

Audi A3 1997 ➤

Heating, Air Conditioner

Edition 06.2000



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List of Workshop Manual Repair GroupsList of Workshop Manual Repair Groups

Audi A3 1997 ➤

Heating, Air Conditioner

Repair Group

01 - Self-diagnosis, Electrical check

80 - Heating

87 - Air conditioning

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Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions for working on motor vehicles must, as a matter of course, be observed.

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Contents

01 - Self-diagnosis, Electrical check	1
1 Air conditioner self-diagnosis	1
1.1 Air conditioner self-diagnosis	1
1.2 Assignment of the operating and display unit -E87	1
1.3 Function	2
1.4 Technical self-diagnosis data	3
1.5 Self-diagnosis test prerequisites	3
1.6 Safety precautions	4
2 Connecting vehicle diagnosis, measurement and information system VAS 5051 or fault reader V.A.G 1551 and selecting function	4
2.1 Connecting vehicle diagnosis, measurement and information system VAS 5051 or fault reader V.A.G 1551 and selecting function	4
3 Interrogating fault memory	7
3.1 Interrogating fault memory	7
4 Fault table	9
4.1 Fault table	9
5 Final control diagnosis	18
5.1 Final control diagnosis	18
6 Basic setting	24
6.1 Basic setting	24
7 Erasing fault memory, ending output	26
7.1 Erasing fault memory, ending output	26
8 Encoding operating and display unit	27
8.1 Encoding operating and display unit	27
8.2 Coding of operating and display unit with two displays	27
8.3 Coding of operating and display unit with one display	29
9 Reading measured value block	31
9.1 Reading measured value block	31
9.2 Display groups 001 to 006	34
9.3 Display groups 007 to 012	39
10 AC electrical check	46
10.1 AC electrical check	46
10.2 Electrical check on operating and display unit -E87	46
10.3 Test in vehicles with an operating and display unit with two displays	48
10.4 Checking in vehicles with an operating and display unit with one display	60
11 Perform electrical check at radiator fan control unit -J293	70
11.1 Perform electrical check at radiator fan control unit -J293	70
11.2 Electrical check at control unit -J293 (version for pressure switch -F129)	71
11.3 Electrical check at control unit -J293 (version for High-pressure sensor -G65)	76
11.4 Check signal from high-pressure sensor -G65	85
12 Electrical check of rear window heating	87
12.1 Electrical check of rear window heating	87
80 - Heating	89
1 Servicing heating	89
1.1 Servicing heating	89
1.2 Dash panel vents and air ducts	89
1.3 Removing and installing centre dash-panel vents	91
1.4 Making an auxiliary tool for dismantling the dash panel vents	92
1.5 Removing and installing "left" and "right" dash panel vent	92
1.6 Removing and installing windscreen defroster vent	93
1.7 Checking vent frame	93



1.8	Removing and installing air duct to defroster vent	94
1.9	Heating, heater control and air ducts	95
1.10	Removing and installing heater control	100
1.11	Detaching and fitting Bowden cables from/on heater control	104
1.12	Connection diagram for Bowden cables to the heater control	104
1.13	Connection diagram for Bowden cables on the heater control	105
1.14	Removing, installing and adjusting Bowden cables from/on the heater control	105
1.15	Replacing the bulb for heater control	107
1.16	Removing and installing fresh air blower -V2	108
1.17	Removing and installing series resistor -N24 for fresh air blower	108
1.18	Removing and installing positioning motor for fresh/recirculated air flap -V154	109
1.19	Checking the function of the positioning motor for fresh/recirculated air flap -V154 and switch -E159	110
1.20	Removing and installing footwell vent	112
1.21	Removing and installing dust and pollen filter	113
1.22	Connection diagram for vacuum hoses for actuating the refrigerant shut-off valve	114
1.23	Notes on heater in vehicles with map-controlled heating	115
2	Tools	116
2.1	Tools	116
2.2	Special tools, testers, measuring instruments and auxiliary items required	116
3	Removing and installing heater	117
3.1	Removing and installing heater	117
3.2	Removing and installing heating system heat exchanger	122
4	Servicing electrical additional heater - Vehicles with TDI engine	123
4.1	Servicing electrical additional heater - Vehicles with TDI engine	123
4.2	Checking function of electrical additional heater	123
87	- Air conditioning	125
1	Safety precautions when working on cars with air conditioners and when handling refrigerant	125
1.1	Safety precautions when working on cars with air conditioners and when handling refrigerant	125
2	Notes on general repairs	127
2.1	Notes on general repairs	127
2.2	Notes on air conditioner in vehicles with map-controlled heating	127
3	Repairing refrigerant circuit	129
3.1	Repairing refrigerant circuit	129
3.2	Air conditioner pressure switch -F129	135
3.3	Remove and install High-pressure sensor -G65	137
3.4	O-ring seals for refrigerant circuit	137
3.5	Detach and re-attach compressor from/to bracket (4 cyl. petrol engine)	138
3.6	Detach and re-attach compressor from/to bracket (4 cyl. petrol engine)	138
4	Repairing the air conditioner magnetic clutch -N25	139
4.1	Repairing the air conditioner magnetic clutch -N25	139
4.2	Sanden compressor	140
4.3	"Zexel" compressor	146
5	Components for the control and regulation of the air conditioner (in the engine compartment)	150
5.1	Components for the control and regulation of the air conditioner (in the engine compartment)	150
5.2	Removing and installing radiator fan control unit -J293	161
5.3	Checking condensation drain, removing and installing valve	161
5.4	Removing and installing heat insulation for the expansion valve	162
5.5	Connection diagram for vacuum hoses for actuating the refrigerant shut-off valve	163
6	Components for air conditioner control and regulation (in the passenger compartment)	165
6.1	Components for air conditioner control and regulation (in the passenger compartment)	165

6.2	Removing and installing operating and display unit -E87	174
6.3	Removing and installing blower control unit -J126	178
6.4	Removing and installing footwell vent temperature sender -G192	178
6.5	Removing and installing centre vent temperature sensor -G191	179
6.6	Removing and installing fresh air blower -V2	179
6.7	Removing and installing sunlight penetration photosensor -G107	180
6.8	Removing and installing footwell vent	181
6.9	Removing and installing footwell/defroster flap positioning motor -V85	181
6.10	Removing and installing temperature flap positioning motor - Remove and install -V68	182
6.11	Removing and installing central flap positioning motor -V70	182
6.12	Removing and installing dash panel temperature sensor -G56	183
6.13	Removing and installing dash panel temperature sensor blower -V42	184
6.14	Removing and installing fresh air intake temperature sensor -G89	185
6.15	Removing and installing air flow flap positioning motor -V71	185
7	Checking air conditioner refrigeration capacity	186
7.1	Checking air conditioner refrigeration capacity	186
8	Servicing electrical additional heater - Vehicles with TDI engine 06.94 ä	190
8.1	Servicing electrical additional heater - Vehicles with TDI engine 06.94 ä	190
8.2	Checking function of electrical additional heater	190
9	Repairing refrigerant circuit	191
9.1	Repairing refrigerant circuit	191
9.2	Removing and installing fluid reservoir	201
9.3	Removing and installing condenser	201
9.4	Detach and re-attach refrigerant lines from/to expansion valve	203
9.5	Removing and installing expansion valve	203
9.6	Detach and re-attach refrigerant lines from/to compressor	204
9.7	Removing and installing compressor	204
9.8	Filling quantities	205
10	Tools	205
10.1	Tools	205
10.2	Special tools, testers, measuring instruments and auxiliary items required	205
11	Removing and installing air conditioner (complete)	206
11.1	Removing and installing air conditioner (complete)	206
11.2	Removing and installing the air conditioner heat exchanger	212
12	Dismantle and assemble air conditioner (version 1)	213
12.1	Dismantle and assemble air conditioner (version 1)	213
12.2	Disassembling and assembling evaporator housing	218
13	Dismantle and assemble air conditioner (version 2)	223
13.1	Dismantle and assemble air conditioner (version 2)	223
13.2	Removing and installing air conditioner attachment parts	224
13.3	Removing and installing air conditioner electrical components	227
13.4	Dismantling and assembling air conditioner	231



Audi A3 1997 ➤

Heating, Air Conditioner - Edition 06.2000



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01 - Self-diagnosis, Electrical check

1 - Air conditioner self-diagnosis

1.1 - Air conditioner self-diagnosis

1.2 - Assignment of the operating and display unit -E87

Part number	Special features
8L0 820 043 A ... C	Model with two displays: ▪ For all vehicles of model year 97 Illumination of the -E87 is via terminal 58 and 58d
8L0 820 043 D or E	Model with two displays. Illumination of the -E87 is also via terminal 58s. ▪ For vehicles of model years 1998 and 1999. Not for vehicles with map-controlled cooling
8L0 820 043 M or N	Model with two displays. Assignment of ignition key is recognised. ▪ For vehicles with map zone cooling (model years 1999 and 2000 only) ▪ For all vehicles of model year 2000)

Part number	Special features
8L0 820 043 H, J, K or L and from O onwards	Model with one display. ▪ For all vehicles from Model Year 2001.

Notes:

- ◆ Note the precise assignment when replacing an operating and display unit -E87:

=> Parts List

- ◆ Different designs for the operating and display unit -E876 as of model year 2001 in vehicles with and without a radio navigation system (or radio with large display zone) with and without switches for heated seats (e.g. Index "H", "J", "K" or "L").

=> Parts List

- ◆ Air conditioner control remains in operation during self-diagnosis.



1.3 - Function

Air conditioner control and display unit -E87 (control unit) receives information from electrical and electronic components (signal senders) and then processes this information according to the programmed specified values.

The output signals of the control unit then regulate the electrical components (control elements).

To enable the cause of the problem to be established quickly in the event of a component failure or open circuit in wiring, operating and display unit -E87 is equipped with a fault memory which can be read with fault reader V.A.G 1551, vehicle diagnosis system VAS 5051 or vehicle system tester V.A.G 1552.

If faults occur in the monitored sensors and components, these are stored in the fault memory together with an indication of type of fault.

Always commence fault finding by starting self-diagnosis and interrogating the stored information with fault reader V.A.G 1551

vehicle system tester V.A.G 1552,

or

vehicle diagnostic, measuring and information system VAS 5051.

The fault information which is displayed indicates specific repair measures via a fault table.

Notes on fault remedy:

- ♦ Data output is only possible with the ignition switched on or with the engine running and an engine speed of less than 3000 rpm. At higher engine speeds, data output is restricted or terminated (for example, final control diagnosis can only be implemented up to an engine speed of 3000 rpm; if this speed is exceeded, self-diagnosis is terminated).
- ♦ If a fault situation exists for longer than a specific period, the fault is stored as a static fault. If the fault is no longer present after a specified period, it becomes a sporadic fault. This process is constantly repeated. Sporadic faults are also identified as such (the letters /SP appear on the display).
- ♦ If a sporadic fault ceases to occur for a specific period, it is automatically erased.

The possibilities offered by self-diagnosis can only be utilised by employing fault reader V.A.G 1551 (mode 1, "Rapid data transfer"), V.A.G 1552, or VAS 5051.

Self-diagnosis is not restricted to storage, interrogation, erasing and final control diagnosis. It also has basic setting, control unit identification and encoding functions.

Mode -2- (flash code output) is not envisaged for electronic climate/heating control. Modes -3- (self-test) and -4- (dealership identification) only apply to fault reader V.A.G 1551 and vehicle system tester V.A.G 1552 and are described in the appropriate manuals.

Note:

The following describes self-diagnosis using the fault reader V.A.G 1551 only.

Self-diagnosis can also be performed in the same manner with VAS 5051 or V.A.G 1552. In order to be able to provide proof of faults in the event of subsequent queries, it is advisable to print out any faults found after interrogating the fault memory.

If the fault memory has been read out using V.A.G 1552, before erasing the fault memory, connect V.A.G 1551 or VAS 5051 and print out the faults found (V.A.G 1552 does not have a printer).

1.4 - Technical self-diagnosis data

▪ Memory	Non-volatile memory
▪ Data output	Rapid data transfer "Mode 1"
▪ self-diagnosis	Electronic climate/heating control"Address word 08"
- Check control unit version	Function 01
- Interrogating fault memory	Function 02
- Performing final control diagnosis	Function 03
- Performing basic setting	Function 04
- Erasing fault memory	Function 05
- End of output	Function 06
- Encoding control unit	Function 07
- Reading measured value block	Function 08

Notes:

- ◆ Fitting locations of components => Page **165**.
- ◆ If a newly installed operating and display unit has not been encoded, or if an impermissible code has been entered into operating and display unit -E87 the coding "04042" (Audi A4 - 4 cyl -USA) is stored or the previous coding remains. The model with one display the fault "coding not accepted" is displayed with fault during coding.
- ◆ If the display of a newly installed operating and display unit flashes (for approx. 2 minutes) after the ignition is switched on, encode the operating and display unit and perform basic setting.
- ◆ Air conditioner control remains operational and is not terminated on entering into self-diagnosis mode (compressor, positioning motors, radiator fan etc. can be actuated).
- ◆ Air conditioner control is not terminated on entering into self-diagnosis mode. However, it is deactivated if the following functions are selected:
 - Perform final control diagnosis
 - Perform basic setting.
 When the other functions are selected, the control function remains fully operative.
- ◆ Operating and display unit -E87 is no longer connected to terminal 30 of the vehicle electrical system. The last valid setting (on operating and display unit -E87) is stored in -E87 on switching off the ignition and is re-activated when the ignition is switched on.
- ◆ The elapsed time interval after the ignition is switched off is calculated by operating and display unit -E87 when the ignition is switched on (time signal is supplied by dash panel insert). If more than 4 hours have elapsed since the ignition was switched off, the current measured values of the ambient temperature sensor are used as temporary ambient and engine temperature for purposes of system control. If the "standing time" was less than 4 hours, the current values are calculated by the operating and display unit -E 887 (since heat radiation from the engine and radiator leads to incorrect measurements, the current values measured by the temperature sensors are suppressed for a specific period).
- ◆ For purposes of air conditioner control and for the ambient temperature display, the lower of the two temperature values measured by the ambient temperature sensors is used.
- ◆ The assignment of the terminal at the operating and display unit -E87 has been changed for model year 1998 (vehicles with an operating and display unit -E87 as of index "D"), (inputs for illumination, terminal 58, terminal 58s).
- ◆ Vehicles as of model year 2001 a revised operating and display unit -E87 has been installed. Plug A is no longer present in this type.

1.5 - Self-diagnosis test prerequisites

- ◆ All fuses OK in line with current flow diagram.
- ◆ Battery voltage OK
- ◆ The ignition must be switched on or the engine must be running.
(Engine speed below 3000 rpm)



1.6 - Safety precautions

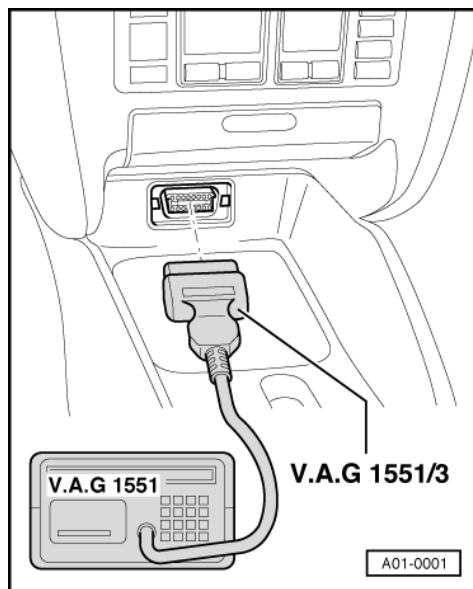
Note the following points if testers and measuring instruments have to be used during a road test:

Important:

- ♦ Always attach testers and measuring instruments to the back seat and have a second person operate them from there.
- ♦ If test equipment were operated from the front passenger seat, the person sitting there could be injured if the front passenger airbag were triggered in the event of an accident.

2 - Connecting vehicle diagnosis, measurement and information system VAS 5051 or fault reader V.A.G 1551 and selecting function

2.1 - Connecting vehicle diagnosis, measurement and information system VAS 5051 or fault reader V.A.G 1551 and selecting function



- Switch ignition off.
- -> Remove cover for diagnosis plug (only in vehicles up to model year 2000).
- Connect fault reader V.A.G 1551 using cable V.A.G 1551/3.

Notes:

- ♦ The illustration shows the arrangement of the diagnosis plug in vehicles up to model year 2000. In vehicles as of model year 2001 the diagnosis plug is located near the "right-hand A-pillar" in the cover underneath the dash panel.
- ♦ Alternatively the vehicle diagnosis, measuring and information system VAS 5051 can be connected with the diagnosis wire VAS 5051/1 or the vehicle system tester V.A.G 1552 with diagnosis wire V.A.G 1551/3.
- ♦ If testers and measuring equipment have to be used during a test drive, observe safety precautions => Page 4
- ♦ The following describes self-diagnosis using the fault reader V.A.G 1551 only.
- ♦ When using vehicle diagnosis, measurement and information system VAS 5051, or the vehicle system tester V.A.G 1552, follow the procedures described in the appropriate operating instructions.

-> Display:

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font=symbol charset=fontspecific code=042 is displayed alternately.

V.A.G self-diagnosis HELP
1 - Rapid data transfer*
2 - Flash code output*

Notes:

- ◆ If nothing is displayed on the fault reader V.A.G 1551, check wiring for diagnostic connector according to current flow diagram.

=> Current Flow Diagrams, Electrical Fault-Finding and Fitting Locations

- ◆ Depending on the program, additional operating instructions can be printed out by pressing the HELP key on V.A.G 1551.
 - ◆ Use the =>key to continue through the program.
 - ◆ The PRINT key switches on the printer (lamp in the key lights up).
 - ◆ The fault memory cannot be erased until it has been interrogated.
- Switch on ignition/start engine.
 - Switch on compressor (press "Auto" button of operating and display unit -E87).
 - Press key -1- to select "Rapid data transfer" mode.

Note:

To check the vehicle speed signal (in the "Reading measured value block" function), move vehicle a few metres at walking pace before entering into self-diagnosis mode.

-> Display:

Rapid data transfer HELP
Enter address word XX

- Press keys -0- and -8- (08 enters address word for testing the vehicle's "electronic climate/heating control").

-> Indicated on display:

Rapid data transfer Q
08 - Electronic climate/heating control

- Press Q to confirm entry.

-> Display following input of the address word 08:

Rapid data transfer
Tester transmits address word 08

-> After a short time, the control unit identification, the code and the workshop code for the V.A.G 1551 are displayed:

8L0 820 043 X A3 Fully aut. air
cond. DXX
Code XXXXX WSC ZZZZ

Control unit identification (example)

- 8L0 820 043 X	Part-No.; assignment => Parts List
- A3 Full air conditioner	Audi A3 control unit for fully automatic air conditioner
- DXX	Control unit data status (soft- ware type)
- Code XXXXX:	Different codings => Page 27

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- WSC XXXXX:	Workshop Code for the V.A.G 1551 which was used to perform the last encoding
--------------	--

Notes:

- Depending on the coding, the displayed vehicle type is A3 or A4 (up to index "E"). A4 is always displayed for newly installed operating and display units that have not yet been encoded =>Page 3.
- For vehicles with map-controlled cooling (for 1.6 l engine to be gradually introduced as from model year 1999):
 - The codes for the operating and display unit -E87 are different to those for vehicles without map-controlled cooling.
 - A centre vent temperature sender -G191 is also installed (in air duct for "centre" dash panel vent).
 - The -E87 must be adjusted to the other set-up for the engine cooling via a different code (the refrigerant temperature is controlled by the engine control unit according to the engine load and is higher when the engine is running at part throttle in comparison to full throttle).

8L0 820 043 H	A3	Fully aut. air
cond. DXX		
Code XXXXX	WSC ZZZZZ	

- > Only an operating and display unit -E87 with part number 8L0 820 043 as of index "H" can be installed in vehicles with map-controlled cooling, as the map-controlled cooling coding is only recognised as of this index. As indices "H", "J", "K" and "L" are already allocated to a modified version of -E87 (use in series production as of model years 2001), operating and display units with part number 8L0 820 043 and indexes "M" (or "N" for Japan) will be installed until production has been reorganised.
- The codes for the operating and control unit -E87 vary from the versions with part number 8L0 820 043 up to index "E", indices "M" and "N", indices "H", "J", "K" and "L" and as of index "O".
 - As of model year 2000, the assignment of the ignition key is conveyed by the dash panel insert (data telegram) together with the refrigerant temperature (when ignition is switched on). This information can only be processed by operating and display unit -E87 with part number 8L0 820 043 as of index "H". As the indices "H", "J", "K" and "L" are already allocated to a modified version of -E87 (use in series production for model years 2001), operating and display units with part number 8L0 820 043 and indices "M" (or "N" for Japan) will be installed until production has been reorganised.

=> Electrical System; Repair group 01

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=> Parts List

- Control unit identification 8L0 820 043 X A3 or A4 Fully automatic air conditioner (depending on the code, assignment=> Parts List).

=> Parts List

- Coding XXXXX =>Page 27
- WSC ZZZZZ is the workshop code for V.A.G 1551 that was used to perform the previous encoding.
- DXX designates the software version of operating and display unit -E87 and has no relevance for customer service.

List of functions	Page
01 - Interrogate control unit version	4
02 - Interrogate fault memory	7
03 - Final control diagnosis	18
04 - Basic setting	24
05 - Erase fault memory	26
06 - End output	26
07 - Encoding control unit	27
08 - Reading measured value block	31

Only the functions listed above can be used for the self-diagnosis of the electronic climate/heating control.

- Press ➡key.

-> Indicated on display (selection of function, e.g. 02 - interrogate fault memory):

Rapid data transfer	HELP
Select function XX	

Notes:

- ◆ Pressing the HELP key prints a list of possible functions.
- ◆ Pressing the ➡ key returns V.A.G 1551 program to its initial setting.
- ◆ If one of the following fault messages appears on the display:

Rapid data transfer	HELP
No control unit response	

-> Use the HELP key to print out the possible fault causes.

Rapid data transfer	HELP
K-line not switched to positive	

-> Check diagnostic connector wiring using current flow diagram.

=> Current Flow Diagrams, Electrical Fault-Finding and Fitting Locations

->

Rapid data transfer
No signal from control unit

Rapid data transfer
Communication problem

-> If this display appears at the start of or during the program, faults have occurred and data exchange is no longer possible between the fault reader V.A.G 1551 and the control unit -E87. Check wiring of diagnostic connector using the current flow diagram.

=> Current Flow Diagrams, Electrical Fault-Finding and Fitting Locations

- After eliminating the possible causes of trouble, enter address word 08 again for "Electronic climate/heating control" and confirm with Q key.

-> Display following input of the address word 08:
and the following display then appears:

Rapid data transfer
Tester transmits address word 08

-> The control unit identification, the code and the workshop code for the V.A.G 1551 are displayed:

8L0 820 043 X	A3	Fully aut. air
cond. DXX		
Code xxxxx	WSC	ZZZZZ

- Press ➡key.

-> Indicated on display (selection of function, e.g. 02 - interrogate fault memory):

Rapid data transfer	HELP
Select function XX	

3 - Interrogating fault memory

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3.1 - Interrogating fault memory

- Connect fault reader V.A.G 1551,
Enter address word 08 "Electronic climate/heating control" and advance the program until "Select function XX" appears on display (=>as of Page 4).



- Switch on printer by pressing PRINT key (lamp in key lights up).

-> Indicated on display (function selection):

Rapid data transfer	HELP
Select function XX	

- Press keys 0 and 2. (02 selects the "Interrogating fault memory" function.)

-> Indicated on display:

Rapid data transfer	Q
02 - Interrogate fault memory	

- Press Q to confirm entry.

-> The number of stored faults or "No fault identified" is indicated on the display.

X faults detected

No faults detected

- Press ➡key.

The stored faults are displayed and printed out one after the other.

- After the last fault has been displayed and printed out, **rectify the faults in line with the fault table** (=>Page 9).

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As with "No faults detected" the program returns to its initial position when the ➡key is pressed.

-> Indicated on display (function selection):

Rapid data transfer	HELP
Select function XX	

- End output (function 06) =>Page 26
- Switch off ignition and detach diagnostic connector.

Notes:

- ♦ If a fault was detected:
 - 1. Rectify fault.
 - 2. Interrogate fault memory (function 02).
 - 3. Erase fault memory (function 05).
 - 4. Check code (function 01) or encode control unit (function 07).
 - 5. Perform basic setting (function 04).
 - 6. Interrogate fault memory (function 02) and erase if applicable (function 05).
 - 7. End output (function 06).
- ♦ If no faults have been detected and complaints have been received about the air conditioner (e.g. the compressor is not functioning or only functioning intermittently, system control unsatisfactory, fresh air blower speed cannot be regulated):
 - 1. Read measured value block (Function 08) =>Page 31 .
 - 2. Perform final control diagnosis (function 03) =>Page 18 .
 - 3. Check refrigeration capacity of air conditioner=> Page 186 .
- ♦ If, when the ignition is switched on, no "Signal for ignition off time" has been detected by operating and display unit -E87, the -E87 assumes a standing time of more than 4 hours and it is assumed that the engine temperature is the same as the ambient temperature. It can happen when operating the heater that there is a delay before the fresh air blower starts, even though the engine has reached operating temperature (=>Page 31 Reading measured value block). The ambient temperature indicator -G106 in the dash panel insert may display incorrect ambient temperature values.

- ♦ If the two display zones in the operating and control unit -E87 are not illuminated when the ignition is switched on, rectify voltage supply from terminals 58, 58d and 58s (dimming) to -E87 according to the current flow diagram =>Page **46** (Electrical check).

4 - Fault table

4.1 - Fault table

Notes:

- ♦ Listed below in ascending order of fault codes are all the faults detected by air conditioner operating and display unit -E87 and displayed on V.A.G 1551.
- ♦ Faults are displayed as being sporadic if they only occur from time to time or if the fault memory has not been erased following fault remedy. (The content of the fault memory is retained until it is erased, "non-volatile memory".)
- ♦ In "Rapid data transfer" mode the fault code and flash code (for individual components only) only appear on the printout.
Example:
Fault code Flash code
5-digit 4-digit
00532 2232
- ♦ An indication of the type of fault may also appear in the fault table (a display marked * appears, as well as the component concerned or the "info" display).
- ♦ Once repairs have been completed, the fault memory is always to be interrogated again with fault reader V.A.G 1551 and erased.
- ♦ Before replacing components, always check the relevant positive and earth connections (terminals 15, 75, 30 and 31), as well as all connectors (between -E87 and the component detected as being defective), according to the current flow diagram.
- ♦ With all sporadic faults, it is particularly important to check the connectors for possible loose contacts.
- ♦ After replacing a component of the air conditioner/heating system, the basic setting (function 04) must always be performed and then the fault memory read out and any faults indicated rectified and erased from the memory (functions 02 and 05).
- ♦ Use test box V.A.G 1598/11 and V.A.G 1598/12 for checking the electrical connections of operating and display unit -E87 in line with the current flow diagram.
- ♦ If the operating and display unit -E87 remains in operation after switching off the ignition, check wiring to -E87, (plug -D- contact -1- in model with two displays or plug -D- contact 10 in model with one display) for "short to positive" according to current flow diagram.
- ♦ If a fault is detected on the potentiometer in one of the air distribution positioning motors, the air distribution can be influenced by actuating the keys on operating and display unit -E87.
- ♦ The display is switched from °C (Celsius) to °F (Fahrenheit) and vice versa by actuating the "Temperature +" key when the "Air recirculation key" is pressed.
- ♦ If problems have been reported with the AC/heating electronics but no faults can be detected, perform functions
"Final control diagnosis 03" and "Reading measured value block 08".
- ♦ Check refrigeration capacity of air conditioner =>Page **186**.

V.A.G 1551 printer	Possible causes of fault	Fault remedy
00000 No faults detected	If "No faults detected" appears after performing repairs, the self-diagnosis is completed.	
00532 2234 Power supply * Signal too low /SP	- Voltage dips in electrical system to values below 9.5 V 1) Contact resistance in the wiring to -E87 (terminal 15 or 31).	- Check alternator and voltage regulator. => Electrical System; Repair group 01 Use current flow diagram to locate and eliminate contact resistance.

1) If the vehicle's voltage drops to a value below 9.5 V, the compressor is switched off for at least 25 s. It is switched back on only when the voltage exceeds a value of 10.8 V.



V.A.G 1551 printer	Possible causes of fault	Fault remedy
00600 Potentiometer G92 in positioning motor -V68 (for temperature flap) 1) * Short to earth/SP * Open circuit/short to positive /SP * Adaptation limit exceeded 2)	- Short circuit, open circuit in wiring or fault in pin assignment of connectors between -G92 and -E87. Temperature flap stiff. Potentiometer -G92 in -V68 defective	- Use current flow diagram to locate and eliminate short circuit, open circuit in wiring or fault in pin assignment. Check freedom of movement of temperature flap3) Replace positioning motor -V68.
00601 Potentiometer -G112 in positioning motor -V70 (for central flap) * Short to earth/SP * Open circuit/short to positive /SP * Adaptation limit exceeded 2)	- Short circuit, open circuit in wiring or fault in pin assignment of connectors between -G112 and -E87. Central flap stiff. Potentiometer -G112 in -V70 defective	- Use current flow diagram to locate and eliminate short circuit, open circuit in wiring or fault in pin assignment. Check freedom of movement of central flap3). Replace positioning motor -V70

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1) In the event of a fault at potentiometer -G92, positioning motor -V68 can be adjusted manually by actuating the "+" or "-" key for temperature selection (display range between 0°C and 50 °C).

2) This fault is only detected during basic setting.

3) Both end stops must be reached.

V.A.G 1551 printer	Possible causes of fault	Fault remedy
00602 Potentiometer -G114 in positioning motor -V85 (for footwell/defroster flap) * Short to earth/SP * Open circuit/short to positive /SP * Adaptation limit exceeded 1)	- Short circuit, open circuit in wiring or fault in pin assignment of connectors between -G114 and -E87. Footwell/defroster flap stiff. Potentiometer -G114 in -V85 defective.	- Use current flow diagram to locate and eliminate short circuit, open circuit in wiring or fault in pin assignment. Check freedom of movement of footwell/defroster flap2). Replace positioning motor -V85.
00603 Footwell/defroster flap positioning motor -V85 * Blocked or de-energised /SP	- Short circuit, open circuit in wiring or fault in pin assignment of connectors between -V85 and -E87. Footwell/defroster flap stiff. Positioning motor -V85 defective.	- Use current flow diagram to locate and eliminate short circuit, open circuit in wiring or fault in pin assignment. Check freedom of movement of footwell/defroster flap. Check positioning motor -V85 (=> Final control diagnosis, Page 18).

1) This fault is only detected during basic setting.

2) Both end stops must be reached.

V.A.G 1551 printer	Possible causes of fault	Fault remedy
00604 Potentiometer -G113 in positioning motor -V71 (for air flow flap) 1) * Short to earth/SP * Open circuit/short to positive /SP * Adaptation limit exceeded 2)	- Short circuit, open circuit in wiring or fault in pin assignment of connectors between -G113 and -E87. Air flow flap or fresh/recirculated air flap stiff. Potentiometer -G113 in -V71 defective.	- Use current flow diagram to locate and eliminate short circuit, open circuit in wiring or fault in pin assignment. Check air flow valve and fresh/recirculated air flap3) for ease of movement. Replace positioning motor -V71.

1) This positioning motor actuates the fresh/recirculated air flap in addition to the air flow flap.

2) This fault is only detected during basic setting.

3) Both end stops must be reached.

V.A.G 1551 printer	Possible causes of fault	Fault remedy
00606 Two-way valve for refrigerant shut-off valve -N147 1) *Short to earth/SP *Open circuit/short to positive /SP	▪ In the event of an-E87 with two displays Fault not intended	
	▪ In vehicles without map-controlled engine cooling and one -E87 with one display Wrongly coded operating and display unit -E87	Check and correct coding of -E87 (=> Page 27).
	▪ In vehicles with map-controlled engine cooling and one -E87 with one display Wrongly coded operating and display unit -E87 Short circuit or open circuit between -N147 and -E87. Two-way valve -N147 defective.	Checking and correcting coding of -E87 (=> Page 46).

1) The two-way valve -N147 is only installed in vehicles with map-controlled engine cooling and one operating and display unit -E87 with one display.

V.A.G 1551 printer	Possible causes of fault	Fault remedy
00625 Vehicle speed signal * Implausible signal /SP	- Loose contact in the wiring between road speed sender -G68, dash panel insert or another component also connected to this signal (e.g. radio or cruise control unit) and -E87. Invalid signal from speedometer -G21/dash panel insert, or another connected component destroys the signal.	- Use current flow diagram to locate and eliminate loose contact: Check road speed signal from sender -G21 or from the dash panel insert (note all the components connected to this signal wire). => Electrical System; Repair group 90
00779 3133 Ambient temperature sensor -G17 *Short to earth/SP *Open circuit/short to positive /SP	- Short circuit or open circuit between -G17 and -E87. Temperature sensor -G17 defective.	- Use current flow diagram to locate and eliminate short circuit or open circuit Check temperature sensor -G17 (=>Electrical check, Page 46).



V.A.G 1551 printer	Possible causes of fault	Fault remedy
00785 3211 Dash panel temperature sensor - G56 * Short to earth/SP * Open circuit/short to positive /SP	- In the event of an -E87 with two displays Short circuit or open circuit between -G56 and -E87. Temperature sensor -G56 defective. - In the case of an -E87 with one display: Operating and display unit -E87 defective.	- In the event of an -E87 with two displays Use current flow diagram to locate and eliminate short circuit or open circuit Check temperature sensor -G56 (=>Electrical check, Page 46). - In the case of an -E87 with one display: Renew operating and display unit -E87.
00787 3213 Temperature sensor for fresh air intake duct -G89 * Short to earth/SP * Open circuit/short to positive /SP	- Short circuit or open circuit between -G89 and -E87. Temperature sensor -G89 defective.	- Use current flow diagram to locate and eliminate short circuit or open circuit Check temperature sensor -G89 (=>Electrical check, Page 46).

Vehicles with air conditioner pressure switch -F129

V.A.G 1551 printer	Possible causes of fault	Fault remedy
00792 3224 Air conditioner pressure switch - F129 * Short to earth /SP	- Open circuit in wiring between - F129 and -E87. - Actuation of radiator fan -V7 (speed 1) defective. - Condenser or radiator dirty. - Actuation of radiator fan -V7 (speed 2) from pressure switch -F129 defective. - Pressure switch -F129 defective. - Fault in refrigerant circuit (overpressure or vacuum).	- Use current flow diagram to locate and eliminate open circuit or loose contact. - Check the actuation of the fan -V7 (speed 1) =>Final control diagnosis, Page 135). - Send vehicle to a specialist VW/Audi air-conditioning service centre.

Notes:

- High-pressure sensor -G65 will gradually replace air conditioner pressure switch -F129 (as of Model Year 1999, initially vehicles with 1.6 l engines). As of model year 2001 only high pressure switches -G65 are installed.
- Radiator fan control unit -J293 versions and vehicle wiring differ for vehicles with pressure switch -F129 and high-pressure sensor -G65.

=> Parts List

=> Current Flow Diagrams, Electrical Fault-Finding and Fitting Locations

- Pressure switch -F129 consists of 2 switching elements.
 - The compressor is switched off via contacts 1 and 2 in the event of vacuum or overpressure in the refrigerant circuit (switch opens).
 - The radiator fan is switched to the 2nd speed via contacts 3 and 4 (switch closes).
- If the switch between contacts 1 and 2 in pressure switch -F129 is open, this is initially recognised by operating and display unit -E87 as overpressure in the refrigerant circuit and stored as a fault. If the measured ambient temperature is between 0 °C and 50 °C and the switch remains open for longer than 30 seconds, the function switches from overpressure to vacuum pressure (low-pressure switch function) =>Reading measured value block, Page 31 (display group 01, compressor shut-off criteria).
- If open high-pressure switch -F129 is detected 30 times within one driving period due to a loose contact, for example, the compressor is switched off. The compressor can be switched on again by actuating the "Compressor on" button or by switching the ignition off and on again. If this fault occurs over several driving cycles, the compressor cannot be switched on again until the fault memory has been erased.

Vehicles with high-pressure sensor -G65

V.A.G 1551 printer	Possible causes of fault	Fault remedy
00792 3224 Air conditioner pressure switch - F129 * Short to earth /SP (cont.) ▼	- Open circuit in the wiring between radiator fan control unit -J293 and -E87. Open circuit in the wiring between High-pressure sensor -G65 and control unit -J293.	- Use current flow diagram to locate and eliminate open circuit or loose contact. => Current Flow Diagrams, Electrical Fault-Finding and Fitting Locations

V.A.G 1551 printer	Possible causes of fault	Fault remedy
(cont.) (cont.) ▼	- Open circuit in the power supply or in the earth connection to high-pressure sensor - G65. Short circuit in the wiring between -G65, -J293 and the engine control unit - Actuation of radiator fan -V7 (speed 1) defective. Condenser or radiator dirty. Actuation of radiator fan -V7 (speed 2) by radiator fan control unit -J293 defective	- Use current flow diagram to locate and eliminate open circuit or loose contact. => Current Flow Diagrams, Electrical Fault-Finding and Fitting Locations Use current flow diagram to locate and eliminate short circuit - Check the actuation of the fan -V7 (speed 1) =>Final control diagnosis, Page 46).

V.A.G 1551 printer	Possible causes of fault	Fault remedy
(cont.)	- High-pressure sensor -G65 defective. Radiator fan control unit -J293 defective. Fault in refrigerant circuit (overpressure or vacuum).	- Check signal from high-pressure sensor - G65 (=>Page 76). Send vehicle to a specialist VW/Audi air-conditioning service centre.

Notes:

- ♦ High-pressure sensor -G65 will gradually replace air conditioner pressure switch -F129 (as of model year 1999, initially vehicles with 1.6 l engines). As of model year 2001 only high-pressure switches -G65 are installed.
- ♦ Radiator fan control unit -J293 versions and vehicle wiring differ for vehicles with pressure switch -F129 and high-pressure sensor -G65.

=> Parts List

=> Current Flow Diagrams, Electrical Fault-Finding and Fitting Locations

- ♦ The high-pressure sensor -G65 generates a square wave-signal whose duty cycle changes in line with the refrigerant circuit pressure =>Page 85
- ♦ Depending on high-pressure sensor -G65 signal, radiator fan control unit -J293:
- indicates to operating and display unit -E87 that the refrigerant circuit pressure is OK and the compressor can be switched on (magnetic clutch -N25 via control unit -J293).
- switches radiator fan to 2nd speed if pressure increases.
- ♦ The signal generated by high-pressure sensor -G65 is also used for engine control (the required compressor drive torque is governed by the refrigerant circuit pressure). Depending on the engine control unit version,



the measured value block signal is displayed as a duty cycle (e.g. for 1.6l aluminium engine in measured value block 57, display zone 4).

=> Relevant Workshop Manual Injection and Ignition system

- ♦ If within one driving period an excessively high pressure is measured 30 times in the refrigerant circuit and the compressor (magnetic clutch -N25) is switched off by operating and display unit -E87, the compressor no longer switches on automatically. The compressor can be switched on again by actuating the "Compressor on" button or by switching the ignition off and on again. If this fault occurs over several driving cycles, the compressor cannot be switched on again until the fault memory has been erased.

V.A.G 1551 printer	Possible causes of fault	Fault remedy
00796 3234 Dash panel temperature sensor blower -V42 * Blocked or de-energised /SP	- Open circuit in the power supply to -V42 or in the wiring between -V42 and -E87. Blower -V42 defective	- Locate and eliminate the open circuit using the current flow diagram Replace blower -V42.
00797 3241 Sunlight penetration photo sensor -G107 * Open circuit/short to positive /SP * Short to earth /SP	- Short circuit or open circuit between -G107 and -E87. Photosensor -G107 defective.	- Use current flow diagram to locate and eliminate short circuit, open circuit in wiring or fault in pin assignment. Replace photosensor -G107 .
00818 Evaporator outlet temperature sender -G263 * Short to earth /SP * Open circuit/short to positive /SP	- The sender -G263 is not installed in the Audi A3 at the moment. Short circuit to connector B contact 15 at -E87.	- Use current flow diagram to locate and eliminate short circuit

Notes:

- ♦ With operating and display units -E87 with one display the blower -V42 is installed into -E87.
- ♦ The fault "sender for ambient temperature evaporator -G263" can only be displayed by an operating and display unit -E87 with one display.

V.A.G 1551 printer	Possible causes of fault	Fault remedy
01044 Control unit incorrectly encoded (cont.) ▼	Operating and display unit up to index "E" (two displays)	
	- Proper encoding procedure for -E87 was not followed Wrong code was entered	- Code operating and display unit -E87 as specified =>Page 27

Note:

The faults "Control unit incorrectly encoded" and "Basic setting not performed" are not stored by all operating and display unit versions (operating and display units that store these faults are gradually introduced as of Model Year 1999).

V.A.G 1551 printer (cont.)	Possible causes of fault	Fault remedy
	Operating and display unit -E87 with index "M" or "N" (two displays)	

V.A.G 1551 printer	Possible causes of fault	Fault remedy
01044 Control unit incorrectly encoded	• Vehicles without map-controlled cooling Proper encoding procedure for -E87 was not followed Wrong code was entered The -E87 is coded for a vehicle without map-controlled cooling and a resistance smaller than 100 kilo-ohms is measured at the inlet for sender -G191 (connector B, contact 6).	Code operating and display unit -E87 as specified =>Page 27 Determining and rectifying short circuit to contact 6 in connector -B- to -E87
	• Vehicles with map-controlled coding Proper encoding procedure for -E87 was not followed	Code operating and display unit -E87 as specified =>Page 27
	Operating and display unit -E87 as of index "H" except index "M" or "N" (one display)	
	- Proper encoding procedure for -E87 was not followed Wrong code was entered	- Code operating and display unit -E87 as specified =>Page 27

V.A.G 1551 printer	Possible causes of fault	Fault remedy
01087 Basic setting not performed	- Either a fault occurred during the "basic setting" function, or the ignition was switched off and -E87 was not able to complete the function. When -E87 was replaced, no basic setting was performed. The basic setting was performed on an -E87 that was incorrectly encoded or not encoded at all	- Check the coding of operating and display unit -E87 =>Page 24
01206 Signal for ignition off time 1) * Implausible signal /SP	- Open circuit or short in wiring between dash panel insert and -E87. Dash panel insert defective.	- Use current flow diagram to locate and eliminate short circuit, open circuit in wiring or fault in pin assignment. Check signal from dash panel insert (=> Reading measured value block, Page 31).

1) If, when the ignition is switched on, no "ignition off time" signal is detected by the operating and display unit -E87(transmitted by the dash panel insert), the -E87 assumes a standing time of more than 4 hours and it is assumed that the engine temperature is the same as the ambient temperature. In heating mode, the fresh air blower may thus have a delayed start despite the engine being warm. Ambient temperature indicator -G106 in the dash panel insert may also display incorrect ambient temperature values.

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V.A.G 1551 printer	Possible causes of fault	Fault remedy
01271 4122 Temperature flap positioning motor -V68 * Blocked or de-energised /SP	- Short circuit, open circuit in wiring or fault in pin assignment of connectors between -V85 and -E87. Temperature flap stiff. Positioning motor -V85 defective.	- Use current flow diagram to locate and eliminate short circuit, open circuit in wiring or fault in pin assignment. Check freedom of movement of the temperature flap. Check positioning motor -V68 (=> Final control diagnosis, Page 18).



V.A.G 1551 printer	Possible causes of fault	Fault remedy
01272 4123 Central flap positioning motor -V70 * Blocked or de-energised /SP	- Short circuit, open circuit in wiring or fault in pin assignment of connectors between -V70 and -E87. Central flap stiff. Positioning motor -V70 defective	- Use current flow diagram to locate and eliminate short circuit, open circuit in wiring or fault in pin assignment. Check freedom of movement of the central flap. Check positioning motor -V70 (=> Final control diagnosis, Page 18).

V.A.G 1551 printer	Possible causes of fault	Fault remedy
01273 4124 Fresh air blower -V2 * Control difference /SP	- Short circuit or open circuit between -V2, blower control unit -J126 and/or -E87. Open circuit in the power supply or earth connection to -J126. Control unit -J126 defective. Fresh air blower -V2 defective.	- Use current flow diagram to locate and eliminate short circuit or open circuit Use current flow diagram to locate and eliminate the open circuit: Check control unit -J126 (=> Electrical check, Page 46). Replace fresh air blower -V2.
01274 4131 Air flow flap positioning motor -V71.1) * Blocked or de-energised /SP	- Short circuit, open circuit in wiring or fault in pin assignment of connectors between -V71 and -E87. Air flow flap or fresh/recirculated air flap stiff. Positioning motor -V71 defective.	- Use current flow diagram to locate and eliminate short circuit, open circuit in wiring or fault in pin assignment. Check freedom of movement of air flow flap and fresh/recirculated air flap. Check positioning motor -V71 (=> Final control diagnosis, Page 18).

1) This positioning motor actuates the fresh/recirculated air flap in addition to the air flow flap.

V.A.G 1551 printer	Possible causes of fault	Fault remedy
01296 Centre vent temperature sender - G191 * Short to earth /SP * Open circuit/short to positive /SP (cont.) ▼	Operating and display unit -E87 up to index "E" (two displays) - Operating and display unit -E87 wrongly coded. Short circuit to earth on connector B, contact 6 to -E87.	- Correct coding of operating and display unit -E87 (Checking coding => Page 27). Use current flow diagram to locate and eliminate short circuit

Note:

In vehicles with an operating and display unit -E87 up to index "E" no sender for the venting temperature -G191 is installed.

V.A.G 1551 printer	Possible causes of fault	Fault remedy
01296 Centre vent temperature sender - G191 * Short to earth /SP * Open circuit/short to positive /SP	Operating and display unit -E87 with index "M" or "N" (two displays) ▪ Vehicles without map-controlled cooling Short circuit to earth on connector B, contact 6 to -E87. Operating and display unit -E87 incorrectly coded (sender -G191 is not installed in Audi A3 without map-controlled cooling).	Use current flow diagram to locate and eliminate short circuit Correctly code operating and display unit -E87 (Checking coding => Page 27).

V.A.G 1551 printer	Possible causes of fault	Fault remedy
(cont.) ▼	- Vehicles with map-controlled coding - Short circuit or open circuit in wiring between -G191 and -E87. - Sender -G191 defective.	Use current flow diagram to locate and eliminate short circuit or open circuit Checksender -G191 (=>Electrical check, Page 46).

V.A.G 1551 printer	Possible causes of fault	Fault remedy
01296 Centre vent temperature sender - G191 * Short to earth /SP * Open circuit/short to positive /SP	Operating and display unit -E87 as of index "H" except index "M" or "N" (one display)	
	- Vehicles without map-controlled cooling - Short circuit to earth on connector B, contact 11 to -E87. - Operating and display unit -E87 incorrectly coded (sender -G191 is not installed in Audi A3 without map-controlled cooling).	Use current flow diagram to locate and eliminate short circuit Correctly code operating and display unit -E87 (Checking coding => Page 27).
	- Vehicles with map-controlled coding - Short circuit or open circuit in wiring between -G191 and -E87. - Sender -G191 defective.	Use current flow diagram to locate and eliminate short circuit or open circuit Check sender -G191 (=>Electrical check, Page 46).

V.A.G 1551 printer	Possible causes of fault	Fault remedy
01297 Footwell vent temperature sender - G192 * Short to earth /SP * Open circuit/short to positive /SP	- Short circuit or open circuit in wiring between -G192 and -E87. - Sender -G192 defective.	- Use current flow diagram to locate and eliminate short circuit or open circuit - Check sender -G192 (=>Electrical check, Page 46).
01582 Signal for refrigerant temperature1 * Implausible signal /SP * Open circuit/short to positive /SP	- Open circuit or short in wiring between dash panel insert and -E87. - Dash panel insert defective.	- Use current flow diagram to locate and eliminate short circuit, open circuit in wiring or fault in pin assignment. - Checksignal from dash panel insert (=> Reading measured value block, Page 31).

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Notes:

- ♦ The refrigerant temperature is calculated by the dash panel insert and transferred to the operating and display unit -E87. If the refrigerant temperature exceeds 118 °C, the dash panel insert switches the output to earth and -E87 switches off the air-conditioner magnetic clutch -N25.
- ♦ The fault "signal for refrigerant temperature" is only detected by the operating and display units with one display.

V.A.G 1551 printer	Possible causes of fault	Fault remedy
65535 Control unit (-E87) * Defective	- Open circuit, contact resistance or loose contact in wiring (terminal 15 or 31) to -E87. - Operating and display unit -E87 defective.	- Use current flow diagram to locate and eliminate fault in wiring to -E87. - Renew operating and display unit -E87.



5 - Final control diagnosis

5.1 - Final control diagnosis

Notes:

- ♦ Fitting locations of components actuated =>Page 165 .
- ♦ The final control diagnosis can be performed more than once if necessary.
- ♦ Faults in final controls identified with a * are stored in the fault memory.
- ♦ To check the "idling speed regulation" function
=> Page 23 .
- ♦ During the final control diagnosis, the vehicle must not be moved and the engine speed must be less than 3000 rpm.
- ♦ During the final control diagnosis, the control is deactivated and all segments in the two -E87 displays are actuated.

Starting final control diagnosis

- Start engine.
- Switch on compressor (press "Auto" button).
- Open the dash panel vents.
- Set air distribution to dash panel vents.
- Connect fault reader V.A.G 1551,
Enter address word 08 "Electronic climate/heating control" and advance the program until "Select function XX" appears on display => Page 4 .
- Switch on printer by pressing PRINT key (lamp in key lights up).
- Interrogate fault memory => Page 7 .

-> Indicated on display (function selection):

Rapid data transfer HELP
Select function XX

- Press keys -0- and -3- (03 selects the "Final control diagnosis" function).

-> Indicated on display:

Rapid data transfer Q
03 - Final control diagnosis

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- Press Q to confirm entry.

-> Display:

Final control diagnosis
DANGER: Fan is switched on

- The ➡key can be used to advance to the next component.

-> Indicated on display:

Final control diagnosis
Air conditioner magnetic clutch -N25

Notes:

- ♦ Final control diagnosis can be stopped by pressing key C.
- ♦ Interrogate fault memory on completion of final control diagnosis => Page 7 .
- ♦ If "Function unknown or cannot be implemented at present" is displayed at the start of the final control diagnosis, e.g. with the engine stopped, press ➡ key and re-select the "03 Final control diagnosis" function (the "AC magnetic clutch -N25" control element is no longer actuated for this test).
- ♦ If the display "Function unknown or cannot be implemented at present" appears => Page 31 Reading measured value block (display group "001").

-> Indicated on display:

Function unknown or cannot
be executed at present

End

If one of these messages appears on the display (after actuation of last control element) the final control diagnosis is completed.

- Press =>key.

Indicated on display	Desired function	Fault remedy
DANGER: Fan is switched on	- Info display IMPORTANT Radiator fan -V7 is switched on when =>button is next pressed. Do not reach into the fan area.	
AC magnetic clutch -N25	- Air conditioner magnetic clutch -N25 clicks in 2 sec. cycle, the compressor is driven. Operating and display unit -E87 output is switched from 0 V to 12 V in 2 sec. intervals.	- Use current flow diagram to check the power supply for magnetic clutch -N25 (via control unit -J293). Repairing the air conditioner magnetic clutch -N25 (=>Page 139). Use current flow diagram to check the wiring between -E87,-F129, -J293 and -N25. Renew operating and display unit -E87. (cont.) ▼

Indicated on display	Desired function	Fault remedy
Radiator fan -V7 is also actuated.	- Fan -V7 (1st speed) is switched on and off at 2 sec. inter- vals.	- Use current flow diagram to check the wiring between -E87 and radiator fan control unit -J293 for open circuit or short to positive. Check actuation of fan -V7 from con- trol unit -J293 1). => Current Flow Diagrams, Electrical Fault-Finding and Fitting Locations Check functionality of control unit - J293 (=> Electrical check, Page 46).

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Notes:

- ◆ Radiator fan -V7 is automatically switched on together with the magnetic clutch in vehicles with pressure switch for air conditioner -F129.
- ◆ Control unit -J293, installed in vehicles with high-pressure sensor -G65, is available in 2 designs.

- In design "1" the radiator fan is automatically switched on in conjunction with the compressor (the first fan speed is activated regardless of the pressure in the refrigerant circuit).

- In design "2" the compressor is switched on without actuation of the radiator fan; the first fan speed is only activated once the pressure in the refrigerant circuit exceeds 12 bar.

- ◆ The radiator fan is switched to 2nd speed by control unit -J293:



- when thermoswitch -F18 is closed.

-when AC pressure switch -F129 (switch between the contacts 3 and 4) is closed.

- as soon as a refrigerant circuit pressure in excess of 16 bar is calculated by -J293 on the basis of a signal from high-pressure sensor -G65.

- ♦ In vehicles with map-controlled cooling the radiator fans are switched on and off by the engine control unit dependent on the refrigerant temperature.
- ♦ In vehicles with 8l KW diesel engine and 132 KW petrol engine the engine control unit fans are also activated dependent on the refrigerant temperature or after switching of the ignition (as radiator fan runout).

=> Relevant Workshop Manual Injection and Ignition system; Repair group 01

Indicated on display	Desired function	Fault remedy
At the same time the output "air conditioner compressor cut-in" is also activated.	- The operating and display unit -E87 output is switched from 0V to 12V at 2 sec. intervals (check for example by switching the compressor on and off via the "ECON button" while the measured value block for the engine control unit is being displayed). => Relevant Workshop Manual Injection and Ignition system; Repair group 01 => Relevant Workshop Manual Automatic Gearbox; Repair group 01	

Notes:

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- ♦ Only check this output "Air conditioner compressor cut-in" in the event of a complaint (check => Page 23).
- ♦ In operating and display units with two displays the output "air conditioner compressor cut-in" is connected to connector -C- contact -12-.
- ♦ With operating and display units with one display the output "air conditioner compressor cut-in" is connected to connector -C- contact -1-.
- ♦ The "ECON key" is the key with the frost symbol in the model of the -E87 with two displays.
- ♦ The engine control unit uses the "AC compressor cut-in" signal to compensate for the brief increase in engine load when the compressor is switched on.

=> Relevant Workshop Manual Injection and Ignition system

- ♦ The air conditioner compressor can be switched off by the engine control unit and/or control unit for automatic gearbox -J217 via the output/input ("Air conditioner compressor cut-in") (=> Reading measured value block, Page 31 display group 01, Injection and Ignition system Workshop Manual and Automatic Gearbox Workshop Manual).
- ♦ To test, e.g. read out measured value block of ignition and injection system control unit with engine running while switching the compressor on and off (by actuating the "key with frost symbol") or connect test box V.A.G 1598.

Indicated on display	Desired function	Fault remedy
Two-way valve for refrigerant shut-off valve -N147	- The two-way valve -N147 is switched on and off in 2 second intervals. The refrigerant shut-off valve closes and opens in 2 second intervals (blocks the flow of refrigerant through the heat exchanger of the air conditioning unit).	- Wiring between -N147 and -E87 for open circuit or incorrect installation according to current flow diagram. Check two-way valve -N147 (=> Electrical check, Page 163)

Notes:

- ♦ The control element "two-way valve -N147" is only activated with an operating and display unit -E87 with one display which is coded to an engine with map- controlled engine cooling.

- ♦ The "two-way valve -N147" is only installed into vehicles with map-controlled engine cooling.

Indicated on display	Desired function	Fault remedy
Fresh air blower -V2	- Fresh air blower -V2 is actuated for 2 secs. at a time at 0 V, 3 V, 6 V, 9 V, 12 V, 15 V, 0 V, etc.	- Check freedom of movement of the fresh air blower. Use current flow diagram to check the earth connection to fresh air blower control unit -J126. Check control unit -J126 (=> Electrical check, Page 46). Renew operating and display unit - E87.
Temperature sensor blower -V42 (with an operating and display unit -E87 with one display)	- Blower -V42 (for temperature sensor installed into -E87) is switched on and off in 5 sec. Switching intervals on or off (smoke is sucked up by blower) 1).	- Check intake frame and intake hose for blockage (=>Page 184). Renew operating and display unit - E87.

1) Check function of blower -V42, using for example, smoke test, (hold smoke source in front of the intake frame installed into the operating and display unit).

Indicated on display	Desired function	Fault remedy
Temperature flap positioning motor -V68	- Positioning motor -V68 moves from stop to stop (fresh air blower is operating, air recirculation mode). Air temperature from the vents changes.	- Check wiring between -V68 and - E87 for open circuit or incorrect installation according to current flow diagram. Check freedom of movement of the temperature flap. Check positioning motor -V68 (=> Electrical check, Page 46). Renew operating and display unit - E87.

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Indicated on display	Desired function	Fault remedy
Central flap positioning motor -V70	- Positioning motor -V70 moves from stop to stop (fresh air blower operating, air recirculation mode, temperature flap set to "cold"). Air distribution switches between footwell and dash panel vents.	- Check wiring between -V70 and - E87 for open circuit or incorrect installation according to current flow diagram. Check freedom of movement of the central flap. Check positioning motor -V71 (=> Electrical check, Page 46). Renew operating and display unit - E87.
Footwell/defroster flap positioning motor -V85	- Positioning motor -V85 moves from stop to stop (fresh air blower operating, air recirculation mode, temperature flap set to "cold"). Air distribution switches between footwell and defrost.	- Check wiring between -V85 and - E87 for open circuit or incorrect installation according to current flow diagram. Check freedom of movement of footwell/defroster flap. Check positioning motor -V85 (=> Electrical check, Page 46). Renew operating and display unit - E87.



Indicated on display	Desired function	Fault remedy
Air flow flap positioning motor - V71 1)	- Positioning motor -V71 moves from stop to stop (fresh air blower operating, temperature flap set to "warm", air distribution to windscreen). Air throughput changes (air flow flap), air conditioner switches between fresh air and recirculated air mode (recirculated/fresh air flap)	- Check wiring between -V71 and -E87 for open circuit or incorrect installation according to current flow diagram. Check freedom of movement of air flow flap and fresh/recirculated air flap. Check positioning motor -V71 (=> Electrical check, Page 46). Renew operating and display unit -E87.
Temperature sensor blower -V42 (with an operating and display unit -E87 with two displays)	- Blower -V42 (for temperature sensor in the dash panel) is switched on and off in 5 sec. intervals (smoke is drawn in by blower) 2).	- Use current flow diagram to check the wiring between -V42 and operating and -E87 for open circuit or short to earth. Use current flow diagram to check power supply for -V42. Check intake frame and intake hose for blockage (=>Page 46).

- 1) This positioning motor also controls the recirculated/fresh air flap in addition to the air flow flap.
- 2) Check function of blower -V42, using smoke test, for example (hold smoke source in front of the intake frame in the centre part of the dash panel).

Indicated on display	Desired function	Fault remedy
Segment test (with an operating and display unit -E87 with two displays)	- All segments of operating and display unit -E87 are switched on and off in 3-second intervals.	- Renew operating and display unit -E87.
Ambient temperature indicator - G106 (in the auto-check system)	- The ambient temperature display (in auto-check system) counts in ascending order starting at 45°C or 113°F (approx. 3 sec. per step).	- Use current flow diagram to check the wiring between the auto-check system and -E87 for open circuit or short circuit. Use current flow diagram to check positive and earth connection to -G106 for open circuit. Check auto-check system. => Electrical System; Repair group 01 Renew operating and display unit -E87.
Segment test (with an operating and display unit -E87 with one display)	- All segments of the display of the operating and display unit -E87 are switched on and off at 1 second intervals.	- Renew operating and display unit -E87.

Note:

With operating and display units with one display the ambient temperature display -G106 are activated before the segment test.

Indicated on display	Desired function	Fault remedy
Idling speed regulation 1)	- The operating and display unit -E87 output is switched from 0V to 12V at 5 sec. intervals (check =>Page 23).	

Indicated on display	Desired function	Fault remedy
Heated rear window -Z1	- The heating of the rear window is switched on once for 10 seconds The rear window is heated near the heating wires.	- Check control and power intake of heated rear window -Z1 =>Electrical testing, Page 177
End (only with an operating and display unit -E87 with one display)	End of final control diagnosis	

1) Depending upon the vehicle equipment, when the rear window heating is switched on, a positive signal is applied to this output (switch off heated rear window for the test).

=> Current Flow Diagrams, Electrical Fault-Finding and Fitting Locations

Starting the "idling speed control" final control diagnosis.

- Switch off ignition.
- Remove engine control unit and connect test box V.A.G 1598 adapter cable to engine control unit connector (do not connect engine control unit to test box).

=> Relevant Workshop Manual Injection and Ignition system; Repair group 01

Note:

- ◆ Pin assignment on connector to engine control unit

=> Current Flow Diagrams, Electrical Fault-Finding and Fitting Locations

=> Relevant Workshop Manual Injection and Ignition system; Repair group 01

- Switch ignition on.
- Switch off rear window heating.
- Connect fault reader V.A.G 1551,
Enter address word 08 "Electronic climate/heating control" and advance the program until "Select function XX" appears on display => Page 4.
- Switch on printer by pressing PRINT key (lamp in key lights up).

-> Indicated on display (function selection):

Rapid data transfer HELP
 Select function XX

- Press keys -0- and -3- (03 selects the "Final control diagnosis" function).

-> Display:

Rapid data transfer Q
 03 - Final control diagnosis

- Press Q to confirm entry.

-> Indicated on display:

Function unknown or cannot be
 implemented at present.

- Press =>key.
- Press keys -0- and -3- again.

-> Display:

Rapid data transfer Q
 03 - Final control diagnosis

- Press Q to confirm entry.

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**Note:**

Re-entering the function "Final control diagnosis" does not cause the magnetic clutch -N25 to be actuated => Page 31 Reading measured value block (display group 001).

- Connect the V.A.G 1527 voltage tester between the earth and the input to be tested (to the engine control unit) on the test box.

Indicated on display	Desired function	Fault remedy
Fresh air blower -V2	- Fresh air blower -V2 is actuated for 2 secs. at a time at 0 V, 3 V, 6 V, 9 V, 12 V, 15 V, 0 V, etc.	- => Page 19 .
Keep pressing the ➡key until "idle control" appears on the display.		
Idling speed regulation 2)	- The output from operating and display unit -E87 is switched at 5 second intervals from 0 V to 12 V (LED in V.A.G 1527 flashes).	- Use current flow diagram to check the cabling between -E87 and engine control unit 1). Renew operating and display unit -E87.

- 1) Check with the engine control unit installed:

=> Relevant Workshop Manual Injection and Ignition system; Repair group 01

- 2) Causes an increase in the idle speed or a change in the pilot control value in the engine control unit.

=> Relevant Workshop Manual Injection and Ignition system; Repair group 01

Notes:

- ♦ The output "increase idle speed" is not actuated if the compressor is switched off manually (during normal control).
- ♦ With operating and display units with two displays the output "air conditioner compressor cut-in" is connected to connector -A- contact -3-.
- ♦ With operating and display units with one display the output "air conditioner compressor cut-in" is connected to connector -C- contact -2-.

6 - Basic setting

6.1 - Basic setting

- Connect fault reader V.A.G 1551, Enter address word 08 "Electronic climate/heating control" and advance the program until "Select function XX" appears on display => Page 4 onwards.
- Switch on printer by pressing PRINT key (lamp in key lights up).
- Interrogate fault memory =>Page 7 and rectify any faults displayed.
- Erase fault memory =>Page 26.
- Check coding => Page 27 and correct if necessary.

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-> Indicated on display (function selection):

Rapid data transfer	HELP
Select function XX	

- Press keys 0 and 4 (04 selects the "Basic setting" function).

-> Indicated on display:

Rapid data transfer	Q
04 - Initiate basic setting	

- Press Q to confirm entry.

-> Display:

Initiate basic setting HELP
 Enter display number XXX

- Enter display group number 01 or 001 (depending on the software version installed in the fault reader).
- Press Q to confirm entry.

Note:

- ◆ The following positioning motors are now actuated one after the other and their end stop positions are stored in operating and display unit -E87 (resistance of the potentiometers fitted in the positioning motors):
 - Temperature flap positioning motor -V68.
 - Central flap positioning motor -V70
 - Footwell/defroster flap positioning motor -V85.
 - Air flow flap positioning motor -V71.

-> Indicated on display:

Basic setting 1
 XXX XXX XXX XXX

Note:

It is possible to track the movement of the positioning motors on the display (feedback values change).

-> Indicated on display:

Basic setting 1
 0 0 0 0

When 0 appears on the display, basic setting has been completed.

- Press the => key.

-> Indicated on display (function selection):

Rapid data transfer HELP
 Select function XX

- Press keys 0 and 2. (02 selects the "Interrogating fault memory" function.)

-> Indicated on display:

Rapid data transfer Q
 02 - Interrogate fault memory

- Press Q to confirm entry.

-> The number of stored faults or "No fault identified" is indicated on the display.

X faults detected

- Press =>key.

The stored faults are displayed and printed out one after the other.

- After the last fault has been displayed and printed out, rectify the faults in line with the fault table (=> Page 9).
- Press the => key.

-> Indicated on display (function selection):

Rapid data transfer HELP
 Select function XX



7 - Erasing fault memory, ending output

7.1 - Erasing fault memory, ending output

Prerequisite

- ♦ Fault memory interrogated.

Erasing fault memory

- Press ⇒ key.

-> Indicated on display (function selection):

Rapid data transfer HELP
Select function XX

- Press keys -0- and -5- (05 selects the "Erase fault memory" function.)

-> Indicated on display:

Rapid data transfer Q
05 - Erase fault memory

- Press Q to confirm entry.

-> Display:

Rapid data transfer Q
Fault memory is erased

- Press the ⇒ key.

-> Indicated on display:

Rapid data transfer HELP
Select function XX

Notes:

Important:
Fault memory has not been interrogated

- > If the text below appears on the display, an error has occurred in the test sequence.
- ♦ Observe test sequence exactly:
 - Interrogate fault memory
 - Rectify any faults.
 - Delete fault memory.
- ♦ The fault memory is not erased if, for example, the ignition was switched off between "Interrogating fault memory" and "Erase fault memory" (interrogate fault memory again).

