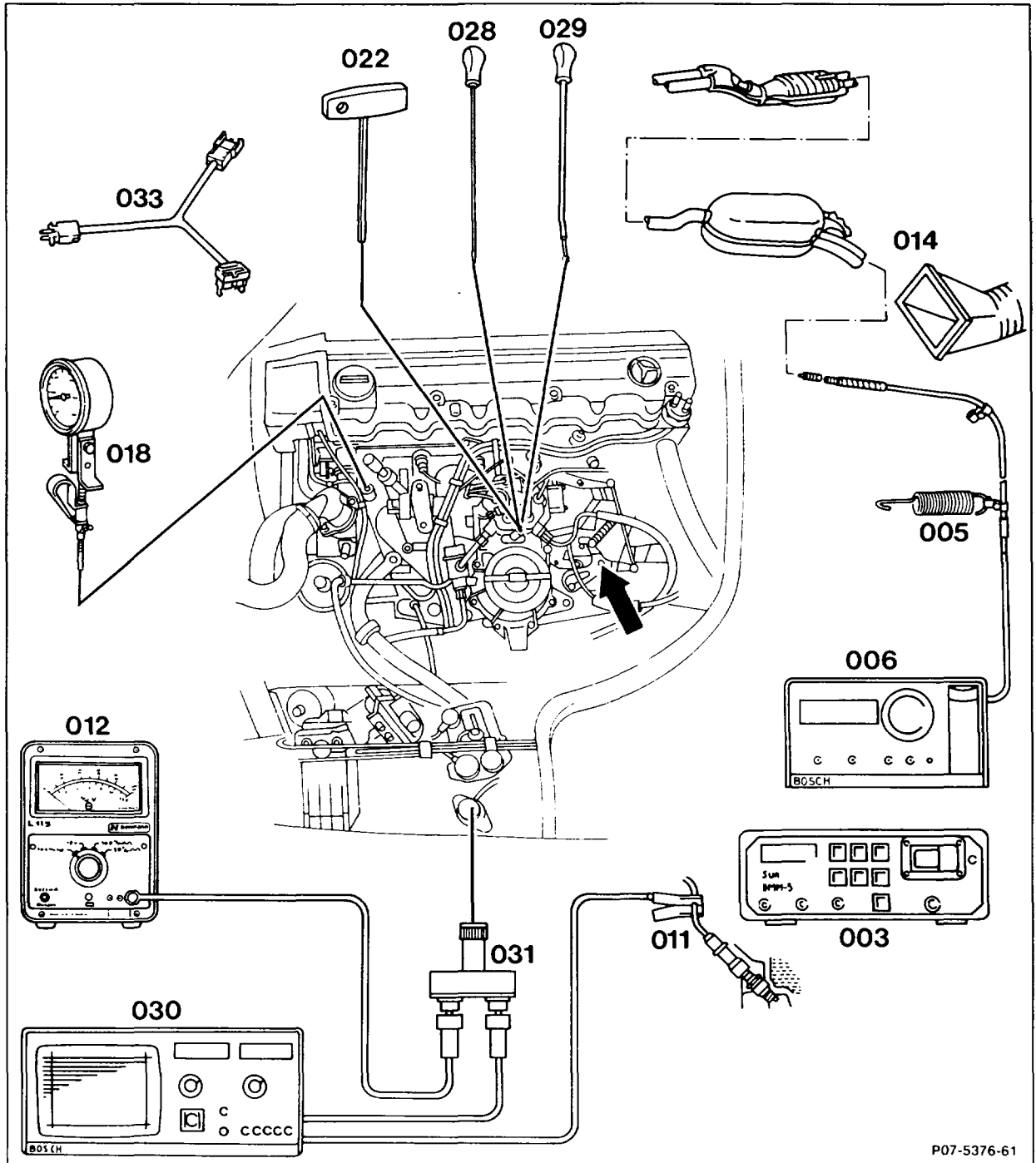


07.3-1100 Testing, adjusting engine

Operation no. of operation texts and work units or standard texts and flat rates:
07-1100.

