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

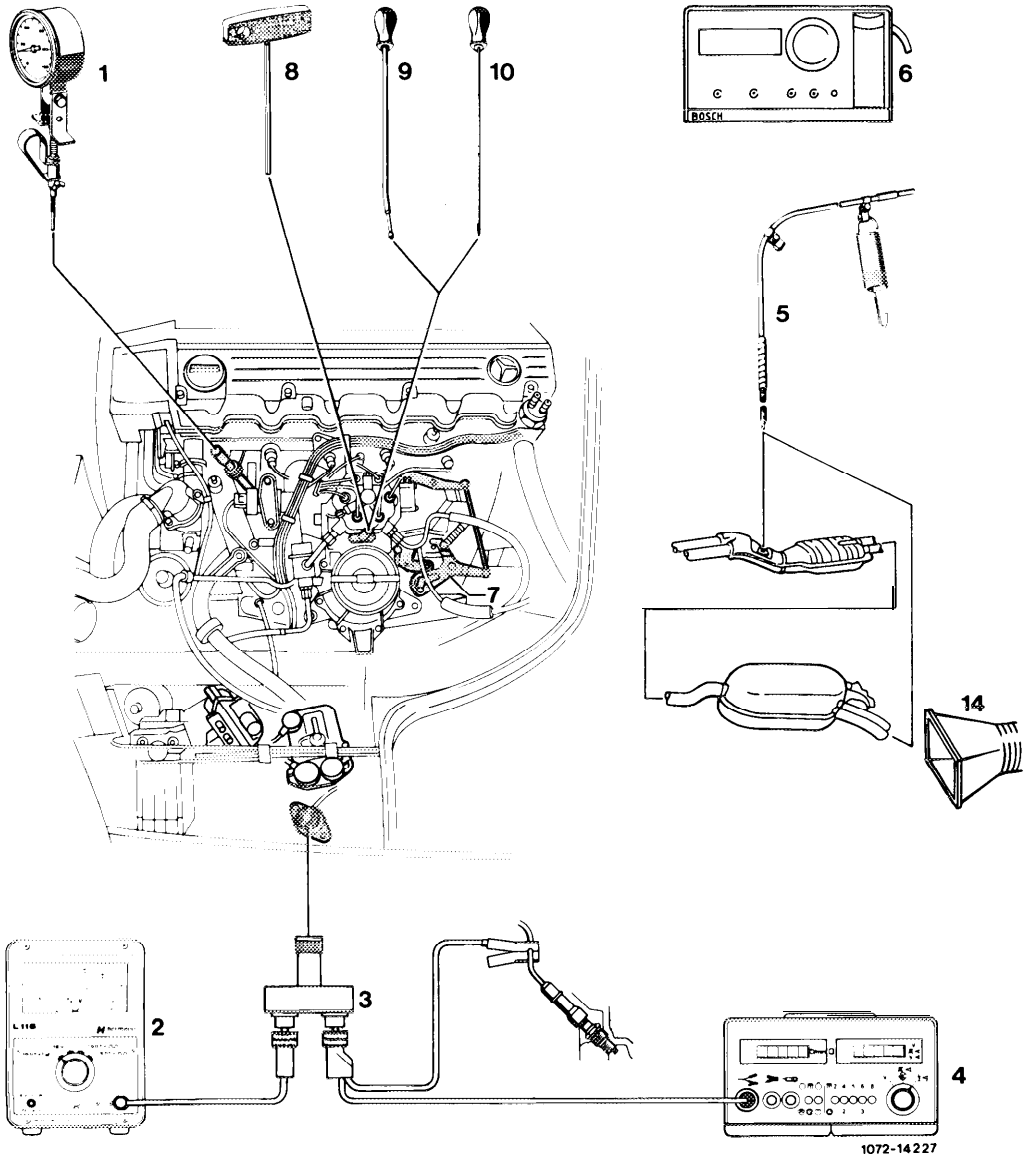
Job No.

Testing and adjusting jobs

Assembly jobs

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

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	–

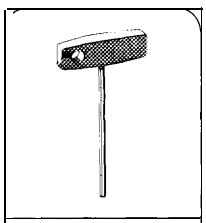
[1]) Test lambda control at 2500 rpm and read mean value. Compare this value with idling speed value and readjust, if required. The medium value at idling speed should not deviate from value measured at 2500 rpm by more than ± 10. For test, pull off purge line and close.

Ignition timing (EZL)

Engine	Version or type of fuel	Engine rpm	Ignition timing[1] in 'crank angle before TDC		
			Adjustment plug position	Vacuum	
		rpm		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	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) 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).

Special tools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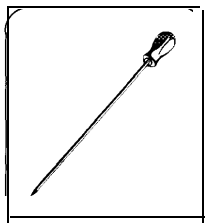
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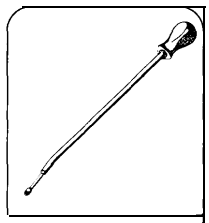
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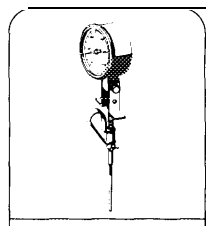
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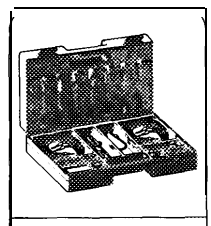
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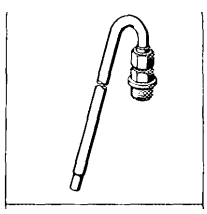
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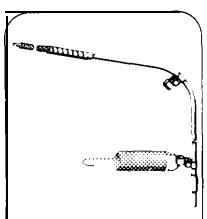
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Conventional testers

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.

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

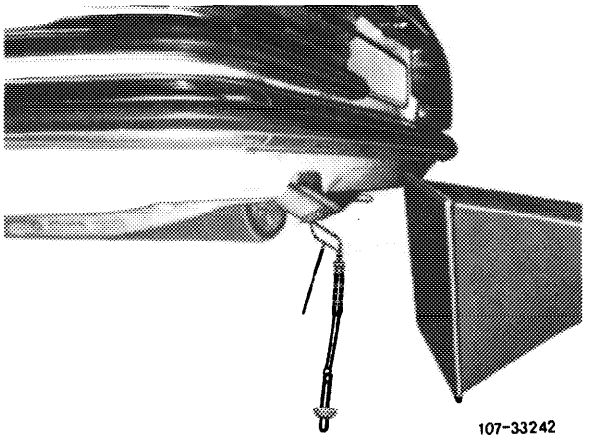
6 Check idling speed (refer to Table).

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).

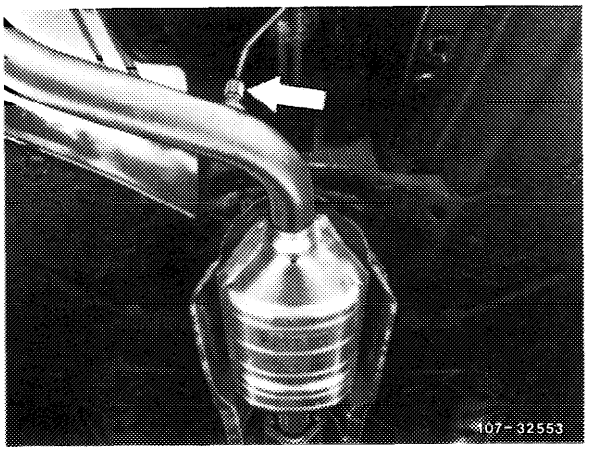
Measuring point at exhaust end pipe.

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



8 Test lambda control.

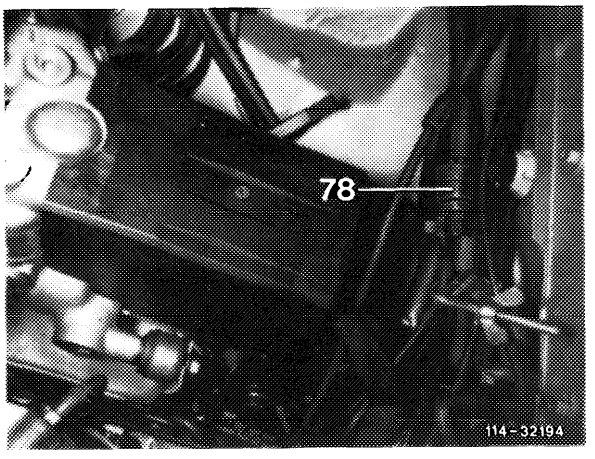
Attention!
While measuring, the indicated value should oscillate. If a constant value is shown, a fault on lambda control is indicated, e.g. O_2 sensor pulled off.



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.



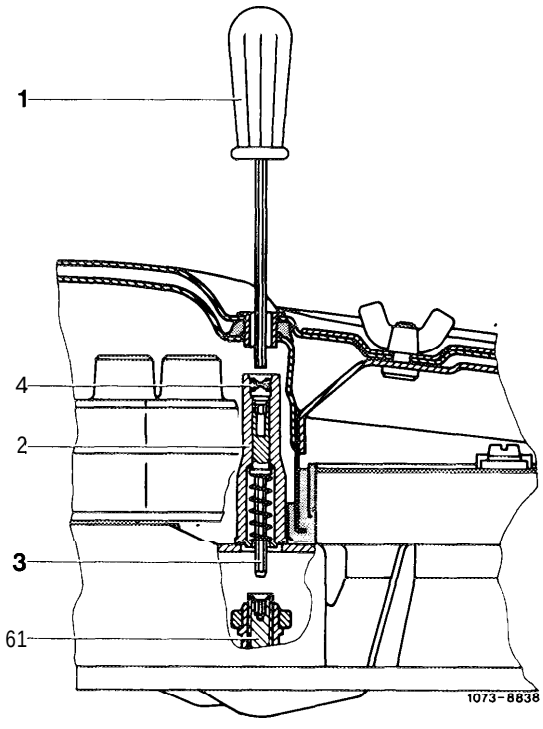
9 Set idling speed emission value or lambda control.

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.

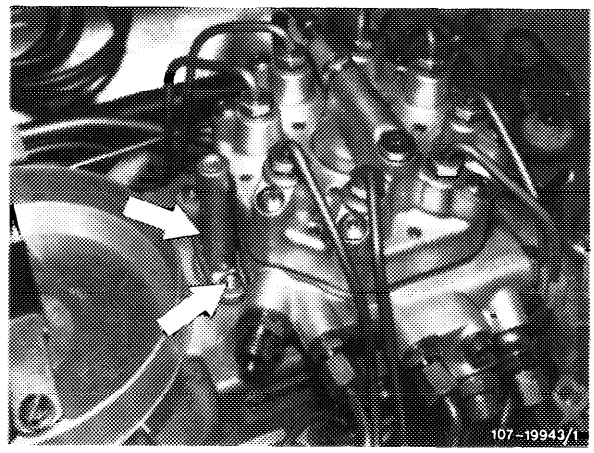
10 (USA)

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.

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.



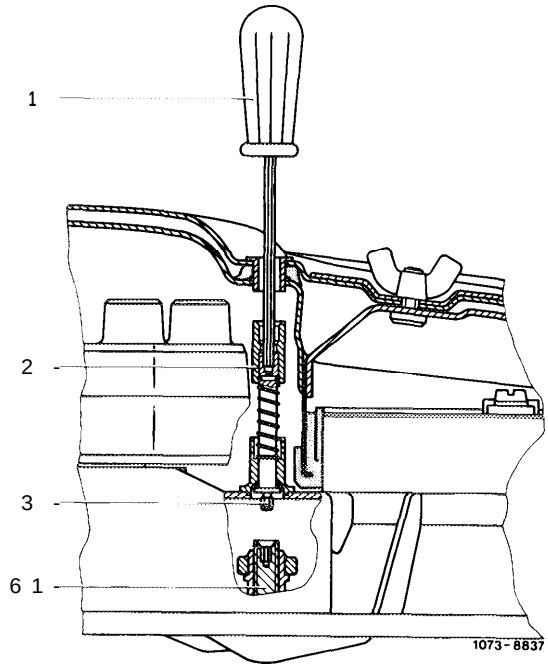
Attention!
Do not drill completely through screws, since engine damage may be caused by the resulting chips. Thoroughly remove metal chips with a rag.

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).

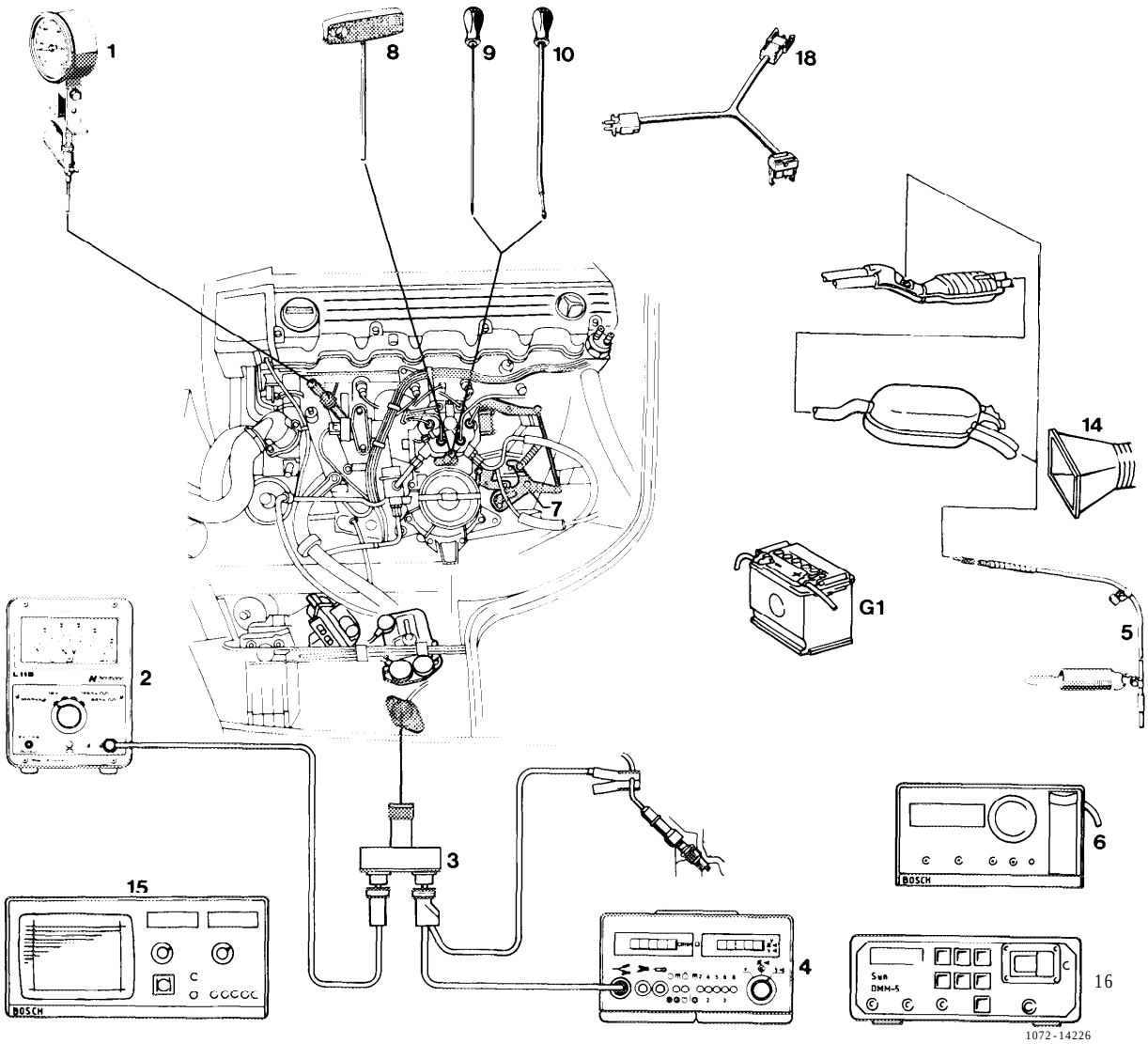
Mount air cleaner.

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.

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

Basic and national versions starting 1986



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

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.

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).

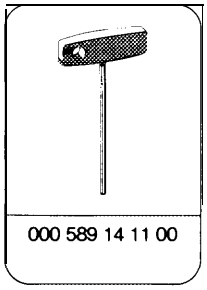
Battery voltages

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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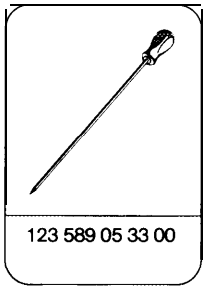
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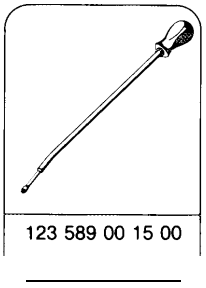
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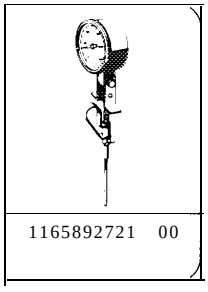
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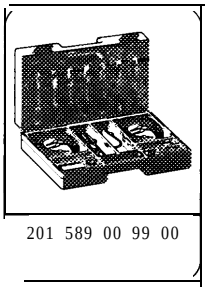
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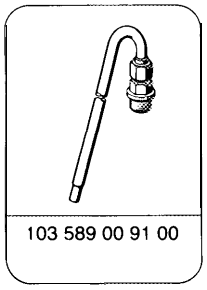
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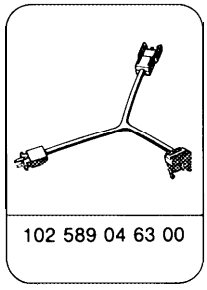
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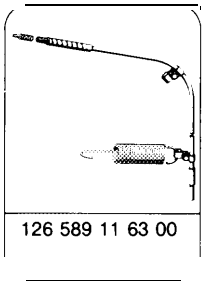
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Conventional testers

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

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".

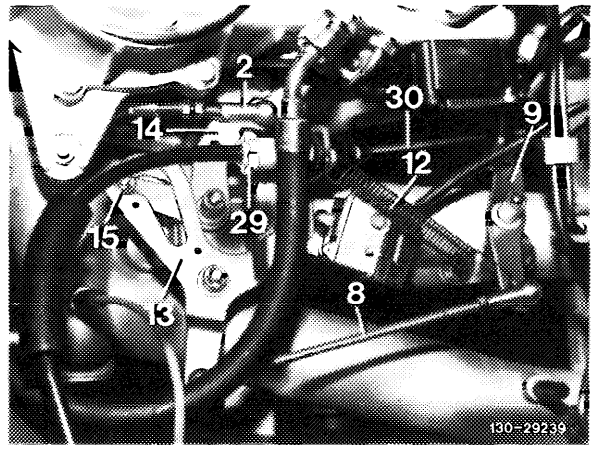
6 Remove air cleaner.

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.

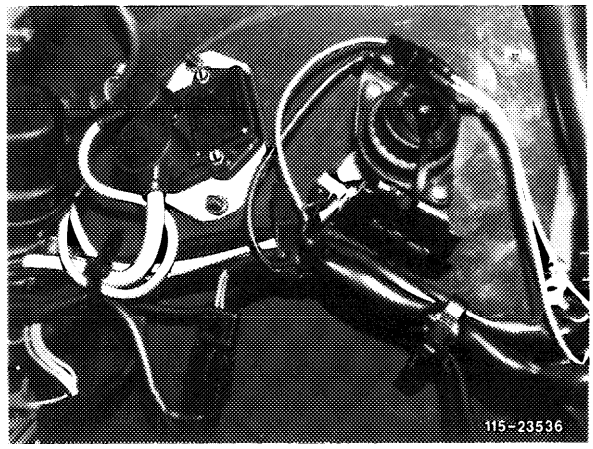


11 Test voltages (battery, start and ignition coil).

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).

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).

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

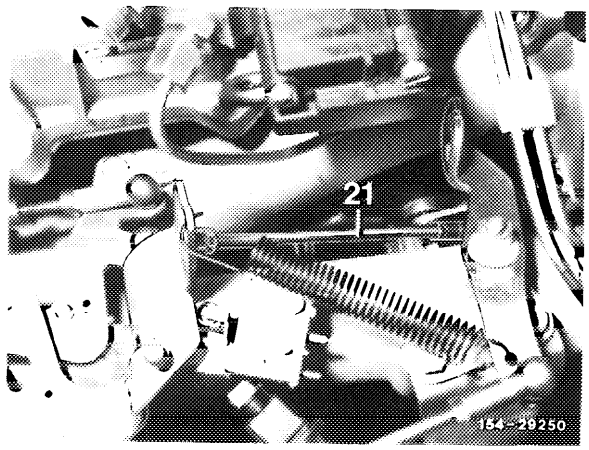
Engine stopped. Switch on ignition 70 %.

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.

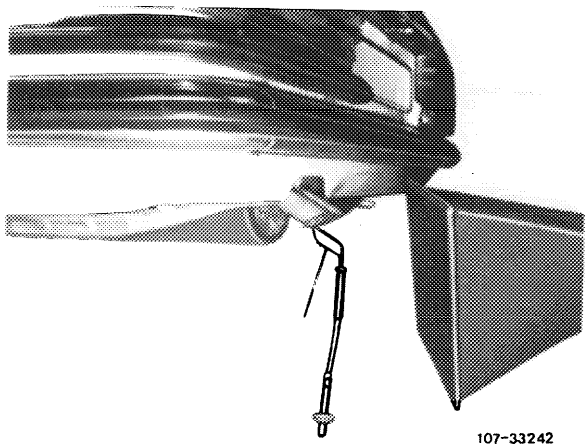
21 Mount air cleaner.

22 Check idling speed (refer to Table).

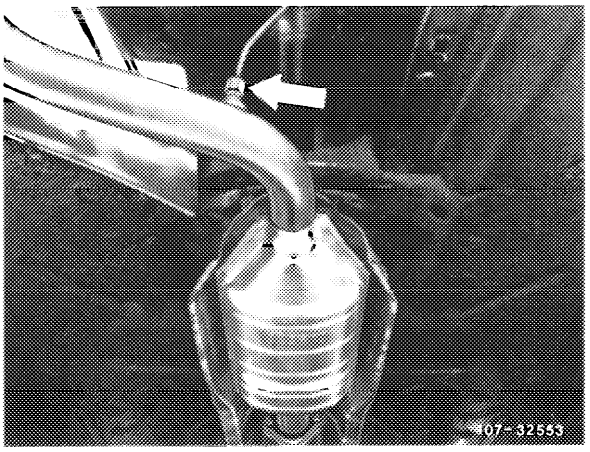
Attention!
On engines with electronic idle speed control, the idling speed can no longer be adjusted. Perform test program, if idling speed deviates (07.3-I 12).

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

Measuring point at exhaust end pipe.



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



24 Test lambda control (refer to Table).

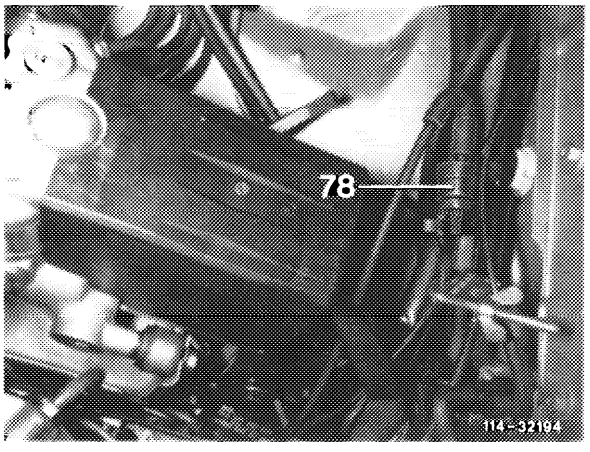
Attention!
While measuring, the indicated value should oscillate. If a constant value is shown, a fault on lambda control is indicated, e.g. O_2 sensor pulled off.

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.

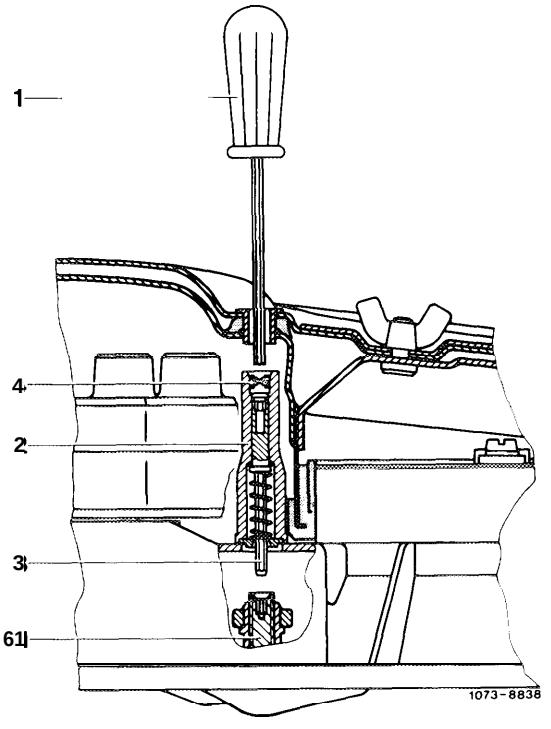
Pull out safety plug (4) by means of puller.

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

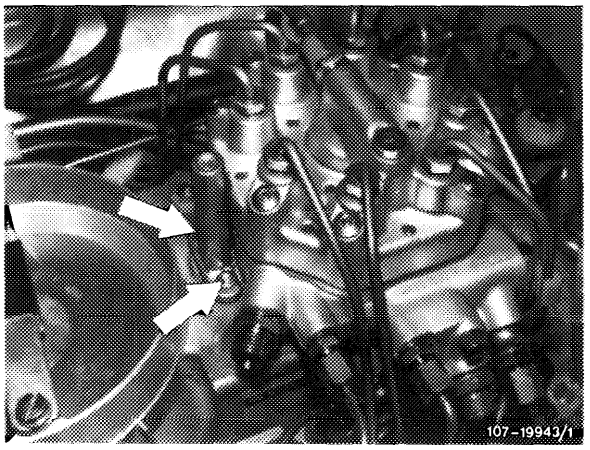
USA

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.

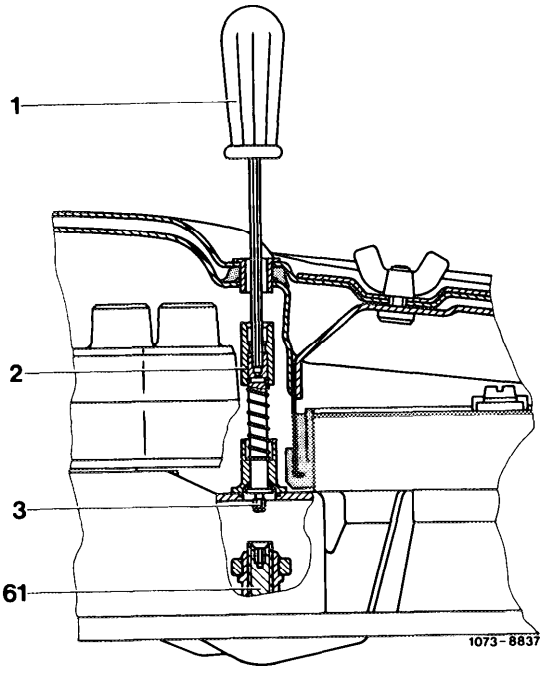
Install new repair kit, part No. 102 586 02 07, while tightening screws until breakaway head is breaking off.

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.

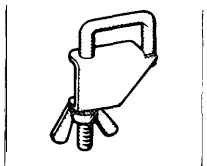
26 Reconnect purge line.

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).

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

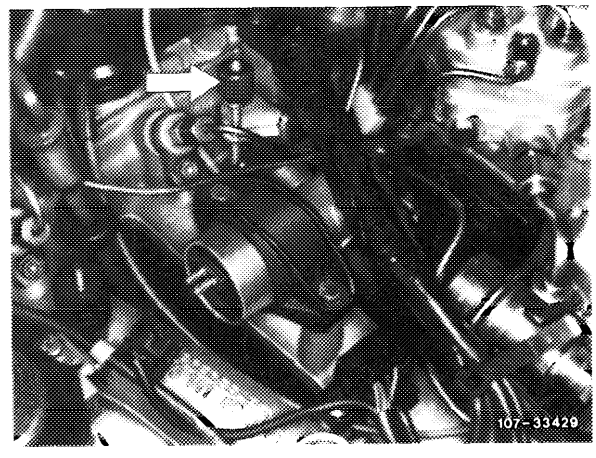
Engine tester	SUN, 2110

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.

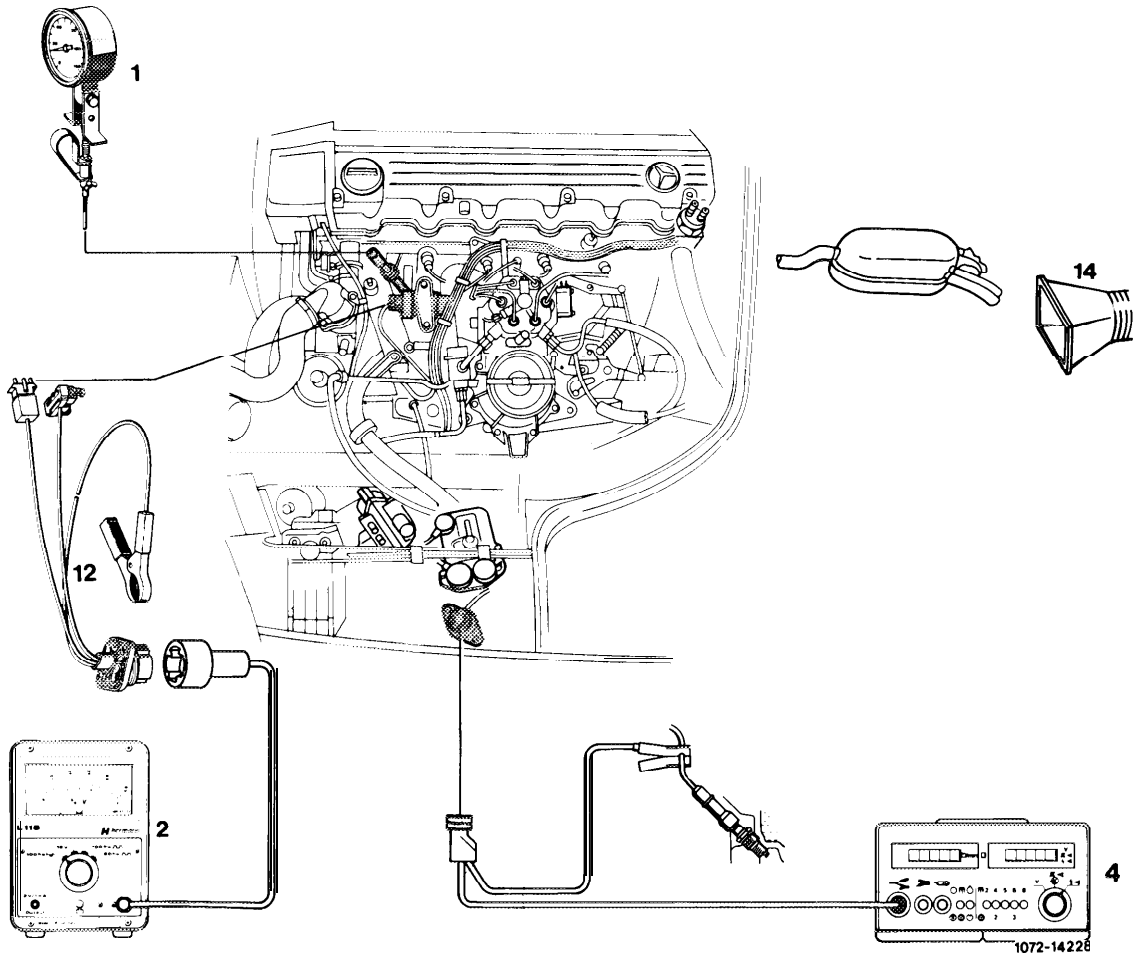
6 Push button ,,Engine stop" again, engine will be running.

