

14 Intake manifold, exhaust manifold, emission control system

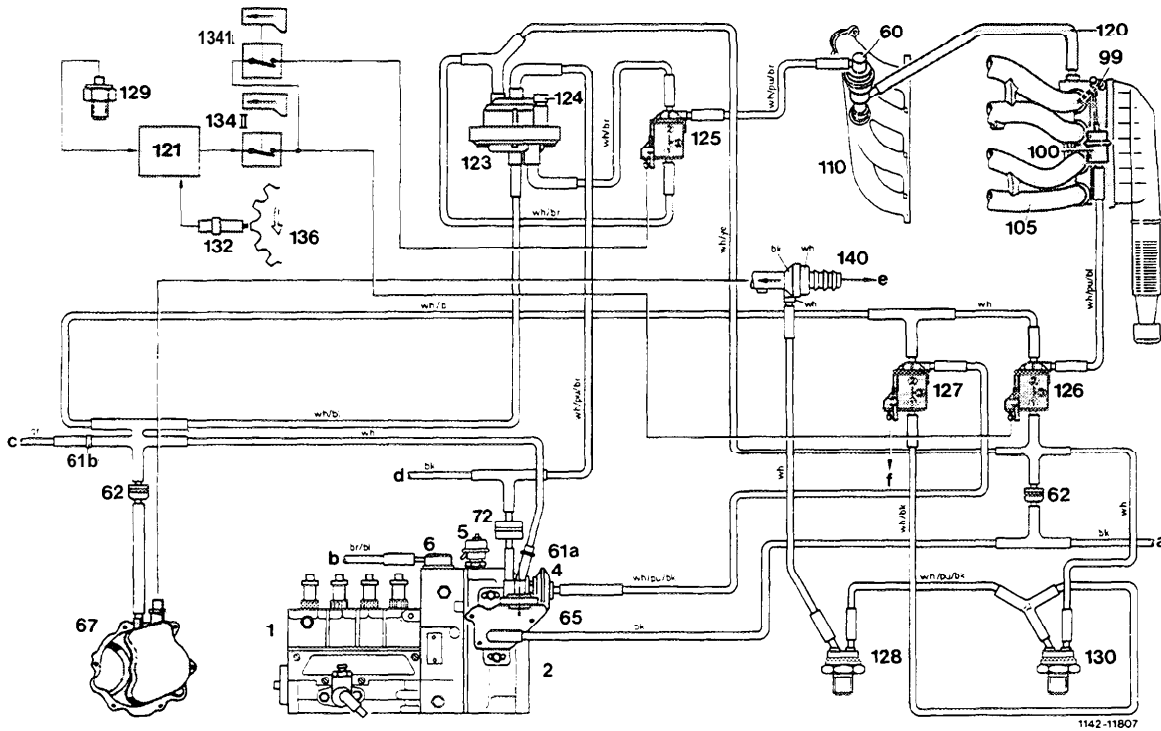
	Job No.
Operation of emission control system	14-050
A. General	
B. Components and operation	
C. Overall operation	
Checking emission control system	100
Removal and installation of intake manifold	180
Removal and installation of exhaust manifold	350
A. Standard version and (USA) Federal	
B. @California.	

14-050 Operation of emission control system

A. General

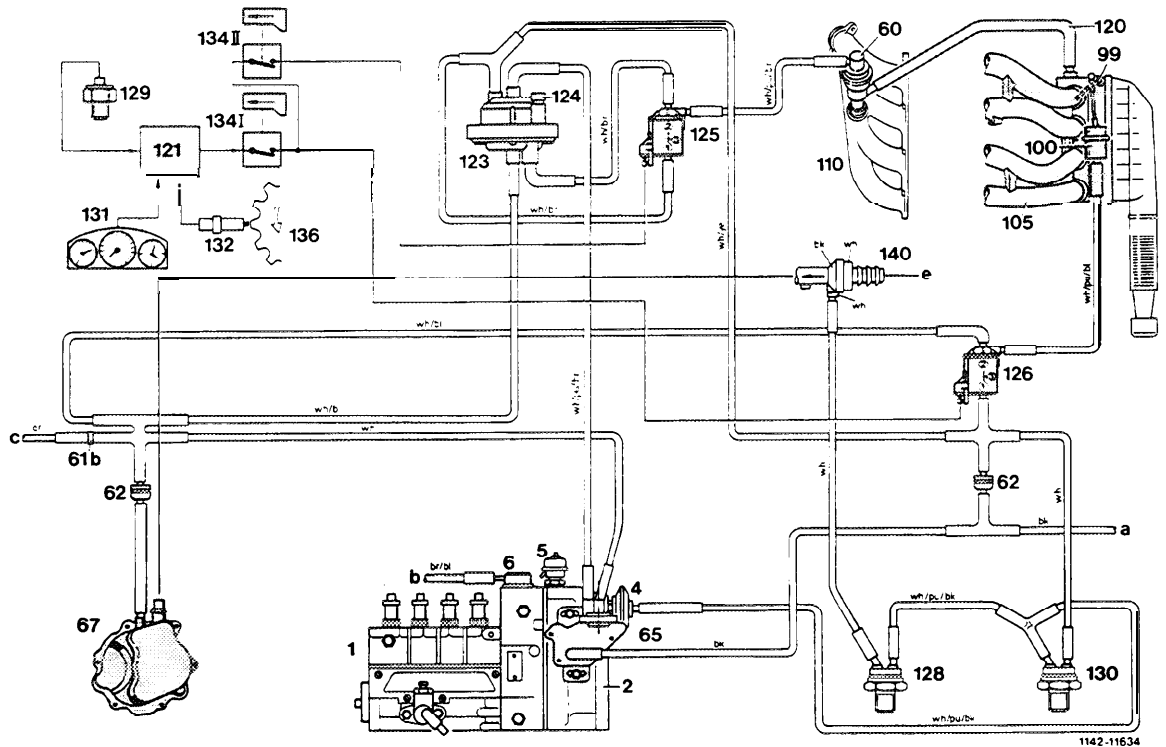
Starting model year 1984, engine 601.92 is provided with a pneumatically/electronically controlled EGR-system for California.

Engines in Federal version vehicles are not provided with EGR.



Function diagram with automatic transmission

- | | | |
|--|---|--|
| 1 Injection pump | 120 EGA-line | a Vent line to vehicle interior |
| 2 Regulator | 121 Control unit | b Key shutoff |
| 4 Vacuum control unit idle speed increase | 123 Pressure converter | c Remaining consumers |
| 5 ADA-capsule (altitude pressure compensation) | 124 Adjusting screw for (123) | d Automatic transmission |
| 6 Vacuum control unit (stop) | 125 Switchover valve, electric for EGR-line | e Brake unit |
| 60 EG R-valve | 126 Switchover valve, electric, for pressure control flap | f To refrigerant compressor - control unit |
| 61 a Orifice | 127 Switchover valve, electric, for rpm increase | |
| 61 b Orifice 0.5 mm dia. | 128 Thermovalve closes at approx. 17 °C | |
| 62 Vent filter | 129 Temperature sensor coolant 100 °C | |
| 65 Vacuum control valve | 130 Thermovalve opens at approx. 17 °C | |
| 67 Vacuum pump | 132 Rpm sensor, engine | |
| 72 Damper | 134/I Microswitch | |
| 99 Pressure control flap | 134/II Microswitch | |
| 100 Vacuum control unit for (99) | 136 Starter ring gear | |
| 105 Intake manifold | 139 Orifice | |
| 110 Exhaust manifold | 140 Check valve brake unit | |
| | | bk = black |
| | | bl = blue |
| | | br = brown |
| | | gr = green |
| | | pu = purple |
| | | re = red |
| | | ye = yellow |



