#### Automatic climate control

#### **Automatic climate control**

Model 124 has an automatic climate control system similar to that of model 123.

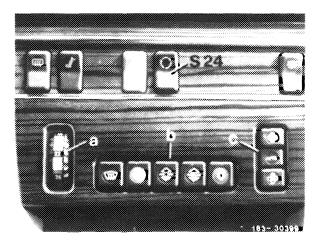


Fig. 83/1

Pushbutton switch unit consists of

- a Temperature selector
- b Pushbutton switch with 5 buttons
- c Blower switch

S24 Mode switch for fresh/recirculating air

The following descriptions are only for additional or modified components.

#### Pushbutton switch unit

The pushbutton switch unit has an electronic system with the following functions:

- Regulating the in-car temperature. The A/C compressor is actuated through the negative (—) side of the electrical circuit (previously positive side) via the control unit.
- 2. Controlling the blower speeds.
- 3. Controlling the fresh/recirculating air flap.
- 4. Controlling the air flaps.

The circuit board in the pushbutton switch unit is protected against shorts from any of its externally connected circuits.

The design of the short circuit protection feature varies depending on the manufacturer of the push-button switch unit.

#### Pushbutton switch unit made by Kammerer (MK)

The respective output signal is switched off in the event of a short circuit, and switched on again when the short circuit is no longer detected.

#### Pushbutton switch unit made by Bosch

All output signals are switched off (except the blower control) in case of a short circuit. Outputs are switched on again within 30 seconds after the short circuit has been eliminated.

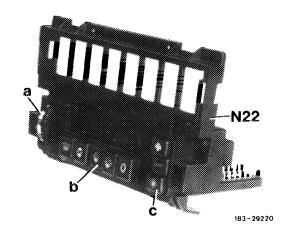


Fig. 83/2

#### Blower control

The blower control unit consists of a transistor-controlled current regulator and a heat sink. In the automatic mode, the blower control unit provides stepless control of the blower speeds. The blower speed is continuously varied (depending on the control voltage supplied by the pushbutton switch in the range between min. and max. speed (no distinct steps).

In the event of a short circuit or excess temperature in the blower control unit, it switches the blower motor off.

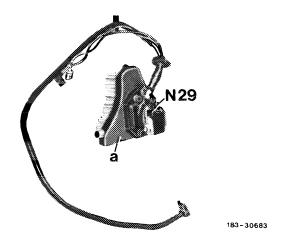


Fig. 83/3
N29 Current regulator
a Heat sink

The blower control unit (regulator with heat sink) is located in the blower housing behind the blower motor. As a result, the blower control unit is constantly cooled when the blower motor is running.

#### Repair note

To gain access to the current regulator, remove the blower motor with bracket and the mounting screws (arrows), pull up carefully on the housing and remove the blower control from the side.

Three nuts attach the current regulator to the heatsink. Prior to installation coat the heat sink-to-regulator contact surface with commercially available heat conducting paste.

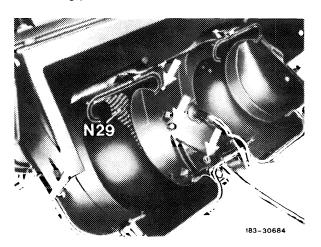


Fig. 83/4 Location of current regulator (N29)

#### Operation of blower control unit

The blower control unit provides stepless regulation of the blower speed.

The blower control unit is connected to the main fusebox and receives battery voltage when the ignition is switched on. The blower control unit is also wired to the pushbutton switch unit.

Depending on the blower switch mode selection, the pushbutton switch unit continuously provides a control voltage (between 0.4 and 9 volts) to the blower control unit, which regulates the current (between 5 and 28 Amps) to the blower motor, thereby controlling the blower speed.

Control voltage depending on blower switch mode selection:

Fixed Hi : 6.0 to 9.0 Volts (28 Amps. blower current).

Automatic Stepless : 1.4 to 4.5 Volts (7.5 to 22 Amps. blower current).

Fixed LO : approx. 1.0 Volt (5 Amps. blower current).

In all blower switch modes (except in 100% recirculation) the control voltage is influenced by the vehicle speed via a Hall-effect speed sensor. With increasing vehicle speed, the control voltage is decreased (by 0.3 Volt/60 mph), thereby decreasing the blower speed.

This offsets the increase in air volume otherwise caused by ram air.

In the automatic mode, the control voltages are also influenced:

- By the desired and actual in-car temperature (via in-car temperature sensor (B10/4, Fig. 83/5) and the temperature selector).
- By the outside temperature (via outside air temperature sensor B 10/5 on the blower housing).
- By the operating mode of the system (heating or cooling).
- By the coolant temperature (from temperature sensor for coolant temperature gauge (B13, Fig. 83/34).

Blower control during mode selection and

a) Coolant temperatures below 40°C
 Outside temperatures below 20°C

The blower will not switch on if the in-car temperature is colder than the temperature set on the temperature selector wheel (cold engine lock-out via the temperature sensor B13 for the temperature gauge).

At coolant temperatures between 40°C and 80°C, the control voltage of 1.6 volts is continuously increased to a max. 4.5 volts in mode selection , and in mode selection from 2.0 volts to a max. 4.5 volts. The blower speed increases correspondingly.

b) Coolant temperature below 40°C
 Outside temperatures above 20°C

The blower will switch on immediately if the outside temperature is above 20°C or the in-car temperature is warmer than the temperature set on the temperature selector wheel.

