



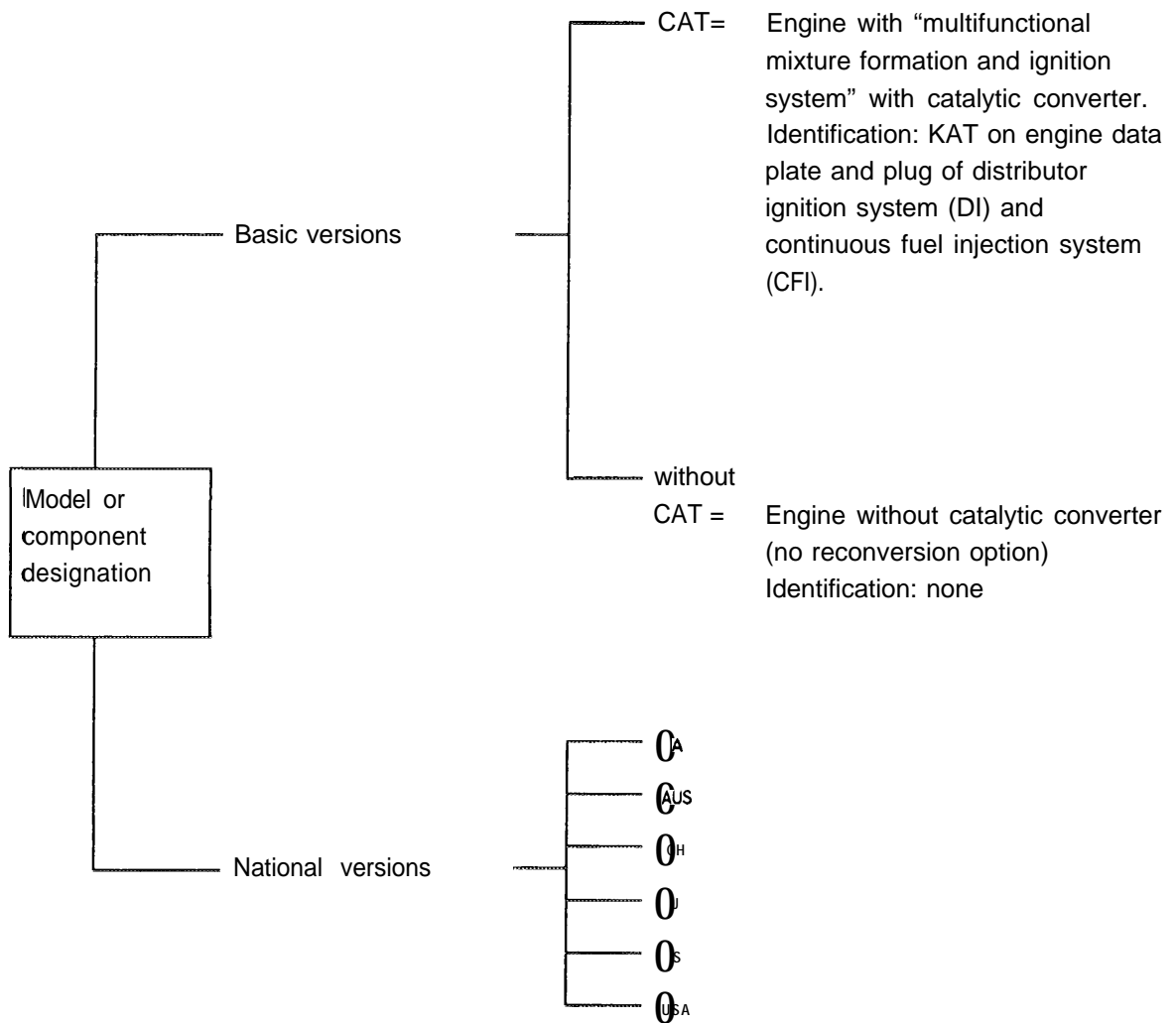
Job No.

Model designation survey	07.3 - 001
Vehicle features	07.3 - 004
Parameters of mixture adaptation	- 005
Function diagram of continuous fuel injection system (CFI)	- 013
Testing on/off ratio	- 105
Testing, adjusting engine	- 110
Testing electronic idle speed control	- 112
Determining fuel consumption by test drive	- 117
Testing fuel pressure and internal leaktightness	- 120
Testing electrical components	- 121
Testing continuity of inductor in fuel distributor	- 122
Testing start device	- 124
Testing start valve actuation	- 126
Performing cold start	- 127
Wiring diagrams	- 128
Testing fuel pump	- 130
Testing fuel injectors	- 135
Testing, replacement of WOT/CTP switch	- 152
Performing fuel quantity comparison measurement	- 160
Testing fuel pump relay module	- 165
Testing kickdown switch	- 167
Removal and installation of mixture control unit	- 200
Removal and installation of fuel distributor	- 205
Replacing seal for control plunger	- 207
Removal and installation of fuel injectors	- 215
Replacement of air flow sensor	- 220
Removal and installation of mixture control unit with air guide housing	- 225
Removal and installation of throttle body	- 230
Replacement, centering air flow sensor plate and checking and adjustment of zero	- 245
Removal and installation of CFI control module	- 250
Replacement of engine coolant temperature sensor	- 251
Replacement of electrohydraulic actuator	- 255
Replacement of heated oxygen sensor	- 258
Replacement of rubber rings or pads for fuel pump set	- 268
Removal and installation of fuel pump set	- 269
Replacement of check valve for fuel pump	- 285
Survey of fuel pump sets	- 290

07.3-0001 Model designation survey

Model designation

The models and components with their 3- to 6-digit designation (e. g. 201 or 201.028) may have different versions, data and operations. These differences are identified by the following suffixes:




If there are no suffixes following the designation of models or components, the respective data apply to all the models or components listed in each case.

Model survey

Sales designation	Model	Model year	Engine
190 E 2.3	201.024	1984	102.961
190 E 2.3	201.028	1985- 1993	102.985

07.3-004 Vehicle features

National version

Engine	102. 961 (2.3)
Version	 1983, 1984
Model	201. 024
CFI designation	CFI (KE) II
Compression ratio ϵ	8
Ignition system	TSZ
Distributor ignition system resistance trimming plug	-
CFI system resistance trimming plug	-
Coolant temperature sensor	one-pin connection for CFI control module
Starting valve control	via thermo-time switch up to +5 °C
Idle speed device	Electronic idle speed control

Continuation

Engine	102.961 (2.3)
Version	(USA) 1983, 1984
Model	201.024
CFI designation	CFI (KE) II
Idle speed air valve	3-pin connection
Fault detection	
Further features	Fuel pump relay in front of electrical centre. Multi-belt drive. AC compressor cut-in signal from pressure switch. Altitude correction sensor

Engine	102.985	102.985
Version	USA up to 1986	USA 1987
Model	201.024	201.028
CFI designation	CFI (KE) II	CFI (KE) III
Compression ratio ϵ	8	9
Ignition system	TSZ	Distributor (DI - formerly EZL)
Distributor ignition system resistance trimming plug	-	750 Ω reference resistor incorporated in cable set
CFI system resistance trimming plug	-	0 Ω reference resistor incorporated in cable set
Coolant temperature sensor	two one-pin connections for CFI control module/fuel pump relay	two one-pin connections for CFI control module/distributor ignition system
Starting valve control	via fuel pump relay up to + 60 °C	via fuel pump relay up to + 60 °C
Idle speed device	Electronic idle speed control	Electronic idle speed control
Idle speed air valve	3-pin connection	2-pin connection
Fault detection		as of 08/86 fault diagnosis via on/off ratio

Continuation

Engine	102. 985	102. 985
Version	Ⓢ up to 1986	Ⓢ 1987
Model	201. 024	201. 028
CFI designation	CFI (KE) II	CFI (KE) III
Further features	Altitude correction sensor. Oxygen sensor warning lamp.	Altitude correction sensor. Oxygen sensor warning lamp.

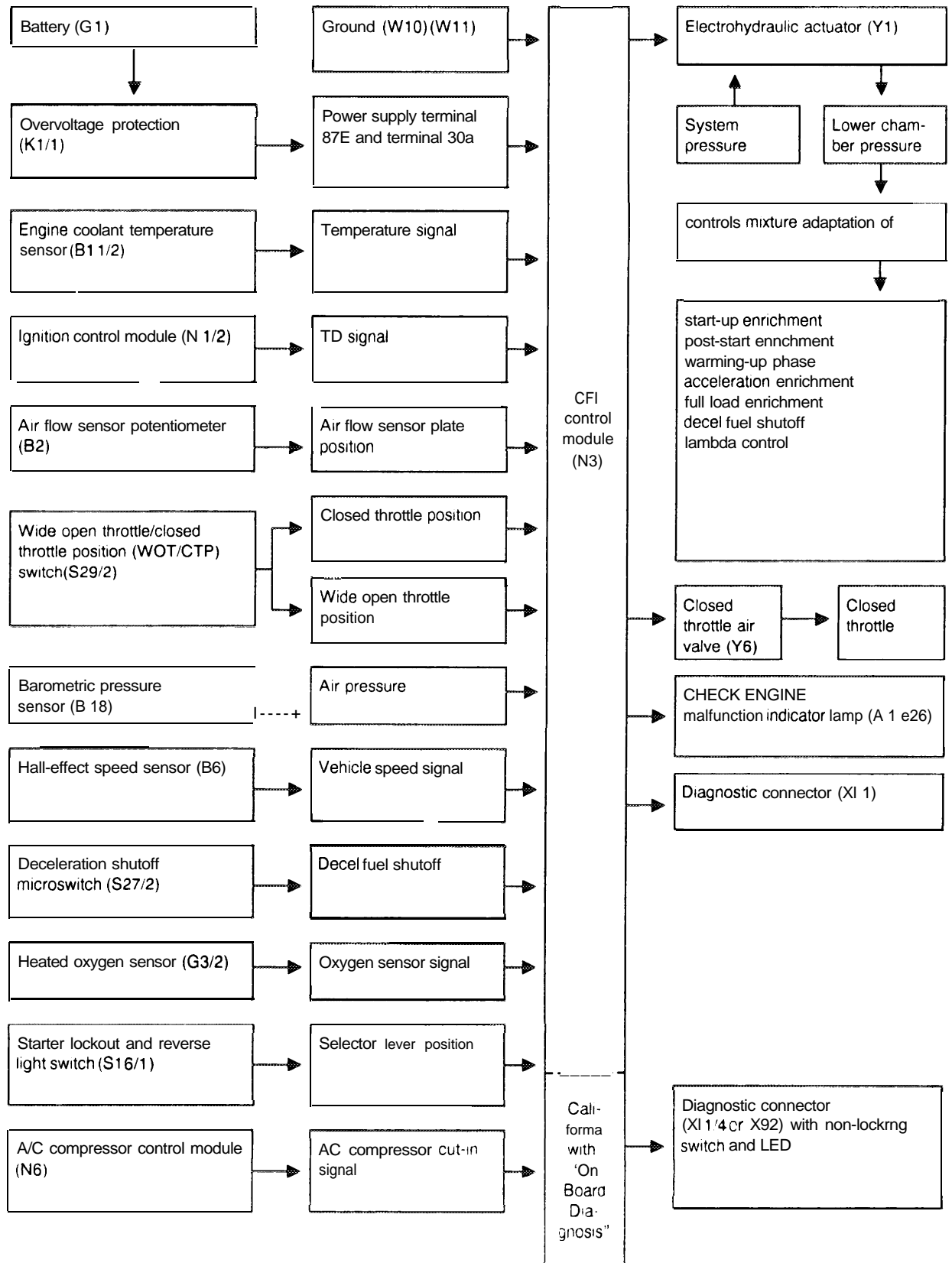
Engine	102.985	102.985	102.985
Version	USA 1988 Federal	USA 1988 California	USA 1991
Model	201.028	201.028	201.028
CFI designation	CFI (KE) III	CFI (KE) III	CFI (KE) III
Compression ratio ϵ	9	9	9
Ignition system	DI	DI	DI
Distributor ignition system resistance trimming plug	750 Ω reference resistor	750 Ω reference resistor	1.3 k Ω reference resistor (manual transmission), 2.4 k Ω reference resistor (automatic transmission) incorporated in cable set
CFI system resistance trimming plug	Fixed resistor integrated in CFI control unit	Fixed resistor integrated in KE control unit	Fixed resistor integrated in CFI control unit
Coolant temperature sensor	two one-pin connections for CFI control module/distributor ignition system	four one-pin connections, 2 for CFI control module, 2 for distributor ignition system	four one-pin connections, 2 for CFI control module, 2 for distributor ignition system
Starting valve control	via fuel pump relay up to +60 °C	via fuel pump relay up to +60 °C	via fuel pump relay up to +60 °C
Idle speed device	Electronic idle speed control with road speed signal	Electronic idle speed control with road speed signal	Electronic idle speed control with road speed signal
Idle speed air valve	2-pin connection	2-pin connection	2-pin connection

Continuation

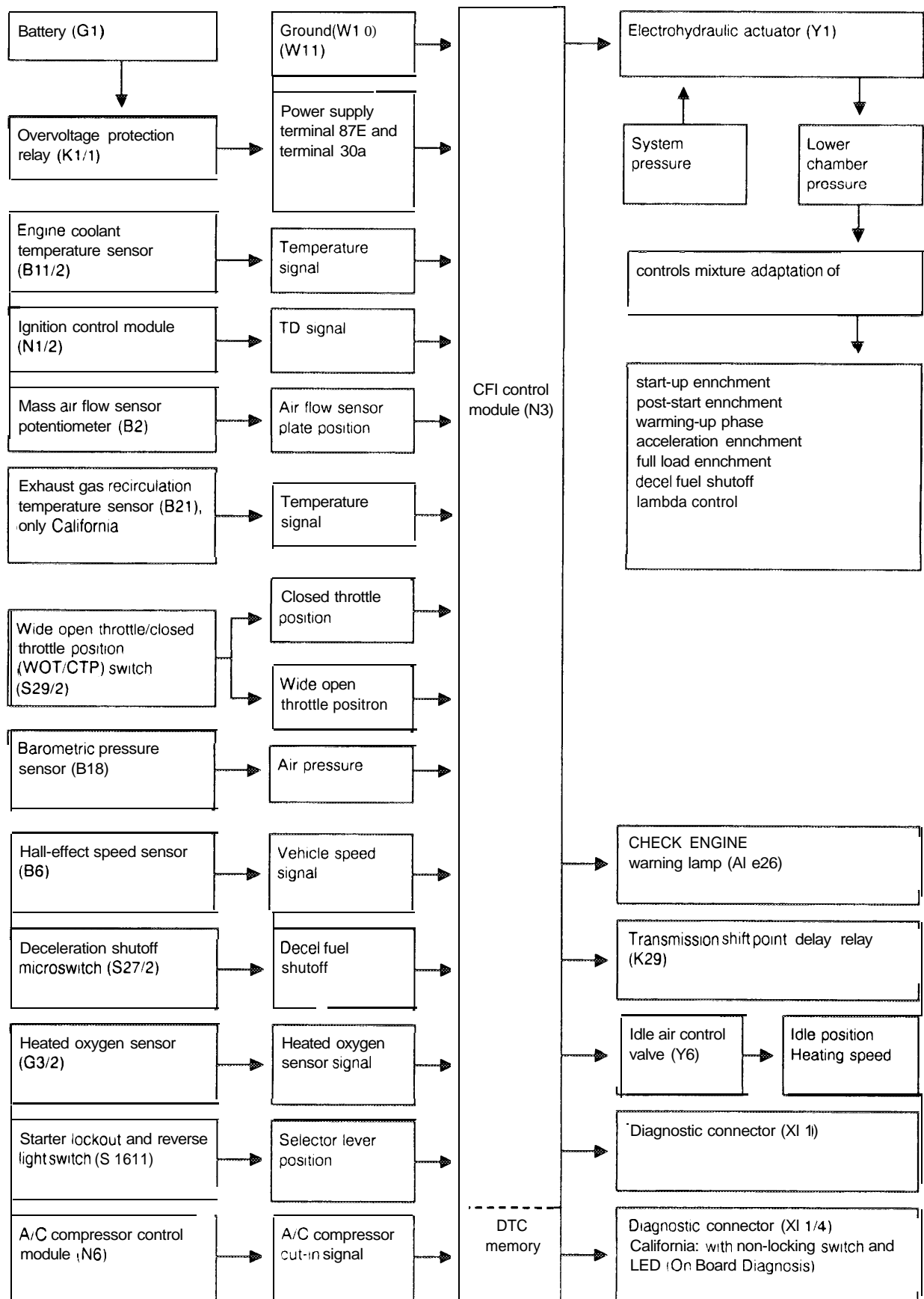
Engine	102.985i	102.985	102.985
Version	USA 1988 Federal	USA 1988 California	USA 1991
Model	201.028	201.028	201.028
CFI designation	CFI (KE) III	CFI (KE) III	CFI (KE) III
Fault detection	Fault diagnosis via on off ratio	Fault diagnosis via on/off ratio. "On Board Diagnosis" fault storage.	Fault diagnosis via on/off ratio. Fault storage.
Further features	Altitude correction sensor. CHECK ENGINE warning lamp.	Altitude correction sensor. CHECK ENGINE warning lamp. Non-locking switch with LED at test coupling.	Altitude correction sensor. CHECK ENGINE warning lamp. Oxygen sensor at exhaust manifold. Oxygen sensor heated as of + 20 °C. Transmission shift point delay (automatic transmission). Intake air temperature sensor for CFI eliminated (now DI). Decel fuel shutoff as of + 40 °C. Intake air preheating. Without pre-catalytic converters. Exhaust gas recirculation. California: exhaust gas recirculation temperature sensor (621). California: Non-locking switch with LED at test coupling ("On Board Diagnosis").

07.3-005 Parameters of mixture adaptation

A. National version (USA) 1988 Engine 102.985

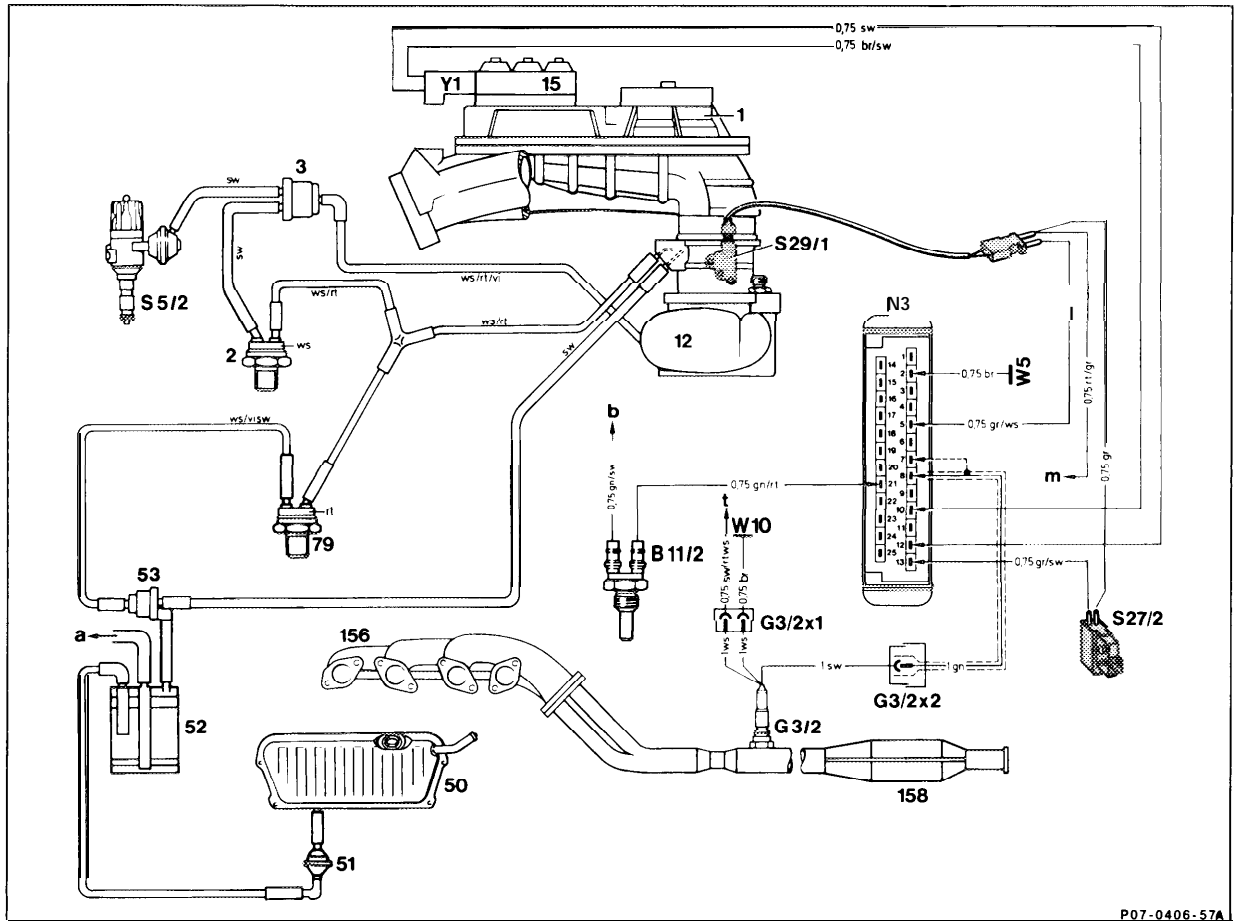


B. National version (USA) 1991 Engine 102.985

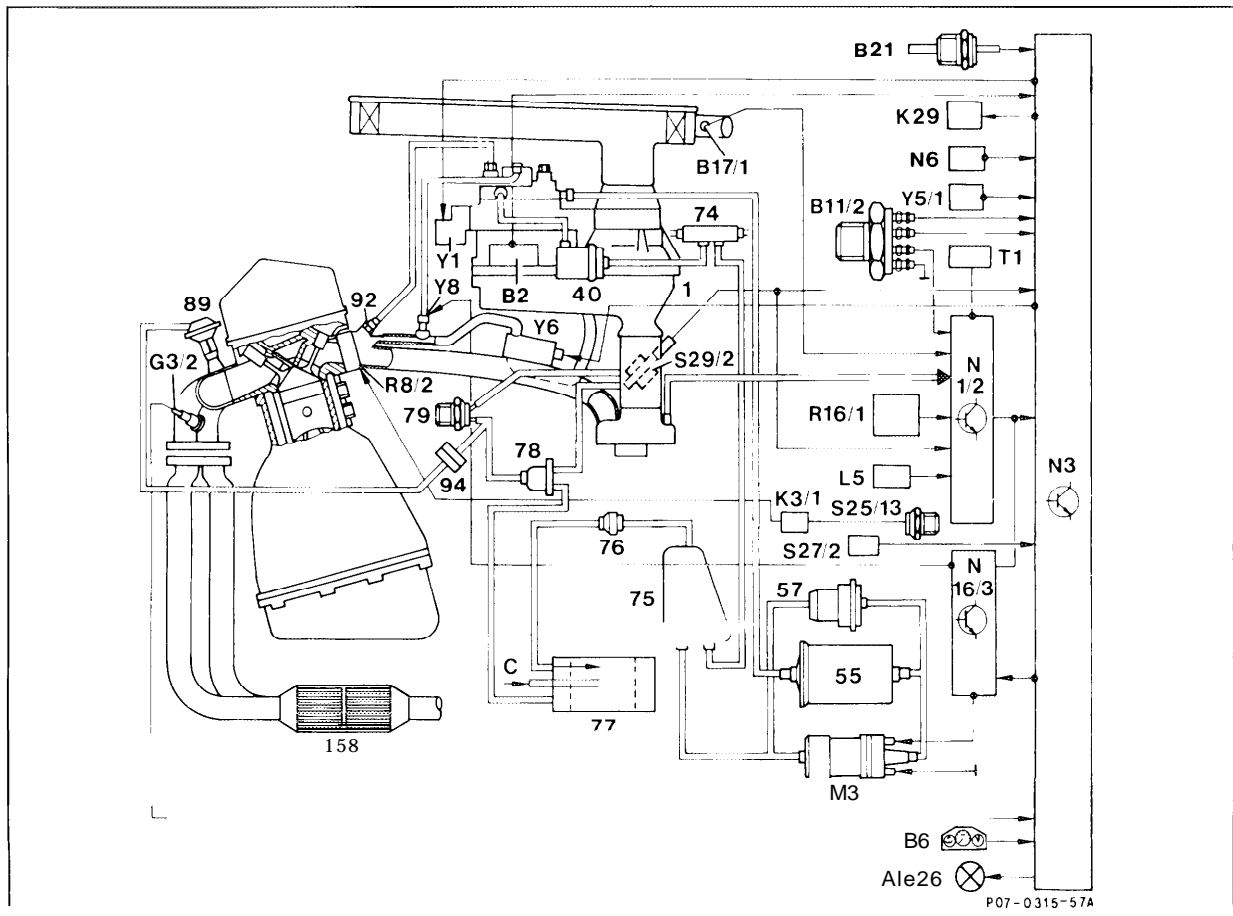


07.3-013 Function diagram of KE injection system

F. (USA) 1984 Engine 102.961 (2.3), (USA) 1985186 Engine 102.985



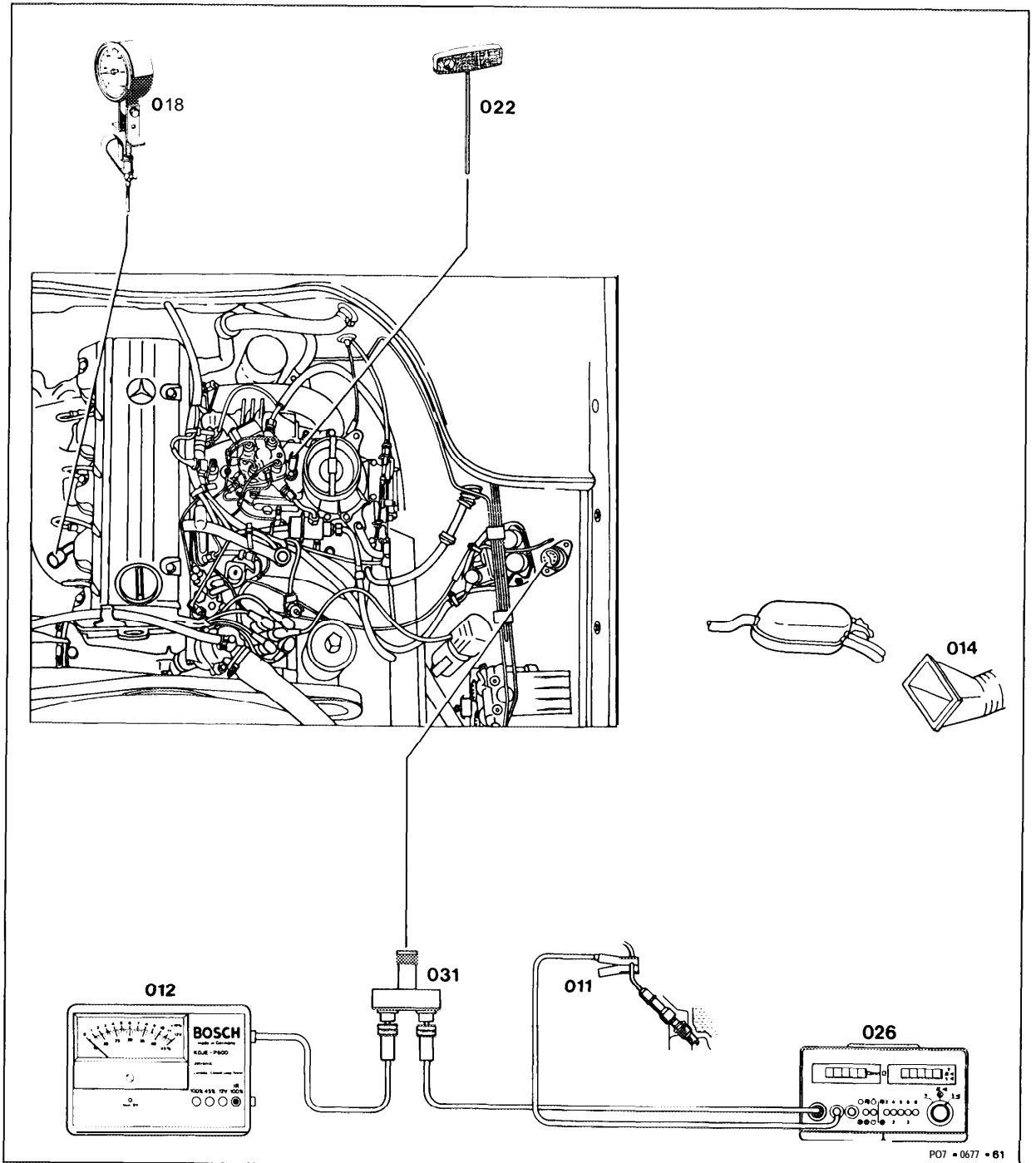
1	Mixture control unit	G3/2	Heated oxygen sensor
2	60 °C thermo valve (white)	G3/2x1	Oxygen sensor heating coil plug connection
3	Check valve with Integrated restrictor	G3/2x2	Oxygen sensor signal plug connection
12	Intake manifold	N3	CFI control module
15	Fuel distributor	S5/2	Distributor (breakerless)
33b	Underfloor catalytic converter	S27/2	Decel fuel shutoff microswitch
50	Fuel tank	S29/1	WOT/CTP switch
51	Vent valve	W5	Engine ground
52	Charcoal canister	W10	Battery ground
53	Purge valve	Y1	Electrohydraulic actuator
79	50 °C thermo valve (red)		
156	Exhaust manifold	a	Air admissions line (engine compartment)
158	Under-floor catalytic converter	b	Fuel pump relay, contact 2
B11/3	Engine coolant temperature sensor	m	Idle speed air valve, contact 2 Fuel pump relay module, contact 7, terminal 87



1	Mixture control unit	K29	Transmission upshift delay relay
10	Diaphragm pressure regulator	L5	Crankshaft position sensor
55	Fuel filter	M3	Fuel pump
57	Fuel accumulator	N1/2	Ignition control module
75	Fuel tank	N3	CFI control module
76	Vent valve	N6	A/C compressor control module
77	Charcoal canister	N16/3	Fuel pump relay module
78	Purge valve	R8/2	Intake air preheater (PSV)
79	70 °C thermostatic valve	R16/1	Reference resistor (DI)
89	Exhaust gas recirculation valve	S25/13	60 °C temperature switch (PSV)
92	Injector	S27/2	Decel fuel shutoff microswitch
94	Deceleration valve (manual transmission only)	S29/2	WOT/CTP switch
158	Under-floor catalytic converter	T1	Ignition coil
Ale26	CHECK ENGINE malfunction indicator lamp	Y1	Electrohydraulic actuator
B2	Air flow sensor potentiometer	Y5/1	A/C compressor electromagnetic clutch
B6	Hall-effect speed sensor	Y6	Idle air control valve
B11/2	Engine coolant temperature sensor, 4-pin	Y8	Start valve
B17/1	Intake air temperature sensor	c	Air admission
B21	Exhaust gas recirculation temperature sensor (EGR) (California only)		
G3/2	Heated oxygen sensor		
K3/1	Intake air preheating (PSV) relay		

07.3-105 Testing on/off ratio USA

Preceding work:



Air conditioning or automatic air conditioning switch off.

Selector lever in park position "P".

Testers connect.

Engine oil remote thermometer (018)
124 589 07 21 00,
Lambda control tester (012),
Twin socket (031),
Engine tester (026),
Trigger clamp (011).

Extraction device (014) position at exhaust tail pipe.

Throttle control check for ease of movement and condition.

Ignition point test (see table).

Engine oil temperature approx. 80 °C.

Idle speed test (see table).

Lambda control test (see table).


Caution!
All adjustments may only be performed when replacing a component of the injection system or performing engine repairs.
Pay attention to note.
Install repair kit 102 070 01 74.

Smooth engine running check by switching on all ancillary components.

Idle speed, lambda control

Engine	Model year	Idle speed	Idle speed	Lambda control
		1/min	Control range	Control range
102.961 (2.3)	1983/1984	720 ± 50	25-31%	2.1-4.8 volts ¹⁾
102.983	1986-I 989	900 ± 50	35-45%	50 ± 10%
102.985	1985/1986	720 ± 50	25-31%	2.1-4.8 volts ¹⁾
102.985	1987/1988 ²⁾	750 ± 50	36-50%	50 ± 10%
102.985	1991 ²⁾	700-800	580 ± 50mA ³⁾	50 ± 10%

¹⁾ Adjust. Detach heated oxygen sensor coupling. Take reading of control value (volts). Readout must not fluctuate. Plug together heated oxygen sensor coupling - readout fluctuates. Test value must not vary more than ± 0.8 volts from reference value.

²⁾ California 1988 and  1991 with diagnostic trouble code (DTC) memory: "CHECK ENGINE" malfunction Indicator lamp must not light up. First, switch over CFI control module (N3) to on/off ratio output.

³⁾ Current measurement at idle speed air valve with multimeter (wait at least 28 seconds after starting, heating speed).

TSZ ignition point

Engine	Model year	Type of fuel	Distributor Bosch No.	Setting ¹⁾ of ignition point in °CKA before TDC ± 1 ° with vacuum at idle speed	Test value Ignition point adjustment in °CKA before TDC without vacuum at 3500/min
102.961 (2.3)	1983/1984	unleaded	0 237 002 094	5	19–25
102.961 102.985	1985/1986		0 237 002 098		22–26

¹⁾ If normal-compression engines are operated with fuel of less than 98 RON (min. 88 MON) or low-compression engines with fuel of less than 92 RON (min. 82 MON), the ignition point should be retarded and adapted to the octane number of the fuel used. The rule of thumb for this adjustment is: retard ignition point by 1 – 2° CKA per 1 RON. The ignition point must not be retarded more than 6° CKA.

This results in reduced engine power output and increased fuel consumption. In addition, the engine must not be operated at full load. Full ignition advance should be re-set as soon as fuel of the specified octane number is available.

Distributor ignition point

Engine	Model year	Distributor ignition control unit Part No. alternatively	Resistance trimming plug	Engine speed in 1/min	Ignition point in °CKA BTDC	Ignition point in °CKA BTDC
					without vacuum	with vacuum
102.983	1986/1987	004 545 57 32 004 545 59 32	Reference resistor 750 Ω	4000	18–22 ¹⁾	29–33 ¹⁾
				Idling	14–18	14–18
102.985	1987/1988	005 545 30 32 005 545 32 32		3200	25–29	39–43
				Idling	8–12	8–12
102.985	1989	007 545 47 32 ²⁾³⁾ 007 545 48 32 ²⁾³⁾		3200	23–27	39–43
				Idling	8–12	8–12
102.985	1991	010 545 59 32 010 545 60 32	Reference resistor 1.3 kΩ (manual transmission) 2.4 kΩ (automatic transmission)	3200	22–26 ⁴⁾	39–43 ⁴⁾
				Idling	8–12	8–12

¹⁾ Intake air temperature sensor connector unplugged.

²⁾ These ignition control modules may also be installed in vehicles prior to 1988. In this case, the ignition point values alter as shown in the table.

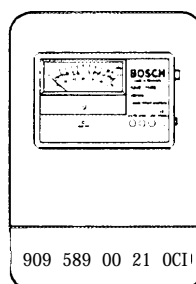
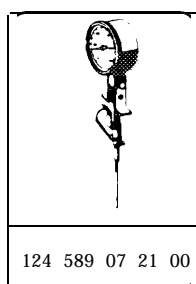
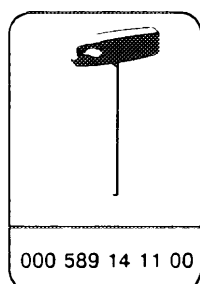
³⁾ Test ignition point at 80 °C engine coolant temperature by unplugging the temperature sensor connector B11/2 and feeding in 320 Ω with resistance decade between green/black cable and engine ground.

⁴⁾ For testing, unplug the intake air temperature sensor and engine coolant temperature sensor connectors. Test ignition point at 80 °C coolant temperature by feeding in 320 Ω with resistance decade between contact 1 at 4-pin connector and engine ground.

Note

Ignition control module with ignition map for manual and automatic transmission (activated by different DI resistance trimming plugs), boiling protection correction (max. 5° CKA), intake air correction (max. 7° CKA) and safety retarded adjustment (6° CKA) in the event of open circuit to reference resistor

Special tools



Commercially available testers

Engine tester (rpm, dwell angle, ignition angle)

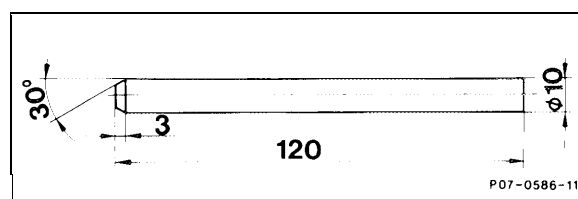
e. g. Bosch, MOT 001.03
Sun,
Hermann

Twin socket

e. g. Hermann, ECD 53

Shop-made tool

Drift for inserting steel anti-tamper lock



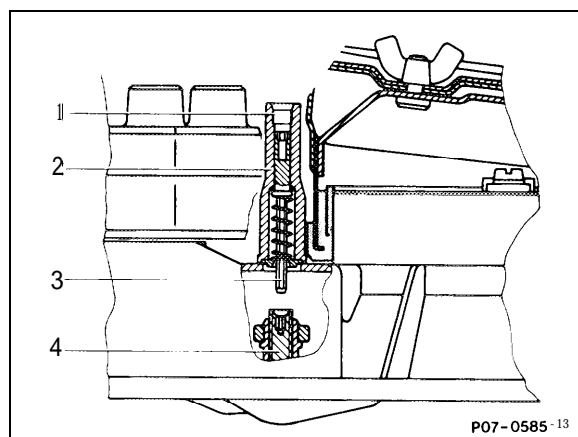
Note

The adjustment device (2) for the fuel/air mixture setting is secured with a steel anti-tamper lock (1) to prevent any unauthorized alteration of the setting.

This anti-tamper lock is factory-installed with a special tool after the fuel/air mixture is set and must not be removed in the workshops.

The fuel/air mixture setting may only be corrected when replacing a component of the injection system (e. g. fuel distributor) or when performing engine repairs.

In such cases, the adjustment device (2) must be replaced.



- 1 Steel anti-tamper lock
- 2 Adjustment device
- 3 Hexagon head
- 4 Mixture regulating screw

The lambda control must not be tested when the engine is very hot, e. g. immediately after a long drive or after measuring engine output on the dynamometer.

1 Switch off air conditioning. Move selector lever into park position "P".

2 Connect testers:

Oil remote thermometer (018) 124 589 07 2100

Lambda control tester (012)

Twin socket (031)

Engine tester (026)

Trigger clamp (011)

3 Position extraction device (014) at exhaust pipe.

4 Check throttle control for ease of movement and condition.

5 Test ignition point (see table).

6 Run engine to warm up oil to 80 °C.

7 Test idle speed (see table).

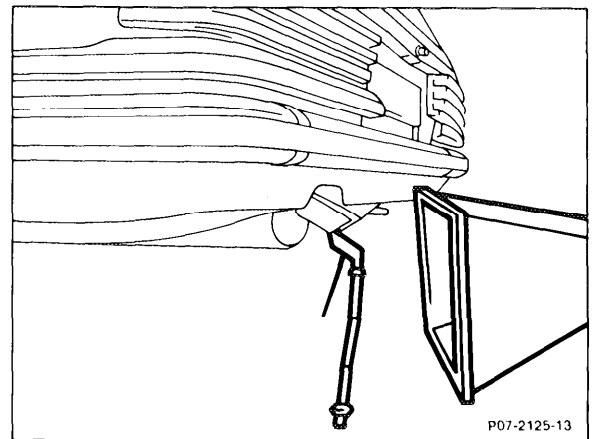
Note

If idle speed varies, test electronic idle speed control (07.3-l 12).

8 Test lambda control (see table).

Note

The readout must fluctuate during the measurement. If a constant readout is indicated, there is a fault in the lambda control, e. g. oxygen sensor faulty. See "Testing electrical components of CFI system" (07.3-l 21) for trouble diagnosis table.



a) Measuring on/off ratio with lambda control tester at diagnostic connector.

Engine 102.983

Engine 102.985 as of 1987

Test value: 50 ± 10%

Press 100 % IR button on Bosch lambda control tester.

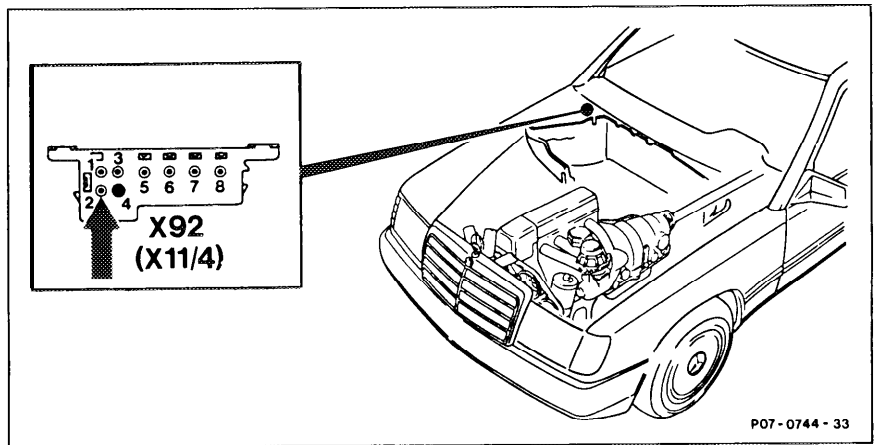
Ⓢ California 1988 and Ⓢ 1991 Engine 102.985 with diagnostic trouble code memory: The CFI control module must be switched over to on/off ratio output with the impulse counter scan tool or with the pushbutton switch (California only) at the diagnostic connector X92 or XI 1/4 (see also 07.3-121, Section F).

California versions:

Press switch (2, arrow) at diagnostic connector (X92 or XI 1/4) for between 2 and 4 seconds. LED (4) flashes once (no DTC stored in system). Again press switch (2) for between 2 and 4 seconds, CFI control module is switched over to on/off ratio output. LED shows steady light.

Requirement:

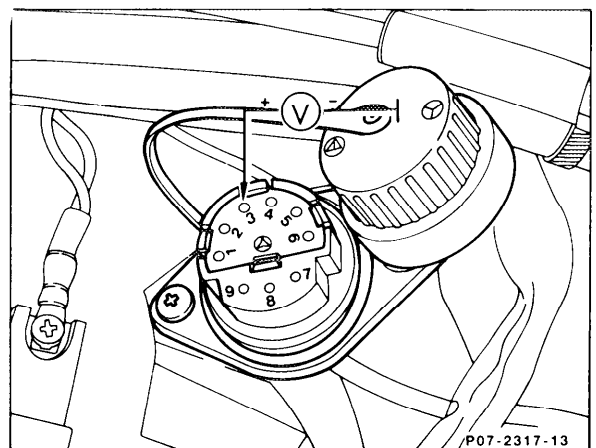
“CHECK ENGINE” malfunction indicator lamp does not light up.



b) Voltage measurement with multimeter or lambda control tester (12 volt position) at contact 3 of diagnostic connector to ground.

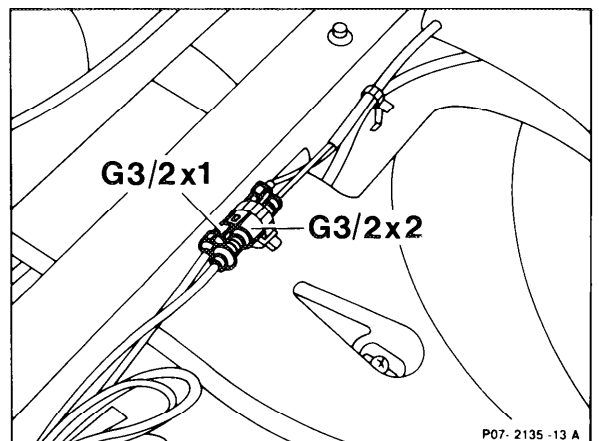
Engine 102.961 (2.3) 198311984
 Engine 102.985 up to 1986

Test value: 2.1–4.8 volts



Switch off all ancillary components.
 Detach heated oxygen sensor signal plug connection (G3/2x2). Take reading of control value (e. g. 3.3 volts). Readout must not fluctuate.

Plug together heated oxygen sensor signal plug connection (G3/2x2) – readout fluctuates. Test value must vary not more than ± 0.8 volts from control value. Variation > 0.8 volts, set control value.

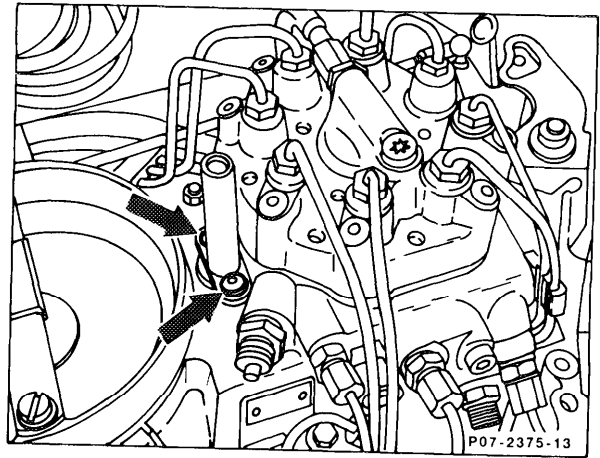


9 Adjust lambda control.

Should it be necessary to set the on/off ratio after performing engine repairs or replacing a part of the CFI system, proceed as follows:

Remove air cleaner.

Strike shear-off screws (arrow) in the middle with a chisel and drill approx. 6 – 8 mm deep with a 2.5 mm twist drill.



Caution!

Do not drill through screws as the metal chips may cause engine damage. Thoroughly remove metal chips with a cloth.

Unscrew shear-off screws with left-hand drill.

Install new repair kit, Part No. 102 070 01 74.
Tighten screws until head shears off.

Install air cleaner.

Start engine.

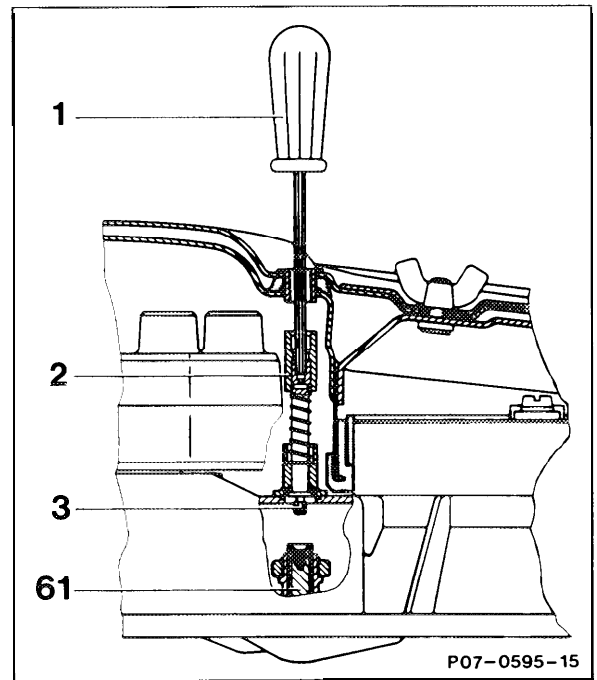
Push the screwdriver (1) through the recess in the top of the air cleaner onto the adjusting device (2).

Press the adjusting device down with the screwdriver against the spring force, turn it slightly until the hexagon head (3) engages in the mixture regulating screw (61).