Basic and national versions



P07-5376-61

Test sheet	complete.
A/C or automatic climate control	switch off.
Selector lever	move into position "P."
Testers	connect: oil remote thermometer (018) 124 589 07 21 00, lambda control tester (012), twin socket (031), exhaust probe (005) 126 589 11 63 00, CO analyzer (006), engine tester with oscilloscope (030), trigger clamp (011), multimeter (003), test cable (033) 102 589 04 63 00.
Extraction device (014)	position at exhaust tailpipe.
Coolant level	check, adjust to correct level.
Engine oil level	check, pay attention to condition of oil (visual check).
Air cleaner	remove, install.
Accelerator control linkage (arrow) and throttle valve	check ease of movement and condition. Grease bearing points, relay levers, ball sockets.
Idle stop	check.
Fulcrum lever	check, adjust.
Full throttle stop	check from accelerator pedal, adjust.
Voltages	test at battery and ignition coil terminal and 15.
Current at actuator	test with ignition switched on.
Ignition timing	test, adjust (see table).
Vacuum advance	test, adjust (see table).
Oil level in automatic transmission	check, adjust to correct level.
Engine oil level	approx. 80°C.
Oscilloscope image	analyze.
Intake system	check for leaks by spraying.

Functional check of electrical components	perform.
Exhaust gas recirculation valve	test.
Idle speed	check (see table).
Idle emissions level or lambda control	test, adjust (see table).
	For adjusting use special tools screwdriver (022) 000 589 14 11 00, puller (028) 123 589 05 33 00, insertion drift (029) 123 589 00 15 00.
Smooth engine running	check. Switch on all ancillaries for this step.

Test and adjustment data

Basic version

Engine	Version	Idle speed		Idle emissions level	Lambda control
		1/min	Control range	% CO	Control range %
103.940 103.941 103.942 103.943	RÜF NV (RÜF) KAT	650-750	35-45% 21-27° Δ	1 ± 0.5	-
				≤ 0.5 ²⁾	¹⁾
103.980	Std. Std. KAT	600-700		1 ± 0.5	-
				1 ± 0.5 < 1.5 ²⁾	
103.981	RÜF NV (RÜF) KAT			1 ± 0.5	
				≤ 0.5 ²⁾	¹⁾
103.982 103.983 103.985	RÜF NV (RÜF) KAT	up to 5/90: 600-700 as of 6/90: 650-750		1 ± 0.5	-
				≤ 0.5 ²⁾	¹⁾
103.984	RÜF KAT	650-750		1 ± 0.5	-
				≤ 0.5 ²⁾	¹⁾

¹⁾ Test lambda control at 2500/min and read off mean value. Detach regeneration line at regeneration valve for this step and seal. Compare this reading with idle emissions reading. The mean value at idle speed must not differ by more than ± 10 from the reading obtained at 2500/min.

²⁾ For special emissions test (ASU).

National version (AUS) 1986–1991 silver information plate

Engine	Version	Idle speed		Idle emissions level	Lambda control
		1/min	Control range	% CO	
103.94	(AUS)	700 ± 50	35–45% 21–27° Δ	–	1)
103.98		650 ± 50			

1) Test lambda control at 2500/min and read off mean value. Detach regeneration line at regeneration valve for this step and seal. Compare this reading with idle emissions reading. The mean value at idle speed must not differ by more than ± 10 from the reading obtained at 2500/min.