Function diagram with manual transmission

- | | | |
|--|---|--|
| 1 Injection pump | 123 Pressure converter | a Vent line to vehicle interior |
| 2 Regulator | 124 Adjusting screw for (123) | b Key shutoff |
| 4 Vacuum control unit idle speed increase | 125 Switchover valve, electric, for EGR-valve | c Remaining consumers |
| 5 ADA-capsule (altitude pressure compensation) | 126 Switchover valve, electric, for pressure control flap | d Automatic transmission |
| 6 Vacuum control unit (stop) | 128 Thermovalve closes at approx. 17 °C | e Brake unit |
| 60 EGR-valve | 129 Temperature sensor coolant 100 °C | f To refrigerant compressor – control unit |
| 61 b Orifice 0.5 mm dia. | 130 Thermovalve opens at approx. 17 °C | |
| 62 Vent filter | 131 Rpm sensor, tachometer | |
| 65 Vacuum control valve | 132 Rpm sensor, engine | |
| 67 Vacuum pump | 134/I Microswitch | |
| 99 Pressure control flap | 134/II Microswitch | |
| 100 Vacuum control unit for (99) | 136 Starter ring gear | |
| 105 Intake manifold | 139 Orifice | |
| 110 Exhaust manifold | 140 Check valve brake unit | |
| 120 EG R-line | | |
| 121 Control unit | | |
- bk = black
 bl = blue
 br = brown
 gr = green
 pu = purple
 re = red
 ye = yellow

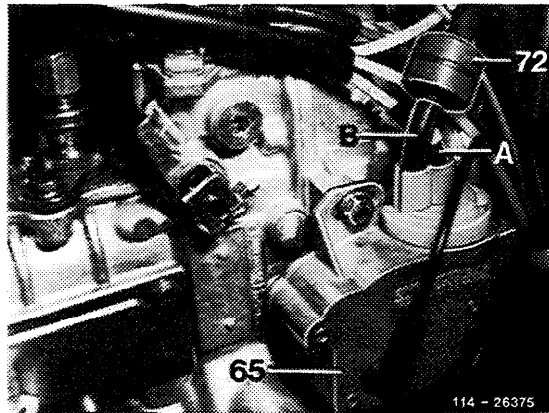
B. Components and operation

Vacuum control valve

The vacuum control valve is attached to injection pump and connected to adjusting lever by means of a driver. With supply vacuum connected (central connection) the valve modulates under increasing load a pressure with dropping characteristic. This modulated pressure is processed still further by pressure converter (also refer to group 27).

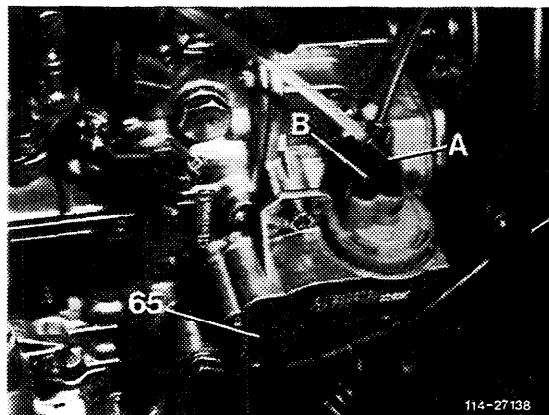
Layout automatic transmission

- 65 Vacuum control valve
- 72 Vacuum damper
- A Control line
- B Suction line



Layout manual transmission

- 65 Vacuum control valve
- A Control line
- B Suction line



Pressure converter

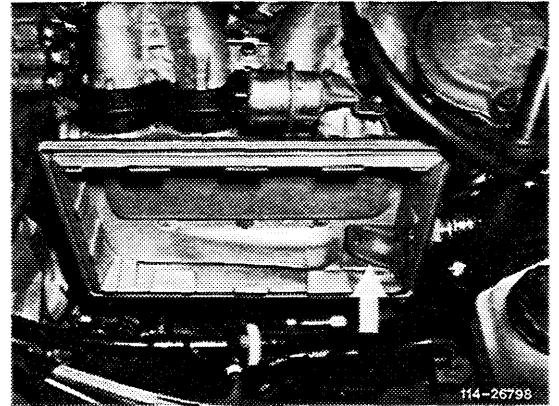
The pressure modulated by pressure control valve is converted for EGR-system in pressure converter. The EG R-valve is activated via switchover valve (125). The modulated pressure can be continuously changed by means of adjusting screw (124) — under red protective cap — by approx. 100 mbar.



Air guide housing with pressure control flap

A pneumatically operated pressure control flap is located in air guide housing to increase the vacuum in intake manifold. When the engine is running in EGR-mode, the pressure control flap closes the fresh air duct. In closed condition, a minimum opening (arrow) remains between pressure control flap and air guide housing.

Pressure control flap closed

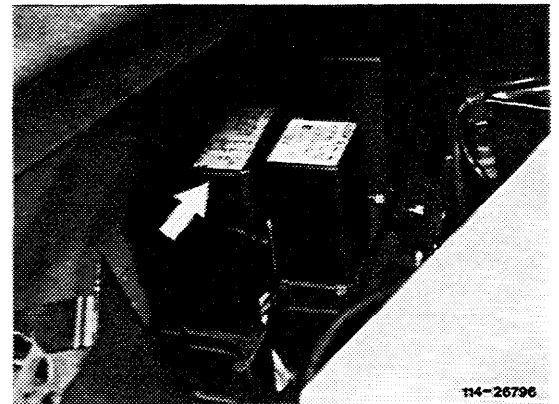


Note

Do not operate linkage on vacuum control unit for pressure control flap manually.

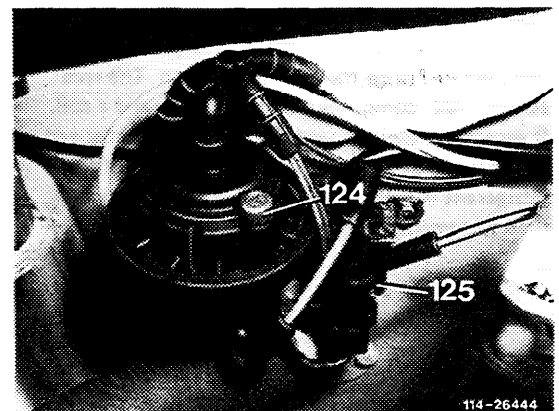
Control unit

Installed behind battery. After switching on ignition, the control unit is connected to battery voltage. Minimum working voltage approx. 11 Volts.



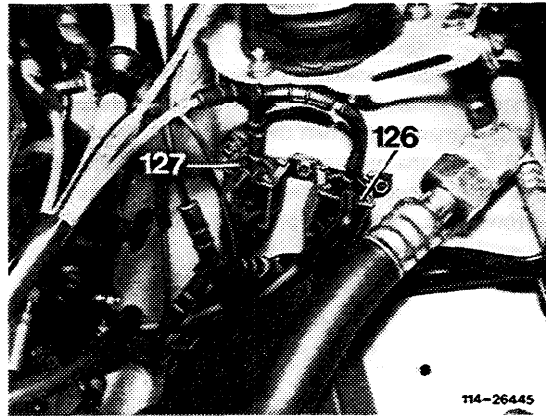
Electric switchover valve (125)

Valve releases the vacuum for EGR-valve under given operating conditions. Activation is by means of control unit in dependence of coolant temperature and engine speed, as well as speed and load-dependent on microswitch (134/1).