End of output

Note:

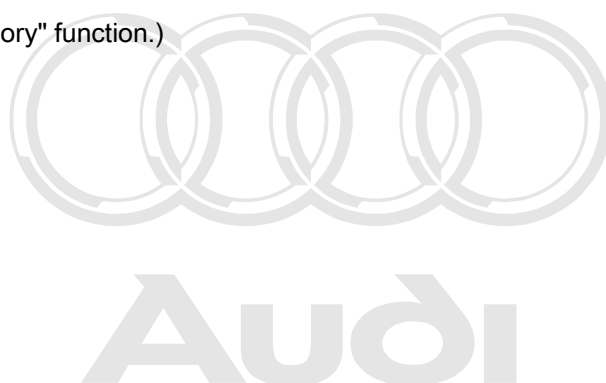
The fault memory has been interrogated and erased, basic setting has been performed, and the encoding has been checked.

-> Indicated on display:

Rapid data transfer HELP
Select function XX

- Press keys -0- and -6- (06 selects the "End output" function).

-> Indicated on display:



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Rapid data transfer Q
 06 - End of output

- Press Q to confirm entry.

-> Indicated on display:

Rapid data transfer HELP
 Enter address word XX

- Switch off ignition and detach diagnostic connector.

8 - Encoding operating and display unit

8.1 - Encoding operating and display unit

Notes:

- ◆ After each coding, basic setting must be performed => Page 24 .
- ◆ If the display of a newly installed operating and display unit flashes (for approx. 2 minutes) after the ignition is switched on, encode the operating and display unit and perform basic setting.
- ◆ The codes for the operating and control unit -E87 vary from the versions with part number 8L0 820 043 up to index "E", indices "M" and "N" (model with two displays) as well as for indices "H", "J", "K" and "L" and as of index "O" (model with one display).

8.2 - Coding of operating and display unit with two displays

Notes:

- ◆ Operating and display units with the part no. 8L0 820 043 up to index "E" and with indices "M" and "N" are equipped with two displays.
- ◆ For vehicles with map-controlled cooling (for 1.6 l engine to be gradually introduced as from model year 2000):
- The codes for the operating and display unit -E87 are different to those for vehicles without map-controlled cooling.
- A centre vent temperature sender -G191 is also installed (in air duct for "centre" dash panel vent).
- The -E87 must be adjusted to the other set-up for the engine cooling via a different code (the refrigerant temperature is controlled by the engine control unit according to the engine load and is higher when the engine is running at part throttle in comparison to full throttle).

8L0 820 043 H A3 Fully aut. air cond. DXH
 Code XXXXX WSC ZZZZZ

-> Only an operating and display unit -E87 with part number 8L0 820 043 as of index "H" can be installed in vehicles with map-controlled cooling, as the map-controlled cooling coding is only recognised as of this index. As the indices "H", "J", "K" and "L" are already allocated to a modified version of -E87 (use in series production as of model year 2001), operating and display units with part number 8L0 820 043 and indexes "M" (or "N" for Japan) will be installed until production has been reorganised.

8L0 820 043 H A3 Fully aut. air cond. DXH
 Code XXXXX WSC ZZZZZ

-> As of model year 2000, the assignment of the ignition key is conveyed by the dash panel insert (data telegram) together with the refrigerant temperature (when ignition is switched on). This information can only be processed by operating and display unit -E87 with part number 8L0 820 043 as of index "H". As the indices "H", "J", "K" and "L" are already allocated to a modified version of -E87 (use in series production as of model year 2001), operating and display units with part number 8L0 820 043 and indexes "M" (or "N" for Japan) will be installed until production has been reorganised.

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=> Electrical System; Repair group 01

=> Parts List

- Connect fault reader V.A.G 1551,
Enter address word 08 "Electronic climate/heating control" and advance the program until "Select function XX" appears on display => Page 4 onwards.
- Switch on printer by pressing PRINT key (lamp in key lights up).

-> Indicated on display (function selection):

Rapid data transfer	HELP
Select function XX	

- Press keys -0- and -7- (07 selects the "Encoding control unit" function.)

-> Indicated on display:

Rapid data transfer	Q
07 - Encoding control unit	

- Press Q to confirm entry.

-> The following appears on the display:

Encoding control unit
Enter code number XXXXX

Note:

Next position can be selected by pressing the => key.

Different codes:

- ♦ Codes for operating and display unit -E87 with the following indices:
 - up to and including index "E"
 - for indices "M" and "N"

Code	Model	Country (export version)	Engine
03140	Audi A3 (without map-controlled cooling)	LHD	4-cylinder -petrol
03141		RHD	
03142		USA	
03143		LHD	4-cylinder -TDI
03144		RHD	
03145		USA	
13140	Audi A3 (with map-controlled cooling)	LHD	4-cylinder -petrol
13141		RHD	
13142		USA	

Note:

Explanation of the individual code digits (e.g. 03140):

0 = Unallocated (up to index "E") or

a vehicle without map-controlled cooling (for indices "M" and "N")

3 = Audi A3

1 = Compressor without sender for speed

4 = 4-cyl. Engine

0 = petrol engine in an LHD vehicle

(e.g. 13140):

1 = Vehicle with map-controlled cooling (only for

indices "M" and "N")

3 = Audi A3

1 = Compressor without sender for speed

4 = 4-cyl. Engine

0 = petrol engine in an LHD vehicle

- Encode operating and display unit -E87 according to the vehicle type, engine and country.
- Press Q to confirm entry.
- Perform basic setting =>Page 24 .

Notes:

- ◆ If an invalid code is entered in operating and display unit -E87, it is suppressed and the code "04042" (Audi A4 4 cyl. USA) is stored. It could happen that the fault "sender for venting temperature in centre -G191" is stored although this component is not installed into the Audi A3 without map-controlled engine cooling.
- ◆ Assignment of operating and display unit -E87.

=> Parts List

8.3 - Coding of operating and display unit with one display

Notes:

- ◆ The operating and display units with the part number 9L0 820 043 and the indices "H", "J", "K" and "L" and as of "O" are equipped with one display.
- ◆ In vehicles with map-controlled cooling the coding of the operating and display unit -E87 is different than vehicles without map-controlled cooling.
- ◆ The main differences between the codes for "Rest of world" and "USA" or "Japan" are as follows:
USA = Temperature display in °F has priority over °C.
Japan = The function "Manually actuated air circulation" is not erased when ignition is switched off.

- Connect fault reader V.A.G 1551,
Enter address word 08 "Electronic climate/heating control" and advance the program until "Select function XX" appears on display => Page 4 onwards.
- Switch on printer by pressing PRINT key (lamp in key lights up).

-> Indicated on display (function selection):



Rapid data transfer HELP
Select function XX

- Press keys -0- and -7- (07 selects the "Encoding control unit" function.)

-> Indicated on display:

Rapid data transfer Q
07 - Encoding control unit

- Press Q to confirm entry.

-> The following appears on the display:

Encoding control unit
Enter code number XXXXX

Note:

Next position can be selected by pressing the ➡ key.

Different codes:

- ♦ Codes for operating and display unit -E87 with the following indices:
 - Indices "H", "J", "K" or "L"
 - and from index "O" onwards

Code		Meaning
0		No assignment
		Type of engine cooling
	0	Vehicle without map-controlled cooling
	1	Vehicle with map-controlled cooling
		Country (export version)
	0	Rest of the world (ROW) except for USA and Japan
	1	USA
	2	Japan
		Engine version
	4	4-cylinder
		Vehicle/engine type
	0	LHD/petrol engine
	1	RHD/petrol engine
	3	LHD/diesel engine
	4	RHD/diesel engine

Examples of code

00040	4-cylinder Left-hand drive petrol engine without map-controlled cooling for rest of the world
01040	4-cylinder Left-hand drive petrol engine with map-controlled cooling for rest of the world

- Encode operating and display unit -E87 according to the vehicle type, engine and country.
- Press Q to confirm entry.
- Perform basic setting =>Page 24 .

Notes:

- ♦ If a wrong coding was entered into the operating and display unit -E87 it will be suppressed. The fault "coding XXXXX not accepted" is displayed and the old coding remains intact.
- ♦ If an operating and display unit -E87 is newly installed (out of spare part programme) it is coded with "00001".

- ♦ Assignment of operating and display unit -E87.

=> Parts List

9 - Reading measured value block

9.1 - Reading measured value block

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Notes:

- ♦ 10 measured value blocks with 4 measured values each are intended for operating and display units -E87 with two displays.
- ♦ 12 measured value blocks with 4 measured values each are intended for operating and display units -E87 with one display.
- ♦ The AC control function remains switched on during self-diagnosis (function "Reading measured block value") and the current measured values are displayed.
- ♦ Display groups 2 to 5 show the currently valid actual/specified value or the value learnt and stored during the last basic setting for the end stops of the individual positioning motors.
- ♦ The position of the positioning motors, and therefore of the flaps, can be changed during the self-diagnosis using the controls on -E87, and the current actual and specified values can be displayed directly on the fault reader.
- ♦ If the printer is switched on, the current display will be recorded in the form of a printout.

Starting "Reading measured value block"

- Start engine.
- Set "AUTO" mode on operating and display unit -E87 (compressor is switched on).
- Run fresh air blower for approx. 1 minute at high speed (to adjust the positioning motors).
- Connect up fault reader V.A.G 1551, enter address word 08 "Electronic climate/heating control" and advance the program until "Select function XX" appears on display => Page 4 onwards.

-> Indicated on display (function selection):

Rapid data transfer	HELP
Select function XX	

- Press keys -0- and -8- (08 selects the "Reading measured value block" function.)

-> Indicated on display:

Rapid data transfer	Q
08 - Reading measured value block	

- Press Q to confirm entry.

-> Display:

Reading measured value block
Enter display group number XXX

- Enter display group number (overview =>Page 32).
- Press Q to confirm entry.

-> Indicated on display:

Reading measured value block	X
1 2 3 4	

To select another display group:

- Press C key.

-> Indicated on display:



Reading measured value block
Enter display group number XXX

- Enter display group number.

Notes:

- ♦ The next display group can be selected by pressing the "3" key; to switch back to the previous display group press "1".
- ♦ If all the display zones show the specified values:

- Press the ⇒ key.

-> Indicated on display:

Rapid data transfer HELP
Select function XX

List of available group numbers**Notes:**

- ♦ The vent temperature sender -G191 is additionally installed in vehicles with map-controlled cooling; the value measured is displayed in display zone 1 of display group 007.
- ♦ Display zone 4 in display group 009 is only occupied for operating and display units -E87 with two displays only in models with part number 8L0 820 043 and indices "M" and "N".

Display group no.	Display zone	Designation	Details on page
001	1	Compressor shutoff criteria	34
	2	Operating and display unit -E87 with two displays Voltage for magnetic clutch -N25.	
		Operating and display unit -E87 with one display Voltage, terminal "15" in V.	
	3	Operating and display unit -E87 with two displays Voltage, terminal "15" in V.	
		Operating and display unit -E87 with one display Signal for "ignition off time" (standing time) in minutes.	

Display group no.	Display zone	Designation	Details on page
001	4	Operating and display unit -E87 with two displays Signal for "ignition off time" (standing time) in minutes.	34
		Operating and display unit -E87 with one display Not used	
002	1-4	Temperature flap positioning motor -V68	37
003	1-4	Central flap positioning motor -V70	37
004	1-4	Footwell/defroster flap positioning motor -V85	38
005	1-4	Air flow flap positioning motor -V71.	38
006	1	Calculated ambient temperature (for ambient temperature indicator -G106)	38
	2	Temperature sensor for fresh air intake duct -G89	
	3	Ambient temperature sensor -G17	
	4	Sunlight penetration photo sensor-G107	

Display group no.	Display zone	Designation	Details on page
007	1	Centre vent temperature sender -G191 Sender -G191 is not installed in vehicles without map-controlled cooling. Sender -G191 is only available in vehicles with map-controlled cooling.	39
	2	Footwell vent temperature sender -G192	
	3	Dash panel temperature sensor -G56	
	4	Refrigerant temperature	
008	1	Specified voltage at fresh air blower -V2	40
	2	Actual voltage at fresh air blower -V2	
	3	Lighting displays (terminal 58d)	
	4	Operating and display unit -E87 with two displays Side lights (terminal 58 or 58s) Operating and display unit -E87 with one display Lighting switch (terminal 58s)	

Display group no.	Display zone	Designation	Details on page
009	1	Engine speed	41
	2	Vehicle speed	
	3	Operating and display unit -E87 with two displays Auxiliary heater	
		Operating and display unit -E87 with one display Side lights (terminal 58)	
	4	Operating and display unit up to index "E" (with two displays) Display zone vacant (disregard display).	
		Operating and display unit with indices "M" or "N" (two displays) Assignment of ignition key	
		Operating and display unit with one display. Auxiliary heater	

Display group no.	Display zone	Designation	Details on page
010	1	Signal from dash panel insert for refrigerant temperature "too high"	43
	2	Air conditioner compressor cut-in	
	3	Air conditioner pressure switch -F129/high-pressure sensor -G65	
	4	Operating and display unit with two displays. Vacant	
		Operating and display unit with one display. Actuation for heated rear window	

Display group no.	Display zone	Designation	Details on page
011	1 ... 4	The last four compressor shut-off criteria which were effective for longer than 20 seconds.	45
012	1	Increase in idle speed	45
	2	Actuation of two-way valve for refrigerant shut-off valve - N147	
	3	Sender for outlet temperature -G263 The sender -G263 is not installed into the Audi A3 at the moment, ignore display.	



Display group no.	Display zone	Designation	Details on page
	4	Assignment of ignition key	

Note:

The display groups "011" and "012" are only present in operating and display units with the Part Number 8L0 820 043 and the indices "H", "J", "K", "L" and from index "O" onwards (model with one display).

9.2 - Display groups 001 to 006**Display group 001:**

Compressor shut-off conditions, voltage for magnetic clutch, at terminal "15" and signal for period "ignition off"

Notes:

- ♦ If one of the compressor shut-off criteria 1, 8, 11 or 12 exists, the magnetic clutch -N25 cannot be actuated during the final control diagnosis (=>Page 18)
- ♦ If compressor shutoff criterion "5" appears in addition to another compressor shutoff condition, disregard shutoff criterion "5".
- ♦ If several compressor shutoff conditions exist simultaneously (display zone 1), the display will either show them all alternately or it will show only the shutoff condition assigned the highest priority by operating and display unit -E87.
- ♦ If pressure switch -F129 is open, compressor shutoff criterion "1" (overpressure) first appears and then the compressor is switched off. If pressure switch -F129 remains open for more than 30 secs., the program switches to compressor shutoff criterion "3" (vacuum, refrigerant circuit empty).
- ♦ High-pressure sensor -G65 will gradually replace air conditioner pressure switch -F129 (as of model year 1999, initially vehicles with 1.6 l engines). As of model year 2001 only high-pressure switches -G65 are installed.
- ♦ For vehicles with high-pressure sensor -G65, radiator fan control unit -J293 calculates the refrigerant circuit pressure and relays no more positive signals to -E87 if the pressure is NOK.

Display zone	Display	
1	Code	Compressor shutoff criteria:
	0	Compressor switched on: ▪ No shut-off criterion identified (if compressor is not switched on, perform Final control diagnosis => Page 46).
	1	Compressor switched off (in vehicles with pressure switch -F129): ▪ Open pressure switch -F129 (between contacts 2 and 1) (overpressure or loose contact in the wiring). Fault remedy =>Fault table, Page 46.
		Compressor switched off (in vehicles with high-pressure sensor -G65): ▪ No positive signal from radiator fan control unit -J293 (refrigerant circuit pressure NOK or fault in wiring, in -J293 or in -G65). Fault remedy =>Fault table, Page 46.
	2	Vacant

Display zone	Display	
1	Code	Compressor shutoff criteria:
	3	Compressor switched off (in vehicles with pressure switch -F129): ▪ Open pressure switch -F129 (between contacts 2 and 1) (overpressure, empty refrigerant circuit or open circuit). Fault remedy =>Fault table, Page 46.

Display zone	Display	
		Compressor switched off (in vehicles with high-pressure sensor -G65): ▪ No positive signal from radiator fan control unit -J293 (refrigerant circuit pressure NOK or fault in wiring, in -J293 or in -G65). Fault remedy => Fault table, Page 46.
	4	Vacant
	5	Compressor switched off: ▪ Engine speed less than 300 rpm ▪ No engine speed signal detected. Open circuit in wiring between dash panel insert, engine control unit and -E87 - connector C, contact 6 (with one -E87 with two displays) - connector C, contact 9 (with one -E87 with one display) Engine control unit or dash panel insert supplies an unusable engine speed signal (check engine speed signal). => Electrical System; Repair group 01

Display zone	Display	
1	Code	Compressor shutoff criteria:
	6	Compressor switched off: ▪ Compressor switched off via the -E87 "ECON" key (key with frost symbol). Switch on compressor (press "Auto" button).
	7	Compressor switched off: ▪ Air conditioner switched off via the -E87 "minus key" (for fresh-air blower speed) or "OFF" key. Switch on compressor (actuate "auto key").
	8	Compressor switched off: ▪ Measured ambient temperature less than 2 °C (Celsius). Ambient temperature less than 2 °C (place vehicle in heated area for test) Temperature sensor (-G17 or -G89) issues incorrect values (check => Page 38).
	9	Vacant
	10	Compressor switched off: ▪ Supply voltage for operating and display unit -E87 lower than 9.5V (=> display zone 2 or 3 and Fault table, Page 9).

Display zone	Display	
1	Code	Compressor shutoff criteria:
	11	Compressor switched off: ▪ Engine temperature too high Dash panel insert has detected an excessive engine temperature and switched input to earth - check. Short to earth in wiring between dash panel insert and -E87 (check => electrical test, Page 46). => Electrical System; Repair group 90
	12	Compressor switched off: ▪ AC compressor cut-in. The engine control unit has switched off the compressor (check => display group 10, Page 18).

Display zone	Display	
1	Code	Compressor shutoff criteria:
	13	Compressor switched off: ▪ Compressor cut-in delay (approx. 10 secs.) at engine speeds above 6000 rpm. Of no significance for customer service



Display zone	Display
14	Compressor switched off (in vehicles with pressure switch -F129): - Air-conditioner pressure switch -F129 (switch between contacts 1 and 2) actuated 30x during the current driving period. Loose contact in wiring between -F129 and -E87. Fault at switch -F129 or in the refrigerant circuit. Fault remedy => Fault table, Page 9 and Electrical check, Page 01-77. Compressor switched off (in vehicles with high-pressure sensor -G65): - The positive signal from radiator fan control unit -J293 was switched off 30x during the current driving period. (Refrigerant circuit pressure NOK or loose contact in wiring.) Loose contact in wiring between -J293 and -E87. Loose contact in wiring between -J293 and -G65. Fault in high-pressure sensor -G65, in control unit -J293 or in refrigerant circuit. Fault remedy => Fault table, Page 46.

Display zone	Display
2	Operating and display unit with two displays. - Display zone vacant (disregard display). In the Audi A3, the voltage is measured only via connector -D-, contact -9- (see display zone 3). Operating and display unit with one display. - Voltage at terminal "15" in V (connector -D-, contact -15-). If the display value is less than 12 V while the engine is running, check wiring to -E87 (positive and earth), using current flow diagram.
3	Operating and display unit with two displays. - Voltage at terminal "15" in V (connector -D-, contact -9-). If the display value is less than 12 V while the engine is running, check wiring to -E87 (positive and earth), using current flow diagram. Operating and display unit with one display. - Signal for "ignition off time" (standing time) in minutes. Time between the last ignition switch-off and renewed switch-on. Display value between 00:00 h and 04:00 h.

Display zone	Display
4	Operating and display unit with two displays. - Signal for "ignition off time" (standing time) in minutes. Time between the last ignition switch-off and renewed switch-on. Display value between 0 and 240 (or 00:00 h and 04:00 h). Operating and display unit with one display. - Display zone vacant (disregard display).

Notes (on display zones 3 or 4):

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- The time interval after the ignition is switched off is calculated by operating and display unit -E87 when the ignition is switched on (time signal is transmitted by the dash panel insert).
- If, when the ignition is switched on, no "Signal for ignition off time" has been detected by operating and display unit -E87, the -E87 assumes a standing time of more than 4 hours (240 minutes) and it is assumed that the engine temperature is the same as the ambient temperature. In heating mode, the fresh air blower may thus have a delayed start despite the engine being warm. The ambient temperature indicator -G106 in the dash panel insert may display incorrect ambient temperature values.
- If more than 4 hours have elapsed since the ignition was switched off, the current measured values of the ambient temperature sensor are used as temporary ambient and engine temperature for purposes of system control. If the "standing time" was less than 4 hours, the current values are calculated by the operating and display unit -E 887 (since heat radiation from the engine and radiator leads to incorrect measurements, the current values measured by the temperature sensors are suppressed for a specific period).

Display group 002:

Temperature flap positioning motor -V68

Display zone	Display
1	- Actual feedback value of potentiometer -G92 (in positioning motor -V68). Display value greater than 5 and less than 250 - Maximum permissible deviation: 3 units greater or less than the specified feedback value (only in the range greater than 50 but less than 190).
2	Specified feedback value of potentiometer -G92 (calculated by -E87). Display range: 5 to 250.
3	-G92 value determined during the "basic setting" and stored in -E87 with positioning motor set to "heating stop" (the temperature flap routes the air flow through the heat exchanger). Display value greater than 5 and less than 50
4	-G92 value determined during the "basic setting" and stored in -E87 with positioning motor set to "cooling stop" (the temperature flap routes the air flow past the heat exchanger). Display value greater than 190 and less than 250

Notes:

- ♦ If the display values in display zones 3 or 4 are outside the permitted range => Fault table, Page 9 .
- ♦ If the feedback value in display zone 1 is less than 5 (short circuit) or greater than 250 (open circuit), =>perform electrical check => Page 46 .
- ♦ The actual feedback value (between 5 and 50 and between 190 and 250) is specified, for example, as the permissible tolerance range for the positioning motor stop for the temperature flap or the flap in operating and display unit -E87.

Display group 003:

Central flap positioning motor -V70

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Display zone	Display
1	- Actual feedback value of potentiometer -G112 (in the positioning motor -V70) Display value greater than 5 and less than 250 - Maximum permissible deviation: 3 units greater or less than the specified feedback value (only in the range greater than 50 but less than 190)
2	Specified feedback value of potentiometer -G112 (calculated by -E87). Display range: 5 to 250
3	-G112 value determined during the "basic setting" and stored in -E87 with the positioning motor in the setting "Lower stop" (the temperature flap routes the air flow to the footwell/defroster flap). Display value greater than 5 and less than 50
4	- G112 value determined during the "basic setting" and stored in -E87 - with positioning motor set to "Upper stop" (the central flap directs the air to the dash panel vents). - Display value greater than 190 and less than 250

Note:

In the event of deviations from specified values, observe notes on display group 02 (see Page 37).



Display group 004:

Footwell/defroster flap positioning motor -V85

Display zone	Display
1	▪ Actual feedback value of potentiometer -G114 (in positioning motor -V85). Display value greater than 5 and less than 250 Maximum permissible deviation: 3 units greater or less than the specified feedback value (only in the range greater than 50 but less than 190)
2	▪ Specified feedback value of potentiometer -G114 (calculated by -E87). Display range: 5 to 250
3	▪ -G114 value determined during the "basic setting" and stored in -E87 with the positioning motor in the setting "Lower stop" (the footwell/defroster flap routes the air flow to the dash panel defroster vents). Display value greater than 5 and less than 50
4	▪ -G114 value determined during the "basic setting" and stored in -E87 with the positioning motor in the setting "Upper stop" (the footwell/defroster flap routes the air flow to the vents in the footwell). Display value greater than 190 and less than 250

Note:

In the event of deviations from specified values, observe notes on display group 02 (see Page 37).

Display group 005:

Air flow flap positioning motor -V71

Display zone	Display
1	▪ Actual feedback value of potentiometer -G113 (in positioning motor -V71). Display value greater than 5 and less than 250 Maximum permissible deviation: 3 units greater or less than the specified feedback value (only in the range greater than 50 but less than 210)
2	▪ Specified feedback value of potentiometer -G113 (calculated by -E87). Display range: 5 to 250.
3	▪ -G113 value determined during the "basic setting" and stored in -E87 with the positioning motor set to "lower stop" (the air flow flap in the evaporator intake area is closed and the air conditioner is in recirculated air mode). Display value greater than 5 and less than 30
4	▪ -G113 value determined during the "basic setting" and stored in -E87 with the positioning motor set to "upper stop" (the air flow flap in the evaporator intake area is open and the air conditioner is in fresh air mode). Display value greater than 210 and less than 250

Note:

In the event of deviations from specified values, observe notes on display group 02 (see Page 37).

Display group 006:

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Calculated outside temperature for external temperature display -G106, measured values for fresh air intake duct temperature sensor -G89, outside temperature sensor -G17 and sunlight penetration photo sensor -G107

Display zone	Display
1	▪ Calculated ambient temperature in °C. for ambient temperature display -G106 in dash panel insert

Display zone	Display
2	▪ Temperature sensor for fresh air intake duct -G89. Measured value of sensor in °C(check=> Electrical test, Page 46).
3	▪ Ambient temperature sensor -G17 Measured value of sensor in °C(check =>Electrical test, Page 46).
4	▪ Sunlight penetration photosensor -G107. 0%to 100 %(corresponds to 4.5 V and 0.5 V)depending on sunlight penetration intensity.

Notes (display zones 1, 2 and 3):

- ♦ The basis for the display in display zone 1 is the lower of the two measured ambient temperatures (=>Display zones 2 and 3). When the ignition is switched off, the value is stored up to 4 hours.
- ♦ The measured value from a defective temperature sensor is suppressed by -E87, and -E87 then uses an internal calculated value for the further control.

Notes on display zone 4:

- ♦ The display value for photosensor -G107 may be changed by shining an appropriate bulb at the sensor.
- ♦ If, irrespective of the light conditions for photosensor -G107, the display always shows about 90 % or approx. 1V of the maximum sunlight penetration, use the current flow diagram to check the cabling to photosensor -G107 for interchanges.

9.3 - Display groups 007 to 012

Display group 007:

Sender for venting temperature -G191 and -G192, temperature sensor dash panel -G56 and calculated refrigerant temperature

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Display zone	Display
1	Vehicles with an operating and display unit -E87 with two displays but without map-controlled engine cooling. ▪ Display zone not used. Ignore display, no venting temperature sender in centre of -G191 is installed into Audi A3 without map-controlled cooling and in this model of the -E87.
	Vehicles with an operating and display unit -E87 and two displays (indices "M" or "N") and with map-controlled engine cooling (in vehicles with 1.6 l engine, gradual introduction as of model year 1999). ▪ Centre vent temperature sender -G191. Measured value of sensor in °C(check=> Electrical test, Page 46).

Display zone	Display
1 (cont.)	Vehicles with an operating and display unit -E87 with one display and map-controlled engine cooling. ▪ Centre vent temperature sender -G191. Measured value of sensor in °C(check=> Electrical test, Page 46).
	Vehicles with an operating and display unit -E87 with one display and without map-controlled engine cooling. ▪ Centre vent temperature sender -G191. Ignore display, centre vent temperature sender -G191 not installed in Audi A3 without map-controlled cooling at the moment. Check connectors to -E87 for short circuit (connector which is intended for the -G191=> Electrical test, Page 46).

**Notes on display zone 1:**

In the event of a faulty display, also check encoding of the operating and display unit -E87.

Display zone	Display
2	Footwell vent temperature sender -G192. Measured value of sensor in °C (check=> Electrical test, Page 46).
3	Operating and display unit -E87 with two displays - Dash panel temperature sensor -G56. Measured value of sensor in °C (check=> Electrical test, Page 46). Operating and display unit -E87 with one display - Temperature sensor dash panel -G56 (installed in -E87). Check temperature in front of the intake grille installed into -E87.
4	Refrigerant temperature supplied from dash panel insert in °C Auxiliary variable for control of fresh air blower speed. Shut-off criterion exists for compressor if refrigerant temperature too high (check=> Electrical check, Page 46).

Note on display zones 2 and 3:

The measured value from a defective temperature sensor is suppressed by -E87, and -E87 then uses an internal calculated value for the further control (the current measured value is displayed).

Notes on display zone 4:

- The signal is used by -E87 for control calculation starting at a refrigerant temperature of + 40 °C.
- In the absence of a signal, -53 °C (+ 125 °C only for software version D71) is displayed as the refrigerant temperature, and the refrigerant temperature is calculated by -E87.
- If the refrigerant temperature from the dash panel insert is too high, the dash panel insert switches its output to earth and 121 °C is displayed as refrigerant temperature and the compressor is switched off.
- The "refrigerant temperature" wiring from -E87 to the dash panel insert does not exist in all model year 1997 and 1998 vehicles.

=> Current Flow Diagrams, Electrical Fault-Finding and Fitting Locations

- For vehicles without "refrigerant temperature" wiring between -E87 and the dash panel insert, compressor shutoff in the event of excessively high refrigerant temperature is actuated by refrigerant temperature switch -F14.

=> Current Flow Diagrams, Electrical Fault-Finding and Fitting Locations

- For vehicles with pressure switch -F129 with "refrigerant temperature" wiring between -E87 and dash panel insert, compressor shutoff in the event of excessively high refrigerant temperature is controlled by refrigerant temperature switch -F14 or by the dash panel insert.

=> Current Flow Diagrams, Electrical Fault-Finding and Fitting Locations

Display group 008:**Voltage at fresh-air blower -V2, side lights, voltage at terminal 58d and 58s**

Display zone	Display
1	Specified voltage for fresh air blower -V2 (calculated by -E87). 0 V to 12.5 V (depending on the -E87 setting).
2	Actual voltage at fresh air blower -V2. Deviation from the specified voltage (in the vehicle voltage range) less than 0.7 V.

Display zone	Display
3	Operating and display unit -E87 with two displays and with part number up to index "C" ▪ Voltage for illuminating the various display elements of -E87. Approx. battery voltage when side lights are off. approx. 2.0 V to 12.5 V with side lights switched on (voltage at connector -A- contact -5- to -E87, governed by the position of the control for instrument illumination -E20 terminal 58d). Operating and display unit -E87 with two displays and with part number with indices "D", "E", "M" or "N" ▪ Voltage for the lighting of displays of -E87 (terminal 58d). 0% to 100% (corresponds to approx. 1.0 V to 12.5 V). Operating and display unit -E87 with one display ▪ Voltage for the lighting of the display of -E87 (terminal 58d). 0% to 100% (corresponds to approx. 1.0 V to 12.5 V).

Display zone	Display
4	Operating and display unit -E87 with two displays and with part number up to index "C" ▪ Display zone not used. Checking terminal 58 => Electrical testing, Page 46 Operating and display unit -E87 with two displays and with part number with indices "D", "E", "M" or "N" ▪ Voltage for the lighting of displays of -E87 (terminal 58s). Side lights switched on 10% to 100% (corresponds to approx. 1.0 V to 12.5 V). Side lights switched off 0% to 10%. Operating and display unit -E87 with one display ▪ Voltage for the lighting of displays of -E87 (terminal 58s). Side lights switched on 10% to 100% (corresponds to approx. 1.0 V to 12.5 V). Side lights switched off 0% to 10%.

Notes on display zones 3 and 4:

- ♦ A voltage between 0 and 2V is displayed in operating and display units with part number index "B"; the electrical check must be performed on these vehicles, Page **46**.
- ♦ Regardless of the operating and display unit -E87 version, the values are displayed in volts or percent.
- ♦ Checking input voltage for terminals 58, 58d and 58s on operating and display unit -E87 =>Electrical check, Page **46**.
- ♦ The -E87 operating controls are illuminated only if voltage is applied to terminal 58 and 58s.
- ♦ The brightness of the -E87 display illumination can be changed via the -E20 illumination control, even if the side lights are switched off.
- ♦ The voltage at terminal 58d is generated as a square-wave signal by the dash panel insert. The brightness of -E87 displays is determined by the actuation time. The measuring instrument displays the average value.
- ♦ The actuation time at terminal 58d is governed by the illumination control setting and the brightness level determined by the photosensor in the dash panel insert.
- ♦ The voltage at terminal 58s (with side lights switched on) is governed by the illumination control setting and the brightness level determined by the photosensor in the dash panel insert.

Display group 009:

Engine speed, vehicle speed, auxiliary heater, side lights (terminal 58) and assignment ignition key)

Display zone	Display
1	▪ Engine speed in rpm.
2	▪ Vehicle speed in km/hour. 0 = No speed signal detected since the ignition was switched on. 1 = At least one vehicle speed signal detected since the ignition was switched on.

**Notes on display zone 2:**

If the vehicle is moving at more than 1 km/h, this speed will be displayed.

Display zone	Display
3	Operating and display unit -E87 with two displays ▪ Auxiliary heater. 0 = No auxiliary heater mode (voltage at connector -D- contact -1- less than 5 V). 1 = Auxiliary heater mode (voltage at connector -D- contact -1- greater than 5 V).
	Operating and display unit -E87 with one display ▪ Side lights (terminal 58). 0 = Side light off (voltage at connector -D- contact -12- less than 5 V). 1 = Side light on (voltage at connector -D- contact -12- greater than 5 V).

Notes (for display zone 3 with an -E87 with two displays):

- ♦ There are no immediate plans to install an auxiliary heater in the Audi A3.
- ♦ If -E87 remains in operation after the ignition is switched off and if the display shows "1", locate and rectify short to positive to connector -D-, contact -1- using current flow diagram.

Display zone	Meaning	Explanatory Notes
4	Operating and display unit with two displays and with part number up to index "E" ▪ Display zone not used. Ignore display	
	Operating and display unit with two displays and with part number with indices "M" or "N" ▪ Assignment of ignition key Display 0 = The ignition was switched on with a key for which there is no assignment in the dash panel insert. No information was received from the dash panel insert.	▪ Check adaptation of the ignition key. => Electrical System; Repair group 90; Repair dash panel insert Repair dash panel insert
	Display 1 = The ignition was switched on with the key (2, 3 or 4) which was set to position 1 (2, 3 or 4) in the dash panel insert.	▪ Up to 4 keys may be assigned.

Notes (for display zone 4 with an -E87 with two displays):

- ♦ In vehicles from model year 2000, the assignment of the ignition key will be transmitted to the -E87 by the dash panel insert together with the refrigerant temperature and the signal "Engine temperature too high" when the ignition is switched on (data telegram). The assignment of the key can only be processed by operating and display units with the part number 8L0 820 043 as from index "H". If the refrigerant temperature is too high, no information may be transmitted.
- ♦ The assignment of the ignition key can only be recognised and therefore transmitted by the dash panel insert on vehicles fitted with an immobiliser.

=> Electrical System; Repair group 90; Repair dash panel insert Repair dash panel insert

- ♦ When the ignition is switched on, the -E87 starts with the setting which was valid the last time the ignition was switched off with this key (temperature, air distribution, fresh air, blower speed).
- ♦ Check signal from dash panel insert => Electrical check, Page 46.

Display zone	Display
4	Operating and display unit -E87 with one display ▪ Auxiliary heater. 0 = No auxiliary heater mode (voltage at connector -D- contact -10- less than 5 V). 1 = Auxiliary heater mode (voltage at connector -D- contact -10- greater than 5 V).

Notes (for display zone 4 with an -E87 with one display):

- ♦ There are no immediate plans to install an auxiliary heater in the Audi A3.
- ♦ If -E87 remains in operation after the ignition is switched off and if the display shows "1", locate and rectify short to positive to connector -D- contact -10- using current flow diagram.

Display group 010:

Kick-Down switch, temperature switch for refrigerant, air conditioner compressor cut-in, high pressure switch

-F129/high pressure switch -G65 and actuation heated rear window

Display zone	Display
1	▪ Refrigerant temperature switch too "hot" (in dash panel insert). 0 = Temperature switch open (refrigerant temperature ok) - Voltage at connector C, contact 6 greater 5V (with one -E87 with one display) - Voltage at connector C, contact 6 greater 5V (with one -E87 with one display) 1 = Temperature switch closed (refrigerant temperature too high) - Voltage at connector A, contact 11 lower than 5 V (with one -E87 with two displays) - Voltage at connector C, contact 6 smaller than 5V (with one -E87 with one display) => Display group 001, Page 34 display zone 1.
2	▪ Air conditioner compressor cut-in. 0 = Output air conditioner cut-in "open" - Voltage at connector C, contact 12 lower than 5 V (with one -E87 with two displays) - Voltage at connector C, contact 1 smaller than 5V (with one -E87 with one display) 1 = Output air conditioner cut-in "closed" - Voltage at connector C, contact 12 higher than 5 V (with one -E87 with two displays) - Voltage at connector C, contact 1 greater than 5V (with one -E87 with one display).

Notes on display zone 1:

- ♦ Checking the refrigerant temperature and the dash panel insert.

=> Electrical System; Repair group 90

- ♦ The "refrigerant temperature" wiring from -E87 to the dash panel insert does not exist in all model year 1997 and 1998 vehicles.

=> Current Flow Diagrams, Electrical Fault-Finding and Fitting Locations

- in vehicles without wiring "refrigerant temperature" between -E87 and dash panel insert the

switching off of the compressor when refrigerant temperature is too high occurs through refrigerant temperature switch -F14

=> Current Flow Diagrams, Electrical Fault-Finding and Fitting Locations

- In vehicles with pressure switch -F129 where there is a wiring "refrigerant temperature" between the -E87 and the dash panel insert switching off of the compressor occurs when refrigerant temperature is too high through refrigerant temperature switch -F14 or via dash panel insert.

=> Current Flow Diagrams, Electrical Fault-Finding and Fitting Locations

Notes on display zone 2:

- ♦ When air conditioner magnetic clutch -N25 is engaged, the output is closed (voltage greater than 5 V).
- ♦ If, when the magnetic clutch is engaged, the voltage drops below 5 V (engine control unit or AT The gearbox -J217 switches input to earth), the magnetic clutch is switched off by -E87 (=> display group 001, Page



34 display zone 1 and Workshop Manual, Current flow Diagrams, Electrical Fault finding and Fitting Locations binder).

=> Current Flow Diagrams, Electrical Fault-Finding and Fitting Locations

Display zone	Display
3	AC pressure switch -F129 (for vehicles without High-pressure sensor -G65). 1 = Open pressure switch (voltage at connector -C- contact -2- less than 2 V). 0 = Closed pressure switch (circuit pressure OK, voltage at connector -C- contact -2- greater than 2 V). Positive signal from -J293 (for vehicles with high-pressure sensor -G65). 1 = Positive signal not present (pressure in circuit not OK) - Voltage at connector -C-, contact -2- lower than 2 V (with one -E87 with two displays) - Voltage at connector -D-, contact -7- lower than 2 V (with one -E87 with one display) 0 = Positive signal present (pressure in circuit OK) - Voltage at connector -C-, contact -2- higher than 2 V (with one -E87 with two displays) - Voltage at connector -D-, contact -7- higher than 2 V (with one -E87 with one display)

Notes on display zone 3:

- ♦ Radiator fan control unit -J293 versions and vehicle wiring differ for vehicles with pressure switch -F129 and high-pressure sensor -G65.

=> Parts List

=> Current Flow Diagrams, Electrical Fault-Finding and Fitting Locations

- ♦ When air conditioner pressure switch -F129 is open (high/low pressure switch between contacts 1 and 2), the compressor is switched off (=>display group 001, Page 34 display zone 1).
- ♦ If the refrigerant circuit pressure is less than 1.4 bar (overpressure) or less than 31 bar (vacuum), control unit -J293 relays no positive signal (for vehicles with high-pressure sensor -G65) to -E87 and the compressor is switched off.

Display zone	Meaning	Explanatory Notes
4	Operating and display unit -E87 with two displays ▪ Display zone not used. Ignore display	
	Operating and display unit -E87 with one display ▪ Actuation of rear window heating Display 0 = Heated rear window off Display 1 = Heated rear window on	▪ Voltage at connector F, contact 1 (output from -E87 to the heated rear window) less than 5 V ▪ Voltage at connector F, contact 1 (output from -E87 to the heated rear window) greater than 5 V

Notes (for display zone 4 with an -E87 with one display):

- ♦ Check the actuation of the heated rear window =>Page 87 .
- ♦ If the ambient temperature is below 0 °C, the rear window heating remains activated until ignition is switched off (can be deactivated manually at any time). If, during the journey, the temperature rises above 0°C, the rear window heating is deactivated after the operating period stored in -E87 (approx. 10 minutes) has elapsed.
- ♦ If the ambient temperature is above 0 °C, the rear window heating is automatically deactivated by -E87 after the operating period stored within it (approx. 10 minutes) has elapsed.

Display group 011:

The last four compressor shut-off criteria

Notes:

- ♦ The display group "011" is only present in operating and display units with the Part Number 8L0 820 043 and the indices "H", "J", "K", "L" and from index "O" onwards (model with one display).
- ♦ Only the last four compressor shut-off criteria which were effective for longer than 20 seconds are stored.

Display zone	Meaning	Explanatory Notes
1	▪ Fourth last compressor shutoff criterion	▪ Coding => Page 34 Display group 001, display zone 1
2	▪ Third last compressor shutoff criterion	
3	▪ Last but one compressor shutoff criterion	
4	▪ Last compressor shutoff criterion	

Display group 012:

Idling speed increase, actuation of two-way valve for refrigerant shut-off valve -N147, venting temperature sender -G263 and assignment ignition key

Note:

The display group "012" is only present in operating and display units with the Part Number 8L0 820 043 and the indices "H", "J", "K", "L" and from index "O" onwards (model with one display).

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Display zone	Meaning	Explanatory Notes
1	▪ Actuation of idling speed regulation Display 0 = Idling speed regulation off Display 1 = Idling speed regulation on	▪ Voltage at connector C, contact 2 to -E87 less than 2 V ▪ Voltage at connector C, contact 2 to -E87 greater than 2 V

Notes on Display zone 1:

- ♦ Checking the idling speed regulation function (increase in idling speed) => Page **23** Starting final control diagnosis for "idling speed regulation".
- ♦ The condition for the switching on of the idling speed regulation is that no compressor shutoff criterion exists which does not allow the magnetic clutch to be switched on (e.g. pressure switch -F129 open, engine not running or operating mode "Econ" selected).

Display zone	Meaning	Explanatory Notes
2	▪ Actuation of two-way valve for refrigerant shut-off valve -N147 Display 0 = Actuation two-way valve -N147 off Display 1 = Actuation two-way valve -N147 on	▪ Voltage at connector D, contact 6 to -E87 greater than 5 V Refrigerant shut-off valve open. ▪ Voltage at connector D, contact 6 to -E87 less than 5 V Refrigerant shut-off valve closed.
3	▪ Sender for outlet temperature -G263 Disregard display zone The sender -G263 is not installed into Audi A3 at the moment.	

Notes on display zone 2:

- The "two-way valve -N147" is only installed into vehicles with map-controlled engine cooling.
- The refrigerant shut-off valve is controlled with vacuum pressure via the two-way valve for refrigerant shut-off valve -N147. The refrigerant shut-off valve closes as soon as vacuum pressure is present and blocks the flow of refrigerant through the heat exchanger of the air conditioner.

Display zone Meaning	Explanatory Notes
4 ▪ Assignment of ignition key Display 0 = The ignition was switched on with a key for which there is no assignment in the dash panel insert. No information was received from the dash panel insert. Display 1 = The ignition was switched on with the key (2, 3 or 4) which was set to position 1 (2, 3 or 4) in the dash panel insert.	▪ Check adaptation of the ignition key. => Electrical System; Repair group 90; Repair dash panel insert Repair dash panel insert ▪ Up to 4 keys may be assigned.

Notes on display zone 4:

- The assignment of the ignition key is transmitted to the -E87 by the dash panel insert together with the refrigerant temperature and the signal "engine temperature too high" when ignition is switched on (data telegram). If the refrigerant temperature is too high information cannot be transmitted.
- The assignment of the ignition key can only be recognised and therefore transmitted by the dash panel insert on vehicles fitted with an immobiliser.

=> Electrical System; Repair group 90; Repair dash panel insert Repair dash panel insert

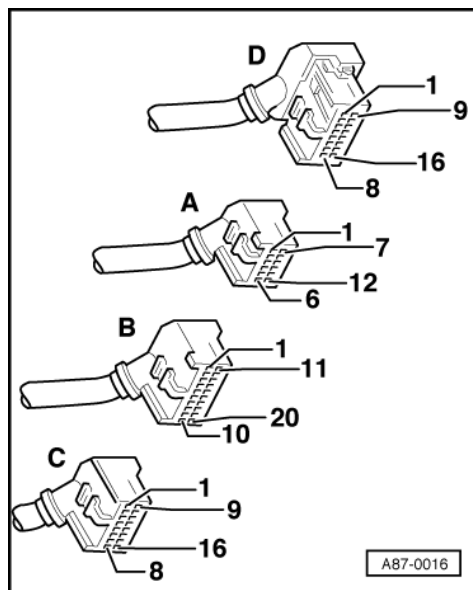
- When the ignition is switched on, the -E87 starts with the setting which was valid the last time the ignition was switched off with this key (temperature, air distribution, fresh air blower speed).
- Check signal from dash panel insert =>Electrical check, Page 46 .

10 - AC electrical check

10.1 - AC electrical check

10.2 - Electrical check on operating and display unit -E87

Notes:



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- ◆ When working with the fault reader, no adapter cable from test box V.A.G 1598 may be connected to operating and display unit -E87.

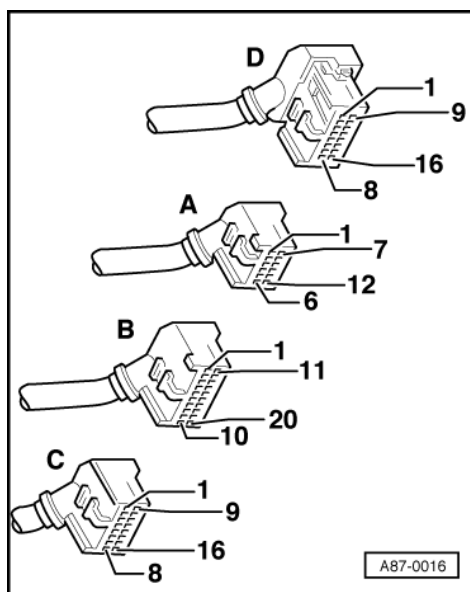
Required measuring and testing equipment:

- -> Test box V.A.G 1598 and the pertinent adapter cables V.A.G 1598/11 and V.A.G 1598/12.
- Handheld multimeter V.A.G 1526,
- Adapter set V.A.G 1594,
- Diode test lamp V.A.G 1527,
- Temperature sensor with appropriate tester,

Test requirements

All fuses OK in line with current flow diagram.

Connect test box adapter cables V.A.G 1598/11 and 12 to connector for operating and display unit -E87



- Switch off ignition.
- Remove operating and display unit -E87 (=>Page 174).
- -> Connect adapter cables V.A.G 1598/11 and 12 to the vehicle wiring harness connectors.

Notes:

- ◆ Do not connect operating and display unit -E87.
- ◆ For measurement purposes, connect test box V.A.G 1598 to the respective adapter cable.
- ◆ On adapter cable V.A.G 1598/12, the socket assignment is identical to the pin assignment of operating and display unit -E87.
- ◆ On adapter cable V.A.G 1598/11, the socket assignment is not identical to the pin assignment of operating and display unit -E87.
=>Pin assignment, Page 47 .

Pin assignment of test box V.A.G 1598 with adapter cable V.A.G 1598/11

Notes:

- ◆ With adapter cable V.A.G 1598/11, the contact assignment of connectors A and B is not identical to the socket assignment on the test box.
- ◆ The pin assignment of connector C in adapter cable V.A.G 1598/11 is not identical to those of the sockets on the test box.
- ◆ The pin assignment of connector D in adapter cable V.A.G 1598/12 is identical to those of the sockets on the test box.
- ◆ Due to the use of two adapter cables for the connectors for operating and display unit -E87 (V.A.G 1598/11 and 12), no earth connection is possible when adapter cable V.A.G 1598/11 is connected. To perform the Electrical checks, it is therefore necessary in various test steps to take measurements against a suitable



earthing point on the vehicle body or to use a second V.A.G 1598 test box (when the adapter cable 1598/12 is connected, sockets 15 is earthed).

-E87 with two displays at socket 15.

-E87 with one display at socket 14.

=> Current Flow Diagrams, Electrical Fault-Finding and Fitting Locations

- ♦ The connector A is not present in operating and display units -E87 with one display.

Connector A	V.A.G 1598 Socket	Connector B	V.A.G 1598 Socket	Connector C	V.A.G 1598 Socket
1	41	1	21	1	1
2	42	2	22	2	2
3	43	3	23	3	3
4	44	4	24	4	4
5	45	5	25	5	5
6	46	6	26	6	6
7	47	7	27	7	7
8	48	8	28	8	8
9	49	9	29	9	9
10	50	10	30	10	10
11	51	11	31	11	11
12	52	12	32	12	12
(cont.)			(cont.)		

Connector A	V.A.G 1598 Socket	Connector B	V.A.G 1598 Socket	Connector C	V.A.G 1598 Socket
		13	33	13	13
		14	34	14	14
		15	35	15	15
		16	36	16	16
		17	37		
		18	38		
		19	39		
		20	40		

10.3 - Test in vehicles with an operating and display unit with two displays

List of envisaged electrical checks (at operating and display unit -E87)

Test step	Component tested	Page
1	- Power supply, earth connection and illumination of operating and display unit -E87. Signal for ignition off time	49
2	- Temperature sensors/senders (-G17, -G89, -G191, -G151, -G192).	51
3	- Fresh air blower with corresponding control unit (-V2, -J126).	53
4	- Positioning motors for air conditioner and corresponding potentiometers (-V68/-G92, -V70/-G112, -V71/-G113, -V85/-G114).	54

Test step	Component tested	Page
5	- Air conditioner pressure switch -F129 / Signal from control unit for radiator fan -J293. Temperature sensor blower -V42. "Air conditioner compressor cut-in" output. Signal "Engine temperature too high".	55
6	- Actuation of air conditioner magnetic clutch -N25. Actuation of radiator fan -V7	58

Test step 1

Power supply, earth connection and illumination of operating and display unit -E87.

Select measuring range on hand-held multimeter V.A.G 1526: Voltage measurement (20V =) - Adapter cable V.A.G 1598/12 connected					
Test step	V.A.G 1598 socket	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
1.1	9 and 15	Terminal 15 and earth connection on -E87	▪ Ignition on	- Approx. battery voltage	- Use current flow diagram to repair power supply and/or earth connection
Select measuring range on hand-held multimeter V.A.G 1526: Voltage measurement (20V =) - Adapter cable V.A.G 1598/11 connected					
1.2	7 and earth	Terminal 58 on - E87	▪ Ignition on. ▪ Switch side lights on	- Approx. battery voltage	- Use current flow diagram to repair power supply

Notes:

- ♦ Test steps 1.3 to 1.5 must be implemented only for model year 1997 vehicles (operating and display unit with part no. 8L0 820 043 up to and including index "C").
- ♦ Earth applied e.g. to connector D contact 15.

Select measuring range on hand-held multimeter V.A.G 1526: Voltage measurement (20V =) - Adapter cable V.A.G 1598/11 connected					
Test step	V.A.G 1598 socket	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
1.3	7 and earth	Terminal 58 on - E87	▪ Ignition on ▪ Side lights off	- less than 2 V	- Use the current flow diagram to rectify short to positive
1.4	45 and earth	Terminal 58d on - E87	▪ Ignition on ▪ Side lights on	- 0 to 12 V (regardless of the illumination control setting)	- Use current flow diagram to locate and eliminate open circuit or short circuit



Select measuring range on hand-held multimeter V.A.G 1526: Voltage measurement (20V =) - Adapter cable V.A.G 1598/11 connected					
Test step	V.A.G 1598 socket	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
1.5	45 and earth	Terminal 58d on - E87	▪ Ignition on ▪ Side lights off	- 0 to 12 V (regardless of the illumination control setting)	- Use current flow diagram to locate and eliminate open circuit or short circuit

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Earth applied e.g. to connector D contact 15.

Voltage tester V.A.G 1527, - Adapter cable V.A.G 1598/11 connected					
Test step	V.A.G 1598 socket	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
1.6	33 and earth	Signal for ignition off time	▪ Ignition on	- the LED illuminates in voltage tester	- Use current flow diagram to locate and eliminate open circuit or short circuit
1.7	33 and earth	Signal for ignition off time	▪ Ignition on Start engine	- the LED illuminates in voltage tester when the engine is started, the LED in the voltage tester flickers briefly (time signal) and remains illuminated	- Use current flow diagram to locate and eliminate open circuit or short circuit Check dash panel insert.

Note:

Earth applied e.g. to connector D contact 15.

Note:

The test steps 1.8 to 1.11 must not be carried out in vehicles of model year 1997 (operating and display unit with part number 8 L0 820 043 and the indices "B" or "C").

Select measuring range on hand-held multimeter V.A.G 1526: Voltage measurement (20V =) - Adapter cable V.A.G 1598/11 connected					
Test step	V.A.G 1598 socket	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
1.8	7 and earth	Terminal 58s on - E87	▪ Ignition on. ▪ Side lights switched on.	- 0 to 12 V	- Use current flow diagram to locate and eliminate open circuit or short circuit
1.9	7 and earth	Terminal 58s on - E87	▪ Ignition on. ▪ Side lights off	- approx. 0 V	- Use the current flow diagram to locate and rectify short to positive

Notes:

- ◆ Earth applied e.g. to connector D contact 15.
- ◆ The voltage at terminal 58s is governed by the setting of the illumination control.

Select measuring range on hand-held multimeter V.A.G 1526: Voltage measurement (20V =) - Adapter cable V.A.G 1598/11 connected					
Test step	V.A.G 1598 socket	Testing of	Test conditions - Additional operations	Specified value	Remedies if specified value not attained
1.10	45 and earth	Terminal 58d on - E87	▪ Ignition on ▪ Side lights on	- 0 to 12 V	- Use current flow diagram to locate and eliminate open circuit or short circuit
1.11	45 and earth	Terminal 58d on - E87	▪ Ignition on ▪ Side lights off	- 0 to 12 V	- Use current flow diagram to locate and eliminate open circuit or short circuit

Notes:

- ◆ Earth applied e.g. to connector D contact 15.
- ◆ The voltage at terminal 58d is generated as a square-wave signal by the dash panel insert. The brightness of -E87 displays is determined by the actuation time. The measuring instrument displays the average value.
- ◆ The actuation time at terminal 58d is governed by the illumination control setting and the brightness level determined by the photosensor in the dash panel insert.

Test step 2

Temperature sensor/sender

Select measuring range on hand-held multimeter V.A.G 1526: Resistance measurement (20 k Ω) - Adapter cable V.A.G 1598/11 connected					
Test step	V.A.G 1598 socket	Testing of	Test conditions - Additional operations	Specified value	Remedies if specified value not attained
2.1	48 and 49	Ambient temperature sensor -G17	- Measure temperature at the sensor fitting location.	- Governed by the temperature at the sensor/pickup fitting location => Table, Page 52 .	- Use current flow diagram to locate and eliminate short circuit, open circuit or contact resistance. - Replace temperature sensor/sender.
2.2	50 and 49	Dash panel temperature sensor -G56	- Measure temperature at the sensor fitting location.		
2.3	47 and 49	Temperature sensor for fresh air intake duct -G89	- Measure temperature at the sensor fitting location.		
2.4	25 and 49	Footwell vent temperature sender - G192	- Measure temperature at sender fitting location.		



Select measuring range on hand-held multimeter V.A.G 1526:

Resistance measurement (20 kW)

- Adapter cable V.A.G 1598/11 connected

Test step	V.A.G 1598 socket	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
2.5	26 and 49	Centre vent temperature sender - G191	- Measure temperature at the sensor fitting location.	- Governed by the temperature at the sensor fitting location => Table, Page 52.	- Use current flow diagram to locate and eliminate short circuit, open circuit or contact resistance. Replace sensor.

Notes:

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- ♦ Centre vent temperature sender -G191 is only installed in vehicles with map-controlled cooling.
- ♦ Correct assignment and coding of the operating and display unit -E87 must be ensured in vehicles with map-controlled cooling.

Ambient temperature-dependent resistance of temperature sensors/senders in kW(kilo-ohms)

At sensor/sender installation location, temperature measured in °C (degrees Celsius)	Temperature sensor -G56 Sender -G192	Temperature sensor -G17 -G89	Sender -G191
-30	(52.7)	18.1	-
-20	(28.6)	9.95	-
-10	16.2	5.59	(47)
0	9.40	3.28	(29)
5	7.27	2.54	(23)
10	5.66	1.99	18.5
15	4.45	1.57	15
20	3.50	1.25	12.2
25	2.79	1.00	10.0
30	2.23	0.80	8.3
35	1.80	0.65	6.8
40	1.45	0.53	5.7
50	0.97	0.36	4.1
60	0.67	0.25	2.9
70	0.47	-	2.2

Test step 3

Fresh air blower -V2 and relevant control unit -J216

Select measuring range on hand-held multimeter V.A.G 1526: Voltage measurement (20V =) - Adapter cable V.A.G 1598/11 connected					
Test step	V.A.G 1598 socket	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
3.1	16 and earth	Control unit -J126	▪ Ignition on	- Voltage less than 5 V Fresh air blower not running	- Use current flow diagram to locate and eliminate short to positive in the wiring between -J126 and -E87. Replace control unit -J126.
3.2	14 and earth	Power supply for fresh air blower -V2	▪ Ignition on	- approx. battery voltage	- Use current flow diagram to repair power supply.
3.3	11 and earth	Power supply for control unit -J126 (via fresh air blower -V2)	▪ Ignition on	- approx. battery voltage	- Use current flow diagram to repair power supply.

Note:

Earth applied e.g. to connector D contact 15.

Voltage tester V.A.G 1527, - Adapter cable V.A.G 1598/11 connected					
Test step	V.A.G 1598 socket	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
3.4	14 and 16	Control unit -J126	▪ Ignition on.	- LED in voltage tester lights up - Fresh air blower is running	- Use current flow diagram to locate and eliminate open circuit in the wiring between -J126 and -E87. Find open circuit in earth wiring to -J126 and eliminate. Check freedom of movement of fresh air blower -V2. - Replace control unit -J126.

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Test step 4

Positioning motors for air conditioner and associated potentiometers

Select measuring range on hand-held multimeter V.A.G 1526: Resistance measurement (20 k ω) - Adapter cable V.A.G 1598/11 connected					
Test step	V.A.G 1598 socket	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
4.1	52 and 28 / 29 / 37 / 30	Potentiometer (in the positioning motor) -G 92 (-V 68) -G112 (-V70) -G113 (-V71) -G114 (-V85)		- Greater than 0.1 k ω and less than 5.7k ω ((depending on the setting of the positioning motor)	- Use current flow diagram to locate and eliminate open circuit, contact resistance or short circuit Replace positioning motor
4.2	8 and 28 / 29 / 37 / 30	Potentiometer (in the positioning motor) -G 92 (-V 68) -G112 (-V70) -G113 (-V71) -G114 (-V85)		- Greater than 0.1 k ω and less than 5.7k ω ((depending on the setting of the positioning motor)	- Use current flow diagram to locate and eliminate open circuit, contact resistance or short circuit Replace positioning motor

Notes:

- ♦ The resistance of potentiometers in the positioning motors (specified value: 3.6 k ω to 5.7 k ω between contact 1 and 3) can only be measured directly on the positioning motor (parallel connection).
- ♦ The resistance of the potentiometers in the positioning motors (between contacts 1 and 2, as well as contacts 3 and 2) is governed by the setting of the positioning motor, it must only be measured with the positioning motor fitted. The maximum specified value will not be obtained in test steps 4.1 and 4.2. (To obtain the maximum specified value, all connectors on the other positioning motor would have to be detached during the measurement; the motors are connected in parallel).
- ♦ If -E87 detects the fault "potentiometer short to earth or open circuit/short to positive", check all the potentiometers (in the 4 positioning motors) and the corresponding wiring.
- ♦ On vehicles with right-hand drive, connections 1 and 3 as well as 4 and 6 on the positioning motor are reversed (check part number and current flow diagram).

Select measuring range on hand-held multimeter V.A.G 1526: Resistance measurement (200 ω) - Adapter cable V.A.G 1598/12 connected					
Test step	V.A.G 1598 socket	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
4.3	2 and 10	Temperature flap positioning motor - V68		- 20 ω to 100 ω .	- Use current flow diagram to locate and eliminate open circuit, contact resistance or short circuit Replace positioning motor

Select measuring range on hand-held multimeter V.A.G 1526: Resistance measurement (200 ω) - Adapter cable V.A.G 1598/12 connected					
Test step	V.A.G 1598 socket	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
4.4	4 and 12	Central flap positioning motor -V70		- 20 ω to 100 ω .	- Use current flow diagram to locate and eliminate open circuit, contact resistance or short circuit - Replace positioning motor
4.5	5 and 13	Air flow flap positioning motor -V71		- 20 ω to 100 ω .	
4.6	3 and 11	Footwell/defroster flap positioning motor -V85		- 20 ω to 100 ω .	

Test step 5

Pressure switch -F129 / signal from radiator fan control unit -J293, "AC compressor cut-in" output, "engine temperature too high" signal and temperature sensor blower -V42

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- ♦ High-pressure sensor -G65 will gradually replace air conditioner pressure switch -F129 (as of model year 1999, initially vehicles with 1.6 l engines).
 - ♦ Test step 5.1 must be implemented only for vehicles with pressure switch -F129.
 - ♦ Test steps 5.2 to 5.5 are identical for vehicles with pressure switch -F129 and high-pressure sensor -G65.
 - ♦ Test step 5.6 must be implemented only for vehicles with high-pressure sensor -G65.

Select measuring range on hand-held multimeter V.A.G 1526: Resistance measurement (200 ω) - Adapter cable V.A.G 1598/11 connected					
Test step	V.A.G 1598 socket	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
5.1	2 and 42	Air conditioner pressure switch -F129 (switch between the contacts 1 and 2)	▪ Ignition off.	- Less than 20 ω	- Use current flow diagram to locate and eliminate open circuit or contact resistance. Check pressure switch -F129 (=>Seite 135).

Notes:

- ♦ Test step 5.1 must be implemented only for vehicles with pressure switch -F129.
 - ♦ If code 1 "pressure switch -F129 open" is displayed in measured value block 1 as a compressor shutoff criterion:
- Also use current flow diagram to check the wiring to -F129 for a loose contact.
- Check the actuation of the radiator fan -V7 speed 1 (=>Final control diagnosis, Page 18).
- Check AC pressure switch -F129 (switch between contacts 3 and 4, actuation of radiator fan -V7 speed 2) (=>Page 135).



If no fault can be determined, the vehicle should be sent to an VW and Audi air conditioner service centre.

Select measuring range on hand-held multimeter V.A.G 1526: Current measurement (20 A =) - Adapter cable V.A.G 1598/11 connected					
Test step	V.A.G 1598 socket	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
5.2	44 and earth	Temperature sensor blower -V42.	▪ Ignition on.	- less than 1 A. Blower running.	- Use current flow diagram to locate and eliminate open circuit or short to positive or earth in the wiring between -V42 and -E87.

Notes:

- ♦ Test steps 5.2 to 5.5 are identical for vehicles with pressure switch -F129 and high-pressure sensor -G65.
- ♦ Earth applied e.g. to connector D contact 15.

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Voltage tester V.A.G 1527, Operating and display unit connected to the test box (adapter cable V.A.G 1598/11 and /12) - Adapter cable V.A.G 1598/11 connected					
Test step	V.A.G 1598 socket	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
5.3	Earth and 51	Signal "Engine temperature too high"	▪ Engine running	▪ LED in the voltage tester flickers briefly.	- Use the current flow diagram to locate and rectify short to earth. Rectify the air conditioner compressor shutoff condition in the dash panel insert.

Notes:

- ♦ If the LED does not illuminate and there is not short circuit to earth to socket 51, this test step must be truncated for model year 1997 and 1998 vehicles - the connection has not been installed in these vehicles.
- ♦ Earth applied e.g. to connector D contact 15.
- ♦ Brief flickering of the LED in the voltage tester indicates that the dash panel insert is transmitting a temperature signal.
- ♦ In vehicles from model year 2000, the assignment of the ignition key will be transmitted to the -E87 by the dash panel insert together with the refrigerant temperature and the signal "Engine temperature too high" when the ignition is switched on (data telegram). The assignment of the key can only be processed by operating and display units with the part number 8D0 820 043 as from index "H". If the refrigerant temperature is too high, no information may be transmitted.
- ♦ The assignment of the ignition key can only be recognised and therefore transmitted by the dash panel insert on vehicles fitted with an immobiliser.
- ♦ When the ignition is switched on, the -E87 starts with the setting which was valid the last time the ignition was switched off with this key (temperature, air distribution, fresh air blower speed).
- ♦ The signal from the dash panel insert (data telegram) cannot be checked with workshop tools.

=> Electrical System; Repair group 90; Repair dash panel insert Repair dash panel insert

Voltage tester V.A.G 1527, Operating and display unit connected to the test box (adapter cable V.A.G 1598/11 and /12) - Adapter cable V.A.G 1598/11 connected					
Test step	V.A.G 1598 socket	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
5.4	14 and 12	"Air conditioner compressor cut-in" output	▪ Engine running ▪ Compressor switched off (frost symbol in the display zone of -E87 is not illuminated). - Switch on compressor.	- LED in voltage tester lights up. LED in voltage tester lights up a little less brightly.	- Use current flow diagram to locate and eliminate open circuit or short circuit. Rectify AC compressor shutoff condition in the engine control (emergency operation). Rectify AC shutoff condition in the automatic gearbox control unit -J217. Use the current flow diagram to locate and rectify short to earth.

Select measuring range on hand-held multimeter V.A.G 1526: Current measurement (200 mA =) Operating and display unit connected to the test box (adapter cable V.A.G 1598/11 and /12) - Adapter cable V.A.G 1598/11 connected.					
Test step	V.A.G 1598 socket	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
5.5	Earth and 12	"Air conditioner compressor cut-in" output	▪ Engine running ▪ Compressor switched off. - Switch on compressor.	- Less than 5 mA Less than 50 mA Compressor is not switched on.	- Use current flow diagram to locate and eliminate short circuit. Check actuation of control unit -J293 (=>Page 70). Renew operating and display unit -E87.