- National version**
- (CH) up to 1986 green information plate
 - (CH) 1986, 1987 green information plate
 - (CH) KAT 1986, 1987 light green information plate
 - (CH) KAT as of 1988 information plate not fitted, engine data setting plate instead
 - (S) 1986, 1987 blue information plate
 - (S) KAT as of 1986 light blue information plate

Engine	Version	Idle speed		Idle emissions level	Lambda control
		1/min	Control range	% CO	
103.94	(CH) KAT (S) KAT	700 ± 50	35–45% 21–27° Δ	≤ 0.5	1)
103.98 außer 103.984				(CH) (S)	780 ± 50
	(CH) KAT (S) KAT	650 ± 50; as of 06/90 750 ± 50		≤ 0.5	1)
103.984	(CH) KAT (S) KAT	700 ± 50			

1) Test lambda control at 2500/min and read off mean value. Detach regeneration line at regeneration valve for this step and seal. Compare this reading with idle emissions reading. The mean value at idle speed must not differ by more than ± 10 from the reading obtained at 2500/min.

National version (J) 1986–1990 information plate in Japanese

Engine	Version	Idle speed		Idle emissions level	Lambda control
		1/min	Control range	% CO	
103.94	(J)	700 ± 50	35–45%	–	1)
103.98		650 ± 50			

1) Test lambda control at 2500/min and read off mean value. Detach regeneration line at regeneration valve for this step and seal. Compare this reading with idle emissions reading. The mean value at idle speed must not differ by more than ± 10 from the reading obtained at 2500/min.

National version (USA) 1986–1989 black information plate

(USA) 1990 black information plate Federal, yellow California

Engine	Version	Idle speed		Idle emissions level	Lambda control
		1/min	Control range	% CO	Control range %
103.94	(USA)	700 ± 50	35–45%	–	1)
103.98		650 ± 50; as of model year 1990 700 ± 50			

1) Test lambda control at 2500/min and read off mean value. Detach regeneration line at regeneration valve for this step and seal. Compare this reading with idle emissions reading. The mean value at idle speed must not differ by more than ± 10 from the reading obtained at 2500/min.

Current at actuator

Engine	Version	Current with ignition switched on (mA)
103.94	KAT	20
103.98		
103.94	RÜF, without KAT	10
103.98 1)		

1) Engine 103.980 Std.: 0 mA.

EZL ignition timing point

Engine	EZL ignition control unit	Engine speed 1/min	Ignition timing point in ° CA before TDC		
			Resistance trimming plug position or type of fuel	without vacuum	with vacuum

Basic version KAT/RÜF and (CH) (S) KAT

103.940	003 545 95 32	3200	S	25-29	40-44				
103.941	003 545 96 32		N	19-23					
103.942	005 545 84 32	Idle speed	S and N	7-11	7-11				
103.943	005 545 86 32								
	006 545 73 32								
	006 545 75 32								
	008 545 61 32								
	008 545 63 32								
	011 545 88 32								
	011 545 89 32								
103.980	003 545 14 32	3200	1/ premium leaded	23-27	39-43				
	003 545 15 32	Idle speed		8-13	8-13				
		3200	3/ premium unleaded	19-23	39-43				
		Idle speed		8-13	8-13				
103.981	004 545 44 32	3200	S	27-31	40-44				
103.983	004 545 46 32		N	21-25	40-44				
103.985	005 545 85 32	Idle speed	S and N	6-11	6-11				
	005 545 87 32								
	006 545 74 32								
	006 545 76 32								
	007 545 86 32								
	007 545 87 32								
	008 545 62 32								
	008 545 64 32								
103.982	004 545 44 32								
	004 545 46 32								
	005 545 85 32								
	005 545 87 32								
	006 545 74 32								
	006 545 76 32								
103.984	007 545 86 32								
	007 545 87 32								

National version (CH) 1986, (S) 1986 1)

103.981	004 545 69 32	3200	S	29-33	40-44
103.983	005 545 49 32		N	23-27	
	005 545 88 32	Idle speed	S and N	OT ± 2	OT ± 2

1) For (CH) KAT, (S) KAT, same values as basic version KAT.