Electric switchover valve (126)

Releases vacuum for pressure control flap under given operating conditions. Activation is by means of control unit in dependence of coolant temperature and engine speed, as well as speed and load-dependent on micro-switch (134/II).

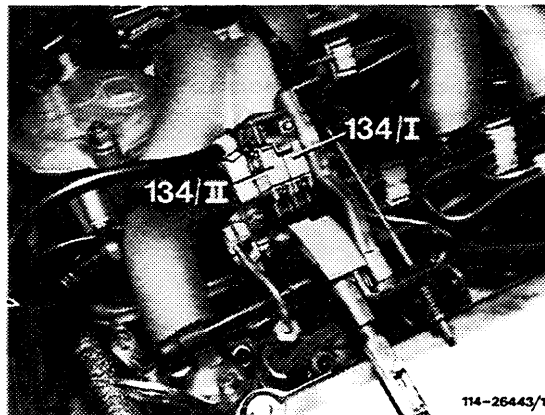


Microswitch (134/I)

Switches off EGR and refrigerant compressor prior to full load (refrigerant compressor only if air conditioning-comfort circuit is operating).

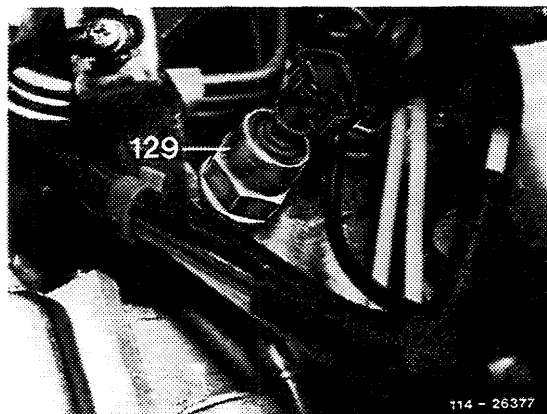
Microswitch (134/II)

Switches off pressure control flap prior to full load.



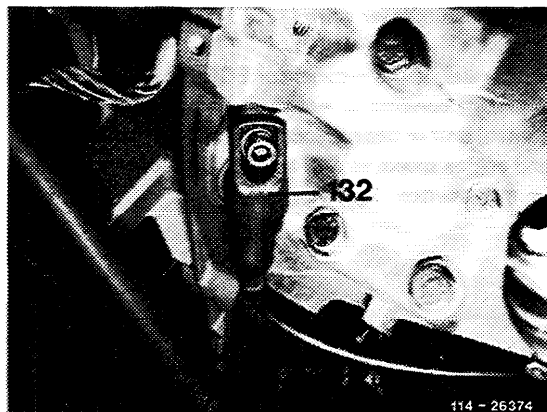
Temperature switch coolant 100 °C (129)

For thermic protection of engine, EG R is switched off as from 100 °C coolant temperature by temperature switch (129) via control unit.



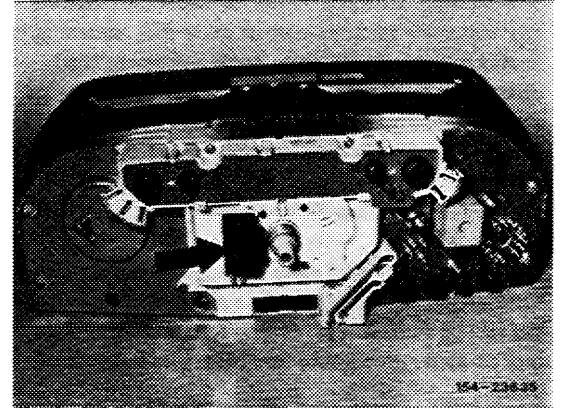
Rpm sensor engine (132)

Installed on flange toward transmission. The rpm sensor (132) comprises a magnetic core and a coil. It senses the engine speed and transmits that speed in the shape of an AC-voltage to control unit for refrigerant compressor. The transformed signal is then transmitted to control unit.



Rpm sensor on tachometer (manual transmission only).

The vehicle speed is sensed by rpm sensor (arrow) on tachometer. At a speed above 78 ± 8 km/h (48 mph) the switching unit will switch off EGR.



C. Overall function

EGR proceeds when the following items have been met:

- Engine speed
 - > 1200 ± 50 /min
 - < 2950 ± 50 /min
- Coolant temperature < 100 °C
- Load-dependent shutoff via microswitches shortly before full load.
 - 134/I EG R-valve
 - 134/II Pressure control flap
- Speed-dependent < 78 ± 8 km/h (48 mph)
(on vehicles with manual transmission only)

Central connection (A) of vacuum control valve (65) is connected to vacuum from vacuum pump (67).

The modulated pressure from vacuum control valve outlet (B) is adapted to EGR-valve (60) in pressure converter (123).

The pressure converter (123) regulates the pressure modulated by vacuum control valve (67) according to load condition (accelerator pedal position). The pressure control flap (99) is pneumatically operated and activated by control unit (121) via switchover valve (126). The full vacuum of vacuum pump (67) is then resting against vacuum control unit (100). The pressure control flap (99) will then close.

With pressure control valve closed, the vacuum in intake manifold increases. As a result, more exhaust gas will be recirculated. Engine rpm and speed are picked up by rpm sensor and processed by control unit.

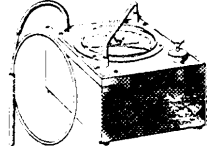
The pressure control valve and the EGR-valve will be opened or closed, depending on operating condition of engine, via magnetic switchover valves (125 and 126).

When exhaust gas is recirculated, a part of the exhaust gases is guided into intake manifold via EGR-pipe and EGR-valve and sucked up again.

