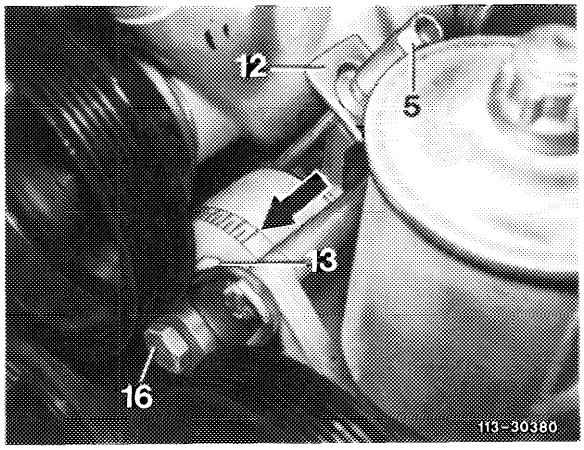
Renewing

6 Remove viscous fan clutch (20-312).

7 Slacken bolt (16) approx. 1/4 - 1/2 turns. Release tensioning device with tensioning nut (5) (turn to the left) until the belt can be removed. Check belt pulley profiles and tensioning device for signs of damage and dirt, renew if necessary (e. g. worn bearing points of tensioning device, dents in the belt pulleys etc.).

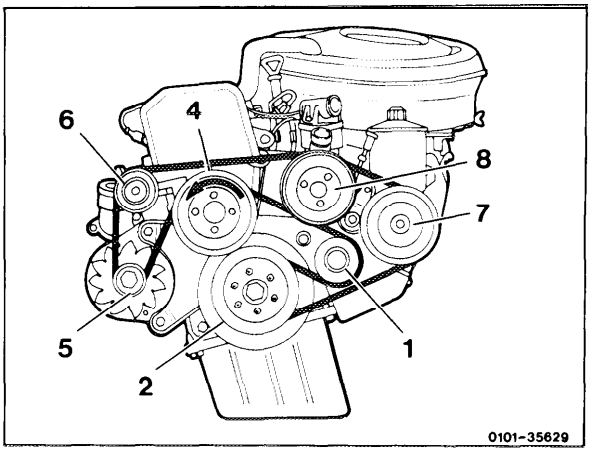
8 Turn setting pointer (13) to the left and position to the first graduation mark (arrow).



9 Fit on V-belt beginning in the numerical order of the running diagrams with tensioning pulley (1).

Note
Do not use belt wax or similar products.

Running diagram without refrigerant compressor:
Length of belt 2170 mm
Setting pointer/graduations 7



1	Tensioning pulley	6	Guide pulley
2	Crankshaft	7	Power steering pump
4	Fan	8	Coolant pump
5	Alternator		

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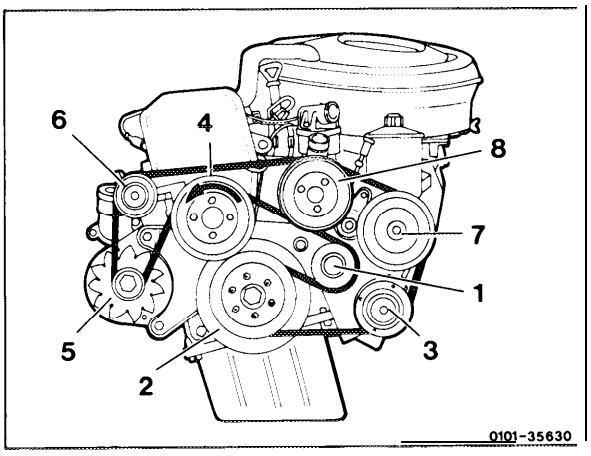
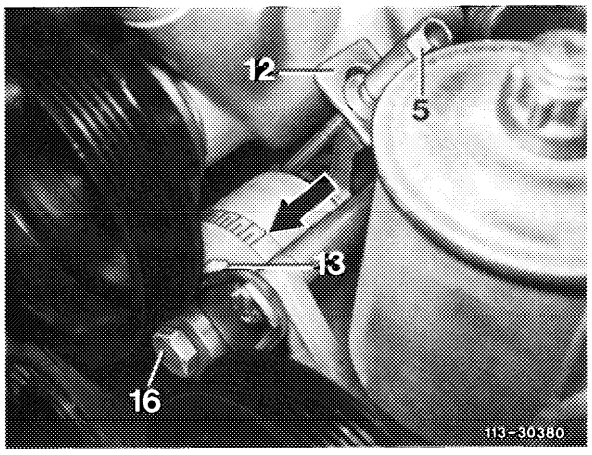
Running diagram with refrigerant compressor:
Length of belt 2255 mm
Setting pointer/graduations 7



1 Tensioning pulley
2 Crankshaft
3 Refrigerant compressor
4 Fan
5 Alternator
6 Guide pulley
7 Power steering pump
8 Coolant pump

10 Turn tensioning nut (5) to the right until the setting pointer is positioned above the following graduations (arrow).
Engine without refrig. compr. 5th mark
Engine with refrig. compr. 7th mark



11 Tighten bolt (16) to 75 Nm (reference value).

Note
As from November 1986 the alternator is attached at the bottom to the bracket with a 13 mm collar bolt. If this collar bolt is removed, the V-belt can be slackened by swivelling the alternator without slackening the bolt (16).

12 Check that the belt is correctly located on the belt pulleys.

13 Install in the reverse order.

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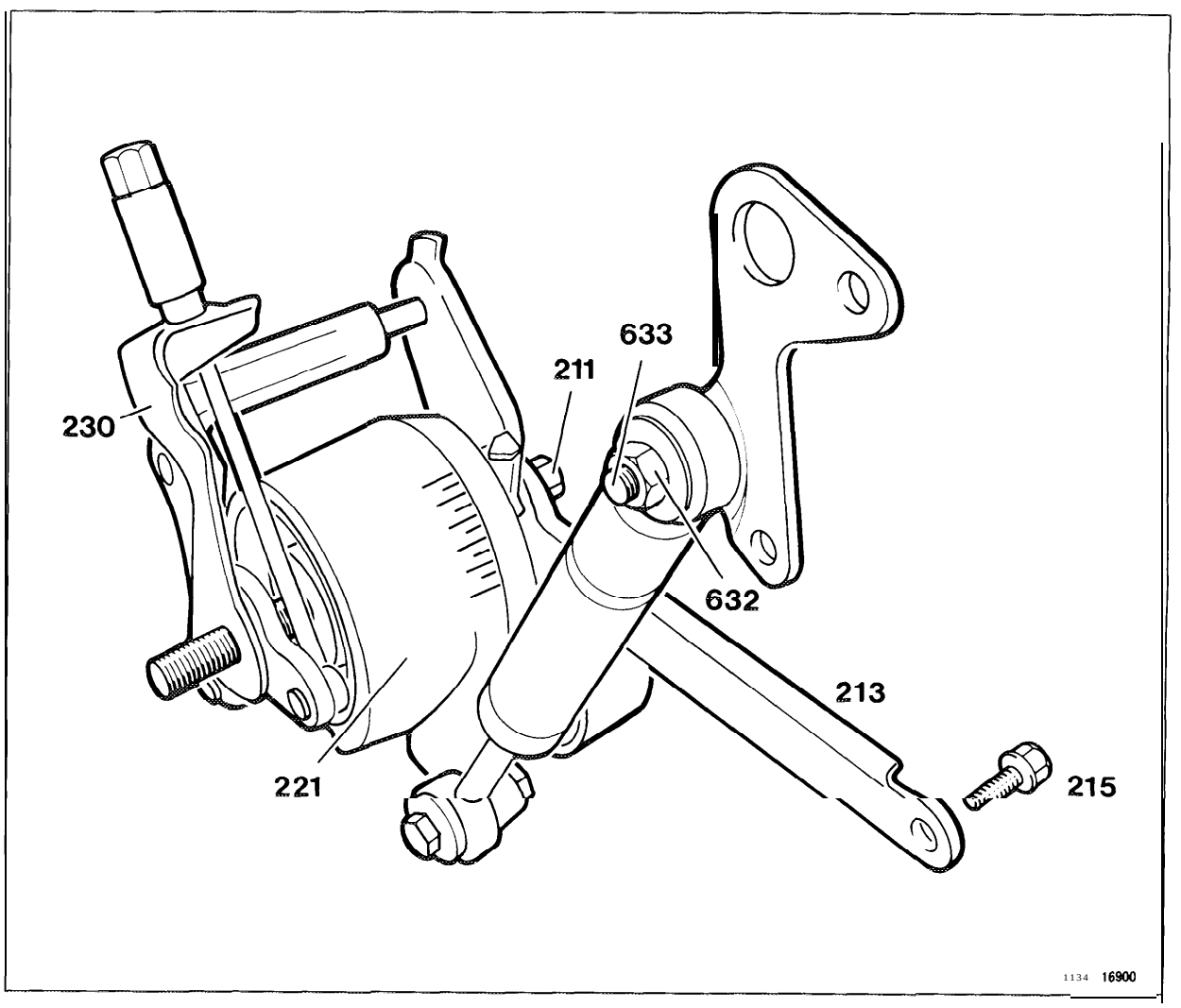
13-345 Removing, installing tensioning device

Job No. of job texts and job values or standard texts and flat rates ..... 13-1202 – 13-4001



Air filter	remove, install (09-400).
Poly V-belt	remove, install (13-342).
Belt pulley of fan clutch, coolant pump, tandem pump	remove, install, 10 Nm (step 5).
Tensioning device (221)	remove, install, tightening torque for bolt (211) 75 Nm (steps 6 to 8).

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Bracket (230)	remove, install (steps 9 and 10).
Nut (632)	screw down, withdraw bolt (633) (step 6).
Bolt (215)	unscrew, screw on, apply sealant 001 589 29 20 to mounting hole of bracket (213) (step 7).

Removal. installation

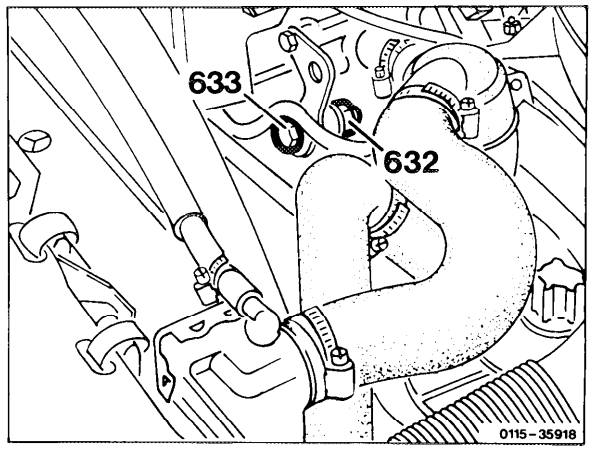
1 Remove air filter (09-400).

2 Remove viscous fan clutch (20-312).

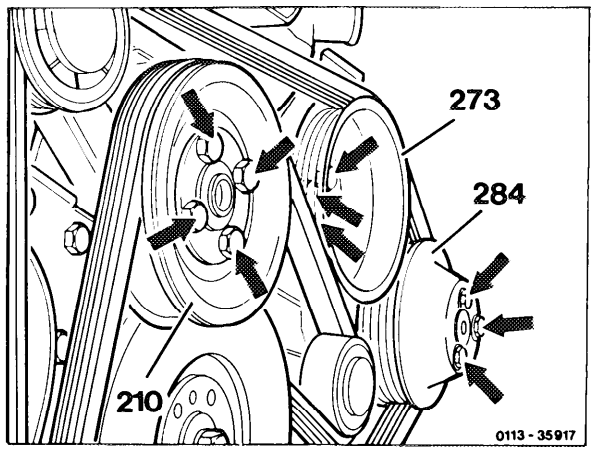
3 Slacken bolt (arrows).

4 Remove V-belt (13-342).

5 Unscrew bolts (arrows), tightening torque 10 Nm.
Take off belt pulleys of fan clutch (210), coolant pump (273) and tandem pump (284).



6 Screw down nut (632), withdraw bolt (633).



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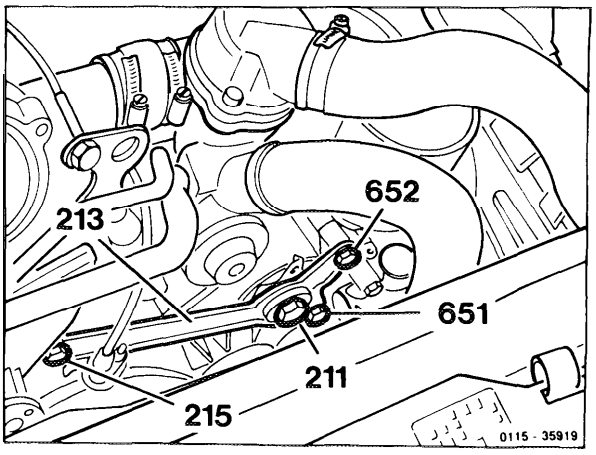
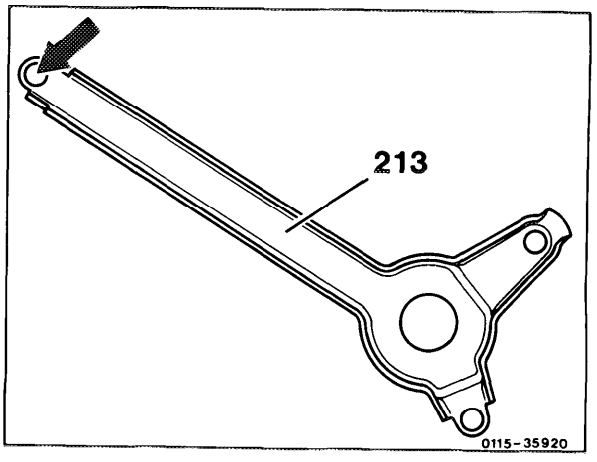
7 Unscrew bolts (211, 652, 651, 215).
Remove bracket (213).
Tightening torque for bolt (211) 75 Nm.

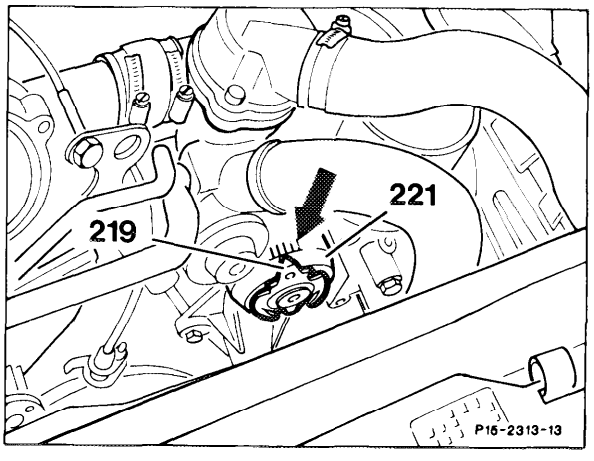


Installation instruction
Apply sealant 001 989 29 20 to the front and rear sides of the mounting hole (arrow) of the bracket (213).



8 Take off setting pointer (219), carefully pull tensioning device (221) forward and remove.

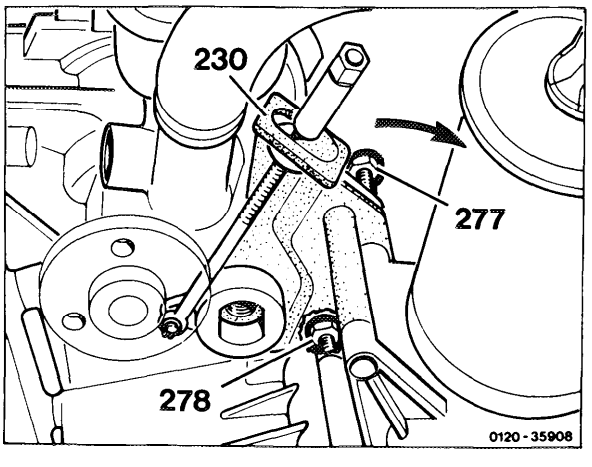
Installation instruction
In the untensioned state, the setting pointer (219) must be aligned with the first graduation mark (arrow).



9 Unscrew bolts (277, 278).

10 Swivel tandem pump in direction of arrow.
Remove bracket (230).

11 Install in the reverse order.



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	Job No.
Distinguishing features of vehicles with exhaust emission control system	14 – 001
Function of emission control system	– 050
Checking oxygen sensor failure indication I	– 116
Removal and installation of intake manifold, replacement of gasket	– 450
Renewal of intake manifold (intake manifold removed)	– 455
Removal and installation of exhaust manifold	– 470
Renewal of oxygen sensor	– 480

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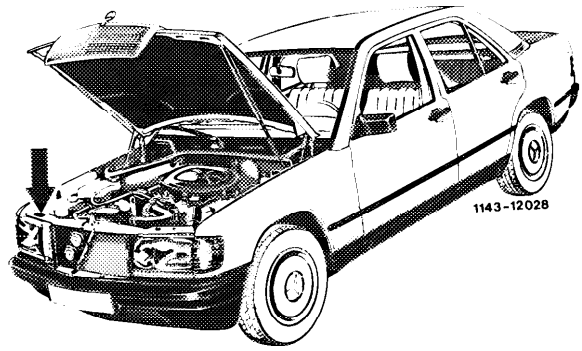
14-001 Distinguishing features of vehicles with exhaust emission control system

In order to identify the vehicles an information plate (arrow) is glued onto the cross member. The plate shows the most important engine adjusting data.



(AUS) as of 1986
(CH) (S) as of 1986
Std./RÜF/CAT as of 1985

Identification of the information plates

(AUS)	silver
(CH)	green
(CH) CAT	light green
(S)	blue
(S) CAT	light blue
Std./RÜF/CAT	white

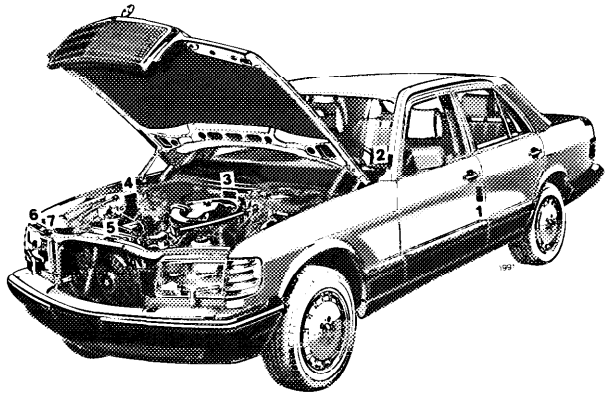
(J) as of 1986

Vehicles in version for Japan are provided with an information plate for the exhaust emission control system in the engine compartment in the local language. This plate shows the most important engine adjusting data.

(USA) as of 1986

Information plate for the exhaust emission control system on the cross member in front of the radiator (7).

The engine characteristic data as well as the most important engine adjusting data are shown on this plate.



7 Information plate exhaust emission control system

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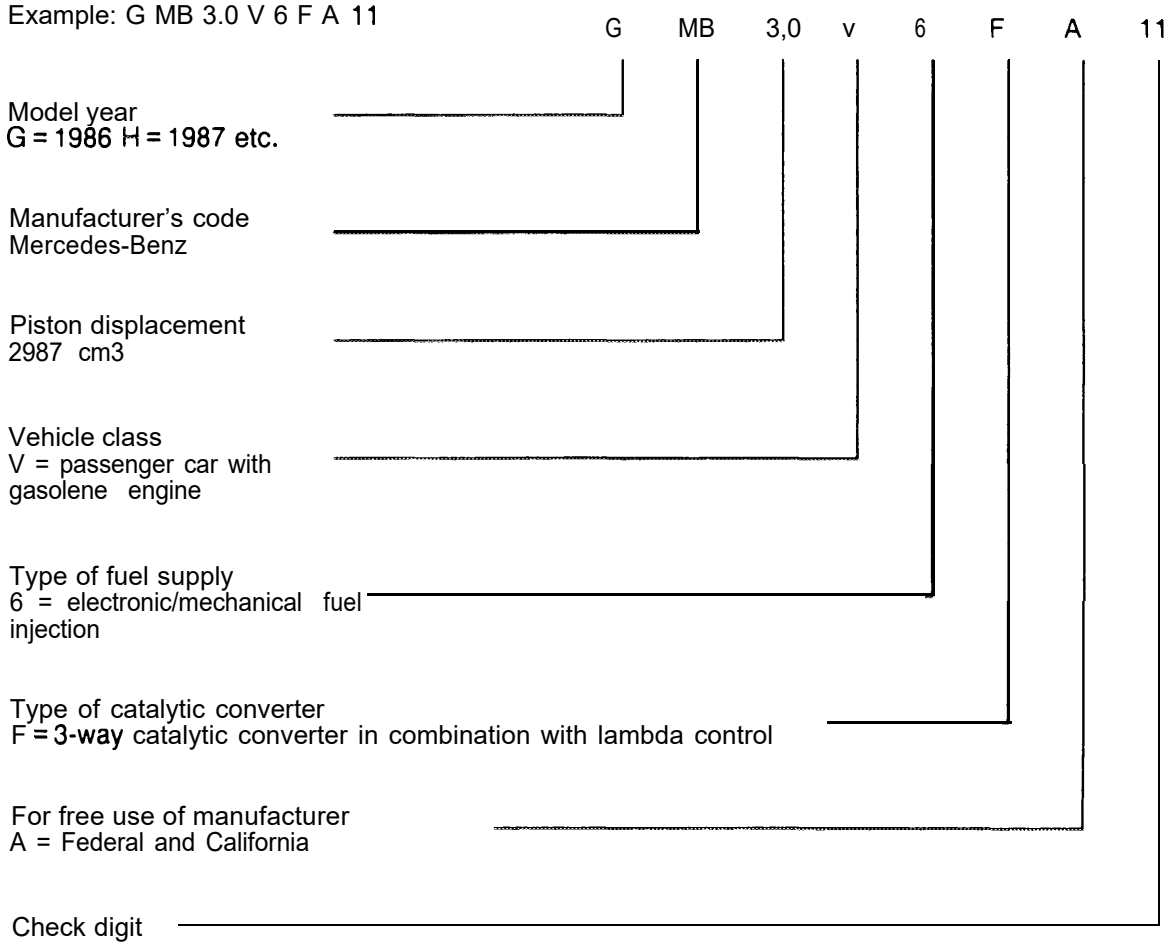
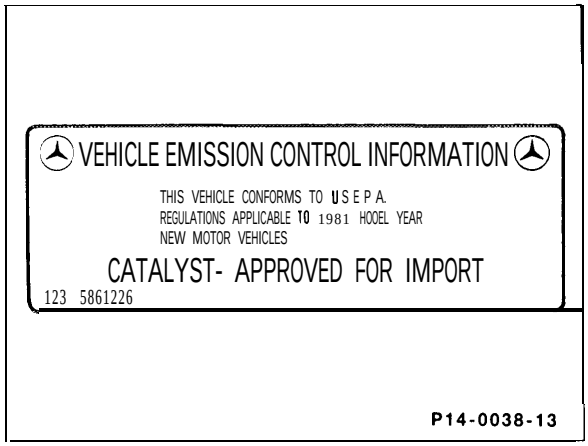
lo-digit code of engine identification data.



USA version
This vehicle is equipped with catalytic converters.

Color code of the information plate:
Basic color black, writing silver.

Tourist version
Vehicles in tourist version are not equipped with catalytic converters. Prior to importing into the USA the catalytic converters must be installed.



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RÜF/CAT as of 1985
(AUS) (CH) (J) (S) (USA)
as of 1986

General

Components:

CIS-E control unit	with mixture characteristic, lambda control, oxygen sensor control signal amplification and from the input signals the calculation of the output signals for the electrohydraulic adjusting element.
Adjustment plug RÜF-version	with writing “ECE” and lead-sealed at the factory in postion 1.
Adjustment plug CAT-version	with writing “CAT” and lead-sealed at the factory in position 1.
Oxygen sensor	installed in the front exhaust pipe.
Catalytic converter	3-way catalytic converter, pre-catalytic converter and underfloor catalytic converter.
Catalytic converter warning system (J)	warning lamp in instrument cluster.
Oxygen sensor failure display (USA) 1986	control lamp in instrument cluster.
Fuel evaporation system	reduces escape of fuel vapors into the atmosphere (47-200, and 47-300).

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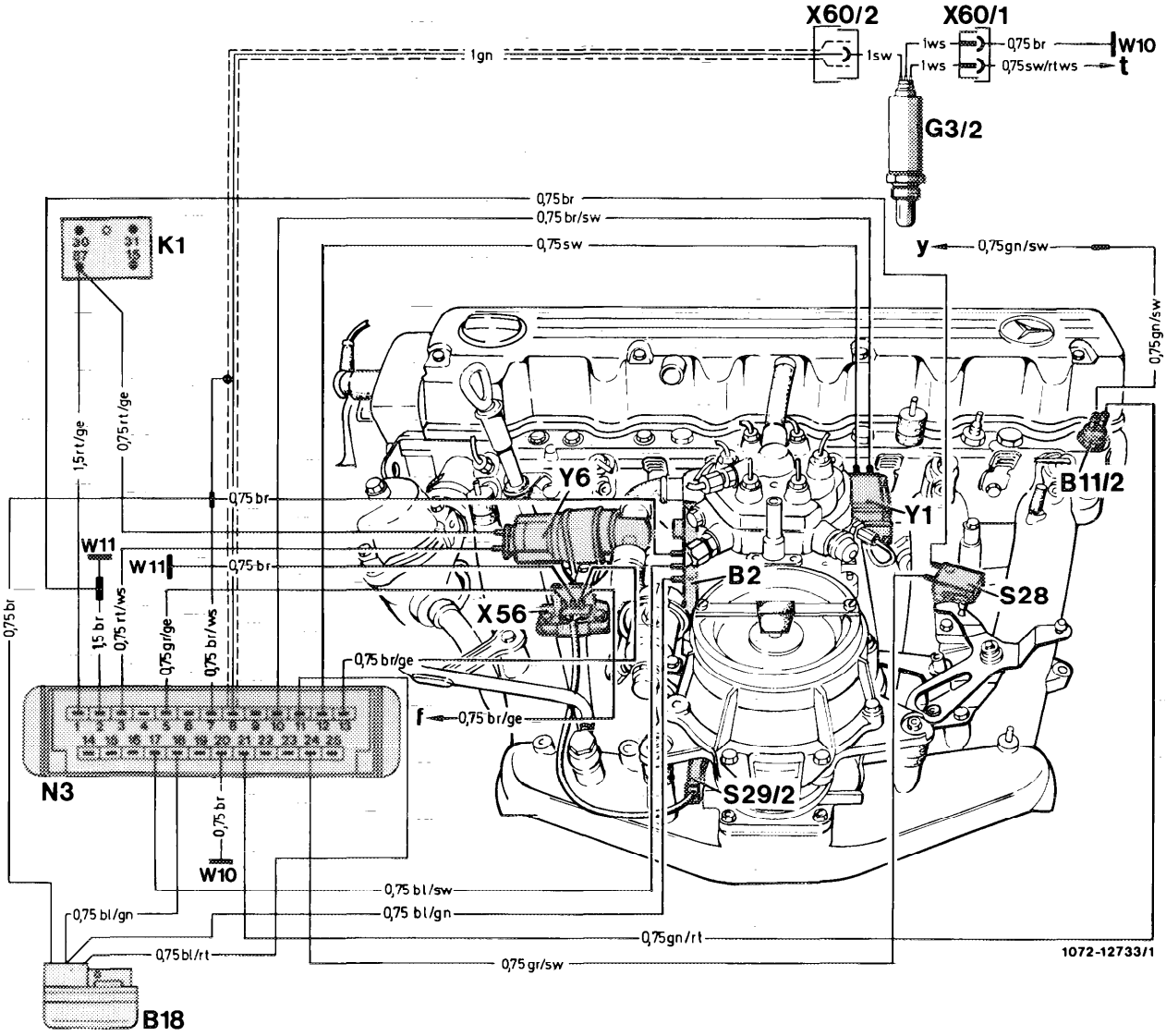

Function diagram for example of (J) (USA) mechanically/electronically controlled fuel injection

82	Sensor, air flow meter	X56	Plug connection, throttle valve switch
B11/2	Coolant temperature sensor (2-pole)	X60/1	Plug connection, heater coil oxygen sensor
B18	Altitude adjustment capsule	X60/2	Plug connection, oxygen sensor signal
G3/2	Oxygen sensor heated	Y1	Electrohydraulic actuator
K1	Relay, overvoltage protection	Y6	Idle speed adjuster
N3	Fuel injection system control unit (25-pole coupling)	f	To the control unit electronic Ignition system socket 2
S28	Deceleration cutoff	t	To the fuel pump relay socket 7 terminal 87
S29/2	Throttle valve switch, full load/idle detection	y	To the control unit electronic ignition system socket 1
W10	Ground, battery		
W11	Ground, engine (electric cable screwed on)		

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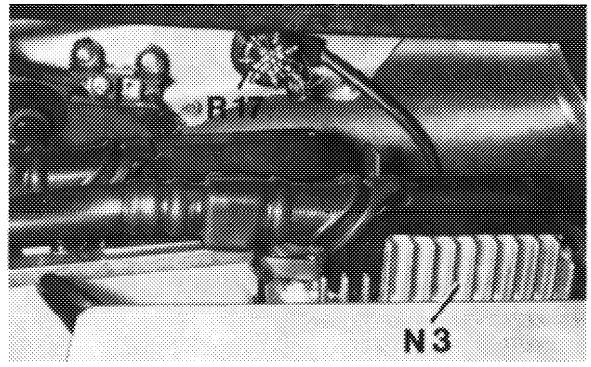
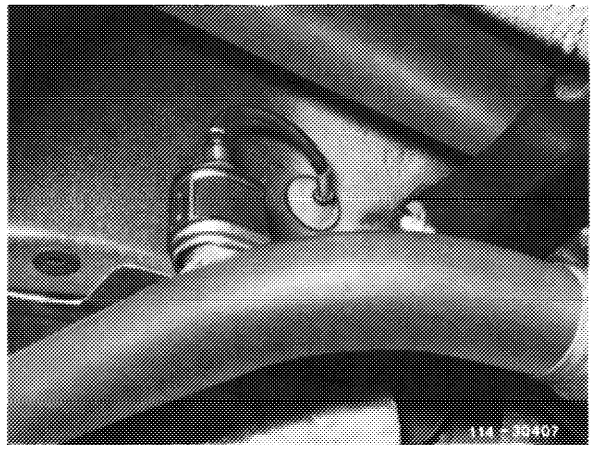
The lambda control is not functioning, i.e. not controlled , under the following operating conditions:
Oxygen sensor not operational or defective.
Coasting with deceleration cutoff.
Full load operation.
Acceleration enrichment.
When starting below 15 °C up to + 40 °C coolant temperature.

CIS-E control unit (N3)
Mounted at the right behind the battery.

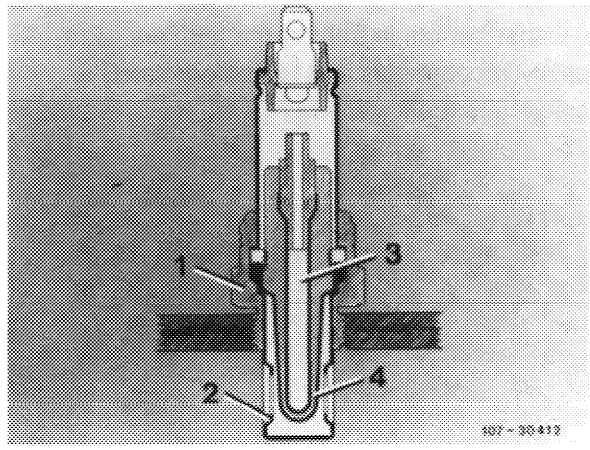


RUF/CAT
N3 Control unit fuel injection system
R17 Adjustment plug fuel injection system

Oxygen sensor
The oxygen sensor is screwed into the front exhaust pipe.



The outer electrocde is exposed to the exhaust emission, the inner electrode is connected with the atmosphere. The active part of the oxygen sensor is a ceramic body mainly consisting of zirconium dioxide. At the surface it is provided with a gas-permeable platinum layer and an additional protective layer on the exhaust side.



1 Sensor housing
2 Slotted protective tube
3 Heater element
4 Sensor ceramic element

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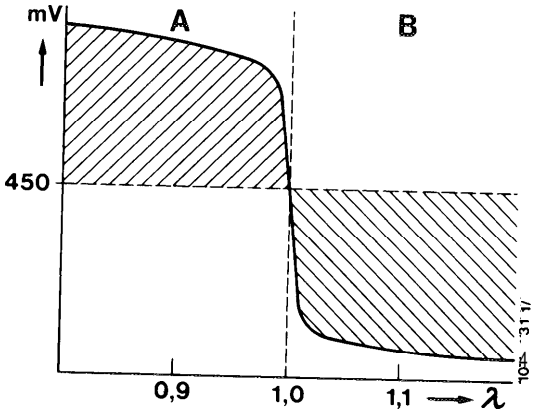
At operating temperature the ceramic material conducts the oxygen ions. The different oxygen proportion of exhaust gas and atmosphere generates a voltage in the oxygen sensor.

In order to maintain a constant operating temperature the sensor is heated.

The heater element of the oxygen sensor is supplied with voltage via terminal 87 of the fuel pump relay and is heated as long as the fuel pump is operating (circuit ciagram).

At operating temperature (> 300 °C) the oxygen sensor emits a voltage signal to the control unit.
Voltage > 450 millivolt mixture rich.
Voltage < 450 millivolt mixture poor

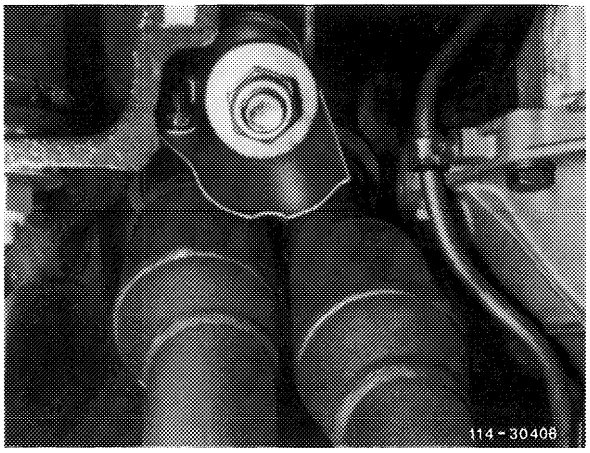
Because of the steep voltage jump with lambda (h) = 1, the exhaust gas composition can be analysed very quickly and the fuel-air mixture corrected within a narrow control range.



A Rich fuel-air mixture
B Poor fuel-air mixture

Catalytic converters

The 3-way catalytic converters are located in the exhaust system in front of the mufflers. Pre-catalytic converters and underfloor catalytic converters are installed.



Pre-catalytic converter

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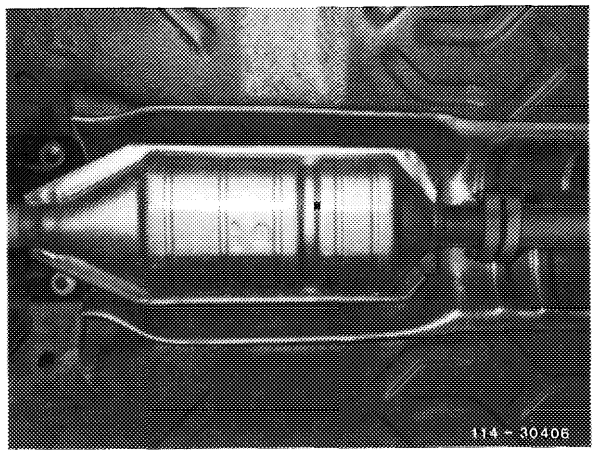
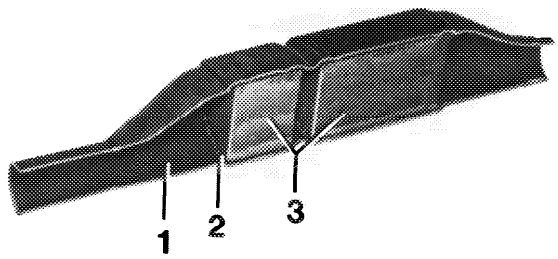


Under-floor catalytic converter

The catalytic converters consist of three main parts:
Carrier material made of high-strength ceramic material and highly heat-resistant high-grade steel, also called monolith (ceramic material elastically mounted on wire braiding).
Intermediate layer for surface enlargement.
Catalytically active layer made of platinum/rhodium.



107 - 16849

1 Braiding
2 Wire braiding
3 Monolith

Function

Exhaust gas flows through the catalytic converter and comes into contact with the precious metals. By way of **oxidation,** carbon monoxide (CO) is converted into carbon dioxide (CO_2) and hydrocarbons (HC) into water (H_2O), while the nitric oxides (NO_X) are converted into nitrogen (N_2) by way of **reduction.** Decisive in this process are temperature and the residual oxygen content in the exhaust gas. From a temperature of approximately 250 °C the catalytic process commences, i.e. a chemical reaction takes place. Too high temperatures lead to thermal overload.

Oxygen is required for the oxidation of CO and HC. The reduction of the nitric oxides takes place under oxygen deficiency.

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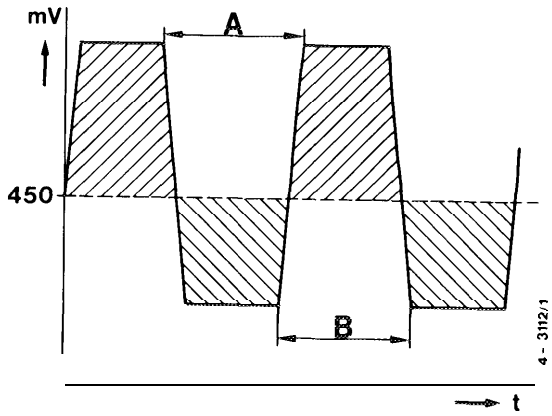
Fluctuation betweenoxygen-deficient and oxygen-rich exhaust gas is achieved by changing the fuel-air mixture. The ratio of the fuel-air mixture is described with the letter lambda (A). Lambda <1 means rich mixture, lambda >1 means poor mixture.



A Rich fuel-air mixture
B Poor fuel-air mixture

The fluctuation of the oxygen content in the exhaust gas is controlled by the oxygen sensor. Only by means of these oxygen fluctuations is it possible to chemically convert the three mentioned exhaust cnstituents in the catalytic converter.

Only unleaded fuel may be used in vehicles with catalytic converters and oxygen sensor. Lead additives in the fuel form deposits on the chemically reactive surface of the catalytic converter and the oxygen sensor, rendering the system inactive.

Catalytic converter temperature warning system (J)

By means of a warning lamp in the instrument cluster, this warning system indicates to the driver an impermissibly high temperature rise in the catalytic converter.

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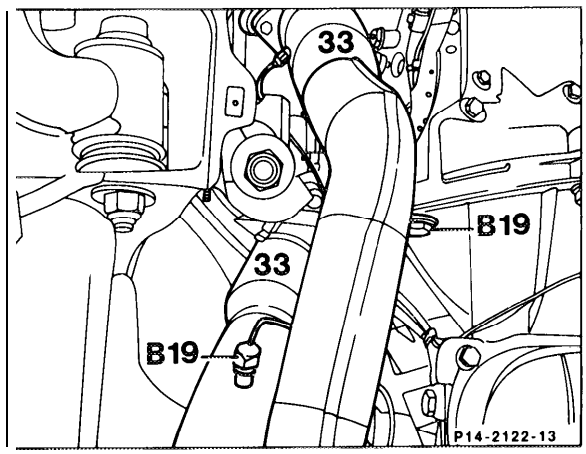
Components of the catalytic converter temperature warning system:

Catalytic converter temperature sensor (B19)

A temperature sensor (B19) is mounted behind the pre-catalytic converter; this sensor feels the exhaust gas temperature in the exhaust system, passing it on to the catalytic converter warning control unit (N44).

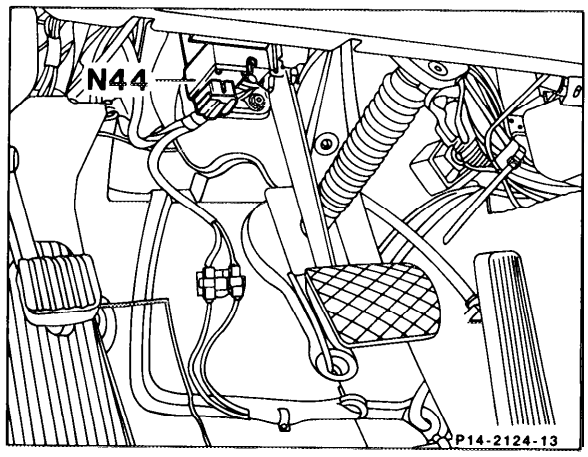


33 Pre-catalytic converter
B19 Temperature sensor

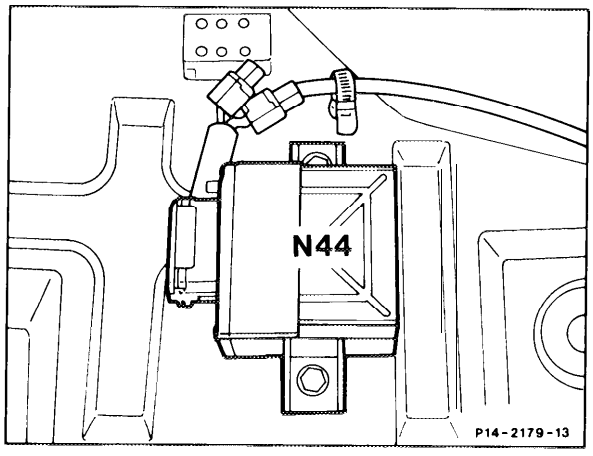
Catalytic converter warning control unit (N44)

A relay and a timer are housed in the control unit.

In the model 124 LHD this unit is installed at the front left near the pedal assembly



On model 124 RHD at the front left in the footwell.



On model 201 LHD and RHD, at the left below the rear seat.

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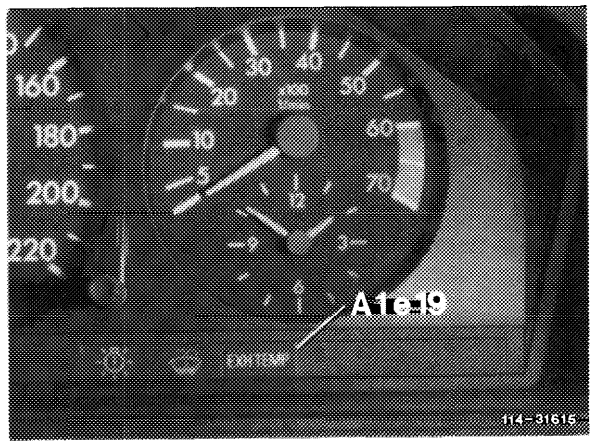
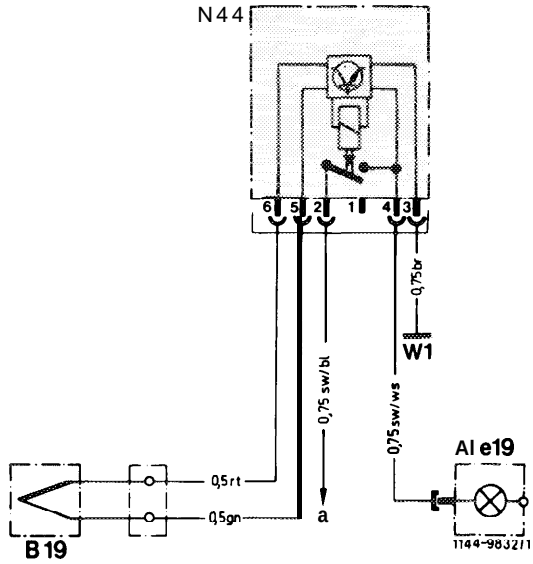
Indicator lamp catalytic converter overheating (A1e19) "EXH TEMP"

The indicator lamp catalytic converter overheating (Ale1 9) "EXH TEMP" is located in the instrument cluster bottom right.



Functional description

Depending on temperature, the temperature sensors (B19) send a very small voltage (millivolt) to the electronics in the control unit **(N44).** At temperatures of approximately 900 °C the voltage is so great that the electronic unit triggers the relay in the control unit. The relay closes and connects plus to the indicator lamp (Ale1 9), which is connected to ground. For an automatic check of the indicator lamp and the lines, actuate the warning system for 5-10 seconds after switching on the ignition.

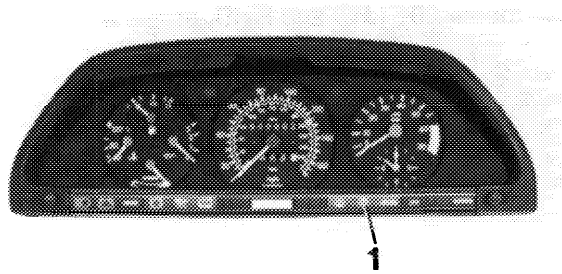


Ale19	Indicator lamp catalytic converter overheating
B 19	Temperature sensor catalytic converter
N 44	Control unit catalytic converter warning system
W 1	Main ground (behind instrument cluster)
a	To the fuse terminal 15

Oxygen sensor failure indication (USA) as of model year 1986

A failure of the oxygen sensor is indicated in the instrument cluster by the control lamp lighting up. The light is controlled by the CIS-E control unit.

The control lamp lights up when switching on the ignition.



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During starting, the oxygen sensor failure indication (Ale1 0) lights up briefly.

yes	no

Remove and check control lamp.

Control lamp ok.	Control lamp defective.

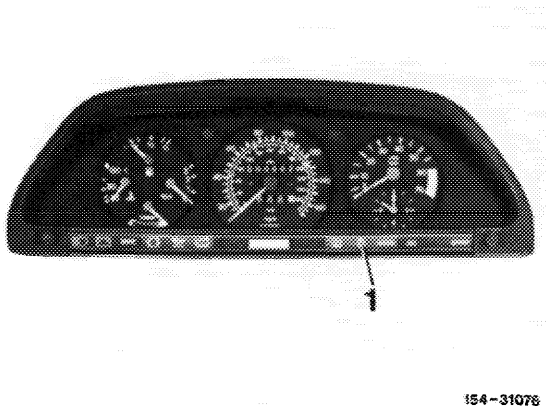
Renew control lamp

Switch on ignition. On oxygen sensor failure indicator A1e1 0, check voltage on wire rt/ge against ground.

Voltage approximately 12 volt

yes	no

Check voltage supply according to circuit diagram



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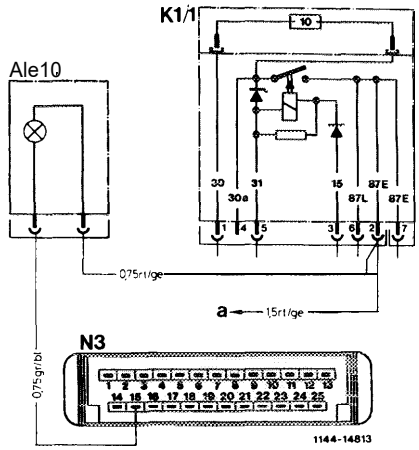
Switch off ignition. Check wire betwen oxygen sensor failure indication and CIS-E control unit (N3), socket 15, for continuity.

Resistance approximately 0 Ω

yes	no

Eliminate interruption according to circuit diagram.

End of test



Ale10 Oxygen sensor Indicator lamp
K1/1 Relay overvoltage protection
3 CIS-E control unit
W10 Ground, battery
a To the CIS-E control unit, socket 1

Electric circuit diagrams see repair instructions engine 103 combustion CIS-E injection system 07.3-1 28.

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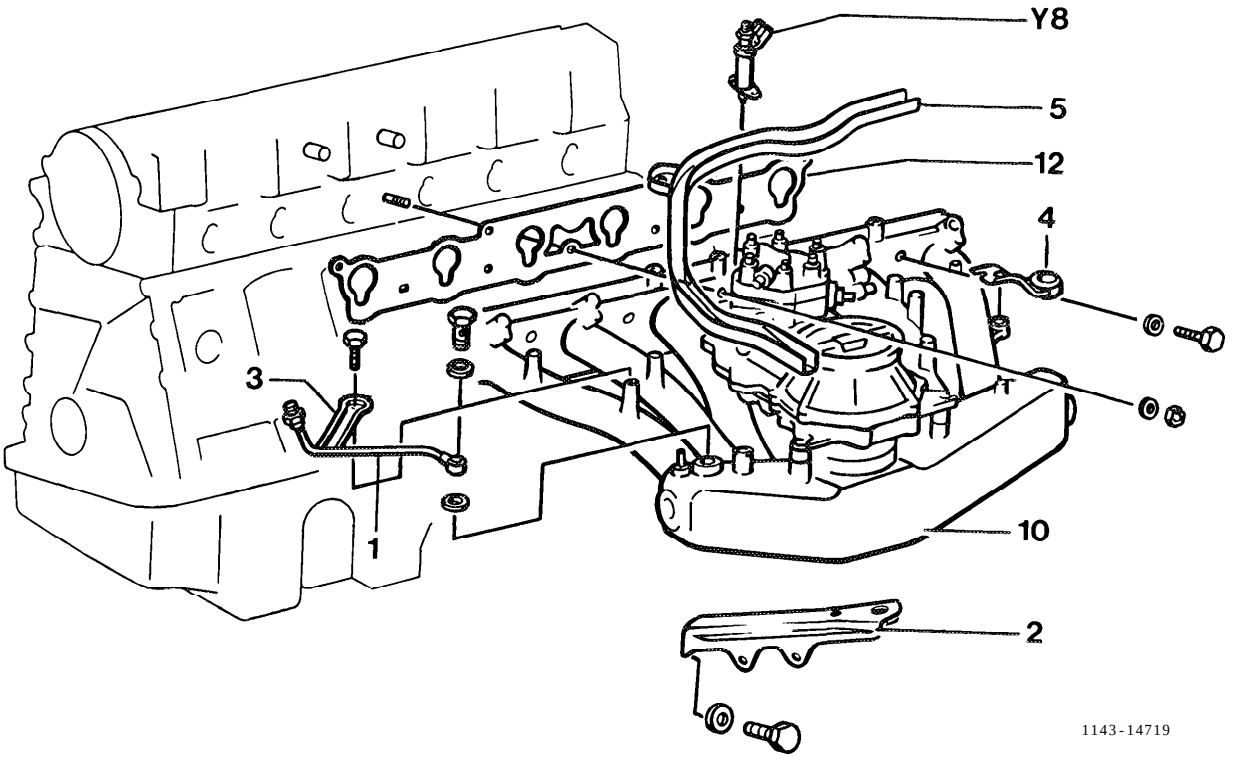
14–450 Removal and installation of intake manifold, replacement of gasket

Job no. of the job texts and work units and standard texts and flat rates respectively 14-0180



Engine compartment cover	remove, install
Plastic rail (5) for engine electric cable harness	remove, install
Mixture controller with air guide housing	remove, install (07.3225).
Holder (4) for starter cable	unscrew, screw on
Vacuum connections on intake manifold and throttle valve assembly	pull off, fit.
Vacuum line (1) for brake assembly with holder (3)	remove, install.
Starter valve (y8)	remove, install. Electrical connection to the engine, mount.
Bowden cable for control and for automatic transmission	disconnect, connect

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Support (2) for intake manifold	unscrew, screw on. Unscrew both supports (on the intake manifold). Loosen on crankcase and, on vehicles with cruise control, unscrew (with cruise control).
Protective cap on ignition coil	remove, mount.
Vehicle with level control	remove suction hose. For this purpose, loosen hose clamp and force hose off the pipe, mount.
All fastening screws and one nut	unscrew, screw on.
Intake manifold (10)	remove, install. Clean, flange surfaces, check with straight edge, machine on straightening plate if necessary.
Intake manifold gasket (12)	renew.
Control linkage	adjust (30-300).
Idling	check, adjust (07.3-I 00).