The control voltage to the blower control unit depends on the in-car or outside temperature (up to max. 4.5 Volts).

# Blower control during mode selection and or

The blower switches on immediately even below coolant temperatures of 40°C. After switching to or or the blower continues to operate and can only be switched off by pushing the button.

# Blower control during mode selection

The blower switches on immediately at coolant temperatures below 40°C and the speed increases with increasing coolant temperature (depending on the control voltage of 1.4 to 5 volts). If the fixed mode, max. is pushed, the blower runs at maximum speed (28 Amps. blower current) independent of coolant temperature.

#### Control of air flaps

Operating condition of system		Temperature on temperature sensor for heat exchanger starting at approx.  O°C for a period of at least 15 s	Positions of air flaps  Defroster nozzles   Center nozzle   Legroom nozzles		
	Heating	40°C	leak air	closed	open open
		29°C	open	opens	open
Cooling direction	Transition zone	26°C	open	open	closes
		15°C 10°C	closes (leak air) closes (closed)	open open	closed closed
*	Cooling	8°C	closed	open	closed
Heating	Transition	15°C	opens (leak air)	open	closed
direction	zone	34°C	leak air	open	opens
		37°C	leak air	closes	open
•	Heating	40°C	leak air	closed	open

Control of the air flaps is influenced by the temperature sensor for the heat exchanger (B10/1, fig. 83/7).

The transition is indicated by the switchover of the air flaps from heating to cooling, from cooling to heating. In this case, several air flaps will open and the change is less noticeable. The air flap control system function is shown above.

#### Control of fresh/recirculating air flap

The fresh/recirculating air flap is controlled as follows:

- Manually via the fresh/recirculating air switch (S24, 100% recirculated air).
- Automatically by the pushbutton switch unit (N22) 80% or 100% recirculating air (see recirculating air flap control).

#### Recirculating air system

# Manual recirculating air switch (S24) depressed = 100% recirculating air (to prevent the entry of unpleasant odors)

During mode selection of or with the compressor engaged and outside temperatures above 7°C, the fresh/recirculating air flap will switch to fresh air or automatic operation 30 minutes after the recirculating air switch is actuated. If the outside temperature is below 7°C (compressor does not engage) the flap will switch to fresh air or automatic operation 5 minutes after the recirculating air switch is actuated.

This means that in the heating mode, the limit of 100% manual recirculation to 5 minutes will allow exclusion of outside unpleasant odors and also not cause the inside glass surfaces to fog-up.

During mode selection , regardless of outside temperature, the flap will switch to fresh air or automatic operation 5 minutes after the recirculating air switch is actuated.

The above sequences are repeated each time the switch is reactuated.

The fresh/recirculating air flap moves to the fresh air position when the recirculating air switch or ignition is switched off, or when mode selection is pushed.

Manual operation at 100% recirculation will be maintained idefinitely if the switch is activated, the outside temperature is above 20°C, and the temperature selector is in "MIN".

# Automatic recirculating air mode = 80% or 100% recirculating air (to improve cooling capacity).

The automatic mode (80% or 100% recirculating air) depends on in-car temperature (in-car temperature sensor), and the difference between the temperature set on the temperature selector wheel and the outside temperature (outside temperature sensor).

The warmer the in-car temperature or the greater the temperature difference, the sooner the system will switch to the recirculating air mode (see recirculating air flap control).

Automatic operation at 100% recirculation is limited to 30 minutes, independent of temperature difference. The system then automatically switches to 80%.

## Control of the diverter flap

Operation of the diverter flap depends on the following conditions:

- On set temperature on the temperature selector wheel relative to incar temperature.
- On outside air temperature.

The higher the outside air temperature, the sooner the flap will be actuated, independent of recirculating air mode.

#### Recirculating air flap control (Temperature selector wheel set to 22°)

Approx. in-car sensor temperature	Outside ten	side sensor temperature, <sup>c</sup> nperature rising g air flap position	Outside temperature falling Recirculating air flap position		
°C	Fresh air	80% Recirculating air	100% Recircu- lating air¹)	80% Recirculating air	Fresh air
+25 +30 +35 +40	< +30 < +28 < +27 < +25	+30 to +45 +28 to +41 +27 to +38 +25 to +35	> +45 > +41 > +38 > +35	+40 to +27 +36 to +25 +32 to +24 +29 to +22	< +27 < +25 < +24 < +22

<sup>&#</sup>x27;) 30 minute duration. The sequence is repeated for 30 minutes if ignition is turned off and on again

Note: ≥ warmer than

< cooler than

#### Location of components

### In-car temperature sensor and aspirator blower

The in-car temperature sensor (B 10/4) is located in the front dome lamp housing.

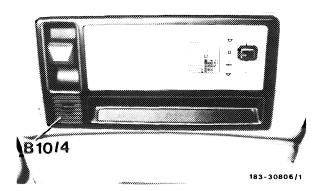


Fig. 83/5

With the ignition switched on, the aspirator blower (M9) runs continuously and is connected with a hose to the in-car temperature sensor. This increases the accuracy of temperature control inside of the vehicle.