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

Perform cylinder comparison test and evaluate.

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

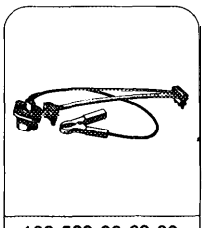
Basic versions and (CH) KAT

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				

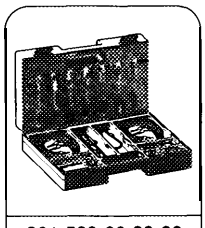
National versions

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

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

Note

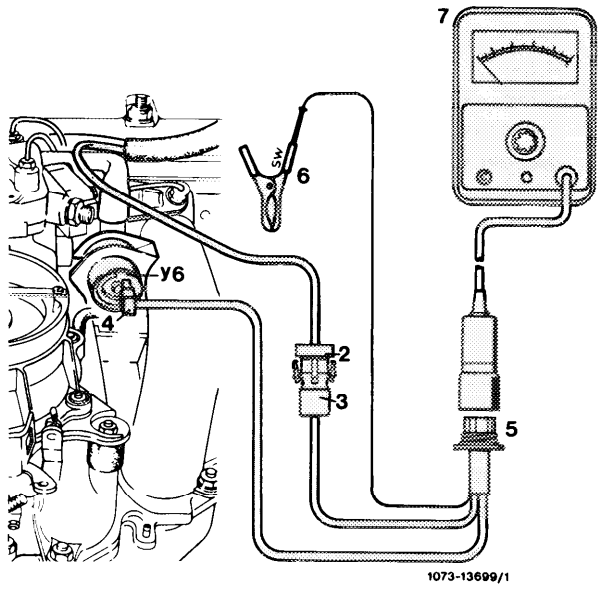
Electric wiring diagrams 07.3-I 28.

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.



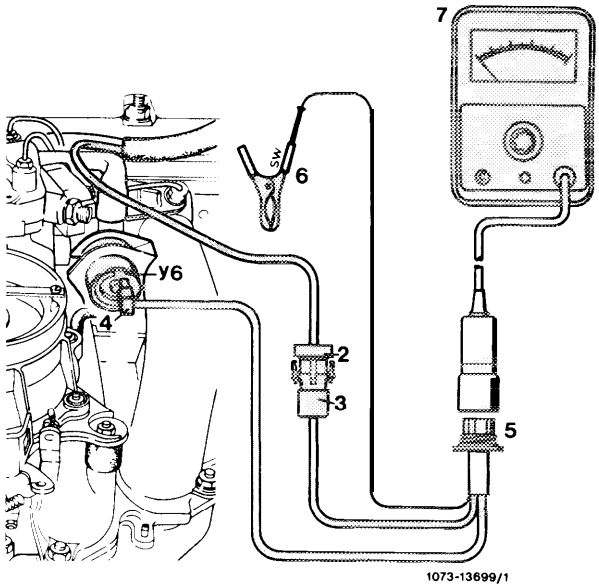
2 Plug, engine harness
3 Plug connection, test cable
4 Plug, idling speed air valve
5 Test cable
6 Ground terminal
7 Lambda control tester
Y6 Idling speed air valve

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.

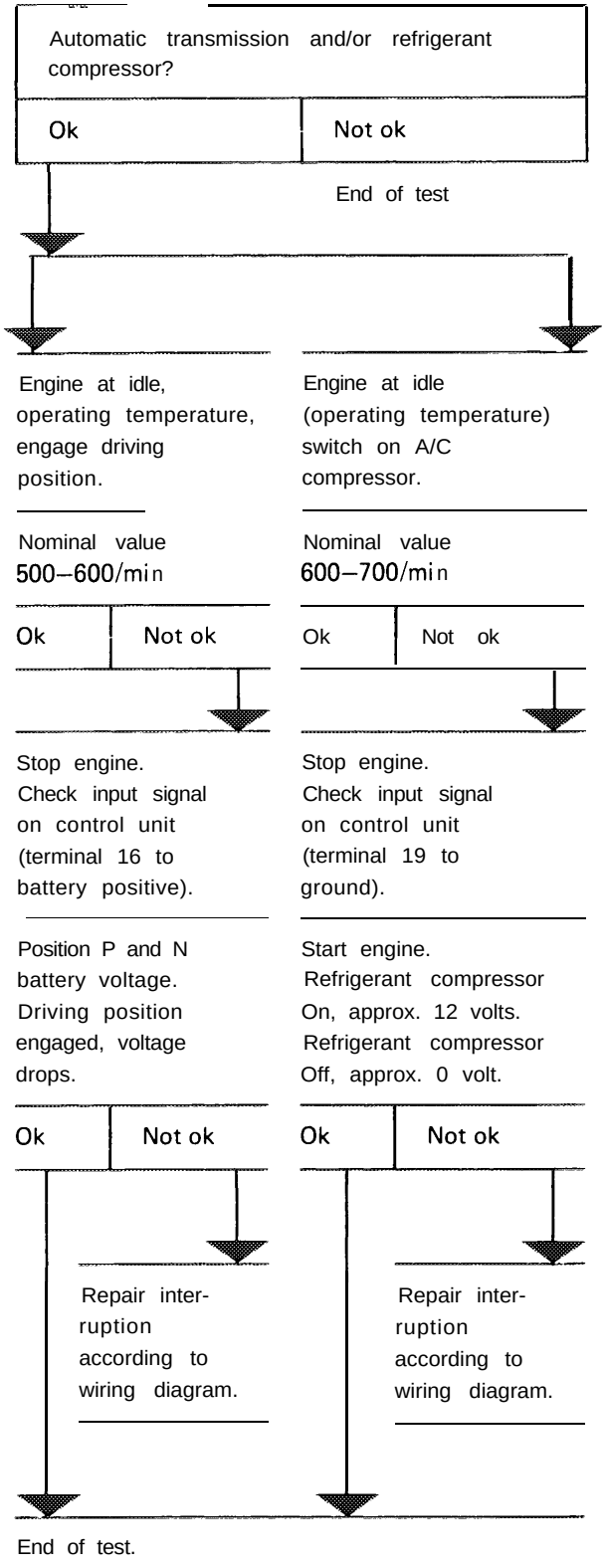
Check voltage supply according to wiring diagram.

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.

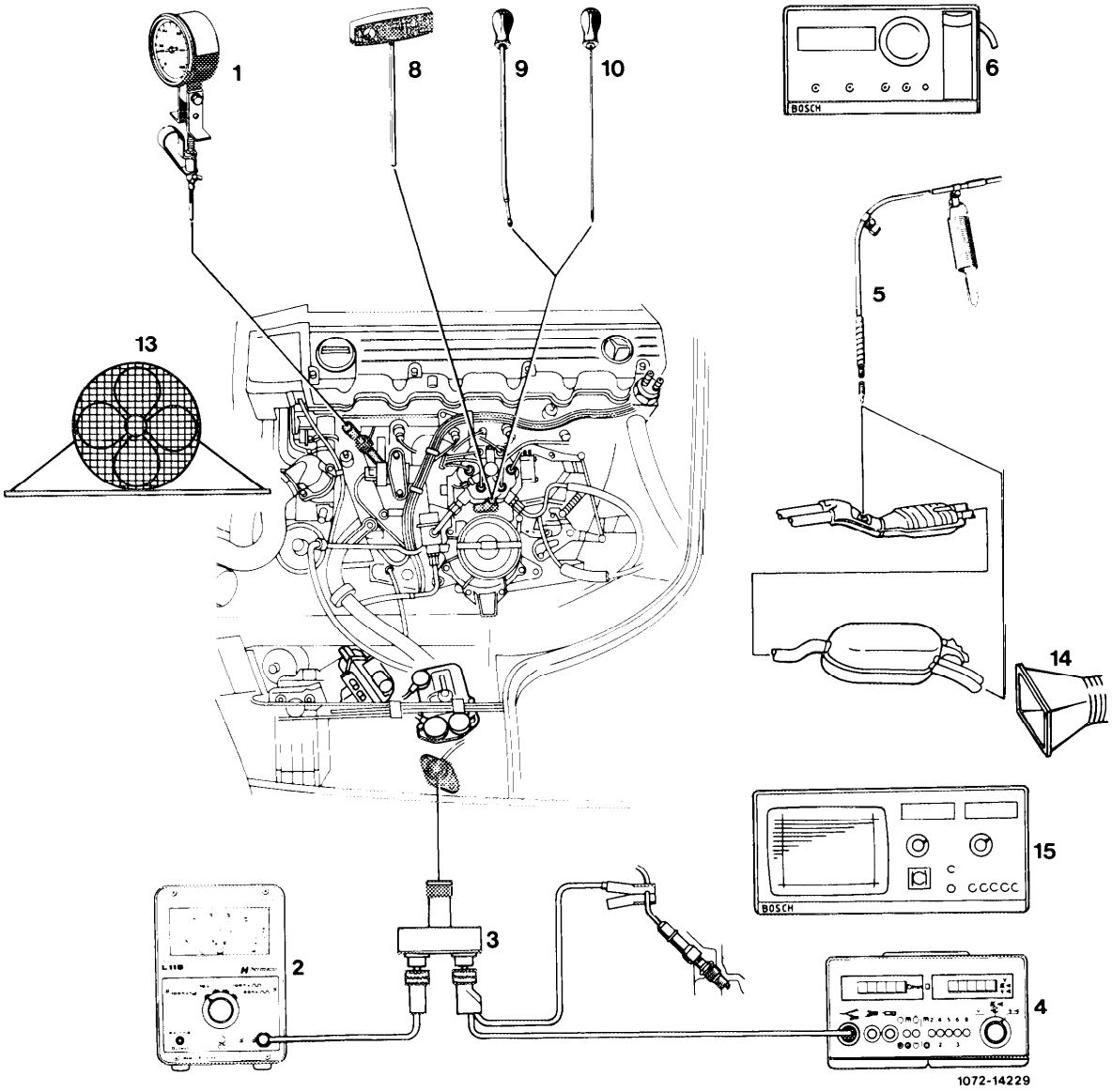
Repair interruption.


Automatic transmission and/or refrigerant compressor?
Ok
Not ok
End of test
Engine at idle, operating temperature, engage driving position.
Engine at idle (operating temperature) switch on A/C compressor.
Nominal value 500–600/min
Nominal value 600–700/min
Ok
Not ok
Ok
Not ok
Stop engine. Check input signal on control unit (terminal 16 to battery positive).
Stop engine. Check input signal on control unit (terminal 19 to ground).
Position P and N battery voltage. Driving position engaged, voltage drops.
Start engine. Refrigerant compressor On, approx. 12 volts. Refrigerant compressor Off, approx. 0 volt.
Ok
Not ok
Ok
Not ok
Repair interruption according to wiring diagram.
Repair interruption according to wiring diagram.
End of test.

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.**

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.

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

Engine output test

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

Emission test

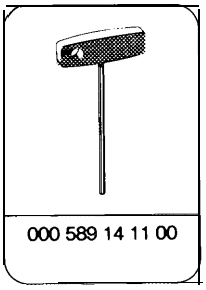
		rpm	**600-700**			
Idling speed		% co	**1 ± 0.5**	**2 ± 0.5**	1 ± **0.5**	≦ 0.5[2])
	Lambda control	%	–	**Readout oscillating**	–	**Readout oscillating**
Full **load**	3rd **speed driving position** ,,3''	**% CO**[3])	1.5-5			
		rpm	3500			
Upper partial load	**4th speed** driving pos. ,,D'' 120 km/h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

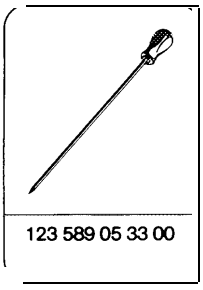
[1]) **Test values are minimum output values.**
[2]) **With special emission test (ASU).**
[3]) **On vehicles with lambda control, lambda control will move to control operation during full load test.**

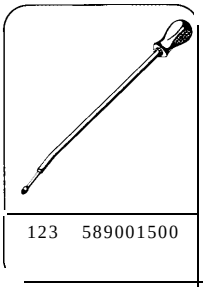
Note: When measuring output, be sure to take the various influencing factors into consideration.

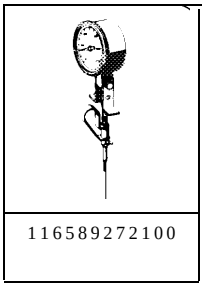
Output correction factor
Notes for output test.

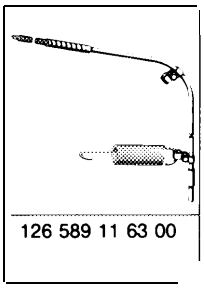
Special tools


000 589 14 11 00


123 589 05 33 00


123 589001500


116589272100


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.

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).**

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.

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

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
975	0,9719	0,9807	0,9895	0,9982	1,0068	1,0154	1,0239	1,0323	1,0406	1,0489	1,0571
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
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
845	1,1214	1,1316	1,1417	1,1518	1,1617	1,1716	1,1814	1,1911	1,2007	1,2103	1.2198
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

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.

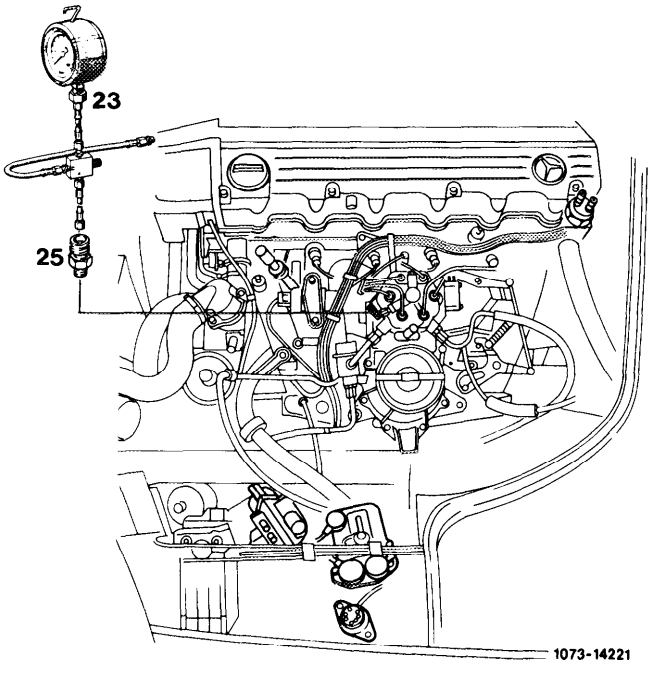
Example:
Fuel consumption in liters/l00 km

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

07.34 20 Checking fuel pressures and for internal leaks

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

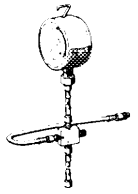
Test and adjustment values

Fuel pressures in bar gauge pressure

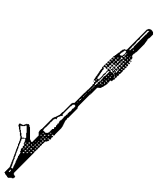
Engine				103.980	103 (except 103.980)
System pressure with engine cold or at operating temperature				5.3–5.5	
Lower chamber pressure	engine at operating temperature		approx.	0.4[1])	
	with plug pulled from coolant temperature sensor			–	
	at coolant temperature of +20 °C	stationary or at idle	approx.	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

102 589 05 63 00

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").

Visual checkup

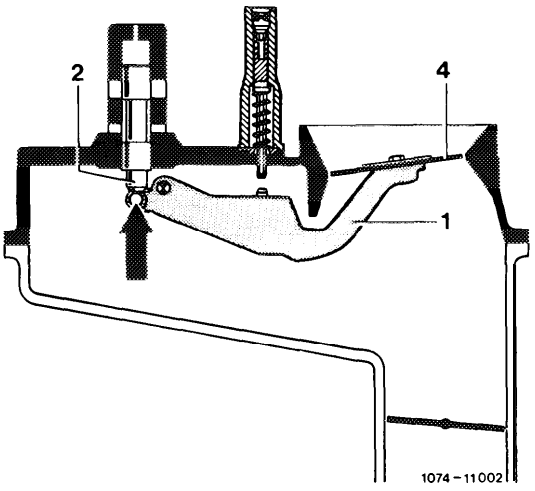
1 Remove air cleaner.

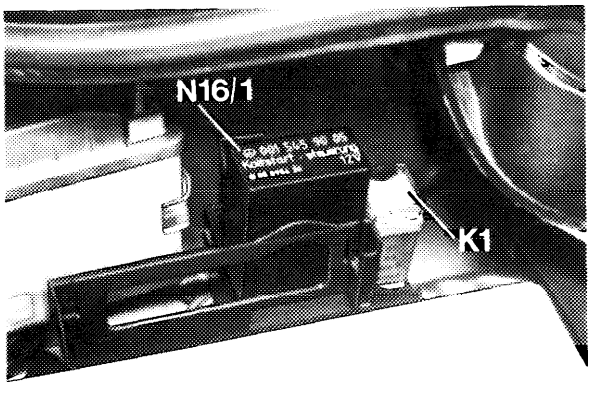
2 Check all fuel connections for leaks.

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.

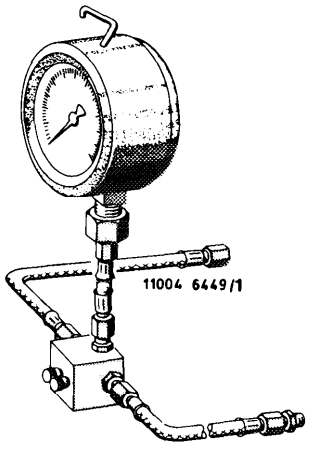




Connecting pressure measuring device

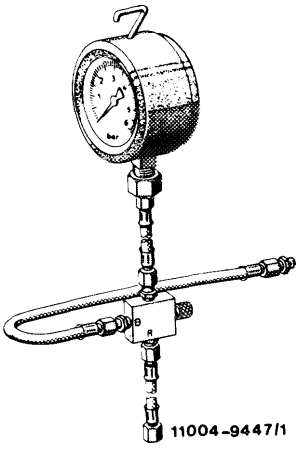
Pressure measuring device 1st version

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)

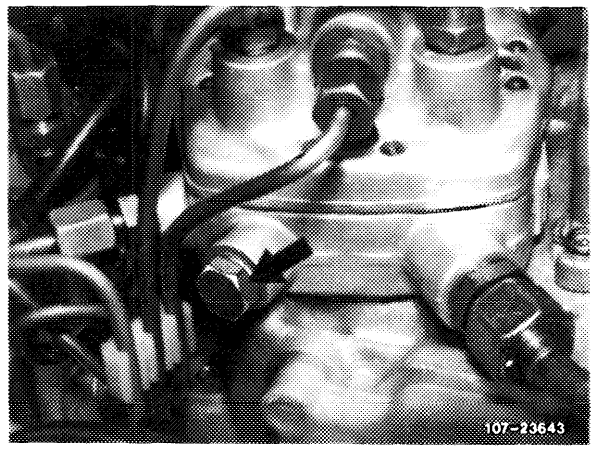


Pressure measuring device 2nd version

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



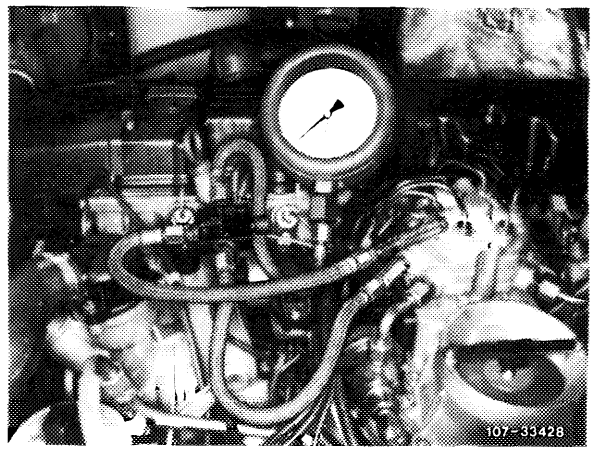
To relieve the sealing rings, keep valve screw or valve screws always open. Connections of three-way valve are numbered.



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.

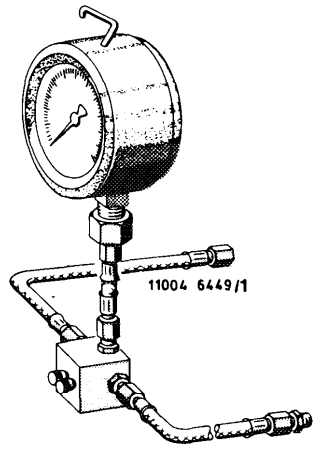
8 Connect hose line of connection ,,B'' or ,,3'' to fuel distributor.

9 Position of valve screws:

a) System pressure

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

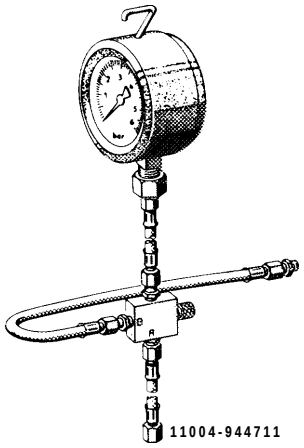
Open pressure measuring device 2nd version = open valve screw.



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.**

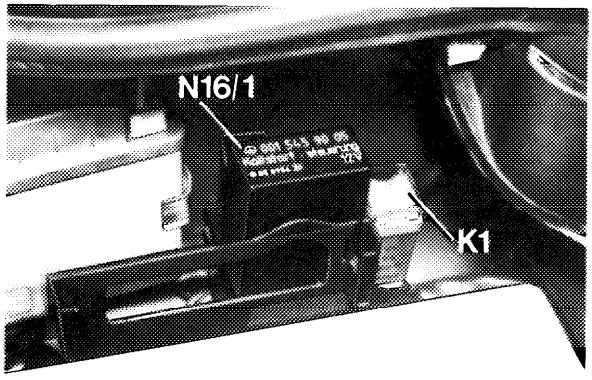
Place pressure measuring device on cylinder head cover.

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.



107-29244

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

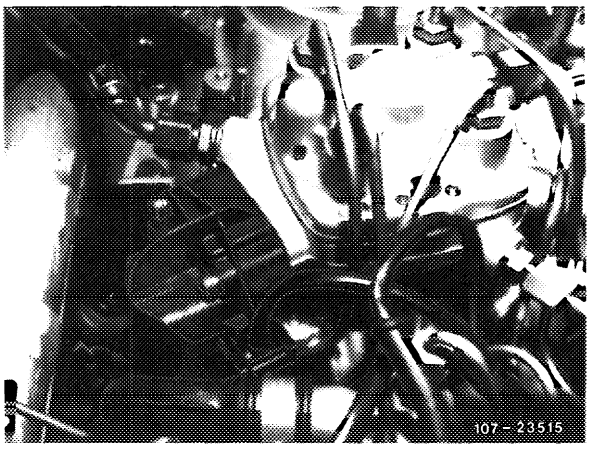
Check fuel pump (07.3–130).

Replace diaphragm pressure regulator.

Check fuel return line for unobstructed passage.

12 Re-open valve screw on connection 1.

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.

If the nominal value is not attained:

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

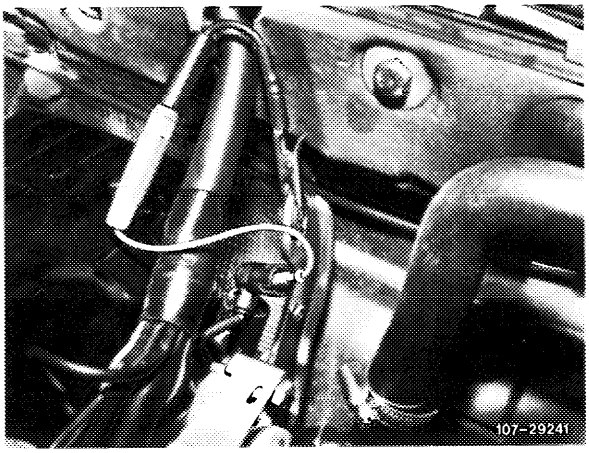
Check control current on actuator (07.3-I 21, section ,,d'').

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**

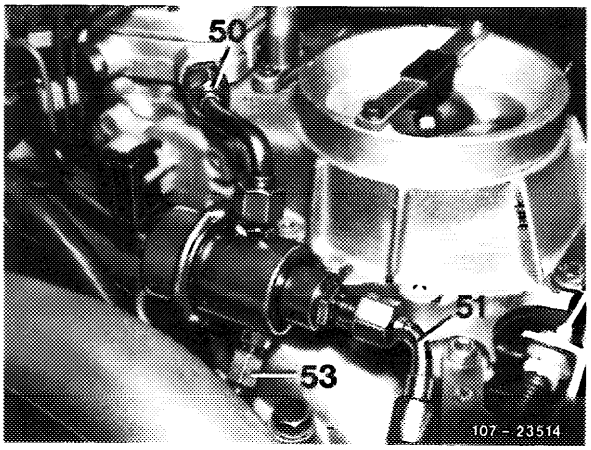
22 Stop engine. Pressure in system will then drop below opening pressure of injection valves (approx. 2.8 bar gauge pressure).

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

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.

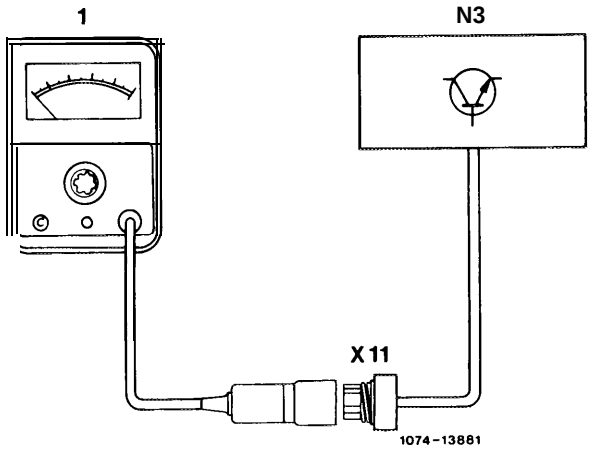
Basic and national versions

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).



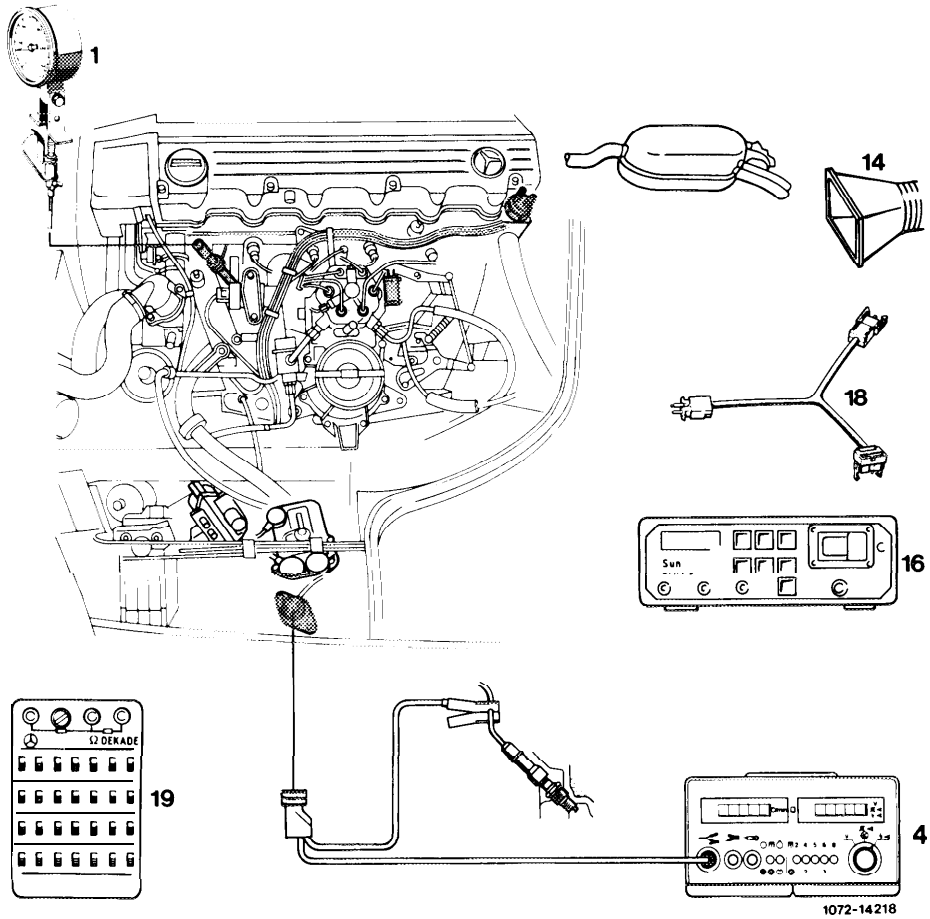
Fault detection permits testing different components of CIS-E injection system by means of measuring the on-off ratio.

Fault detection of control units:

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

Electrical wiring diagrams 07.3-I 28.

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.