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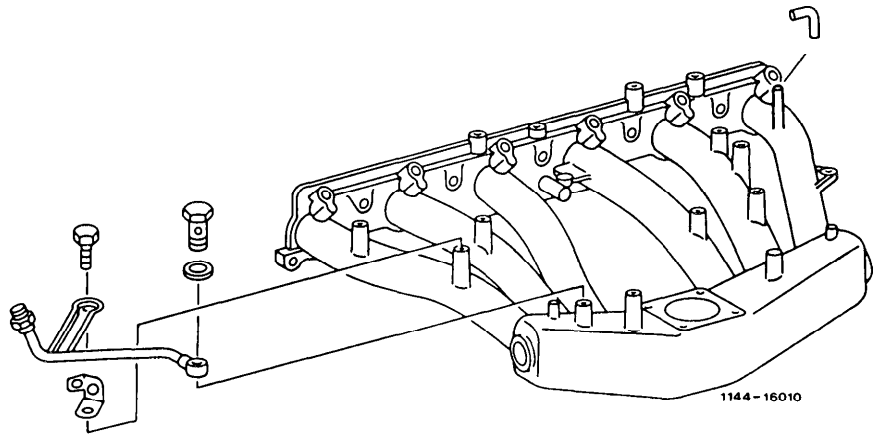
14–455 Renewal of intake manifold (intake manifold removed)

Job no. of the job texts and work units and standard texts and flat rates respectively 14-0205



Intake manifold	remove, install (14-1 50)
Mixture controller with air guide housing	remove, install (07.3-225).
Intake manifold removed	unscrew from the removed intake manifold all parts that can be unscrewed and install in new intake manifold with new gaskets.

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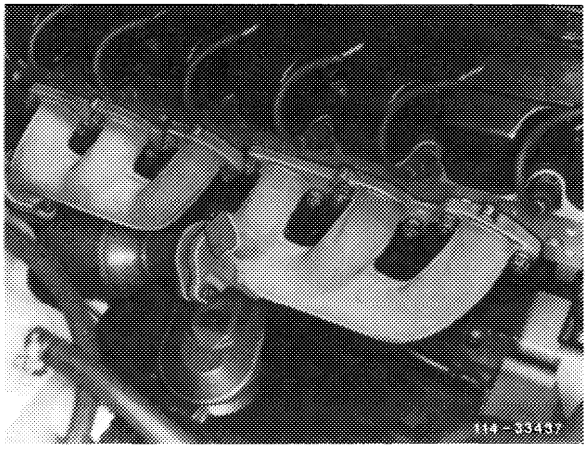
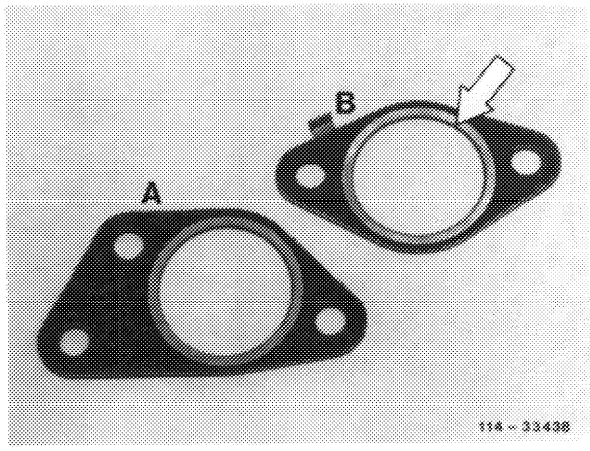
14–470 Removal and installation of exhaust manifold

Job no. of the job texts and work units and standard texts and fiat rates respectively 14-0350

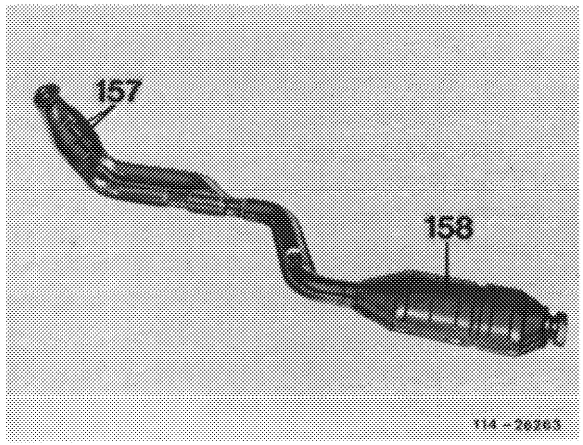




Exhaust system	partly remove and install (49-l 00).
Exhaust nuts	unscrew all exhaust nuts and remove exhaust manifold.
Exhaust manifold with new gaskets	mount. When doing so, observe that the flange (arrow) and the sheet metal lugs are facing the exhaust manifold. For improved stability, the gasket for cylinder 6 (A) has an additional bore. Gaskets for cylinder l-5 (B).

Note

Vehicles with catalytic converters are equipped with pre-catalytic converters and under-floor catalytic converters.



157 Pre-catalytic converter
158 Underfloor catalytic converter

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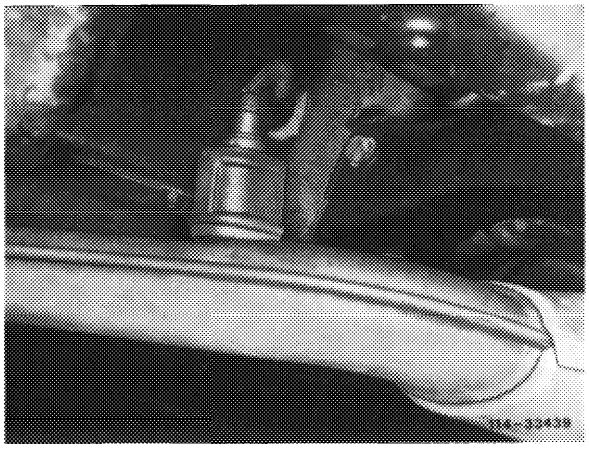
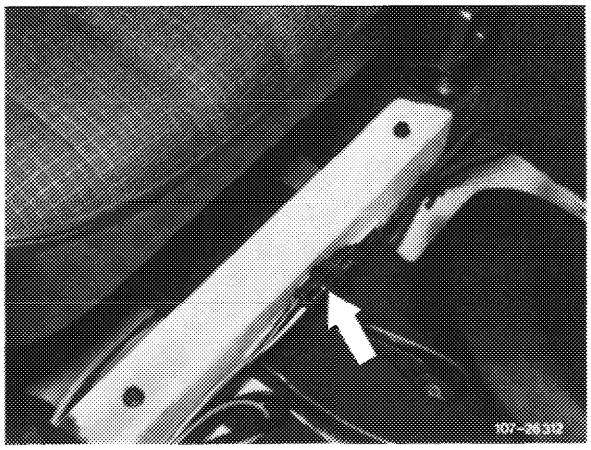
14-480 Renewal of oxygen sensor

Job no. of the job texts and work units and standard texts and flat rates respectively 07-5303





Electric wire for oxygen sensor signal and heater	separate in the vehicle interior
Wire with rubber grommet	press from inside out.
#eat shield	press off. Install so that the opening faces to the back.
Oxygen sensor	unscrew.
Oxygen sensor	mount. Coat thread with paste 000 989 88 51.

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Job No.

Notes regarding jobs on breakerless transistorized ignition system . . . . . 15 – 505
Function of the electronic ignition system with variable characteristics (EZL) . . . . . – 510
Checking ignition timing . . . . . – 515
Evaluation of oscilloscope image . . . . . – 525
Renewing spark plugs . . . . . – 530
Removal and installation of high – voltage distributor . . . . . – 535
Checking the electronic ignition system with variable characteristics (EZL) . . . . . – 545

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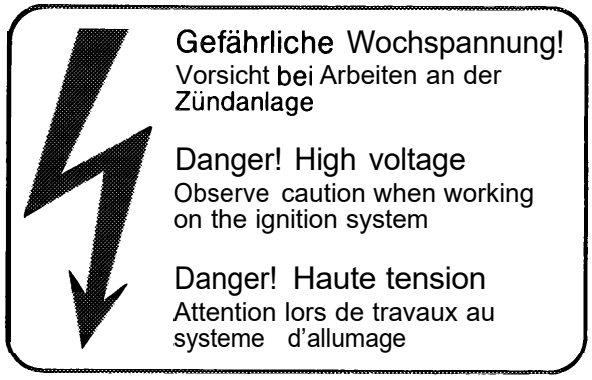
A. Safety information

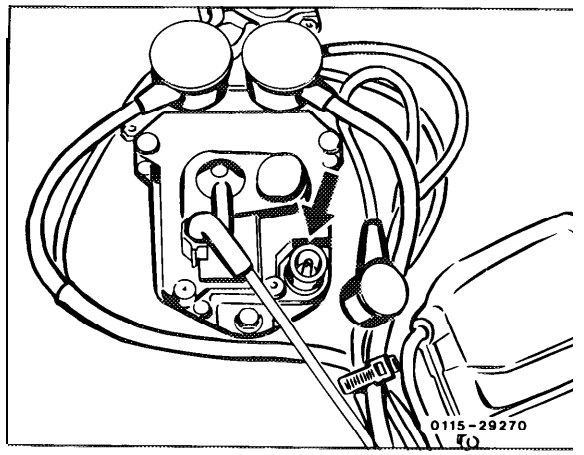
Increased demands of modern engines on ignition systems and the desire for maintenance-free operation have resulted in the use of series-produced electronic ignition systems.

As a rule, the firing output of electronic systems is superior to that of conventional systems: still further output improvements may be anticipated. As a result, electronic ignition systems enter an output range where the contact with live parts or terminals maybe lethal (see warning plate).



Warning plate in the engine compartment

For this reason it is absolutely vital to observe the following safety regulations when working on the breakerless transistorized ignition system:



- Prior to working at starter speed, e.g. when checking the compression or adjusting the valve clearance, switch off the ignition and pull off control cable from control unit (arrow) or fit protective plug, part no. 102 589 02 21 00, on the diagnostic socket.
- Persons with heart pace-makers should not work on these ignition systems.
- Do not touch and pull off any of the ignition system components at starting rpm or with the engine running.

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- Perform assembly jobs on the ignition system or connect and disconnect transmitters to ignition cables only with the engine stopped and the ignition switched off.

- Do not install any intermediate pieces with a bright metallic finish or any such transmitters into ignition cables, e.g. cylinder 1.

B. Notes for avoiding damage to ignition system

- **In order to avoid damage to the control unit, only remove and fit the control unit plugs with the ignition switched off.**

- Do not connect any test lamp to terminal 1 of the ignition coil.

- Do not short-circuit terminals 1 and 15 of the ignition coil to ground, e.g. for burglar alarm provision.

- In order to avoid wrong polarity connections, the threaded pins of the ignition coil have different diameters (M5 and M6).

- Install only genuine ignition system components.

- Do not operate the ignition system at starting speed without fully connected ignition gear.

- In order to avoid damage to the control unit, the high-tension side of the ignition system must be loaded with at least 2 kΩ (distributor rotor 1 kΩ, distributor cap 1 kΩ per connection). Do not install 5 kΩ distributor rotors for interference suppression.

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- At starting speed or with running motor, do not carry out tests such as holding ignition cable 4 with a distance against ground, pulling a spark plug connector or cable 4 from the ignition coil.

- For better heat dissipation, the control unit is mounted with heat conductive paste to the inner wing.
  During replacement, do not remove the protective foil as it does not impair the heat dissipation.

- If the short-circuit device (comparison of cylinders) is actuated and the engine stops, the test cannot be carried out with this tester.

- During the separate ignition coil test, do not load the ignition coil with more than 28 kV in order to avoid damage to the ignition coil.

- If checking the ignition spark becomes necessary during a breakdown, this may only be carried out by means of a spark plug connected to a cylinder ignition cable.
  Ensure proper ground contact of the spark plug. Danger, risk of electrocution!

C. Motes for the use of testers and measuring devices

- Connect and disconnect voltage transmitter pliers to cable 4 and trigger pliers to cylinder 1 only with the engine stopped and the ignition switched off.

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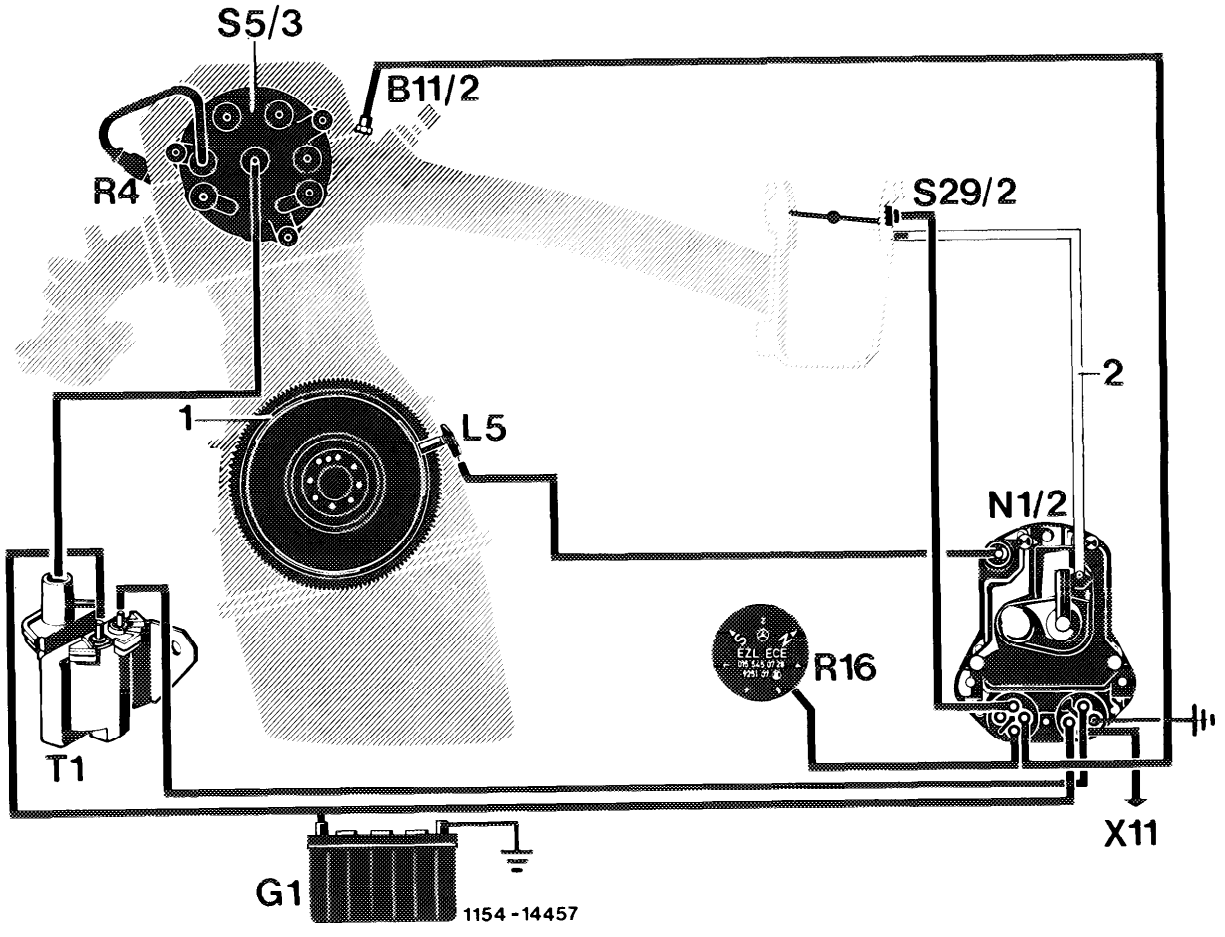
15-510 Function of the electronic ignition system with variable characteristics (EZL)



Function diagram electronic ignition system with variable characteristics (EZL)

B11/2	Temperature sensor, coolant (EZL/CIS-E/2E-E)
G1	Battery
L5	Position pickup, crankshaft
N1/2	Control unit transistorized ignition system (EZL)
R 4	Spark plugs
R16	Reference resistor plug (EZL)
S5/3	High voltage distributor
S29/2	Throttle valve switch, full load/idle speed detection
T1	Ignitron coil
x11	Diagnostic socket/cable connector, terminal TD
1	Segments on flywheel/driven plate
2	Vacuum pipe

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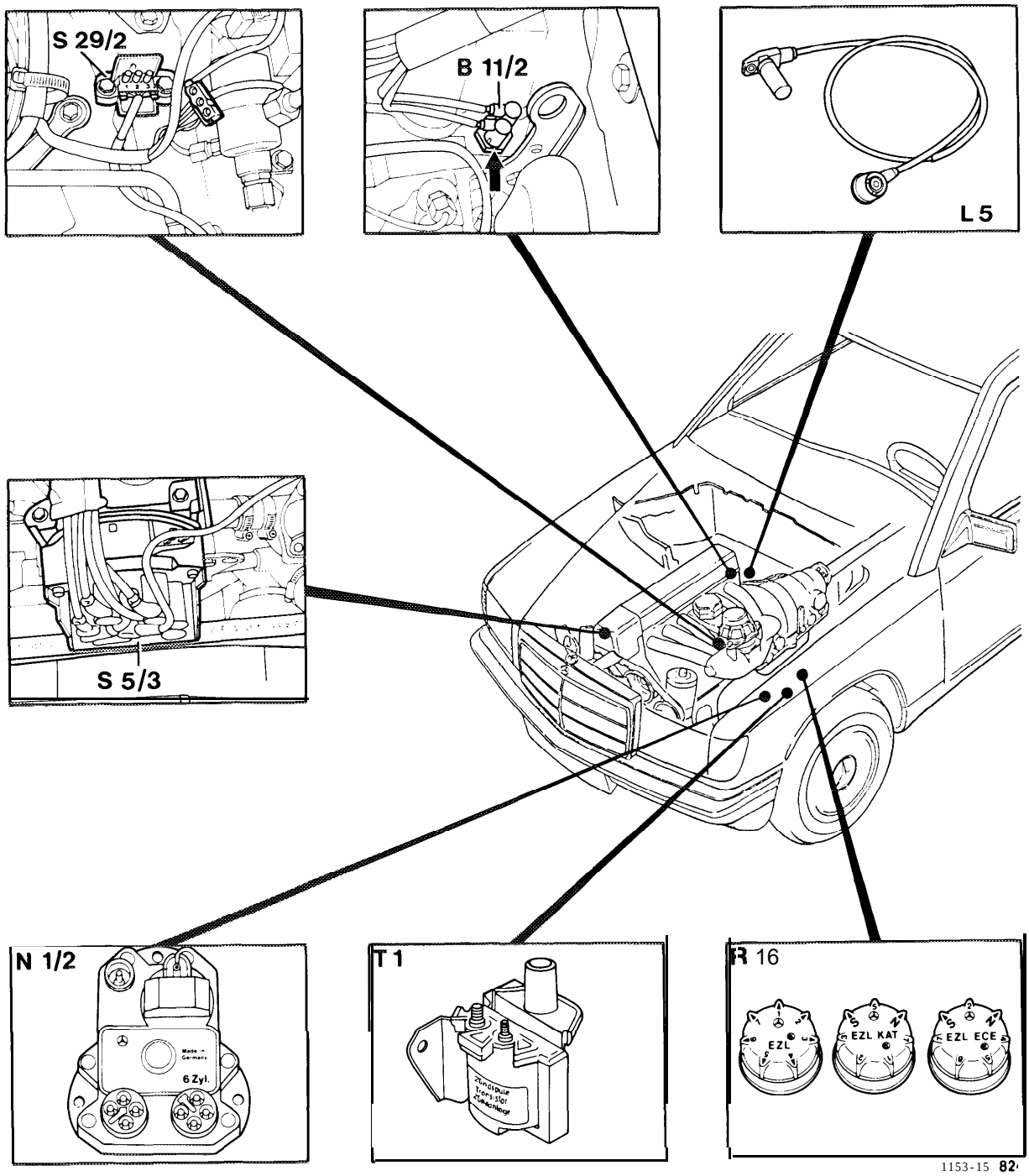

Arrangement of components

B11/2	Temperature sensor, coolant (EZL/CIS-E/2E-E)
L5	Position pickup, crankshaft
N1/2	Control unit transistonzed ignition system (EZL)
R16	Reference resistor plug (EZL)
S5/3	High voltage distnbutor
S29/2	Throttle valve switch, full load/idle speed detection
T1	Ignition coil

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Model survey

Engine	Model	Version	output kW	Compression ε	EZL individual resistor plug
103.940	124.026	USA	118	9.2	750 Ω
103.942	201.029				
103.943	124.226				
103.981	126.024/025	USA	132	9.2	750 Ω
103.983	124.030/050 124.090				
103.985	124.230/290				

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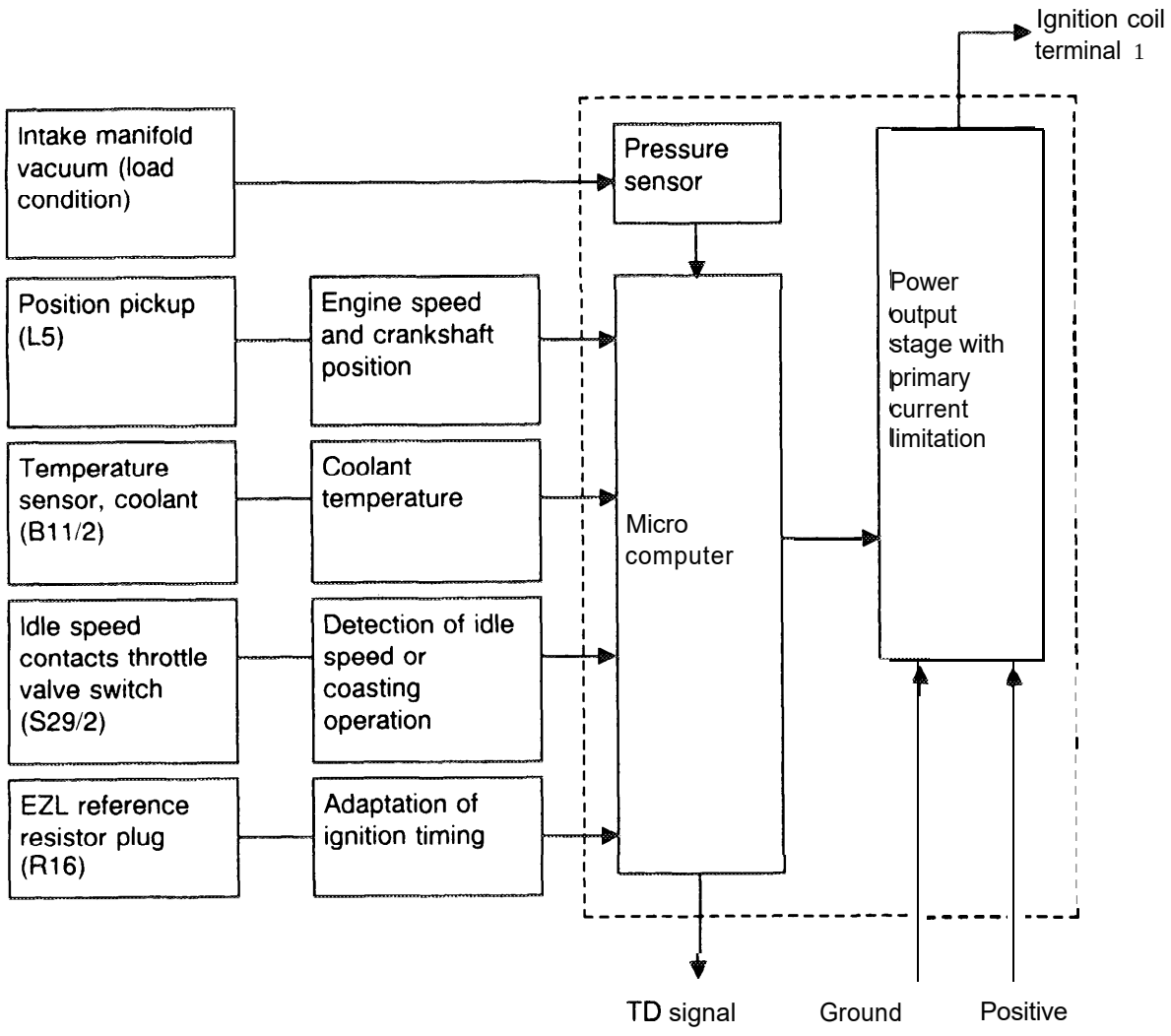
Components and function

Control unit (N1/2)



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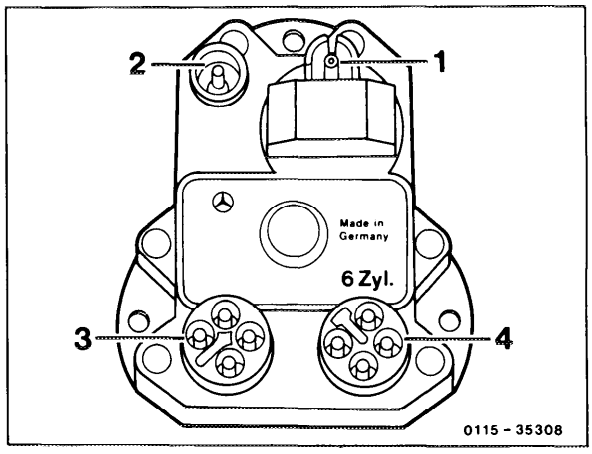
The ignition control unit is arranged on the left inner wing.

For improved heat dissipation it is installed with heat conducting paste. During replacement, do not remove the protective foil. The foil does not impair the heat dissipation. The control unit is equipped with a microcomputer, a pressure sensor and the power output stage.



1 Vacuum connection
2 Coaxial plug for control cable from position pickup
3 Plug - 4-pole pickup
1 temperature sensor, coolant
2 Throttle valve switch
3 EZL reference resistor plug
4 vacant (cable ends in cable harness)
4 Plug - 4-pole supply
15 = Terminal 15
16 = Ignition coil, terminal 1
TD = TD signal
31 = Ground

The characteristics for typical load/speed ranges and a fixed idle speed ignition characteristic are stored in the microcomputer of the control unit.

By means of various input signals, the control unit recognises the current operating condition of the engine. Engine speed and crankshaft position are picked up by the position pickup.

Considering all input signals, the stored characteristics are used to arrive at the optimum ignition timing for the respective operating condition,

The power output stage triggered by microcomputer controls the primary current of the ignition coil between terminals 16 and 31 (4-pole plug, supply).

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The control unit also incorporates the known functions dwell angle control, primary current cutoff and primary current limitation.

The speed-dependent TD-signal is generated in the ignition control unit.

When starting the engine up to approximately 450/min, the ignition timing is controlled only via the segment edges of the flywheel. Only when reaching a certain speed (approximately 460/min), the control unit no longer uses the fixed ignition timing, but the timing calculated from the current operating conditions.

During the warming-up phase, various ignition characteristics are blocked depending on the coolant temperature in order to reach the operating temperature as quickly as possible.

At idle speed and during deceleration, a fixed characteristic is used while the idle speed contact of the throttle valve switch is closed. This characteristic is neither influenced by the temperature sensor, the intake manifold vacuum nor the EZL reference resistor plug.

Note
In the case of coolant temperature sensor interruption (resistance ∞Ω), the fixed characteristic on Bosch ignition control units is no longer used and a certain ignition timing in the family of characteristics is selected, i.e. the ignition timing is advanced.

At full load the ignition timing is determined by the full load characteristic. Under consideration of the octane requirement the ignition timing is advanced at this stage (higher engine torque).

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Full load condition is recognised by the ignition control unit from the input signals intake manifold vacuum and engine speed.

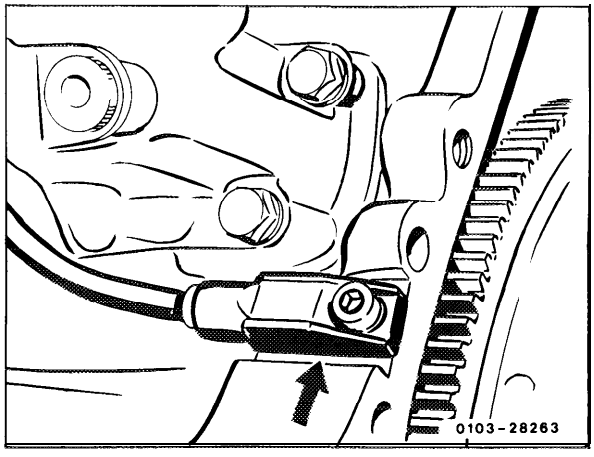
When exceeding a coolant temperature of approximately 95 °C, certain ignition characteristics are retarded in order to counteract further temperature rise.

Depending on the operating condition, the ignition timing of certain ignition characteristics can be adjusted by means of the EZL reference resistor plugs.

Position pickup (L5)

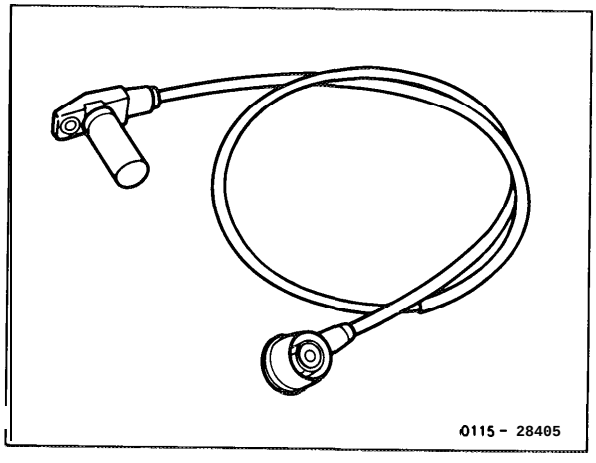
The position pickup registers the crankshaft position and the engine speed and signals this information to the ignition control unit.

The position pickup is mounted to the crankcase above the starter flange (arrow).



The coil body projects to just before the segments on the flywheel/driven plate. The segment position and speed is picked up without being in contact.

With the engine turning, due to induction an alternating voltage is generated in the position pickup. The peak value of the voltage (U,) is approximately 1.5 Volt at starting speed. The voltage rises with increasing speed (U_S approx. 3 Volt at 1200/min).



Note

Measure peak voltage (U,) with the oscilloscope.

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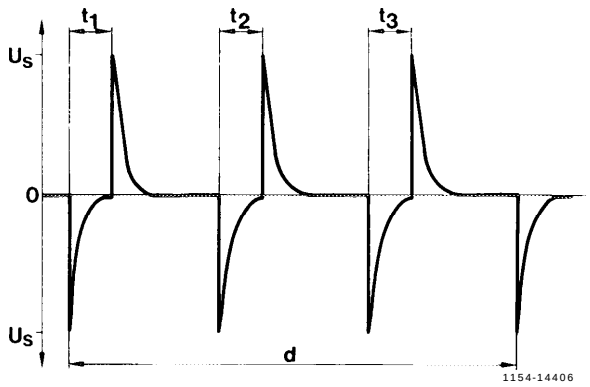
The crankshaft position is recognised from the voltage as follows:

The segment front edge generates a negative voltage signal.
The segment rear edge generates a positive voltage signal.



t l First segment
t2 Second segment
t3 Third segment
d Period for one crankshaft rotation

The engine speed is determined by measuring the period.

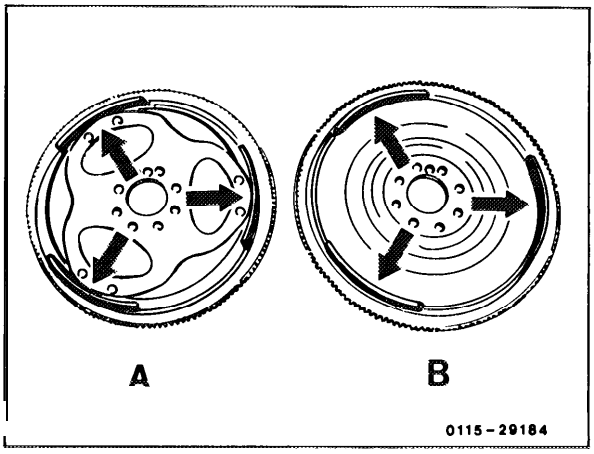
The alternating voltage from the position pickup is directed to terminal 7 on the ignition control unit via the control cable (coaxial cable). The cable is of the single-conductor type. The shield is used as second conductor.

If the ignition control unit does not receive a signal from the position pickup, the entire ignition system does not function, e.g. this can be caused by an interruption of the pickup coil.

The resistance of the position pickup is 680-120052.

Segments

Three segments (arrows) staggered by 120° are provided on flywheel/driven plate.



A Dnven plate with ring gear (automatic transmission)
B Flywheel (manual transmission)

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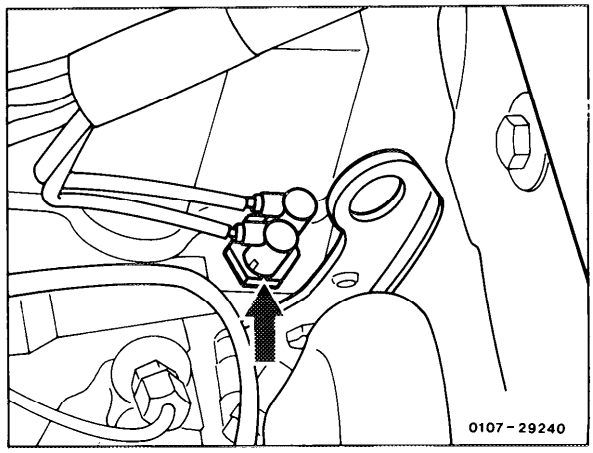
Indications of damaged segments or mechanical damage to the position pickup:

- Alternating voltage from position pickup below nominal value.
- Alternating voltage signals of the individual segments differ greatly.
- No alternating voltage signal.

Temperature sensor, coolant (B11/2)

The temperature sensor coolant has two NTC with a one-pole connector each. One NTC for CIS-E and one NTC for EZL.
The temperature signal reaches the EZL ignition control unit via the green/black cable and the 4-pole plug-pickup (jack 1). The temperature sensor coolant is arranged on the cylinder head rear left.

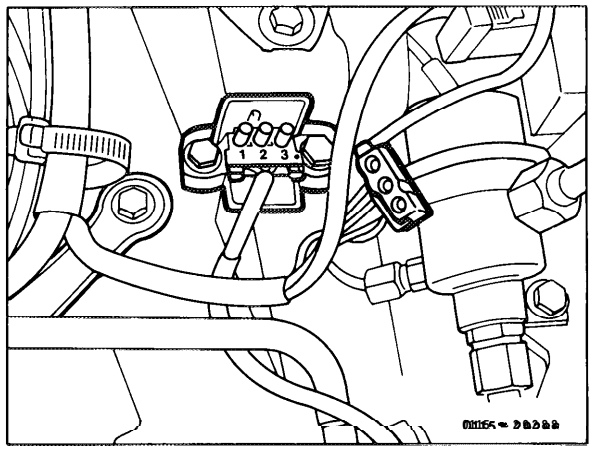


Note

NTC = negative temperature coefficient thermostat, i.e. the resistance is smaller in the hot state.

Throttle valve switch (S29/2)

The fixed idle speed/deceleration characteristic is activated with closed idle speed contact in the throttle valve switch (accelerator not depressed). The control signal reaches the ignition control unit via the 4-pole plug-transmitter (jack 2).



Plug assignment on the plug
1 Idle speed contact
2 Ground
3 Full load contact

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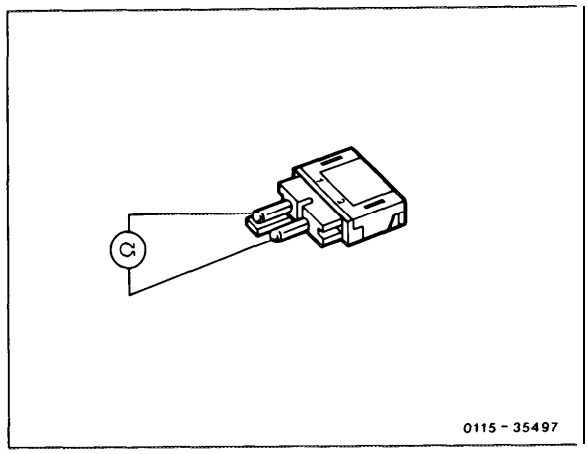
EZL individual reference resistor plug(R16/1)

The EZL individual reference resistor plug (R16/1) is provided with a fixed resistance. Depending on the national versions, the fixed resistances differ as follows:



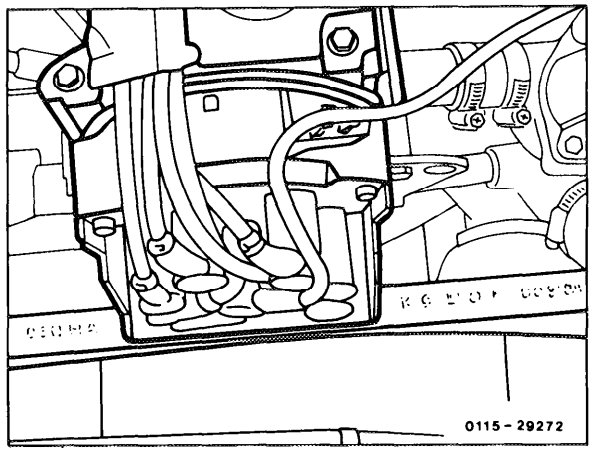
Part No.	Resistance	National version
000 540 21 80	OR	AUS
000 540 22 81	220 Ω	AUS
000 540 24 81	750 Ω	J USA

A certain family of characteristics is activated in the ignition control unit by means of the EZL individual reference resistor plug (R16/1)

Resistance measurement to check the individual reference resistor plug (R16/1) on the ignition control unit between plug-pickup (jack 3) and ground.

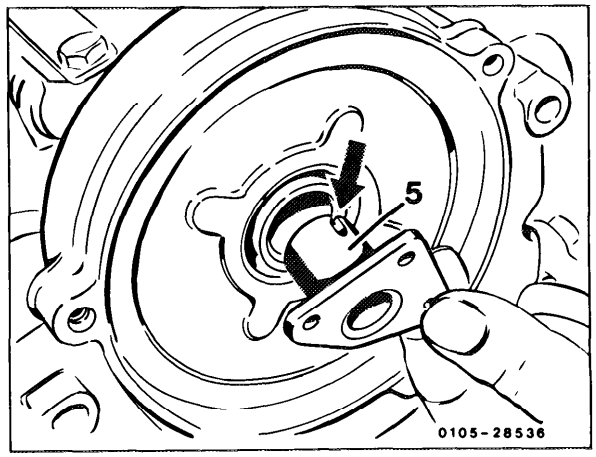
High-voltage distributor (SY3)

The high-voltage distributor only has the duty of distributing the ignition voltage, an adjustment of the ignition timing is no longer possible.



The high-voltage distributor is attached to the front cylinder head cover and is driven directly by the camshaft via the driver (5).

The distributor rotor is attached to the driver by means of three screws.
Interference suppression resistors: on the distributor cap for each connection 1 kΩ, spark plug connector 1 kΩ, distributor rotor 1 kΩ.



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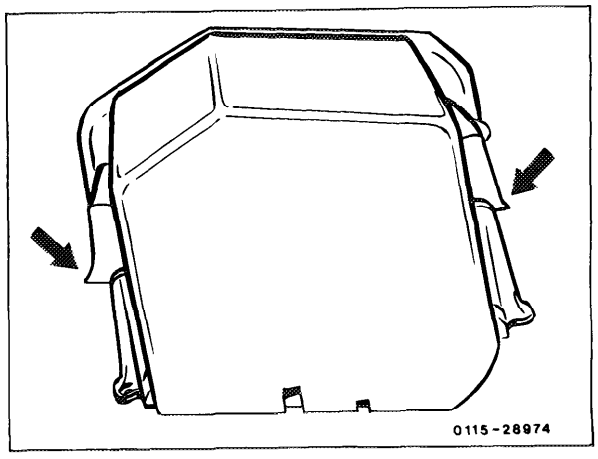
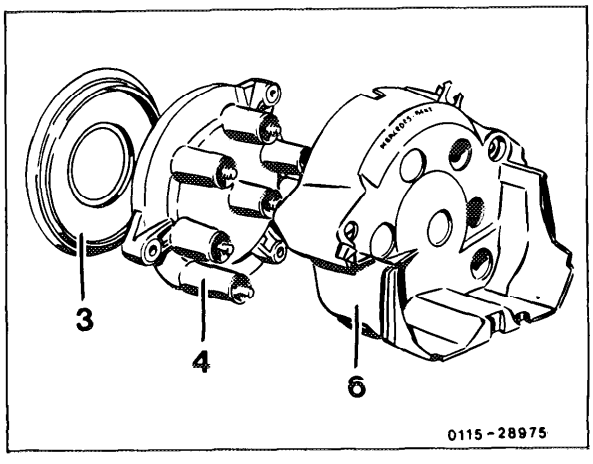
To protect against moisture and dirt, the high-voltage distributor is provided with a cover.



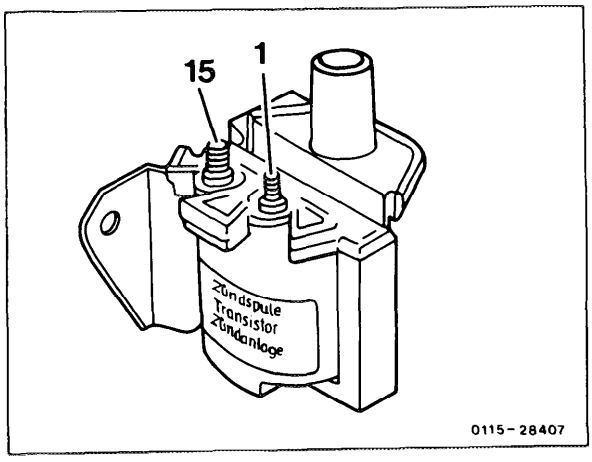
The shielding cover (6) for the long-distance intereference suppression is secured to the distributor cap by means of the three socket head screws.



Ignition coil (T1)

In order to achieve higher ignition energy, the ignition coil has been adapted to the ignition control unit. The high control output of the control unit permits further increase of the primary current. For this purpose the primary winding is designed with a very low resistance (0.3-0.6 Ω). Open-circuit current cutoff and primary current limitation allow ignition coil operation without pre-resistor.

Consequently the current limitation with the pre-resistor is no longer required. If the maximium primary current flows unlimited in the ignition coil (e.g. open-circuit current cutoff defective), the ignition coil will be damaged after a short time due to overheating.



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For identification:

For 4- and 6-cylinder engines with electronic ignition systems with variable characteristics (EZL) the ignition coils are identical.
Identification: yellow nameplate.
The ignition coils are not interchangeable with the ignition coils for 8-cylinder engines (identification: green nameplate). Observe part number when replacing.

Observe notes regarding jobs on electronic ignition systems (15505).

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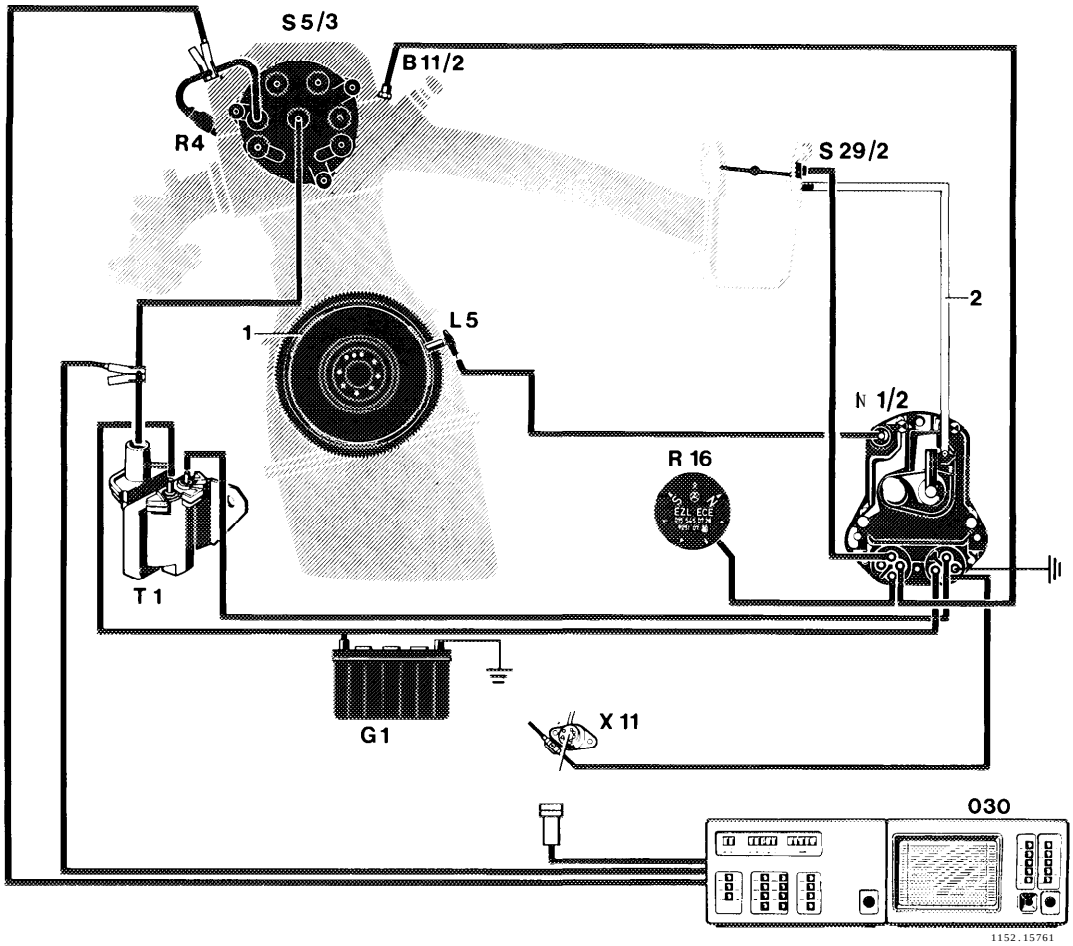

B11/2	Temperature sensor, coolant (EZL/CIS-E/2E-E)	S29/2	Throttle valve switch, full load/idle speed detection
G1	Battery	T1	Ignition coil
L5	Position pickup, crankshaft	x11	Diagnostic socket/cable connector, terminal TD
N1/2	Control unit transistorized ignition system (EZL)	1	Segments on flywheel/driven plate
R4	Spark plugs	2	Vacuum pipe
R16	Reference resistor plug (EZL)	030	Engine tester with oscilloscope
S5/3	High-voltage distributor		

Engine tester with oscilloscope (030) ..... connect to diagnostic socket (Xl 1).

Ignition timing ..... check at specified speed at coolant temperatures below 95 °C with or without vacuum (see table).

Engine	Version or fuel type	Engine speed 1 /min	Ignition timing in °crankshaft BTDC		
			reference resistor plug position	without vacuum	with vacuum
103.940	USA	3200	Individual reference	25-29	40-44
103.942		Idle speed	resistor plug 750 Ω	7-11	7-11
103.983	USA	3200	Individual reference	25-29	40-44
103.985		Idle speed	resistor plug 750 Ω	6-11	6-11

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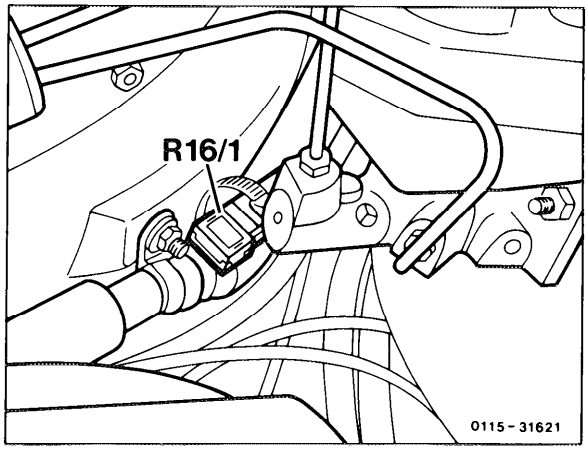
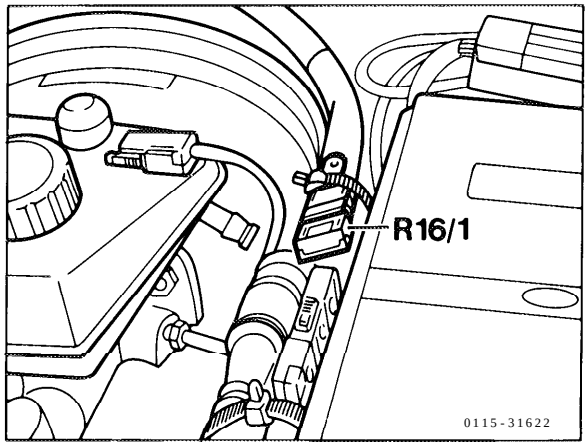
Arrangement of EZL reference resistor plug

(AUS) (J) (USA) EZL
individual reference resistor plug (R16/1)

Model 124
The EZL individual reference resistor plug is arranged on the left in the accessories compartment near the brake assembly.



Model 126
The EZL individual reference resistor plug is connected to the cable harness between the fuse and relay box and the brake assembly.



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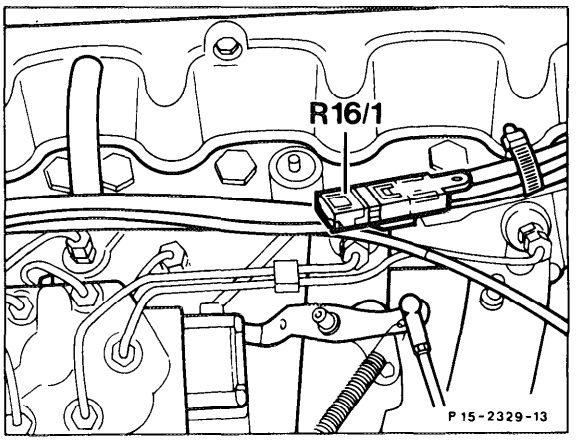
Model 201

The EZL individual reference resistor plug is connected to the engine cable harness in the vicinity of the starting valve.



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Go-image - parade pattern (engine speeds up to approx.1000/min)

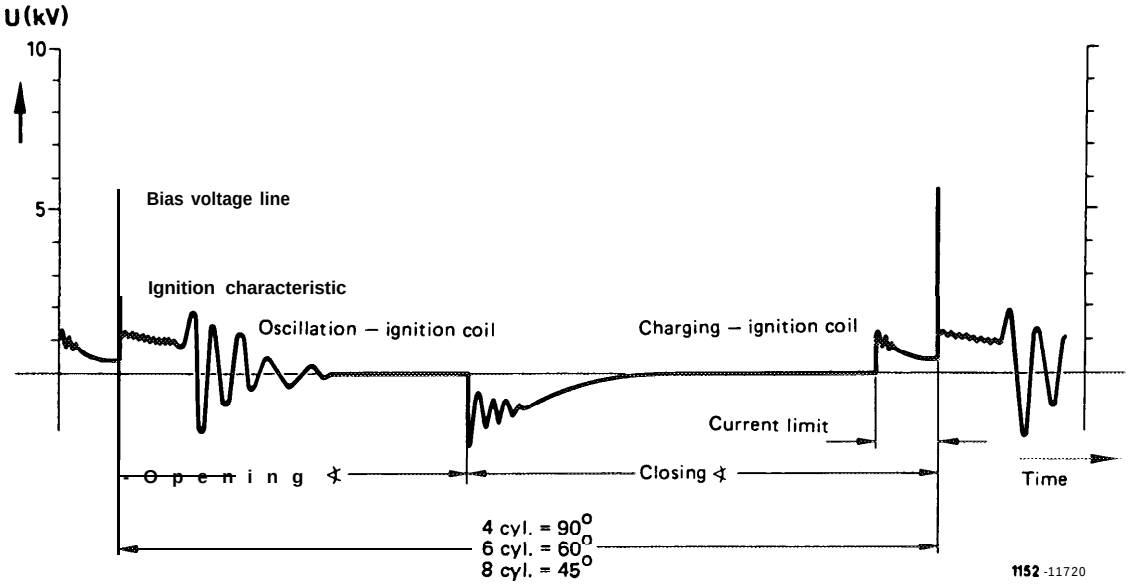

Image selection - Parade pattern. Display image is elongated in horizontal direction.