Turning to the left = leaner – on/off ratio or voltage rises

Turning to the right = richer – on/off ratio or voltage drops

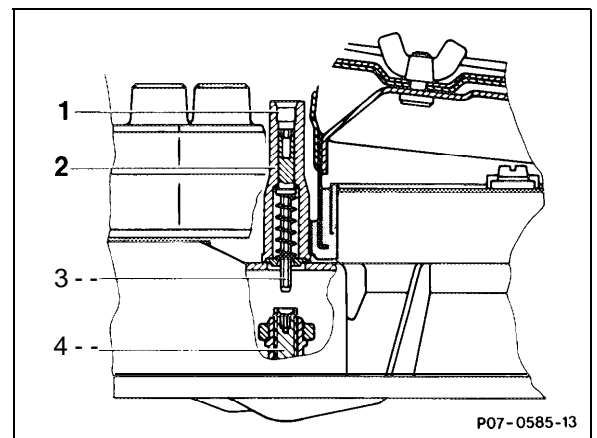
After each adjustment, briefly blip throttle and test lambda control; re-set if necessary.



Switch off engine.

Take off air cleaner.

Knock in steel anti-tamper lock (1) with shop-made drift at the chamfered side far enough for the surface of the anti-tamper lock to be flush with, or slightly lower than, the bottom edge of the taper of the adjusting device (2).



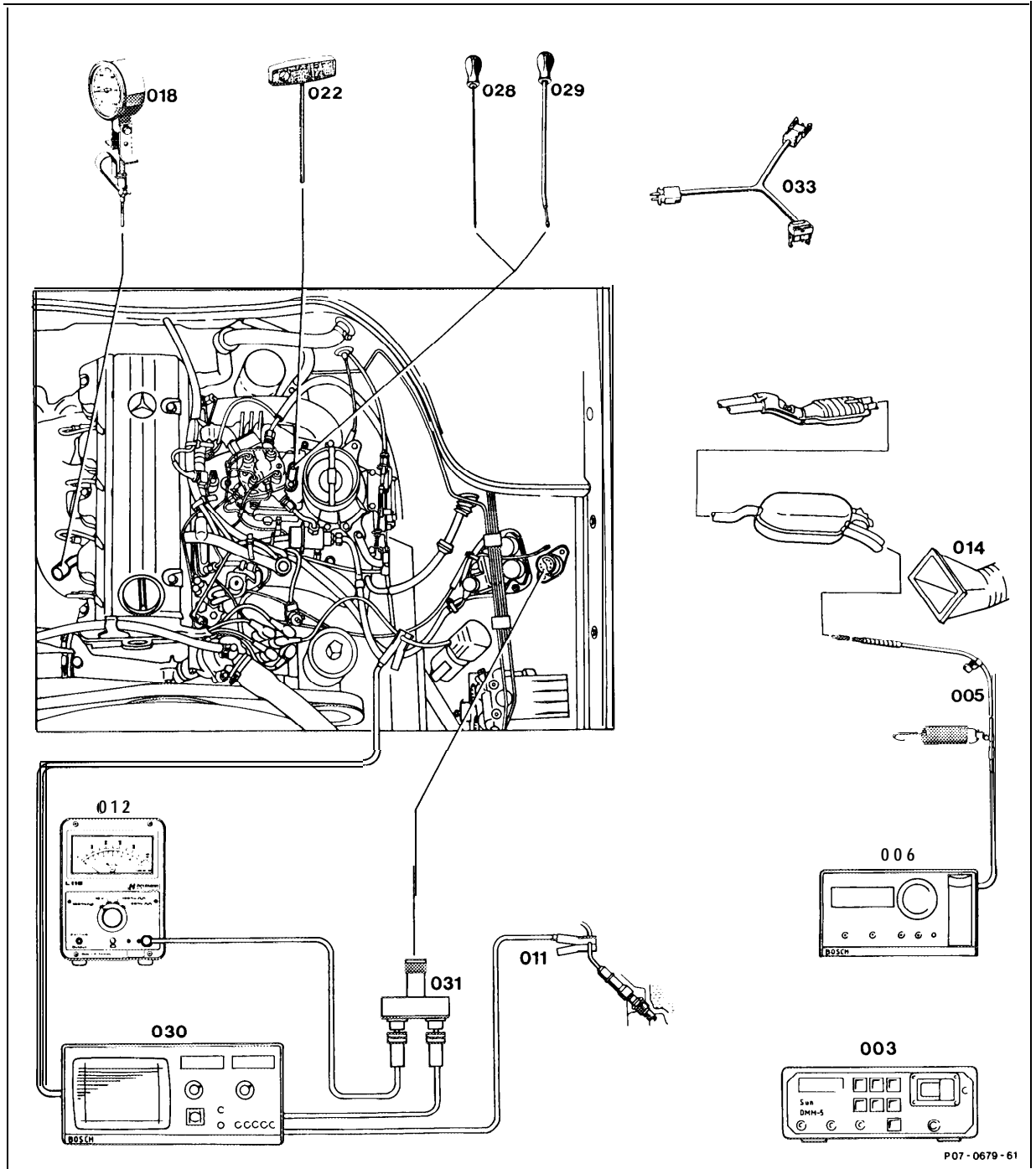
- 1 Steel anti-tamper lock
- 2 Adjusting device
- 3 Hexagon head
- 4 Mixture regulating screw

Install air cleaner.

Check smooth engine running by moving selector lever into Drive mode, switching on air conditioning/automatic climate control, turning power steering to full lock. The engine must continue to run smoothly. Test electronic idle speed control, if necessary (07. 3-1 12).

07.3-110 Engine testing, adjustment

Preceding work:



Air conditioning or automatic climate control	switch off.
Selector lever	in park position "P".
Diagnostic trouble code (DTC) memory	read out and note DTCs (engines with DTC memory).
Testers	connect: oil remote thermometer (018) 124 589 07 21 00, lambda control tester (012), twin socket (031), trigger clamp (01 1), exhaust probe (005) 126 589 11 63 00, CO measuring instrument (006), engine tester with oscilloscope (030), multimeter (003), test cable (033) 102 589 04 63 00.
Extraction device (0 14)	position at exhaust tail pipe.
Engine coolant level	check, adjust to correct level.
Engine oil level	check, pay attention to condition of oil (visual inspection).
Air cleaner	remove, install.
Throttle control linkage (7)	check ease of movement and condition of throttle valve. Grease mounting points, relay levers, ball sockets.
Fulcrum lever	check, adjust.
Idle stop	check.
Wide open throttle stop	check from accelerator pedal, adjust.
Voltage	test at battery and ignition coil, terminals 1 and 15.
Current at actuator	test with ignition switched on.
Ignition point	test, adjust (see table).
Centrifugal advance (TSZ)	test (see table).
Vacuum advance	test (see table).
Oil level in automatic transmission	check, adjust to correct level.
Deceleration shutoff	check.
Engine oil temperature	approx. 80 °C.
Oscilloscope image	analyze.
Intake system	check for leaks by pressure-testing.

Exhaust gas recirculation valve	check.
Idle speed	check (see table).
Lambda control	see 07.3- 105.
Smooth engine running	check by switching on all ancillary components.
DTC memory	erase. (Engines with DTC memory).

Test and adjustment data

(USA) black information plate

Engine	Version	Model year	Idle speed 1/min	Idle speed Control range	Lambda control Control range
102.961 (2.3)	(USA)	1983 1984	720 ± 50	25-31%	2.1-4.8 volts ⁵⁾
102.983		1986-1989	900 ± 50	35-45%	50 ± 10%
102.985		1985 1986	720 ± 50	25-31%	2.1-4.8 volts ⁵⁾
102.985		1987 1988 ⁷⁾	750 ± 50	36-50%	50 ± 10%
102.985		1991 ⁷⁾	700-800	580 ± 50 mA ⁸⁾	50 ± 10%

1) With self aspiration system.

2) 700-800/min with A/C compressor (electronically controlled).

3) Without idle speed control.

4) Without air injection. Detach shaped hose and plug.

5) Adjust. Detach heated oxygen sensor connector. Take reading of control value (volts). Readout must not fluctuate. Plug together heated oxygen sensor connector - readout fluctuates. Test value must vary not more than ± 0.8 volts from control value.

6) Current measurement at idle speed air valve with multimeter (wait at least 28 seconds after starting, heating speed).

7) California 1988 and **(USA)** 1991 with DTC memory: "CHECK ENGINE" malfunction indicator lamp must not light up. First of all switch over CFI control module (N3) to on/off ratio output.

8) Control measurement at idle speed air valve with multimeter (wait at least 28 seconds after starting, heating speed).

Current at actuator with ignition switched on

National version **(USA)**

Engine	Version	Current at actuator with ignition switched on mA
102.961	(USA)	75-85 ⁷⁾
102.985	(USA) up to 1986	75-85 ⁷⁾
	(USA) as of 1987	20

1) 100 mA with CFI control module 004 545 12 32.

2) Manual transmission.

3) As of 01.87 for manual and automatic transmission.

4) Automatic transmission.

5) CFI control module 004 545 93 32 (1986/87).

6) CFI control module 004 545 94 32 (as of 1988).

7) Connector at engine coolant temperature sensor disconnected.

Ignition point (TSZ) US version

Engine	Type of fuel ³⁾	Distributor Bosch No.	Test value and setting ¹⁾ of ignition point in °CKA BTDC ± 1 without/with vacuum		Ignition point adjustment in °CKA before TDC without vacuum			Vacuum advance of ignition point in °CKA BTDC at	Installed ignition point value in °CKA BTDC at starting speed without vacuum
			4500/ min	Idling	Idling	1500/ min	3000/ min	4500/ min	
USA 102.961 1984	un- leaded	0 237 002 094	–	5 with	–	5–11	19–25 ²⁾	24–28 ²⁾	5
		0 237 002 098				10–14	22–26 ²⁾	14–18 ²⁾	5
102.961 102.985 as of 1983									

1) If normal-compression engines are operated with fuel of less than 98 RON (min. 88 MON) or low-compression engines with fuel of less than 92 RON (min. 82 MON), the ignition point should be retarded and adapted to the octane number of the fuel used. The rule of thumb for this adjustment is: retard ignition point by 1 – 2° CKA per 1 RON. The ignition point must not be retarded more than 6° CKA.

The ignition correction should be entered by hand on the "engine setting data" information plate.

This results in reduction in power output and increased fuel consumption. In addition, the engine must not be operated at full load. Full ignition advance should be re-set as soon as fuel of the specified octane number is available.

2) Test at 3500/min

3) Vehicles with catalytic converter must be operated with unleaded fuel.

4) This value must be identical with and without vacuum when engine is at normal operating temperature; test ignition advance in warm-up phase if necessary (15-543).

National version (USA)

Engine	Version	Production breakpoint/ Model year	Distributor ignition control module Part No. alternatively	Engine speed in 1 imin	Resistance trimming plug setting type of fuel ⁷⁾	Ignition point in °CKA BTDC without vacuum	Ignition point in °CKA BTDC with vacuum
102.985	(AUS)	1991	010 545 93 32 alternatively 010 545 94 32	3200	Reference resistor 1.3 kΩ (manual transmission) 2.4 kΩ (automatic transmission)	16-21 ⁹⁾	39-43 ⁹⁾
				At idle		8-12	8-12

CKA = Crank Angle

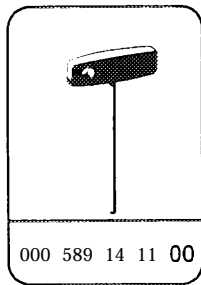
Engine	Version	Production breakpoint/ Model year	Distributor ignition control module Part No. alternatively	Engine speed in 1 min	Resistance trimming plug setting type of fuel ⁷⁾	Ignition point in °CKA BTDC	Ignition point in °CKA BTDC
						without vacuum	with vacuum
102. 985	USA 1)	1987/1988	005 545 30 32 005 545 32 32	at idle	Reference resistor 750 Ω	14- 18	14- 18
				3200		25-29	39- 43
102. 985		1989	007 545 47 32 ⁵⁾⁶⁾ 007 545 48 32 ⁵⁾⁶⁾	at idle		18- 12	18- 12
				3200		23- 27	39-43
102. 985		1991	010 545 59 32 010 545 60 32	at idle		8- 12	8- 12
				3200		22- 26 ⁹⁾	39-43 ⁹⁾
	at idle			8- 12	8- 12		
					Reference resistor 1.3 kΩ (manual transmission) 2.4 kΩ (automatic transmission)		

- 1) Manual transmission.
- 2) Automatic transmission.
- 3) Intake air temperature sensor connector unplugged.
- 4) Resistance trimming plug setting results from adjustment.
- 5) These ignition control modules may also be installed in vehicles prior to 08188. In this case, the ignition point values alter as shown in the table. Resistance trimming plug setting "7" is no longer permitted with these ignition control modules.
- 6) Test ignition point at 80 °C engine coolant temperature by unplugging the temperature sensor connector B11/2 and feeding in 320 Ω with resistance decade between green/black cable (4-pin coolant temperature sensor coupling, contact 1) and engine ground.
- 7) Vehicles fitted with catalytic converter must be operated with unleaded fuel. S = premium grade fuel; N = regular grade fuel.
- 8) Reference resistor (∞ Ω resistance) not fitted to vehicles with ignition control module 003 545 70 32.
- 9) For testing, unplug the intake air temperature sensor and engine coolant temperature sensor connectors. Test ignition point at 80 °C engine coolant temperature by feeding in 320 Ω with resistance decade between contact 1 at 4-pin connector and engine ground.

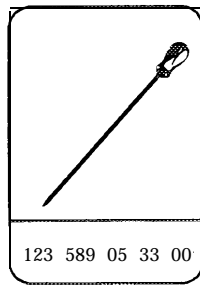
Note

Ignition control module with ignition map for manual and automatic transmission (activated by different resistance trimming plugs), boiling protection correction (max. 5° CKA), intake air correction (max. 7° CKA) and safety retarded setting (6° CKA) in event of open circuit to resistance trimming plug.

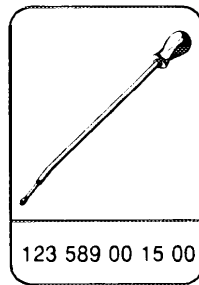
Special tools



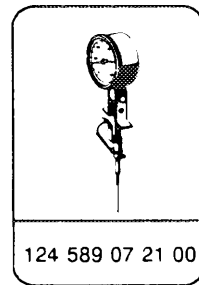
000 589 14 11 00



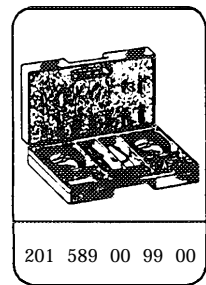
123 589 05 33 00



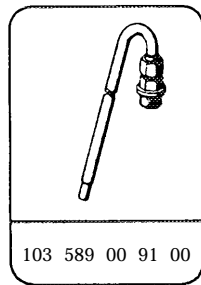
123 589 00 15 00



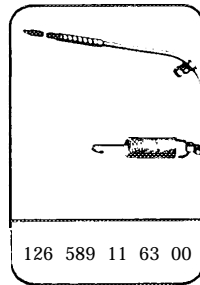
124 589 07 21 00



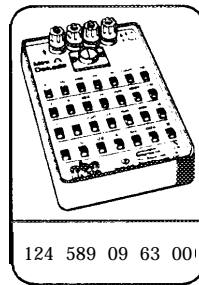
201 589 00 99 00



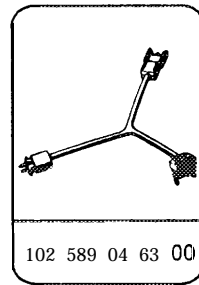
103 589 00 91 00



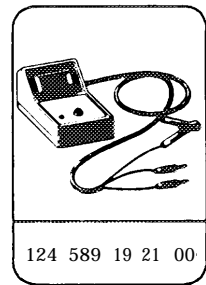
126 589 11 63 00



124 589 09 63 00



102 589 04 63 00



124 589 19 21 00

Commercially available testers

CO measuring instrument

Engine tester (rpm, dwell angle, ignition angle, oscilloscope, voltmeter)	e. g. Bosch, MOT 002.02 Sun, 1019
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Lambda control tester	e. g. Hermann, L 115
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Multimeter	e. g. Sun, DMM-5
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Twin socket	e. g. Hermann, ECD 53
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Shop-made tool

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

Test and adjust lambda control with a lambda control tester.

The lambda control and the idle speed emissions level must not be tested when the engine is very hot, e. g. immediately after driving sharply or after measuring engine output on the dynamometer.

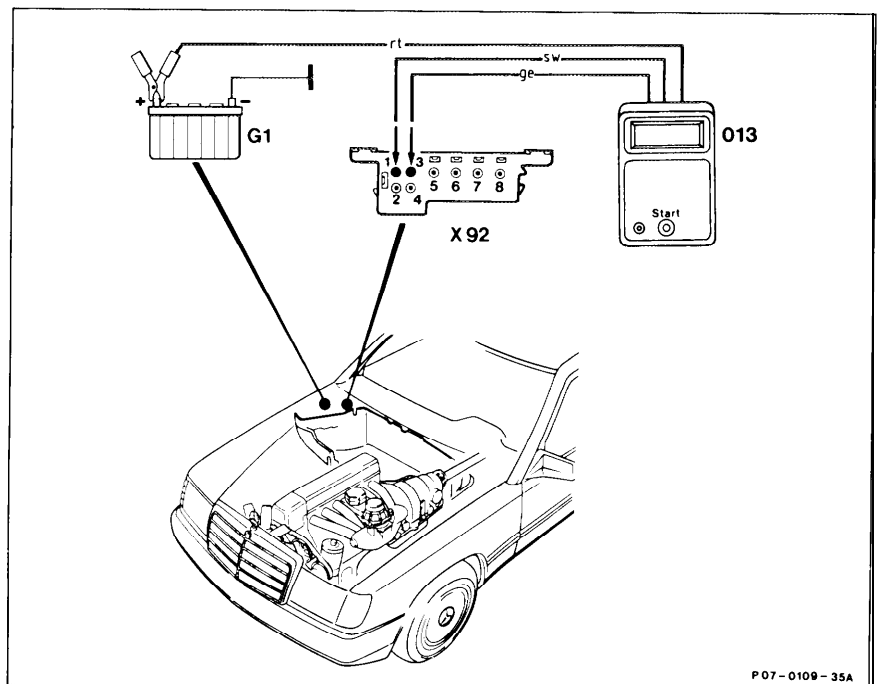
CAUTION!

Engines 102.96/98 as of 09/89 or model year 1990 with DTC memory

If an engine running problem exists, read out the DTC memory as part of Op. No. 07-1 100 and note the DTCs (see 07. 3-1 21, section D) before performing any repairs.

This ensures that a distinction is made between real DTCs and "simulated DTCs" as DTCs are stored when performing test work with the engine running, which may result from a simulation or from wiring being disconnected.

The DTC memory must be erased after completing the test work.



Testing, adjusting

- 1 Complete measurement sheet.
- 2 Switch off air conditioning or automatic climate control. Move selector lever into position "P".

3 Read out DTC memory, note DTCs. Connect impulse counter scan tool (013) to diagnostic connector (XI 1/4) and battery (G1) for this step. Ignition: **ON**. Press start button for 2 – 4 seconds.

Pulse readout 1: no malfunction.

Other DTC readouts: see 07.3-l 21, section "D".

(USA) California 1988 and (USA) 1991, see 07.3-l 21, section "F".

Again press start button for 2 – 4 seconds to display any further DTCs.

No readout: no further DTC stored.

4 Connect testers:

oil remote thermometer (018) 124 589 07 21 00

lambda control tester (012)

twin socket (031)

trigger clamp (011)

exhaust probe (005) 126 589 11 63 00

CO measuring instrument (006)

engine tester with oscilloscope (030)

multimeter (003)

test cable (033) 102 589 04 63 00.

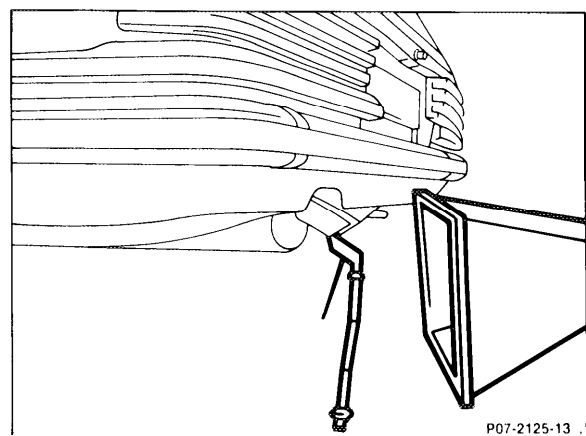
5 Position extraction device (014) at exhaust tail pipe.

6 Check engine coolant level, adjust to correct level.

7 Check engine oil level, pay attention to condition of oil (visual inspection).

8 Take off air cleaner.

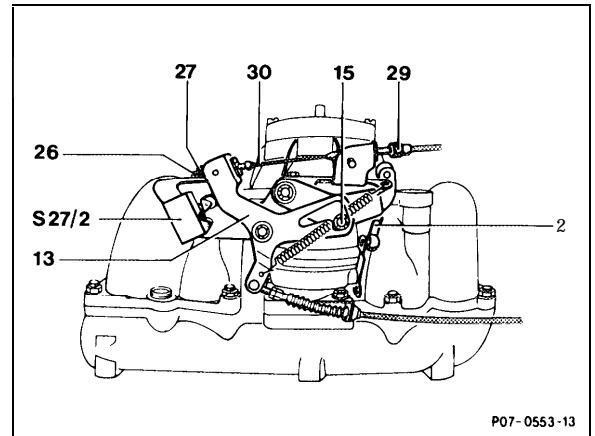
9 Check ease of movement and condition of throttle control linkage and throttle valve. Grease all bearing points and ball sockets (30-335).



10 Check fulcrum lever, adjust.

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

Engine 102.96/985



11 Idle stop.

Check whether the throttle valve is resting against idle stop. Disconnect connecting rod (2) for this step. Adjust throttle control (30-300).

Engines with cruise control only.

Check whether the actuator is resting against idle stop of cruise control by pressing the lever of the actuator clockwise against idle stop at cruise control. When attaching the connecting rod (21), ensure that the lever of the actuator is lifted approx. 1 mm off the idle stop at the cruise control. Adjust tie rod, if necessary. Adjust throttle control (30-300).

12 Check wide open throttle stop from the accelerator pedal, adjust (30-300).

13 Voltages

Test (battery and ignition coil):

No-load voltage

Connect voltmeter to the battery, paying attention to the polarity, and take reading of voltage. Specification: 12.2 volts.

Ignition coil

Switch on ignition with engine not running. Test the voltage terminal 15 to ground at contact 5 of diagnostic connector.

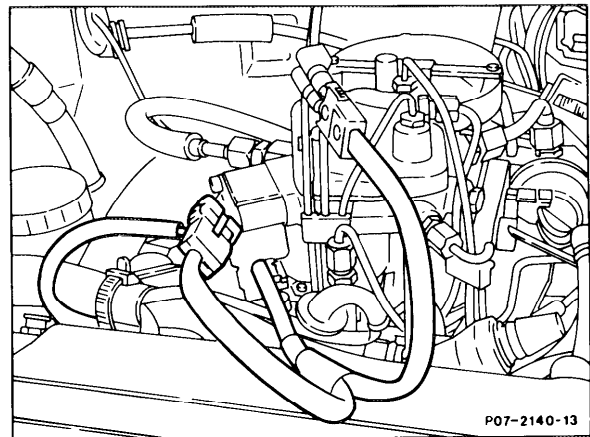
Specification: battery voltage

Test difference in voltage between terminal 15 and terminal 1 at contacts 5 and 4 of diagnostic connector.

Specification: 0 volts

If the specified values are not reached, test ignition system (15-540 or 15-542).

- 14 Test current at actuator with ignition switched on by detaching coupling at actuator and inserting test cable 102 589 004 63 00 into the circuit. Connect multimeter, set to mA (see table).
On Std. version, detach connector at engine coolant temperature sensor.
If the specified values are not reached, test electrical components (07.3-I 21).



15 Test ignition point and vacuum advance (see table). For TSZ version, test centrifugal advance.

If the specified values are not reached, test ignition system (15-540/542).

16 Check oil level in automatic transmission.

17 Test deceleration shut-off (engine coolant temperature $> 50\text{ }^{\circ}\text{C}$).

Hold engine speed at a constant $> 3000/\text{min}$. Operate microswitch by hand; this must cause the engine to saw.

Electrical test of deceleration shutoff, see 07.3-l 21.

Check fuel pressures and internal leaktightness if necessary, see 07.3-l 20, section "C".

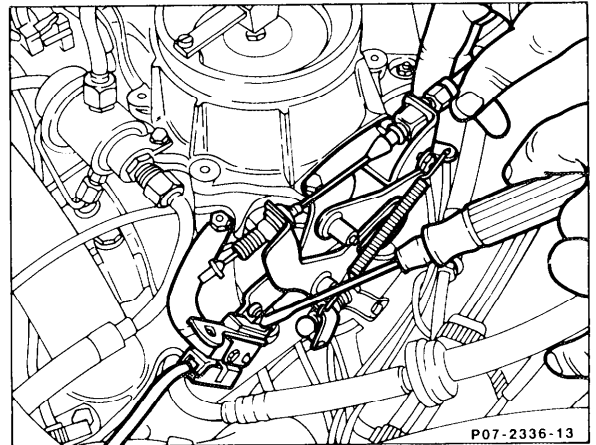
18 Run engine to raise oil temperature to approx. $80\text{ }^{\circ}\text{C}$.

19 Analyze oscilloscope image (15–525).

20 Check intake system for leaks. Fit "shop-made intake pipe" to fuel distributor before spraying. Spray all sealing points with ISO octane DIN 51 756 or cleaning petroleum. CO rise $< 2\%$.

⚠ WARNING!

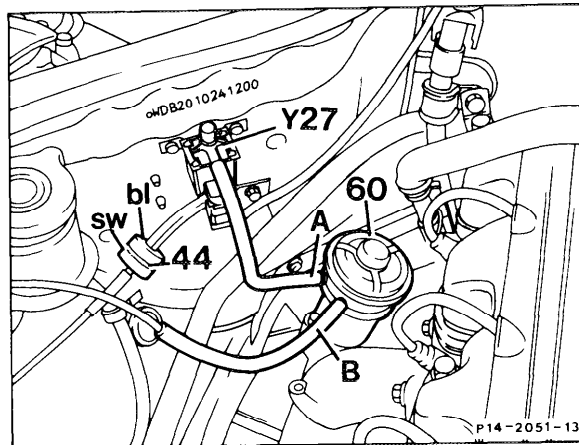
Do not use commercially available fuel for spraying (risk of harmful vapors). Pay attention to fire hazard and do not spray onto glowing parts or parts of the ignition system.



21 Check function of exhaust gas recirculation valve.

Detach both vacuum lines at the exhaust gas recirculation valve (60). Connect tester to EGR valve (connection A, red) and pressurize with vacuum. If there is not a clear deterioration in engine running, replace exhaust gas recirculation valve. Check valve actuation, if necessary (14-100).

(USA) 1991: check exhaust gas recirculation, see 14-475.



22 Install air cleaner.

23 Test idle speed (see table).

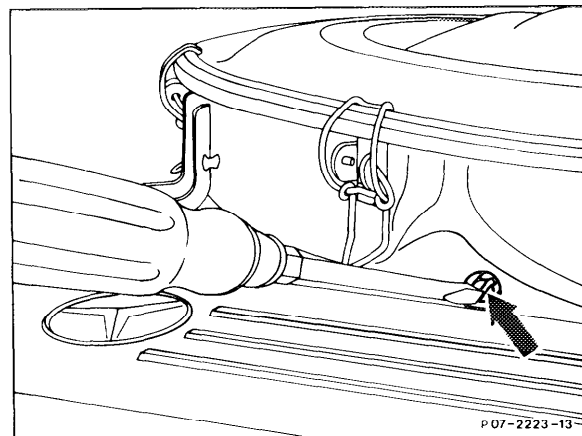
Note

The idle speed of engines fitted with electronic idle speed control cannot be adjusted. If the idle speed varies, test electronic idle speed control (07.3-I 12).

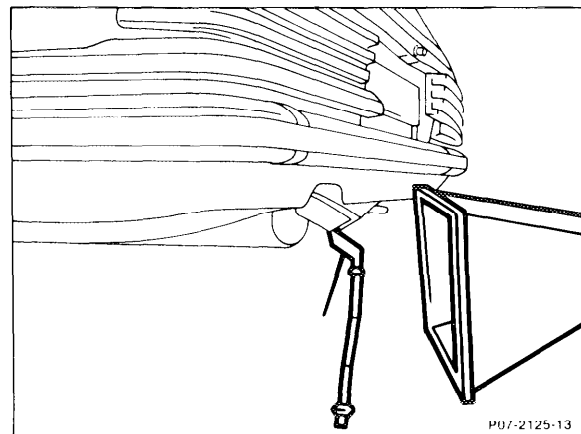
Engine 102.961 without idle speed control:

Adjust engine speed with the idle air screw (arrow).

Check idle stop at throttle body assembly when performing this step.



24 Test idle emissions level (see table). Measured at exhaust tail pipe. Setting idle emissions level, see step 25.

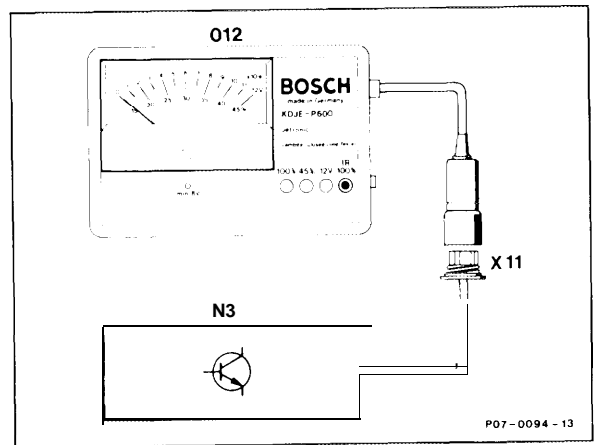


25 Test lambda control (see table).

Note

The readout must fluctuate during the measurement. If a constant value is indicated, there is a fault in the lambda control, e. g. exhaust sensor disconnected.

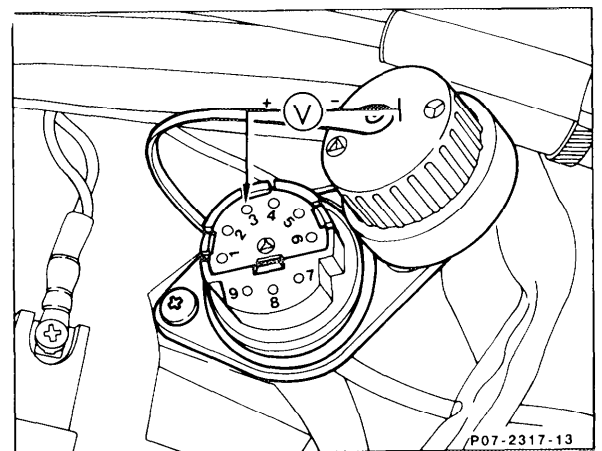
See "Testing electrical components of CFI system" (07.3-I 21) for trouble diagnosis.



b) Measuring voltage with multimeter or lambda control tester (12 volt position) at contact 3 of diagnosis socket to ground.

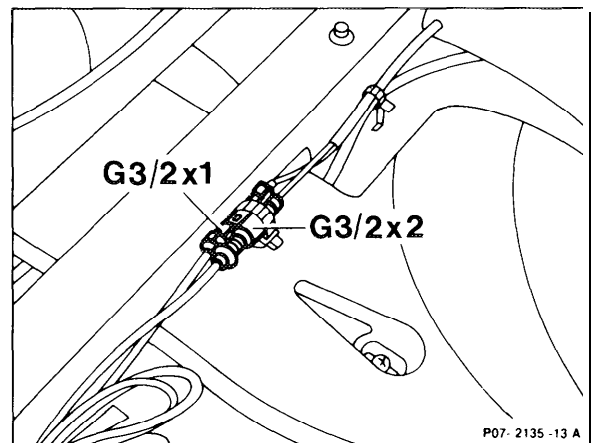
Engine 102.961 (USA) 1984
Engine 102.985 (USA) 1985/1986

Test value: 2.1-4.8 volts



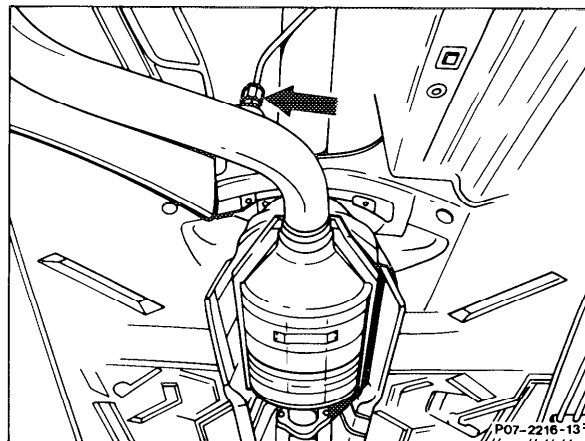
Switch off all auxiliary components.
Detach oxygen sensor signal plug connection (G3/2x2). Take reading of control value (e. g. 3.3 volts). Readout must not fluctuate.

Plug together heated oxygen sensor signal plug connection (G3/2x2) – readout fluctuates. Test value must vary not more than ± 0.8 volts from the control value. Variation > 0.8 volts, set control value.



26 Adjust idle emissions level and lambda control (see table).

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



Remove anti-tamper plug (4) with the extractor.

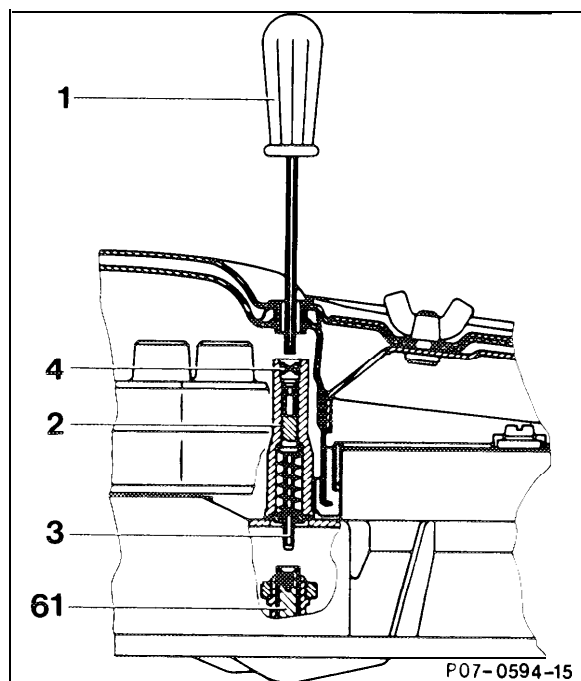
Insert a screwdriver (1) through the recess on the top of the air cleaner onto the adjusting device (2). Press the adjusting device down with the screwdriver against the spring force, turn it slightly until the hexagon head (3) engages in the mixture regulating screw (61).

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

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

After each adjustment, blip throttle slightly; re-adjust if necessary.

After adjusting, insert a blue anti-tamper plug (4), Part No. 000 997 59 86, with the inserting drift.



- 1 Screwdriver
- 2 Adjusting device
- 3 Hexagon head
- 4 Anti-tamper plug
- 61 Mixture regulating screw

.....

27 Check smooth engine running by moving selector lever into Drive mode, switching on air conditioning/automatic climate control, turning power steering to full lock. The engine must continue to run smoothly.

28 Erase fault memory (engines 102.96198 as of 09189).

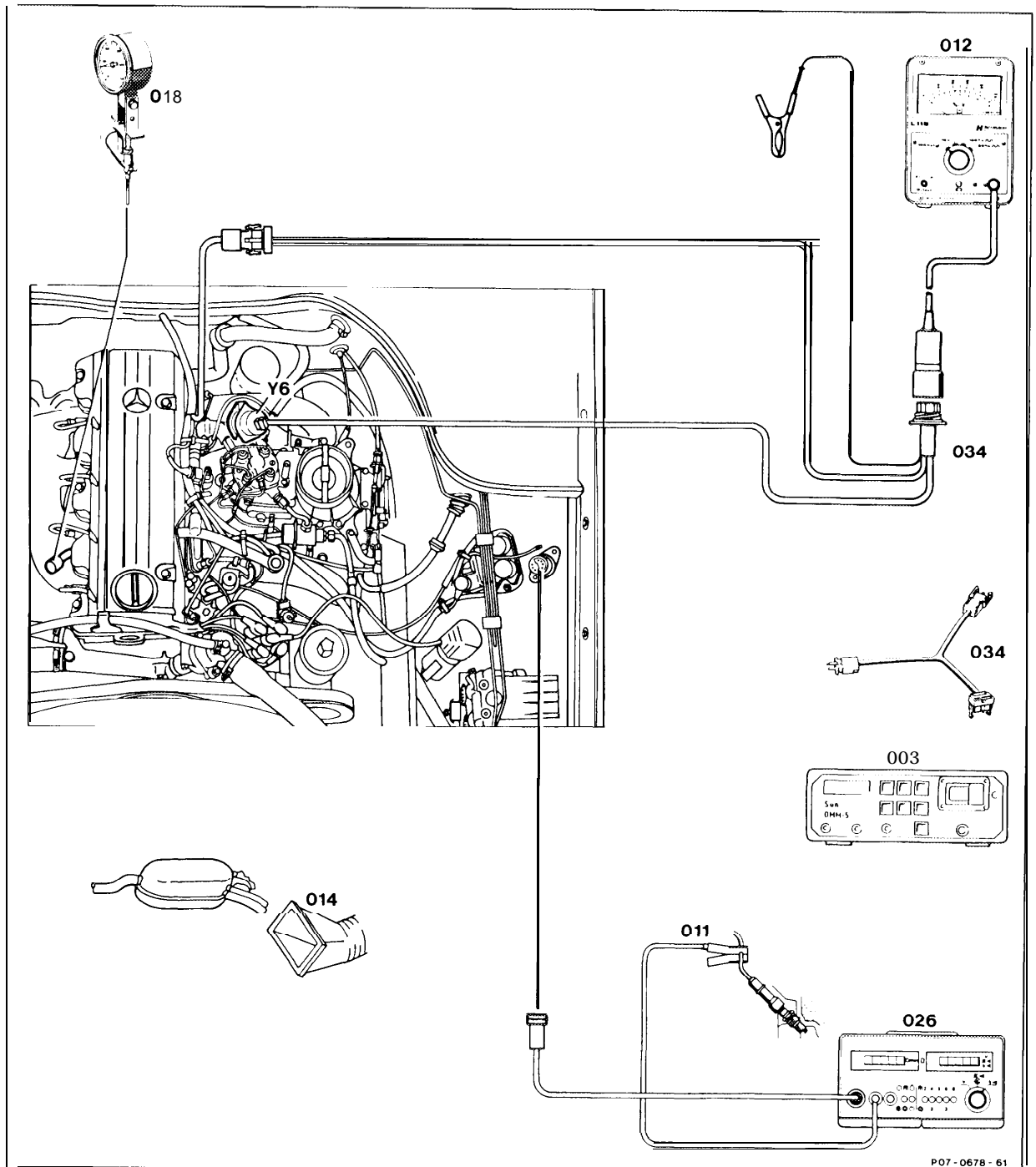
Press start button on pulse counter when pulse indicated for 6 – 8 seconds. If a number (greater than 1) then continues to be displayed, a further fault is stored. Press start button again for 6 – 8 seconds to erase.

Note

Each pulse indicated must be erased **individually**.

07. 3-1 12 Testing electronic idle speed control

Preceding work:
Testing, adjusting engine (07. 3-1 10)



P07 - 0678 - 61

Air conditioning or automatic climate
 control
 Selector lever
 Testers

switch off.
 in position "P" or "N".
 connect:
 oil remote thermometer (018)
 trigger clamp (01 1),
 engine tester (026).

Vehicles up to 09/89 and model year 1990:

Connect test cable (034) to idle speed air valve (Y6).

2-pin: test cable 103 589 00 63 00

3-pin: test cable 102 589 14 63 00

Fit on ground clamp.

Connect lambda control tester (012).

Extraction device (014)
 Engine oil temperature
 Electronic idle speed control

position at exhaust tail pipe.

approx. 80 °C.

test (see table).

As of 09/89 and model year 1990: wait at least 28 seconds after start before measuring (heating speed).

Control range
 Smooth engine running


test at idle speed (see table).

test by switching on all ancillary components.

Test and adjustment data

National version

black information plate

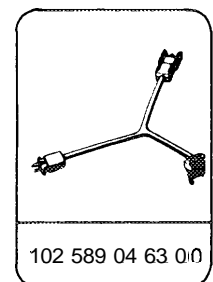
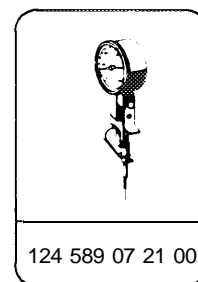
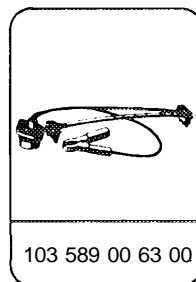
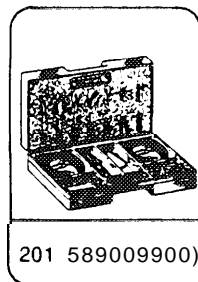
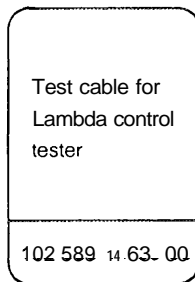
Engine	Version	Model year	Idle speed 1/min	Idle speed Control range	Idle speed air valve connection	Test pro- gramme, see section
102.961		1983/84	720 ± 50	25-31%	3-pin	"a"
102.983		1986-1989	900 ± 50	35-45%	2-pin	"b"
102.985		1985/1986	720 ± 50	25-31%	3-pin	"a"
102.985		1987/1988	750 ± 50	36-50%	2-pin	"b"
		1991	700-800	$580 \pm 50 \text{mA}^2)$		

1) With A/C compressor.

2) Current measurement at idle speed air valve with multimeter (wait at least 28 seconds after start before measuring, heating speed).

3) All national versions with KAT. National versions without KAT, see basic version.

Special tools



Commercially available testers

Engine tester (rpm, dwell angle, ignition angle)

e. g. Bosch, MOT 001.03
Sun,
Hermann

Lambda control tester










e. g. Hermann, L 115

Multimeter

e. g. Sun, DMM-5

a) Idle speed air valve with 3-pin connection

Key to symbols

	Socket box
	Lambda control tester
	Battery
	Multimeter
	Contact
	Connector
	Voltage measurement (volts, direct voltage)
	Current measurement (amperes, direct current)
	Resistance measurement (ohms)

Note

- Wiring diagrams 07.3-128.
- Idle speed control is independent of the air flow sensor potentiometer.
- If the specified value of a test step, e. g. step 4.0, is in order, it is not necessary to perform test step 4.1. Different component designations are possible depending on the wiring diagram or vehicles with optional equipment. These designations are given in parentheses. This has no effect on the test (connections, specified value).
- Engine speed increases when the coupling is disconnected from the decel fuel shutoff microswitch.
- Test TD signal if readout on tester fluctuates and engine surges.

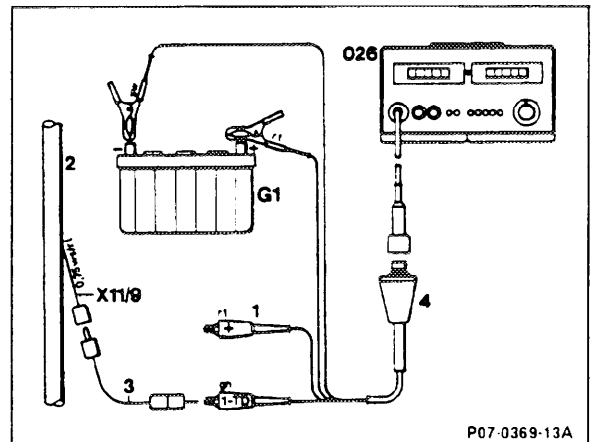
Pest conditions:

- Intake system without leaks.
- Slide in idle speed air valve operates freely.
- Engine oil temperature approx. 80 °C.
- Coolant temperature sensor, decel fuel shutoff microswitch and idle speed detection throttle valve switch (RÜF. KAT) in order (07.3-I 21).

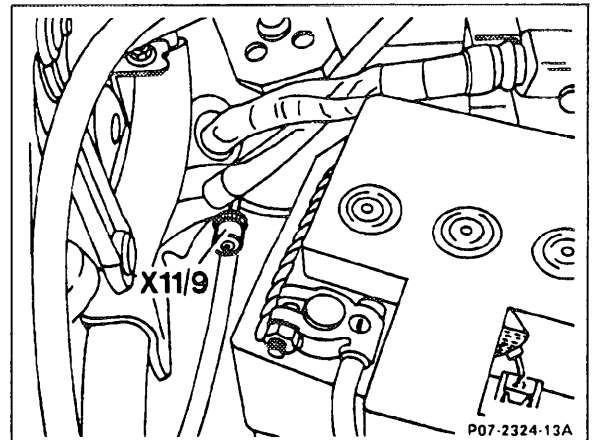
- **Engine 102.983 Std.**

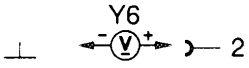
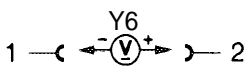
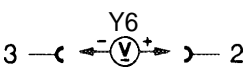

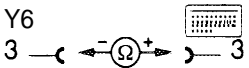
Connect engine tester test cable (4) to test connection of idle air control valve XI 1 9.

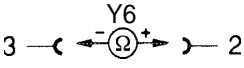
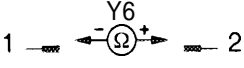
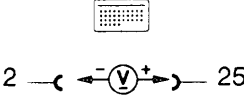
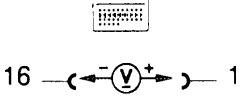
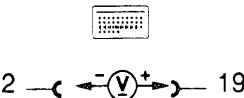
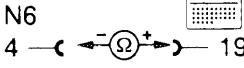
- 1 is not connected
- 2 Engine wiring harness
- 3 Test cable from set 201 589 00 99 00
- 4 Engine tester test cable
- 026 Engine tester
- G1 Battery
- XI 1/9 Idle air control valve test connection



The idle air control valve test connection XI 1/9 is located on the right in the component compartment.












On/off ratio display	Test step/ Test scope	Equipment/ Test connection	Operation/ Requirement	Specifi- cation Function	Possible cause/ Remedy
-	1.0 Idle air control valve (Y6) control range	Connect test cable to idle speed air valve. Connect lambda control tester or engine tester.	Engine at idle.	see table	Set specified value at bypass screw. Idle speed air valve Open circuit to idle air control valve. Closed throttle contact (see 07.3-I 21). Deceleration shutoff microswitch (see 07.3-121). TD signal (test step 3.0) CFI control module
	1.1 Idle air control valve voltage supply		Coupling at Y6 detached. Ignition: ON	11-14 V	Fuse in overvoltage protection relay faulty or not inserted. Lead to contact 1 (terminal 30) has open circuit. Overvoltage protection control at contact 6 (terminal 15) has open circuit. Lead from overvoltage protection, contact 5 (terminal 31, ground) has open circuit. Lead from overvoltage protection, contact 2 to idle air control valve coupling, contact 2 has open circuit.
	1.2 Idle air control valve control	 	Coupling at Y6 detached. Ignition: ON	11-14 V 11-14 V	Test cable between CFI control module, terminal 20 and battery ground.
	1.3 Cable	 	Coupling at Y6 detached. Ignition: OFF	< 1 Ω < 1 Ω	Cable has open circuit. Cable has open circuit.