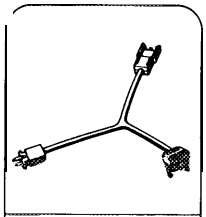
EXIT

Test values

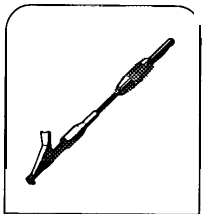
Engine			103.94	
Version			RÜF	KAT
Coolant temperature sensor	Coolant temperature +20 °C (warm-up basic value)	Resistance kΩ	2.2–2.8	
		Current at actuator mA	16–22	2–6
	Coolant temperature +80 °C	Resistance Ω	290–370	
		Current at actuator mA	1–2	Readout oscillating
After-start enrichment	After-start 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	

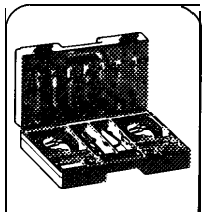
Special tools



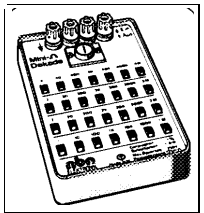
102 589 04 63 00



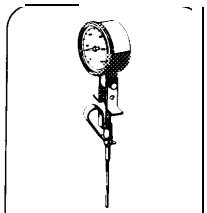
102 589 05 63 00



201 569 00 99 00



124589096300



1165892721 00

Conventional testers

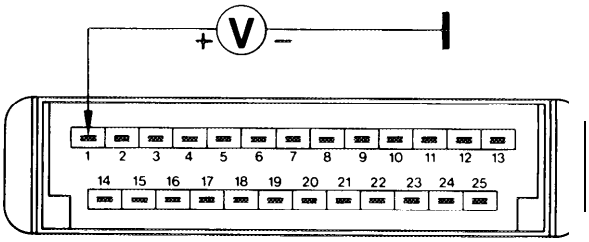
Multimeter	e.g. Sun, DMM-5
Engine tester	e.g. Bosch, MOT 002.02
Twin capsule	e.g. Hermann, ECD 53

a) Testing overvoltage protection

Test fuse on overvoltage protection.

Fuse ok.	Fuse defective.

Replace fuse.



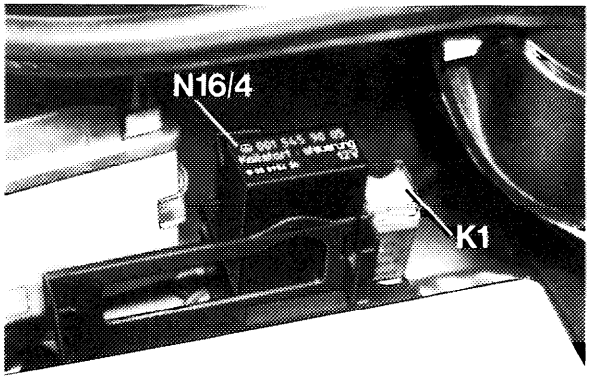
1074-11132

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

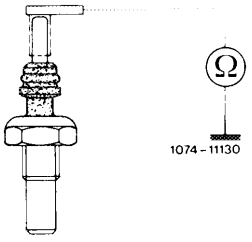
b) Testing coolant temperature sensor

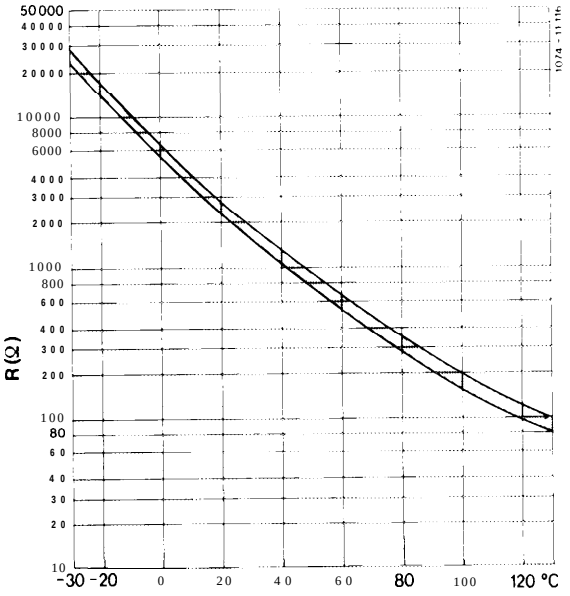
Pull **plug** from coolant temperature sensor.
Test resistance to ground.

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



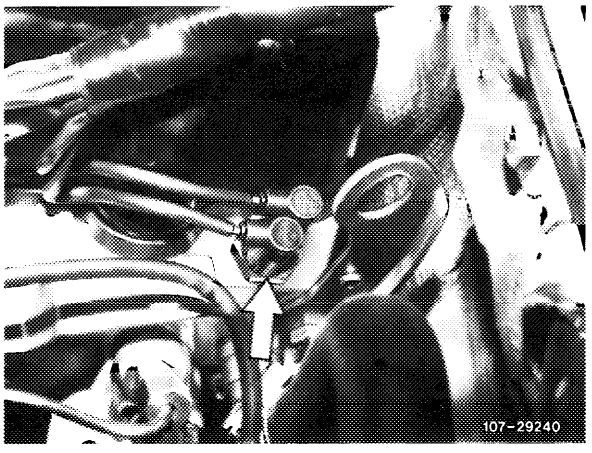


Replace coolant temperature sensor.

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

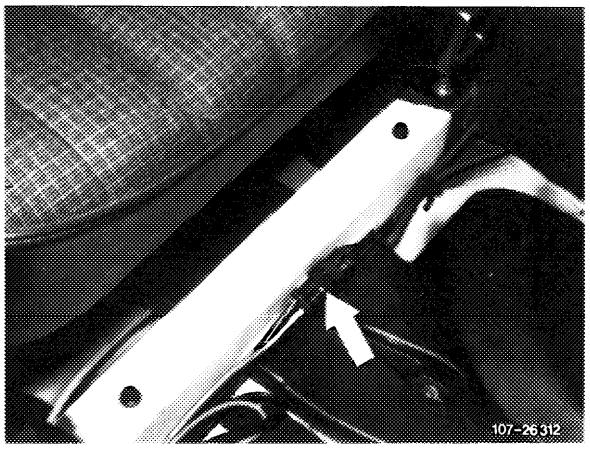


With engine stopped.
Pull plug from actuator.
Test resistance of actuator.

Resistance 18-21 Ω

Ok	Not ok

Replace actuator.

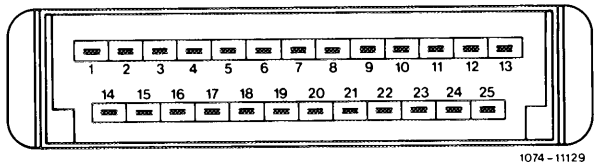


Check green/red line from terminal 21 plug control unit to plug coolant temperature sensor for continuity.

Resistance approx. 0 Ω

Ok	Not ok

Repair interruption according to wiring diagram.



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

Resistance approx. 0 Ω

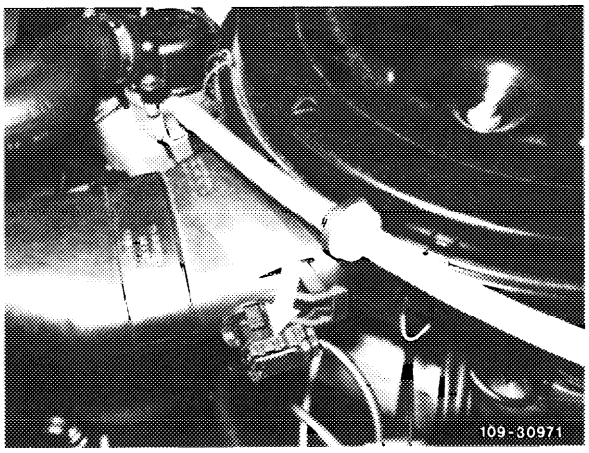
Ok	Not ok

Replace control unit.

Repair interruption according to wiring diagram.

End of test

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

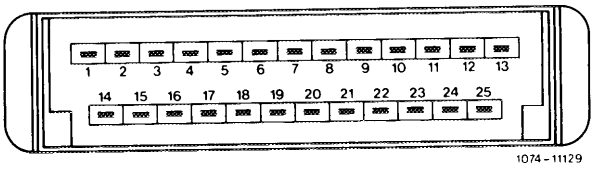
Not ok → Replace temperature sensor external air.

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

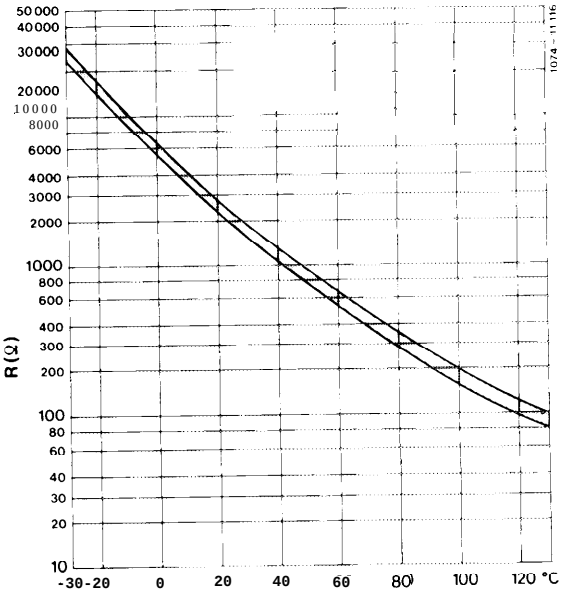
Resistance approx. 0 Ω

Ok	Not ok

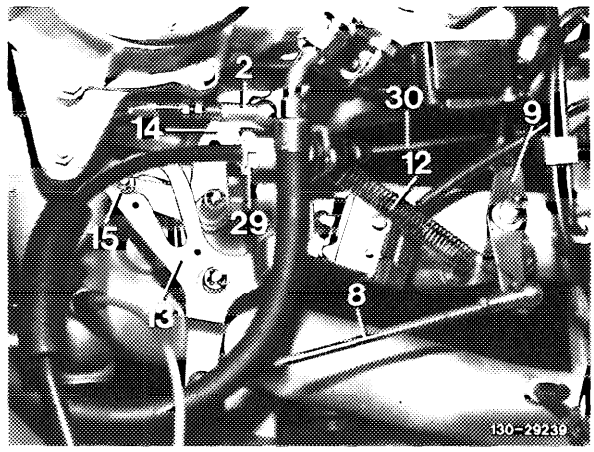
Not ok → Repair interruption according to wiring diagram.



End of test



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.

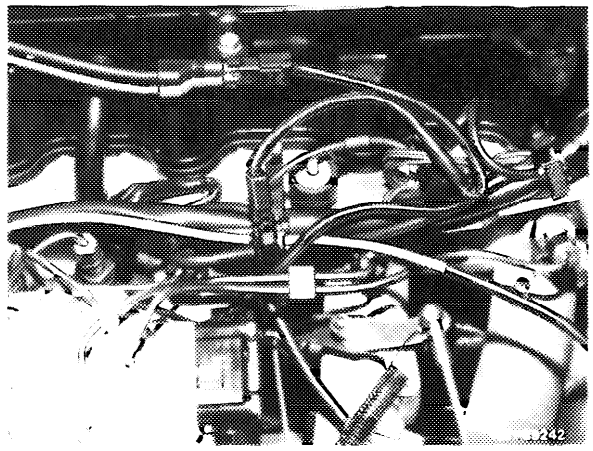
2. Check throttle valve switch, section ,,e''.

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

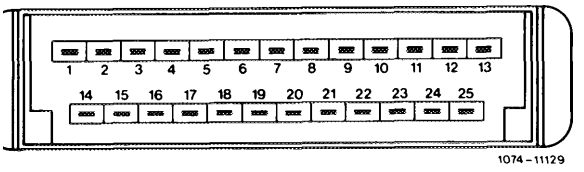
End of test

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

Voltage 6-l 2 V

Ok	Not ok

Repair interruption according to wiring diagram.



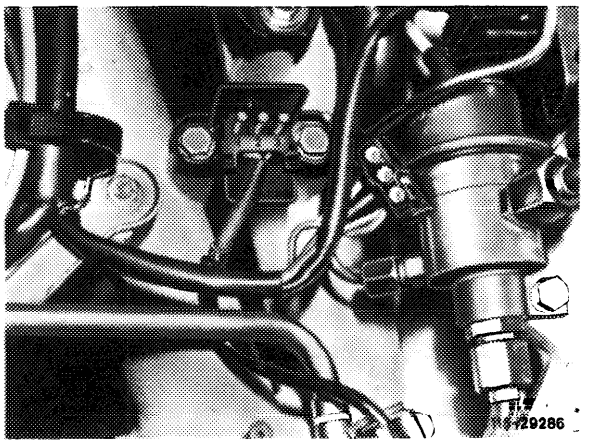
Except RÜF/KAT, test brown/black line (terminal 10) and black line (terminal 12) between control unit and actuator for continuity.

Resistance approx. 0 Ω

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

End of test

e) Testing throttle valve switch

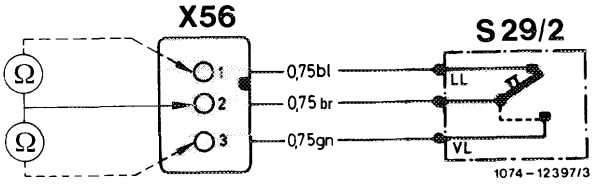


Stop engine.
Separate plug connection between throttle valve switch and control unit. Test resistance of throttle valve switch.

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.

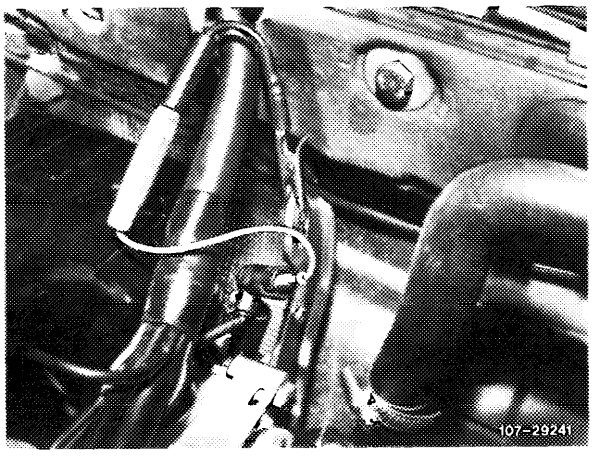
Resistance approx. 0 Ω

Ok	Not ok

Repair interruption according to wiring diagram.

End of test

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

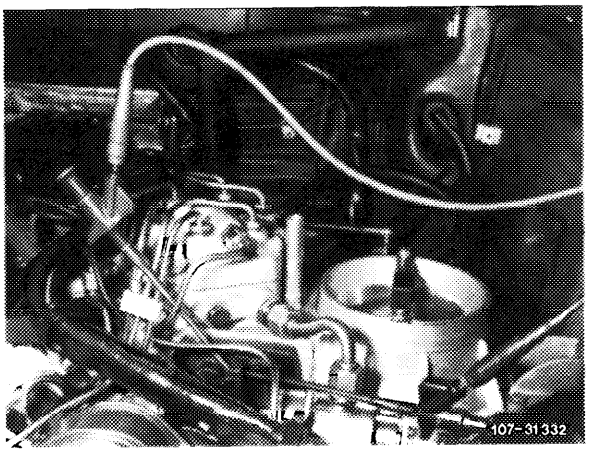
Connect coolant temperature sensor and O_2 sensor.

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.

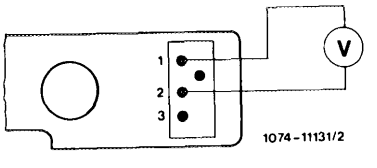


Measure voltage between terminal 1 and 2. Run engine at idling speed.

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



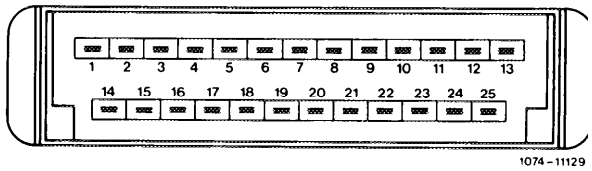
Voltage „0" volt: repair interruption. Voltage higher or lower: replace air volume meter.

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



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.

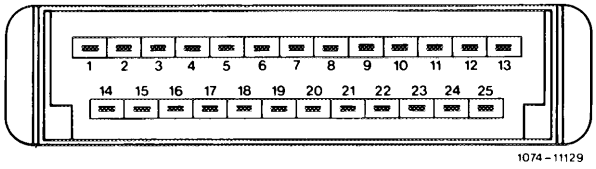
Ok	Not ok

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



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.

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 I 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.

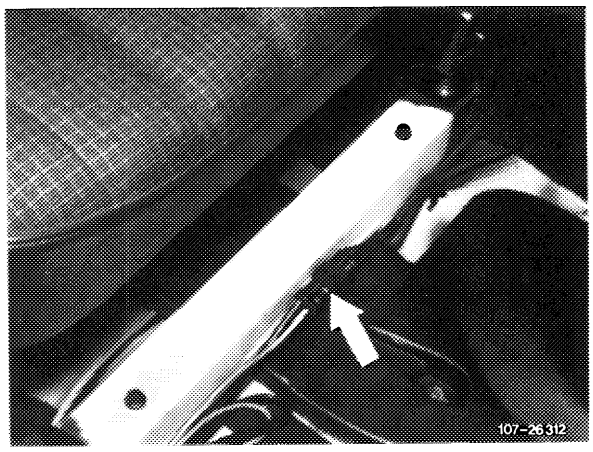
Disconnect plug of O_2 sensor heater. Check current input.

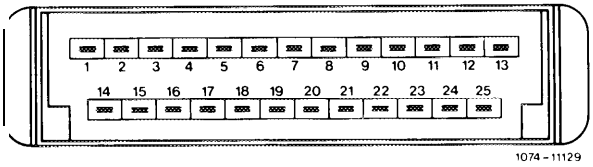
Nominal value 0.5-I .3 A

Ok	Not ok

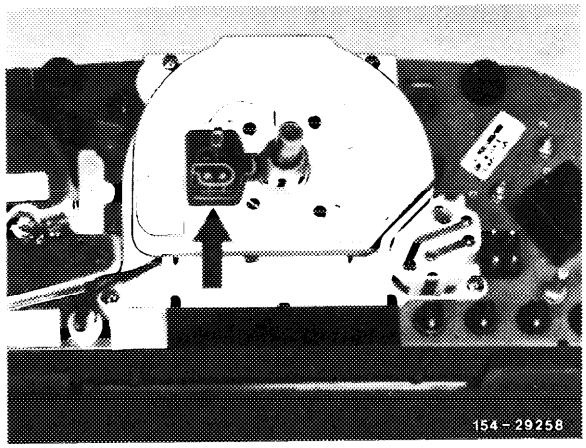
Replace O_2 sensor.

End of test





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.

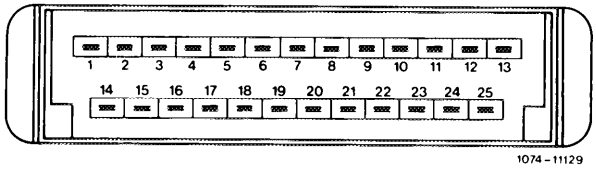
Ignition off. Pull plug from CIS-E control unit. Ignition on. Test voltage on plug of CIS-E control unit, jack 1 and 6, with multimeter (volt position).

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.



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.

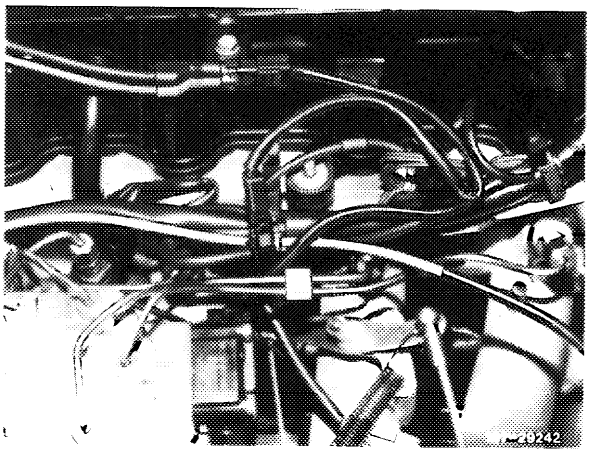
On-off ratio readout 60 % (constant).

Ok	Not ok

Replace control unit.

End of test

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

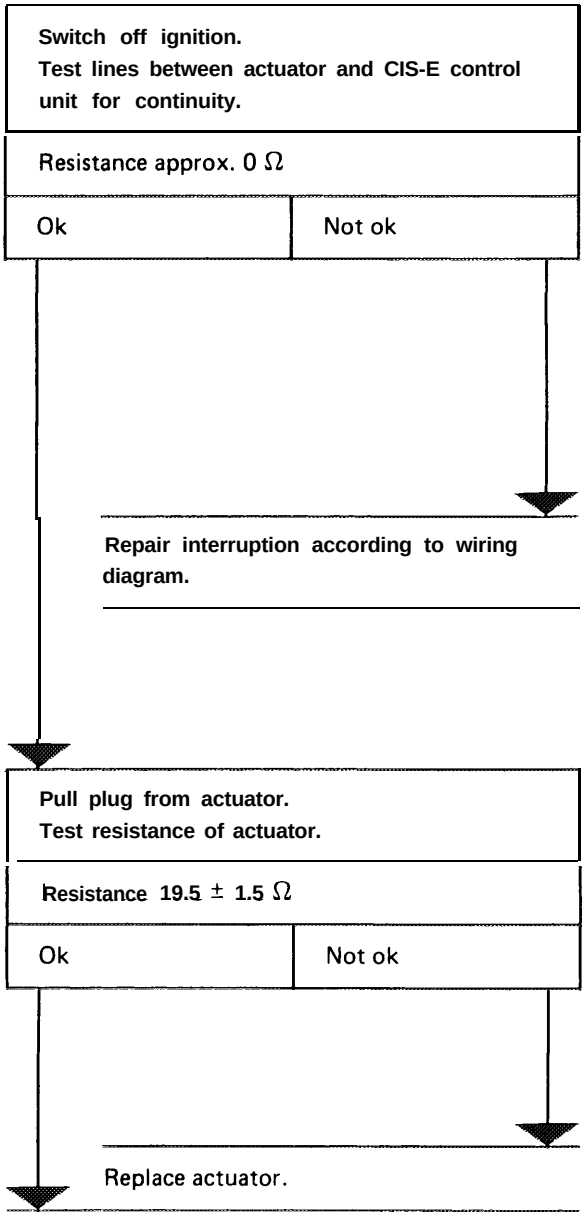
Ok	Not ok

Testing adjustment plug.

Designation without lambda control	ECE
Designation with lambda control	KAT

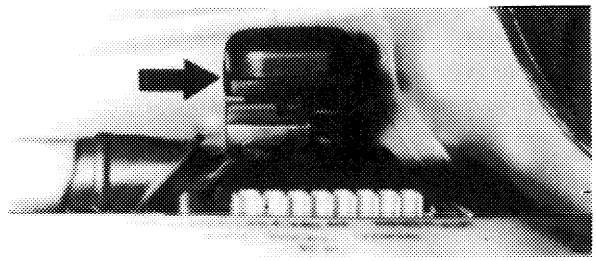
Ok	Not ok

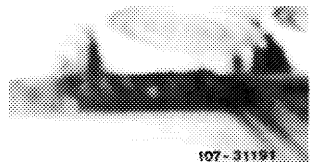
Correct adjustment plug.


Switch off ignition.
Test lines between actuator and CIS-E control unit for continuity.
Resistance approx. 0 Ω
Ok
Not ok
Repair interruption according to wiring diagram.
Pull plug from actuator.
Test resistance of actuator.
Resistance 19.5 ± 1.5 Ω
Ok
Not ok
Replace actuator.

End of test

I) Testing sensor, altitude correction (arrow)
(AUS) (J) (USA)





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.

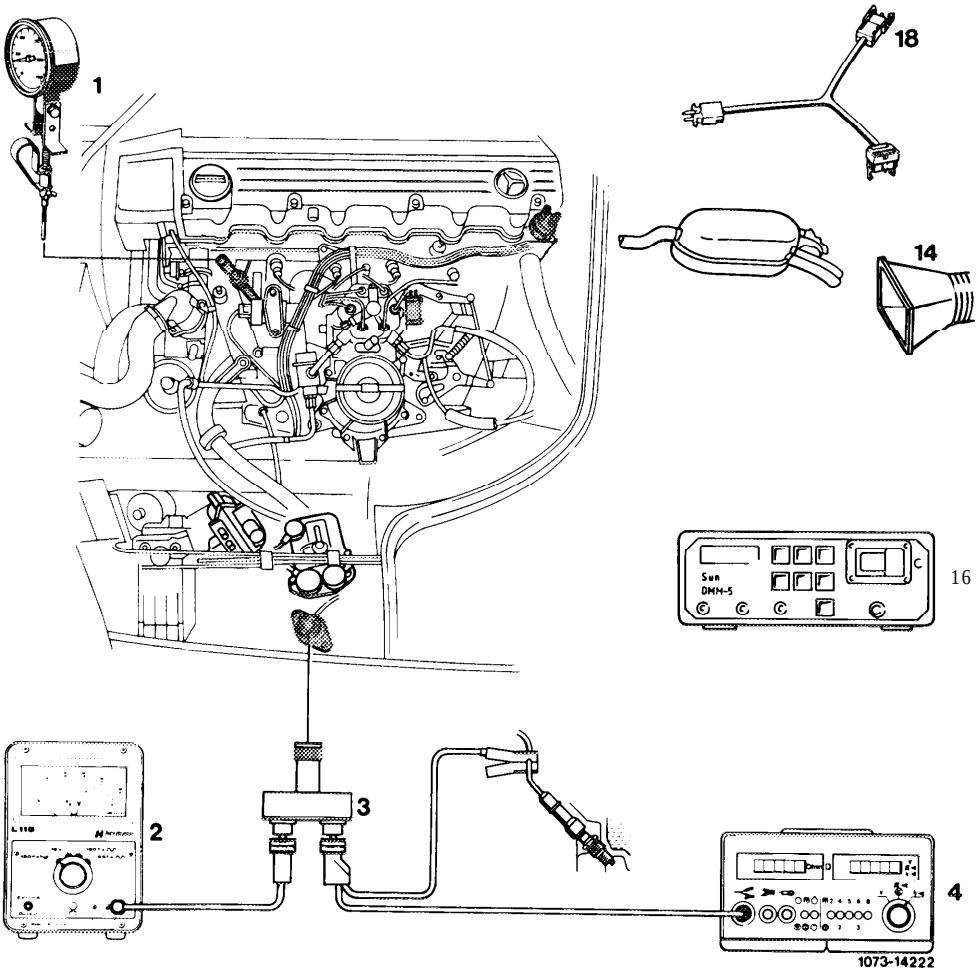
On-off ratio	Readout oscillating

Ok	Not ok

Replace sensor, altitude correction.

End of test

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

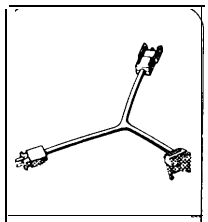
*Job No. of work unit or standard texts and flat rates data.

EXIT

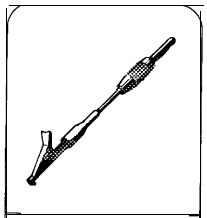
Test sequence

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.	–

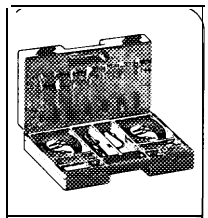
Special tools



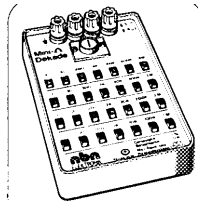
102 589 04 63 00



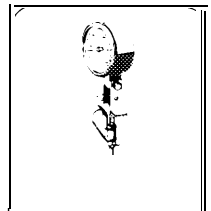
102 589 05 63 00



201 589 00 99 00



124 589 09 63 00



116 589 27 21 00

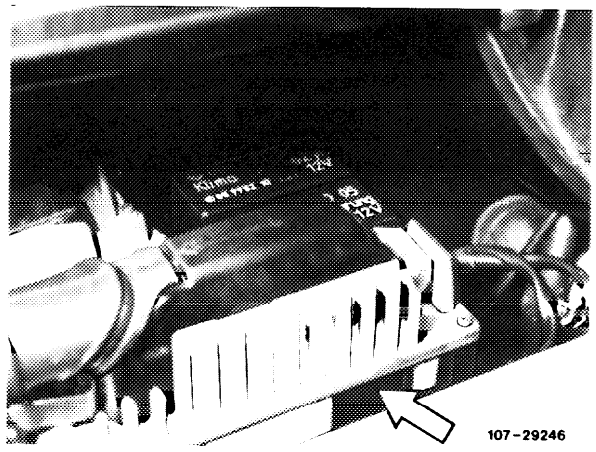
Conventional testers

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

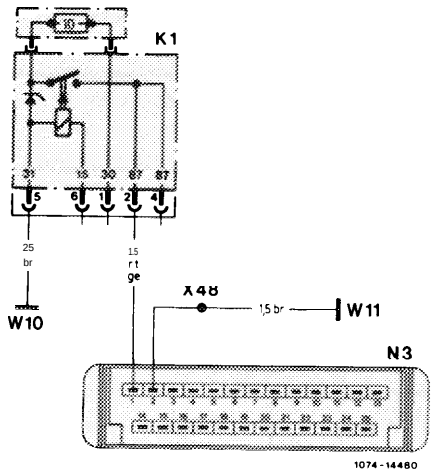
On-off ratio 0 %

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



K1 **Overvoltage protection CIS-E**
N3 **Control unit CIS-E**
W10 **Ground, battery**
W11 **Ground, engine (electric cable screwed on)**

Test voltage on jack 1 against ground (battery).

Voltage approx. 12 volts

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

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

Repair interruption according to wiring diagram.

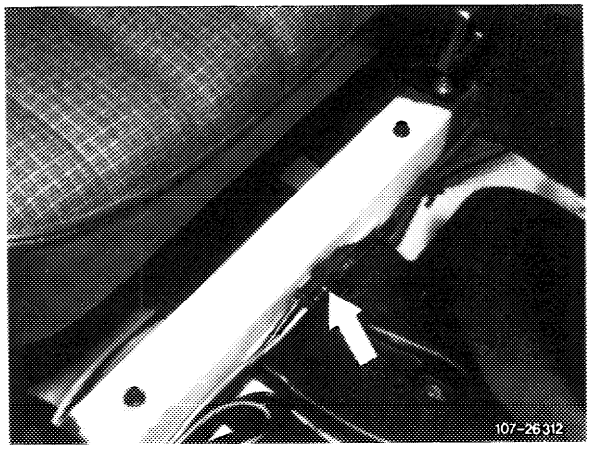
Disconnect plug O_2 sensor signal. Plug to CIS-E control unit to ground. Start engine. On plug connection of O_2 sensor line, check voltage to ground.

Voltage 450 – 1000 mV

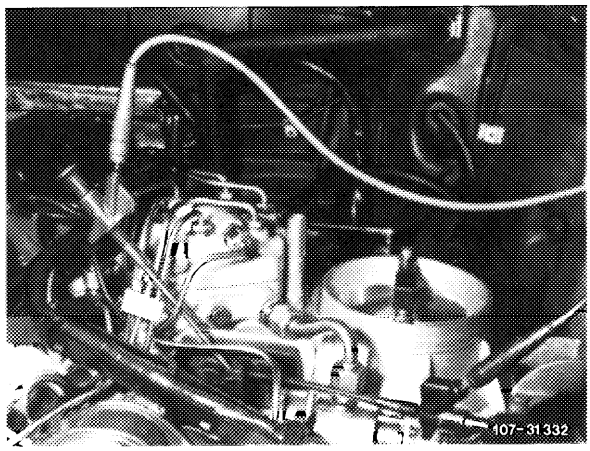
Ok	Not ok

Replace O_2 sensor.