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Go-image - superimposed pattern (engine speeds up to approx.1000/min)

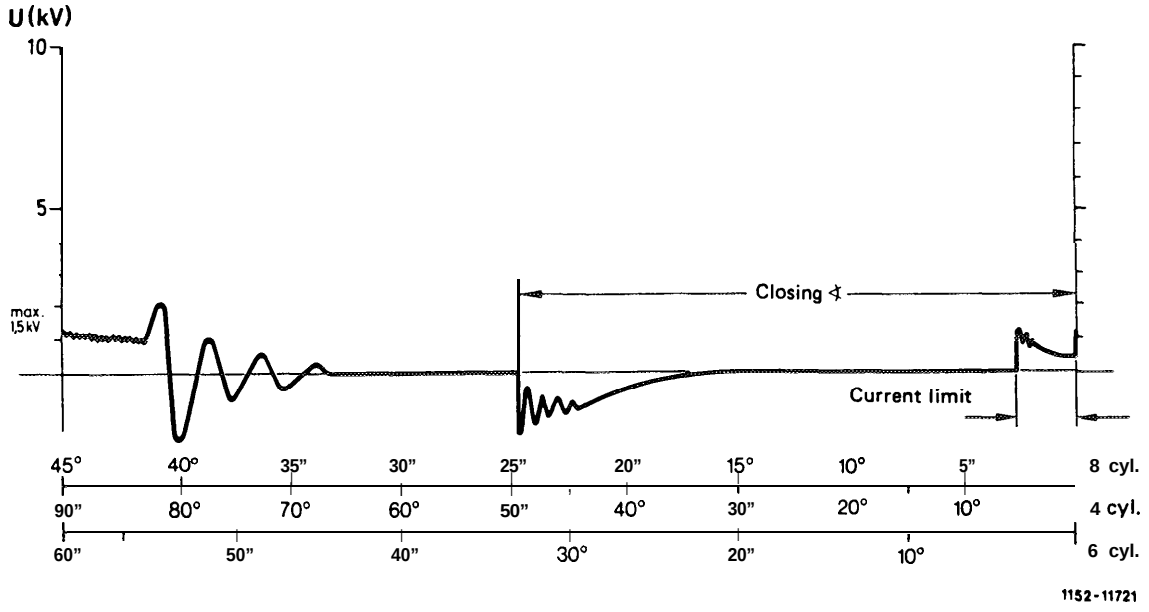

Image selection - Superimposition. For this purpose, set beginning and end of the ignition process on the left and right calibration lines.

Go-image - parade pattern (engine speeds above approx.1000/min)

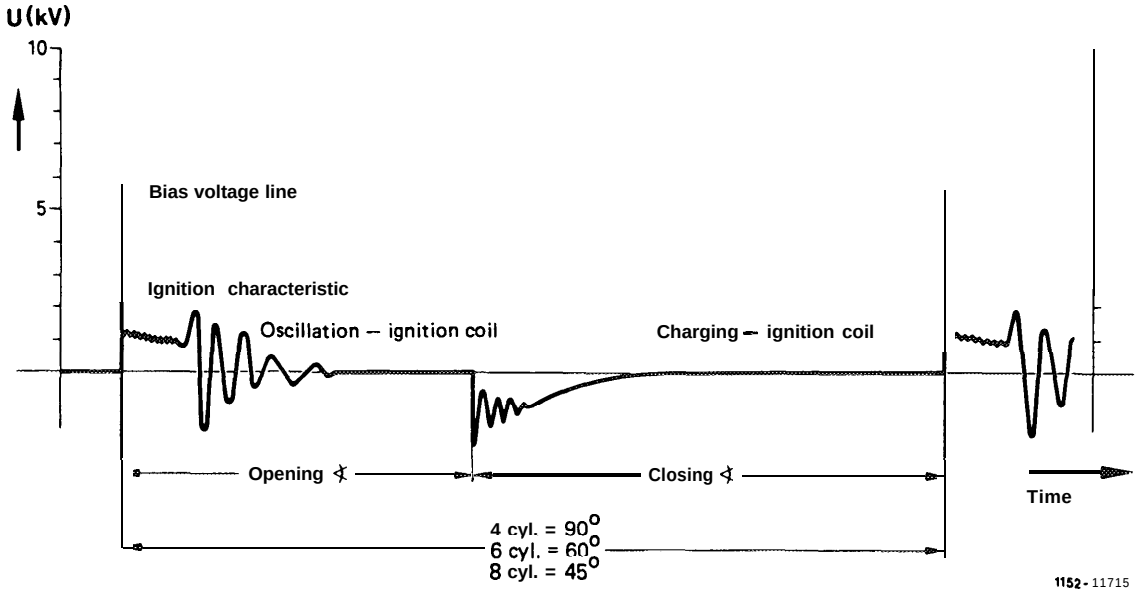

Image selection - Parade pattern. Display image is elongated in horizontal direction.

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Go-image - Superimposition (engine speeds above approx.1000/min)

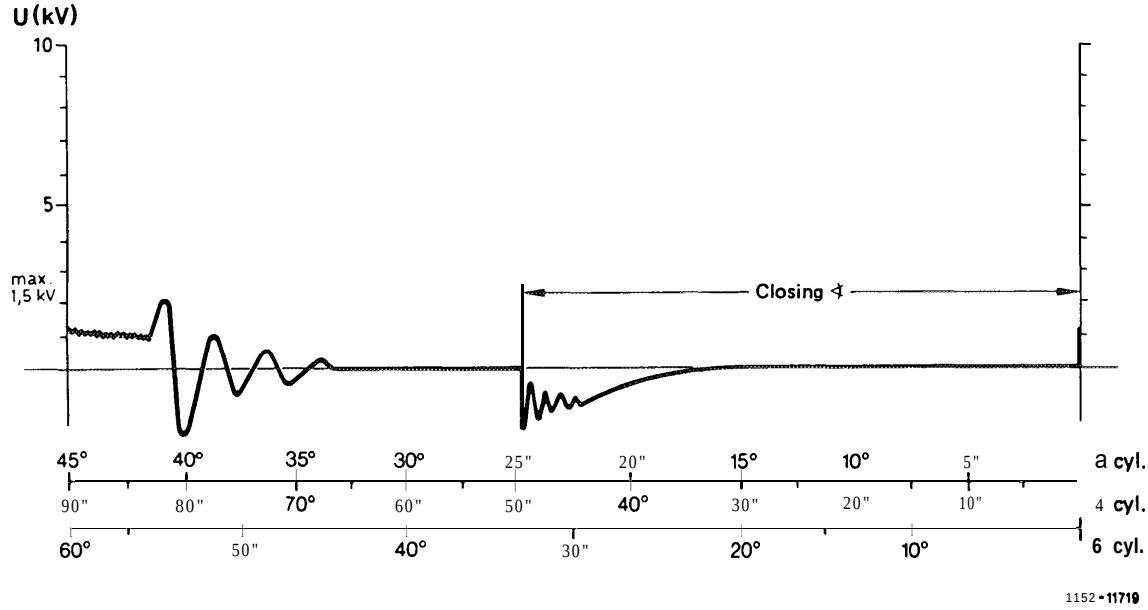

Image selection - Superimposition. For this purpose, set beginning and end of the ignition process on the left and right calibrating lines.

Too high but regular ignition curve starting point

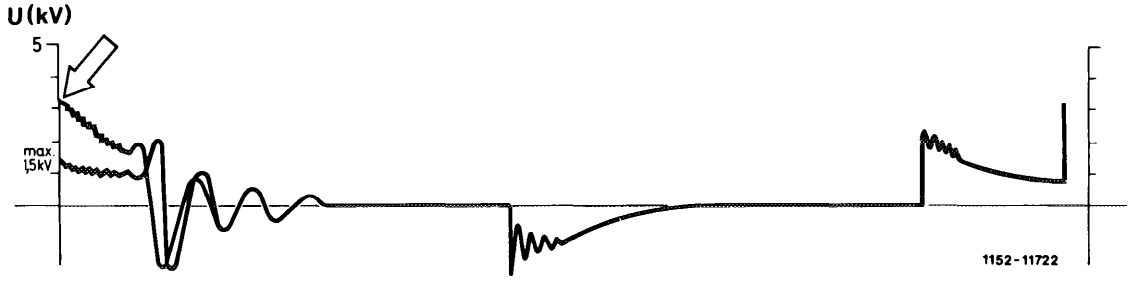

Image selection Superimposition.
Visible Idle speed on one or several cylinders

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Image selection	Parade pattern.
Image error	Ignition curve starting point above 1.5 kV.
Visible	Idle speed on one or several cylinders.
Cause	Too high ohmic resistance on the secondary side due to spark plug connector, distributor rotor, distributor cap, ignition cable, spark plug.
Remedy	Renew parts with too high ohmic resistance (use ohmmeter).

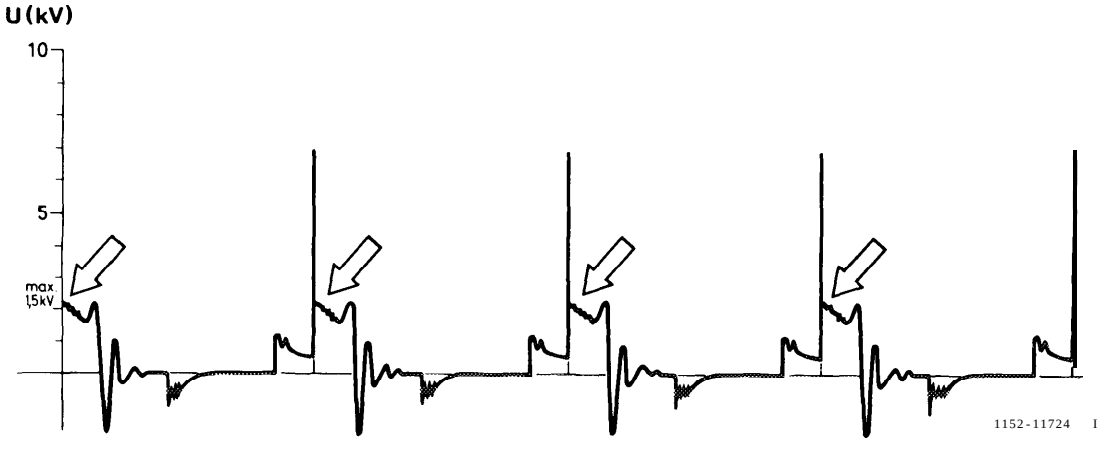

Image selection	Parade pattern.
Image error	Ignition curve starting point above 1.5 kV.
Visible	Idle speed on all cylinders.
Cause	Too high ohmic resistance on the secondary side due to distributor rotor, distributor cap or high-voltage cable no. 4 with plug.
Remedy	Renew parts with too high ohmic resistance (use ohmmeter).

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Required ignition voltage

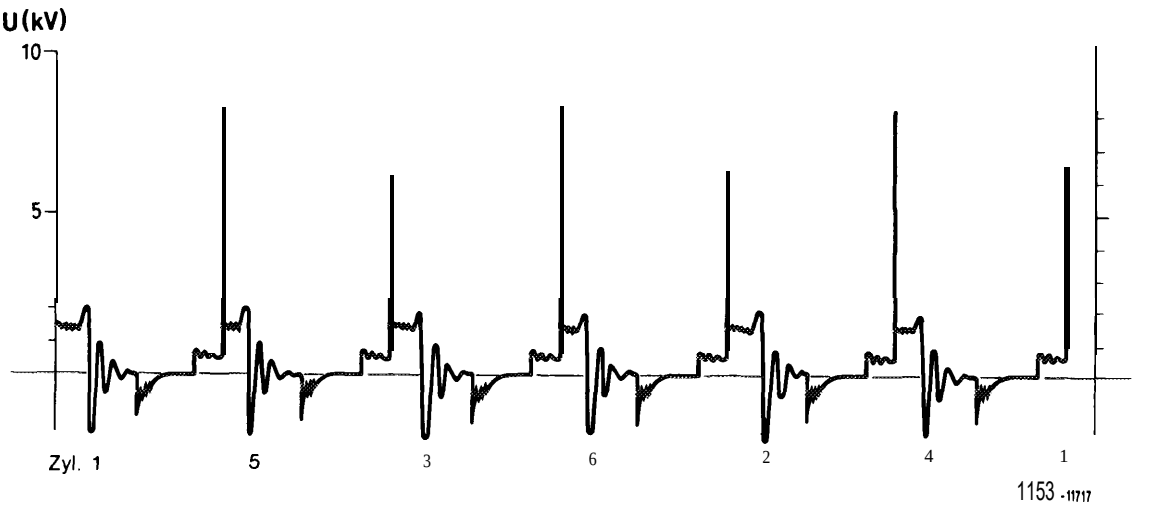

Image selection	Parade pattern.
Image error	Cylinders 4, 5 and 6 require a higher ignition voltage than cylinders 1, 2 and 3 (observe firing order).
Visible	idle speed.
Cause	Uneven mixture distribution.
Remedy	Check mixture distribution (e.g. fuel quantity comparitive measurement 07.3460).

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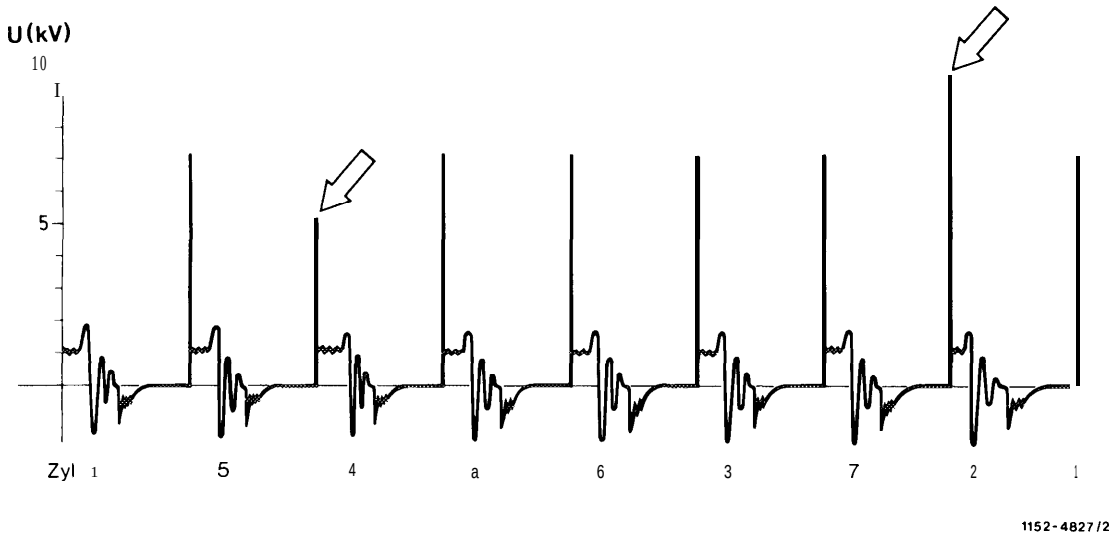

Image selection	Parade pattern.
Image error	Cylinder 4 bias too low • ignition curve longer Cylinder 2 bias too high - ignition curve shorter.
Visible	May occur at all speeds with or without engine load.
Cause	Cylinder 4 spark plug electrode gap too small, fuel-air mixture too rich, loss of compression. Cylinder 2 spark plug electrode gap too great, fuel-air mixture too lean, additional spark gap on the secondary side.
Remedy	Bias too low: correct spark plug electrode gap, check cylinder for leaks. Bias too high: correct spark plug electrode gap, check distributor cap, ignition cable and spark plug for continuity (use ohmmeter).

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Jumping ignition curve starting point

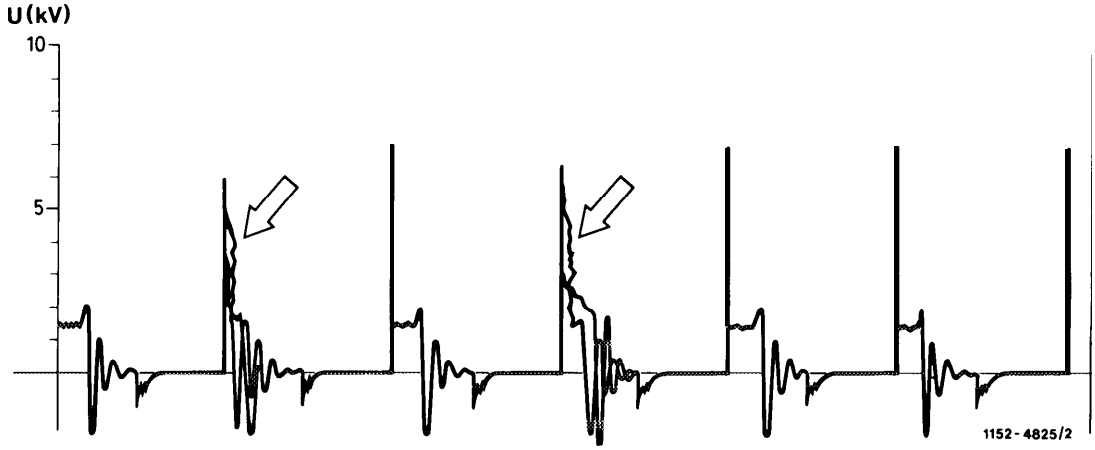

Image selection	Parade pattern.
Image error	Ignition curve starting point changes, jumps.
Visible	Can be visible at all speeds with or without engine load.
Cause	Spark plug carbon-fouled, oil-fouled, burnt, insulation damage on spark plug connector.
Remedy	Clean or renew spark plug, renew spark plug connector.

Required ignition voltage, intermittent acceleration load

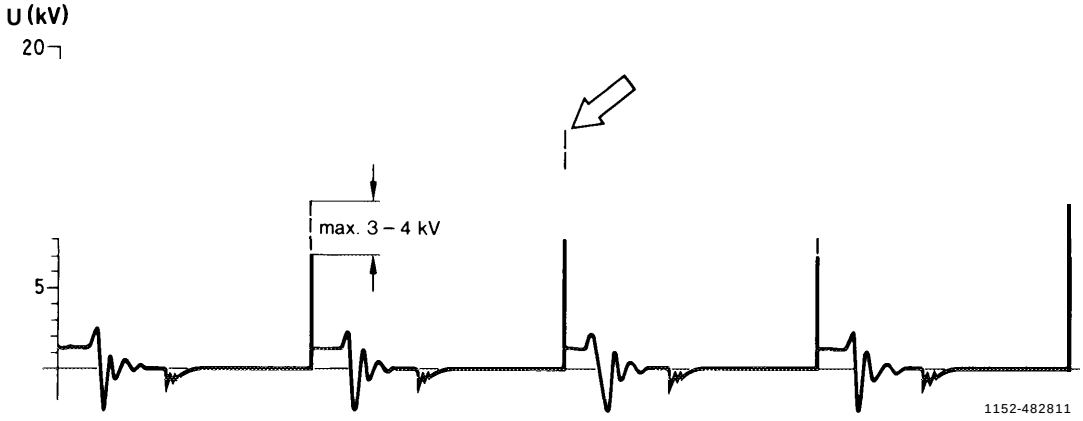

Image selection	Parade pattern.
Image error	Increase of required ignition voltage by more than 4 kV.
Visible	Accelerate engine intermittently to approx. 3000/min.
Cause	Spark plug electrode gap too large.
Remedy	Correct spark plug gap, renew spark plug if required.

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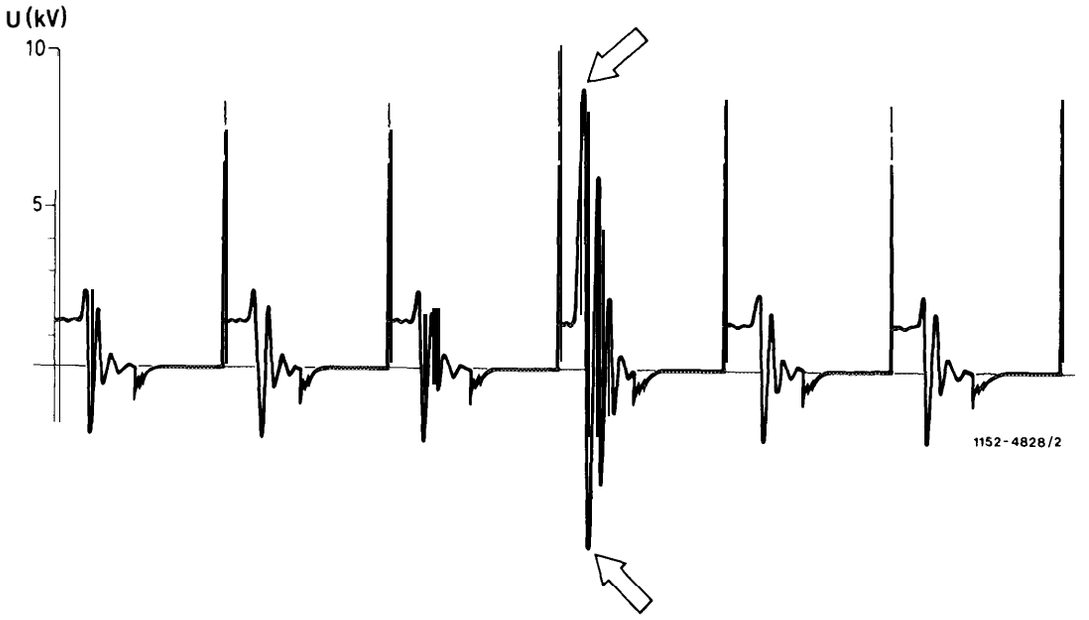

Image selection	Parade pattern.
Image error	The required ignition voltage increases by more than 4 kV on shortened ignition curve, high increase of the oscillations in the opening sector above and below the zero line.
Visible	With oscilloscope connected, start engine after prolonged inoperative period, repeatedly accelerate engine intermittently to approx. 3000/min.
Cause	Fuel-air mixture too lean.
Remedy	Check injection valve, renew if required (07.3135, 07.3-215).

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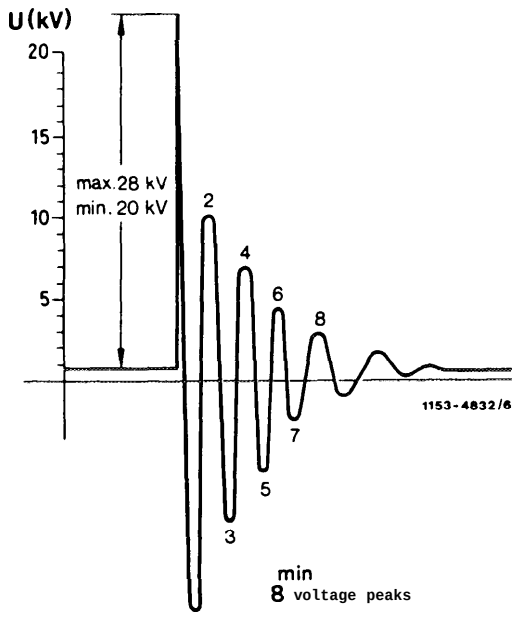
Ignition coil - separate test

go



no-go

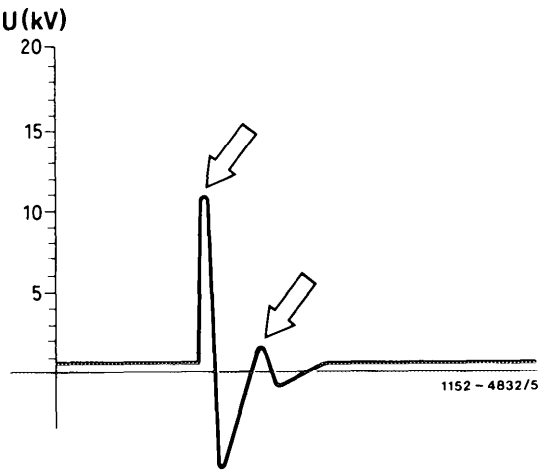


Image selection	Parade pattern.
Image error	Voltage below 20 kV, less than 8 voltage peaks.
Cause	Winding interruption, interturn short-circuit or insulation damage to ground.
Remedy	Renew ignition coil.
Note	Do not exceed 28 kV as this will already damage the ignition coil.

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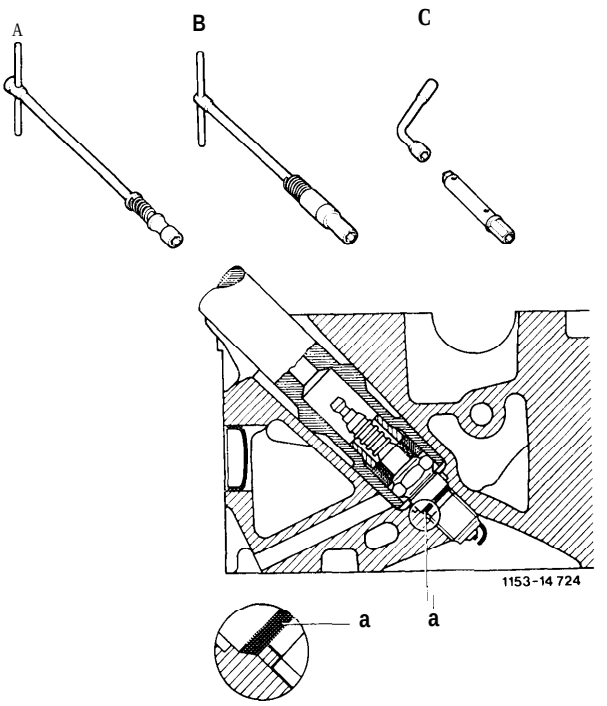
Job no. of the job texts and work units and standard texts and flat rates respectively 15-1031



Spark plug connector	loosen by turning to the left and right and pull off. Blow recesses with compressed air.
Ignition cable cover	remove and clean, when fitting, ensure correct routing of ignition cables.
Spark plugs	for removal and installation use only approved spark plug wrench (with Nm limitation "B"). A102589020900 B 162 589 01 09 00 C on-board tools Install only approved spark plugs with tapered seat (a). Tightening torque 20 Nm

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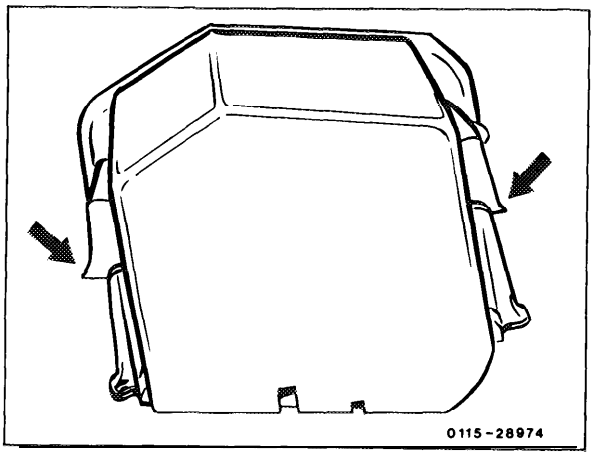
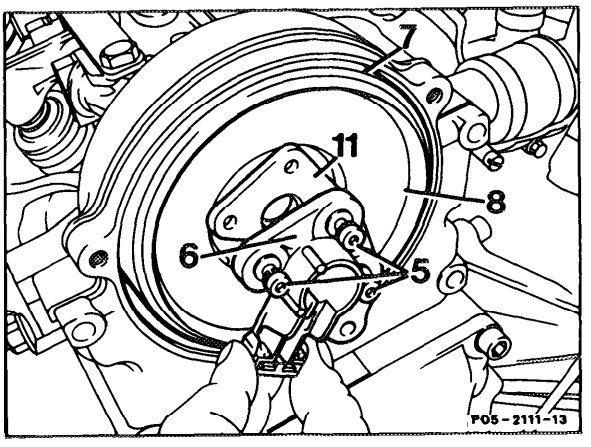
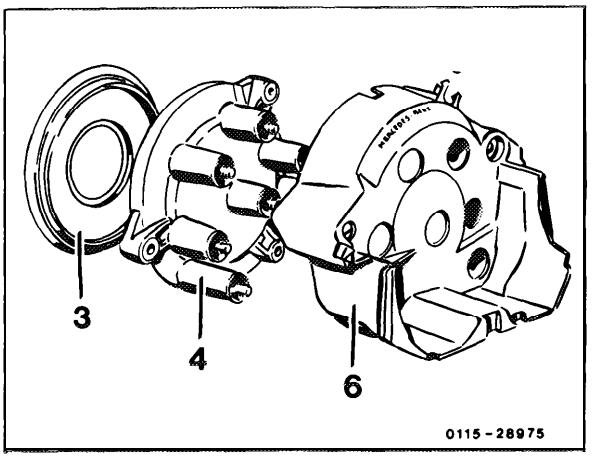
15-535 Removal and installation of high-voltage distributor

Job number of the job texts and work units and standard texts and flat rates respectively 1 S-3010







3 Sealing cover
4 Distributor cap
6 Shielding cap

Cover on high-voltage distributor . . . . . pull up by unclipping the two straps (arrows).

Distributor cap (4) . . . . . remove by loosening the three socket-head screws.

Caution!

During removal and installation of the distributor cap **(4),** observe in particular that the carbon does not contact the dome of the distributor rotor (2) with subsequent damage.

Distributor rotor (2) . . . . . remove by loosening the three socket-head screws (1) on the driver.

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Note

After removal and installation of the high-voltage distributor the ignition timing need no longer be adjusted. The ignition timing is determined by the control unit.

Install the ignition cables on the distributor cap in the sequence 1, 3, 6, 2, 4, 5 so that the ignition cables can be routed properly.

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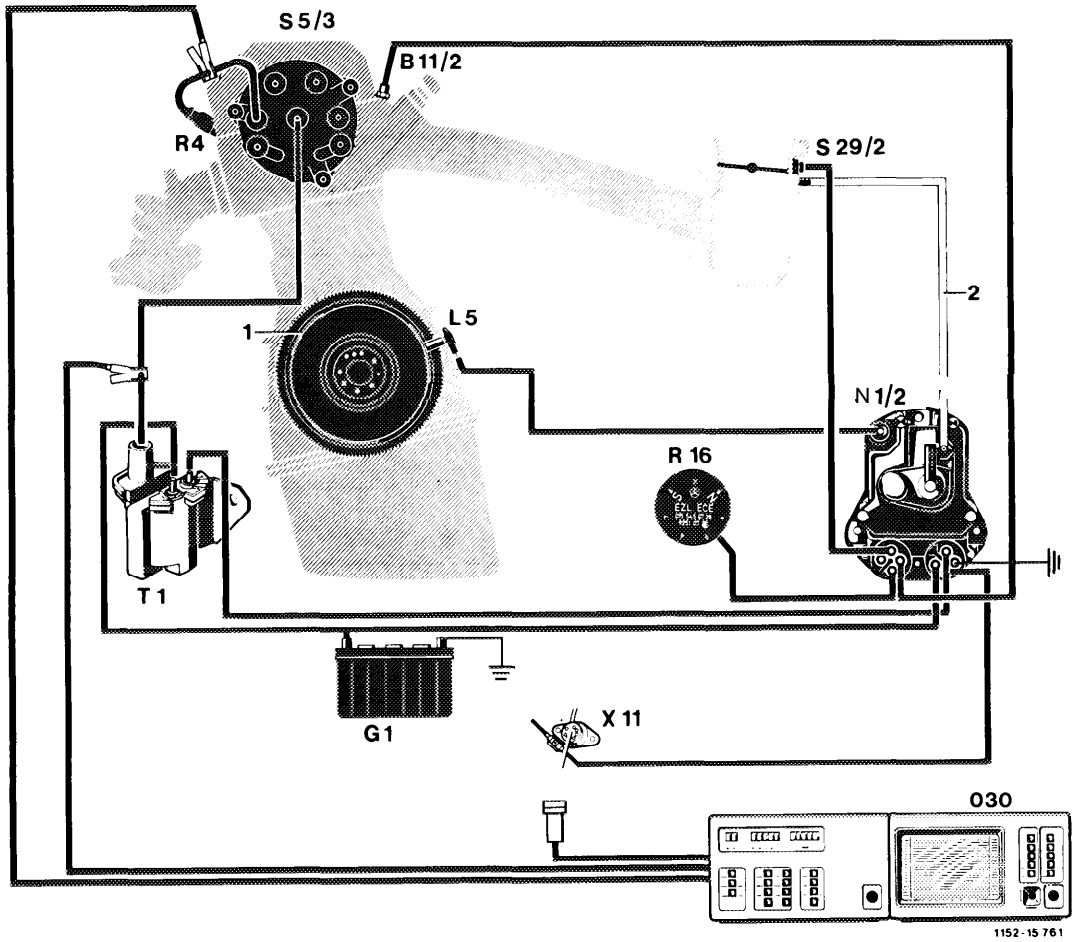
15-540 Checking the electronic ignition system with variable characteristics (EZL)

Job number of the job texts and work units and standard texts and fiat rates respectively 1 S-2450



B11/2	Temperature sensor, coolant (EZUCIS-E/2 E-E)	S29/2	Throttle valve switch, full load/idle speed detection
G1	Battery	T1	Ignition coil
L5	Position pickup, crankshaft	x11	Diagnostic socket/cable connector, terminal TD
N1/2	Control uinit transistonzed ignition system (EZL)	1	Segments on flywheel/driven plate
R4	Spark plugs	2	Vacuum pipe
R16	Reference resistor plug (EZL)	030	Engine tester with oscilloscope
S5/3	High-voltage distributor		

Precondition for the following ignition system tests:

Spark plugs, ignition gear, distributor rotor and distributor cap mechanically and electronically o.k.

Check for instance by means of visual inspection, resistance measurement and ignition oscilloscope.

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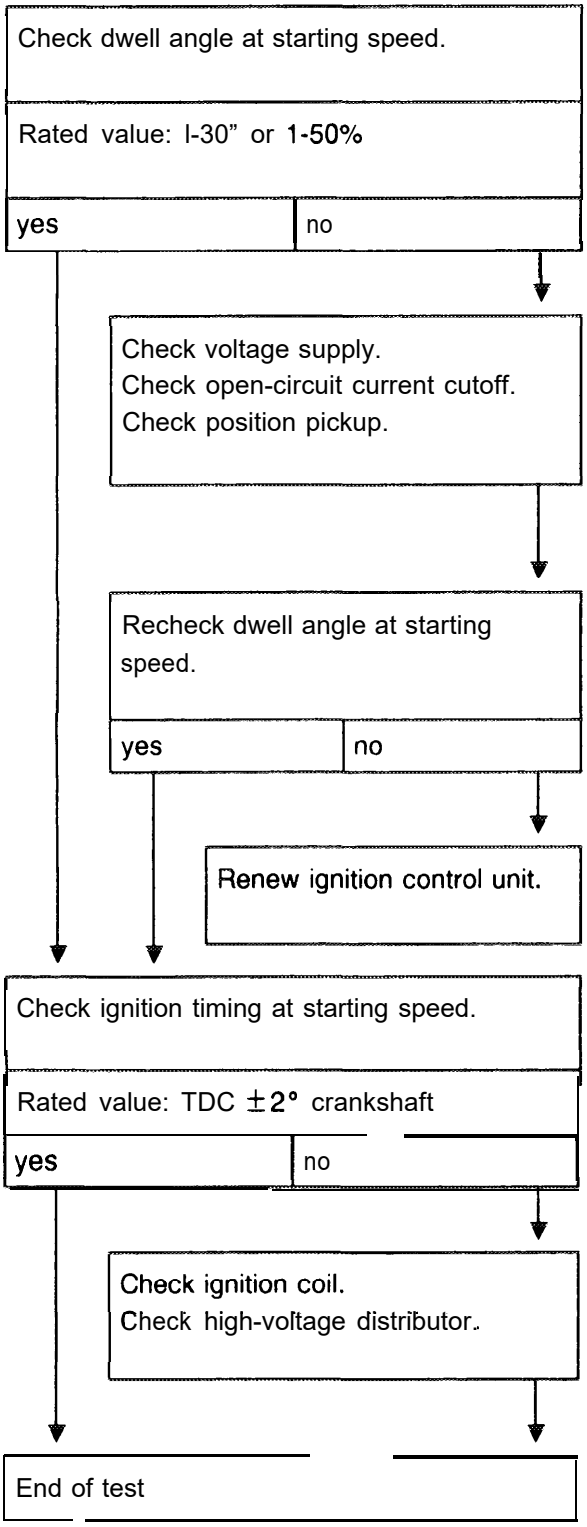
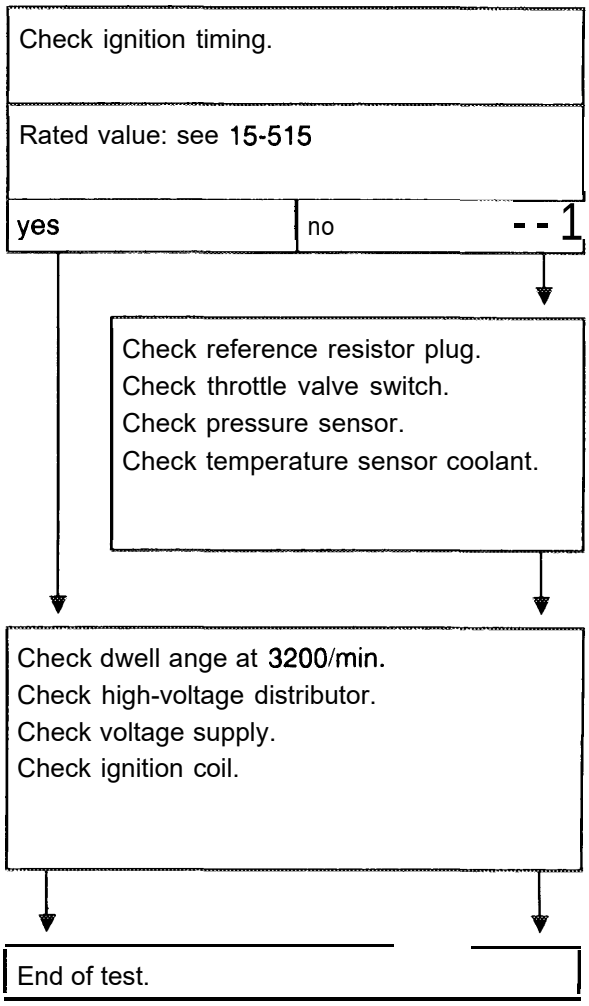
Test sequence - survey

A. Engine not running



Note
When complaint cannot be rectified, continue trouble diagnosis in CIS-E injection system.

B. Engine running



Note
When complaint cannot be rectified, continue trouble diagnosis in CIS-E injection system.

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Test values

Resistances (test values from O-100 °C)

Ignition coil	primary (terminals 1 and 15)	Ω	0,3-0,6
Ignition coil	secondary (terminals 1 and 4)	kΩ	8-13
Position pickup		Ω	680-1200
Distributor cap for each connection, distributor rotor, spark plug connector		kΩ	1

Voltages, engine not running, ignition switched on

Terminals 15 and 31 (jack 5 and 2 diagnostic socket)			Battery voltage
Between terminals 15 and 1 (jacks and 5 and 4 diagnostic socket)		V	0
Round plug 4-pole	terminals 15 and 31		Battery voltage
Round plug 4-pole	terminals 16 and 31		Battery voltage

Dwell angle

At starting speed	I-30" or 1-50%
At 3200/min	24-53° or 40-88%

Ignition timing

At starting speed	"crankshaft	TDC ± 2

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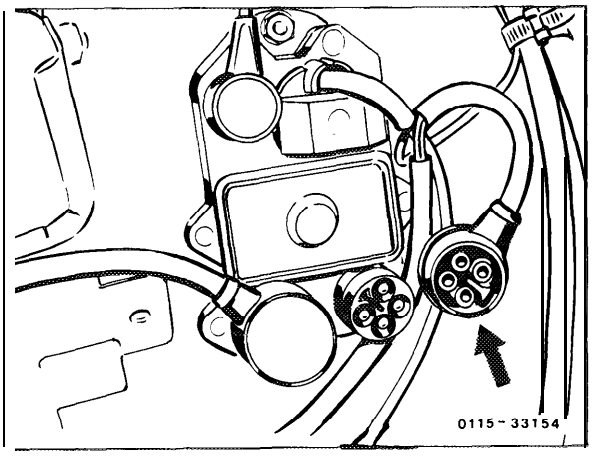
A. Engine fails to run

Check dwell angle at starting speed
Connect measuring instruments.
Start engine.
Check dwell angle on jack 1 of the diagnostic socket.

Rated value: l-30" or 1-50%

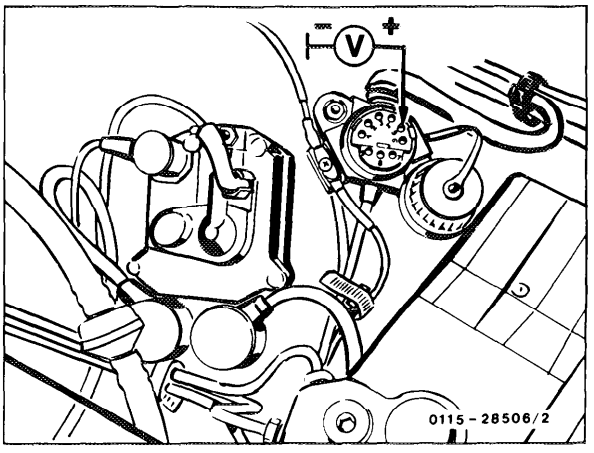
yes	no



Check voltage supply
Pull off 4-pole round supply plug on ignition control unit.
Switch on ignition.
Measure voltage on plug between terminal 15 (corresponding to jack 5 of the diagnostic socket) and terminal 31.

Rated value: battery voltage.

yes	no

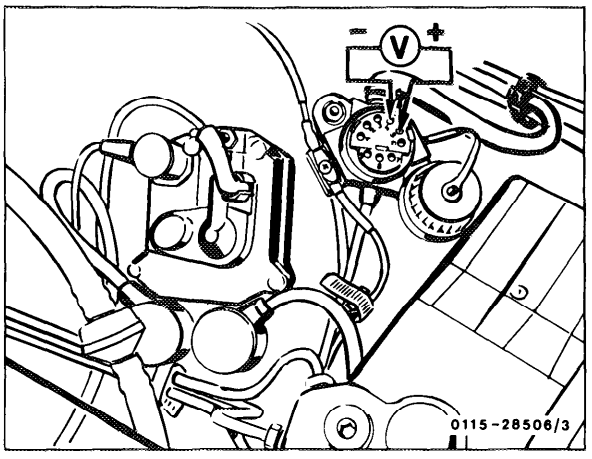


Check voltage supply via ignition lock.
Check ground cable.

Check open-circuit current cutoff
Check voltage differential between jacks 5 and 4 (terminals 15 and 1) of the diagnostic socket.

Rated value: 0 volt

yes	no



Renew ignition control unit and ignition coil.

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Check position pickup
Switch off ignition.

Pull ignition pickup plug off ignition control unit. Measure pickup resistance between terminals 7 and 31d with the ohmmeter.

Rated value: 680-l 200 Ω

yes	no

Renew position pickup.

Check position pickup for ground connection.

Check resistance between terminal 7 and vehicle ground.

Rated value: ≥200 kΩ or ∞

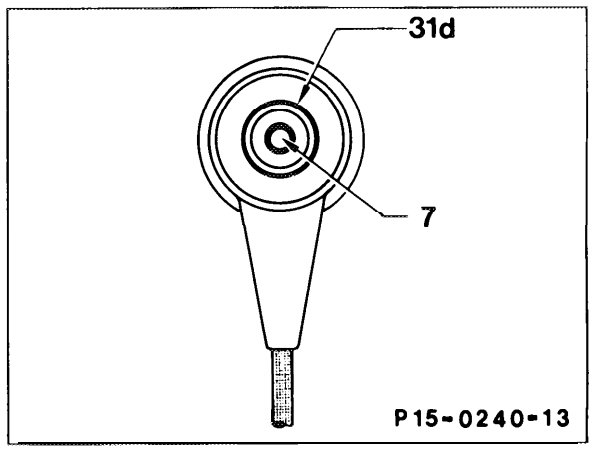
yes	no

Visual inspection of control cable.
Renew position pickup.

Check alternating voltage from the position pickup with the oscilloscope.
Pull off control cable.
Measure alternating voltage between terminals 7 and 31d at starting speed.

Rated value: $U_s \geq 1$ volt

yes	no



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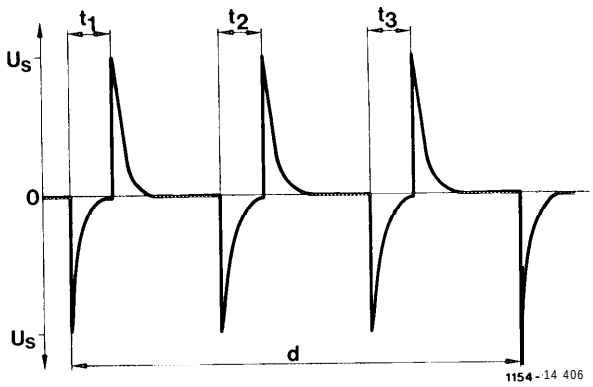
Renew position pickup.
If alternating voltage remains below rated value, check segments on the flywheel/driven plate.

t1 1st segment
t2 2nd segment
t3 3rd segment
d Period for one crankshaft rotation



Check dwell angle at starting speed

Connect measuring instruments.
Start engine.
Check dwell angle on jack 1 of the diagnostic socket (terminal TD).

Rated value: 1-30° or 1-50%

yes | no

Renew ignition control unit.

Check ignition timing at starting speed

Rated value: TDC ±2°

yes | no

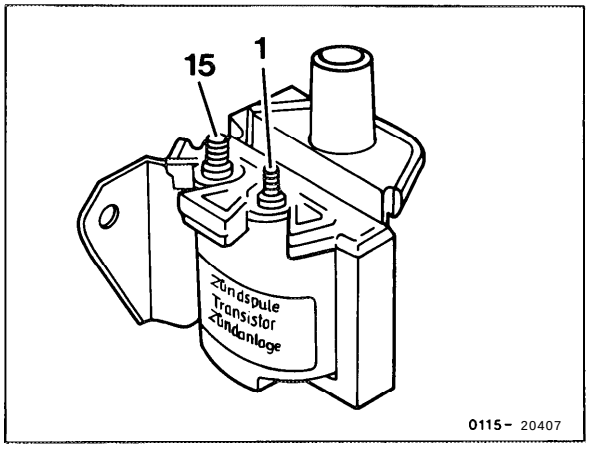
Check ignition coil

(Unscrew cables from the ignition coil).

Rated values:
Terminals 1 and 15: 0.3-0.6 Ω
Terminals 1 and 4: 8-13 kΩ

yes | no

Renew ignition coil.



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Check high-voltage distributor
Visually inspect distributor cap and rotor.
Measure interference suppression resistors.

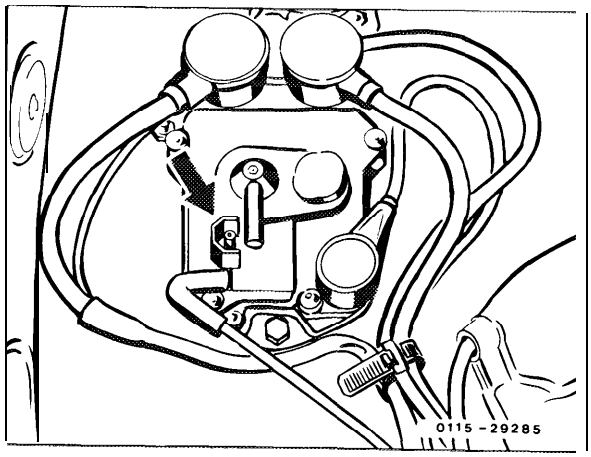
End of test.

B. Engine running

Check ignition timing
Engine at operating temperature.
Coolant temperature below 95 °C.
Check ignition timing at idle speed.
Check ignition timing at 3200/min with and without vacuum (disconnect vacuum line on control unit).
Observe reference resistor plug position.

Rated values: see 15-515

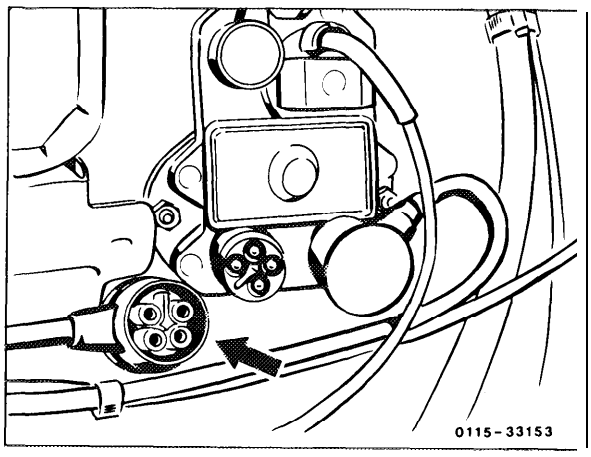
yes	no



Check reference resistor plug
a) Reference resistor plug (R16)
Compare engine version and reference resistor plug lettering. Pull 4-pole plug-pickup (arrow) off ignition control unit.
Measure resistance value between jack 3 and vehicle ground.

b) Individual reference resistor plug (R16/1)
Compare national version and part number.
Pull 4-pole plug-pickup (arrow) off ignition control unit.
Measure resistance value between jack 3 and vehicle ground.

yes	no



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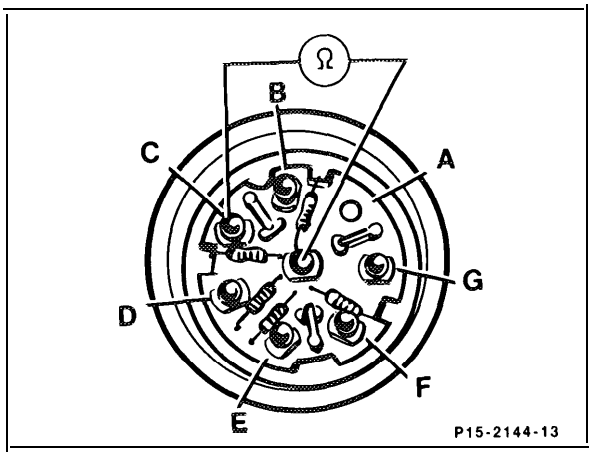
a) Reference resistor plug (R16)

Check resistance values in the reference resistor plug (between the outer and center plug pins).

Rated values for all reference resistor plugs:

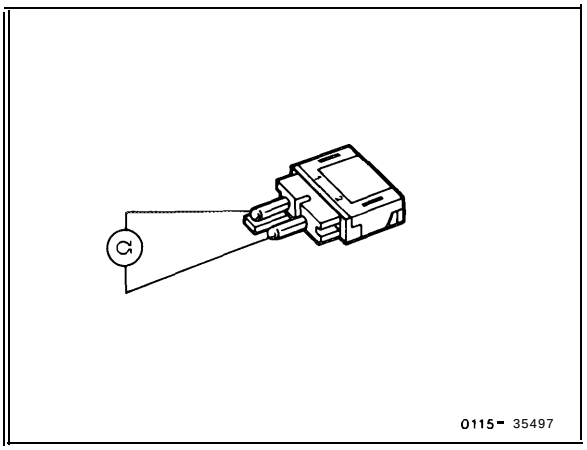
A		E	470 Ω
B	2.4 kΩ	F	220 Ω
C	1.3 kΩ	G	0 Ω
D	750 Ω		



b) Individual reference resistor plug (R16/1)

Check resistance values measure resistance values on the individual reference resistor plug between the two plug pins.

Part number	Resistance	National version
000 540 21 81	0 Ω	AUS
000 540 22 81	220 Ω	AUS
000 540 24 81	750 Ω	USA J



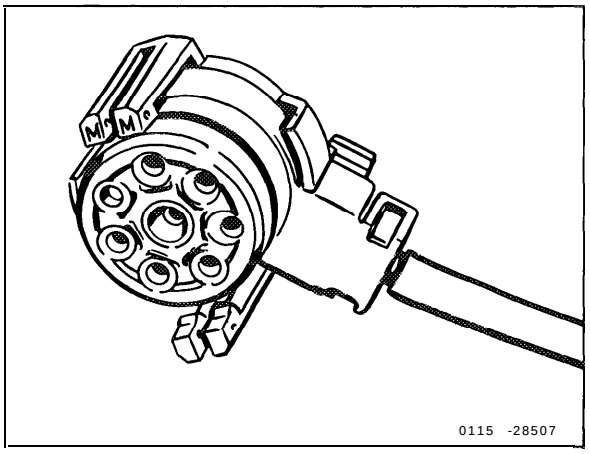
yes | no

Renew reference resistor plug.

Check cable to ignition control unit.
Check ground cable.
Check plug lower part.

yes | no

Renew damaged parts.



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Disconnect vacuum line on control unit.
Run engine at approx. 1200/min (not idling).
Ignition timing changes when turning the reference resistor plug.

yes	no

Renew ignition control unit.

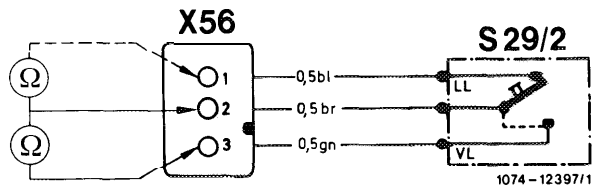
Check throttle valve switch
Disconnect coupling on throttle valve switch.
Check resistance of throttle valve switch.