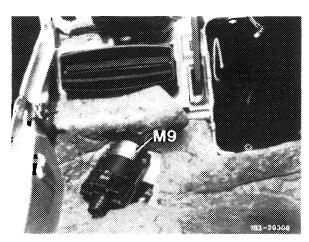


Fig. 83/6 Aspirator blower (M9) under dash, right

#### Heat exchanger temperature sensor

The temperature sensor (B10/1) is located inside the heat exchanger housing and accessable after removing the pushbutton unit.

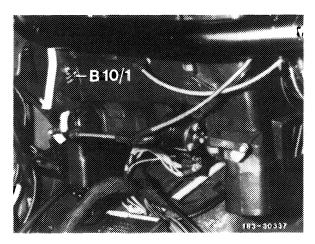


Fig. 83/7

#### **Evaporator temperature sensor**

This sensor (B10/6) is located in the evaporator housing on the left side above the accelerator pedal.

The sensor probes the evaporator fin air temperature and transmits its resistance to the electronic system of the pushbutton switch unit. This sensor value provides input for temperature regulation and evaporator freeze protection. As a result, the outlet temperature at the air outlets (nozzles) will fluctuate only slightly. The sensor also prevents icing-up of the evaporator.

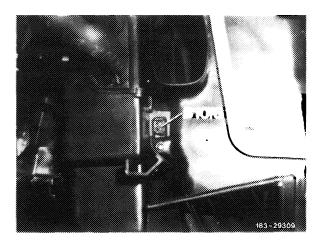


Fig. 83/8

#### Outside air temperature sensor

The outside air temperature sensor (B10/5) transmits its resistance value, under influence of outside temperature, into the electronic system of the pushbutton switch unit and influences in-car temperature control and fresh/recirculating air flap. It is located at the right side of the blower housing under the air inlet grill.

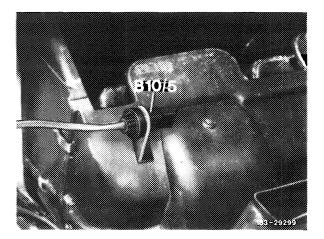


Fig. 83/9

For test values of the evaporator temperature sensor and outside air temperature sensor, refer to technical data.

### Fresh/recirculating air flap and blower motor

The fresh/recirculating air flap (34) is vacuum controlled by the switchover valve (Y 7.1) (refer to function diagram Fig. 83/30).

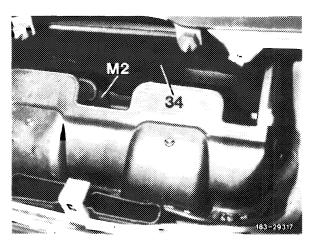


Fig. 83/10

34 Fresh/recirculating air flap

M 2 Blower motor

The blower motor has dual centrifugal fans (4 fluted squirrel cages). The blower motor draws approx. 28 amps in "Fixed Hi"; speed with 13 volts applied.

#### Evaporator/heat exchanger

The evaporator is located in the heater box in front of the heat exchanger.

#### Repair note

Remove and disassemble heater box to replace the evaporator.

To replace the heat exchanger, remove the instrument panel and the diverter flap cover with vacuum element (41).

#### Layout of vacuum elements and switchover valve unit for controlling air flaps

The switchover valve unit (Y7) consists of seven switchover valves.

Repair of the switchover valve unit is not possible, the complete unit must be replaced.

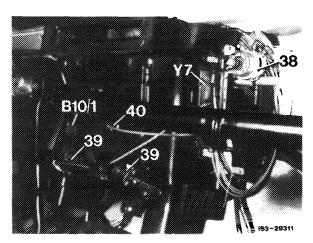


Fig. 83/11

B10/1 Temperature sensor for heat exchanger

Switchover valve unit, 7 connections

38 Vacuum element for defroster nozzle flaps (no vacuum, flaps open)

Vacuum elements for legroom flaps (no vacuum, flaps closed)

Connection vacuum element for center nozzle flap

(no vacuum, flap closed).

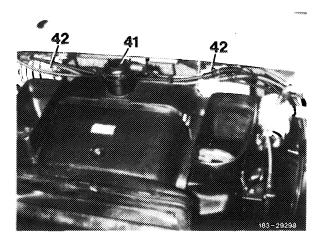
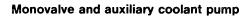


Fig. 83/12

- 41 Vacuum element for diverter flap (no vacuum, flap closed)
- 42 Vacuum elements for fresh/recirculating air flap (no vacuum, flap in fresh air position)



The monovalve (Y19) is located in the coolant return flow circuit and regulates flow volume to the heat exchanger. The valve is completely open when not energized and completely closed when energized.

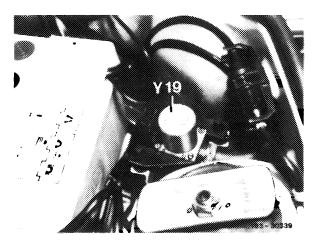


Fig. 83/13

The auxiliary coolant pump (M13) is also in the coolant return flow circuit. It runs in the heating mode, when the monovalve is either completely open or cycling.

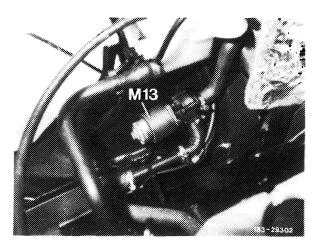


Fig. 83/14

#### Ventilation

Air inlet and air outlets are basically the same as on model 126.