On/off ratio display	Test step/ Test scope	Equipment/ Test connection	Operation/ Requirement	Specifi- cation Function	Possible cause/Remedy
-	2.0 Idle air control valve resistance	 	Ignition: OFF Coupling Y6 disconnected.	$12 \pm 3 \Omega$ $12 \pm 3 \Omega$	Replace idle air control valve.
-	3.0 TD signal		Engine at idle. CFI control module connected.	6-12 V	Ignition control module. Wiring.
-	4.0 Selector lever position (for automatic transmis- sion)		Engine at idle. Selector lever in position "P". Parking brake applied. Selector lever in position "D".	11-14 V Voltage drops ¹⁾	Starter lockout and reverse light switch (S16/1, 27-130). Test cable open circuit according to wiring diagram.
-	5.0 A/C compressor cut-in signal		Ignition: ON AC compressor switched on	11-14 v	A/C compressor control module (N6). Cable.
	5.1 Cable		Ignition: OFF N6 detached.	< 1 Ω *	Cable has open circuit.

¹⁾ Voltage may drop to 0 volts on analog Instruments.

b) Idle air control valve with 2-pin connection

Key to symbols

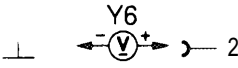
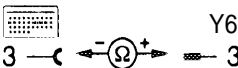
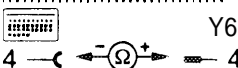
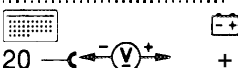
	Socket box
	Lambda control tester
	Battery
	Multimeter
	Contact
	Connector
	Voltage measurement (volts, direct voltage)
	Current measurement (amperes, direct current)
	Resistance measurement (ohms)


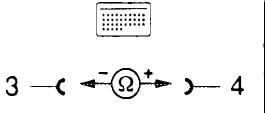
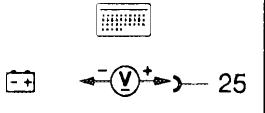
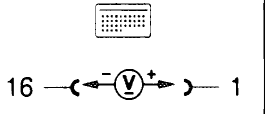
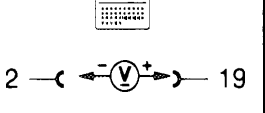
Note

- Wiring diagrams 07.3-128.
- If the specified value of a test step, e. g. step 4.0, is in order, it is not necessary to perform test step 4.1. Different component designations are possible depending on wiring diagram and vehicles with optional equipment. These designations are given in parentheses. This has no effect on the test (connections, specified value).
- Engine speed increases when the coupling is disconnected from the deceleration shutoff microswitch.
- As of 09/88 and model year 1989: idle speed control with road speed signal. The idle speed is deactivated from approx. 1.4 km/h.
If the complaint "jerking when car moving with throttle valve closed" is indicated, test the road speed signal (07.3-121).
- As of 09/89 and model year 1990: idle speed control with heating speed. This is activated for not more than 28 seconds after each start (conditions: closed throttle position contact closed and selector lever in position "P" or "N").

Test conditions

- Engine coolant temperature sensor, decel fuel shutoff microswitch and idle speed detection throttle valve switch (RÜFKAT) in order (07.3-I 21).
- Intake system not leaking.
- Engine oil temperature approx. 80 °C.

On off ratio display	Test step/ Test scope	Equipment/ Test connection	Operation/ Requirement	Specifi- cation/ Function	Possible cause/Remedy
	1.0 Idle air control valve (Y6) control range	Connect test cable 102 589 14 63 00 to idle speed air valve (Y6). Connect lambda control tester. As of 09/89 connect test cable 102 589 04 63 00 and multimeter (current measurement).	Engine at idle.	see table	Readout 0% or 100% or 0 mA: Voltage supply, see test step 1. 1. Open circuit to idle air control valve, idle speed contact (see 07.3-I 21). Decel fuel shutoff microswitch (see 07.3-I 21). TD signal (see test step 4.0). Air flow sensor potentiometer (see 07.3-I 21). CFI control module.
	1.1 Idle air control valve (Y6) voltage supply	 Y6 ← - (V) + → 2	Coupling at Y6 disconnected Ignition: ON	11-14 V	Fuse in overvoltage protection faulty or not inserted. Cable to contact 1 (terminal 30) has open circuit. Overvoltage protection control at contact 6 (terminal 15) has open circuit. Cable from overvoltage protection contact 2 (terminal 87) to idle speed air valve has open circuit. Cable from overvoltage protection contact 5 (terminal 31) to ground has open circuit.
	1.2 Cable	 Y6 3 ← - (Ω) + → 3	Y6 disconnected.	< 1 Ω	Cable has open circuit.
	1.3 Cable	 Y6 4 ← - (Ω) + → 4	Y6 disconnected.	< 1 Ω	Cable has open circuit.
	1.4 Ground	 Y6 20 ← - (V) + → +		11-14 v	Battery ground (W10) loose, cable has open circuit.

On/off ratio display	Test step/ Test scope	Equipment/ Test connection	Operation/ Requirement	Specifi- cation/ Function	Possible cause/ Remedy
-	2.0 Idle air control valve (Y6)		Coupling at Y6 disconnected. Briefly apply battery voltage to Y6.	Idle air control valve switches audibly.	Idle air control valve.
-	3.0 Idle air control valve (Y6)		Ignition: OFF	20-30 Ω	Idle air control valve. Wiring.
-	4.0 TD signal		Engine at idle.	6-12 V	Wiring has open circuit.
-	5.0 Selector lever position (with automatic transmission)		Engine at idle. Selector lever position "P". Parking brake applied. Selector lever position "D".	11-14 v Voltage drops ¹⁾	Starter lockout and reversing light switch (S16/1, 27-130). Test open circuit according to wiring diagram.
-	6.0 A/C compressor cut-in signal		Engine at idle. A/C compressor switched on.	11-14 v	AC compressor control module (N6) Cable (USA) pressure switch compressor cutoff (S3 1). Test open circuit according to wiring diagram.

1) Voltage may drop to 0 volts on analog instruments.

07.3-I 17 Determining fuel consumption by test drive

- 1 Park vehicle on level ground and fill fuel tank fully in the presence of the customer.
- 2 Driving distance approx. 100 km (60 miles.), of which approx. 40 km (25 miles.) on highway and approx. 60 km (37.5 miles.) on main roads and in town.
- 3 After test drive, fill fuel tank again full and calculate fuel consumption.

Example

Fuel consumption in liters/100 km

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

Fuel consumption in miles/gallon

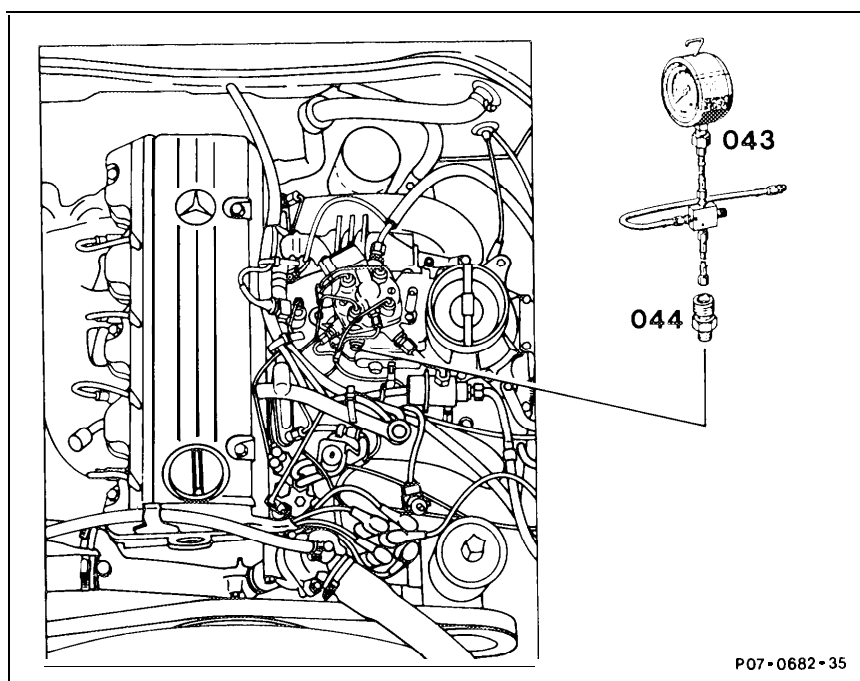
$$= \frac{\text{miles driven}}{\text{fuel consumed in gallons}}$$



07.3-l 20 Testing fuel pressure and internal leaktightness

Preceding work:
Testing, adjusting engine (07.3-1 10)

Basic and national versions



All fuel connections	check for leaks.
Ease of operation of air flow sensor plate and control plunger	check.
Pressure gauge (043)	connect. Special tool 103 589 00 21 01.
Double fitting (044)	connect. Special tool 102 589 06 63 00.
System pressure	test.
Lower chamber pressure	test.
Deceleration shut-off	test.
Acceleration enrichment	test.
Fuel distributor and fuel pump	test for leaks.

Fuel pressures in bar gauge

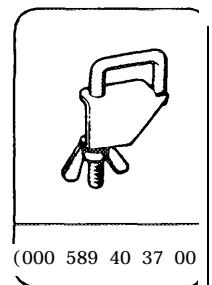
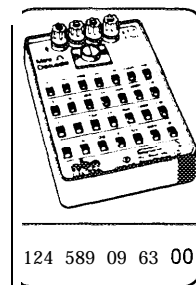
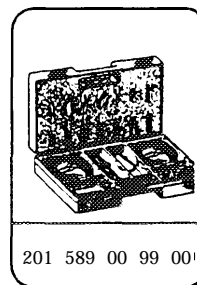
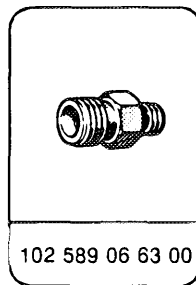
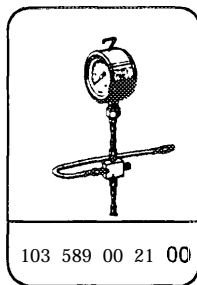
Engine		102.961
Version		I ^{USA}
System pressure when engine cold or engine at normal operating temperature		5.3–5.5
Lower chamber pressure	when engine at normal approx. operating temperature	0.4 ¹⁾
	with connector of engine coolant temperature sensor disconnected	1.0-1.3 ¹⁾
	at engine coolant approx. temperature of + 20 °C, engine stationary or idling	0.5 ³⁾ 0.4 ²⁾
	at engine coolant temperature of + 20 °C and acceleration enrichment	≥ 3.8
	at wide open throttle approx. enrichment and engine at normal operating temperature	0.05 ³⁾
	with deceleration shut-off	5.3–5.5 ⁴⁾

¹⁾ Below previously measured system pressure.

³⁾ Below previously measured lower chamber pressure.

⁴⁾ Lower chamber pressure equal to system pressure

Special tools



Commercially available tester

Multimeter

e. g. Sun, DMM-5

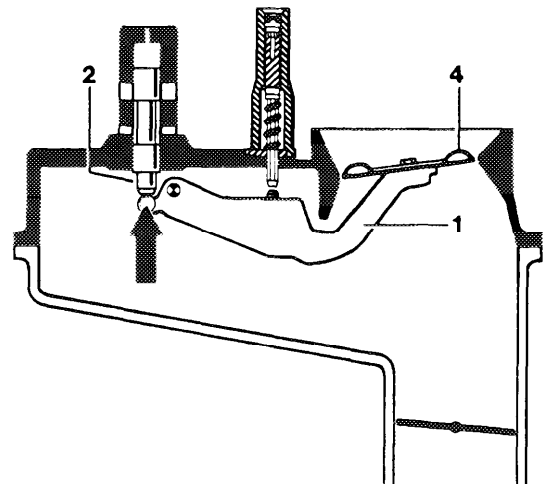
Note

The leak test should only be performed if there exists a problem regarding starting when engine warm.

After switching off the engine, the fuel pressure after 30 minutes must still be 3.0 bar.

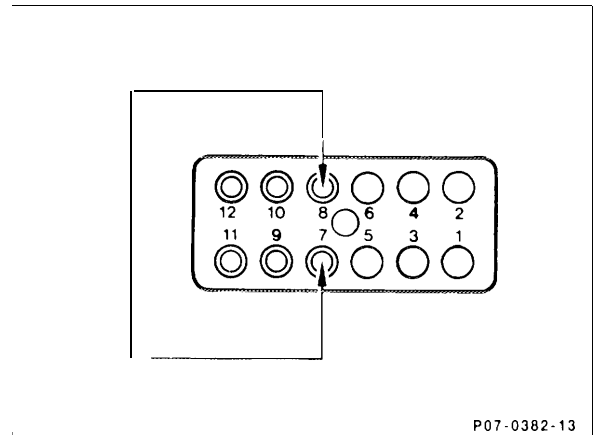
Visual inspection

- 1 Remove air cleaner.
- 2 Check all fuel connections for leaks.
- 3 Check ease of operation of control lever (1) together with air flow sensor plate (4) in the air distributor and of the control plunger (2) in the fuel distributor.



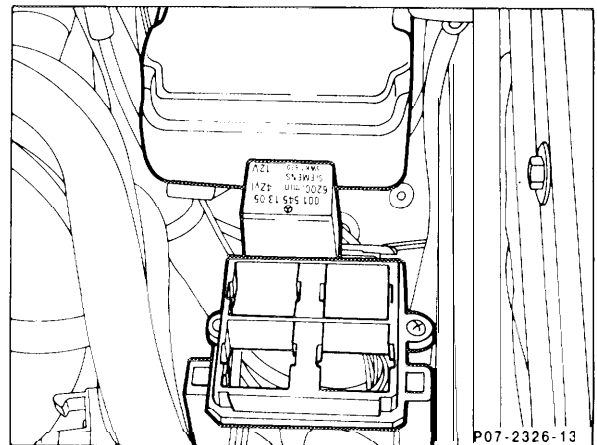
P07-0074-15

This is done by detaching the fuel pump relay module in the right of the component compartment and bridging the two contacts 7 and 8 briefly to build up pressure.



Engine 102.961 in Model 201

The fuel pump relay module is located in front of the electrical center.



Press air flow sensor plate (4) down by hand. The resistance which is felt must be even over the entire travel. No resistance must be felt when the plate is moved rapidly upward as the slow-moving control plunger lifts away from the control lever (1). During a slow upward movement, the control plunger (2) must follow, maintaining a positive contact.

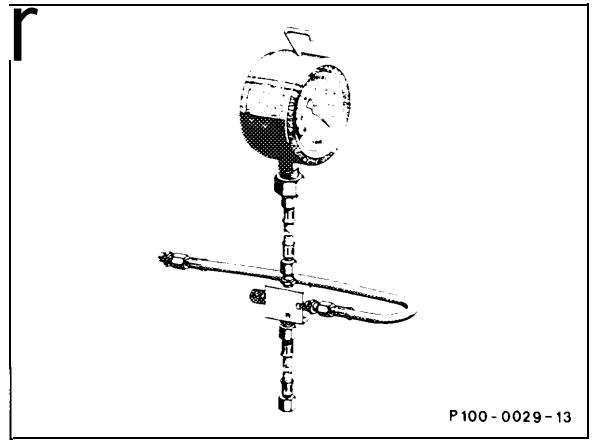
4 Check control plunger in fuel distributor for leaks.

Briefly fully depress air flow sensor plate and hold in this position; a slight leak quantity is permissible (illuminate with endoscope lamp, if necessary).

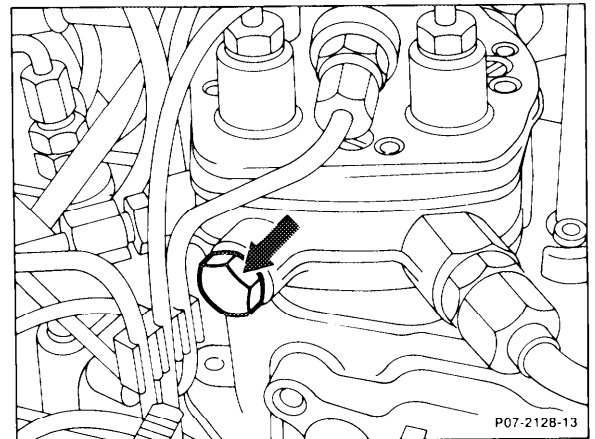
Connecting pressure measuring device.

Connection A = Hose line to lower chamber of fuel distributor

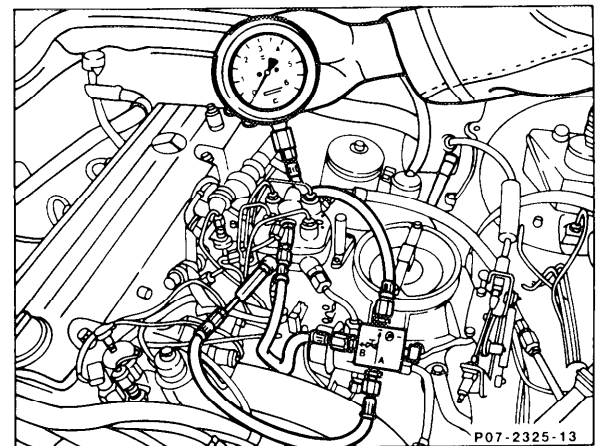
Connection B = Hose line to upper chamber of fuel distributor at starting valve



1 Remove screw plug (arrow) on the lower chamber of the fuel distributor.

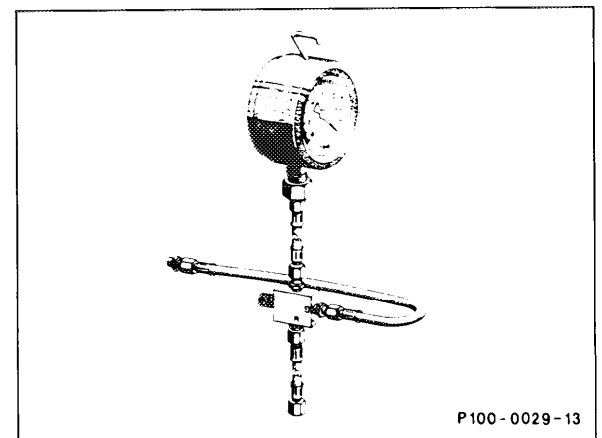


2 Connect hose line from connection "A" on lower chamber.
Use double fitting M8 x1/M12 x1.5, special tool 102 589 06 63 00 for this step.



3 Unscrew fuel line for start valve at fuel distributor.

4 Connect hose line from connection "B" at fuel distributor.



5 Position of valve screws:

a) System pressure

Pressure measuring device = open valve screw.

b) Lower chamber pressure

Pressure measuring device = close valve screw.

Testing

The test of the system and of the lower chamber pressure must be performed with the engine running.

Place pressure measuring device on cylinder head cover.

a) System pressure when engine cold or at normal operating temperature

1 Engine at idle.

2 Take reading of system pressure.

Specification:

Engine 102.96/98 5.3-5.5 bar pressure

3 If the specified value is not reached or is exceeded:

Test fuel pump (07.3-130).

Replace diaphragm pressure regulator.

Check that fuel return line is not blocked.

b) Lower chamber pressure with engine at normal operating temperature

4 Take reading of lower chamber pressure.

Specified pressure **at** operating temperature approx. **0.4** bar below system pressure.

If the specified values are not reached:

Test electrohydraulic actuator **(07.3-I 21)**.

c) Deceleration shut-off

Engine at normal operating temperature.

5 Valve screw closed.

6 Run engine at idle speed. Briefly increase engine speed to approx. 3500/min. As the engine speed drops, the pressure in the lower chamber must rise to system pressure.

Combustion is restored at approx. 1200 – 1600/min.

If the specified value is not reached:

Test microswitch **(07.3-I 21)**.

Test current at actuator **(07.3-121)**.

Vehicles up to 09/88 and model year 1989 with cruise control:

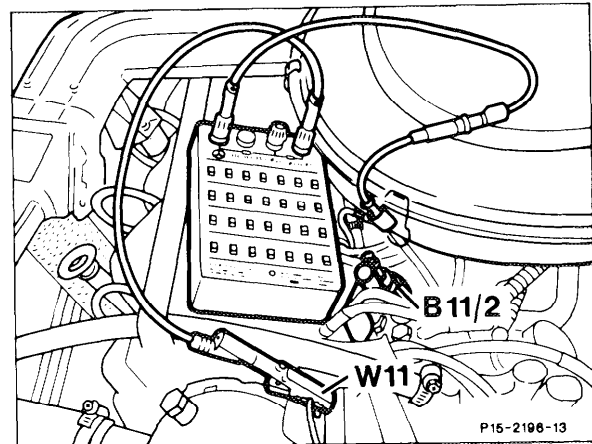
Test signal for cruise control operation (Group **54**).

d) Acceleration enrichment

“Engine cold” must be simulated for testing acceleration enrichment.

7 Valve screw closed.

8 Simulate “engine cold” by feeding in $2.5\text{ k}\Omega$ with Ω decade, corresponds to approx. $+20\text{ }^{\circ}\text{C}$, between engine coolant temperature sensor connection cable and vehicle ground.



B11/2 Engine coolant temperature sensor
W11 Engine ground

9 Start engine. Specified value at $+20\text{ }^{\circ}\text{C}$ approx. 0.5 bar below the previously measured system pressure. Increase engine speed sharply to approx. 2500/min. Lower chamber pressure must drop as engine speed increases.

If the specified value is not reached:

Test volume air flow sensor potentiometer (07.3421).

Test current at actuator (07.3421).

Checking fuel system for leaks

1 Switch off engine. The pressure in the system drops below the opening pressure of the injectors (approx. 3.0 or as from 09188 approx. 3.2 bar gauge pressure).

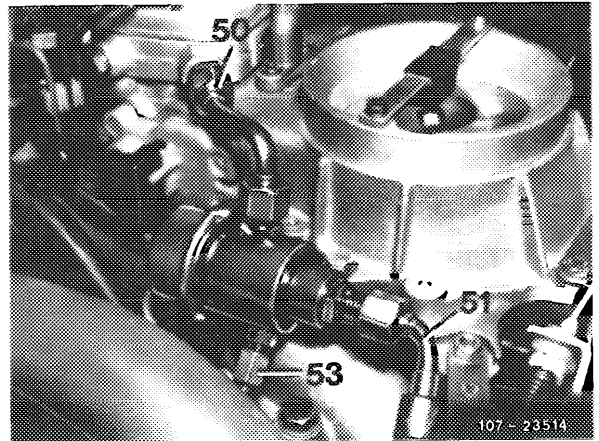
2 If the pressure drops immediately to 0 bar, replace check valve at the fuel pump.

3 If the pressure drops slowly, unscrew fuel return line (51) at the diaphragm pressure regulator. No fuel must flow out subsequently from the diaphragm pressure regulator (a slight leak quantity is permissible).

Caution!

If fuel flows out in the fuel return line (51), seal line with a dummy plug.

4 Pinch leak line at the fuel accumulator with a clamp. If the pressure does not drop, replace fuel accumulator (07.3-270).



5 If no leak is found after performing the leak test, check start valve for leaks by removing start valve (07.3-1 24, test step 2.0 and 2.1). Replace fuel distributor (07.3-205).

6 Disconnect pressure measuring device, collect fuel with a cloth.

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

8 Install air cleaner.

07.3-I 21 Testing electrical components

Preceding work:
Testing, adjusting engine (07. 3-1 10)

The individual test steps (e. g. coolant temperature sensor, intake air temperature sensor etc.) are combined in a test program. If a fault is found during the engine diagnosis which relates to an individual test step, it is not necessary to perform the complete test program but only the individual test step.

The test program is divided into the following sections depending on engine version, model year and CFI designation:

A. National version (USA)

(CFI designation: CFI (KE) II)

(USA) Engine 102.961 and engine 102.985 up to model year 1986

B. National version (USA)

(CFI designation: CFI (KE) III)

(USA) model year 1987/88 engine 102.985

(USA) model year 1991 engine 102.985

**A. National version ^(USA)
(CFI designation: CFI (KE) II)**

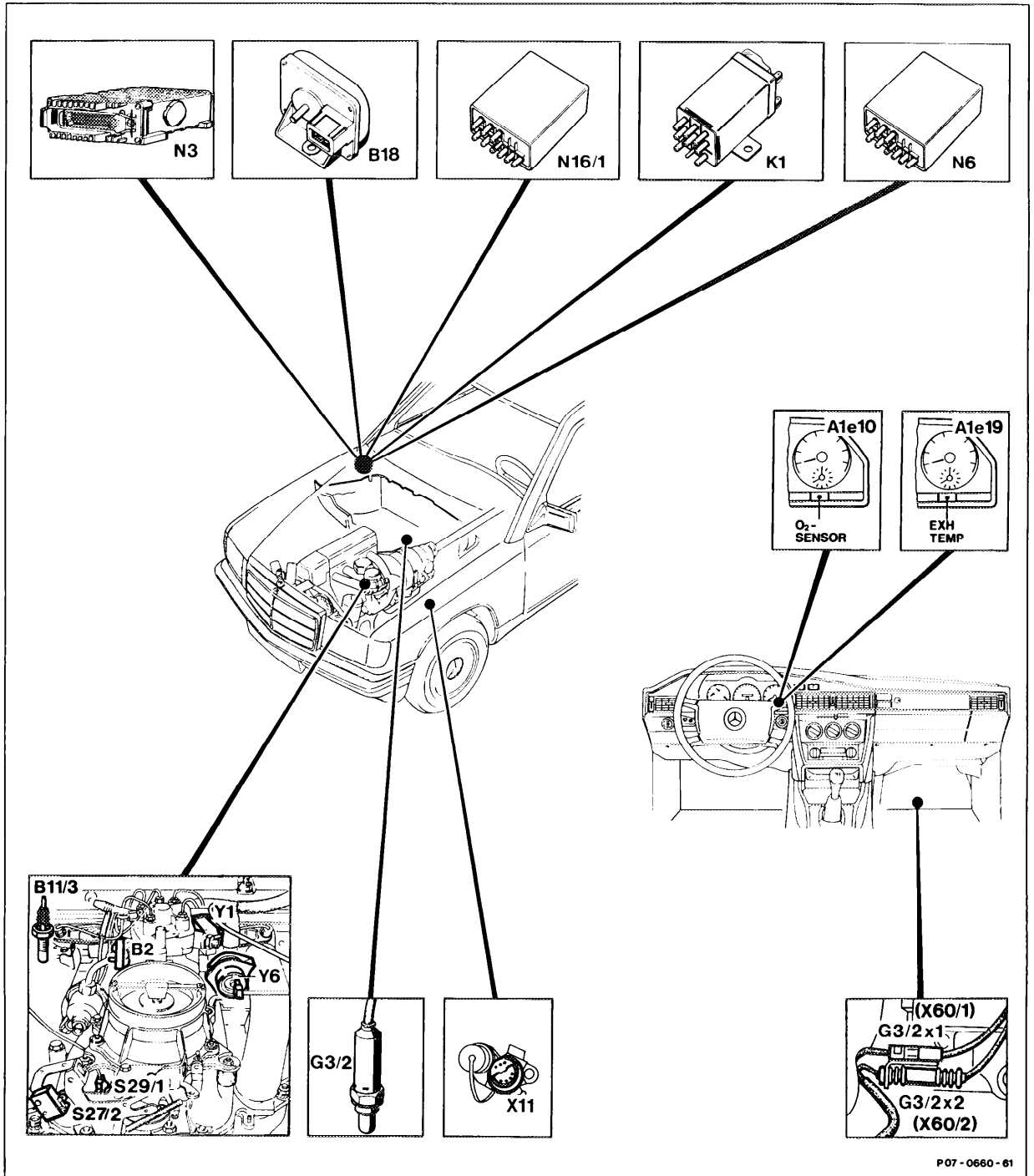
^(USA) Engine 102.961 and engine 102.985 up to model year 1986

- a) Model survey
- b) Arrangement of components
- c) Electrical test data
- d) Wiring diagrams
- e) Pin assignment of CFI control module (N3) coupling
- f) Special tools, commercially available tools
- g) Connecting testers according to connection diagram
- h) Test program with socket box
- i) Table of voltage values for engine coolant temperature sensor (B113)
- j) Table of barometric pressure sensor (B18)
- k) Testing deceleration shut-off

a) Model survey

Model	Engine	Version	Model year
201.024	102.961	^(USA)	1984
	I 102.985	I ^(USA)	1985
	I 102.985	I ^(USA)	1986

b) Arrangement of components



P07 - 0660 - 61

Ale10	"heated oxygen sensor" malfunction indicator lamp 1984/85: alternating display 1986/87: failure display	N3 N6	CFI control module A/C compressor control module
B2	Volume air flow sensor position Indicator	N16/1	Fuel pump relay module (USA) 1984: (N5/1) in front of electrical center)
B11/3	Engine coolant temperature sensor	S27/2	Deceleration shut-off microswitch
B18	Barometric pressure sensor	S29/1	Wide open throttle throttle position switch
G3/2	Heated oxygen sensor	XI 1	Diagnosis connector/terminal block terminal TD
G3/2x1	Heated oxygen sensor connector	Y1	Electrohydraulic actuator
G3/2x2	Oxygen sensor signal connector (1 -pole)	Y6	Idle air control valve
K1	Ovoltage protection relay (USA) 1984: in electrical center)		

c) Electrical test data (current at actuator in mA)

Engine	National version model year	Ignition: ON	Engine coolant temperature sensor		Post-start enrichment Post-start at + 20 °C	Acceleration enrichment Engine coolant temperature + 20 °C and blipping throttle	Wide open throttle correction at approx. 2000/min	Partial load mixture adaptation
			Engine coolant temperature + 20 °C (warm-up base value) Resistance 2.3-2.8 kΩ	Engine coolant temperature + 80 °C Resistance 290-370 Ω				
102.961	(USA) 1984	-	9-14	7-9	20-28	> 15	7-9 ¹⁾	Readout fluctuates
102.985	(USA) 1985/186	-			1-4		8-11	

Deceleration shut-off: current at actuator approx. -60 mA

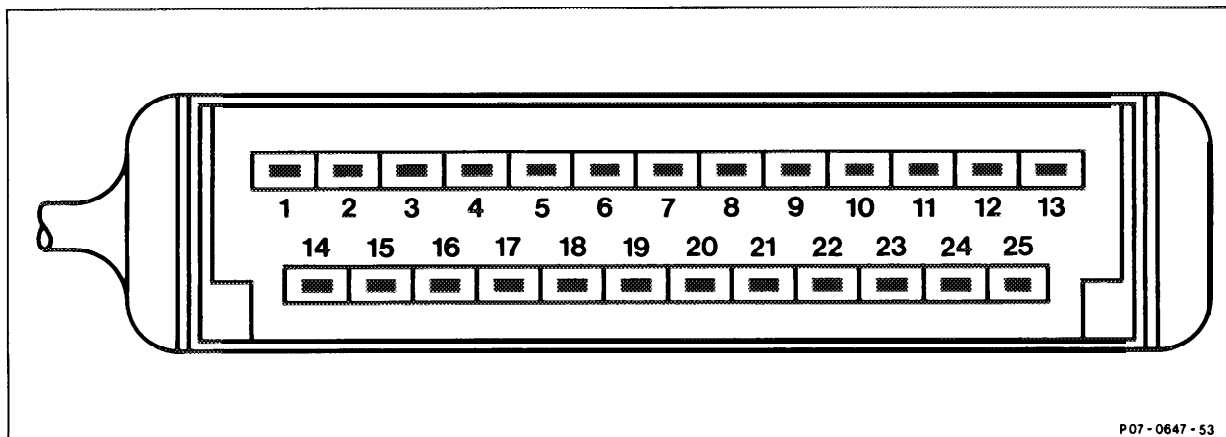
¹⁾ independent of engine speed

d) Wiring diagrams

The wiring diagrams are assigned to the relevant electrical troubleshooting manual according to the model.

Electrical Troubleshooting Manual Model 201

e) Pin assignment of CFI control module coupling (N3)

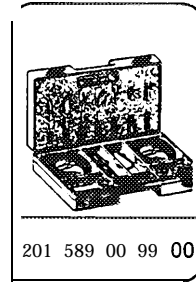
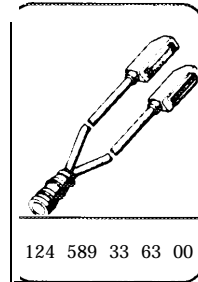
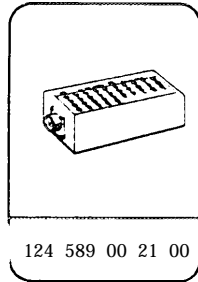
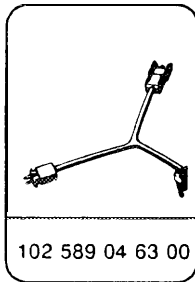


P07 - 0647 - 53

1	Overvoltage protection relay (K1) contact 2, terminal 87	17	Air flow sensor potentiometer (B2), contact 2
2	Engine ground(W1 1) (USA) 1984: battery ground (W1 0)	18	Air flow sensor potentiometer (B2), contact 3 looped via Barometric pressure sensor (B18)
3	Idle air control valve (Y6), contact 3	19	Compressor cutoff control module (N6) (USA) A/C compressor pressure switch plug connection (X78)
4	Idle air control valve (Y6), contact 1	20	Battery ground (W 10)
5	Wide open throttle/closed throttle position switch (S29/1 or S29/2)	21	Engine coolant temperature sensor
6	Cruise control plug connection	22	not assigned
7	Ground of connector 7 is linked internally to ground of connector 2	23	Diagnosis connector (XI 1), contact 3 via headlamp wiring harness plug connection (lambda control)
8	Heated oxygen sensor (G3/2), sensor signal	24	Fuel pump relay (N5/1,N5/2,N16/1,N16/2) contact 12, terminal 50
9	not assigned	25	Fuel pump relay (N5/1,N5/2,N16/1,N16/2) contact 10, TD signal
10	Electrohydraulic actuator (Y 1)		
11	Barometric pressure sensor		
12	Electrohydraulic actuator (Y 1)		
13	Deceleration shut-off microswitch(S27/2),idle speed detection		
14	Air flow sensor potentiometer (B2), contact 1 and Barometric pressure sensor (B18), connector 3		
15	not assigned		
16	Model 201with manual transmission: Battery ground (W10) (USA) 1984 engine 102.961: not assigned Model 201 with automatic transmission: (USA) fuel pump wiring harness plug connection (X36/1) contact 3		

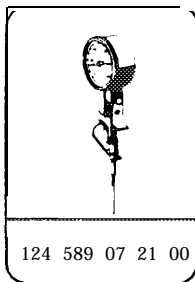
f) Special tools, commercially available tools

Special tools



Test resistance
for testing
electrical
components of
CFI

102 589 05 63 00



Commercially available tools

Multimeter

e. g. Sun, DMM-5

Twin socket

e. g. Hermann, ECD 53

Lambda control tester

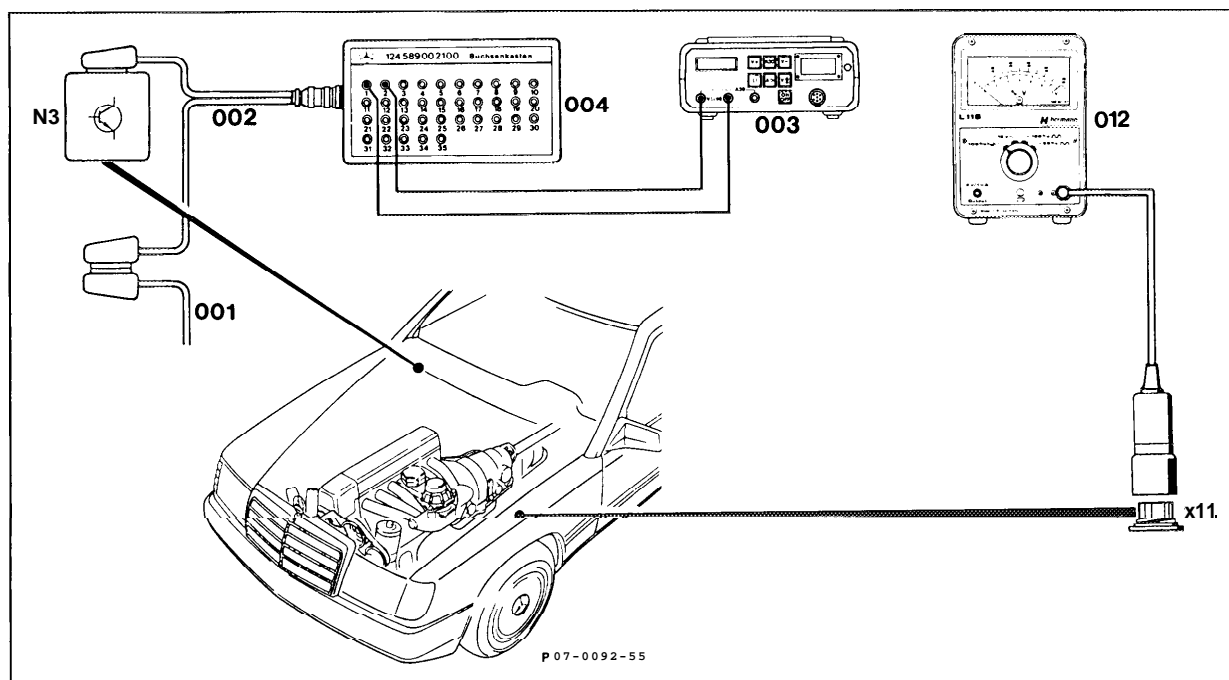
e. g. Hermann, L 115
e. g. Bosch, KDJE-P 600 ¹⁾

Engine tester

e. g. Bosch, MOT 002.02

¹⁾ Special tool in USA

g) Connecting testers according to connection diagram








- 001 CFI control module coupling
- 002 Test cable
- 003 Multimeter
- 004 Socket box
- 012 Lambda control tester

- 033 Test cable 102 589 04 63 00
- N3 CFI control module
- x11 Diagnostic connector

h) Test program with contact box

Key to symbols

	Socket box
	Battery
	Multimeter
	Contact
	Connector



Voltage measurement (volts, direct voltage)



Voltage measurement (amperes, direct voltage)












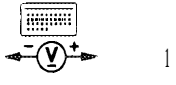
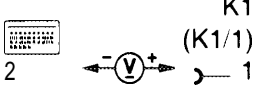
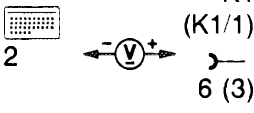
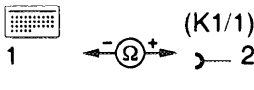

Resistance measurement (ohms)


Note








If the specified value of a test step, e. g. step **4.0**, is in order, it is not necessary to perform test step 4.1.

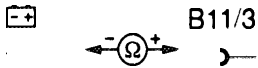
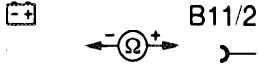
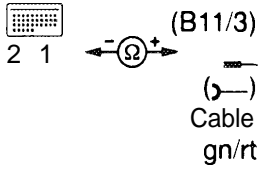


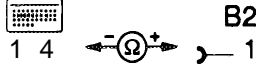
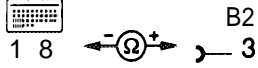
Different component designations are possible depending on the wiring diagram or in the case of vehicles with optional equipment. These designations are given in parentheses.


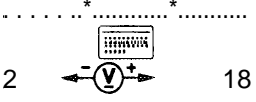






On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specifi- cation	Possible cause/Remedy
-	1.0 Ground	 2   +	Ignition: ON	11-14 V	Ground connection W11 loose, cable has open circuit
-	2.0 Ground	 7   +		11-14 V	CFI control module defective
-	3.0 Ground	 20   +		11-14 V	Ground connection W10 loose, cable has open circuit

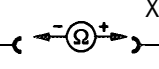


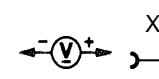

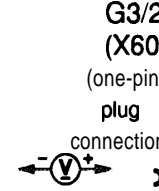
On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specifi- cation	Possible cause/ Remedy
	4.0 Supply voltage from (N3), terminal 15		Ignition: ON	11 - 14v	Fuse in overvoltage protection, overvoltage protection defective or not connected. Cable to contact 1 (terminal 30) has open circuit. Actuation of contact 3 (terminal 15) has open circuit. Cable from contact 2 (terminal 87 or 87E) to (N3) contact 1 has open circuit
	4.1 Cable terminal 30		Ignition: OFF Overvoltage protection disconnected	11 - 14v	Cable has open circuit
	4.2 Cable terminal 15		Ignition: ON Overvoltage protection disconnected	11 - 14v	Cable has open circuit
	4.3 Cable terminal 87 or 87E		Ignition: OFF Overvoltage protection disconnected	< 1 Ω	Cable has open circuit
	4.4 Cable terminal 31 (ground)		Ignition: OFF Overvoltage protection disconnected	< 1 Ω	Cable has open circuit

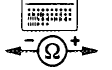
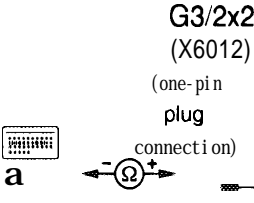
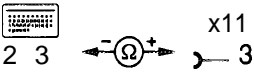
On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specifi- cation	Possible cause/Remedy
	5.0 Current at actuator	 set to A	<p>Connect test cable 102 545 04 63 00 to actuator. Ignition: ON</p> <p>Coupling at engine coolant temperature sensor disconnected</p> <p>20 °C simulated with test resistance</p> <p>Additionally coupling of Deceleration shut-off microswitch (S27/2) disconnected. Start engine and blip throttle</p> <p>Coupling of Wide open throttle/closed throttle position switch (wide open throttle contact) bridged.</p> <p>Coupling of Deceleration shut-off microswitch (S27/2) disconnected. Start engine</p>	<p>75-05 mA</p> <p>see table section c), warm-up base value</p> <p>see table, acceleration enrichment</p> <p>see table, wide open throttle correction at 2000/min</p>	<p>Electrohydraulic actuator Wiring CFI control module</p> <p>Volume air flow sensor potentiometer, see test step 9.0</p>

On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specifi- cation	possible cause/Remedy
-	6.0 Electro- hydraulic actuator	10  12	Ignition: QFF Disconnect test cable. Coupling at CFI control module disconnected	19.5 $\pm 1 \Omega$	Electrohydraulic actuator Wiring
	6.1 Electro- hydraulic actuator	1  2	Coupling at (Y1) dis- connected	19.5 $\pm 1 \Omega$	Replace electrohydraulic actuator
	6.2 Cable	 Y1		$< 1 \Omega$	Cable has open circuit
	6.3 Cable	 Y1		$< 1 \Omega$	Cable has open circuit
-	7.0 Wide open throttle contact	1  5	Ignition: OFF Coupling at CFI control module disconnected Accelerator in wide open throttle position	∞ $< 1 \Omega$	Wide open throttle contact Wiring (to terminal 15)
	7.1 Wide open throttle contact	 S29/1	Coupling of Wide open throttle/closed throttle position switch plug connection disconnected Accelerator in wide open throttle position	∞ $< 1 \Omega$	Set or replace throttle position switch
-	8.0 Engine coolant temperature sensor	2  2 11	Engine at idle (operating temperature). CFI control module connected	At $+ 80 \text{ }^\circ\text{C}$ 0.29– 0.35 v other values see table section i)	Engine coolant temperature sensor Wiring

On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specifi- cation	Possible cause/Remedy
-	A 8.1 Engine coolant temperature sensor 1-pin	 B11/3	Coupling at temperature sensor disconnected	Ω value see table section i)	Replace engine coolant temperature sensor
	B 8.1 Engine coolant temperature sensor 2-pin	 B11/2	Both couplings at temperature sensor disconnected (measure both contacts)	Ω value see table section i)	Replace engine coolant temperature sensor
	8.2 Cable	 B11/2 (B11/3) Cable gn/rt		< 1 Ω	Cable has open circuit
	9.0 Volume air flow sensor potentiometer	14  18 14  17	Ignition: OFF CFI control module disconnected. Air flow sensor plate in zero position Volume air flow sensor plate in zero position Volume air flow sensor plate deflected	3.2-4.8 kΩ 560-840 Ω 3.8-5.6 kΩ	Replace or set volume air flow sensor potentiometer Wiring CFI control module Barometric pressure sensor, see test step 10.0
	9.1 Cable	 B2	Ignition: OFF measure at coupling (B2)	< 1 Ω	Cable has open circuit
	9.2 Cable	 B2		< 1 Ω	Cable has open circuit

On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specifi- cation	Possible cause/Remedy
-	9.3 Cable	 B2 1 7		< 1 Ω	Cable has open circuit
	9.4 CFI control module	 2 18	Ignition: ON CFI control module connected	7.4- 8.6 v	Replace CFI control module
	10.0 Barometric pressure sensor	 7 1	Ignition: OFF CFI control module coupling and coupling at volume air flow sensor potentiometer disconnected	Values, see table section j	Wiring Replace Barometric pressure sensor
	10.1 Cable	 B18 1 1	Ignition: OFF Coupling at (B18) dis- connected	< 1 Ω	Cable has open circuit
	10.2 Cable	 B18 1 8		< 1 Ω	Cable has open circuit
	10.3 Cable	 B18 1 1		< 1 Ω	Cable has open circuit
	11.0 TD signal	 2 25	Engine at idle (operating temperature). CFI control module connected	6-12 V	Ignition control module Wiring
	11.1 Cable	 x11 2 5	Ignition: OFF	< 1 Ω	Cable has open circuit

On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specifi- cation	Possible cause/Remedy
	11.2 Cable	N1/2 TD  XI 1 1	Coupling (TD signal) at ignition control module dis- connected	< 1 Ω	Cable has open circuit
	12.0 Terminal 50 (start detection)	2  2 4.	Starter: ON Selector lever of automatic transmission in position "P" or "N"	11-14 V	Cable
	12.1 Cable	 Relay Fuel pump 24 12	Ignition: OFF	< 1 Ω	Cable has open circuit
	13.0 Lambda control	 XI 1 3	Engine at idle (operating temperature). CFI control module connected	2.1-4.8 V Readout fluctu- ates	Heated oxygen sensor Wiring
	13.1 Heated oxygen sensor	7  8	Engine at idle (operating temperature). CFI control module connected	fluctu- ates between 0.1-0.9 v	Heated oxygen sensor Wiring
	13.2 Heated oxygen sensor	 G3/2x2 (X60/2) (one-pin plug connection) 7	Engine at idle (operating temperature). Separate plug connection (G3/2x2) and place connector to ground (lean simulation)	> 450 mV	Replace heated oxygen sensor

On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specifi- cation	Possible cause/Remedy
-	13.3 Cable	7  8	Ignition: QFF Coupling at CFI control module disconnected	∞	Cable defective
	13.4 Cable	 G3/2x2 (X6012) (one-pin plug connection)		< 1 Ω	Cable has open circuit
	13.5 Cable	 x11		< 1 Ω	Cable has open circuit

i) Table of voltage values for engine coolant temperature sensor

Temperature in °C	Resistance	Voltage at contact 21 coolant (volts)
-20	15.7 k Ω	3.24-3.94
-10	9.2 k Ω	2.04-3.47
0	5.9 k Ω	2.39-2.93
10	3.7 k Ω	1.94-2.37
20	2.5 k Ω	1.51-1.84
30	1.7 k Ω	1.16-1.42
40	1.18 k Ω	0.88-1.08
50	840 Ω	0.66-0.80
60	600 Ω	0.50-0.61
70	435 Ω	0.38-0.46
80	325 Ω	0.29-0.35
90	247 Ω	0.22-0.26

Note

For engine 102.961 only the engine coolant temperature sensor (B11/3) with the M14 × 1.5 thread is supplied for parts requirements. When performing repairs, fit the temperature sensor in place of the M14 × 1.5 plug.