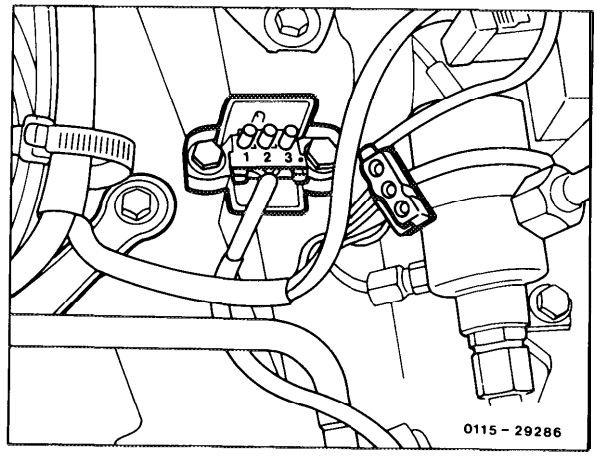
Idle speed position	approx. 0 Ω
Full load	approx. 0 Ω
Part load position	approx. ∞ Ω

yes	no

Adjust or renew throttle valve switch.

Check cable to ignition control unit.
Check ground cables.





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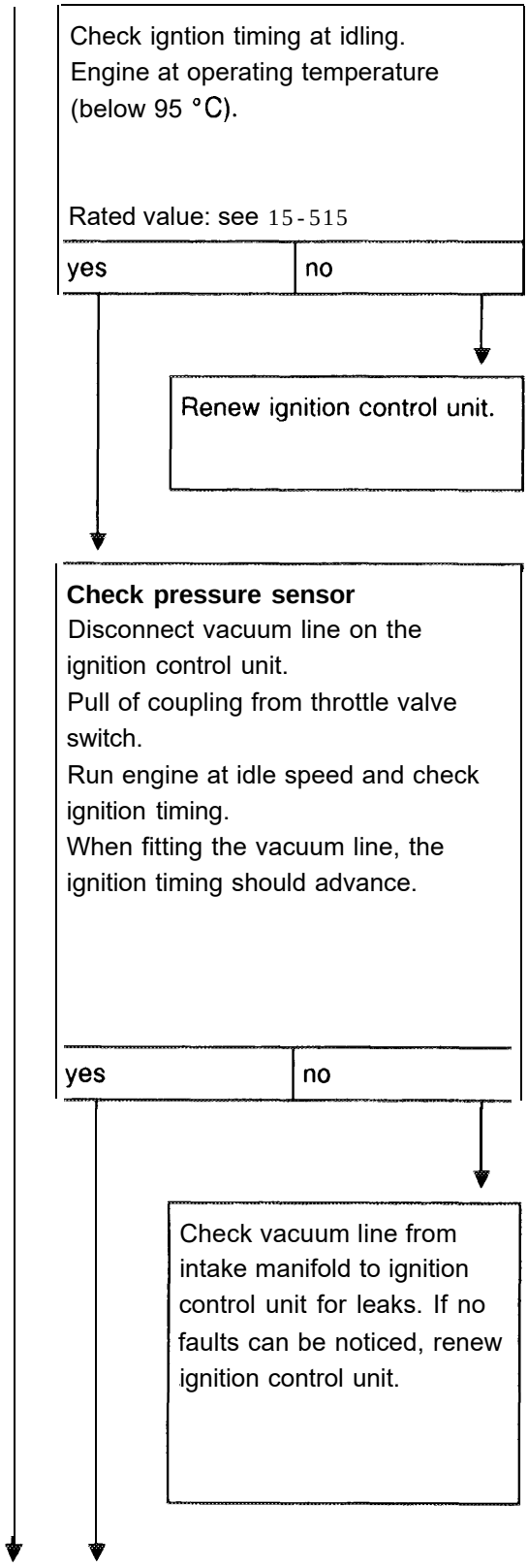

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Check temperature sensor, coolant

Disconnect 4-pole plug-pickup on control unit.

Measure resistance between jack 1 and ground.

Rated value see diagram.

Check resistance at two temperatures.

Example:

+ 20 °C ⇒ 2.28-2,72 kΩ

+ 80 °C ⇒ 290-364 Ω

yes	no

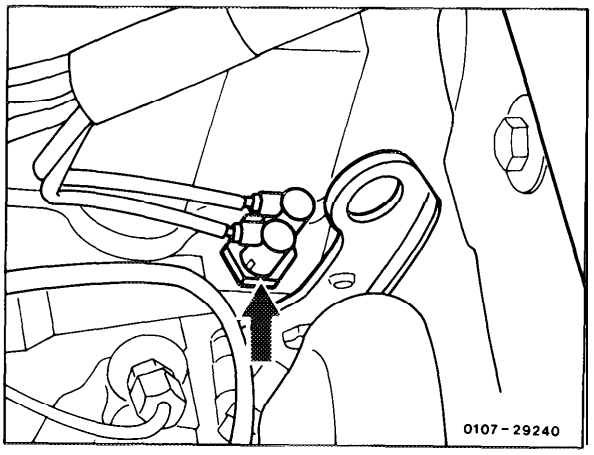
Check cable.
Renew temperature sensor, coolant.

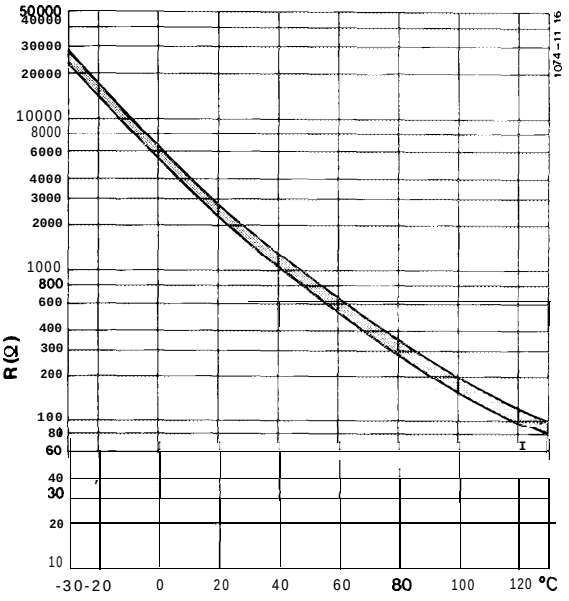
Check ignition timing at 3200/min without vacuum.

Rated value: see 15-515

yes	no

Renew ignition control unit.





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Check dwell angle at 3200/min

Vacuum line and 4-pole plug (pickup) on ignition contol unit connected.
Run engine at 3200/min.
Check dwell angle

Rated value: 24-53° or 40-88%

yes	no

Renew ignition control unit.

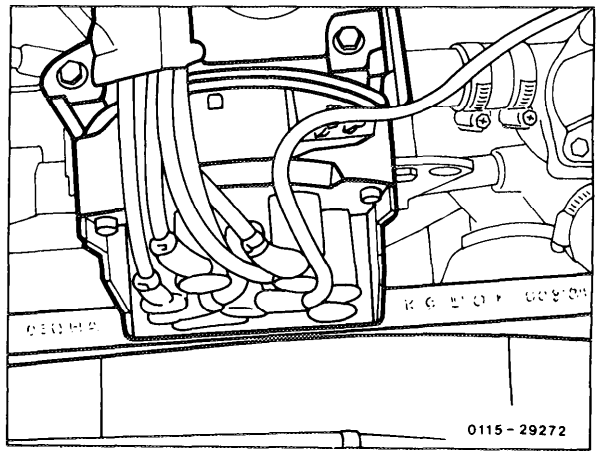
Check high-voltage distributor

Visually inspect distributor cap and rotor.
Measure interference suppression resistors.

Rated value: 1 kΩ

yes	no

Renew parts.



Check voltage supply

Measure voltage drop:
Remove ignition coil cover.
Connect measuring instrument to negative terminal of battery.
Run engine.
Measure voltage on the positive terminal of the battery and subsequently on terminal 15 of the ignition coil.

Rated value: voltage differential < 1 volt

yes	no

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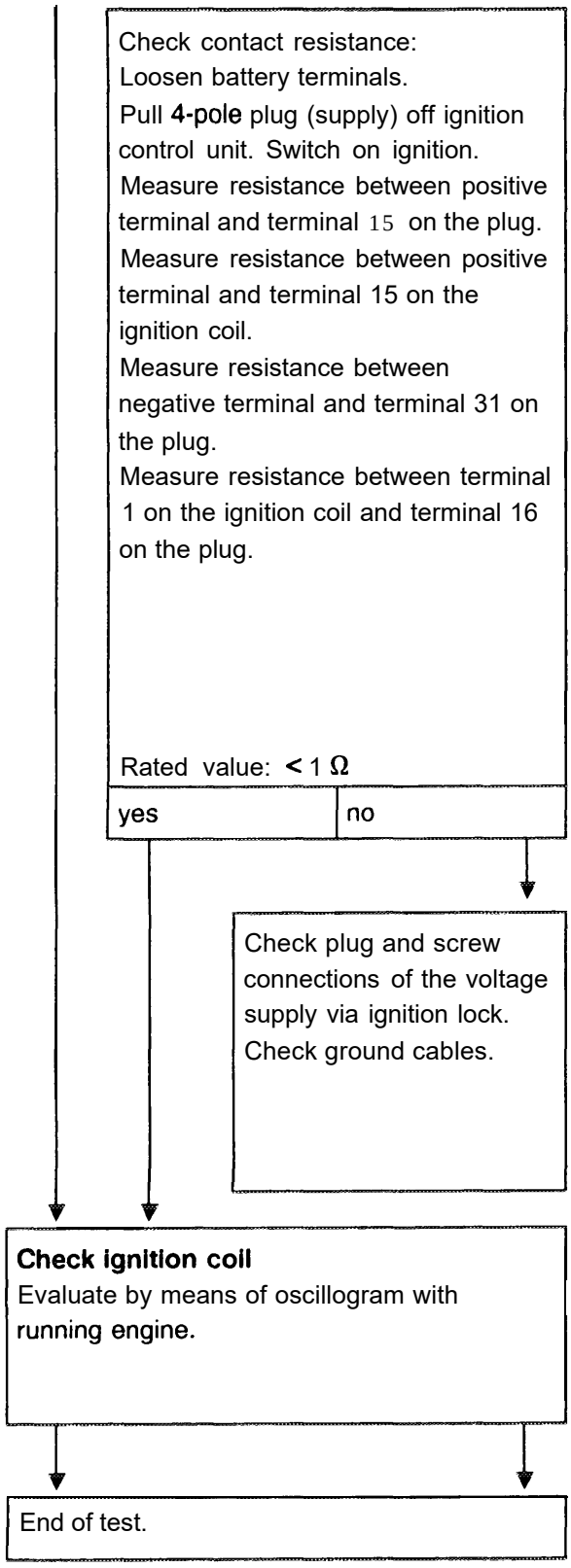

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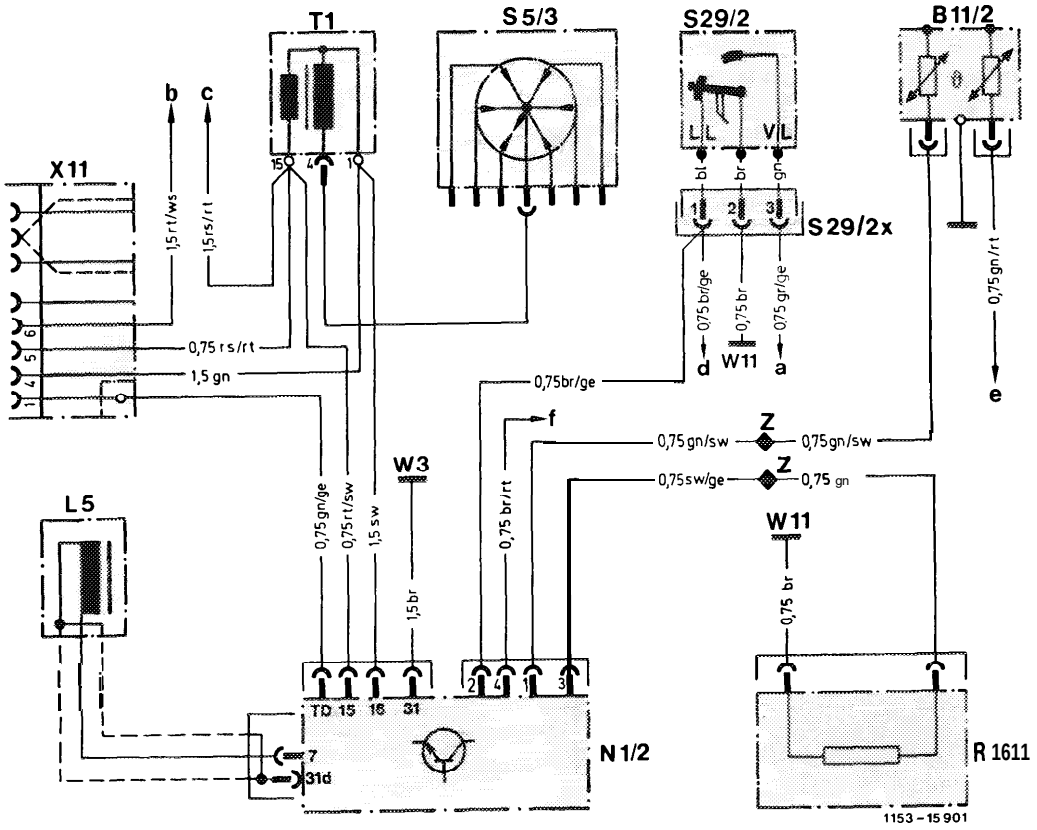

Circuit diagram electronic ignition system with variable characteristics EZL, model 124 (AUS) (J) (USA)

B11/2	Temperature sensor, coolant (EZL, CIS-E, 2 E-E)
L5	Position pickup, crankshaft
N1/2	Control unit transistorized ignition system (EZL)
R16	Reference resistor plug (EZL)
S5/3	High-voltage distributor
S29/2	Throttle valve switch, full load/idle speed detection
S29/2x	Plug connector throttle valve switch
T1	Ignition coil
W3	Ground, inner wing front left (ignition coil)
W11	Ground engine (electric line screwed on)
x11	Diagnostic socket/line connector, terminal TD
Z	End sleeve (soldering connector in cable harness)
a	CIS-E control unit, jack 5
b	Via plug connector X26 jack 3 to fuse 9, terminal 30
c	Via plug connector X26 jack 1 to fuse 7, terminal 15
d	CIS-E control unit, jack 13
e	CIS-E control unit, jack 21
f	Cable ends in cable harness

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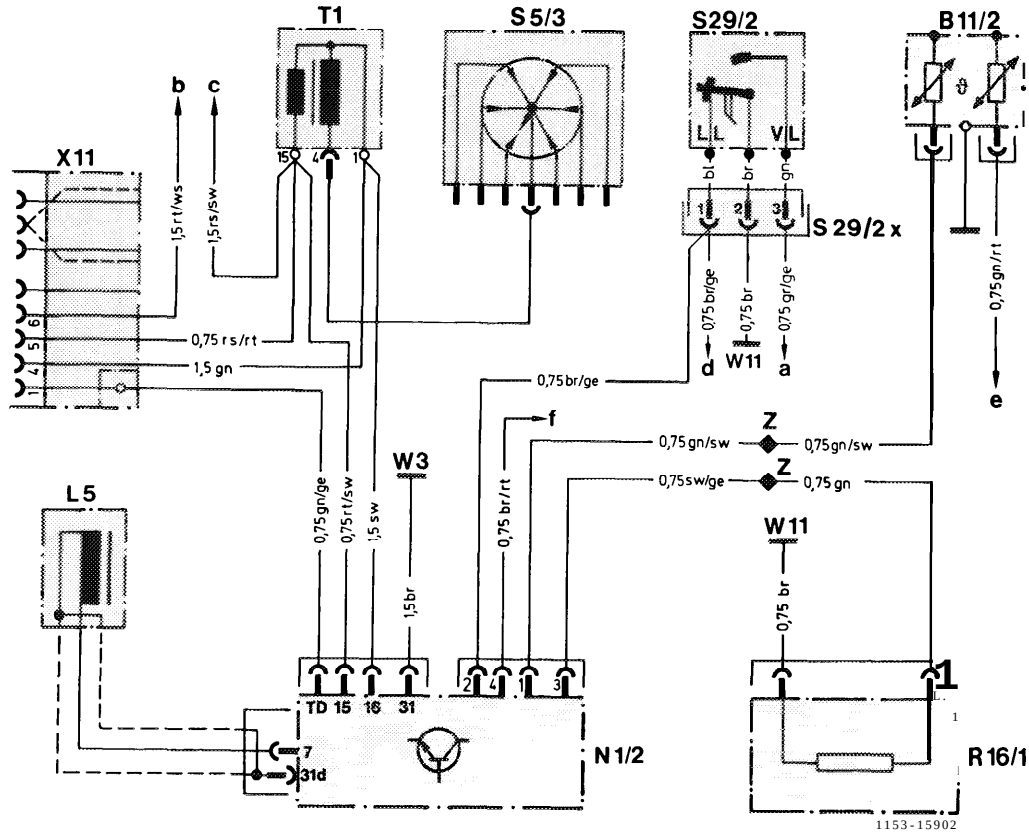

Circuit diagram electronic ignition system with variable characteristics EZL, model 126 (AUS) (J) (USA)

B11/2	Temperature sensor, coolant (EZL, CIS-E, 2 E-E)	a	CIS-E control unit, jack 5
L5	Position pickup, crankshaft	b	Via plug connector X26 jack 3 to fuse 2, terminal 30
N1/2	Control unit transistorized ignition system (EZL)	c	Via plug connector X26 jack 1 to fuse 7, terminal 15
R16	Reference resistor plug (EZL)	d	CIS-E control unit, jack 13
S5/3	High-voltage distributor	e	CIS-E control unit, jack 21
S29/2	Throttle valve switch, full load/idle speed detection	f	Cable ends in cable harness
S29/2x	Plug connector throttle valve switch		
T1	Ignition coil		
W3	Ground, inner wing front left (ignition coil)		
W11	Ground engine (electric line screwed on)		
x11	Diagnostic socket/line connector, terminal TD		
Z	End sleeve (soldering connector in cable harness)		

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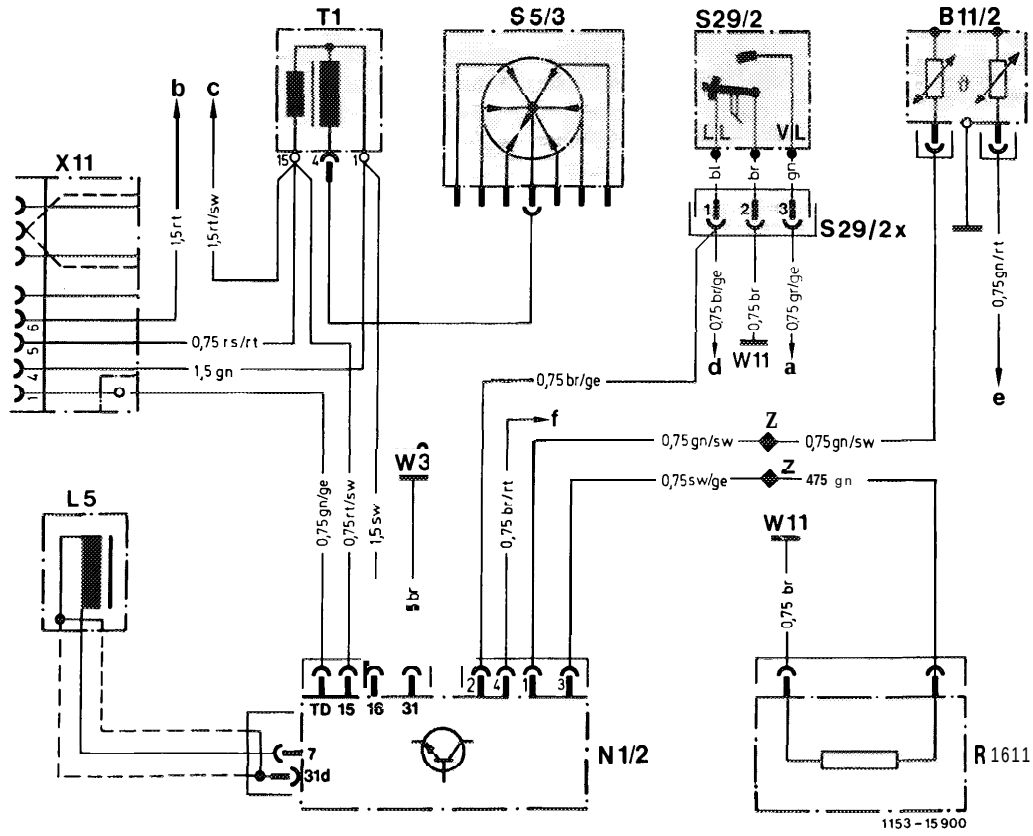

Circuit diagram electronic ignition system with variable characteristics EZL, model 201 (AUS) (J) (USA)

Bl 1/2	Temperature sensor, coolant (EZL, CIS-E, 2 E-E)
L5	Position pickup, crankshaft
N1/2	Control unit transistorized ignition system (EZL)
R16	Reference resistor plug (EZL)
S5/3	High-voltage distributor
S29/2	Throttle valve switch, full load/idle speed detectron
S29/2x	Plug connector throttle valve switch
TI	Ignition coil
W3	Ground, inner wing front left (ignitioncoil)
W11	Ground engine (electric line screwed on)
x11	Diagnostic socket/line connector, terminal TD
Z	End sleeve (soldering connector in cable harness)
a	CIS-E control unit, jack 5
b	To central electric system connector S jack 11, terminal 30
c	To central electric system connector S jack 4, terminal 15
d	CIS-E control unit, jack 13
e	CIS-E control unit, jack 21
f	Cable ends in cable harness

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Job No.

Engine oil and filter change . . . . . 18 – 002
Removing, installing oil filter . . . . . - 110
Removing, installing oil pump . . . . . – 210
Renewing oil pump chain . . . . . – 212
Removing, installing oil pressure relief valve in oil pump . . . . . – 215
Removing, installing oil level sensor . . . . . – 330
Renewing oil level return lock . . . . . - 415

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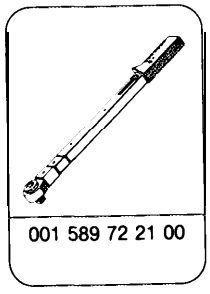
18-002 Engine oil and filter change

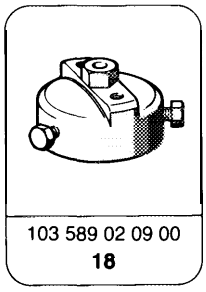
Job No. of job texts and job values or standard texts and flat rates 00-6200

Engine oil	drain or extract (25 Nm).
Cover (3) with seal (4)	unscrew, screw on (20 Nm), renew seal (4).
Filter element (5)	renew.
Cap(6)	open, close.
Engine oil	pour in.
Engine	run.
Oil level and leaktightness	check.

Special tools



001 589 72 21 00



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18

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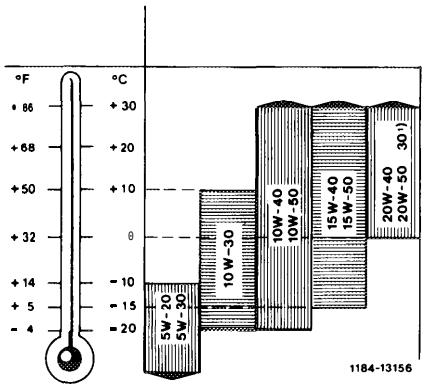
Specified viscosity classes according to SAE at prolonged outside temperatures



1) At prolonged outside temperature above + 30 °C SAE 40 may be used.

Precise use of the SAE classes according to the outside air temperatures would necessitate frequently changing engine o The temperature limits for the SAE classes should therefore be regarded as a guide which may be transgressed for brief periods.

In moderate climatic zones SAE 30 may be used from April onward for all engine versions.

The following oils may be used as an all-season oil for all gasoline engines

SAE 10 W-40 and SAE 10 W-50	
SAE 5 W-20	below+ 10 °C
SAE 5 W-30, 10 W-30	all-year-round in moderate climatic zones, i.e. up to + 30 °
SAE15 W-30	all-year-round in moderate climatrc zones

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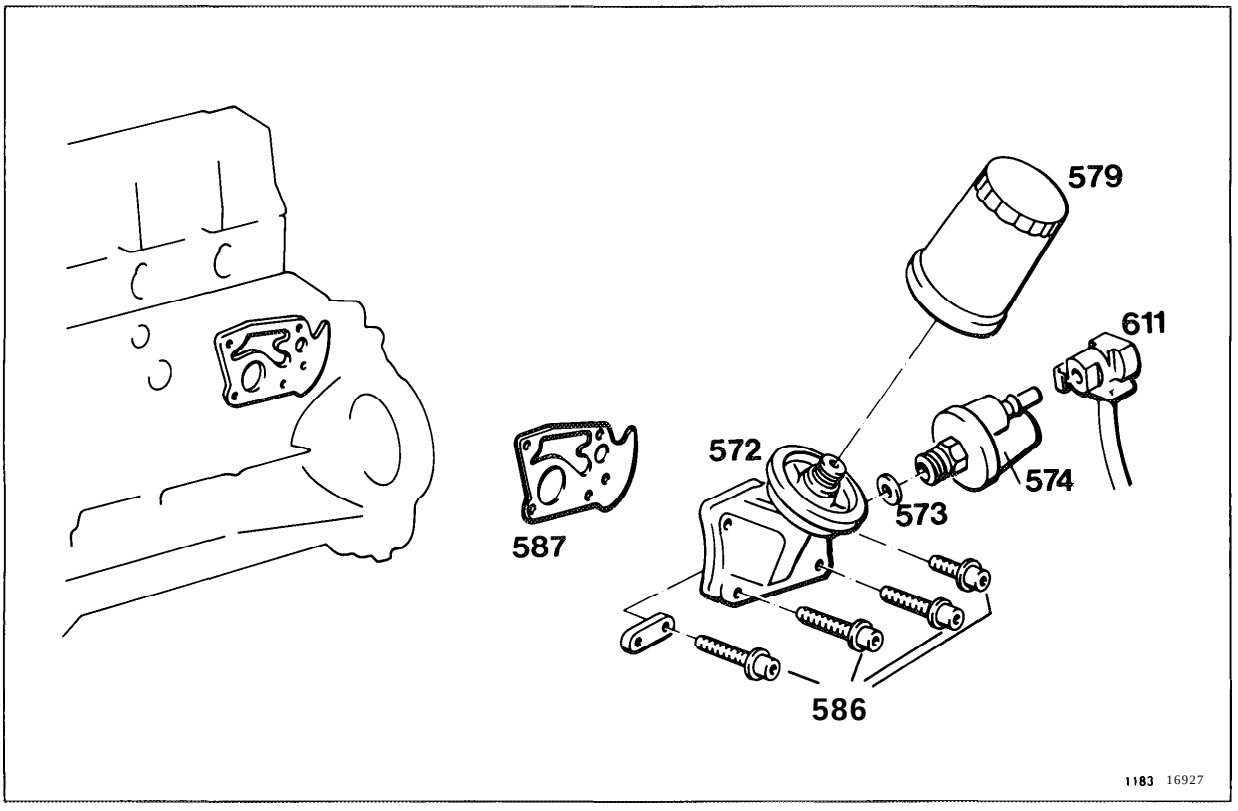
Job No. of job texts and job values or standard texts and flat rates ..... 18-3090 - 18-3800

Model 124



Hood	raise to vertical position (01-008).
Air filter	remove, install (09-400).
Replaceable cartridge (579)	remove, install, approx. 20 Nm (step 2).
Connector (611)	detach, plug in (step 3).
Oil filter housing (572)	remove, install, bolts (586) 25 Nm. Oil seal.
Sealing surfaces	clean.
(Gasket 587)	renew.
Oil level in engine	check.
Leaktightness check	perform.

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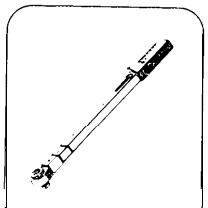
Special tools



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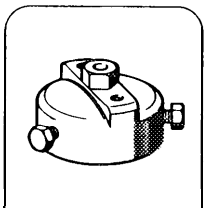

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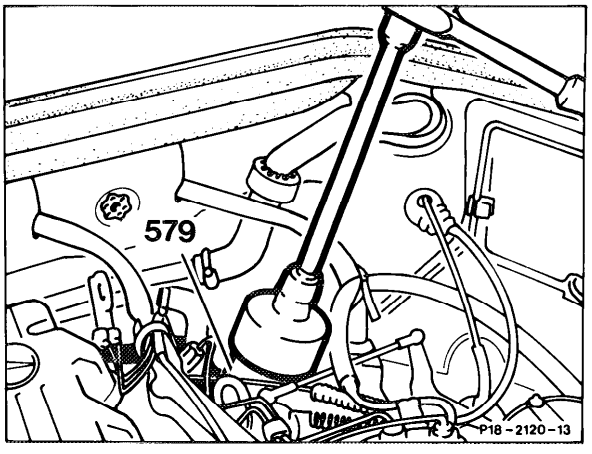
18

Removal, installation

1 Raise hood to vertical position (01-008).

2 Remove air filter (09-400).

3 Use socket wrench insert 103 589 02 09 00 to unscrew replaceable cartridge (579).



Installation instruction

Apply a light coating of oil to gasket (arrows) of replaceable cartridge, screw on and tighten by hand. Following this, turn on 1/4 turns (90°) with the socket wrench insert 103 589 02 09 00.

118-28819

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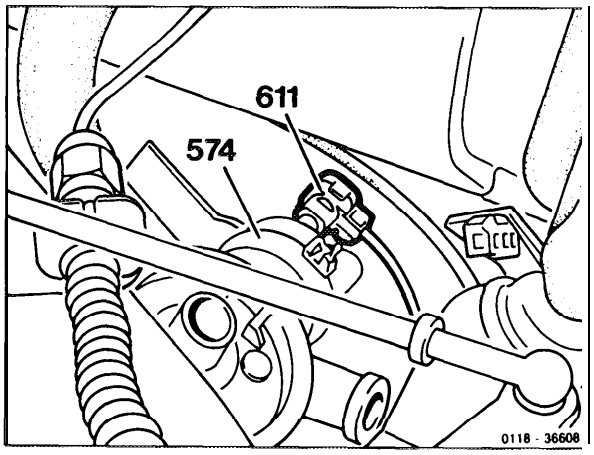
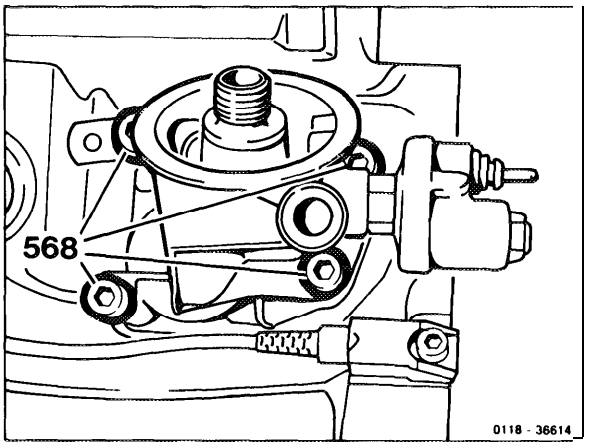
4 Detach connector (611) from oil pressure sensor (574).



5 Unscrew bolts (568) and take off oil filter housing.
Tightening torque 25 Nm.



Installation instruction
Clean sealing surfaces and renew gasket.

Install in the reverse order.

6 Check oil level in engine.

7 Perform leaktightness check.

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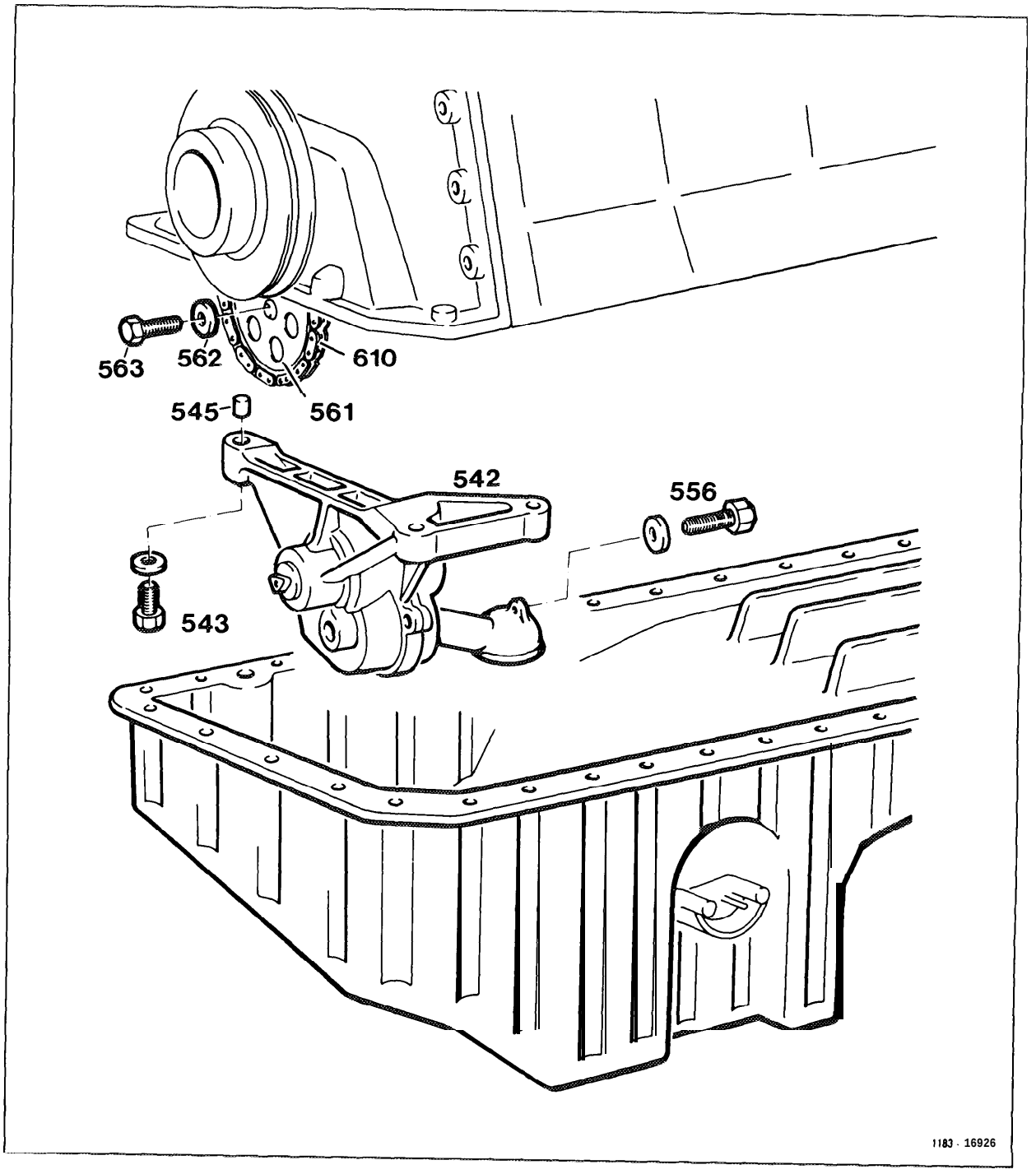
Job No. of job texts and job values or standard texts and flat rates ..... 18-6020 - 18-6025



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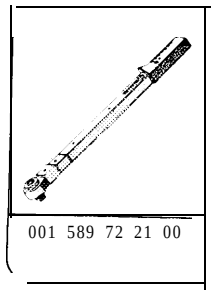
Oil sump	remove, install (01-310).
Bolt (563) with washer (562)	unscrew, screw in. Tightening torque 32 Nm. Detach oil pump drive gear (561) with oil pump chain (610), fit on (step 2). Pay attention to installation instruction.
Bolts (543, 556)	unscrew, screw in. Tightening torque 25 Nm (step 3).
Oil pump (542)	remove, install.

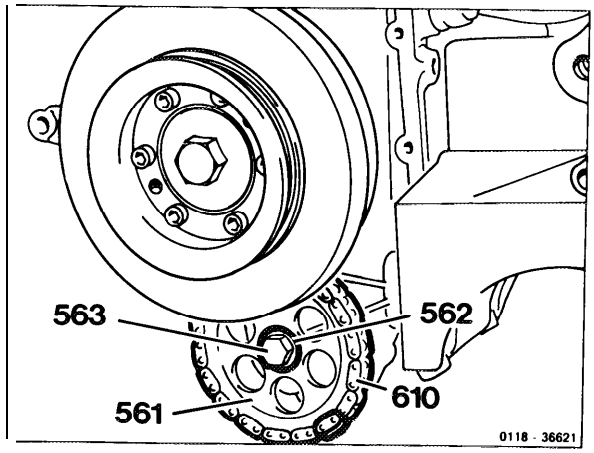
Special tool



Removal, installation

1 Remove oil sump (01-310).

2 Unscrew bolt (563) with washer (562), tightening torque 32 Nm. Detach oil pump drive gear (561) together with oil pump chain (610).



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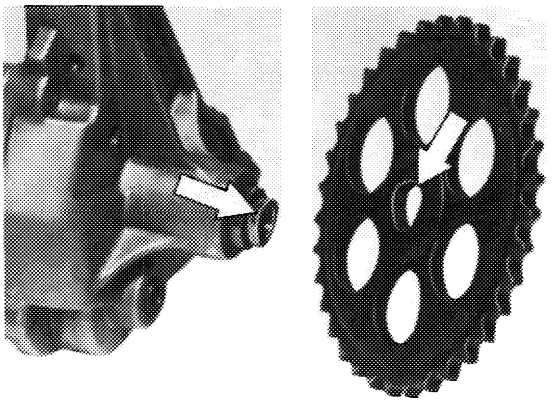
Installation instruction

Install oil pump drive gear with the curved face (arrow) toward the oil pump.



116 ▬ 26004

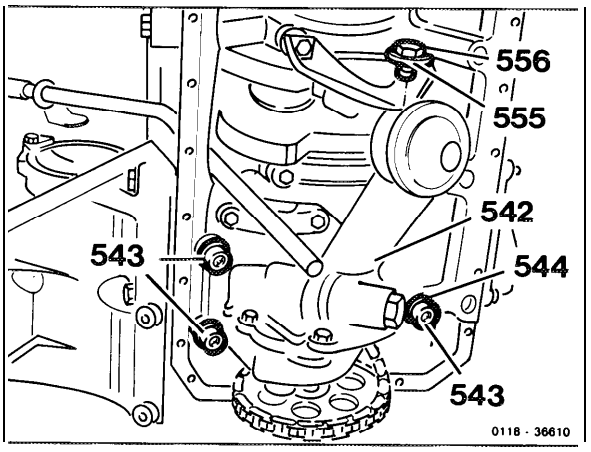
3 Unscrew bolt (543, 556) together with washers (544, 555), tightening torque 25 Nm.

4 Remove oil pump (542).

Note

The oil pump (542) is located by two roll pins.

Install in the reverse order.



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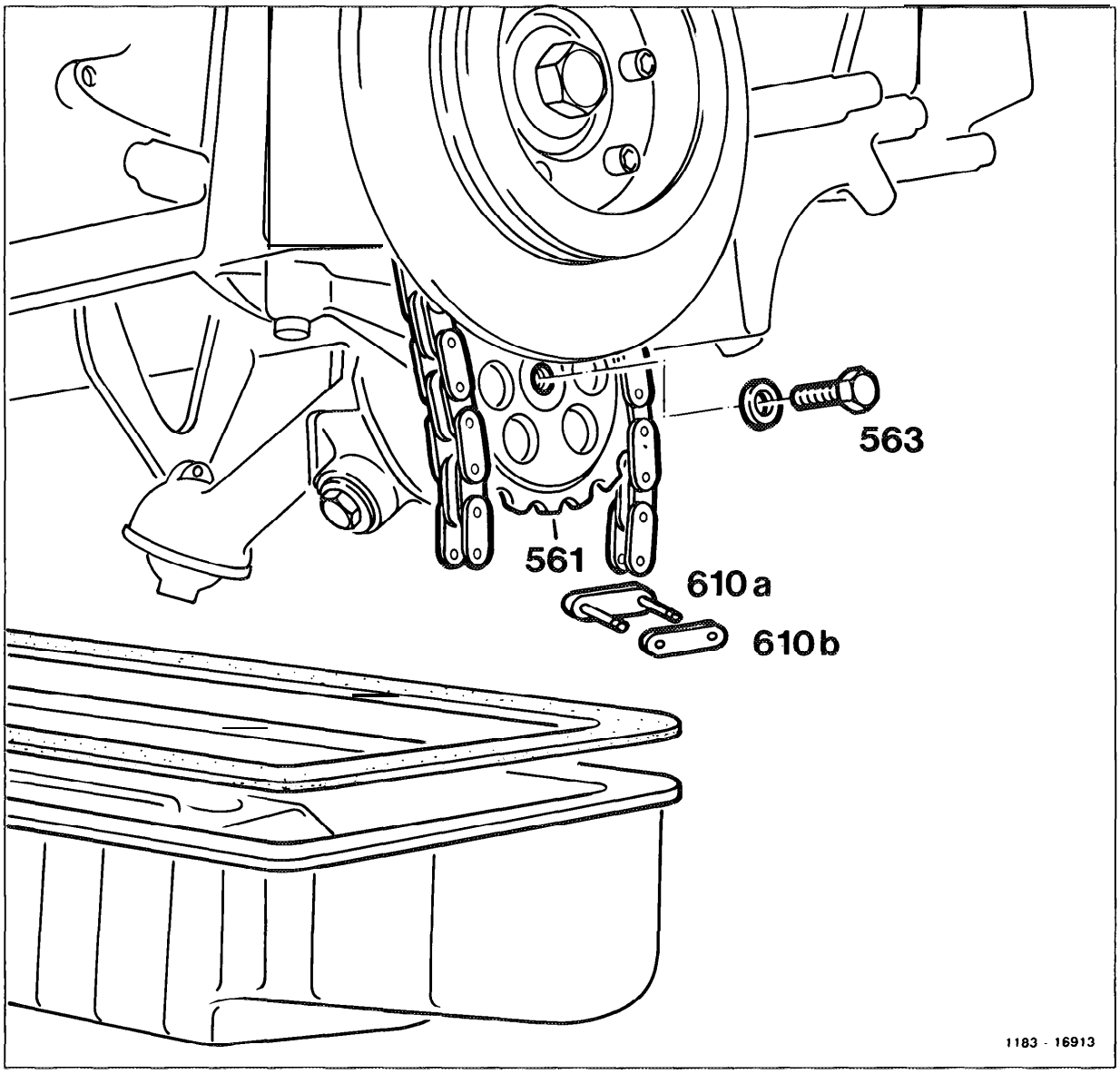
18-212 Renewing oil pump chain

Job No. of job texts and job values or standard texts and flat rates .....



Oil sump	remove, install (01-310).
Bolt (563)	slacken, tighten, 32 Nm (step 2).
Rivet link pins	grind open (step 3).
Oil pump drive gear (561)	renew (steps 4 and 5).
New oil pump chain with old oil pump chain	connect, fit on (steps 6 and 7).
Rivet link (610a)	insert in oil pump chain from behind (step 8).

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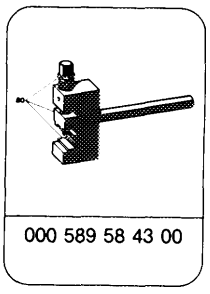
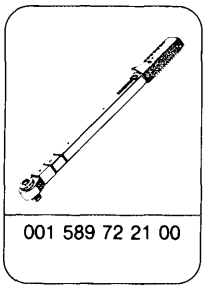
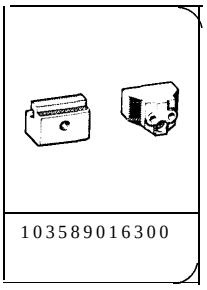
Plate (610b)	insert into rivet tool, press on (steps 11 to 13).
Individual rivet link pins of oil pump chain	rivet, 30 Nm (step 15).

Special tools







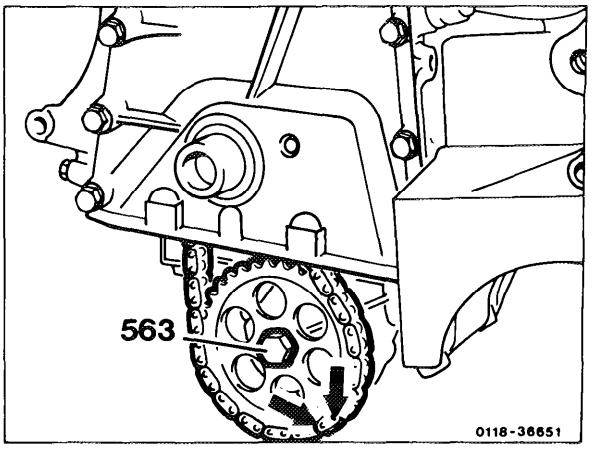
Note
When renewing the oil pump chain, the oil pump drive gear should also be renewed.

Removal, installation

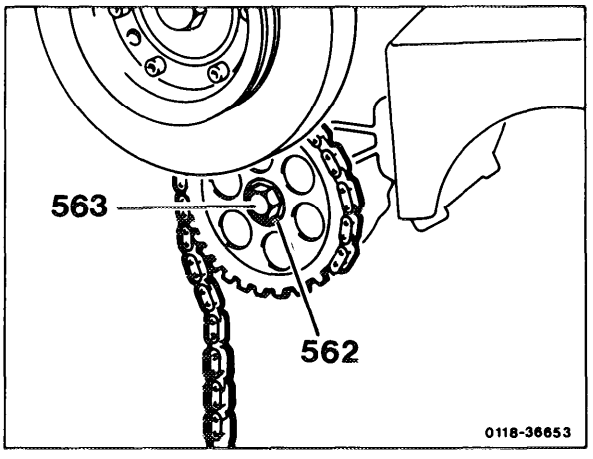
1 Remove oil sump (01-310).

2 Slacken bolt (563). Tightening torque 32 Nm.

3 Grind open both rivet link pins (arrows) on **one double link** of the oil pump chain. Press out ground open double link.



4 Unscrew bolt (563) together with washer (562).



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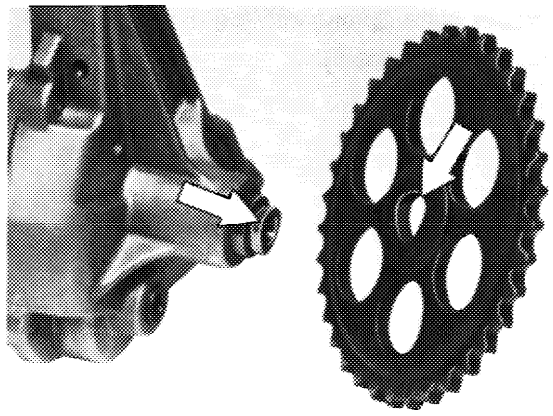
5 insert new oil pump drive gear with the curved face toward the oil pump.



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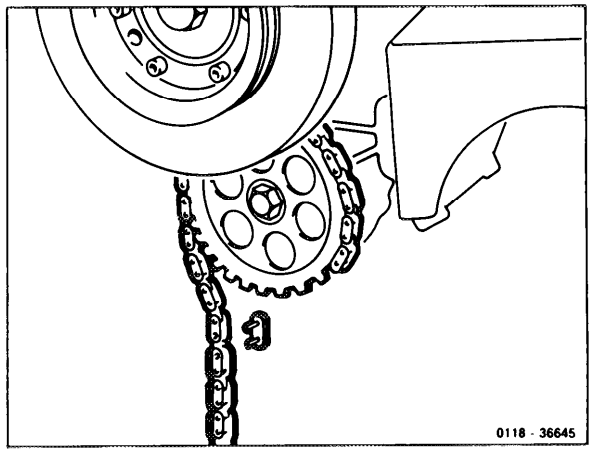
6 Attach new oil pump chain to the old oil pump chain with the rivet link.

7 Pull in new oil pump chain connected to old chain, by slowly turning the crankshaft in the direction of rotation of the engine.

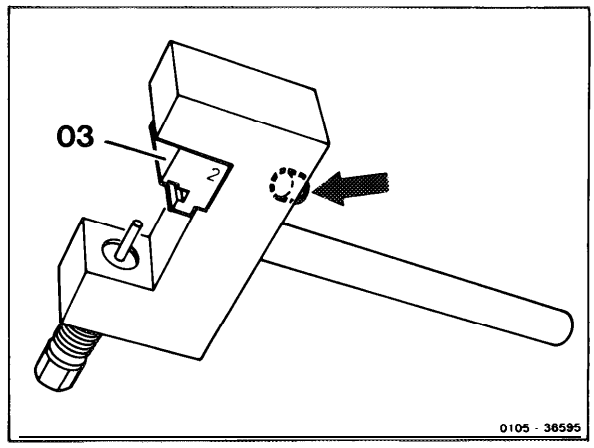
8 Detach old oil pump chain. Insert rivet link into the new oil pump chain from behind.



0118 - 36645

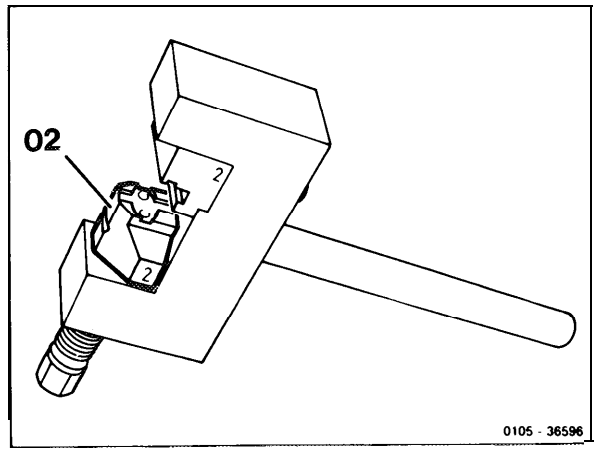
9 Insert thrust piece (03) into the rivet tool as shown in the drawing and tighten with the screw (arrow).

Note
The figure 2 is stamped on the side of the thrust piece (03).



0105 - 36595

10 Insert moving jaw (02) with the figure 2 into the rivet tool as shown in the drawing.



0105 - 36596

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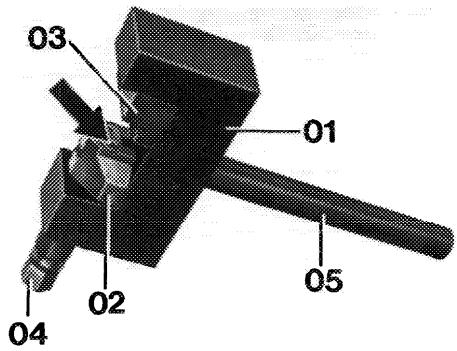
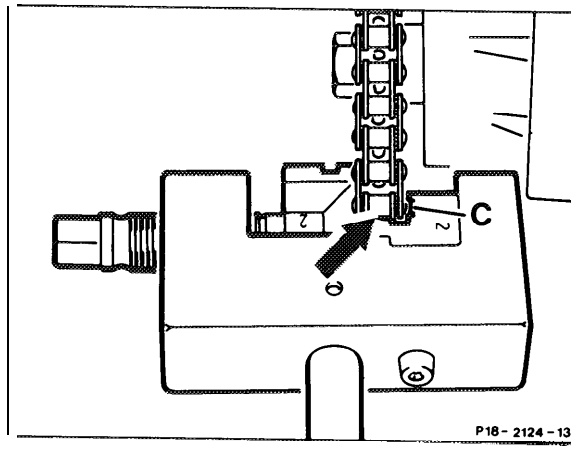
11 insert plate (arrow) into the moving jaw (02) (sticks by magnetism).



12 Place web (arrow) onto both rollers on the rivet link.

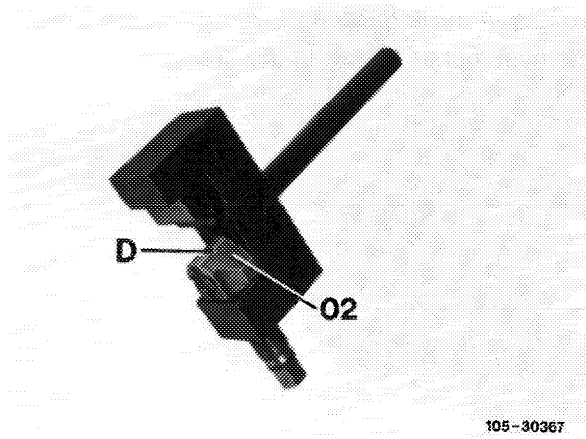
Note
Rivet heads of the rivet link pins must be guided in the slot (C).



13 Screw in spindle (04) until a firm resistance is felt.

Note
When screwing in, ensure that the pins of the rivet link are guided in the hose of the plate.