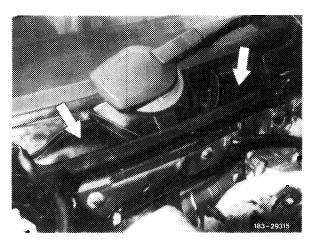


Fig. 83/15 Air inlet grille

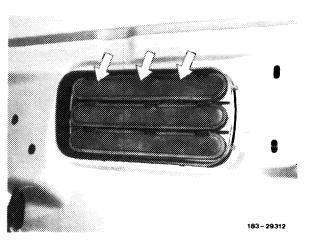


Fig. 83/16 Ventilation check valves left and right behind bumper

# Air-Conditioning (A/C) compressor and compressor cut-out

Installed on all 124 models is a swash plate A/C compressor made by Nippondenso.

The filling capacity of the system is 1.1 kg refrigerant R12.

All the accessories are driven by one poly-V-belt. To ensure continued operation of the accessories in case of a jammed air conditioning compressor (i.e. overcharged or internally damaged parts), the protective cut-out switch will disengage the compressor's electromagnetic clutch.

The function of the protective cut-out is the same as 1985 Model 201. For testing the compressor cut-out refer to the test program.

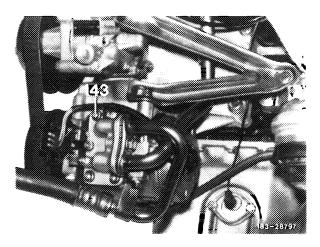
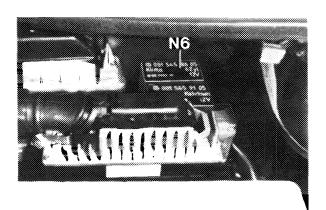


Fig. 83/17
143 A/C compressor



183-29313

Fig. 83/18
N6 Control unit for compressor cut-out

#### Air conditioning compressor overheating cut-out

As a protection against engine overheating an emergency cut-out is provided. After reaching approximately 115°C engine coolant temperature, the switch (S25/5) is closed (grounded) and the A/C compressor via control unit (N6) is cut-out. The switch (S25/5) opens at approx. 108°C and the A/C compressor is then re-engaged.

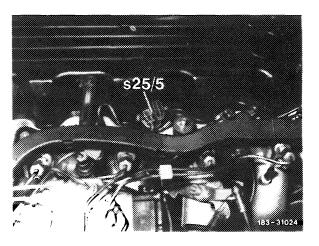


Fig. 83/19
S25/5 Engine coolant temperature switch 105/115°C 105°C for auxiliary fan high speed 115°C for overheating cut-out

#### Expansion valve and auxiliary fan

The expansion valve (82) is accessible after removal of the air inlet grill.

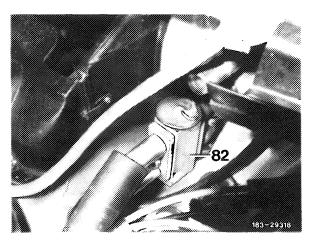


Fig. 83/20

All models have a large electric auxiliary fan. At max. speed the fan draws approx. 17.5 Amps at 13 Volts battery voltage.

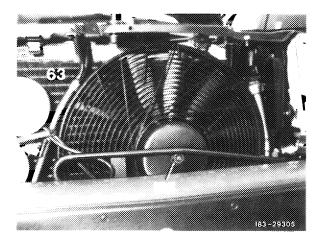


Fig. 83/21
63 Condenser
M4 Auxiliary fan

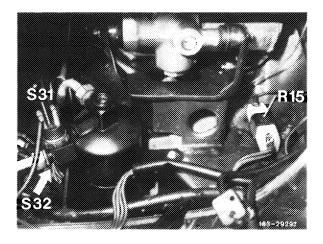


Fig. 83/22 R15 Pre-resistor, aux. fan S31 Low pressure switch, compressor cut-out S32 High pressure switch for auxiliary fan On 20 bar/Off 15 bar

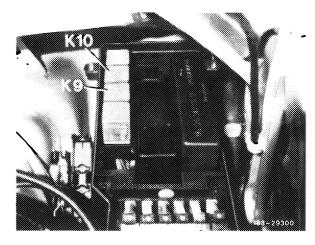


Fig. 83/23

K 9 Relay, auxiliary fan

K10 Relay, auxiliary fan pre-resistor

The auxiliary fan has two operating modes: Low speed: Activated by pressure switch (S32), at a refrigerant pressure of 20 bar, via relay (K10) and preresistor (R15) (Fig. 83/22 and 83/23).

High speed: Activated by temperature switch (S25/5, Fig. 83/19) at 105°C coolant temperature via relay (K9, Fig. 83/23) directly.

# Interior wiring harness to engine wiring harness plug connector (X26)

The plug connector (X26) located on the bottom of the fuse box (Fig. 83/26) transmits the A/C compressor control signal, control unit for compressor cut-out supply voltage, and the auxiliary fan control voltage.