EZL ignition timing point

Engine	EZL ignition control unit	Engine speed 1/min	Ignition timing point in ° CA before TDC		
			Resistance trimming plug position or type of fuel	without vacuum	with vacuum

National version (AUS)

103.940	005 545 84 32	3200	Reference resistor 220 Ω	19-23	40-44
103.942	005 545 86 32 006 545 73 32 006 545 75 32 008 545 61 32 008 545 63 32	National version		7-11	7-11
103.981	004 545 44 32	3200	Reference resistor 220 Ω	21-25	40-44
103.983	004 545 46 32 005 545 85 32 005 545 87 32 006 545 74 32 006 545 76 32 008 545 62 32 008 545 64 32	National version		6-11	6-11

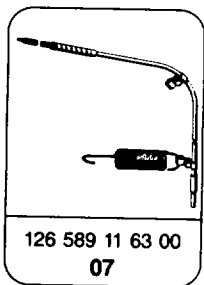
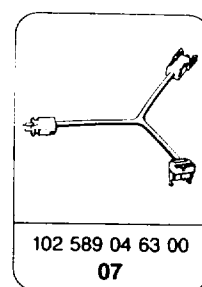
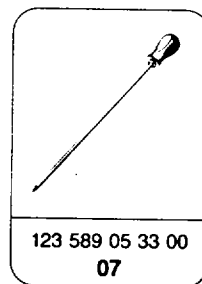
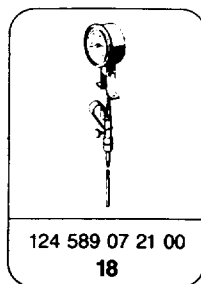
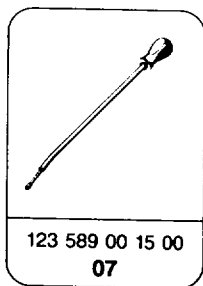
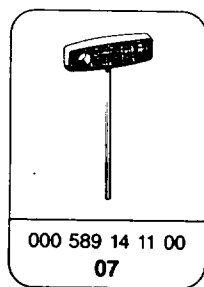
National version (J)

103.940	005 545 84 32	3200	Reference resistor 750 Ω	25-29	40-44
103.942	005 545 86 32 006 545 73 32 006 545 75 32 008 545 61 32 008 545 63 32	National version		7-11	7-11
103.981	004 545 44 32	3200	Reference resistor 750 Ω	27-31	40-44
103.983	004 545 46 32	National version		6-11	6-11
103.985	005 545 85 32 005 545 87 32 006 545 74 32 006 545 76 32 008 545 62 32 008 545 64 32				

National version (USA)

103.940	005 545 84 32	3200	Reference resistor 750 Ω	25-29	40-44
103.942	005 545 86 32 006 545 73 32 006 545 75 32 008 545 61 32 008 545 63 32 008 545 95 32 009 545 79 32	National version		7-11	7-11
103.981	004 545 44 32	3200	Reference resistor 750 Ω	27-31	40-44
103.983	004 545 46 32 005 545 85 32 005 545 87 32 006 545 74 32 006 545 76 32 008 545 96 32 009 545 80 32	National version		6-11	6-11

Special tools



Commercially available testers (see Workshop Equipment Manual)

Designation	e.g. Make, order no.
CO analyzer	
Engine tester (engine speed, dwell angle, ignition angle, oscilloscope, voltmeter)	Bosch, MOT 002.02 Sun, 1019
Lambda control tester	Hermann, L 115
Multimeter	Sun, DMM-5
Twin outlet	Hermann, ECD 53

Shop-made tools

Intake pipe DIN 19534 DN 100 for air flow sensor	length approx. 500 mm
Seal	e.g. from air cleaner