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Select measuring range on hand-held multimeter V.A.G 1526: Voltage measurement (20V =) - Adapter cable V.A.G 1598/11 connected					
Test step	V.A.G 1598 socket	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
5.6	2 and earth	Signal from radiator fan control unit -J293 (in vehicles with high-pressure sensor -G65)	▪ Ignition on.	- approx. battery voltage	- Use current flow diagram to locate and eliminate open circuit or contact resistance. Check high-pressure sensor (=>Page 85).

Notes:

- ♦ Test step 5.6 must be implemented only for vehicles with high-pressure sensor -G65.
- ♦ Earth applied e.g. to connector D contact 15.
- ♦ Depending on high-pressure sensor -G65 signal, radiator fan control unit -J293:



- indicates to operating and display unit -E87 that the refrigerant circuit pressure is OK and the compressor can be switched on (via magnetic clutch -N25).

- switches radiator fan to 2nd speed if pressure increases.

- ♦ High-pressure sensor -G65 will gradually replace air conditioner pressure switch -F129 (as of model year 1999, initially vehicles with 1.6 l engines).
- ♦ If code 1 "pressure switch -F129 open" is displayed in measured value block 1 as a compressor shutoff criterion:

- Use current flow diagram to check the wiring to -G65 for a loose contact.

- Use current flow diagram to check wiring between control unit -J293 and -E87 for loose contact.

- Check the actuation of the radiator fan -V7 speed 1 (=>Final control diagnosis, Page 18).

- Check signal from high-pressure sensor -G65 =>Page 85.

Test step 6

Radiator fan actuation -V7, magnetic clutch actuation -N25

Select measuring range on hand-held multimeter V.A.G 1526: Current measurement (20 A =) - Adapter cable V.A.G 1598/11 connected					
Test step	V.A.G 1598 socket	Testing of	Test conditions - Additional operations	Specified value	Remedies if specified value not attained
6.1	14 and 42	Actuation of radiator fan -V7	▪ Engine running	- Less than 1 A Radiator fan -V7 running at speed 1 (observe relevant notes)	- Use current flow diagram to locate and eliminate open circuit or short to positive or earth in the wiring between -J293 and -E87. Check actuation of control unit -J293 (=>Page 70). Control unit -J293 defective - replace. (cont.) ▼

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Select measuring range on hand-held multimeter V.A.G 1526: Current measurement (20 A =) - Adapter cable V.A.G 1598/11 connected					
Test step	V.A.G 1598 socket	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
6.1 (cont.)		Actuation of air conditioner magnetic clutch -N25	▪ Engine running	- Compressor is driven.	- Open pressure switch -F129 (checking =>Test step 5). Use current flow diagram to locate and eliminate open circuit or short to positive or earth in the wiring between -E87 and -J293. Check actuation of control unit -J293 (=>Page 70). Refrigerant temperature switch -F14 defective (open) or refrigerant too hot - check. Control unit -J293 defective - replace.

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Notes:

- ♦ Radiator fan -V7 is automatically switched on together with the magnetic clutch in vehicles with pressure switch for air conditioner -F129.
- ♦ Control unit -J293, installed in vehicles with high-pressure sensor -G65, is available in 2 designs.

- In design "1" the radiator fan is automatically switched on in conjunction with the compressor (the first fan speed

is activated regardless of the pressure in the refrigerant circuit).

- In design "2" the compressor is switched on without actuation of the radiator fan; the first fan speed is only activated once the pressure in the refrigerant circuit exceeds 12 bar.

- ♦ Refrigerant temperature switch -F14 must be implemented only for vehicles with pressure switch -F129.

Note:

Test step 6.2 must be implemented only for vehicles with pressure switch -F129.



Select measuring range on hand-held multimeter V.A.G 1526:

Current measurement (20 A =)

- Adapter cable V.A.G 1598/11 connected

Test step	V.A.G 1598 socket	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
6.2	10 and 14	Actuation of radiator fan -V7 (speed 2)	▪ Engine running	- less than 1 A. Fan running at speed 2.	- Use current flow diagram to locate and eliminate open circuit or short to positive or earth in the wiring between -E87 and control unit - J293. Use current flow diagram to locate and eliminate open circuit in the wiring between control unit - J293 and fans -V7. (cont.) ▼

Test step	V.A.G 1598 socket	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
Select measuring range on hand-held multimeter V.A.G 1526: Current measurement (20 A =) - Adapter cable V.A.G 1598/11 connected					
6.2 (cont.)	10 and 14	Actuation of radiator fan -V7 (speed 2)	▪ Engine running	- less than 1 A. Fan running at speed 2.	- Check actuation of control unit -J293 (=>Page 70). Check radiator fan - V7. => Current Flow Diagrams, Electrical Fault-Finding and Fitting Locations

10.4 - Checking in vehicles with an operating and display unit with one display

List of envisaged electrical checks (at operating and display unit -E87)

Test step	Component tested	Page
1	- Power supply, earth connection and illumination of operating and display unit -E87. Signal for ignition off time	61
2	- Temperature sensors/senders (-G17, -G56, -G89, -G192).	63
3	- Fresh air blower with corresponding control unit (-V2, -J126).	64
4	- Positioning motors for air conditioner and corresponding potentiometers (-V68/-G92, -V70/-G112, -V71/-G113, -V85/-G114).	65
5	- Pressure signal from radiator fan control unit -J293. "Air conditioner compressor cut-in" output Signal "Engine temperature too high".	66

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Test step	Component tested	Page
6	- Actuation of air conditioner magnetic clutch -N25. Actuation of radiator fan -V7 Actuation of two-way valve for refrigerant shut-off valve -N147	69

Test step 1

Voltage supply, earth connection, illumination of the operating and display unit -E87 and signal for "ignition off time" (standing time)

Select measuring range on hand-held multimeter V.A.G 1526:

Voltage measurement (20V =)

- Adapter cable V.A.G 1598/12 connected

Test step	V.A.G 1598 socket	Testing of	Test conditions - Additional operations	Specified value	Remedies if specified value not attained
1.1	15 and 14	Terminal 15 and earth connection on -E87	▪ Ignition on.	- Approx. battery voltage	- Use current flow diagram to repair power supply and/or earth connection.
1.2	15 and 13	Earth connection at the -E87	▪ Ignition on.	- Approx. battery voltage	- Use current flow diagram to repair earth connection.

Select measuring range on hand-held multimeter V.A.G 1526:

Voltage measurement (20V =)

- Adapter cable V.A.G 1598/12 connected

Test step	V.A.G 1598 socket	Testing of	Test conditions - Additional operations	Specified value	Remedies if specified value not attained
1.3	12 and 14	Terminal 58 on - E87	▪ Ignition on. ▪ Switch side lights on	- Approx. battery voltage	- Use current flow diagram to repair power supply.
1.4	12 and 14	Terminal 58 on - E87	▪ Ignition on. ▪ Side lights off	- less than 2 V	- Use the current flow diagram to rectify short to positive.

Select measuring range on hand-held multimeter V.A.G 1526:

Voltage measurement (20V =)

- Adapter cable V.A.G 1598/11 connected

Test step	V.A.G 1598 socket	Testing of	Test conditions - Additional operations	Specified value	Remedies if specified value not attained
1.5	10 and earth	Terminal 58d on - E87	▪ Ignition on. ▪ Side lights on	- 0 to 12 V (regardless of the illumination control setting).	- Use current flow diagram to locate and eliminate open circuit or short circuit
1.6	10 and earth	Terminal 58d on - E87	▪ Ignition on. ▪ Side lights off	- 0 to 12 V (regardless of the illumination control setting).	- Use current flow diagram to locate and eliminate open circuit or short circuit

Notes:

- ♦ Earth applied e.g. to connector D contact 14.
- ♦ The brightness of the display of the -E87 is controlled via terminal 58d.
- ♦ The voltage at terminal 58d is generated as a square-wave signal by the dash panel insert. The brightness of -E87 displays is determined by the actuation time. The measuring instrument displays the average value.



- ♦ The actuation time at terminal 58d is governed by the illumination control setting and the brightness level determined by the photosensor in the dash panel insert.

Select measuring range on hand-held multimeter V.A.G 1526:**Voltage measurement (20V =)****- Adapter cable V.A.G 1598/11 connected**

Test step	V.A.G 1598 socket	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
1.7	11 and earth	Terminal 58s on - E87	▪ Ignition on. ▪ Side lights switched on.	- 0 to 12 V	- Use current flow diagram to locate and eliminate open circuit or short circuit
1.8	11 and earth	Terminal 58s on - E87	▪ Ignition on. ▪ Side lights off	- approx. 0 V.	- Use the current flow diagram to locate and rectify short to positive

Notes:

- ♦ Earth applied e.g. to connector D contact 14.
- ♦ The brightness of the display of the -E87 is controlled via terminal 58s.
- ♦ The voltage at terminal 58s is governed by the setting of the illumination control.

Voltage tester V.A.G 1527,**- Adapter cable V.A.G 1598/11 connected**

Test step	V.A.G 1598 socket	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
1.9	12 and earth	Signal for ignition off time	▪ Ignition on.	- the LED illuminates in voltage tester	- Use current flow diagram to locate and eliminate open circuit or short circuit
1.10	12 and earth	Signal for ignition off time	▪ Ignition on. Start engine.	- the LED illuminates in voltage tester when the engine is started, the LED in the voltage tester flickers briefly (time signal) and remains illuminated	- Use current flow diagram to locate and eliminate open circuit or short circuit Check dash panel insert

Note:**Earth applied e.g. to connector D contact 14.**

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Test step 2

Temperature sensor/sender

Select measuring range on hand-held multimeter V.A.G 1526: Resistance measurement (20 kΩ) - Adapter cable V.A.G 1598/11 connected					
Test step	V.A.G 1598 socket	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
2.1	32 and 25	Footwell vent temperature sender - G192	- Measure temperature at sender fitting location.	- Governed by the temperature at the sensor/pickup fitting location	- Use current flow diagram to locate and eliminate short circuit, open circuit or contact resistance.
2.2	31 and 25	Centre vent temperature sender - G191	▪ Vehicles with map-controlled cooling Measure temperature at sender fitting location.	=> Table, Page 64 .	- Replace temperature sensor/sender.
		Contact in connector B contact 11 for short circuit	▪ Vehicles without map-controlled cooling	-	Find short to connector B contact 11 according to current flow diagram and eliminate.

Note:

Centre vent temperature sender -G191 is only installed in vehicles with map-controlled cooling.

Select measuring range on hand-held multimeter V.A.G 1526: Resistance measurement (20 kΩ) - Adapter cable V.A.G 1598/11 connected					
Test step	V.A.G 1598 socket	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
2.3	33 and 25	Temperature sensor for fresh air intake duct -G89	- Measure temperature at the sensor fitting location.	- Dependent on the temperature at the sensor fitting location => Table, Page 64 .	- Use current flow diagram to locate and eliminate short circuit, open circuit or contact resistance. Replace temperature sensor.

Select measuring range on hand-held multimeter V.A.G 1526: Resistance measurement (20 kΩ) - Adapter cable V.A.G 1598/12 connected					
Test step	V.A.G 1598 socket	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
2.4	8 and 2	Ambient temperature sensor -G17	- Measure temperature at the sensor fitting location.	- Dependent on the temperature at the sensor fitting location => Table, Page 64 .	- Use current flow diagram to locate and eliminate short circuit, open circuit or contact resistance. Replace temperature sensor.



Ambient temperature-dependent resistance of temperature sensors/senders in kW(kilo-ohms)

At sensor/sender installation location, temperature measured in °C (degrees Celsius)	Sender -G192	Temperature sensor -G17 -G89	Sender -G191
-30	(52.7)	18.1	-
-20	(28.6)	9.95	-
-10	16.2	5.59	(47)
0	9.40	3.28	(29)
5	7.27	2.54	(23)
10	5.66	1.99	18.5
15	4.45	1.57	15
20	3.50	1.25	12.2
25	2.79	1.00	10.0
30	2.23	0.80	8.3
35	1.80	0.65	6.8
40	1.45	0.53	5.7
50	0.97	0.36	4.1
60	0.67	0.25	2.9
70	0.47	-	2.2

Test step 3

Fresh air blower -V2 and relevant control unit -J216

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Select measuring range on hand-held multimeter V.A.G 1526: Voltage measurement (20V =) - Adapter cable V.A.G 1598/11 connected					
Test step	V.A.G 1598 socket	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
3.1	16 and earth	Control unit -J126	▪ Ignition on.	- Voltage less than 5 V. Fresh air blower not running.	- Use current flow diagram to locate and eliminate short to positive in the wiring between -J126 and -E87. Replace control unit -J126.
3.2	4 and earth	Power supply for fresh air blower -V2	▪ Ignition on.	- approx. battery voltage	- Use current flow diagram to repair power supply.

Note:

Earth applied e.g. to connector D contact 14.

Voltage tester V.A.G 1527, - Adapter cable V.A.G 1598/11 connected					
Test step	V.A.G 1598 socket	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
3.3	3 and earth	Power supply for control unit -J126 (via fresh air blower -V2)	▪ Ignition on.	- approx. battery voltage	- Use current flow diagram to repair power supply.
3.4	4 and 16	Control unit -J126	▪ Ignition on.	- LED in voltage tester lights up. - Fresh air blower is running	- Use current flow diagram to locate and eliminate open circuit in the wiring between -J126 and -E87. Find open circuit in earth wiring to -J126 and eliminate. Check freedom of movement of fresh air blower -V2. - Replace control unit -J126.

Note:

Earth applied e.g. to connector D contact 14.

Test step 4

Positioning motors for air conditioner and associated potentiometers

Select measuring range on hand-held multimeter V.A.G 1526: Resistance measurement (20 kΩ) - Adapter cable V.A.G 1598/11 connected					
Test step	V.A.G 1598 socket	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
4.1	25 and 36 / 37 / 38 / 39	Potentiometer (in the positioning motor) -G 92 (-V 68) -G 114 (-V85) -G 112 (-V70) -G 113 (-V71)		- Greater than 0.1 kΩ and less than 5.7kΩ ((depending on the setting of the positioning motor)	- Use current flow diagram to locate and eliminate open circuit, contact resistance or short circuit Replace positioning motor
4.2	34 and 36 / 37 / 38 / 39	Potentiometer (in the positioning motor) -G 92 (-V 68) -G 114 (-V85) -G 112 (-V70) -G 113 (-V71)		- Greater than 0.1 kΩ and less than 5.7kΩ ((depending on the setting of the positioning motor)	- Use current flow diagram to locate and eliminate open circuit, contact resistance or short circuit Replace positioning motor

Notes:

- ♦ The resistance of potentiometers in the positioning motors (specified value: 3.6 kΩ to 5.7 kΩ between contact 1 and 3) can only be measured directly on the positioning motor (parallel connection).
- ♦ The resistance of the potentiometers in the positioning motors (between contacts 1 and 2, as well as contacts 3 and 2) is governed by the setting of the positioning motor, it must only be measured with the positioning motor fitted. The maximum specified value will not be obtained in test steps 4.1 and 4.2. (To obtain the



maximum specified value, all connectors on the other positioning motor would have to be detached during the measurement; the motors are connected in parallel).

- ♦ If -E87 detects the fault "potentiometer short to earth or open circuit/short to positive", check all the potentiometers (in the 4 positioning motors) and the corresponding wiring.
- ♦ On vehicles with right-hand drive, connections 1 and 2 as well as 4 and 6 on the positioning motor are reversed (check part number and current flow diagram).

Select measuring range on hand-held multimeter V.A.G 1526:

Resistance measurement (200 ω)

- Adapter cable V.A.G 1598/11 connected

Test step	V.A.G 1598 socket	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
4.3	21 and 22	Temperature flap positioning motor - V68		- 20 ω to 100 ω .	- Use current flow diagram to locate and eliminate open circuit, contact resistance or short circuit Replace positioning motor

Select measuring range on hand-held multimeter V.A.G 1526:

Resistance measurement (200 ω)

- Adapter cable V.A.G 1598/11 connected

Test step	V.A.G 1598 socket	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
4.4	26 and 27	Central flap positioning motor -V70		- 20 ω to 100 ω .	- Use current flow diagram to locate and eliminate open circuit, contact resistance or short circuit
4.5	28 and 29	Air flow flap positioning motor -V71		- 20 ω to 100 ω .	- Replace positioning motor
4.6	23 and 24	Footwell/defroster flap positioning motor -V85		- 20 ω to 100 ω .	

Test step 5

Pressure signal from radiator control unit for refrigerant -J293, output "air conditioner compressor cut-in", signal "engine temperature too high"

Select measuring range on hand-held multimeter V.A.G 1526:

Voltage measurement (20V =)

- Adapter cable V.A.G 1598/12 connected

Test step	V.A.G 1598 socket	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
5.1	7 and 14	Signal from radiator fan control unit - J293.	▪ Ignition on.	- approx. battery voltage	- Use current flow diagram to locate and eliminate open circuit or contact resistance. Check high-pressure sensor (=>Page 85).

Notes:

- ◆ Depending on high-pressure sensor -G65 signal, radiator fan control unit -J293:
 - indicates to operating and display unit -E87 that the refrigerant circuit pressure is OK and the compressor can be switched on (via magnetic clutch -N25).
 - switches radiator fan to 2nd speed if pressure increases.
- ◆ If code 1 "pressure switch -F129 open" is displayed in measured value block 1 as a compressor shutoff criterion:
 - Use current flow diagram to check the wiring to -G65 for a loose contact.
 - Use current flow diagram to check wiring between control unit -J293 and -E87 for loose contact.
 - Check the actuation of the radiator fan -V7 speed 1 (=>Final control diagnosis, Page 18).
 - Check signal from high-pressure sensor -G65 =>Page 85

Voltage tester V.A.G 1527, Operating and display unit connected to the test box (adapter cable V.A.G 1598/11 and /12) - Adapter cable V.A.G 1598/11 connected					
Test step	V.A.G 1598 socket	Testing of	Test conditions - Additional operations	Specified value	Remedies if specified value not attained
5.2	Earth and 6	Signal "Engine temperature too high"	▪ Engine running	▪ LED in the voltage tester flickers briefly.	- Use the current flow diagram to locate and rectify short to earth. Rectify the air conditioner compressor shutoff condition in the dash panel insert.

Notes:

- ◆ Earth applied e.g. to connector D contact 14.
- ◆ Brief flickering of the LED in the voltage tester indicates that the dash panel insert is transmitting a temperature signal.
- ◆ The assignment of the ignition key is transmitted to the -E87 through the dash panel insert together with the refrigerant temperature and the signal "engine temperature too high" when ignition is switched on (data telegram). If the refrigerant temperature is too high, no information may be transmitted.
- ◆ The assignment of the ignition key can only be recognised and therefore transmitted by the dash panel insert on vehicles fitted with an immobiliser.
- ◆ When the ignition is switched on, the -E87 starts with the setting which was valid the last time the ignition was switched off with this key (temperature, air distribution, fresh air blower speed).
- ◆ The signal from the dash panel insert (data telegram) cannot be checked with workshop tools.

=> Electrical System; Repair group 90; Repair dash panel insert Repair dash panel insert



Voltage tester V.A.G 1527, Operating and display unit connected to the test box (adapter cable V.A.G 1598/11 and /12) - Adapter cable V.A.G 1598/11 connected					
Test step	V.A.G 1598 socket	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
5.3	4 and 1	"Air conditioner compressor cut-in" output	▪ Engine running ▪ Compressor off (lamp in ECON button of -E87 lights up). Switch on compressor.	- LED in voltage tester lights up. LED in voltage tester lights up a little less brightly.	- Use current flow diagram to locate and eliminate open circuit or short circuit. Rectify AC compressor shutoff condition in the engine control (emergency operation). Use the current flow diagram to locate and rectify short to earth.

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Select measuring range on hand-held multimeter V.A.G 1526: Current measurement (200 mA =) Operating and display unit connected to the test box (adapter cable V.A.G 1598/11 and /12) - Adapter cable V.A.G 1598/11 connected.					
Test step	V.A.G 1598 socket	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
5.4	Earth and 1	"Air conditioner compressor cut-in" output	▪ Engine running ▪ Compressor switched off. Switch on compressor.	- Less than 5 mA Less than 50 mA Compressor is not switched on.	- Use current flow diagram to locate and eliminate short circuit. Check actuation of control unit -J293 (=>Page 70). Renew operating and display unit -E87.

Note:

Earth applied e.g. to connector D contact 14.

Test step 6

Radiator fan actuation -V7, magnetic clutch actuation -N25

Select measuring range on hand-held multimeter V.A.G 1526: Current measurement (20 A =) - Adapter cable V.A.G 1598/12 connected					
Test step	V.A.G 1598 socket	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
6.1	15 and 4	Actuation of radiator fan -V7	▪ Engine running	- Less than 1 A Radiator fan -V7 running at speed 1 (observe relevant notes)	- Use current flow diagram to locate and eliminate open circuit or short to positive or earth in the wiring between -J293 and -E87. Check actuation of control unit -J293 (=>Page 70). Control unit -J293 defective - replace. (cont.) ▼

Select measuring range on hand-held multimeter V.A.G 1526: Current measurement (20 A =) - Adapter cable V.A.G 1598/11 connected					
Test step	V.A.G 1598 socket	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
6.1 (cont.)	(15 and 4)	Actuation of air conditioner magnetic clutch -N25	▪ Engine running	- Compressor is driven.	- Use current flow diagram to locate and eliminate open circuit or short to positive or earth in the wiring between -E87 and -J293. Check actuation of control unit -J293 (=>Page 70). Control unit -J293 defective - replace.

Notes:

- ♦ Control unit -J293, installed in vehicles with high-pressure sensor -G65, is available in 2 designs.

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- In design "1" the radiator fan is automatically switched on in conjunction with the compressor (the first fan speed is activated regardless of the pressure in the refrigerant circuit).

is activated regardless of the pressure in the refrigerant circuit).

- In design "2" the compressor is switched on without actuation of the radiator fan; the first fan speed is only activated once the pressure in the refrigerant circuit exceeds 12 bar.



- ♦ In vehicles with map-controlled cooling the radiators are controlled by the engine control unit dependent on the refrigerant temperature.

=> Relevant Workshop Manual Injection and Ignition system

Select measuring range on hand-held multimeter V.A.G 1526: Current measurement (20 A =) - Adapter cable V.A.G 1598/12 connected					
Test step	V.A.G 1598 socket	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
6.2	4 and 6	Actuation of two-way valve for refrigerant shut-off valve -N147	▪ Engine running	- lower than 1 A (observe notes)	- Use current flow diagram to locate and eliminate open circuit or short to positive or earth in the wiring between - J293 and -E87. Defective twoway valve, replace.
				- the refrigerant shut-off valve closes (observe notes)	- Check vacuum pressure supply via two-way valve - N147 to refrigerant shut-off valve (=> Page 163) Defective twoway valve, replace. Refrigerant shut-off valve defective, replace.

Notes:

- ♦ The "two-way valve -N147" and the refrigerant shut-off valve is only installed into vehicles with map-controlled engine cooling.
- ♦ The refrigerant through flow through the heat exchanger of the air conditioner unit is blocked via the refrigerant shut-off valve by the operating and display unit -E87.

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11 - Perform electrical check at radiator fan control unit -J293

11.1 - Perform electrical check at radiator fan control unit -J293

Required measuring and testing equipment:

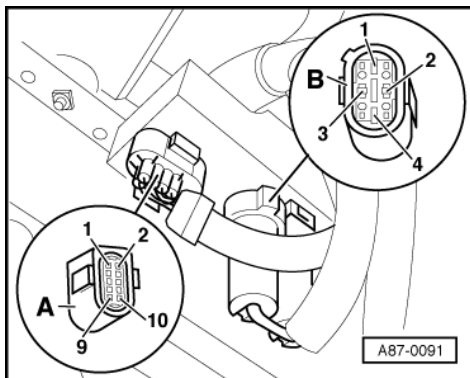
- Handheld multimeter V.A.G 1526,
- Adapter set V.A.G 1594,
- Diode test lamp V.A.G 1527,
- Vehicle diagnosis system VAS 5051 (for vehicles with high-pressure sensor -G65 for testing pressure signal)

Test requirements

All fuses OK in line with current flow diagram.

The fault memory of operating and display unit -E87 has been interrogated - there are no faults.

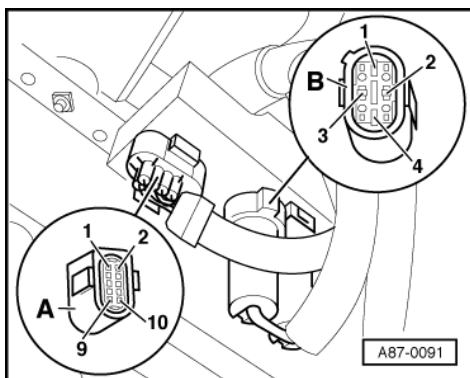
No compressor shutoff condition has been displayed in the measured value block (display group 001 display zone 1) of operating and display unit -E87 with the engine running.



Operating and display unit -E87 is installed.

-> Connector -A- and -B- are disconnected from control unit -J293 (the illustration shows the type which is installed into vehicles with pressure switch -F129).

11.2 - Electrical check at control unit -J293 (version for pressure switch -F129)



-> Pin assignment for radiator fan control unit -J293 (version with pressure switch -F129)

- Location:
on left longitudinal member in engine compartment
- Function:
 - Switches radiator fans -V7 to 1st and 2nd speed
 - Actuates AC magnetic clutch -N25.

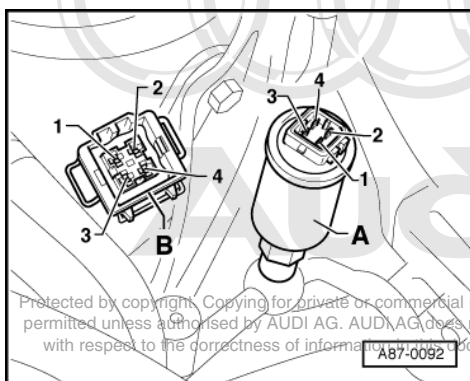
Notes:

Radiator fan control unit -J293 versions and vehicle wiring differ for vehicles with pressure switch -F129 and high-pressure sensor -G65.

=> Parts List

=> Current Flow Diagrams, Electrical Fault-Finding and Fitting Locations

- ◆ The radiator fan -V7 is automatically switched on together with the magnetic clutch if this control unit is used.



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**-> Pin assignment for air conditioner pressure switch -F129**

Switch between contact 1 and 2 (opens in the event of vacuum and overpressure in the refrigerant circuit - the compressor is switched off)

Switch between contacts 3 and 4 (closes if pressure increases in the refrigerant circuit - the radiator fan is switched to 2nd speed)

Pin assignment at refrigerant temperature switch -F18 / -F54

Switch -F54 (between contact 1 and 2 closes at approx. 95 °C - the radiator fans are switched to 1st speed).

Switch -F18 (between contact 3 and 2 closes at approx. 102 °C - the radiator fans are switched to 2nd speed).

Refrigerant temperature control switch (too hot) -F14

Switch opens at approx. 118 °C - the compressor is switched off.

Note:

Only installed in vehicles with pressure switch -F129

=> Current Flow Diagrams, Electrical Fault-Finding and Fitting Locations

Test step 1 (voltage supply)

Select measuring range on hand-held multimeter V.A.G 1526: Voltage measurement (20V =)					
Test step	Contact at connector to -J293	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
1.1	Connector B contact 3 and connector A, contact 6	Voltage supply		- approx. battery voltage	- Use current flow diagram to repair power supply and/or earth connection.
1.2	Connector B contact 4 and connector A, contact 6	Voltage supply		- approx. battery voltage	- Use current flow diagram to repair power supply.

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Select measuring range on hand-held multimeter V.A.G 1526: Voltage measurement (20V =)					
Test step	Contact at connector to -J293	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
1.3	Connector A contact 4 and connector A, contact 6	Voltage supply		- approx. battery voltage	- Use current flow diagram to repair power supply.
1.4	Connector A contact 9 and connector A, contact 6	Voltage supply	▪ Ignition on.	- approx. battery voltage	- Use current flow diagram to repair power supply.

Test step 2 (actuation of radiator fan)

Select measuring range on hand-held multimeter V.A.G 1526: Voltage measurement (20V =)					
Test step	Contact at connector to -J293	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
2.1	Connector A contact 5 and connector A, contact 6	"Fan ON" signal from -E87 (1st speed from -E87).	▪ Engine running Operating and display unit -E87 in "auto" mode (compressor on)	- approx. battery voltage	- Use circuit flow diagram to locate and rectify open circuit or short circuit to earth in the wiring between control unit -J293 and -E87. Renew operating and display unit -E87.

Select measuring range on hand-held multimeter V.A.G 1526: Voltage measurement (20V =)					
Test step	Contact at connector to -J293	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
2.2	Connector A contact 2 and connector A, contact 6	"Fan ON" signal from -E87 (2nd speed from pressure switch -F129).	▪ Connector removed from pressure switch -F129, and contacts 3 and 4 jumpered ▪ Ignition on.	- approx. battery voltage	- Use current flow diagram to rectify voltage supply to pressure switch -F129. Use current flow diagram to locate and eliminate open circuit in the wiring between pressure switch -F129 and control unit -J293.

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Select measuring range on hand-held multimeter V.A.G 1526: Voltage measurement (20V =)					
Test step	Contact at connector to -J293	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
2.3	Connector A and connector B attached to -J293	Actuation of fan -V7 (speed 2) from pressure switch -F129.	▪ Ignition on. ▪ Connector detached from pressure switch -F129. Contacts 3 and 4 jumpered (at connector to -F129).	- Radiator fan running at speed 2	- Use current flow diagram to rectify voltage supply to pressure switch -F129. Use current flow diagram to locate and eliminate open circuit in the wiring between control unit -J293 and fans -V7. Service radiator fan -V7. Control unit -J293 defective - replace.

**Select measuring range on hand-held multimeter V.A.G 1526:
Voltage measurement (20V =)**

Test step	Contact at connector to -J293	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
2.4	Connector B contact 2 and connector A, contact 6	"Fan ON" signal from -E87 (1st speed from temperature switch -F54).	▪ Connector detached from temperature switch -F18/-F54, and contacts 1 and 2 jumpered ▪ Ignition on.	- approx. battery voltage Radiator fan running at speed 1	- Use current flow diagram to rectify voltage supply to temperature switch -F54. - Use current flow diagram to locate and eliminate open circuit in the wiring between temperature switch -F54 and control unit -J293. - Use current flow diagram to locate and eliminate open circuit in the wiring to fans -V7. - Service radiator fan -V7.

**Select measuring range on hand-held multimeter V.A.G 1526:
Voltage measurement (20V =)**

Test step	Contact at connector to -J293	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
2.5	Connector A contact 7 and connector A, contact 6	"Fan ON" signal from -E87 (2nd speed from temperature switch -F18).	▪ Connector detached from temperature switch -F18/-F54, and contacts 2 and 3 jumpered ▪ Ignition on.	- approx. battery voltage	- Use current flow diagram to rectify voltage supply to temperature switch -F18. - Use current flow diagram to locate and eliminate open circuit in the wiring between temperature switch -F18 and control unit -J293.

**Select measuring range on hand-held multimeter V.A.G 1526:
Voltage measurement (20V =)**

Test step	Contact at connector to -J293	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
2.6	Connector A and connector B attached to -J293	"Fan ON" signal from -E87 (2nd speed from temperature switch -F18).	▪ Connector detached from temperature switch -F18/-F54, and contacts 2 and 3 jumpered ▪ Ignition on.	- Radiator fan running at speed 2	- Use current flow diagram to locate and eliminate open circuit in the wiring to fans -V7. - Service radiator fan -V7. - Control unit -J293 defective - replace.

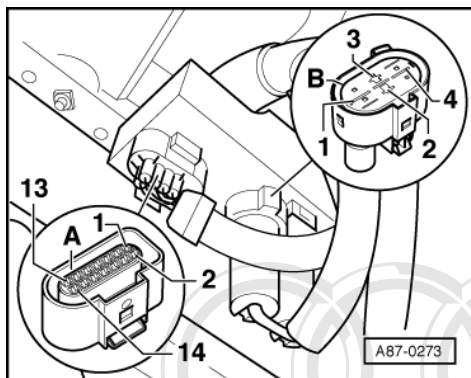
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Test step 3 (actuation of magnetic clutch)

Select measuring range on hand-held multimeter V.A.G 1526: Voltage measurement (20V =)					
Test step	Contact at connector to -J293	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
3.1	Connector A contact 8 and connector A, contact 6	"Compressor ON" signal from -E87 Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the content of this document. Copyright by AUDI AG	▪ Engine running ▪ Operating and display unit -E87 in "auto" mode (compressor on) ▪ No compressor shutoff condition is displayed in the -E87 measured value block (display group 001).	- approx. battery voltage	- Use current flow diagram to locate and eliminate open circuit or short to positive or earth in the wiring between pressure switch -F129, temperature switch -F14 and control unit -J293. - Refrigerant temperature switch -F14 defective (open) or refrigerant too hot - check. => Current Flow Diagrams, Electrical Fault-Finding and Fitting Locations

Select measuring range on hand-held multimeter V.A.G 1526: Current measurement (20 A=)					
Test step	Contact at connector to -J293	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
3.2	Connector A contact 4 and connector A, contact 10	Actuation of air conditioner magnetic clutch -N25	▪ Ignition on.	- Less than 10 A Magnetic clutch clicks (when applying voltage)	- Use current flow diagram to locate and eliminate open circuit or short to earth in the wiring between control unit -J293 and magnetic clutch -N25. - Open circuit in the earth connection to magnetic clutch -N25 => Current Flow Diagrams, Electrical Fault-Finding and Fitting Locations - Magnetic clutch defective - rectify.

11.3 - Electrical check at control unit -J293 (version for High-pressure sensor -G65)

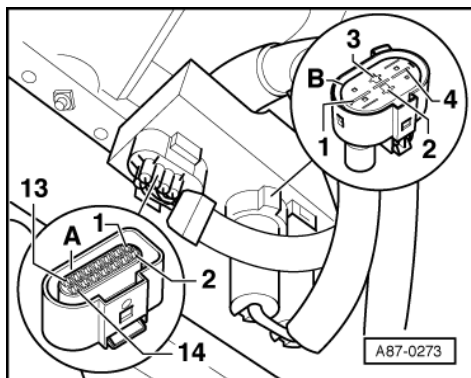


-> Pin assignment for radiator fan control unit -J293

- Location:
 - on left longitudinal member in engine compartment
- Function:
 - Switches radiator fans -V7 to 1st and 2nd speed
 - Actuates AC magnetic clutch -N25.
 - Processes the square-wave signal of high-pressure sensor -G65 and, if the refrigerant circuit pressure is OK, sends a positive signal to -E87.
 - Switches on pump for refrigerant supply -V51 (in vehicles with pump for refrigerant supply -V51) when the ignition is switched on. The pump remains in operation for a brief time after the ignition is switched off.

=> Relevant Workshop Manual Injection and Ignition system

Notes:



- ♦ -> The following contacts in connector -A- to control unit -J293 are vacant:
 - Contact 1 (in vehicles without pump for refrigerant supply -V51)
 - Contact 3
 - Contact 11 (at the moment only in vehicles with petrol engines with map-controlled engine cooling and in vehicles with 81 KW diesel engine).
 - Contacts 5 and 14 (dependent on type of -J293 there can be a bridge between these two contacts).

=> Current Flow Diagrams, Electrical Fault-Finding and Fitting Locations

- Contact 13 (reserved for compressor switch-off by dash panel insert, only occupied in individual vehicles).

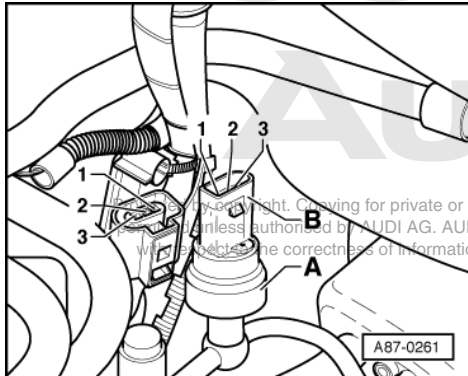
=> Current Flow Diagrams, Electrical Fault-Finding and Fitting Locations

- ♦ Radiator fan control unit -J293 versions and vehicle wiring differ for vehicles with pressure switch -F129 and high-pressure sensor -G65.

=> Parts List

=> Current Flow Diagrams, Electrical Fault-Finding and Fitting Locations

- ♦ Control unit -J293, installed in vehicles with high-pressure sensor -G65, is available in 2 designs.
 - In design "1" the radiator fan is automatically switched on in conjunction with the compressor (the first fan speed is activated regardless of the pressure in the refrigerant circuit).



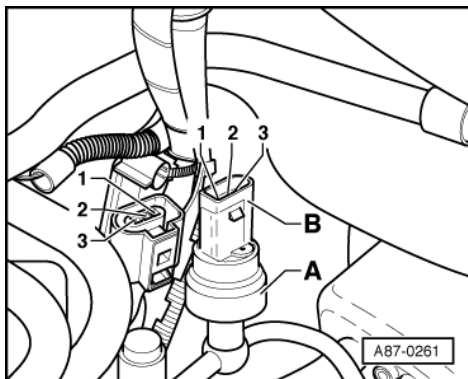
- In design "2" the compressor is switched on without the radiator fan; the first fan speed is only activated once the pressure in the refrigerant circuit has exceeded 12 bar.

-> Pin assignment for high-pressure sensor -G65

Contact 1, earth

Contact 2, signal output (square-wave signal to -J293 and to engine control unit)

Contact 3, positive (terminal 15)



Notes:

- ♦ -> The compressor will not be switched on if connector -B- is disconnected.
- ♦ High-pressure sensor -A- is an electronic control unit that generates a square-wave signal whose duty cycle changes with refrigerant circuit pressure =>Page 85 .

Pin assignment at refrigerant temperature switch -F18 / -F54

Switch -F54 (between contact 1 and 2 closes at approx. 95 °C - the radiator fans are switched to 1st speed).

Switch -F18 (between contact 3 and 2 closes at approx. 102 °C - the radiator fans are switched to 2nd speed).

**Note:**

In vehicles with map-controlled cooling the radiator fans are switched on and off by the engine control unit dependent on the engine load and the refrigerant temperature (temperature switch -F18/-F54 is not installed).

Test step 1 (voltage supply)

Select measuring range on hand-held multimeter V.A.G 1526: Voltage measurement (20V =)					
Test step	Contact at connector to -J293	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
1.1	Connector B contact 3 and connector A, contact 6	Voltage supply		- approx. battery voltage	- Use current flow diagram to repair power supply and/or earth connection.
1.2	Connector B contact 1 and connector A, contact 6	Voltage supply		- approx. battery voltage	- Use current flow diagram to repair power supply.

Select measuring range on hand-held multimeter V.A.G 1526: Voltage measurement (20V =)					
Test step	Contact at connector to -J293	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
1.3	Connector A contact 4 and connector A, contact 6	Voltage supply		- approx. battery voltage	- Use current flow diagram to repair power supply.
1.4	Connector A contact 9 and connector A, contact 6	Voltage supply	▪ Ignition on.	- approx. battery voltage	- Use current flow diagram to repair power supply.

Test step 2 (actuation of radiator fan)**Notes:**

- ♦ Test steps 2.1, 2.2 and 2.3 are only carried out in vehicles without map-controlled engine cooling.
- ♦ The test step 2.4 is only carried out in vehicles with diesel engine (performance 81 KW) (actuation for radiator fan run out).
- ♦ The test steps 2.5 and 2.6 are only carried out in vehicles with map-controlled engine cooling.
- ♦ In vehicles with map-controlled cooling the radiator fans are switched on and off by the engine control unit dependent on the engine load and the refrigerant temperature (temperature switch -F18/-F54 is not installed).
- ♦ If a fault is found in vehicles with map-controlled engine cooling when the radiator fan is actuated or if the actuation of the fan is to be checked proceed as described in the workshop manual Ignition and Injection system for this engine.

=> Relevant Workshop Manual Injection and Ignition system

Select measuring range on hand-held multimeter V.A.G 1526: Voltage measurement (20V =)					
Test step	Contact at connector to -J293	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
2.1	Connector B contact 2 and connector A, contact 6	"Fan ON" signal (1st speed) from temperature switch -F54. ▪ only to be performed in vehicles without map-controlled cooling	▪ Connector detached from temperature switch - F18/-F54, and contacts 1 and 2 jumpered ▪ Ignition on.	- approx. battery voltage Radiator fan running at speed 1	- Use current flow diagram to rectify voltage supply to temperature switch - F54. Use current flow diagram to locate and eliminate open circuit in the wiring between temperature switch -F54 and control unit -J293. Use current flow diagram to locate and eliminate open circuit in the wiring to fans -V7. Service radiator fan -V7.

Select measuring range on hand-held multimeter V.A.G 1526: Voltage measurement (20V =)					
Test step	Contact at connector to -J293	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
2.2	Connector A contact 7 and connector A, contact 6	"Fan ON" signal (2nd speed) from temperature switch -F18. ▪ only to be performed in vehicles without map-controlled cooling	▪ Connector detached from temperature switch - F18/-F54, and contacts 2 and 3 jumpered ▪ Ignition on.	- approx. battery voltage	- Use current flow diagram to rectify voltage supply to temperature switch - F18. Use current flow diagram to locate and eliminate open circuit in the wiring between temperature switch -F18 and control unit -J293.

Notes:

- ♦ Test step 2.2 is only to be performed in vehicles without map-controlled engine cooling.
- ♦ In vehicles with map-controlled cooling the radiator fans are switched on and off by the engine control unit dependent on the engine load and the refrigerant temperature (temperature switch -F18/-F54 is not installed).


Select measuring range on hand-held multimeter V.A.G 1526:
Voltage measurement (20V =)

Test step	Contact at connector to -J293	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
2.3	Connector A and connector B attached to -J293	"Fan ON" signal (2nd speed) from temperature switch -F18. ▪ only to be performed in vehicles without map-controlled cooling	▪ Connector detached from temperature switch - F18/-F54, and contacts 2 and 3 jumpered ▪ Ignition on.	- Radiator fan running at speed 2	- Use current flow diagram to locate and eliminate open circuit in the wiring to fans -V7. Service radiator fan -V7. Control unit -J293 defective - replace.

Notes:

- ♦ The test step 2.3 is only to be performed in vehicles without map-controlled engine cooling.
- ♦ In vehicles with map-controlled cooling the radiator fans are switched on and off by the engine control unit dependent on the engine load and the refrigerant temperature (temperature switch -F18/-F54 is not installed).

Select measuring range on hand-held multimeter V.A.G 1526:
Voltage measurement (20V =)

Test step	Contact at connector to -J293	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
2.4	Connector A contact 11 and connector A, contact 6	Fan on signal (vent run out) from engine control unit. ▪ only to be performed in vehicles with 81 KW diesel engine	▪ Ignition on. Actuate this control element in the final control diagnosis for the engine control unit. => Relevant Workshop Manual Diesel Direct Injection and Preglow system	- approx. battery voltage during the actuation	- Check output at engine control unit. Use current flow diagram to locate and eliminate open circuit or short to positive or earth in the wiring between - E87 and control unit -J293.

Select measuring range on hand-held multimeter V.A.G 1526:
Voltage measurement (20V =)

Test step	Contact at connector to -J293	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
2.5	Connector A contact 11 and connector A, contact 6	Fan on Signal (fan actuation speed 1) from engine control unit. ▪ only to be performed in vehicles with map-controlled engine cooling	▪ Ignition on. Actuate this control element in the final control diagnosis for the engine control unit. => Relevant Workshop Manual Injection and Ignition system	- approx. battery voltage during the actuation	- Check output at engine control unit. Use current flow diagram to locate and eliminate open circuit or short to earth in the wiring between engine control unit and control unit -J293.

Notes:

- ♦ The test step 2.5 is only to be performed in vehicles with map-controlled engine cooling.

- ♦ In vehicles with map-controlled cooling the radiator fans are switched on and off by the engine control unit dependent on the engine load and the refrigerant temperature (temperature switch -F18/-F54 is not installed).

Select measuring range on hand-held multimeter V.A.G 1526: Voltage measurement (20V =)					
Test step	Contact at connector to -J293	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
2.6	Connector A contact 7 and connector A, contact 6	Fan on Signal (fan actuation speed 2) from engine control unit. ▪ only to be performed in vehicles with map-controlled engine cooling	▪ Ignition on. Actuate this control element in the final control diagnosis for the engine control unit. => Relevant Workshop Manual Injection and Ignition system	- approx. battery voltage during the actuation	- Check output at engine control unit. Use current flow diagram to locate and eliminate open circuit or short to earth in the wiring between engine control unit and control unit -J293.

Notes:

- ♦ The test step 2.6 is only to be performed in vehicles with map-controlled engine cooling.
- ♦ In vehicles with map-controlled cooling the radiator fans are switched on and off by the engine control unit dependent on the engine load and the refrigerant temperature (temperature switch -F18/-F54 is not installed).

Test step 3 (actuation of magnetic clutch)

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Select measuring range on hand-held multimeter V.A.G 1526: Current measurement (20 A=)					
Test step	Contact at connector to -J293	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
3.1	Connector A contact 4 and connector A, contact 10	Actuation of air conditioner magnetic clutch -N25	▪ Ignition on.	- Less than 10 A Magnetic clutch clicks (when applying voltage)	- Use current flow diagram to locate and eliminate open circuit or short to earth in the wiring between control unit -J293 and magnetic clutch -N25. Open circuit in the earth connection to magnetic clutch -N25. => Current Flow Diagrams, Electrical Fault-Finding and Fitting Locations Magnetic clutch defective - rectify.

Select measuring range on hand-held multimeter V.A.G 1526: Current measurement (20 A=)					
Test step	Contact at connector to -J293	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained

**Select measuring range on hand-held multimeter V.A.G 1526:****Current measurement (20 A=)**

3.2	Connector A contact 4 and connector A, contact 12	Signal for "Refrigerant circuit pressure OK" to -E87	▪ Engine running ▪ The fault reader V.A.G 1551 remains connected. ▪ The self-diagnosis for the air conditioner (address word "08") is initiated. ▪ The display group "001" is selected in the function "read measured value block". Press "Auto"-key on -E87.	- Less than 1 A "0" is displayed in the measured value block of -E87 (display group "001", display zone "1")	- Use current flow diagram to locate and eliminate open circuit or short to positive or earth in the wiring between control unit -J293 and -E87. Eliminate cause of compressor shutoff condition
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Select measuring range on hand-held multimeter V.A.G 1526:**Current measurement (20 A=)**

Test step	Contact at connector to -J293	Testing of	Test conditions - Additional operations	Specified value	Remedies if specified value not attained
3.3	Connector A contact 6 and connector A, contact 12	Signal for "Refrigerant circuit pressure NOK" to -E87	▪ Engine running. ▪ The fault reader V.A.G 1551 remains connected. ▪ The self-diagnosis for the air conditioner (address word "08") is initiated. ▪ The display group "001" is selected in the function "read measured value block".	- Less than 1 A "1" is displayed in the measured value block of -E87 (display group "001", display zone "1")	- Use current flow diagram to locate and eliminate open circuit or short to positive in the wiring between control unit -J293 and -E87.

Select measuring range on hand-held multimeter V.A.G 1526:**Current measurement (20 A=)**

Test step	Contact at connector to -J293	Testing of	Test conditions - Additional operations	Specified value	Remedies if specified value not attained
3.4	Connector A contact 4 and connector A, contact 13	Connection to input for "Refrigerant temperature too high" recognition	▪ Ignition on.	- 0 A	- Rectify short circuit to earth in connector A contact 13.

Notes:

- ♦ The contact 13 in connector -A- is not occupied in all vehicles. Switching off of the compressor when refrigerant temperature is too high occurs via the operating and display unit -E87 in vehicles in which the contact is not occupied (if the contact is occupied switching off occurs simultaneously via -E87 and -J293).
- ♦ If earth is applied to connector -A- contact 13, the radiator fans are actuated and the compressor is not switched on.

Select measuring range on hand-held multimeter V.A.G 1526:**Voltage measurement (20V =)**

Bridge at connector A between contact 4 and contact 12

Test step	Contact at connector to -J293	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
3.5	Connector A contact 8 and connector A, contact 6	"Compressor ON" signal from -E87	▪ Engine running ▪ Operating and display unit -E87 in "auto" mode (compressor on)	- approx. battery voltage	- Use current flow diagram to locate and eliminate open circuit or short to positive or earth in the wiring between -J293 and -E87. Eliminate cause of compressor shutoff condition

Test step 4 (signal from high-pressure sensor -G65)

Vehicle diagnosis system VAS 5051 (or commercially available oscilloscope) "DSO" (digital storage oscilloscope) measurement system Setting 2V/Div =, 5ms/Div (2 V DC and 5 milliseconds per unit)					
Test step	Contact at connector to -J293	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
4.0	Connector A contact 2 (signal) and connector A, contact 6 (earth)	Pressure-dependent square-wave signal from sender -G65	▪ Ignition on.	- Square-wave signal (dependent on pressure in refrigerant circuit =>Page 85	- Use current flow diagram to check voltage supply and earth connections to High-pressure sensor -G65. Use current flow diagram to locate and eliminate open circuit in the wiring between High-pressure sensor -G65 and control unit -J293. (cont.) ▼

Vehicle diagnosis system VAS 5051 (or commercially available oscilloscope) "DSO" (digital storage oscilloscope) measurement system Setting 2V/Div =, 5ms/Div (2 V DC and 5 milliseconds per unit)					
Test step	Contact at connector to -J293	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
4.0 (cont.)	Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.				- Use circuit flow diagram to locate and rectify short circuit in the wiring from -G65 to -J293 or to the engine control unit. High-pressure sensor -G65 defective - replace.

Notes:

- ♦ The signal from high-pressure sensor -G65 depends on pressure in refrigerant circuit => Page 85



- ♦ The signal generated by high-pressure sensor -G65 is also used for engine control (the required compressor drive torque is governed by the refrigerant circuit pressure). Depending on the engine control unit version, the signal in the measured value block is displayed as duty cycle.

=> Relevant Workshop Manual Injection and Ignition system

Test step 5 (other connections)

Select measuring range on hand-held multimeter V.A.G 1526: Voltage measurement (20V =)					
Test step	Contact at connector to -J293	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
5.1	Connector A contact 5 and connector A, contact 14	Connection via connector A (observe notes).		- smaller 10 ω (observe note).	- Eliminate open circuit or contact resistance.

Note:

Connection (bridge) between contacts 5 and 14 at connector A are not present in all types of the control unit - J293.

=> Current Flow Diagrams, Electrical Fault-Finding and Fitting Locations

Select measuring range on hand-held multimeter V.A.G 1526: Current measurement (20 A=)					
Test step	Contact at connector to -J293	Testing of	▪ Test conditions - Additional operations	Specified value	Remedies if specified value not attained
5.2	Connector A contact 1 and connector A, contact 4	Function of pump for refrigerant run out -V51 (observe note).		- smaller than 5A (observe note). - Pump -V51 is running (running noise audible)	- Use current flow diagram to locate and eliminate open circuit in the wiring between pump -V51 and control unit - J293. Pump defective, replace. - Use current flow diagram to locate and eliminate open circuit in the wiring between pump -V51 and control unit - J293. Locate open circuit in earth wiring to pump -V51 and eliminate. Pump defective, replace.

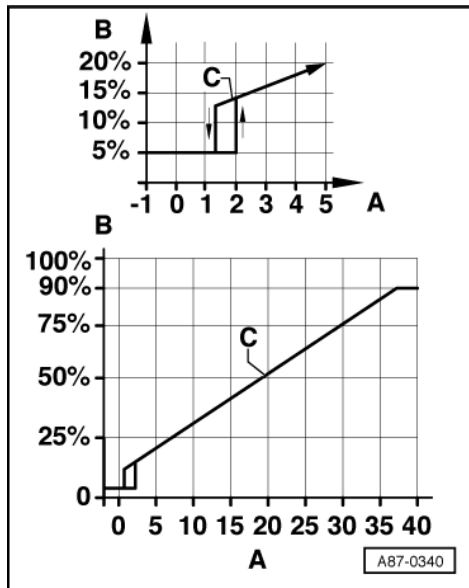
Note:

The pump for refrigerant run-out -V51 is only present in certain engine variations.

=> Current Flow Diagrams, Electrical Fault-Finding and Fitting Locations

=> Relevant Workshop Manual Injection and Ignition system

11.4 - Check signal from high-pressure sensor -G65



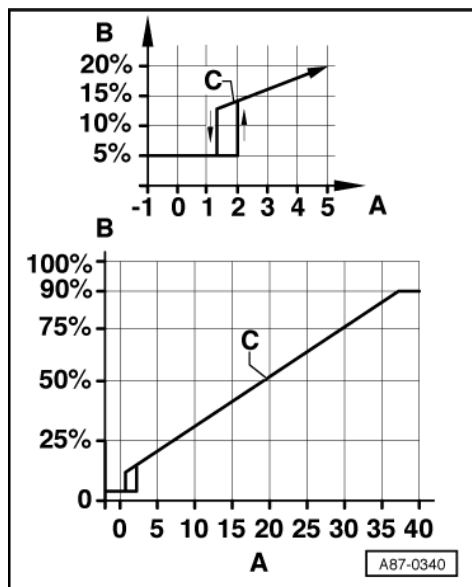
-> A- Pressure on high-pressure side of refrigerant circuit in bar (overpressure)

B- Duty cycle of the square-wave signal

C- Curve

Notes:

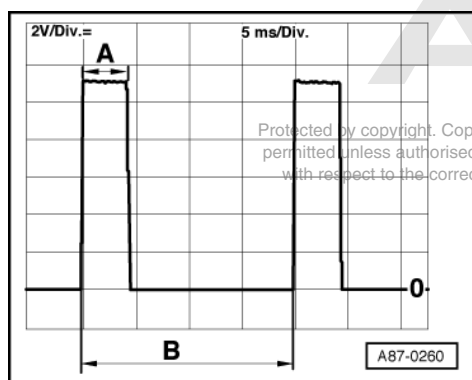
- ♦ Control unit -J293 transmits a positive signal to operating and display unit -E87:
 - When duty cycle is larger than 13% (equivalent to approx. 1.2 bar overpressure) and less than 78% (equivalent to approx. 32 bar overpressure).
 - If the duty cycle is less than 13% or greater than 78%, no positive signal is transmitted to -E87, and -E87 transmits no signal to -J293 - as a result -J293 does not switch on the compressor (via magnetic clutch -N25).
- ♦ If the refrigerant circuit pressure was greater than 32 bar (duty cycle greater than 78%), control unit -J293 does not re-transmits a positive signal to -E87 until the pressure drops below 24 bar (duty cycle less than 65%).



- -> Control unit -J293 switches radiator fan -V7 to speed 2:
 - As soon as the refrigerant circuit pressure exceeds 16 bar (duty cycle exceeds 45%). If the pressure drops below 12.5 bar (duty cycle drops below 37%), the fans are switched back to 1st speed.
 - Refrigerant thermoswitch -F18 closed.
 - As soon as a positive signal from the engine control unit is present (only in vehicles with map-controlled engine cooling).
- The control unit -J293 switches radiator fans -V7 to 1. speed:
 - As soon as a signal from the -E87 for switching on of the compressor is present.
 - When thermo switch -F54 is closed.
 - As soon as a positive signal from the engine control unit is present (only in vehicles with map-controlled engine cooling and in vehicles with 81 KW diesel engine).
- The signal generated by high-pressure sensor -G65 is also used for engine control (the required compressor drive torque is governed by the refrigerant circuit pressure). Depending on the engine control unit version, the signal in the measured value block is displayed as duty cycle.

=> Relevant Workshop Manual Injection and Ignition system

Check signal from -G65



- -> Connect test lead of one oscilloscope to the signal wire of high-pressure sensor -G65 (=> Page 83 test step 4).

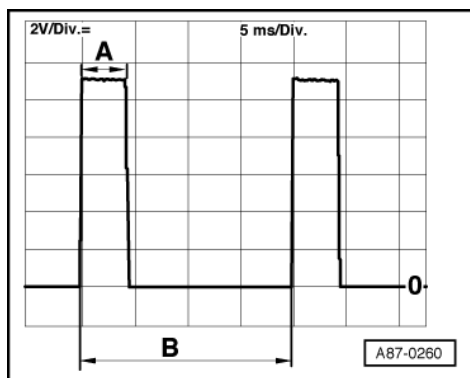
This display appears on the oscilloscope screen if the following conditions have been satisfied.

- Ignition switched on (positive and earth applied at sender -G65)
- Oscilloscope setting:
 - 2 V/Div. = (2 V DC per unit)
 - 5 ms/Div. (5 milliseconds per unit)

- Test lead (signal wire) at contact 2 of high-pressure sensor -G65.
- Test lead (screening) connected to earth.

Notes:

- ♦ The illustration shows the signal transmitted at a refrigerant circuit pressure of approx. 5 bar overpressure, which is equivalent to a duty cycle of approx. 20% (automatic adjustment with compressor at a standstill, at an ambient temperature of 20 °C, and with filled refrigerant circuit).



- ♦ -> Pulse width -A- depends on the refrigerant circuit pressure (if the pressure increases, the -A- range widens).
- ♦ Signal gap -B- is always 20 milliseconds.
- ♦ The duty cycle is derived from the ratio between pulse width -A- and signal gap -B-.

12 - Electrical check of rear window heating

12.1 - Electrical check of rear window heating

Note:

This test should only be performed with an operating and display unit with only one display (switch for heated rear window integrated in the -E87).

Special tools, testers and auxiliary equipment required

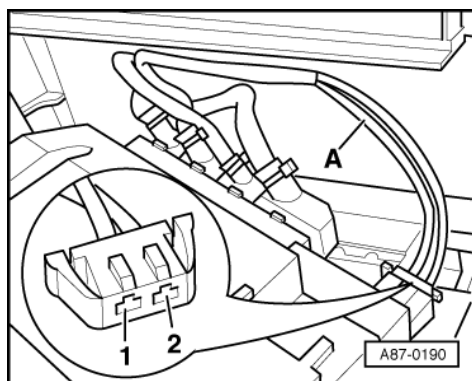
- ♦ Multimeter V.A.G 1715 (with current probe)
- ♦ Measuring tool set V.A.G 1594 A

Test requirements:

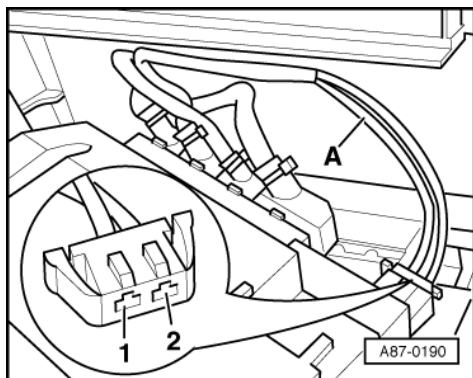
- All fuses OK:

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=> Current Flow Diagrams, Electrical Fault-Finding and Fitting Locations



- Switch ignition off.
- Remove operating and display unit -E87 => Page 174 .
- Pull the connector "F" off the operating and display unit -E87.
- -> Connect multimeter between contacts 1 and 2 to measure voltage.
- Switch the ignition on.
 - Specified value: approx. battery voltage
- Switch ignition off.
- Fit the connector "F" to the -E87.



- -> Route lead -A- to connector "F" through V.A.G 1715's current probe.

Note:

All the connectors on the -E87 must be inserted

- Select the function "Current measurement via current probe" on V.A.G 1715.
- Start the engine.
- Switch on heated rear window at the -E87 (telltale in button lights).
 - Specified value: display changes from approx. 0 A to less than 25 A
- Wait for approx. 10 minutes
 - Specified value: The display changes from less than 25 A to approx. 0 A (telltale in button goes out)

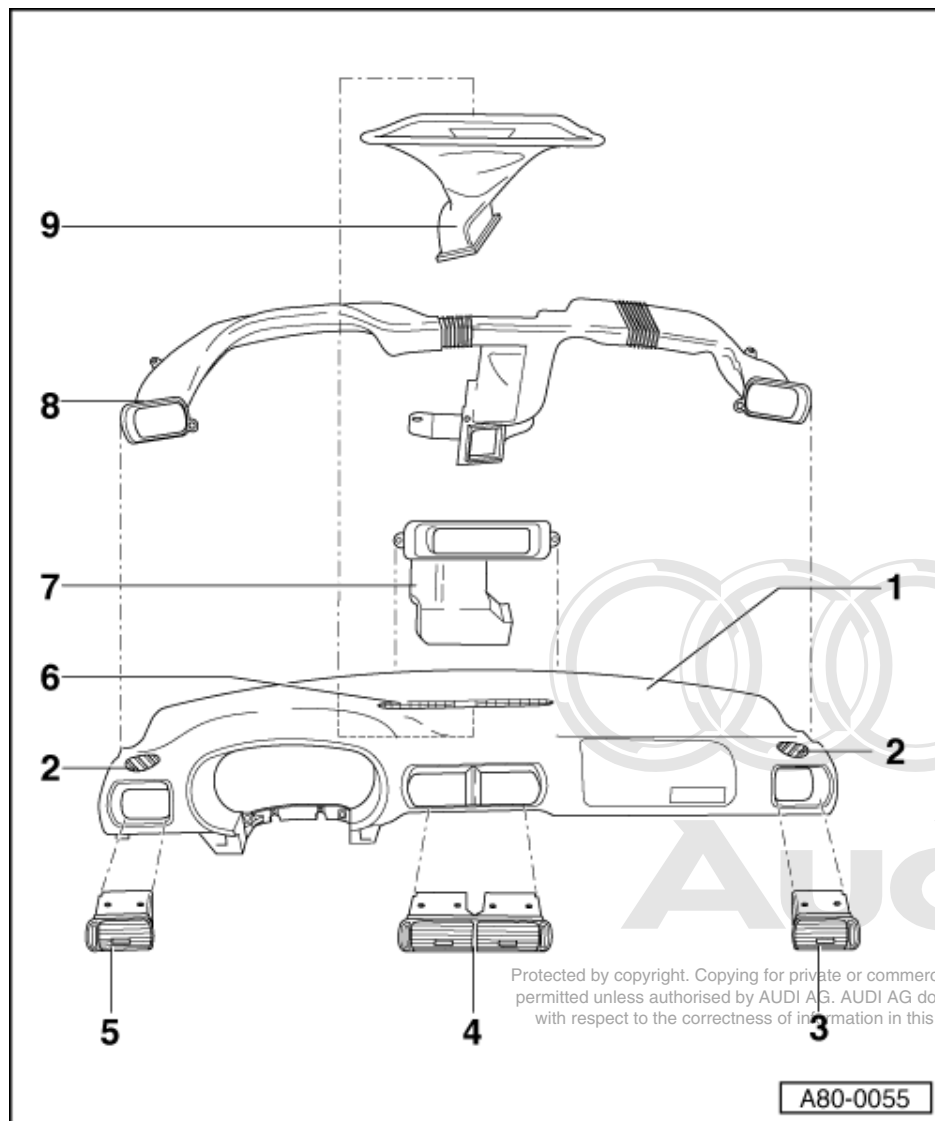
Notes:

- ♦ The current probe may be influenced by stray current which could cause the display to show a low current reading when the rear window heating is switched off.
- ♦ If the ambient temperature is below 0 °C, the rear window heating remains activated until ignition is switched off (can be deactivated manually at any time). If, during the journey, the temperature rises above 0 °C, the rear window heating is deactivated after the operating period stored in -E87 (approx. 10 minutes) has elapsed.
- ♦ If the ambient temperature is above 0 °C, the rear window heating is automatically deactivated by -E87 after the operating period stored within it (approx. 10 minutes) has elapsed.

80 - Heating

1 - Servicing heating

1.1 - Servicing heating



1.2 - Dash panel vents and air ducts

Note:

The passenger compartment is ventilated by 2 venting frames (in the boot, on the left and right in the area of the bumper) =>Page 93.

1 Dash panel fascia



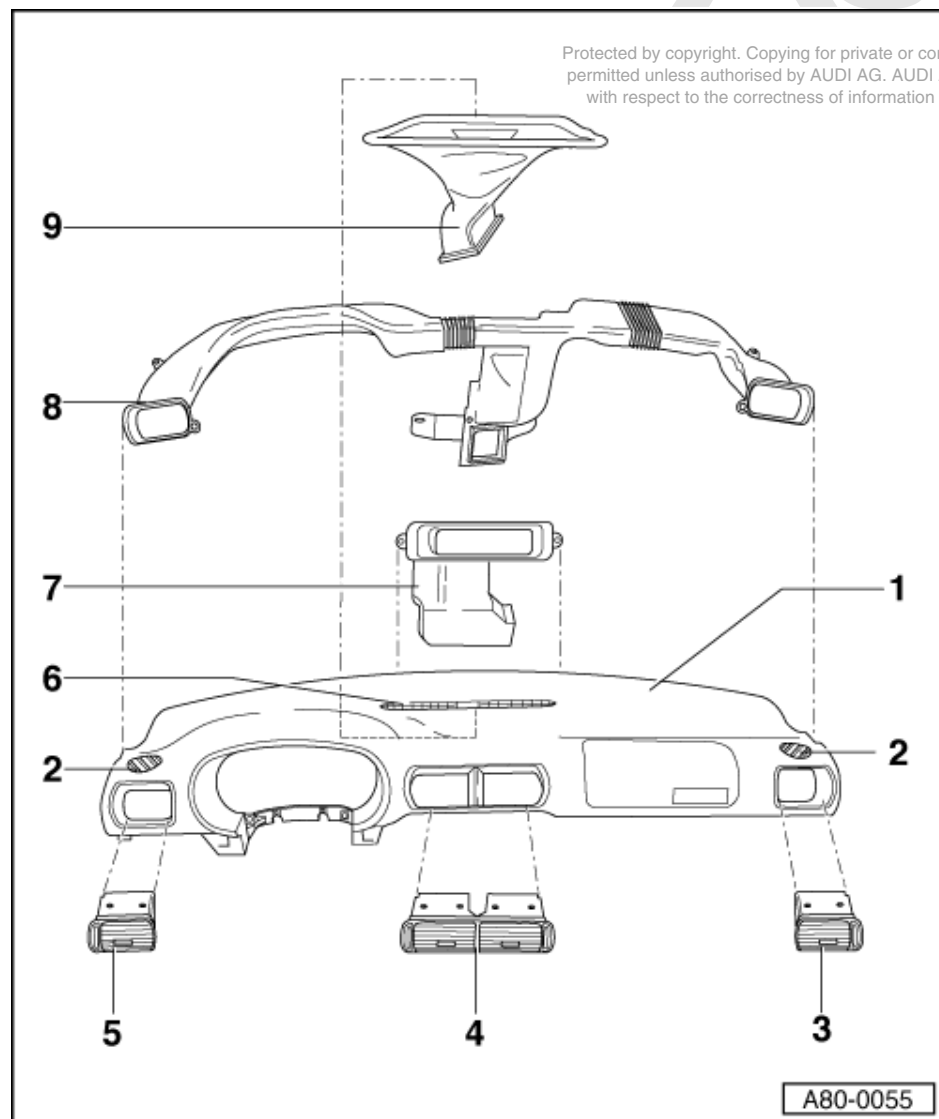
- ♦ Removing and installing.