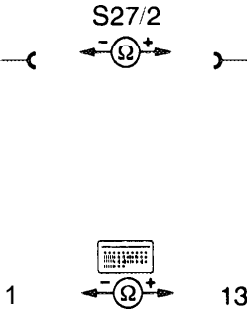


The previous installation point should be sealed with the M10 × 1 plug,
Part No. 007 604 01 01 02, and seal,
Part No. 007 603 01 01 01.


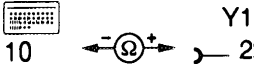
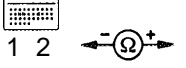
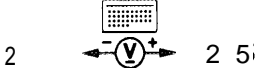
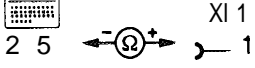
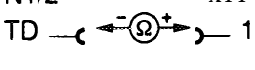
j) table of Barometric pressure sensor (B18)

Altitude above sea level/meters	Barometric pressure p absolute/mbar	Voltage at contact 14 (to ground) volts
0	1013	4 ± 1
1000	899	3 ± 1
2000	795	2 ± 1

k) Testing deceleration shut-off

Connection diagram of socket box, see section g)

On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specifi- cation	Possible cause/Remedy
	1.0 Deceleration shut-off		Engine speed > 3000 (engine at operating temperature). CFI control module connected Operate deceleration shut-off microswitch (S27/2) by hand	Engine surges	Deceleration shut-off microswitch Wiring CFI control module Check throttle control (30-300)
	1.1 Deceleration shut-off microswitch (S27/2)		Coupling at microswitch disconnected Depress accelerator Ignition: OFF Depress accelerator	< 1 Ω ∞ < 1 Ω ∞	Replace microswitch Wiring
	1.2 Cable			< 1 Ω	(Cable has open circuit
	1.3 Cable			< 1 Ω	(Cable has open circuit to terminal 15

On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specifi- cation	Possible cause/Remedy
	2.0 Current at actuator	 set to A	Connect test cable 102 545 04 63 00 to actuator. Engine speed > 3000/min. Operate deceleration shut-off microswitch (S27/2) by hand	-60 mA	Wiring TD signal CFI control module
	2.1 Cable	 10 ← Ω+ → 2		< 1 Ω	Cable has open circuit
	2.2 Cable	 1 2 ← Ω+ → Y1		< 1 Ω	Cable has open circuit
	2.3 TD signal	 2 ← V+ → 2 5	Engine at idle (operating temperature). CFI control module connected	6-12 V	Wiring
	2.4 Cable	 2 5 ← Ω+ → XI 1	Ignition: OFF	< 1 Ω	Cable has open circuit
	2.5 Cable	 N1/2 ← Ω+ → x11 TD ← Ω+ → 1	Coupling (TD signal) at ignition control module dis- connected	< 1 Ω	Cable has open circuit

B. National version (USA)
(CFI designation: CFI (KE) III)

(USA) model years 1987/88 engine 102.985

(USA) model year 1991 engine 102.985

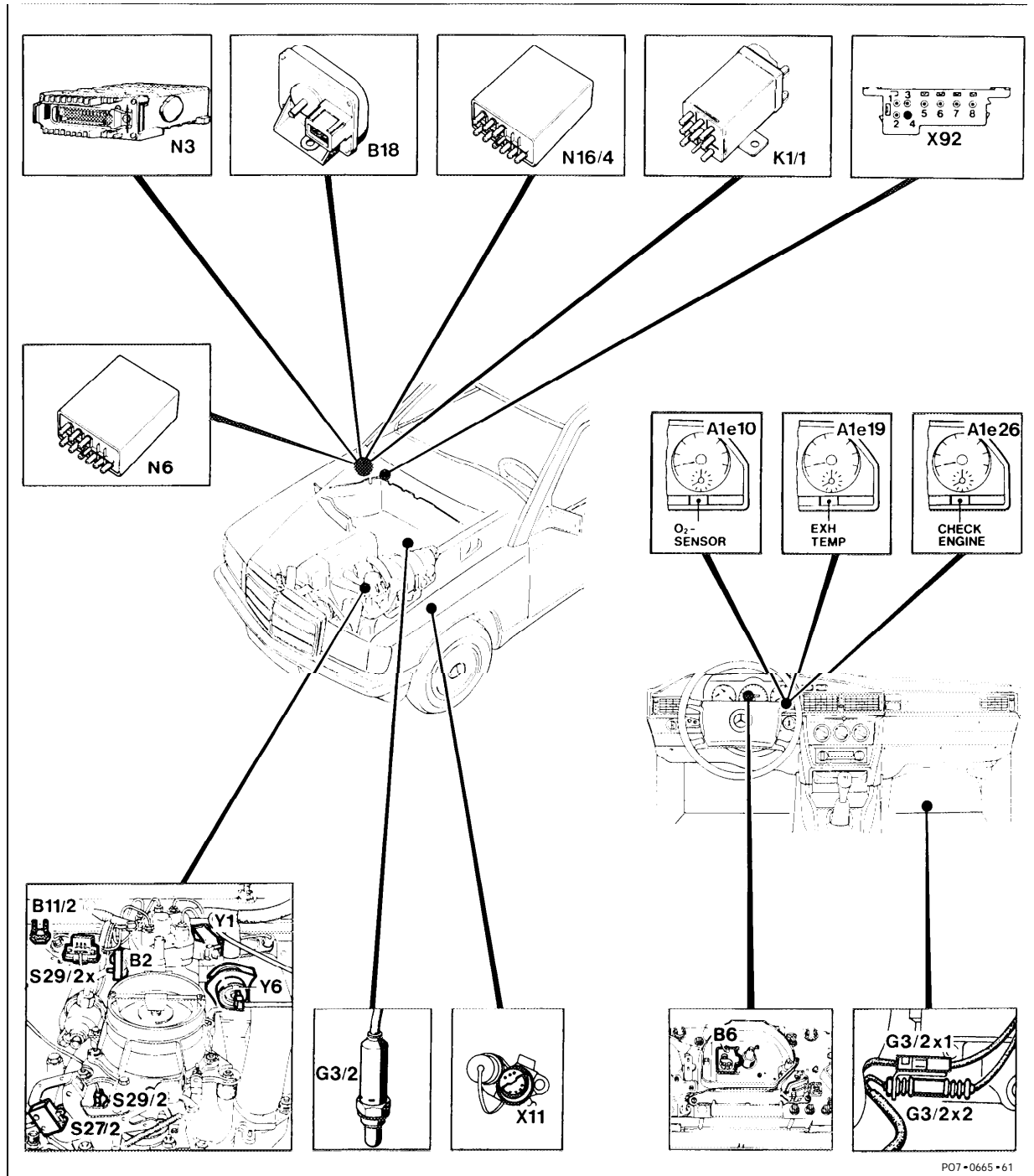
- a) Model survey
- b) Arrangement of components
 - (USA) up to model year 1988
- c) Electrical test data
- d) Wiring diagrams
- e) Pin assignment of CFI control module (N3) coupling
- f) Without fault diagnosis by measuring on/off ratio
- g) Fault diagnosis by measuring on/off ratio
- h) Special tools, commercially available tools
- i) Trouble diagnosis diagram
- j) Test program with socket box
- k) Table of voltage values of engine coolant temperature sensor (B11/2) and of intake air temperature sensor (B17/2)
- l) Barometric pressure sensor (B18)
- m) DTC output at diagnosis test coupling
 - On Board Diagnosis System (USA) California model year 1988/1991
- n) Testing deceleration shut-off
- o) Testing road speed signal (USA) model year 1988
- p) Testing post-start enrichment and warm-up base value (USA) 1991
- q) Testing transmission upshift delay relay module (USA) 1991
- r) Testing exhaust gas recirculation temperature sensor (B21) (USA) 1991 California

a) Model survey

Model	Engine	Version	Model year
201.028	102.985	USA	1988
		USA Federal	1988/1991
		USA California	

b) Arrangement of components

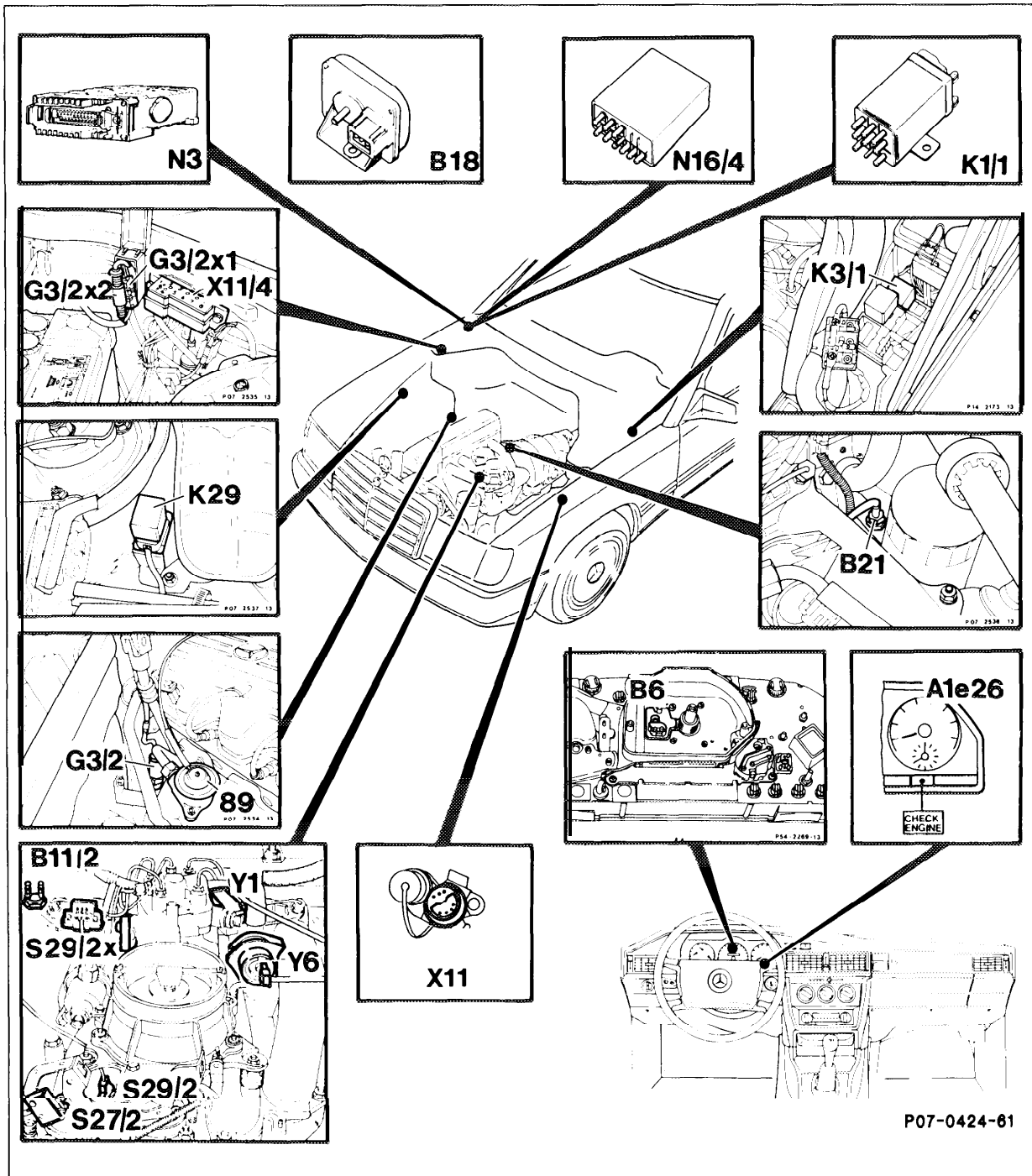
(USA) up to model year 1988



Ale10	(USA) "heated oxygen sensor" malfunction indicator lamp (1986/87: failure Indicator)	K1/1	Overvoltage protection relay
Ale26	(USA 1988) "CHECK ENGINE" malfunction indicator lamp	N3	CFI control module
B2	Volume air flow sensor position Indicator	N6	A/C compressor control module
B6	Hall-effect speed sensor (USA 1988)	N16/4	Fuel pump relay
B11/2	Engine coolant temperature sensor	S27/2	Deceleration shut-off microswitch
B18	Barometric pressure sensor	S29/2	Wide open throttle/closed throttle position switch
G3/2	Heated oxygen sensor	S29/2x	Throttle position switch plug connection
G3/2x1	Heated oxygen sensor heating coil plug connectron	x11	Diagnosis socket/terminal block, terminal TD
G3/2x2	Heated oxygen sensor signal plug connectron	x92	(USA California 1988): Diagnostic connector
		Y1	Electrohydraulic actuator
		Y6	Idle air control valve

Arrangement of components

USA 1991 Engine 102.985






A1e26 CHECK ENGINE malfunction Indicator lamp
 B2 Volume air flow sensor position indicator
 B6 Hall-effect speed sensor
 B11/2 Engine coolant temperature sensor
 4-pin
 B18 Barometric pressure sensor

B21 Exhaust gas recirculation (EGR) temperature sensor (California only)
 G3/2 Heated oxygen sensor
 G3/2x1 Heated oxygen sensor heating coil plug connection
 G3/2x2 Heated oxygen sensor signal plug connection
 K1/1 Overvoltage protection relay
 K29 Transmission shift point retard relay

N3	CFI control module	S29/2x1	Wide open throttle/closed throttle position switch plug connection
N16/4	Fuel pump and kickdown shutoff relay	x11	Diagnosis socket/terminal block, terminal TD
S27.2	Deceleration shut-off microswitch	X11/4	Diagnostic connector, 8-pin (pulse signal)
S29/2	Wide open throttle/closed throttle position switch	Y1	Electrohydraulic actuator
		Y6	Idle air control valve

c) **Electrical test data** (current at actuator in mA)

Engine	National version Model year	Ignition: ON	Engine coolant temperature sensor		Post-start enrichment Post-start at +20 °C	Acceleration enrichment Coolant temperature +20 °C and blipping throttle	Wide open throttle correction at approx. 2000/min	Part load mixture adaptation
			Engine coolant temperature +20 °C (warming-up base value) Resistance 2.3–2.8 kΩ	Engine coolant temperature +80 °C Resistance 290–370 Ω				
102.985	 1985/86	20	0 ± 1 ²⁾ 40 s after start	0 ± 3	8–14	> 15	3–6	Readout fluctuates
102.985	 1987/88	20	1–5 ¹⁾ 2) ⁴⁾	0 ± 3	7–13 ¹⁾ 2) ³⁾	> 8	2–5	Readout fluctuates
102.985	 1991	50	-6 to ± 0	0 ± 3	-3 to +3	> 15	4–6	Readout fluctuates

Deceleration shut-off: current at actuator approx. -60 mA


- 1) Must be greater by the indicated current value than that at 80 °C engine coolant temperature.
- 2) Test with plug connection **G3/2x2** (heated oxygen sensor signal plug connection) separated
- 3) Take reading of current value at multimeter 1 – 2 seconds after end of start
- 4) Take reading of current value at multimeter 5 seconds after end of start

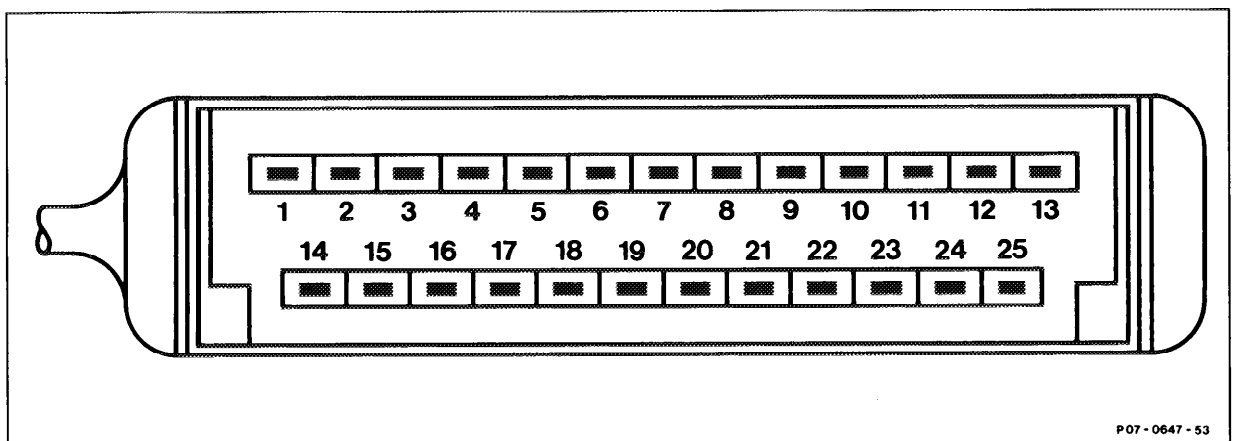
d) Wiring diagrams

The wiring diagrams are assigned to the relevant electrical troubleshooting manual according to the model.

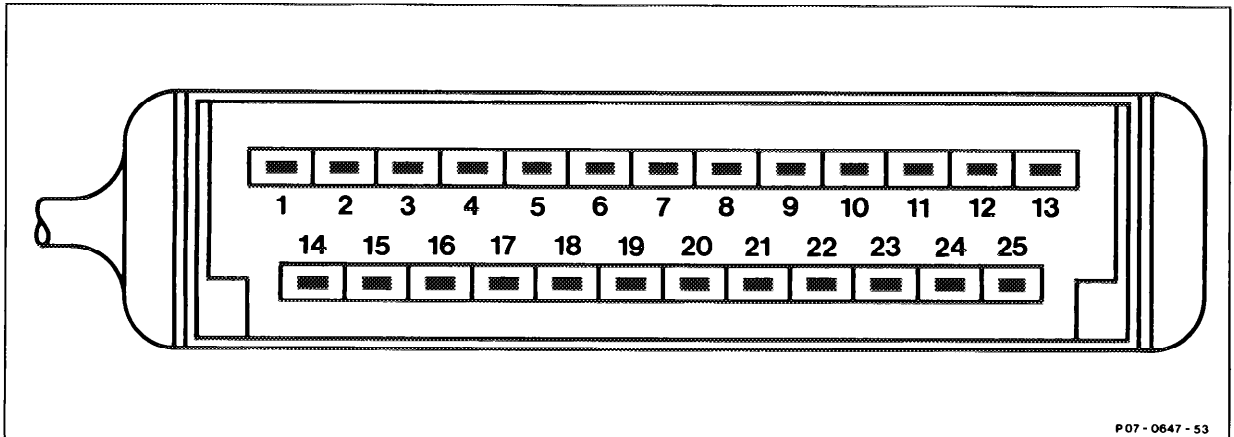
Electrical Troubleshooting Manual Model 201

e) Pin assignment of CFI control module (N3) connector

 model year 1987/88



	Overvoltage protection relay up to 08/88: (K1) contact 2, terminal 87 as of 09/88: (K1 /1) contact 2, terminal 87E	16	Gear detection with automatic transmission via terminal 50 (in selector lever position "P" or "N", ground at connector 16 via starter)
2	Engine ground (W 11)		Model 201 manual transmission:
3	Idle air control valve (Y6), contact 1		Battery ground (W 10)
4	not assigned		Model 201 automatic transmission:
5	Throttle positron switch (S29/2), contact 3, wide open throttle detection		Engine wiring harness/taillamp harness plug connection, 2-pin (X1 8, X26/3)
6	USA up to 1987: Cruise control injection system plug connection (X33)	17	Volume air flow sensor position indicator (B2), contact 2
	USA 1988: Hall-effect speed sensor signal	18	Volume air flow sensor position indicator (B2), contact 3
	Ground of connector 7 is linked internally to ground of connector 2	19	A/C compressor control module (N6), contact 4 (terminal 87z)
8	Heated oxygen sensor (G3/2), sensor signal	20	Battery ground (W 10)
		21	Engine coolant temperature sensor (B 11/2)
9	Fuel pump relay (N16/1, N16/2, N16/3, N16/4) contact 2, TF signal	22	CFI reference resistor (R17/1) Jumper (0 Ω) incorporated in cable set
10	Electrohydraulic actuator (Y1), contact 2 (10)		USA 1988: not assigned (fixed resistor in CFI control module)
11	Engines 102.96/985:	23	Diagnosis socket (X1 1), contact 3 (on/off ratio)
	Barometric pressure sensor (B18), contact 1		Model 201: via headlamp wiring harness plug connection (X24, X26/1)
12	Electrohydraulic actuator (Y1), contact 1 (12)		USA California 1988: "CHECK ENGINE" malfunction Indicator lamp
13	Throttle position switch (S29/2), contact 1, closed throttle position detection	24	Deceleration shut-off microswitch (S27/2), contact 1
14	not assigned	25	Fuel pump relay (N16/1, N16/2, N16/3, N16/4), contact 10, TD signal
15	USA Federal up to 1987: heated oxygen sensor malfunction indicator lamp (AI e10)		
	USA Federal 1988: "CHECK ENGINE" malfunction Indicator lamp (AI e26)		
	USA California 1988 (with DTC memory): Terminal 30a, of overvoltage protection relay (K1/1), contact 4		



P07 - 0647 - 53

1	Battery voltage, terminal 67 L (K1/1)	16	Gear detection
2	Engine ground (W11)	17	Air flow sensor signal
3	Idle air control valve	18	Supply voltage of barometric pressure sensor, volume air flow sensor
4	not assigned	19	A/C compressor signal
5	Full throttle contact	20	Battery ground
6	Road speed signal (Hall-effect sensor)	21	Engine coolant temperature sensor
7	Looped ground from contact 2	22	Exhaust gas recirculation temperature sensor (California only)
8	Heated oxygen sensor signal	23	Output signal for lambda control on/off ratio, fault pulse display, CHECK ENGINE malfunction indicator lamp
9	TF signal at pump relay	24	Deceleration shut-off microswitch
10	Electrohydraulic actuator	25	TD signal
11	Barometric pressure sensor signal		
12	Electrohydraulic actuator		
13	Closed throttle position contact		
14	Transmission shift point retard		
15	Terminal 30 of overvoltage protection relay (K1/1)		

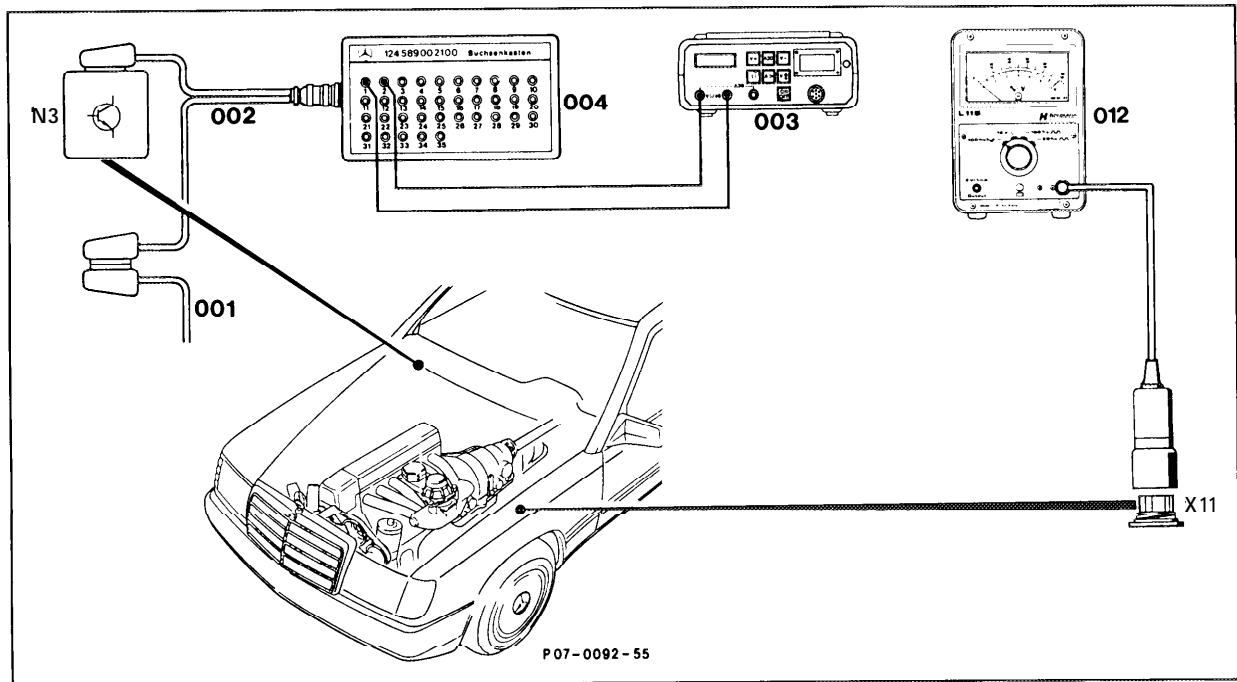
f) Without fault diagnosis by measuring on/off ratio

Up to approx. 1986 no diagnostic trouble code detection is integrated in the CFI control module (see table, 07.3-250).

On these vehicles it is not possible to specifically start the test program by measuring the on/off ratio.

In such cases the "Test program with socket box" without % display should be performed in turn.

g) Fault diagnosis by measuring on/off ratio



Testers	connect to CFI control module (N3), CFI control module coupling (001) and diagnostic connector (X1 1): test cable (002) multimeter (003) contact box (004) lambda control tester (012) test cable (033).
Engine	at idle.
Battery voltage	11 - 14 volts.
Engine oil temperature	approx. 80 °C.
On/off ratio	measure. Rectify faults according to "Fault diagnosis table" or "Test program with socket box".

**(USA) 1988 California and
(USA) 1991 with diagnostic trouble code**

storage:

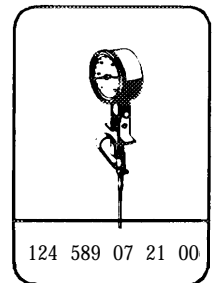
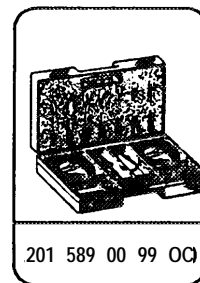
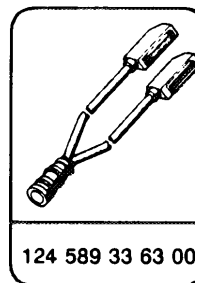
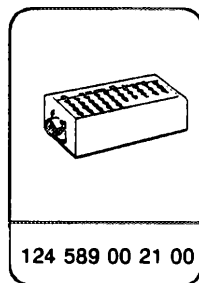
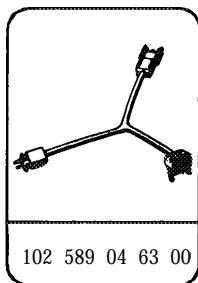
The CFI control module must be switched over to output of on/off ratio because the signal for the diagnostic trouble code (DTC) display is output as priority.

The output of the on/off ratio is performed once all the DTCs have been read out and the start button of the impulse counter scan tool or the non-locking switch on the diagnostic connector (California version only) is then once again pressed (see section m).

The % readout now fluctuates when the engine is running at normal operating temperature and there are no DTCs.

h) Special tools, commercially available tools

Special tools



Commercially available tools

Multimeter

e. g. Sun, DMM-5

Twin socket

e. g. Hermann, ECD 53

Lambda control tester

e. g. Bosch KDJE-P 600
e. g. Hermann, L 1 1 5

Engine tester

e. q. Bosch, MOT 002.02

i) Trouble diagnosis table

The CFI control module monitors various components of the CFI injection system since approx. 1986 (see Op. No. 07.3-250). If a fault is detected, a certain on/off ratio is output to the diagnostic connector (contact 3) and can be measured there with the lambda control tester. The relation of on/off ratio and possible cause of fault is presented in the table below.

On/off ratio in %	Possible causes of fault
0	<ul style="list-style-type: none"> - No voltage or ground at diagnostic connector (XI 1) - Cable from diagnostic connector (XI 1) to CFI control module (N3) has open circuit - Lambda control tester defective - Mixture setting too "rich" (on/off ratio 0 - 8 % also possible) - (USA) California model year 1988 and (USA) 1991: CFI control module not switched over to on/off ratio output.
10	<ul style="list-style-type: none"> - Volume air flow sensor position indicator (B2) has incorrect polarity or is defective (possibly fast idle speed) - Pin assignment of throttle position switch coupling, closed throttle position and wide open throttle contact, has incorrect polarity or closed throttle position contact defective (ignition point at idle speed advanced approx. 10°)
20	<ul style="list-style-type: none"> - Wide open throttle contact has incorrect polarity or is defective Readout 20 % only when deceleration shut-off microswitch actuated
30	<ul style="list-style-type: none"> - Short circuit or open circuit between CFI control module and engine coolant temperature sensor (B11/2) - Engine coolant temperature sensor defective
40	<ul style="list-style-type: none"> - Short circuit or open circuit between CFI control module and volume air flow sensor position indicator (B2) - Volume air flow sensor position indicator defective (possible fast closed throttle position)
50	<ul style="list-style-type: none"> - Heated oxygen sensor (G3/2) not operational or defective - Cable to heated oxygen sensor has open circuit

On/off ratio in %	Possible causes of fault
60	(USA) up to model year 1988: not assigned No road speed signal (speedometer) ¹⁾
70	- No engine speed signal (TD signal)
80	Up to 09/89 or model year 1989: - Short circuit or open circuit between CFI control module and barometric pressure sensor (B18) - Barometric pressure sensor defective
90	not assigned
100	- No voltage or ground at diagnostic connector (XI 1) - Cable from diagnostic connector (XI 1) to CFI control module (N3) has open circuit - Lambda control tester defective - No voltage or ground at CFI control module (N3) (overvoltage protection fuse or overvoltage protection defective) - CFI control module defective - Mixture setting too "lean" (on/off ratio approx. 95 – 100 % also possible) - Heated oxygen sensor (G3/2) defective (signal line has short circuit to ground)
Readout fluctuates	All monitored signals are in order.

¹⁾ The road speed signal can be checked by the CFI control module only when driving (dynamometer/road). If an incorrect road speed signal is detected, the on/off ratio 60 % is output. This on/off ratio remains stored until the ignition is switched off. Without a road speed signal this leads e. g. to the complaint: jerking when vehicle moving and throttle valve closed.

j) 'Test programme with contact box

Key to symbols



Contact box



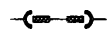
Lambda control tester



Battery



Multimeter



Jumper (Bridge)



Contact



Connector



Voltage measurement (volts,
direct voltage)



Current measurement
(amperes, direct voltage)



Resistance measurement
(ohms)

Note

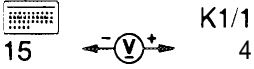
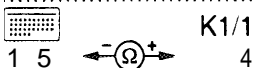

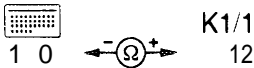
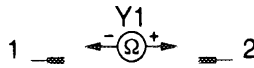
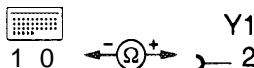
If no on/off ratio is output, or if the readout is constant (0 % or 100 %), first of all perform test steps 1 – 3.

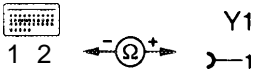

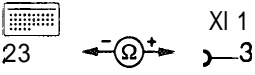
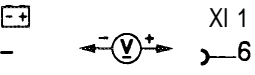
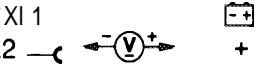
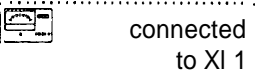
If the specified value of a test step, e. g. step 4.0, is in order, it is not necessary to perform test step 4.1.


Different component designations are possible depending on wiring diagram or in the case of vehicles with optional equipment. These designations are given in parentheses. This has no effect on the test (connections, specified value).

The on/off ratio readout must be constant. If the readout constantly changes, no fault diagnosis is possible by measuring the on/off ratio.


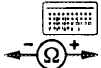

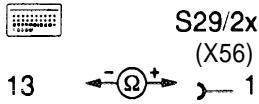
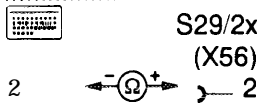
On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specifi- cation	Possible cause/Remedy
-	1.0 Ground		Ignition: ON	11-14 V	Ground connection W11 loose, cable has open circuit
-	2.0 Ground			11-14 V	CFI control module defective
-	3.0 Ground			11-14 V	Ground connection W10 loose, cable has open circuit
-	4.0 Supply voltage from (N3), terminal 15		Ignition: ON	11-14 V	Fuse in overvoltage protection, overvoltage protection defective or not connected. Cable to contact 1 (terminal 30) has open circuit. Actuation of contact 3 (terminal 15) has open circuit Cable from contact 2 (terminal 87/87E) to (N3), contact 1 has open circuit
	4.1 Cable terminal 30		Ignition: OFF Overvoltage protection disconnected	11- 14v	Cable has open circuit
	4.2 Cable terminal 15		Ignition: ON Overvoltage protection disconnected	11- 14v	Cable has open circuit
	4.3 Cable terminal 87E		Ignition: OFF Overvoltage protection disconnected	< 1 Ω	Cable has open circuit
	4.4 Cable terminal 31 (ground)		Ignition: OFF Overvoltage protection disconnected	< 1 Ω	Cable has open circuit



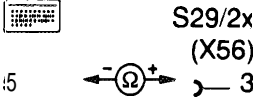
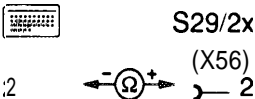

On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specifi- cation	Possible cause/Remedy
	4.5 Cable terminal 30a (fault memory)		Ignition: OFF Overvoltage protection disconnected	11-14 v	Overvoltage protection defective, second fuse in overvoltage protection may be defective Cable has open circuit
	4.6 Cable		Ignition: OFF Overvoltage protection disconnected	< 1 Ω	Cable has open circuit
	5.0 Current at actuator		Connect test cable 102 545 04 63 00 at actuator. Ignition: ON	See test data section c)	Electrohydraulic actuator Wiring CFI control module CFI resistance trimming plug
	6.0 Electro- hydraulic actuator		Ignition: OFF Disconnect test cable. Coupling at CFI control module disconnected	19.5 ± 1 Ω	Electrohydraulic actuator Wiring
	6.1 Electro- hydraulic actuator		Coupling at (Y1) dis- connected	19.5 ± 1 Ω	Replace electrohydraulic actuator
	6.2 Cable			< 1 Ω	Cable has open circuit

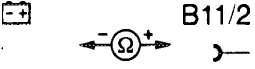
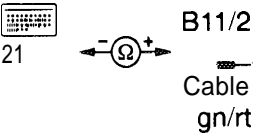

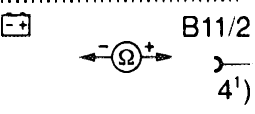
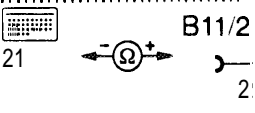

On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specifi- cation	Possible cause/Remedy
	6.3 Cable			$< 1 \Omega$	Cable has open circuit
	6.4* CFI reference resistor (R17/1)		Ignition: OFF	$< 1 \Omega$	Jumper in wiring harness has open circuit
0 % ²⁾	7.0 Cable		Ignition: OFF Coupling at CFI control module disconnected	$< 1 \Omega$	Cable has open circuit
0 % ²⁾	8.0 Cable (terminal 30 protected)		Ignition: OFF	11-14 v	Test fuse Model 201: fuse 9 Cable has open circuit
0 % ²⁾	9.0 Cable (ground)		Ignition: OFF	11-14 v	Cable has open circuit to ground Model 201: (W9)
0 % ²⁾	10.0 Lambda control		Engine at idle (operating temperature) (CFI control module connected)	$50 \pm 10 \%$	Set lambda control (on/off ratio), see (17.3-I 10)


1) not for  1988, fixed resistor in CFI control module

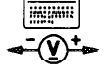
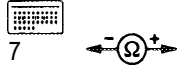
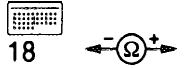
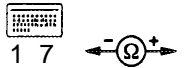
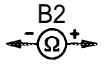
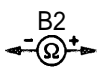

2) If an on/off ratio between 10 – 90 % is indicated with ignition ON (engine not running), test steps, 7.0, 8.0 and 9.0 need not be performed.

On/off ratio readout	Test step/ Pest scope	Test connection	Operation/ Requirement	Specifi- cation	Possible cause/Remedy
10 %	11.0 Closed throttle position contact	 connected to x11	Ignition: ON Open microswitch (throttle valve must not be opened)		Readout 20 %: see test step wide open throttle contact (S29/2) Readout 40 %: see test step volume air flow sensor potentiometer Readout 70 %: see test step closed throttle position contact (S29/2)
10 %	12.0 Closed throttle position contact	2  13	Ignition: OFF Coupling at CFI control module and coupling of ignition control module (code number 1- 4) disconnected Depress accelerator	< 1 Ω ∞	Pin assignment of coupling (S29/2x, X56) has incorrect polarity Closed throttle position contact Wiring Pin assignment of coupling (S29/2x, X56) has incorrect polarity Closed throttle position contact Wiring
	12.1 Closed throttle position contact	 S29/2x (X56) 1 — 2	Coupling (S29/2x) disconnected Depress accelerator	< 1 Ω ∞	Set or replace throttle position switch Wiring Set or replace throttle position switch Wiring
	12.2 Cable	 S29/2x (X56) 13 — 1		< 1 Ω	Cable has open circuit
	12.3 Cable	 S29/2x (X56) 2 — 2		< 1 Ω	Cable has open circuit

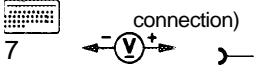
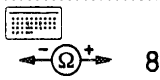
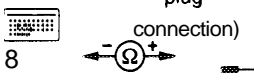

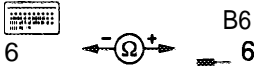
On/off ratio readout:	Test step/ Test scope	Test connection	Operation/ Requirement	Specifi- cation	Possible cause/Remedy	
20 %	13.0 Wide open throttle contact	2  5	Ignition: OFF Coupling at CFI control module disconnected Accelerator in wide open throttle position	∞ $< 1 \Omega$	Coupling (S29/2x, X56) has incorrect polarity Wide open throttle contact Wiring Coupling (S29/2x, X56) has incorrect polarity Wide open throttle contact Wiring	
	13.1 Wide open throttle contact	2  3	Coupling (S29/2x) disconnected Accelerator in wide open throttle position	∞ $< 1 \Omega$	Set or replace throttle position switch Set or replace throttle position switch	
	13.2 Cable * *	 5 — 3			$< 1 \Omega$	Cable has open circuit
	13.3 Cable	 2 — 2			$< 1 \Omega$	Cable has open circuit
30 %	14.0 Coolant temperature sensor (B11/2) *	7  2 1	Engine at idle (operating temperature) CFI control module connected	At $+ 80^{\circ} \text{C}$ 0.29– 1.35 v other values see table section k0	Engine coolant temperature sensor Wiring	

On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specifi- cation	Possible cause/Remedy
30 %	A 14.1 Engine coolant temperature sensor 2-pin		Both couplings at temperature sensor dis- connected (measure both contacts)	Ω value, see diagram/ table section k)	Replace engine coolant temperature sensor
	A 14.2 Cable			$< 1 \Omega$	Cable has open circuit
	B 14.1 Engine coolant temperature sensor 4-pin		Ignition: QFF Temperature sensor coupling dis- connected. Measure 2 x diagonally	Ω value, see diagram/ table section k)	Replace engine coolant temperature sensor
	B 14.2 Cable			$< 1 \Omega$	Cable has open circuit
	B 14.3 Cable			$< 1 \Omega$	Cable has open circuit
40 %	15.0 Air flow sensor potentio- meter signal		Engine at idle (operating temperature) CFI control module connected	0.55- 0.95 V	Air flow sensor potentiometer









1)  1988 California without contact designation, see section k).

On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specifi- cation	Possible cause/Remedy
40 %	15.1 Supply voltage of volume air flow sensor potentio- meter	7  18		4.6- 5.1 v	CFI control module
	15.2 Cable	 B2 7 — 1	Ignition: OFF measure at coupling (B2)	< 1 Ω	Cable has open circuit
	15.3 Cable	 B2 18 — 3		< 1 Ω	Cable has open circuit
	15.4 Cable	 B2 1 7 — 2		< 1 Ω	Cable has open circuit
	15.5 Air flow sensor potentio- meter	1  B2 — 3	Ignition: OFF coupling at (B2) dis- connected	3.6- 4.4 k Ω	Replace volume air flow sensor
	15.6 Air flow sensor potentio- meter	1  B2 — 2	Slowly deflect volume air flow sensor plate by hand	Ω value 1)	Replace volume air flow sensor
50 %	16.0 Oxygen sensor	7  8	Engine at idle (operating temperature) CFI control module connected	fluctu- ates between 0.1- 0.9 v	Oxygen sensor Wiring Test CFI resistance trimming plug






1) Ω value increases continuously up to 2/3 of deflection, and then drops off again.

On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specifi- cation	Possible cause/Remedy
50 %	16.1 Heated oxygen sensor	<p>G3/2x2 (X6012) (one-pin plug connection)</p> 	Engine at idle (operating temperature). Separate plug connection (G3/2x2) and lay connector to ground (lean simulation)	> 450 mV	Replace heated oxygen sensor
	16.2 Cable		Ignition: OFF Coupling at CFI control module disconnected	∞	Cable defective
	* 16.3 Cable	<p>G3/2x2 (X6012) (one-pin plug connection)</p> 		< 1 Ω	Cable has open circuit
60 % ¹⁾	A 17.0 Road speed signal Model 201		Ignition: ON Move vehicle approx. 1 m	Readout fluctuates 0 - 12 v (0 - 9 V with ancillaries)	Cable Hall-effect sensor
	A 17.1 Cable		Coupling at (B6) disconnected	< 1 Ω	Cable has open circuit

¹⁾ not assigned on vehicles without road speed signal and (USA) 1988

On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specifi- cation	Possible cause/Remedy
60 % ¹⁾	B 17.0 Road speed signal	2  6	Drive vehicle on dynamo- meter (approx. 40 km/h)	> 1 v	Cable Electronic speedometer
	B 17.1 Cable	 Alp8 (A2) 6  1	Connector at (AI p8) dis- connected	< 1 Ω	Cable has open circuit
60 % ¹⁾	18.0 CFI control module	 connected to x11	Drive vehicle in 3rd gear/ drive mode 3 on road/dyna- mometer; accelerate fully at approx. 2000/min (approx. 6 seconds)	Readout fluctu- ates after accelera- tor pedal eased off	If readout 60 %: replace CFI control module
70 %	19.0 TD signal	2  2 5	Engine at idle (operating temperature) CFI control module connected	6-12 V	Ignition control module Wiring
	19.1 Cable	 x11 2 5  1	Ignition: OFF	< 1 Ω	Cable has open circuit
	19.2	N1/2 TD  x11 1	Coupling (TD signal) at ignition control module dis- connected	< 1 Ω	Cable has open circuit

1) not assigned on vehicles without road speed signal and (USA) 1988

On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specifi- cation	Possible cause/Remedy
80 % ¹⁾	20.0 Barometric pressure sensor (B18)	7  1 8	Ignition: ON CFI control module connected	4.6- 5.1 v	Barometric pressure sensor Wiring
	20.1 Altitude correction sensor	7  1 1		see table section l)	Replace barometric pressure sensor
	20.2 Cable	 B18 1 1 3	Ignition: OFF Coupling at (B18) dis- connected	< 1 Ω	Cable has open circuit
	20.3 Cable	 B18 1 8 2		< 1 Ω	Cable has open circuit
	20.4 Cable	 B18 1 1 1		< 1 Ω	Cable has open circuit
90 %	not assigned				
100% ²⁾	21.0				see on/off ratio 0 % and 50 %

¹⁾ not assigned on vehicles without barometric pressure sensor

²⁾ Idle speed too high

k) Voltage values of engine coolant temperature sensor(B11/2) and CFI intake air temperature sensor (B17/2)

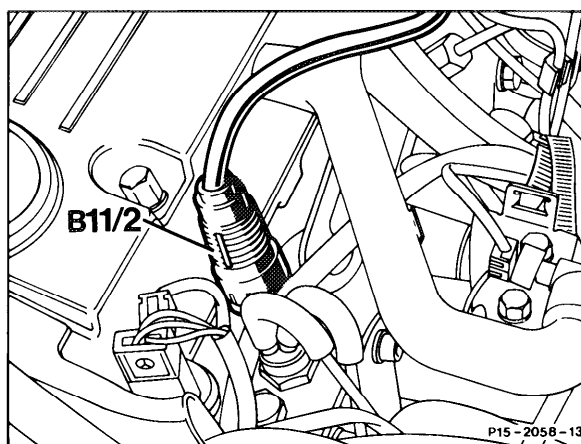
Temperature in °C	Resistance	Voltage at contact 11 intake air (volts)	Voltage at contact 21 coolant (volts)
-20	15.7 kΩ	2.85-3.49	3.24-3.94
-10	9.2 kΩ	2.50-3.06	2.84-3.47
0	5.9 kΩ	2.10-2.56	2.39-2.93
10	3.7 kΩ	1.69-2.07	1.94-2.37
20	2.5 kΩ	1.32-1.62	1.51-1.84
30	1.7 kΩ	1.03-1.25	1.16-1.42
40	1.18 kΩ	0.77-0.94	0.88-1.08
50	840 Ω	0.57-0.69	0.66-0.80
60	600 Ω	0.42-0.52	0.50-0.61
70	435 Ω	0.32-0.40	0.38-0.46
80	325 Ω	0.25-0.31	0.29-0.35
90	247 Ω	0.18-0.22	0.22-0.26

Note

Testing engine coolant temperature sensor (B11/2)

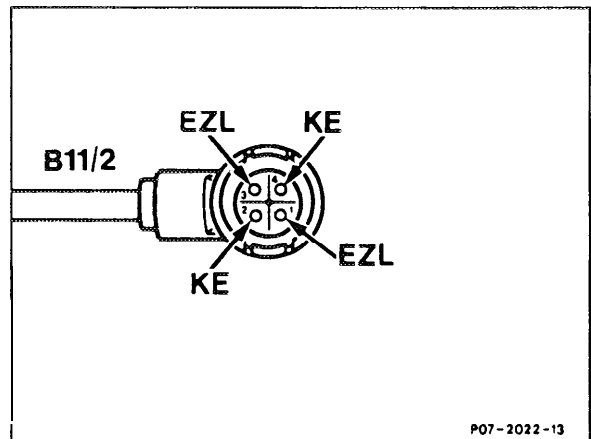
The engine coolant temperature sensor is a 4-pin design. It integrates two separate temperature sensors (NTC), which do not have any electrical connection to the housing of the engine coolant temperature sensor. One temperature sensor (NTC) is for the distributor ignition system and one for the CFI injection system.

The connector of the engine coolant temperature sensor is designed so that it can be plugged in in any position.

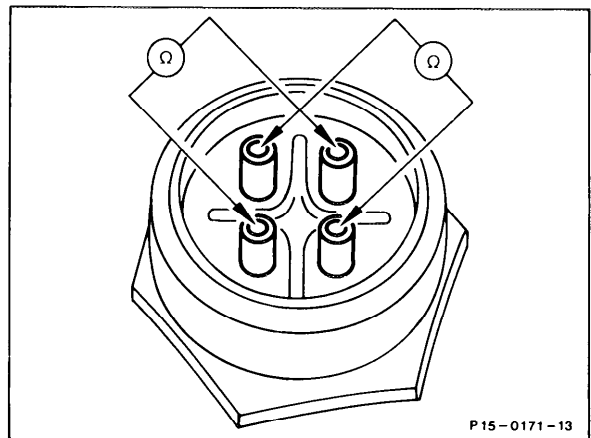


Pin assignment:

- 1 = Distributor ignition temperature sensor
- 2 = CFI temperature sensor
- 3 = Engine ground at intake manifold for ignition
- 4 = CFI control module ground

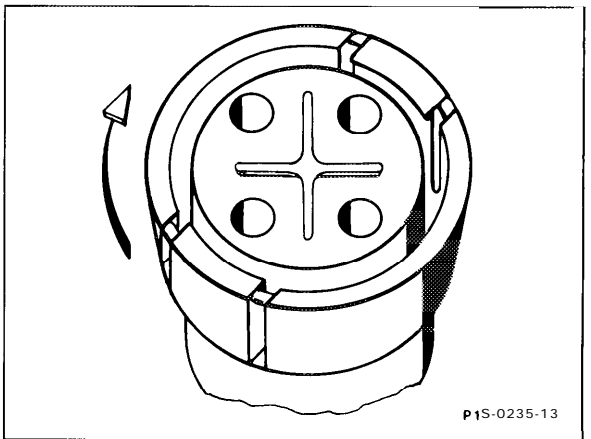


When testing the engine coolant temperature sensor, measure the resistances 2 × diagonally and compare. The resistances of the maps are identical to those of the previous version.