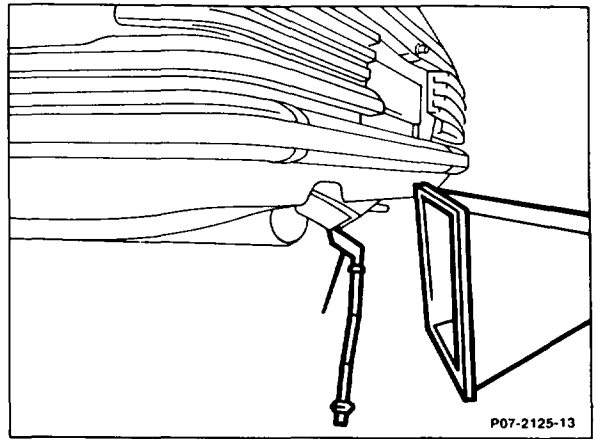
Note

Test and adjust lambda control with a lambda control tester. If no lambda control tester is available, a dwell angle tester may be used. Idle speed must not be set when the engine is too hot, e.g. immediately after driving sharply or after measuring engine output on the dynamometer.

Testing, adjusting

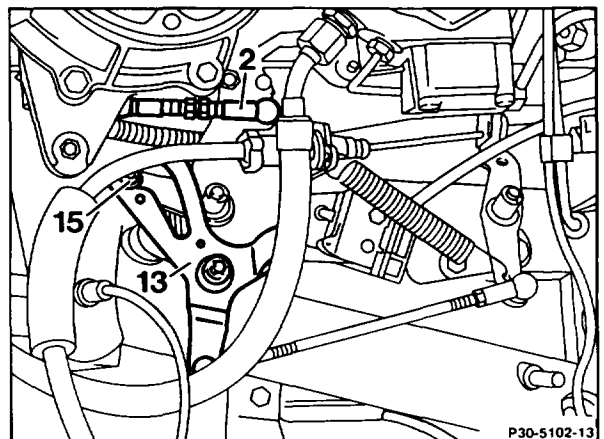
- 1 Complete test sheet.
- 2 Switch air conditioner or automatic climate control.
- 3 move selector lever into position "P."
- 4 Connect testers:
oil remote thermometer (018) 124 589 07 21 00,
lambda control tester (012),
twin outlet (031),
exhaust probe (005) 126 589 11 63 00,
CO analyzer (006),
engine tester with oscilloscope (030),
trigger clamp (011),
multimeter (003),
test cable (033) 102 589 04 63 00.

- 5 Fit extraction device (014) into exhaust tailpipe.
- 6 Check coolant level, adjust to correct level if necessary.
- 7 Check engine oil level, paying attention to condition of oil (visual check).
- 8 Check oil level in automatic transmission.
- 9 Remove air cleaner (09-1051).
- 10 Check ease of movement and condition of accelerator control linkage and throttle valve. Lubricate all bearing points and ball sockets.
- 11 Check idle speed stop.



Engines without ASR

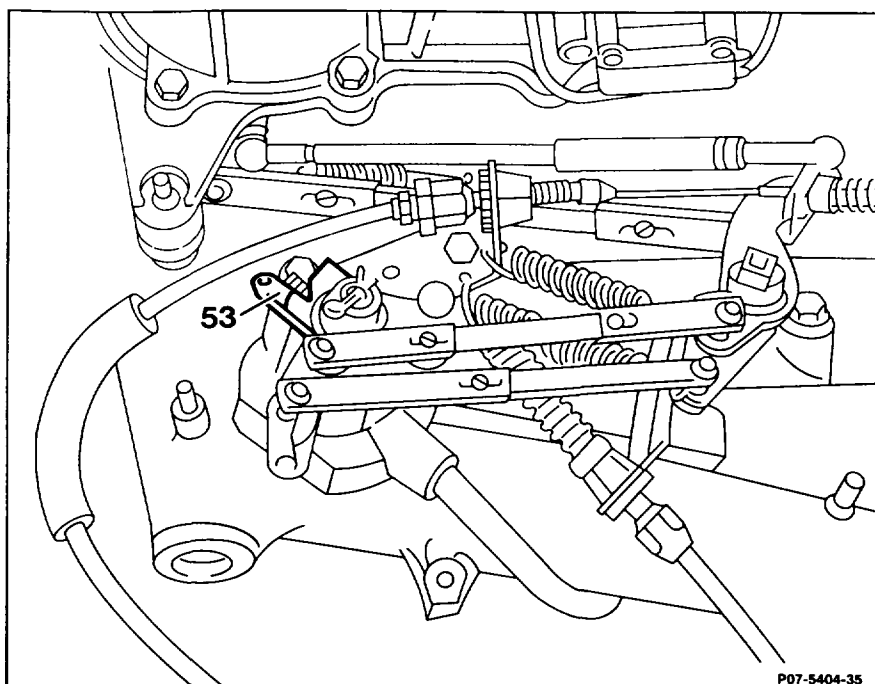
Check fulcrum lever, adjust. Check whether the roller (15) in the fulcrum lever (13) is resting free of testing against end stop. Adjust fulcrum lever (13) if necessary with the connecting rod (2) so that the roller (15) is resting free of tension against end stop.