14-100 Checking emission control system

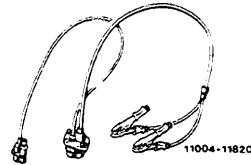
Special tools

Tester O-1000 mbar for vacuum



116589252100

TDC-impulse transmitter



601 5890421 00

Conventional tools

Digital tester

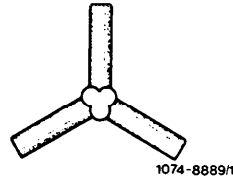
e.g. Bosch, MOT 001.03

e.g. Sun, DIT 9000

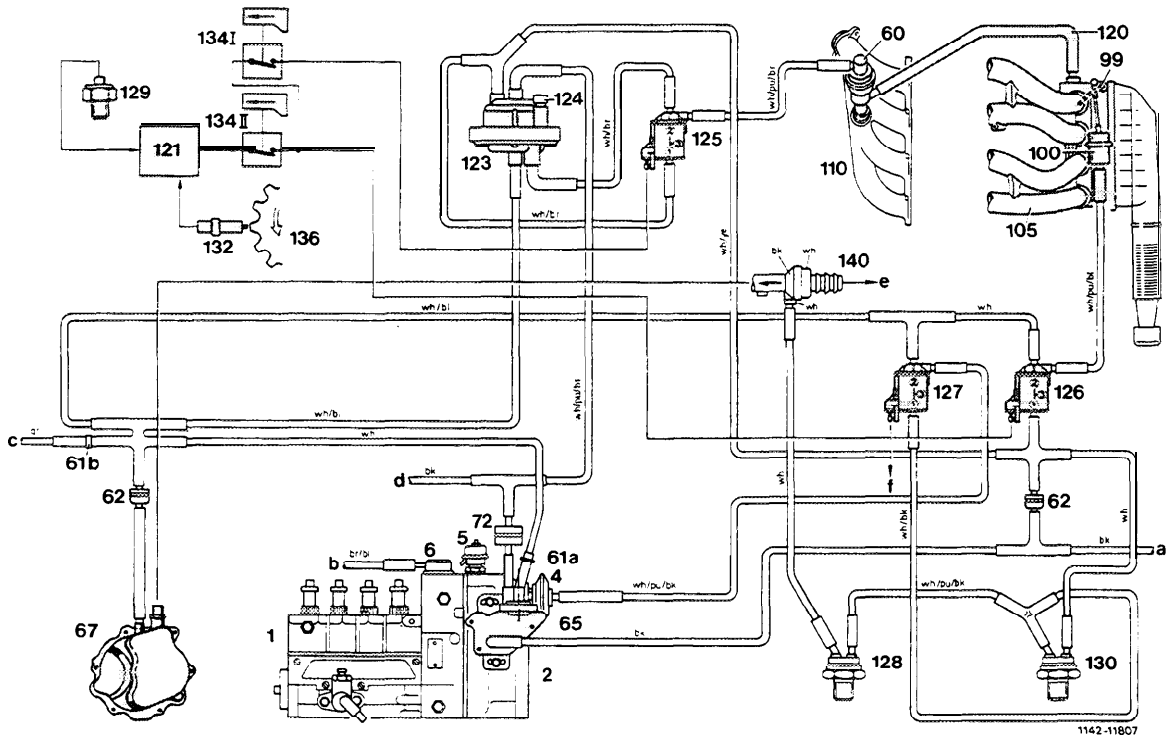
Multimeter

e.g. Sun, DMM-5

Distributor



117 078 01 45

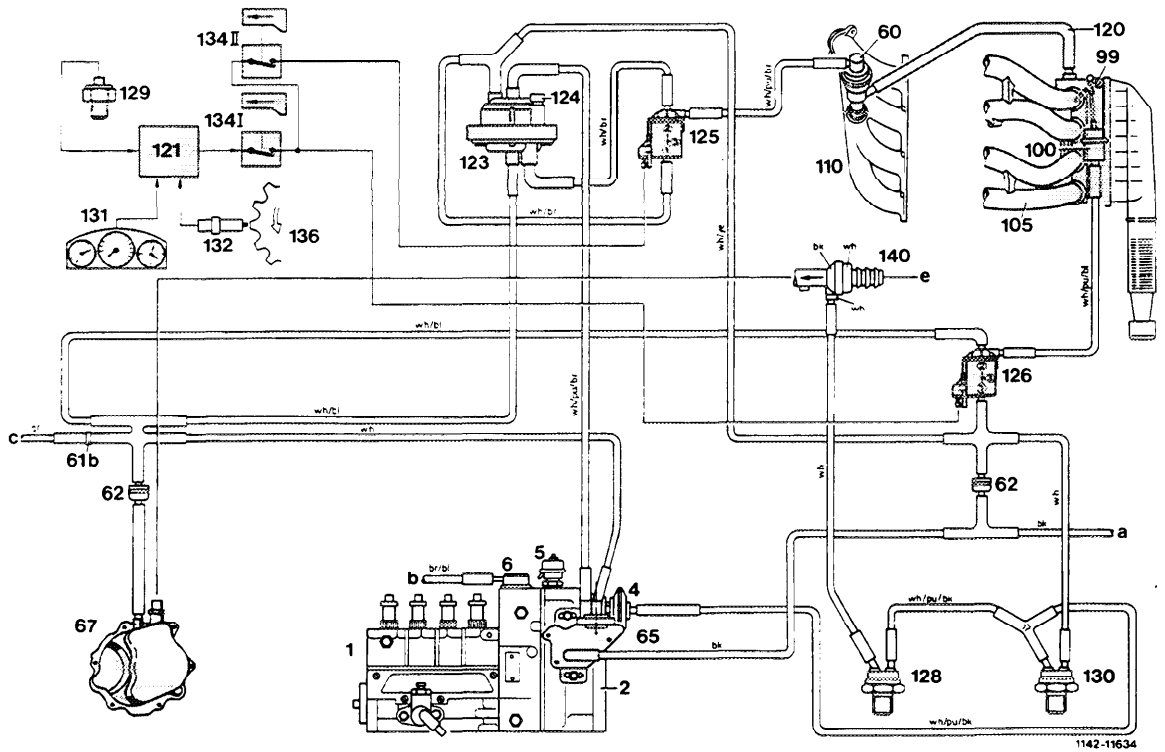


Function diagram automatic transmission

- 1 Injection pump
- 2 Regulator
- 4 Vacuum control unit idle speed increase
- 5 ADA-capsule (altitude pressure compensation)
- 6 Vacuum control unit (stop)
- 60 EGR-valve
- 61a Orifice
- 61b Orifice 0.5 mm dia.
- 62 Vent filter
- 65 Vacuum control valve
- 67 Vacuum pump
- 72 Damper
- 99 Pressure control flap
- 100 Vacuum control unit for (99)
- 105 Intake manifold
- 110 Exhaust manifold
- 120 EGR-line
- 121 Control unit

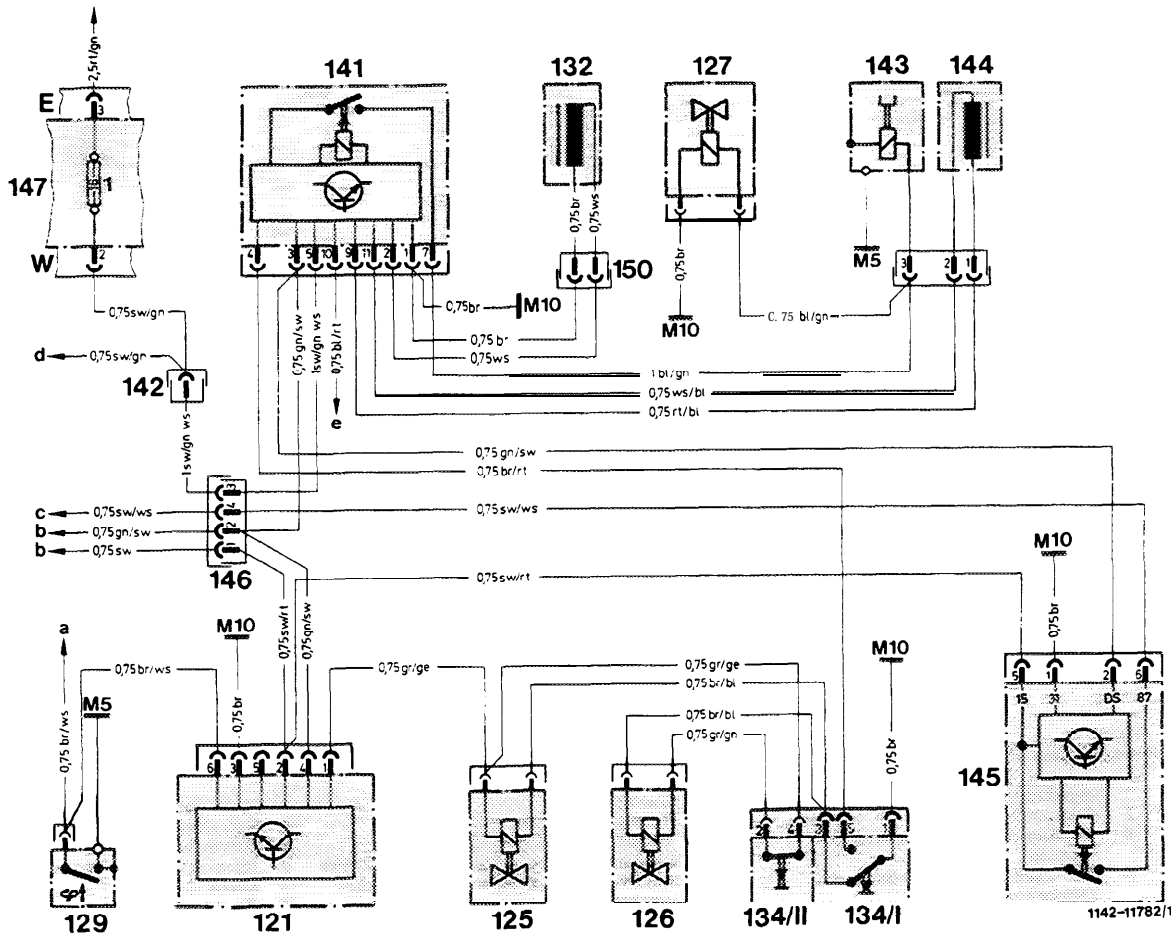
- 123 Pressure converter
- 124 Adjusting screw for (123)
- 125 Switchover valve, electric, for EGR-valve
- 126 Switchover valve, electric, for pressure control flap
- 127 Switchover valve, electric, for rpm increase
- 128 Thermostat closes at approx. 17 °C
- 129 Temperature sensor coolant 100 °C
- 130 Thermostat opens at approx. 17 °C
- 132 Rpm sensor, engine
- 134/I Microswitch
- 134/II Microswitch
- 136 Starter ring gear
- 139 Orifice
- 140 Check valve brake unit