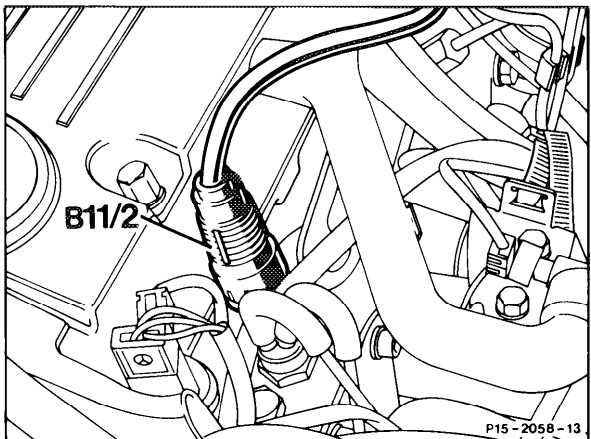


(USA) 1988 California (without contact designation on coupling B11/2):

When testing the wiring from the CFI control module (contacts 7 or 21) to the connector (B11/2), the contacts on the connector should be tested clockwise; only one cable may have continuity ($< 1 \Omega$) in each case.



Arrangement of engine coolant temperature sensor (B11/2)

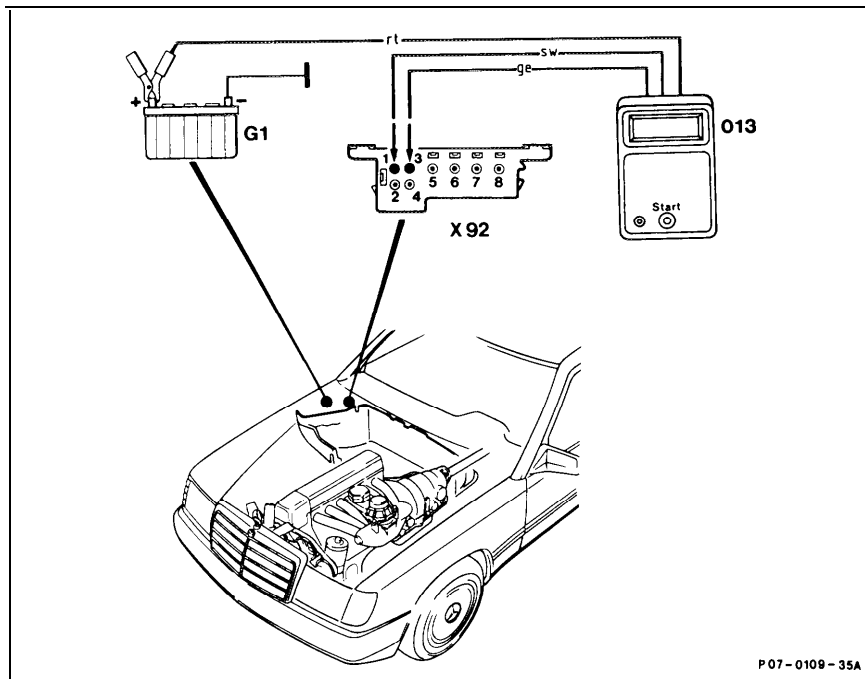


Engine 102 96/98

l) table of altitude correction sensor (818)

Height above sea level (m)	Atmospheric pressure p absolute (mbar)	Voltage at contact 14 (to ground) (volts)
0	1013	4 ± 1
1000	899	3 ± 1
2000	795	2 ± 1

m) Diagnostic Trouble Code (DTC) readout at diagnostic connector



Impulse counter scan tool (013)	connect to positive pole of battery (G1) and to diagnostic connector (X92) or (XI 114) according to connection diagram. LED U Bat-t must light UP-
Ignition	ON.
Start button	press for 2 to 4 seconds. Note readout. DTC readout 1 indicates: no fault in system. Other readouts: see fault table.
Start button	again press for 2 to 4 seconds. Note any further DTCs . If no more faults are stored, no further readout appears.
	(USA) CFI control module switches over to on/off ratio output.
Noted codess	rectify according to DTC table.
Ignition	OFF (pulse output completed).
Ignition	ON (pulse output can once again be read out).

Erasing diagnostic trouble code(DTC) memory

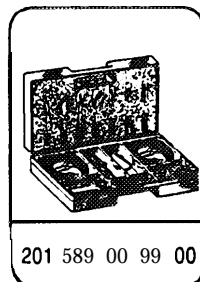
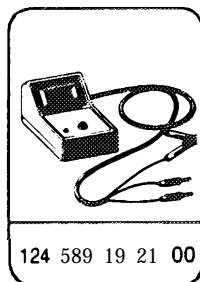
Once a fault has been rectified without having disconnected the CFI control module or the battery, the DTC displayed must be erased as follows:

- When the DTC is displayed, wait 2 seconds before pressing start button for 6 – 8 seconds.
- No display; stored DTC is erased.
- A number (greater than 1) is displayed; further DTC in system.

Note

Each displayed DTC must be erased **individually**.

Special tools



Notes regarding impulse counter scan tool display

The number 1 indicates that no fault is stored in the system. All other numbers are assigned a particular DTC. If there are several DTCs in the system, the malfunction with the lowest DTC number is output first.

Numbers from 1 to 12 appear in the display of the impulse counter scan tool.

- If the LED U Batt appears after connecting the impulse counter scan tool, the impulse counter scan tool and power supply for impulse counter scan tool are in order.

- If no display appears during the test after one or several DTCs (numbers), no further DTC is stored.

If the LED U Batt does not light up:

- Test contact 1 at diagnostic connector (X92) to battery positive (11 – 14 V).
- Test contact 3 at diagnostic connector (X92) to contact 1 (0.7 – 2.5 V).

Fault table

Diagnostic trouble code DTC	Possible cause	Remedy
1	no malfunction in system	–
2	Throttle position switch, wide open throttle contact	13.0
3	Engine coolant temperature sensor (B11/2)	14.0
4	Air flow sensor potentiometer	15.0
5	Heated oxygen sensor (G3/2)	16.0
6	not assigned	–
7	TD signal	19.0
8	Barometric pressure sensor	20.0
9	Electrohydraulic actuator	5.0
10	Throttle position switch, closed throttle position contact	11.0, 12.0
12 ¹⁾	Exhaust gas recirculation temperature sensor	Section r)

only (USA) 1991 California

On Board Diagnosis System(DTC) California Model Year 1988/1991

The CFI control module monitors all the exhaust components of the CFI injection system and the exhaust gas recirculation. Malfunctions caused by an open circuit or failure of one of these components are indicated by the malfunction indicator lamp in the "CHECK ENGINE" instrument cluster and simultaneously stored in the CFI control module.

A diagnostic connector (X92) with non-locking switch (2) and LED (4) is provided for this purpose on the right of the component compartment partition wall. When the non-locking switch is pressed (ignition: ON) for between 2 and 4 seconds, the flashing DTC output is initiated and the fault path indicated by the number of flashes.

After completion of the flashing DTC output, the LED shows a steady light. If the non-locking switch is again pressed for between 2 and 4 seconds, a further fault path can be indicated if it exists. If no further fault code is detected, the CFI control module switches over to on/off ratio output.

Erasing flashing DTCs

Once a fault has been rectified without having disconnected the CFI control module, the flashing DTC output displayed must be erased as follows:

- When the flashing DTC output is displayed, wait 2 seconds before pressing the non-locking switch for 6 – 8 seconds.

Note

Each flashing DTC output displayed must be erased individually.

- LED flashes once, stored DTC is erased.

Note

The non-locking switch and LED have been developed to enable customers and non-MB dealers to specifically pinpoint the fault path with "on board means" in conformity with legal requirements. An impulse counter scan tool which indicates the stored fault(s) on a digital display has been developed for MB workshop personnel (see DTC output to diagnostic connector).

On/off ratio output

The on/off ratio is not output until the CFI control module has been programmed for on/off ratio output. Otherwise, when the engine is running, the readout shows 0 % or 85 % if the "CHECK ENGINE" malfunction indicator lamp lights up.

The control module is switched over to on/off ratio output for testing the lambda control by operating the non-locking switch (see 07.3-105 or 07.3-I 10).

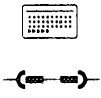

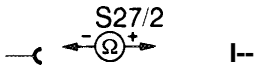
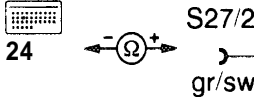
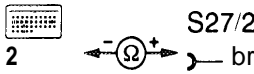


In the event of an engine running problem, the DTC memory should be read out and the DTCs noted before performing any repairs as part of 07-1 100. This ensures that a distinction can be made between genuine and simulated DTCs as DTCs are stored when performing test work with the engine running, which may originate from a simulation or a disconnected cable.

The DTC memory must be erased after completing the test work.

n) Testing deceleration shut-off

Connection diagram of contact box, see section g)

On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specifi- cation	Possible cause/remedy
-	1.0 Deceleration shut-off	 13 2	Engine speed > 3000/min (engine at operating temperature) CFI control module connected Operate deceleration shut-off microswitch (S27/2) by hand		Decel fuel shutoff microswitch Throttle position switch closed throttle position contact, test, see "Test programme with contact box" test step 12.0 Wiring CFI control module
		 13 remove jumper 2		Engine surges Engine running un- changed	
	2.0 Deceleration shut-off microswitch (S27/2)	 S27/2 1 2	Ignition: OFF Coupling at microswitch disconnected Depress accelerator	< 1 Ω ∞	Check throttle control (30300) Replace microswitch
	2.1 Cable	 24 S27/2 gr/sw		< 1 Ω	Cable has open circuit
	2.2 Cable	 2 S27/2 br		< 1 Ω	Cable has open circuit to ground (W1 1)

o) Testing road speed signal model year 1988

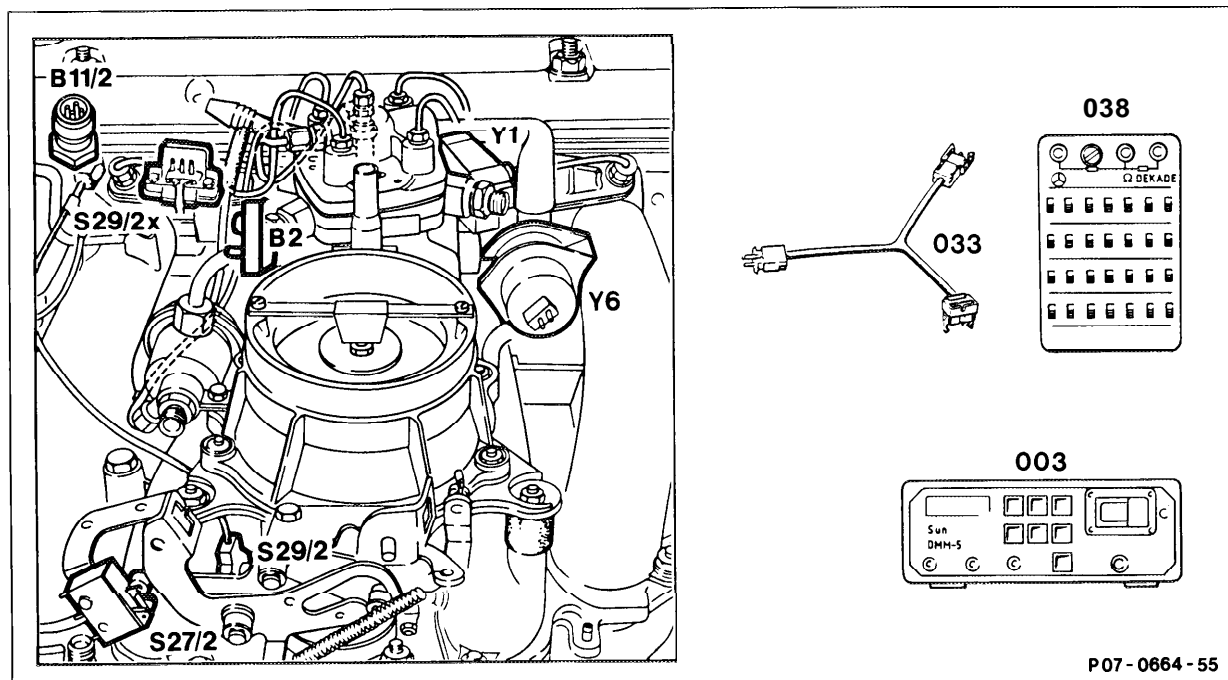
Note

The test should only be performed if the following complaint exists:

- Jerking when vehicle moving with throttle closed.

For testing see "Pest program with socket box", test steps A17.0 and 18.0 (initiating with on/off ratio not yet possible in model year 1988).

p) Testing post-start enrichment and warm-up base value



P07 - 0664 - 55

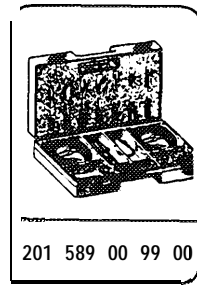
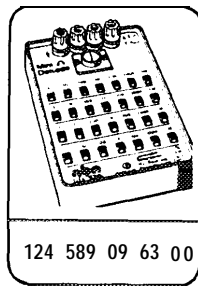
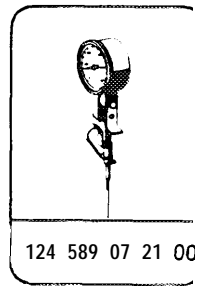
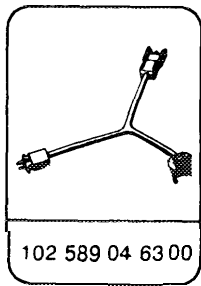
Engine oil temperature	approx. 80 °C.
Plug connection (G3/2x2) (oxygen sensor signal)	separate on right of component compartment.
Resistance decade (038)	connect to engine coolant temperature sensor coupling (B17/2), contact 2 and contact 4 (coupling disconnected). Set 320 Ω (approx. 80 °C engine coolant temperature).
Multimeter (003)	connect to electrohydraulic actuator (Y1) with test cable (033). Measuring range amperes.
Engine	start.
Current level	read and note no sooner than 5 seconds after end of start.
Ignition	OFF
Resistance decade (038)	switch over to 2.5 kΩ (approx. 20 °C engine coolant temperature).
Engine	start.
Post-start enrichment current value	take reading 1– 2 seconds after end of start. Specification: 7 – 13 mA greater than the value noted at approx. 80 °C engine coolant temperature.

Warm-up base value

Specification: 1 – 5 mA greater than the value noted at approx. 80 °C engine coolant temperature.

Take reading of current value no sooner than 28 seconds (after elapse of heating speed).

Special tools

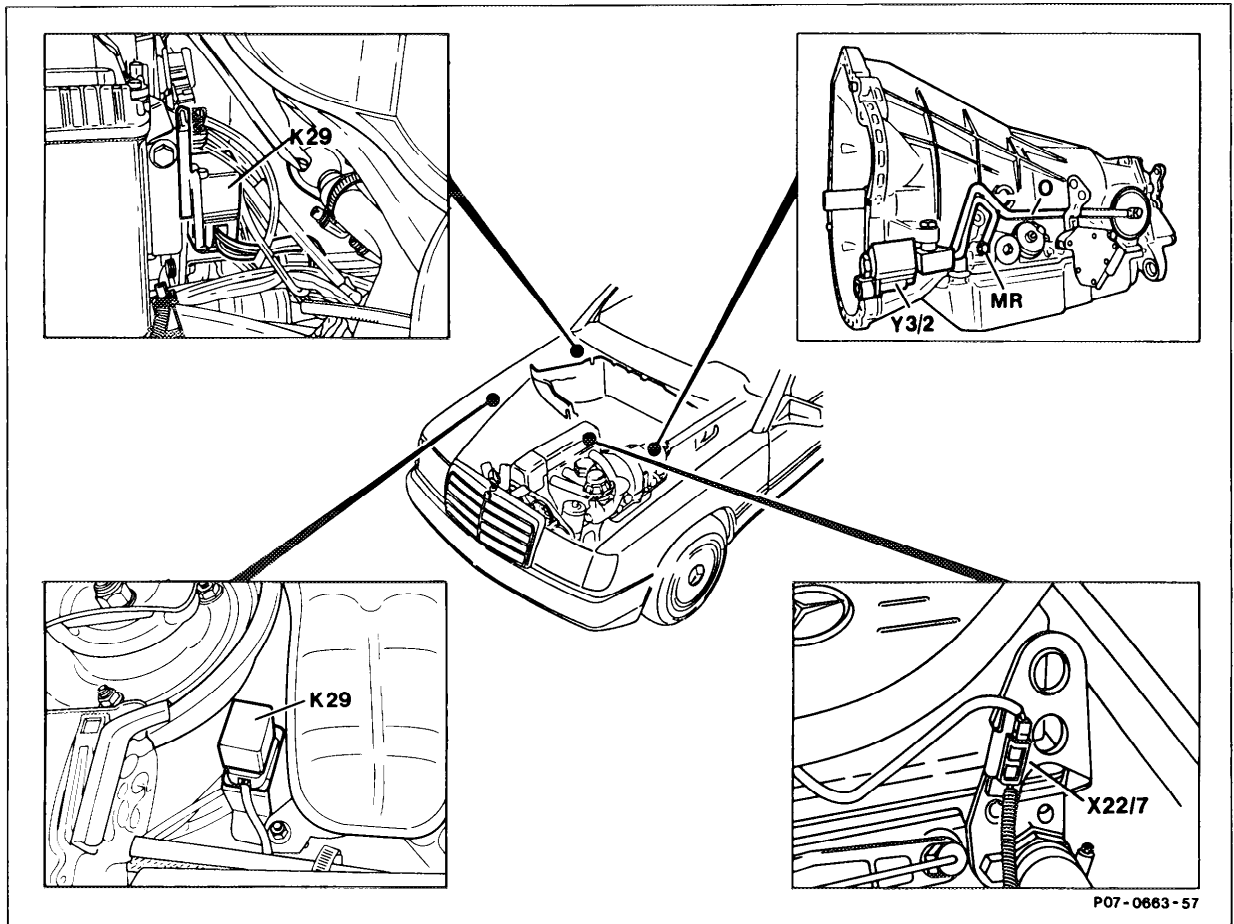


Commercially available tools or testers

Multimeter

e. g. Sun, **DMM-5**

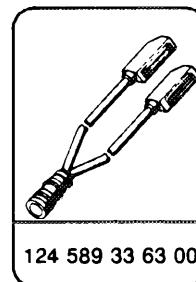
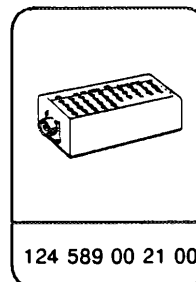
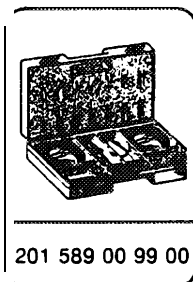
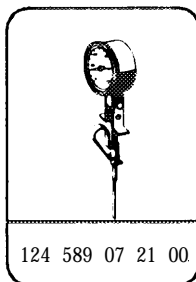
q) Testing transmission upshift delay (automatic transmission only)



K29 Transmission upshift delay relay module
Model 201 right wheelhouse

X22/7 Transmission upshift delay valve plug connection,
1 -pin
Y3/2 Transmission upshift delay solenoid valve

Special tools



Commercially available tools or testers

Multimeter

e. g. Sun, DMM-5

Test conditions

- Engine oil temperature approx. **80 °C**
- All electrical ancillaries switched off
- Battery voltage 11 - 14 V

Symbols for measuring instruments:



Multimeter



Contact

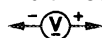


Connector



Jumper (Bridge)

Symbols for type of measurement with multimeter:



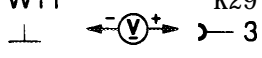
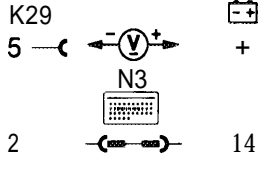
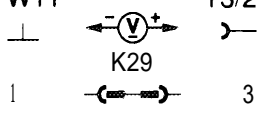
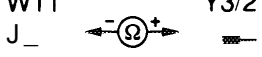
Voltage measurement (volts, direct voltage)



Resistance measurement (ohms)

Connection diagram of contact box, see section g)

On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specifi- cation	Possible cause/Remedy
-	1.0 Function of transmission upshift delay relay module (K29)		Engine at idle	11-14V	<p>Voltage and ground supply for transmission upshift delay relay module (K29), relay (K29) defective.</p> <p>No road speed signal. No engine coolant temperature signal. CFI control module (N3) defective.</p>
-	2.0 Voltage supply of transmission upshift delay relay module (K29)		Transmission upshift delay relay module (K29) disconnected. Run engine	11-14V	<p>Model 201: Fuse No. 2, open circuit transmission upshift delay relay module (K29) ■ intake manifold preheating relay (K3/1) ■ ignition starter switch (S2/1).</p>

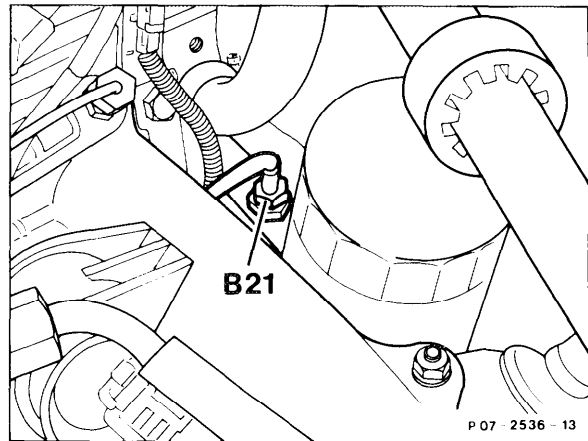
On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specifi- cation	Possible cause/Remedy
-	2.1	W11 	Transmission upshift delay relay module (K29) disconnected. Ignition: ON	11-14V	Overvoltage protection relay (K1/1). Open circuit transmission upshift delay relay module (K29) ■ overvoltage protection relay (K1/1).
-	3.0 Ground supply of transmission upshift delay relay module (K29).	K29 	Transmission upshift delay relay module (K29) disconnected. Ignition: OFF	11-14V	Open circuit transmission upshift delay relay module (K29) ■ CFI control module (N3).
-	4.0 Cable	W11 	Transmission upshift delay relay module (K29) disconnected. Ignition: ON	11-14V	Open circuit transmission upshift delay relay module (K29) ■ plug connection (X22/7) ■ shift point retard solenoid valve coupling (Y3/2) ■
-	4.1 Shift point upshift delay solenoid valve (Y3/2)	W11 		10-18Ω	Replace upshift delay relay solenoid valve.

r) Testing exhaust gas recirculation temperature sensor 821

USA 1991 California

Test resistances of the EGR temperature sensor (B21) according to diagram. The temperature sensor is installed in the exhaust gas recirculation line.

Tightening torque **23 – 28 Nm**.



The temperature of the recirculated exhaust gases is detected by the temperature sensor. If the exhaust gas temperature drops below approx. 120 °C when driving, "no exhaust gas recirculation" is performed. The CFI control module detects this as a DTC which is stored and the CHECK ENGINE malfunction indicator lamp is activated.

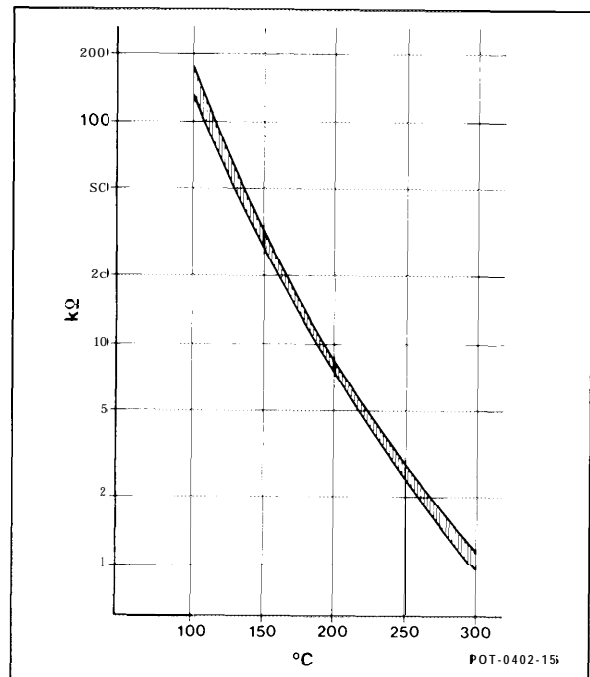
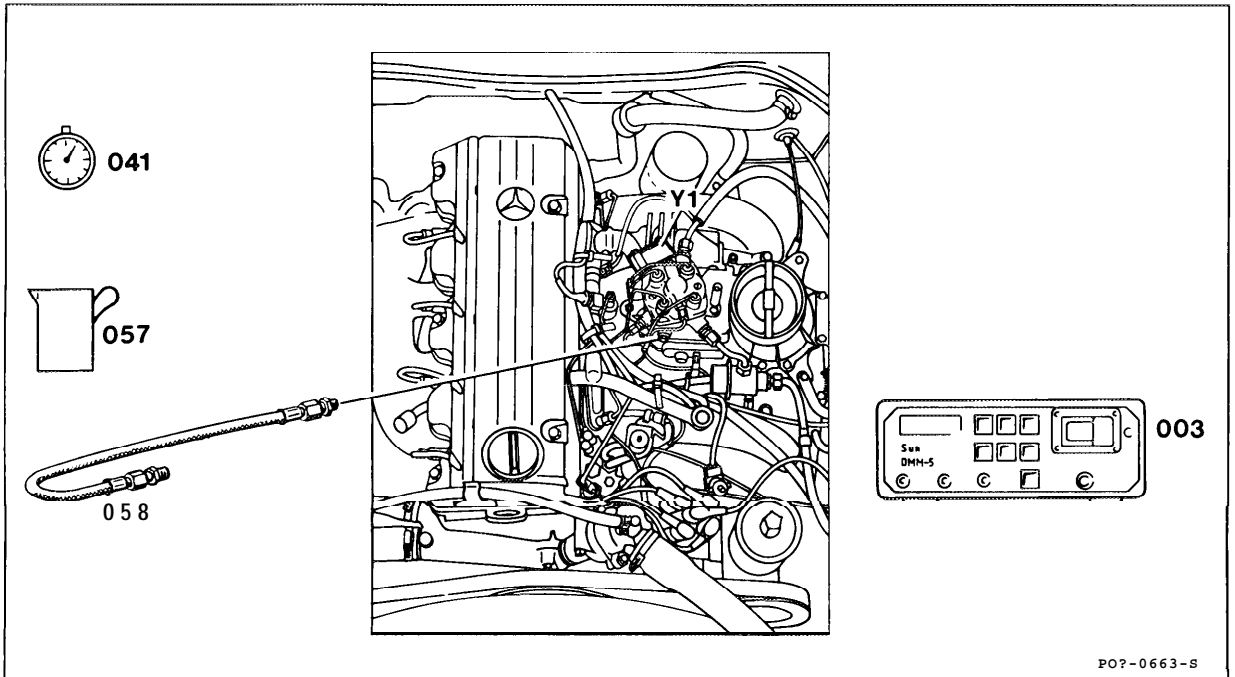


Diagram
Exhaust temperature resistance at
exhaust gas recirculation
temperature sensor

07.3-122 Testing continuity of inductor in fuel distributor

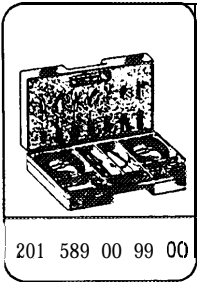
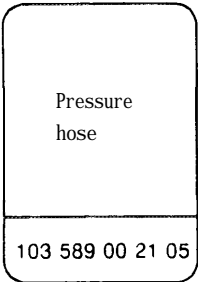
Preceding work:

Testing fuel pressures and internal leaktightness (07.3-I 20)



Connector at electrohydraulic actuator (Y1).....	detach. With lambda control: switch on ignition. Detach oxygen sensor signal plug connection.
Fuel line	unscrew at fuel distributor and seal with M10×1 plug.
Pressure hose (058)	connect to fuel distributor and hold into measuring beaker. Special tool 103 589 00 21 05.
Fuel pump relay module	detach and bridge contacts 7 and 8. (Fuel pump running) Special tool 201 589 00 99 00.
Inductor	test continuity Specification: 130 – 150 cm ³ /min at minimum voltage of 11.5 V at fuel pump. If specification is not reached, replace fuel distributor.

Special tools



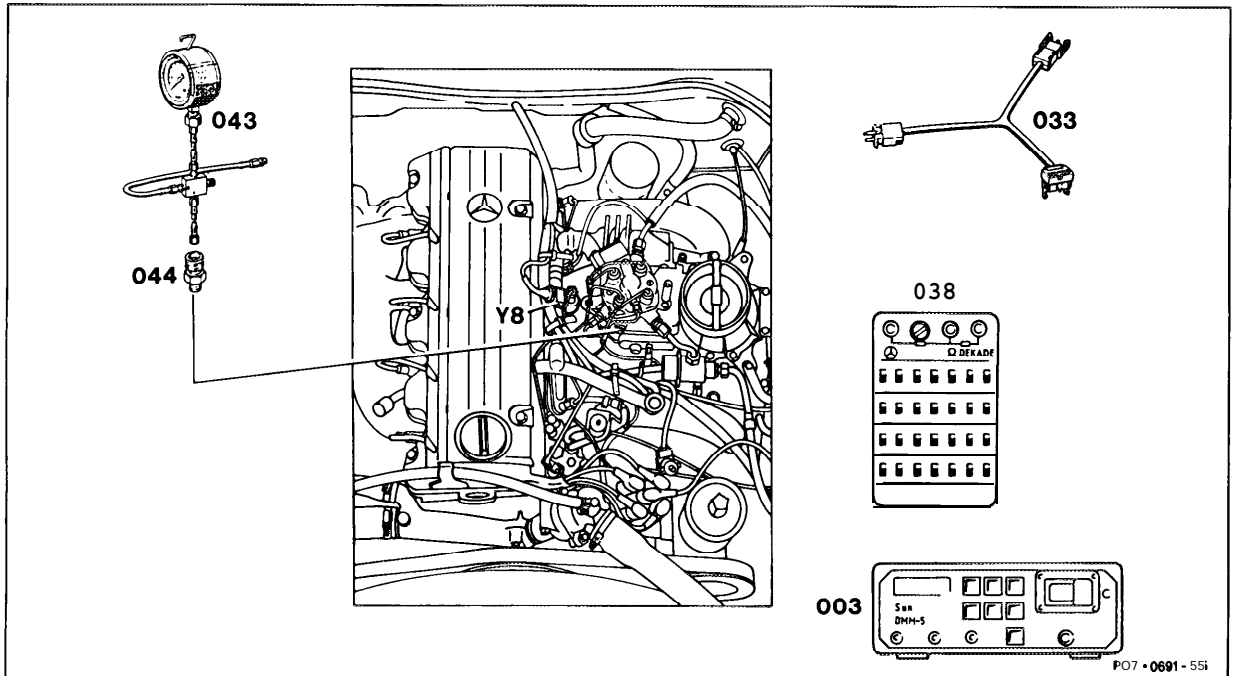
Commercially available testers

Multimeter, measuring glass or measuring beaker, stopwatch

07. 3424 Testing start device

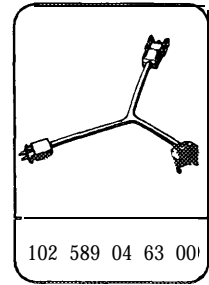
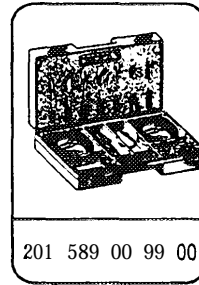
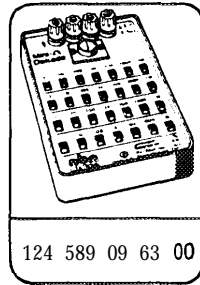
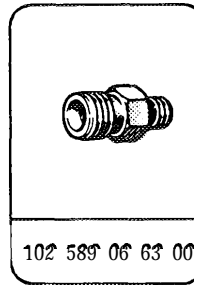
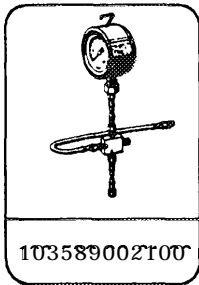
Preceding work:

Testing fuel pressure and internal leaktightness (07.3-l 20)



Testers	connect:
	pressure gauge (043)
	103 589 00 21 00,
	double fitting (044) 102 589 06 63 00,
	multimeter (003),
	Ω decade (038) 124 589 09 63 00,
	test cable (033) 102 589 04 63 00.
Fuel pressures and internal leaktightness	test (07.3-l 20).
Start valve	check operation and for leaks.
Post-stat-t enrichment	test.

Special tools



Commercially available tester

Multimeter

e. g. Sun, DMM-5

Note

Wiring diagrams (07. 3-1 28).

Engine 102.961 version (USA):

Start valve control by thermo-time switch (S26).

a) If engine speed is too low after the cold start

Compress shaped hose (arrow).








If engine speed does not change, the idle air control valve is jamming and must be replaced.

b) Engine speed too high at normal operating temperature

Compress formed hose (arrow).



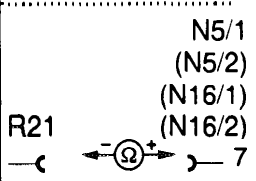
If there is a significant change in engine speed, the idle air control valve is jamming or is not electrically heated.

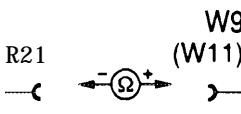
Key to symbols

	Battery
	Multimeter
	Contact
	Connector
	Voltage measurement (volts, direct voltage)
	Current measurement (amperes, direct current)
	Resistance measurement (ohms)

Notes

- If the specified value of a test step, e.g. step **4.0**, is in order, it is not necessary to perform test step **4.1**.
- Different component designations are possible depending on wiring diagram or in the case of vehicles with optional equipment. These designations are given in parentheses.

On/off ratio readout	Test step/ Test scope	Tester/ Test connection	Operation/ Requirement	Specifi- cation/ Function	Possible cause/Remedy
-	1.0 Test idle air control valve		Start cold engine Start engine at normal operating temperature	up to approx. 70°C engine coolant temperature 900 – 1200/min 750 – 850/min	Idle air control valve jamming. Idle air control valve jamming. Heating coil Voltage supply of heating coil
-	1.1 Idle air control valve heating coil (R21)		Ignition: QFF Connector at idle air control valve disconnected	approx. 40 Ω	Replace auxiliary air fan
-	1.2 Voltage supply of heating coil (R21)		Engine closed throttle position connector at idle air control valve disconnected	11-14 v	Wiring Fuel pump relay module (07.3-I 65).
-	1.3 Wiring		Ignition: OFF	< 1 Ω	Cable has open circuit.

On/off ratio readout	Test step/ Test scope	Tester/ Test connection	Operation/ Requirement	Specifi- cation/ Function	Possible cause/Remedy
-	1.3 Wiring	R21 	Ignition: OFF	< 1 Ω	Cable has open circuit.
-	2.0 ¹⁾	Disconnect fuel line at start valve, remove start valve, reconnect fuel line	Detach connector at thermo-time switch, connect terminal "W" on connector to ground (not necessary below + 5°C). Hold start valve in vessel. Start engine.	Start valve must eject finely atomized spray.	Test start valve actuation via thermo-time switch (07.34 26).
-	3.0 ²⁾	Disconnect fuel line at start valve, remove start valve, re-connect fuel line	Connector of engine coolant temperature sensor disconnected. Feed in 10 kΩ at connector of engine coolant temperature sensor with Ω decade (simulate approx. - 15°C). Pay attention to Ω decade connection! I-pin temperature sensor (B11/3): Ω decade to ground and detached cable.	Start valve must eject finely atomized spray.	Test start valve actuation via fuel pump relay (07.3-126).

¹⁾ Start valve actuation via thermo-time switch: only engine 102.961 Std. and national version (USA).

²⁾ Start valve actuation via fuel pump relay module.

On/off ratio readout	Test step/ Test scope	Tester/ Test connection	Operation/ Requirement	Specification/ Function	Possible cause/Remedy
-	3.0 ²⁾		<p>2-pin engine coolant temperature sensor (B11/2) and ignition system CFI (KE I and KE II): Ω decade to ground and detached cable (gn/sw) to fuel pump relay module (terminal TF).</p> <p>2-pin temperature sensor (B11/2) and DI ignition system CFI (KE III): Ω decade to ground and detached cable (gn/rt) to KE control unit (connector 21).</p> <p>4-pin temperature sensor (B11/2): Ω decade diagonally to contacts 2 and 4.</p> <p>Hold start valve in vessel.</p> <p>Start engine.</p>		
-	4.0 Test start valve for leaks.		Ignition: OFF Dry off start valve at nozzle	Start valve must not leak	Replace start valve.

²⁾ Start valve actuation via fuel pump relay module.

Note

Plastic connector at start valve colored green
(previously blue).

Production breakpoint: 08/88


Model	Engine	Engine End No.	
		manual transmission	automatic transmission
201.028	102.985	026332	076393

Testing post-start enrichment**National version** (USA)

Engine	Version	CFI control module	Post-start ¹⁾ at +20°C	Warm-up base value	Pest acc. to section
		Part No.	mA	mA	
102.961	(USA) 1983/84	003 545 38 32		9-14	"a"
102.985	(USA)	004 545 26 32	-	5-15	
	(USA) 1985186	003 545 38 32	1-4	3-9	
	(USA) 1987188	005 545 94 32 006 545 80 32 006 545 55 32	13-19		

¹⁾ After end of start current value drops to the temperature-dependent warm-up base value.

a) USA national version

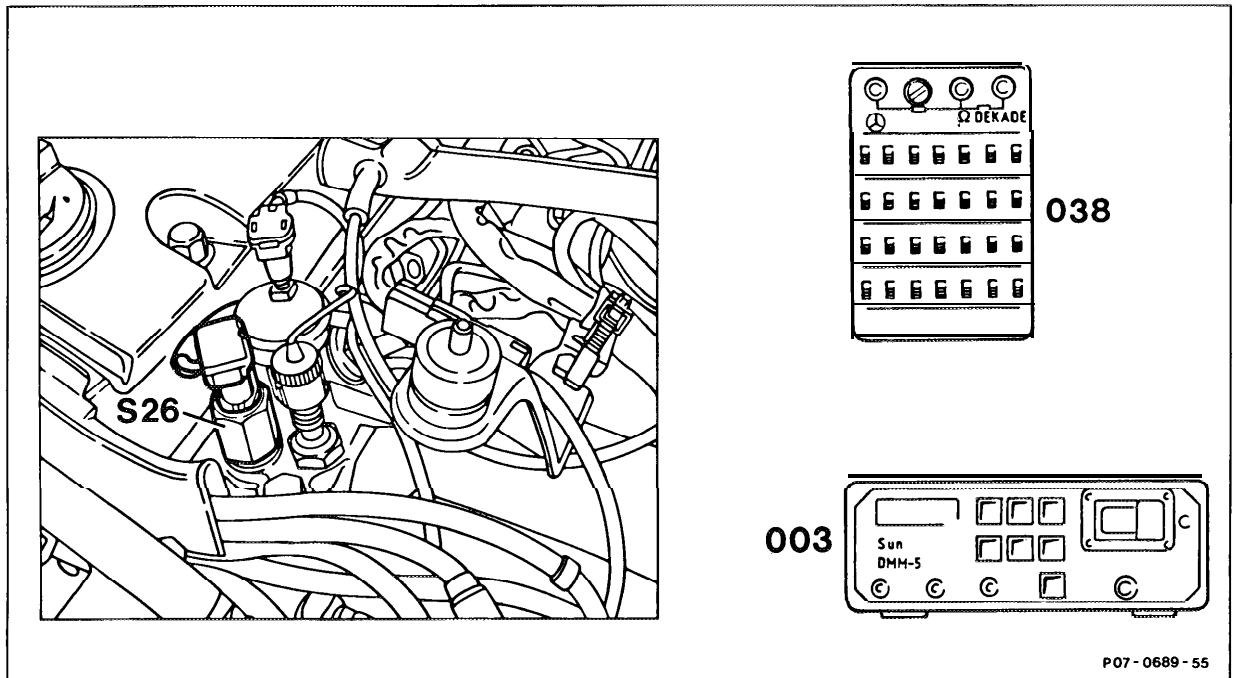
On/off ratio readout	Test step/ Test scope	Tester/ Test connection	Operation/ Requirement	Specifi- cation/ Function.	Possible cause/Remedy
	<p>1.0 Test current at electro- hydraulic actuator (Y1)</p>		<p>Connect test cable (033) 102 589 04 63 00 to electrohydraulic actuator (Y1) and multimeter. Feed in 2.5 kΩ at engine coolant temperature sensor connector with Ω decade.</p> <p>Pay attention to Ω decade connection!</p> <p>1 -pin temperature sensor (B11/3): Ω decade to ground and detached cable.</p> <p>2-pin temperature sensor (B11/2) and TSZ ignition system (KE I and KE II): Ω decade to ground and detached cable (gn/sw) to fuel pump relay module (terminal TF).</p> <p>2-pin temperature sensor (B11/2) and DI ignition system (KE III): Ω decade to ground and detached cable (gnlrt) to CFI control module (connector 21)</p>		

On/off ratio readout	Test step/ Test scope	Tester/ Test connection	Operation/ Requirement	Specifi- cation/ Function	Possible cause/Remedy
			<p>4-pin tempera- ture sensor (B11/2): Ω decade diagonally to contacts 2 and 4</p> <p>Start engine</p>	<p>See table for values</p>	<p>Supply voltage CFI control module Engine coolant temperature sensor Volume air flow sensor potentiometer TD signal Start detection (terminal 50) at CFI control module (connector 24), only for KE I and KE II</p> <p>Note Tests, see 07.3-1 21.</p>

07.3-126 Testing start valve actuation

Preceding work:

Testing starting device (07. 3-1 24)



Testers

connect:

multimeter (003)

ohms decade (038) 124 589 09 63 00.

Starting voltage

test. At least 10 V in approx. 5 seconds.

Electric wiring between starting valve and
fuel pump relay

test for continuity. Resistance approx. 0 Ω .

a) Vehicles with actuation via thermo-time switch (S26)

Thermo-time switch (S26)

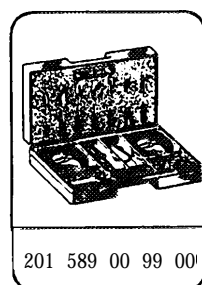
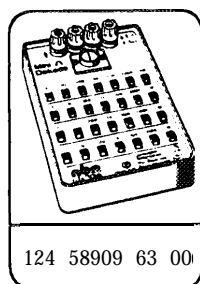
test (102.961 ^{USA}).

b) Vehicles with actuation via fuel pump relay module

Voltage at fuel pump relay module

test. Contact **12** (terminal 50) at least 10 V,
contact 2 (terminal TF).

Special tools



Commercially available tester

Multimeter

e. g. Sun, DMM-5

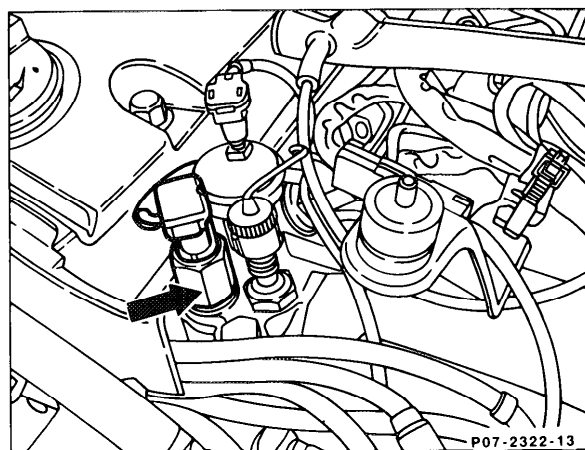
Note

Wiring diagrams (07.3-I 28).

a) Vehicles with actuation via thermo-time switch (arrow)

The start valve is operated by the closed thermo-time switch only when the engine coolant temperature is below + 5°C.

The actuation time increases as the temperature drops and reaches approx. 12 seconds at -20°C.



Test below + 5°C engine coolant temperature

Remove thermo-time switch and cool with commercially available refrigerant.

Connect voltmeter to terminal of start valve (Y8).

Operate starter. Depending on the engine coolant temperature, the voltmeter must then indicate ≥ 10 volts over a certain period.

The switching time increases as the temperature drops by approx. 1.5 seconds per 5°C .

e.g. $+5^{\circ}\text{C} = 0$ seconds
 $0^{\circ}\text{C} = 1.5$ seconds

It is recommended to still test the thermo-time switch (S26) with an ohmmeter for this test.

Test value below $+5^{\circ}\text{C}$:

Terminal W-G approx. 93Ω
(contacts in switch closed).

Test above $+5^{\circ}\text{C}$ engine coolant temperature

Above an engine coolant temperature of $+5^{\circ}\text{C}$ the test of the thermo-time switch (S26) can only be performed with an ohmmeter. Unplug the connector at the thermo-time switch for this step.

Test value above $+5^{\circ}\text{C}$:

Terminal W-G $\infty\Omega$
(contacts in switch open).

b) Vehicles with actuation via fuel pump relay






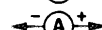
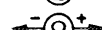
Depending on the engine coolant temperature the start valve is actuated by the coolant pump relay.

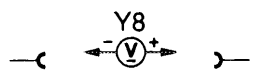
Example:

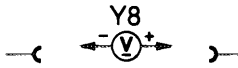
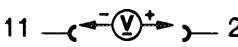
$-20^{\circ}\text{C} = 10$ seconds.

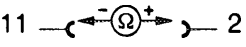

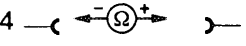
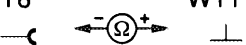
No further actuation occurs above $+60^{\circ}\text{C}$ or $+15^{\circ}\text{C}$, respectively (see 07.3-004).