14 Take off rivet tool and change over the moving jaw (02) to the rivet profile (D).



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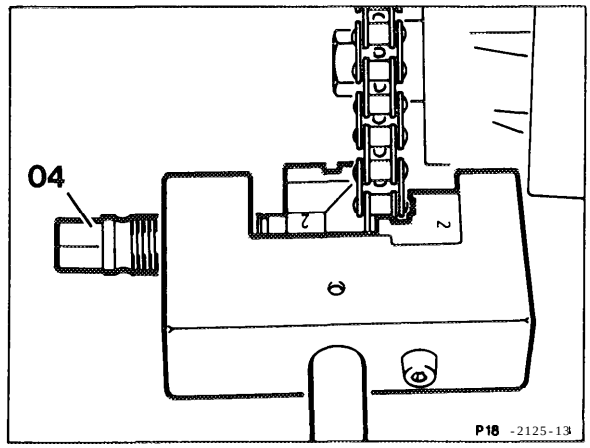
15 Position rivet tool exactly in centre of rivet link pin.
Rivet pins of the rivet link individually by tightening the spindle (04) to 30 Nm.

16 Check riveting, re-rivet if necessary.

17 Install in the reverse order.



18 Fit bolt (563) together with washer (562).
Tightening torque 32 Nm.

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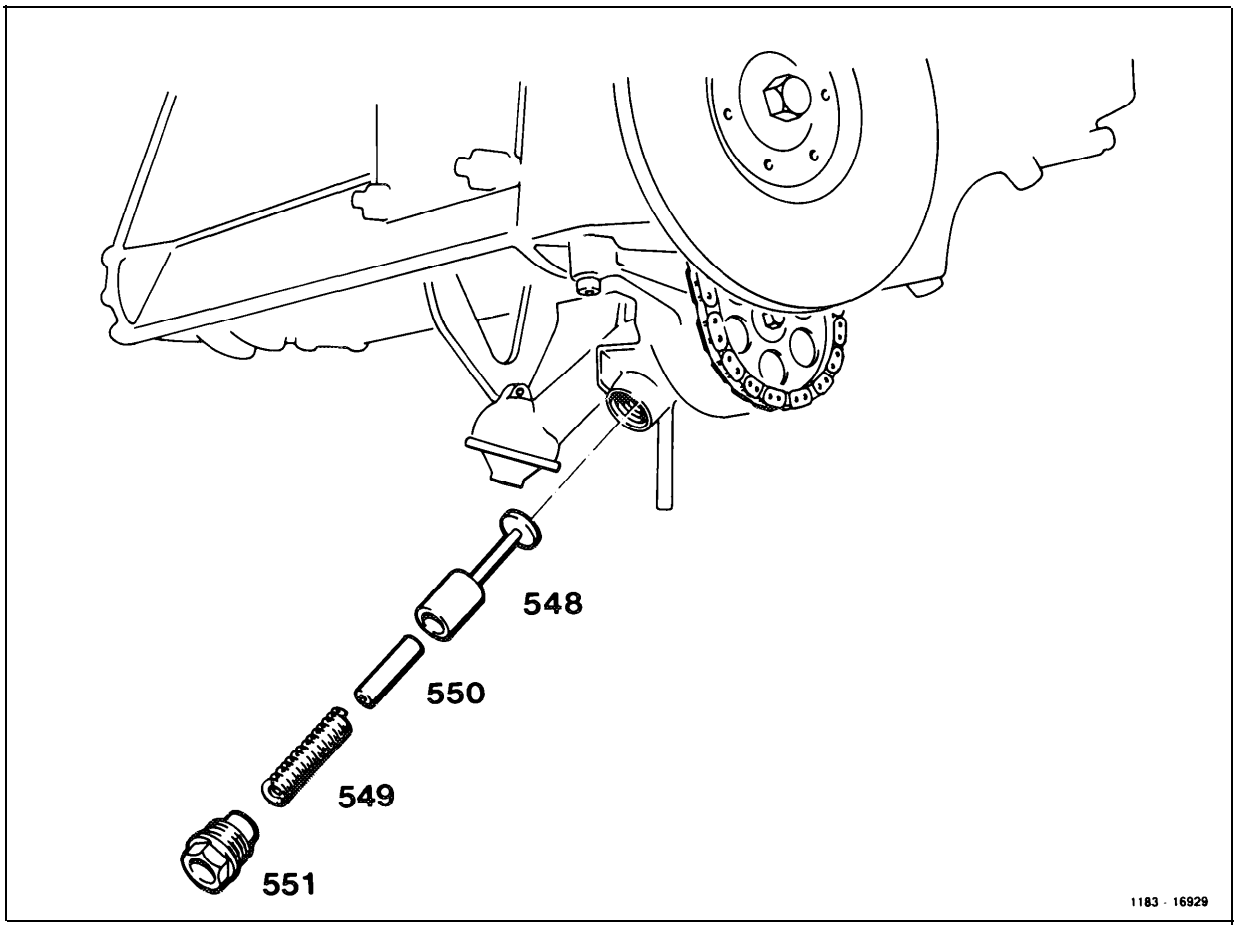
Job No. of job texts and job values or standard texts and flat rates 18-5043



Oil sump	remove, install (01-310).
Screw plug (551)	unscrew, tighten, 50 Nm, special tool 001 589 60 21 00. ⚠ Screw plug is pressurized by spring.
Compression spring (549)	remove, install.
Guide pin (550)	remove, install.
Piston (548)	remove, install.

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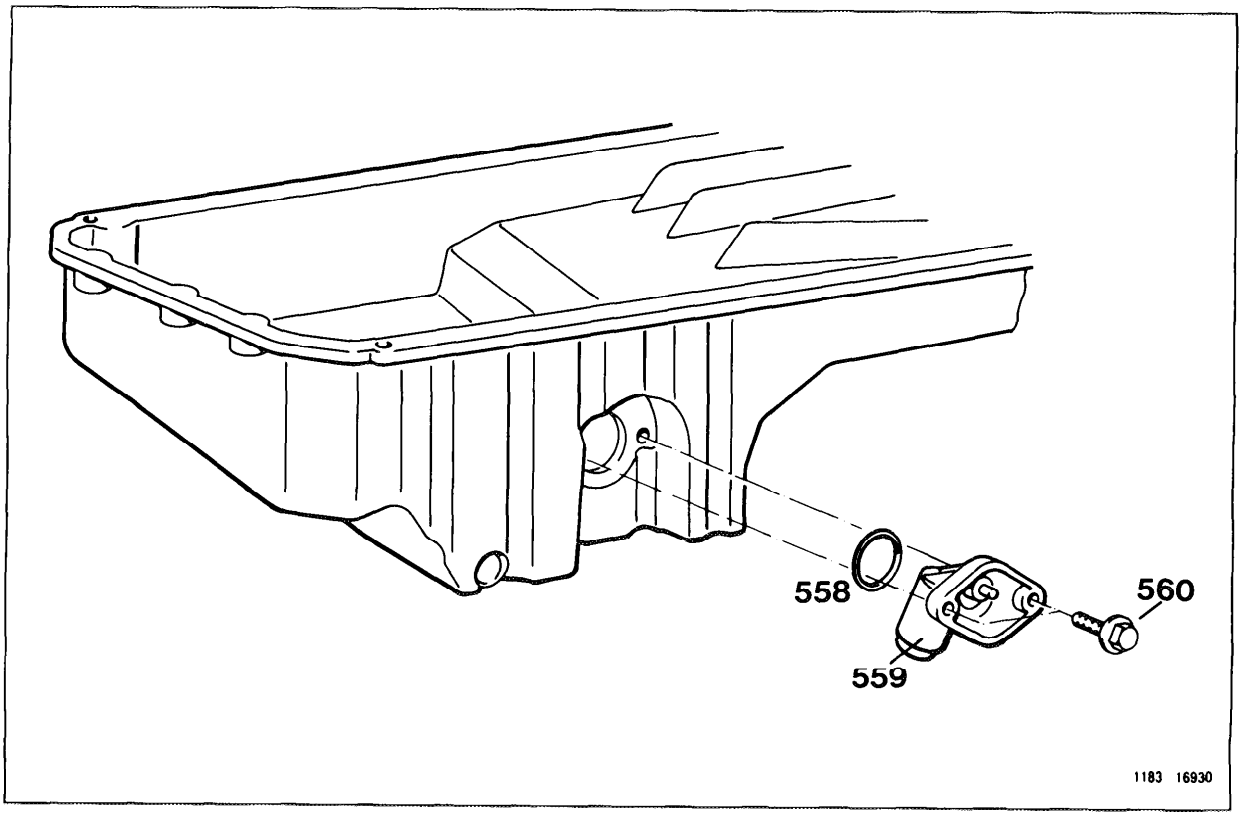
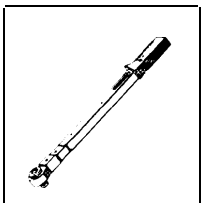
18-330 Removing, installing oil level sensor

Job No. of job texts and job values or standard texts and flat rates 18-4111, 18-4113



Engine compartment covering below	.....	remove, install.
Engine oil (approx. 2.5 litres)	.....	extract or drain, tightening torque of oil drain plug 25 Nm.
Bolts (560)	.....	unscrew, screw in, 10 Nm. Remove, install oil level sensor (559) (step 4). Renew O-ring (558).

Special tool



001 5896621 00

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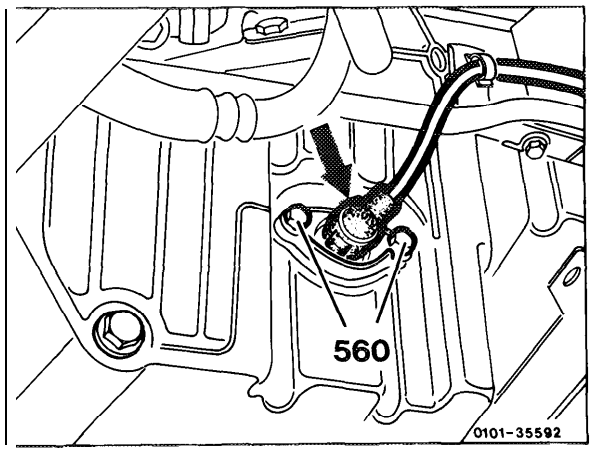
Note
The dynamic oil level gauge monitors the oil level in the sump when the engine is running and when oil temperature is about 60 °C.

Removal, installation



1 Remove engine compartment covering below.

2 Partially drain or extract engine oil.

3 Detach cable connector (arrow) from the oil level sensor.

4 Unscrew bolts (560), tightening torque 10 Nm.

5 Remove oil level sensor.

Installation instruction
Renew O-ring from oil level sensor.

Install in the reverse order.

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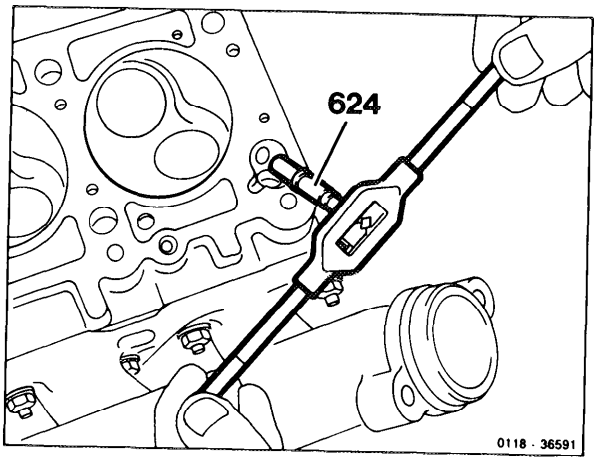
18-415 Rmewing oil level return lock

Job No. of job texts and job values or standard texts and flat rates .....

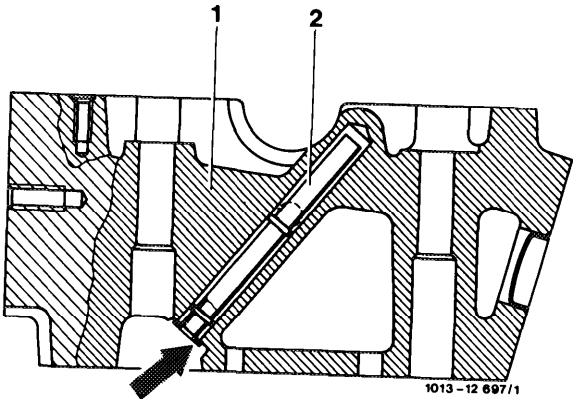
Removal, installation

1 Remove cylinder head (01-415).

2 Screw left-hand spiral drill into the oil nozzle return lock (624) and withdraw.



3 Use a suitable drift to knock in oil nozzle return lock as far as the collar (arrow).



Note
As from 12/86 an oil nozzle return lock with collar (arrow) is installed in the cylinder head.

4 Install cylinder head (01-415).

When performing repairs, install oil nozzle with collar (arrow) (standard as from 12/86).

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Job No.

Draining, pouring in coolant – Antifreeze protection table . . . . . 20 – 010
Testing cooling system for leaks . . . . . – 017
Removing, installing coolant thermostat . . . . . – 110
Removing, installing coolant pump . . . . . – 210
Removing, installing viscous fan clutch . . . . . – 312
Removing, installing radiator . . . . . – 420
Removing, installing overflow tank . . . . . – 450

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20-010 Draining, pouring in coolant - Antifreeze protection table

Job No. of job texts and job values or standard texts and flat rates ..... 20-I 142 – 20-I 151

Total capacities of cooling system with heater and mixing ratio of anti-corrosion/antifreeze agent[1]) and water[2]) in litres

Model	Total capacities of coolant system with heater	Mixing ratio antifreeze agent/water -37 °C	-45 °C
107/126	a 9.0	4/4 4.5/4.5	4.4/3.6 4.5
1241201	9.5[3])	4.75/4.75	5.25/4.25
129	11.5	5.75/5.75	6.3/5.2

[1]) Refer to Service Product Specifications sheet 325.1 and 325.2
[2]) Refer to Service Product Specifications sheet 310
[3]) With airconditioning/automatic climate control

Tightening torques	Nm
Radiator drain plug	1.5
Crankcase drain plug	30

Commercial tool

Antifreeze tester	e. g. Ph. Gather
Prestone-W-Check (Union Carbide)	4020 Mettmann

Note

Composition of coolant

50 % by vol. water (Service Product Specifications sheet 310)
50 % by vol. anti-corrosion/antifreeze agent (Service Product Specifications sheet 310, 325.1 and 325.2 respectively).

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Water

Use water which is clean and not too hard. These requirements are frequently, but not always, met by drinking water. The content of dissolved substances in the water may be the cause for the occurrence of corrosion. If in doubt, have the water analysed.

Anti-corrosion/antifreeze agent

The anti-corrosion/antifreeze agent should perform the following tasks:

- Provide adequate anti-corrosion and cavitation protection for all components
- Provide antifreeze protection
- Increase the boiling point

Approximately 50 % by vol. anti-corrosion/antifreeze agent must be added to the water. This concentration offers antifreeze protection down to approximately –37 °C. A higher concentration is not recommended even if ambient temperatures are lower.

More than 55 % by vol. anti-corrosion/antifreeze agent reduces the antifreeze protection and impairs heat dissipation.

55 % by vol. anticorrosion/antifreeze agent offers antifreeze protection down to approx. -45 °C.

Anti-corrosion/antifreeze agent increases the boiling point which is why the coolant does not evaporate so rapidly. The ejection of coolant is avoided at high coolant temperatures.

Use only approved anti-corrosion/antifreeze agents (refer to Service Product Specifications sheet 325.1 and 325.2).

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Operational monitoring of coolant

Before the commencement of the cold season of the year, check the antifreeze protection of the coolant.

In countries with high ambient temperatures, check anti- corrosion/antifreeze agent concentration once annually.

When topping up (after loss of coolant) it must be assured that there is **a 50 %** by vol. portion of anti- corrosion/antifreeze agent in the coolant to provide antifreeze protection down to -37 °C.

The corrosion protection in the coolant decreases during engine operation. Such coolants have an extremely corrosive effect. The maximum permissible life of the specified coolant in a car engine is 3 **years.**

Before adding new coolant, flush the used coolant out of the cooling system.

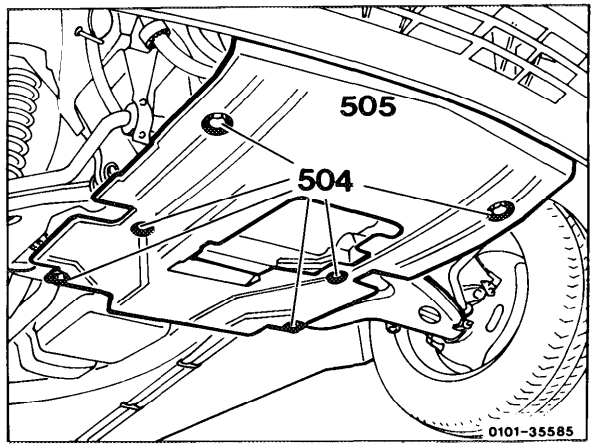
Disposing of coolants

Pay attention to statutory regulations or local waste water requirements regarding disposal of coolant agents.

Draining, pouring in Model 124 and Model 129

1 Raise hood to vertical position (01-008).

2 Remove bottom engine compartment covering (505).



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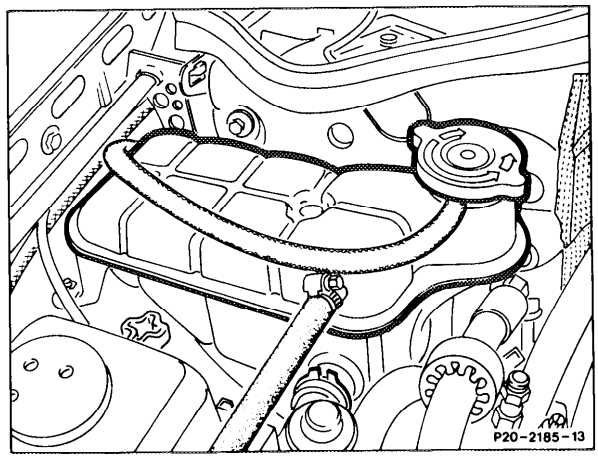
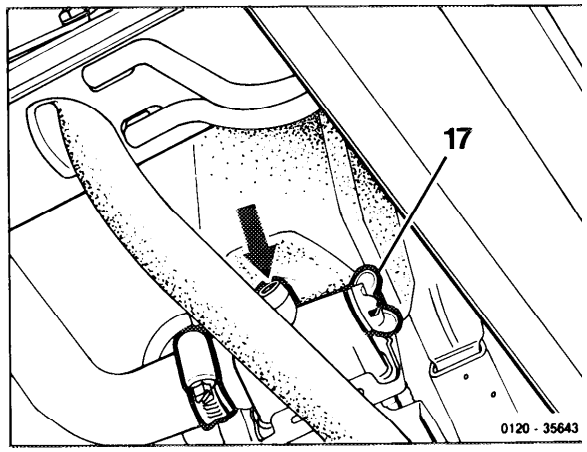
3 Do not open the expansion tank or radiator cap unless the coolant temperature is below 90 °C.
To open expansion tank: First of all turn to 1 st detent only to release the pressure, then turn on to 2nd detent and remove radiator cap.

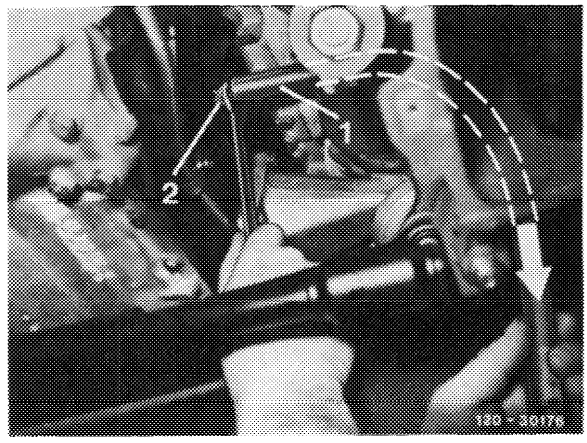


4 Drain coolant at radiator. This is done by connecting a hose (inner diameter 12 mm) to the connection (arrow) and unscrewing drain plug (17). Drain coolant into a suitable vessel (approx. 4 l).

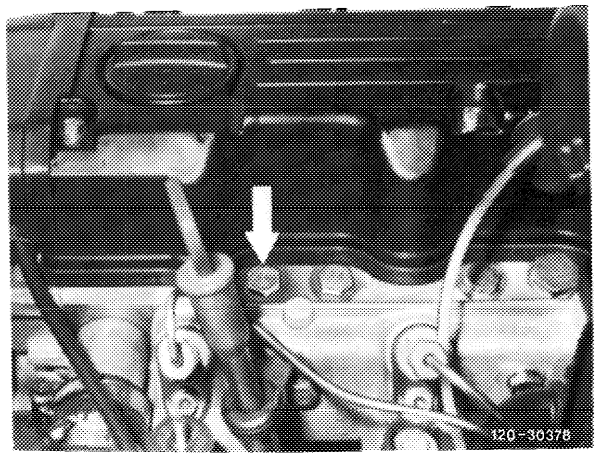


5 Drain coolant at crankcase. This is done by connecting a hose (arrow) (inner diameter 14 mm) to the drain plug and slackening the drain plug slightly. Drain coolant into a suitable vessel (approx. 4 l).

6 Tighten drain plugs for radiator and crankcase. Tightening torques: radiator 1.5 Nm, crankcase 30 Nm.



7 Pour in coolant.
Unscrew front screw plug (arrow) from the measuring sensor strip. Pour in coolant until it flows out at the tapped hole. Screw in plug and pour in remaining coolant.



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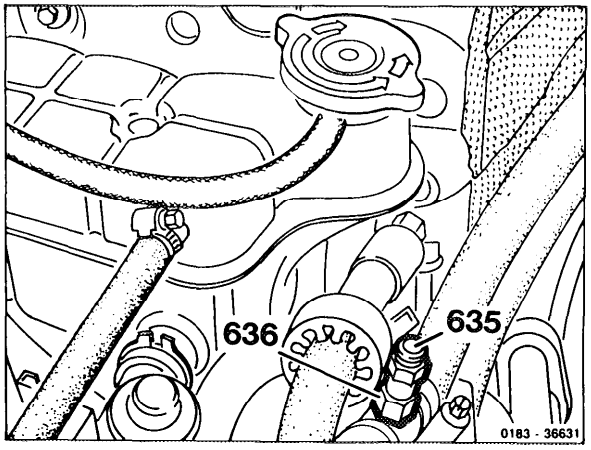
8 If car fitted with auxiliary heater: Take off cap (635), slightly unscrew bleeder screw (636) until no more air flows out.



Note
Repeat operation several times.

9 Switch on heater and warm up engine until the thermostat opens. Following this, top up coolant to the marking (arrow) on the expansion tank.

Note
Close filler connection on expansion tank as soon as coolant temperature has reached approx. 60 – 70 °C.

10 Test cooling system for signs of leaks (20-017).

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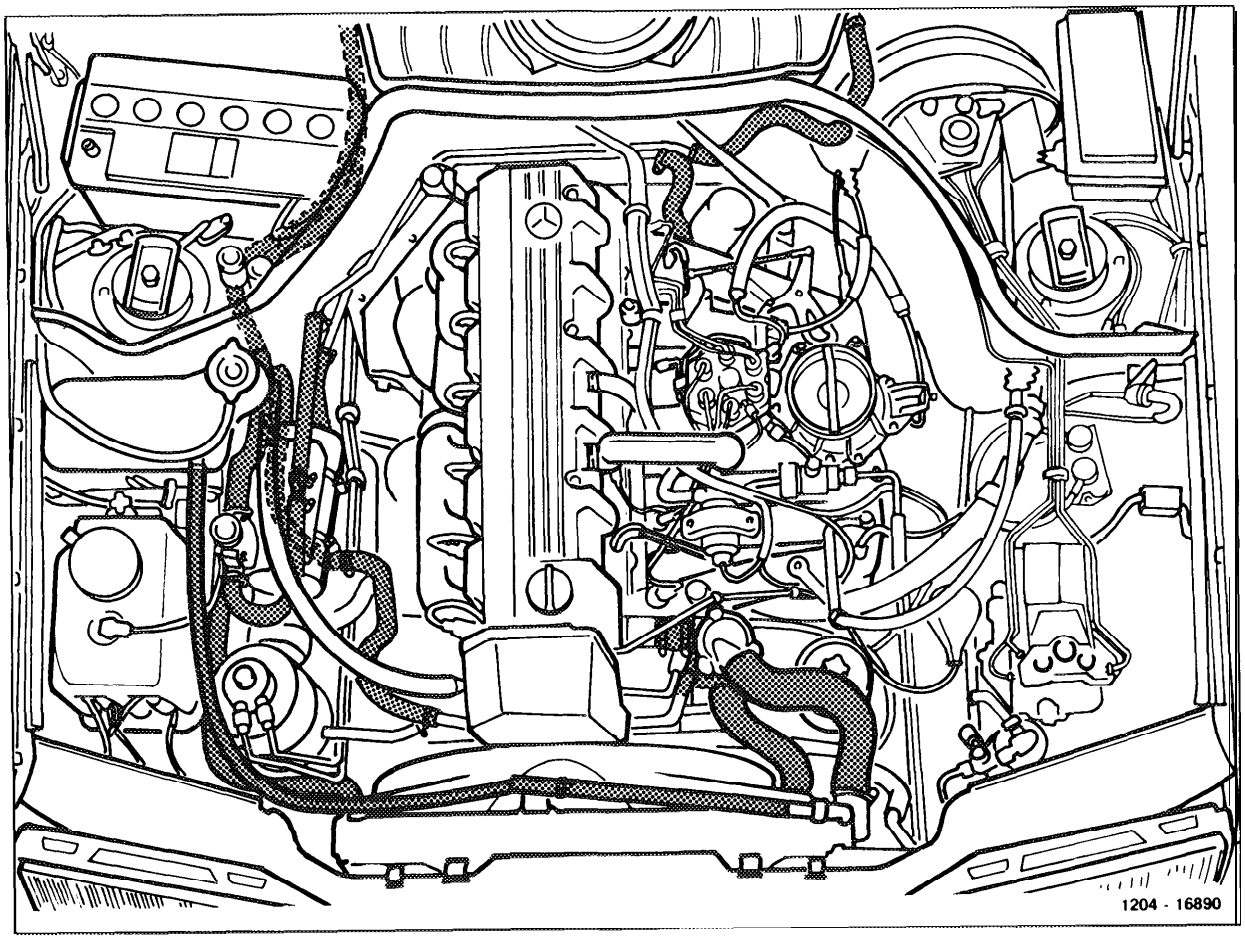
Job No. of job texts and job values or standard texts and flat rates 20-1010

Model 124



Note
Illustration shows joints which require to be examined when pressure-testing the cooling system.
Shown here with auxiliary heater.

Cap	turn to 1st detent to relieve pressure. Turn on to 2nd detent and remove (step 1).
Coolant level	check (step 2).
Tester 124 589 15 21 00	attach to radiator or expansion tank. Test cooling system for leaks.

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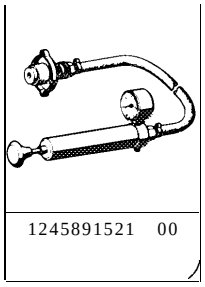
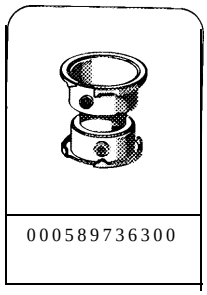
Testing cap and vacuum valve

Double connection 000 589 73 63 00	. . . . .	attach to tester 124 589 15 21 00, fit cap onto double connection. Test opening pressure (step 4).
Vacuum valve	. . . . .	test (step 5).

Special tools





Test data of caps

Cap code number	Pressure relief valve opens at bar gauge pressure		Vacuum valve opens at bar vacuum	Test pressure for pressure-testing cooling system, bar gauge
	new	used		
120	1.2 ± 0.1	1.2 – 0.1	0.1	1 – 1.3
140 as from 06/88	1.4 ± 0.1	1.4 – 0.1	0.1	1 – 1.3

Note

Do not open the cap unless the coolant temperature is below 90 °C.

1 To open: turn first of all only to the 1st detent to release the pressure, then turn on to 2nd detent and remove cap.

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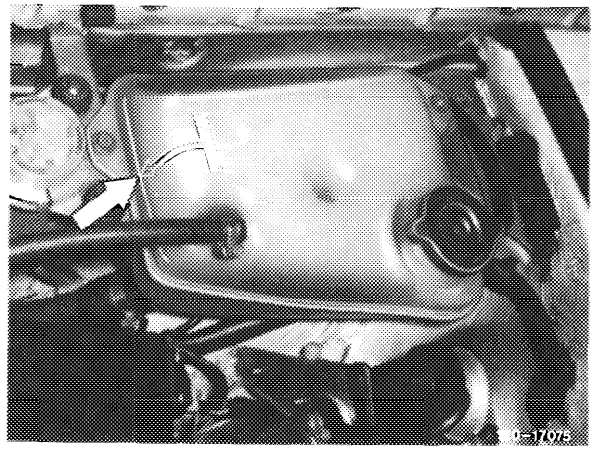
2 The coolant level must extend up to the marking (arrow) on the reservoir.
It should extend to approx. 1 cm above this marking at normal operating temperature.

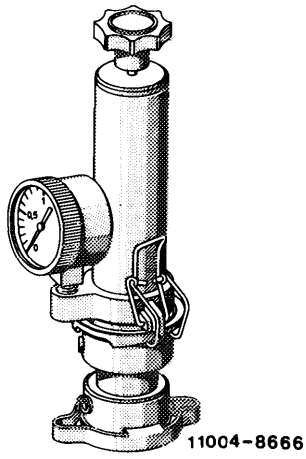


3 Pressure-test cooling system with tester 124 589 15 21 00 and examine for signs of leaks.

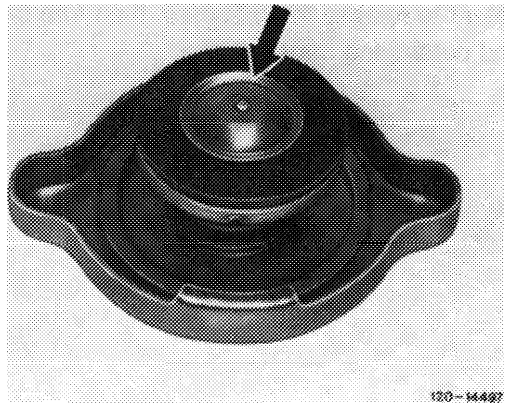
Testing cap and vacuum valve

Note
If corrosion exists on the radiator expansion tank, renew cap. The cap has been fitted with a rubber seal to ensure that no outside air can be drawn in through the cap when a vacuum exists in the cooling system.

4 Attach double connection 000 589 73 63 00 to the tester. Fit cap onto the double connection. Test the opening pressure by pumping.



5 The vacuum valve (arrow) must be resting against the rubber seal. It must be possible to raise it slightly and it should spring back into place when released.



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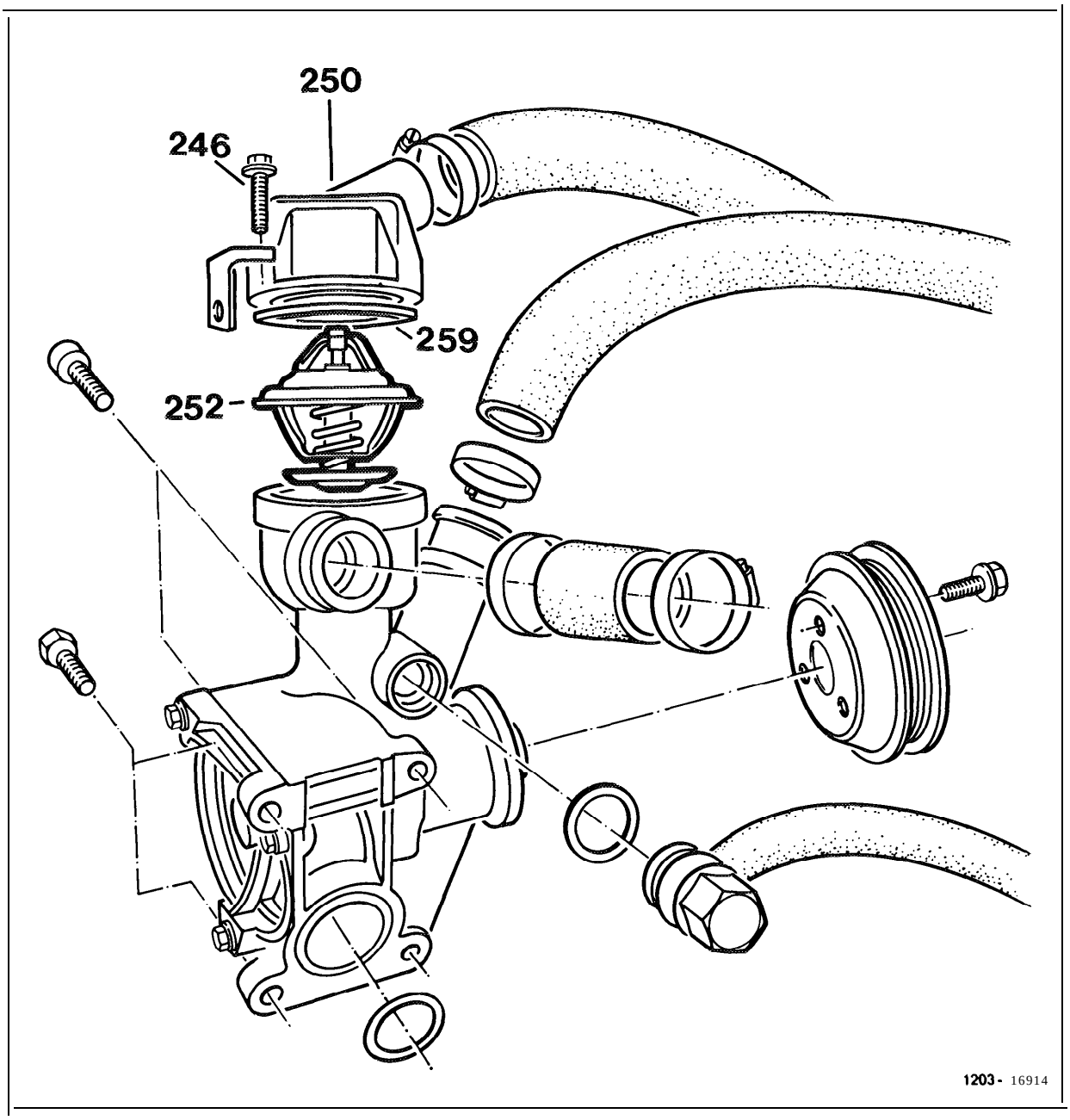
Job No. of job texts and job values or standard texts and fiat rates ..... 20-2460 – 20-2482



Coolant	drain, pour in (20-010).
Top section of coolant thermostat housing (250)	detach, attach, tightening torque for bolt (246) 6 Nm (steps 2 and 3).
Coolant thermostat (252)	remove, install, renew O-ring (259). Insert coolant thermostat so that ball valve (663) is at the highest point (step 4).

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Removal, installation

1 Drain coolant at radiator (20-010).

2 Unscrew bolts (12), tightening torque 6 Nm.

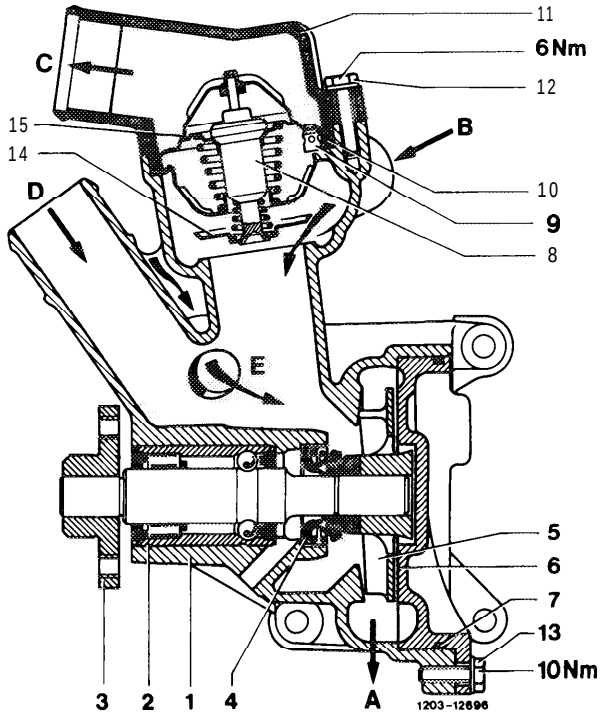
3 Place top section of coolant thermostat housing (11) with connected hose to the side.

4 Remove coolant thermostat (8).

Installation instruction

Renew O-ring (10).
Install coolant thermostat (8) so that the ball valve (9) is at the highest point.

Install in the reverse order.



A	To crankcase
B	From cylinder head
C	To radiator (top)
D	From radiator (bottom)
E	From heater
12	Screw
11	Top section of coolant thermostat housing
10	O-ring
15	Main valve
14	Bypass valve
8	Coolant thermostat
9	Ball valve

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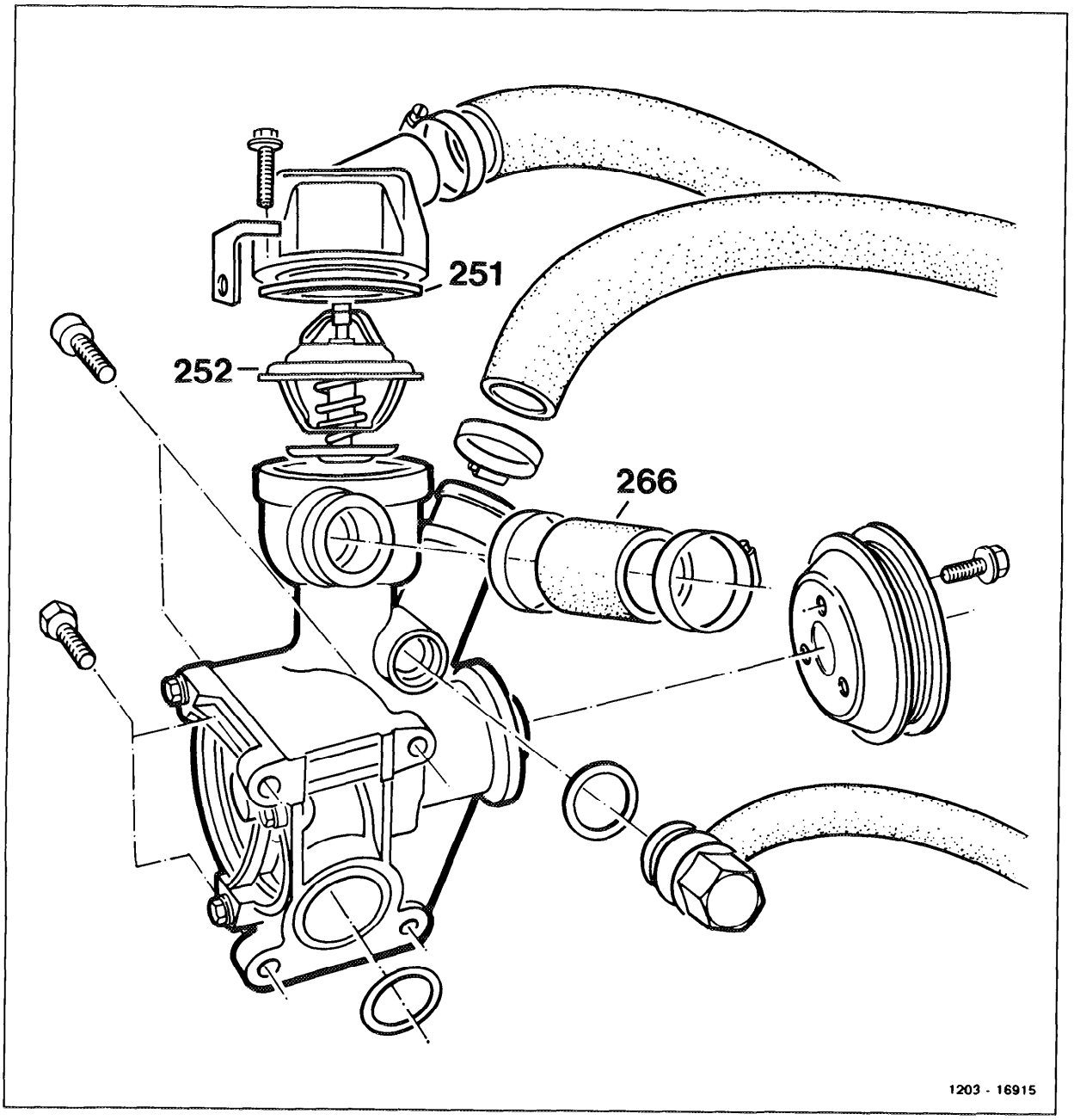
Job No. of job texts and job values or standard texts and flat rates ..... 20-I 270 - 20-2351

Model 124



Hood	raise to vertical position (01-008).
Ground cable to battery	detach, attach.

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Coolant at engine and radiator	drain, pour in (20-010).
Air scoop	remove, install (step 4).
Viscous fan clutch	remove, install (20-312).
Poly V-belt	remove, install (13-342).
Belt pulleys of fan clutch and coolant pump	remove, install.
Engine compartment covering below	remove, install (step 9).
If airconditioning fitted	unscrew, screw on refrigerant compressor with pipe group from engine (step 10).
Support with tandem pump and connected lines	unscrew, screw on (step 11).
Thermostat (252) with new seal (251)	remove, install.
Belt tensioning bracket	slacken, remove.
Return line	unscrew, screw on (step 12).
Coolant hoses (266) and oil line	detach, attach (step 14).
Coolant pump	remove, install (step 15).

Tightening torques	Nm
Bolt of coolant pump to crankcase	25
Viscous fan clutch to bearing bracket	40
Belt pulley of viscous fan to hub	10
Support of power steering pump to crankcase	25
M 12 bolt of tensioning device for poly V-belt	70
Refrigerant compressor to support of power steering pump	25
Belt pulley to coolant pump shaft	10
Thermostat housing to cooling pump	6

Commercial tools

Hexagon socket wrench with 6 mm, 3/8" joint	
7 mm hexagon socket wrench on flexible shaft for hose clip with screw drive	e. g. Hazet 5630 Remscheid Order No. 426-7

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Removal, installation

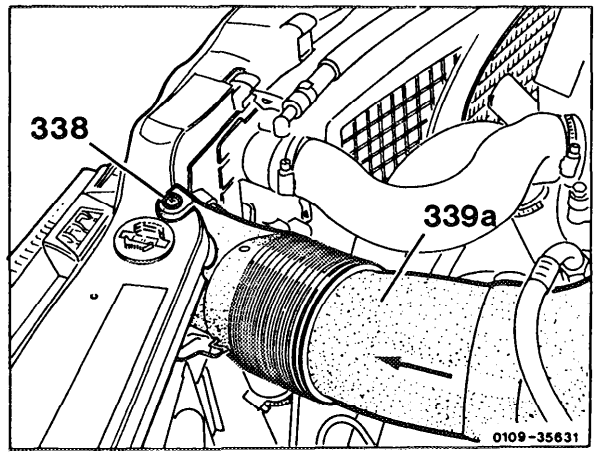
1 Raise hood to vertical position (01-008).

2 Detach ground cable on battery.

3 Drain coolant at engine and radiator (20-010).

4 Unscrew bolt (338). Detach air scoop (339a) from air filter in direction of arrow and remove.

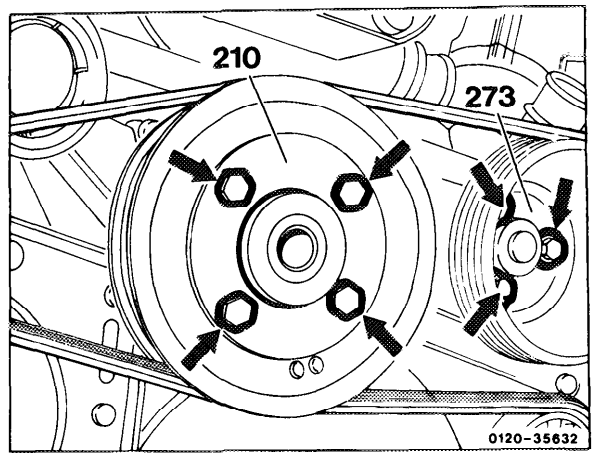
5 Remove viscous fan clutch (20-312).



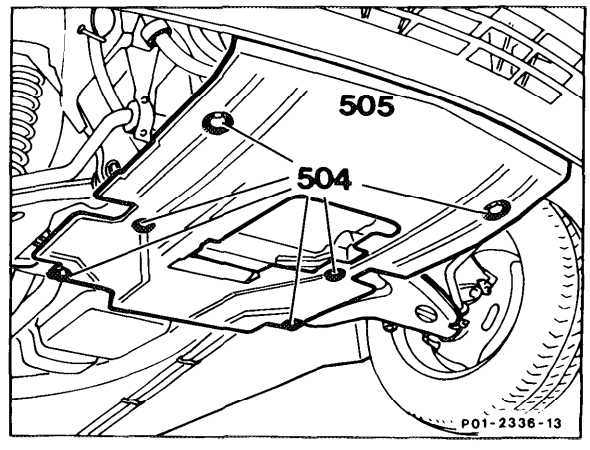
6 Slacken bolts (arrows).

7 Remove V-belt (13-342).

8 Unscrew bolts (arrows), tightening torque 10 Nm.
Take off belt pulleys of fan clutch (210) and coolant pump (273).



9 Unscrew bolts (504) and take ofl bottom engine compartment covering (505).



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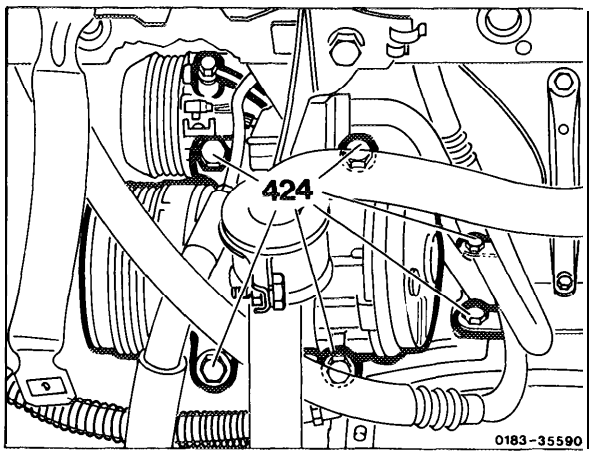
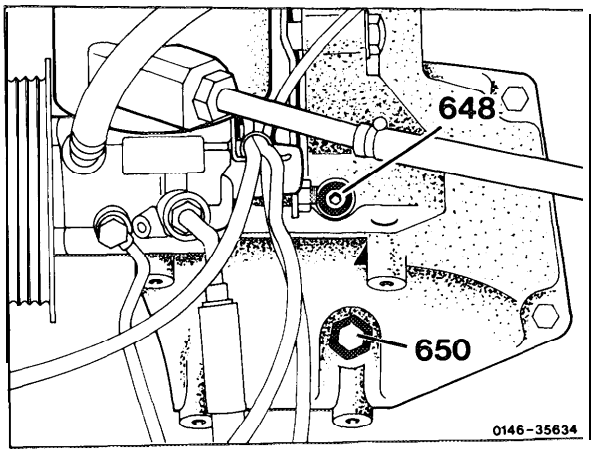
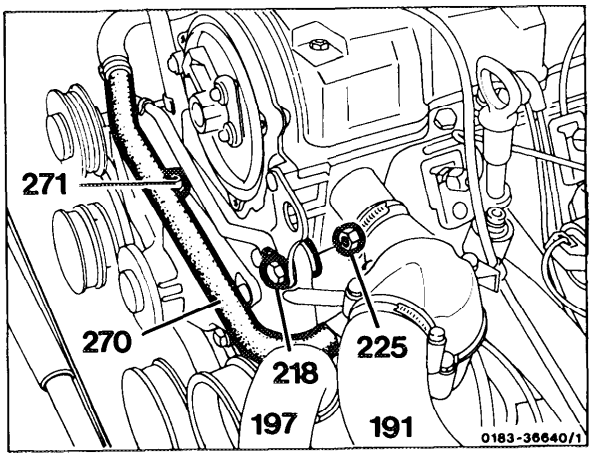
10 If air conditioning fitted: detach refrigerant compressor of air conditioning system from engine.
Unscrew bolts (424), tightening torque 25 Nm.
Attach refrigerant compressor with connected pipe group to side of bottom of engine compartment.



11 Unscrew bolts (648, 650) from support of tandem pump, tightening torque 25 Nm.



12 Slacken bolt (271). Withdraw heating water return line (270) from coolant pump and place to the side. Screw down nut (225) and withdraw bolt (218) from the front.
Detach coolant hoses (191, 197). Disconnect ignition cable from the bracket.
Place support with tandem pump and connected lines to the side.



Note
As from 10/1987, the heating water return line is attached additionally to the coolant pump with a bolt.

Installation instruction
Renew sealing ring of heating water return line (270).

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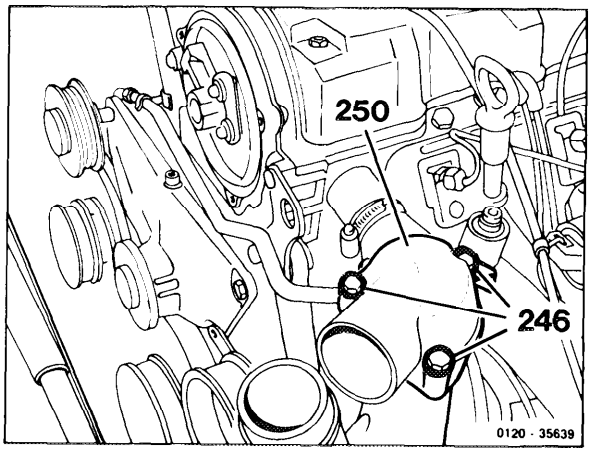
13 Unscrew bolts (246), tightening torque 10 Nm. Take off thermostat housing (250) and remove thermostat.

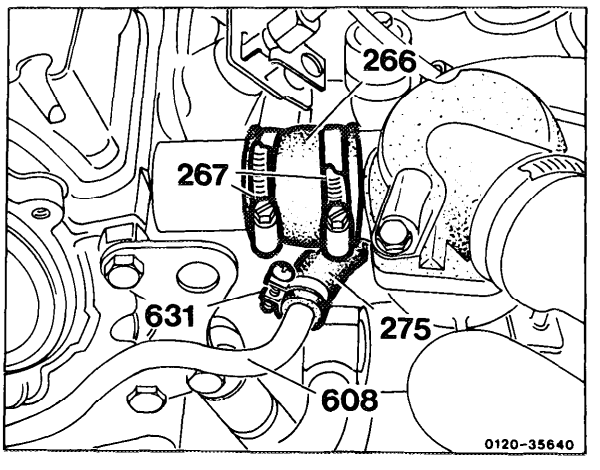


Installation instruction

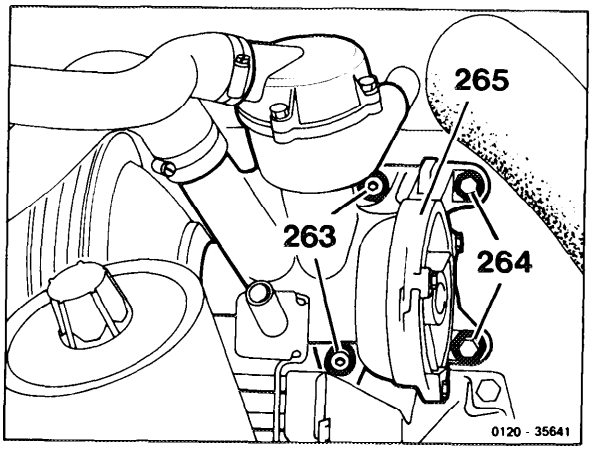
The thermostat must be installed so that the ball valve is at the highest point (20-I 10).

Install new seal.

14 Slacken clips (267), move coolant hose (266) to the left.
If car fitted with self-levelling suspension, slacken clip (631). Detach hose (275) and seal line (608).



15 Unscrew bolts (263, 264) on crankcase. Remove coolant pump (265).



Installation instruction

Renew seal of coolant pump (265).

Install in the reverse order.