- a Vent line to vehicle interior
 - b Key shutoff
 - c Remaining consumers
 - d Automatic transmission
 - e Brake unit
 - f To refrigerant compressor
- bk = black
 bl = blue
 br = brown
 gr = green
 pu = purple
 re = red
 ye = yellow



Function diagram manual transmission

- | | | | | | |
|-----|--|--------|---|---|-------------------------------|
| 1 | Injection pump | 121 | Control unit | a | Vent line to vehicle interior |
| 2 | Regulator | 123 | Pressure converter | b | Key shutoff |
| 4 | Vacuum control unit idle speed increase | 124 | Adjusting screw for (123) | c | Remaining consumers |
| 5 | ADA-capsule (altitude pressure compensation) | 125 | Switchover valve, electric, for EGR-valve | d | Automatic transmission |
| 6 | Vacuum control unit (stop) | 126 | Switchover valve, electric, for pressure control flap | e | Brake unit |
| 60 | EG R-valve | 128 | Therموالve closes at approx 17 °C | f | To refrigerant compressor |
| 61b | Orifice 0.5 mm dia. | 129 | Temperature sensor coolant 100 °C | | |
| 62 | Vent filter | 130 | Therموالve opens at approx. 17 °C | | |
| 65 | Vacuum control valve | 131 | Rpm sensor, tachometer | | |
| 67 | Vacuum pump | 132 | Rpm sensor, engine | | |
| 99 | Pressure control flap | 134/I | Microswitch | | |
| 100 | Vacuum control unit for (99) | 134/II | Microswitch | | |
| 105 | Intake manifold | 136 | Starter ring gear | | |
| 110 | Exhaust manifold | 139 | Orifice | | |
| 120 | EGR-line | 140 | Check valve brake unit | | |
-
- | | |
|----|----------|
| bl | = black |
| bl | = blue |
| br | = brown |
| gr | = green |
| pu | = purple |
| re | = red |
| ye | = yellow |



Electric wiring diagram EGR

- 121 Control unit = EGR
- 125 Switchover valve EG R-valve
- 126 Switchover valve pressure control flap
- 127 Switchover valve refrigerating system
- 129 Temperature sensor coolant 100 °C
- 132 Rpm sensor, engine
- 134/I Microswitch EGR
- 134/II Microswitch pressure control flap
- 141 Control unit refrigerant compressor
- 142 Plug connection auxiliary fan
- 143 Electromagnetic clutch refrigerant compressor
- 144 Rpm sensor refrigerant compressor
- 145 Relay kickdown switch
- 146 Plug connection interior
- 147 Central electrics, coupling
E = plug connection 8-point
W = plug connection 4-point
- 150 Plug connection

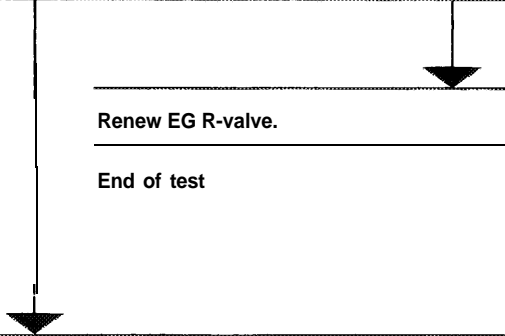
- a To electromagnetic clutch
- b To plug connection revolution counter
- c To kickdown switch
(automatic transmission only)
- d Relay auxiliary fan
- e Pressure switch air conditioning
- f Terminal 15 x preglow switch

- Ground connection points
M 5 Ground, engine
M 10 Ground, battery

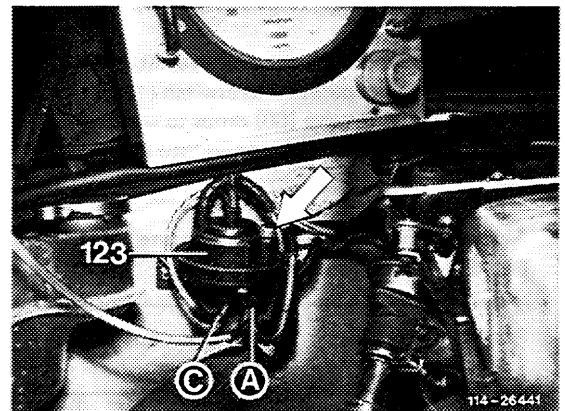
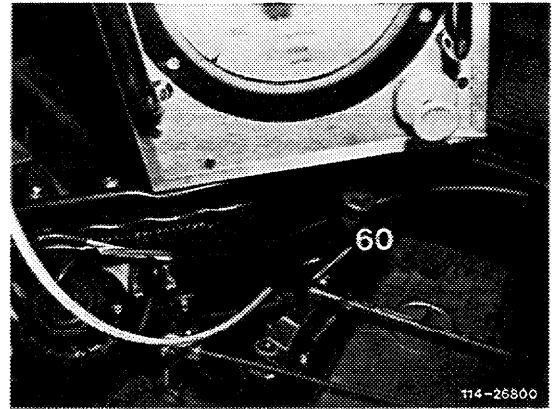
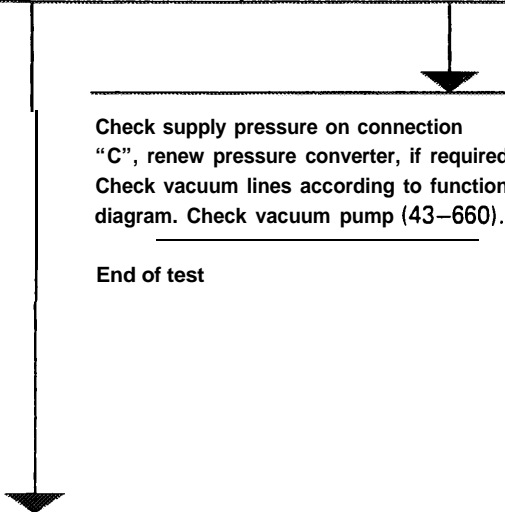
- bl = blue (bl)
- br = brown (br)
- el = ivory (el)
- ye = yellow (ge)
- gn = green (gn)
- gr = gray (gr)
- na = natural (nf)
- pi = pink (rs)
- re = red (rt)
- bl = black (sw)
- pu = purple (vi)
- wh = white (ws)