=> Inner Body Assembly; Repair group 70

2 Defroster vent for "side window"

- ♦ Removing and installing.

=> Inner Body Assembly; Repair group 70



3 Dash panel vent, right

- ♦ Removing and installing =>Page 92 .

4 Centre dash panel vent

- ♦ Removing and installing => Page 91 .

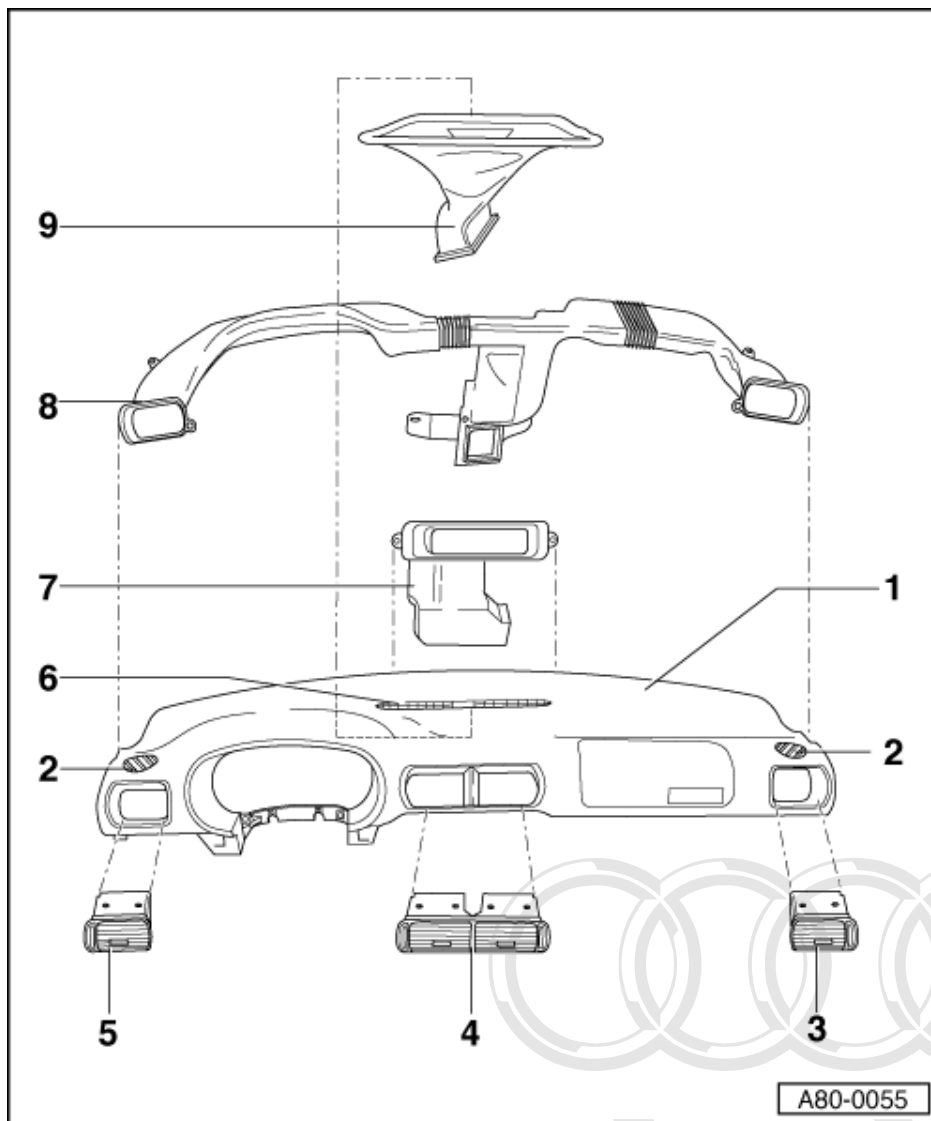
5 Dash panel vent, left

- ♦ Removing and installing => Page 92 .

6 Windscreen defroster vent

- ♦ Removing and installing =>Page 93 .

7 "Centre" dash panel vent air duct



8 "Left and right" dash panel vent air duct

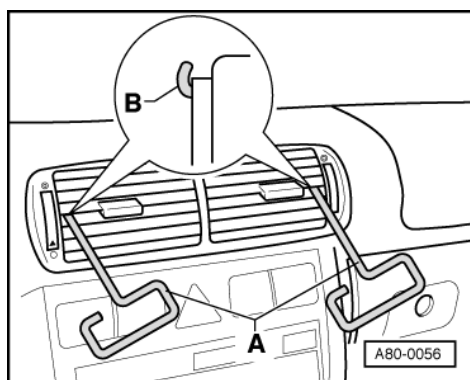
- ♦ Fastened to the dash panel fascia with clamping washers.

9 Air duct to defroster vent

- ♦ Removing and installing =>Page 94

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1.3 - Removing and installing centre dash-panel vents



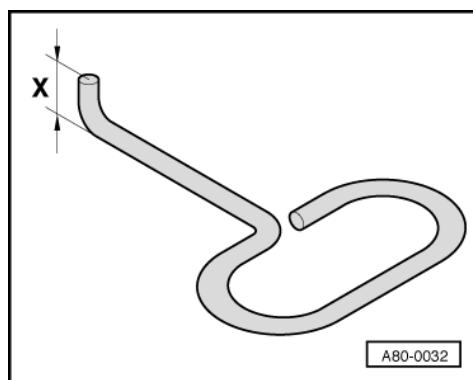


- -> Insert auxiliary tools -A- in dash panel vent and withdraw dash panel vent evenly from dash panel.

Note:

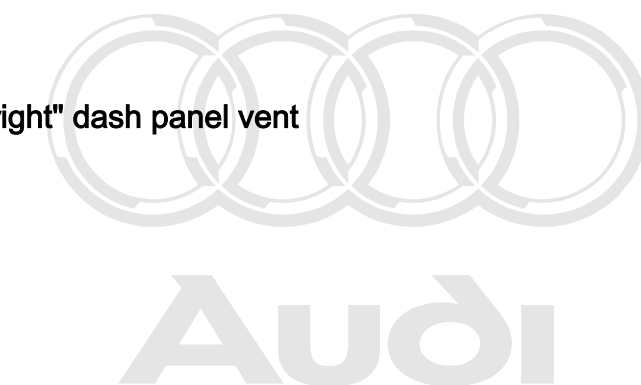
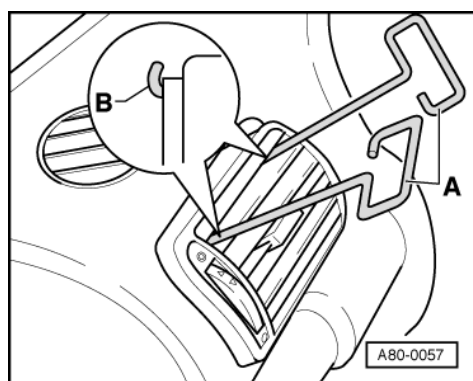
Attach hook -B- of the auxiliary tool to the housing rear to prevent damage to the vent.

1.4 - Making an auxiliary tool for dismantling the dash panel vents



- -> Bend wire (diameter 3 mm) as shown in illustration.
- Dimension x = 6 mm

1.5 - Removing and installing "left" and "right" dash panel vent



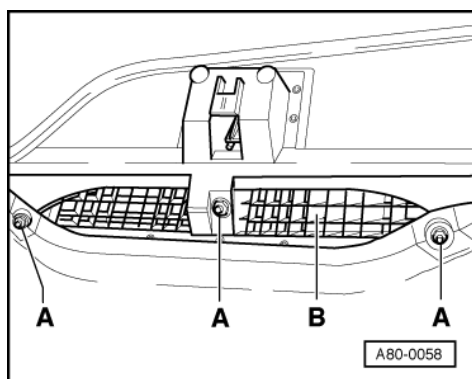
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- -> Insert auxiliary tools -A- in dash panel vent and withdraw dash panel vent from dash panel.

Note:

Attach hook -B- of the auxiliary tool to the housing rear to prevent damage to the vent.

1.6 - Removing and installing windscreen defroster vent

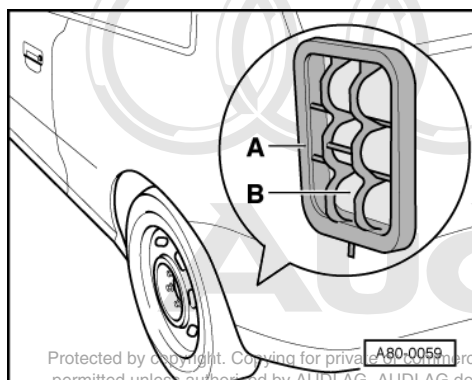


- Remove dash panel fascia.

=> Inner Body Assembly; Repair group 70

- -> Remove speed nuts -A- and detach defroster vent -B- from dash panel fascia.

1.7 - Checking vent frame

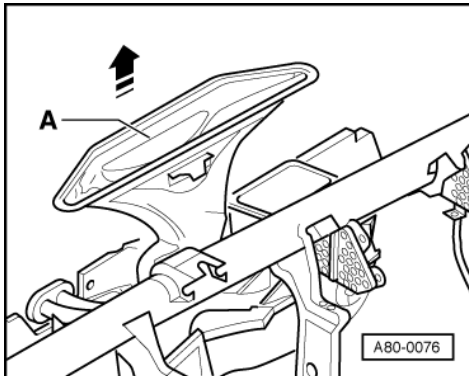


- -> The sealing lips -B- in the vent frame -A- must move freely and close automatically.

Notes:

- ◆ The illustrations show the vent frame after removal of the rear bumper.
- ◆ The vehicle is fitted with two vent frames (left and right) for forced air extraction.
- ◆ In order for the vehicle interior ventilation to work properly, the air ducts which run through the luggage compartment trim must be unobstructed.

1.8 - Removing and installing air duct to defroster vent



- Remove dash panel fascia.

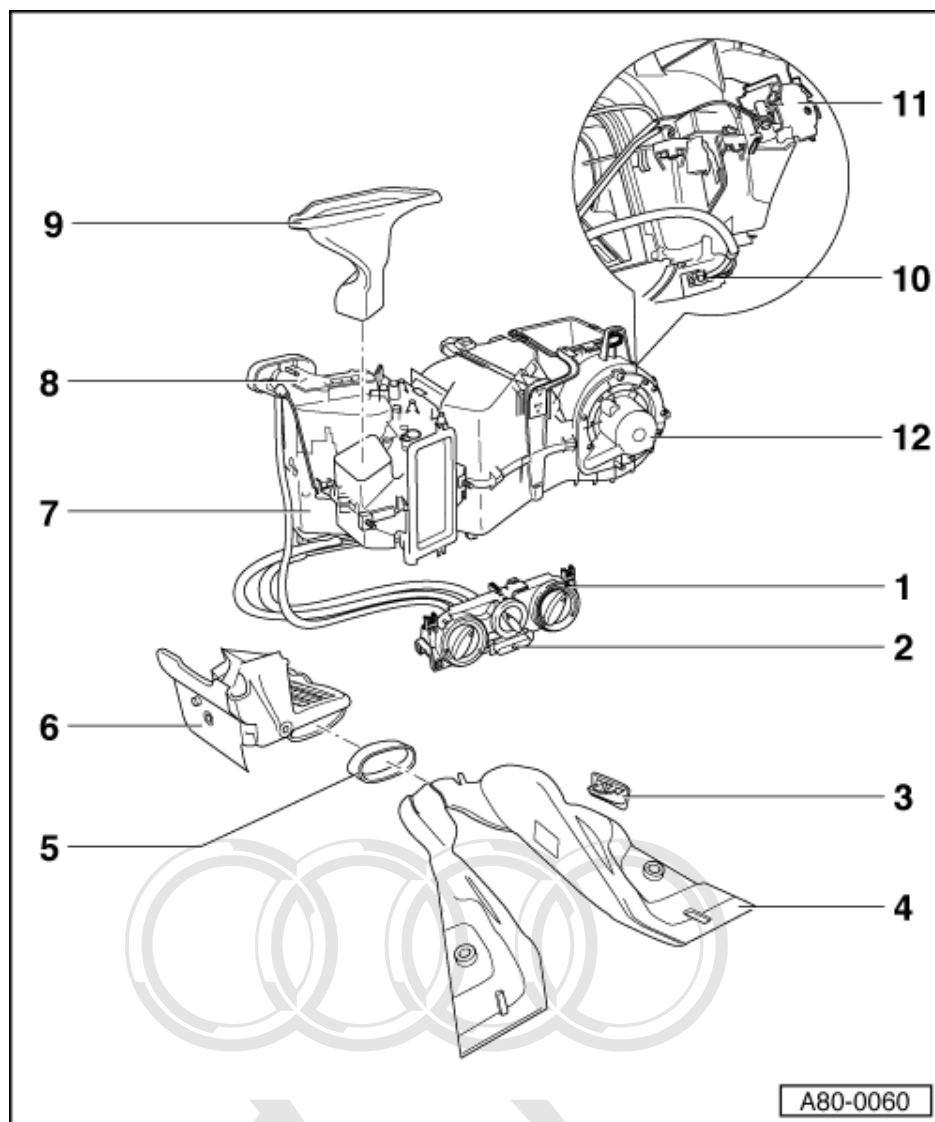
=> Inner Body Assembly; Repair group 70

- -> Draw air duct -A- upwards and remove.



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1.9 - Heating, heater control and air ducts



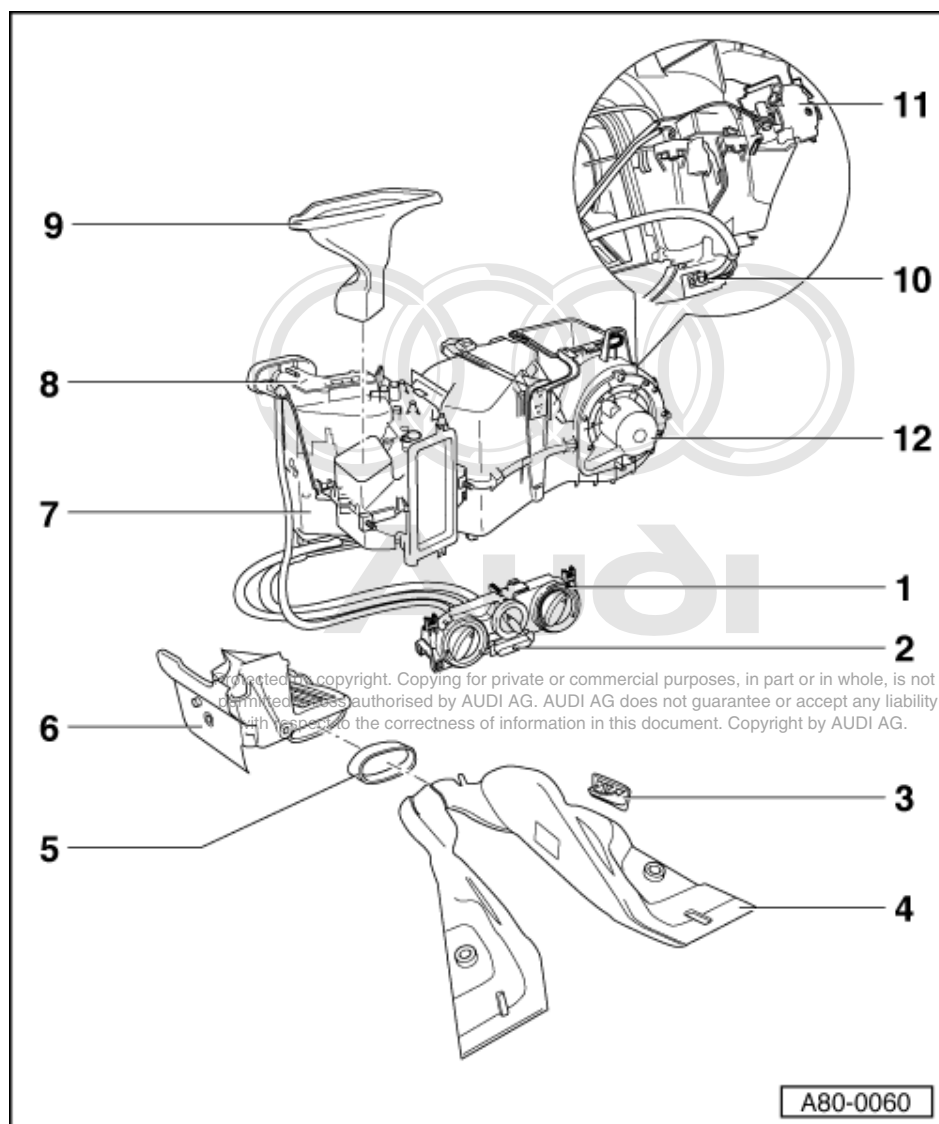
Note:

The fresh air is drawn in through a dust and pollen filter; removing and installing =>Page 113

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1 Heater control

- ♦ Removing and installing =>Page 100 .
- ♦ Disconnect and connect Bowden cables =>Page 104 .
- ♦ Adjust Bowden cables => Page 105 .
- ♦ Connection diagram for Bowden cables =>Page 104 .
- ♦ Replace bulb =>Page 107 .

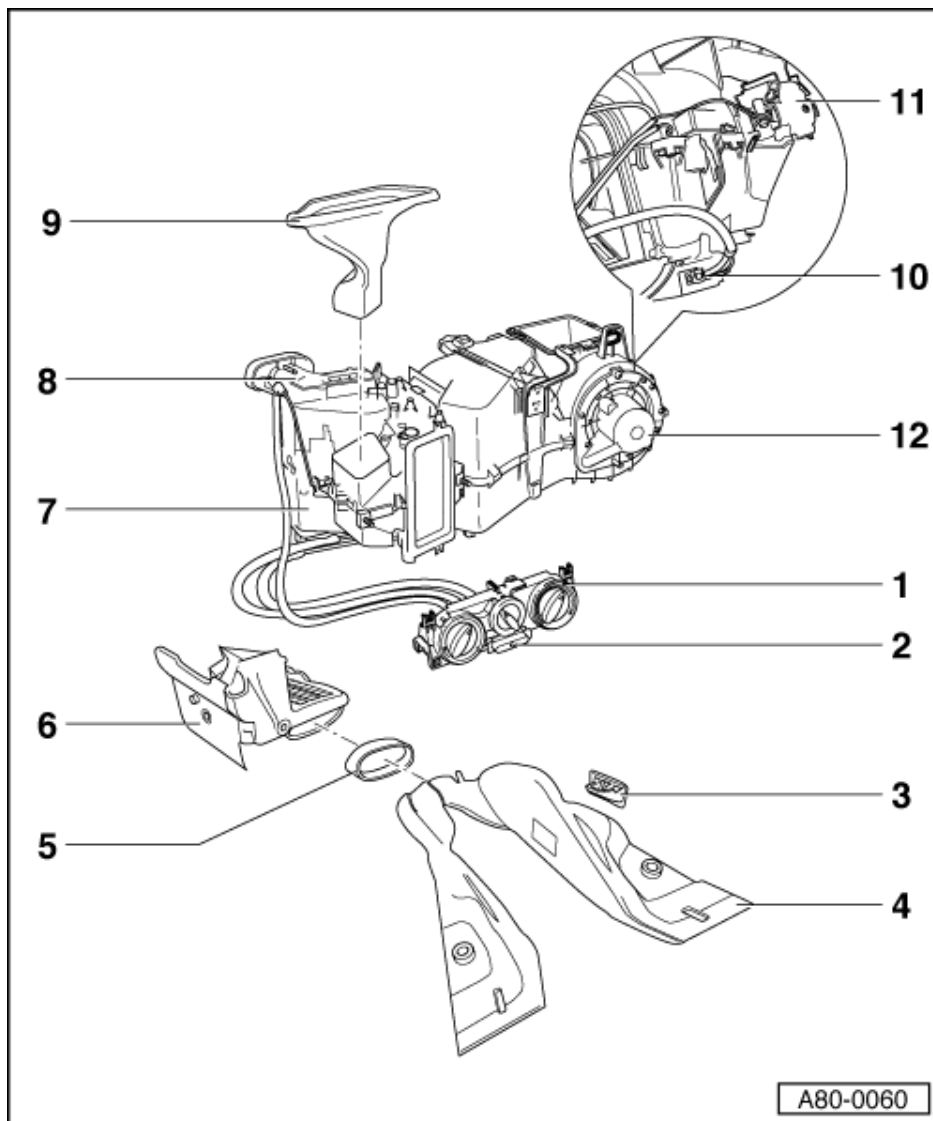


Notes:

- ♦ Different types of the heater controls:

=> Parts List

- For vehicles up to and including model year 2000.
- For vehicles as of model year 2001 (with switch for heated rear window).
- For vehicles without or with map-controlled engine cooling.
- ♦ The illumination of the rotary control is with a bulb in the type which was installed up to and including model year 2000 (at start of production). Later, the lighting was changed to LEDs. These can no longer be replaced.



♦ The following are also installed at the heater control in vehicles with map-controlled cooling:

- Switch -F269 for temperature selection rotary knob
- Potentiometer -G267 for temperature selection rotary knob

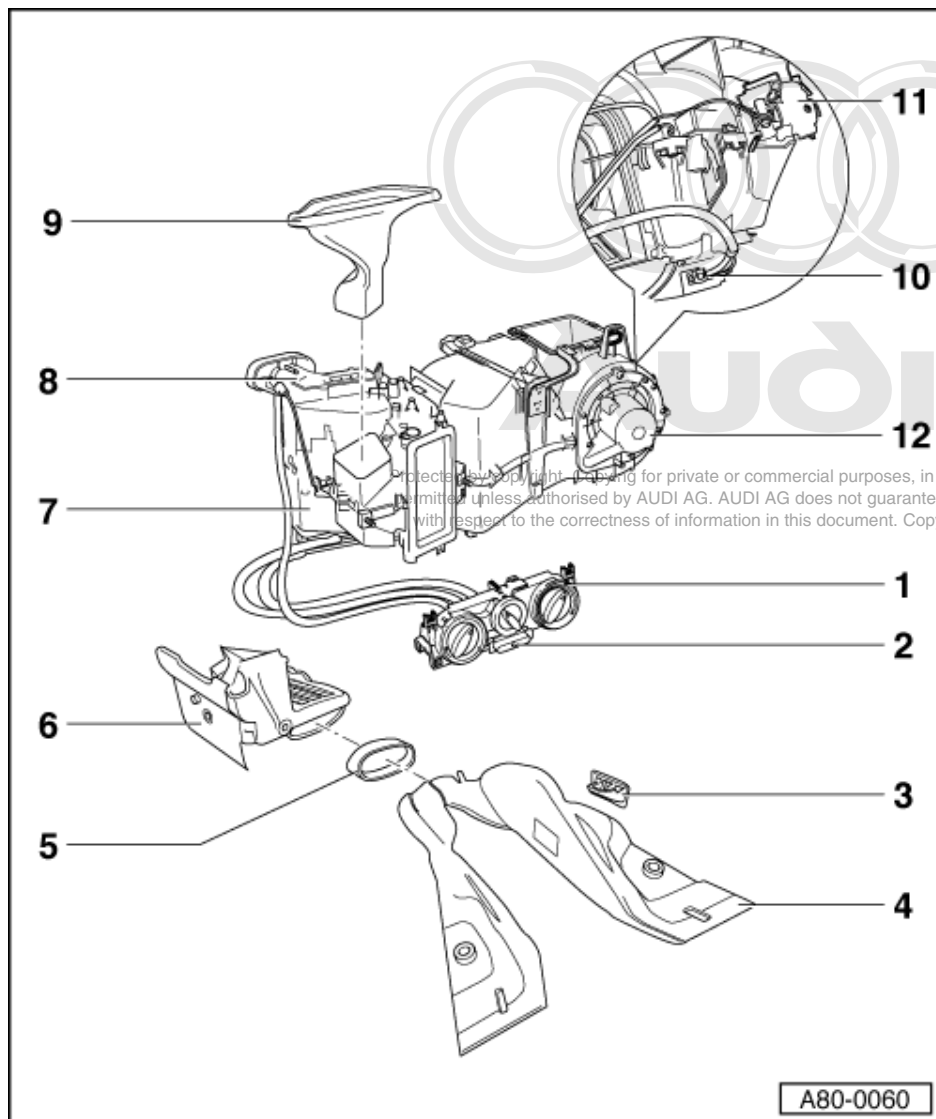
2 Switch for fresh/recirculation air flap -E159 / switch for heated rear window

- ♦ Check switch function for fresh/recirculation air flap =>Page 110
- ♦ Function of switch for heated rear window =>Page 100

Notes:

- ♦ The switch for fresh/recirculation air flap is permanently connected to the heater control.

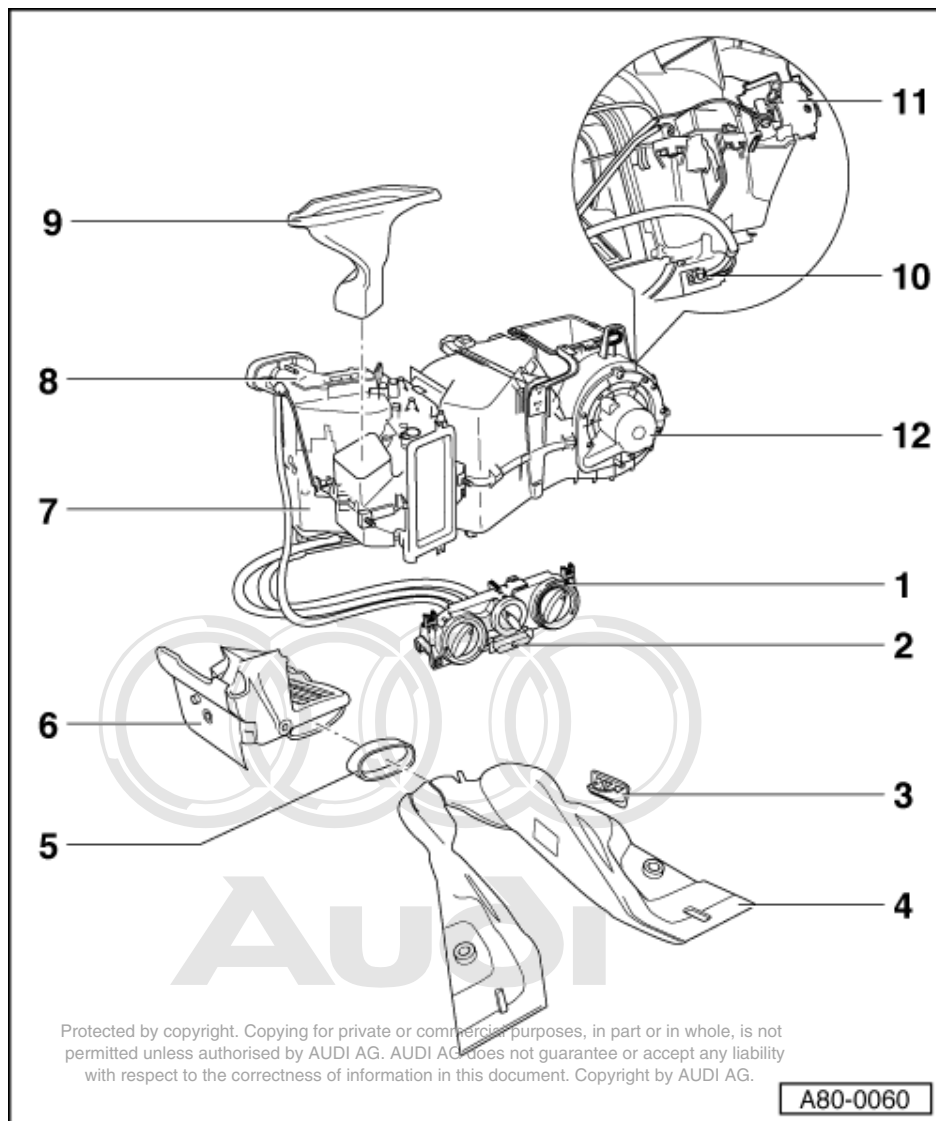
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- ♦ The switch for the heated rear window is permanently connected to the heater controls. It is only present in types which are installed as of model year 2001.
- ♦ In "defrost mode", air recirculation is not possible (air recirculation mode is switched off approx. 15° before the rotary control for air distribution reaches the end stop "air to windscreen").



- 1.9 - Heating, heater control and air ducts 99



8 Heat exchanger

- ♦ Removing and installing =>Page 122 .

9 Air duct to defroster vent

- ♦ Removing and installing =>Page 94 .

10 Series resistor -N24 for fresh air blower

- ♦ Removing and installing =>Page 109 .

11 Positioning motor for fresh/recirculated air flap -V154

- ♦ Check function =>Page 110 .
- ♦ Removing and installing =>Page 109 .

12 Fresh air blower -V2

- ♦ Removing and installing =>Page 108 .

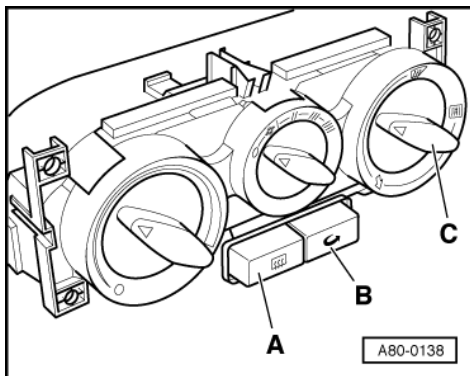
1.10 - Removing and installing heater control

Notes:

- ♦ Different types of the heater controls:

=> Parts List

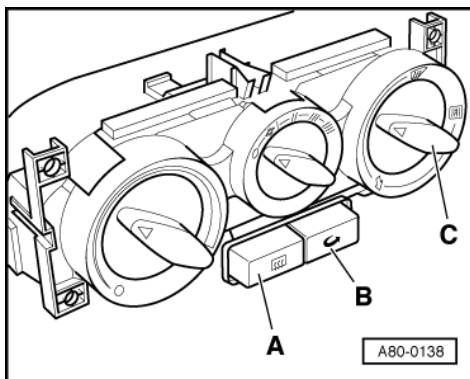
- For vehicles up to and including model year 2000.
 - For vehicles as of model year 2001 (with switch for heated rear window).
 - For vehicles without or with map-controlled engine cooling.
- ♦ The illumination of the rotary control is with a bulb in the type which was installed up to and including model year 2000 (at start of production). Later, the lighting was changed to LEDs. These can no longer be replaced.



- ♦ -> To ensure misted windows are demisted as quickly as possible, recirculated air mode is not possible with "air distribution to windscreen". The control unit switches off the air recirculation mode approx. 15° before the rotary switch for air distribution -C- reaches its final position (air to windscreen) and the switch-on telltale in switch -B- goes out. If the rotary switch is turned back again, the heating remains in fresh air mode (this applies to all heater control designs).
- ♦ The rotary switches and switches on the heater control are illuminated via terminals 58s and 58d.

=> Current Flow Diagrams, Electrical Fault-Finding and Fitting Locations

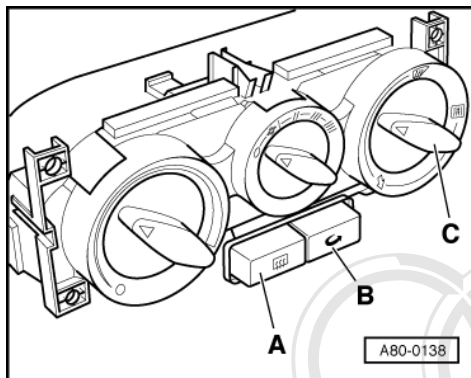
Notes on the type which are installed into vehicles as of model year 2001:



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- ♦ -> In vehicles as of model year 2001 a heater control is installed in which the switch for the heated rear window -A- is installed.
- Note the following:
- In these vehicles, the heated rear window is switched on via a relay which is controlled by the control unit installed in the heater control.

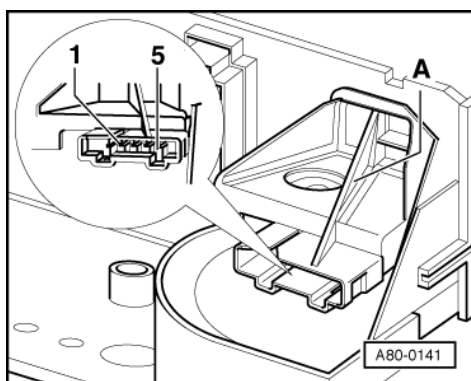
=> Current Flow Diagrams, Electrical Fault-Finding and Fitting Locations



- > The control unit switches off the heated rear window after a heating period of approx. 15 minutes and the switch-on telltale in switch -A- goes out.
- If the voltage on the control unit for the heated rear window falls below 9V, the heated rear window remains switched off until it is above 10 V again.
- When the heated rear window is switched on, the telltale in switch -A- is lit.
- When the air recirculation mode is selected, the telltale in switch -B- is lit.
- The control unit for the heated rear window and fresh-air/recirculated air switchover and the lamps (LEDs = light emitting diodes) for illuminating the switches and rotary switches may not be replaced individually.
- If the ignition is switched off and then back on again, the heated rear window remains switched off and the heating changes to or remains in fresh air mode.

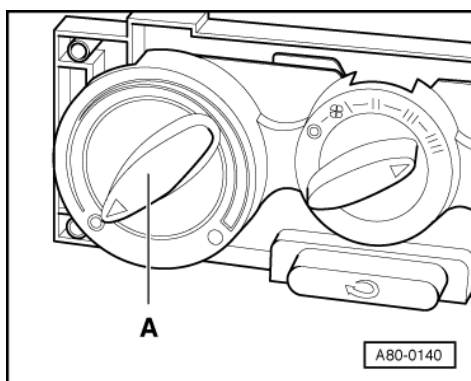
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Notes for vehicles with map-controlled cooling



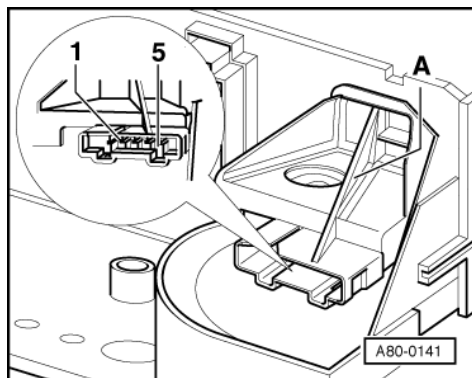
- ♦ -> A heater control with an additional electrical component -A- is installed in vehicles with map-controlled cooling. Switch -F269 for temperature selection rotary knob and potentiometer -G267 for temperature selection rotary knob are installed in this component (potentiometer = variable resistance).

=> Parts List



- ♦ -> Two-way valve -N147 is actuated via switch -F269 (contacts 1 and 2) if rotary temperature switch -A- is at "cold" stop. This then switches vacuum through to refrigerant shut-off valve and the refrigerant shut-off valve shuts off the flow of refrigerant through the heat exchanger in heater.

- ♦ The resistance of potentiometer -G267 is approx. 1000 ohms between contacts 3 and 5 and between 100 and 900 ohms between contacts 4 and 3 / 5 (depending on rotary switch setting).



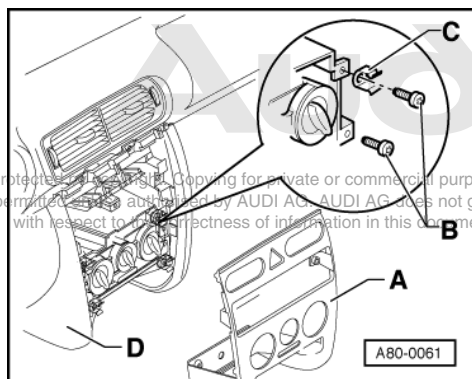
- ♦ -> The rotary switch setting is transmitted to the engine control unit via potentiometer -G267 (contacts 3, 4 and 5). This setting affects the characteristic curve in the engine control unit for actuation of the thermostat -F265 for map-controlled cooling (e.g. if the engine is running at part throttle, the refrigerant temperature is controlled such that the temperature of the air emanating from the vents when the heater is in operation (rotary temperature switch set to heat) does not exceed that in vehicles without map-controlled cooling).
- A refrigerant thermostat is installed in vehicles with map-controlled cooling; an additional electrical actuator is integrated in this thermostat. This actuator (thermostat -F265 for map-controlled engine cooling) is actuated by the engine control unit according to the current engine load and the rotary temperature switch setting.

=> Relevant Workshop Manual Injection and Ignition system

=> Relevant Workshop Manual Automatic Gearbox, Repair group 13

- Actuation of thermostat -F265 alters the refrigerant temperature (the refrigerant thermostat opens at a higher temperature when the engine is running at part throttle in comparison to full engine throttle).

Removing



- Remove radio.

=> Electrical System; Repair group 91; Repairing radio; Removing and installing radio Repairing radio Removing and installing radio

- Remove panel for dash panel centre section -A-.

=> General Body Repairs Interior; Repair group 68; Shelves and trays/covers; Removing and installing front part of centre console Shelves and trays/covers Removing and installing front part of centre console

- -> Remove screws -B-.
- Removing centre section of dash panel:

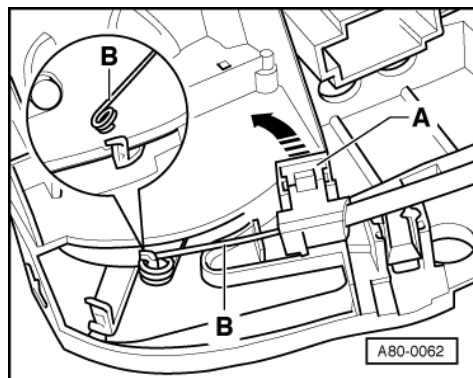
=> General Body Repairs Interior; Repair group 68; Shelves and trays/covers; Removing and installing front part of centre console Shelves and trays/covers Removing and installing front part of centre console

Installing

Installation is carried out in the reverse order, when doing this note the following:

- When installing, ensure that the spring clips -C- are in the correct position.

1.11 - Detaching and fitting Bowden cables from/on heater control



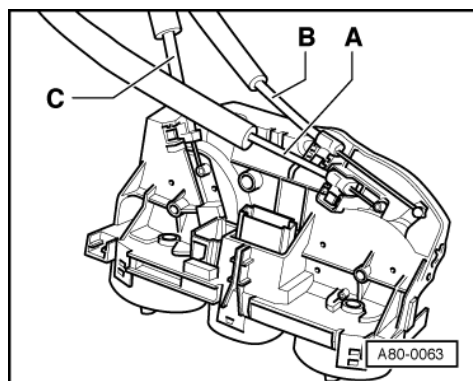
- Remove heater control.
- -> Unclip Bowden cable support bracket -A-.
- Detach Bowden cable.

Notes:

- ♦ Check the Bowden cables before fitting, replace stiff or damaged Bowden cables
- ♦ Attach wire core -B- the correct way round (end of coil positioned below).

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1.12 - Connection diagram for Bowden cables to the heater control



Note:

Colours in brackets apply to right-hand drive vehicles.

- -> Bowden cable -A- to footwell/defrost flap.

Colour: Green (black).

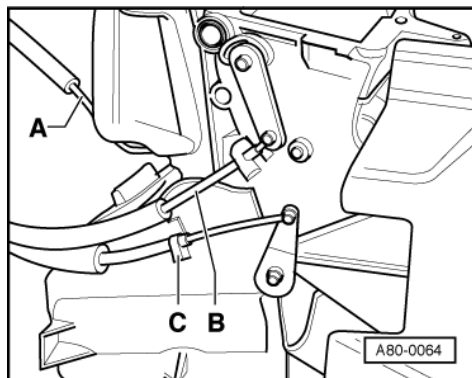
- Bowden cable -B- to central flap.

Colour: Yellow (grey).

- Bowden cable -C- for temperature flap.

Colour: Brown (white).

1.13 - Connection diagram for Bowden cables on the heater control



Notes:

- ◆ When assembling, secure the Bowden cables with cable ties and clips so that they cannot come into contact with moving parts.
- ◆ Colours in brackets apply to right-hand drive vehicles.

- -> Bowden cable -A- to footwell/defrost flap.

Colour: Green (black).

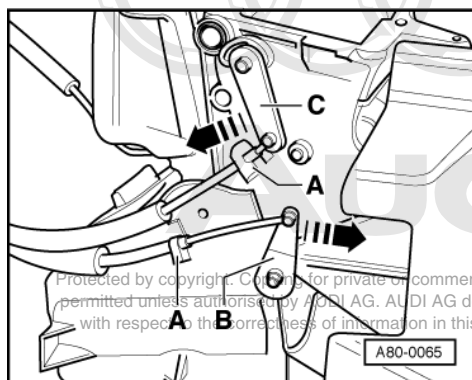
- Bowden cable -B- to central flap.

Colour: Yellow (grey).

- Bowden cable -C- for temperature flap.

Colour: Brown (white).

1.14 - Removing, installing and adjusting Bowden cables from/on the heater control



Remove Bowden cables

- Remove footwell vent =>Page 112
- -> Lever off securing clip -A-.

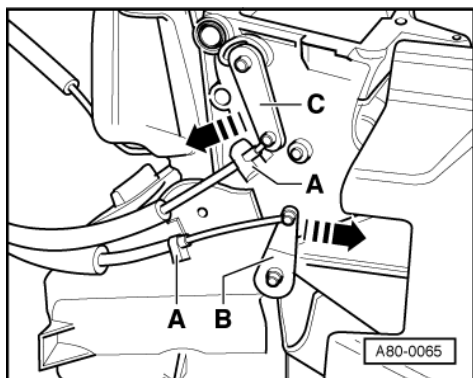
- Carefully detach Bowden cable from lever arm.

Notes:

- ♦ Check the Bowden cables before fitting, replace stiff or damaged Bowden cables
- ♦ After installing the Bowden cables, turn the rotary control from end stop to end stop (both stops must be reached).

Install and adjust Bowden cable on temperature flap

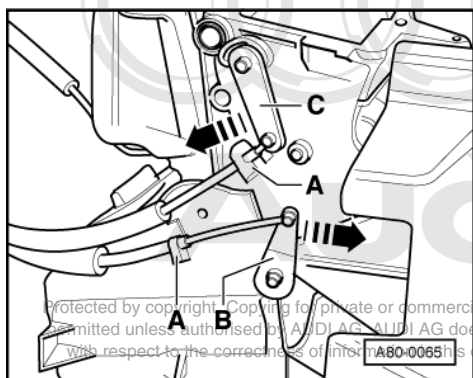
- Turn rotary control for temperature flap to maximum setting for "cold".



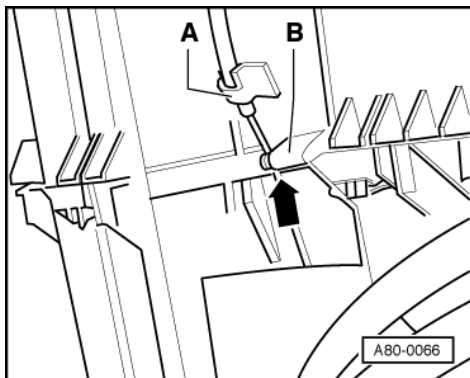
- -> Connect Bowden cable to lever arm for temperature flap -B-.
- Push down slightly on lever arm -B- for temperature flap in direction of arrow.
- Secure Bowden cable sheath with clip -A-.
- Turn the rotary control for temperature flap from end stop to end stop (both stops must be reached).

Install and adjust Bowden cable on central flap and footwell/defroster flap

- Turn rotary control for air distribution to end stop in the "Air to windscreen" position.



- -> Connect Bowden cable to lever arm for central flap -C-.
- Push down slightly on lever arm -C- for central flap in direction of arrow.
- Secure Bowden cable sheath with clip -A-.
- Turn the rotary control for air distribution from end stop to end stop (both stops must be reached).

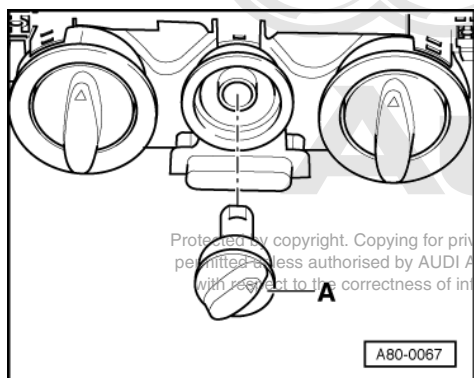


- Turn rotary control for air distribution to end stop in the "Air to windscreen" position.
- -> Connect Bowden cable to lever arm for footwell-/defrost flap -B-.
- Push down slightly on lever arm -B- for footwell/defroster flap in direction of arrow.
- Secure Bowden cable sheath with clip -A-.
- Turn the rotary control for air distribution from end stop to end stop (both stops must be reached).

1.15 - Replacing the bulb for heater control

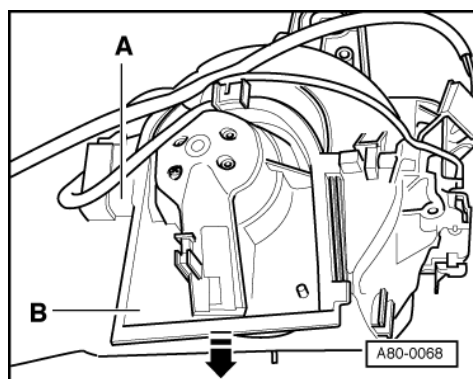
Notes:

- ◆ To avoid damaging the knob on the rotary control, place a thick cloth, for example, between the knob and the jaws of the pliers, or use pliers with plastic or rubber jaws.



- ◆ The illumination of the rotary control is with a bulb in the type which was installed up to and including model year 2000 (at start of production). Later, the lighting was changed to LEDs. These can no longer be replaced.
- -> Detach rotary knob -A- from rotary switch for fresh air blower using pliers.
- Use, for example, nose pliers or puller for lamps to remove bulb from socket.

1.16 - Removing and installing fresh air blower -V2

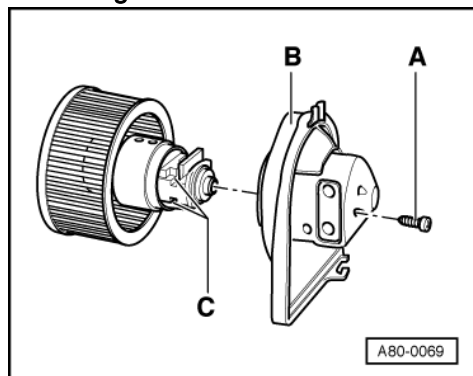


- Remove glove compartment.

=> Inner Body Assembly; Repair group 68

- Remove series resistor -N24 => Page 109 .
- -> Disconnect connector -A- from fresh air blower.
- Pull fresh air blower -B- downwards out of heater.

Detaching fresh air blower -V2 from base plate

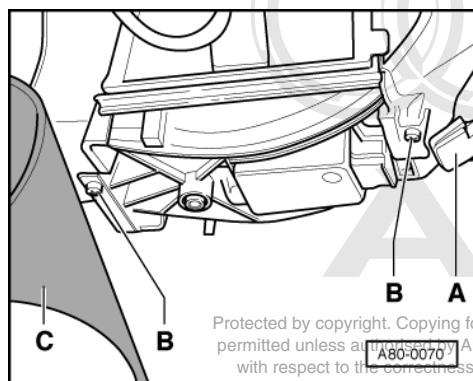


- -> Remove bolt -A-.
- Pull fresh air blower out of base plate -B-.

Notes:

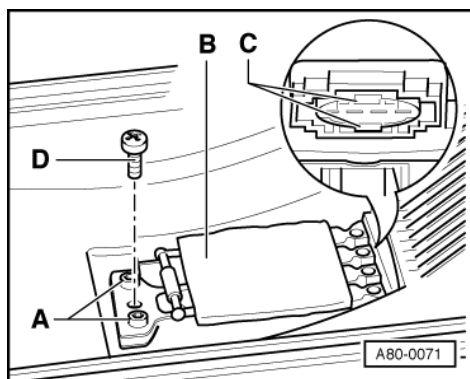
- ♦ A soundproofing mat can be attached to base plate -B- for noise insulation.
- ♦ When installing the fresh air blower in the base plate, ensure that connectors -C- are correctly positioned.
- ♦ Following installation, ensure that the fresh air blower is properly positioned in the heater.

1.17 - Removing and installing series resistor -N24 for fresh air blower



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- Remove bolt clip for foam cover.
- Fold foam cover -C- to one side.
- -> Disconnect connector -A- from series resistor.
- Remove screws -B- and remove resistor holder.



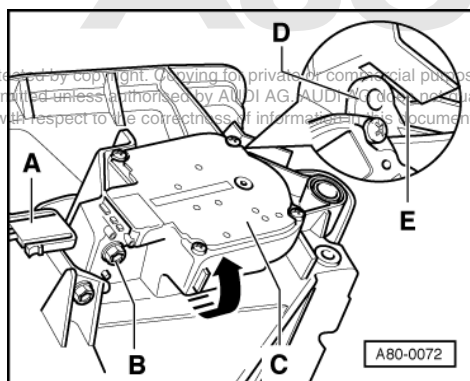
Removing the series resistor from its holder

- -> Drill off or detach securing elements -A-.
- Push back catches -C-.
- Remove series resistor -B-.

Note:

When installing, fasten series resistor with self-tapping screw -D- 3.2 x 10 mm.

1.18 - Removing and installing positioning motor for fresh/recirculated air flap -V154



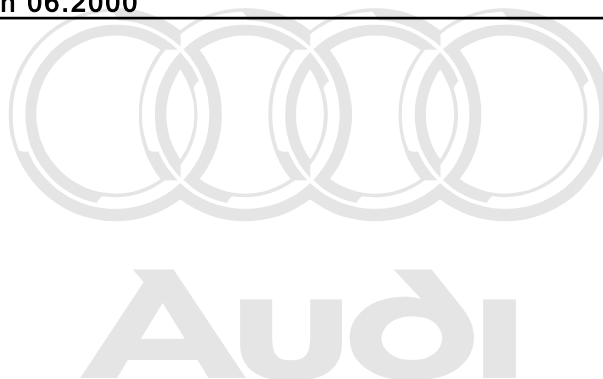
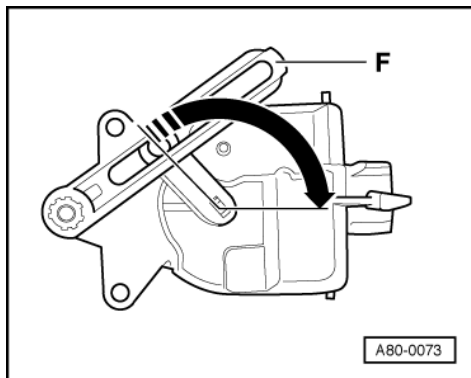
- Remove glove compartment.

=> Inner Body Assembly; Repair group 68

- -> Detach connector -A-.
- Remove bolt -B-.
- Remove positioning motor in direction of arrow.

Installation notes:

- ◆ When inserting the positioning motor, ensure that the bracket -D- is correctly positioned in slot -E-.



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- ♦ -> If the positioning motor is in an awkward position for installation, attach connector -A-, switch on ignition and set lever arm -F- on positioning motor to centre position by actuating the fresh/recirculated air flap switch.

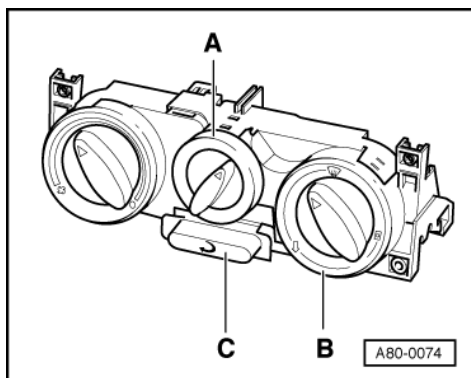
1.19 - Checking the function of the positioning motor for fresh/recirculated air flap -V154 and switch -E159

Notes:

- ♦ To ensure that misted windows are de-misted as soon as possible, air recirculation mode will not operate with "air to windscreen". (Switch -E159 is released mechanically via the rotary control).
- ♦ In air recirculation mode, the windows may become misty (the air humidity inside the vehicle increases and moisture condenses on the windows - the air is not dried as it is in vehicles with air conditioners).
- ♦ Different types of the heater controls:

=> Parts List

- For vehicles up to and including model year 2000 (only with switch -E159).
 - For vehicles as of model year 2001 (with switch -E159 and with switch for heated rear window).
- ♦ Function of switch for heated rear window =>Page 100



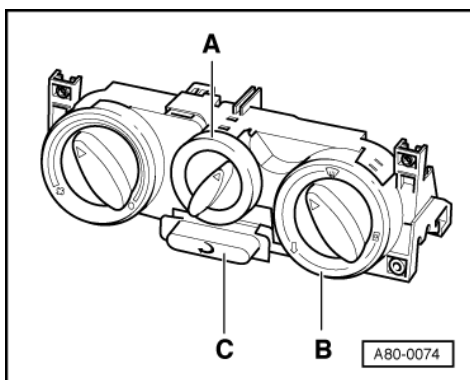
Check function of switch -E159 and positioning motor -V154

- Switch on ignition.
- -> Set rotary switch -A- for fresh air blower -V2 to speed 3.
- Turn rotary control -B- for air distribution to the "Air to dash panel vents" position.
- Do not activate switch -C- for fresh/recirculation air flap -E159 (key with arrow; the illustration shows the type which were installed up to and including model year 2000).

Air is drawn in through the dust and pollen filter (fresh air mode - telltale in switch does not illuminate).

- Actuate switch -C- (air recirculation mode - telltale in switch illuminates).

Air is drawn out of the passenger's footwell area (air recirculation mode).



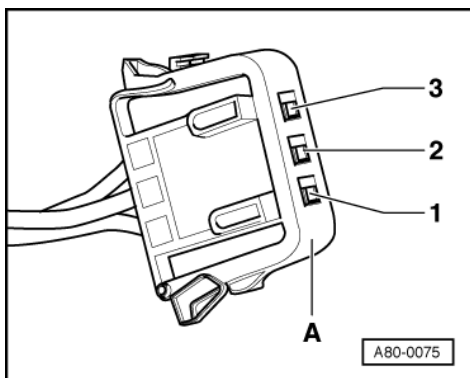
- -> Turn rotary control -B- for air distribution to end stop in the "Air to windscreen" position.

Telltale in switch -C- extinguishes, fresh/recirculated air flap moves to the "fresh air mode" position (-E159 is released via rotary control -B-).

Notes:

- ♦ If the function is OK, but the windows mist up:
 - Check dust and pollen filter for dirt =>Page 113
 - Check forced air extraction =>Page 93
 - Check passenger compartment for the ingress of water.
- ♦ If the function is NOK, check switch -E159.

Check function of switch -E159



- Remove glove compartment.

=> Inner Body Assembly; Repair group 68

- -> Detach connector -A- from positioning motor for fresh/recirculation air flap -V154.
- Switch ignition on.
- Turn rotary control for air distribution to the "Air to dash panel vents" position.
- Switch -E159 is not actuated (not pressed).

Fresh air mode - telltale does not illuminate in switch.

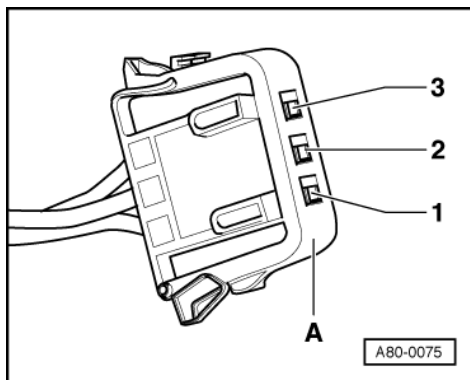
- Activate voltage tester V.A.G 1527 between contact 1 and 3 at connector -A- (between contact 2 and 3 in RHD vehicles).

Telltale in voltage tester illuminates.

- Actuate switch -E159 (press).

Air recirculation mode - telltale illuminates in switch.

Telltale in voltage tester extinguishes.



- -> Activate voltage tester between contacts 2 and 3 on connector A (between contacts 1 and 3 for RHD vehicles).

Telltale in voltage tester illuminates.

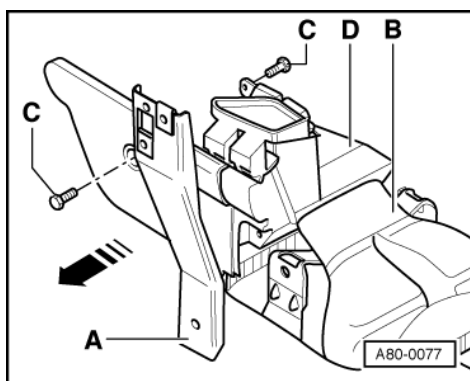
- Turn rotary control for air distribution to end stop in the "Air to windscreen" position.

Telltale in switch and in voltage tester extinguishes.

Notes:

- ♦ If no faults are determined during this test:
 - Check the freedom of movement of the fresh/recirculated air flap.
 - Replace positioning motor -V154.
- ♦ If the function is NOK:
 - Check the wiring between -E159 and -V154 for open circuit or short circuit.
 - Check the power supply and earth connection to switch -E159.
 - Replace heater control.

1.20 - Removing and installing footwell vent

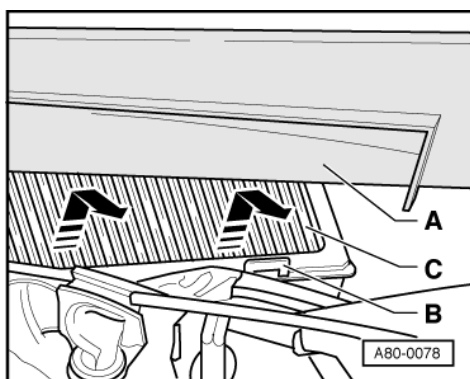


- -> Remove driver's storage compartment and tunnel brace -A-.

=> Inner Body Assembly; Repair group 68

- Remove connection pieces between footwell vent and rear heating duct -B-.
- Remove bolts -C-.
- Remove footwell vent -D- in direction of driver's footwell (arrow).

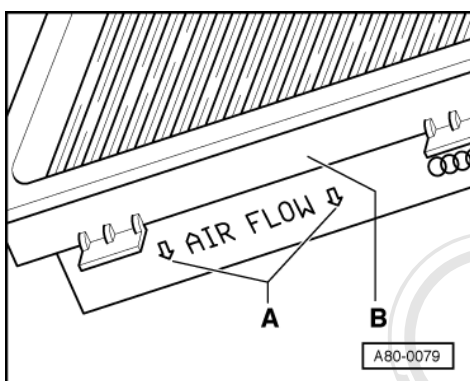
1.21 - Removing and installing dust and pollen filter



- -> Fold up movable section -A- of the plenum chamber cover.
- Push back lugs -B-.
- Remove the dust and pollen filter element from its housing.

Notes:

- ♦ To prevent water from entering the dust and pollen filter or the heater, ensure that the plenum chamber cover and cowl panel trim are fitted correctly.



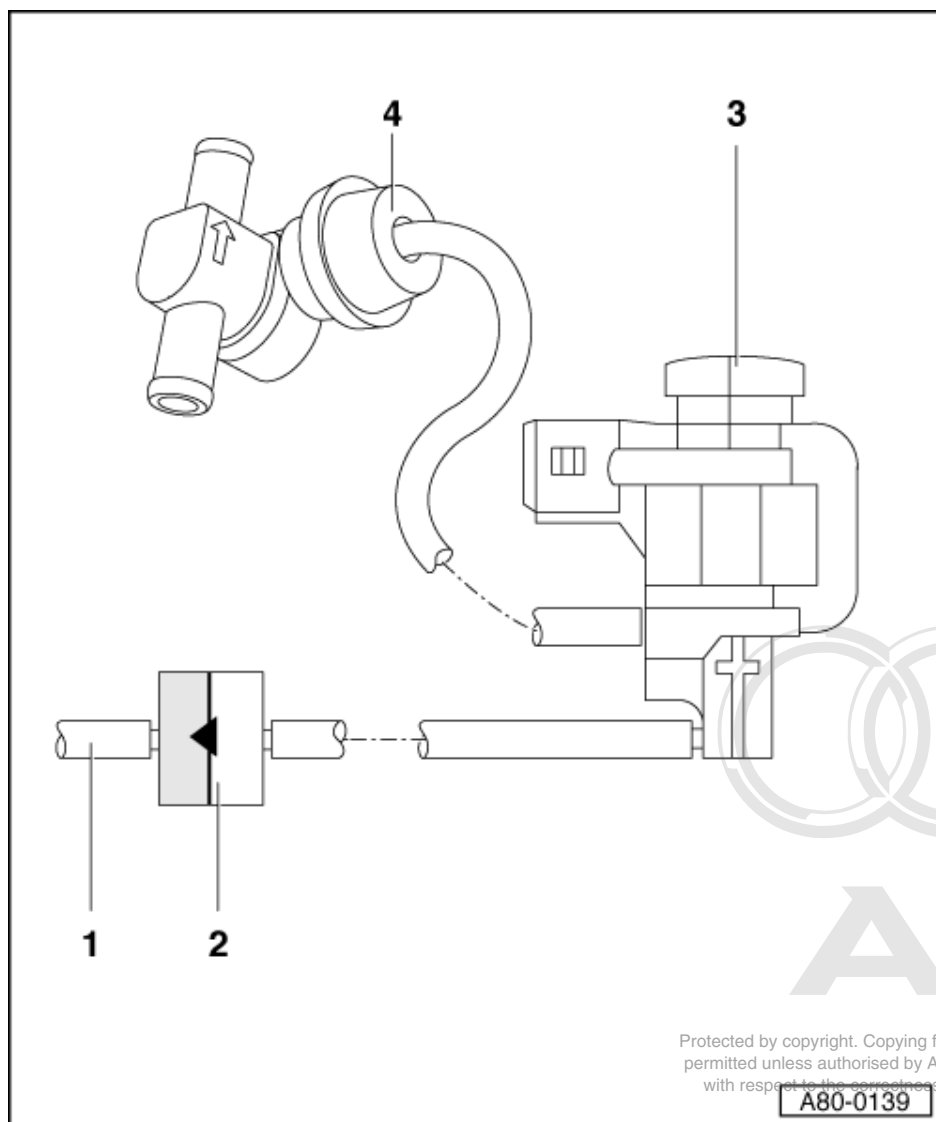
- ♦ The movable section -A- of the plenum chamber cover must not rest on the dust and pollen filter.
- ♦ The dust and pollen filter element should be renewed at regular intervals.

=> Maintenance manual

- ♦ -> The dust and pollen filter must be installed correctly in mounting frame -B-; the arrows -A- printed on the filter indicate the direction of airflow through the filter.

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1.22 - Connection diagram for vacuum hoses for actuating the refrigerant shut-off valve



Note:

The refrigerant shut-off valve is only installed in vehicles with map-controlled cooling.

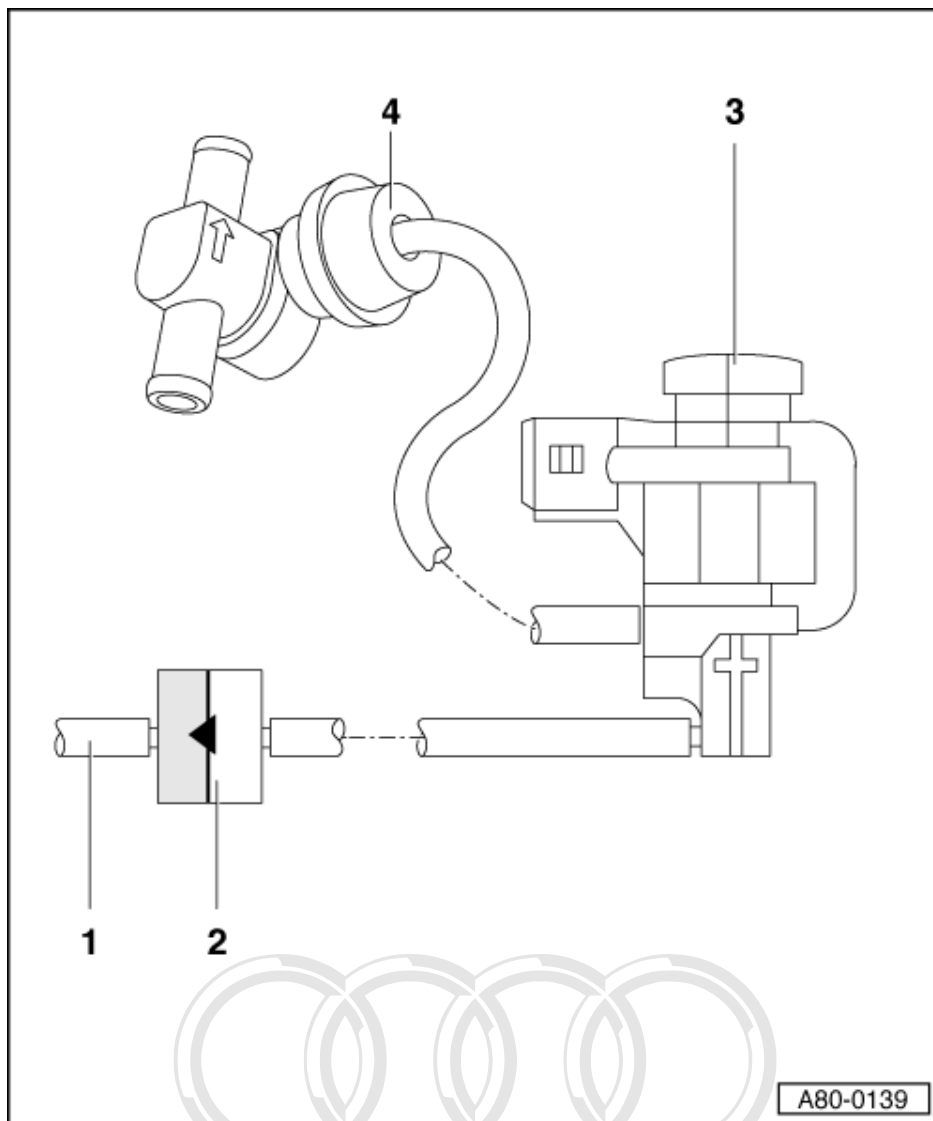
1 Vacuum hose

- ♦ To vacuum connection on engine

=> Relevant Workshop Manual Engine Mechanical Components

2 Non-return valve

- ♦ Arrow on vacuum valve points towards engine



3 Two-way valve for refrigerant shut-off valve -N147

- ♦ An additional switch for rotary temperature selection knob -F269 is attached to the heater control; this switch actuates -N147.
- ♦ The two-way valve -N147 is installed on the left-hand side of the engine compartment (as viewed in direction of travel) above the master brake cylinder.