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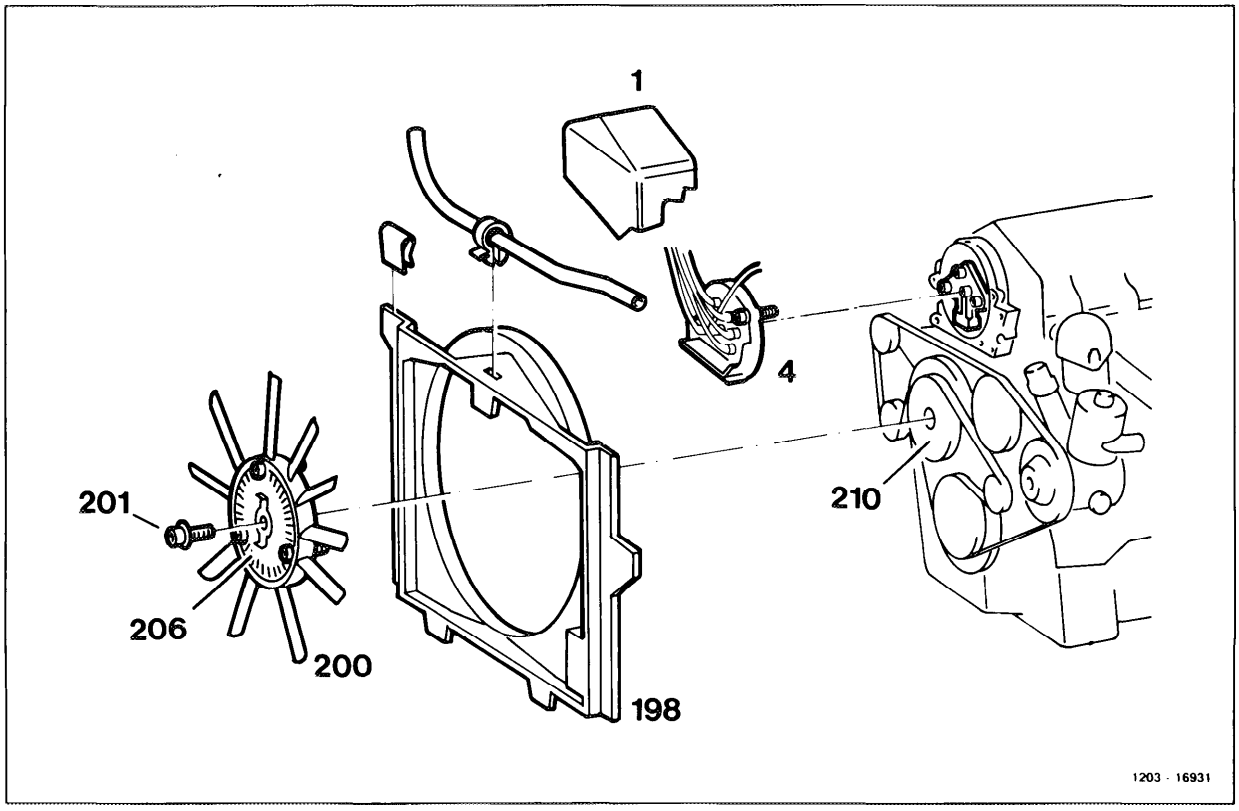
20-312 Removing, installing viscous fan clutch

Job No. of job texts and job values or standard texts and flat rates ..... 20-6600 – 20-6602

A. Model 124



I-lood	raise to vertical position (01-008).
Ground cable to battery	detach, attach.
Protective cover (1)	take off, fit on (step 3).
High voltage distributor (4)	remove, install (step 4).
Fan cowl (198)	detach, attach (steps 5 and 6).
Belt pulley (210)	turn and insert counter-holder 103 589 00 40 00, remove.
Viscous fan clutch (206) with fan (200)	remove, install, tightening torque bolt (201) 45 Nm (steps 6 to 9).
Fan (200)	detach from viscous fan clutch (206), screw on, 10 Nm (step 10).

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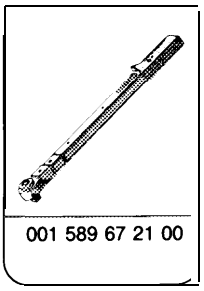
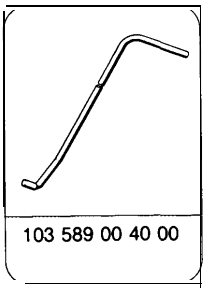
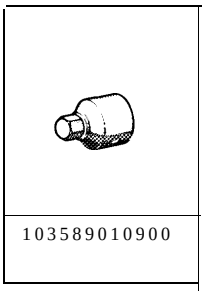
Special tools


001 589 67 21 00


103 589 00 40 00

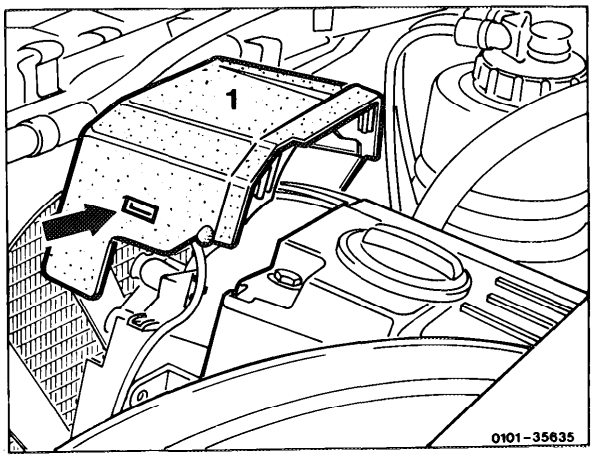

103589010900

Removal, installation

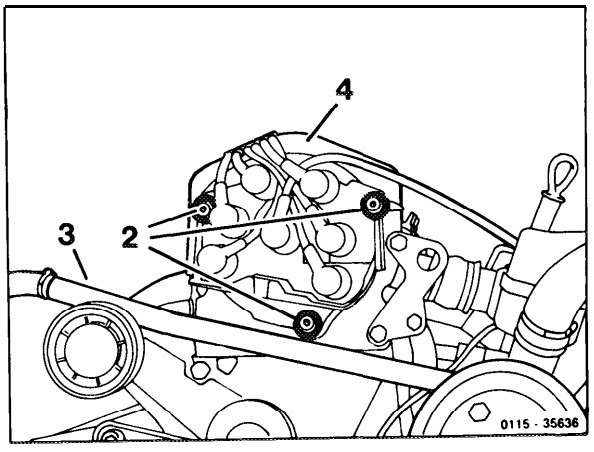
1 Raise hood to vertical position (01-008).

2 Detach ground cable on battery.

3 Unclip both catches (arrow).
Detach protective cover (1) up the way.



4 Unscrew bolts (2). Take off high voltage distributor (4) and place ignition cable to the side.



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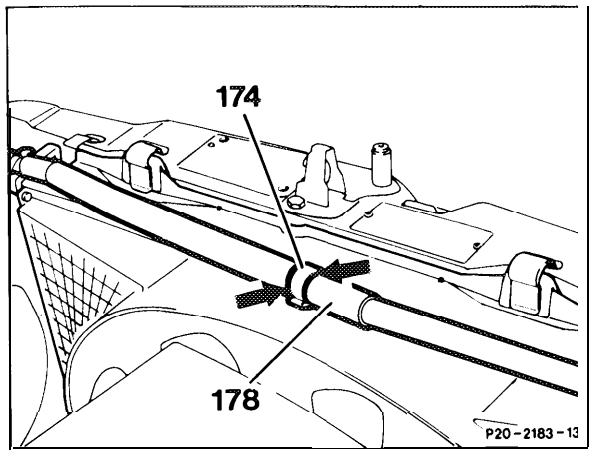
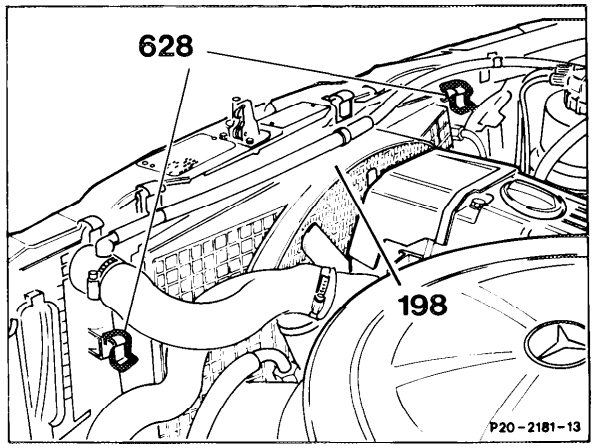
5 Compress plastic holder (174) at the point marked (arrows), pull off together with coolant hose (178) and place to the side.



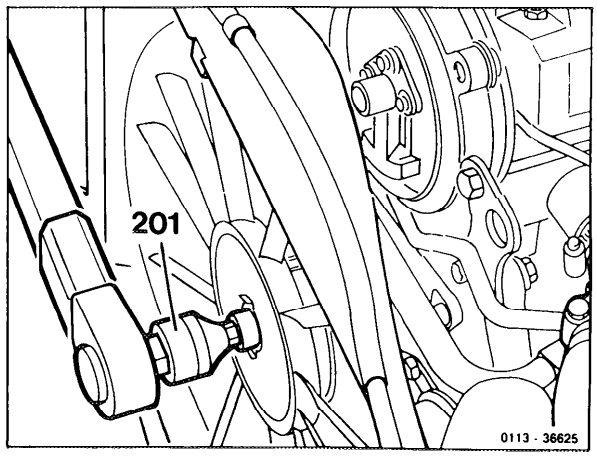
6 Withdraw flat springs (628) up the way. Raise fan cowl (198) slightly and place over the fan.

Installation instruction
Introduce retaining catches on the fan cowl into the mounts on the radiator.

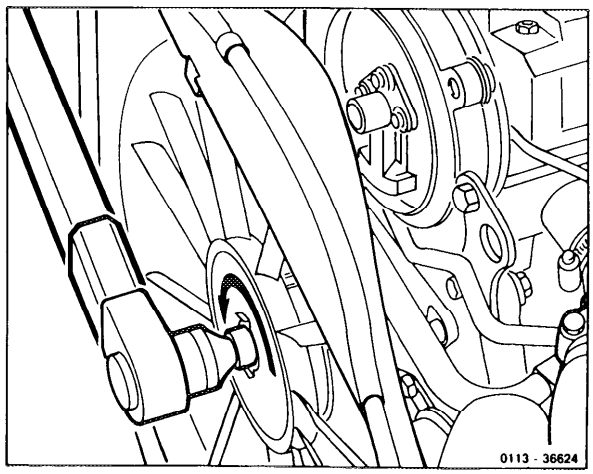


7 Insert hexagon socket insert (8 mm) 103 589 01 09 00 into the screw (201).

Fit on torque wrench 001 589 67 21 00, tightening torque 45 Nm.



8 Turn belt pulley until retaining slot of fan bearing bracket and mounting bore of belt pulley are aligned.



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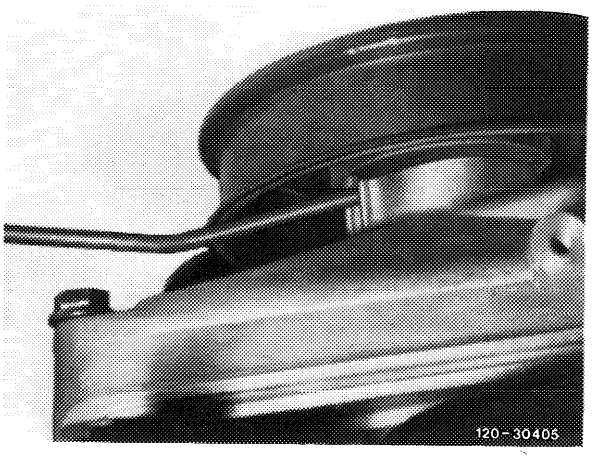
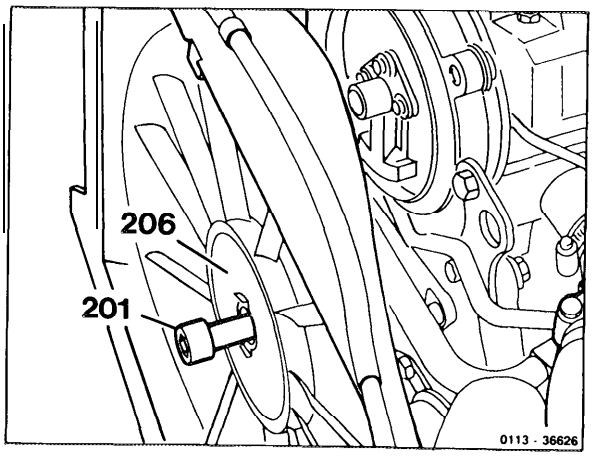
9 Insert counter-holder 103 589 00 40 00 from the rear of the belt pulley into the retaining slot of the fan bearing bracket and at the same time into the mounting hole of the belt pulley.



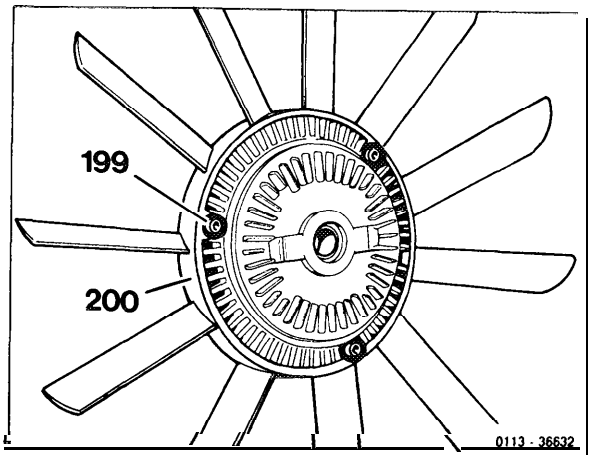
10 Remove screw (201).
Remove viscous fan clutch (206) up the way.



11 Unscrew bolts (199), tightening torque 10 Nm.
Take off fan (200).

Installation instruction
The fan must be installed so that the cast part number is to the front (radiator side).

Install in the reverse order.



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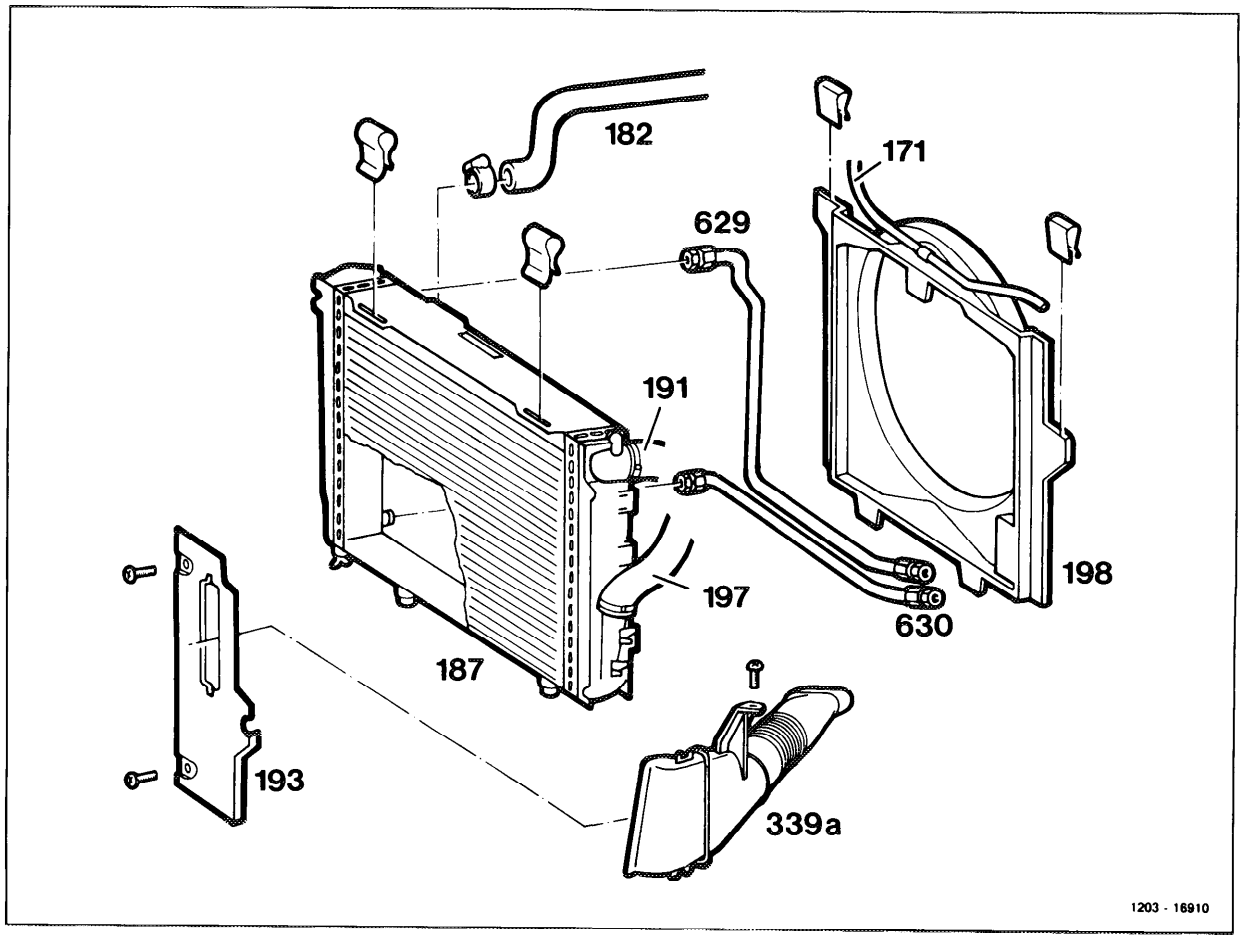
Job No. of job texts and job values or standard texts and flat rates ..... 20-3865 – 20-4535

A. Model 124



Coolant	drain, pour in (20-010).
Coolant hose (171, 182, 191, 197)	detach, attach (step 2).
If automatic transmission fitted	
oil lines (629, 630)	detach, unclip and attach, tightening torque 20 Nm. Pay attention to note.
Air scoop (339a)	remove, install (step 3).
Fan cowl (198)	detach, attach (step 4).
Radiator cover (193)	detach, attach (step 5).
Radiator (187)	remove, install (step 6).
If automatic transmission fitted	check oil level.

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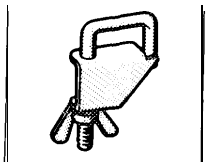
Special tool



000 589 40 37 00

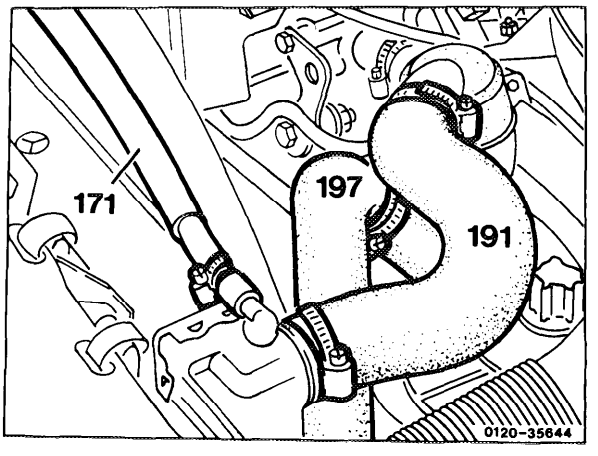
Commercial tool

Socket wrench insert 7 mm on flexible shaft for hose clip with screw drive	e. g Hazet D-5630 Remscheid Order No. 426-7

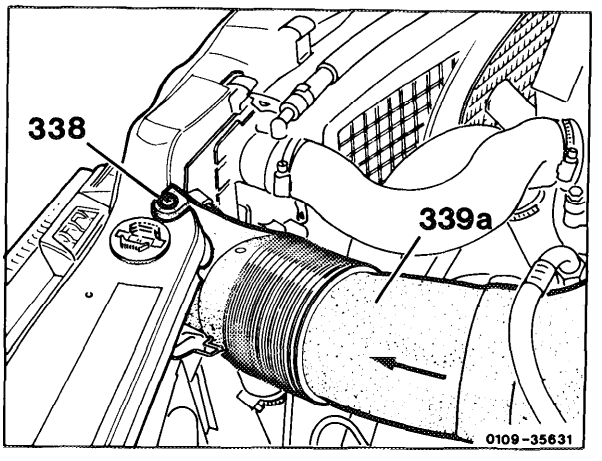
Removal, installation

1 Drain coolant (20-010).

2 Detach coolant hose (191, 197) on the coolant pump and coolant hose (171) at the radiator.



3 Remove screw (338). Detach air scoop (339a) from the air filter in direction of arrow and remove.



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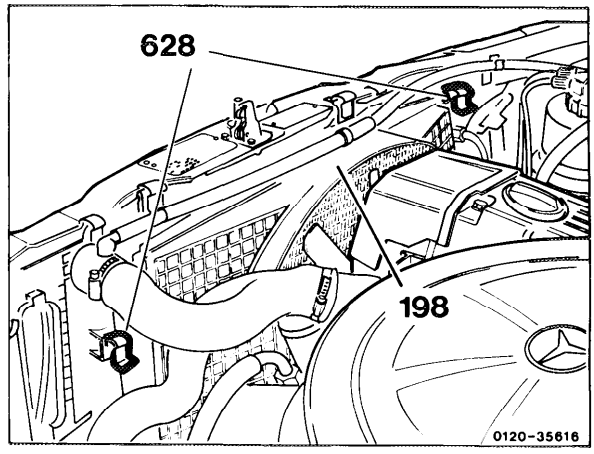
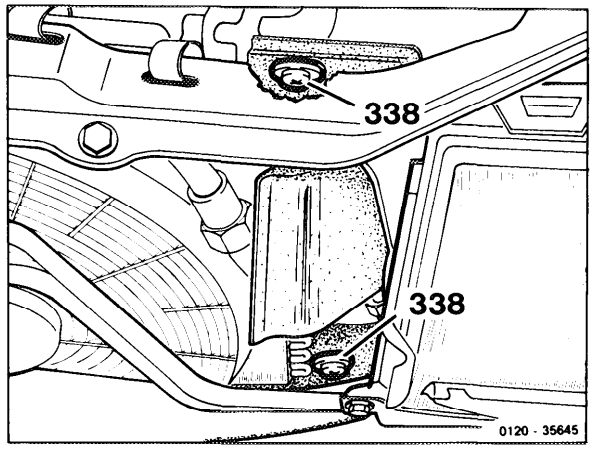
4 Withdraw flat springs (628) up the way, raise fan cowl (198) slightly and place over the fan.



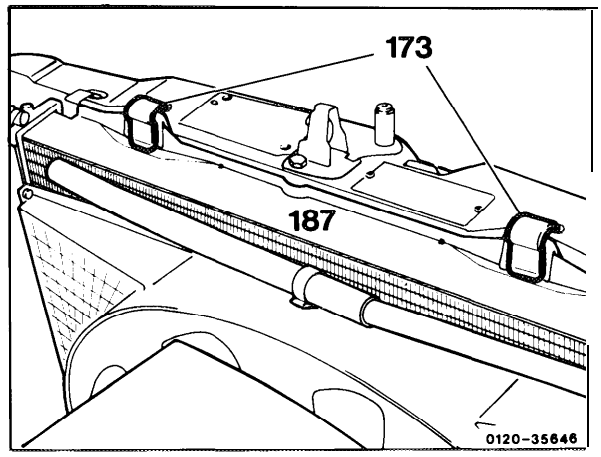
Installation instruction
introduce retaining straps on the fan cover into the mount on the radiator.

5 Remove screws (338) for radiator cover.



Note
If car fitted with automatic transmission, detach oil lines from or to the transmission and unscrew at the radiator. Tightening torque 20 Nm. Check oil level.

6 Withdraw flat springs (173) up the way and raise radiator (187) up the way out of the rubber grommets of the crossbar.



Installation instruction
The mounting spigots of the radiator must be inserted into the rubber grommets of the cross-piece or bracket.

Install in the reverse order.

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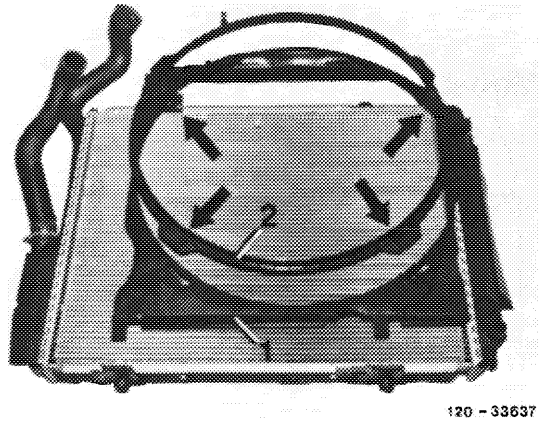
Removal, installation

Note:
The crossflow radiator is installed in a forward location under the removable front center reinforcement.

The fan shroud can be separated (4 bayonet latches, arrows).

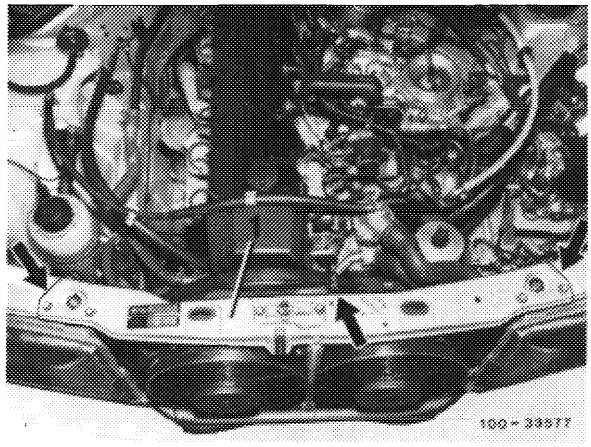


1 Main shroud
2 Ring

1 Remove bumper.

2 Drain coolant at radiator.

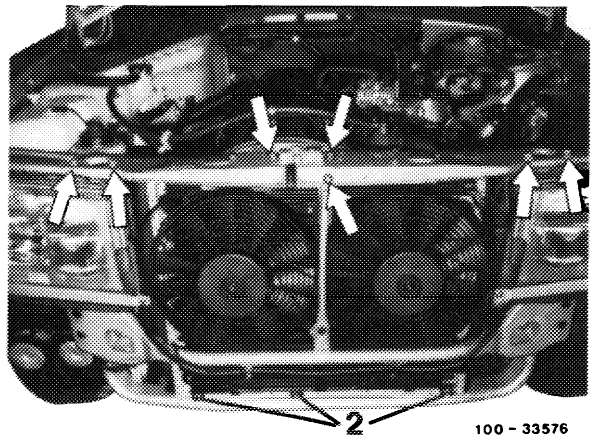
3 Mark position of front center reinforcement (1) to avoid altering hood latch adjustment. Remove front center reinforcement.



4 Remove upper and lower bolts (2) holding condenser to radiator.

5 Loosen and remove radiator hoses.

6 Release radiator shroud (arrow) and release the 4 bayonet latches by turning ring. The main shroud remains on the radiator.



7 Remove air scoop from intake noise damper.

8 Lift radiator out.

Installation instruction
The mounting spigots of the radiator must be engaged in the rubber grommets of the front center reinforcement.

Install in the reverse order.

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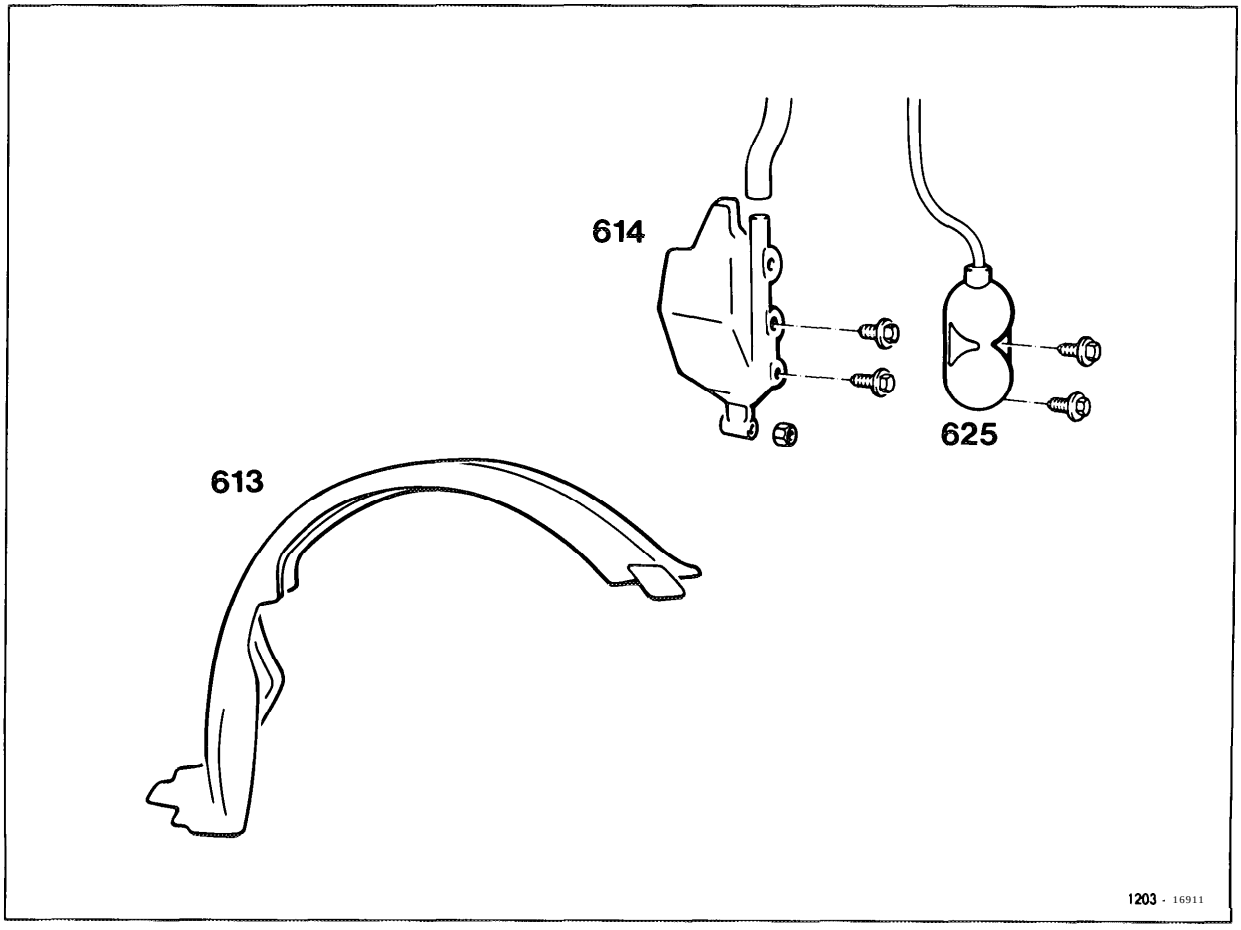
20-450 Rmoving, installing overflow tank

Job No. of job texts and job values or standard texts and flat rates .....

Model 124



Front right wheel	remove, fit on, tightening torque 110 Nm.
Partition wall (613) below front ring	remove, install (step 2).
Vacuum reservoir (625)	remove, install (step 3).
Overflow tank (614)	remove, install (step 4).

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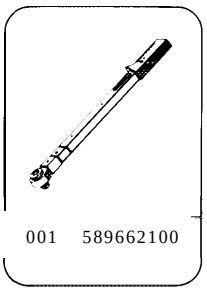
Special tool

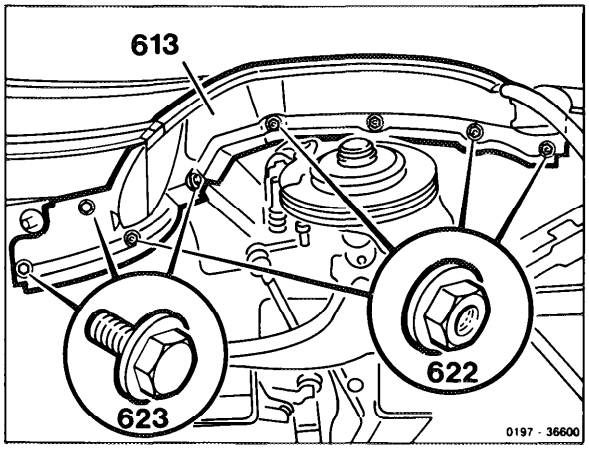


001 589662100

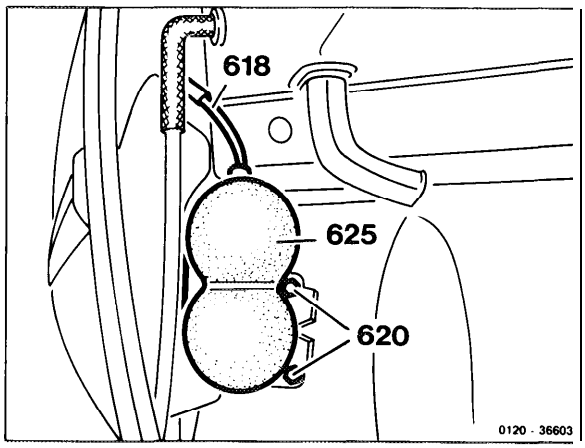
Removal, installation

1 Remove front right wheel.

2 Unscrew bolts (623) and nuts (622), remove partition wall (613).

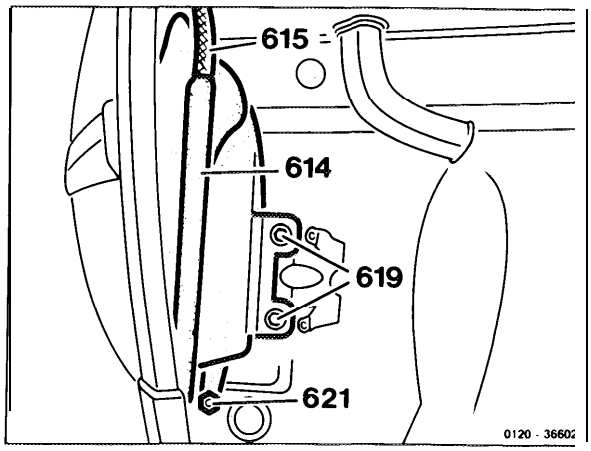


3 Detach vacuum hose (618). Unscrew bolts (620) and remove vacuum reservoir (625).



4 Unscrew bolts (619) and nuts (621). Detach hose (615) and remove overflow tank (614).

5 Install in the reverse order.



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Job No.

Removing, installing front engine mounts . . . . . 22 – 211
Removing, installing rear engine mounts . . . . . – 212
Rear engine mount (Freeway hop) Model 124 USA . . . . . – 213
Setting engine stop, Model 124 4MATIC . . . . . – 220

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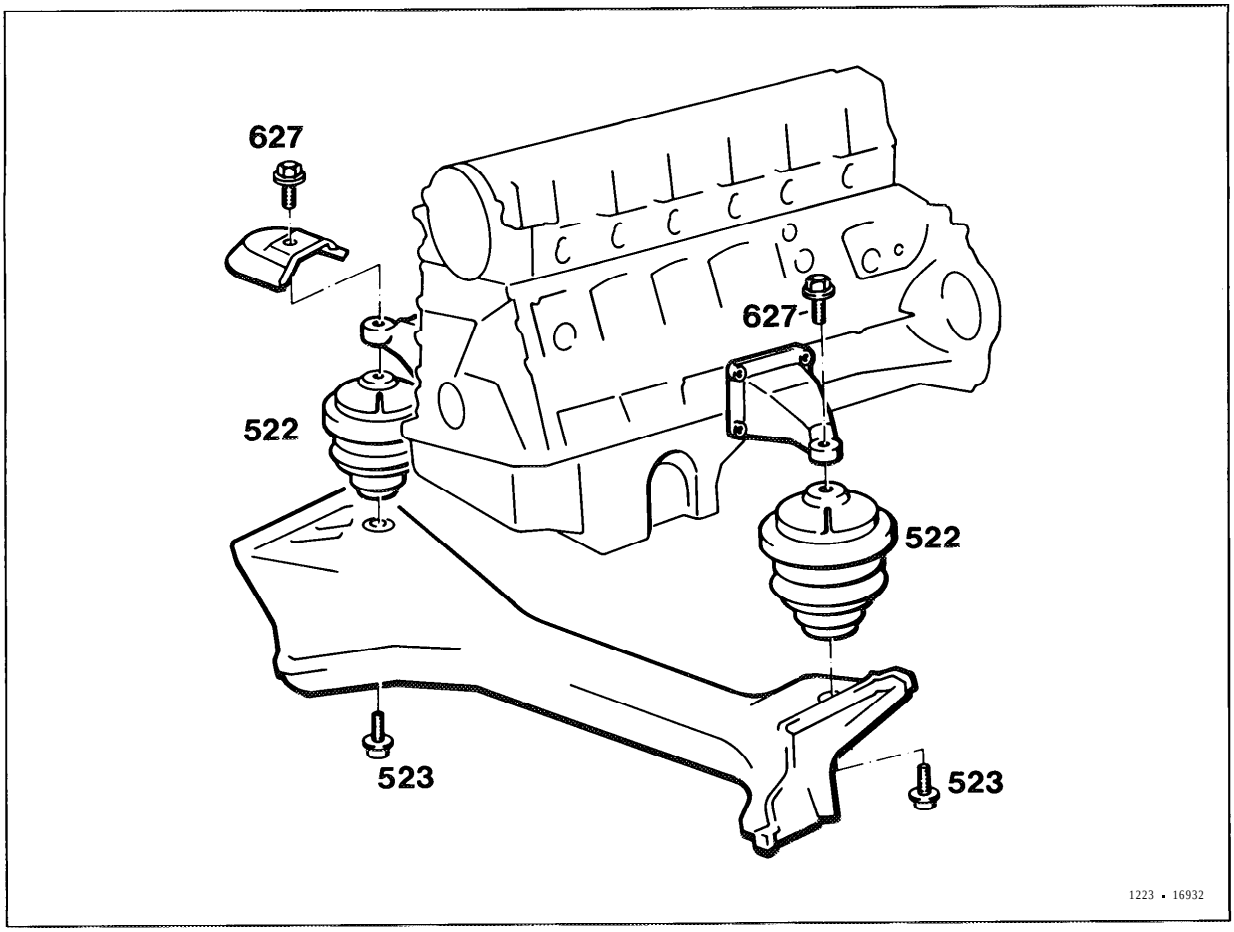
Model 124



Wood	raise to vertical position (01-008).
Ground cable to battery	detach, attach.
Air scoop	remove, install.
Fan cowl	detach, attach.
Engine compartment covering below	remove, install.
Bolts (627)	unscrew, screw in, tightening torque 55 Nm (steps 5 and 7). Pay attention to installation instruction.
Engine	raise, lower.
Bolts (523)	unscrew, tighten, tightening torque 40 Nm (step 9).
Engine mount (522)	remove, install.

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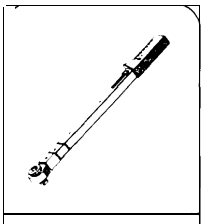
Tightening torques	N m
Hexagon socket bolts for engine mounts to frame cross member	40
Hexagon bolt for engine mounts to engine support	55

Special tool



Removal, installation

1 Raise hood to vertical position **(01-008).**

2 Detach ground cable at battery.

3 Detach air scoop from air filter.

4 Detach fan cowl and place over the fan.

Installation instruction

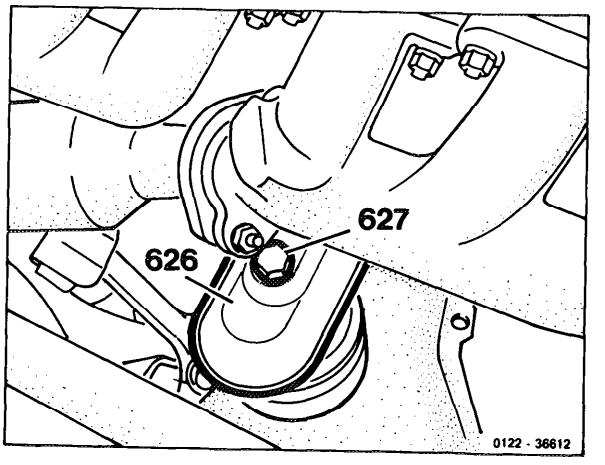
Introduce retaining catches into the mounts on the radiator.

5 Unscrew bolt (627) on the right engine mount from above, tightening torque 55 Nm.

Note

A shield (626) is inserted above the right engine support.

6 Remove engine compartment covering below.



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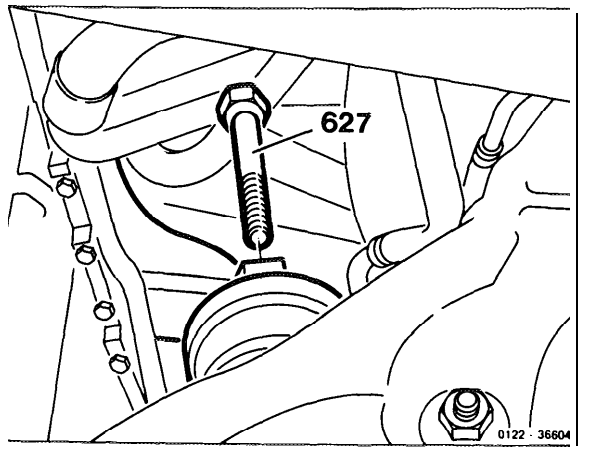
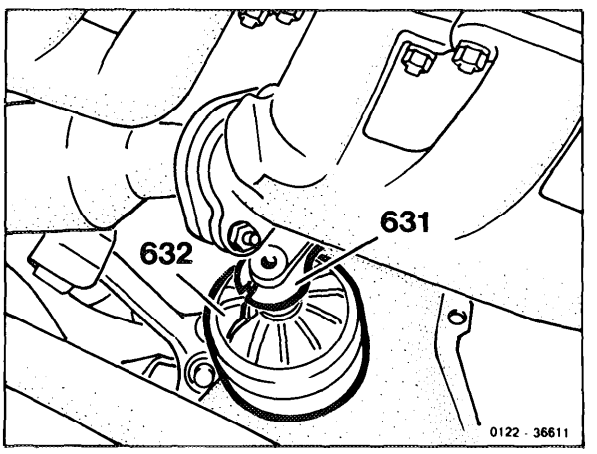
7 Unscrew bolt (627) on left engine mount, tightening torque 55 Nm.



Installation instruction

Anti-twist lock (632) on left and right engine mounts must engage into the retaining slot of the engine support.



8 Attach engine to the front suspension lock and raise slightly, paying attention to the rear suspension lock, oil filter and coolant hoses.

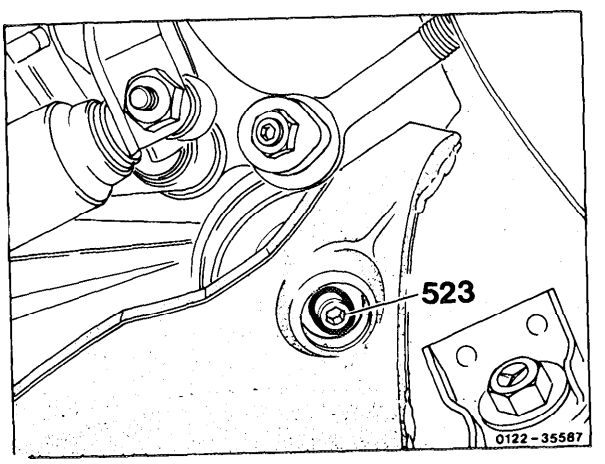
9 Unscrew bolts (523) on the left and right front engine mounts from below, tightening torque 40 Nm.

4MATIC: unscrew 2 bolts from below.

10 Take out engine mount.

Note

The engine mounts on the left and right are identical.



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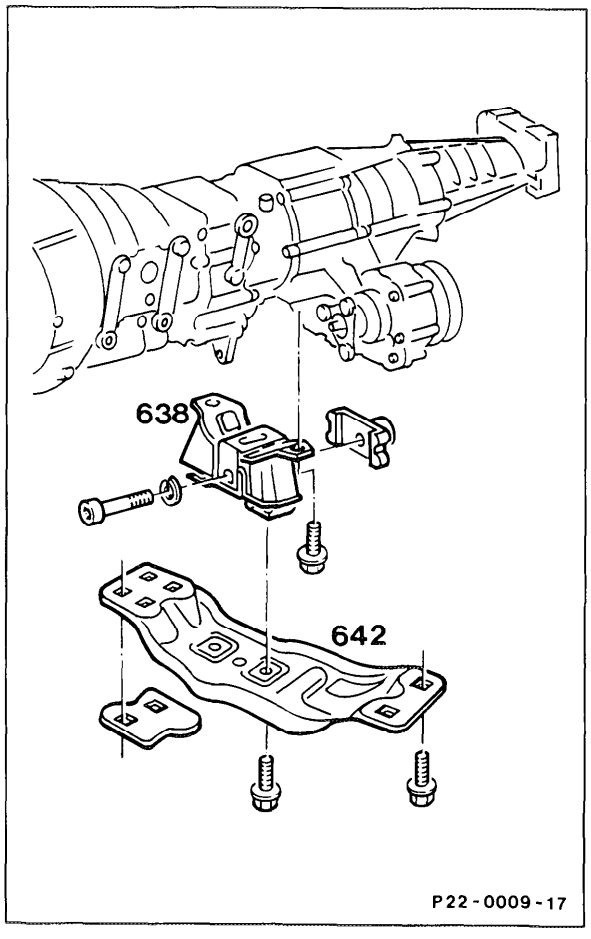
Job No. of job texts and job values or standard texts and flat rates .....

Model 124 4MATIC



Transmission	support.
Engine support (642)	remove, install, M8 (20 Nm), Ml0 (40 Nm), torque wrench 001 589 66 21 00.
Engine mount (638)	remove, install, torque wrench 001 589 66 21 00.

Note

If the rear engine mount on 4MATIC cars is renewed, the engine stop must be stress-relieved after approx. 1000 km or 10000 km distance, respectively (22-220).

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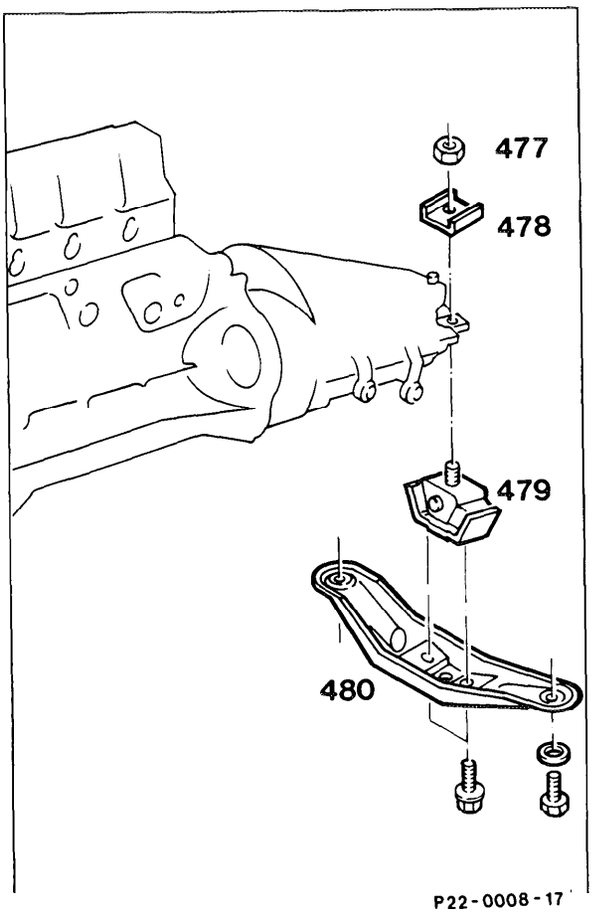

Transmission	support.
Engine support (480) or (8)	remove, install, M8 (20 Nm), MI0 (40 Nm), torque wrench 001 589 66 21 00.
Engine mount (479) or (3) with bracket (5)	remove, install, nut (477) or (1) 70 Nm, bolt (7) 45 Nm. Torque wrench 001 589 66 21 00.

Note

If the rear engine mount with stop limit (Freeway hop) is renewed, the engine stop must be set after 1000 km and after approx. 10000 km distance (22-213).

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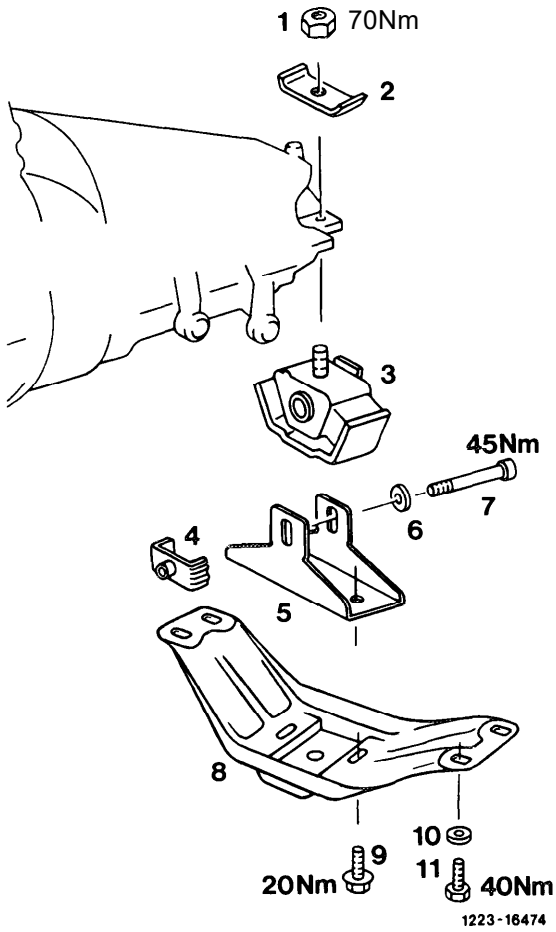
Job No. of job texts and job values or standard texts and flat rates .....



1	Flat nut	7	Adjusting screw 10.9
2	Packing	8	Engine support
3	Engine mount	9	Screw-and-washer assy.
4	Nut	10	Washer
5	Bracket	11	Bolt
6	Washer		

The rear engine mount with variable engine stop and higher load carrying capacity can be installed if complaints are received regarding engine vibration on roads with transverse grooves (Freeway hop).

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If this engine mount is installed, the engine stop must be set after approx. 1000 and after 10000 km distance.

Setting

1 Slacken adjusting screw **(7)** on rear engine mount completely.

2 Move engine by shaking back and forward by hand.

3 Tighten adjusting screw **(7)** on rear engine mount.

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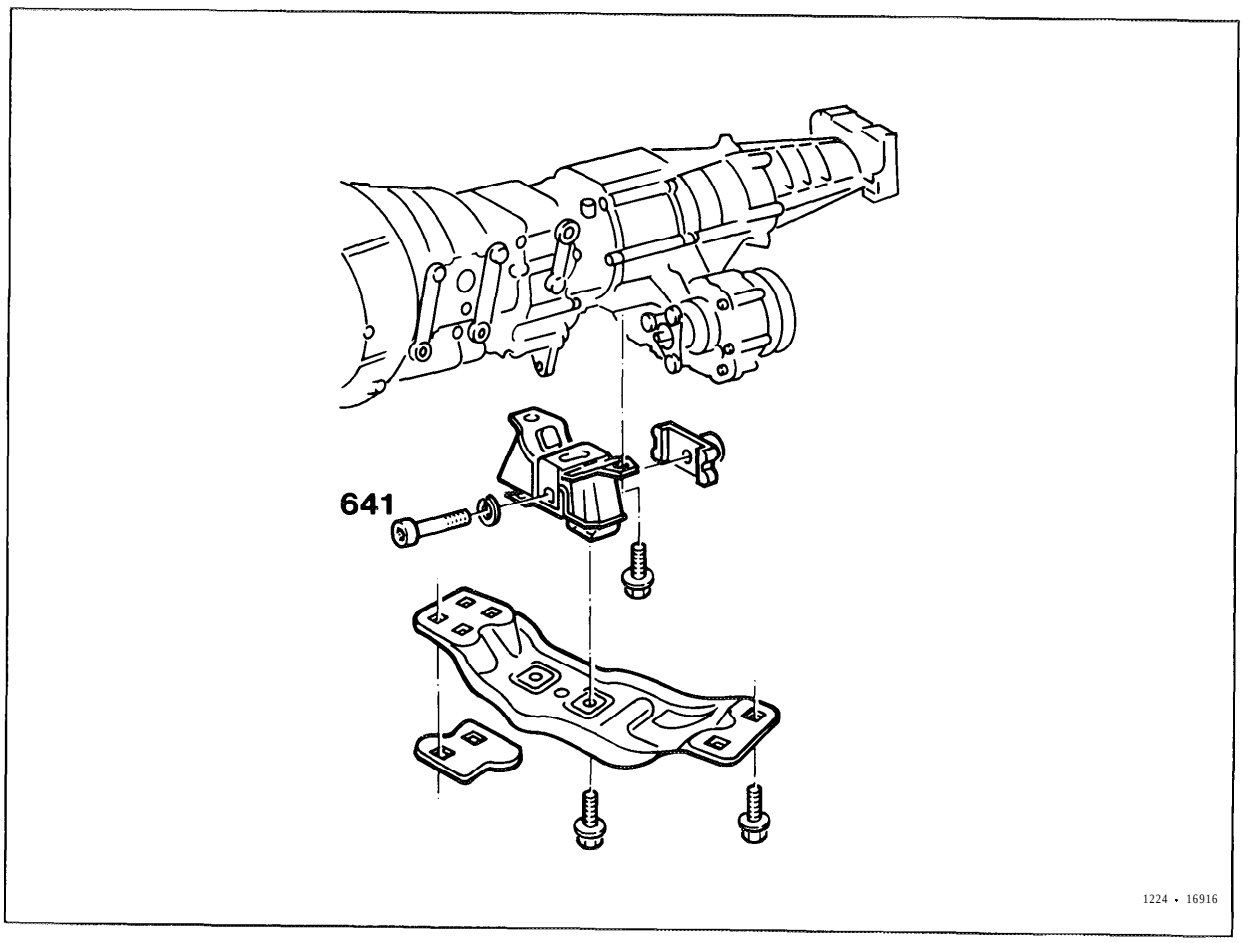

Screw (641)	.....	slacken.
Start engine	.....	depress accelerator pedal sharply several times to allow the engine stop to adjust.
Screw (641)	.....	tighten, 45 Nm. Torque wrench 001 589 66 21 00.