End of test



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

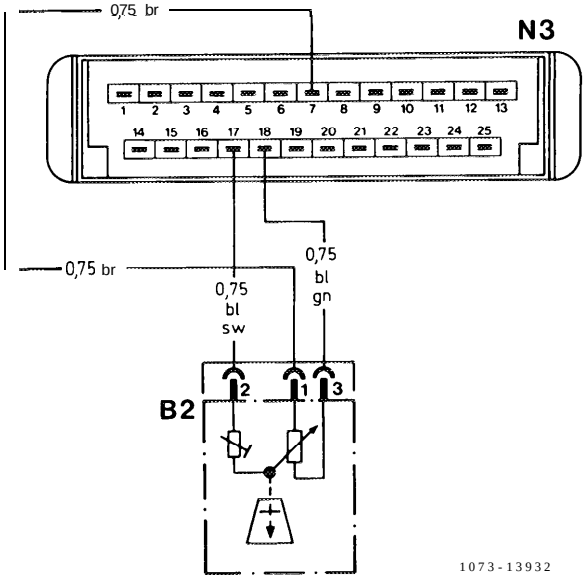
Voltage higher or lower, replace air volume meter.

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.



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.

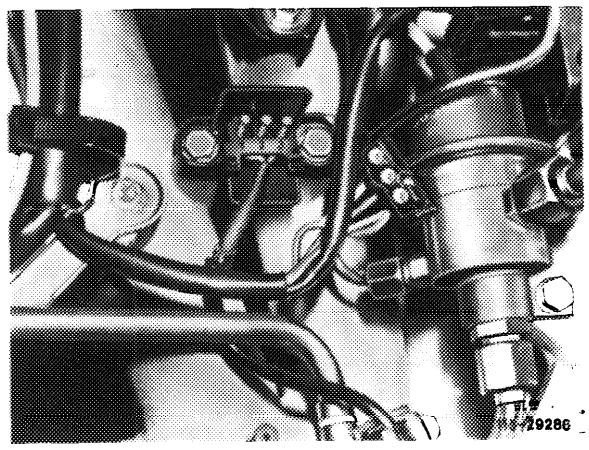
On-off ratio:

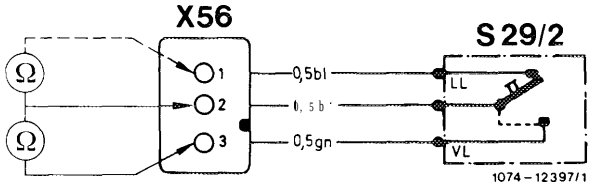
With lambda control:	Readout oscillating
Without lambda control:	Readout 50 %

Ok	**Not** ok

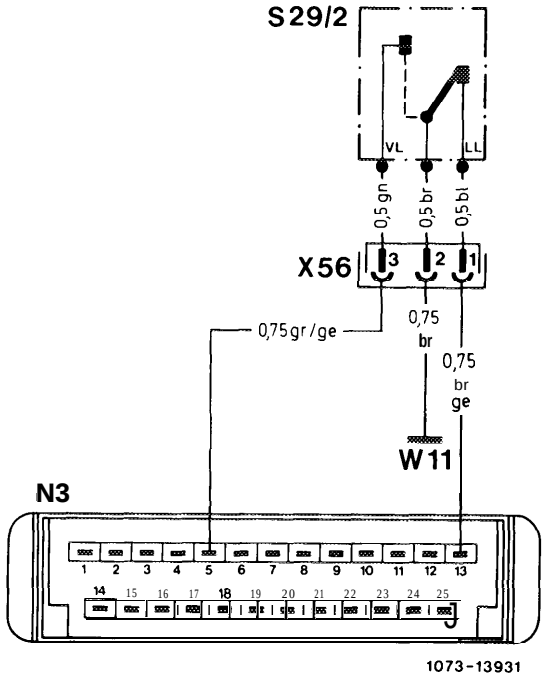
For other on-off ratio refer to test diagram.

End of test



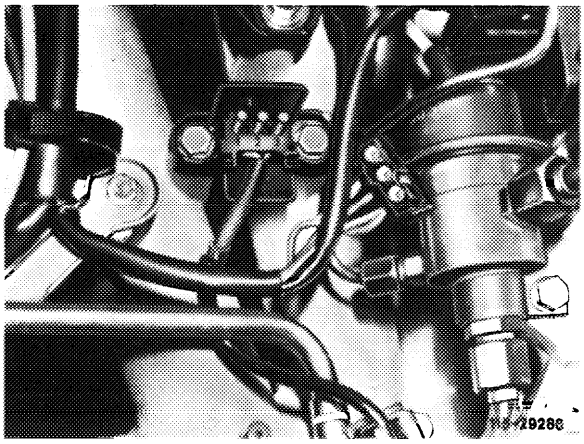


S29/2 **Throttle valve switch full load/idle detection**
X56 **Plug connection throttle valve switch**



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**

On-off ratio 20 %



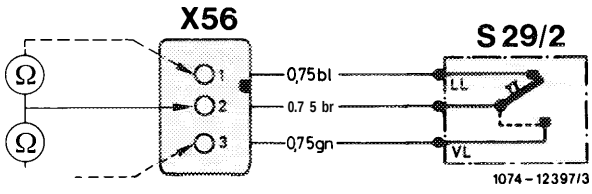
Testing throttle valve switch (full load contact)

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**

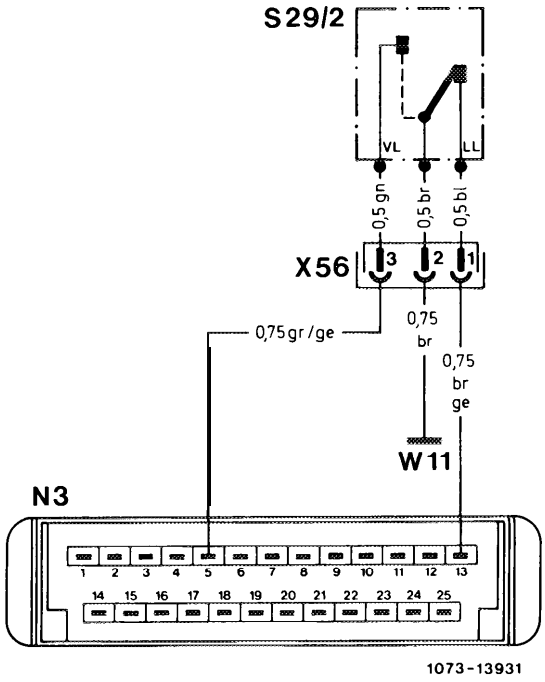
Test lines from plug, throttle valve switch to CIS-E control unit and ground for continuity.

Resistance approx. 0 Ω

Ok	Not ok

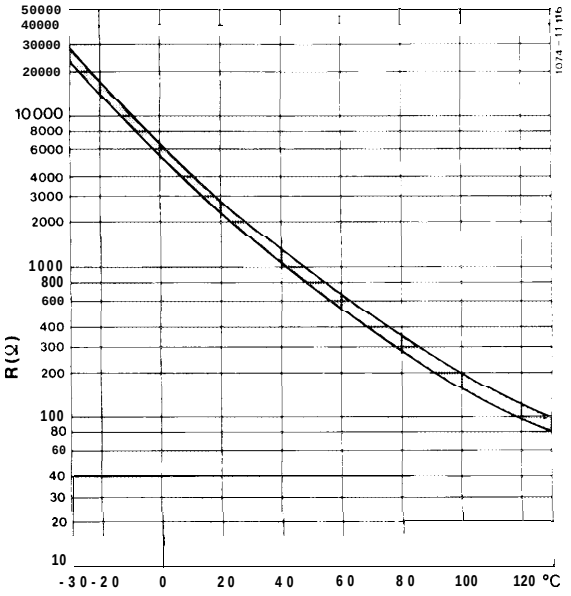
Repair interruption according to wiring diagram.

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**

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.

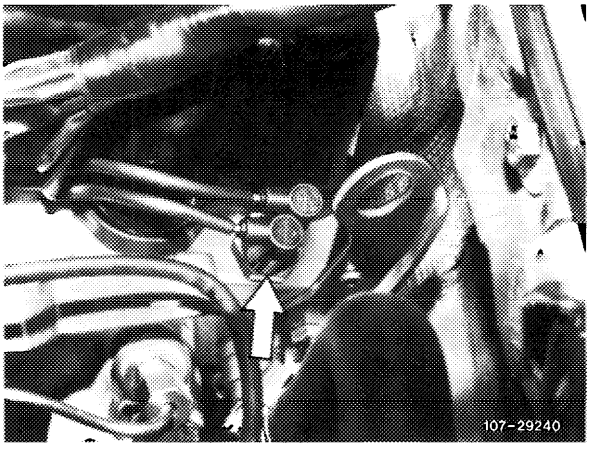
Test green/red line from terminal 21 plug, control unit (N3) to plug, coolant temperature sensor (B11/2) for continuity.

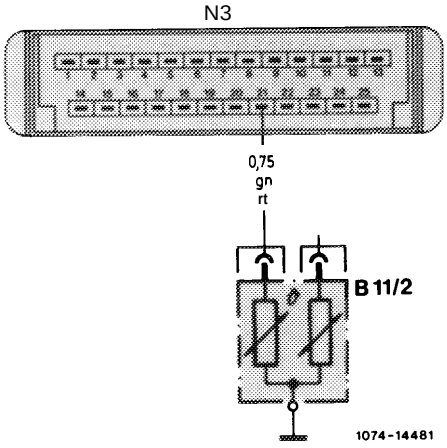
Resistance approx. 0 Ω

Ok | Not ok

Repair interruption according to wiring diagram.

End of test





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.

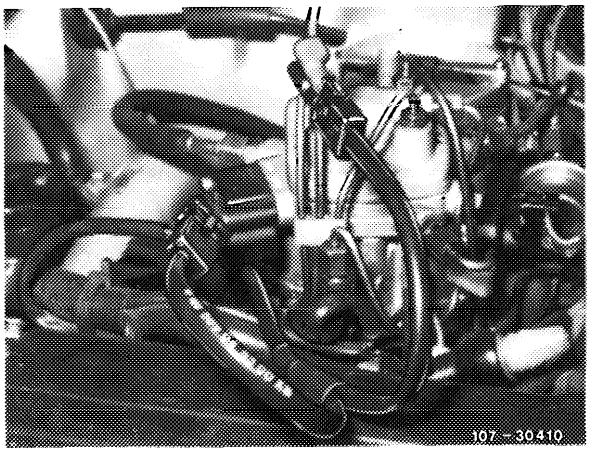
Ok	Not ok

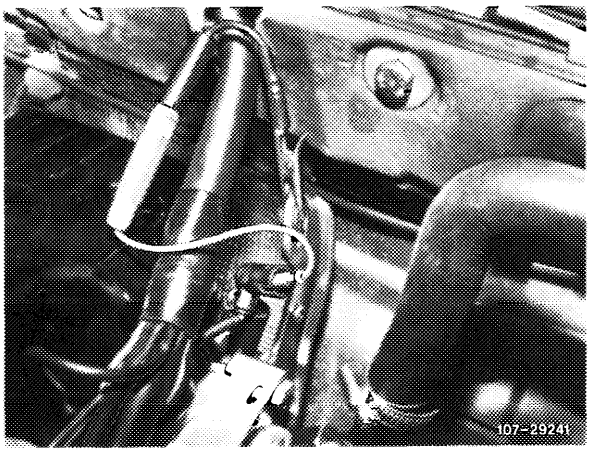
Reconnect coolant temperature sensor and O_2 sensor.

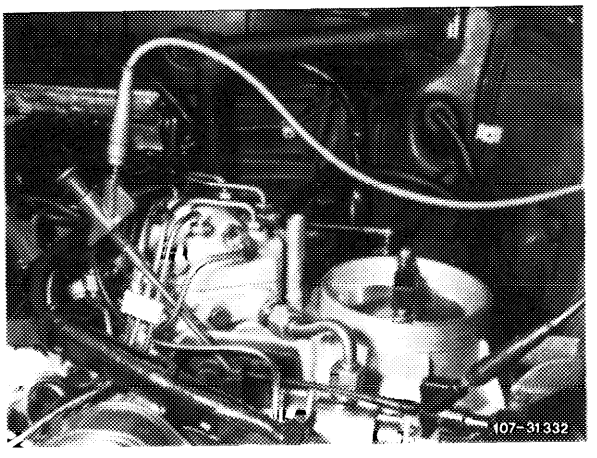
Pull off plug, sensor air volume meter to the extent that voltage can be measured. Start engine. Test voltage between terminal 1 and 3.

Voltage	4.6-5.1 V
Ok	Not ok

Repair interruption according to wiring diagram.



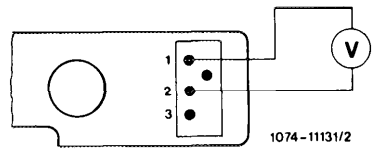




Measure voltage between terminal 1 and 2, run engine at idling speed.
If idling speed deviates, pull plug from idle speed adjuster (air valve) and set idle speed with a clamp on air hose to mean value of tolerance data.

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.

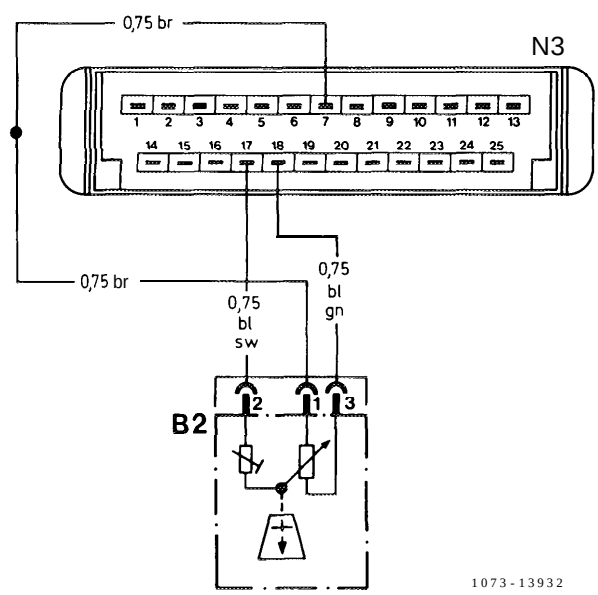
Voltage higher or lower, replace air volume meter.

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

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

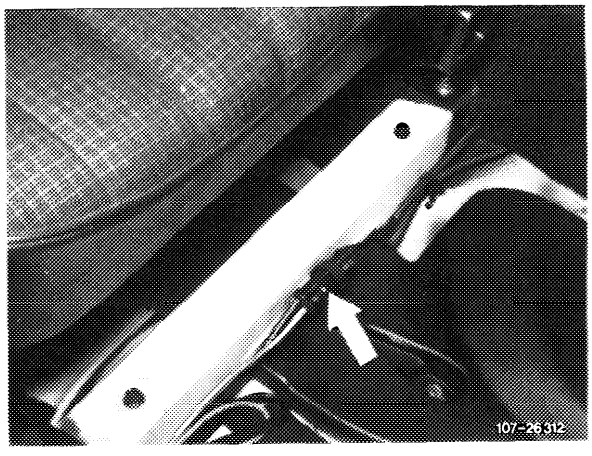
Ok	Not ok

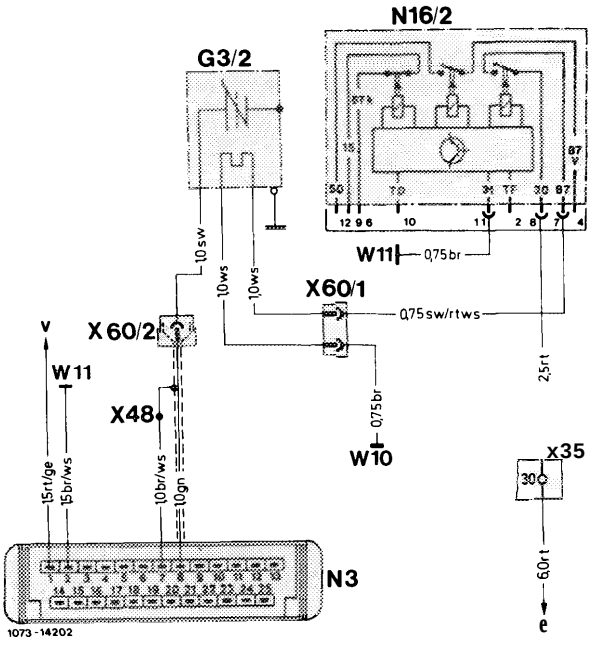
Stop engine. Test line to CIS-E control unit, jack 8, for continuity.

Resistance approx. 0 Ω

Ok	Not ok

Repair interruption according to wiring diagram.





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.

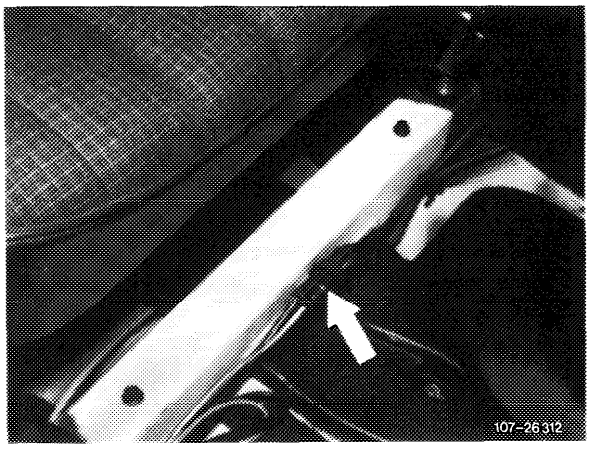
Disconnect plug, O_2 sensor heater.
Test current input.

Nominal value 0.5-l .3 A

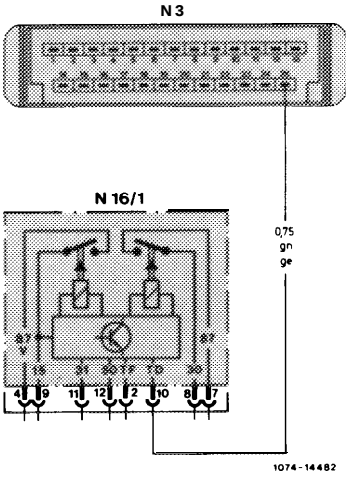
Ok	Not ok

Replace O_2 sensor.

End of test



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

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.

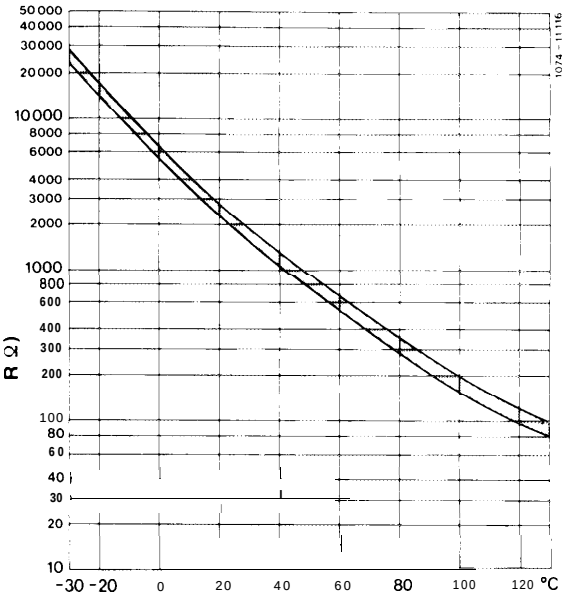
Check lines between temperature sensor, intake air and ground or control unit, injection system terminal 11 for continuity.

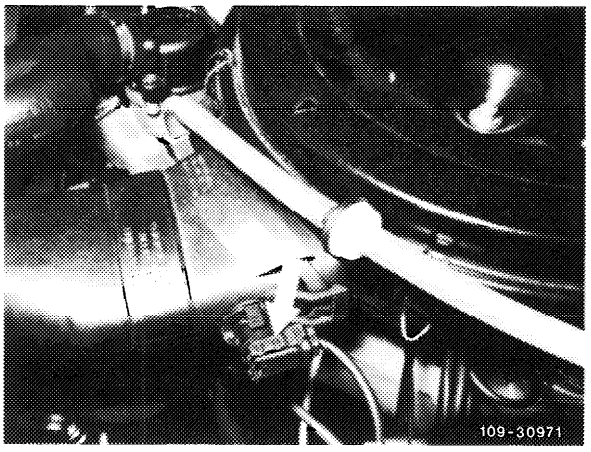
Resistance approx. 0 Ω

Ok	Not ok

Repair interruption according to wiring diagram.

End of test



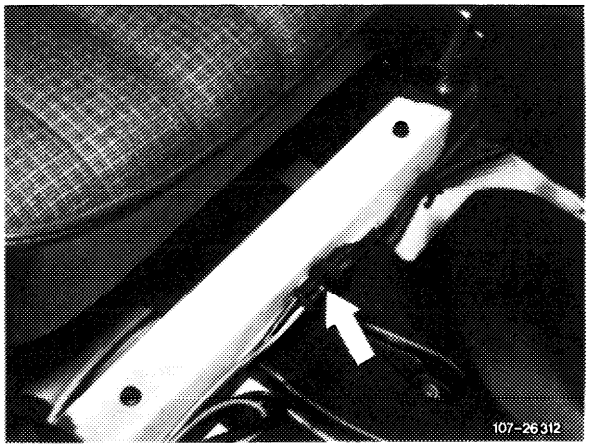


On-off ratio 100 %

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



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.

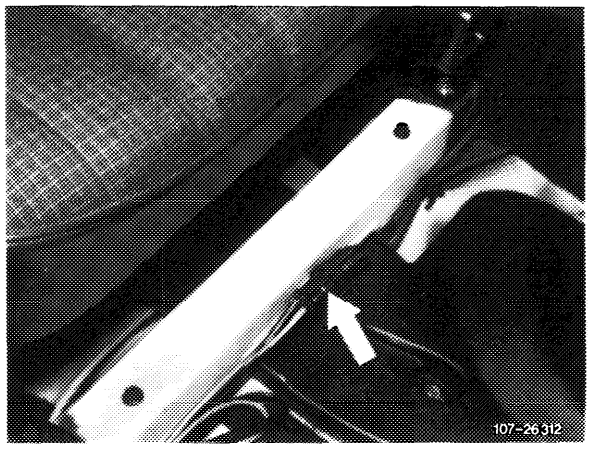
Disconnect plug, O_2 sensor heater.
Test current input.

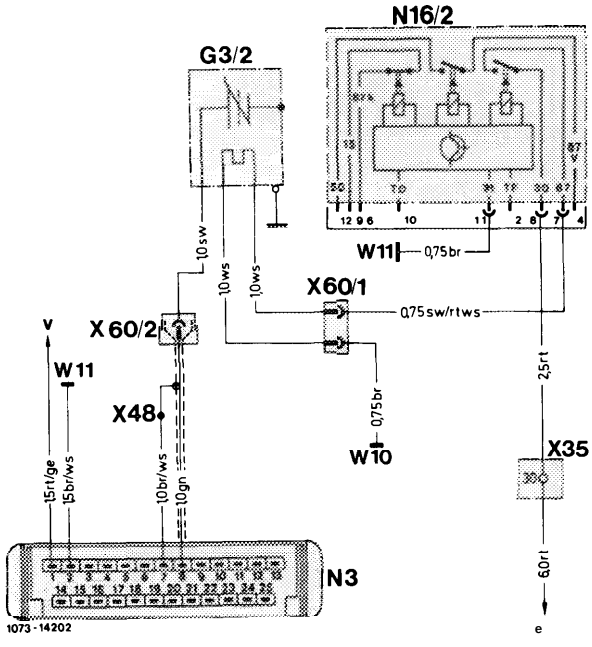
Nominal value 0.5-1 .3 A

Ok | Not ok

Replace O_2 sensor.

End of test

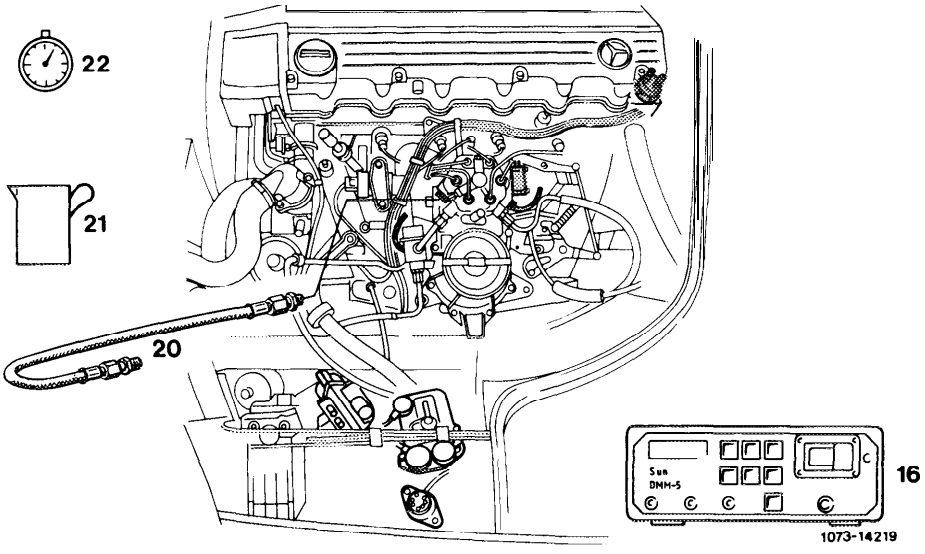




G3/2 O_2 sensor heated
N3 Control unit CIS-E
N16/1 Relay, fuel pump with starting valve activation
W10 Ground, battery
X60/1 Plug connection heater coil O_2 sensor
X60/2 Plug connection signal O_2 sensor

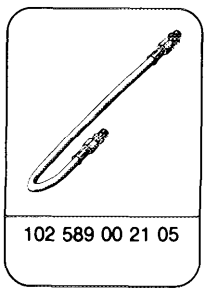
07.3-I 22 Testing throttle (orifice) in fuel distributor for unobstructed passage

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



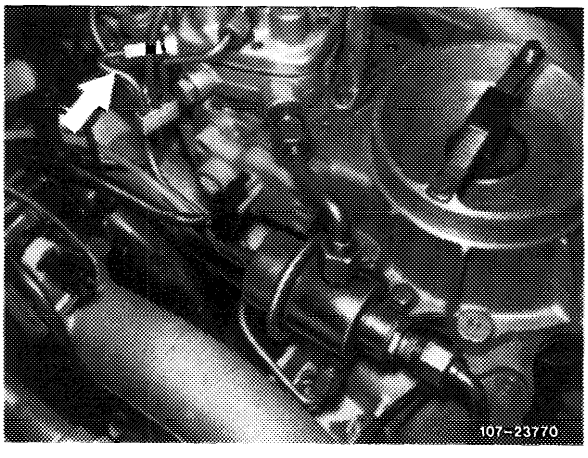
Conventional testers

Voltmeter, measuring glass or measuring cup, stop watch

Testing

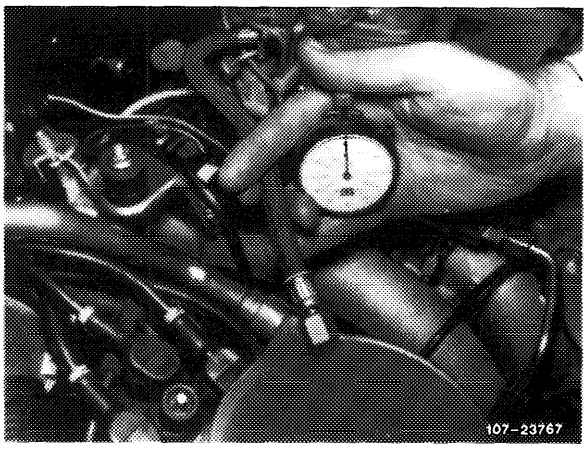
1 Pull plug from actuator.

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.

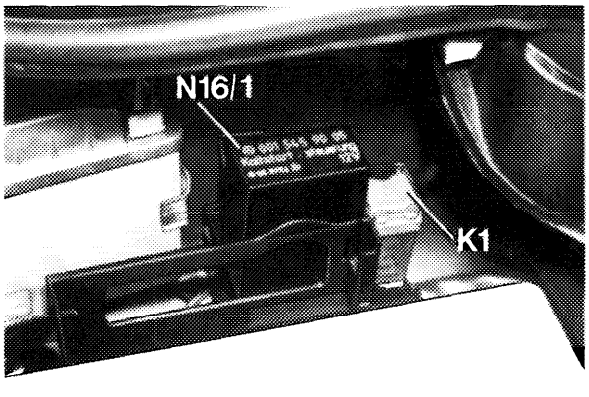
3 Connect fuel hose to fuel distributor and hold into measuring glass or measuring cup.



4 Pull off fuel pump relay and bridge the two jacks 7 and 8. This will energize the fuel pump.

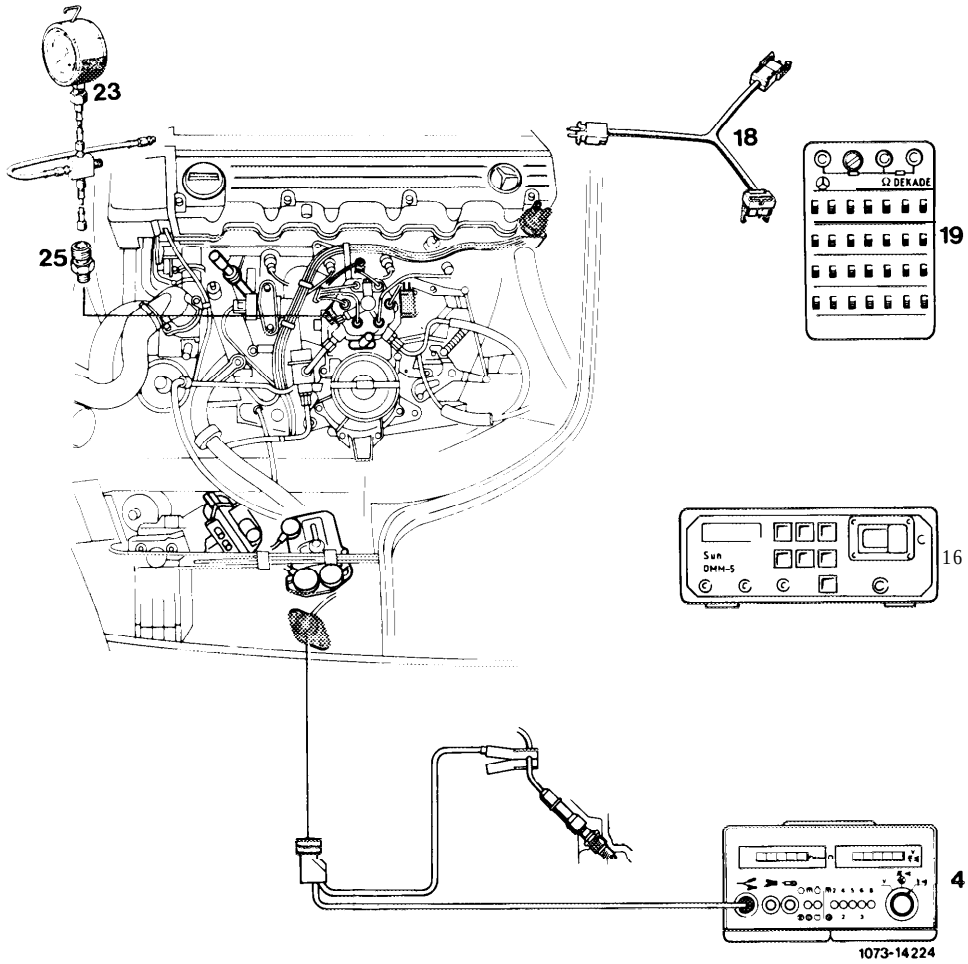
Pull off contact bridge after 1 minute.