4 Refrigerant shut-off valve

- ♦ Ensure refrigerant flows in correct direction (arrow).
- ♦ The refrigerant shut-off valve is installed in the refrigerant hose between the engine and heat exchanger in heater (refrigerant feed).

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1.23 - Notes on heater in vehicles with map-controlled heating

In vehicles and map-controlled cooling (gradual introduction first in vehicles with 1.6 litre engine as of model year 1999):

- A modified heater control with an additional switch -F269 for rotary temperature selection knob and a potentiometer -G267 for rotary temperature selection knob will be installed.

=> Parts List

- A two-way valve for refrigerant shut-off valve -N147 is also fitted (it actuates the refrigerant shut-off valve via vacuum; the refrigerant shut-off valve is installed in the refrigerant hose between the engine and the heat exchanger in heater).

=> Parts List

Notes:

- ♦ The two-way valve -N147 is actuated by the switch -F269 installed in the heater control to ensure that the flow of refrigerant through the heat exchanger is shut off if the setting "no heating" is activated (rotary temperature switch at "cold" stop).
- ♦ The engine control unit detects the setting of the rotary temperature switch via the potentiometer -G267 installed in the heater control. The rotary temperature switch setting is taken into account by the engine control unit when controlling the refrigerant temperature (via actuation of the thermostat -F265 for map-controlled engine cooling).

=> Relevant Workshop Manual Injection and Ignition system

- A different heat exchanger is installed in the heater (the heat exchanger is calibrated to the higher refrigerant temperature).

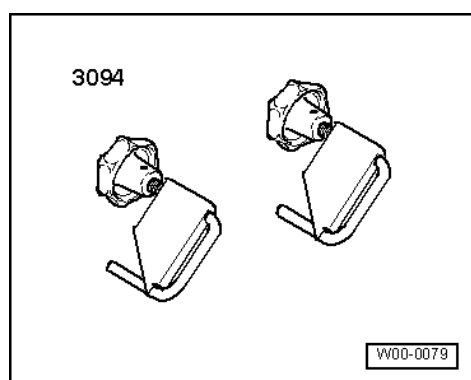
=> Parts List

- The installation of the heat exchanger in the refrigerant circuit has been modified (feed and return lines have been interchanged).

2 - Tools

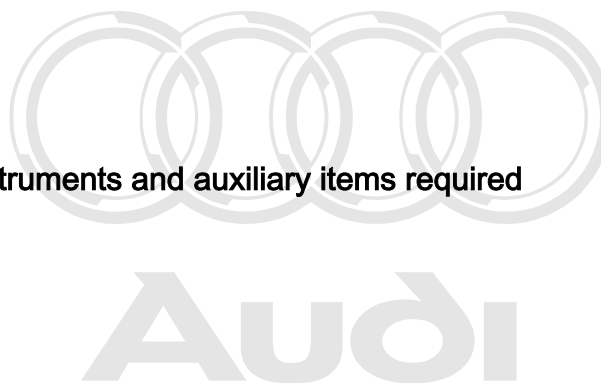
2.1 - Tools

2.2 - Special tools, testers, measuring instruments and auxiliary items required

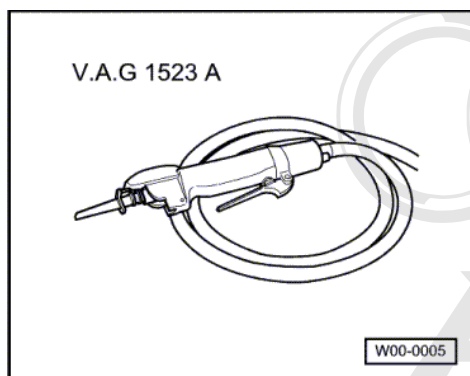


- ♦ -> Special tool 3094

To remove heater



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- ♦ -> Body saw V.A.G.1523 A

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To remove heater

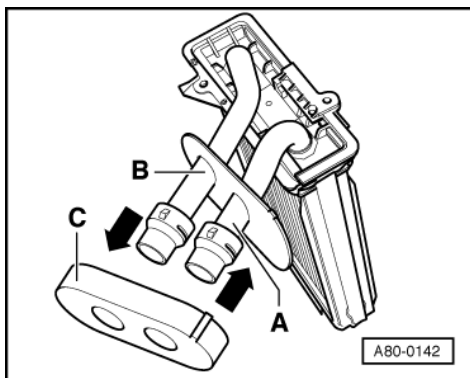
3 - Removing and installing heater

3.1 - Removing and installing heater

- Remove dust and pollen filter =>Page 113 .
- Disconnect battery.

Notes:

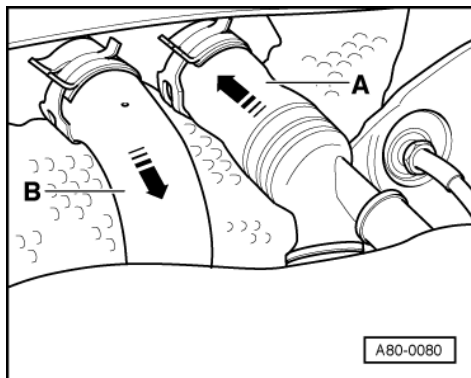
- ♦ If necessary, obtain radio code before disconnecting battery.
- ♦ In vehicles with electrically adjustable seats, move the seats back as far as possible before disconnecting the battery.
- ♦ A heat exchanger has been installed in vehicles with map-controlled cooling (to be introduced gradually as of model year 1999 vehicles with 1.6 l engine) which has been adapted to the different usage conditions. The following must be noted for this heat exchanger:



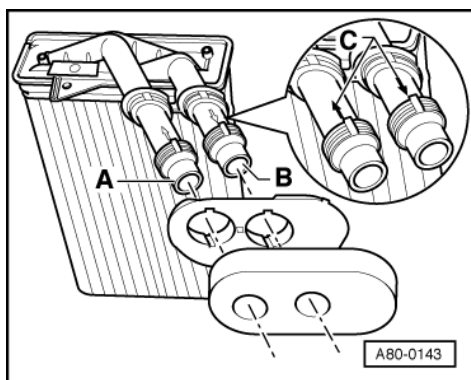
- -> The flow direction of the refrigerant in the heat exchanger is not marked at the refrigerant connections (observe feed and return flow).
- The heat exchanger can be recognised when installed by the metal refrigerant pipes (as opposed to plastic pipes as in other versions).
- Reduce pressure in cooling system by opening the lock on the refrigerant expansion tank
- Unclamp and disconnect both refrigerant hoses to heat exchanger in heater (e.g. using special tool V.A.G 3094).

Notes:

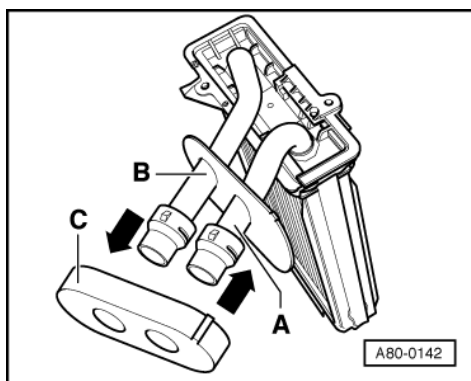
- ♦ Mark both refrigerant hoses before disconnection.



- ♦ The refrigerant hoses are to be connected on the correct side. Different connection and flow direction of the refrigerant dependent on the type of heat exchanger.
- ♦ -> Arrangement in a vehicle without map-controlled cooling and a heat exchanger without quick release couplings:
 - Refrigerant hose -A-: supply hose from cylinder head
 - Refrigerant hose -B-: return hose to water pump
 - The flow direction is marked by an arrow at the connection pipes of the heat exchanger (not visible when installed).



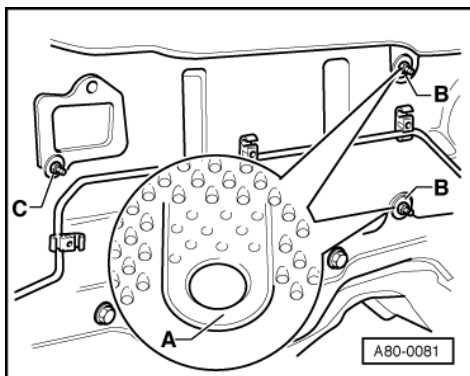
- ♦ -> Arrangement in a vehicle without map-controlled cooling and a heat exchanger with quick release couplings:
 - Refrigerant hose -A-: supply hose from cylinder head
 - Refrigerant hose -B-: return hose to water pump
 - The flow direction is marked by the arrows -C- at the connection pipes of the heat exchanger (visible when installed).



- ♦ -> Arrangement in a vehicle with map-controlled cooling:
 - Refrigerant hose -A-: supply hose from cylinder head
 - Refrigerant hose -B-: return hose to water pump
 - The connection pipes of the heat exchanger are made of metal, the flow direction of the refrigerant is not marked.
- ♦ Bleeding refrigerant circuit.

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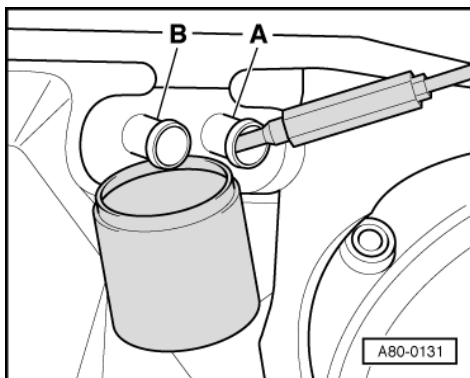
=> Relevant Workshop Manual Engine; Mechanical Components; Repair group 19



- -> Fold up pre-punched points -A- of the thermal insulation mat and remove the hexagon nuts located behind with washer -B- (tightening torque 15 Nm).
- Remove hexagon nuts with washer -C-.

Note:

A fitting must accompany the seal at the hexagon nut washers.

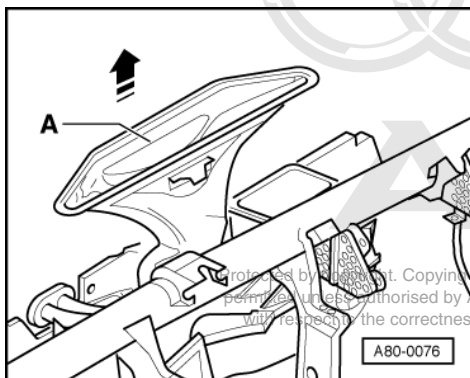


- -> Place a container under connection -B- and carefully blow out the refrigerant from the heat exchanger (in flow direction of refrigerant using compressed air) via connection -A- (different types, observe flow direction of refrigerant).
- Remove glove compartment.

=> Inner Body Assembly; Repair group 68

- Remove driver's storage compartment, centre console and dash panel fascia.

=> Inner Body Assembly; Repair group 70



- -> Remove air duct -A- to defroster vent.
- Remove footwell vent =>Page 112.

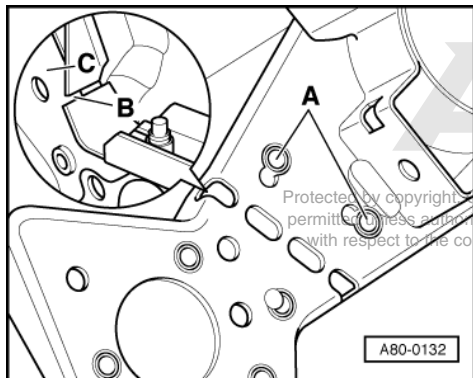
- Remove passenger side complete airbag unit with left bracket to dash panel cross member.

=> Electrical System; Repair group 96

- Disconnect earth connection from the heater to pillar-A right bottom earthing point.

=> Current Flow Diagrams, Electrical Fault-Finding and Fitting Locations

- Cover all open connectors and heater air ducts to protect metal particles from entering.

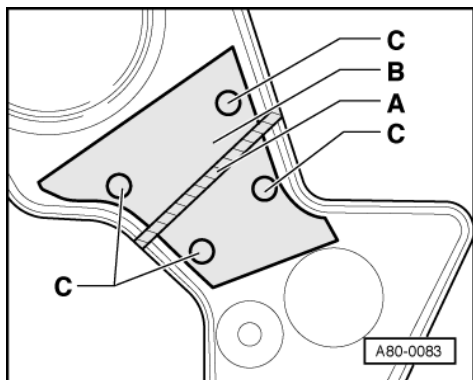


- -> Drill a 7 mm diameter hole at each of the points on the dash panel support (weld points) designated by - A- (drill through both panels at the weld points).
- Use a saw to cut through support at point designated by -B- (e.g. use body saw V.A.G 1523 A).

Note:

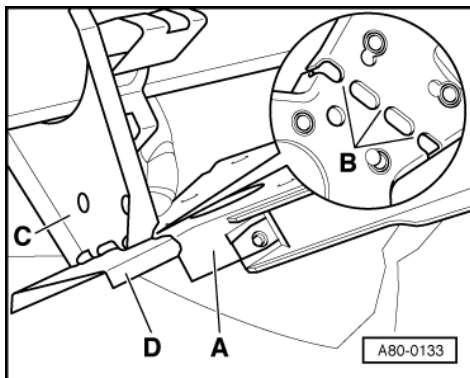
Do not saw through section -C- of the support (reinforcement plate).

Note for model year 1997 vehicles

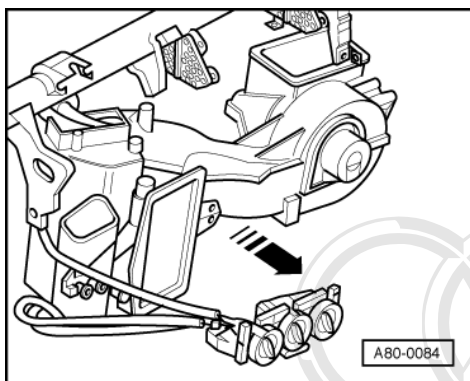


Vehicles at the start of production still have dash panel cross members installed without a break section - proceed as follows for these vehicles:

- -> Cut to size a section of bodywork panel -B- (shaded in grey in the drawing) over 2.5 mm thick to conform with contour -B- (deburr edges).
- Drill 4 holes -C- (according to drawing) in the bodywork panel and in the support and deburr (drill upper holes so that bolts to be installed do not contact bracket for the passenger airbag unit, or use flat-head bolts).
- Use a suitable saw to cut through support at the point marked -A-.
- After the heater is installed, screw together both sections of the support and bodywork panel -B- (e.g. using 4 M 6 x 10 mm bolts) at holes -C-.



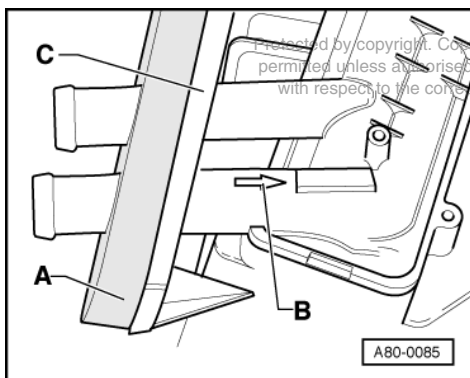
- Remove tunnel brace.
- -> Bend aside or break off section -A- of support at break section -B-.
- Deburr holes drilled in sections -C- and -D- of the support.
- Mask over all resulting sharp edges e.g. with adhesive tape so that is no possibility of injury.
- Disconnect all the electrical connections between body and heater at the connectors.



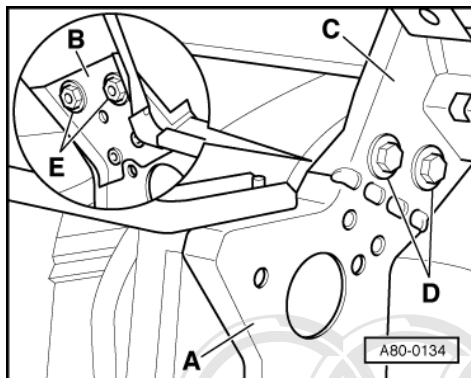
- -> Remove heater towards passenger's side.

Installation notes:

- ◆ Check all seals on the heater for damage before installation and replace any damaged seals.

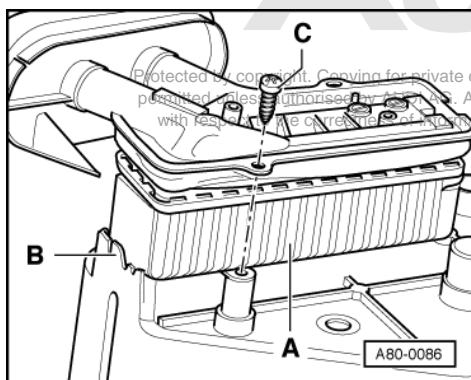


- ◆ When installing the heater, ensure that the intake duct gasket makes contact with the vehicle body.
- ◆ -> Replace gasket -A- and check for correct positioning on contact surface -C-.
- ◆ The refrigerant hoses are to be connected on the correct side. Different connection and flow direction of the refrigerant dependent on the type of heat exchanger => Page 117 . This illustration shows a heat exchanger for a vehicle without map-controlled cooling and without quick release couplings (flow direction marked with arrow -B-).
- ◆ After assembling, all cable ties that were removed in order to take out the heater must be refitted in their original positions.



- ♦ -> After the heater is installed:
 - Bend back section -A- of the support.
 - Screw together section -B- (welded to support -A-) and section -C- of the support using two bolts -D- (e.g. M 6 x 10) and two combi nuts -E-.
- ♦ When inserting bolts -D- into holes, ensure that bolts do not come into contact with the airbag unit bracket.

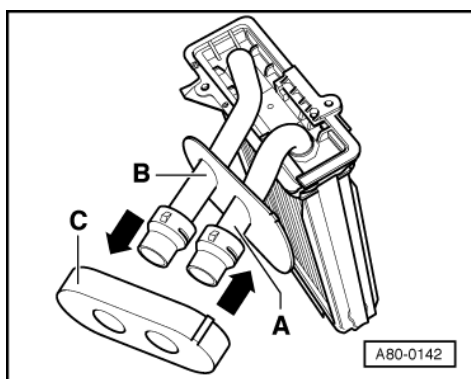
3.2 - Removing and installing heating system heat exchanger



- -> Remove heater => Page 117 .
- Press back catches -B- and remove the heat exchanger -A- from the heater.

Notes:

- ♦ Secure the installed heat exchanger in the heater flap unit using 2 suitable screws -C- (e.g. 3.2 x 20 mm self-tapping screws).
- ♦ The heat exchanger is installed in the heater flap unit without an all-round seal (vehicles without map-controlled cooling).
- ♦ The refrigerant hoses are to be connected on the correct side. Different connection and flow direction of the refrigerant dependent on the type of heat exchanger => Page 117 .



- ♦ The heat exchanger has been installed in vehicles with map-controlled cooling (to be introduced gradually as of model year 1999 vehicles with 1.6 l engine) which has been adapted to the different usage conditions. The following must be noted for this heat exchanger:
 - -> The flow direction of the refrigerant in the heat exchanger is not marked at the refrigerant connections (observe feed and return flow).
 - The heat exchanger components carrying refrigerant are produced entirely from metal due to the higher feed refrigerant temperature.

=> Parts List

4 - Servicing electrical additional heater - Vehicles with TDI engine

4.1 - Servicing electrical additional heater - Vehicles with TDI engine

4.2 - Checking function of electrical additional heater

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Electrical additional heater is activated by control unit for diesel direct injection system -J248 when following conditions occur at the same time:

- ♦ Measured ambient or intake pipe air temperature (when engine starts) lower than 5 °C
- ♦ Refrigerant temperature less than 70 °C
- ♦ Engine speed above 800 rpm
- ♦ Other actuation conditions:

=> Relevant Workshop Manual Diesel Direct Injection and Preglow System; Repair group 01; Reading measured value block

Test sequence

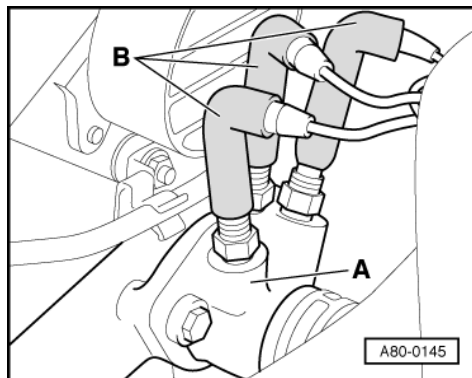
- Check low heating output relay -J359 or high heating output relay -J360:

=> Relevant Workshop Manual Diesel Direct Injection and Preglow System; Repair group 01; Final control diagnosis

If the relays are OK:

- Test wiring for open circuit and short to positive or earth.

=> Current Flow Diagrams, Electrical Fault-Finding and Fitting Locations



- -> Check earth wiring to refrigerant stump -A- (in which the glow lamps are screwed into) to the cylinder head.



If no wiring fault is detected:

- Inspect glow plugs:
- Remove the electrical wiring -B- from the glow plugs.
- Connect multimeter for resistance measurement to the glow plug and measure resistance between glow plug and refrigerant stud -A-.
- Specified value: 0.5 ... 0.7 wat room temperature

If specified value is not attained:

- Replace glow plug.
- Check refrigerant level:

=> Relevant Workshop Manual Automatic Gearbox; Repair group 19



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87 - Air conditioning

1 - Safety precautions when working on cars with air conditioners and when handling refrigerant

1.1 - Safety precautions when working on cars with air conditioners and when handling refrigerant

The assemblies and pipes in the air conditioner are filled with refrigerant

1.1.1.2 Tetrafluoroethane (CF₃-CH₂F or CH₂F-CF₃)

This refrigerant is currently known in Germany by the trade names R134a, H-FKW 134a, SUVA 134a and KLEA 134a (other trade names may be used in other countries).

Safety precautions

The following precautions should be observed with this refrigerant in Germany (additional regulations may be applicable in other countries).

If it is necessary to open the refrigerant circuit during repair work, first drain the refrigerant circuit (=> Page 125), making sure to avoid all contact with liquid refrigerant or refrigerant vapours. If, despite the observance of the safety precautions, refrigerant should escape, the refrigerant/air mixture must not be inhaled.

For this reason, always switch on the extractor systems, and protect hands with gloves and eyes with safety goggles.

Reason:

The intensive action of refrigerants will cause frostbite on unprotected parts of the body.

Warning!

It is recommended that an eye bath be kept to hand.

If liquid refrigerant comes into contact with the eyes, the eyes should be thoroughly rinsed for about 15 minutes. Then apply eye drops and consult a doctor, even if the eyes are not painful. The doctor should be informed of the type of refrigerant which caused the frostbite.

If, despite observance of all the security precautions, refrigerant should come into contact with other parts of the body, they should also be thoroughly rinsed immediately for at least 15 minutes in cold water.

Although refrigerants do not represent a fire hazard, smoking, welding, soldering and brazing are not permitted in areas exposed to refrigerant.

Reason:

The high temperature of a naked flame or hot objects causes refrigerant gas to undergo chemical decomposition. The inhalation of the toxic decomposition products results in dry coughing and nausea.

Draining the refrigerant circuit

Refrigerant must not be allowed to escape into the environment, it should be extracted from the refrigerant circuit by means of a suction unit or service station. The extracted refrigerant is then reprocessed on site or returned to the manufacturer for environmentally friendly disposal (in other countries, different or additional



regulations may apply). For these reasons, vehicles should be sent to Audi and VW air-conditioning servicing centres (these workshops have the relevant equipment and tools).

Reason:

Escaped refrigerant R134a in the earth's atmosphere aggravates the greenhouse effect.

Notes:

- ♦ The greenhouse effect of refrigerant R134a is much less than that of refrigerant R12.
- ♦ The refrigerant R134a does not affect the ozone layer in the earth's atmosphere (R134a is an H-FC with no chlorine atoms). The depletion of the ozone in the upper atmosphere is only caused by the splitting of carbon-chlorine bonds (as is the case, for example, with the refrigerant R12).

When the air conditioner has been drained, disconnect the power supply to the air conditioner magnetic clutch -N25 (e.g. detach the connector from the AC pressure switch -F129 or from high pressure sender -G65).

Reason:

Disconnecting the voltage supply or the pressure signal ensures that the compressor cannot be activated by mistake while the refrigerant circuit is empty.

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Working on the refrigerant circuit

Work on the refrigerant circuit must only be performed in well ventilated rooms. Care should be taken to ensure that there are no inspection pits, shafts or cellar entrances within a radius of 5 metres. Switch on the extraction systems.

Reason:

Escaping refrigerant is not only colourless and odourless, but also heavier than air and therefore displaces oxygen. If, despite the observance of all the safety precautions, refrigerant gas is emitted, there may be a negligible risk of asphyxiation in poorly ventilated rooms and workshop pits.

Note:

The mixture of gas and air which forms when refrigerant gas escapes must not be inhaled; it must be extracted using suitable extraction systems (workshop extractor).

Welding, brazing and soldering must not be performed on parts of the filled air conditioner. The same applies to welding and soldering work on the vehicle if there is a risk that parts of the air conditioner could become warm.

Reason:

The application of heat creates a severe build-up of pressure in the system which could cause it to burst.

Remedy:

Drain the refrigerant circuit (=>Page 125).

Note:

Damaged or leaking parts of the air conditioner may not be repaired by welding or soldering; they should be renewed instead.

During repair work on the air conditioner, all open components and pipe connections in the air conditioner should be re-sealed immediately.

Reason:

Air conditioner components left open for a lengthy period present a risk of moisture penetration. Air conditioners which have been left open for a lengthy period cannot, therefore, be re-filled without replacing parts of the system.

Painting work on vehicles with air conditioner

When carrying out paintwork repairs, ensure that the vehicle is not exposed to temperatures of more than 80 °C in the drying ovens or their preheating zones.

Reason:

The application of heat creates a severe build-up of pressure in the system which could cause it to burst.

2 - Notes on general repairs

2.1 - Notes on general repairs

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Only if required by the relevant safety precautions
(=> Page 125).

The air conditioner refrigerant circuit must remain closed during all other normal repair operations.

Repair work which can be performed on the heater and air conditioner without opening the refrigerant circuit are described in this workshop manual from page 129 onwards.

Note:

The connections for the switches described in this workshop manual are fitted with a valve which closes automatically when the switches are unscrewed. These switches may therefore be replaced with a full refrigerant circuit in any VW and Audi workshop.

Repair work on the air conditioner that requires the refrigerant circuit to be drained and hence cannot be performed in every VW/Audi workshop, is described from page 191 onwards (vehicles should be sent to an VW/Audi air conditioning service centre for the refrigerant circuit to be drained).

Repair work on the air conditioner involving the refrigerant circuit can be performed in a VW and Audi air-conditioning service centre only.

Note:

VW and Audi air-conditioning service centres have the requisite equipment, tools and information material for performing repair work on the refrigerant circuit.

=> Air conditioner with refrigerant R134a

2.2 - Notes on air conditioner in vehicles with map-controlled heating

In vehicles with map-controlled cooling (gradual introduction into vehicles with 1.6 litre engine as of model year 1999) into model years 1999 and 2000:

- Only an operating and display unit -E87 with part number 8L0 820 043 as of index "H" should be installed.



Note:

Only operating and display units -E87 with part number 8L0 820 043 and index "M" (or "N" for Japan) must be installed in vehicles from model year 1999 and 2000 with map-controlled cooling. The indices "H", "J", "K" and "L" are occupied for the changed type of the -E87 (serial introduction as of model year 2001).

- If the sender for the central venting temperature -G191 is also present.
- The -E87 must be coded according to the other set-up for the engine cooling (the refrigerant temperature is controlled by the engine control unit according to the engine load and is higher when the engine is running at part throttle in comparison to full throttle).

=> Relevant Workshop Manual Injection and Ignition system

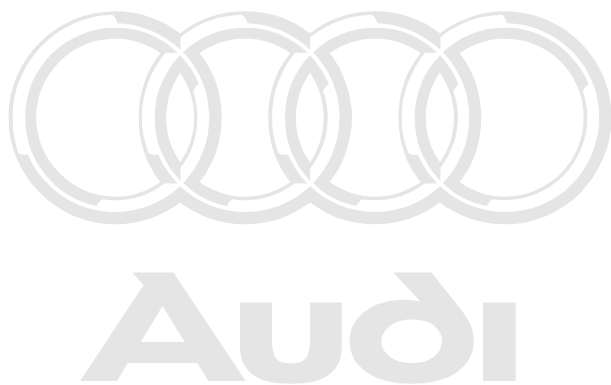
- A different heat exchanger is installed in the air conditioner (the heat exchanger is calibrated to the higher refrigerant temperature).

=> Parts List

- The installation of the air conditioner heat exchanger in the refrigerant circuit has been modified (feed and return lines have been interchanged).
- ♦ As of model year 2000, the assignment of the ignition key is conveyed by the dash panel insert (data telegram) together with the refrigerant temperature (when ignition is switched on). This information can only be processed by operating and display unit -E87 with part number 8L0 820 043 as of index "H".

=> Electrical System; Repair group 01

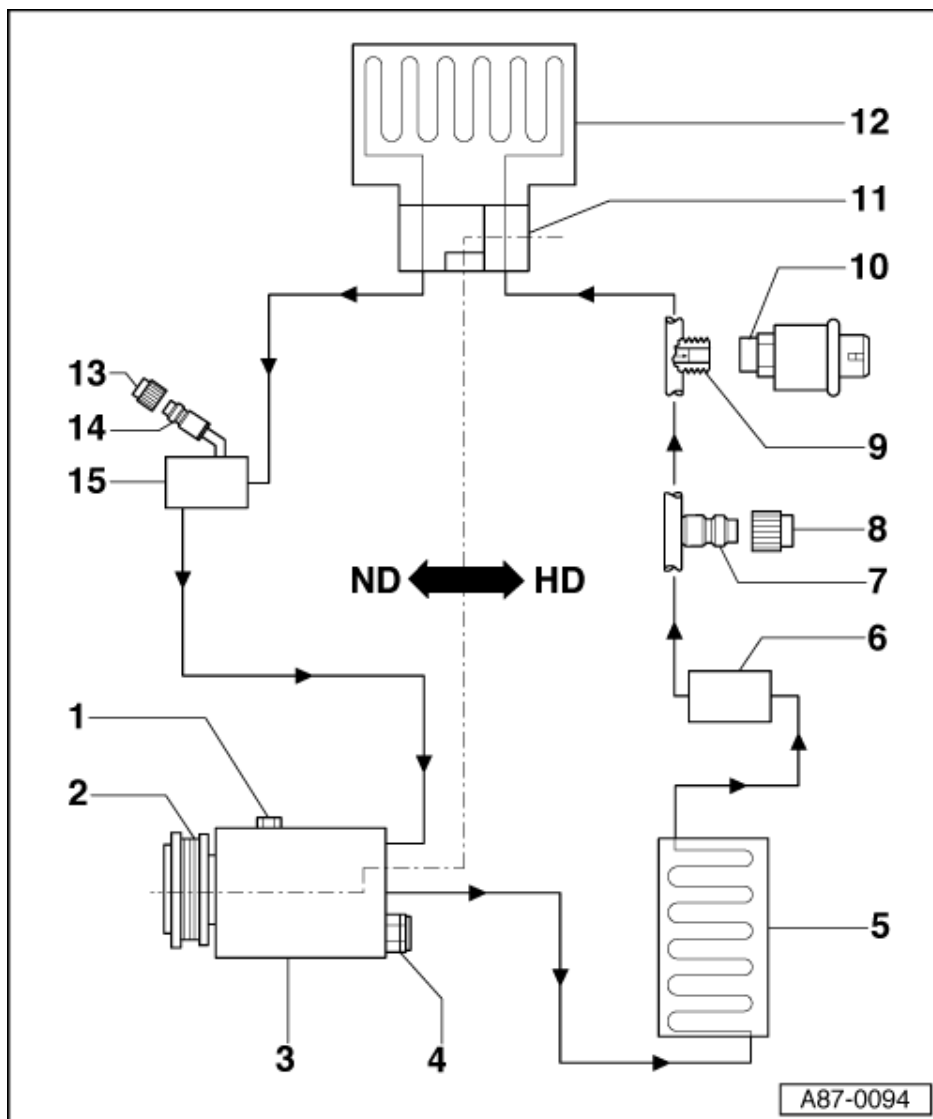
=> Parts List



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3 - Repairing refrigerant circuit

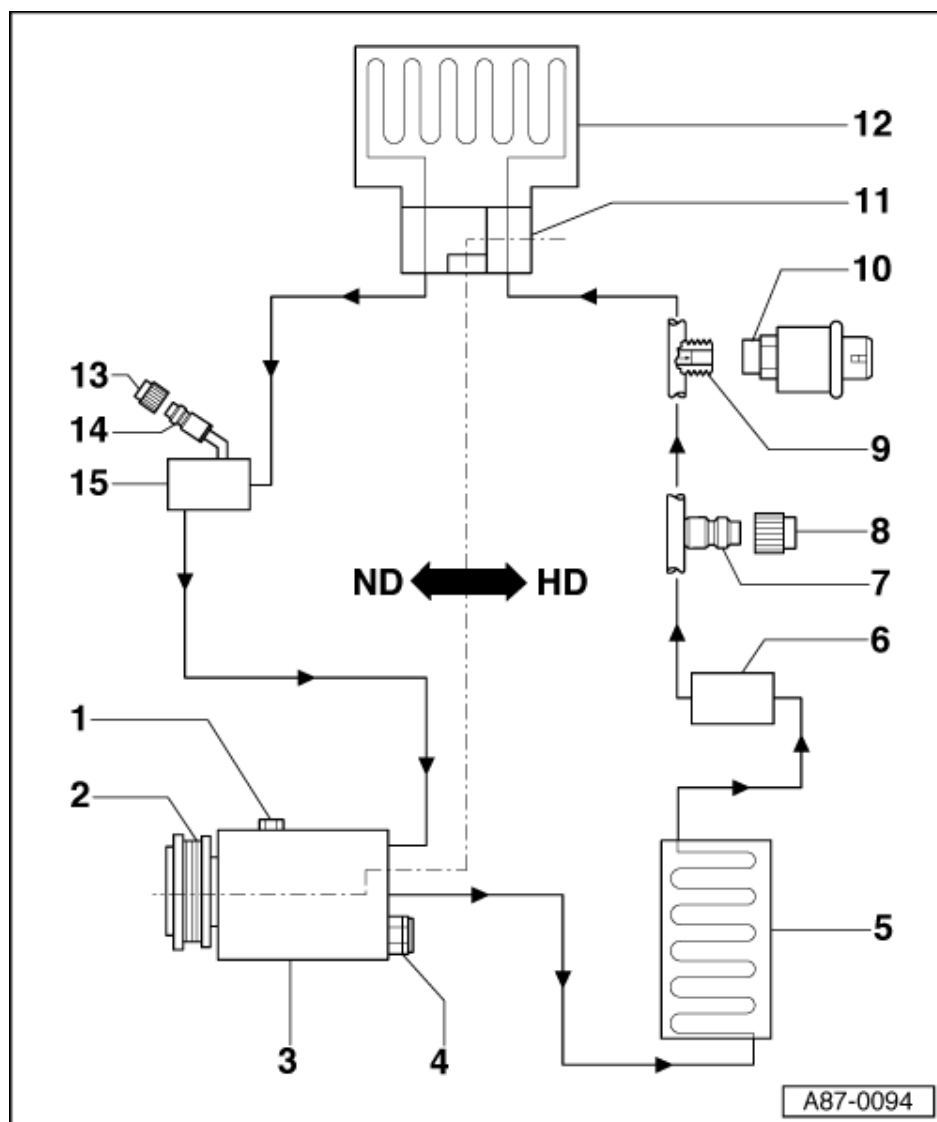
3.1 - Repairing refrigerant circuit



Notes:

- ♦ All AC components not marked with an * can be repaired/renewed in any VW and Audi workshop (repair work not involving the refrigerant circuit).
- ♦ All AC components marked with an *, as well as all refrigerant hoses and pipes, can be repaired/renewed in a VW and Audi air conditioning service centre only.
- ♦ Repairing refrigerant circuit => Page 191 .

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HD = High-pressure end

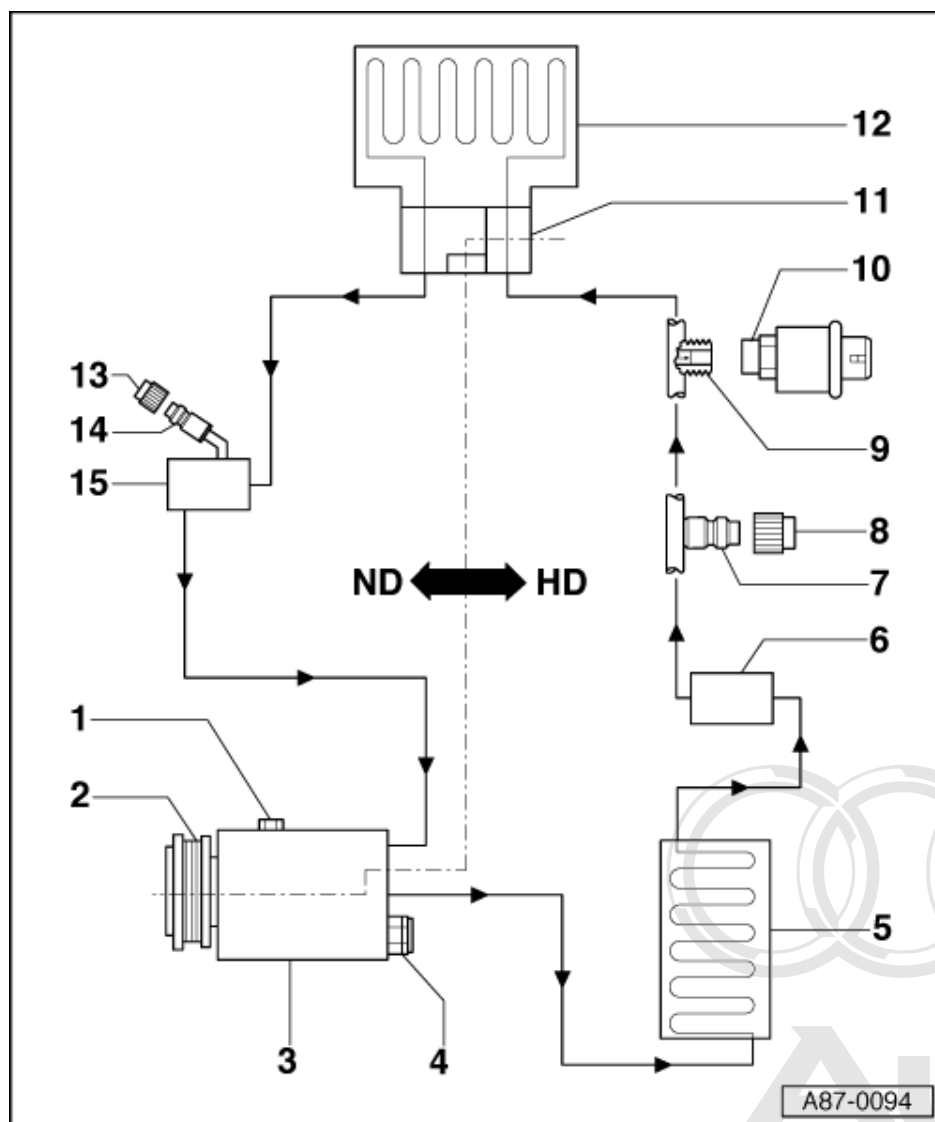
ND = Low-pressure end

- 1 Oil drain plug *
- 2 Air conditioner magnetic clutch -N25
 - ♦ Repairing => Page 139 .
 - ♦ Check and adjust gap width between pulley and clutch plate => Page 139 .
- 3 Compressor *
 - ♦ Removing and installing compressor bracket

=> Relevant Workshop Manual Engine Mechanical Components

- ♦ Removing and re-attaching compressor from/to bracket
- 4-cyl. petrol engine=>Page 138 .
- 4-cyl. diesel engine => Page 138

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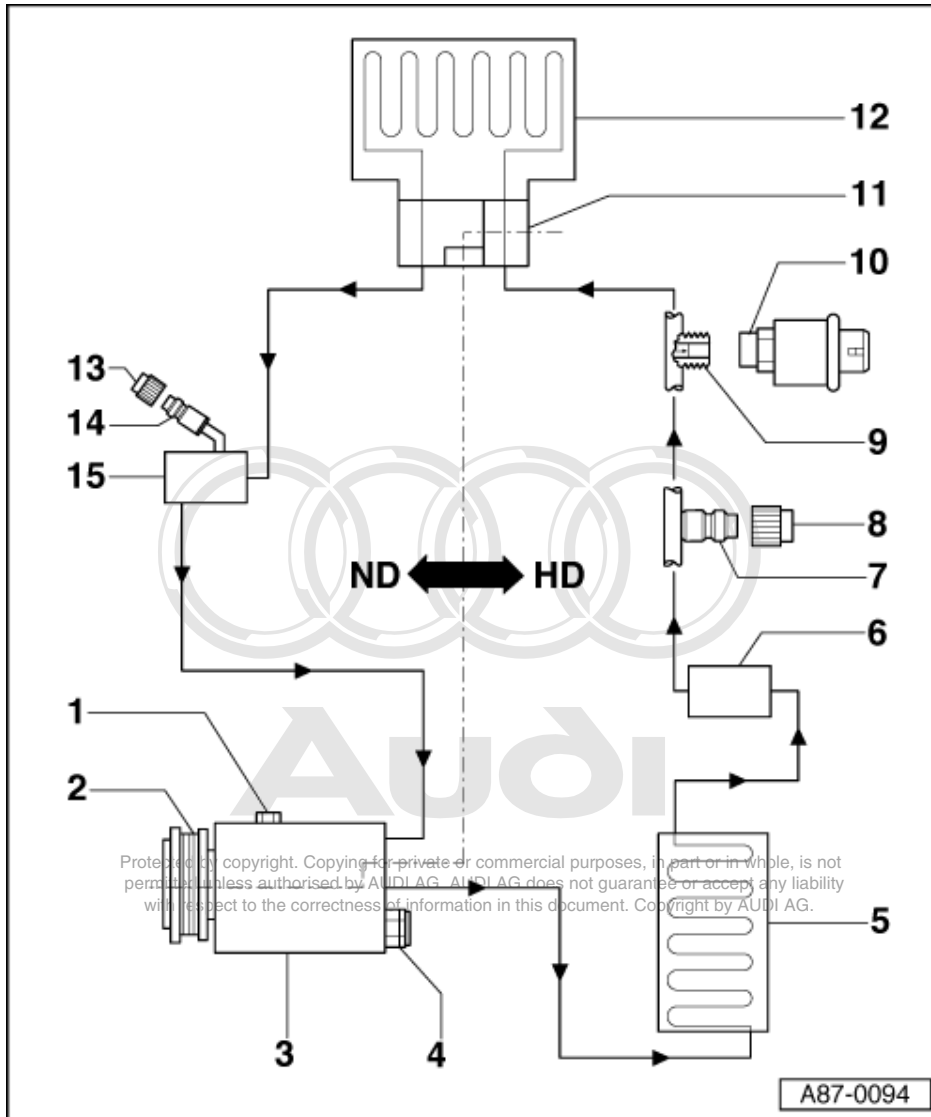
- ♦ Removing and installing ribbed belt.

=> Relevant Workshop Manual Engine Mechanical Components

- ♦ Mark direction of ribbed belt before removing - reversing the direction of rotation can destroy the belt.
- ♦ Only compressors manufactured by Sanden were installed up to model year 1999.
- ♦ A compressor manufactured by either Sanden or Zexel can be installed in vehicles as of model year 1999.

=> Parts List

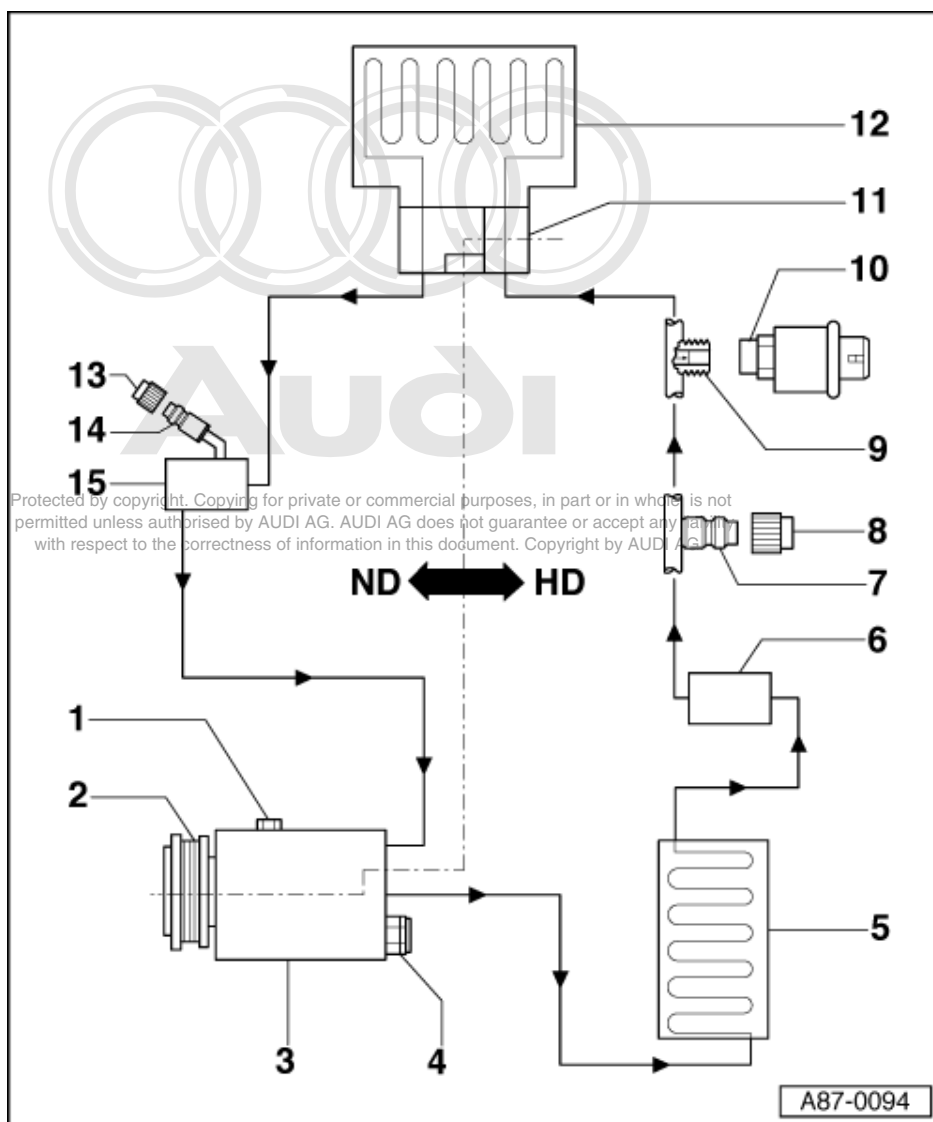
4 Pressure relief valve *



- 5 Condenser *
- 6 Fluid reservoir *
- 7 Service connection *
 - ♦ High-pressure end

Warning!

The service connections may be removed only if the refrigerant circuit is empty - the connection is not supplied with a valve.



8 Cap

- ♦ With seal, must always be fitted.

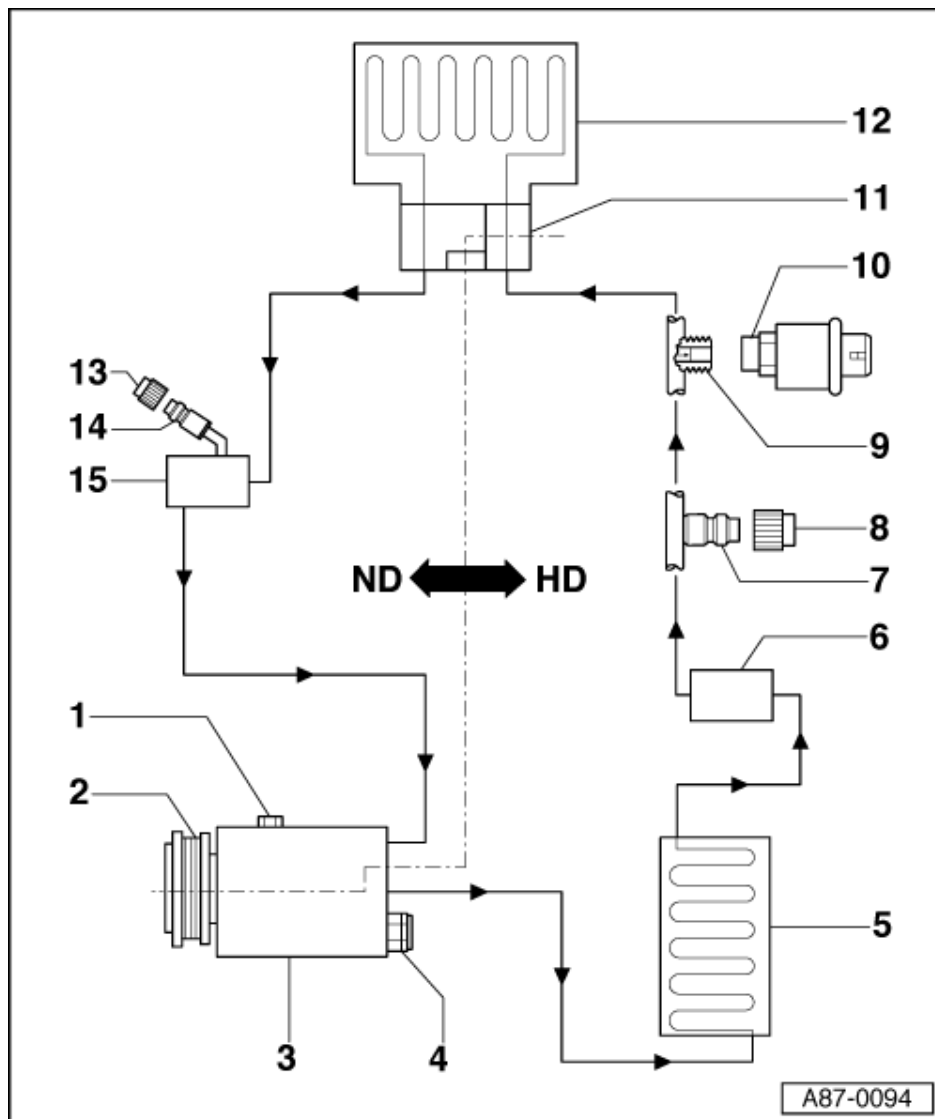
9 Connection with valve *

10 Air conditioner pressure switch

-F129 / high-pressure sensor -G65

- ♦ High-pressure sensor -G65 will gradually replace air conditioner pressure switch -F129 (as of model year 1999, initially vehicles with 1.6 l engines).
- ♦ Function, removing and installing pressure switch -F129 => Page 135 .
- ♦ Check function of high-pressure sensor -G65 and signal emitted =>Page 85 .
- ♦ Remove and install high-pressure sensor -G65 =>Page 137 .

11 Expansion valve *



12 Evaporator *

13 Cap

- ♦ With seal, must always be fitted.

14 Service connection *

- ♦ Low-pressure end

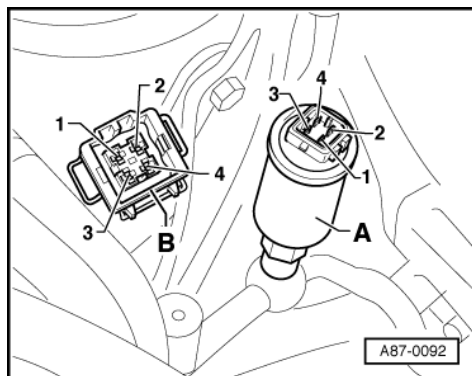
Warning!

The service connections may be removed only if the refrigerant circuit is empty - the connection is not supplied with a valve.

15 Pre-volume *

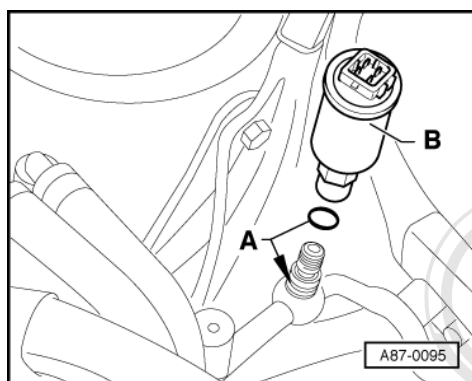
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3.2 - Air conditioner pressure switch -F129



Functions

- ♦ -> The low/high pressure switch (switch between contacts 1 and 2) deactivates the compressor in the event of a vacuum or overpressure in the refrigerant circuit (via the operating and display unit -E87).
- Switching pressures (overpressure in bar):
 - Switch open (compressor off):
 - Low pressure switch (opens at 1.2 bar and closes at 2.4 bar).
 - High pressure switch (opens at 32 bar and closes at 24 bar).
 - Switch closed (compressor on):
 - between 1.2 (2.4) bar and 32 (24) bar.
- ♦ The high pressure switch (between contacts 3 and 4) switches radiator fan -V7 to speed 2.
- Switching pressures (overpressure in bar):
 - Fan (speed 2) on (switch closes) at 16 bar.
 - Fan (speed 2) off (switch opens) at 12.5 bar.

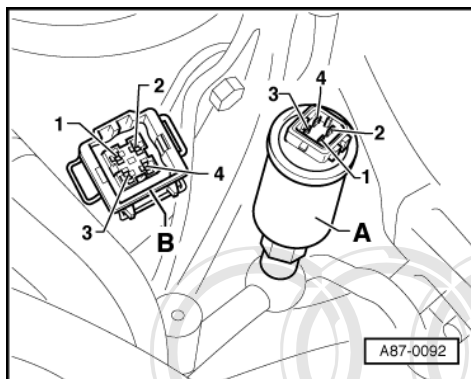


Removing and installing

- -> Detach connector.
- Remove pressure switch -B-.
Tightening torque: 5 Nm
- Replace O-ring seal -A- (10.8 mm; 1.8 mm) =>Page 137 .

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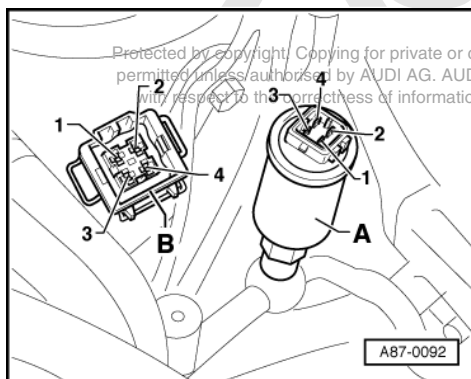
Notes:



- -> Jumper contacts 1 and 2 of connector -B- in order to check refrigeration capacity with switch removed.
- The refrigerant circuit remains closed - connection with valve.

Check function.

- Start engine
- Compressor switched on (set "auto" mode on the operating and display unit).



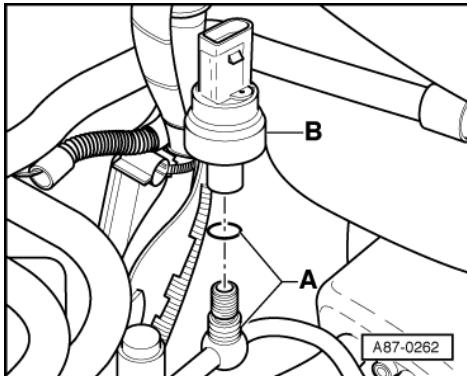
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- Compressor is driven:
- -> Detach connector -B- from switch.
- Compressor stops (low pressure switch open).
- Remove switch -A- and connect connector -B-.
- Compressor is not switched on (low pressure switch open).
- Compressor is not driven:
- Detach connector -B- from switch -A- and jumper contacts 1 and 2 at connector -B- => compressor is switched on.

Notes:

- ♦ If the compressor is switched on when jumpered, either the refrigerant circuit pressure is too low (refrigerant circuit empty) or the switch is defective.
- ♦ To check the pressure in the refrigerant circuit, send the vehicle to an VW and Audi air-conditioning service centre.
- ♦ If the compressor is not switched on and the switch -F129 is displayed as a compressor shutoff criterion in the measured value block, locate and rectify the open circuit in the wiring between the switch -F129 and the -E87 =>Page 46 .

3.3 - Remove and install High-pressure sensor -G65



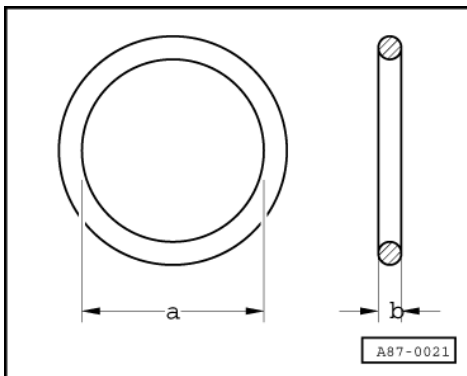
- -> Detach connector.
- Remove High-pressure sensor -B-
Tightening torque: 5 Nm
- Replace O-ring seal -A- (10.8 mm; 1.8 mm) =>Page 137 .

Notes:

- ♦ The refrigeration capacity cannot be checked if sender -G65 is removed - control unit -J293 does not switch on the compressor.
 - ♦ The refrigerant circuit remains closed - connection with valve.
 - ♦ Check function of high-pressure sensor -G65 and signal emitted =>Page 85
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3.4 - O-ring seals for refrigerant circuit

- ♦ Only use once and then replace.
- ♦ Moisten with refrigerant oil before use.
- ♦ Ensure that they are positioned correctly on the pipe or in the groove.
- ♦ Take care to avoid dirt.



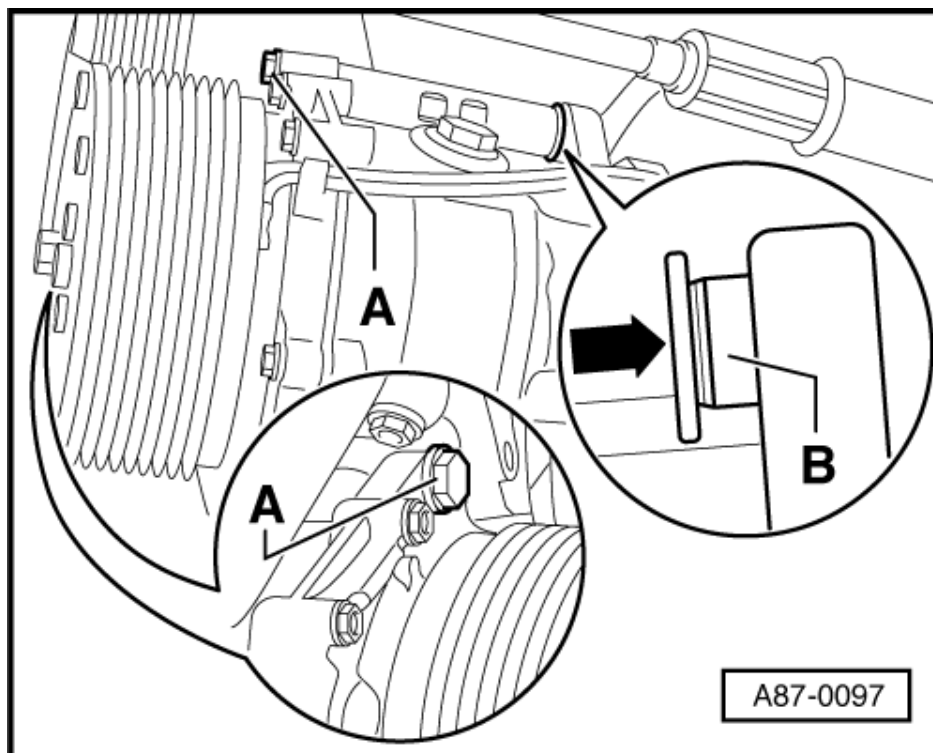
Notes:

- ♦ -> Only install O-ring seals which are resistant to refrigerant R134a and the associated refrigerant oil. These O-ring seals are colour-coded to prevent confusion (currently "red", "lilac" or "violet"):

=> Parts List

- ♦ In addition to the coloured O-ring seals, black O-rings are also used in production for certain connections.
- ♦ Dimensions -a- and -b- vary depending on the fitting location of the O-ring seal.

=> Parts List



- Removing ribbed belt.

=> Relevant Workshop Manual Engine; Mechanical Components; Repair group 13

- Remove noise insulation and division between engine compartment and right wheel housing.

=> General Body Repairs, Exterior; Repair group 50

- -> Remove bolts -A- (tightening torque 45 Nm).

Notes:

- ♦ Before inserting the compressor, push slide bush -B- completely into the compressor hole.
- ♦ When installing ribbed belt, note correct position of pulley.

4 - Repairing the air conditioner magnetic clutch -N25

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4.1 - Repairing the air conditioner magnetic clutch -N25

Notes:

- ♦ The magnetic clutch can be serviced without opening the refrigerant circuit.
- ♦ Mark the direction of rotation with chalk or felt pen before removing the ribbed belt. If the belt rotates in the wrong direction when it is refitted, this can cause breakage.

- Remove the noise insulation and the division between engine compartment and right wheel housing.

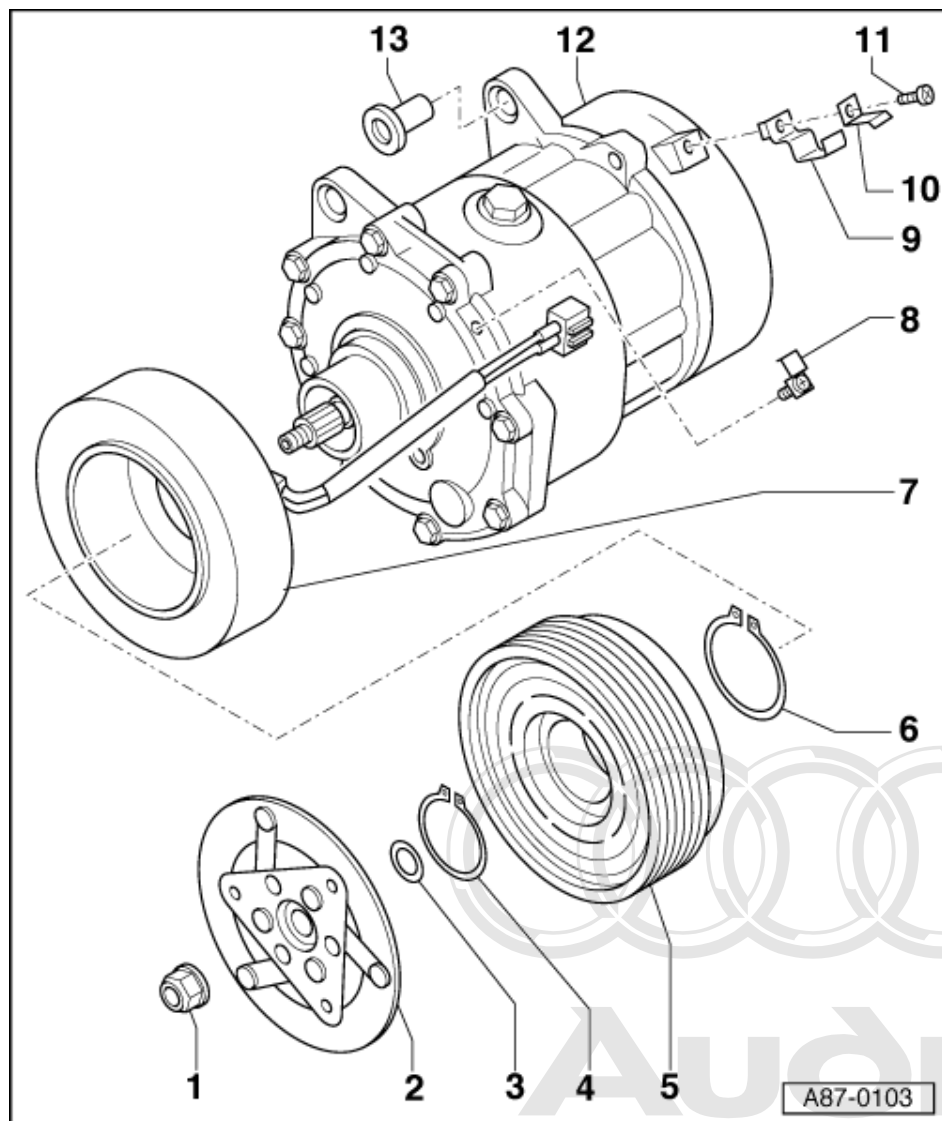
=> General Body Assembly work Exterior; Repair group 50; Body front Body front

- Remove the ribbed belt:

=> Relevant Workshop Manual Engine Mechanical Components, Repair group 13

- Detach the compressor from the bracket:
 - 4 cyl petrol engine=>Page **138** .
 - 4 cyl diesel engine => Page **138** .
- Repairing magnetic clutch:
 - Sanden compressor => Page **140** .
 - Zexel compressor => Page **146** .

4.2 - Sanden compressor



1 Hexagon nut

- ◆ Self-locking - replace.
- ◆ Tightening torque: 25 Nm
- ◆ Loosening and tightening => Fig. **1** .