Key to symbols

-  Battery
-  Multimeter
-  Contact
-  Connector
-  Voltage measurement (volts, direct voltage)
-  Current measurement (amperes, direct current)
-  Resistance measurement (ohms)

On/off ratio readout	Test step/ Test scope	Tester/ Test connection	Operation/ Requirement	Specifi- cation/ Function	Possible cause/Remedy
-	1.0 Test start valve actuation		<p>Feed in 10 kΩ at engine coolant temperature sensor coupling with Ω decade (approx. -15°C). Pay attention to Ω decade terminal!</p> <p>1-pin temperature sensor (B11/3): Ω decade to ground and detached cable.</p> <p>2-pin temperature sensor (B11/3) and TSZ ignition system (KE I and KE III): Ω decade to ground and detached cable (gn/sw) to fuel pump relay (terminal PF).</p>		

On/off ratio readout:	Test step/ Test scope	Tester/ Test connection	Operation/ Requirement	Specifi- cation/ Function	Possible cause/Remedy
	1.0 Test start valve actuation	 <p style="text-align: center;">Y8</p>	<p>2-pin tempera- ture sensor (B11/2) and EZL ignition system (KE III): Ω decade to ground and detached cable (gn/rt) to KE control unit (connector 2 1)</p> <p>4-pin tempera- ture sensor (B11/2): Ω decade diagonally to contacts 2 and 4</p> <p>Plug protective connector Part No. 102 589 02 21 00 into diagnosis socket.</p> <p>Start engine</p>	<p>> 10 V approx. 5 s</p>	<p>Fuel pump relay module (07.3-165) TF signal Voltage Terminal 50 Wiring</p>
-	2.0 ¹⁾ Test TF signal	<p>Fuel pump relay module</p> 	<p>Fuel pump relay module disconnected.</p> <p>Contacts 7 and 8 bridged.</p> <p>Engine at idle.</p>	<p>3-5 v</p>	<p>Engine coolant temperature sensor (07.3-l 21). Open circuit CFI control module (contact 9) ■ fuel pump relay module (contact 2). CFI control module</p>

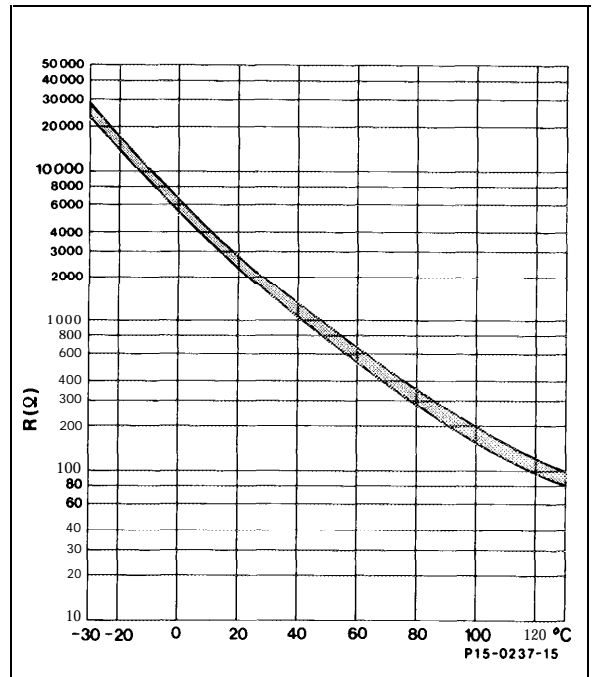
On/off ratio readout	Test step/ Test scope	Tester/ Pest connection	Operation/ Requirement	Specifi- cation/ Function	Possible cause/Remedy
-	3.0 ²⁾ Test TF signal	Fuel pump relay module 11 —  — 2	Fuel pump relay module disconnected.	Ω value e. g. + 80°C approx. 320 Ω + 20°C approx. 2.5 k Ω , other values see diagram	Engine coolant temperature sensor. Open circuit engine coolant temperature sensor ■ fuel pump relay module (contact 2).
-	4.0 Voltage of terminal 50	Fuel pump relay module 11 —  — 12	Fuel pump relay module disconnected. Starter: ON	> 9 v	Open circuit starter (M1) ■ fuel pump relay module.
-	5.0 Wiring	Fuel pump relay module Y8 4 —  — Y8 —  — W11	Fuel pump relay module and start valve coupling (Y8) disconnected. Coupling at start valve (Y8) dis- connected.	< 1 Ω < 1 Ω	Cable has open circuit. Cable has open circuit.

1) Vehicles with wiring routed from CFI control module (contact 9) to fuel pump relay module (contact 2).

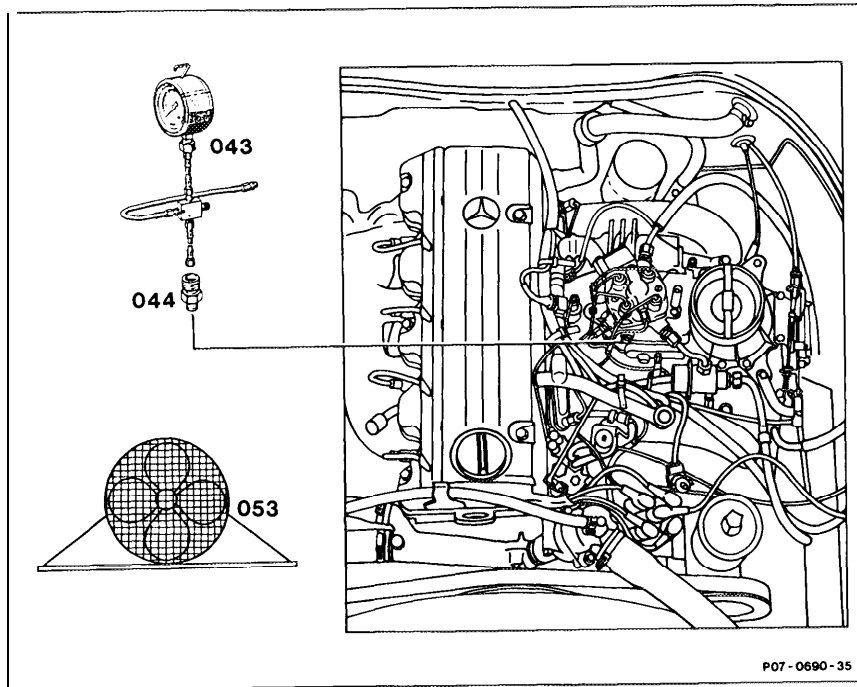
2) Vehicles with wiring routed from engine coolant temperature sensor (B11/2) to fuel pump relay module (contact 2).

Diagram

Resistances of engine coolant temperature sensor (B11/2).



07.3-127 Performing cold start



P07 - 0690 - 35

Pressure measuring device, double fitting (043, 044)

connect (07.3-I 20).

Special tools 103 589 00 21 00, 102 589 06 63 00. Run engine to build up pressure.

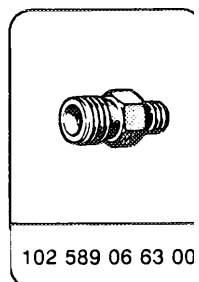
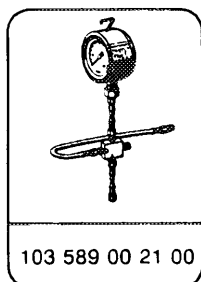
Cooling fan (053)

for cooling engine (or leave to stand overnight).

Cold start

perform, paying attention to pressure gauge: test fuel pressures (07.3-120) or electronic components of CFI injection system (07.3-121), if necessary.

Special tools



Fuel pressures in bar gauge

Engine		102.961 102.985
System pressure when idling and engine cold or at normal operating temperature		5.3–5.5
Lower chamber pressure	Engine oil temperature approx. 80°C	approx. 0.4 ¹⁾
	Engine not running or idling at engine coolant temperature of +20°C	approx. 0.5 ¹⁾
	with deceleration shut-off	5.3-5.5

¹⁾ Below previously measured system pressure

07.3-1 28 Wiring diagrams

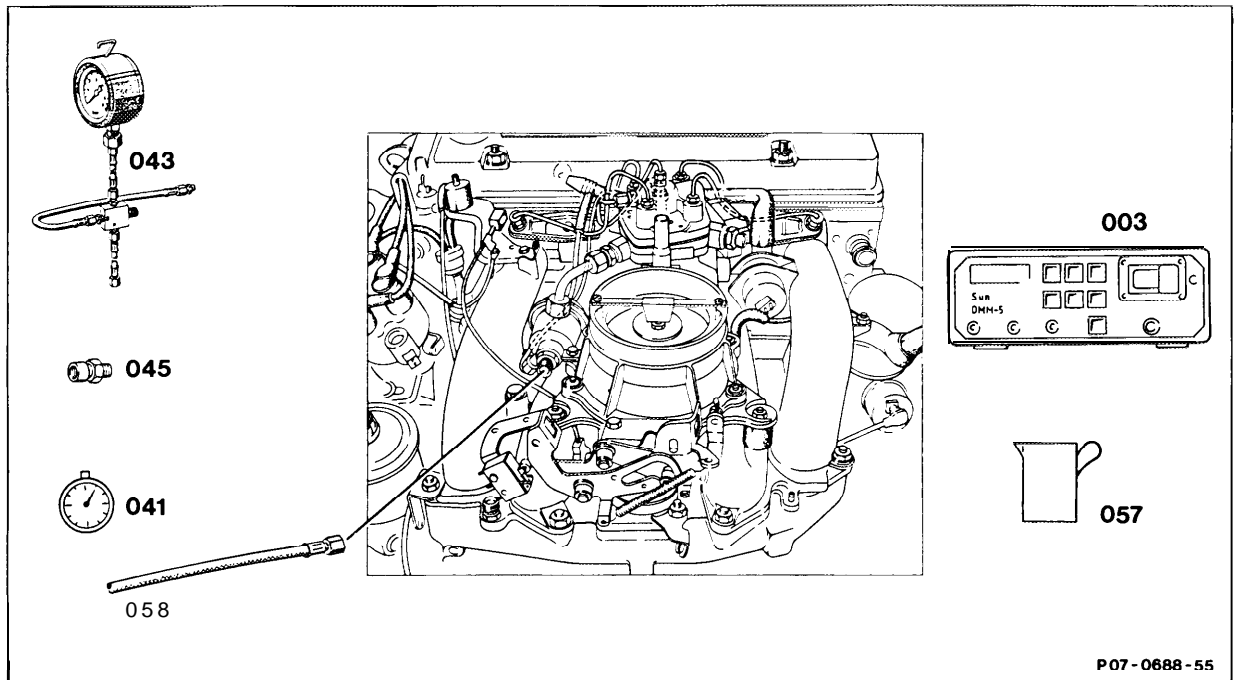
The wiring diagrams are assigned to the relevant electrical troubleshooting manual depending on the model.

Electrical Troubleshooting Manual, Model 201

07.3430 Testing fuel pump

Operation No. of operation texts and work units or standard texts
and flat rates: 07-5701, 07-5702

Versions as of 1986



Current consumption	test. Specification 6 – 10 amperes (step 1). Use multimeter (003) for this test.
Fuel pressure in fuel tank	release by removing filler cap.
Fuel return line (51)	unscrew.
Fuel hose (058)	make in-shop and connect to diaphragm pressure regulator.
Delivery	test. Specification 1 litre in maximum 40 seconds: use measuring beaker (057), stopwatch (041) for this test.
Fuel pressure	test on vehicles with double pump version. Specification 2 – 4 bar gauge. Use pressure measuring device (043) 103 589 00 21 00 , connection fitting (045) 103 589 02 63 00 for this test.

Test data

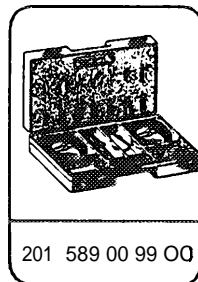
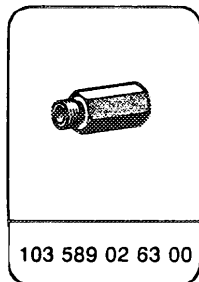
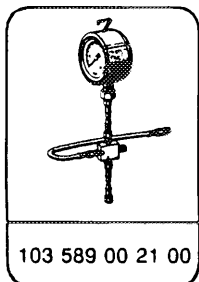
Fuel pump (qty.)	1 pump	1 pump
Designation	EKP 6	EKP 4
Engine	102 up to approx. 02/86	102 as of approx. 03/86
MB Part No.	002 091 59 01 ²⁾	002 091 97 01
	0 580 254 951	0 580 254 943
Test specification	with engine running and voltage of min. 11.5 volts at delivery pump	
Delivery ¹⁾	Test point	Fuel return line downstream of diaphragm pressure regulator
	min. 1 liter in	40 seconds
Current consumption	6–10 amperes ³⁾	

1) The fuel tank must be at least half full for measuring delivery.

2) If replacing, Install Part No. 002 091 88 01.

3) KAT version up to 01/90 with oxygen sensor heater connection at terminal 87 at fuel pump relay: detach oxygen sensor heating coil plug connection (G3/2x1).

Special tools



Commercially available testers

Measuring glass or beaker (at least 1 litre),
stopwatch

Multimeter

e. g. Sun, DMM-5

Shop-made tools

Fuel hose 500 mm long
 Tube with sealing cone
 Union nut M14x1.5

Note

For wiring diagrams see Electrical troubleshooting Manual, Model 201.

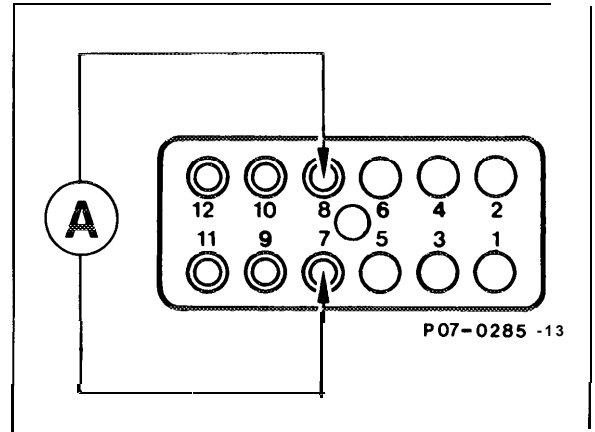
The fuel pump must run audibly for a short time (approx. 1 second) when the ignition is switched on.

A. Delivery

1 Detach fuel pump relay module. Multimeter set to amperes. Test current consumption at contact 7 (terminal 87) and contact 8 (terminal 30).

Current consumption 6 – 10 amperes.

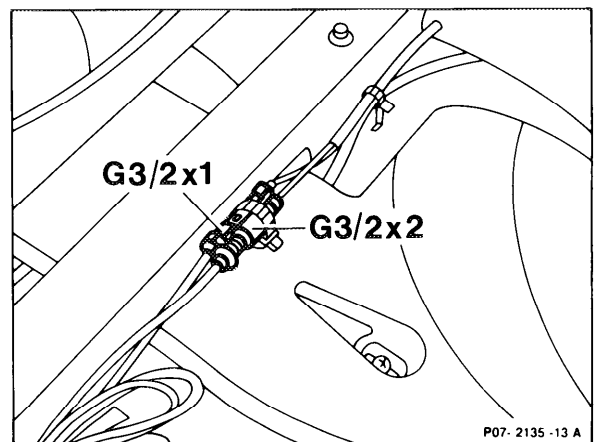
If the readout is greater than 10 amperes, proceed as follows:



a) Vehicle with Catalytic Converter (up to 01/90)

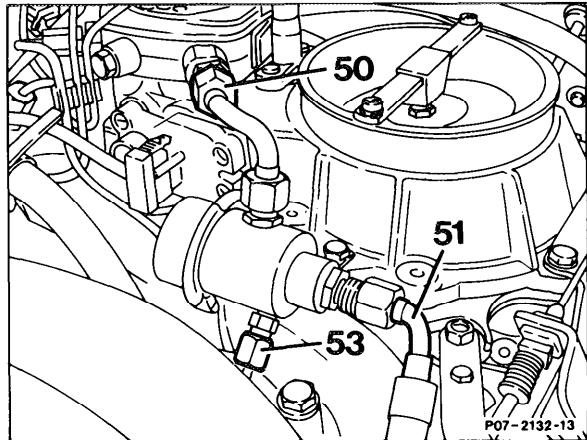
Detach heated oxygen sensor heating coil plug connection (G3/2x 1) and repeat measurement. Located in right footwell (arrow), as of 09/89 next to battery.

Test current consumption of heated oxygen sensor, 0.5 – 1.3 A; test heated oxygen sensor if necessary (see 07.3-I 21, test program with contact box, on/off ratio 50%).

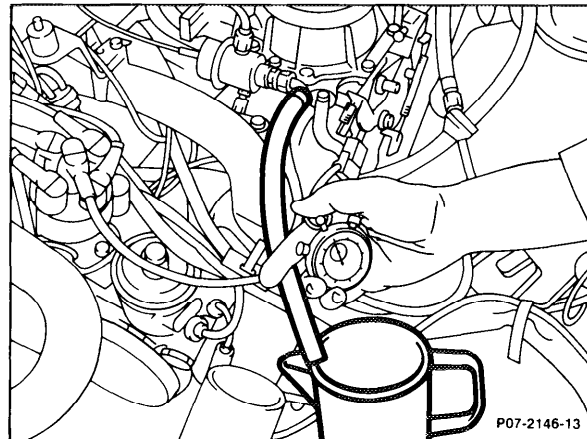


2 Detach wiring from multimeter. The delivery of the fuel pump should be tested in the fuel return. Release fuel pressure in fuel tank by removing filler cap. Unscrew fuel return line (51) at the diaphragm pressure regulator and plug.

- 50 System pressure feed
- 51 Fuel return
- 53 Fuel distributor return

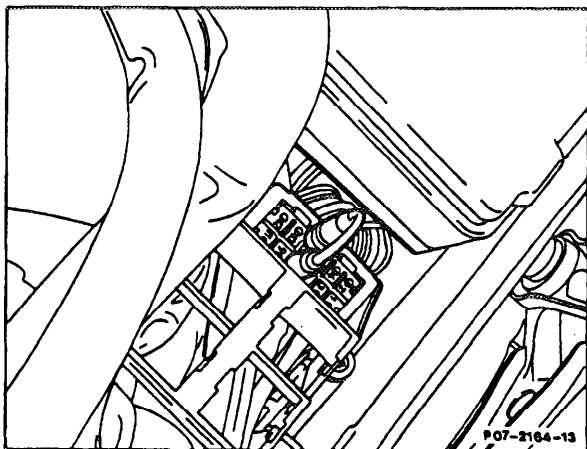


3 Screw shop-made fuel hose onto diaphragm pressure regulator and hold in measuring glass or beaker.



4 Bridge contacts 7 and at fuel pump relay module. This supplies voltage to the fuel pump.

Arrangement of fuel pump relay module in right of component compartment.
Engine 102.961: in front of electrical center (see ill.).



Detach bridge after 40 seconds or before measuring glass/beaker runs over.

Specification:

1 liter in maximum 40 seconds at a minimum voltage of 11.5 volts at the fuel pump.

5 If the delivery is less than 1 liter in 40 seconds, test the following points:

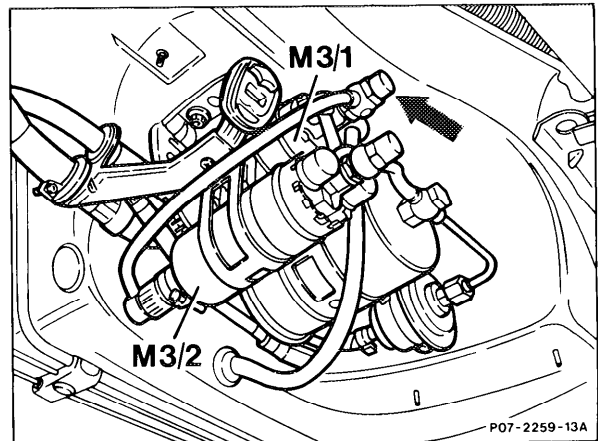
- a) Test voltage at the fuel pump. Specification at least 11.5 volts.
- b) Check that strainer in supply line fitting of fuel distributor is not blocked.
- c) Check fuel lines for restriction points (pinched lines).
- d) Clamp off leak line between fuel accumulator and fuel suction hose. Re-check fuel delivery. If the specified delivery quantity is reached, replace fuel accumulator.
- e) Replace fuel filter.

6 If the delivery is still insufficient, replace fuel pump.

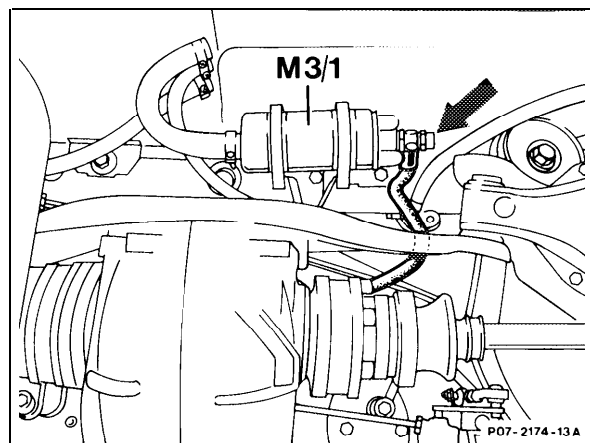
7 Connect fuel return hose, install fuel pump relay module.

B. Fuel pressure

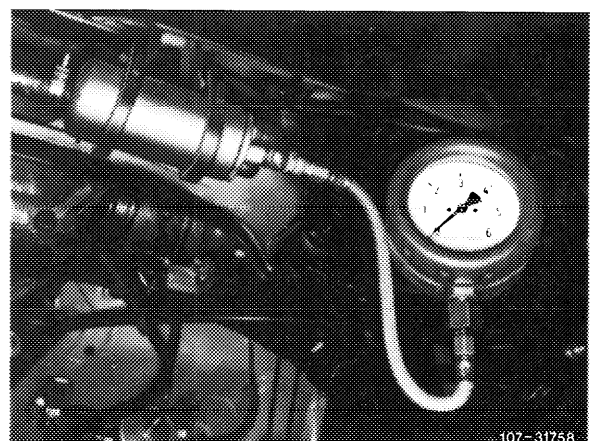
- 1 Take off protective box.
- 2 Unscrew cap nut (arrow) at fuel pump (M3/1). Connect fitting, Part No. 103 589 02 63 00 and pressure gauge, Part No. 103 589 00 21 00.
- 3 Detach fuel pump relay module and bridge contacts 7 and 8 (terminals 30 and 87).



- 4 Take reading on pressure gauge. The pressure must be between 2 – 4 bar. If it is below 2 bar, the fuel pump (M3/1) is defective. If it is above 4 bar, the fuel pump (M3/2) is defective.
- 5 Disconnect pressure measuring device, connect cap nut, install fuel pump relay module and check for leaks.

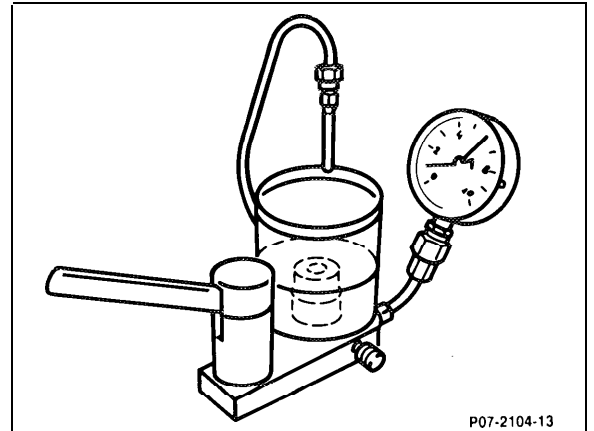
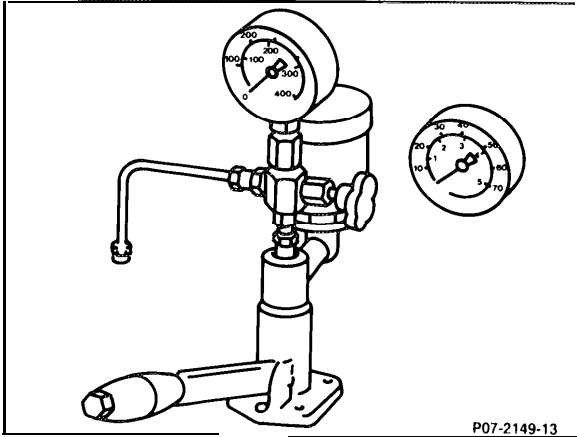


- 6 Install protective box.



07.34 35 Testing fuel injectors

Preceding work:
Removal and installation of injectors (07.3-215)



Fuel injectors
Rough leak test

test.

- a) Connect removed injectors to tester.
Bleed pressure line with shutoff cock open and union nut open. Following this, tighten union nut.
- b) Shutoff cock open; slowly operate hand lever (4 sec./stroke) and build up pressure to max. 1.5 bar gauge. If a leak is detected at the injector, the injector must be replaced.

Test opening pressure

See test data for new injectors.
See test data for used injectors.
Close shutoff cock. Flush through injector by operating hand lever rapidly several times.
Open shutoff cock and test opening pressure with slow movement of hand lever.

Precision leak test Close shutoff cock. Flush through injector by opening hand lever rapidly several times, open shutoff cock and increase pressure slowly up to 0.5 bar gauge pressure below the previously determined opening pressure, and hold. No drop must form at the injector within 15 seconds.

Chatter test, assessing spray pattern Close shutoff cock and flush injector by operating hand lever several times (0.5 sec./stroke). Following this, reduce lever speed to approx. 1 sec./stroke. This must cause the injector to chatter. No drop should form at the mouth of the injector. No string jet should form. Unilateral, atomized jet formation within a total spray angle of approx. 35 ° is permissible.
See illustrations for assessing spray jet.

Test data

Engine	MB Part No. (Bosch No.)	Opening pressure (bar gauge ¹⁾) new injectors	Opening pressure (bar gauge ¹⁾) min. for used injectors
102 up to 08/88	000 078 40 23 (0 437 502 010)	3.5 - 4.1	3.0
as of 09/88	000 078 56 23 ²⁾ (0 437 502 047)	3.7 - 4.3	3.2

1) Fuel injectors which are found to be out of tolerance must be replaced. Injectors may be replaced individually within a set.
2) Brass fuel Injectors.

Tightening torques in Nm

Injection lines to fuel distributor (reference value)	10 - 12
Injection lines to injectors (reference. value)	10 - 15

Commercially available tools and testers

Designation	e. g. Make, Order No.
Injector tester EFEP 60 H ¹⁾	Bosch No. 0 684 200 700
0 – 6 bar pressure gauge, housing Ø100 mm, quality class 1 .0	Bosch No. 1 687 231 000
Pipe line	Bosch No. 1 680 750 001
Adaptor ²⁾	Bosch No. KDJE-P 400/7

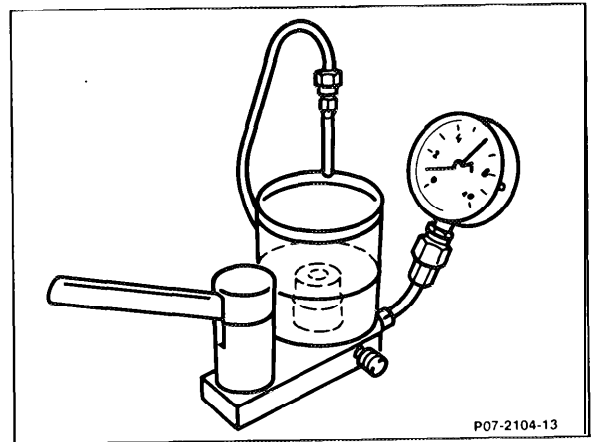
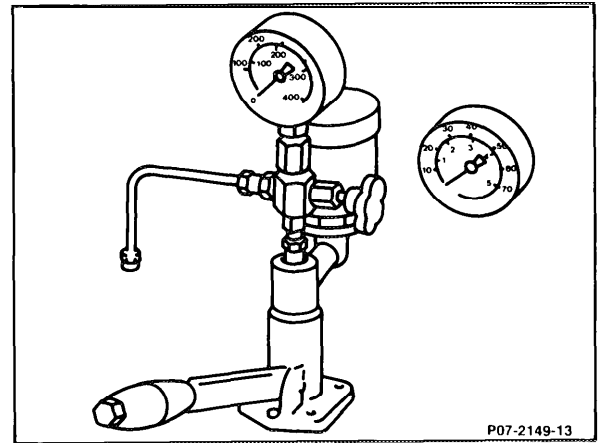
1) Similar to previous injector tester The pressure gauge listed or the pressure gauge of the pressure measuring device 100 589 13 21 00 is required for testing the Injectors.

2) An adaptor must be used due to the modified M1 0 x 1 connection thread of the Injectors.

Note

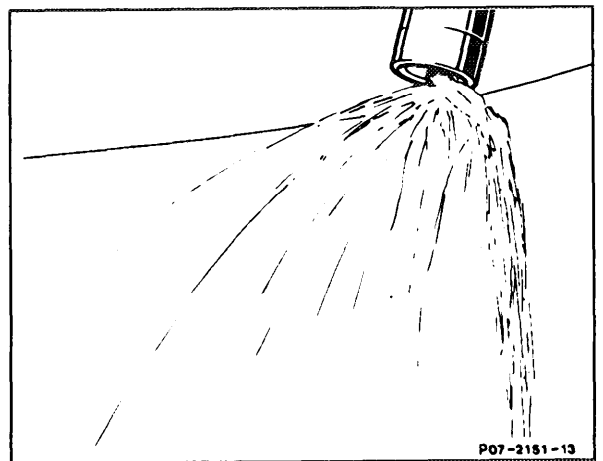
The opening pressure, chatter, the jet and the leaktightness of the fuel injectors must be tested using an injector tester.

Before it is possible to begin testing the injectors, the reservoir tester must be filled and the tester bled. Only clean test fluid (i.e. Shell mineral spirits 135) should be used for testing.



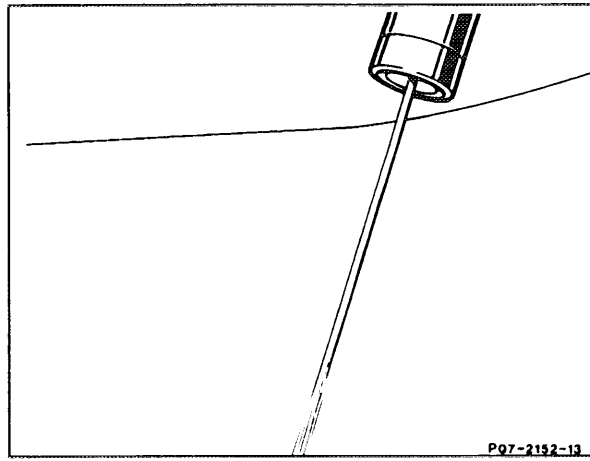
Assessing jet

Damaged fuel injectors

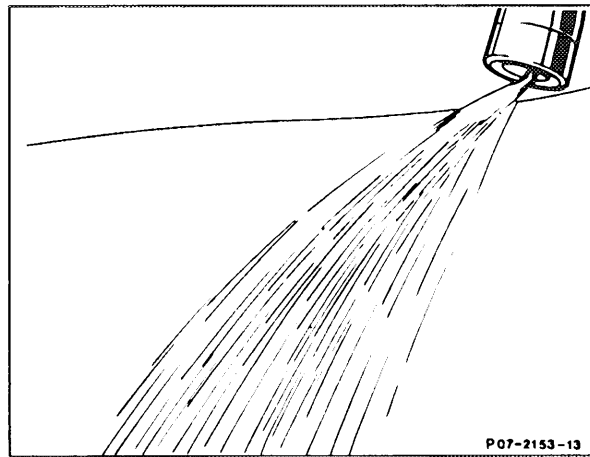


Formation of drops

Pencil shaped jet

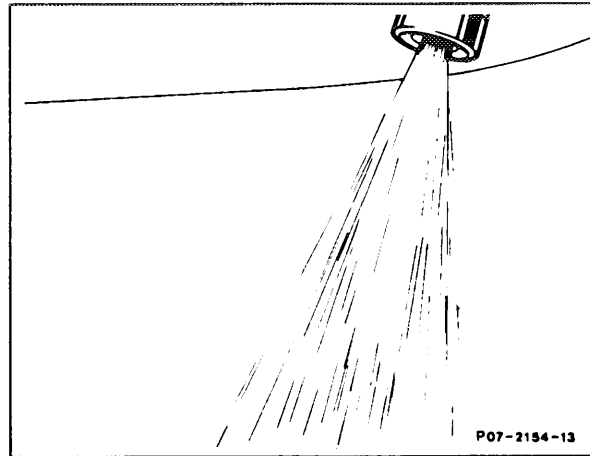


Stringy jet

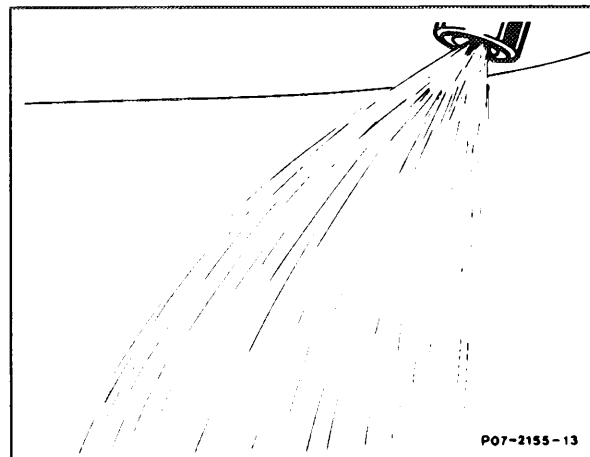


Good fuel injectors

Good spray formation

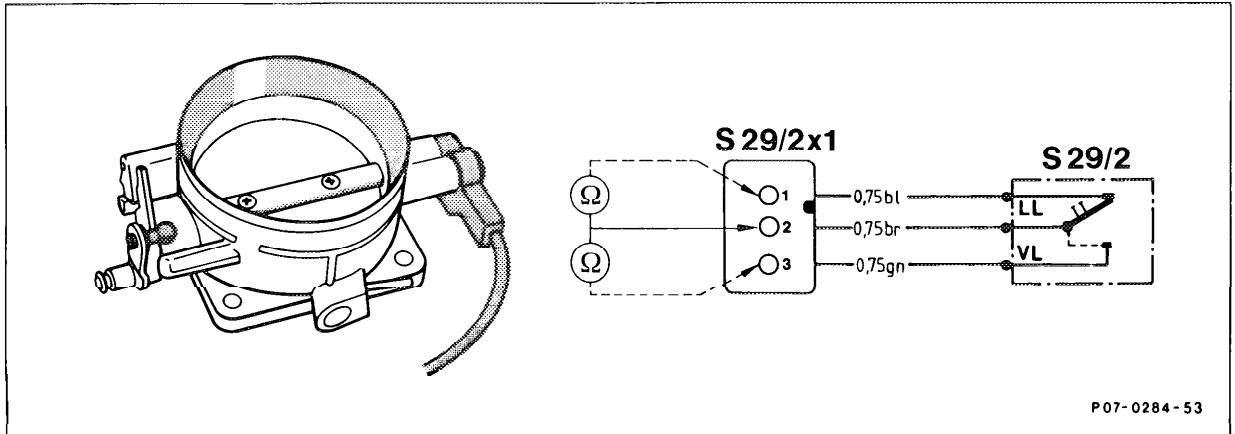


Slightly unilateral atomization



07.3-152 Testing, replacement of wide open throttle/closed throttle position switch

Preceding work:
Removal and Installation of throttle valve assembly
(07.3-230)



S29/2 Wide open throttle/closed throttle position switch
S29/2x1 Wide open throttle/closed throttle position switch connector

Note

Check closed throttle position stop only in the case of wide open throttle/closed throttle position switch with wide open throttle/closed throttle speed detection.

Ohmmeter	set to measuring range 0 – ∞.
Full throttle stop	check by pressing switch against wide open throttle stop. The readout should be 0 Ω. Turn throttle valve slightly towards closed throttle position: this must cause the readout to show ∞Ω.
Closed throttle position stop	check by pressing throttle switch against closed throttle position stop. Turn throttle switch far enough to obtain a readout of 0Ω. Raise throttle switch 0.2 mm; this must cause readout to show ∞Ω.
	Closed throttle position contact:
	closed throttle position approx. 0Ω
	wide open throttle position approx. ∞Ω
	Wide open throttle position contact:
	closed throttle position approx. ∞Ω
	wide open throttle position approx. 0Ω
	partial throttle position approx. ∞Ω

Commercially available tester

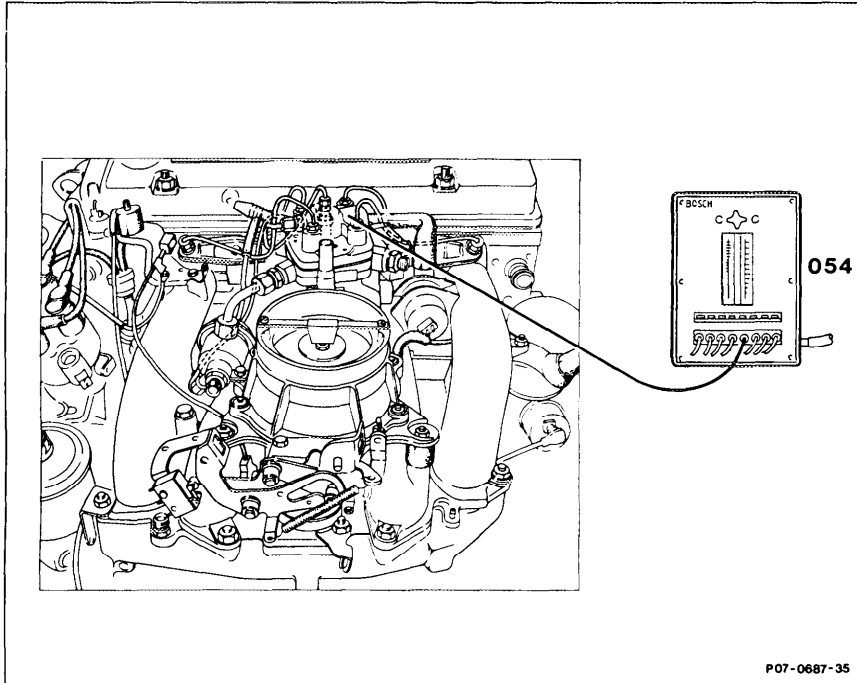
Multimeter

e.g. Sun, DMM-5

WOT/CTP switch (S29/2 and S29/1)..... replace by removing both fastening bolts and bolting on.

07.3-1 60 Performing fuel quantity comparison measurement

Preceding work:
Testing, adjusting engine (07.3-110)



Quantity comparison tester	unscrew, screw in.
Injection lines	Remove at fuel distributor and at injectors, bolt on. Clean connection points before reinstallation.
Quantity comparison tester (054)	connect to fuel distributor (see ill. for sequence).
Fuel return line	insert into filler neck of fuel tank.
Adjusting device for setting air flow sensor plate .	clamp to stop bar of air flow sensor plate (see ill.).
Fuel pump relay	disconnect and bridge contacts 7 and 8 (fuel pump runs).
Air flow sensor plate	deflect and press button 1 to 4 in sequence for bleeding tester.
Tester button 1	press and hold. Deflect air flow sensor plate by means of adjusting device far enough to obtain a reading of 4 cc/min. (idle quantity). Fix air flow sensor plate in position.

Tester buttons 2 to 4 press in sequence and measure flow quantities and enter on sheet B 20 800 99 472 00 (or note on paper). Maximum permissible variation between cylinders 0.4 cc/min (at idle). Following this, identical procedure as before. Test part and wide open throttle flow quantities by deflecting air flow sensor plate.

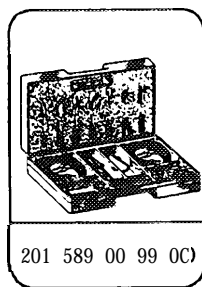
a) Part throttle 30 cc/min
 b) Wide open throttle 100 cc/min

Maximum permissible variation between cylinders:
 Part throttle 4 cc/min
 Wide open throttle 10 cc/min

If the variation is out of tolerance, replace fuel distributor (07.3-205).

Engine run; check all fuel connections for leaks.
 Idle speed set (07.3-l 05).

Special tool



Commercially available Bosch testers and accessories

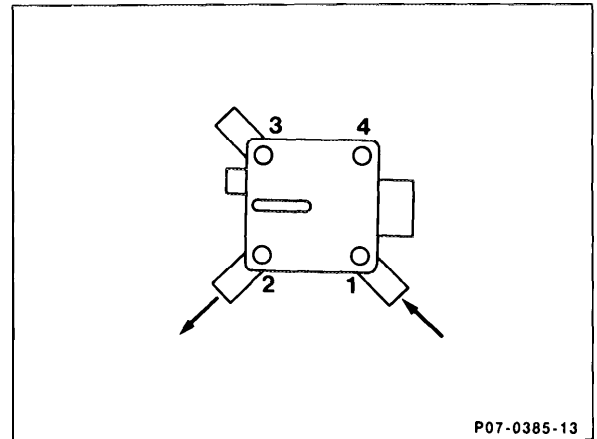
Designation	Order designation
Quantity comparison tester	KDJE-P 300
Tester trolley 1)	M 200/2 or KDJE-W 100

1) If the tester trolley is used for the quantity comparison tester, an additional angle plate is required. This can be shop-made or obtained through a Bosch distributor.

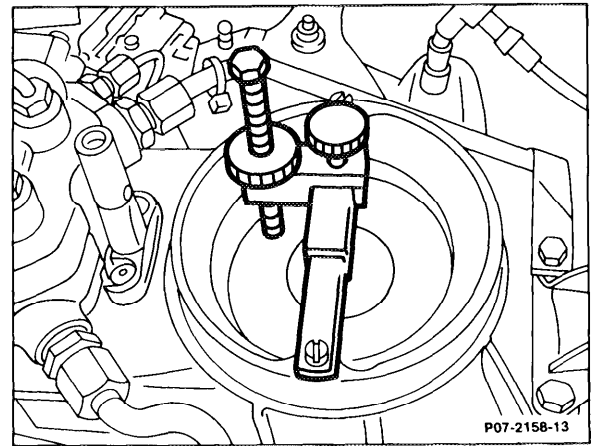
Note

The measurement is performed with the engine not running. The operating condition (idle speed, part or full load) is simulated and set at the air flow sensor plate using an adjusting device.

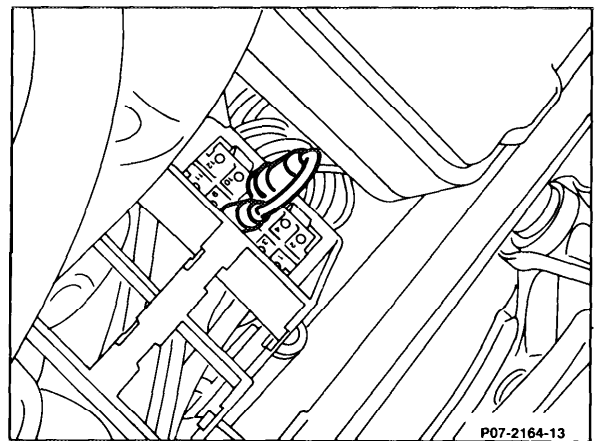
Arrangement of fuel lines at fuel distributor



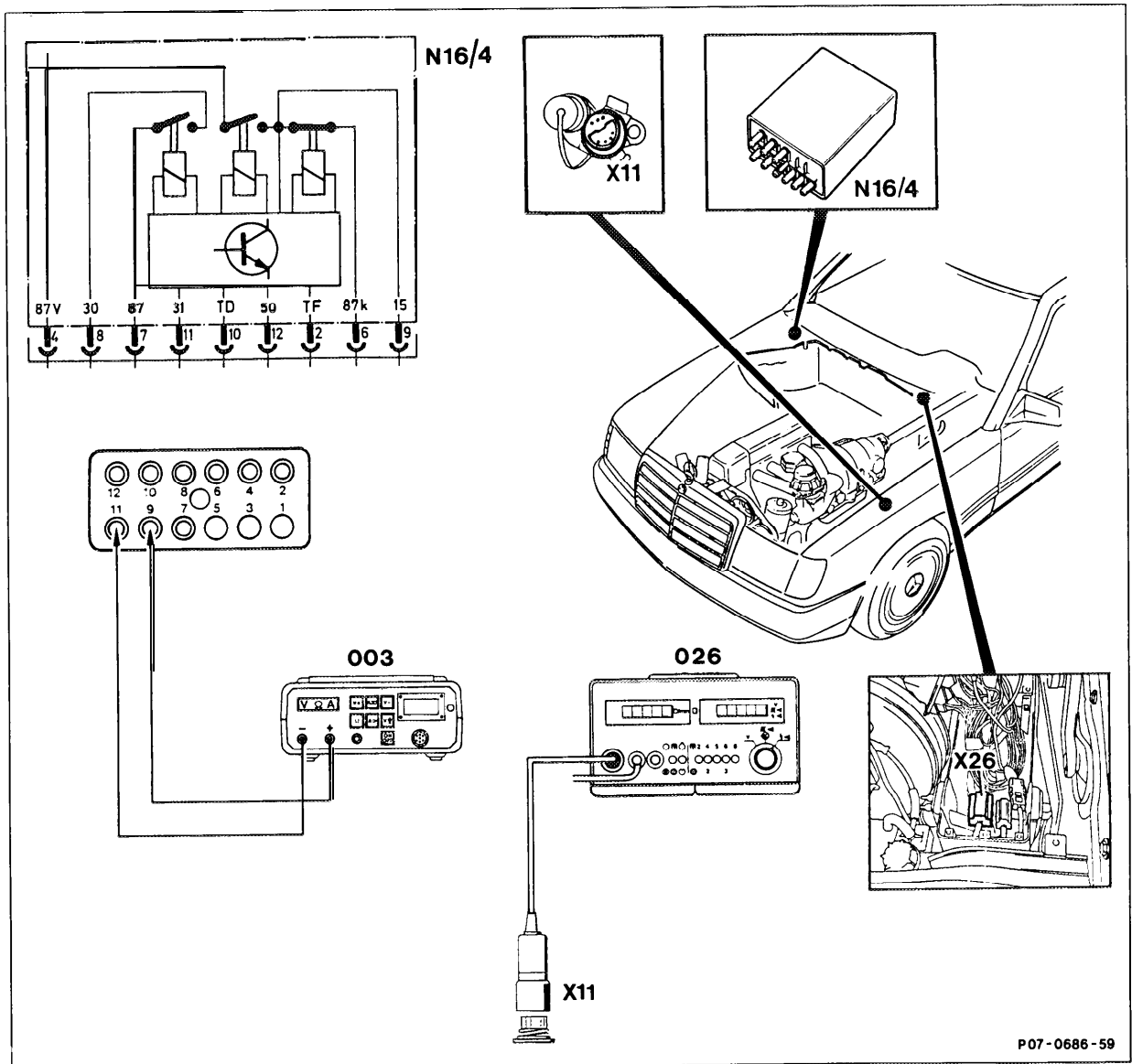
Fix air flow sensor plate with adjusting device



Detach fuel pump relay and bridge contacts 7 and 8 (terminals 30 and 87). This supplies voltage to the fuel pump. The fuel pump relay is located on the right of the component compartment. On engine 102.961 it is located in front of electrical center.



07.3-165 Testing fuel pump relay module



N16/4 Fuel pump relay module
x11 Diagnostic connector/terminal block

X26 Interior/engine connector
003 Multimeter
026 Engine tester

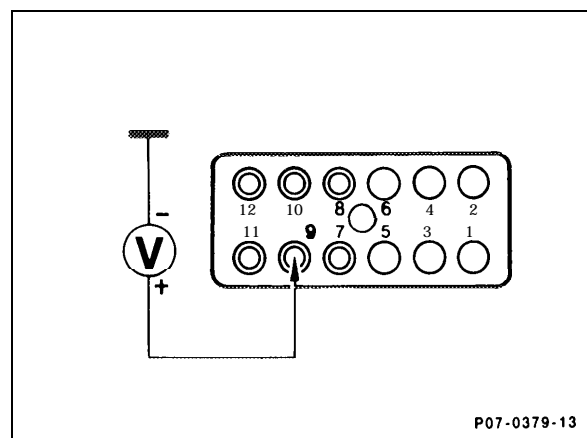
Wiring diagrams (07.3428).
 Check current draw of fuel pump
 (07.3430).