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.



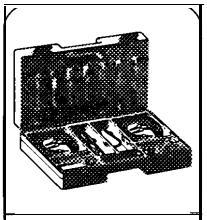
107-29244

Job No. of work unit or standard texts and flat rates data 07-2353.

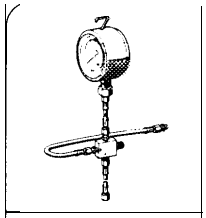


Fuel pressures and internal leaks	**Test (07.3-I 20).**
Starting valve	**Check for function and leaks.**
After-start enrichment	**Check.**

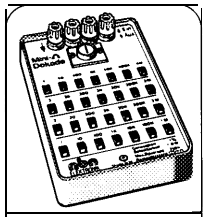
Special tools



201 589 00 99 00



103 589 00 21 00



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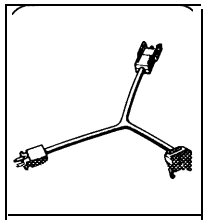
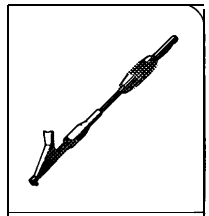
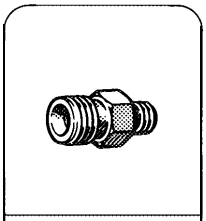


102 589 04 63 00



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").

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).

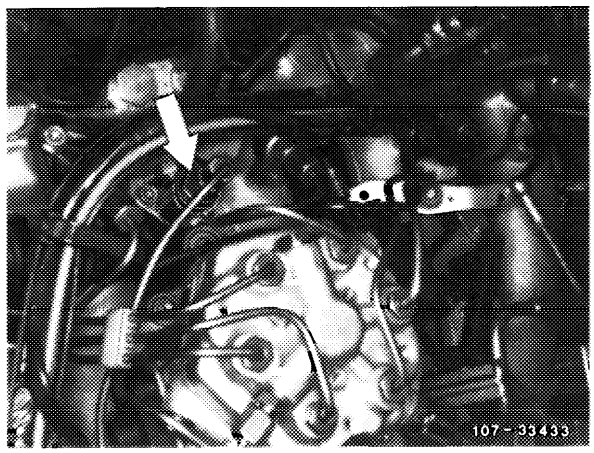
Check for leaks.
Dry starting valve on nozzle.

Formation of drops

Ok	Not ok

Replace starting valve.

End of test



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

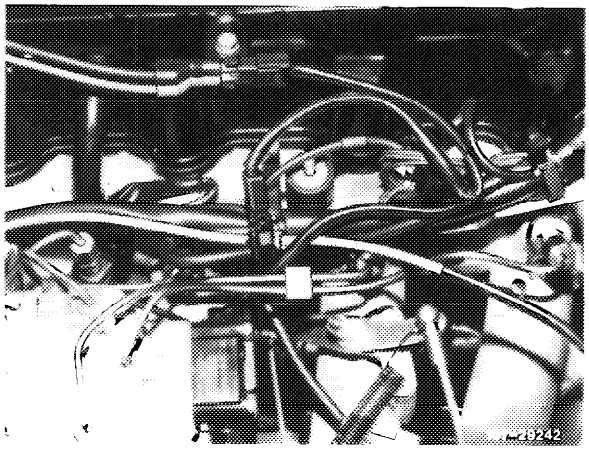
Test rpm signal (TD) on plug, control unit terminal 25 (green/yellow).
Start engine.

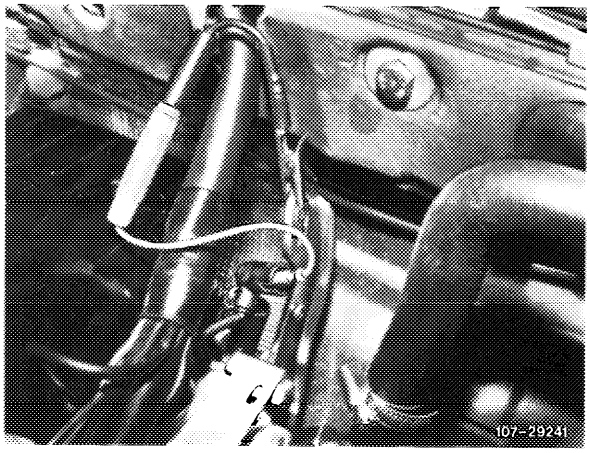
Voltage 6–12 volts.

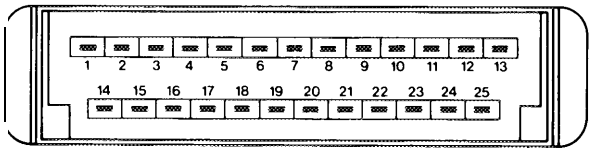
Ok | Not ok

Repair interruption according to wiring diagram.

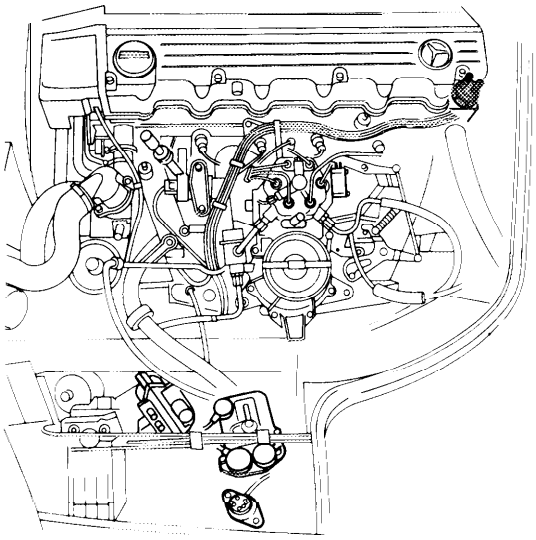
End of test

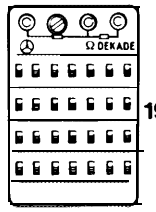


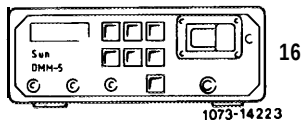




Job No. of work unit or standard texts and flat rates data 07-1607.

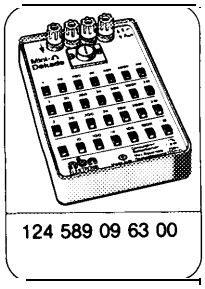






Testers.	Connect: multimeter (16). Ohm decade (19) 124 589 09 63 00.
Starting voltage	Check. Min. 10 V in approx. 5 seconds.
Electric lines between starting valve and fuel pump relay for continuity	Test. Resistance approx. 0 Ω.
Voltage on fuel pump relay	Test. Jack 12 (terminal 50) min. 10 V, jack 2 (terminal TF) 3-5 V, simulated at 10 kΩ.

Special tool



Conventional tester

Multimeter	e.g. Sun, DMM-5

Activation via fuel pump relay.

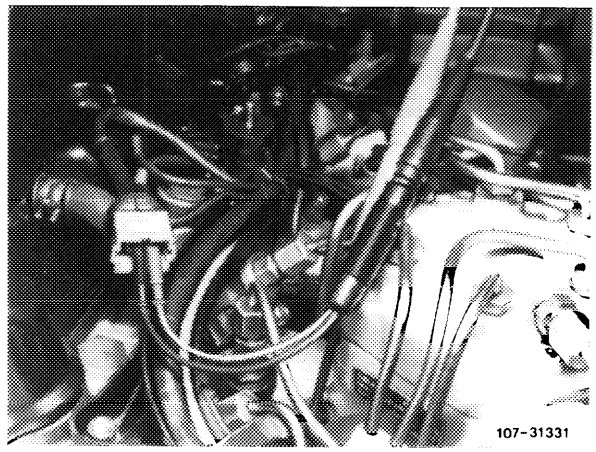
The starting valve is activated via fuel pump relay in accordance with coolant temperature.

Example: -20 °C = approx. 10 seconds.
No more activation above +15 or +60 °C.

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

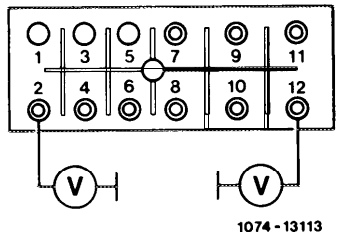
Ok	Not ok

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.

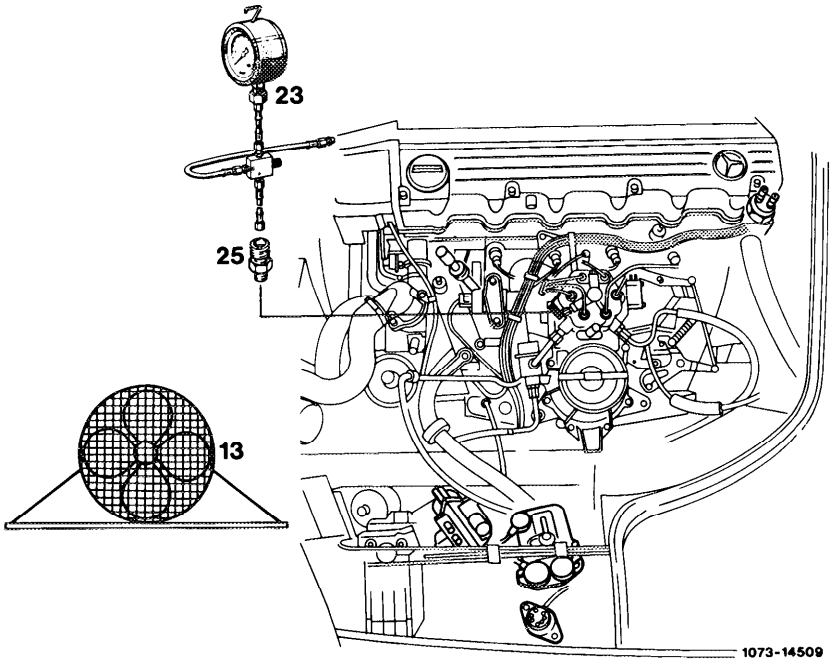
Ok	Not ok



Replace fuel pump relay.	Repair interruption according to wiring diagram.

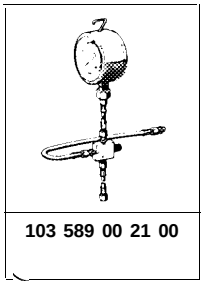
End of test

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

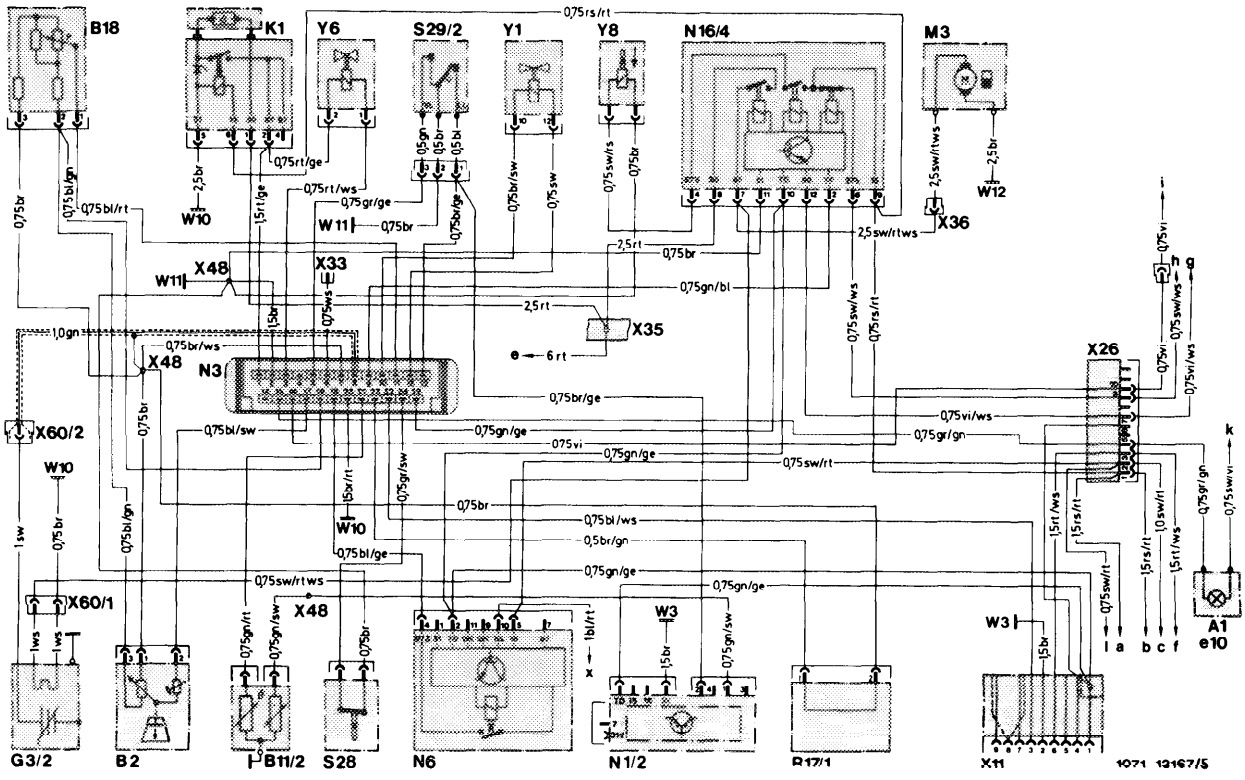


103 589 00 21 00

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

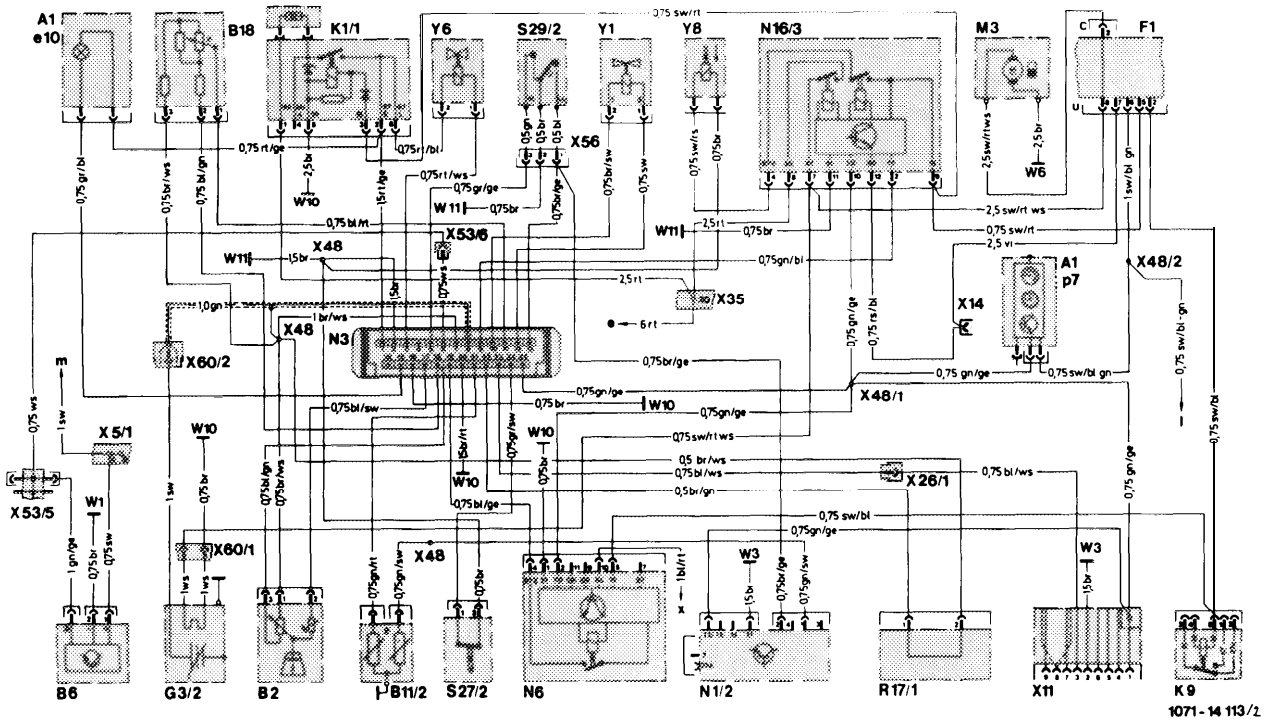
[1]) Below previously measured system pressure.



Wiring diagram mechanically/electronically controlled gasoline injection system

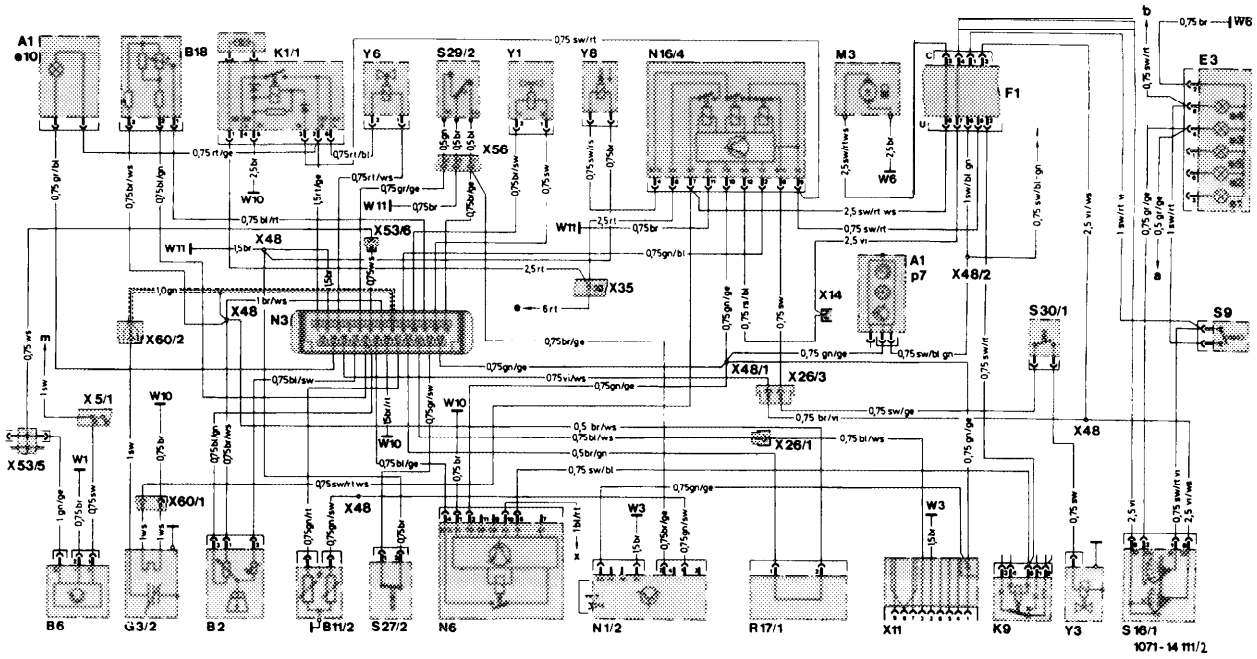
Ale10	O_2 sensor failure indicator
B2	Sensor, air volume meter
B11/2	Temperature sensor, coolant (2-pole)
B18	Sensor, altitude correction
G3/2	O_2 sensor heated
K1	Relay, overvoltage protection
M3	Fuel pump
N1/2	Switching unit, electronic ignition system
N3	Control unit CIS-E (25-pole plug)
N6	Control 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.



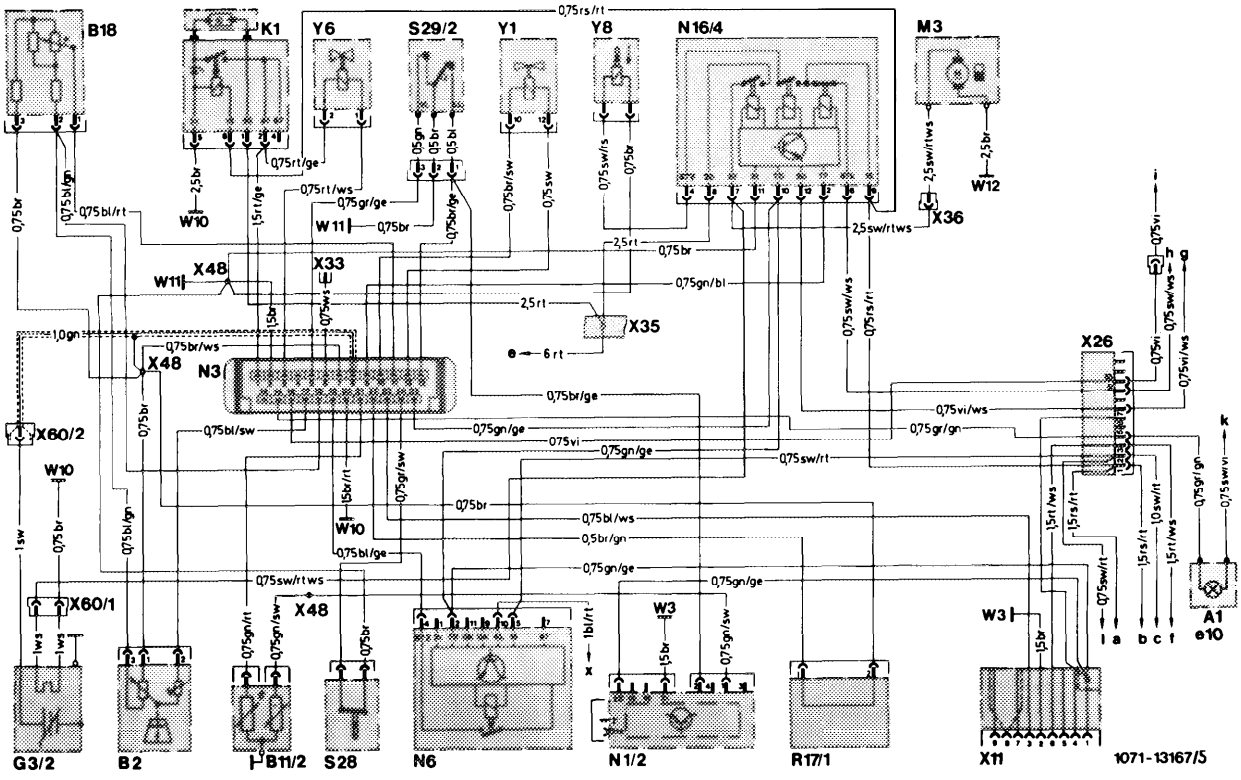
Wiring diagram, mechanically/electronically controlled gasoline injection system with manual transmission

Ale10	Failure indicator lamp, O_2 sensor
Alp7	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



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



Wiring diagram, mechanically/electronically controlled gasoline injection system

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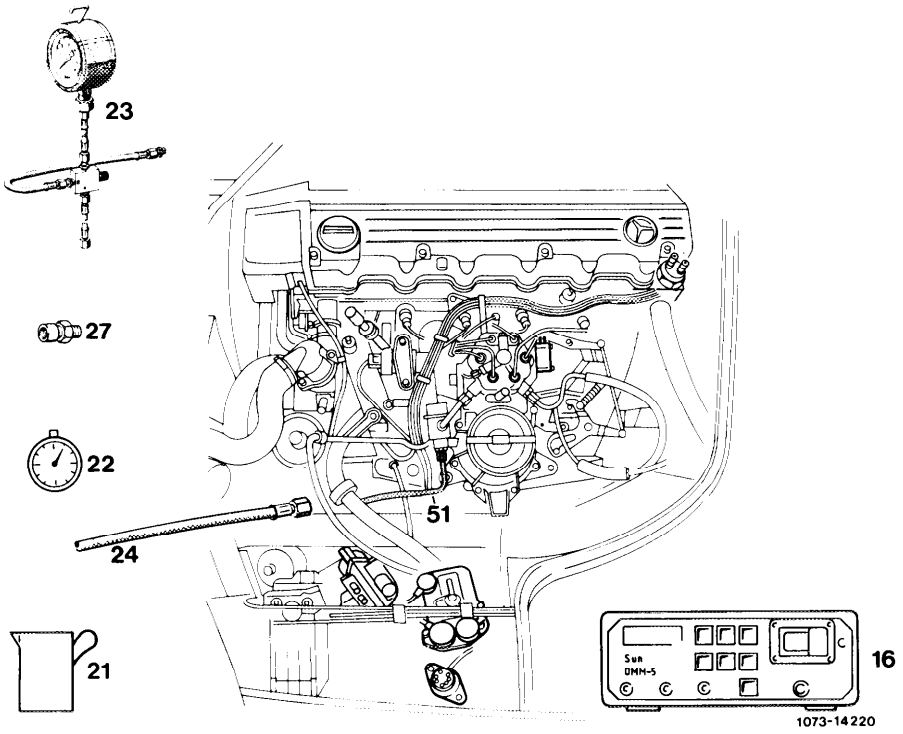
B2	Sensor, air volume meter
B11/2	Temperature sensor, coolant (2-pole)
B18	Sensor, altitude correction
G3/2	O_2 sensor heated
K1	Relay, overvoltage protection
M3	Fuel pump
N1/2	Switching unit, electronic ignition system
N3	Control unit CIS-E (25-pole plug)
N6	Control unit, compressor cutout
N16/3	Relay, fuel pump (manual transmission)
N16/4	Relay, fuel pump (automatic transmission)
R17/1	Single adjustment plug 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.

07.3-130 Testing fuel pump

Job No. of work unit or standard texts and flat rates data 07-5700.



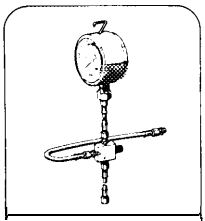
Fuel return line (51).	Unscrew
Fuel hose (24).	Self-made and connected to diaphragm pressure regulator
Del ivery capacity	Check. Nominal value 1 liter in max. 40 seconds. Use testers (16, 21, 22) for this purpose.
Current input	Check. Nominal value 7-10 amps Use tester (16) for this purpose.
Fuel hose	Check. Nominal value 2-4 bar gauge pressure. Use testers (23, 27) for this purpose. Special tool 103 589 00 21 00

Test values

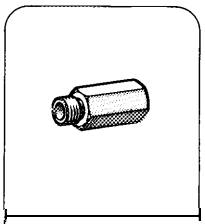
Fuel pump (each)		1	2
Designation		EKP4	EKP6
MB part No.		002 091 97 01	002 091 59 01[1])
Bosch No.		0580 254 942	0580 254 951
Measuring instructions		with engine stopped and a voltage of min. 11.5 volts at delivery pump	
Delivery capacity[2])	Measuring point	Fuel return line following diaphragm pressure 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.

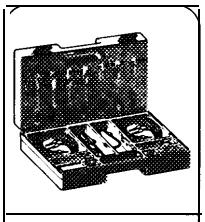
Special tools



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

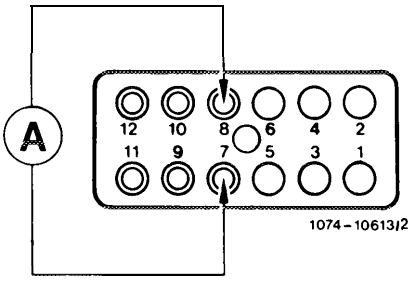
Fuel hose approx.	500 mm long
Pipe with sealing cone	
Coupling nut	M 14 x 1.5

A. Delivery capacity

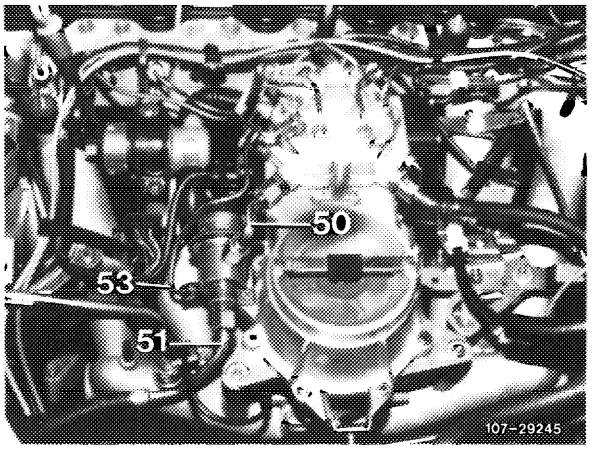
1 Check current input at jack 7 (terminal 87) and jack 8 (terminal 30).

Current input: 7-l 0 amps

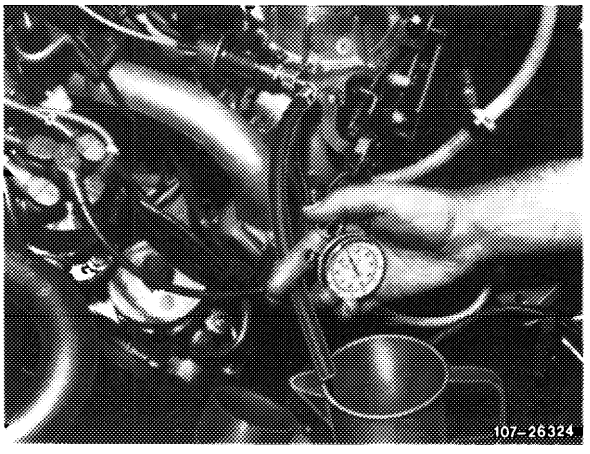
If more than 10 amps are measured, replace fuel pump.



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.