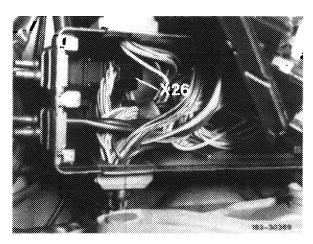


Fig. 83/24

The blower control unit plug connector (X64) is located next to the fuse box on the firewall.

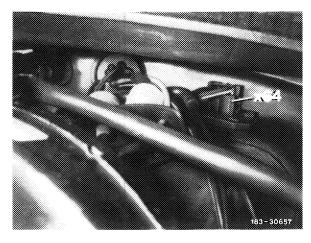
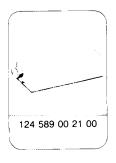
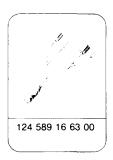


Fig. 83/25

# Automatic climate control test program

### Special tools





#### **Conventional tools**

Multimeter<sup>1</sup>)

SUN, DMM-5

) Available through the MBNA Standard Equipment Program

# Pre-test preparations

Note: Prior to testing, check function of aspirator blower for in-car temperature sensor.

1 Turn key to steering lock position "2" and cover the in-car temperature sensor air inlet with a small piece of paper. Suction at the inlet should keep the paper against the inlet. If not, remove glove box and check function and connections of aspirator blower.

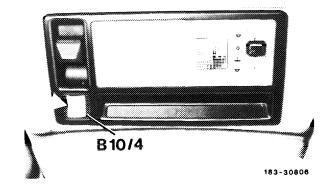


Fig. 83/28

- 2 Remove pushbutton switch unit. Note: The pushbutton unit will not be connected until step 8.
- 3 Connect both male connector plugs from climate control test adapter cable to the pushbutton switch wiring plugs.

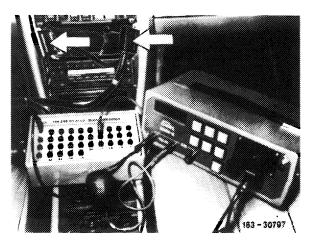
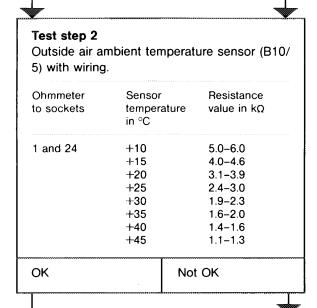


Fig. 83/29

Ohmmeter	Sensor	Resistance
to sockets	temperature in °C	value in kΩ
1 and 17	+10	18.3–21.5
	<del>+</del> 15	15.2-17.2
	+20	11.5-13.5
	+25	9.5-10.5
	+30	7.5- 8.5
	+35	6.0- 7.0
	+40	4.5 5.5
	+45	3.5 4.5

- 1. Check wires (grey/yellow) from terminal 2 and (brown/yellow) from terminal 10 of the right connector for open circuit or wire from terminal 2 for connection to ground.
- 2. Replace in-car temperature sensor (B10/4).



- 1. Check wire (grey/black) from terminal 9 of the right connector for open circuit or ground.
- 2. Replace ambient temperature sensor (B10/5).

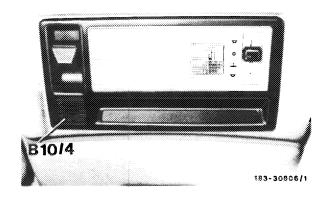


Fig. 83/30

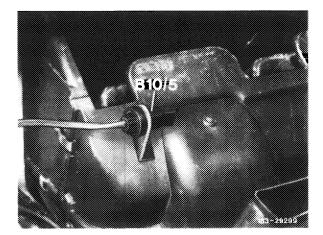
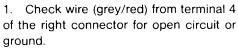
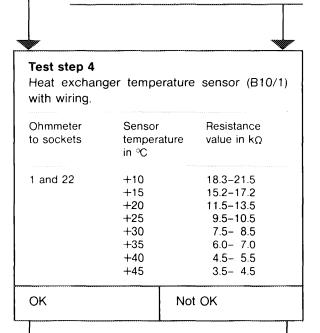


Fig. 83/31

Test step 3 Evaporator temperature sensor (B10/6) with wiring.			
Ohmmeter to sockets	Sensor temperature in °C	Resistance value in $k\Omega$	
1 and 19	+10 +15 +20 +25 +30 +35 +40 +45	18.3-21.5 15.2-17.2 11.5-13.5 9.5-10.5 7.5- 8.5 6.0- 7.0 4.5- 5.5 3.5- 4.5	
OK	No	t OK	



2. Replace evaporator temperature sensor (B10/6).



- 1. Check wire (grey/green) from terminal 7 of the right connector for open circuit or ground.
- 2. Replace heat exchanger temperature sensor (B10/1).

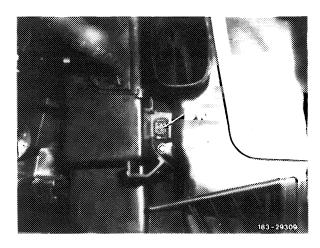


Fig. 83/32

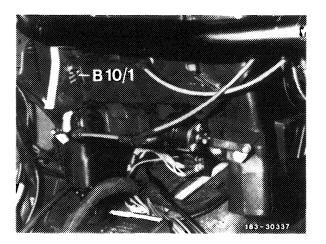


Fig. 83/33

Test step 5			
Coolant tem wiring.	perature gau	uge sensor (B13) with	
Ohmmeter to sockets	Sensor ten perature in		
1 and 23	+20 +60 +85	100-120 60- 70 30- 45	
OK		Not OK	

- 1. Check wire (green) from terminal 8 of the right connector for open circuit or ground.
- 2. Replace temperature gauge sensor (B13).