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Job No.

Adjusting control linkage . . . . . 30 – 300
Removal and installation of accelerator pedal with front wall mounting . . . . . - 315
Removal, installation and adjustment of Bowden cable . . . . . – 325
Removal and installation of accelerator pedal . . . . . – 330
Lubricating control linkage and control shaft . . . . . – 335

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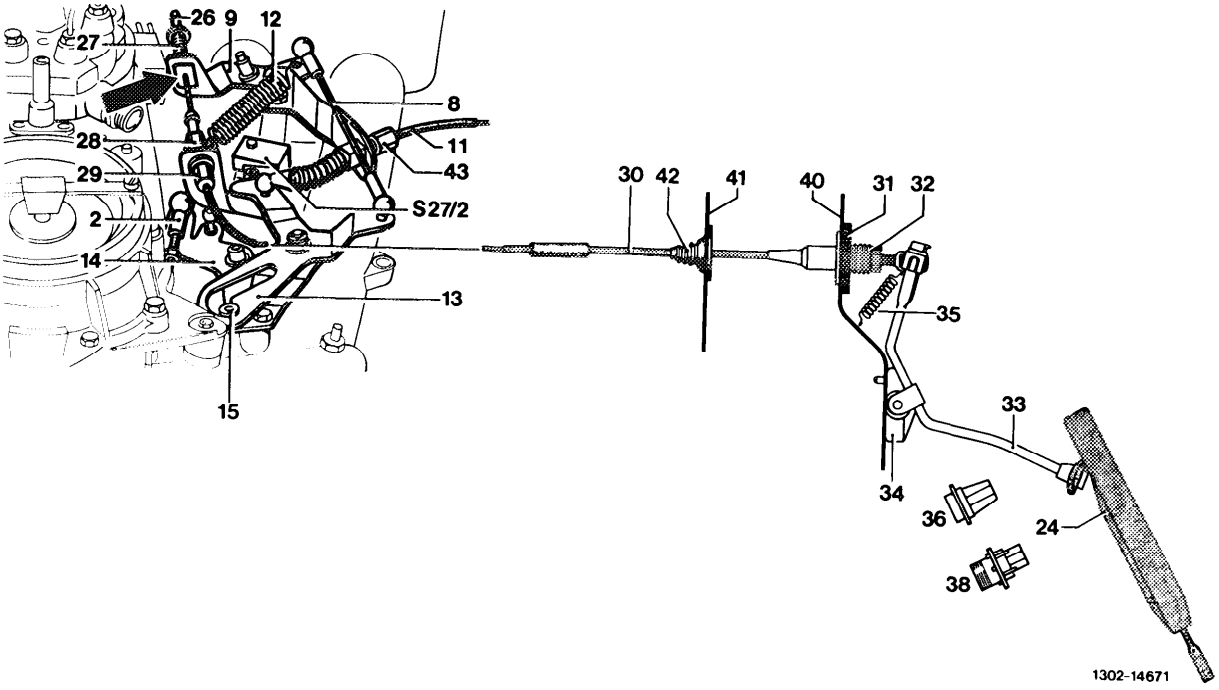
A. Model 124



Control linkage and Bowden cable	check for easy operation and evidence of bending. Renew parts if necessary.
Bowden cable (30)	disconnect. To do so, press off plastic clips (arrow).
Connecting rod (2)	disconnect. Check if throttle valve rests against idle stop. Reconnect connecting rod without tension. Adjust so that the roller (15) rests against the end stop without tension in the slotted link arm (13).
Connecting rod (8)	adjust to approx. 155 mm and connect. Measured from center to center of the ball socket.
Bowden cable (30)	connect. The nipple (26) of the Bowden cable (30) must contact the compression spring (27) without tension. Adjust Bowden cable (30) from the vehicle inside by means of adjusting nut (32).

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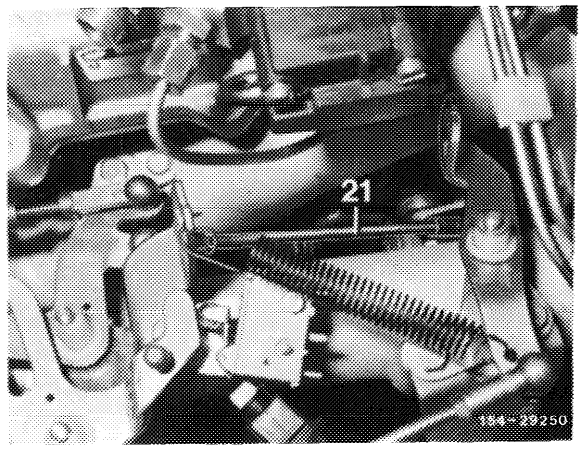
Full throttle stop . . . . . check. Disconnect control pressure cable (11) for automatic transmission. With engine switched off, press accelerator pedal from the vehicle inside up to full throttle stop (36) or, with automatic transmission, to the stop of the kickdown switch (38). While doing so, the throttle valve lever must rest against the full throttle stop. Adjust adjusting screw (29) on the Bowden cable if necessary. Slowly allow accelerator pedal to return into idle position. In this position, the roller in the slotted link arm must contact the end stop without tension and the microswitch (S27/2) must be actuated. Adjust the Bowden cable (30) from the vehicle inside by means of the adjusting nut (32) if required.

Control pressure cable (11) for automatic transmission . . . . . adjust. Push Bowden cable back, then pull forward against noticeable stop. Connect control pressure cable without tension, adjust with adjusting screw (43) if necessary.

Vehicles with cruise control

Check if the final control element contacts the idle speed stop of the cruise control. To do so, disconnect pushrod (21) and push lever of the control element clockwise against the idle speed stop. When connecting the pushrod (21), ensure that the lever of the control element is lifted by approx. 1 mm off the idle speed stop. Adjust pullrod if necessary.



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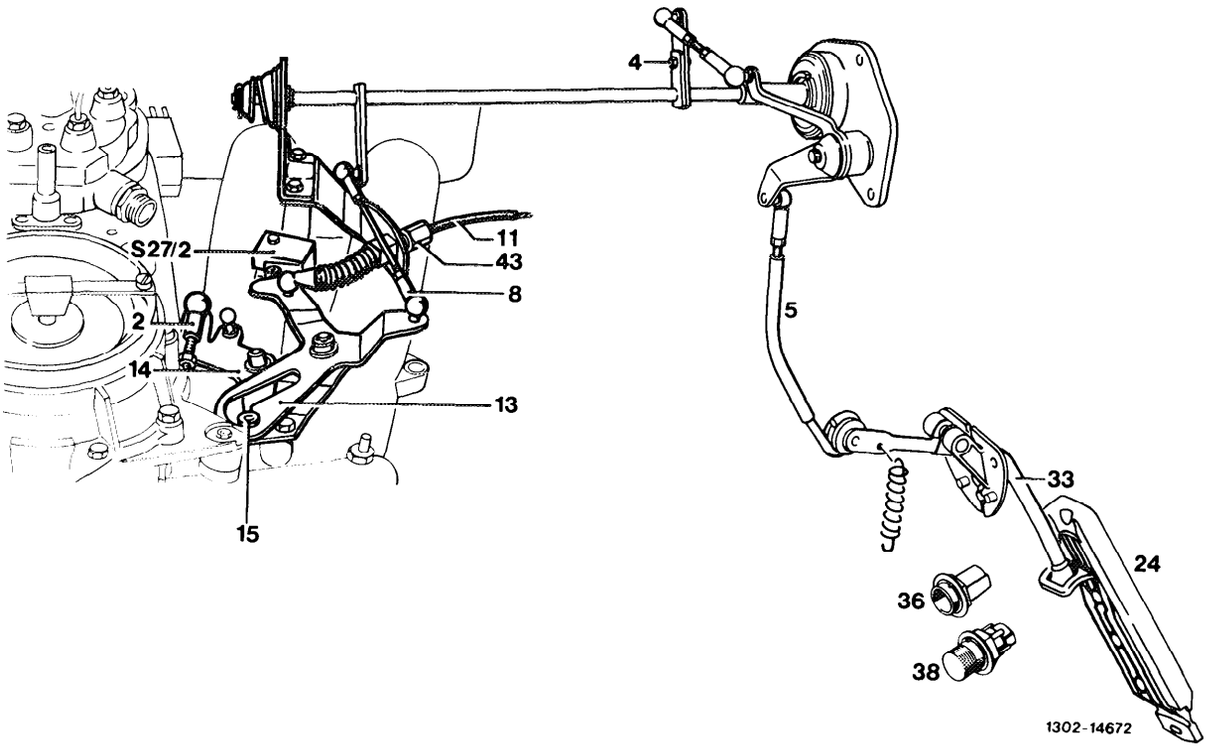
B. Model 126



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Control linkage	check for easy movement and evidence of bending. Renew parts if necessary.
Connecting rod (2)	disconnect. Check if the throttle valve rests against the idle speed stop. Reconnect connecting rod without tension. Adjust so that the roller (15) contacts the end stop in the slotted link arm (13) without tension.
Connecting rod (8)	adjust and connect. Model 107 = 120 mm, model 126 = 105 mm, measured from center to center of the ball socket.
Full throttle stop	check. Disconnect control pressure cable (11) for automatic transmission. With the engine switched off, press accelerator pedal from the vehicle inside up to the full throttle stop (36) or, with automatic transmission, up to the stop of the kickdown switch (38). While doing so, the throttle valve lever must contact the full throttle stop. Loosen adjusting screw (4 or 7) if necessary, adjust control linkage so that the throttle valve lever contacts the full throttle stop. If the full throttle or idle speed stop is not achieved with this position, adjust pushrod (5) from the longitudinal control shaft to the accelerator pedal to the specified length, model 107 = 105 mm, model 126 = 220 mm, measured from center of ball socket to the center of damper ring. To check, slowly allow accelerator pedal to return into idle speed position. In this position, the roller in the slotted link arm must contact the end stop without tension and the microswitch (S27/2) must be actuated.
Control pressure cable (11) for automatic transmission.	adjust. Push back Bowden cable, then pull forward against noticeable stop. Connect control pressure cable without tension, adjust with adjusting screw (43) if required.

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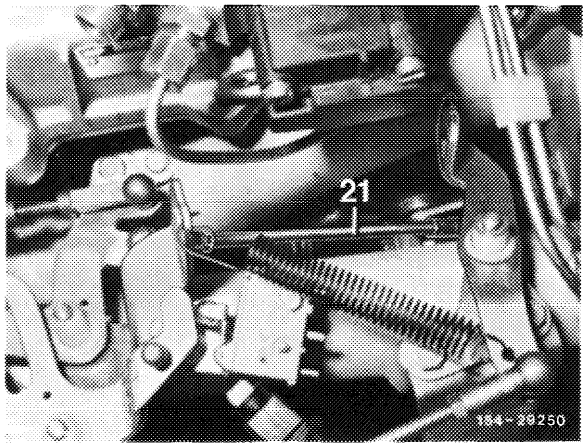
Vehicles with cruise control

Check if the final control element contacts the idle speed stop of the cruise control. To do so, disconnect pushrod (21) and press the lever of the control element clockwise against the idle speed stop. When connecting the pushrod (21) ensure that the lever of the control element is lifted approx. 1 mm above the idle speed stop. Adjust pull rod if necessary.



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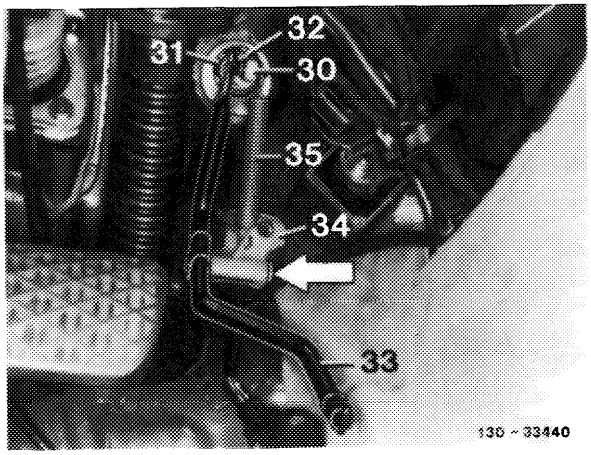
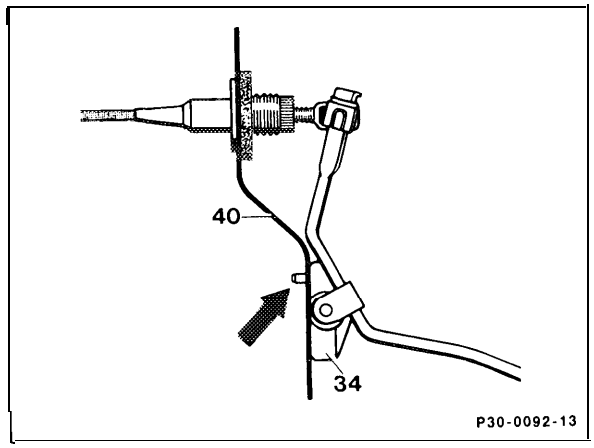
30–315 Removal and installation of accelerator pedal with front wall mounting

Job number of the job texts and work units and standard texts and flat rates respectively 30-0012

Model 124





Accelerator pedal	remove and install (30-330).
Cover	unscrew.
Bowden cable (30)	remove. For this purpose, disconnect return spring (35).
Front wall mounting (34)	unscrew and remove together with the accelerator lever (33).
Front wall mounting (34)	remove from accelerator lever (33). For this purpose, pull of lock (arrow).
Installation	Installation takes place in reverse order. Ensure that the lug (arrow) of the front wall mounting (34) engages in the bore in the front wall (40). Grease the bearing points and the ball sockets of the control linkage with anti-corrosion grease 000 989 87 51 10.
Control linkage	check and adjust if required (30-300).

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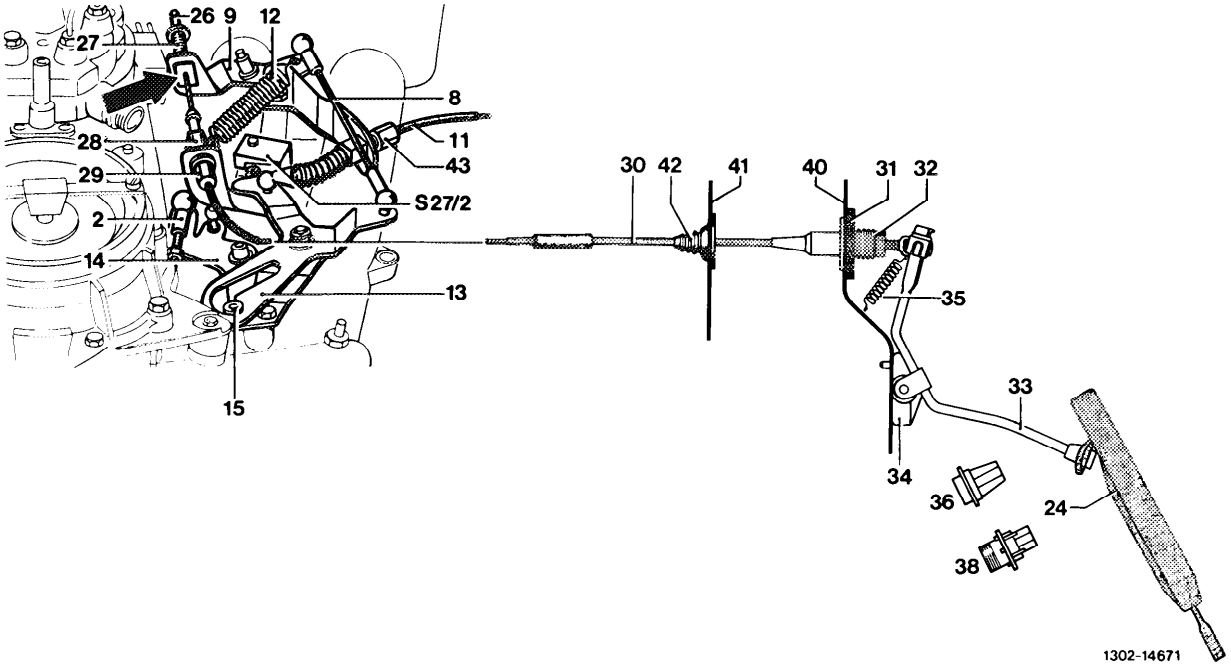
30-325 Removal, installation and adjustment of Bowden cable

Job number of the job texts and work units and standard texts and flat rates respectively 30-0025

Model 124



Return spring (12)	disconnect, connect.
Bowden cable (30)	disconnect, connect. To do so, push plastic ball forward and compress guide piece (arrow) and push out. Remove Bowden cable through the slot.
Plastic clips (28)	compress and remove Bowden cable.
Vacuum lines	disconnect, connect.
Accelerator pedal (24)	remove, install (30-300).
Cover.	dismount, mount.
Return spring (35) in the vehicle interior	disconnect, connect (serves as safey feature).
Bowden cable (30)	push outward, do not push out rubber grommet (31). Remove complete Bowden cable from the engine compartment.
Control linkage	adjust (30-300). Grease bearing points and the ball sockets of the control linkage with anti-corrosion grease 000 989 87 51 10.

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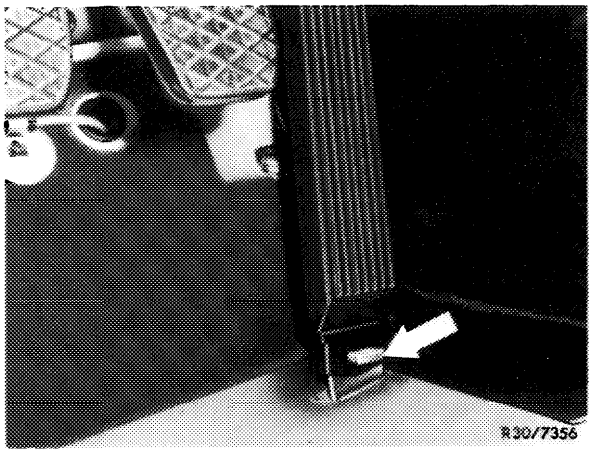
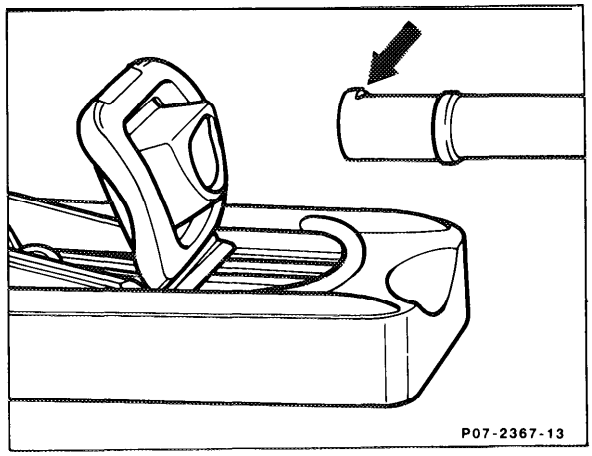
30-330 Removal and installation of accelerator pedal

Job number of the job texts and work units and standard texts and flat rates respectively 30-0010





Spreader clip (arrow) . . . . . compress behind the accelerator pedal and pull out.

Accelerator pedal . . . . . push up and turn by 180°.

Accelerator pedal . . . . . pull down, while the lug (arrow) on the accelerator lever must correspond with the slot in the accelerator pedal.

Installation . . . . . The installation takes place in reverse order. Observe that the spreader clip engages securely.

The connection from accelerator lever to accelerator pedal is maintenance-free and need not be lubricated.

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Lubricating

Following each engine wash and engine compartment conservation, lubricate with an oil can all bearing points, all control levers and joints of the control linkage.

The Bowden cable is maintenance-free and need not be lubricated.

On vehicles in @-version only the following hydraulic oils may be used:

Castrol DB hydraulic fluid
Mobil Aero HFA
Shell Aero fluid 4

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Job No.

Operation of fuel tank with surge bowl . . . . . 47 – 010
Operation of fuel gauge pickup . . . . . – 020
Operation of fuel tank positive and negative ventilation . . . . . – 030
Removal and installation of fuel tank . . . . . – 100
Removal and installation of fuel gauge pickup . . . . . – 120
Function of fuel evaporation system . . . . . – 200
Checking the fuel evaporation system . . . . . – 300
Function of fuel cooler . . . . . – 400

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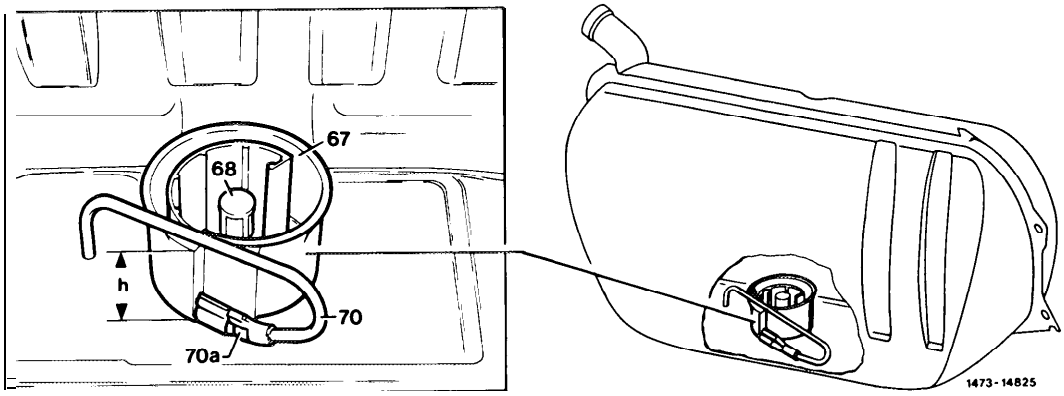

67 surge bowl
68 Fuel tank
70 Return line
70a Return nozzle

A surge bowl (67) is installed in the fuel tank. Its duty is to reliably supply the engine with fuel at low fuel level in the fuel tank and with prolonged driving on winding roads.

While the fuel pump is running, the return fuel jet flows from the return nozzle (70a) at high speed into the surge tank. In this way it drags along into the surge bowl (arrow) the fuel surrounding the return nozzle.

The fuel level (h) is maintained in the surge bowl even when the fuel level in the fuel tank drops below the level (h).

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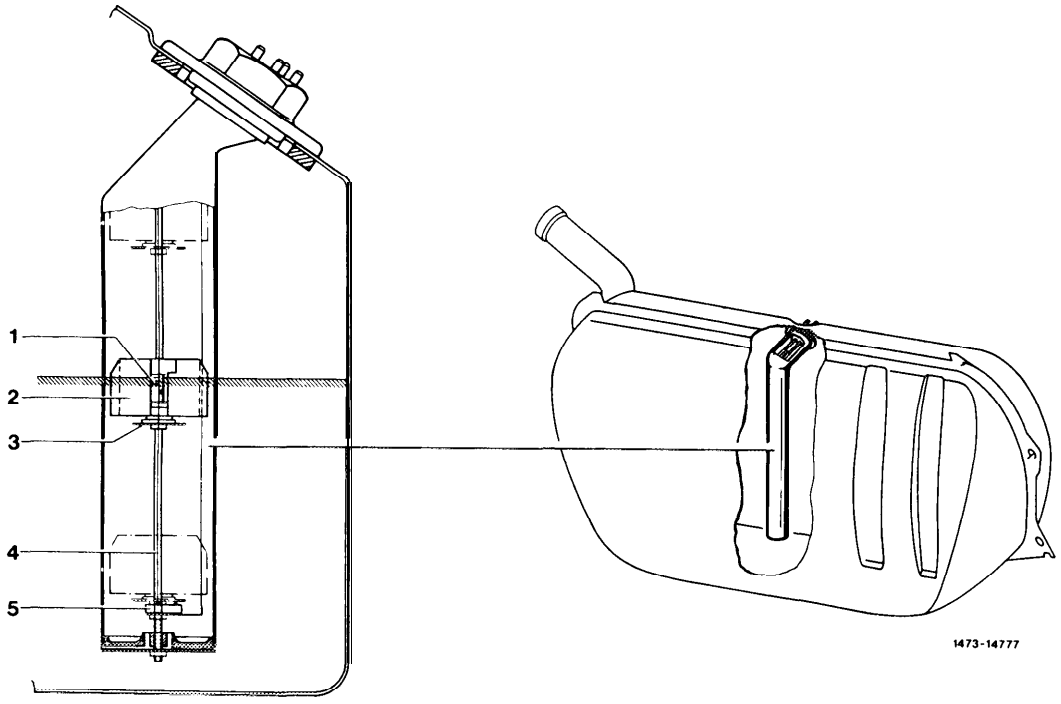
47–020 Operation of fuel gage pickup



1 Sliding contact
2 Float
3 Contact plate
4 Guide and contact rod
5 Reserve warning contact

When the fuel level drops in the fuel tank, the sliding contact (1) on the float (2) increases the resistance value, the voltage drops and the indicating needle in the instrument cluster will swing back.
When the fuel level drops to the reserve volume, the reserve warning contact (5) closes and connects the reserve warning lamp to ground. The reserve warning lamp lights up when the ignition is switched on (control function). As soon as the engine is running, it goes out provided the fuel tank contains more than just the reserve volume.

Note
In control function the reserve warning lamp lights up with less intensity, when reaching the reserve volume, with more insensity.

Check fuel gage (54-269).

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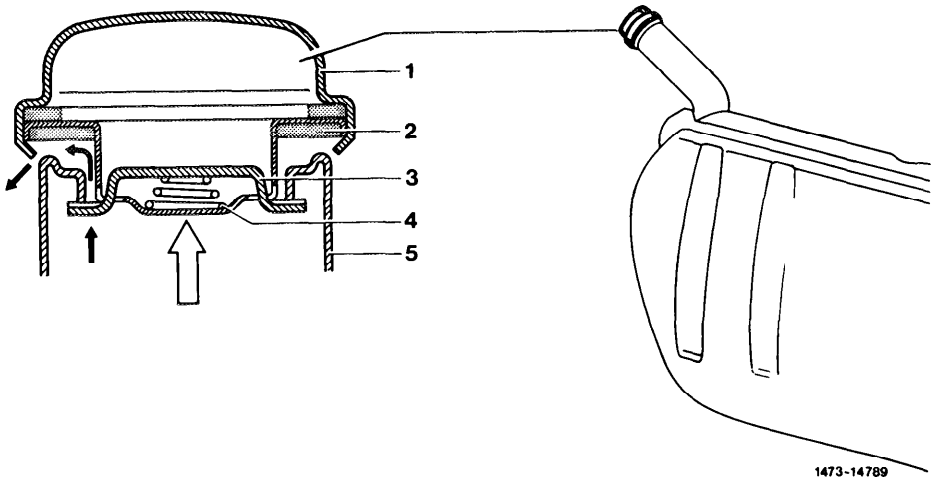
A. Closing cap



All models
1 Closing cap
2 Sealing ring
3 Closing clip
4 Compression spnng
5 Filler neck

At a gage pressure of **100-300** mbar the fuel vapors can escape via the closing cap. However, this is only possible when for instance the breather pipe from the fuel tank is blocked through damage or improper installation. With the system in operating condition, a pressure of up **to 50 mbar may occur in the fuel tank.**

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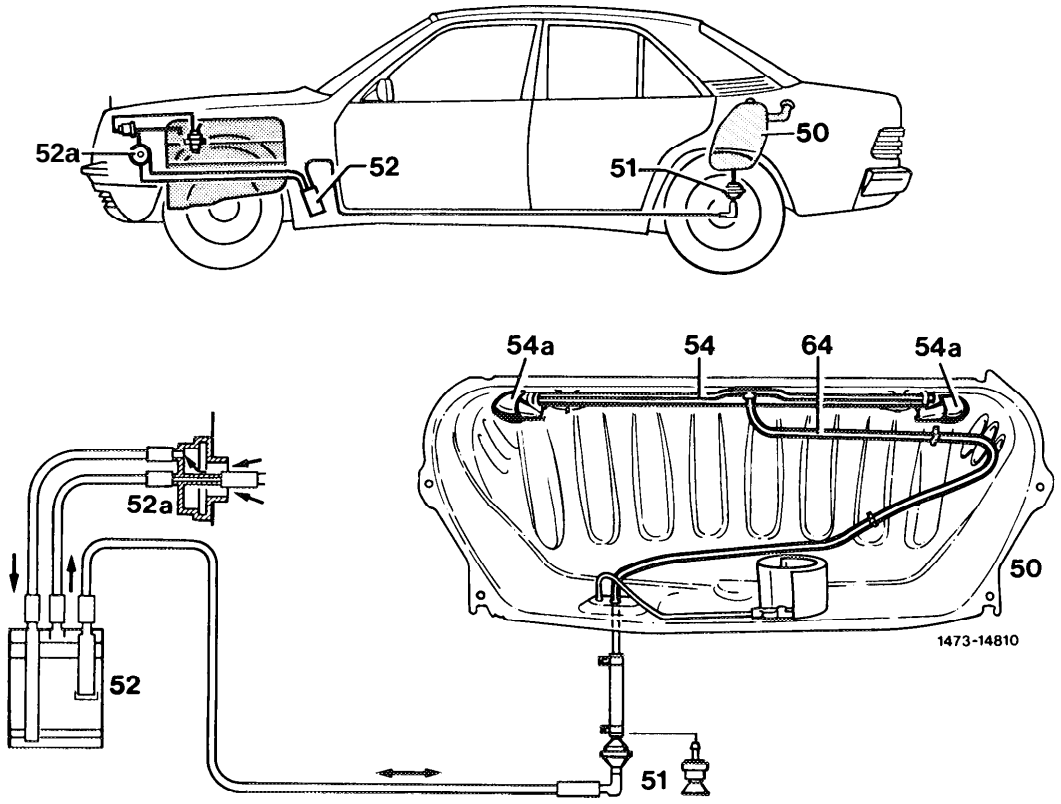
B. Models 124, 126 and 201



The ventilation system consists of a central pipe (54) each with one fuel trap (54a) at the ends. The fuel traps prevent that fuel escapes via the breather pipes. From the central pipe the breather pipe (64) leads to the breather valve (51). On vehicles with fuel evaporation system, positive and negative ventilation of the fuel tank (50) takes place via the charcoal cannister (52) and the diaphragm (52a).

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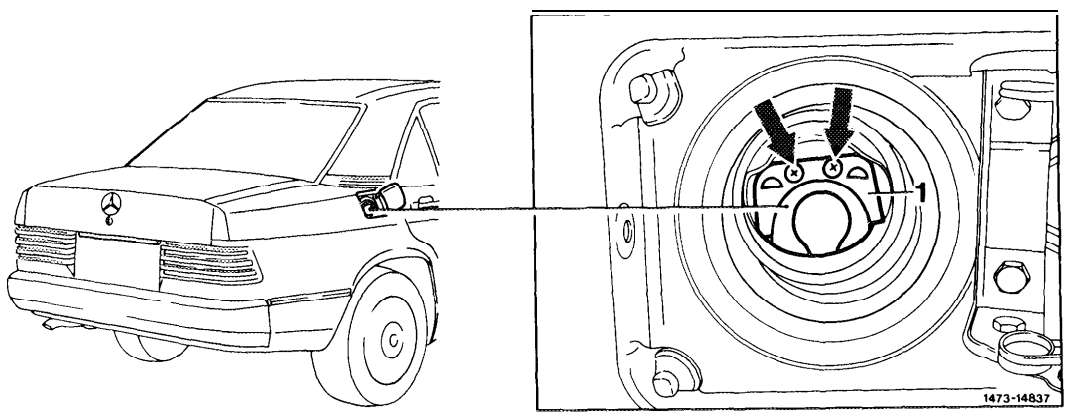
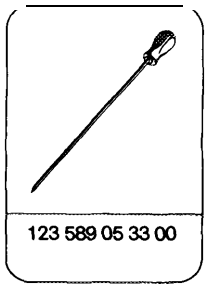
Job number of the job texts and work units and standard texts and flat rates respectively 47-0050

A. All models with catalytic converter emission control system



Guide funnel (1) . . . . . remove, install. For this purpose, use special tool 123 589 05 33 00 to remove as far as possible the rivets (arrows), drive in with mandrel. Because of the smaller filling gun for unleaded fuel a guide funnel (1) has been installed. When replacing the fuel tank, install a guide funnel.

Special tool



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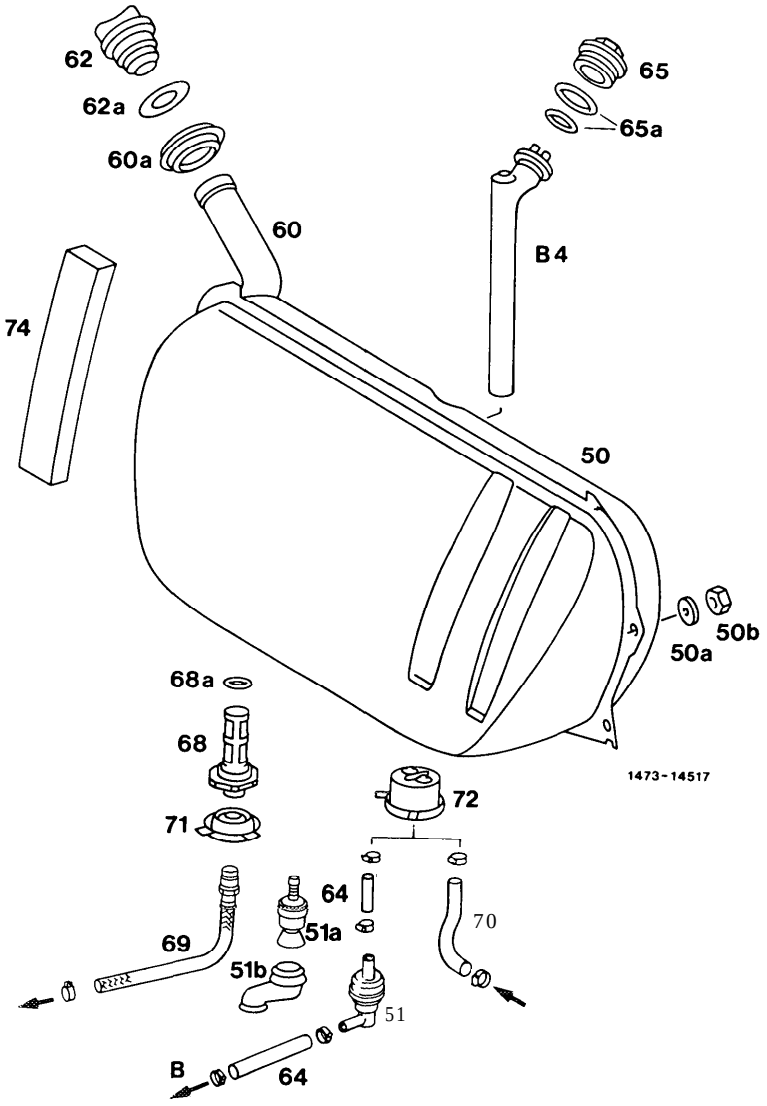
B. Model 124 Sedan



Safety regulations	observe, risk of accidents !
Ground cable, battery	disconnect, connect.
Fuel tank (50)	drain. Carefully pump out fuel so that no residual fuel quantity remains in the fuel tank. Filling capacity is approximately 70 liters. Glue on 4 damping strips (74) with MB universal glue 000 989 92 71 if required.
Closing cap (62)	remove, install. Check sealing ring (62a), renew if required.
Sealing sleeve (60a)	remove, install
Fuel tank covering and left, right lateral boot covering	remove, install.

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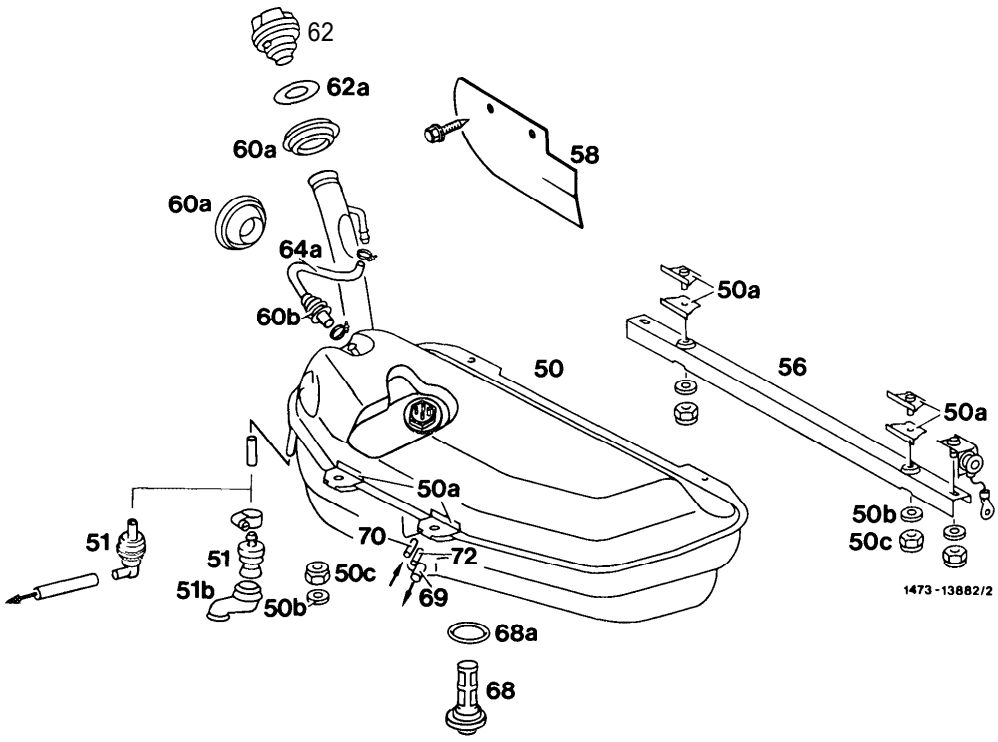
Fuel gage	pull off, fit connector on pickup (B4), check function. Remove, install pickup (B4) 39 Nm if required (47-120). Renew sealing rings.
Supply hose (69), return hose (70), breather valve (51, 51a)	disconnect, connect, 28 Nm. Check reusability. Collect residual fuel. Plug connections. Check seals (71, 72) for proper seating.
Nut (50b, 4 required)	21 Nm, use 4 washers (50a).
Fuel filter (68)	remove, install if required, 39 Nm, clean, check for reusability, renew sealing ring (68a).
Briefly run engine	check connections for leaks.

C.124 T-Sedan



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Safety regulations	observe, risk of accidents!
Ground cable, battery	disconnect, connect.
Closing cap (62a)	remove, install. Check sealing ring (62a) renew if required.
Fuel tank (50)	drain, carefully pump out fuel so that no residual fuel quantity remains in the tank. Filling capacity is approx. 72 liters. Between rear-end floor and fuel tank, glue in damping strips with MB universal glue 000 989 92 71 if required.
Sealing sleeves (60a)	remove, install.
Front load compartment flap or 3rd seat bench back rest	remove, install.
Covering front storage compartment	loosen and fold back; fold forward and attach.
Breather line (64a)	remove, install. Pre-assemble on the fuel tank upon installation. Install the pipe with a steady decline and without kinks. Check sealing sleeve (60b) for proper seating.
Fuel gage	pull off, fit connector on pickup (B4). Check function. Remove, install pickup (B4) 39 Nm (47-120) if required, renew sealing rings.
Sealing sleeve (60a, 2 required)	remove, install.
Supply hose (69), return hose (70), leak-off pipe (72)	disconnect, connect, check reusability. Collect residual fuel. Plug hoses.
Breather valve (51)	dismount, mount (only vehicles with fuel evaporation system).
Exhaust	disconnect, connect (suspend with V-belt) on both rear exhaust suspensions.
Splashguard (58) filler neck	dismount, mount.
Bracket level pipe (left side)	dismount, mount.
U-rail (56)	remove, install, 30 Nm (support fuel tank). Nuts (50c) self-locking.
Attachment (50a-50c) fuel tank front	unscrew, screw on, 30 Nm. When removing the fuel tank ensure that the connection for the breather line (64a, on the filler neck) does not hook into a cable or pipe. Push exhaust and level pipe to the left.
Fuel filter (68)	remove, install if required, 39 Nm, clean, check reusability. Renew sealing ring (68a).
Briefly run engine	check connections for leaks.

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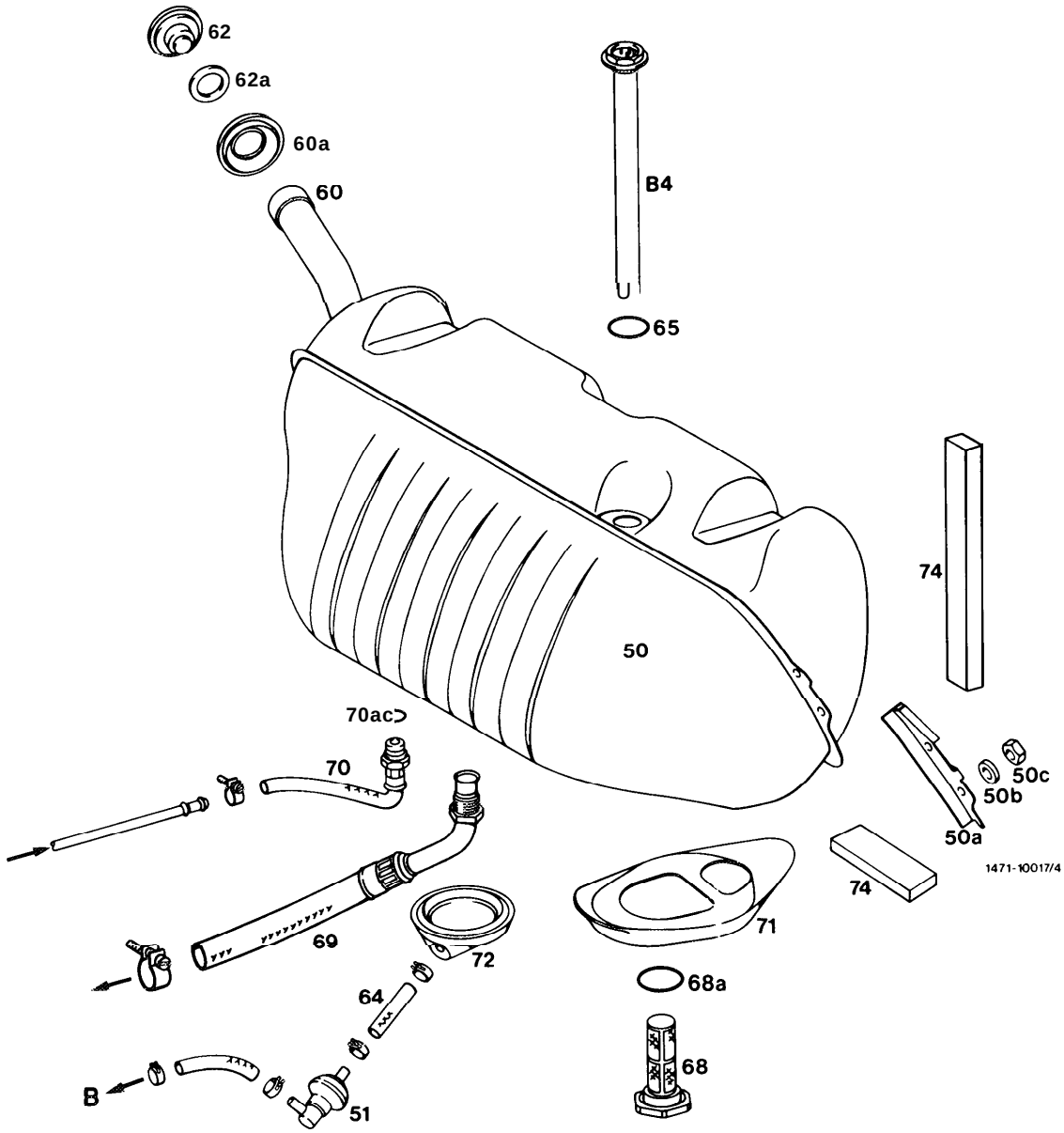
D. Model 126



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Safety regulations	observe, risk of accidents!
Ground cable, battery	disconnect, connect.
Closing cap (62)	remove, install. Check sealing ring (62a), renew if required.
Fuel tank (50)	drain. Carefully pump out fuel so that no residual quantity remains in the fuel tank. Filling capacity is approx. 90 liters. Glue in 4 damping strips (74) with MB universal glue 000 989 92 71 if required.
Sealing sleeve (60a)	remove, install.
Partition panel trunk/fuel tank	remove, install.
Supply hose (69), return hose (70), breather valve (51)	disconnect, connect, 28 Nm, check for reusability. For return line (70), use shortened box wrench (selfmade), renew sealing ring (70a). Collect residual fuel, plug connections. Check seals (71, 72) for proper seating.
Nuts (50c, 4 required)	21 Nm, use 4 washers (50b)
Fuel gage	pull off, fit connector to pickup (B4). Check function. Remove, install pickup (B4) 39 Nm, (47-120) if required, renew sealing ring.
Fuel filter (68)	remove, install if required. 39 Nm, clean, check for reusability, renew sealing ring (68a).
Briefly run engine	check connections for leaks.

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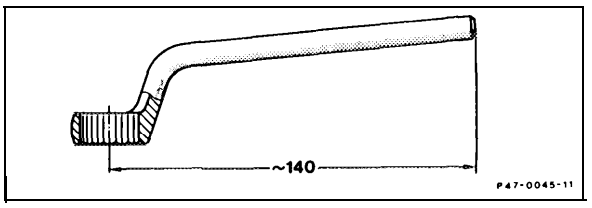
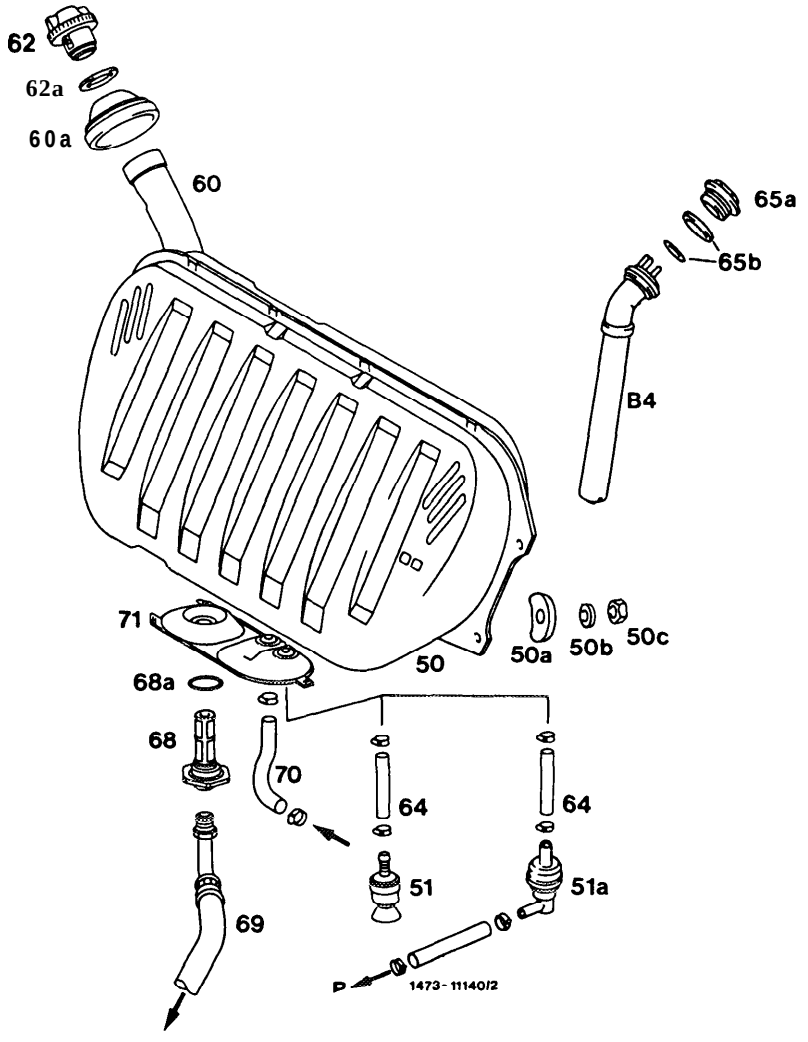
Selfmade tool

Shorten commercially available box wrench as shown.



E. Model 201



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Safety regulations	observe, risk of accidents!
Ground cable, battery	disconnect, connect.
Closing cap (62)	remove, install. Check sealing ring (62a), renew if required.
Fuel tank (50)	drain. Carefully pump out fuel so that no residual quantity remains in the fuel tank. Filling capacity is approx. 55 liters. Glue in 4 damping strips with MB universal glue 000 989 92 71 if required.
Sealing sleeve (60a)	remove, install.
Covering fuel tank	disconnect, connect.
Fuel gage	pull off, fit connector on pickup (84). Check function. Remove, install pickup (B4) 39 Nm, (47-120) if required, renew sealing ring.
Supply hose (69), return hose (70), breather valve (51)	disconnect, connect, 28 Nm, check reusability. Collect residual fuel. Plug connections.Check seal (71) for proper seating.
Nut (50b, 4 required)	21 Nm. Use 4 washers (50a).
Drain hose from tank trough	before removing the fuel tank, pull drain hose slightly up and route behind fuel tank edge. After installation, route in the proper position.
Fuel filter (68)	remove, install, if required. 39 Nm, clean, check for reusability, renew sealing ring (68a).
Briefly run engine	check connections for leaks.

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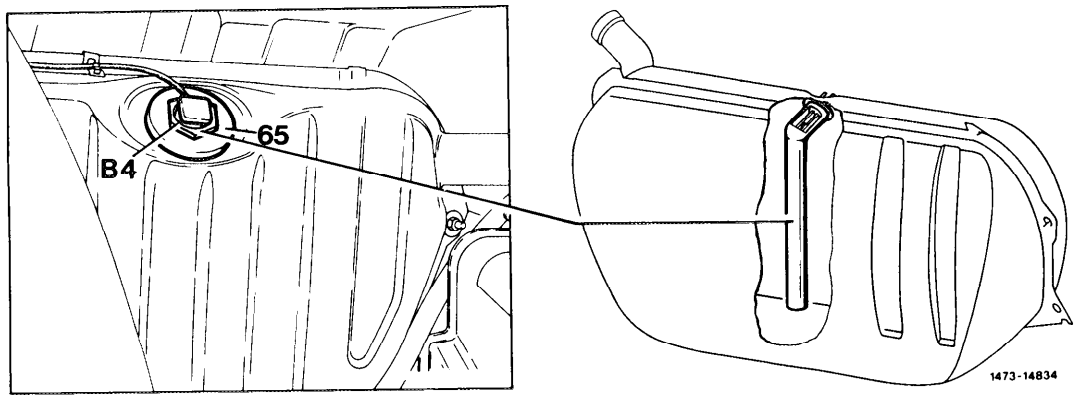
A. Models 124 Sedan, 201



Ground cable, battery	disconnect, connect.
Covering fuel tank	remove, install, model 201 only partially.
Connector on pickup (B4)	pull-off, fit.
Sealing flange (65)	unscrew, screw on, 39 Nm, if fuel tank is full, first pump out approx. 8 liters. Renew sealing rings.
Pickup (B4)	remove, install, allow to run dry if required. Remove safety pin under adhesive foil (only with new part).