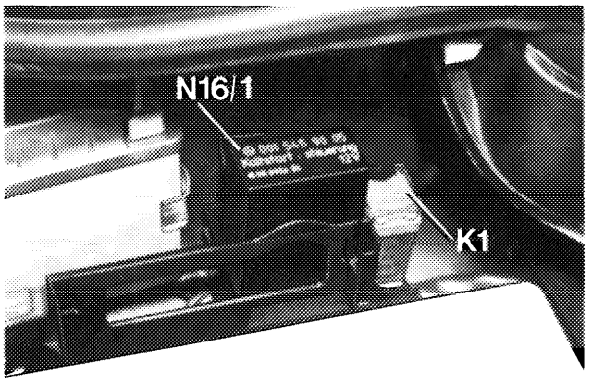
3 Screw self-made fuel hose to diaphragm pressure regulator and hold into measuring glass or measuring cup.



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.



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.

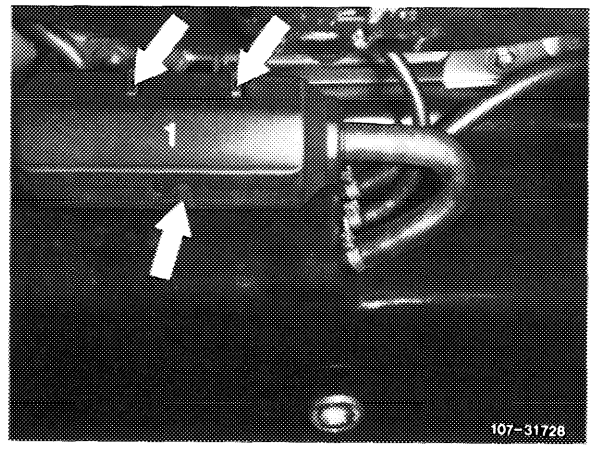
e) Replace fuel filter.

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.

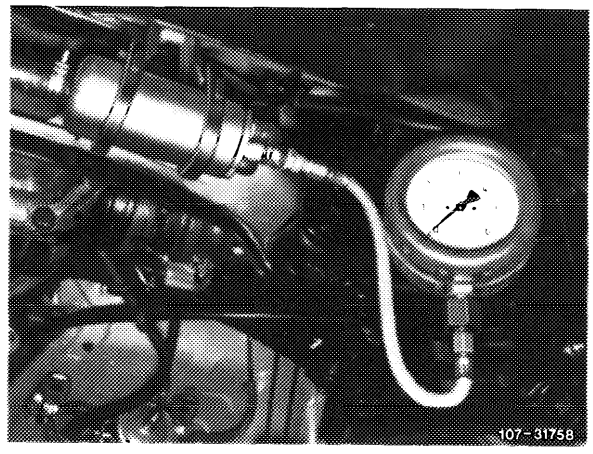
B. Fuel pressure



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.

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

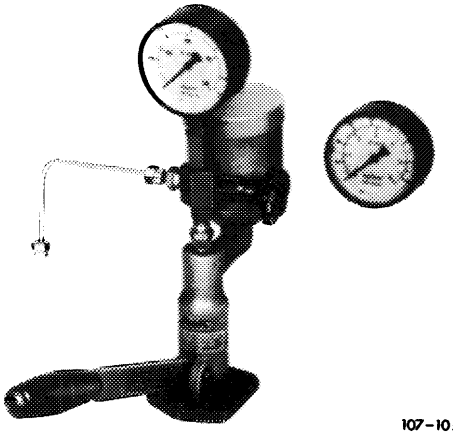
Valve tester Bosch KDJE-P 400	Bosch order designation KDJE-P 400
Nozzle tester EFEP 60 H[1])	Bosch No. 0 684 200 700
Pressure gauge O-6 bar gauge pressure housing dia. 100 mm Quality class 1 .O	Bosch No. 1 687 231 000
Pipe line	Bosch No. 1 680 750 001

[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

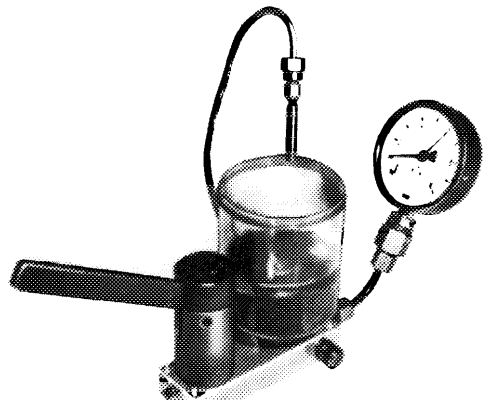
The nozzle or valve tester serves to test the opening pressure, buzzing, the jet and the absence of leaks of injection valves.

Prior to starting injection valve test, fill reservoir of tester and vent the unit. For testing, use kerosene exclusively.



107-10592

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:

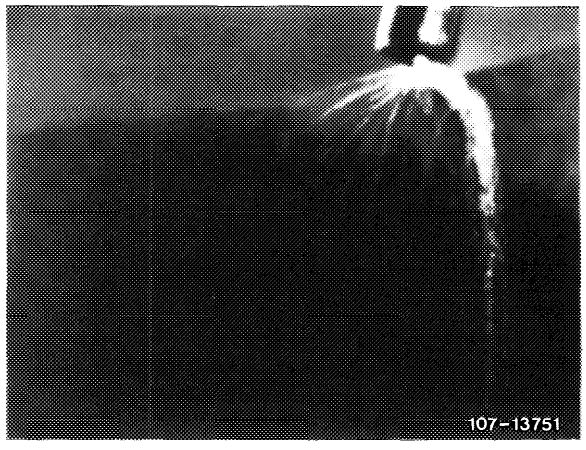
Close shutoff valve. Flush injection valve by a number of fast movements of hand lever. Open shutoff valve and increase pressure slowly up to 0.5 bar gauge pressure below the previously determined opening pressure and hold. No drops should show up on injection valve within 15 seconds.

EXIT

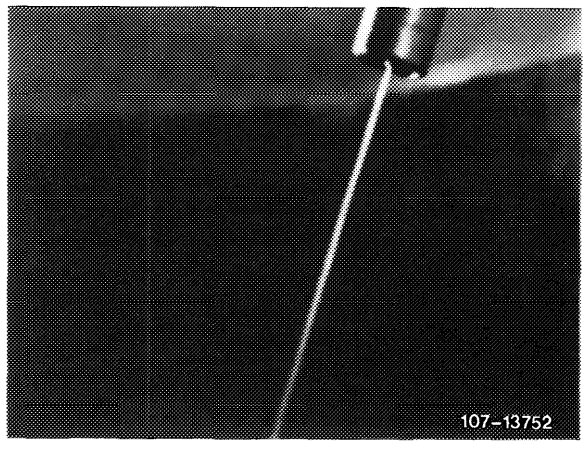
4 Buzzing test, evaluation of **jet**

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.

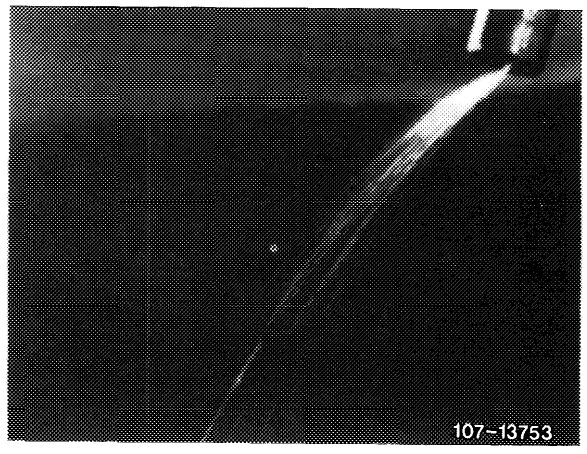
faulty injection valves



Formation of drops

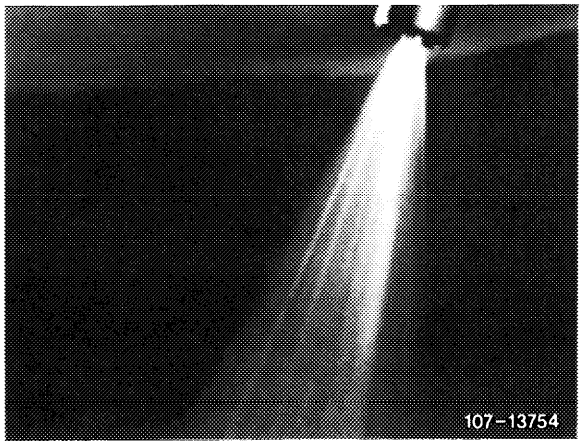


Cord-type jet

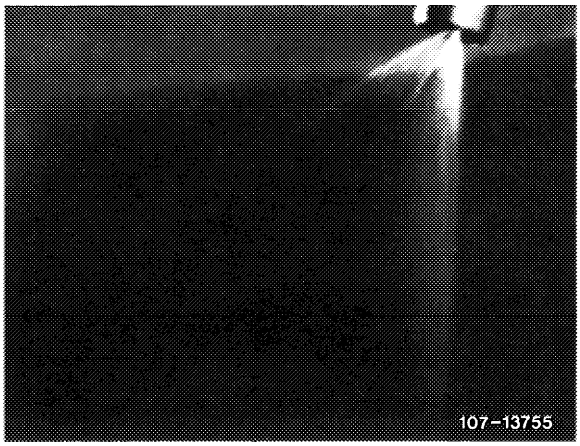


Spreading jet

Good injection valves



Well-proportioned jet



Slightly one-sided atomization

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.

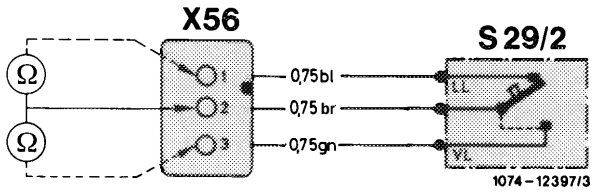
3 Turn throttle valve slightly in direction of idling, readout should move to ∞ Ω.

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.

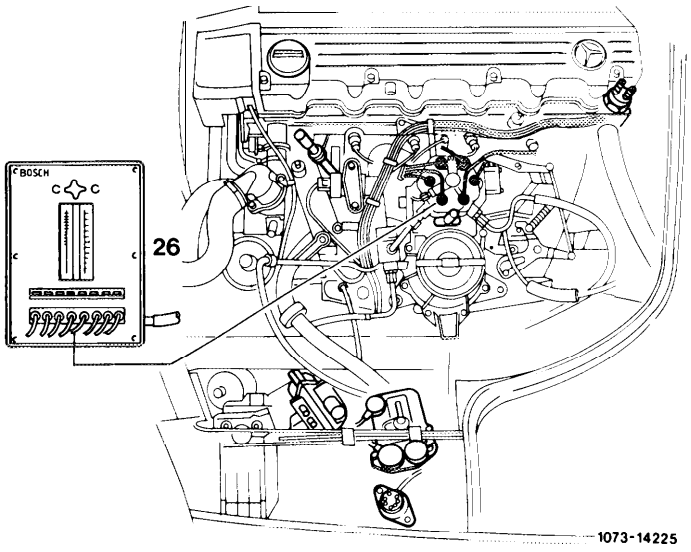
Idle speed contact:	**Idle speed position**
	approx. 0 Ω
	Full load position
	approx. ∞ Ω
Full load contact:	**Idle speed position**
	approx. ∞ Ω
	Full load position
	approx. 0 Ω
	Partial load position
	approx. ∞ Ω



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

07.3-160 Perform fuel quantity comparison measurement

Job No. of work unit or standard texts and flat rates data 07-1609.

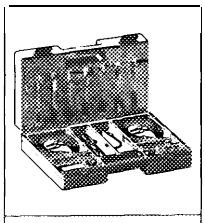


Injection lines	Unscrew
Quantity comparison measuring unit (26)	Connect
Fuel pump relay	Pull off. Bridge jacks 7 and 8. Special tool 201 589 00 99 00
Air flow sensor plate	Deflect and vent quantity comparison measuring unit
Air flow sensor plate	Locate
Test sheet.	Complete. Compute difference between 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

Special tool



201 589 00 99 00

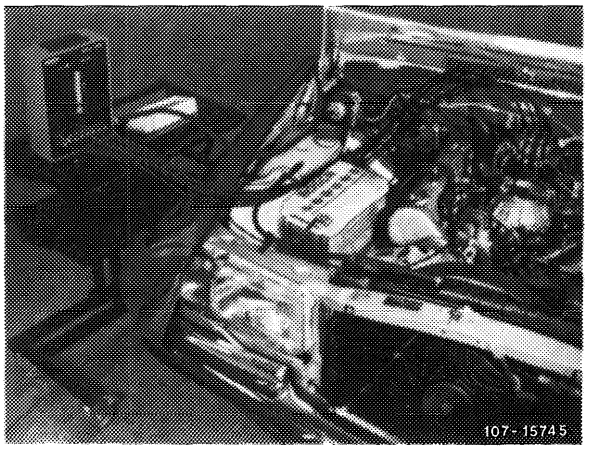
Conventional Bosch testers and accessories

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.

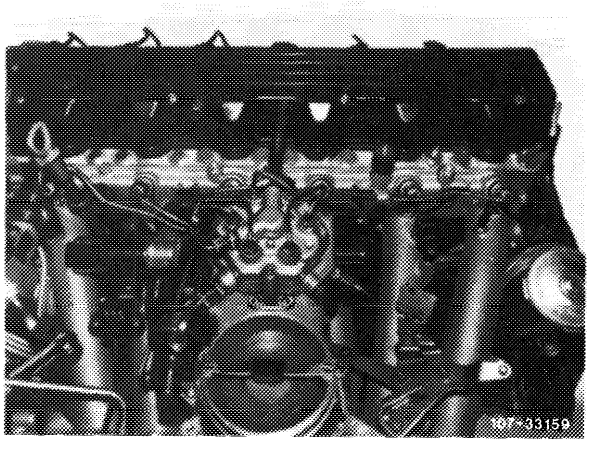


Testing

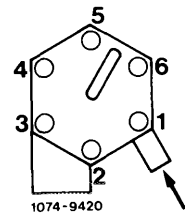
1 Place quantity comparison measuring unit horizontally adjacent to vehicle (tool or tester carriage).

2 Remove air cleaner.

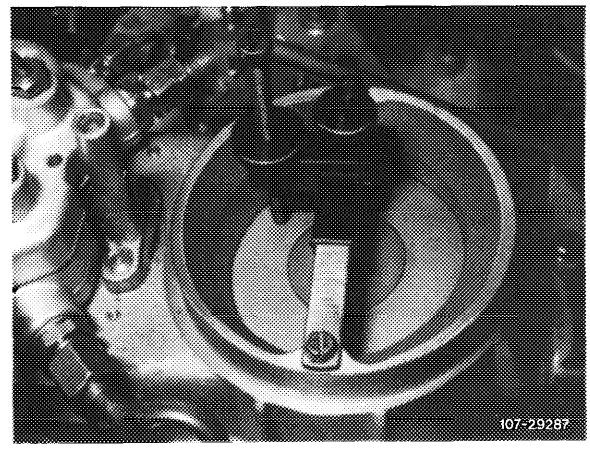
3 Unscrew injection lines on fuel distributor and release at injection valves, unscrew if required.



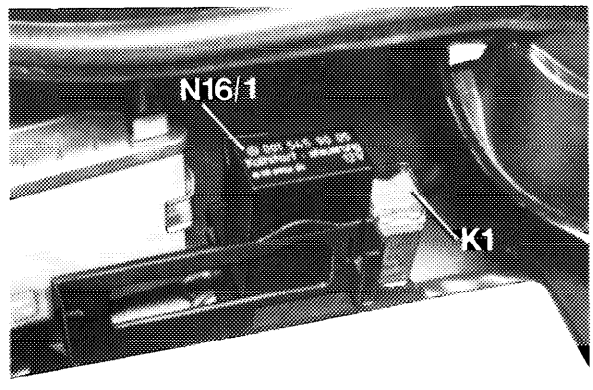
4 Attach connecting lines of quantity comparison measuring unit to fuel distributor (sequence according to Fig.) and insert fuel return line into filler neck of fuel tank.



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

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).

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.

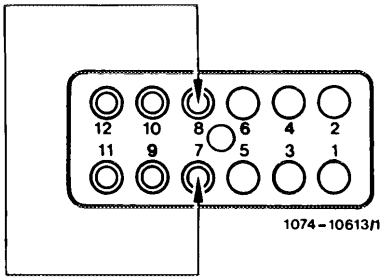
The respective breakaway speed is stamped on fuel pump relay.

For starting valve activation, refer to 07.3-l 26.

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



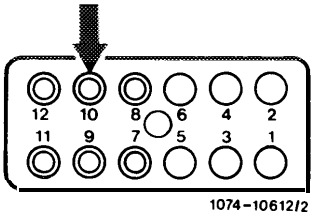
Switch on ignition. Set multimeter to volts. Test voltage on jack 9 (terminal 15) against jack 11 (terminal 31).

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

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.

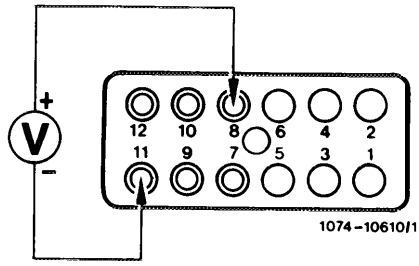
Voltage approx. 12 volts

Ok	Not ok

Replace fuel pump.

Repair interruption according to wiring diagram.

End of test



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.

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).

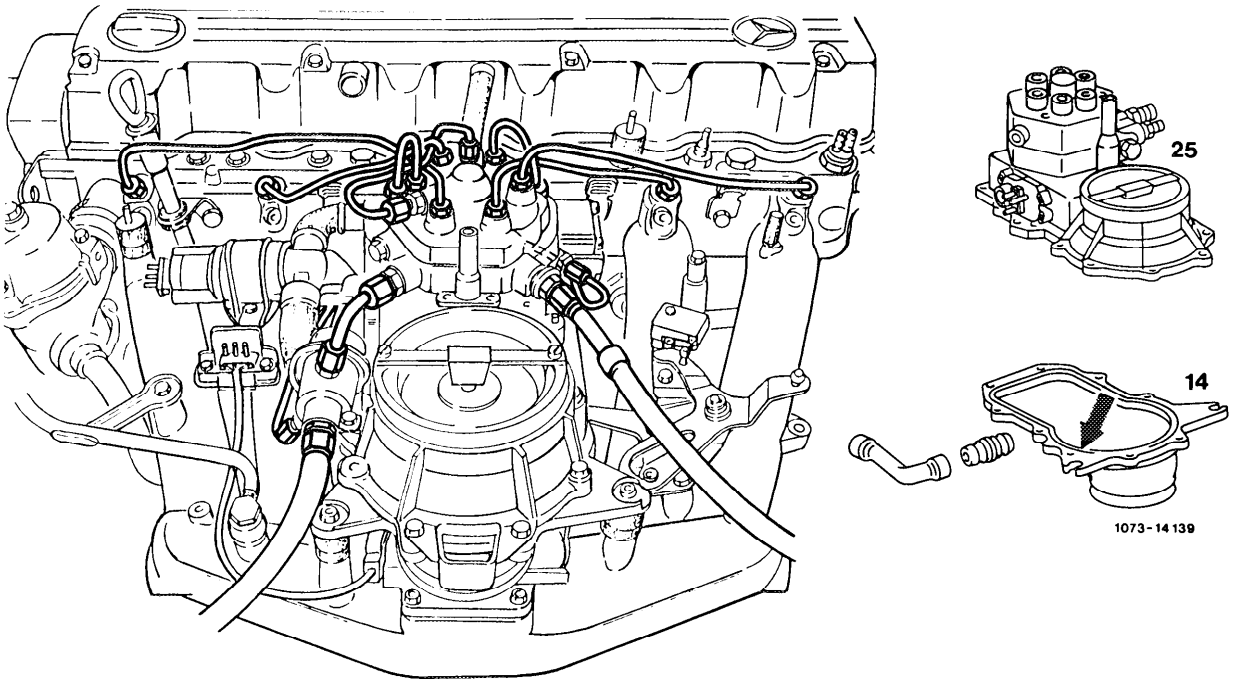
Voltage approx. 12 volts.

Ok	Not ok
Replace solenoid valve.	Repair interruption according to wiring diagram.

End of test

07.3-200 Removal and installation of mixture control unit

Job No. of work unit or standard texts and flat rates data 07-1668



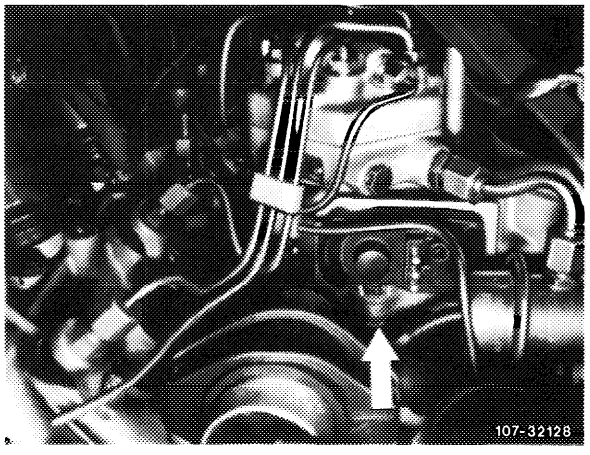
Mixture control unit (25) ..... Remove and install together with air guide housing (14) (07.3-225)

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.

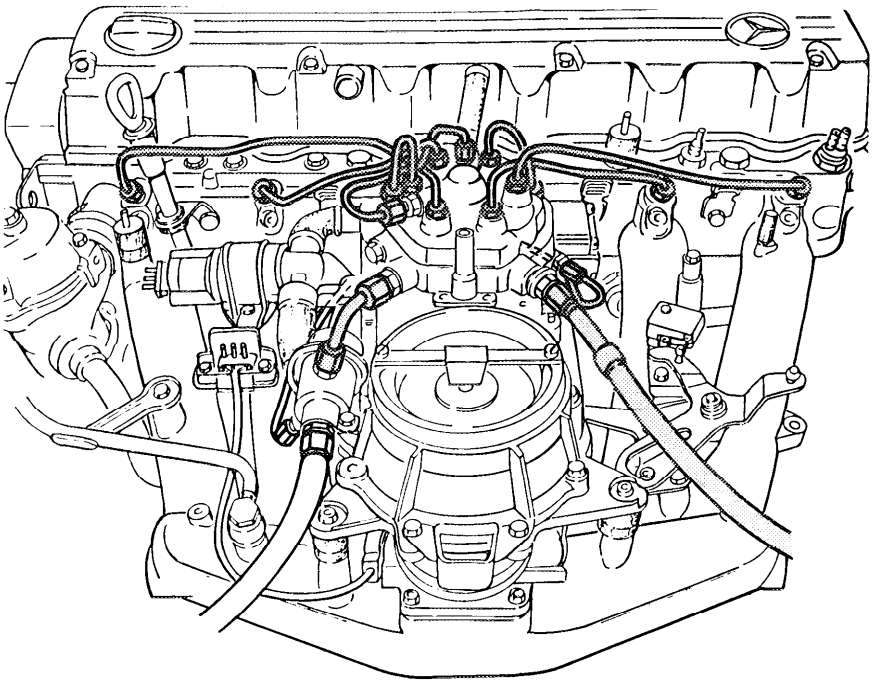
Note

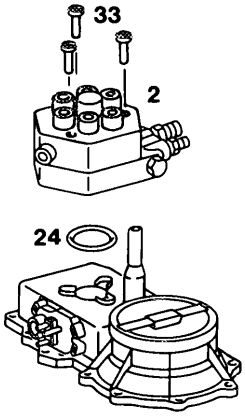
Screws of different length are used for fastening air guide housing to air volume meter (air flow sensor). For this reason, make sure that the removed screw below sensor, air volume meter (arrow) is again installed there. Using a longer screw will damage sensor of air volume meter.



07.3-205 Replacing fuel distributor

Job No. of work unit or standard texts and flat rates data 07-1674



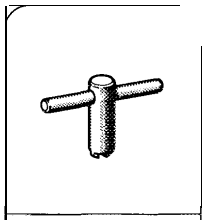


Fuel and injection lines.	Screw off and on, 10-l 5 Nm (reference value)
Fastening screws (33)	Screw off and on
Fuel distributor (2)	Remove by turning to and fro
Rubber sealing ring (24)	Replace, lubricate slightly, carefully mount fuel distributor
Test coordination of control piston in relation to air 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.

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

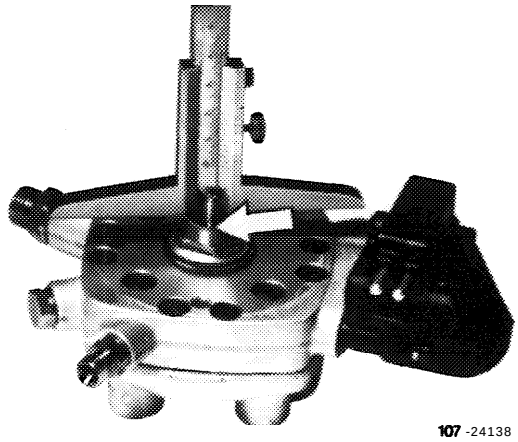


102 589 00 07 00

Replacing

1 Unscrew fuel distributor (07.3–205).

2 Measure position of closing plug with depth gauge (arrow) and mark position with scriber.



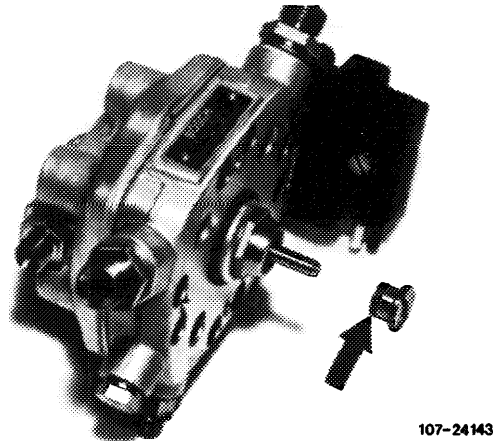
107-24138

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.

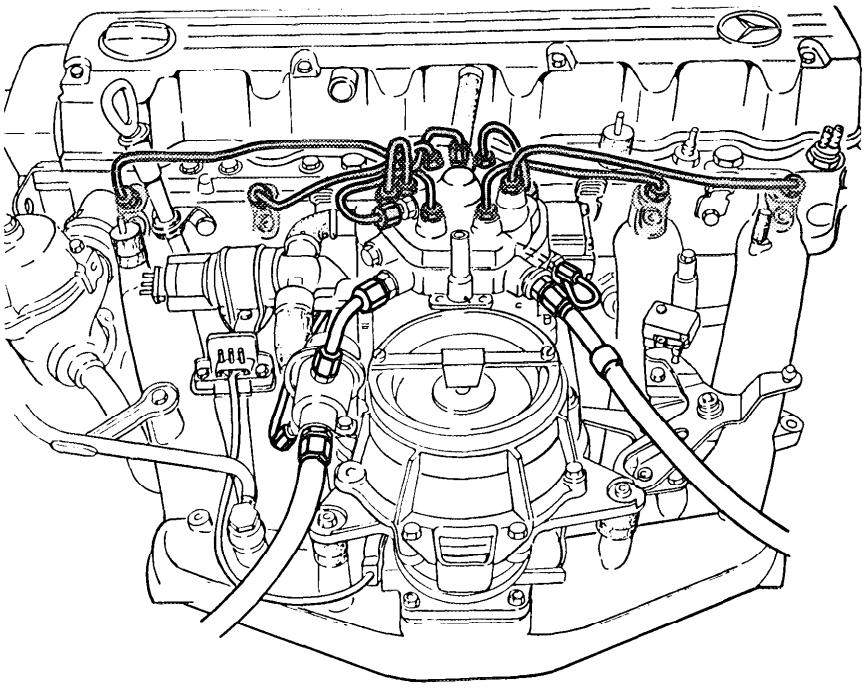
If not, basic adjustment of control piston will be wrong.

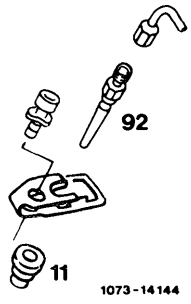


107-24143

07.3-215 Removal and installation of injection valves

Job No. of work unit or standard texts and flat rates data 07-6520

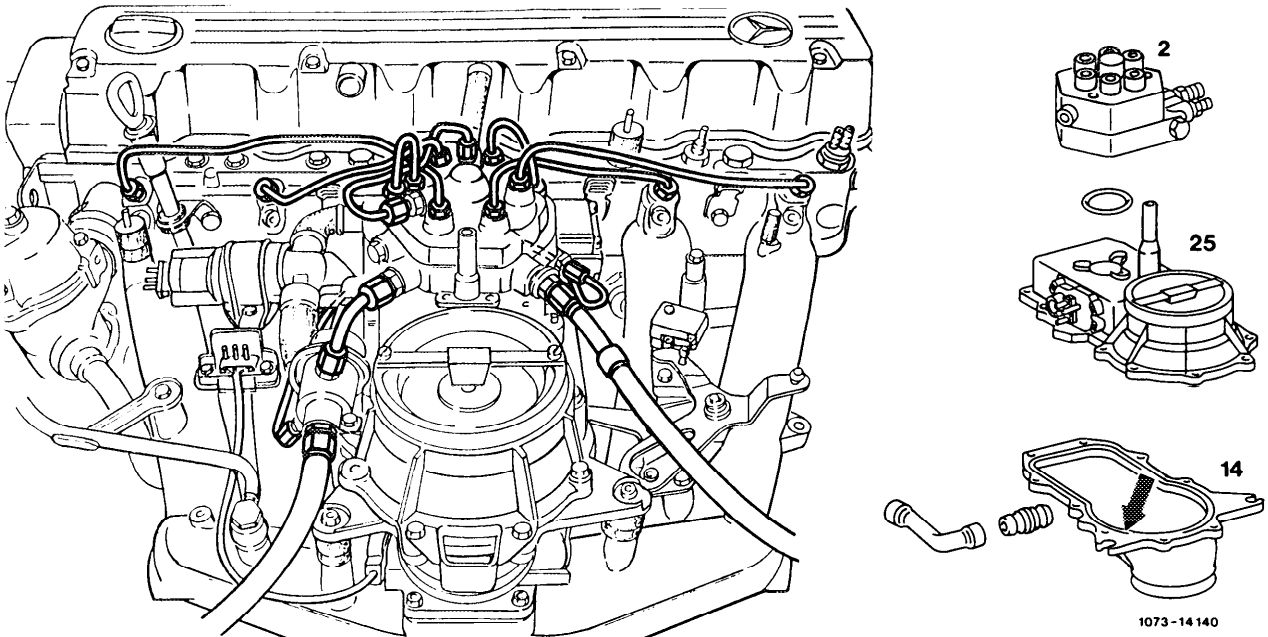




Injection lines	Remove and install, apply counterhold to injection valves. 1 O-l 5 Nm (reference value)
Holder.	Unscrew
Injection valves (92)	Pull out
Rubber sealing ring (11)	Replace

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).