2 Detach clutch plate

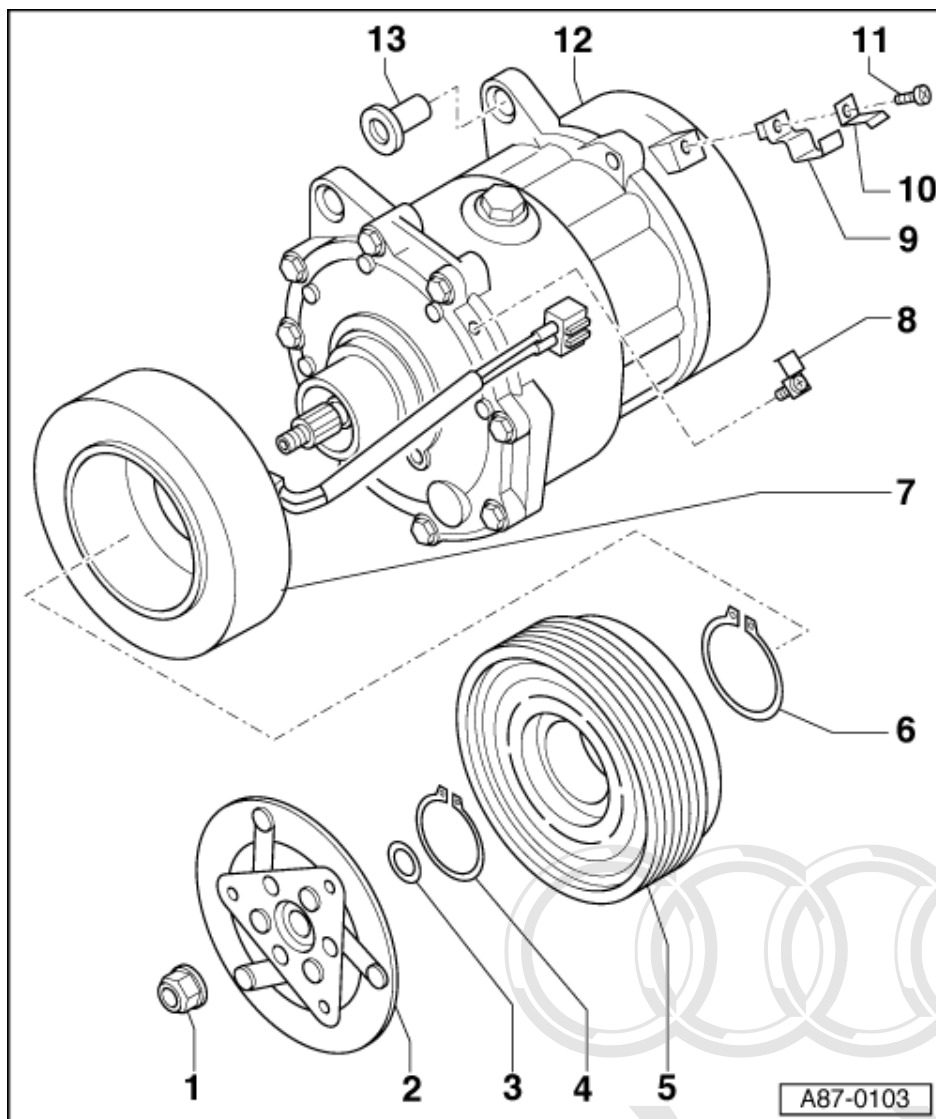
- ◆ Detaching =>Fig. **2** .

3 Spacers

- ◆ To adjust gap between clutch disc and pulley.
- ◆ Gap dimension:
0.4 to 0.8 mm.

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- ♦ Checking and adjusting gap width =>Fig. 5 .



4 Circlip

- ♦ Renew
- ♦ Install on correct side (flat side facing compressor).
- ♦ Ensure correct seating in groove.

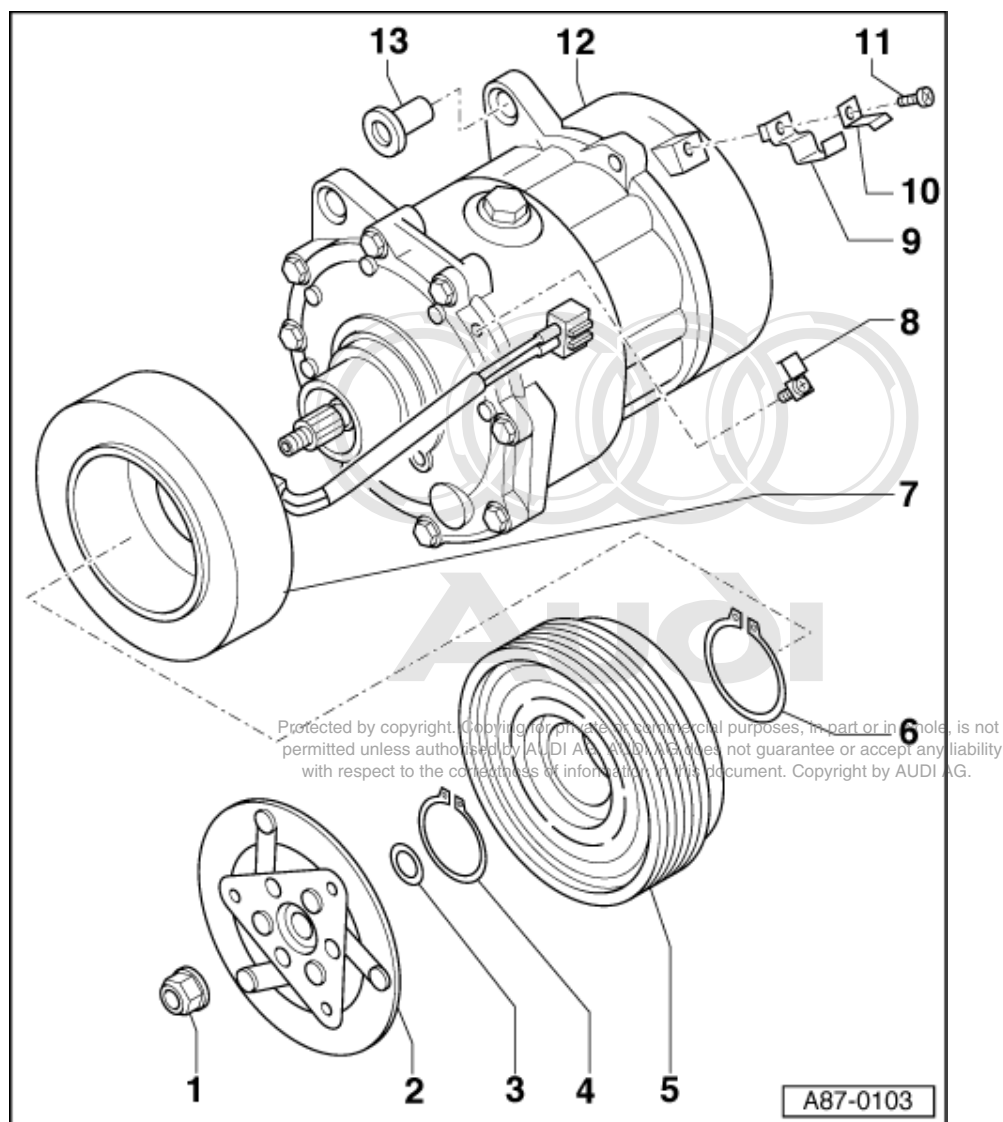
5 Pulley

- ♦ Detaching =>Fig. 3 .
- ♦ Clean contact surface before installation.

6 Circlip

- ♦ Renew
- ♦ Install on correct side (flat side facing compressor).
- ♦ Ensure correct seating in groove.

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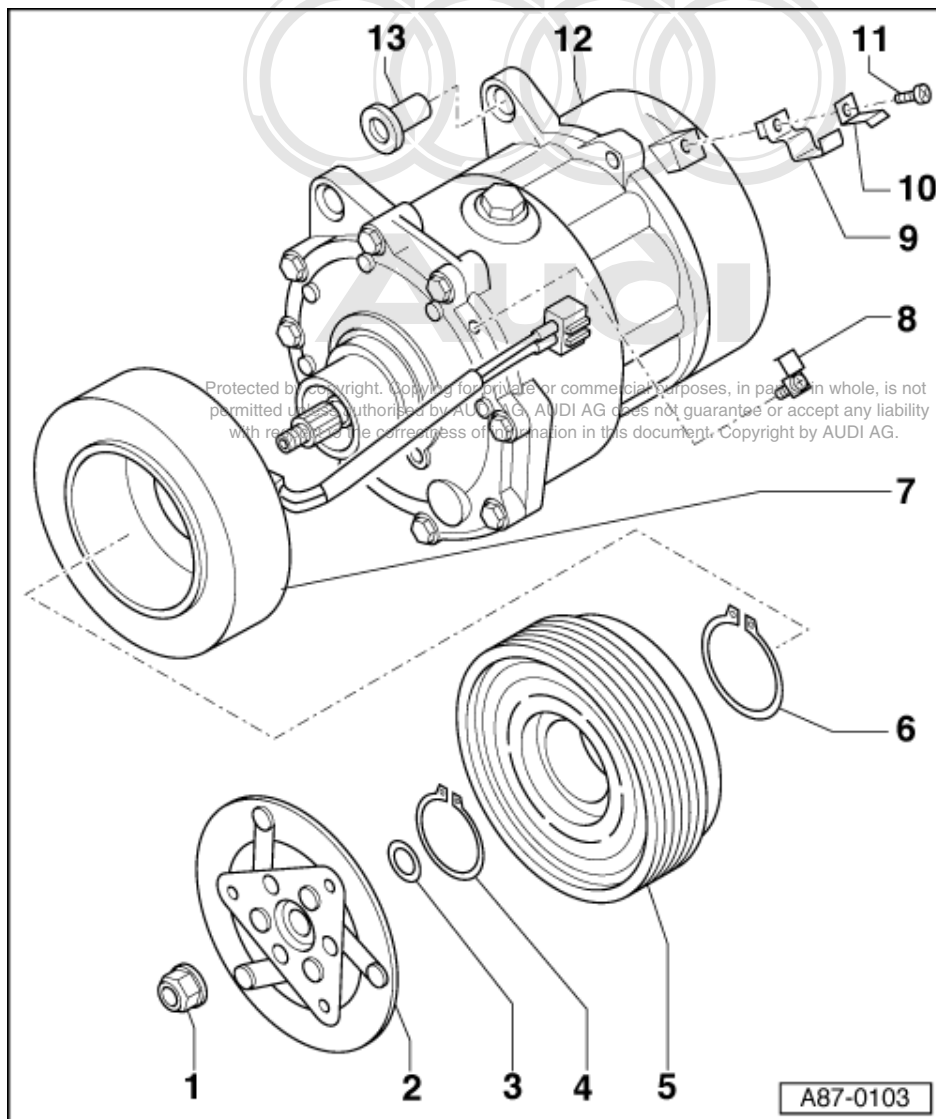


7 Solenoid

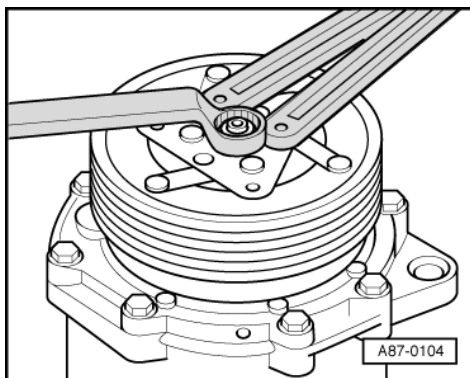
- ♦ Installing =>Fig. 4 .

Notes:

- ♦ An overheating fuse is installed in the solenoid. The overheating fuse interrupts the solenoid as soon as the air conditioner magnetic clutch becomes too hot (e.g. due to a stiff compressor).
- ♦ The familiar protective diode -J201 has already been integrated in this solenoid (reduces the voltage peaks which may occur when the air conditioner magnetic clutch is disengaged).



- 8 Bracket with bolt
- 9 Bracket
- 10 Bracket
- 11 Bolt
- 12 Compressor (Sanden SD7 V16)
- 13 Slide bush
 - ◆ Threaded

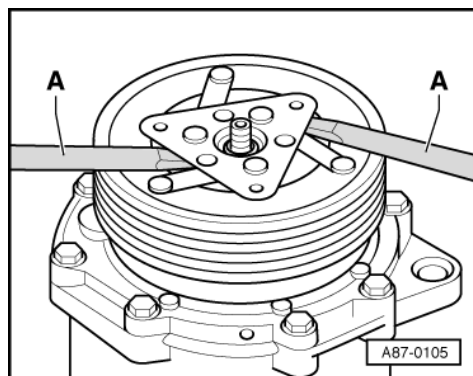


-> Fig.1 Loosening and tightening hexagon nut

- Tightening torque 25 Nm.

Notes:

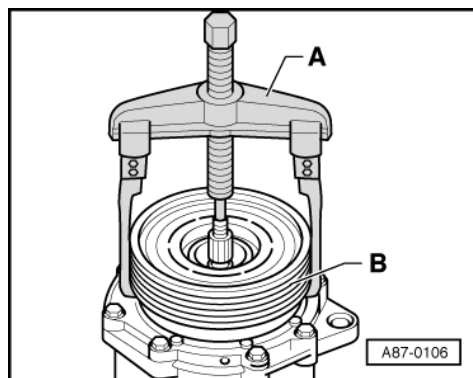
- ♦ Use commercially available pin-type face spanner.
- ♦ Self-locking - replace.



-> Fig.2 Detaching clutch plate

Note:

If clutch disc has seized up, use two screwdrivers -A- to carefully prise it off.

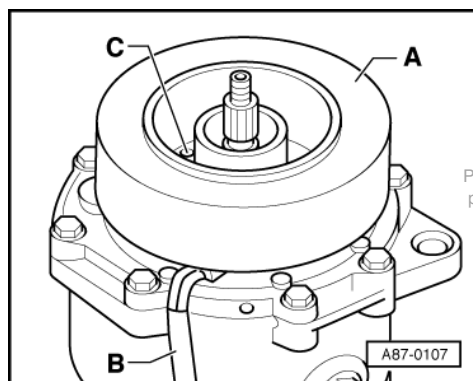


-> Fig.3 Detaching pulley

- Insert two-arm puller -A- at shoulder -B- and detach pulley.

Notes:

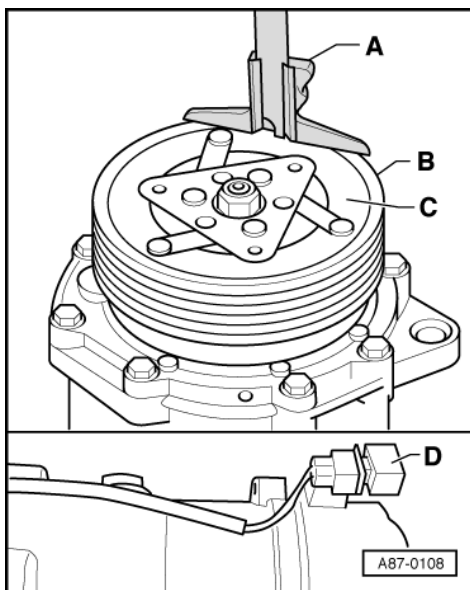
- ♦ Ensure proper seating of puller at shoulder -B- to prevent damage to pulley when detaching.
- ♦ Clean contact surface before installation.
- ♦ If necessary, carefully drive in pulley with suitable driver and a plastic-headed hammer (via the bearing inner race).



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-> Fig.4 Installing solenoid

- Position stud -C- in solenoid recess -A-.
- Ensure correct positioning of wiring -B- to solenoid -A-.



-> Fig.5 Checking and adjusting gap width

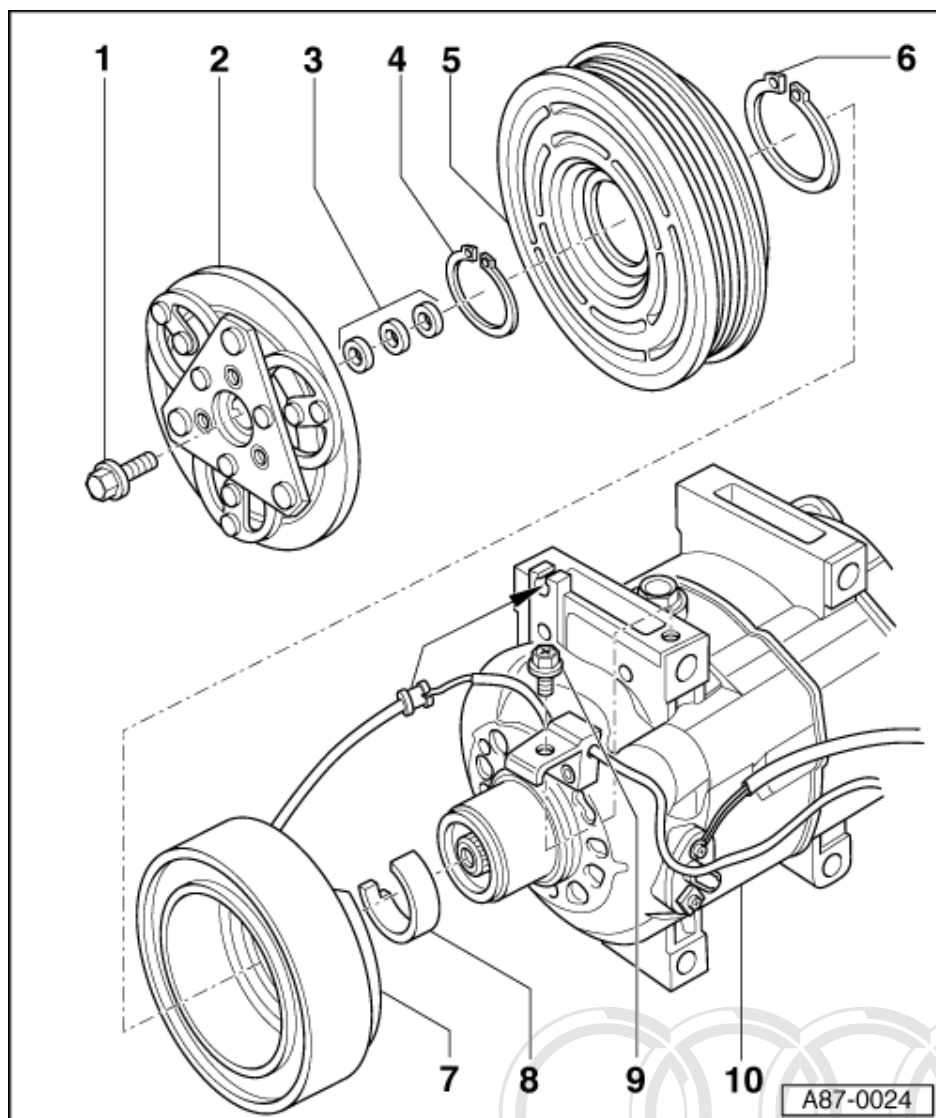
- Use depth gauge -A- to measure dimension "1" between pulley and clutch disc (-B- and -C-) at three points.
- Apply a voltage of 12 V to 2-pin connector -D- (ensure proper voltage polarity).
- Use depth gauge -A- to measure dimension "2" between pulley and clutch disc (-B- and -C-) at three points.
- Gap width (difference between dimension "1" and "2"):
0.4 to 0.8 mm.

Notes:

- ◆ The gap width must be within the tolerance over the entire periphery.
- ◆ The gap width can also be measured with the compressor installed.
- ◆ If the gap width is not within the permissible range, remove the clutch plate and adjust the gap width by removing or inserting spacers.

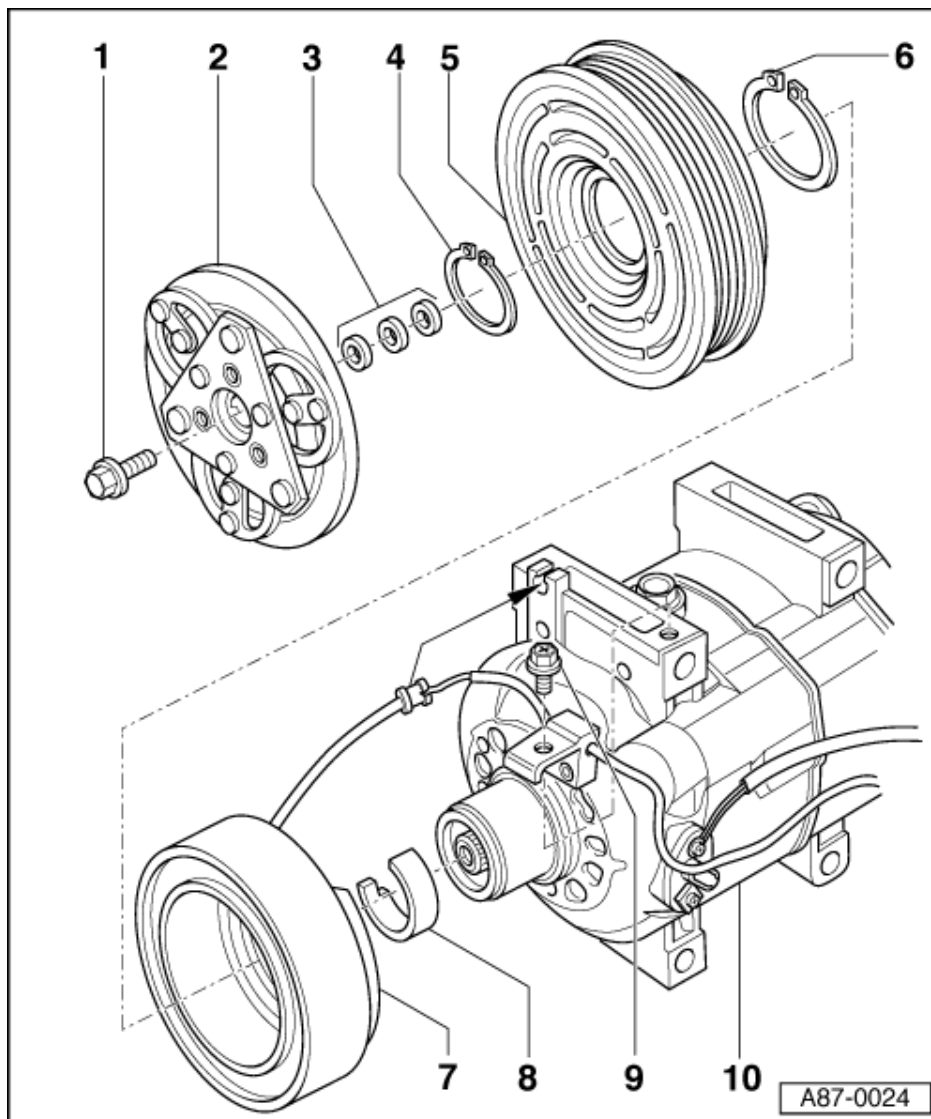
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4.3 - "Zexel" compressor



- 1 **Release and tighten bolt -15 Nm**
 - ◆ Loosening and tightening => Fig. 1
- 2 **Detach clutch plate**
 - ◆ Pulling off => Fig. 2
- 3 **Spacer**
 - ◆ For adjusting the gap width
 - ◆ Checking gap width => Fig. 6
- 4 **Circlip**
 - ◆ Replace
 - ◆ Install on correct side (flat side facing compressor)
 - ◆ Ensure correct seating in groove

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5 Pulley

- ◆ Pulling off => Fig. 3
- ◆ Installing => Fig. 4

6 Circlip

- ◆ Replace
- ◆ Install on correct side (flat side facing compressor)
- ◆ Ensure correct seating in groove

7 Solenoid

- ◆ Installing => Fig. 5

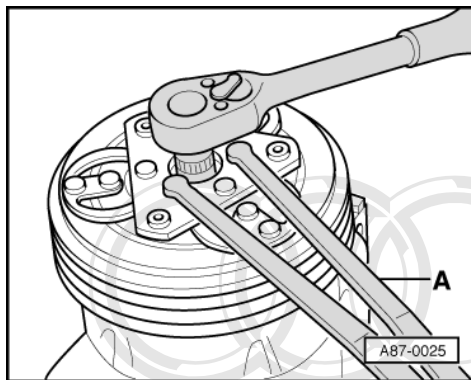
8 Felt ring

- ◆ Replace

9 Bolt

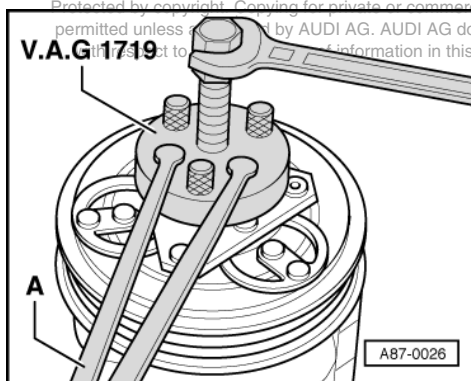
10 Compressor

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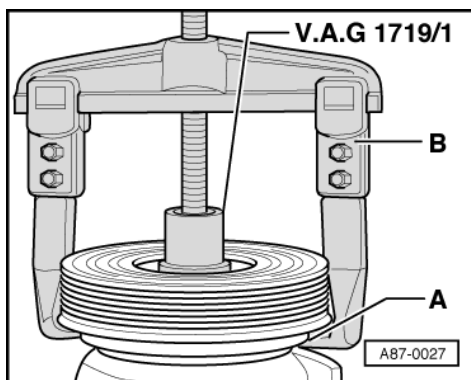
-> Fig.1 Loosening and tightening hexagon bolt

- Counterhold using a commercially available 2-hole pin wrench -A- (pin- $\varnothing$ 4 mm).
- Tighten bolt to 15 Nm.



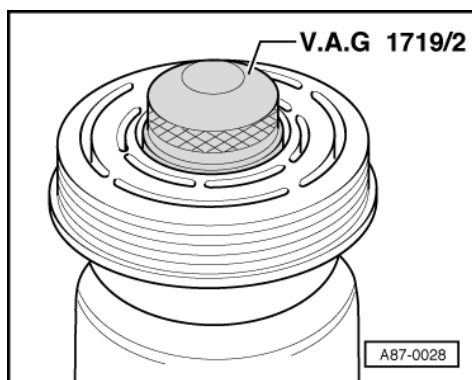
-> Fig.2 Detaching clutch plate

- Counterhold with a commercially available 2-pin wrench -A-.



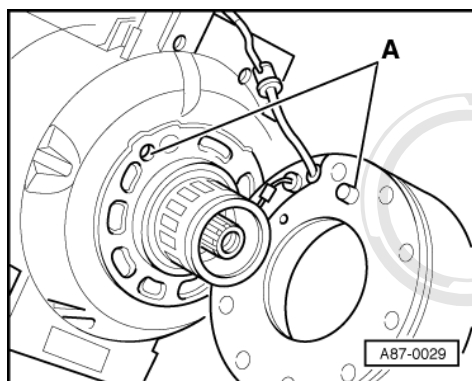
-> Fig.3 Removing pulley

- Remove the felt ring.
- Fit the special tool V.A.G 1719/1.
- Position the two-arm puller -B- on the shoulder-A-, to prevent any damage to the pulley.



-> Fig.4 Installing pulley

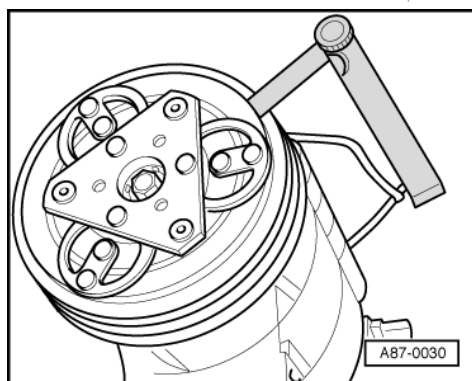
- Clean the contact surface.
- Install the pulley with the special tool V.A.G 1719/2 and a plastic-headed hammer.



-> Fig.5 Installing solenoid

- Place the lug -A- in the recess.

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-> Fig.6 Checking gap width

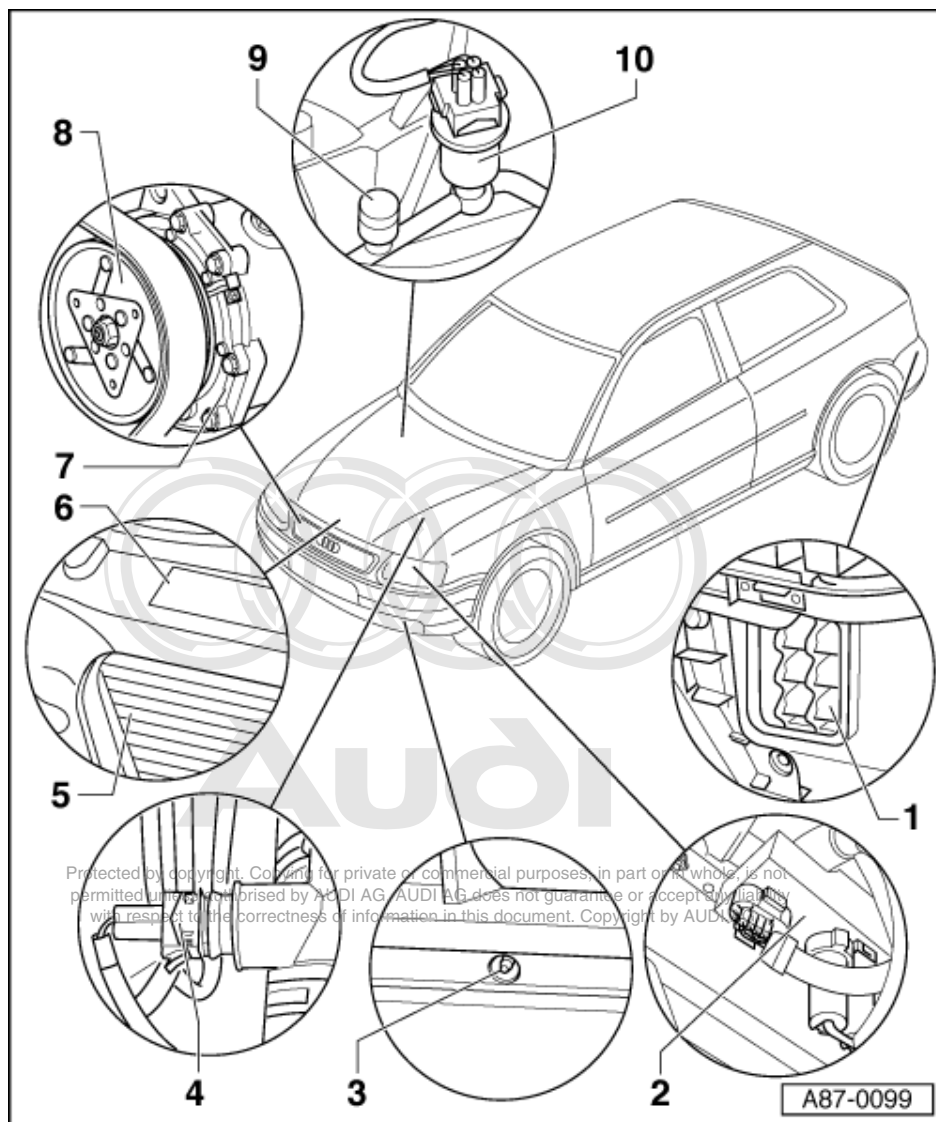
- Check the gap width between the pulley and clutch plate:
 - Gap width = 0.3 - 0.6 mm

Note:

The gap width must be within the tolerance over the entire periphery.

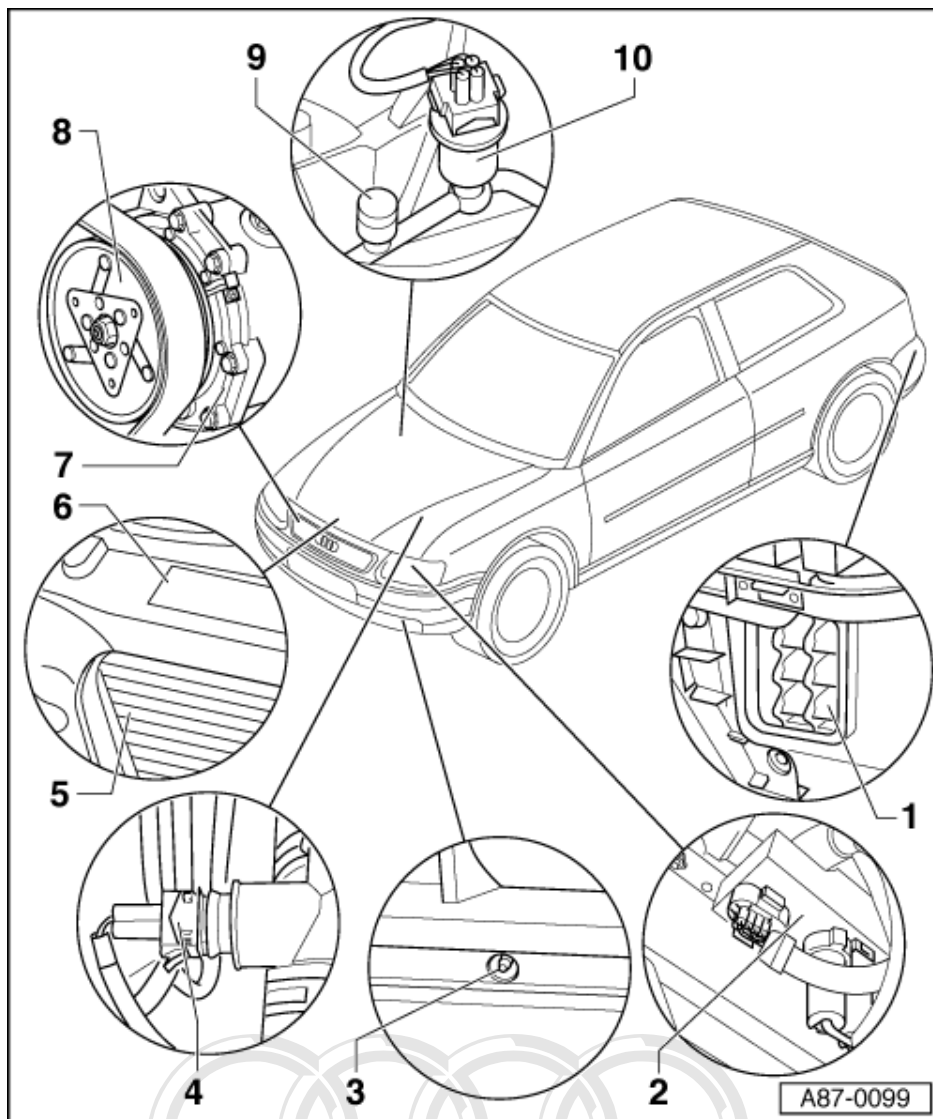
5 - Components for the control and regulation of the air conditioner (in the engine compartment)

5.1 - Components for the control and regulation of the air conditioner (in the engine compartment)



Notes:

- ♦ After completing repair work, always interrogate and erase fault memory, perform basic setting, and check the encoding of -E87.
- ♦ To drain the refrigerant circuit, bring the vehicle to a VW and Audi air-conditioning service centre.
- ♦ Check refrigeration capacity =>Page 186 .
- ♦ Refrigerant circuit =>Page 129 .
- ♦ All components marked with * are actuated during the final control diagnosis => Page 18 .



- ♦ Note the different codes for operating and display unit -E87 => Page 27 .
- ♦ An electrical check can be performed on all components marked with ** =>Page 46 .

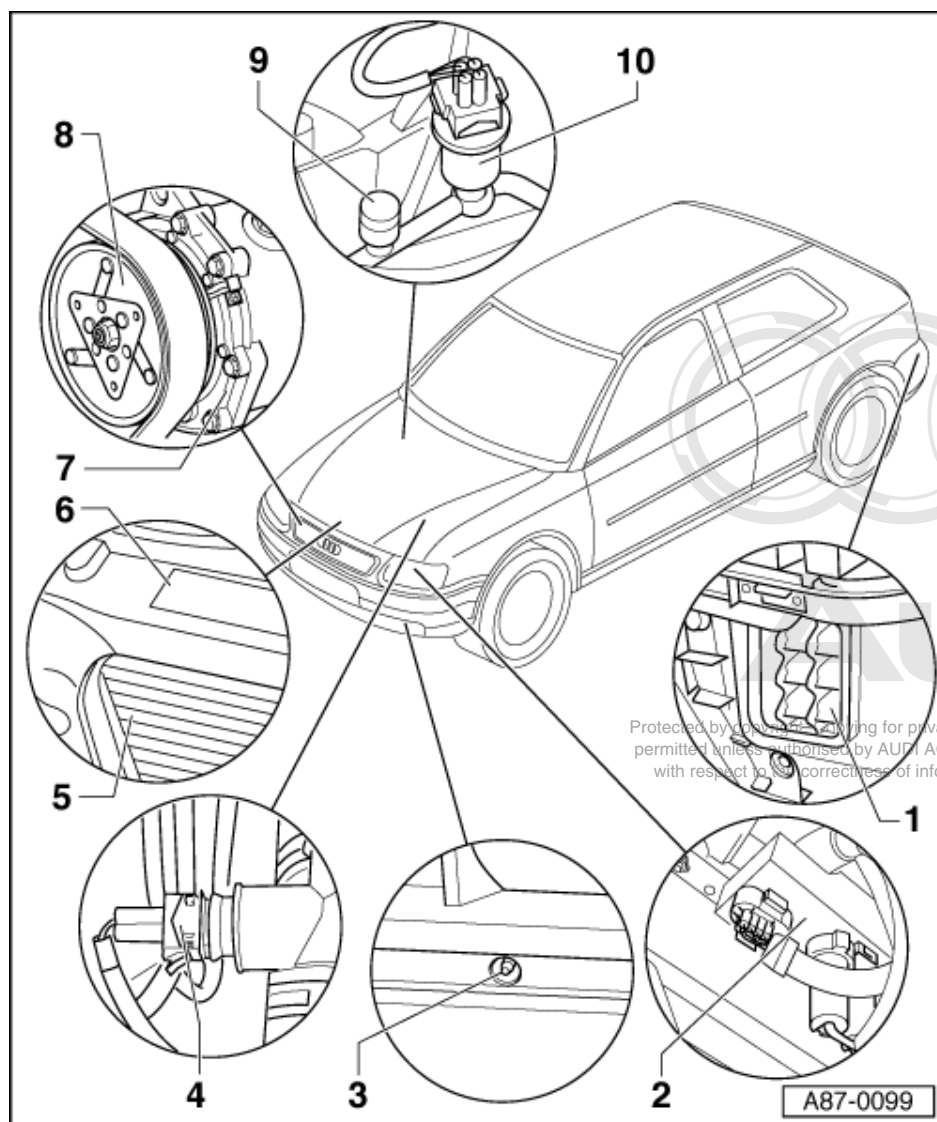
1 Vent frame for forced air extraction

- ♦ The sealing lips on the vent frame must be able to move freely and close by themselves (checking =>Page 93).

Note:

In order for the vehicle interior ventilation to work properly, the air ducts which run through the luggage compartment trim and lead to the two vent frames (under the bumper on the left and right) must be unobstructed.

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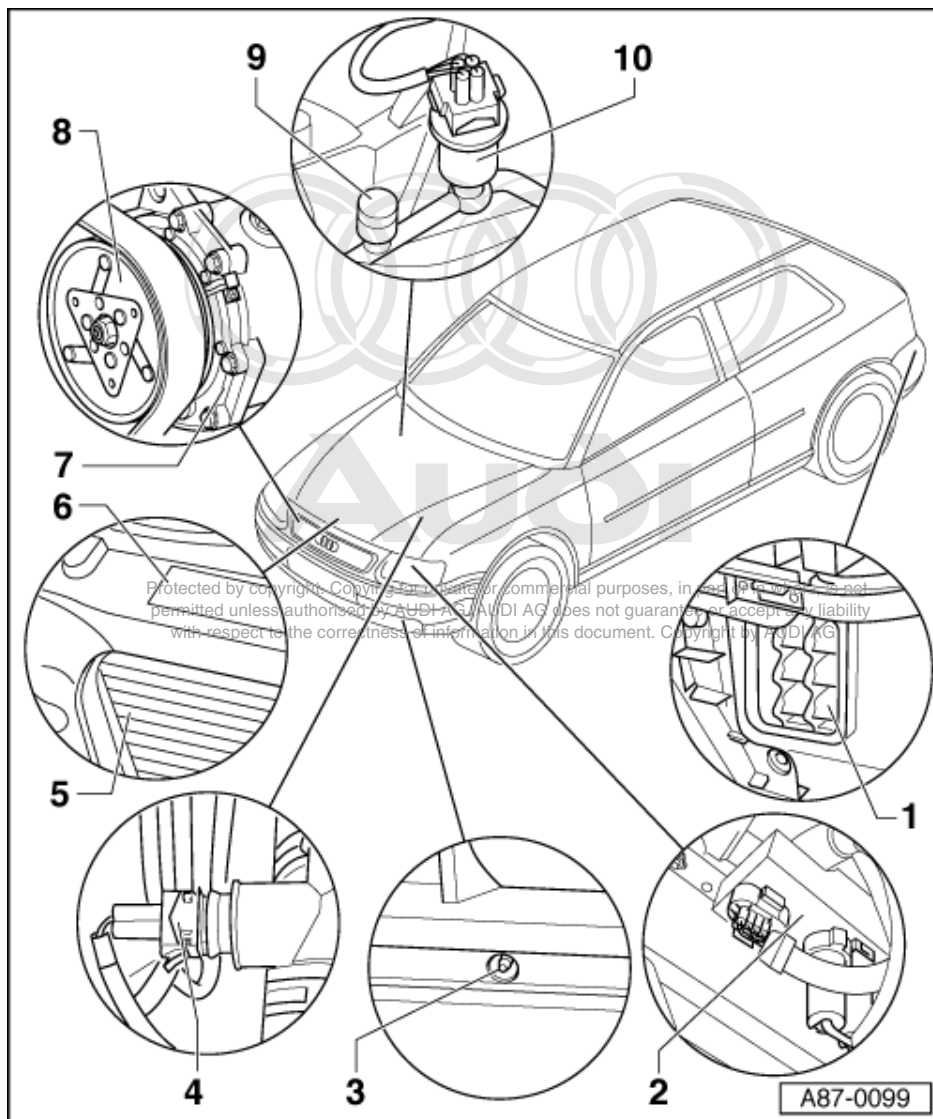
2 Radiator fan control unit -J293 **.

- ♦ Radiator fan control unit -J293 versions and vehicle wiring differ for vehicles with pressure switch -F129 and high-pressure sensor -G65.

=> Parts List

=> Current Flow Diagrams, Electrical Fault-Finding and Fitting Locations

- ♦ Control unit -J293.
 - Switches radiator fans -V7 to 1st and 2nd speed
 - Actuates AC magnetic clutch -N25.
 - Processes the square-wave signal of high-pressure sensor -G65 and, if the refrigerant circuit pressure is OK, sends a positive signal to -E87 (only in vehicles with high-pressure sensor -G65).



♦ Removing and installing =>Page 161

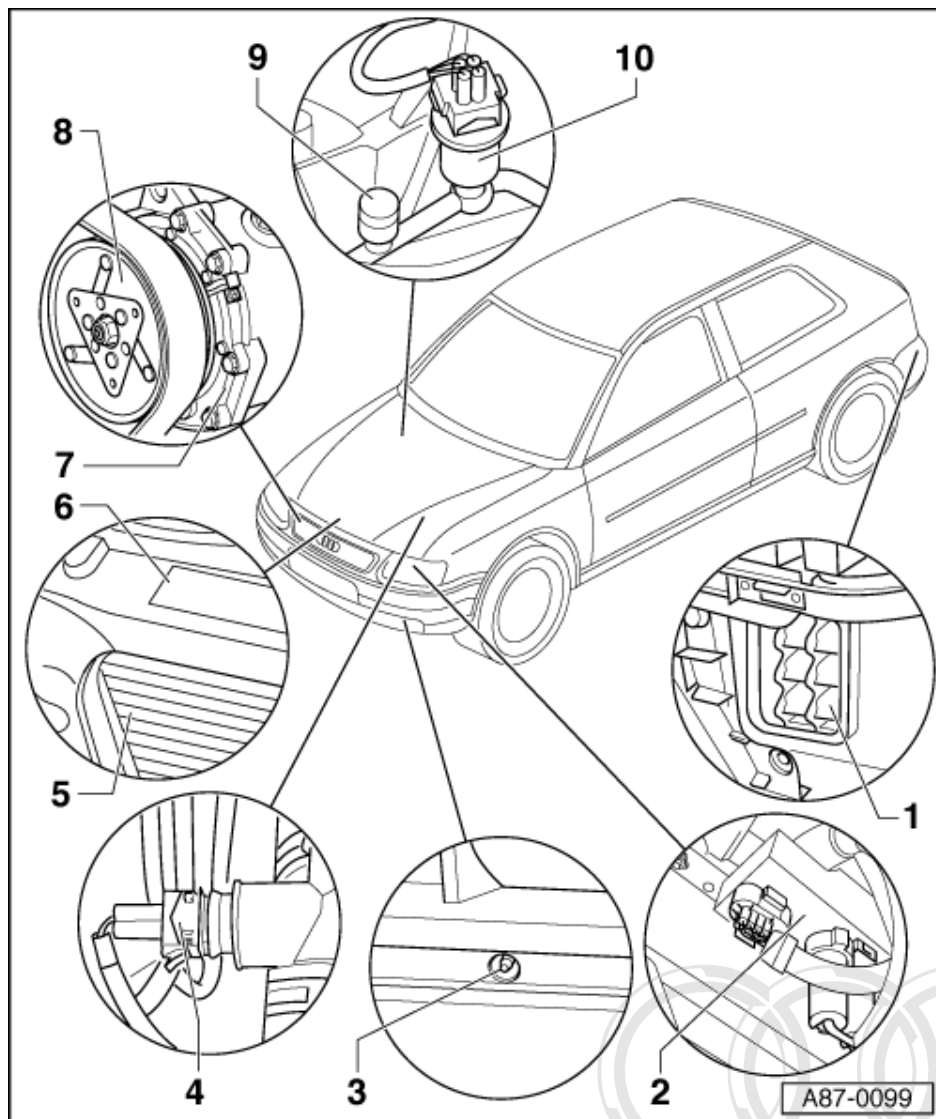
3 Ambient temperature sensor -G17 **

- ♦ Removing and installing:
Remove noise insulation, detach connector and unclip sensor from mount in bumper.

4 Refrigerant temperature control switch (too hot) -F14 **

- ♦ Switches off compressor in the event of excessively high refrigerant temperatures.
- ♦ Only installed in vehicles with pressure switch -F129.

=> Current Flow Diagrams, Electrical Fault-Finding and Fitting Locations



5 Condenser

Warning!

The condenser may be removed only if the refrigerant circuit is empty.

6 Adhesive label for air conditioner

- ◆ Indicates filling quantity and type of refrigerant

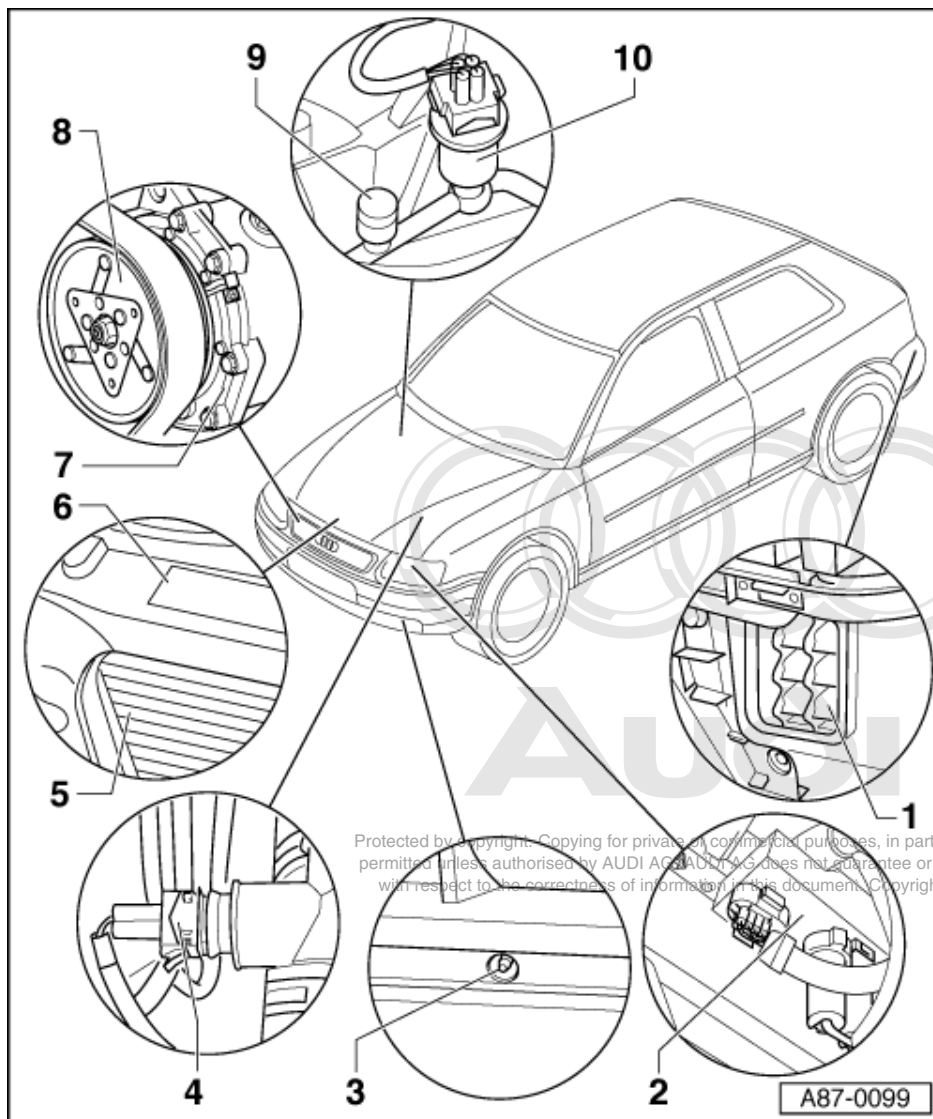
7 Compressor

- ◆ Removing and installing compressor bracket

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=> Relevant Workshop Manual Engine Mechanical Components

- ◆ Removing and re-attaching compressor from/to bracket
 - 4 cyl petrol engine=>Page 138.
 - 4 cyl diesel engine => Page 138 .



Warning!
The compressor may be removed only if the refrigerant circuit is empty.

8 Air conditioner magnetic clutch -N25

- ♦ Repairing =>Page **139**

Notes:

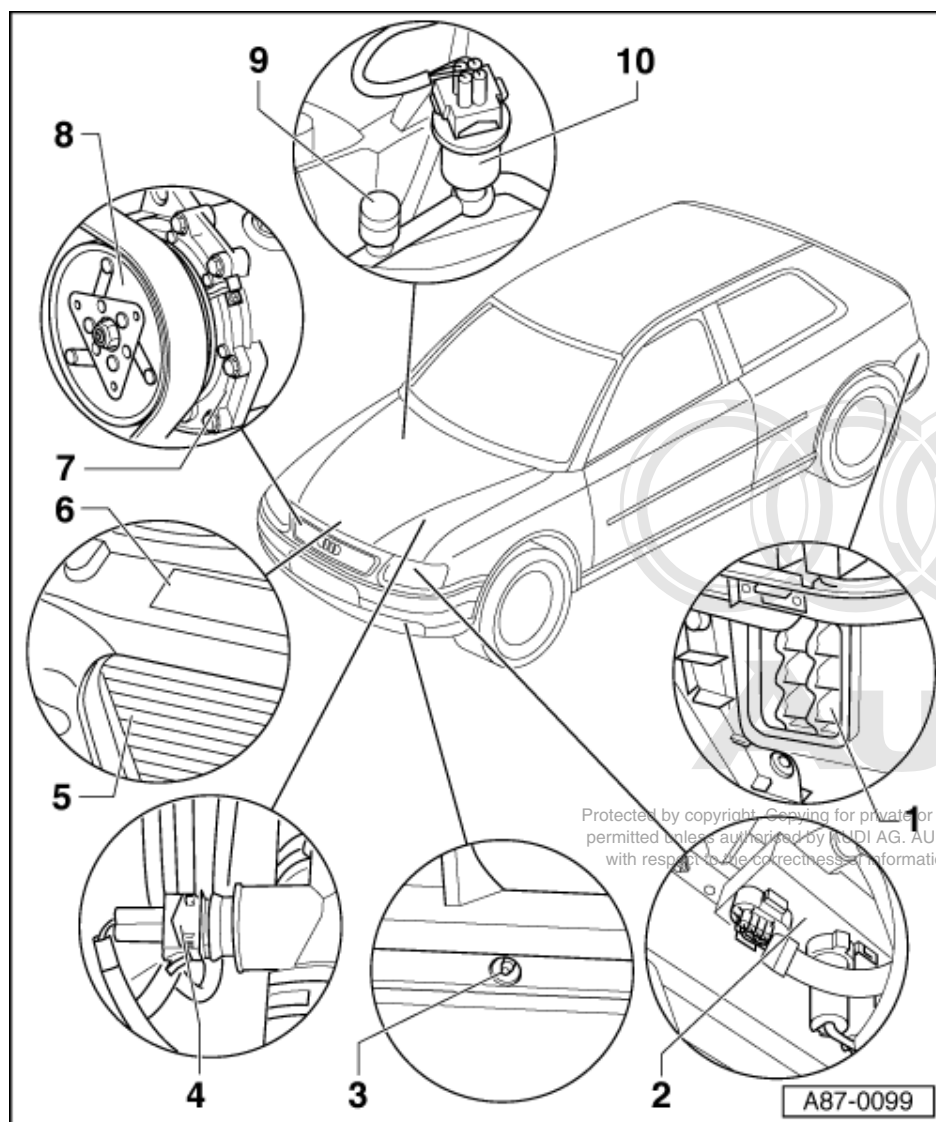
- ♦ Removing and installing ribbed belt.

=> Relevant Workshop Manual Engine; Mechanical Components; Repair group 13

- ♦ Mark direction of ribbed belt before removing - reversing the direction of rotation can destroy the belt.

9 Service connection

- ♦ High-pressure side
- ♦ For measurement, drainage and filling at VW and Audi air-conditioning service centres.



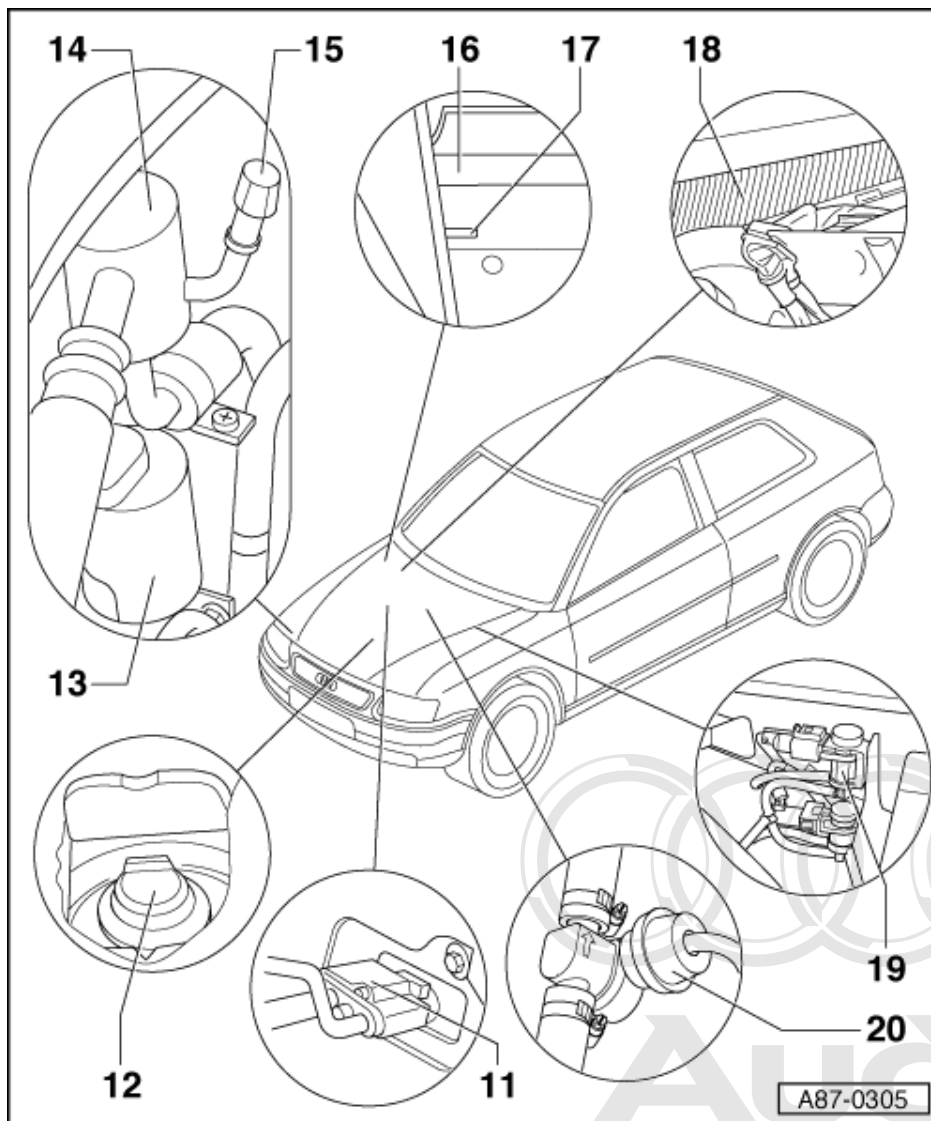
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Note:

Always screw on cap with seal.

**10 Air conditioner pressure switch
-F129 ** / high-pressure sensor
-G65 ****

- ♦ High-pressure sensor -G65 will gradually replace air conditioner pressure switch -F129 (as of model year 1999, initially vehicles with 1.6 l engines).
- ♦ Function, removing and installing pressure switch -F129 =>Page 135 .
- ♦ Check function of high-pressure sensor -G65 and signal emitted =>Page 85 .
- ♦ Remove and install high-pressure sensor -G65 =>Page 137



11 Expansion valve

- ♦ Removing and installing heat insulation =>Page 162

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Warning!

The expansion valve may be removed only if the refrigerant circuit is empty.

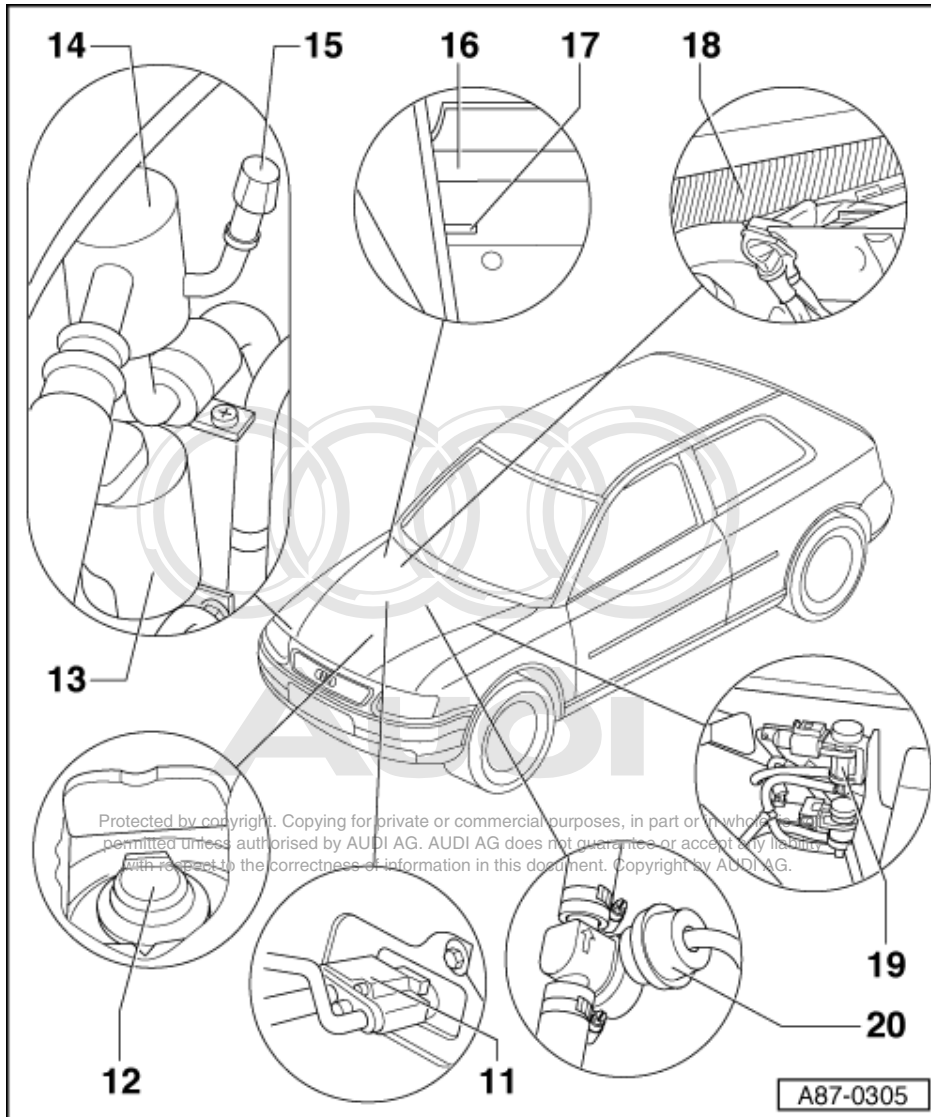
12 Condensation drainage valve

- ♦ Checking, removing and installing =>Page 161 .

13 Fluid reservoir

Warning!

The fluid reservoir may be removed only if the refrigerant circuit is empty.



14 Pre-volume

15 Service connection

- ♦ Low-pressure end
- ♦ For measurement and drainage at VW and Audi air-conditioning service centres.

Note:

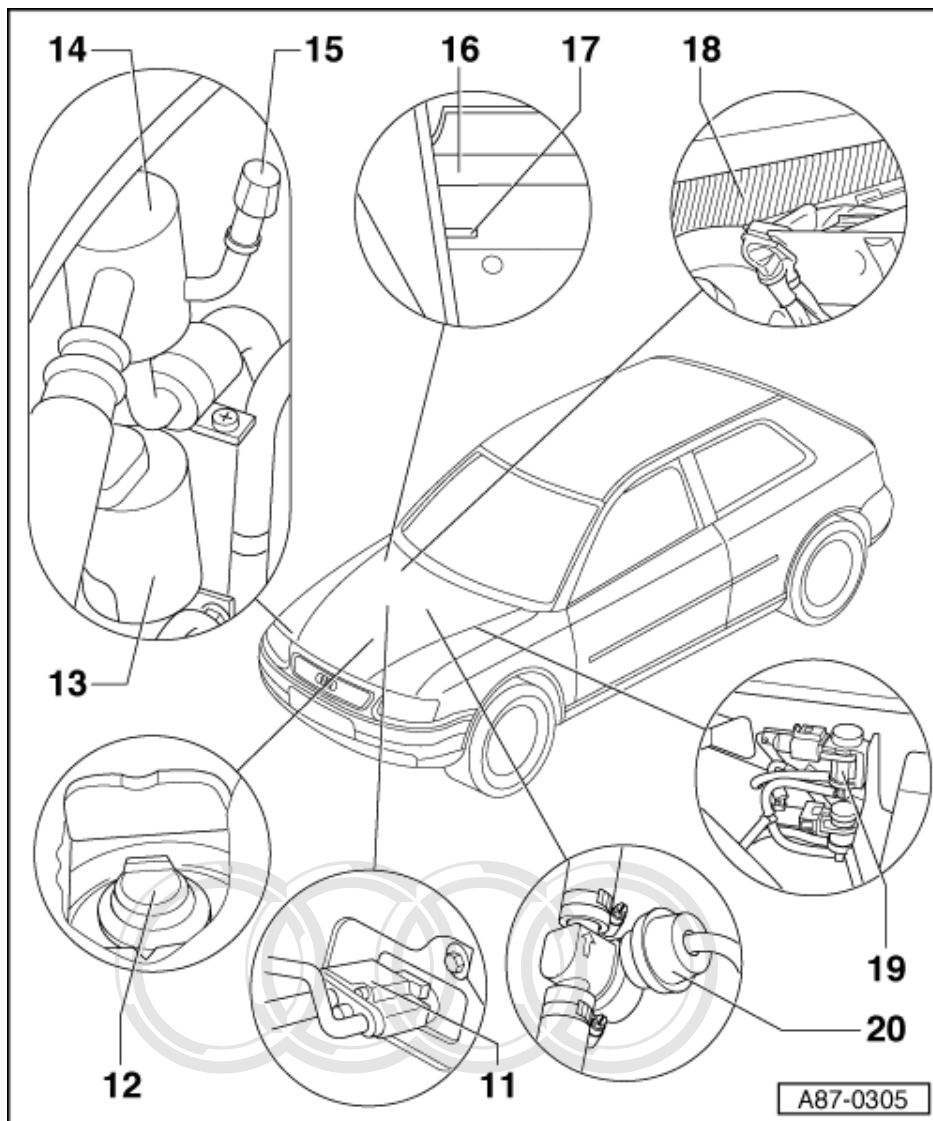
Always screw on cap with seal.

16 Air flow flap

- ♦ Removing and installing positioning motor -V71* (with potentiometer -G113) =>Page **185** .

17 Fresh air intake temperature sensor
-G89 **

- ♦ Removing and installing =>Page **185** .



18 Dust and pollen filter:

- ♦ Removing and installing => Page 113 .