Engines with ASR

Switch on ignition.

Fulcrum lever of set point sensor (53) must be resting against idle speed stop; adjust if necessary (30–1010).

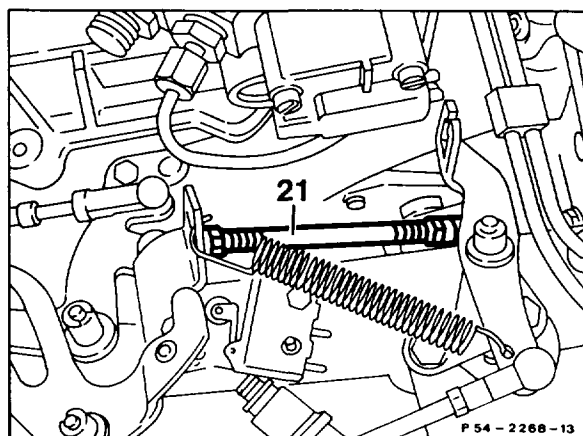


Check whether the throttle valve is resting against idle speed stop. Detach connecting rod for this step.

Vehicles with Tempomat cruise control

Check whether the actuator is resting against idle speed stop of the Tempomat cruise control. To do this, push lever of actuator clockwise against idle speed stop of Tempomat cruise control.

When attaching the pull rod (21), ensure that the lever of the actuator is lifted about 1 mm off the idle stop at the cruise control. Adjust pull rod if necessary.



12 Check full throttle stop from accelerator pedal, adjust (30–1010).

13 Test voltages (battery and ignition coil):

a) No-load voltage

Connect voltmeter to battery and read off voltage.

Specification: 12.2 volts.

b) Ignition coil

Engine not running, switch on ignition. Test voltage terminal 15 to ground at contact 5 of diagnostic socket.

Specification: battery voltage.

Test difference in voltage between terminals 15 and 1 at contacts 5 and 4 of diagnostic socket.

Specification: 0 volts.

If the specifications are not achieved, test ignition system (15–1250).

14 Test current at actuator with ignition switched on. To do this, unplug coupling at actuator, connect test cable 102 589 04 63 00 into circuit.

Connect multimeter, set to mA.

Specification: see table.

If the specification is not achieved, test electrical components of KE injection system (07.3–0121).

15 Test ignition timing and vacuum advance.
For test data see table.

16 Warm up engine to approx. 80°C oil temperature.

17 Analyze oscilloscope image (see Diagnosis Manual Engine Volume 1 Register C).

18 Check intake system for leaks by spraying all sealing points with Iso-Oktan DIN 51756.
CO increase < 2 %.



Do not use commercially available fuel for spraying (harmful vapours). Pay attention to risk of fire and do not spray onto red-hot parts or parts of the ignition system.

19 Test decel fuel shutoff. To do this, hold engine speed at constant > 2500/min. Operate microswitch by hand; engine must surge when this is done.
If necessary, check fuel pressures and internal leaktightness (07.3-1603).