Engine	Version	Fuel pump relay module MB Part No.	Governed speed 1 /min	Kick-down shutoff	Starting valve actuation	Remarks
102.961	USA	001 545 93 05 ¹⁾ 001 545 94 05 ²⁾	5700 ± 50	5500 ± 50	--	up to 09/84
102.985	USA	001 545 93 05 ¹⁾	5700 ± 50	--	--	06/83-08/84
		001 545 94 05 ²⁾	5700 ± 50	5500 ± 50	--	06/83-08/84
		001 545 77 05 ¹⁾	³⁾	--	60°C/ Coolant temperature sensor	09/84-07/86
		001 545 78 05 ²⁾	³⁾	5900 ± 50	60°C/ Coolant temperature sensor	09/84-07/86
		002 545 20 05 ¹⁾ 002 545 21 05 ²⁾	6200 ± 50	6000 ± 50	60°C/ KE voltage signal	as of 08/86
		003 545 20 05	6200 ± 50	6000 ± 50	60°C/ KE voltage signal	1991

- 1) Manual transmission, replacement part as for automatic transmission.
2) Automatic transmission.
3) Without engine speed limiter










Pin assignment for fuel pump relay module connector

- 1 not assigned
2 with start valve actuation (terminal TF):
CFI control module
3 not assigned
4 with start valve actuation (terminal 67V).
start valve (Y8)
5 as of approx. 01/90 (terminal 67H):
heated oxygen sensor heater from + 20°C
6 with automatic transmission (terminal 67k):
kick-down valve (Y3)
7 fuel pump,
oxygen sensor heater (up to 12/89),
auxiliary air fan heating coil (without idle speed control)
(terminal 87)
a Terminal 30
9 Terminal 15
10 engine speed signal (terminal TD)
11 ground (terminal 31)
12 start signal (terminal 50)



Test

Key to symbols






	Battery
	Multimeter
	Socket
	Pin
	Ground
	Bridge
	Voltage measurement (volts, direct voltage)
	Current measurement (amps, direct current)
	Resistance measurement (ohms)

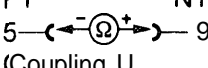
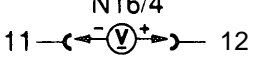
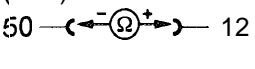
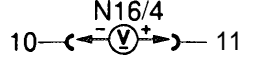

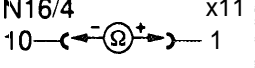
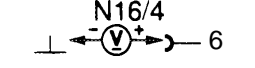
Notes

If the specified value of a test step, e. g. step 4.0, is in order, it is not necessary to perform test step 4.1.

Different component designations are possible depending on wiring diagram or in the case of vehicles with optional equipment.

These designations are given in parentheses. The fuel pump relay module has been designated uniformly with **N16/4** (**N5/1**, **N5/2**, **N16/1**, **N16/2**, **N16/3** also possible in the wiring diagrams).

On/off ratio readout	Test step/ Test scope	Tester Test connection	Operation/ Requirement	Specifica- tion/ Function	Possible cause/Remedy
-	1.0 Voltages at fuel pump relay module (N16/4)	-	Ignition: ON Fuel pump in order.	Fuel pump starts briefly when ignition switched on.	Fuel pump voltage. Fuel pump relay module.
	1.1 Voltage terminal 30	N16/4 11 ← ←  → → 8	Fuel pump relay module disconnected.	11 - 14v	Open circuit to terminal block, terminal 30. Open circuit to ground.
	1.2 Voltage terminal 15	N16/4 11 ← ←  → → 9	Ignition: ON Fuel pump relay module disconnected.	11 - 14v	Cable has open circuit. *
	1.3 Cable	N11 W9) W10) N16/4 ⊥ ← ←  → → 11	Ignition: OFF Fuel pump relay module disconnected.	< 1Ω	Cable has open circuit.
	1.4 Cable	 N16/4 + ← ←  → → 8	Ignition: OFF Fuel pump relay module disconnected.	< 1Ω	Cable has open circuit.

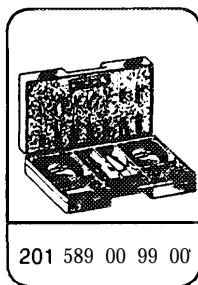
On/off ratio readout	Test step/ Test scope	Tester Test connection	Operation/ Requirement	Specifica- tion/ Function	Possible cause/Remedy
	1.5	F1 5 —  — 9 (Coupling U)	Ignition: OFF Fuel pump relay module disconnected. Electrical center coupling U disconnected.	< 1Ω	(Cable has open circuit.
	2.0 Start signal terminal 50	N16/4 11 —  — 12	Starter: ON Selector lever in position "P" or "N".	10-14 v	(Cable has open circuit.
	2.1 Cable	X14 (X35) 1) N16/4 50 —  — 12	Ignition: OFF Fuel pump relay module and X14 disconnected.	< 1Ω	(Cable has open circuit.
	3.0 Engine speed signal terminal TD	N16/4 10 —  — 11 7 —  — 8	Fuel pump relay module disconnected. Start engine.	6-12 v	(Cable has open circuit.
	3.1 Cable	N16/4 x11 10 —  — 1	Ignition: OFF	< 1Ω	(Cable has open circuit.
-	4.0 Kickdown shutoff 2)	N16/4  — 6	Disconnect fuel pump relay far enough to make connection to connector 6. Start engine Increase engine speed up to approx. 200/min less than governed speed. See table for engine speed.	11-14 v Voltage drops	(Cable has open circuit. (07.3-l 67). Fuel pump relay.

1) Model 201.024 vehicle identification end no. 000 001 - 045 803

2) with automatic transmission, test if engine is governed before upshift.

On/off ratio readout	Test step/ Test scope	Tester Test connection	Operation/ Requirement	Specifica- tion/ Function	Possible cause/Remedy
-	5.0 Governed speed		Start engine increase speed	Governed speed and version with speed limiter, see table	Test TD signal (test step 3.0). Fuel pump relay.

Special tool



Commercially available testers

Multimeter	e. g. Sun, DMM-5
Engine analyzer	e. g. Bosch, MOT 001.03

Function

The fuel pump relay performs the following functions:

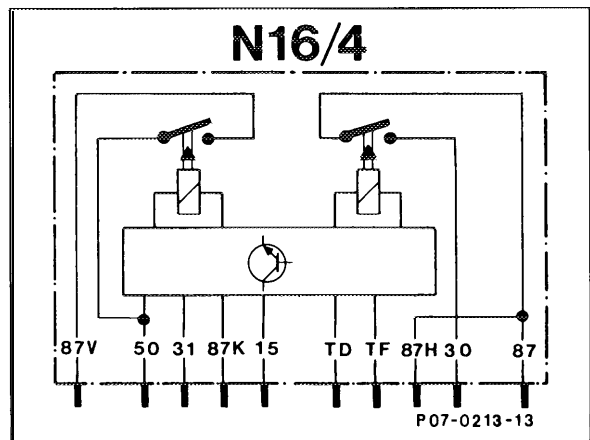
- Brief supply of voltage to fuel pump when ignition is on.
- Voltage supply to fuel pumps when engine started and when running.
With KAT, additionally voltage supply of oxygen sensor heater.
Voltage supply of auxiliary air valve (only vehicles without idle speed control).
- Shuts off fuel pumps when maximum engine speed is reached (speed limiter, versions see table).
- Switches off fuel pump as soon as no further pulses supplied via terminal TD of ignition control module.
- Kick down shutoff (for test see 07.3467).
- Starting valve actuation (for test see 07.3-I 26).

- As of 09/89 the function in the fuel pump relay module is partially supplemented in two stages by a separate oxygen sensor heater:

1st version up to approx. 12/89

The fuel pump relay module is fitted with an additional connector for the oxygen sensor heater with the designation 87H. This also results in a modification to the cable assignment at the relay module.

The actuation is performed as before as the additional connector 87H is linked by a bridge to the connector with the designation 87.

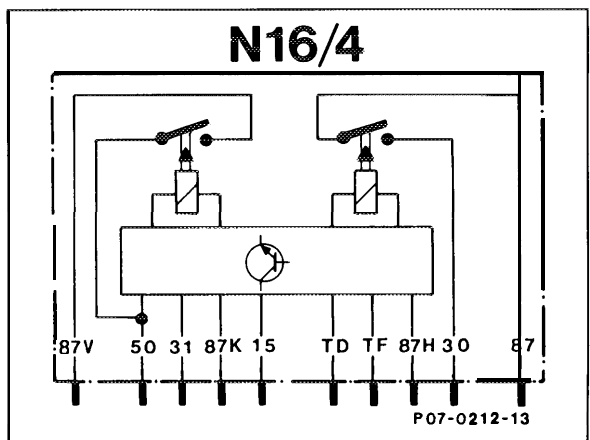


2nd version as of 01/90

From this date on the fuel pump relay module is no longer equipped with a bridge between terminals 87 and 87H. The electronic circuitry in the relay is modified as a result. The cut-in temperature for the oxygen sensor heater is + 20°C and is determined by the coolant temperature sensor.

Note

Only the new fuel pump relay modules are available through replacement parts. This means that in vehicles prior to 09/89, the actuation of the fuel pump and oxygen sensor heater continues to be performed by connector 87. Connector 87H on these vehicles does not perform any function.

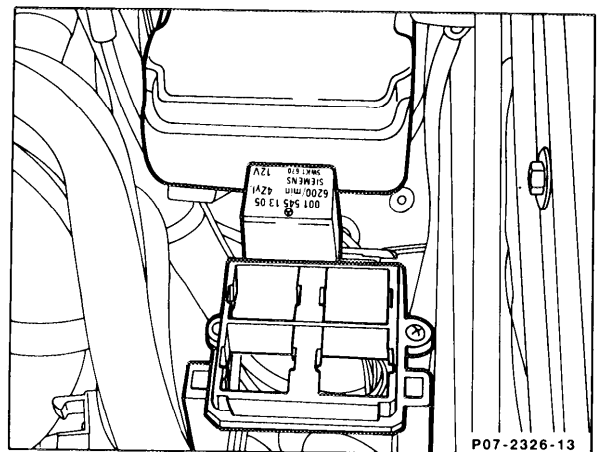


Arrangement of fuel pump relay module

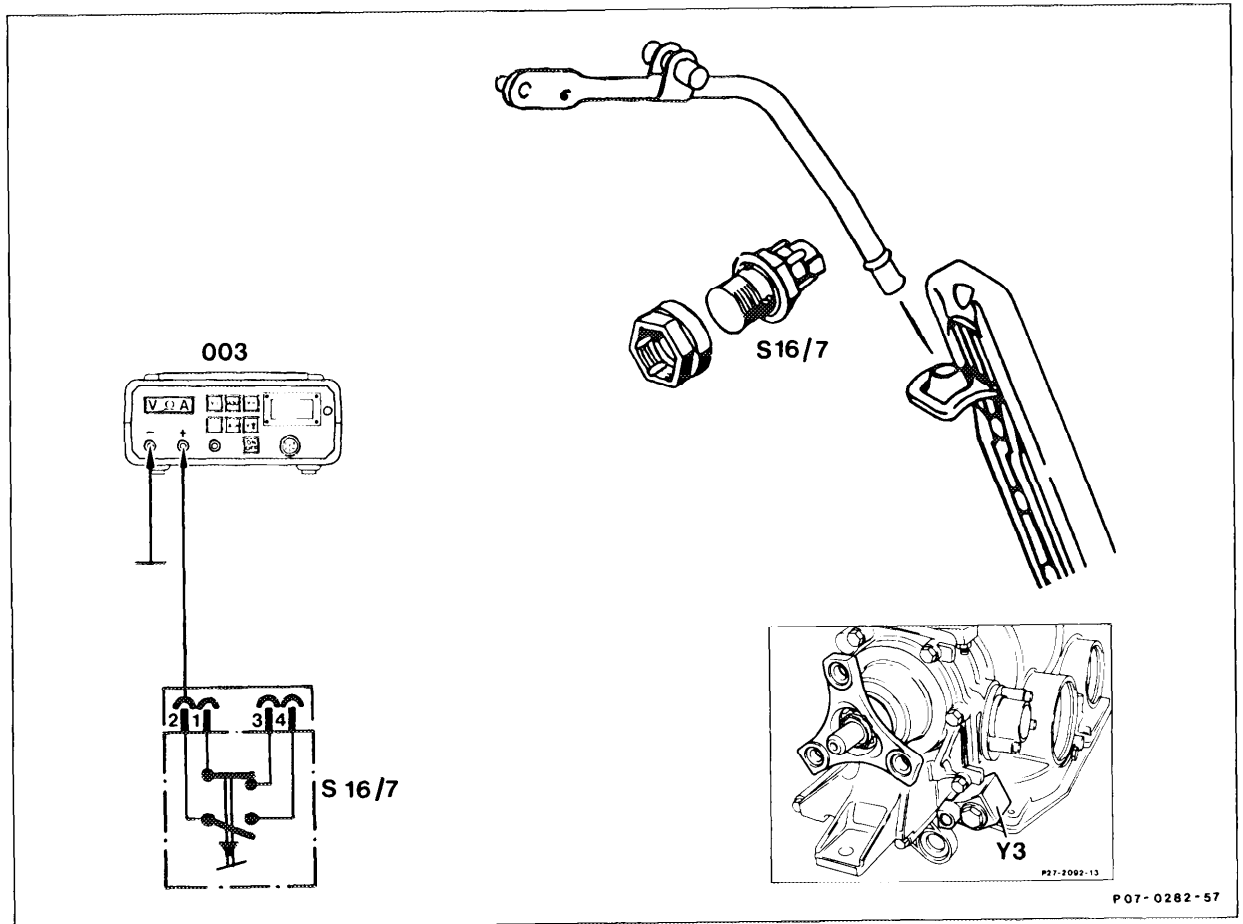
The fuel pump relay module is located on the right of the component compartment.

Exception: engine 102.961 in model 201.

Fuel pump relay in front of electrical center (see ill.).



07.3-1 67 Testing kick-down switch






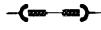





S16/7 Economy mode kickdown switch
Y3 Kickdown valve

003 Multimeter

Test

Key to symbols

-  Battery
-  Multimeter
-  Socket
-  Pin
-  Ground
-  Bridge
-  Voltage measurement (volts, direct voltage)
-  Current measurement (amps, direct current)
-  Resistance measurement (ohms)

Notes

- If the specified value of a test step, e.g. step 4.0, is in order, it is not necessary to perform test step 4.1.
- Different component designations are possible depending on wiring diagram or in the case of vehicles with optional equipment. These designations are given in parentheses.

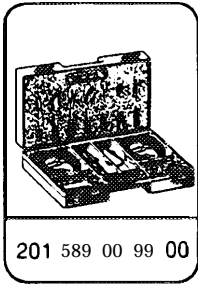
On/off ratio readout	Test step/ Test scope	Tester Test connection	Operation/ Requirement	Specifica- tion/ Function	Possible cause/Remedy
-	1.0 Test kick-down shut-off 1)	<p style="text-align: center;">S16/7 (S30/2) ___/_+ + + + --- 2</p> <p style="text-align: center;">S16/7 (S30/2) 4 ← (V) → 2</p>	Ignition: ON Coupling at kickdown switch disconnected.	11-14 V 11-14 V	Wiring. Wiring.

1) Vehicles without economy mode with 2-pin kickdown switch S16/6 (or S30/1), coupling has no contact designaion (note coloring of wiring).

On/off ratio readout	Test step/ Test scope	Tester Test connection	Operation/ Requirement	Specifica- tion/ function	Possible cause/Remedy
-	1.1 Wiring model 201	<p>X26/3 2) (X18)</p> <p>N16/4 1 ← (Ω) → 6</p> <p>X26/3 2) S16/7 (X18) (S30/2)</p> <p>1 ← (Ω) → 2</p> <p>S16/7 (S30/2) Y3</p> <p>4 ← (Ω) →</p>	Ignition: OFF Fuel pump relay module and connectors X26, S16/7 and Y3 disconnected.	< 1Ω < 1Ω < 1Ω	Open circuit. Open circuit. Open circuit.
-	2.0 Test kick- down switch S16/7 1)	<p>S16/7 (S30/2)</p> <p>4 ← (Ω) → 2</p>	Ignition: OFF Kickdown switch connector disconnected. Operate kick- down switch. Do not operate kick- down switch.	< 1Ω ∞Ω	Kickdown switch.
-	3.0 Kickdown valve (Y3) (automatic transmission)	<p>Y3</p> <p>1 ← (V) →</p>	Ignition: ON Operate kick- down switch.	11-14 V	<ul style="list-style-type: none"> • Cable. • Kickdown valve.

1) Vehicles without economy mode with 2-pin kickdown switch S16/6 (or S30/1), coupling has no contact designation; (note color of wiring).

Special tool



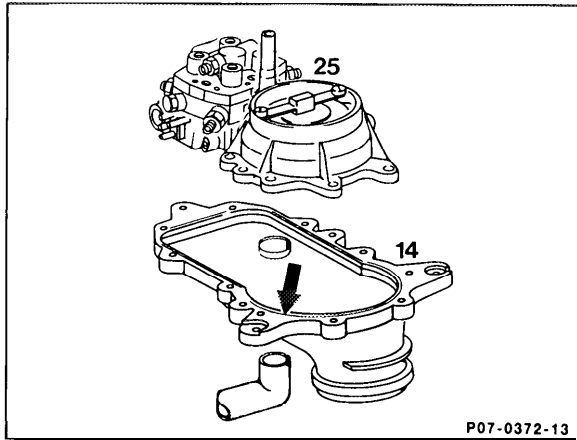
Commercially available tester

Multimeter

e. g. Sun, DMM-5

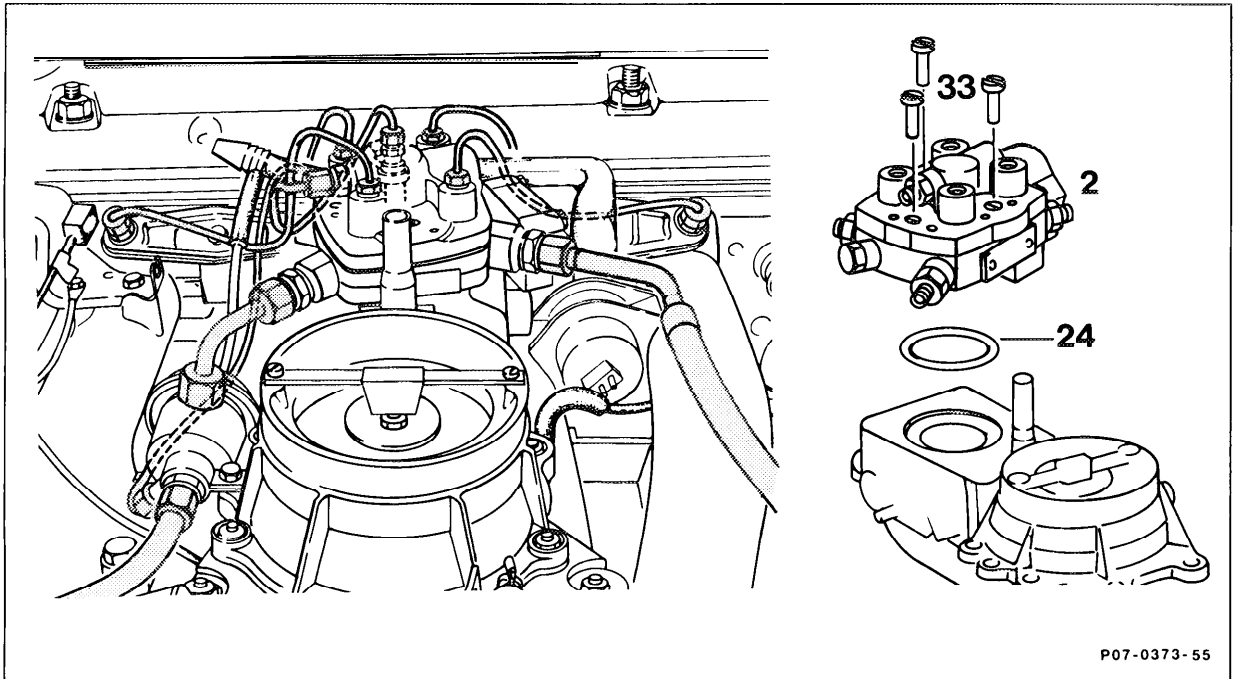
07.3-200 Removal and installation of mixture control unit

Preceding work:



- | | |
|---------------------------------|--|
| Mixture control unit (25) | remove together with air guide housing (14), install (07.3-225). |
| Air guide housing (14) | unbolt from mixture control unit (25).
Replace damaged parts. During installation, do not use sealing compound. Seal is provided by sealing lip (arrow).
The air guide housing is made of rubber. It is inserted into the light alloy frame for fixing in place. |

07.3-205 Removal and installation of fuel distributor



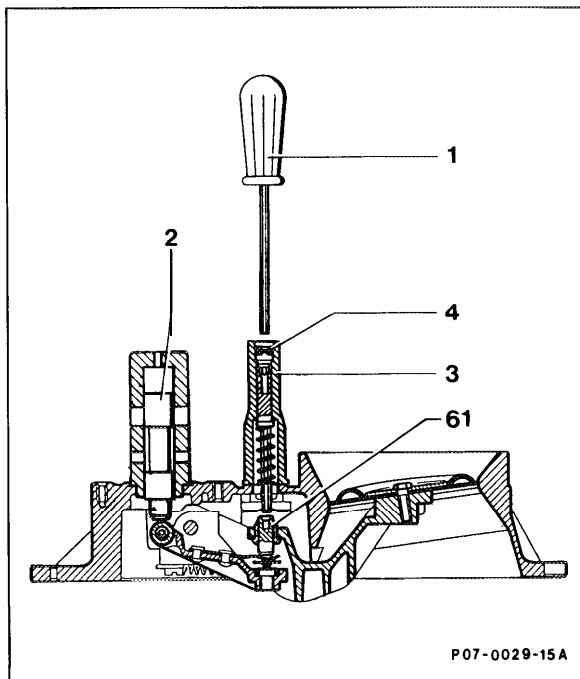
P07-0373-55

Fuel supply and return lines	disconnect, connect
Injection lines	disconnect at fuel distributor and at injectors, connect, 10-15 Nm (reference value).
bolts (33)	remove, bolt in.
Fuel distributor (2)	detach by turning back and forward.
Rubber seal (24)	replace, install dry. Carefully fit on fuel distributor, ensuring that rubber seal (24) does not slip.
Basic position of control plunger relative to air flow sensor plate	check, adjust if necessary. Detach fuel pump relay module for this step and bridge contacts 7 and 8. The fuel must at this point stop or begin to flow from the outlet nozzles for the injection lines; adjust assignment if necessary with the idle mixture regulating screw.
Engine	run, check all fuel connections for leaks.
Idle speed	set (07.3-l 00).

Note

Perform basic setting of control plunger (2) by altering the position of the idle mixture adjusting screw (61).

- 1 Screwdriver
- 2 Control plunger
- 3 Adjusting device for lambda control/idle emissions level
- 4 Anti-tamper plug
- 61 Adjusting screw



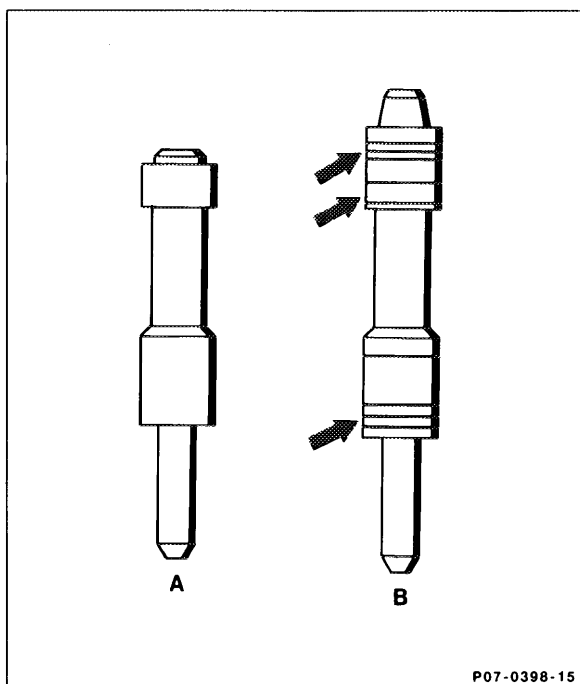
Note

The control plunger in the fuel distributor has been lengthened. At the same time, grooves have been machined on the circumference of the control plunger and a finish (arrows) embossed on the surface.

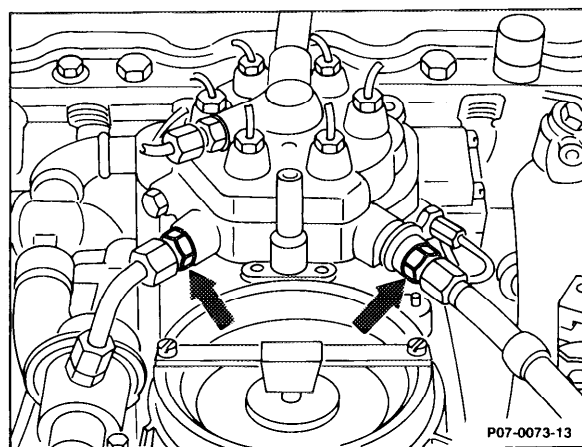
Production breakpoint:

As of 01/85 (production date 541) unspecified.
As of 02/85 (production date 43 T2) general.

- A Previous version
- B Current version



Screw fitting (arrows) for fuel supply and return made of brass (previously steel).

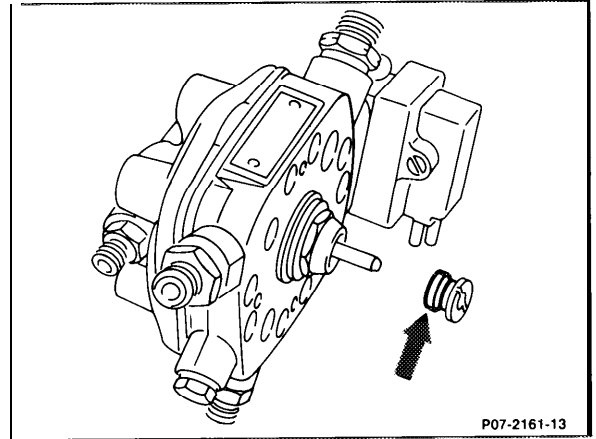
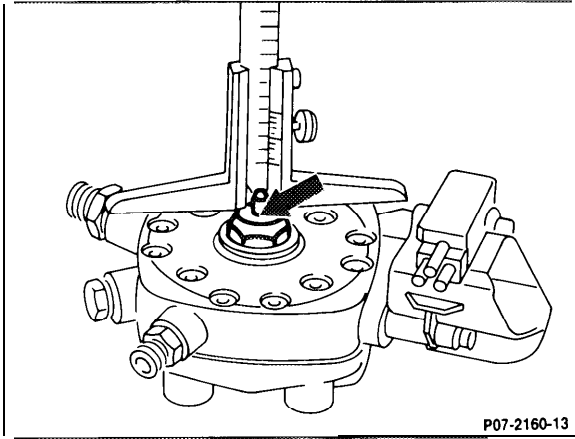


Production breakpoint: March 1989

Model	Engine	Engine End No. manual transmission	Engine End No. automatic transmission
201.024	102.96	217465	112399
201.028	102.985	030864	078604

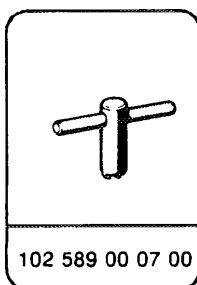
07.3-207 Replacing seal for control plunger

Preceding work:
Removal and installation of fuel distributor (07.3-205)



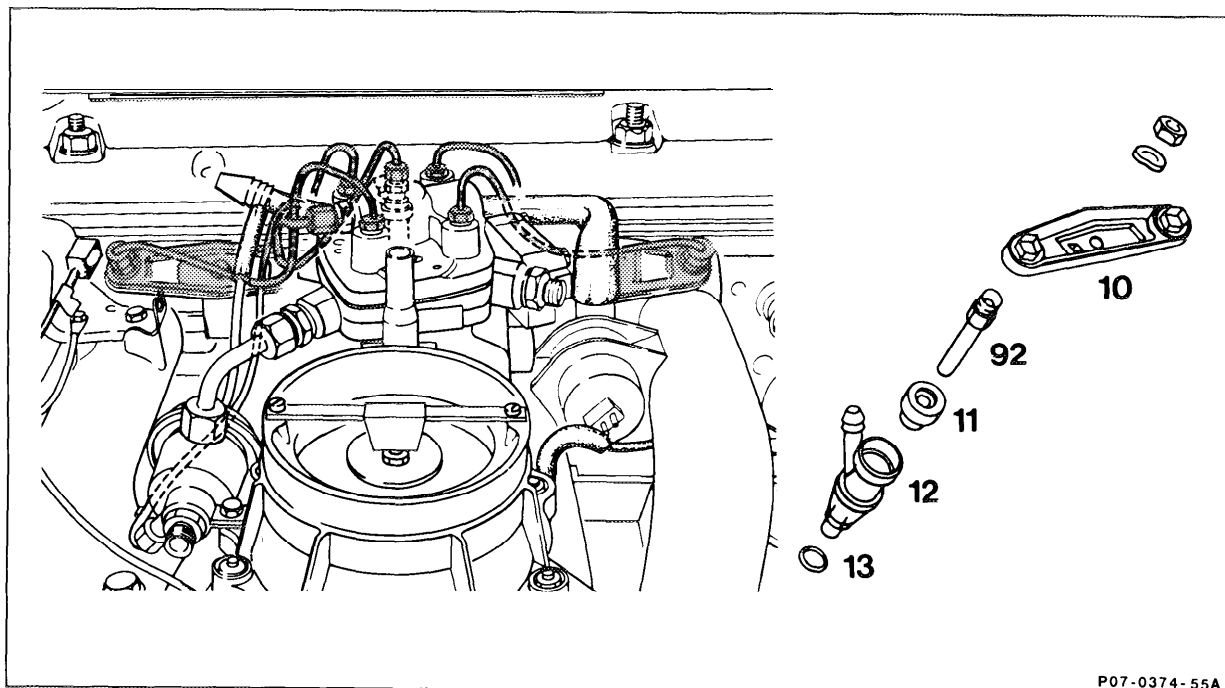
Position (arrow) of screw plug	measure with depth gauge and note. Mark position with marking tool as a safeguard.
Screw plug (arrow)	remove with pronged wrench special tool (102 589 00 07 00).
Seal of screw plug	replace, ensure seal is correctly seated.
Screw plug (arrow)	screw in to the value or marking measured prior to removal.
Idle speed	Caution! Failure to do this means control plunger selects incorrect basic setting. set (07.34 00).

Special tools



.....

07.3-215 Removal and installation of fuel injectors



P07-0374-55A

Fuel and injection lines	remove, install, holding injectors tight. Clean connection points.
Mounting bracket (10)	Tighten to 10–15 Nm as approx. value. unscrew, screw on.
Injectors (92)	remove, insert.
Rubber seal (11)	replace.

Notes

Mounting bracket (10) installed with M8 X 20 combination bolt plus washer (previously M8 X 12 stud).

Production breakpoint: 11/86

Model	Engine	Engine end No. manual transmission	Engine end No. automatic transmission
201.028	102.985	007459	046500

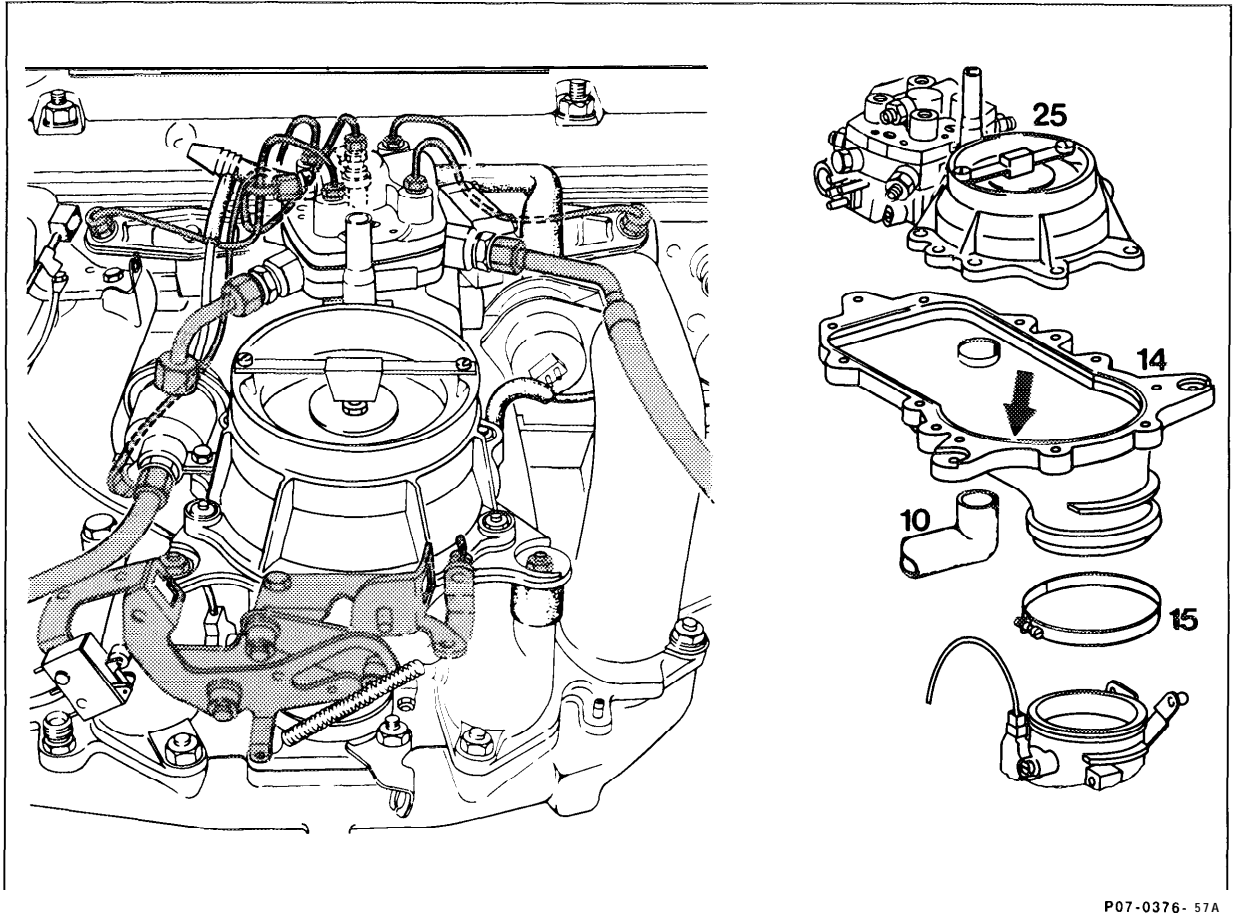
To improve leaktightness, fuel injectors made of brass with higher pressure ratings have been installed (07.3-I 35). Identification located on shaft 000 078 56 23.

Production breakpoint: 03/89

Model	Engine	Engine end No. manual transmission	Engine end No. automatic transmission
201.028	102.985	027063	076715

07.3-220 Replacement of air flow sensor

Preceding work:
 Removing and installing mixture control unit with
 air guide housing (07.3-225)

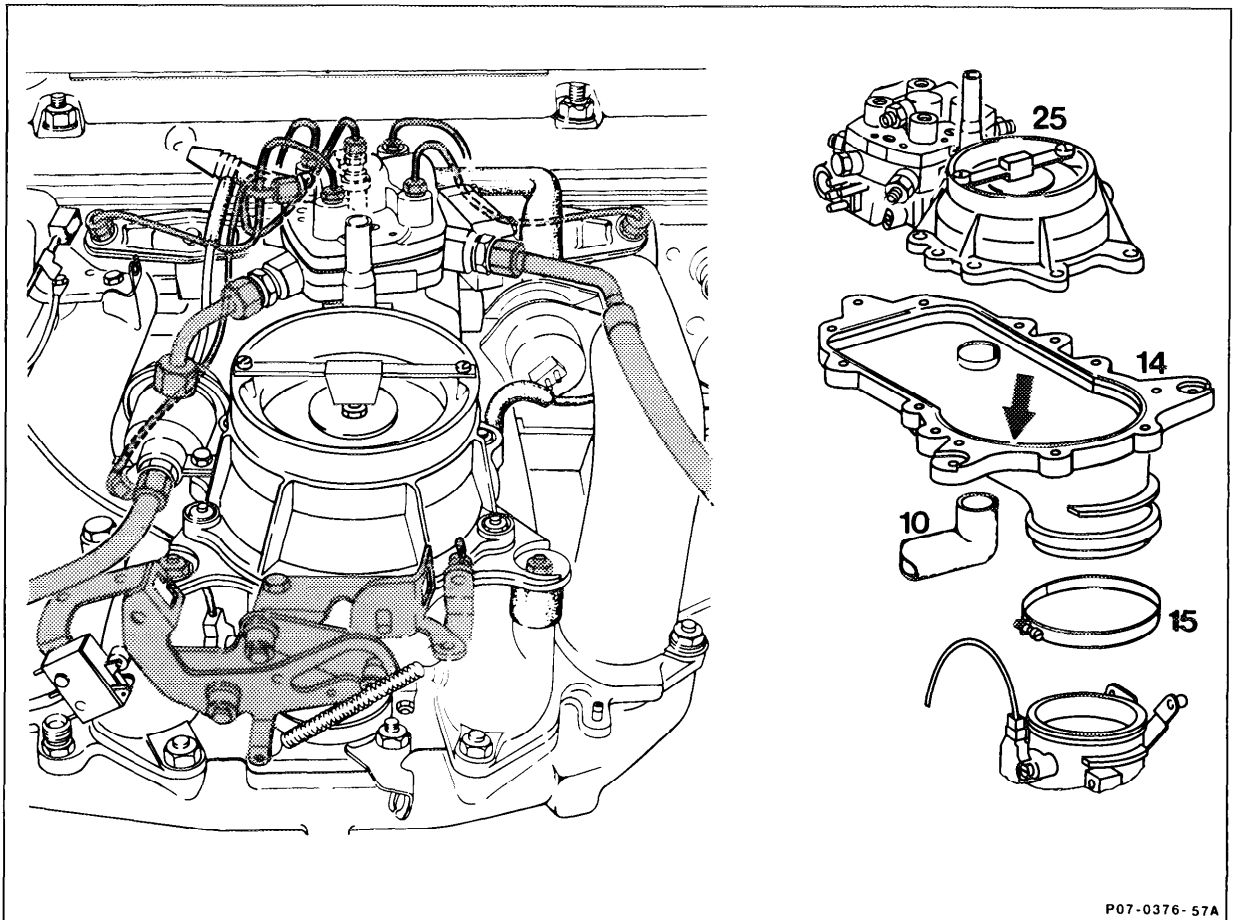


P07-0376-57A

- | | |
|----------------------------------|---|
| Air guide housing (14) | remove from mixture control unit (25).
Replace damaged parts. During installation, do not use sealing compound. Sealing is provided by sealing lip (arrow). The air guide housing is made of rubber. It is located in position by the light alloy frame. |
| Fuel distributor | remove, install (07.3-205). |

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

Preceding work:

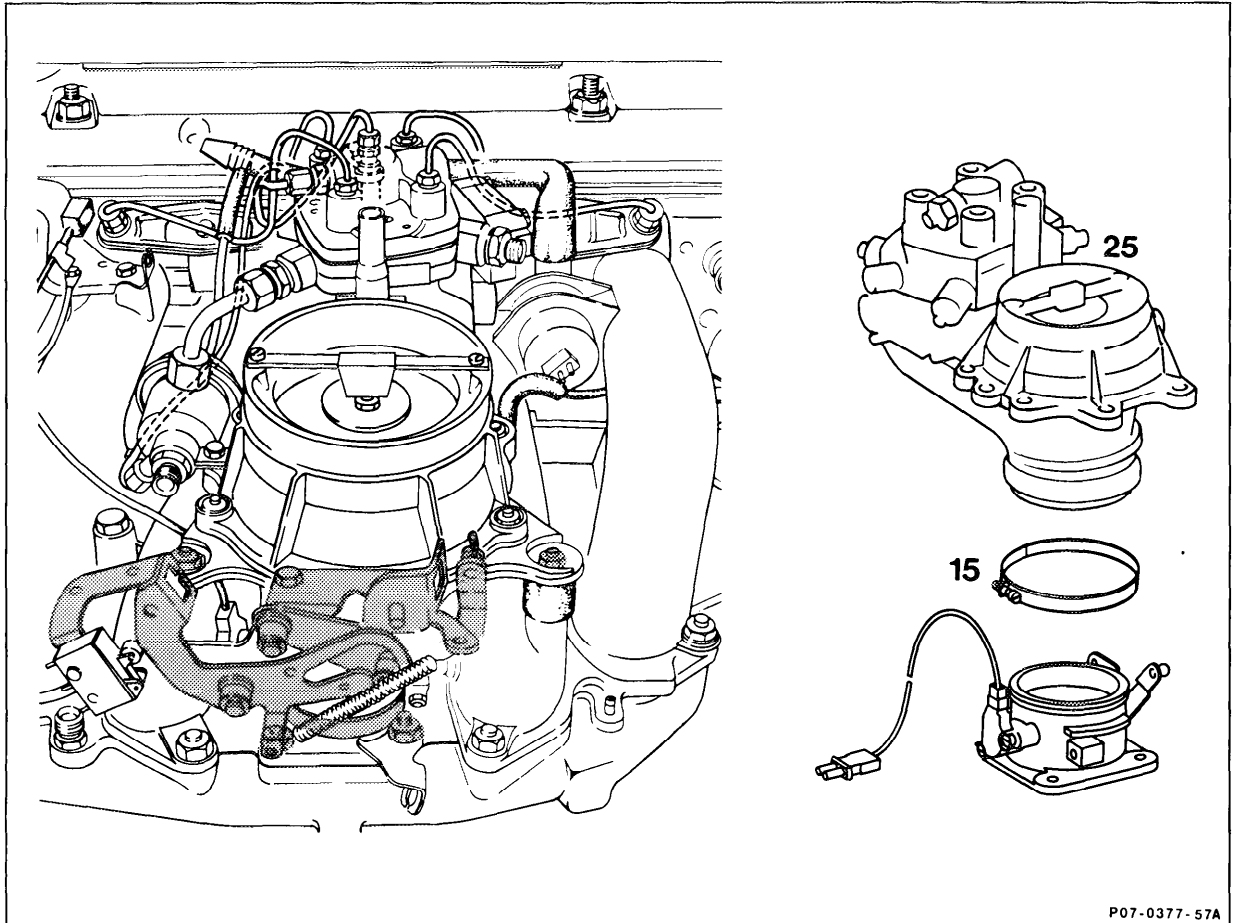


P07-0376-57A

Fuel and injection lines	unscrew, screw on, 1 0- 15 Nm tightening torque (reference value).
Electric wiring	disconnect, connect.
Diaphragm pressure regulator	unbolt, bolt on.
Four fastening nuts for mixture control unit mounting at rubber pads	unscrew, screw on, 9-10 Nm (reference value).
I-lose clip (15) at throttle valve assembly	loosen, tighten.
Mixture control unit (25) complete with air guide housing	lift off, fit on.
Formed hose (10)	pull off, fit on.
Rubber pad for mounting of air guide housing ...	check, replace according to condition.
Engine	run, check all fuel connections for leaks.
Idle speed	set (07.3-100).

07.3-230 Removal and installation of throttle body

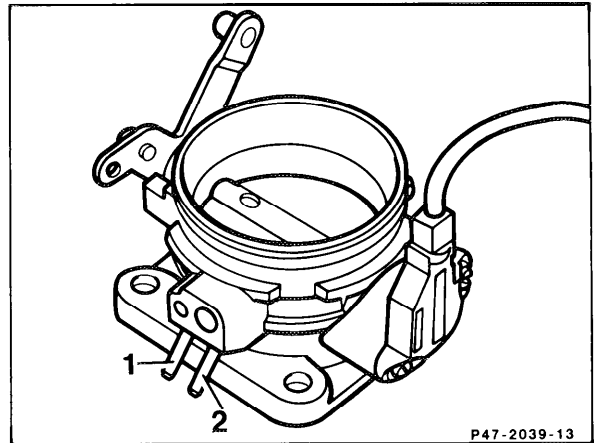
Preceding work:
Removal and installation of mixture control unit with
air guide housing (07.3-225).



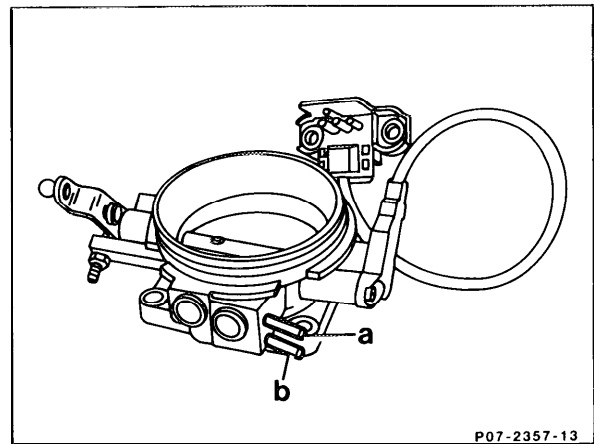
P07-0377-57A

Hose clip (15)	loosen, tighten.
Throttle control linkage and return spring	detach, attach; adjust if necessary.
Throttle body switch plug connection	unbolt, remove and bolt on.
Vacuum connections	pull off, fit on. Ensure that all connections are correct.
Fastening bolts	unbolt. Remove throttle body. Install with new gasket. Tightening torque 21-25 Nm.
Idle speed	set (07.34 00).

- 1 Ignition advance connection
- 2 Extraction line connection to regeneration line for fuel evaporation control system



- a To thermal vacuum valve
- b Vacuum line connection to evaporative emission canister purge valve

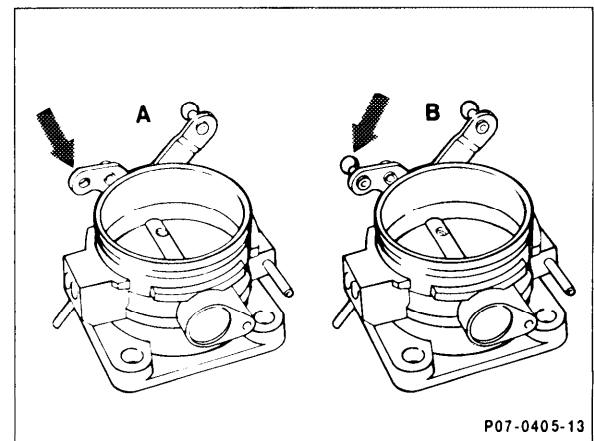


Vehicles with cruise control

The cruise control linkage now pivots on a ball connection. This replaces the previous angled rod.