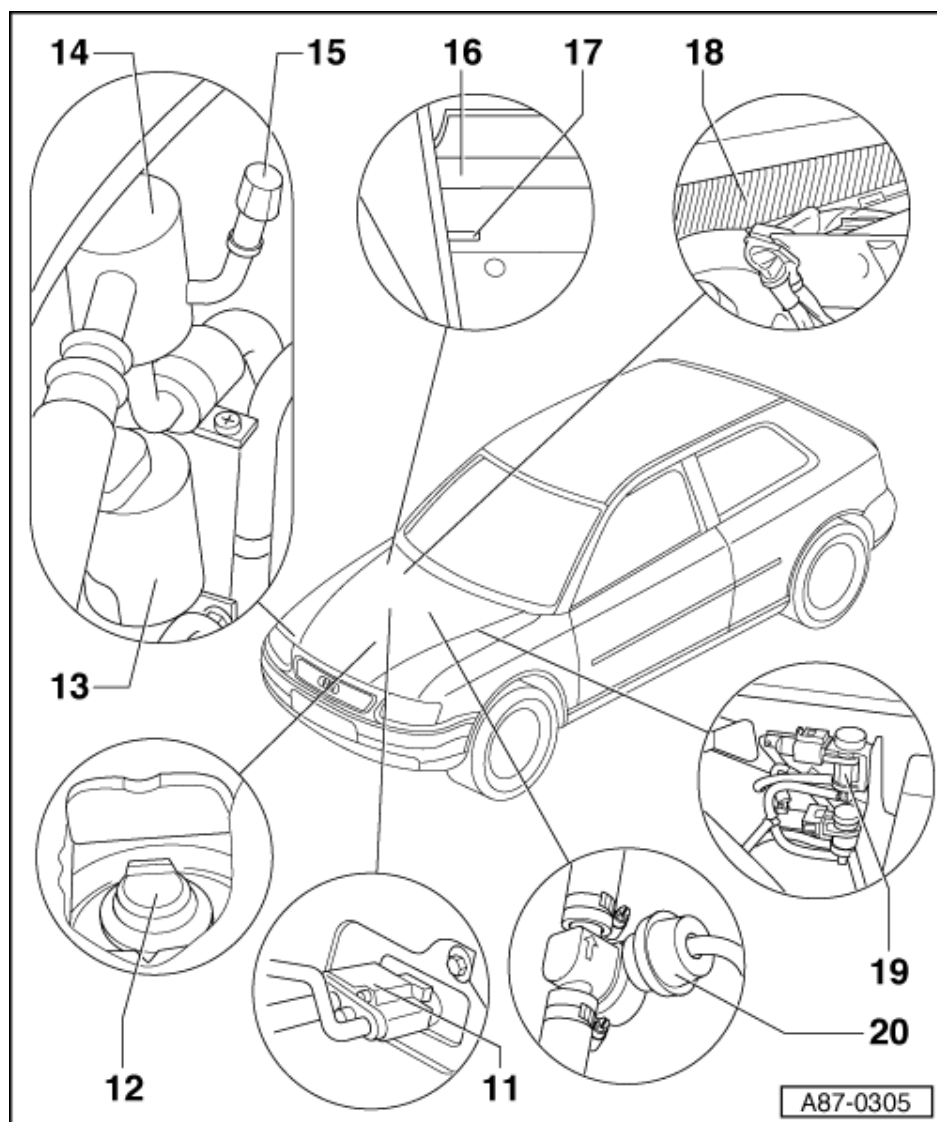
Note:

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The dust and pollen filter element should be replaced at regular intervals.
with respect to the correctness of information in this document. Copyright by AUDI AG.

=> Maintenance manual

19 Two-way valve for refrigerant shut-off valve -N147 *

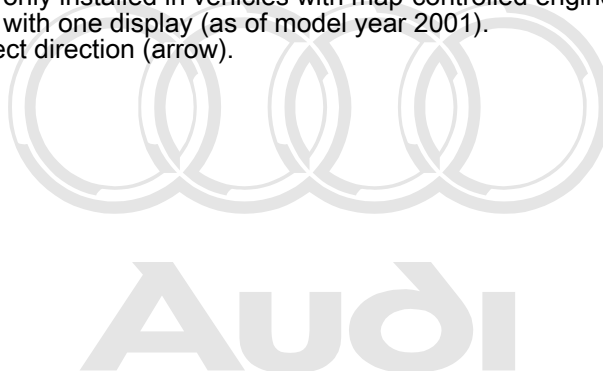
- ♦ The two-way valve -N147 is only installed in vehicles with map-controlled engine cooling and one operating and display unit -E87 with one display (as of model year 2001).
- ♦ Connection diagram for vacuum hoses for actuating the refrigerant shut-off valve => Page 163



- ♦ The two-way valve is actuated by the operating and display unit -E87.

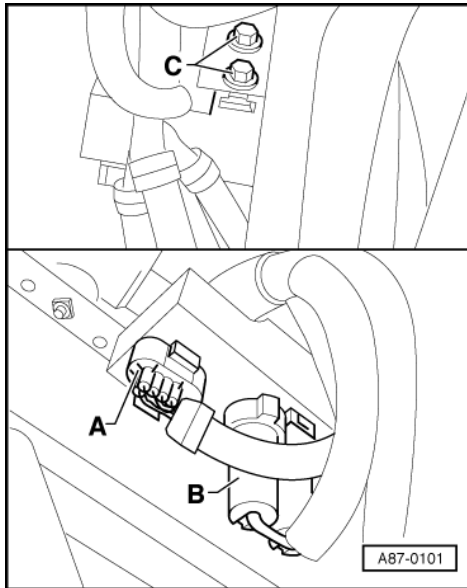
20 Refrigerant shut-off valve

- ♦ The refrigerant shut-off valve is only installed in vehicles with map-controlled engine cooling and one operating and display unit -E87 with one display (as of model year 2001).
- ♦ Ensure refrigerant flows in correct direction (arrow).



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5.2 - Removing and installing radiator fan control unit -J293



- -> Detach connectors-A- and -B-.
- Remove bolts -C-.

Notes:

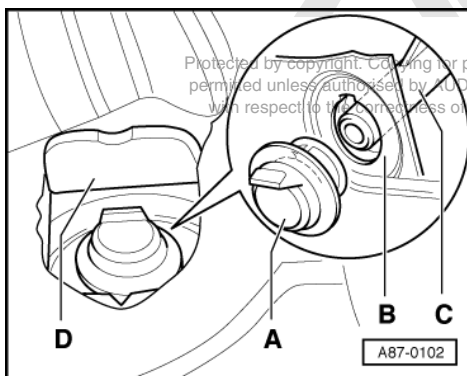
- ♦ Radiator fan control unit -J293 versions and vehicle wiring differ for vehicles with pressure switch -F129 and high-pressure sensor -G65.

=> Parts List

=> Current Flow Diagrams, Electrical Fault-Finding and Fitting Locations

- ♦ Control unit -J293, installed in vehicles with high-pressure sensor -G65, is available in 2 designs.
 - In design "1" the radiator fan is automatically switched on in conjunction with the compressor (the first fan speed is activated regardless of the pressure in the refrigerant circuit).
 - In design "2" the compressor is switched on without the radiator fan; the first fan speed is only activated once the pressure in the refrigerant circuit has exceeded 12 bar.

5.3 - Checking condensation drain, removing and installing valve

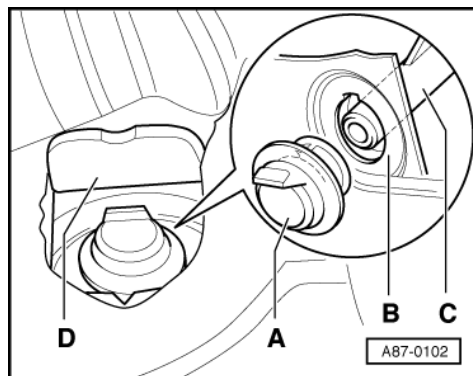


Checking

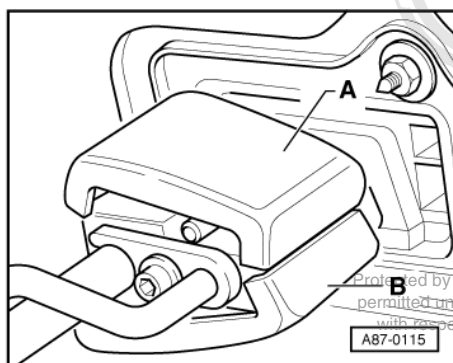
- -> Condensation drain valve -A- must not be gummed up and must close; the drainage aperture must be positioned at bottom.

Removing and installing.

- Open flap -D- of the thermal insulation mat (at the pre-punched point) and remove condensation drain valve.

Notes:

- ♦ Remove condensation drain valve -A- from floor panel downward - ensure proper positioning in cross-panel -B- when installing.
- ♦ The installed condensation drain valve must not make contact with the thermal insulation mat flap -D-.
- ♦ The condensation drain valve must not be gummed up with wax or underseal.
- ♦ -> In the event of complaints of moisture in passenger compartment, check condensation drain -C- is correctly seated in condensation drain valve -A-.

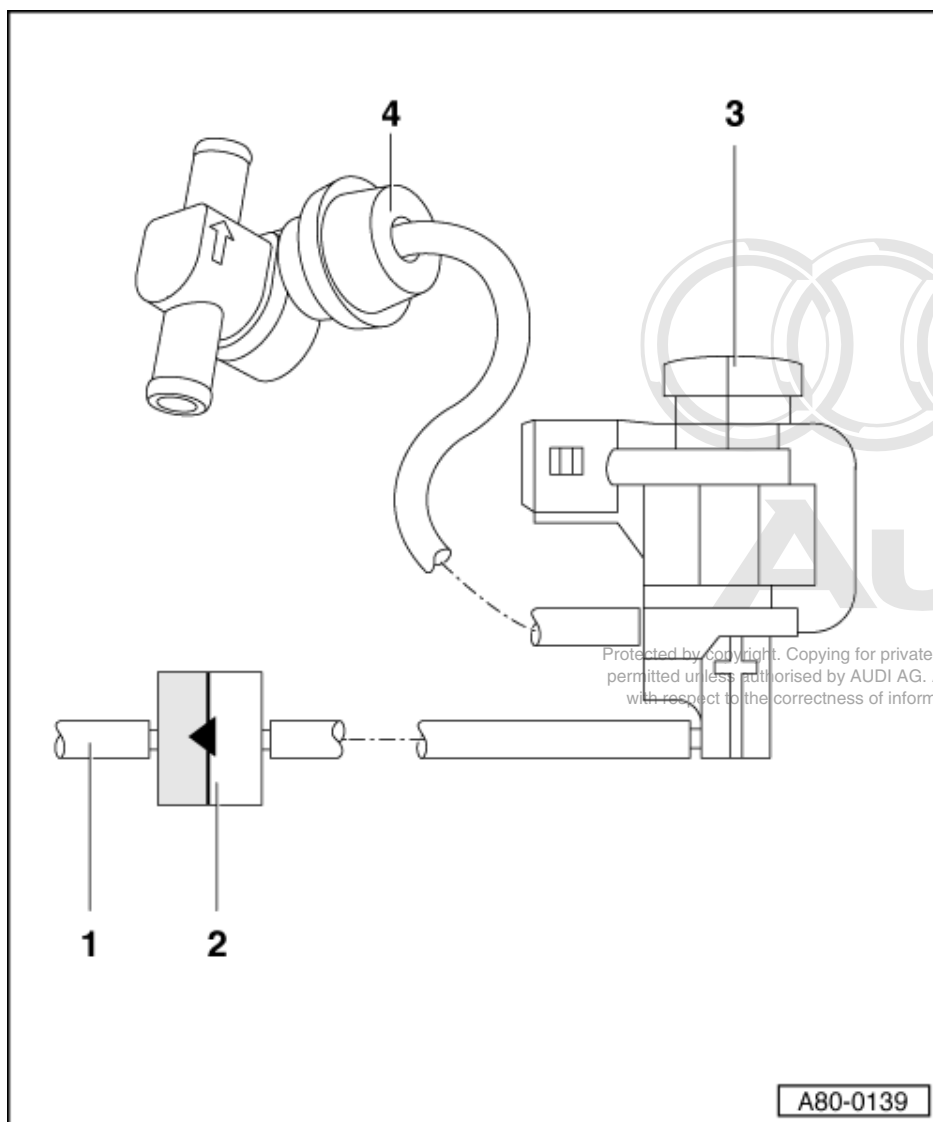
5.4 - Removing and installing heat insulation for the expansion valve

- -> Press together both shells -A- and -B- of the heat insulation until the catches engage.

Note:

If no heat insulation has been installed or if it has been improperly installed, the air conditioner capacity may be adversely affected (pre-set regulatory curve change due to heat radiation).

5.5 - Connection diagram for vacuum hoses for actuating the refrigerant shut-off valve



Note:

The two-way valve -N147 and the refrigerant shut-off valve is only installed in vehicles with map-controlled engine cooling and one operating and display unit -E87 with one display (as of model year 2001).

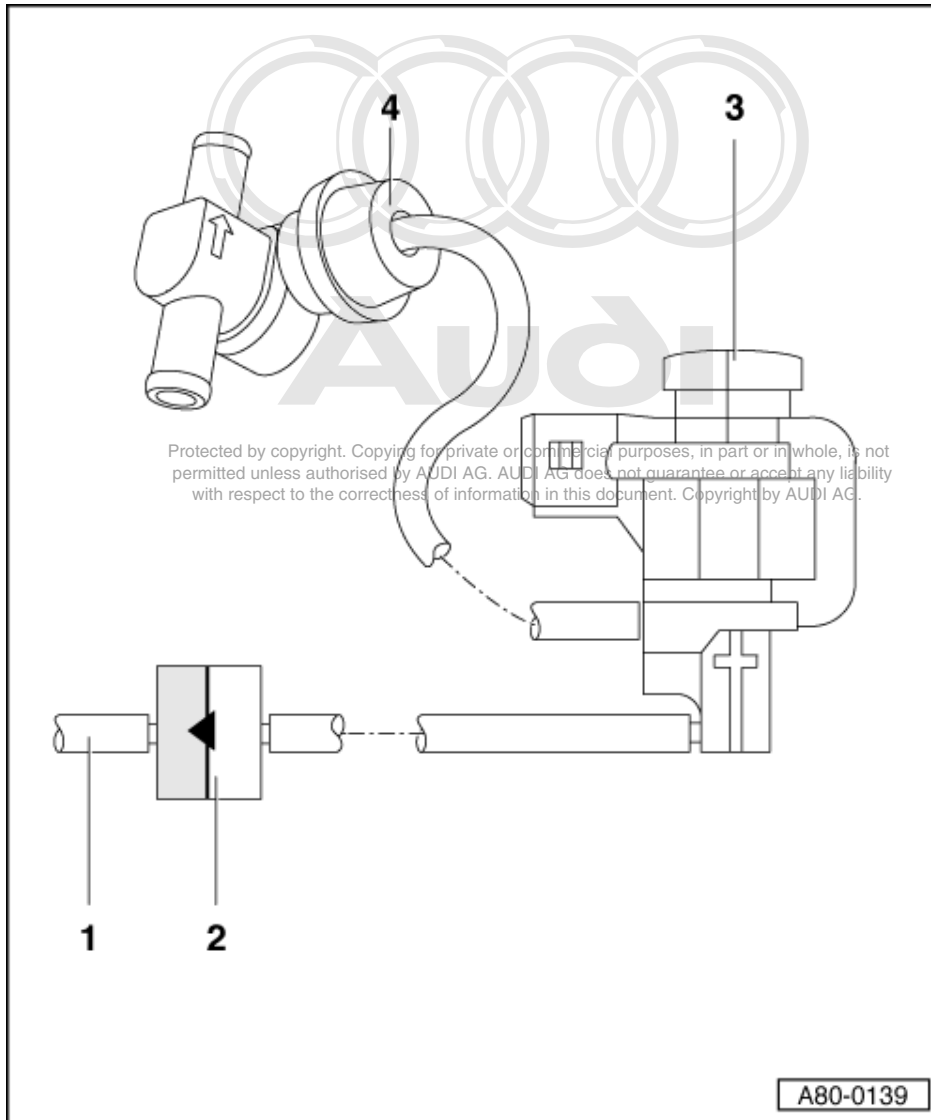
1 Vacuum hose

- ♦ To vacuum connection on engine

=> Relevant Workshop Manual; Engine Mechanical Components

2 Non-return valve

- ♦ Arrow on vacuum valve points towards engine



3 Two-way valve for refrigerant shut-off valve -N147

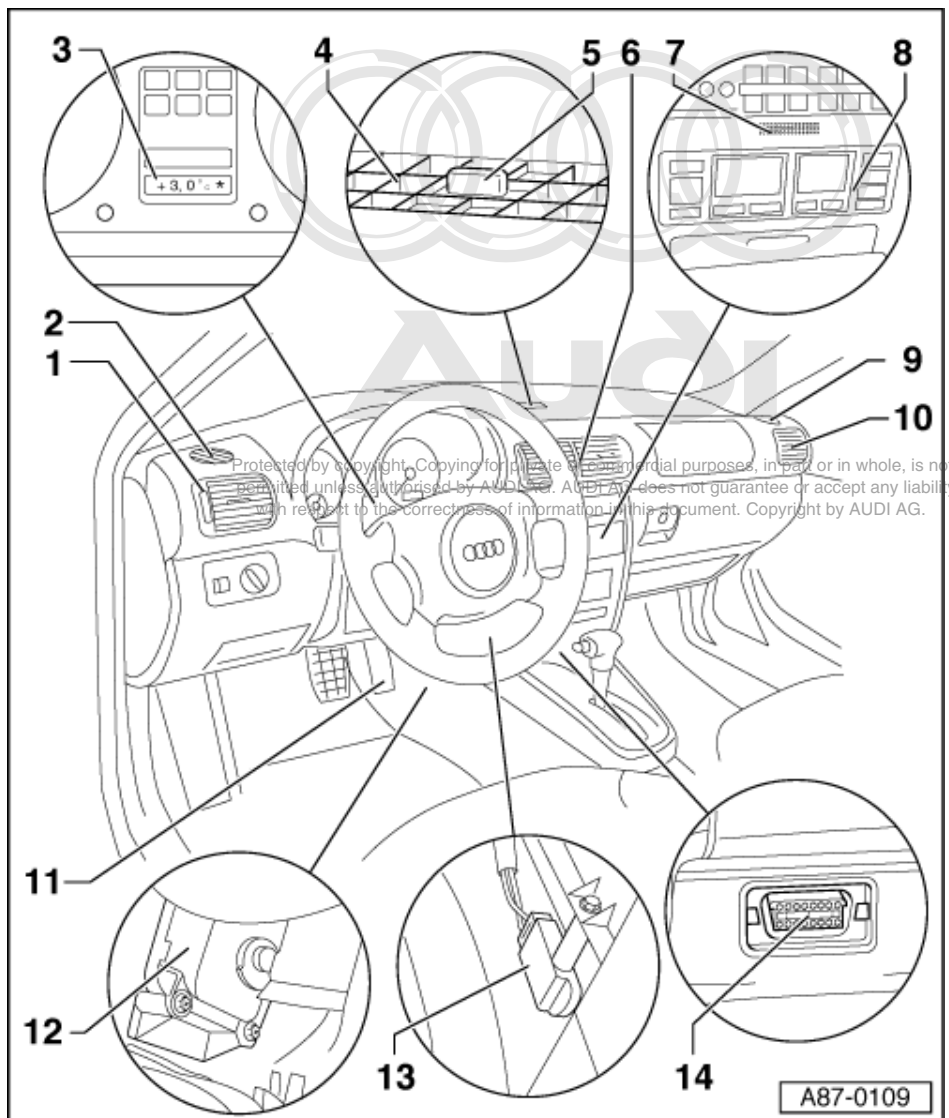
- ◆ The two-way valve is actuated by the operating and display unit -E87.
- ◆ The two-way valve -N147 is installed on the left-hand side of the engine compartment (as viewed in direction of travel) above the master brake cylinder.

4 Refrigerant shut-off valve

- ◆ Ensure refrigerant flows in correct direction (arrow).
- ◆ The refrigerant shut-off valve is installed in the refrigerant hose between the engine and heat exchanger in air conditioner (refrigerant feed).

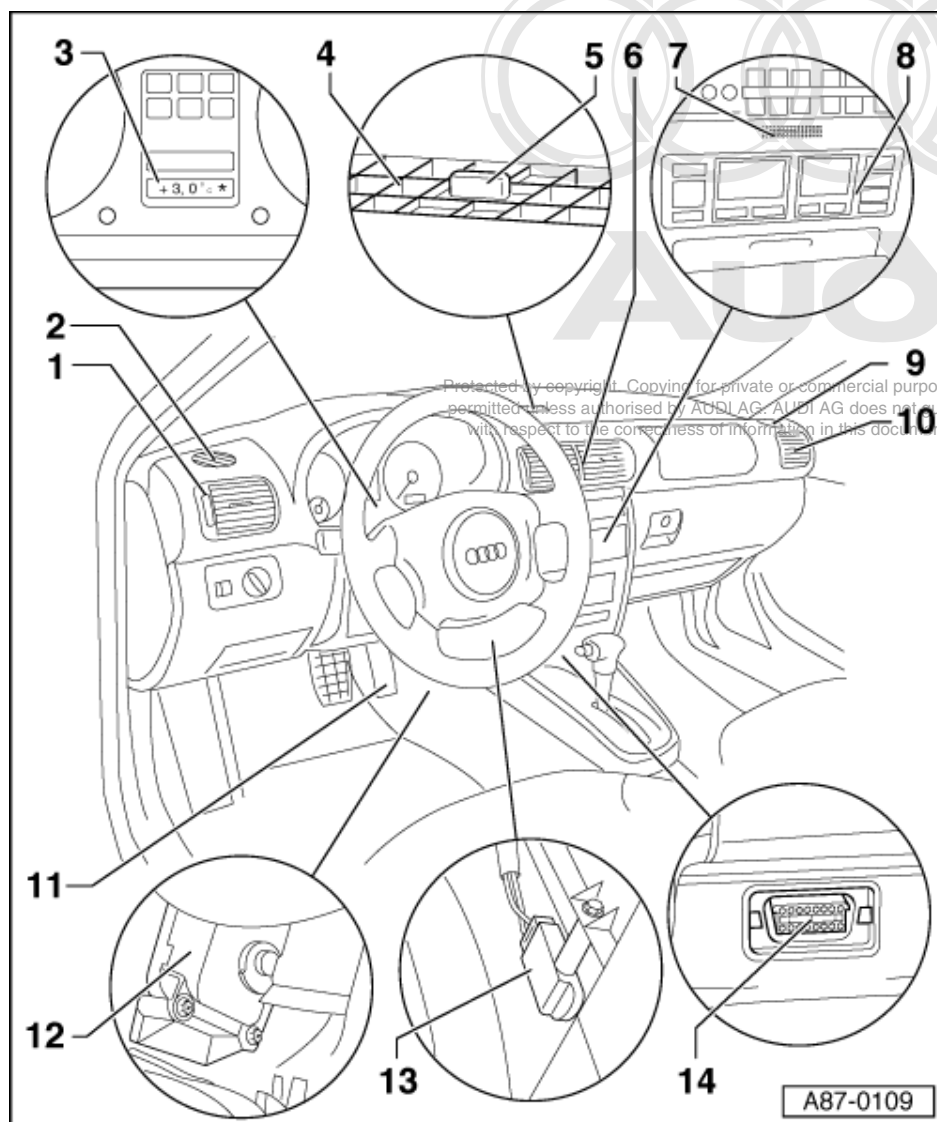
6 - Components for air conditioner control and regulation (in the passenger compartment)

6.1 - Components for air conditioner control and regulation (in the passenger compartment)



Notes:

- ◆ After completing repair work, always interrogate and erase fault memory, perform basic setting, and check the -E87 encoding.
- ◆ Check refrigeration capacity =>Page 186 .
- ◆ Refrigerant circuit =>Page 129 .
- ◆ All components marked with * are actuated during the final control diagnosis =>Page 18 .
- ◆ An electrical check can be performed on all components marked with ** =>Page 46 .
- ◆ Vents and air ducts of the dash panel =>Page 89 .



- ♦ Removing and installing dash panel fascia.

=> General body repairs, Interior; Repair group 70

1 Dash panel vent, left

- ♦ Removing and installing => Page 92 .

2 Defroster vent for "side window"

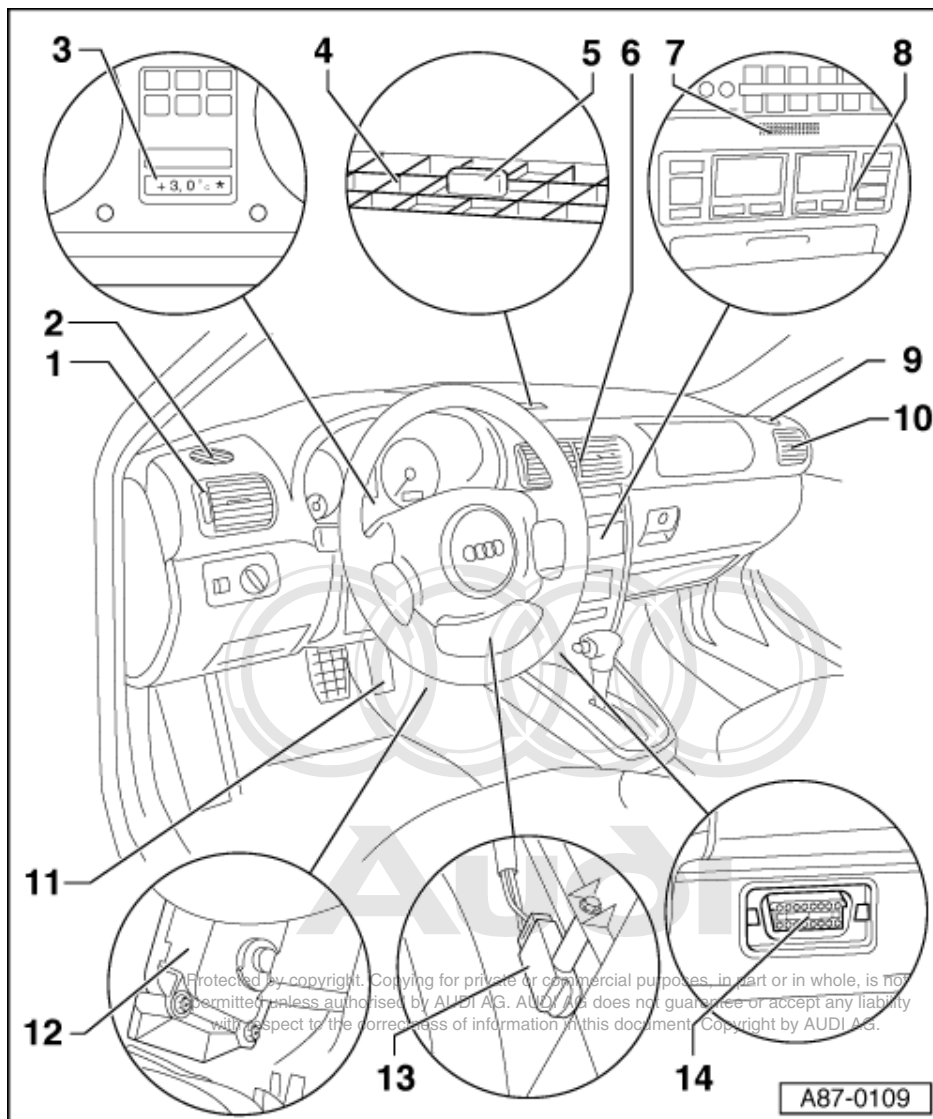
- ♦ Removing and installing.

=> Inner Body Assembly; Repair group 70

3 Ambient temperature indicator

-G106 *

- ♦ The ambient temperature determined can be displayed on the -E87 in °C or °F according to the respective setting.



Note:

In the event of a faulty display, check values measured by temperature sensor => Page 31 (Reading measured value block).

4 Windscreen defroster vent

- ♦ Removing and installing =>Page 93 .

**5 Sunlight penetration photosensor
-G107 ****

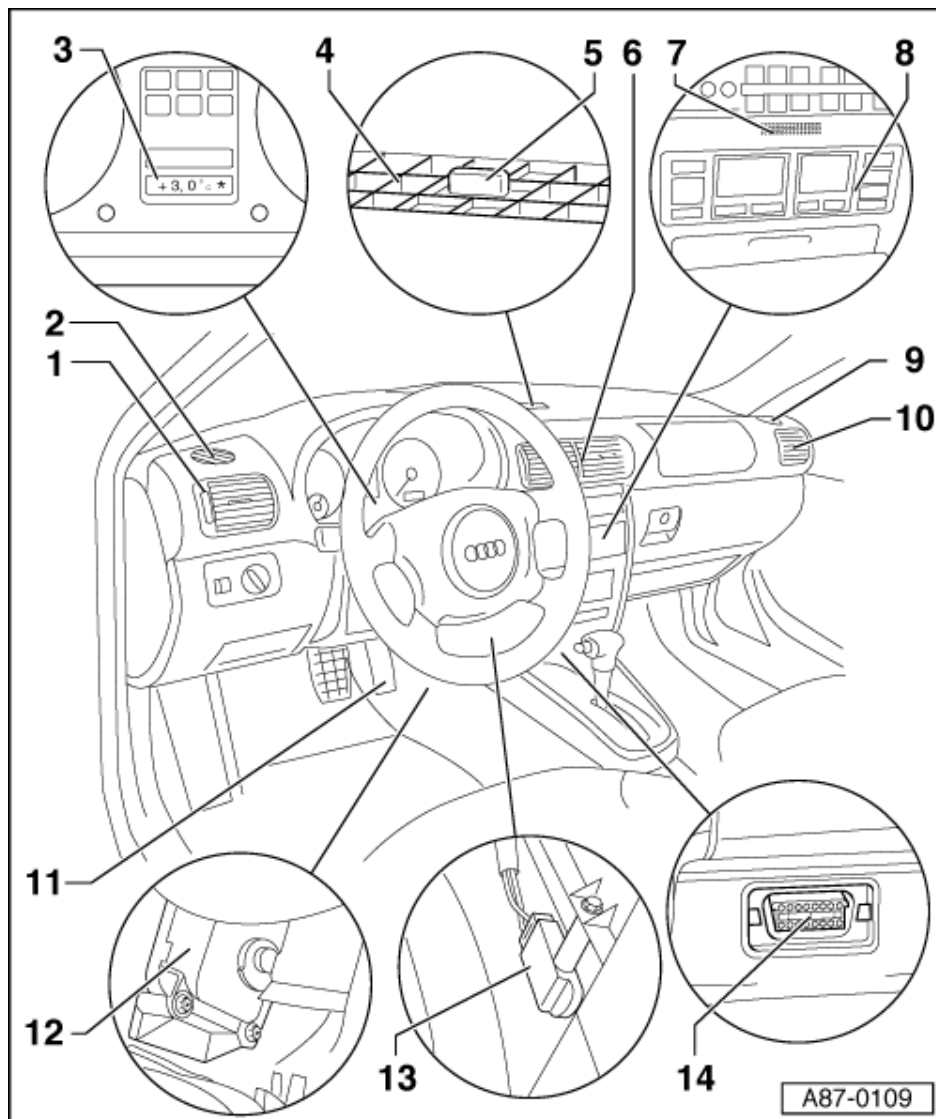
- ♦ Removing and installing =>Page 181 .

6 Centre dash panel vent

- ♦ Removing and installing =>Page 91 .

**7 Dash panel temperature sensor
-G56 ****

- ♦ Removing and installing => Page 183 .



8 Operating and display unit -E87.

- ♦ Removing and installing => Page 174 .
- ♦ Different versions => Page 174 .

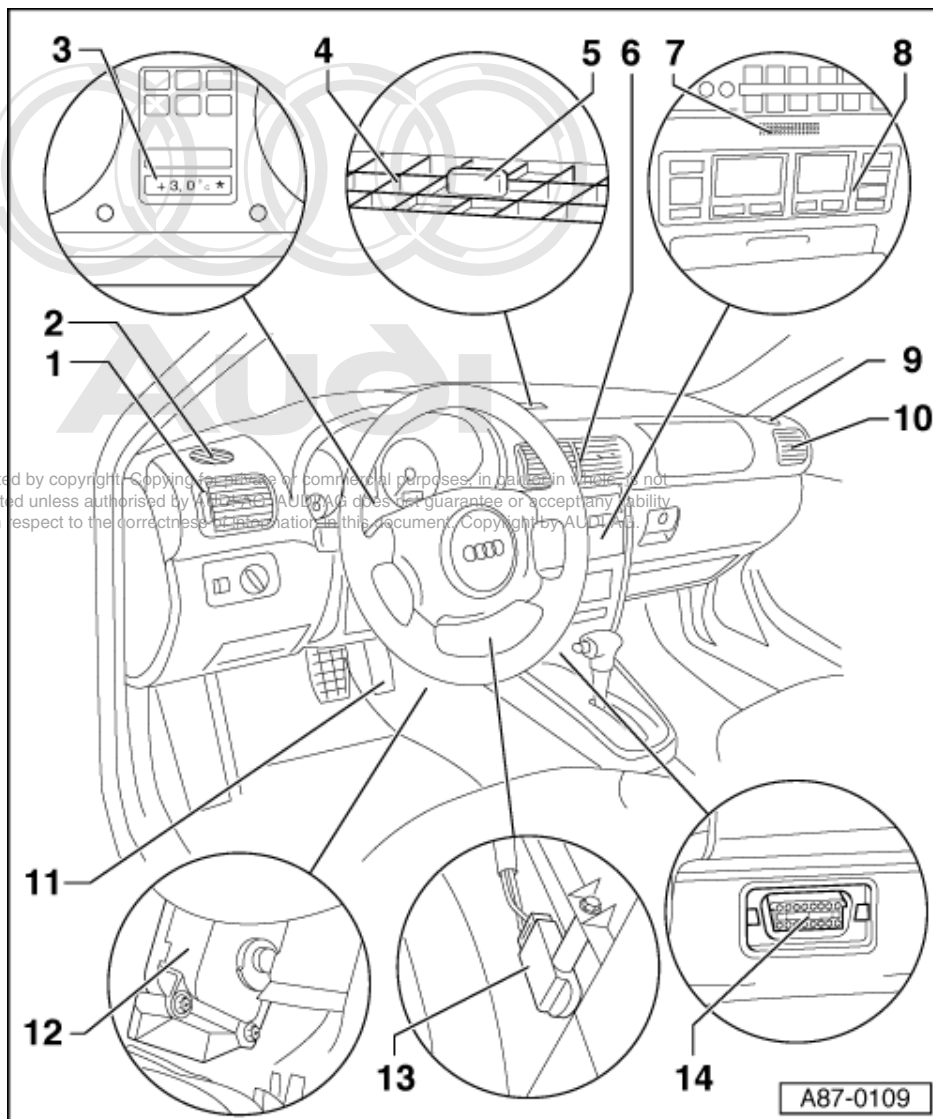
Notes:

- ♦ The display zone and operating controls are illuminated via LED's (not replaceable individually).
- ♦ Different versions vary according to the production date and the vehicle version (e.g. vehicles with map-controlled cooling).

=> Parts List

- ♦ Up to and including model year 2000 operating and display units -E87 with two displays were installed. As of model year 2001 the -E87 with one display is installed.

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9 Defroster vent for "side window"

- ♦ Removing and installing.

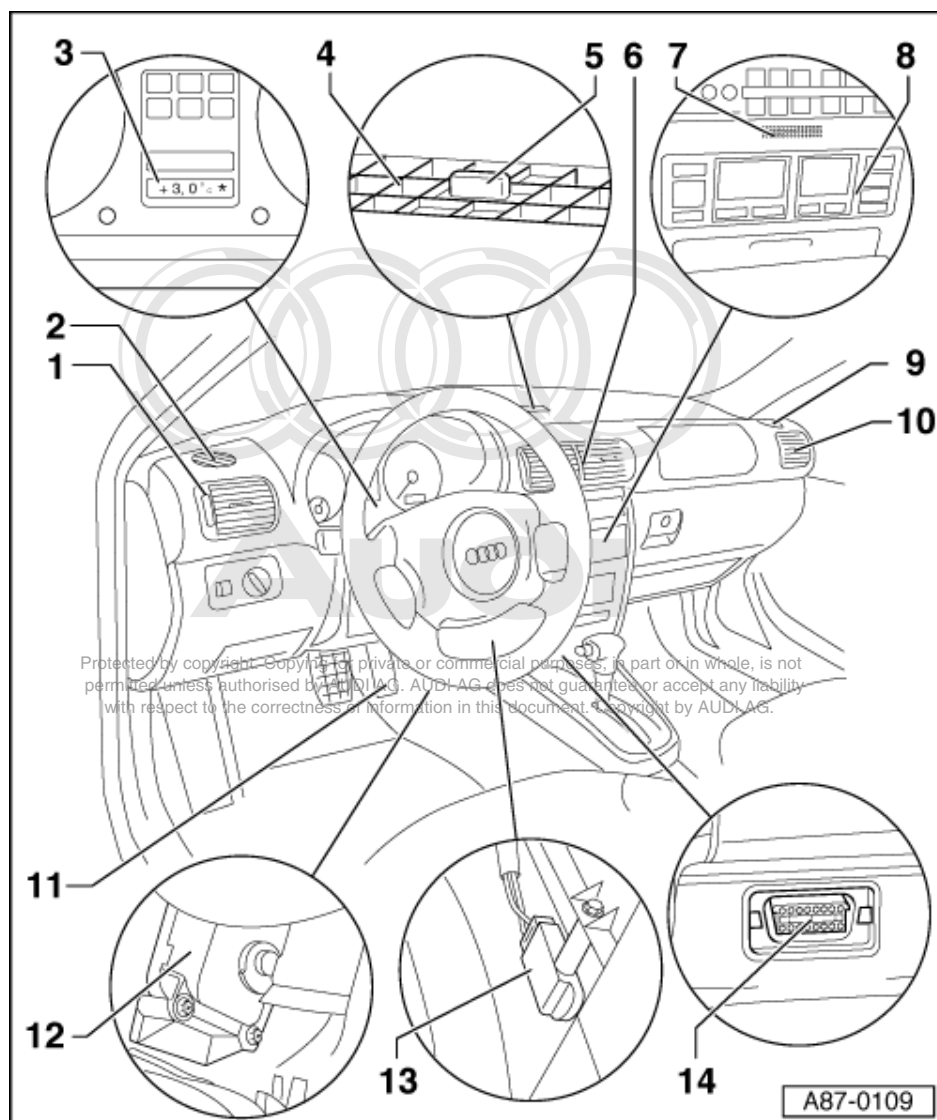
=> Inner Body Assembly; Repair group 70

10 Dash panel vent, right

- ♦ Removing and installing =>Page 92 .

11 Kickdown switch

- ♦ The magnetic clutch is switched off following acceleration either by the engine control unit or the control unit for automatic transmission, depending on the vehicle equipment and the current vehicle speed =>Page 31 (Reading measured value block).



12 Footwell/defroster flap positioning motor -V85 *

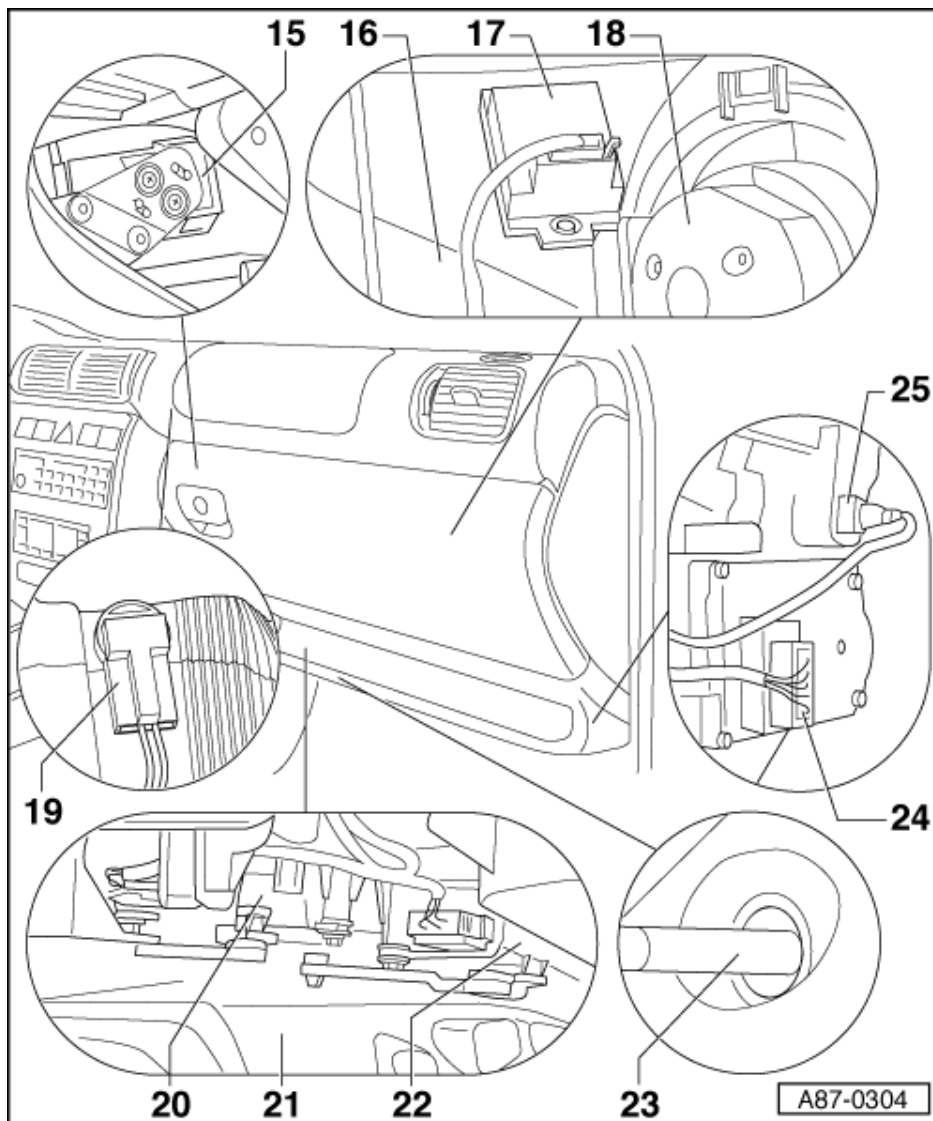
- ♦ With potentiometer -G114
- ♦ Removing and installing =>Page 181 .
- ♦ "yellow" pivot arm

13 Footwell vent temperature sender -G192 **

- ♦ Removing and installing =>Page 178 .

14 Connector for fault reader V.A.G 1551

- ♦ Connect V.A.G 1551 and check air conditioner =>Page 4 .



15 Temperature sensor blower -V42

- ♦ Removing and installing => Page 184 .

16 Air conditioner with evaporator

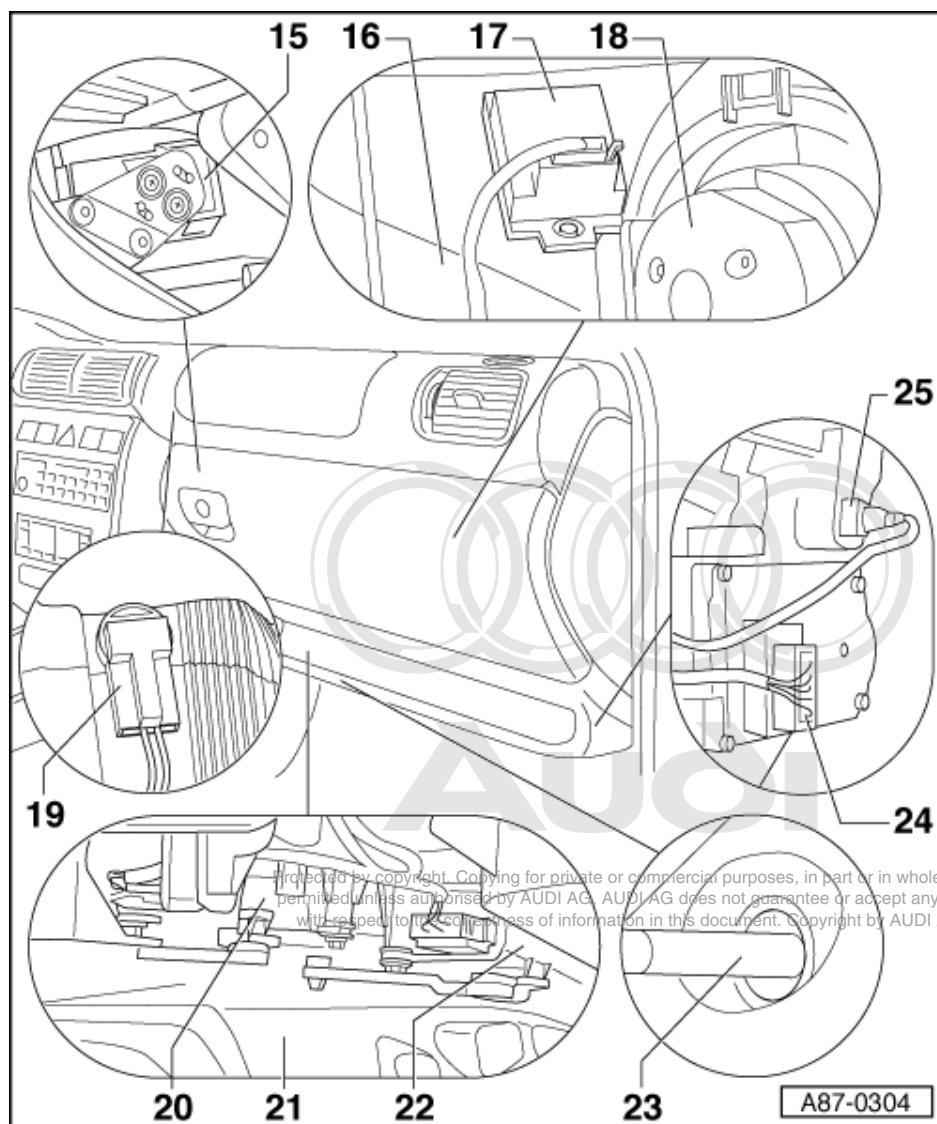
- ♦ Removing and installing => Page 206 .
- ♦ Dismantle and assemble design "1" =>Page 213 .
- ♦ Dismantle and assemble design "2" =>Page 224 .

Warning!

The air conditioner may be removed only if the refrigerant circuit is empty.

Audi

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Note:

As of June 1997, AC version "1" has been gradually phased out of production and AC version "2" gradually phased in.

=> Parts List

17 Blower control unit -J126 **

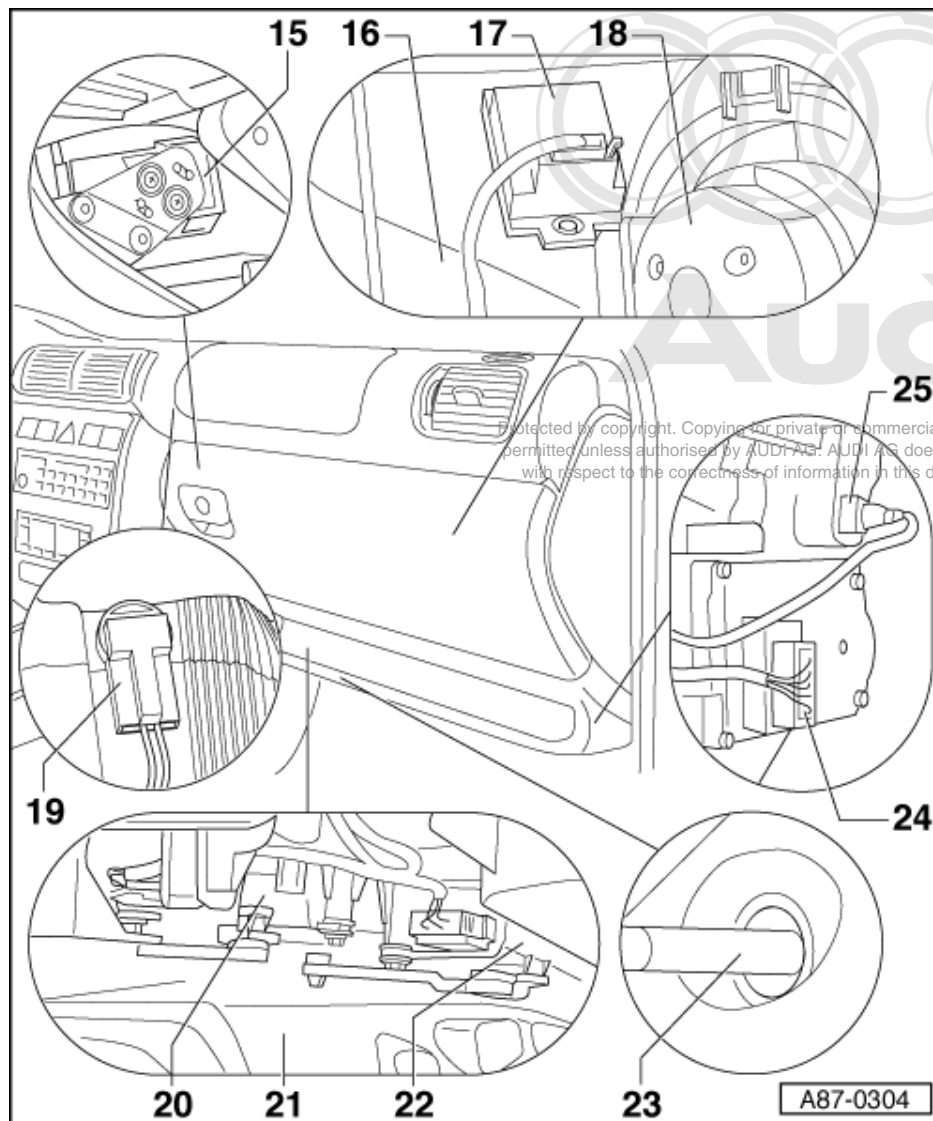
- ♦ Removing and installing =>Page 178 .

18 Fresh air blower -V2 **

- ♦ Removing and installing => Page 179 .

**19 Centre vent temperature sender
-G191 ****

- ♦ Removing and installing => Page 179 .



Note:

The sender for centre vent temperature -G191 is only present in vehicles with map-controlled engine cooling (at the moment only with 1.6 litre engine with gradual introduction into model year 1999).

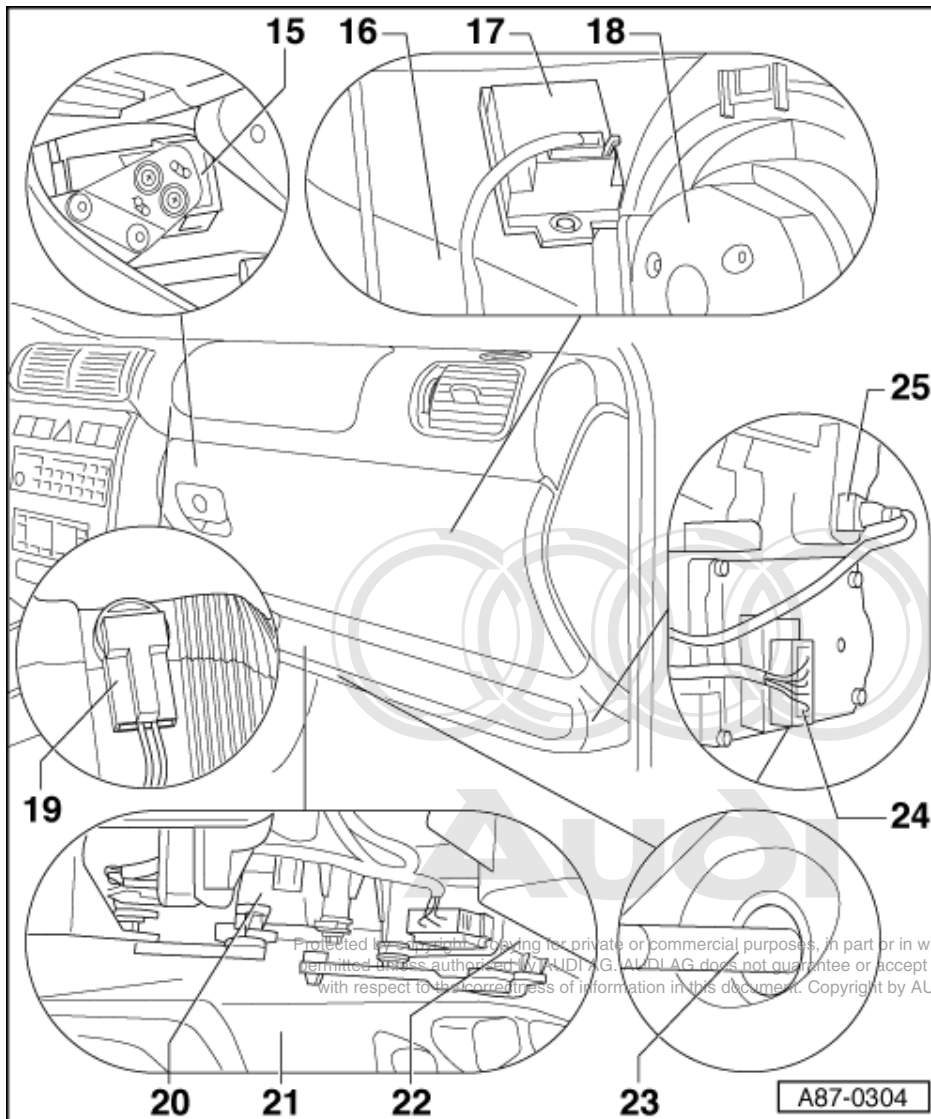
=> Relevant Workshop Manual Injection and Ignition system

**20 Positioning motor for central flap
 -V70 ***

- ♦ With potentiometer -G112
- ♦ Removing and installing =>Page 182 .
- ♦ "Green" pivot arm

21 Footwell vent

- ♦ Removing and installing => Page 181 .



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22 Temperature flap positioning motor -V68 *

- ♦ With potentiometer -G92
- ♦ Removing and installing =>Page **182** .
- ♦ "Black" or "pink" pivot arm

23 Condensation drain

- ♦ Checking =>Page **161** .

24 Air flow flap positioning motor -V71*

- ♦ Actuates the air flow flap and fresh/recirculated air flap
- ♦ With potentiometer -G113
- ♦ Removing and installing =>Page **185** .

25 Fresh air intake temperature sensor -G89 **

- ♦ Removing and installing =>Page **185** .

6.2 - Removing and installing operating and display unit -E87

- Removing and installing the operating and display unit -E87 with two displays => Page **176** .
- Removing and installing the operating and display unit -E87 with one display => Page **177** .

Notes:

- ◆ Prior to removal, interrogate -E87 fault memory.
- ◆ After replacing -E87, always:
 - Check code and enter new code if necessary.
 - Perform basic setting.
 - Interrogate fault memory.
- ◆ The display on -E87 may be switched from °C to °F and vice versa by pressing the "temperature +" button with the "recirculated air" button pressed.
- ◆ If the -E87 continues to function after the ignition has been switched off, use the current flow diagram to check for a short circuit to positive in the wiring to connector -D- contact -1- (type with two displays) or contact -10- (type with one display) (connection auxiliary heater operation).
- ◆ If the display of a newly installed operating and display unit flashes (for approx. 2 minutes) after the ignition is switched on, encode the operating and display unit and perform basic setting.
- ◆ If an -E87 operating and display unit with part number as of index "H" is replaced, the temperature is displayed on -E87 in °F in vehicles in which the assignment of the ignition key is transferred from the dash panel insert. The display can be converted from °F to °C in these vehicles by actuating the "temperature +" key with the "recirculated air button" pressed. Each ignition key must be converted individually (as all ignition keys are not generally available in the workshop, the customer must be instructed as to how to perform the conversion).
- ◆ Up to and including model year 2000 operating and display units with two displays were installed. As of model year 2001 there was a changeover to the type with one display.

Note for the type with one display:

This operating and display unit are available in four different types (for vehicles with or without heated seats, for vehicles with or without radio navigation system).

=> Parts List

Notes for the type with two displays:

- ◆ If the two display zones in the operating and display unit -E87 with part number 8L0 820 043 up to and including index "C" are not illuminated when ignition is switched on service voltage supply terminal 58D (dimmer) to the -E87 according to current flow diagram =>Page 46 (electrical check).

8L0 820 043 B A3 Fully aut. air cond. DXX
Code XXXXX WSC ZZZZZ

-> Only operating and display unit -E87 with part number 8L0 820 043 up to and including index "C" can be installed in vehicles from model year 1997.

- ◆ The pin assignment of control and display unit -E 87 has changed at the start of model year 1998 (inputs for lighting).

8L0 820 043 D A3 Fully aut. air cond. DXX
Code XXXXX WSC ZZZZZ

-> Only operating and display unit -E87 with part number 8L0 820 043 as of index "D" can be installed in vehicles as of model year 1998.

- ◆ If the two display zones of the operating and display unit -E87 with part number 8L0 820 043 as of index "D" are not illuminated when ignition is switched on check voltage supply of terminal 58d (dimmer) to -E87 =>Page 46 (electrical test).
- ◆ If the two display zones in the operating and control unit -E87 with part number 8L0 820 043 as of index "D" are not illuminated when the ignition is switched on, check voltage supply from terminal 58s (search light) to -E87 =>Page 46 (Electrical check).
- ◆ If an operating and display unit -E87 with part number 8L0 820 043 as of index "D" is installed in a vehicle from model year 1997, the brightness of the switch illumination cannot be altered =>Page 46 (Electrical check).
- ◆ If an operating and display unit -E87 with part number 8L0 820 043 as of index "C" is installed in a vehicle from model year 1998, the brightness of the switch illumination cannot be altered =>Page 46 (Electrical check).
- ◆ The coding for the operating and display unit -E87 is different in vehicles with map-controlled cooling to that for vehicles without map-controlled cooling (for 1.6l engine to be gradually introduced as of model year 1999).

8L0 820 043 H A3 Fully aut. air cond. DXX
Code XXXXX WSC ZZZZZ

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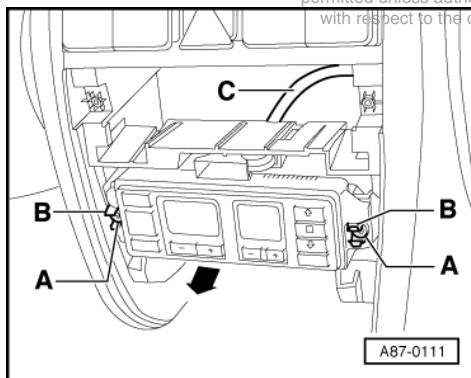
-> Only an operating and display unit -E87 with part number 8L0 820 043 as of index "H" can be installed in vehicles with map-controlled cooling, as the map-controlled cooling coding is only recognised as of this index. As indices "H", "J", "K" and "L" are already allocated to a modified version of -E87 (use in series production planned for first quarter of 2000), operating and display units -E87 with part number 8L0 820 043 and index "M" (or "N" for Japan) will be installed until production has been reorganised.

- ♦ As of model year 2000, the assignment of the ignition key is conveyed by the dash panel insert (data telegram) together with the refrigerant temperature (when ignition is switched on). This information can only be processed by operating and display unit -E87 with part number 8L0 820 043 as of index "H". As the indices "H", "J", "K" and "L" are already allocated to a modified version of -E87 (use in series production as of model year 2001), operating and display units with part number 8L0 820 043 and indexes "M" (or "N" for Japan) will be installed until production has been reorganised.

=> Electrical System; Repair group 01

=> Parts List

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- ♦ The display zone and operating controls are illuminated via LED's (not replaceable).

Removing and installing the operating and display unit -E87 with two displays

- Remove radio.

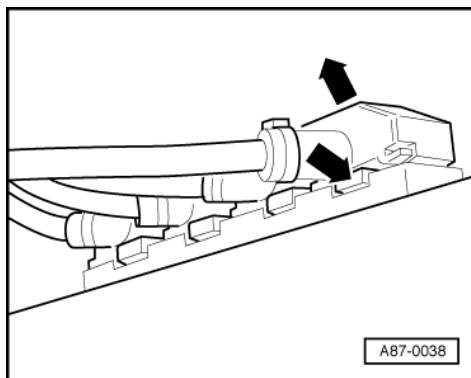
=> Electrical System; Repair group 91

- Remove panel for dash panel centre section.

=> General body repairs,Interior; Repair group 70

- -> Remove bolts -A-.
- Remove operating and display unit.

Notes:



- ♦ After installing operating and display unit -E87, ensure proper seating of moulded hose -C- (from temperature sensor -G56 to blower -V42).

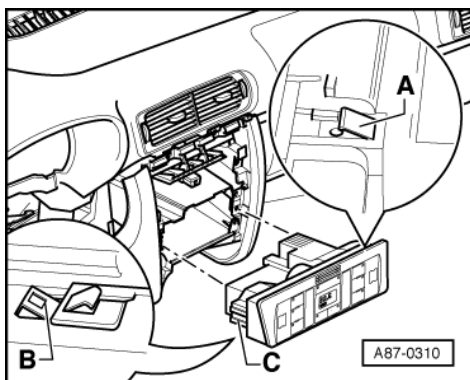
- ◆ When installing bolts -A-, insert the bracket for trim -B- on the correct side.
- -> Press back catches on connector and detach connector.

Removing and installing the operating and control unit -E87 with only one display

Removing

- Remove radio or radio navigation system:
- => Radio, telephone, navigation; Repair group 91; Navigation System Navigation System
- Reach through the opening and push the operating and display unit back

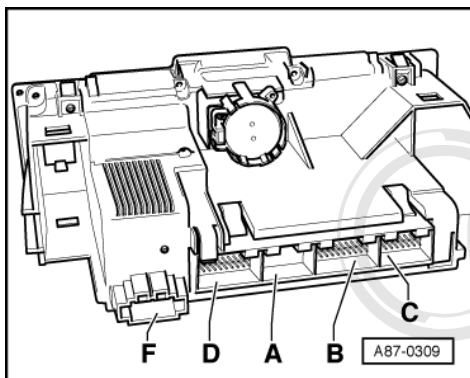
Notes:



- ◆ -> The operating and display unit is secured with 4 retaining clips -A- in the centre console.
- ◆ When replacing an operating and display unit, note the precise layout (e.g. with or without breakthrough for the heated seat switches)

=> Parts List

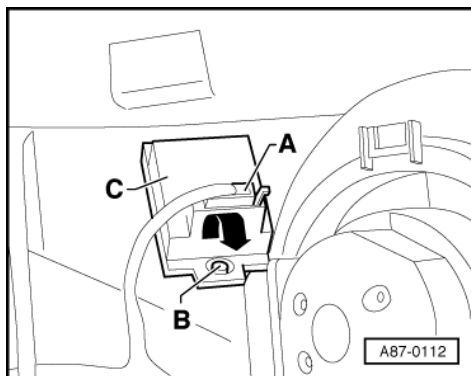
- ◆ To remove the switches for the heated seats, press back the lugs -B- and pull the switch -C- back out of the operating and display unit.



- ◆ If the dash panel temperature sensor -G56 produces a faulty measurement, check the intake grille on the trim panel - must not be closed.
- ◆ -> In this type of the operating and display unit the connector -A- is no longer occupied.
- ◆ The heated rear window is activated via the connector -F-.

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6.3 - Removing and installing blower control unit -J126

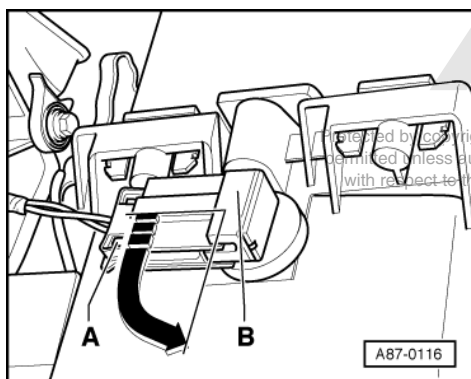


- Remove glove compartment.

=> Inner Body Assembly; Repair group 68

- -> Detach connector-A-.
- Remove bolt -B-.
- Remove control unit -C- in direction of arrow.

6.4 - Removing and installing footwell vent temperature sender -G192

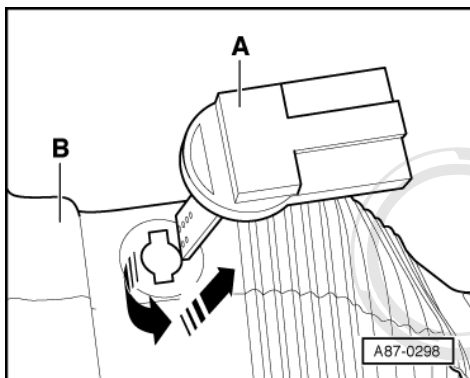


- Remove driver's storage compartment.

=> Inner Body Assembly; Repair group 68

- -> Detach connector-A-.
- Rotate sender -B- 90° and remove from distribution box.

6.5 - Removing and installing centre vent temperature sensor -G191



- Removing dash panel centre section.

=> Inner Body Assembly; Repair group 68

- -> Detach connector.
- Rotate sender -A- 90° and remove from air duct -B-.

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Notes:

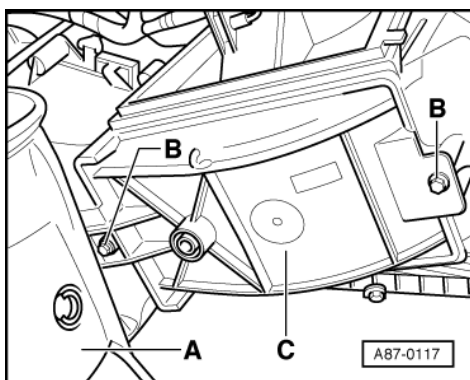
- ◆ Sender -G191 is installed in the air duct for the centre dash panel vent -B- (on right-hand side as viewed in direction of travel). Fitting location of air duct for centre dash panel vent=>Page 89 (Vents and air ducts for dash panel).
- ◆ The sender -G191 in vehicles with an operating and display unit -E87 with the type with two displays is only installed into vehicles with map-controlled cooling.
- ◆ A refrigerant thermostat is installed in vehicles with map-controlled cooling; an additional electrical actuator is integrated in this thermostat. This actuator (thermostat -F265 for map-controlled engine cooling) is actuated by the engine control unit according to the current engine load.

=> Relevant Workshop Manual Injection and Ignition system

=> Relevant Workshop Manual Engine Mechanical Components; Repair group 13

- Actuation of thermostat -F265 alters the refrigerant temperature (the refrigerant thermostat opens at a higher temperature when the engine is running at part throttle in comparison to full engine throttle).
- Sender -G191 is installed to maintain the temperature of the air emitted from the vents as constant as possible, even when the refrigerant temperature fluctuates.