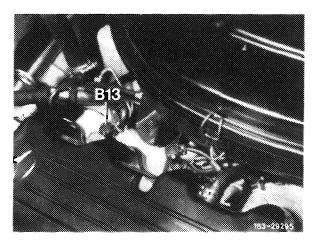


Fig. 83/34 Location coolant temperature gauge sensor

Test step 6		
Switchover valve unit (wiring.	Y7, 7 connections) and	
Ohmmeter to sockets	resistance value in $\Omega$	
13 and 2 13 and 3 13 and 4 13 and 5 13 and 6 13 and 8 13 and 15	50-80	
ОК	Not OK	

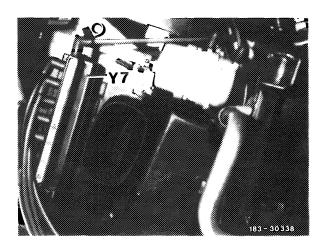
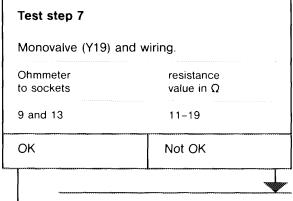


Fig. 83/35

- 1. Check wires from terminals 1 through 6 and terminal 8 of the left connector for open circuit or ground.
- 2. Replace switchover valve unit (Y7).



- 1. Check wire (yellow/green) from terminal 9 of the left connector for open circuit or ground.
- 2. Replace monovalve (Y19).

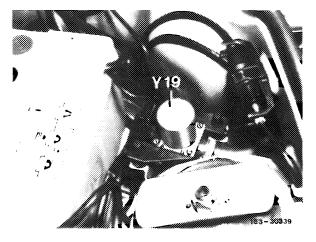


Fig. 83/36

## Preparation for Test steps 8 to 21

Connect both female connector plugs from climate control test adapter cable to pushbutton switch unit. Start engine and run at idle.

## Test step 8

Voltage supply to pushbutton switch unit.

Voltmeter Nominal value in volts

(-) 1 above 11

(+) 13

OK Not OK

- 1. Fuse no. 7 (W 124) blown or open circuit in wiring
- 2. Fuse no. 5 (W 126) blown or open circuit in wiring

#### Test step 9

Hall-effect sensor (B6) for blower speed reduction.

Voltmeter to sockets	move vehic approx 1 m	
( <del></del> ) 18 ( <del>+</del> ) 13		above 11 to below 1.0
ок		Not OK

- 1. Check wire (green/yellow) from terminal 3 of the right connector for open circuit or ground.
- 2. Replace hall-effect sensor on speedometer.

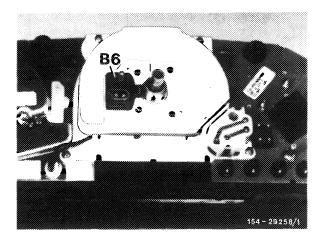
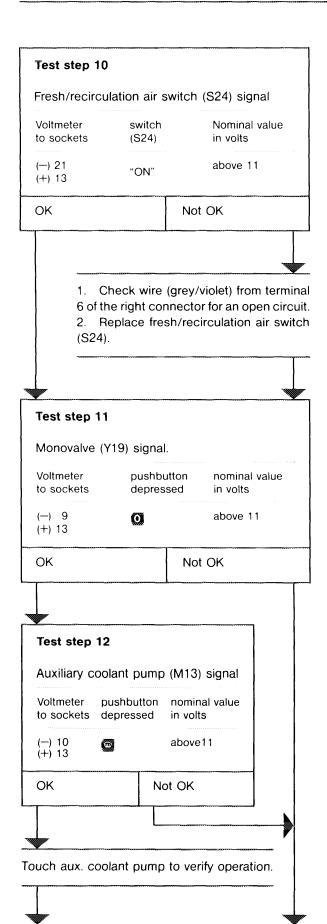