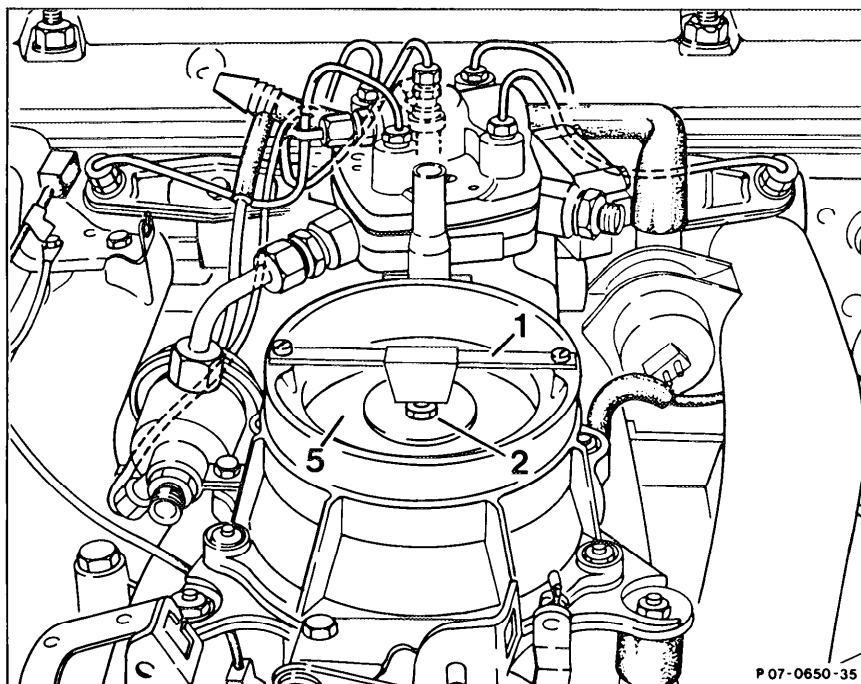
Production breakpoint 12/84

- A Previous version
- B Present version



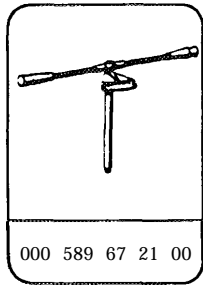
07.3-245 Replacement, centering air flow sensor plate and checking and adjustment of zero position of air flow sensor plate

Preceding work:



Stop bar (1) for sensor plate	unscrew, screw on.
Fastening bolt (arrow)	heat with hot air fan and carefully unscrew (there is a risk of shearing the bolt off), bolt in 5.0-5.5 Nm .
Air flow sensor plate (5)	remove, install, center and check zero position (pay attention to installation notes). Proceed following to this method for mixture control units with shaped sensor plate.
Hole for mounting sensor plate	clean with M6 tap.
Idle speed	set (07.34 00).

Special tool

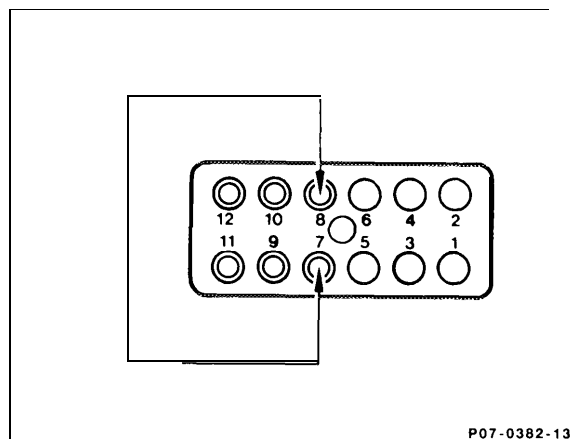
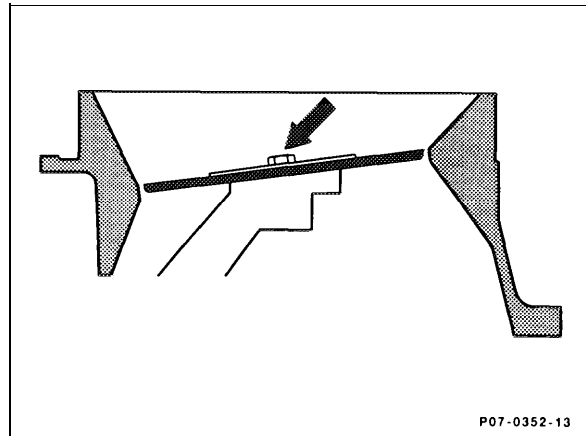


Commercially available equipment and tools

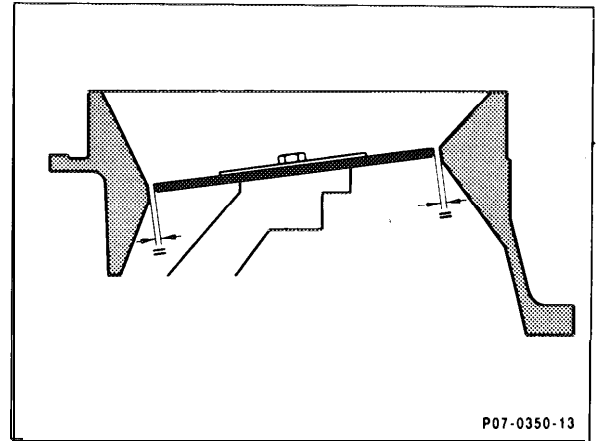
Hot air fan, M6 tap

Installation notes

- 1 Install parts of the repair kit. Insert sensor plate with the inscription "top" facing up and shim. Slightly tighten microencapsulated mounting bolt (arrow, self-locking).
- 2 Center air flow sensor plate by detaching fuel pump relay and briefly bridging the two contacts 7 and 8 (terminals 30 and 87) to build up pressure.



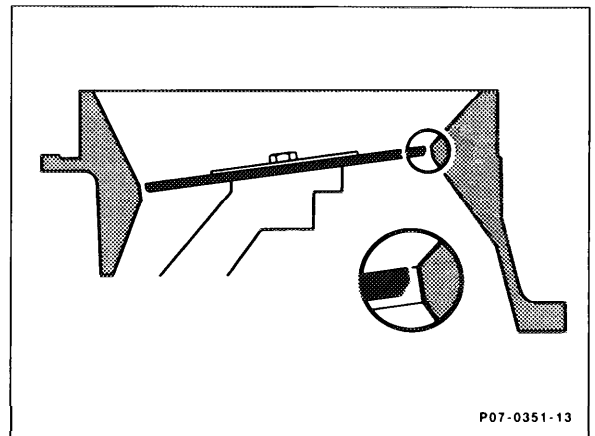
Use a feeler gauge approx. 0.05 mm to ensure that the air flow sensor plate is precisely centered. The sensor plate must not jam even when slight pressure is applied to the side (bearing clearance eliminated).



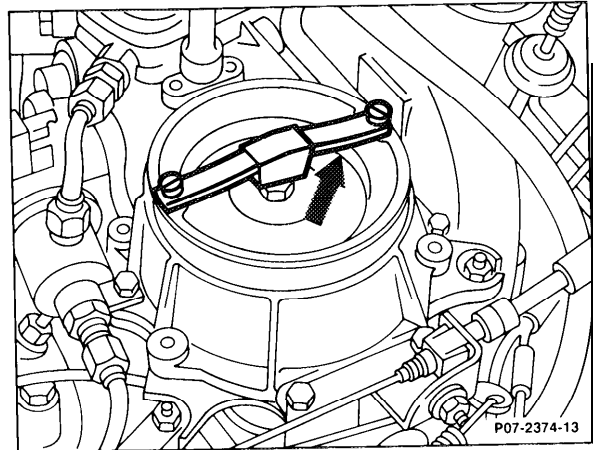
- 3 Tighten fastening bolt to 5.0-5.5 Nm and install stop bar.
- 4 Check that sensor plate operates freely by pressing sensor plate down by hand. The plate must not jam. Release sensor plate. It must also not jam as it moves back. It must audibly strike against the resilient stop. Re-center air flow sensor plate if necessary.

- 5 Check zero position (rest position) of air flow sensor plate. The top edge of the sensor plate must be level with the top edge of the cylindrical part of the air funnel. A position up to 0.2 mm higher is permissible.

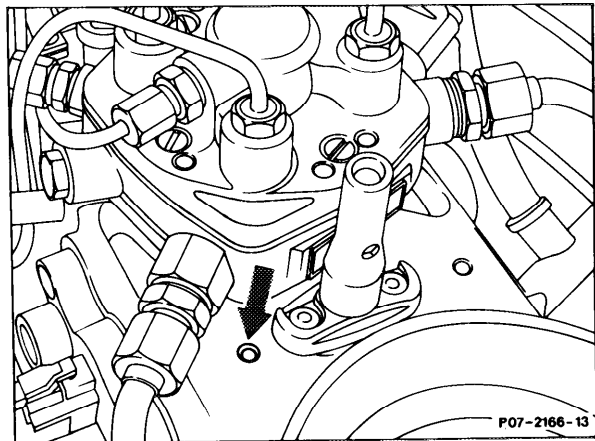
In this position, a clearance of 1-2 mm must exist when the air flow sensor plate is pressed as far as the control plunger.



The measurement point is located directly below the stop bar (arrow).



- 6 Set zero position of air flow sensor plate.
 - a) If position is too high, knock guide pin (arrow) deeper with a drift.
 - b) If position is too low, remove mixture control unit and knock out guide pin from below (07.3-200).



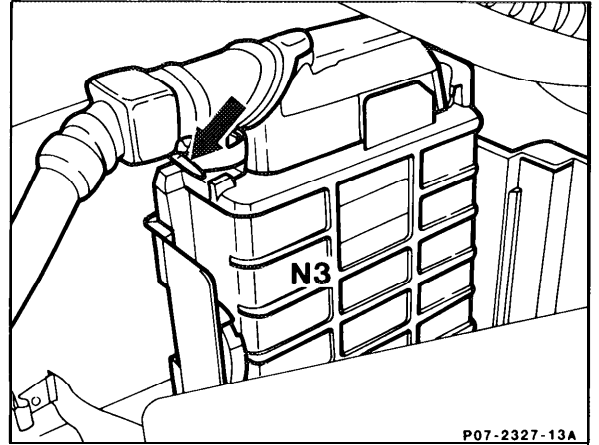
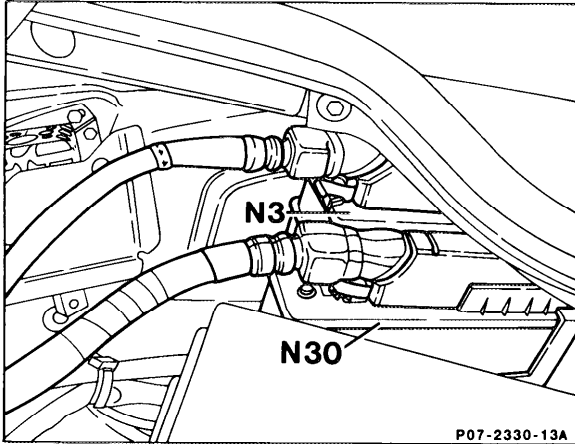
Caution!

Do not knock guide pin in too deep. Avoid repositioning several times in both directions as the interference fit seal will become too loose.

- 7 Install fuel pump relay module.
- 8 Set idle speed (07.3400).

07.3-250 Removal and installation of CFI control module

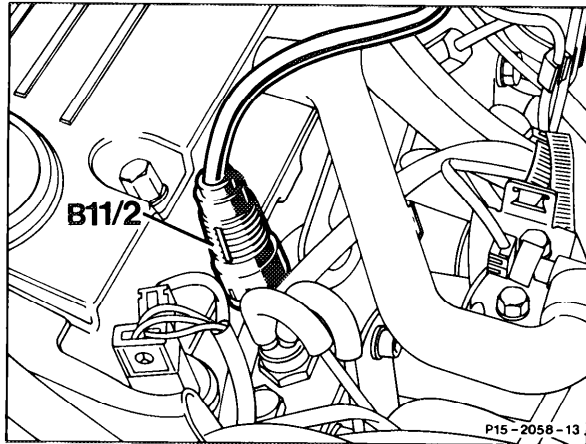
Preceding work:
Removal and installation of fuel distributor (07.3-205)



Plastic cover behind battery	remove, install.
Vehicles equipped with ABS	remove ABS control module (N30). Install by unclipping metal strap, clipping in place.
Vehicles equipped with 64 Ah battery	remove, install battery.
Coupling of CFI control module (N3)	pull off by pressing down clip (arrow).
CFI control module (N30)	remove, install.

Engine	Version	CFI control module MB Part No.	Remarks
102.961	1983 – 1984	003 545 38 32	with deceleration fuel shutoff and engine speed limitation
102.985	1985 – 1986	003 545 38 32	with deceleration fuel shutoff and engine speed limitation
	1987	005 545 94 32	as of 08/86: with fault diagnosis by measuring on-off ratio %
	1988 Federal	006 545 94 32	with Diagnostic Trouble Code (DTC) storage and On-board diagnosis, CHECK ENGINE malfunction indicator lamp, resistance trimming plug integrated into CFI control module.
	1988 Calif.	006 545 55 32	with Diagnostic Trouble Code (DTC) storage and On-board diagnosis, CHECK ENGINE malfunction indicator lamp, resistance trimming plug integrated into CFI control module.
	1991 Federal	010 545 54 32	with Diagnostic Trouble Code (DTC) storage, activation of CHECK ENGINE malfunction indicator lamp if heated oxygen sensor (G3/2) fails, resistance trimming plug integrated into CFI control module (N3).
	1991 Calif.	010 545 55 32	with Diagnostic Trouble Code (DTC) storage and expanded On-board diagnostics (EGR temperature sensor added), activation of CHECK ENGINE malfunction indicator lamp if exhaust related components fail, resistance trimming plug integrated into CFI control module (N3).

07.3-251 Replacement of engine coolant temperature sensor



Engine coolant temperature sensor connector ...
 Engine coolant temperature sensor

 Diagnostic memory

detach, fit on.

unscrew, screw in.

Caution!

Pay attention to position and notes!

read out and erase, if necessary, on engines 102.961/985 as of 09/89 (see 07.3-121, section "D").

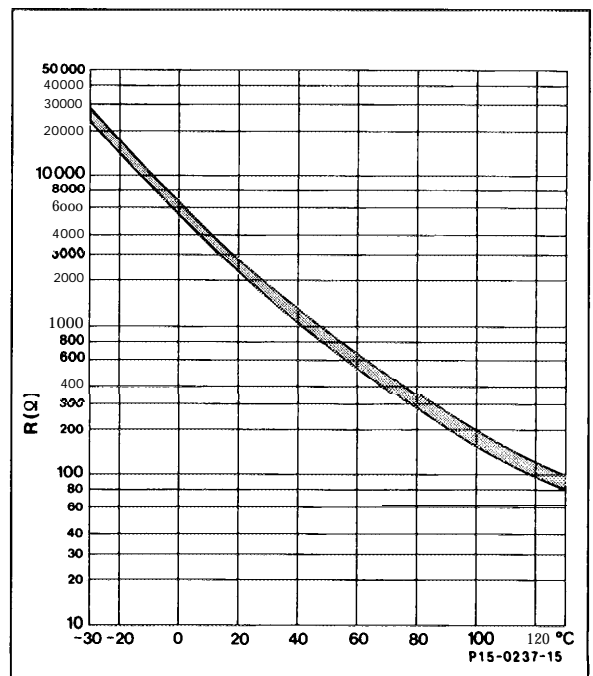
Engine coolant temperature sensor (NTC)

The engine coolant temperature is detected by a temperature sensor.

This is actuated by the electronic CFI control module. The resistance of the current temperature sensor varies as a function of engine temperature (see characteristic curve). The characteristic curves of all versions are identical.

Note

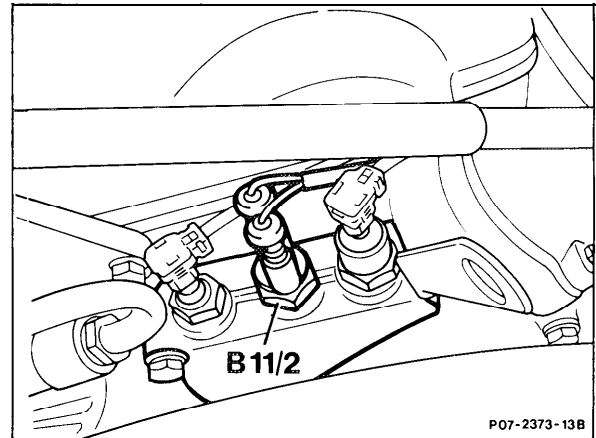
NTC = negative temperature coefficient, i.e. the resistance becomes less as the temperature increases.



2-pin engine coolant temperature sensor (B11/2)

The engine coolant temperature is detected by a double temperature sensor with two I-pin connections. The temperature signal is fed into the CFI control module and into the fuel pump relay module (CFI I, II) or into the ignition control module (CFI III).

Engine 102. 961985



1-pin engine coolant temperature sensor (B11/3)

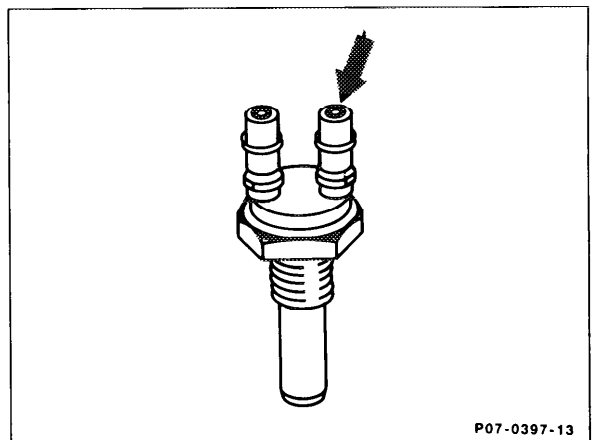
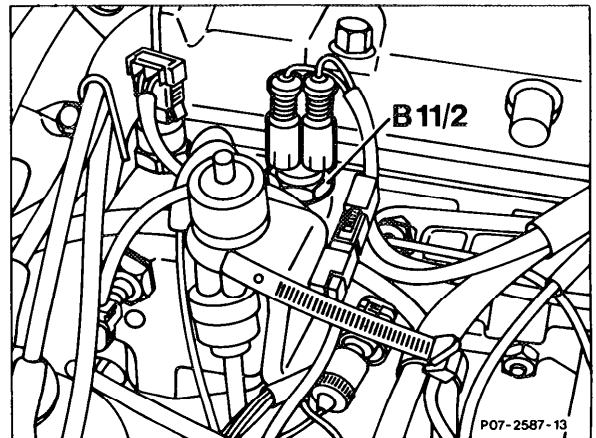
Note

On engine 102.961 only the engine coolant temperature sensor (B11/3) with the M1 4 × 1.5 thread is supplied as a replacement part. When performing repairs, the engine coolant temperature sensor should be installed in place of the M1 4 × 1.5 plug next to the thermal time switch.

The previous installation point should be sealed with the M1 0 × 1 plug, Part no. 007 604 010 102, and gasket, Part No. 007 603 010 101.

Note

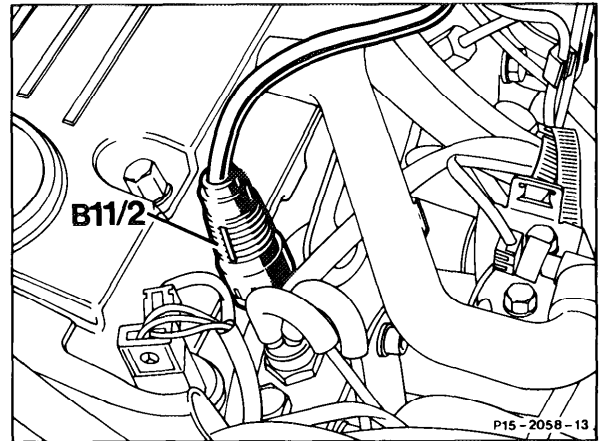
As of a production date 1 1/84, the engine coolant temperature sensor was equipped with reinforced pins (arrow). Part number remains unchanged.



Note

As of 03/90 engine 102 has been equipped with a 4-pin engine coolant temperature sensor.

Engine 102.96/98



4-pin engine coolant temperature sensor (B11/2)

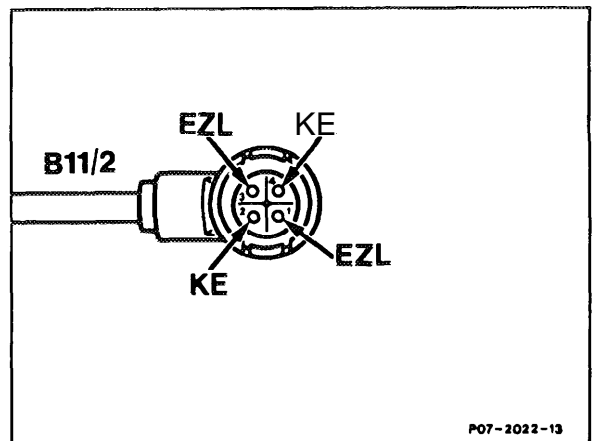
The engine coolant temperature sensor is a 4-pin design. It integrates two separate temperature sensors (NTC), which do not have any electrical connection to the housing of the engine coolant temperature sensor. One temperature sensor is used for the distributor ignition system and one for the CFI injection system. The connector of the engine coolant temperature sensor is designed so that it can be plugged-in in any position.

Pin assignment:

- 1 = Distributor ignition temperature sensor.
- 2 = CFI temperature sensor
- 3 = Engine ground at intake manifold for distributor ignition system.
- 4 = CFI control module ground

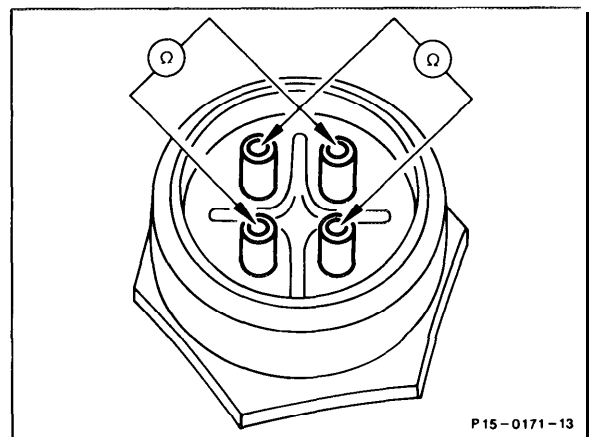
Note

1988 version does not have coupling designations.

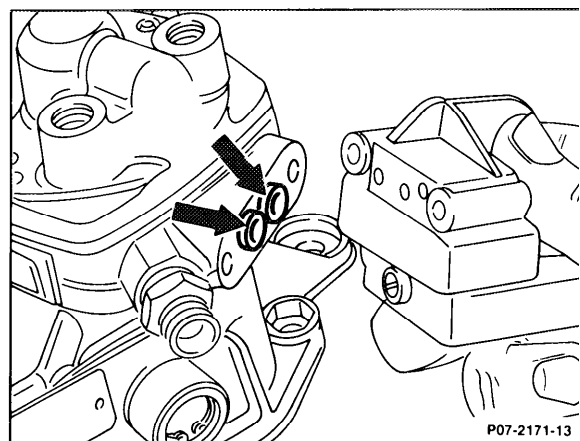
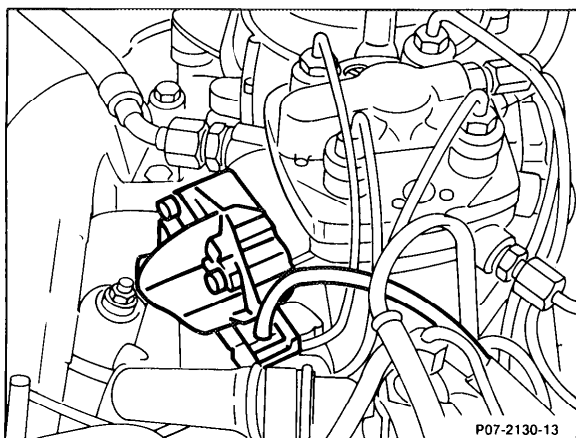


Notes for testing engine coolant temperature sensor (B11/2)

When testing the engine coolant temperature sensor, measure the resistance 2 x diagonally and compare.



07.3-255 Replacement of electrohydraulic actuator



Electrical coupling	disconnect, connect.
Fuel pressure	release by detaching fuel line between fuel distributor and start valve. Collect fuel overflow with a cloth.
Both fastening bolts	unscrew, screw in. Replace O-rings (arrows). Ensure sealing surface is clean; clean surfaces with cleaning petroleum and lint-free cloth, if necessary. Tighten fastening bolts to 3.0 ± 0.5 Nm.
Pressure test of O-rings (arrows)	check that no fuel flows out with the engine running.
Idle speed	set (07.34 00).

Commercially available tool

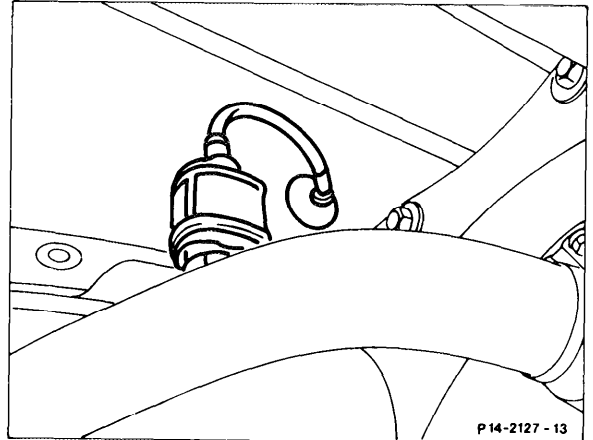
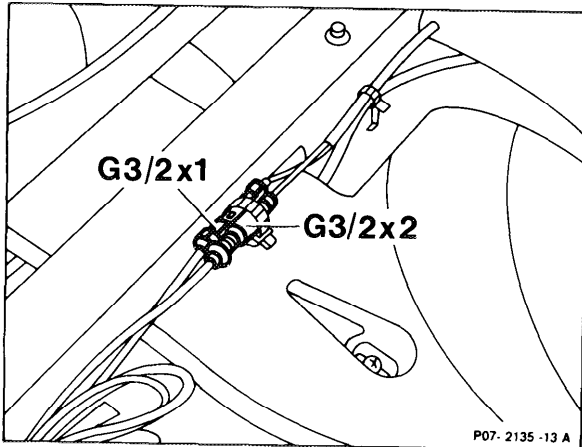
Screwdriver

e. g. **Hazet**,
D-5630 Remscheid

.....

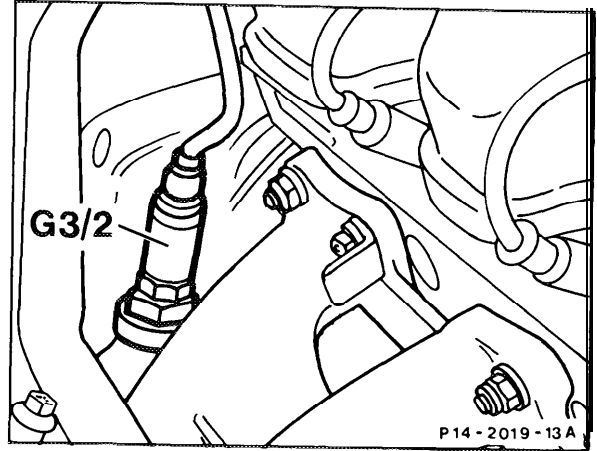
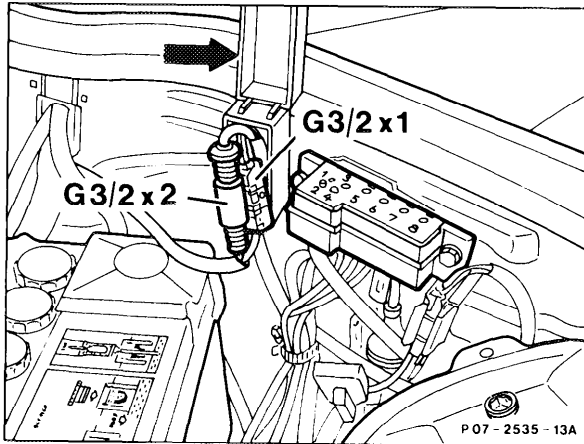
07.3-258 Replacement of heated oxygen sensor

A. Heated oxygen sensor upstream of catalytic converter



Floor mat, right front floor plate	remove, install.
Covering on center tunnel	partially remove.
Connectors (G3/2x1 and G3/2x2)	for heated oxygen sensor signal (coaxial connector) and oxygen sensor heater (2-pin), disconnect.
Wiring with rubber grommet	push to outside.
Shield	pull off, fit on. Note installation position: open side to the rear.
Heated oxygen sensor (G3/2)	unscrew, screw in. Coat threads of heated oxygen sensor with hot lubricating paste, Part No. 000 989 88 51. Tighten heated oxygen sensor (50-60 Nm).
Lambda control	check (07.3-l 00 or 07.3-l 05).

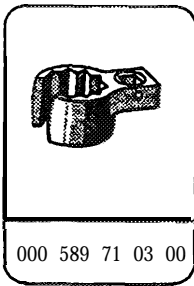
B. Oxygen sensor in exhaust manifold



- Cover (arrow)
- Connector (G3/2x1 and G3/2x2)
- Wiring with rubber grommet
- Heated oxygen sensor (G3/2)
- Lambda control

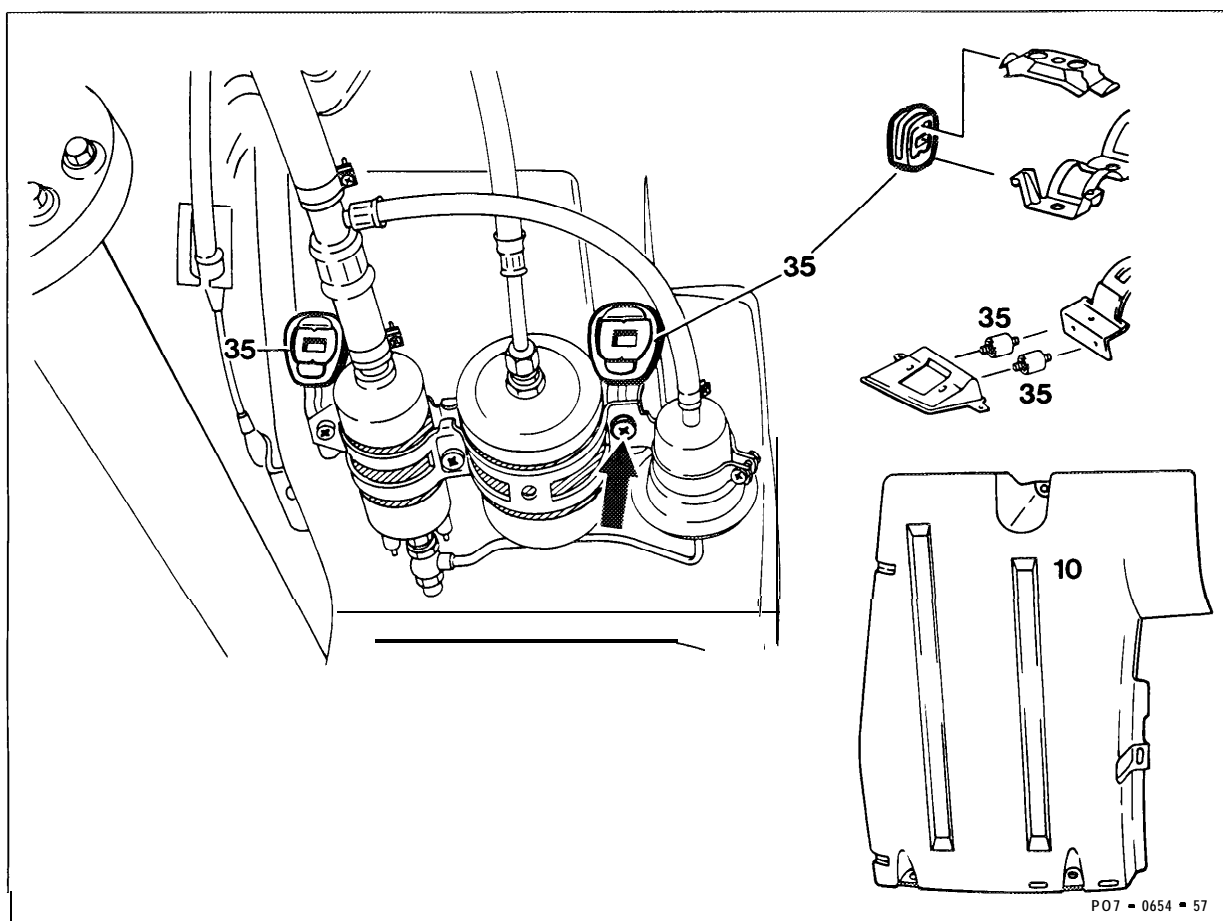
- over plug connector, raise.
- for oxygen sensor signal (coaxial connector) and oxygen sensor heater (2-pin), separate.
- press through partition wall.
- unscrew, screw in. Special tool
- 000 589 71 03 00. Coat threads of heated oxygen sensor with hot lubricating paste, Part No. 000 989 88 51. Torque heated oxygen sensor (SO-SO Nm).
- check (07.3-I 00 or 07.3-I 05).

Special tool



07.3-268 Replacement of rubber rings or pads for fuel pump set

Preceding work:

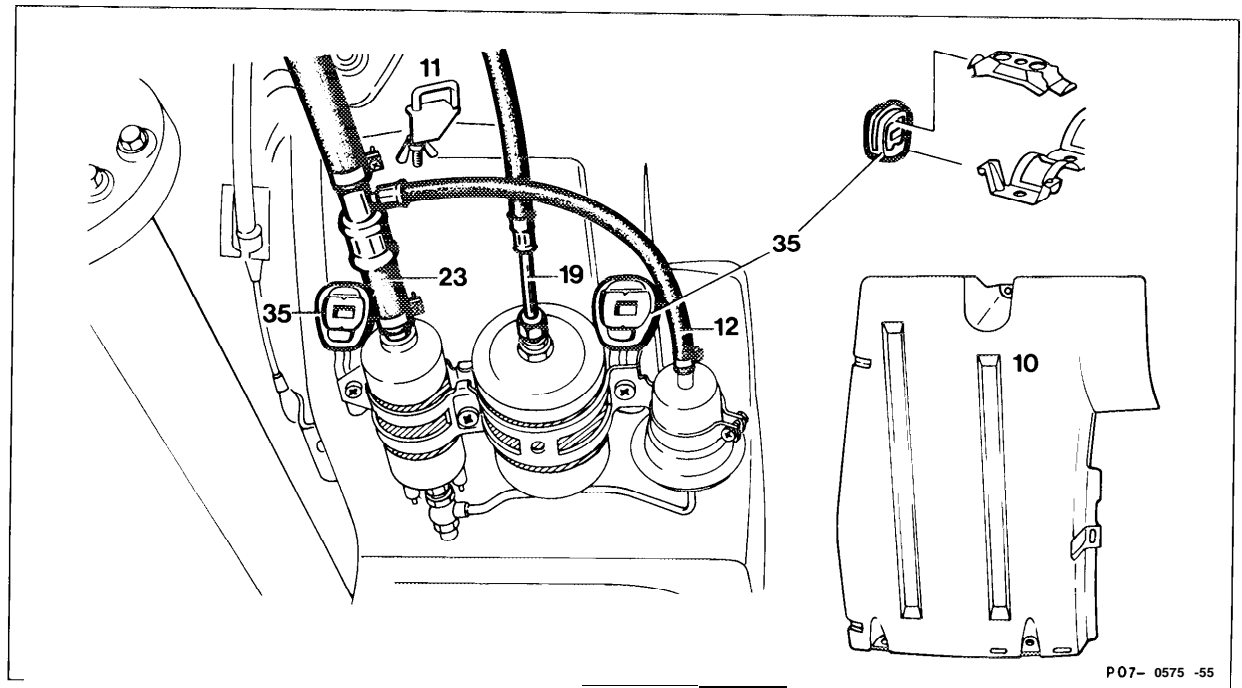


Protective box (10) depending on version unscrew, screw on.
Rubber rings/pads (35) depending on version ... remove, install.

.....

07.3-269 Removal and Installation of fuel pump set

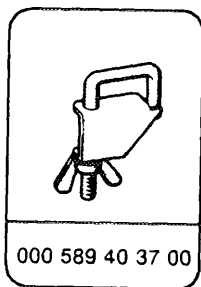
Note
Arrangement of further fuel pump sets
(see 07.3-290).



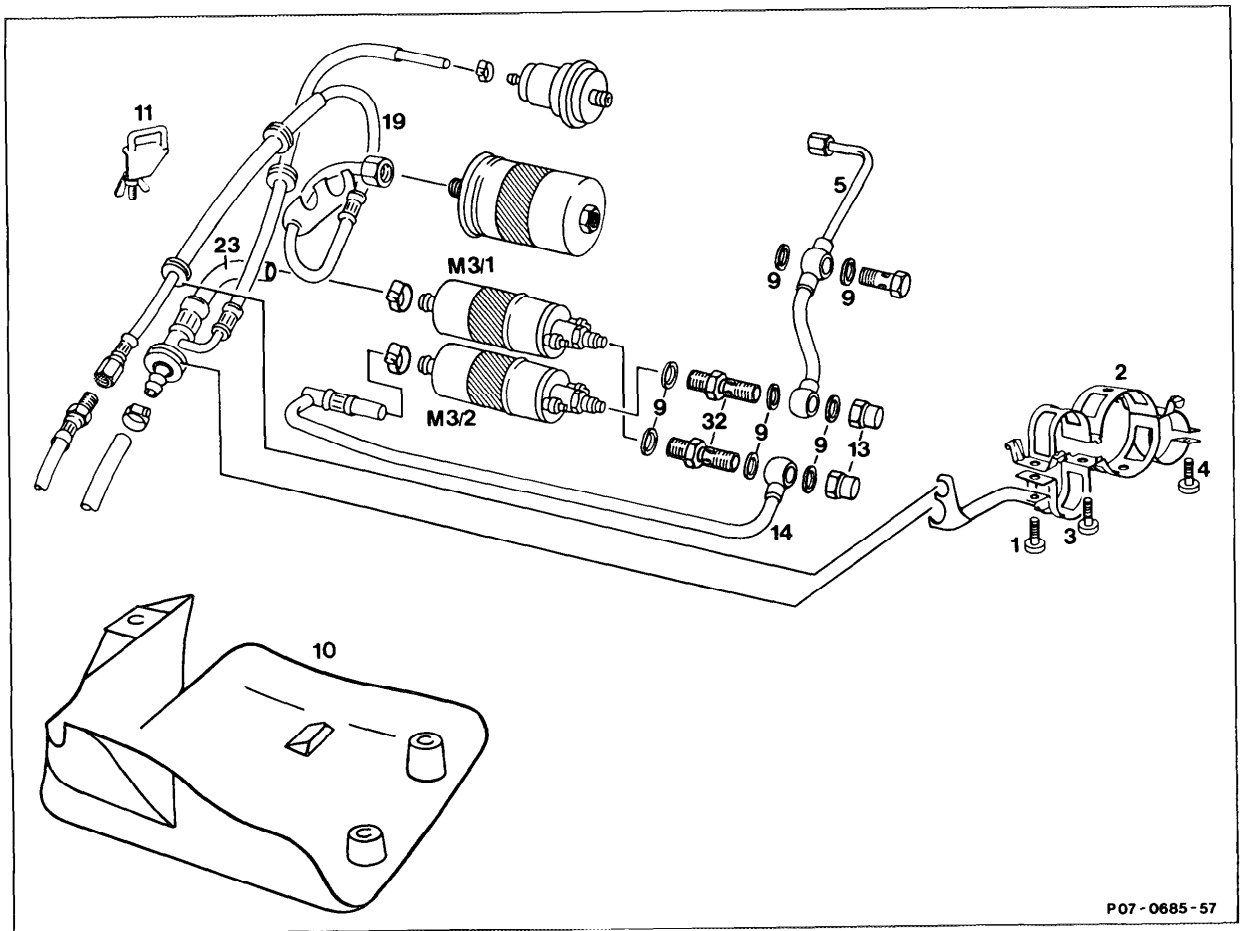
P07- 0575 -55

Battery	disconnect, connect.
Protective cover (10)	unscrew, screw on.
Electric wiring	disconnect, connect.
Fuel suction hose (23) and pressure hose (19) ..	pinch with clamp (11) and remove. Special tool 000 589 40 37 00
Fuel suction hose (23), bleed hose (12) and pressure hose (19)	unbolt, bolt on.
Rubber rings/pads (35)	remove, install.

Special tool



07.3-285 Replacement of check valve for fuel pump



P07-0685-57

Overpressure in fuel tank	release by opening filler cap
Battery	disconnect, connect.
Protective cover (10)	unscrew, screw on.
Fuel suction hose (23) and pressure hose (19) ..	pinch with clamp (11) and remove. Loosen fuel suction hose and detach. Special tool 000 589 40 37 00

Replacing check valve on fuel pump 1 (M3/1):

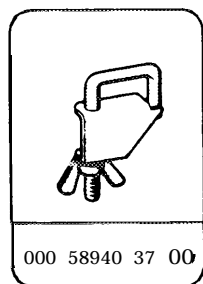
Fastening bolt (1, 3, 4)	at bracket (2) for fuel pump, loosen.
Fuel line (14)	unbolt, bolt on.

Cap nut(13)	unbolt, bolt on.
Fuel pump 1 (M3/1)	push to the left
Check valve (32)	remove, install. Tightening torque 22 Nm as a reference value.
Copper seals (9)	replace.
Run engine	check for leaks.

Replacing check valve on fuel pump 2 (M3/2):

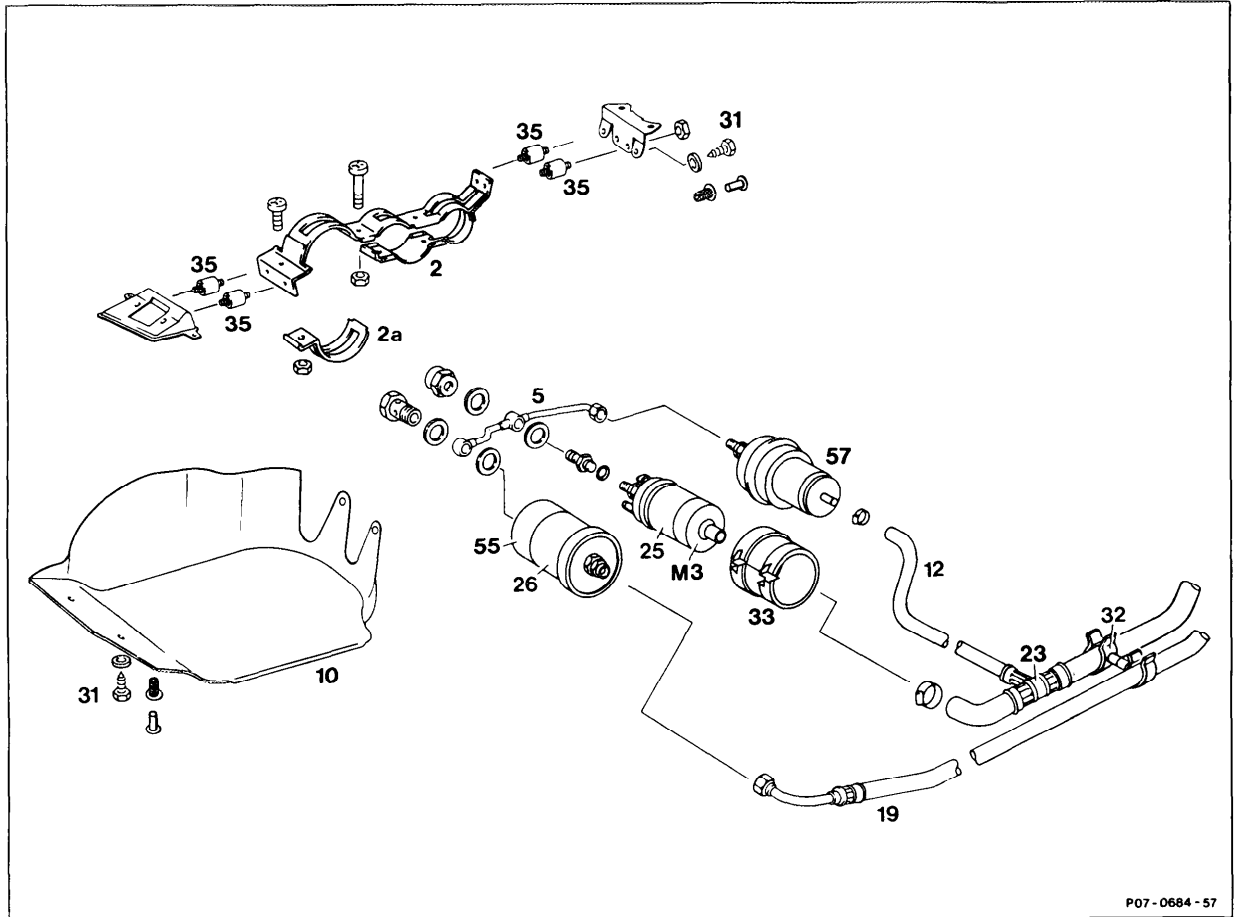
Fuel line (5)	between fuel pump, filter, accumulator, unbolt, bolt on.
Cap nut (13)	unbolt, bolt on.
Check valve (32)	remove, install. Tightening torque 22 Nm as a reference value.
Copper seals (9)	replace.
Run engine	check for leaks.

Special tool



07.3-290 Survey Of fuelpumpsets

A. Model 201



2	Bracket	31	Self-tapping screw (as of 01/85 plastic expanding rivets)
2a	Fuel filter bracket	32	Clip (as of 10/83 rubber ring)
5	Fuel line	33	Spacer sleeve (as of 08/84)
10	Protective cover	35	Rubber-bonded to metal pad
12	Leak line	55	Fuel filter
19	Fuel pressure hose	57	Fuel accumulator
23	Fuel suction hose	M3	Fuel pump
25	Plastic sleeve		
26	Plastic sleeve		

Note

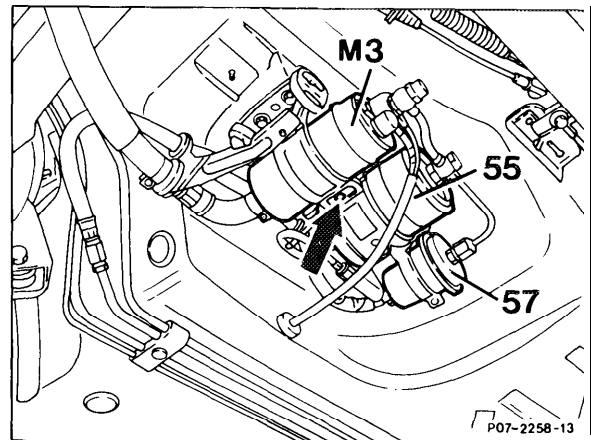
The fuel pump set can be converted to mounting with rubber rings in the event of noise problems (07.3-265).

Note

As of 08/84 the fuel pump has been attached using a modified bracket (for standardization purposes). The diameter for fuel pump mounting is larger. For this reason, the fuel pump is installed with a spacer sleeve (33).

2nd version

As of 07/85 modified fuel pump attachment brackets are equipped with rubber rings.

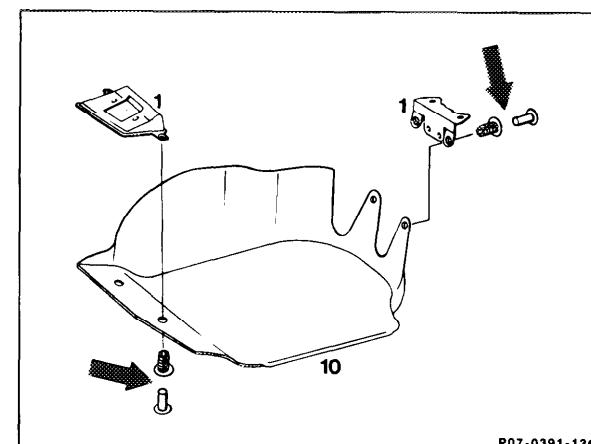


Model 201

1st version of protective cover attached with self-tapping screws (arrows).



As of 01/84 the protective cover (10) for the fuel pump set is attached to the brackets (1) with plastic expanding rivets (arrows).



As of 08/85 the shape of the protective cover has been modified and is attached with plastic nuts.