20 Functional check of KAT/RÜF electrical components:

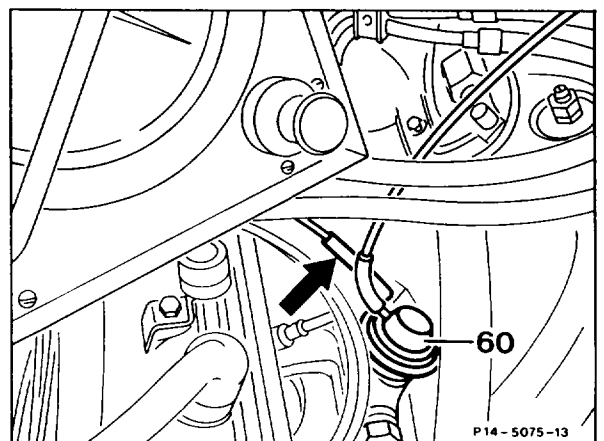
- Fault diagnosis by measuring on/off ratio.
Engine idling
Specification: KAT = readout fluctuates
RÜF = constant readout 50 %
If the specifications are not achieved,
perform test program (07.3-0121).
- Function check of idle speed and full load contact.
Engine: **OFF**.
Ignition: **ON**.
Specification: 70 %.

Deflect air flow sensor plate.
Specification: 10%.
If 70%, test throttle valve switch
(07.3-0121).

Air flow sensor plate zero position.
Specification: 70 %.

Open throttle valve fully.
Specification: 20 %.
If 40 %, test air flow sensor position indicator
(07.3-0121).

21 Test operation of exhaust gas recirculation valve. Detach vacuum line (arrow) at exhaust gas recirculation valve (60), connect tester to exhaust gas recirculation valve and pressurize with vacuum.
If there is no clear deterioration in engine running, replace exhaust gas recirculation valve.
Test actuation if necessary (14-7611).



22 Install air cleaner (09–1051).

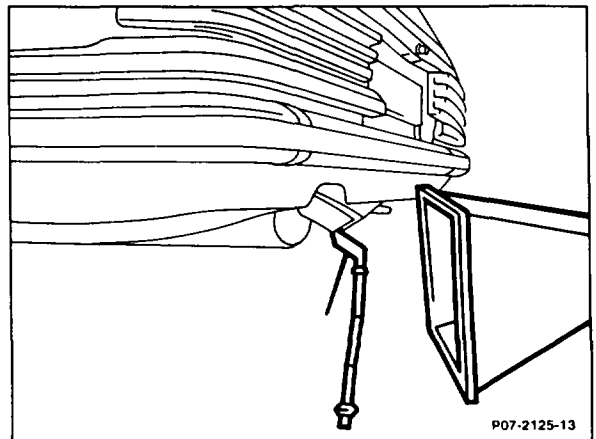
23 Test idle speed (see table).

Note

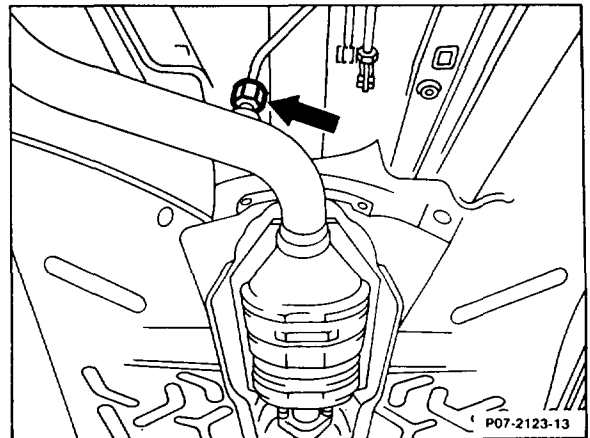
Idle speed can no longer be adjusted on engines with electronic idle speed control. If the idle speed differs, perform test program (07.3–2006).