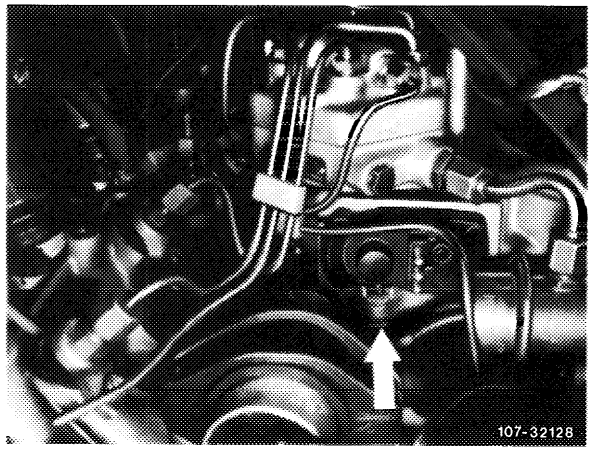
The air guide housing is made of rubber. It is fastened to light-alloy frame by means of buttons.

Fuel distributor (2) . . . . . Remove and install (07.3–205)

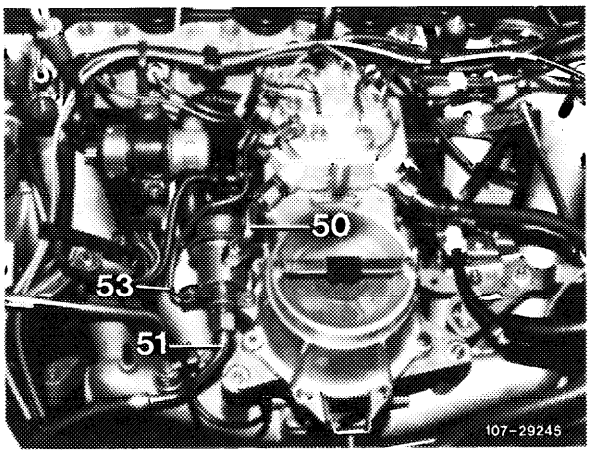
Note

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.

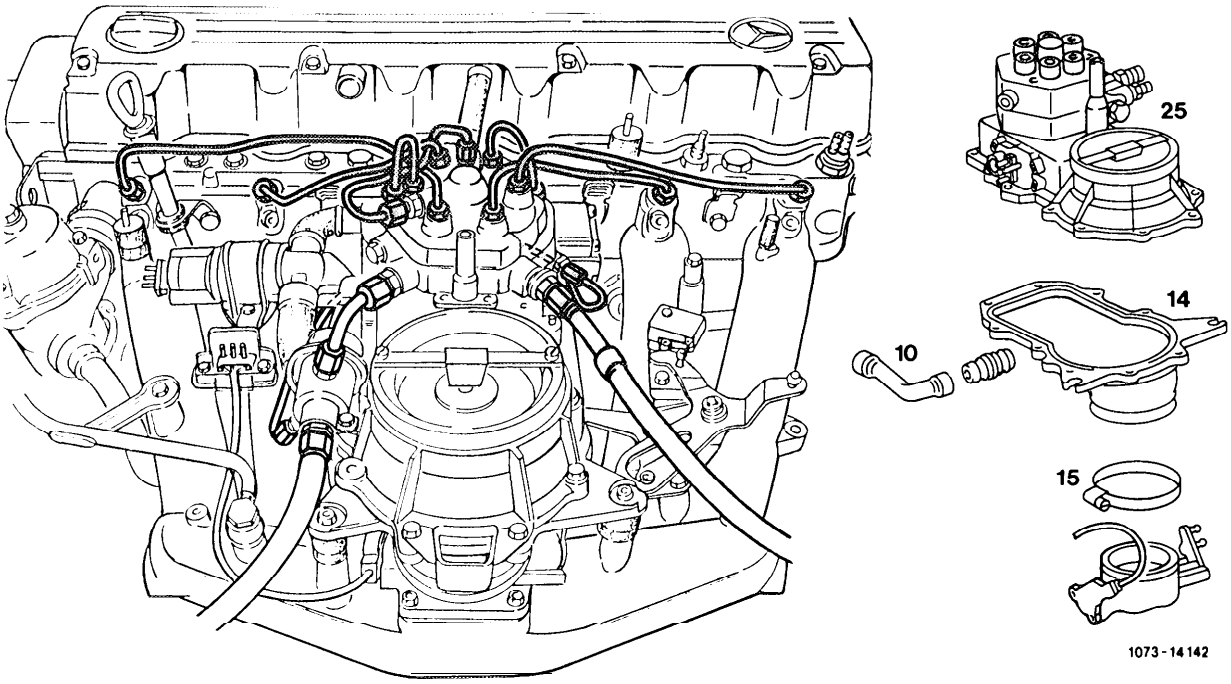


When loosening fuel line (50), fuel distributor to diaphragm pressure regulator make sure that the open-end wrench is not pressing against sensor for air volume meter and will damage the latter.



07.3-225 Removal and installation of mixture control unit with air guide housing

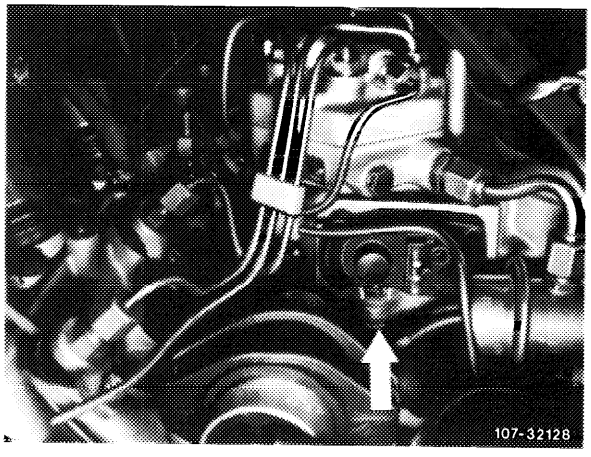
Job No. of work unit or standard texts and flat rates data 07-1668



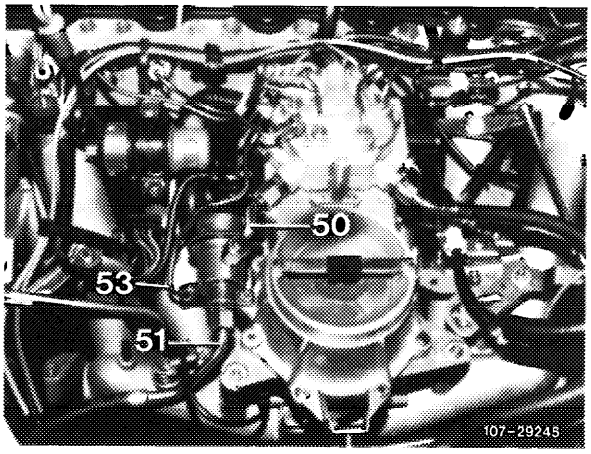
Fuel and injection lines.	Screw **off and** on. 10—15 Nm (reference value)
Electric lines	Disconnect and connect
Diaphragm pressure regulator	Screw off and on
Fastening nuts on rubber buffer	Screw off and on, 9-10 Nm (reference value)
Hose clamp (15)	Loosen, tighten
Mixture control unit (25)	Lift with 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.

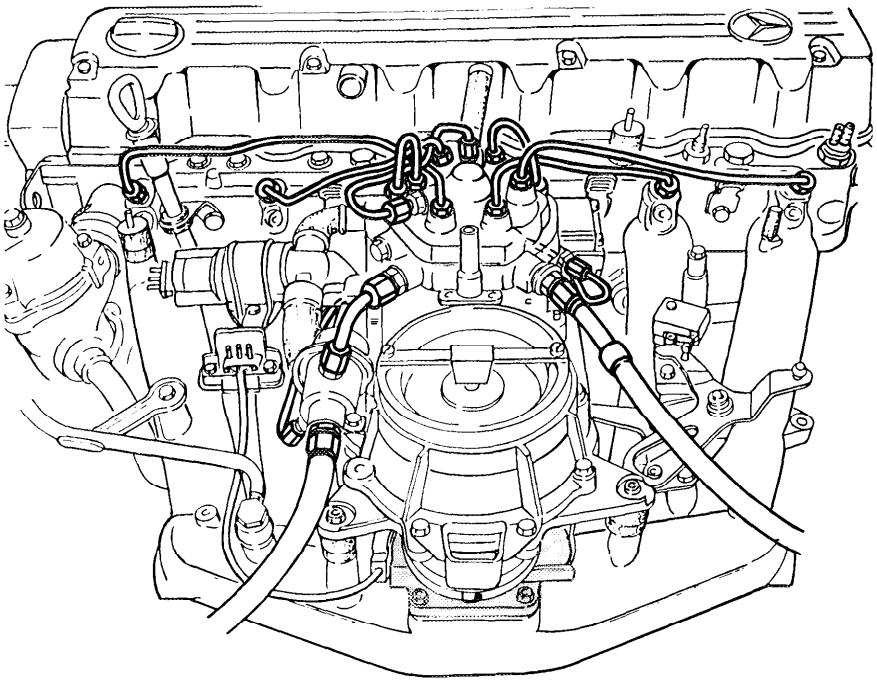


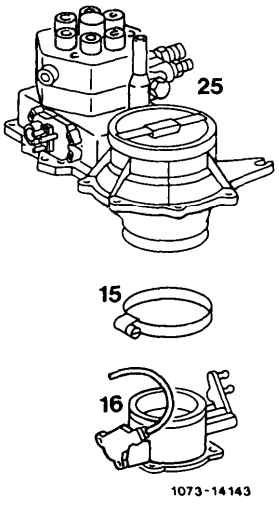
When loosening fuel line (50), fuel distributor to diaphragm pressure regulator make sure that the open-end wrench is not pressing against sensor for air volume meter and will damage the latter.



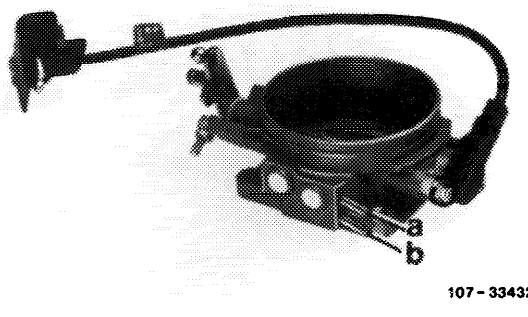
07.3430 Removal and installation of thrdttle valve housing

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-I 00)

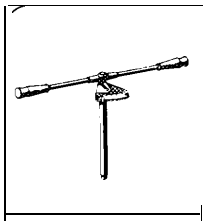


a To thermovalve
b Connection suction line to purge valve for fuel evaporation control system

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



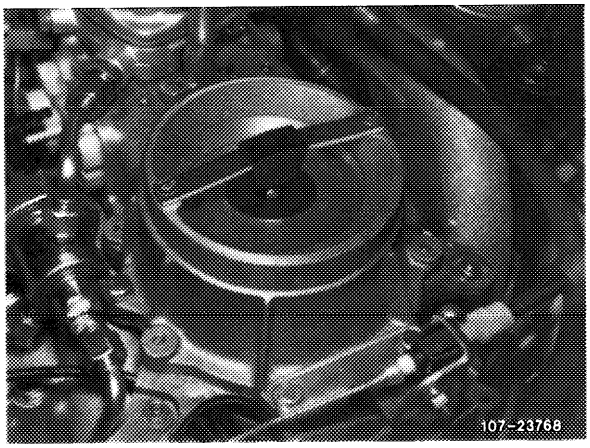
0005696721 00

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.

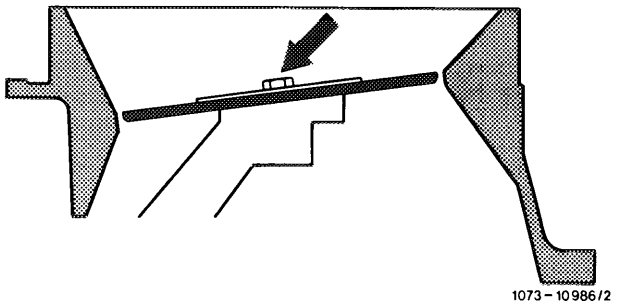
3 Heat fastening screw for air flow sensor plate with a hot air blower and carefully unscrew (avoid breaking off screw).

Attention!
The fastening screw is micro-encapsulated.

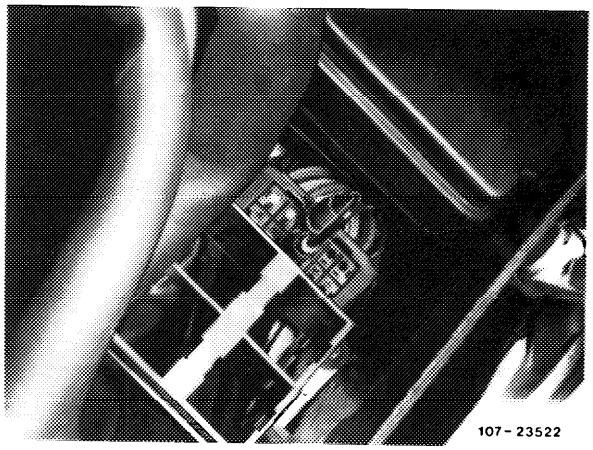
4 Clean bore for fastening air flow sensor plate with tap M 6.

Installation

5 Install parts of repair set. Insert air flow sensor plate and washer. Slightly attach micro-encapsulated fastening screws (arrow, self-locking).

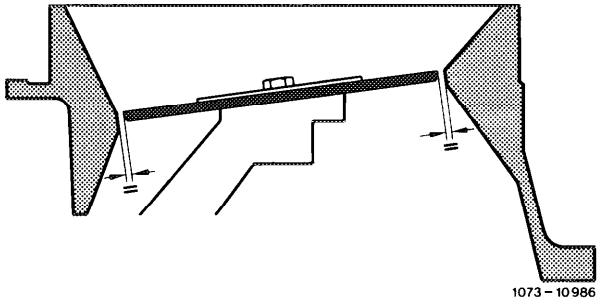


6 Center air flow sensor pla te. For this purpose, pull off fuel pump relay and bridge the two jacks 7 and 8 for a short period so that pressure will be established.



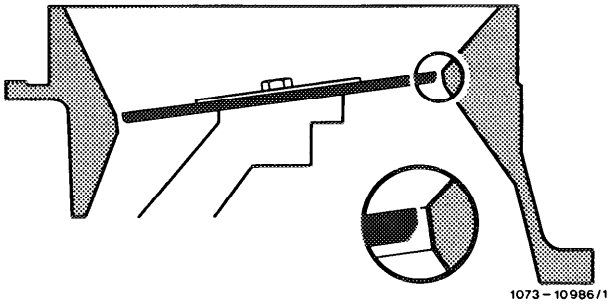
Use a slip gauge of approx. 0.05 mm to make sure that the air flow sensor plate is accurately centered. The air flow sensor plate should not bind even under slight, lateral pressure (bearing play cancelled).

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.

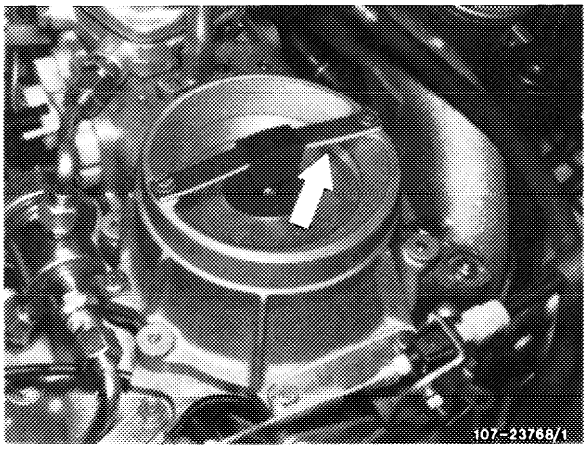
9 Test zero position (rest position) of air flow sensor plate. Upper edge of air flow sensor plate should be flush with upper edge of cylindrical part on air funnel.



The measuring point is directly underneath spring bracket (arrow).

A higher location up to max. 0.2 mm is permitted.

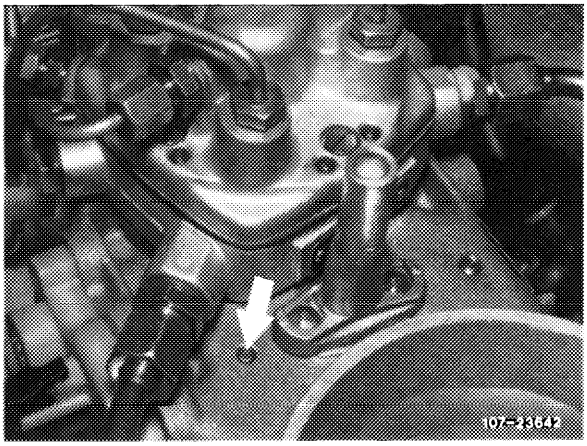
In this position, the clearance should be l-2 mm up to control piston when the air flow sensor plate is pushed.



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.

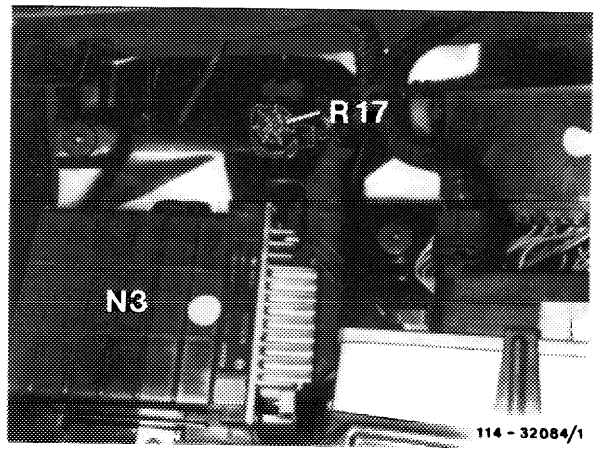
11 Mount fuel pump relay.

12 Adjust idling speed (07.3-100).

Job No. of work unit or standard texts and flat rates data 07-1698

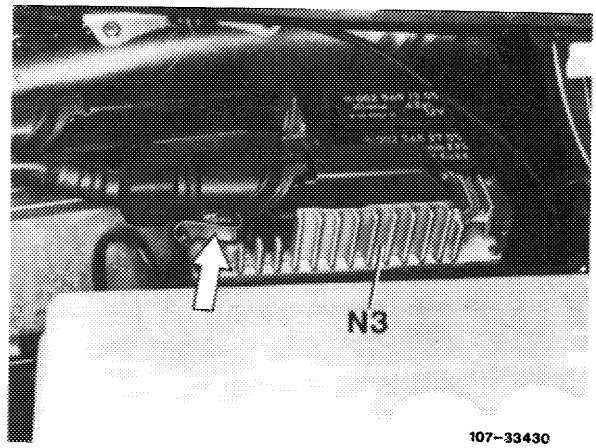
Layout CIS-E control unit (N3)

Model 107
At front right under leg support.

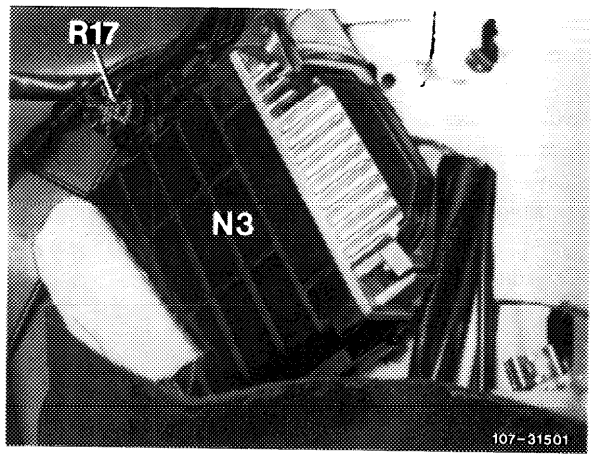


N3 Control unit
R 17 Adjustment plug CIS-E

Model 124
In unit compartment, right.

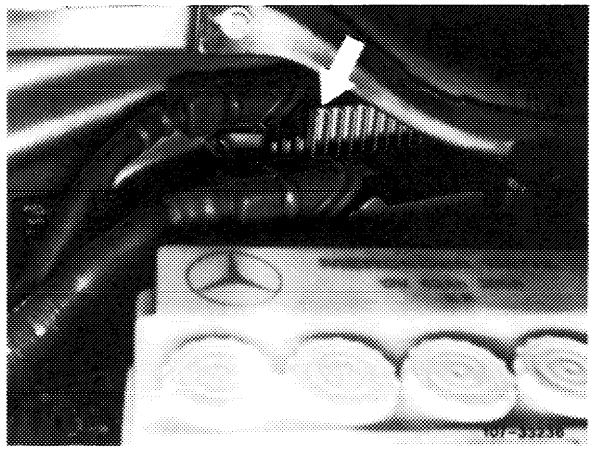


Model 126
In legroom, right, behind side panelling.



N3 Control unit
R 17 Adjustment plug CIS-E

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.

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)

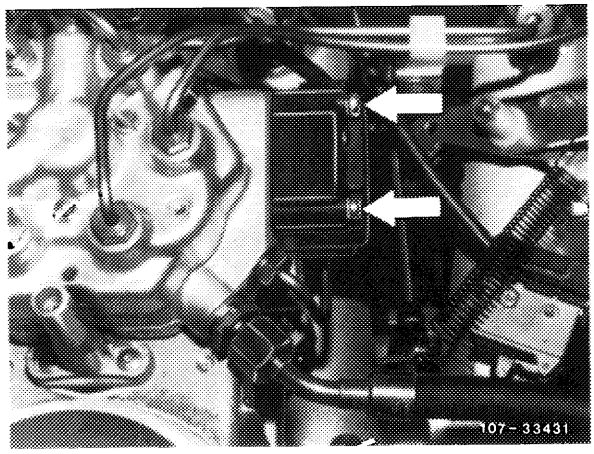
Fastening screws	3.0 + 0.5 Nm

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).



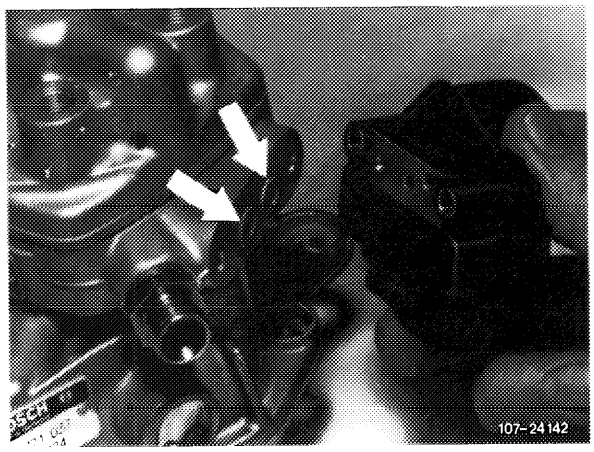
4 For installation, use 2 new O-rings (arrows) in reverse sequence.

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.

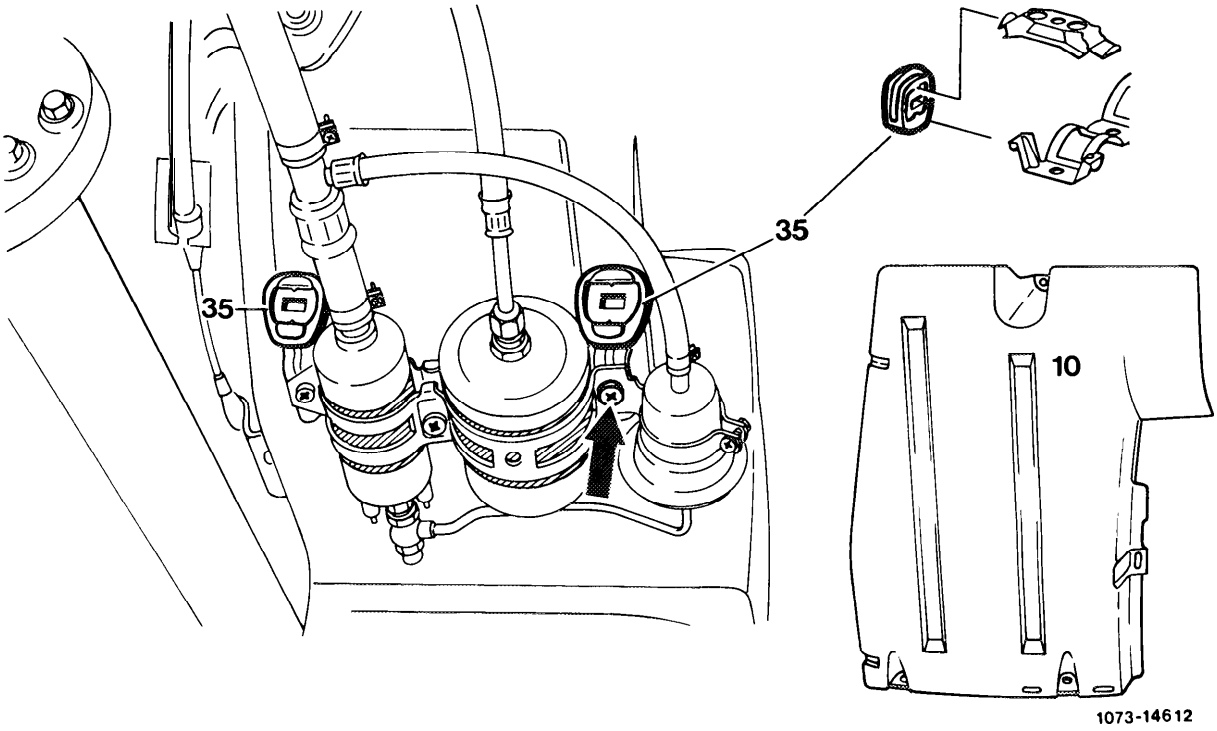
7 Check for leaks.



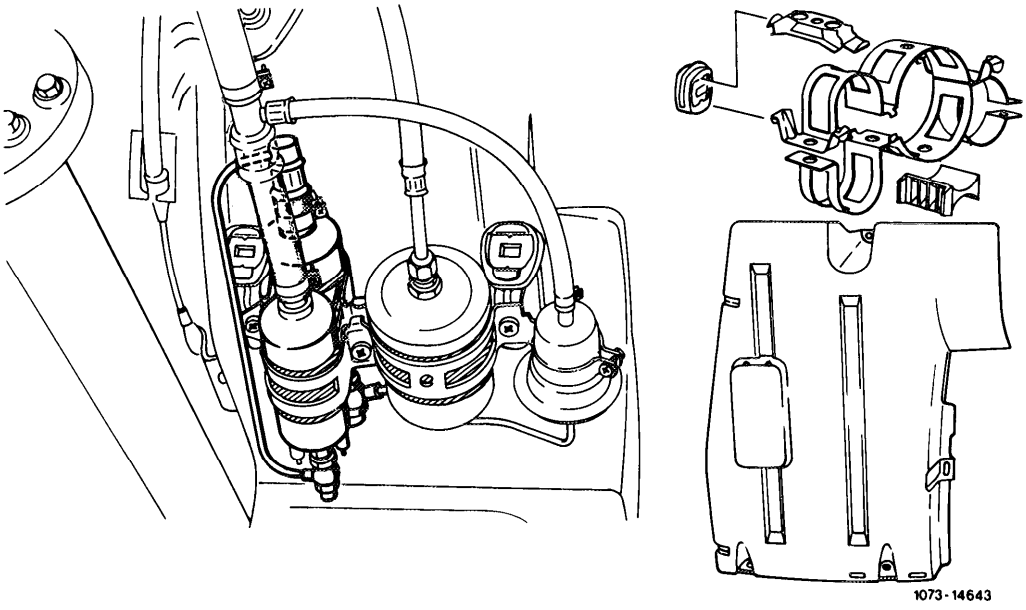
07.34268 Replacing rubber rings or rubber buffers for fuel pump package

Job No. of work unit or standard texts and flat rates data 07–5860/5862

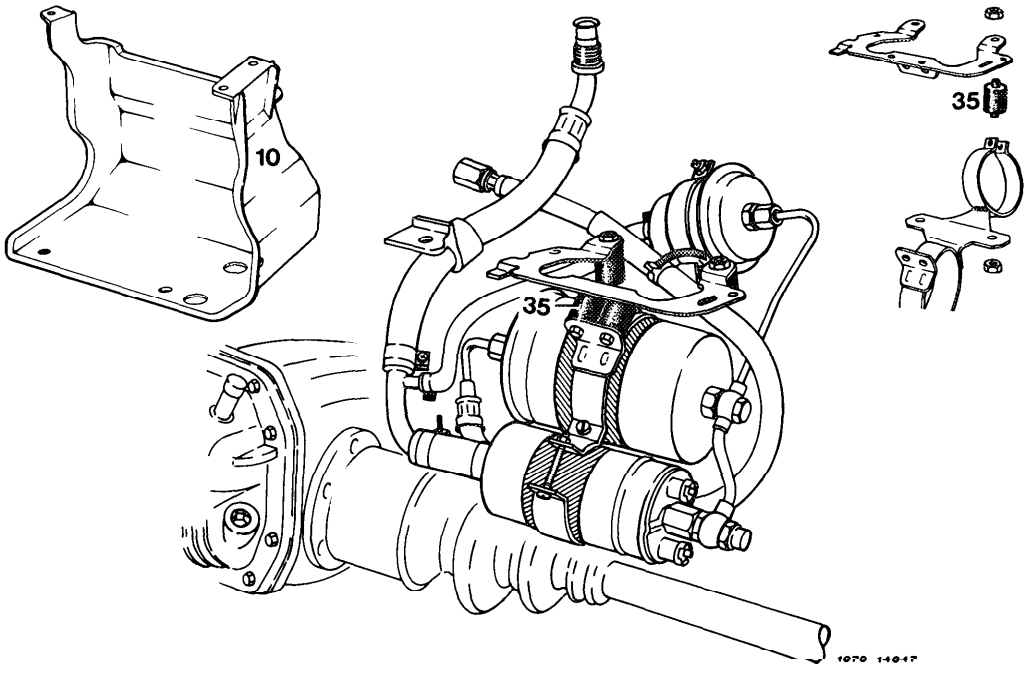
Model 124
Fuel pump package with 1 fuel pump