Fig. 83/37



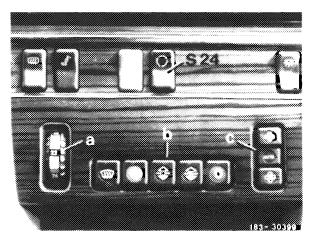


Fig. 83/38

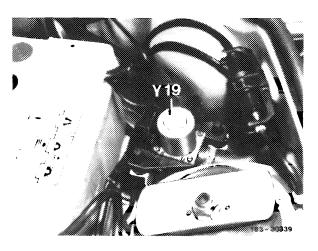


Fig. 83/39

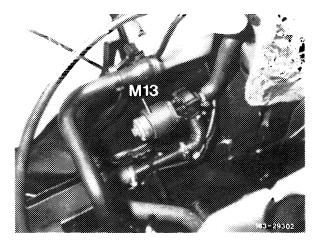
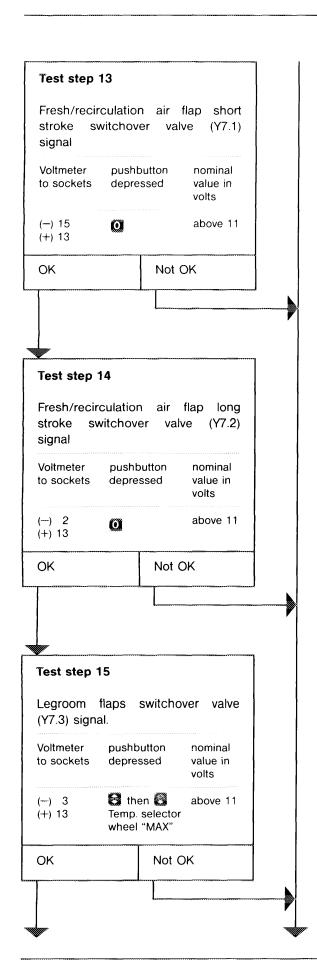


Fig. 83/40



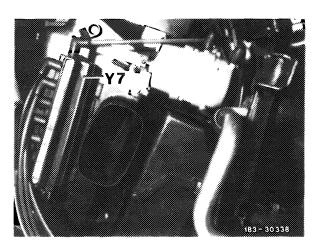
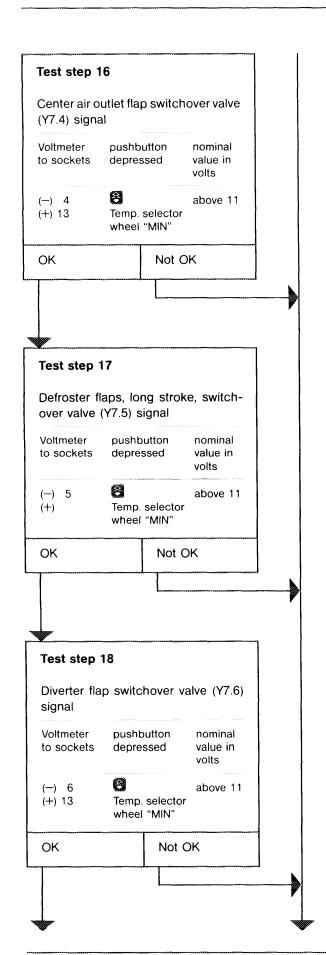


Fig. 83/41



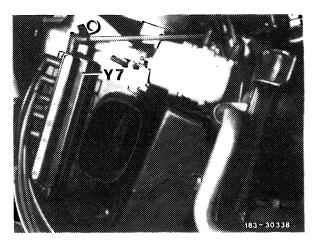
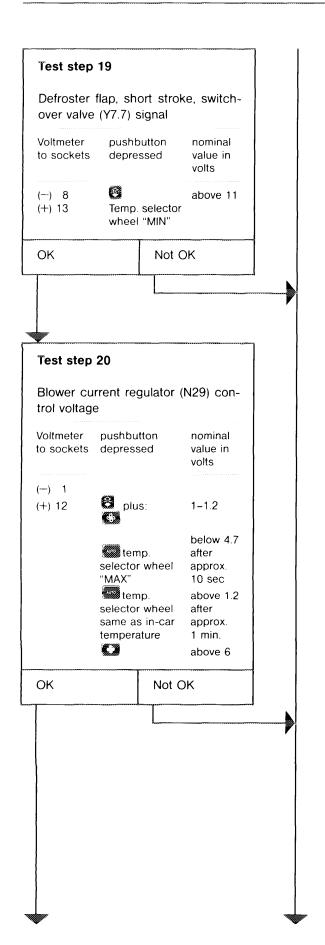


Fig. 83/42



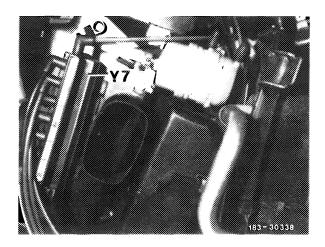


Fig. 83/43

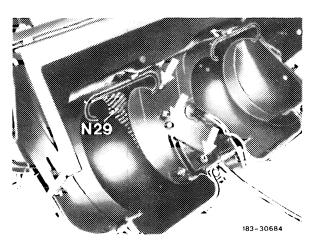
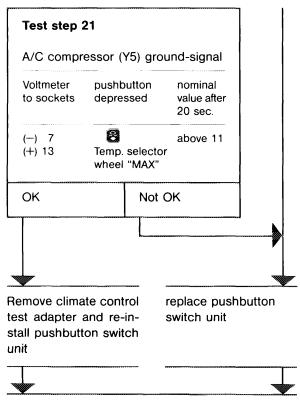


Fig. 83/44



End of test

# Testing compressor protective cutout

#### A. Testing compressor clutch (does not engage)

#### Note:

Do not begin the test below unless you have verified that the compressor control is working properly as follows:

- Turn key to steering lock position "2", depress and set temperature wheel to "MIN" (fully to stop).
- Connect voltmeter (+) to battery and (-) to both terminals (one after the other) of refrigerant low pressure switch (S31) and check if battery voltage is present.

If neither terminal indicates a ground connection, check the signal to the compressor (test step 21 using socket box tester).

If only one terminal indicates ground, pressure check the system to determine the refrigerant charge, with more than 3 bar available replace the low pressure switch (S31). With less than 2 bar available, recharge the system, check for system leaks.