24 Test idle emissions level (see table); adjust if necessary (see step 26).

Measuring point at exhaust tailpipe



Measuring point (arrow) for open-loop KAT, upstream of catalytic converter (only for adjustment work).



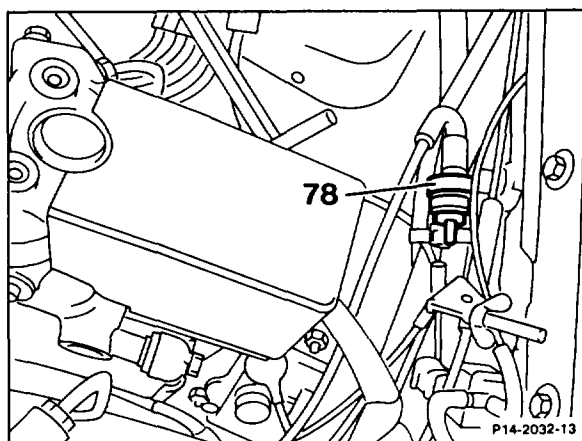
25 Test lambda control (see table).


Note

The readout must fluctuate during the measurement. If a constant readout is indicated, there is a fault in the lambda control, e.g. oxygen sensor disconnected. For troubleshooting, see "Testing electrical components of KE injection system" (07.3-0121).

Detach regeneration line to throttle valve body at regeneration valve (78) and seal.

Connect lambda control tester to diagnostic socket (X11).



Lambda control tester	Position
Bosch	100% IR
Hermann	100% 

Test on/off ratio at 2500/min and read off mean value. Compare this reading with the idle speed value. The mean value at idle speed must not differ by more than ± 10 from the reading obtained at 2500/min.

Adjust lambda control (see step 26).

26 Adjust idle speed emissions level of lambda control.

To do this remove anti-tamper plug (44) with the puller. Insert screwdriver (arrow) through the opening on the top of the air cleaner and push down on adjusting device (42).

Push adjusting device down with screwdriver against spring force, turn slightly until the hexagon head (43) engages in the mixture regulating screw:

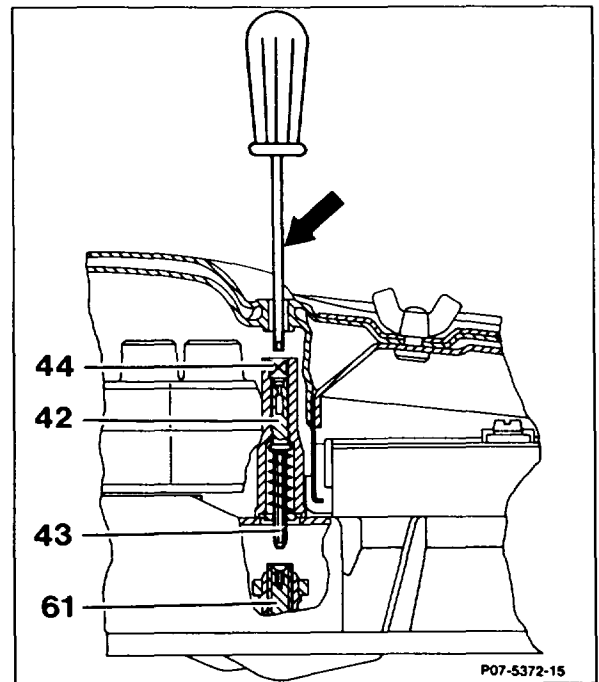
Turning to the left = leaner - on/off ratio rises

Turning to the right = richer - on/off ratio drops

After each adjustment, briefly operate throttle; re-adjust if necessary.

After the adjustment, insert a blue anti-tamper plug (44), part no. 000 997 59 86, with the insertion drift.

Re-connect regeneration line (only if lambda control fitted).



27 Check that engine runs smoothly. To do this, move selector lever into Drive mode, switch on air conditioner/automatic climate control, turn power steering to full lock; engine must continue to run smoothly.