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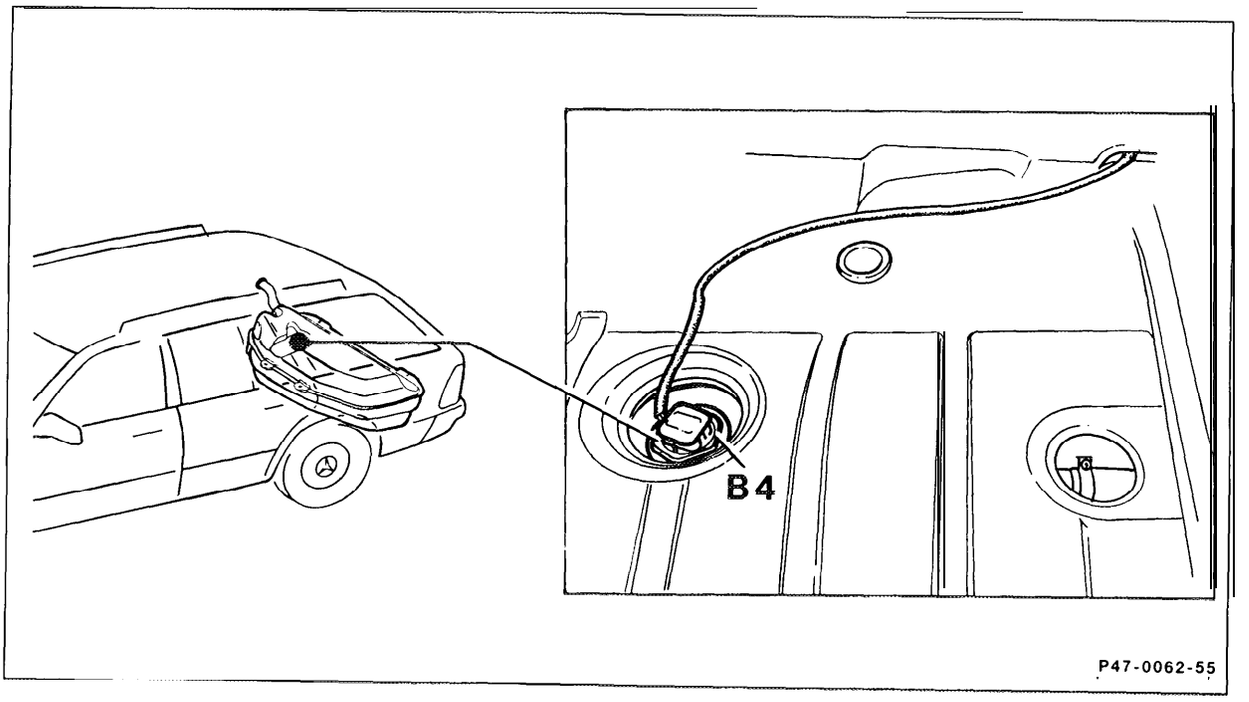
B. Model 124 T-Sedan



Ground cable, battery	disconnect, connect.
Front load compartment flap and 3rd seat bench back rest	remove, install.
Load compartment covering	partially remove, install.
Closing cab	remove, install.
Connector on pickup (B4)	pull off, fit.
Pickup (B4)	remove, install, 39 Nm, allow to run dry if required. Remove safety pin under adhesive foil (only with new part).

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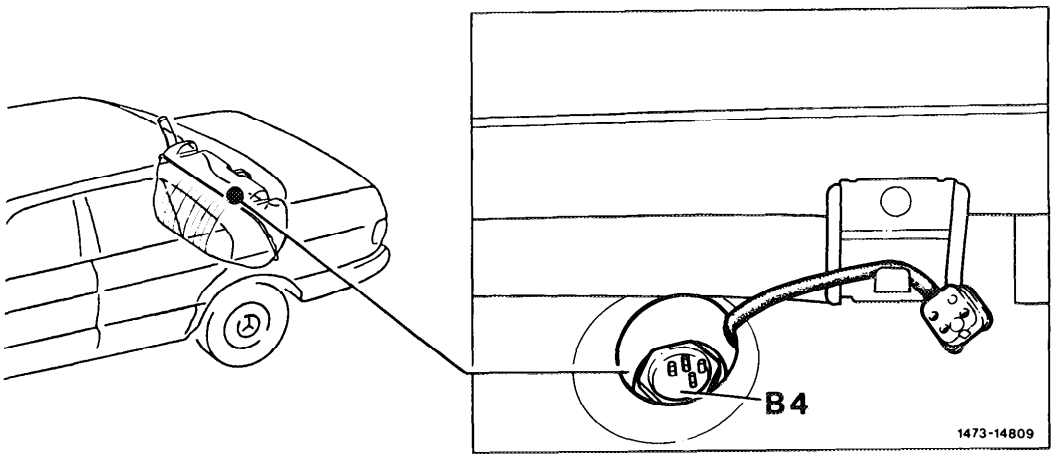
C. Model 126



Ground cable, battery	disconnect, connect.
Rear seat bench, rear back rest	remove, install (91-l 70).
Closing cap	remove, install.
Connector on pickup (B4)	pull off, protect against sliding, fit.
Pickup (B4)	remove, install 39 Nm, allow to run dry if required. Renew sealing ring. Remove adhesive foil and safety pin (only with new part).

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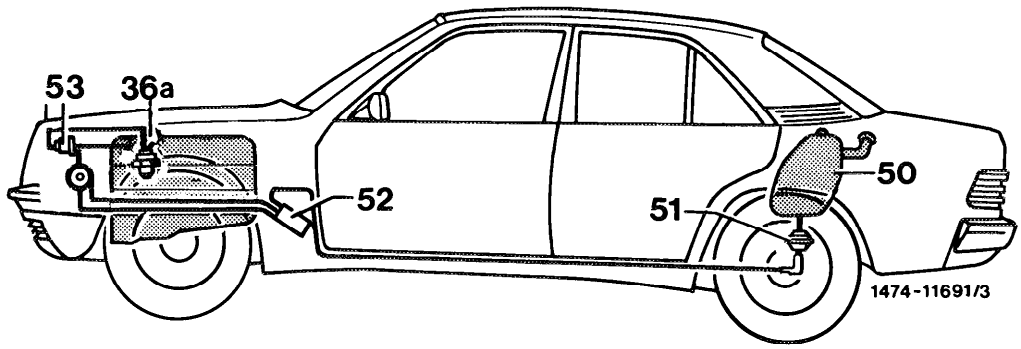

36a	50 °C red thermo valve
50	Fuel tank
51	Breather valve
52	Charcoal canister
52a	Diaphragm
53	Purge valve

General

A fuel evaporation system has been installed in order to allow less fuel vapors to escape into the atmosphere. The fuel vapors from the fuel tank (50) are directed to the charcoal canister (52) where they are stored. Depending on the operating conditions of the engine, the fuel vapors are evacuated via the purge valve (53) and the intake assembly by means of the intake manifold vacuum and burnt in the engine.
Below approx. 50 °C coolant temperature and/or throttle valve at idle speed stop, the fuel vapors are not extracted.

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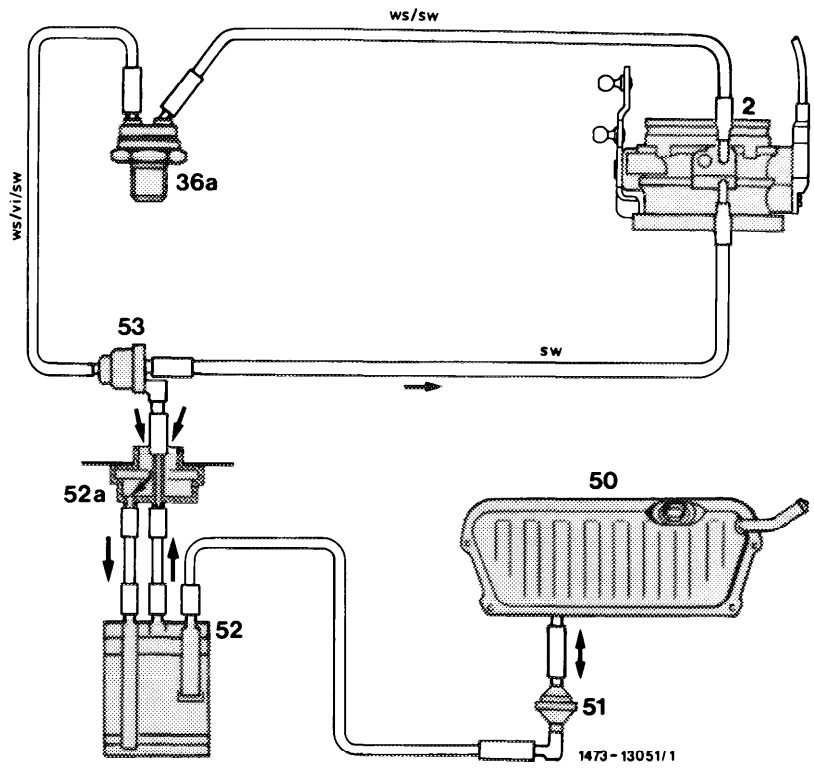
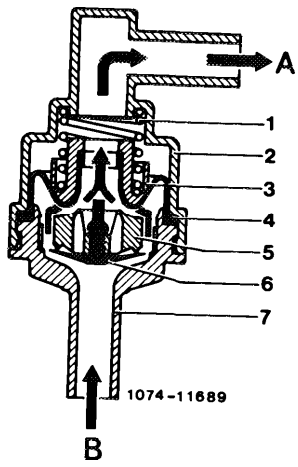
Function diagram

2	Intake pipe assembly
36	Thermo valve (50 °C, red)
50	Fuel tank
51	Breather valve
52	Charcoal canister
52a	Diaphragm



Function

If a gage pressure of 30-50 mbar is reached in the fuel tank, the breather valve (4) opens and the fuel vapors flow to the charcoal canister. The breather valve (51) to the charcoal canister is opened.



1	Compression spring	6	Vent valve
2	Valve housing	7	Connection
3	Spring retainer	A	Charcoal canister connection
4	Breather valve	B	Fuel tank connection
5	Valve plate		

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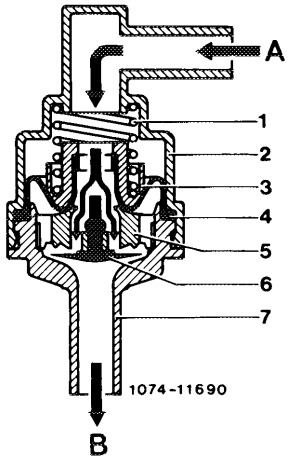
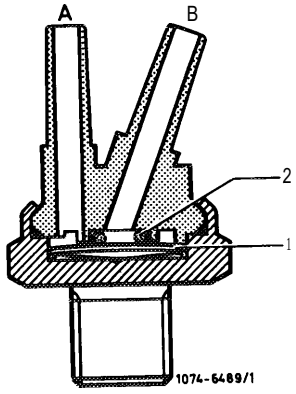
If a vacuum of 1-16 mbar is reached in the fuel tank, the vent valve (6) opens. As a result, air and fuel vapors are drawn in via the charcoal canister.



Breather valve (51) to fuel tank open

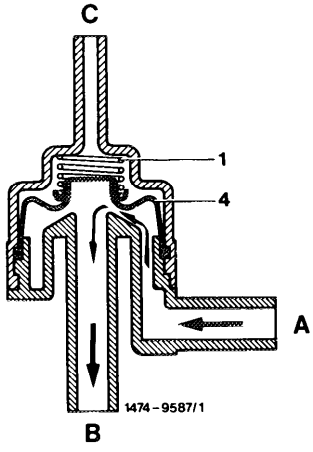
With engine running at a coolant temperature above 50 °C the intake manifold vacuum is applied to the purge valve (connection C) through the thermo valve as from a slightly opened throttle valve position.



Thermo valve 50 °C red
1 Bi-metal plate
2 0-nng
A To the purge valve
B To the intake pipe assembly

As of a vacuum of 20-35 mbar the diaphragm (4) is pulled up against the spring force. The passage from connection A to B is opened.

Purge valve (53) open
1 Compression spring
4 Diaphragm
A Connection charcoal canister
B Connection intake pipe assembly
C Vacuum connection



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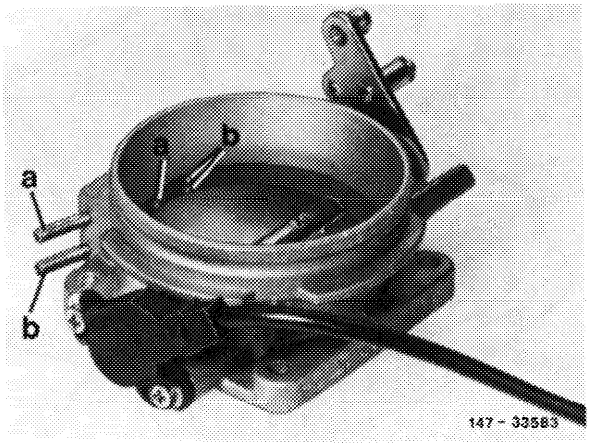
If the throttle valve is further opened, the two extraction bores (b) in the intake pipe assembly, which end in a common passage, become active one after the other, in this way extracting the fuel vapors stored in the charcoal canister. The charcoal in the canister is regenerated.

The intake pipe assembly has vacuum and extraction connection.



a Vacuum control bore
b Extraction bores

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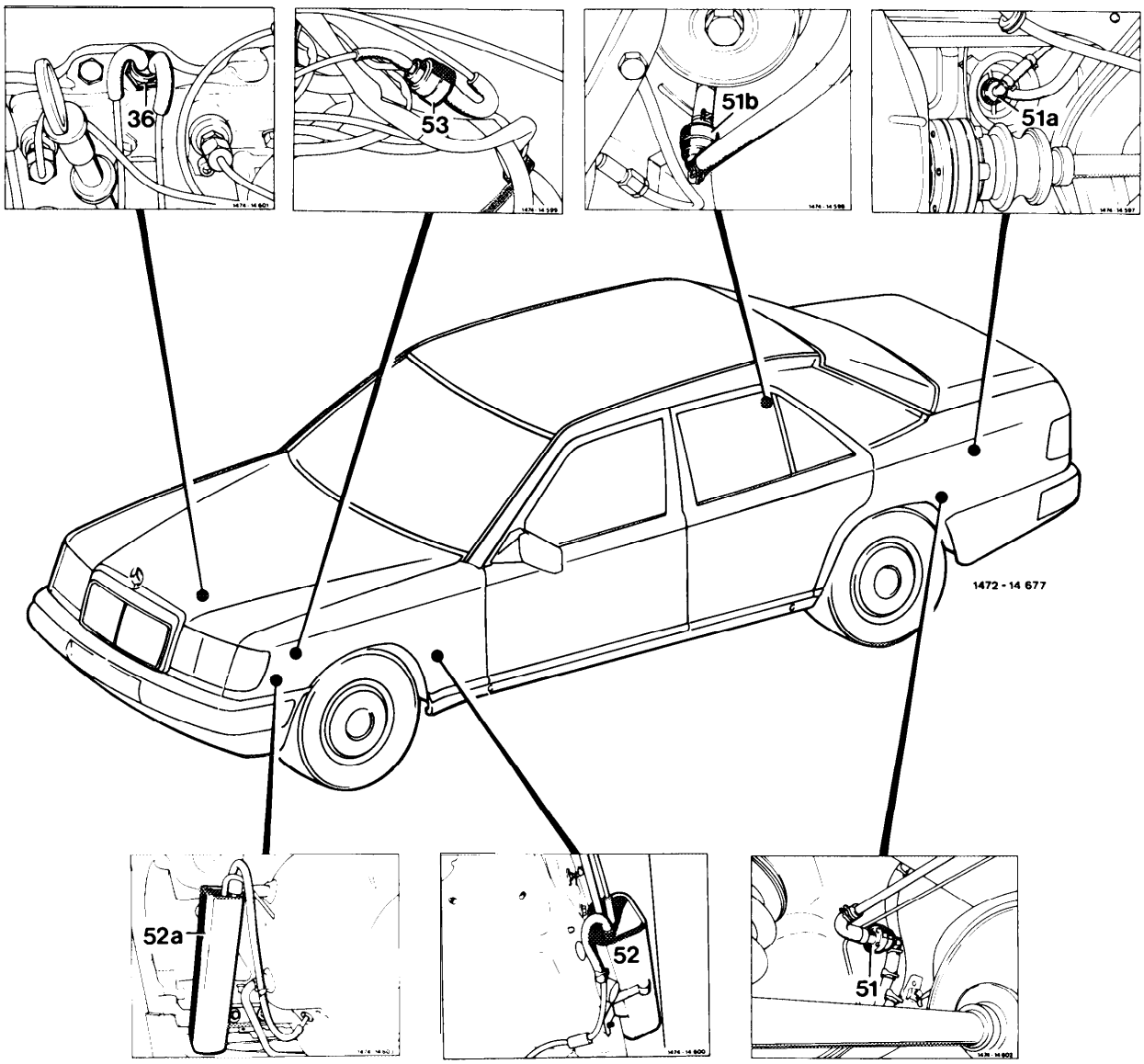

Engine operation temperature	approx. 80 °C engine oil temperature.
Purge valve (53, in the engine compartment front left)	pull off on the inner wing and slowly increase engine rpm to approx. 3000/min. No extraction at idle speed. Extraction commences with increasing speed.
Thermo valve 50 °C, red (36, in sensor strip)	check for continuity.

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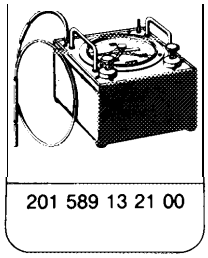
Vacuum lines (white/black and white/purple/black)	ensure proper connection to the intake pipe assembly and thermo valve (36). Check condition.
Breather valve (51, Model 107, 51 a, Models 124 sedan, 201, 126, 51 b 124 T-sedan)	connect tester 201 589 13 21 00 to the fuel tank connection and check function (gage pressure 30-50 mbar, vacuum 1-16 mbar).
Lines	from fuel tank (50) via breather valve (51). Check charcoal canister (52, remove bulkhead if necessary), purge valve (53) to the intake pipe assembly (black).
Charcoal canister (52, Models 124 126, 201; 52a, Model 107)	all connections must have free access to each other.

Special tool



201 589 13 21 00

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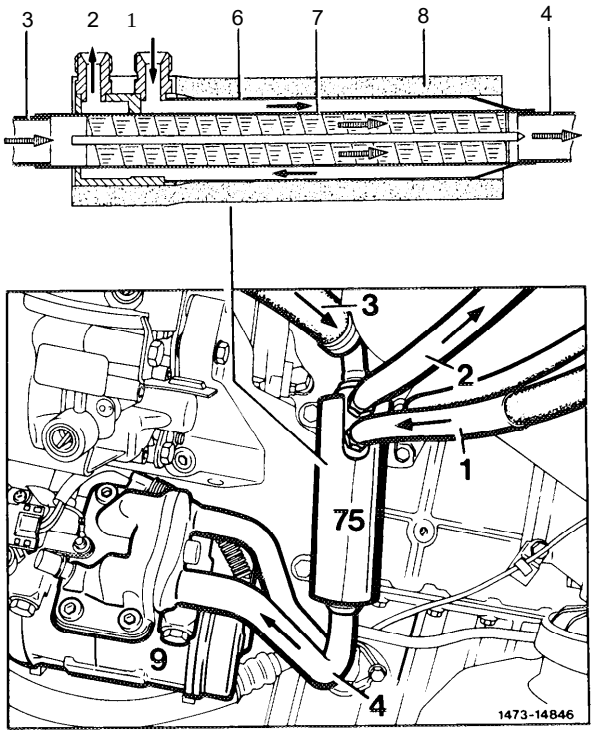
(AUS), (J), (USA) (all models)



75 Fuel cooler
1, 2 Fuel return line
3, 4 Refrigerant return line
6 Outer pipe
7 Inner pipe
8 Insulating hose
9 Refrigerant compressor

A fuel cooler has been installed in order to reduce the formation of bubbles in the fuel system with high outside temperatures. This cooler is located in the coolant return line between evaporator and refrigerant compressor. The fuel cooler is attached to the engine.

With the engine running, the excess fuel in the fuel distributor returns unpressurized through the fuel cooler into the fuel tank.

As long as the refrigerant compressor is switched on, heat is extracted from the fuel by means of the gaseous refrigerant flowing through the inner pipe of the fuel cooler.

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Job No.

Removal, installation of exhaust system . . . . . 49 - 100

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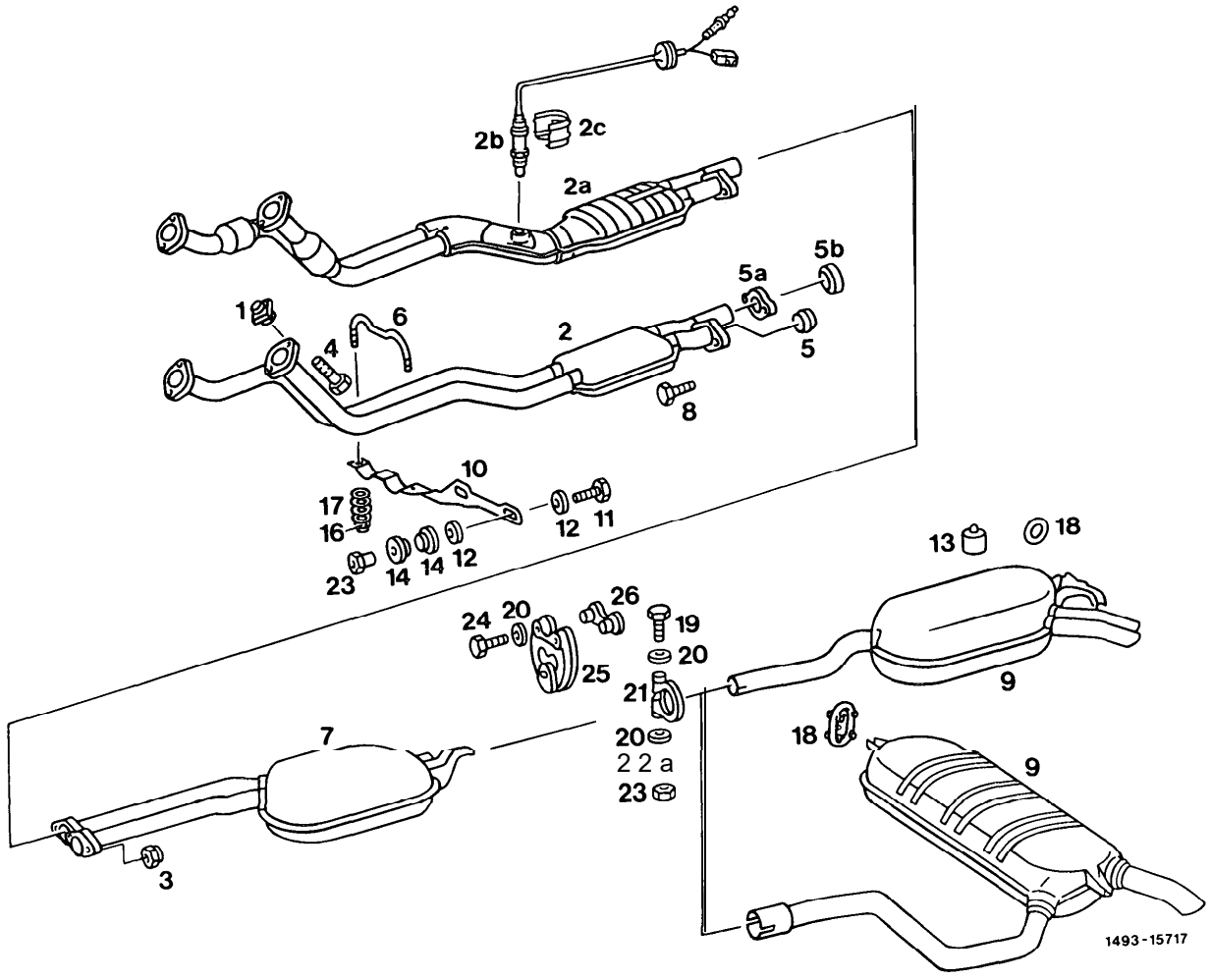
A. Model 124.026/030/050/090 124.226/230/290



Rivet nut in manifold (1)	renew - special tool: rivet screw 103 589 01 39 00, insert rivet nut in manifold and tighten rivet screw with 30 Nm.
Front exhaust pipe with front muffler (2)	uniformly tighten flange connection on manifold.
Front exhaust pipe with primary and underfloor catalytic converter (2a)	uniformly tighten flange connection on the manifold.
Oxygen sensor (2b)	install, ensure proper cable installation. Check lambda control (07.3-I 00).
Cover (2c)	ensure proper installation position.
Self-locking hexagon nut (3)	renew - tightening torque 20 Nm.
Hexagon-head screw (4)	renew - tightening torque 25 Nm.

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Sintered sealing ring (5)	check for damage, ensure proper seating
Flange (5a)	check for reusability, renew if required.
Graphite sealing ring (5b)	renew.
Retaining U-bolt (6)	check for reusability.
Center muffler (7)	check for damage.
Hexagon-head screw (8)	renew.
Rear muffler (9)	check for damage.
Lateral support (10) with hexagon-head screw (11), washer (12) and rubber washer (14)	install, tightening torque 20 Nm.
Rubber buffer (13)	check for wear.
Self-locking hexagon nut (16)	renew, tightening torque 7 Nm.
Diaphragm spring (17)	renew.
Rubber ring (18)	check for wear and damage.
Hexagon-head screw (19), washer (20) and pipe clamp (21)	check for reusability, renew if necessary.
Spring washer (22)	renew.
Hexagon nut (23)	tightening torque 25 Nm.
Hexagon-head screw (24), mounting plate (25) and clamping plate (26)	check for damage and wear.

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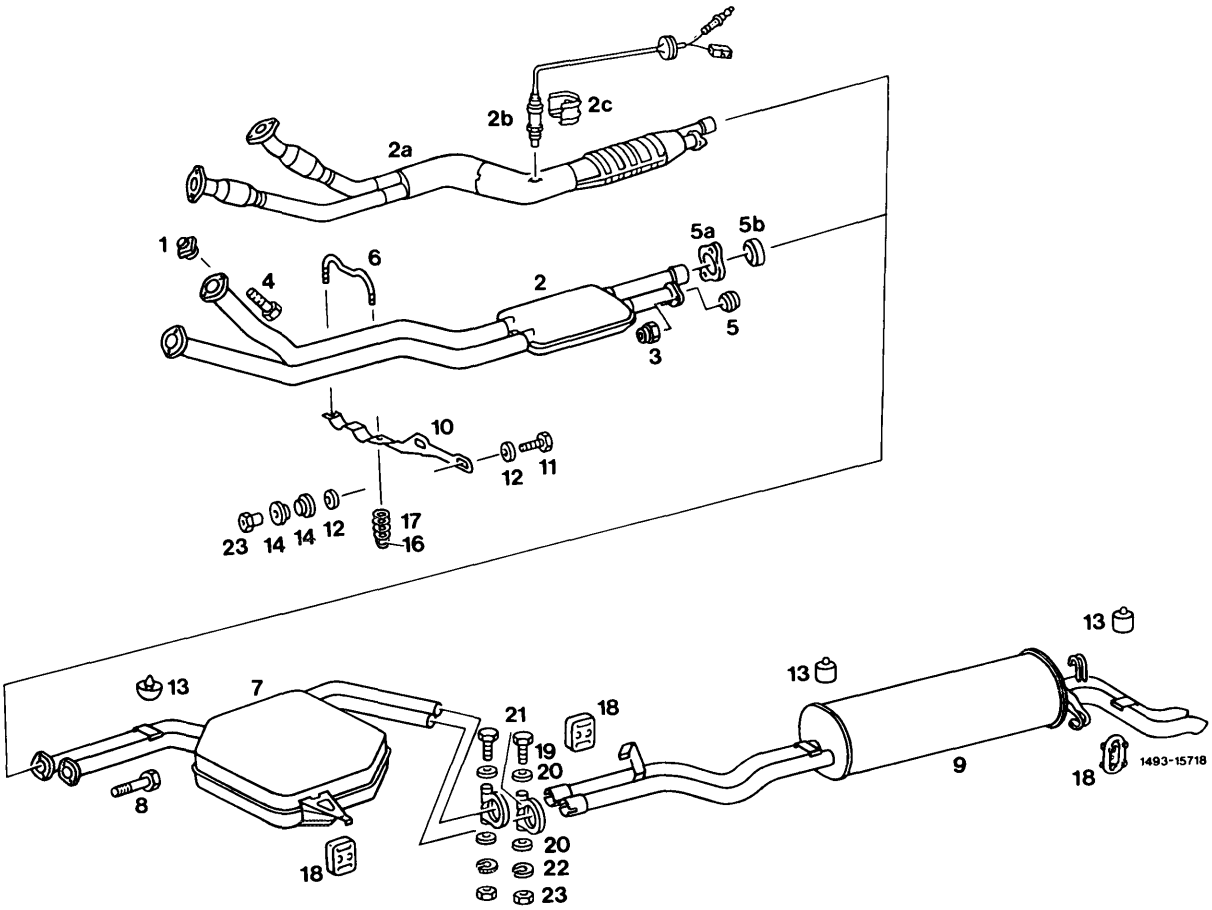
B. Model 126.02



Rivet nut in manifold (1)	renew - special tool: rivet screw 103 589 01 39 00, insert rivet nut in manifold and tighten rivet screw with 30 Nm.
Front exhaust pipe with front muffler (2)	uniformly tighten flange connection on the manifold.
Front exhaust pipe with primary and underfloor catalytic converter (2a)	uniformly tighten flange connection on the manifold.
Oxygen sensor (2b)	install, ensure proper installation of cables. Check lambda control (07.3-100).
Cover (2c)	ensure proper installation position.
Self-locking hexagon nut (3)	renew - tightening torque 20 Nm.
Hexagon-head screw (4)	renew - tightening torque 25 Nm.
Sintered sealing ring (5)	check for damage, ensure proper seating.
Flange (5a)	check for reusability, renew if required.
Graphite sealing ring (5b)	renew.

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Retaining U-bolt (6)	check for reusability.
Center muffler (7)	check for damage
Hexagon-head screw (8)	renew.
Rear muffler (9)	check for damage.
Lateral support (10) with hexagon-head screw (11), washer (12) and rubber washer (14)	mount, tightening torque 20 Nm.
Rubber buffer (13)	check for wear.
Self-locking hexagon nut (16)	renew, tightening torque 7 Nm.
Diaphragm spring (17)	renew.
Rubber ring (18)	check for damage and wear.
Hexagon-head screw (19), washer (20) and pipe clamp (21)	check for reusability, renew if required.
Spring washer (22)	renew.
Hexagon nut (23)	tightening torque 25 Nm.

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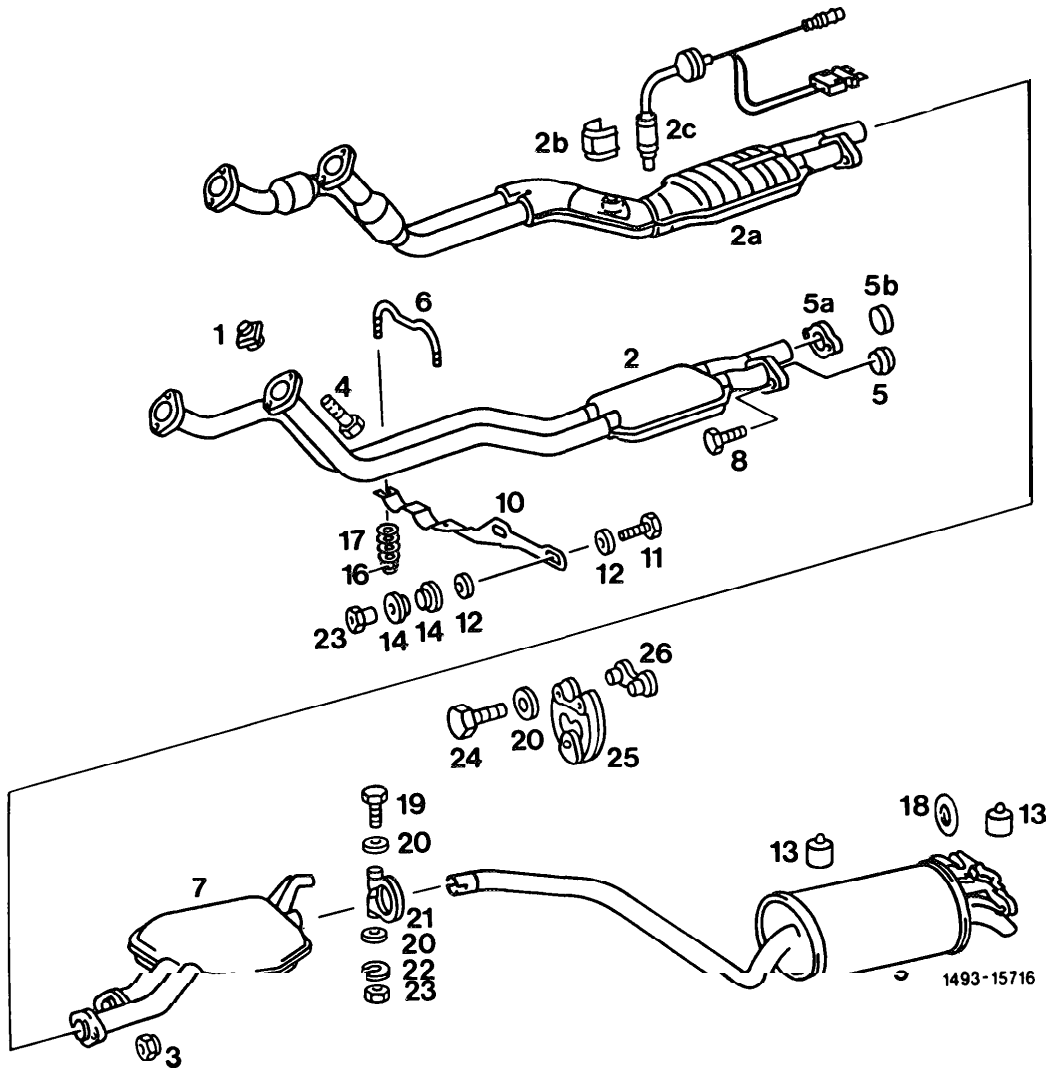
C. Model 201.029



Rivet nut in manifold (1)	renew - special tool: rivet screw 103 589 01 39 00, insert rivet nut in manifold and tighten rivet screw with 30 Nm.
Front exhaust pipe with front muffler (2)	uniformly tighten flange connection on the manifold.
Front exhaust pipe with primary and underfloor catalytic converter (2a)	uniformly tighten flange connection on the manifold.
Oxygen sensor (2c)	mount, ensure proper installation of cables. Check lambda control (07.3-I 00).
Cover (2b)	ensure proper installation position.

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Self-locking hexagon nut (3)	renew - tightening torque 20 Nm.
Hexagon-head screw (4)	renew - tightening torque 25 Nm.
Sintered sealing ring (5)	check for damage, ensure proper seating.
Flange (5a)	check for reusability, renew if required.
Graphite sealing ring (5b)	renew.
Retaining U-bolt (6)	check for reusability.
Center muffler (7)	check for damage.
Hexagon-head screw (8)	renew.
Rear muffler (9)	check for damage.
Lateral support (10) with hexagon-head screw (11), washer (12) and rubber washer (14)	mount, tightening torque 20 Nm.
Rubber buffer (13)	check for wear.
Self-locking hexagon nut (16)	renew, tightening torque 7 Nm.
Diaphragm spring (17)	renew.
Rubber ring (18)	check for damage and wear.
Hexagon-head screw (19), washer (20) and pipe clamp (21)	check for reusability, renew if required.
Spring washer (22)	renew.
Hexagon nut (23)	tightening torque 25 Nm.
Hexagon screw (24), mounting plate (25) and clamping plate (26)	check for damage and wear.

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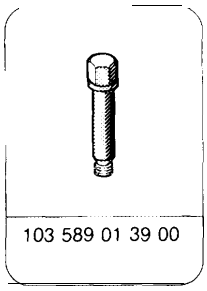
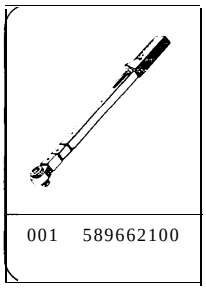
Special tools



103 589 01 39 00



001 589662100

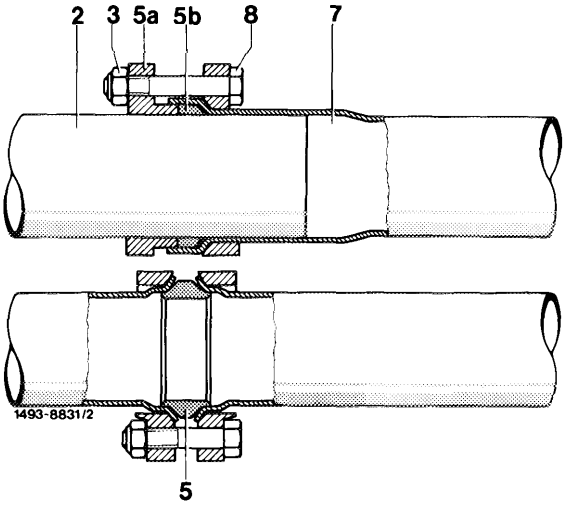
The removal and installation of the exhaust system is not fully explained but some particularly important points are described which must be observed during removal and installation or during partial renewal for instance of the rear muffler with plug connection.

Removal

1 Check suspension components for reusability and renew if required.

2 Prior to assembling the exhaust system ensure that the flanges to the exhaust manifold are not warped. Straighten flanges if necessary.

3 If required, clean cone-shaped pipe connections (2 and 7) and sintered sealing ring (5) of combustion residue or corrosion by means of emery cloth.



2 Front exhaust pipe
3 Self-locking hexagon nut
5 Sintered sealing ring
5a Flange
5b Graphite sealing ring
7 Center exhaust pipe
8 Hexagon-head screw

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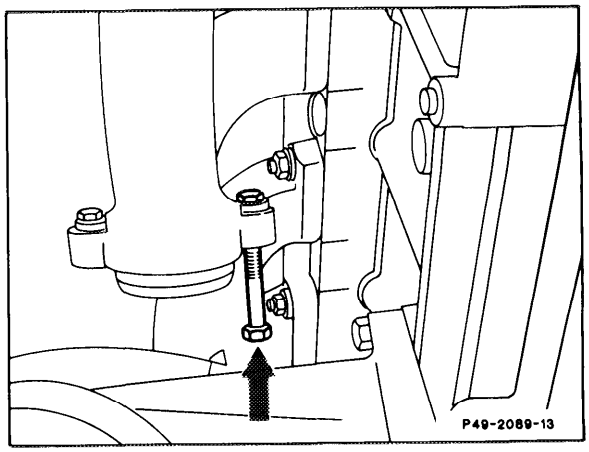
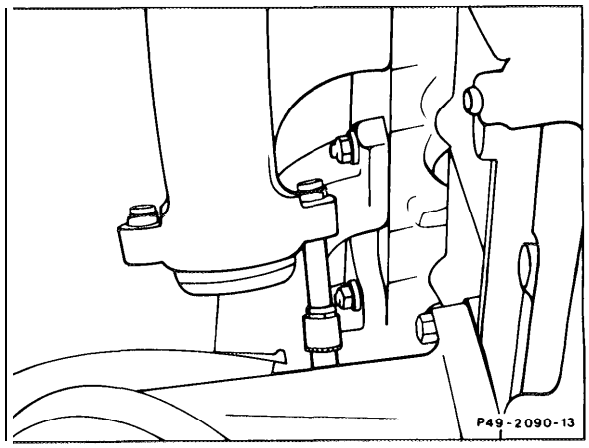
4 Use a suitable hexagon-head screw to drive rivet nuts out of the bores in the exhaust manifold. The hexagon-head screw should only be screwed in by hand.



Installation

5 Insert new rivet nut in the hole of the exhaust manifold. Screw in rivet screw and tighten with a tightening torque of 30 Nm.

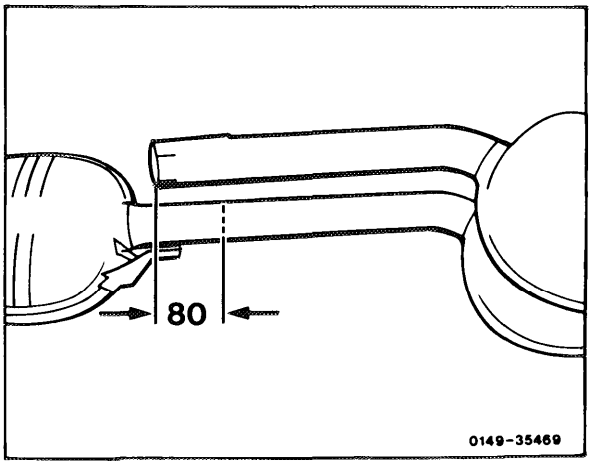


6 Remove rivet screw.

Renewal of rear muffler

7 Place new rear muffler with plug connection accurately over the removed exhaust system and mark off pipe length of the new rear muffler on the removed system.

Cut the pipe (interrupted line) 80 mm from the mark (-10 mm tolerance) in the direction of the rear muffler so that a plug-in depth of 70-80 mm is ensured.



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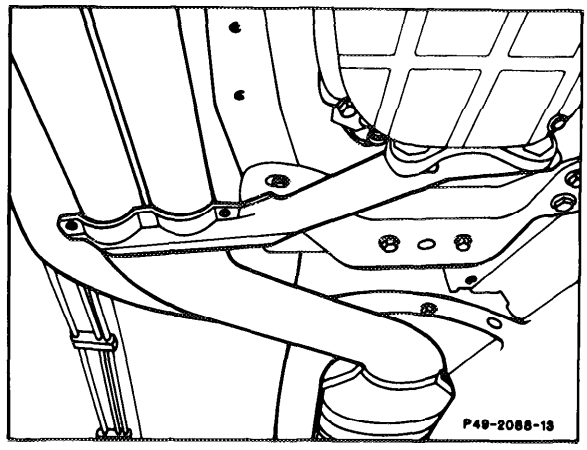
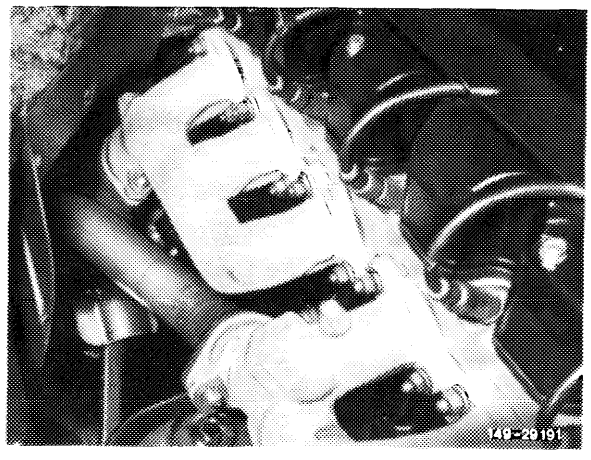
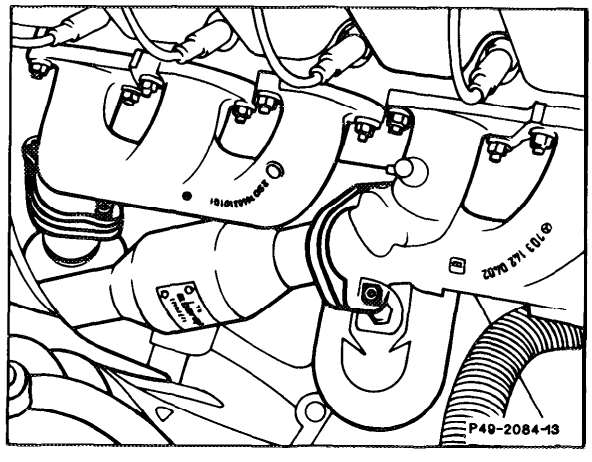
8 Always replace self-locking hexagon nuts and graphite sealing ring on the exhaust flange connection.

9 Uniformly tighten the flange connection on the manifold while the front exhaust system rests on the lateral support on the transmission (except Model 107.041). Tightening torque of the self-locking hexagon nuts is 30 Nm.



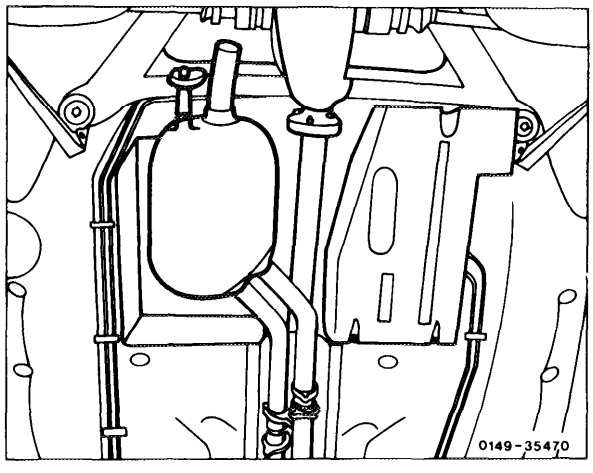


Arrangement of front exhaust pipe RÜF



Arrangement of front exhaust pipe CAT

10 Mount center exhaust system with center muffler while suspending the exhaust system in the rear suspension rubber on the rear axle carrier at the same time (arrow).



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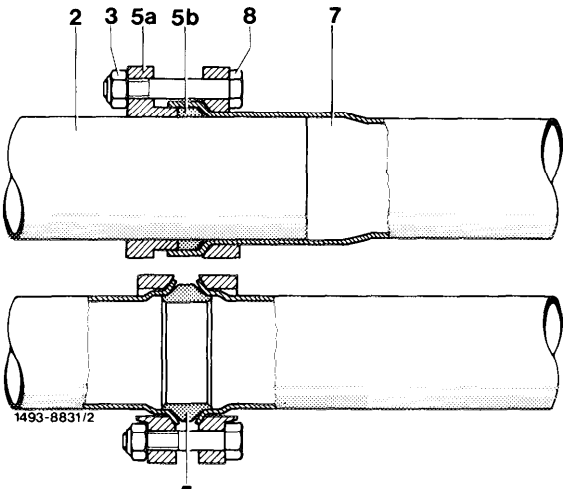
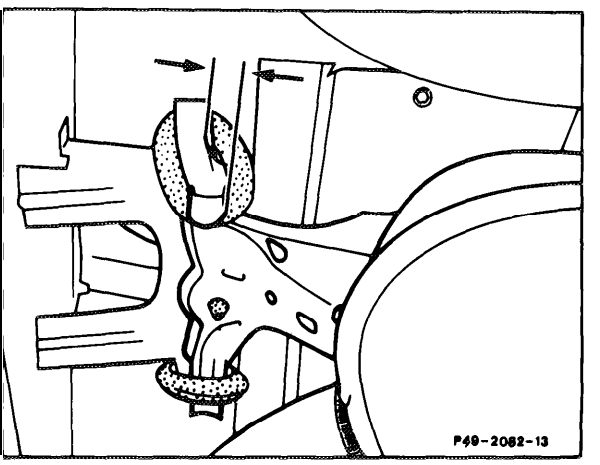
11 Mount sintered graphite sealing ring (5, 5b) on the flange connection and ensure proper seating. Tightening torque of the self-locking hexagon nuts is 20 Nm.



2 Front exhaust pipe
3 Self-locking hexagon nut
5 Sintered sealing ring
5a Flange
5b Graphite sealing ring
7 Center exhaust pipe
8 Hexagon-head screw

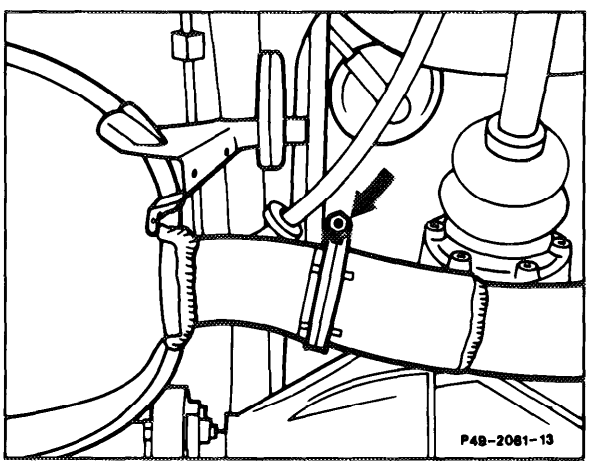
12 Install rear muffler so that the retaining brackets of the rear muffler are located approximately 10 mm from the brackets on the frame floor, so that the proper installation position is ensured if the exhaust system is elongated (arrows).



Note
The above refers only to mufflers in repair version with plug connection between center and rear mufflers.

13 Connect rubber rings with suitable hook to the rear muffler.

14 Centralize exhaust pipe clamp between center and rear muffler and tighten hexagon nut with 25 Nm (arrow).



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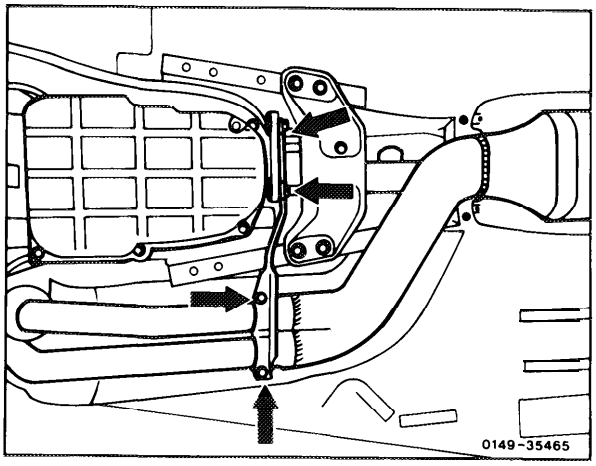
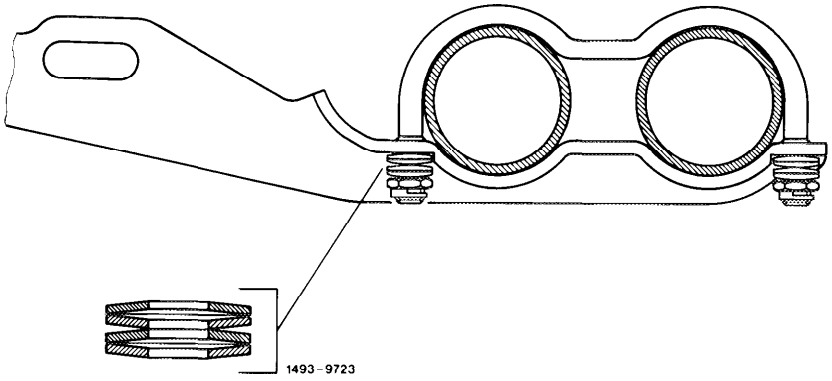
15 Mount exhaust lateral support without tension. Tightening torque of the self-locking hexagon nuts on the U-bolt is 7 Nm, the hexagon-head screws of the lateral support on the transmission 20 Nm (arrows).



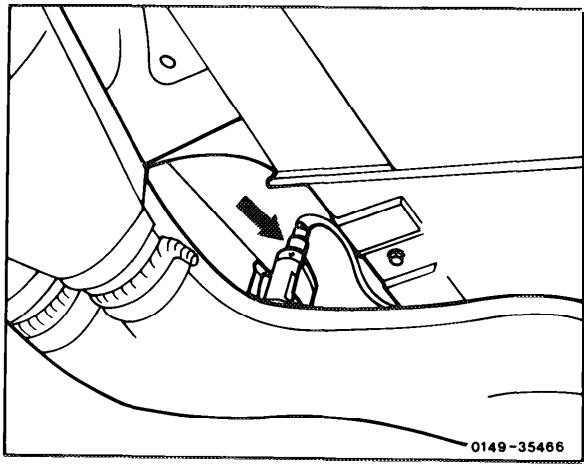
Note

Install 4 diaphragm springs on each side on the retaining U-bolt so that the concave sides of the springs face one another (as shown in the figure).



16 On vehicles with catalytic converter, mount oxygen sensor with shielding plate (arrow). For this purpose, coat thread with paste 000 989 88 51.

17 Run engine and check exhaust system for leaks.



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