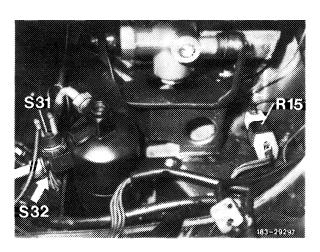


Fig. 83/45

# Testing voltage supply for A/C compressor cut-out control unit (N6)

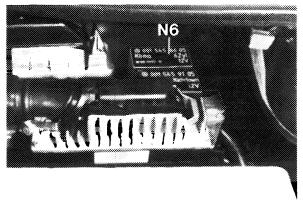
Pull control unit (N6) from 12-pin connector. Connect positive lead of multimeter to pin socket 5 and negative lead to pin socket 1 of 12-pin connector. Turn key to steering lock position "2".

Nominal value: battery voltage

OK

Not OK

Test wiring according to wiring diagram (refer to Fig. 83/28 or 83/29) and repair, if required.



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Testing control voltage for A/C compressor from low pressure switch (S31) to control unit, A/C compressor cut-out (N6).

Connect positive lead of multimeter to pin socket 5 and negative lead to pin socket 10 on 12-pin connector.

Nominal value: battery voltage

OK

Not OK

Test wiring from pin socket 10 to low pressure switch (S31) and repair, if required.

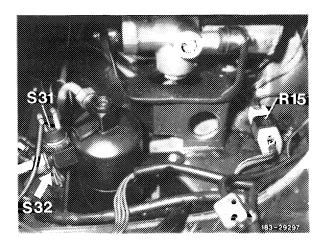


Fig. 83/47

# Testing A/C compressor clutch and wiring

Bridge pin sockets 5 and 7 on 12-pin connector. Start engine briefly and check if A/C compressor is running (clutch engaging).

OK

Not OK

Test A/C compressor clutch and replace, if required, or repair wiring to A/C compressor.

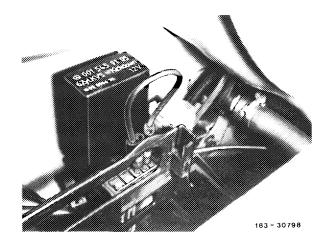


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# Testing rpm sensor for A/C compressor (L4)

Connect multimeter to pin sockets 9 and 11 of 12-pin connector and set meter to V  $\sim$ . Pin sockets 5 and 7 of 12-pin connector remain bridged.

Run engine at idle speed (approx. 750 rpm).

Nominal value: min. 0.3 V~

OK

Not OK

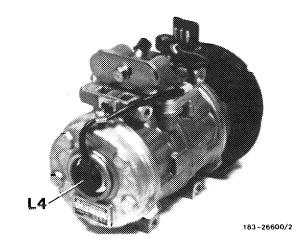


Fig. 83/49

Stop engine and test resistance of rpm sensor (L4) on pin sockets 9 and 11. Nominal value: 530 to 650  $\Omega$ , replace rpm sensor, if required.

#### Testing rpm signal (TD)

Connect positive lead of multimeter to pin socket 2 and negative lead to pin socket 1 of 12-pin connector and set multimeter to V =. Run engine at idle speed (approx. 750 rpm). Nominal value: approx. 8.5 V

OK

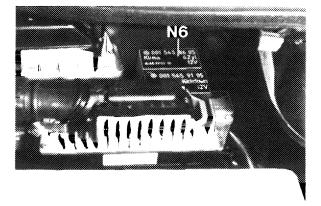
Not OK

Eliminate interruption to wire of diagnostic socket from ignition control module (N1) or replace.

Replace A/C compressor cut-out control unit (N6)

Check air conditioning system for function.

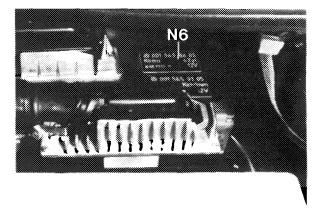
End of test.



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- B. Testing the protective cut-out of the A/C compressor clutch via the A/C compressor cut-out control unit (N6)
- 1 Run engine at idle speed.
- 2 Push button, set temperature control to "MIN" and switch on the fresh/recirculation air switch.



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3 Spray a jet of water between V-belt and A/C compressor clutch pulley (to cause slippage) while accelerating intermittently until the clutch disengages. If the clutch does not disengage, replace A/C compressor cut-out control unit (N6).

#### Note:

After stopping and restarting the engine, the A/C compressor clutch will again engage via the control unit (N6).

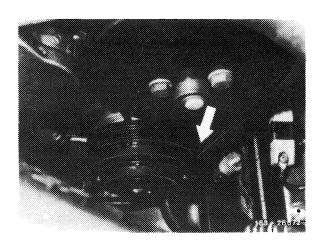


Fig. 83/52

4 Start engine again, pull 1-pin connector from temperature switch 110°C (S25/5) and connect to ground.

The A/C compressor must be switched off immediately. If required, eliminate line interruption or replace control unit (N6).

Location of temperature switch (\$25/5)

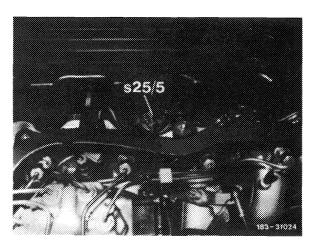


Fig. 83/53