Quick test

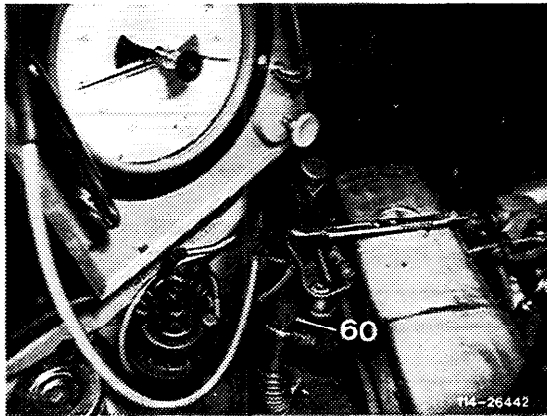
<p>Test EGR-valve (60) with engine stopped</p> <p>Activate EG R-valve with approx. 300 mbar vacuum. Pull off vacuum line.</p>	
EGR-valve audibly closing.	EGR-valve not closing.



<p>Test pressure converter (123) and pressure adjustment</p> <p>Connect vacuum tester with Y-distributor to connection "A" and read vacuum value at idle speed.</p> <p>Nominal values in mbar with: manual transmission 320 ± 5 automatic transmission 350 ± 5</p> <p>If the vacuum is above or below nominal value, adjust vacuum. For this purpose, pull protective cap (arrow) from pressure converter (123) and adjust by means of adjusting screw (124) with socket wrench element (4 mm) to specified nominal value.</p>	
Vacuum in order.	Vacuum not in order.



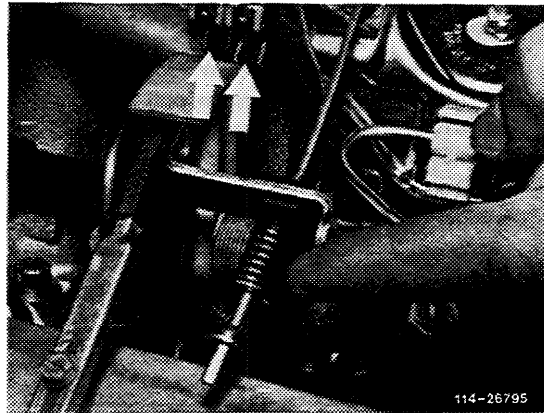
Checking vacuum control		
Connect vacuum tester with Y-distributor to EGR-valve (60). Check vacuum values and position of pressure control flap (99). Read vacuum values at the following speeds:		
1/min	mbar	Pressure control flap
750 ± 50	0	Basic position
1200 ± 50	150-350	Fully attracting
3000 ± 50	0	Basic position
Test values in order.	Test values not in order.	



Check pressure supply as well as individual parts.

End of test

Testing microswitch (134/I and 134/II)	
Connection vacuum tester as above. At 1200 ± 50/min, operate microswitch (134/I), pressure on EGR-valve (60) drops to 0 mbar. Pressure control flap (99) moves into basic position.	
Actuate microswitch (134/II), pressure control flap (99) moves into basic position.	
Function in order.	Function not in order.



Check individual parts.

Testing individual parts

Testing vacuum control valve (65)

Connect vacuum tester with Y-distributor to connection "B" of pressure converter (123) and check vacuum at idle speed.

Nominal values:

At 750 ± 50 : approx. 360-410 mbar

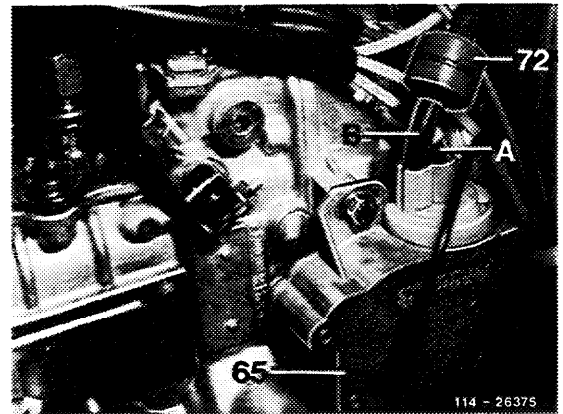
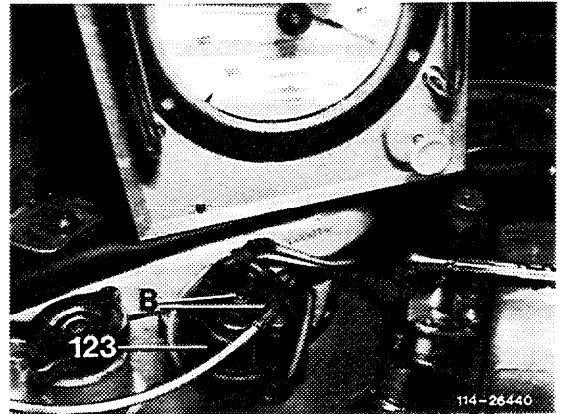
With engine stopped and regulating linkage on full load stop 0 mbar.

Test values in order.

Test values not in order.

Check vacuum lines according to function diagram. Check vacuum pump (43-660), adjust vacuum control valve and renew, if required (27-037).

End of test



Testing switchover valves (125 and 126)

Connect voltmeter to plug connection of switch-over valves and measure voltage at $1200 \pm 50/\text{min}$.

Nominal value: approx. 12 V.

Voltage in order.

Voltage not in order.

Check electric activation according to wiring diagram, renew control unit, if required.

End of test

Connect vacuum tester with Y-distributor to connection "C" and check vacuum at $1200 \pm 50/\text{min}$, with 12 V connected.