Model 124
Fuel pump package with 2 fuel pumps

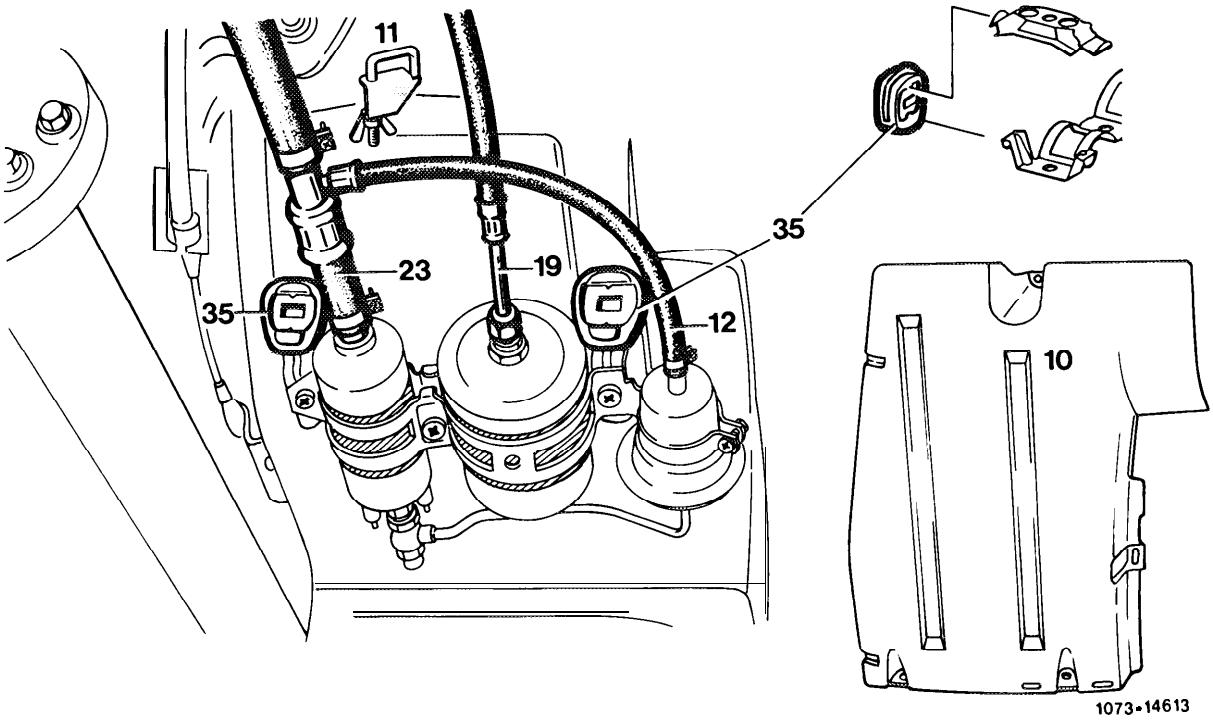


Model 107,126

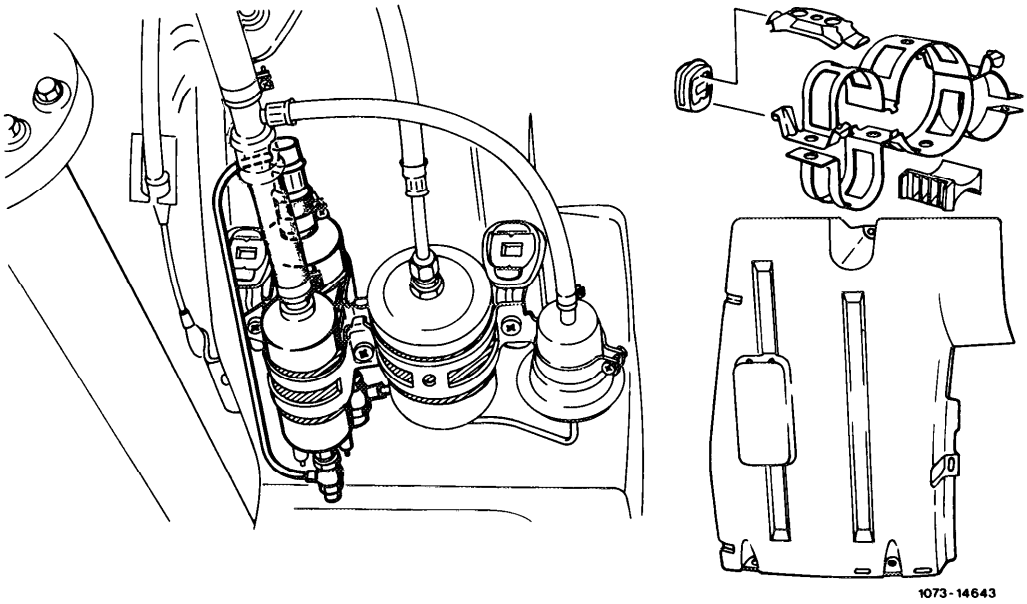


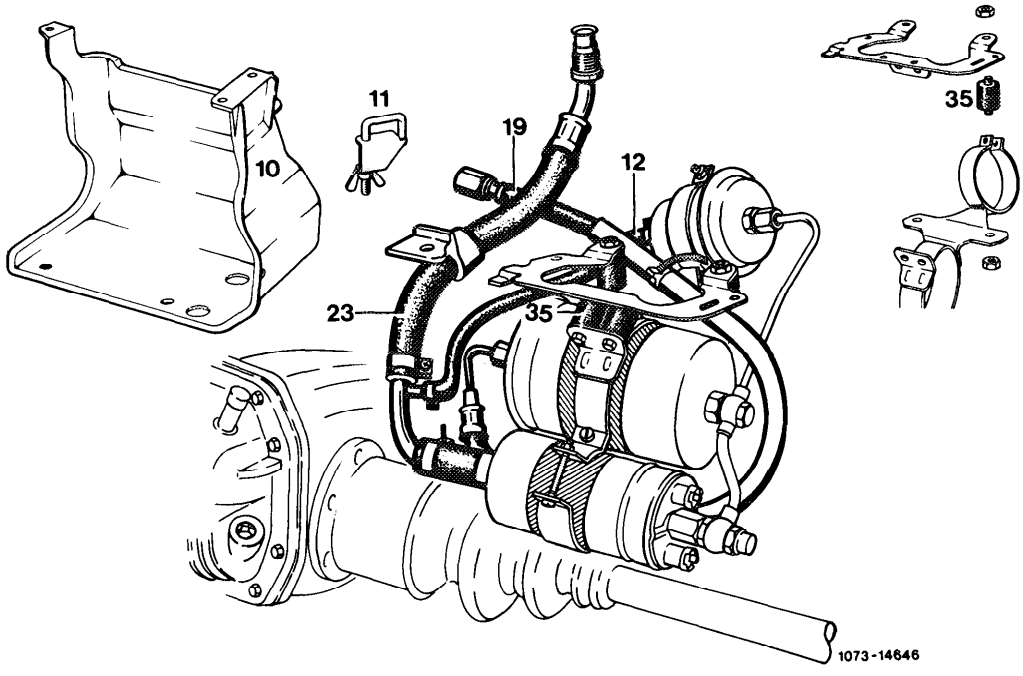
Protective box.	Screw off and on
Rubber rings or rubber buffer (35)	Remove and install, while paying attention to plastic clip for electric line (risk of breaking)
Fastening screw (arrow, model 124).....	Loosen for holder, fuel accumulator, pull slightly forward so that rubber strap will come out

Model 124
Fuel pump package with 1 fuel pump



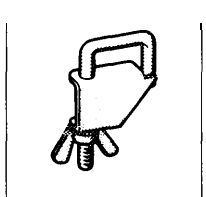
Model 124
Fuel pump package with 2 fuel pumps





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

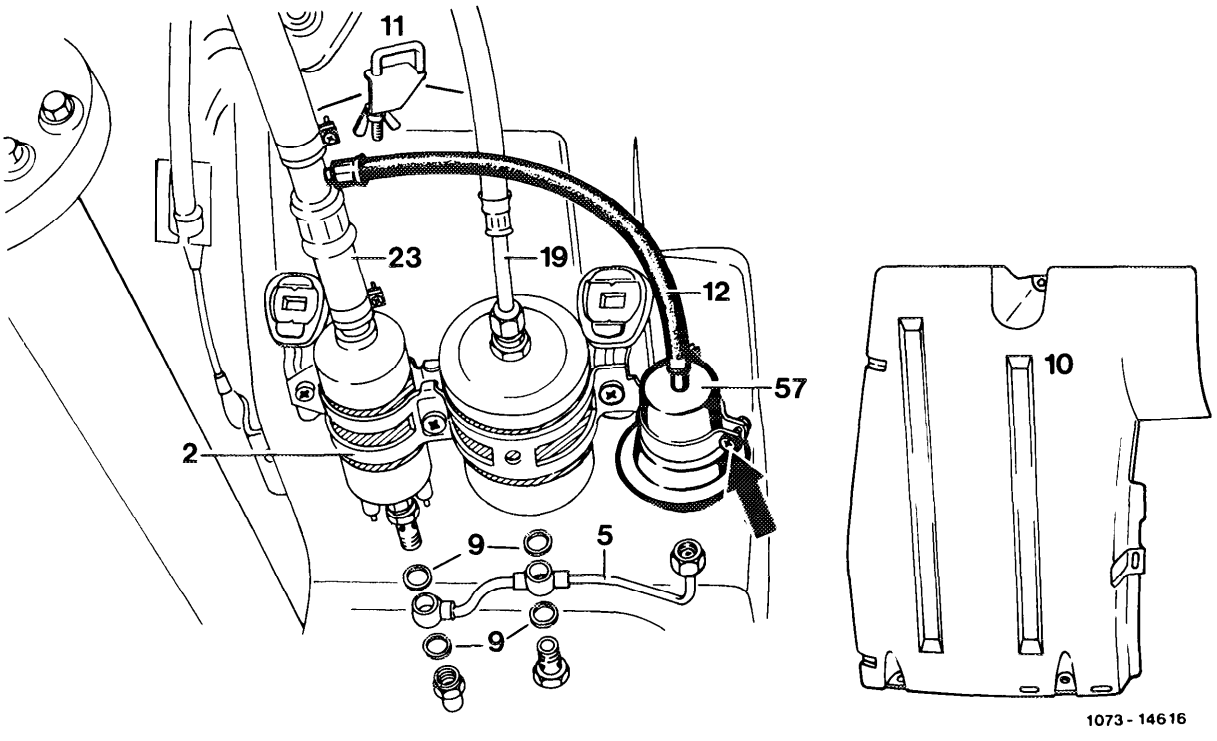


000 589 40 37 00

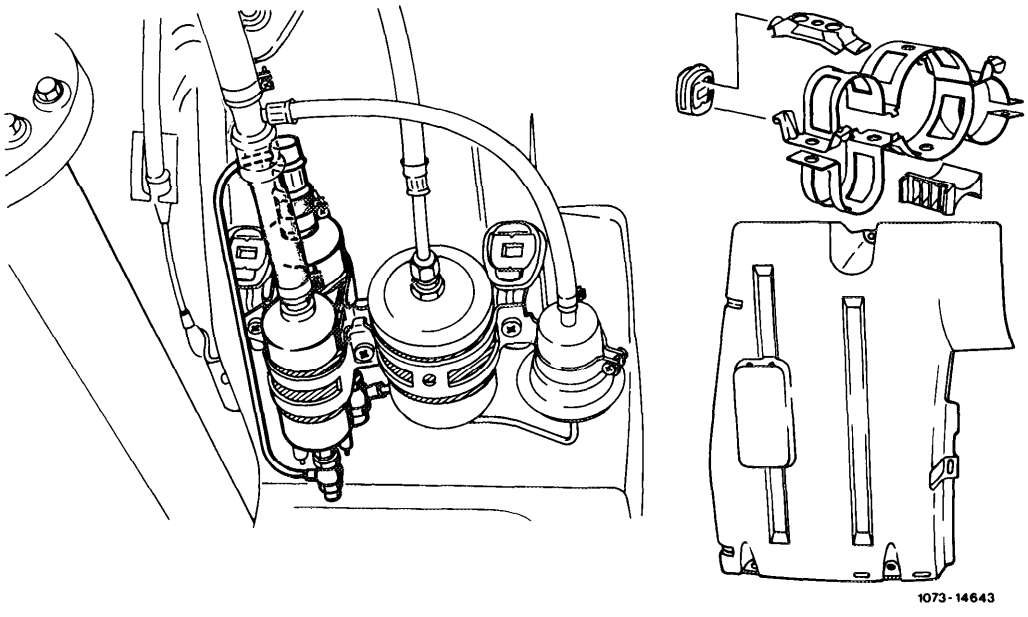
07.3–270 Removal and installation of fuel accumulator

Job No. of work unit or standard texts and flat rates data 07-1683

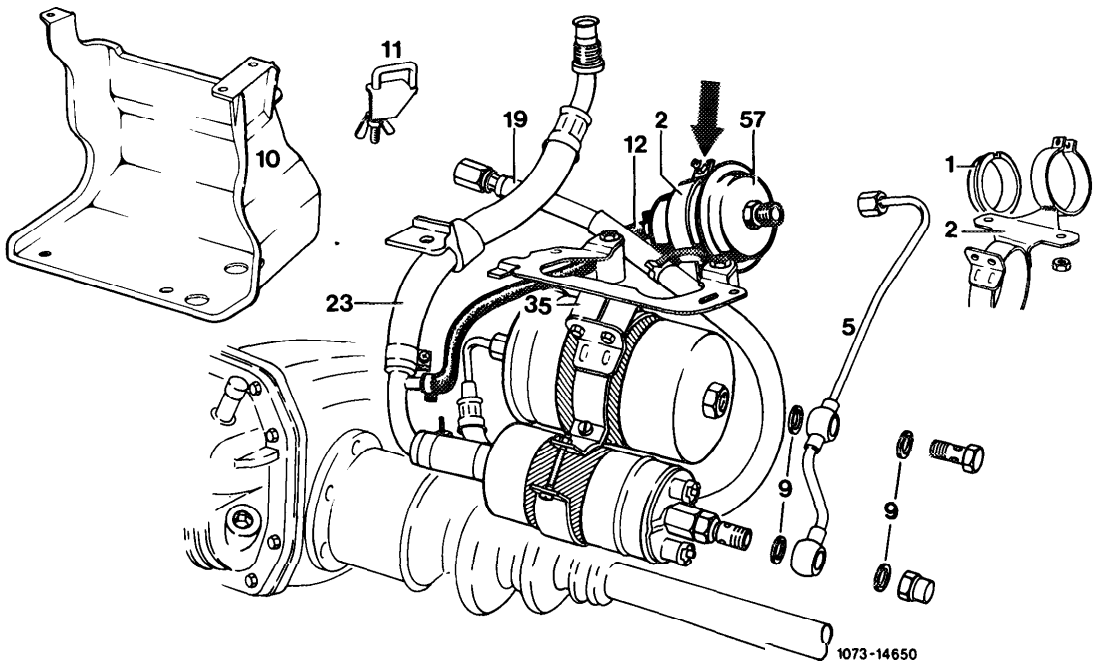
Model 124
Fuel pump package with 1 fuel pump



Model 124
Fuel pump package with 2 fuel pumps

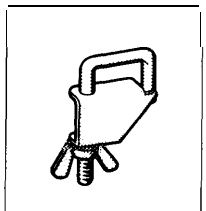


Model 107, 126



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



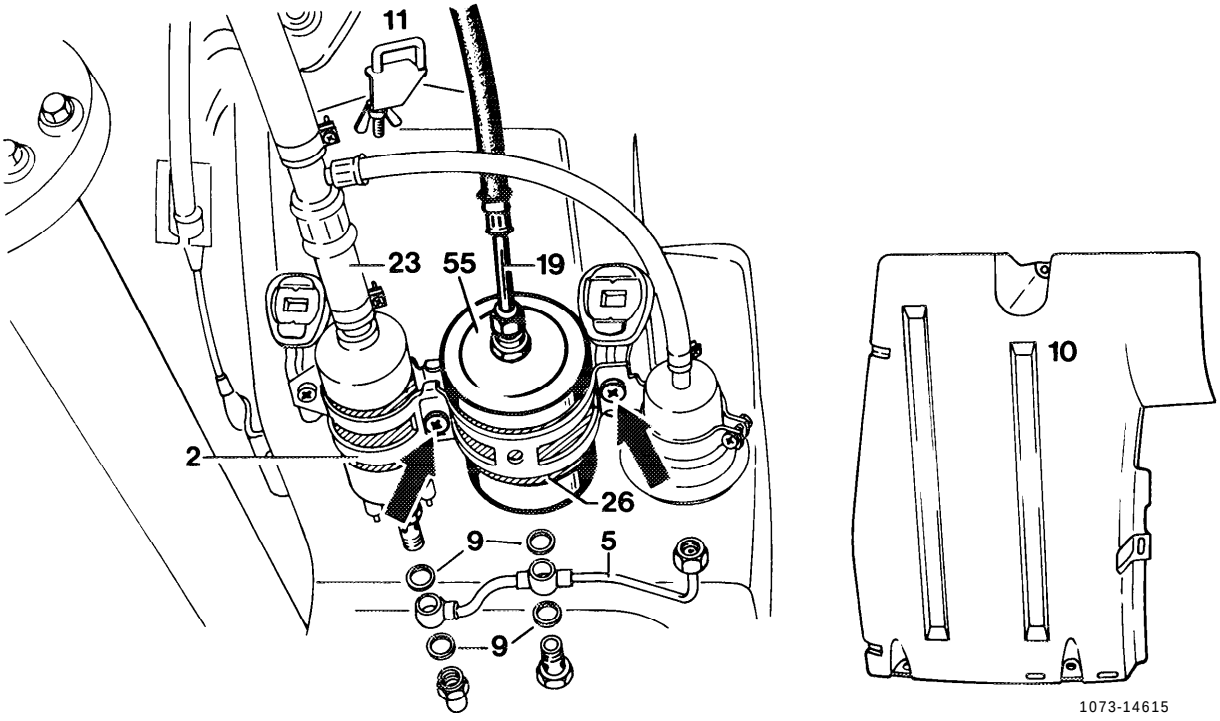
000 589 40 37 00

07.3-275 Removal and installation of fuel filter

Job No. of work unit or standard texts and flat rates data 07-5563

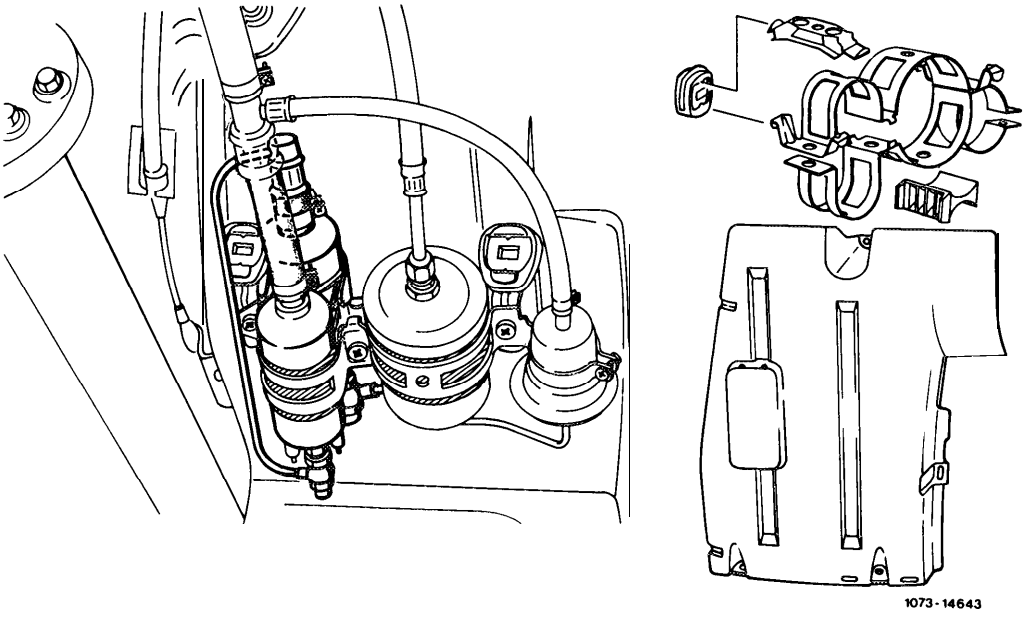
Model 124

Fuel pump package with 1 fuel pump

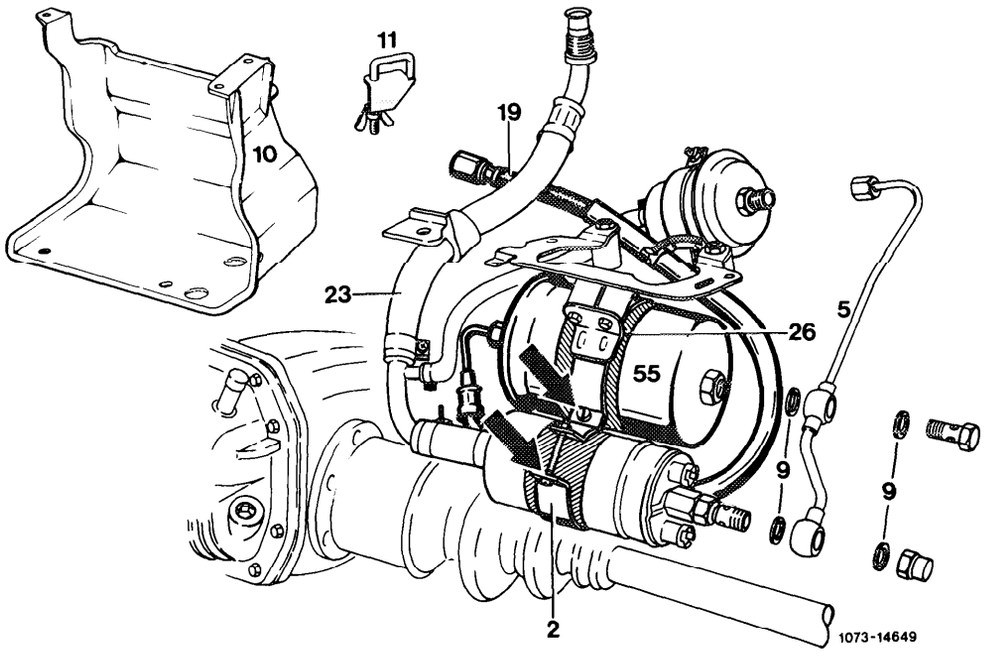


Model 124

Fuel pump package with 2 fuel pumps

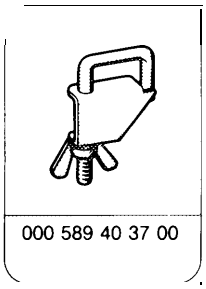


Model 107,126



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

Special tool



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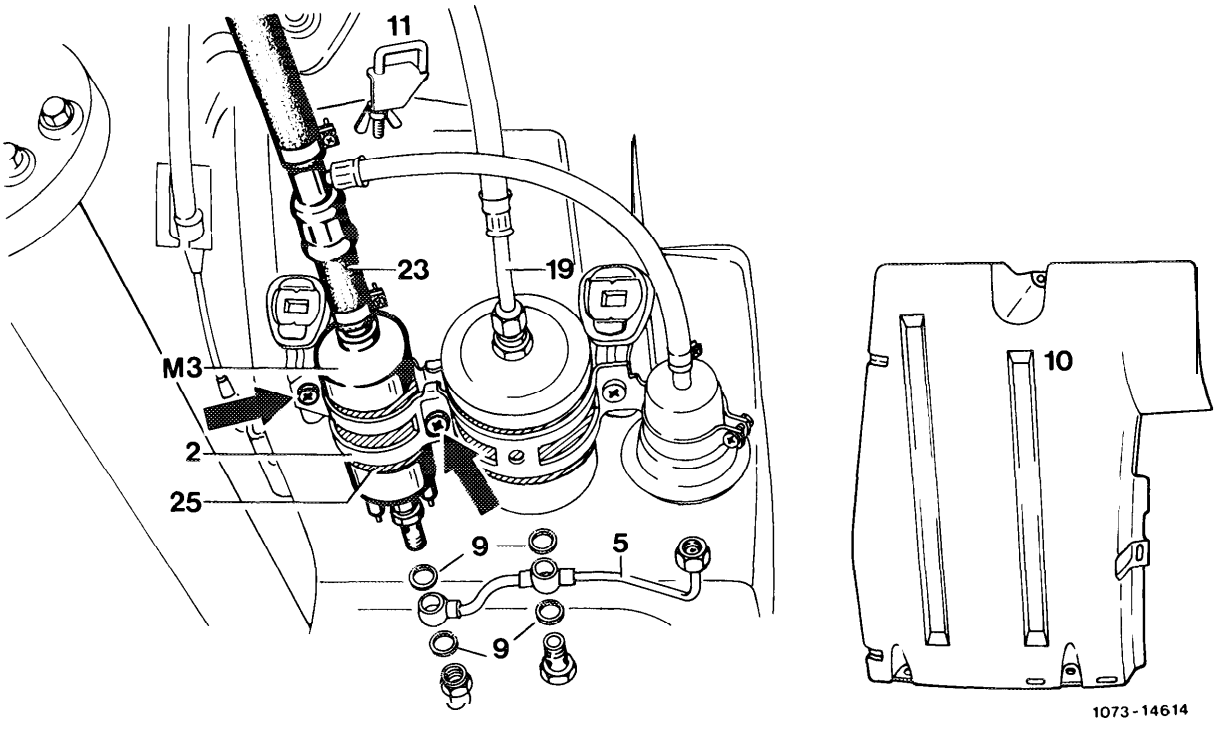
Note

To avoid contact corrosion the fuel filter is provided with a plastic jacket or a plastic sleeve.

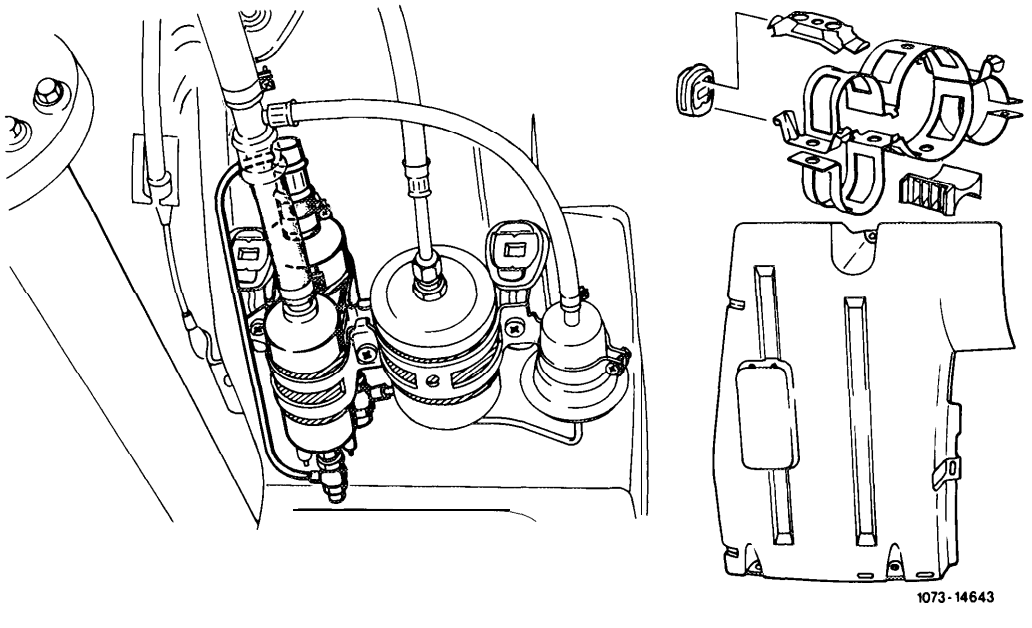
When replacing fuel filter, make sure that the plastic sleeve is mounted between fuel filter (55) and holder (2). The sleeve should project on both sides of holder, since direct contact of fuel filter with holder may lead to contact corrosion.

Job No. of work unit or standard texts and flat rates data 07-5710

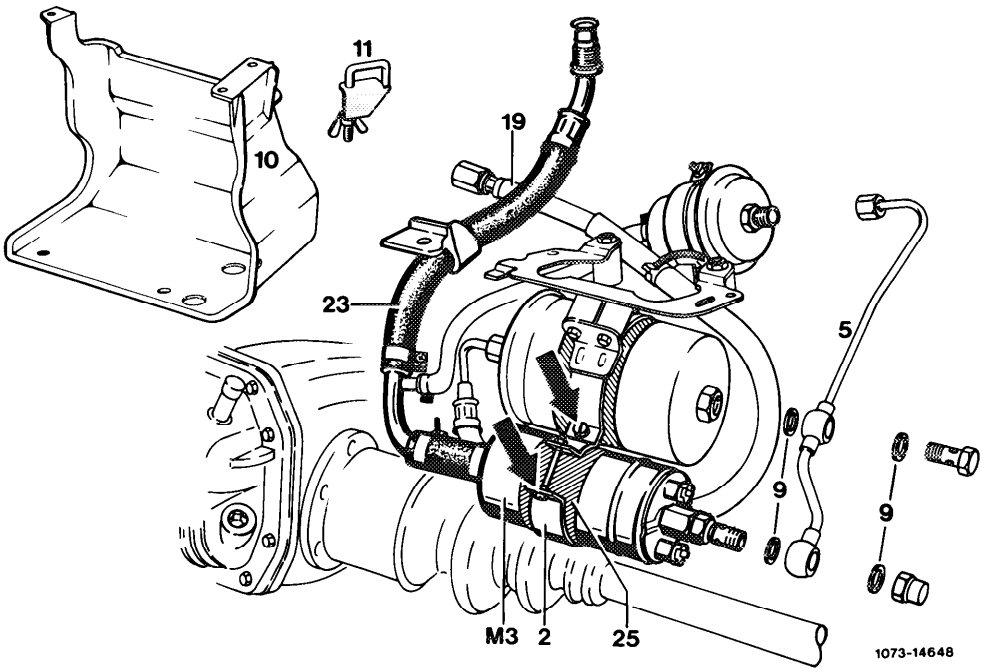
Model 124
Fuel pump package with 1 fuel pump



Model 124
Fuel pump package with 2 fuel pumps

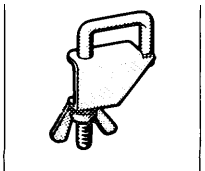


Model 107,126



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



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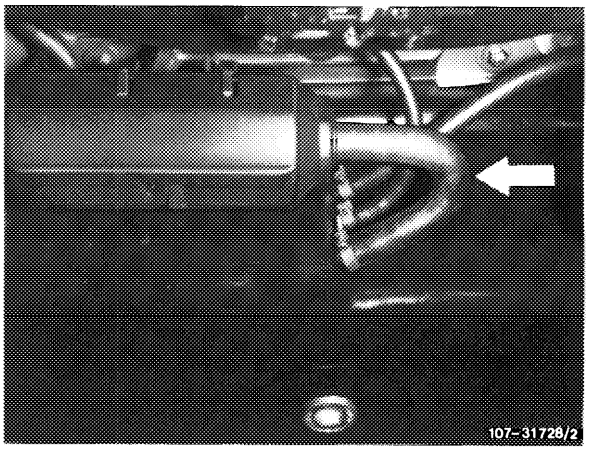
Note

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.