Switchover valve (125): approx. 350 ± 10 mbar

Switchover valve (126): approx. 700 ± 10 mbar

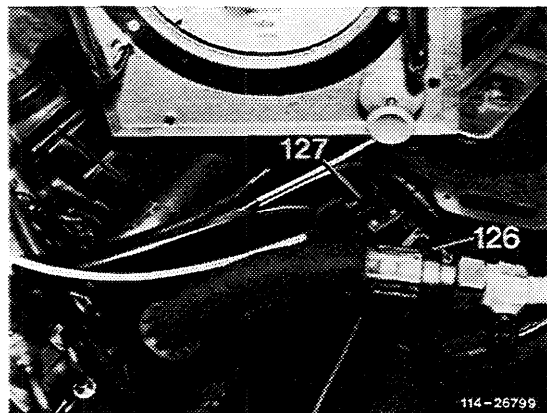
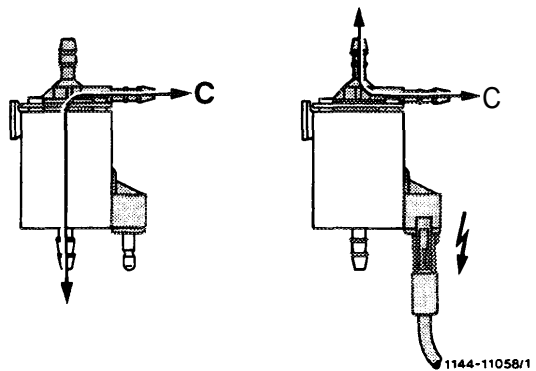
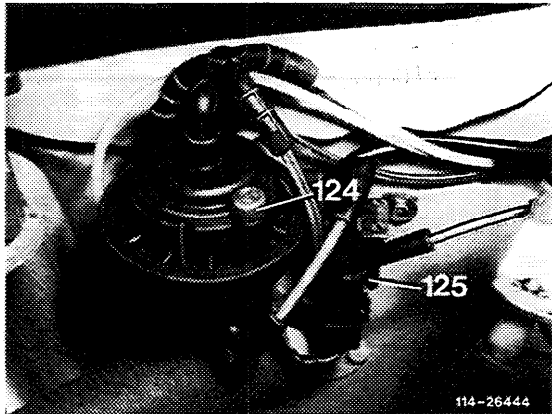
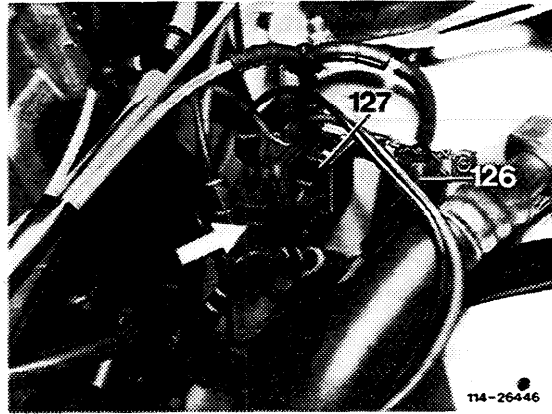
Vacuum value in order.

Vacuum value not in order.

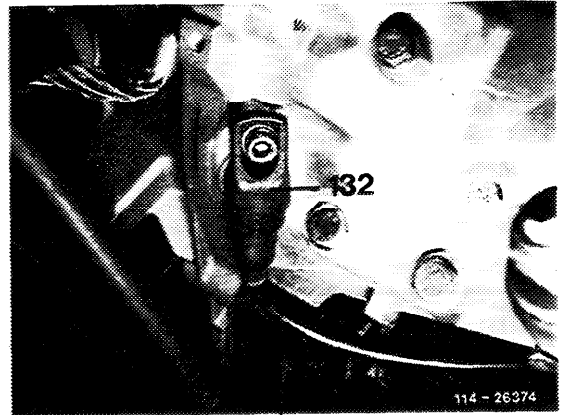
Check vacuum pump (43–660), renew switchover valve, if required.

Check vacuum lines according to function diagram.

End of test

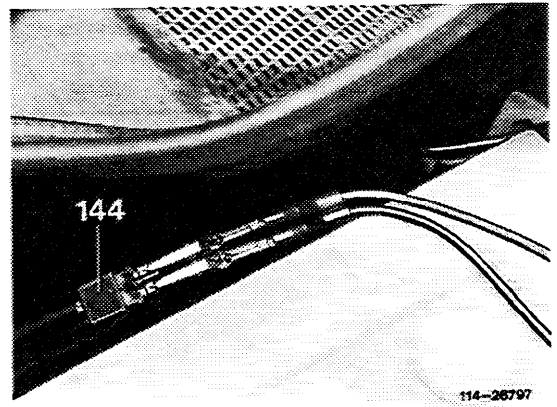


<p>Checking rpm sensor for engine (132)</p> <p>Engine stopped. Separate coupling (144) and test resistance with multimeter.</p> <p>Readout: $1.9 \pm 0.2 \Omega$</p>	
In order.	Not in order.



Renew rpm sensor.

End of test




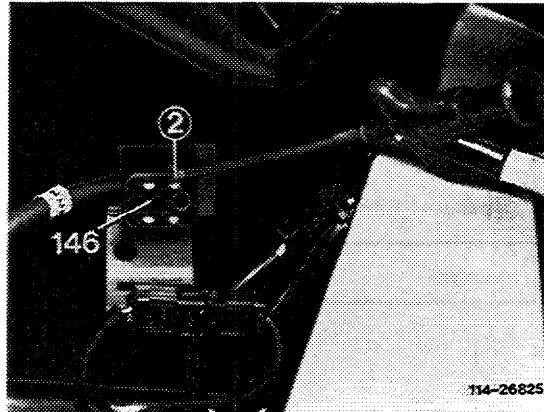
<p>Connection as above. Push button $V\sim$.</p> <p>Read test values at the following engine speeds:</p>	
1/min	$V\sim$
700-800	$> 4^1)$
Test values in order.	Test values not in order.

Renew rpm sensor.


End of test

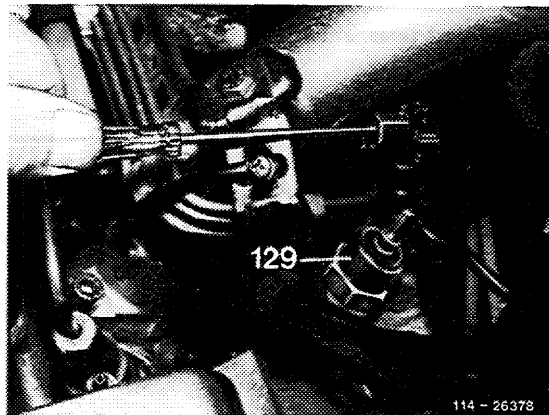
¹⁾With increasing speed, increasing voltage.

Testing TD-signal	
On jack 2 of 4-point plug connection (146) test TD-signal with multimeter button "V" at idle speed:	
1/min	Volt
750 ± 50	approx. 0.35
Test values in order.	Test values not in order.
	
<p>Check electric activation according to wiring diagram, check rpm sensor for engine, if required.</p>	

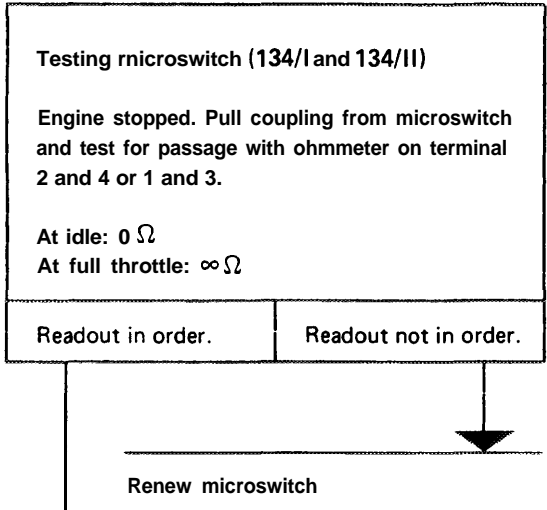


End of test

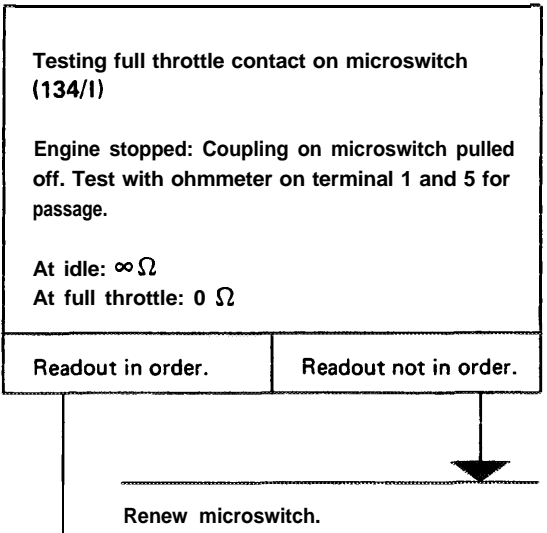
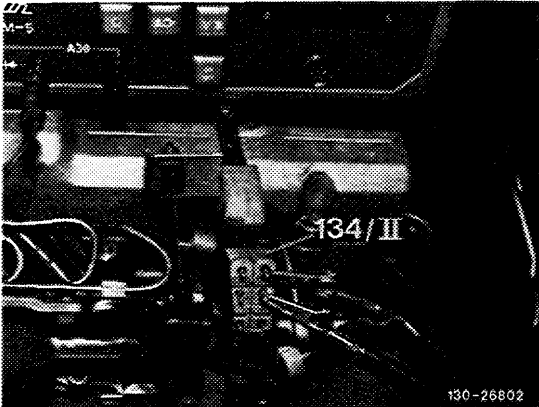
Testing EGR-protective circuit 100 °C	
Connect vacuum tester with Y-distributor to EGR-valve. Run engine to 120/min, pull off plug on temperature switch (129) and hold against ground.	
Vacuum 0 mbar on EGR-valve, fan clutch audibly attracting.	
Function in order.	Function not in order.
	
<p>Test electric activation, renew control unit, if required.</p>	



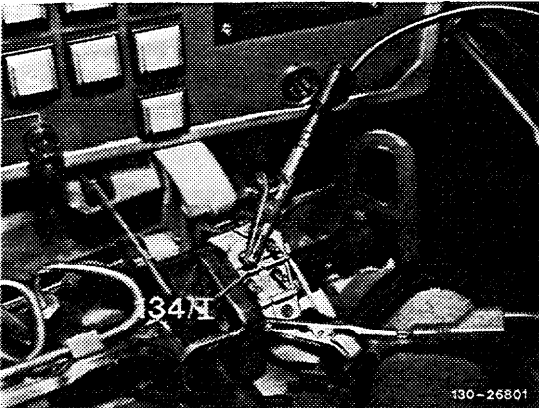
End of test



End of test

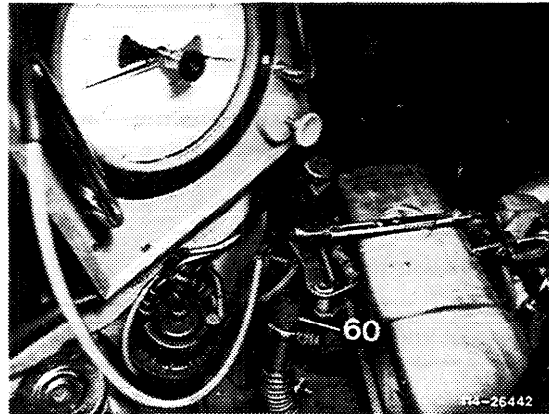


End of test



Vehicles with manual transmission

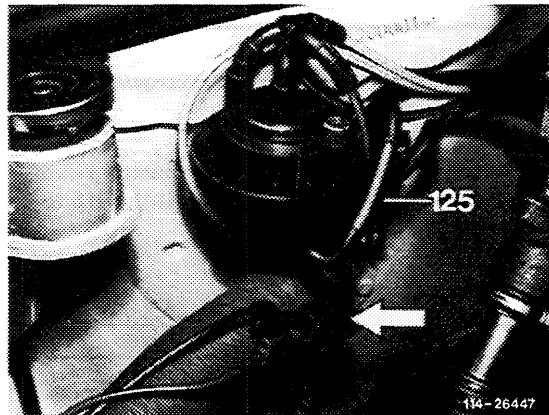
<p>Testing speed shutoff</p> <p>Connect vacuum tester with Y distributor to EGR-valve. Operate vehicle on test bench or on road in 5th gear at partial load.</p> <p>Read vacuum.</p>		
<p>Readout</p> <p>Speed < 78 ± 8 km/h: approx. 300 mbar > 78 ± 8 km/h: approx. 0 mbar</p>		
<p>Vacuum values</p> <table border="1"><tr><td>In order.</td><td>Not in order.</td></tr></table>	In order.	Not in order.
In order.	Not in order.	



Test electrical activation of switchover valve (125). For this purpose, connect multimeter to plug (arrow) of **switch**-over valve and take vehicle again on test run.

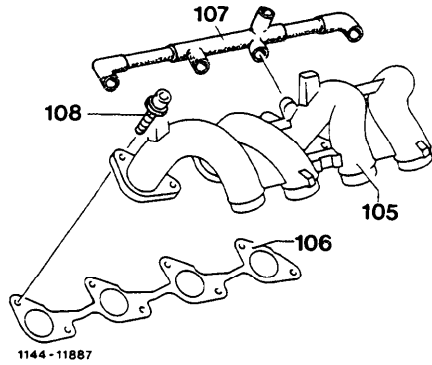
If there is voltage (approx. 12 V) at a speed of $> 78 \pm 8$ km/h, test electric activation of switchover valve according to wiring diagram. Renew defective parts, if required.

If there is no voltage, renew switchover valve.



End of test

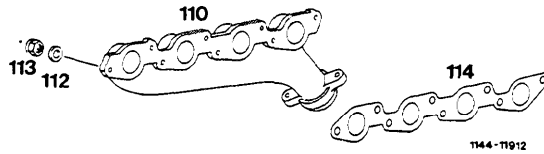
14-180 Removal and installation of intake manifold



- | | |
|----------------------------|------------------------------|
| 105 Intake manifold | 107 Engine breathing |
| 106 Gasket | 108 Combination screw |

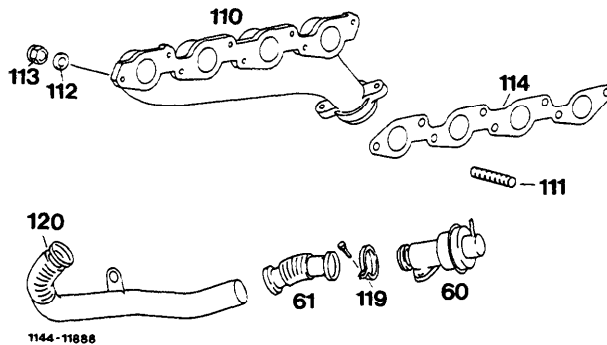
14-350 Removal and installation of exhaust manifold

A. Standard version and (USA) Federal



- | | |
|----------------------|-----------------|
| 110 Exhaust manifold | 113 Nut M 8, Cu |
| 111 Stud | 114 Gasket |
| 112 Washer | |

B. (USA) California



- | | |
|-----------------------------------|-------------------------|
| 60 EG R-valve | 113 Nut M 8, Cu, 8 each |
| 61 Corrugated tube | 114 Gasket |
| 110 Exhaust manifold | 119 Clamp, 2 each |
| 111 Stud in cylinder head, 8 each | 120 EGR-line |
| 112 Washer, 8 each | |