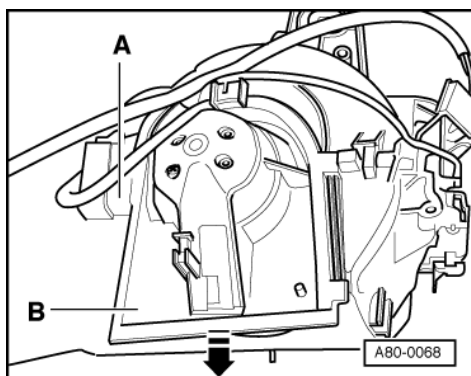
6.6 - Removing and installing fresh air blower -V2



- Remove glove compartment.

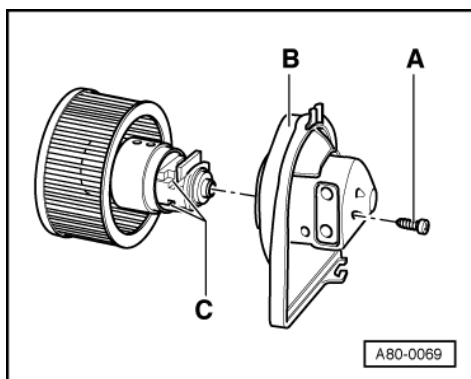
=> Inner Body Assembly; Repair group 68

- Remove bolt clip for foam cover.
- -> Fold foam cover -A- to one side.
- Remove screws -B- and take off cover -C-.



- -> Disconnect connector -A- from fresh air blower.
- Pull fresh-air blower -B- downwards out of air conditioner.

Detaching fresh air blower -V2 from base plate

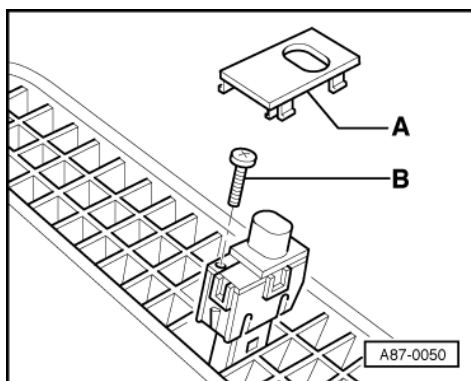


- -> Remove bolt -A-.
- Pull fresh air blower out of base plate -B-.

Notes:

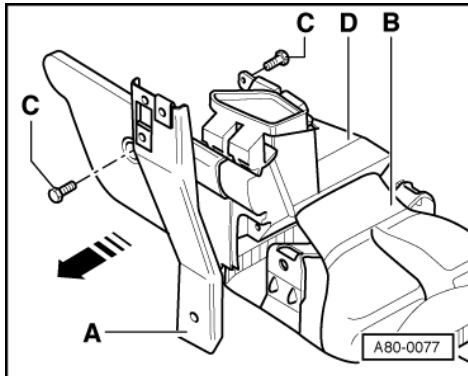
- ♦ A soundproofing mat can be attached to base plate -B- for noise insulation.
- ♦ When installing the fresh air blower in the base plate, ensure that connectors -C- are correctly positioned.
- ♦ Following installation, ensure that the fresh air blower is properly positioned in the air conditioner.

6.7 - Removing and installing sunlight penetration photosensor -G107



- -> Carefully lever off cover -A-.
- Remove bolt -B-.
- Remove photosensor.

6.8 - Removing and installing footwell vent



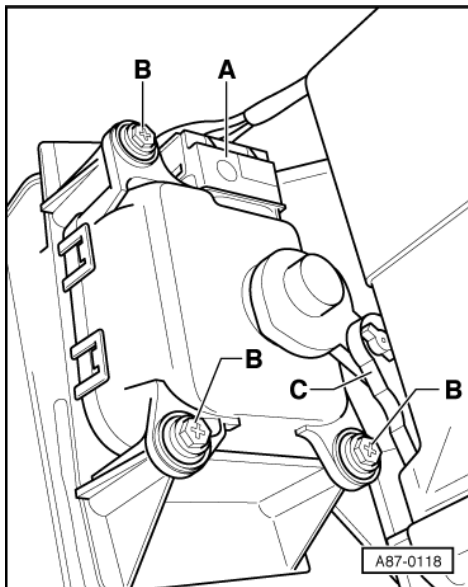
- -> Remove driver's storage compartment and tunnel brace -A-.

=> Inner Body Assembly; Repair group 68

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- Remove connection pieces between footwell vent and rear heating duct -B-.
- Remove bolts -C-.
- Remove footwell vent -D- in direction of driver's footwell (arrow).

6.9 - Removing and installing footwell/defroster flap positioning motor -V85



- Remove compartment on driver's side.

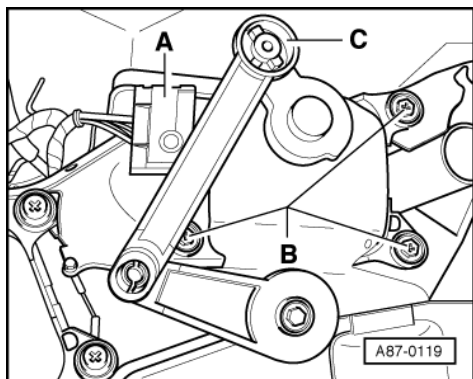
=> Inner Body Assembly; Repair group 68

- -> Detach connector -A-.
- Remove bolts -B- (3x).
- Disengage actuating arm and remove positioning motor.

Installation notes:

- ♦ Always perform self-diagnosis of air conditioner following installation (=> Page 4).
- ♦ When installing the positioning motor, ensure that actuating arm - Check -C- is correctly seated.
- ♦ Fit the wiring harness so that it cannot come into contact with moving parts (e.g. the positioning motor lever).

6.10 - Removing and installing temperature flap positioning motor - Remove and install -V68

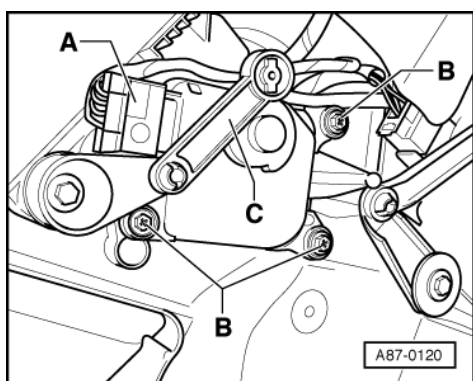


- Remove footwell vent => Page 181 .
- -> Detach connector -A-.
- Remove bolts -B- (3x)
- Disengage actuating arm and remove positioning motor.

Installation notes:

- ♦ Always perform self-diagnosis of air conditioner following installation (=> Page 4).
- ♦ When installing the positioning motor, ensure that actuating arm-Check -C- is correctly seated.
- ♦ Fit the wiring harness so that it cannot come into contact with moving parts (e.g. the positioning motor lever).

6.11 - Removing and installing central flap positioning motor -V70



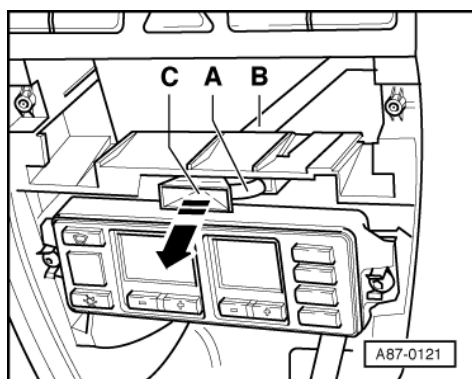
- Remove footwell vent => Page 181 .
- -> Detach connector -A-.
- Remove bolts -B- (3x).
- Disengage actuating arm and remove positioning motor.

Installation notes:

- ♦ Always perform self-diagnosis of air conditioner following installation (=> Page 4).
- ♦ When installing the positioning motor, ensure that actuating arm - Check -C- is correctly seated.
- ♦ Fit the wiring harness so that it cannot come into contact with moving parts (e.g. the positioning motor lever).



6.12 - Removing and installing dash panel temperature sensor -G56



- Remove radio.

=> Electrical System; Repair group 91

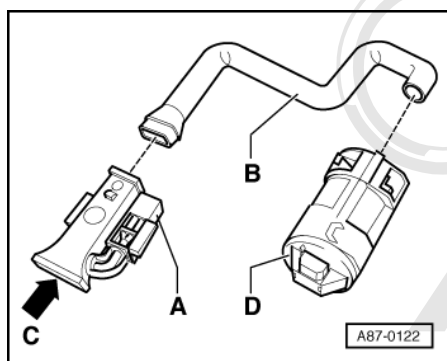
- Remove panel for dash panel centre section.

=> Inner Body Assembly; Repair group 68

- -> Disconnect intake hose -B-.
- Remove temperature sensor housing -A- from the retainer.

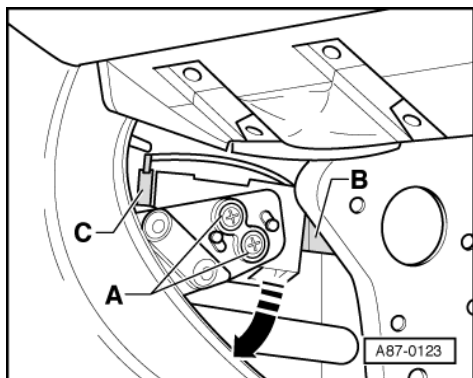
Notes:

- ♦ Temperature sensor -C- must not make contact with housing -A-.



- ♦ Check panel intake grille - it must not be closed.
- ♦ -> With false measurement of temperature sensor -A-:
 - With operating and display units -E87 with two displays, check blower -V42 -D- and associated intake hose -B- (=>Page 184).
 - With operating and display units -E87 with one display, check blower -V42 (=>Page 184). The temperature sensor is permanently installed into -E87.

6.13 - Removing and installing dash panel temperature sensor blower -V42



In vehicles with an operating and display unit -E87 with two displays

- Remove glove compartment.

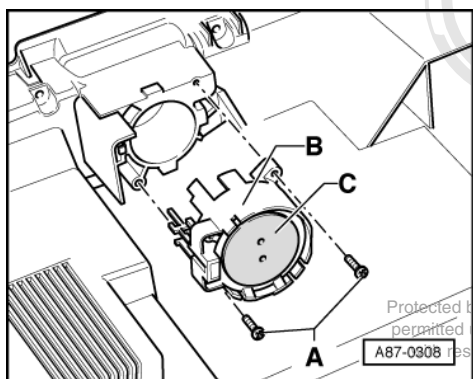
=> Inner Body Assembly; Repair group 68

- -> Remove 2 bolts -A-.
- Detach connector -C-.
- Detach suction hose -B- and remove blower in direction of arrow.

Notes:

- ♦ Check function =>Page 18 (final control diagnosis).
- ♦ Check suction hose -B-. It must not be sealed and must be firmly attached to the temperature sensor connection piece.

In vehicles with an operating and display unit -E87 with one display

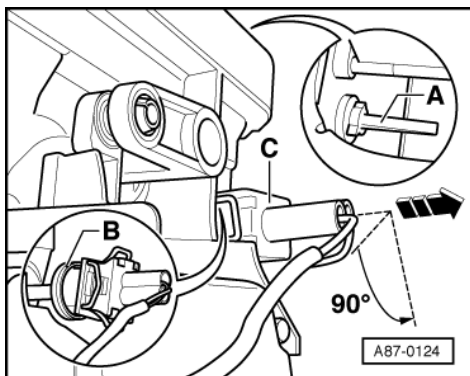


- Remove operating and display unit -E87 => Page 177 .
- -> Remove bolts -A-.
- Remove Blower -V42 -B- from -E87.

Note:

Do not press motor -C- when installing blower -V42 but hold the blower at the housing.

6.14 - Removing and installing fresh air intake temperature sensor -G89



- Remove dust and pollen filter => Page 113
- Remove glove compartment.

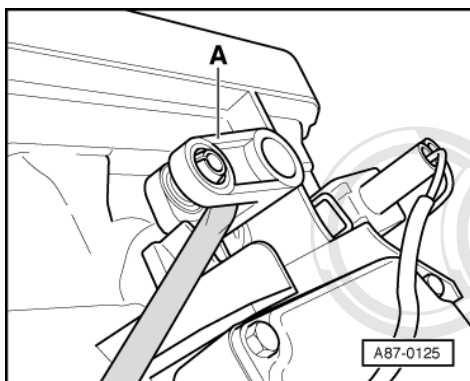
=> Inner Body Assembly; Repair group 68

- -> Reach into the intake housing and turn temperature sensor -A- 90°.
- Reach between air conditioner and A-pillar and remove temperature sensor from the intake with connector -C- attached.

Notes:

- ♦ If the temperature sensor cannot be turned, carefully spray silicone spray onto contact surface of rubber grommet -B-.
- ♦ Checking =>Electrical check, Page 46 .

6.15 - Removing and installing air flow flap positioning motor -V71



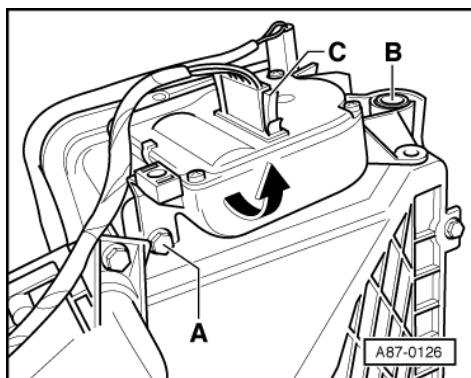
Notes:

This positioning motor actuates the air flow flap and fresh/recirculated air flap.

- Remove glove compartment.

=> Inner Body Assembly; Repair group 68

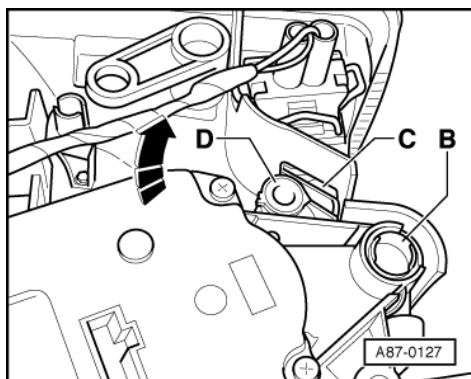
- -> Carefully unclip operating lever -A- (to air flow flap) using a screwdriver.



- -> Remove bolt -A-.
- Detach connector -C-.
- Turn positioning motor downward in direction of arrow and remove from the shaft for fresh-air/recirculated-air flap -B-.

Installation notes:

- ♦ New positioning motors are delivered in the "recirculated air" position. For ease of installation, prior to installation connect the positioning motor to the vehicle electrical system and shift the operating lever in centre position (at the same time, switch on the ignition and change the position of the positioning motor by actuating the "recirculated air" button on the operating and display unit). In centre position the fresh/recirculated air flap is not in the end stop position, and the positioning motor can be installed more easily.



- ♦ -> First insert positioning motor in the shaft of the fresh/recirculation air flap -B-, then rotate in direction of arrow, ensuring that tab -D- sits correctly in slot -C-.
- ♦ Always perform self-diagnosis of air conditioner following installation (=>Page 4).
- ♦ Fit the wiring harness so that it cannot come into contact with moving parts (e.g. the positioning motor lever).

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7 - Checking air conditioner refrigeration capacity

7.1 - Checking air conditioner refrigeration capacity

Test requirements

- ♦ Radiator and condenser are both clean (clean if necessary).
- ♦ The ribbed belt is OK and properly tensioned.
- ♦ All air ducts, covers and seals are OK and correctly fitted.
- ♦ Air flow through dust and pollen filter is not impeded by dirt.
- ♦ The air conditioner is free of leaks (no secondary air drawn in at high fresh air blower speeds - air escapes through vents only).
- ♦ Vehicle is not exposed to sunlight.

- ♦ The heat insulation for the expansion valve is OK and properly fitted.
- ♦ The engine is at operating temperature.
- ♦ All dash panel vents are open.
- ♦ With the engine running and operating and display unit -E87 set at:
 - "Auto" mode
 - Compressor switched on (compressor symbol "frost symbol" lights up on left display or warning lamp in "ECON"- key does not light up).
 - "LO" temperature selected
- If the compressor is driven (air conditioner magnetic clutch is engaged):
- Actuation of radiator fan -V7:
 - in vehicles with pressure switch -F129 (at least at speed 1).
 - in vehicles with high pressure sensor -G65 (at speed 1 or is switched on during refrigerant performance check).

Notes:

- ♦ Radiator fan control unit -J293 versions and vehicle wiring differ for vehicles with pressure switch -F129 and high-pressure sensor -G65.

=> Parts List

=> Current Flow Diagrams, Electrical Fault-Finding and Fitting Locations

- ♦ Control unit -J293, installed in vehicles with high-pressure sensor -G65, is available in 2 designs.
 - In design "1" the radiator fan is automatically switched on in conjunction with the compressor (the first fan speed is activated regardless of the pressure in the refrigerant circuit).
 - In design "2" the compressor is switched on without the radiator fan; the first fan speed is only activated once the pressure in the refrigerant circuit has exceeded 12 bar.
- Fresh air blower -V2 runs at maximum speed.
- The fresh/recirculated air flap switches to "recirculated-air" position (within 1 min. after vehicle start-up).
- Air blows out of the dash panel vents.
- Temperature flap is in the "cooling" position.

Note:

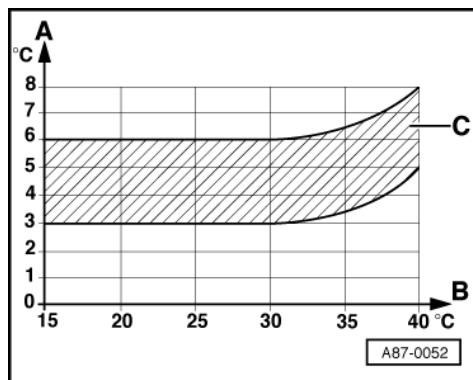
If one of the test requirements is not fulfilled, interrogate fault memory and perform final control diagnosis (=>Page 18).

Preparatory work:

- Interrogate fault memory and locate and rectify any faults displayed (=>Page 7).
- Perform basic setting and check coding (=> Page 4).
- Close bonnet and sliding roof.
- Measure ambient temperature.
- Close doors and windows.

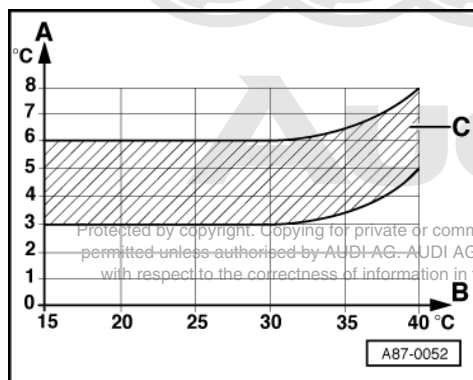
Checking:

- Switch ignition on.
- Set operating and display unit -E87 for "auto" mode and "LO" temperature selection.
- Start engine (compressor is driven).
- Actuate button for recirculated-air flap (symbol for "recirculated air" in the right display illuminates).
- Increase the engine speed to 2000 rpm (start of time measurement).
- Measure air temperature from the "centre" dash panel vents.



-> Compare measured values with chart.

- A - Air temperature from the "centre" dash panel vents.
- B - Measured ambient temperature.
- C - Permissible temperature range for the vent temperature.

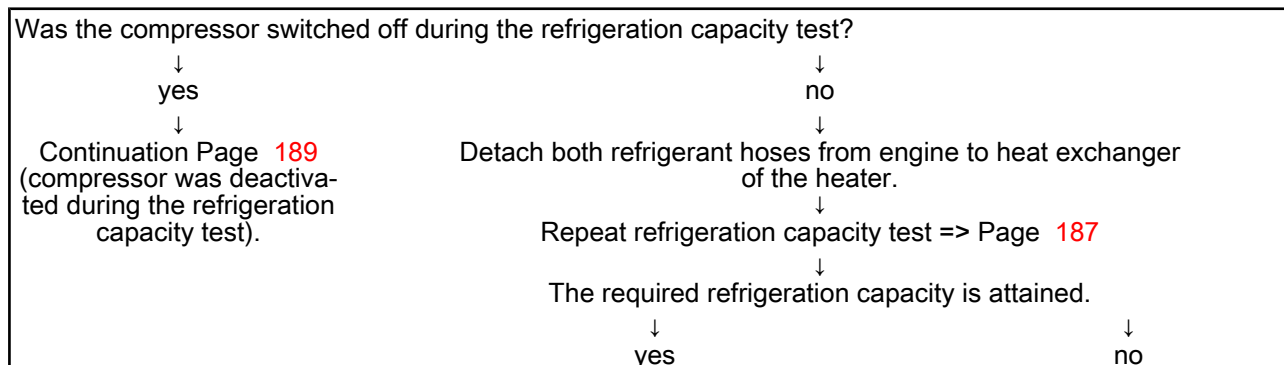


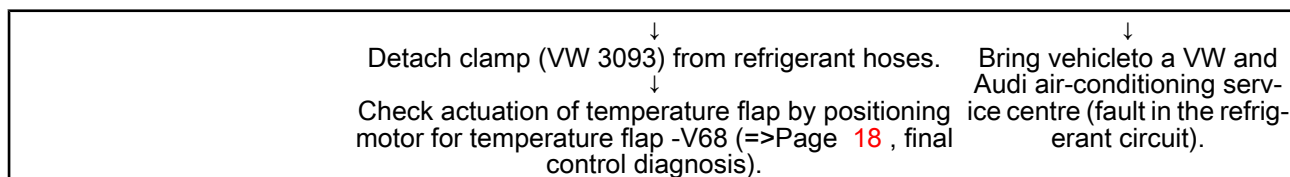
- -> The temperature of the air emanating from the centre dash panel vents must be within tolerance -C- in the chart after 5 minutes (will vary according to the ambient temperature).

Note:

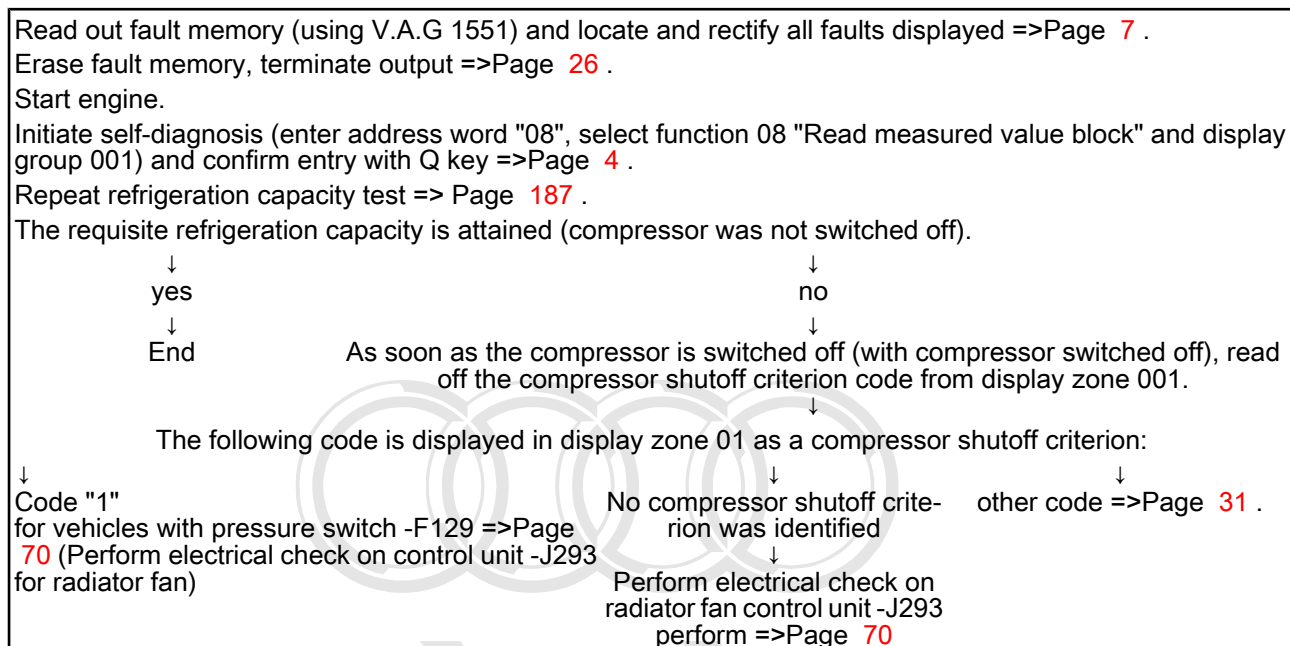
If the required values are not attained =>Page 188 (determine fault if specified value not attained).

Fault determination in the event of deviation from specified value

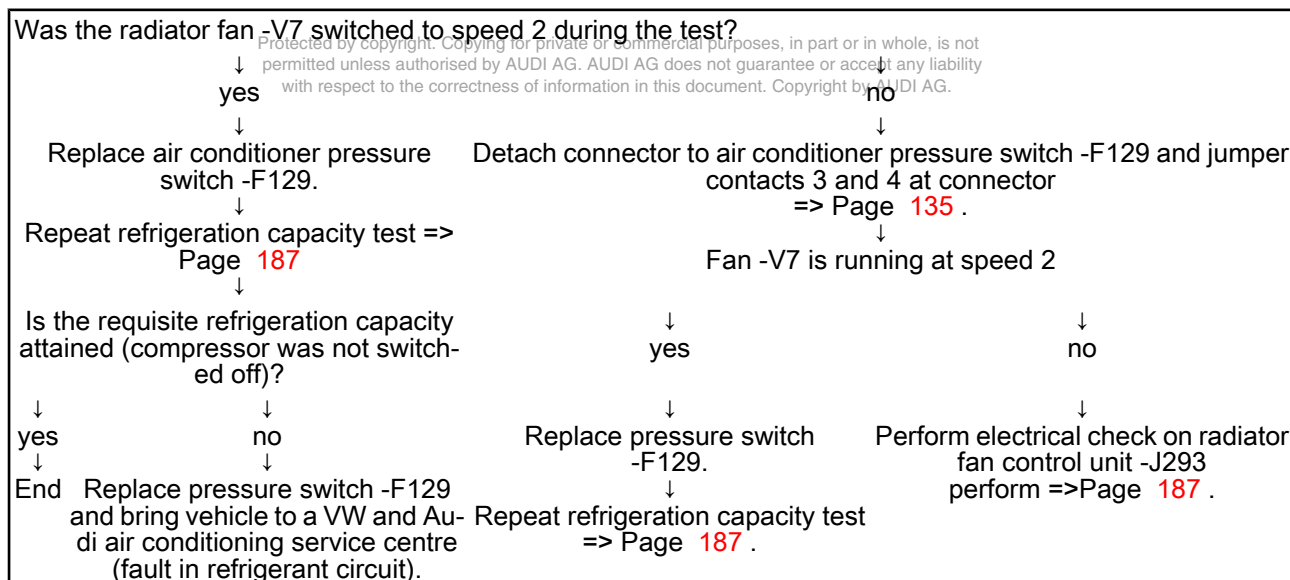




Continuation from Page 188 (compressor was deactivated during the refrigeration capacity test).



Continued from page 189 (compressor shut-off criterion code "1" for vehicles with pressure switch -F129).



8 - Servicing electrical additional heater - Vehicles with TDI engine 06.94 ä

8.1 - Servicing electrical additional heater - Vehicles with TDI engine 06.94 ä

8.2 - Checking function of electrical additional heater

Electrical additional heater is activated by control unit for diesel direct injection system -J248 when following conditions occur at the same time:

- ♦ measured ambient or intake pipe air temperature (when engine starts) lower than 5 °C
- ♦ Refrigerant temperature less than 70 °C
- ♦ Engine speed above 800 rpm
- ♦ Other actuation conditions:

=> Relevant Workshop Manual Diesel Direct Injection and Preglow System; Repair group 01; Reading measured value block

Test sequence

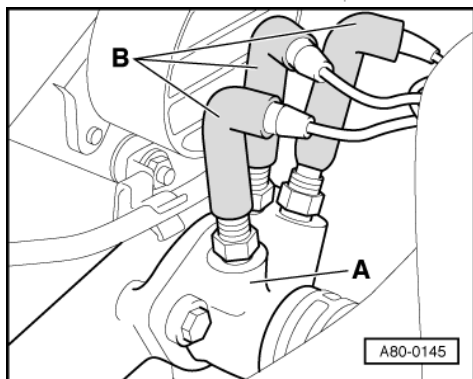
- Check low heating output relay -J359 or high heating output relay -J360:

=> Relevant Workshop Manual Diesel Direct Injection and Preglow System; Repair group 01; Final control diagnosis

If the relays are OK:

- Test wiring for open circuit and short to positive or earth.

=> Current Flow Diagrams, Electrical Fault-Finding and Fitting Locations



- -> Check earth wiring to refrigerant stump -A- (in which the glow lamps are screwed into) to the cylinder head.

If no wiring fault in earth wiring is detected:

- Check glow plugs:
- Remove the electrical wiring -B- from the glow plugs.
- Connect multimeter for resistance measurement to the glow plug and measure resistance between glow plug and refrigerant stud -A-.
- Specified value: 0.5 ... 0.7 wat room temperature

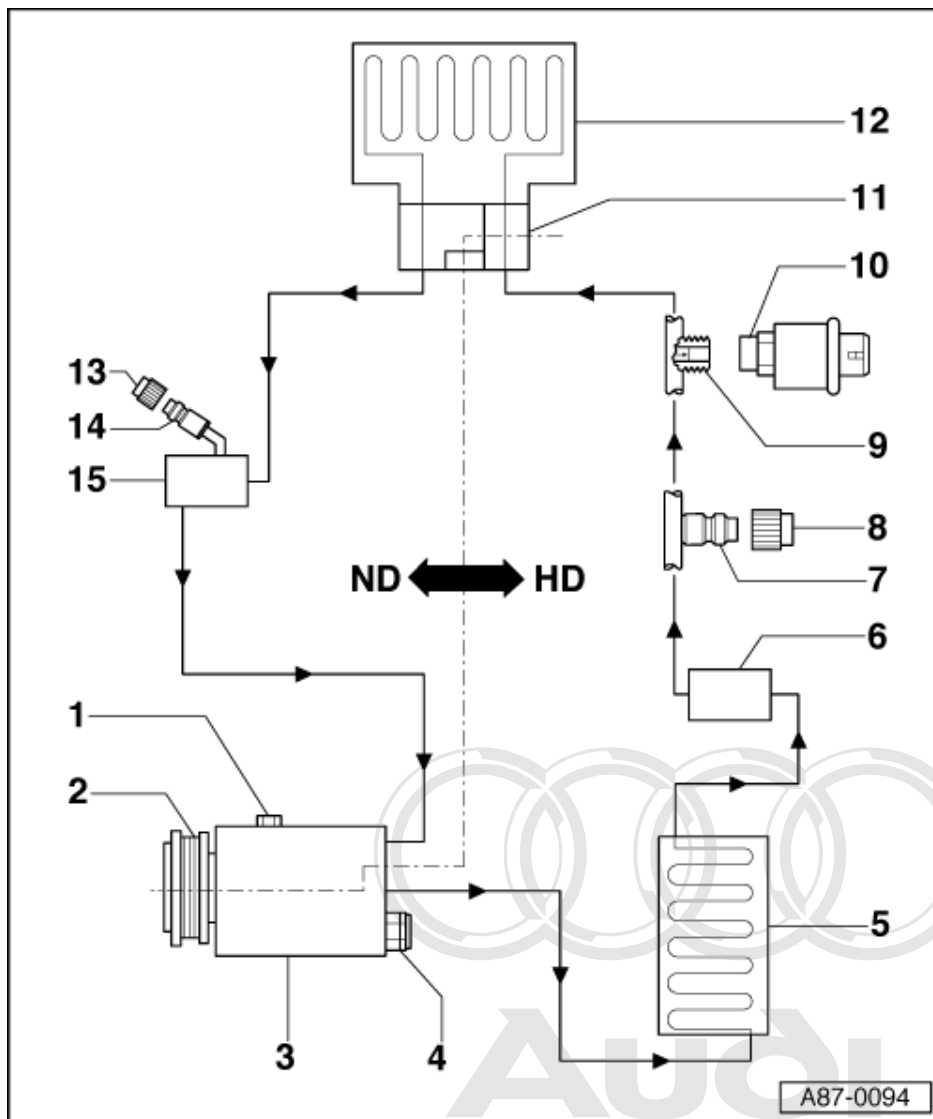
If specified value is not attained:

- Replace glow plug.
- Check refrigerant level:

=> Relevant Workshop Manual Engine Mechanical Components; Repair group 19

9 - Repairing refrigerant circuit

9.1 - Repairing refrigerant circuit

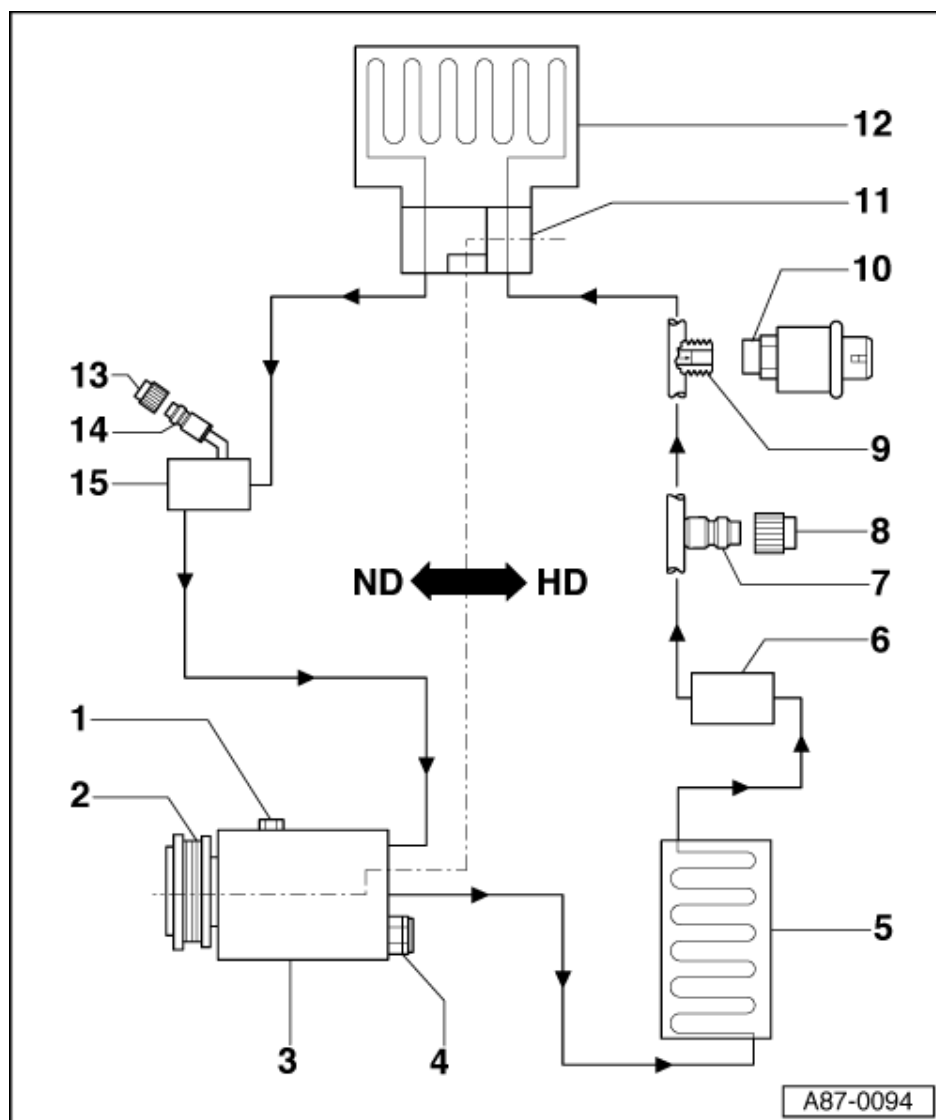


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- ◆ The spare compressor contains all the refrigerant oil to be used to fill the refrigerant circuit (135 cm³).
- ◆ Check refrigeration capacity => Page 186 .
- ◆ No refrigerant may be filled into the refrigerant circuit (empty system, evacuate and re-fill).
- ◆ The specified diameters for the O-ring seals and the tightening torque also apply to the screwed connections in the refrigerant pipes or hoses between the individual components.
- ◆ Adapter to connect the service station to the refrigerant circuit.

=> Air conditioner with refrigerant R134a



- ♦ Only install O-ring seals approved for refrigerant R134a (present colour coding: "red", "lilac" or "violet").

=> Parts List

- ♦ Servicing the refrigerant circuit => Page 129 .
- ♦ Checking pressures in the refrigerant circuit :

=> Air conditioner with refrigerant R134a

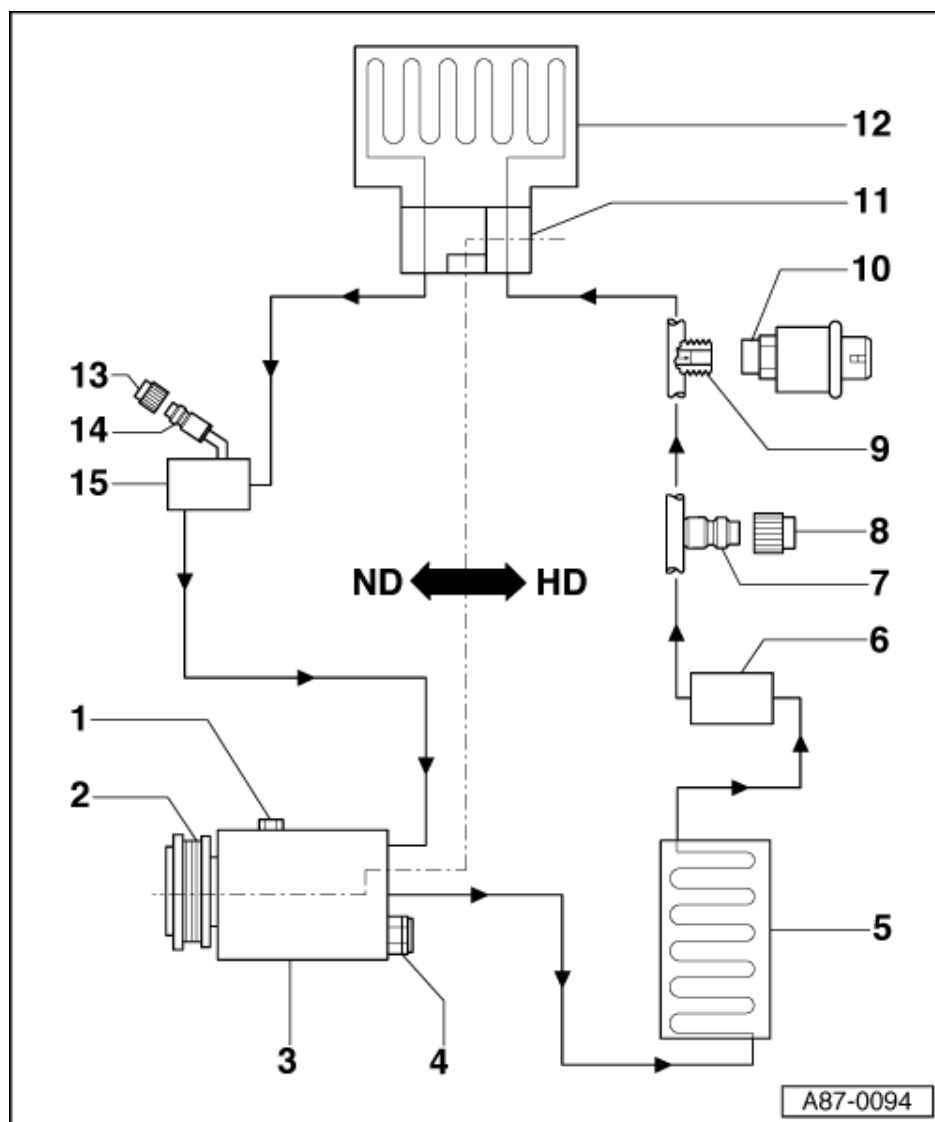
- ♦ All other repairs and tests not described in this workshop manual

=> Air conditioner with refrigerant R134a

HD = High-pressure end

ND = Low-pressure end

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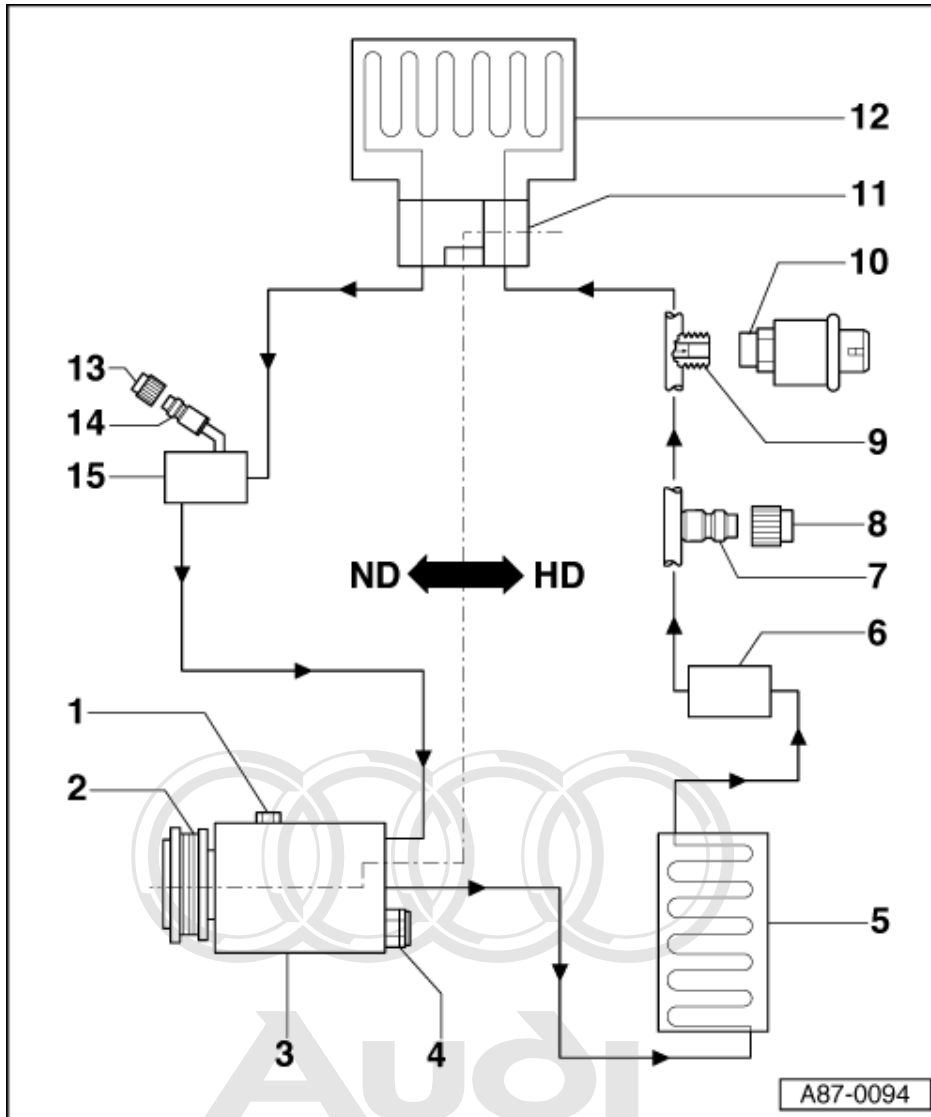
1 Oil drain plug

- ♦ O-ring seal:
"Sanden" compressor 8.8 mm; 1.5 mm (colour: black)
"Zexel" compressor 7.8 mm; 1.9 mm
- ♦ Tightening torque:
"Sanden" compressor
15 Nm
"Zexel" compressor
10 Nm

Notes:

- ♦ To drain refrigerant oil:
 - Remove compressor.
 - Remove oil drain plug.
 - Crank compressor via the magnetic clutch disc to accelerate extraction of oil.

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2 Air conditioner magnetic clutch -N25

- ♦ Servicing => Page 129

3 Compressor

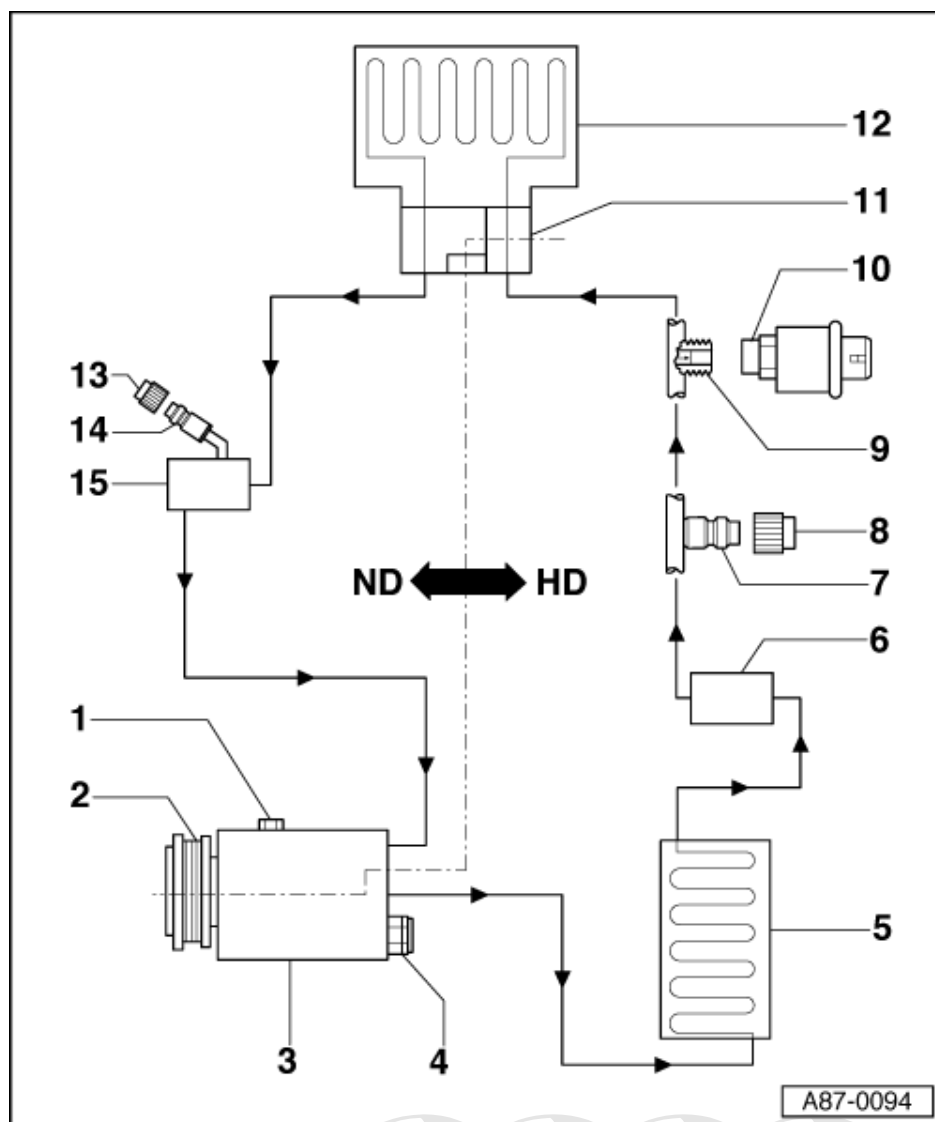
- ♦ Disconnect and connect refrigerant lines =>Page 204
- ♦ Remove and install compressor bracket =>Page 129
- ♦ Remove and install compressor =>Page 204

Notes:

- ♦ Removing and installing ribbed belt.

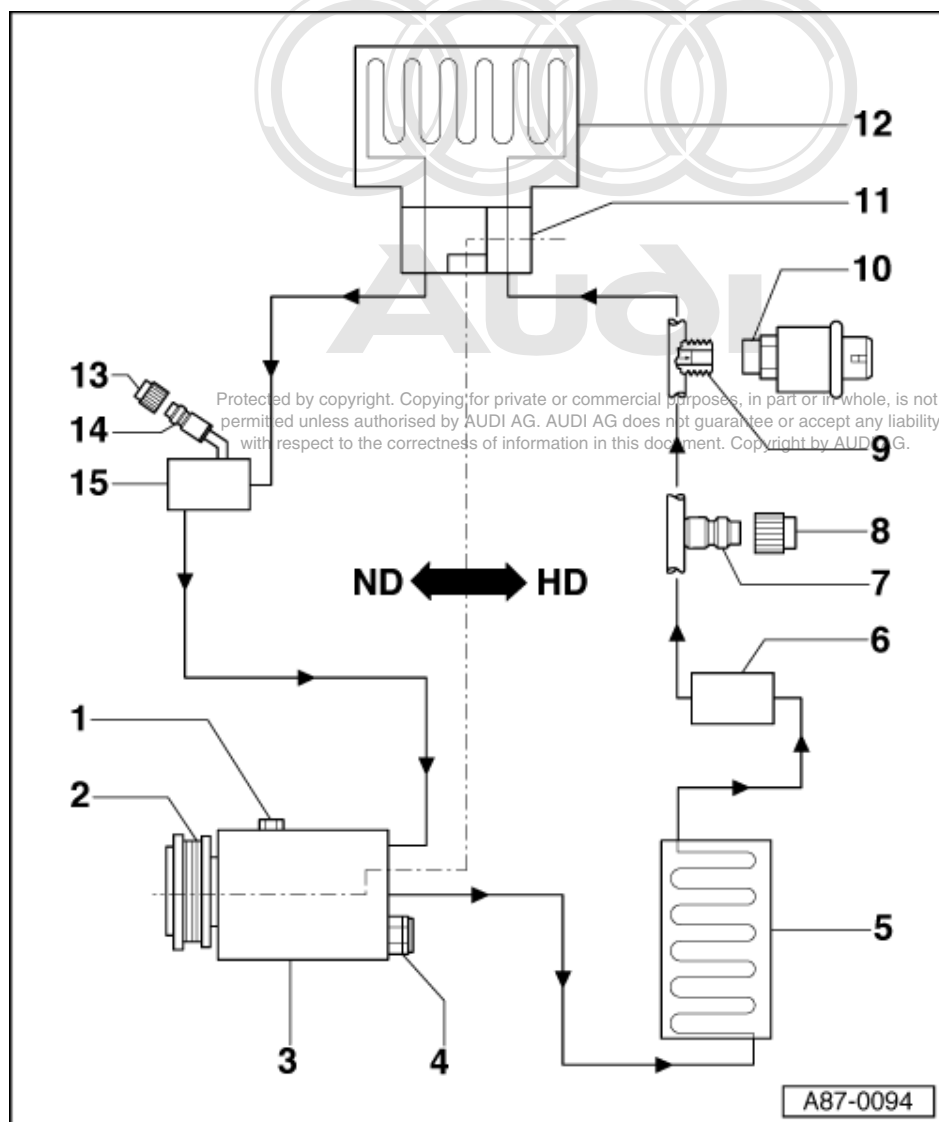
=> Relevant Workshop Manual; Engine Mechanical Components

- ♦ Mark direction of ribbed belt before removing - reversing the direction of rotation can destroy the belt.
- ♦ The piston stroke of the compressor is variable and automatically adjusts to the requisite refrigeration capacity.



- ♦ Only compressors manufactured by Sanden were installed up to model year 1999.
- ♦ A compressor manufactured by either Sanden or Zexel can be installed in vehicles as of model year 1999.
- ♦ After the installation of a new compressor or filling with fresh refrigerant oil (e.g. after blowing out the refrigerant circuit), turn the compressor 10 revolutions by hand before the first start to avoid damage to the compressor.

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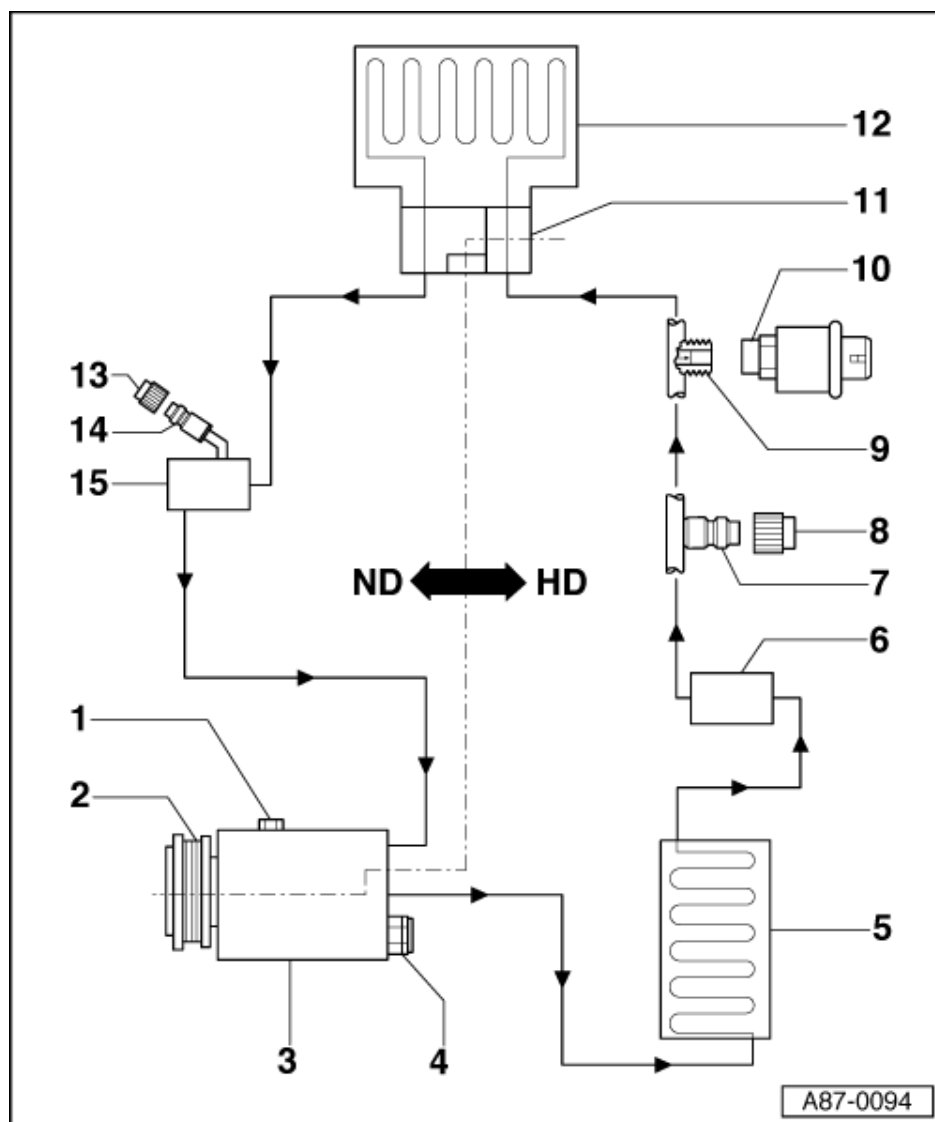


4 Pressure relief valve

- ♦ O-ring seal:
"Sanden" compressor 8.6 mm; 1.8 mm (colour: black).
"Zexel" compressor
8.8 mm/1.9 mm
- ♦ Tightening torque: 10 Nm

Warning!

The connection is not fitted with a valve; only remove pressure relief valve when refrigerant circuit is empty.



5 Condenser

- ♦ Removing and installing => Page 201 .

6 Fluid reservoir

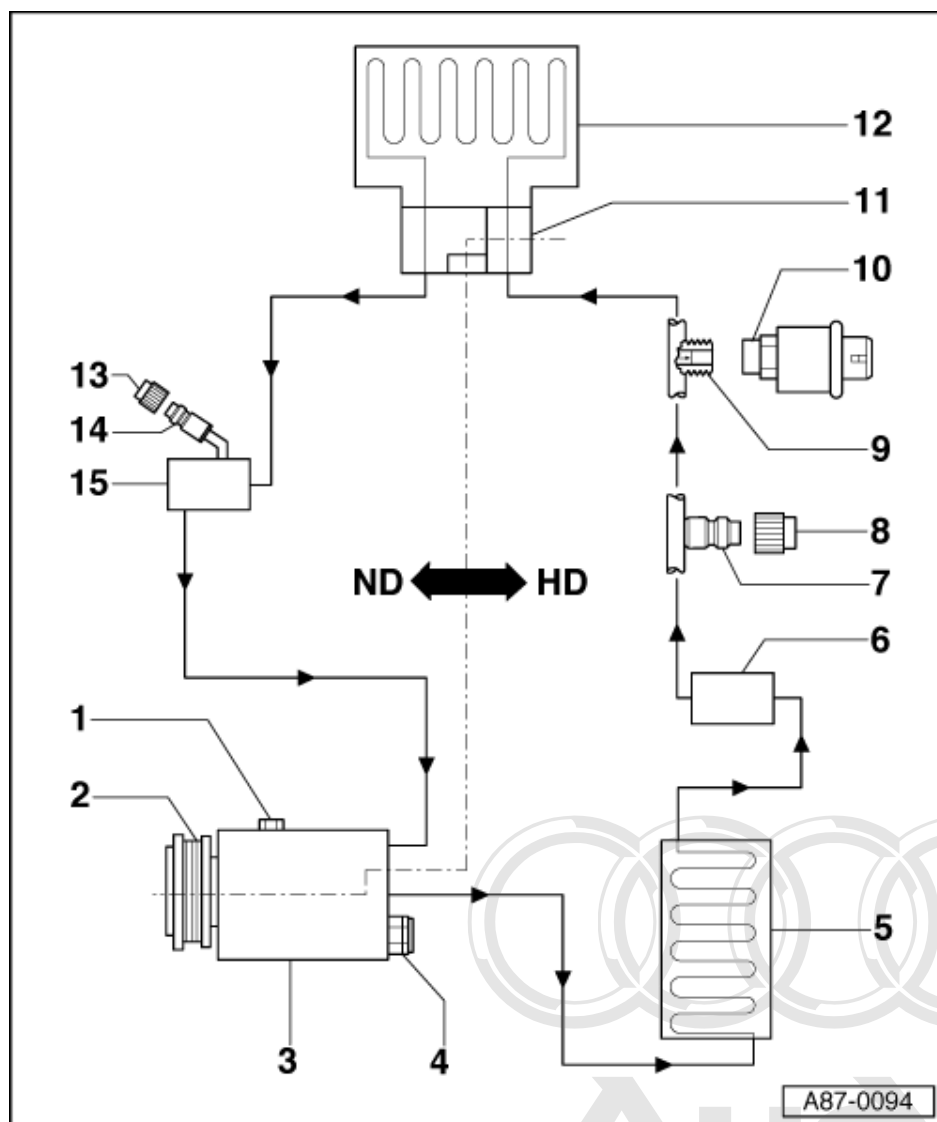
- ♦ Removing and installing => Page 201 .

7 Service connection

- ♦ High-pressure end.
- ♦ For measuring, draining and filling at service station.

Warning!

The service connections may be removed only if the refrigerant circuit is empty - the connection is not supplied with a valve.



8 Cap

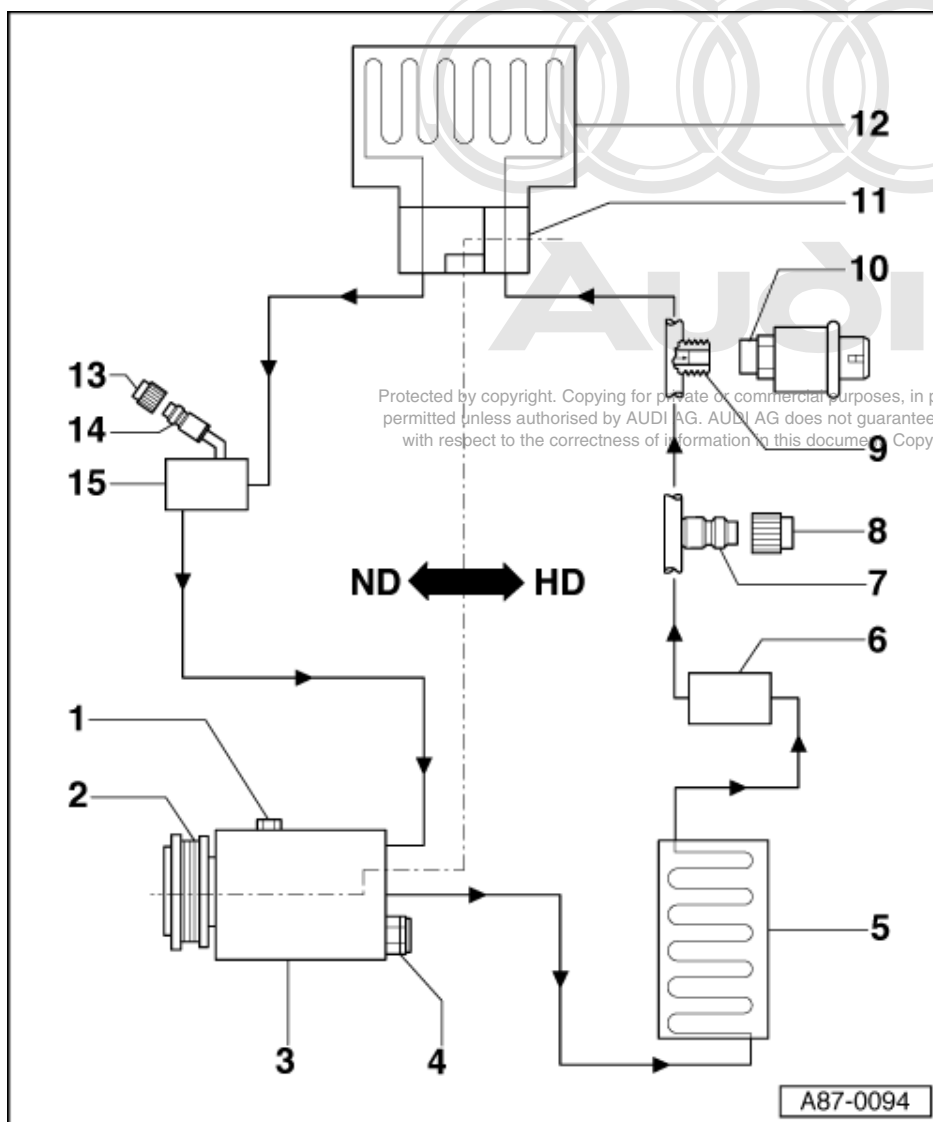
- ♦ With seal, must always be fitted.

9 Connection with valve

10 Air conditioner pressure switch

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- ♦ High-pressure sensor -G65 will gradually replace air conditioner pressure switch -F129 (as of model year 1999, initially vehicles with 1.6 l engines).
- ♦ Function, removing and installing pressure switch -F129 => Page 135 .
- ♦ Check function of high-pressure sensor -G65 and signal emitted =>Page 85 .
- ♦ Remove and install high-pressure sensor -G65 =>Page 137



11 Expansion valve

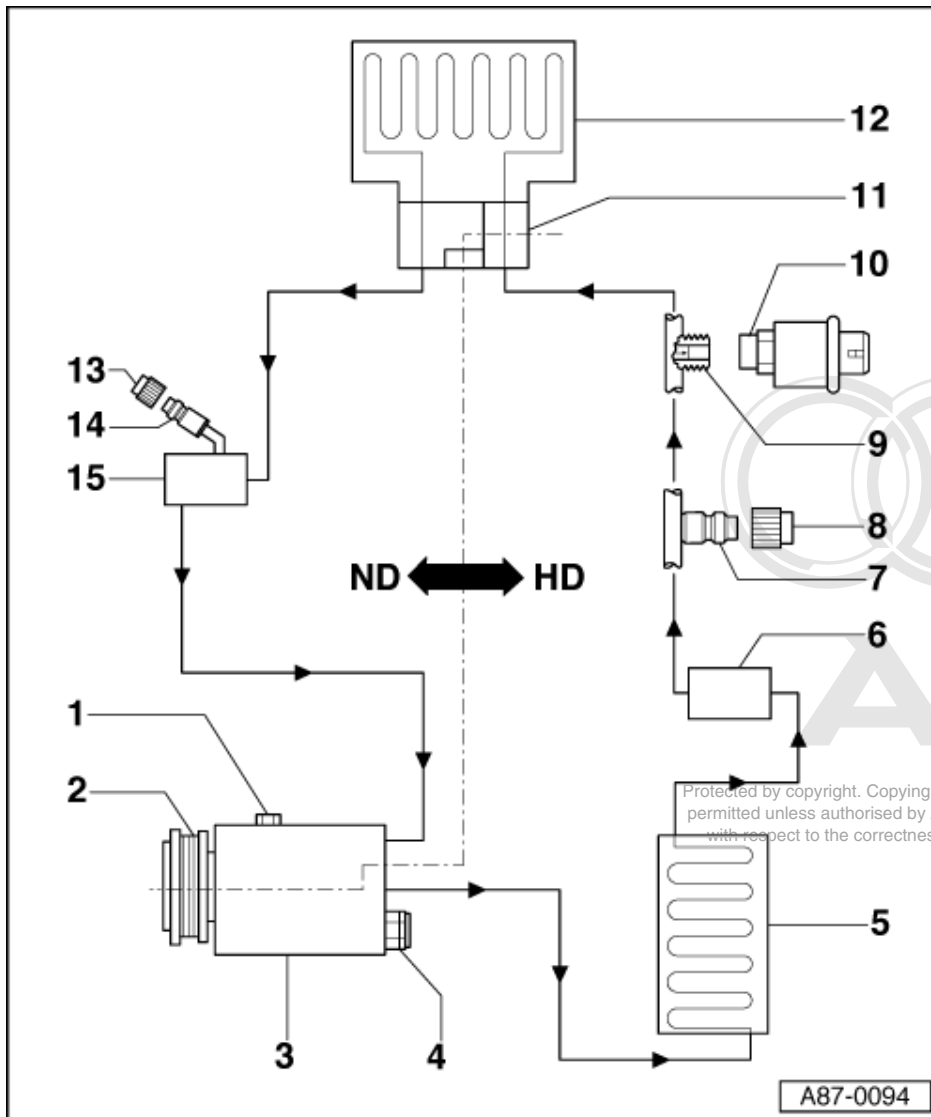
- ♦ Disconnecting and connecting refrigerant lines =>Page 203 .
- ♦ Removing and installing =>Page 203 .
- ♦ Removing and installing heat insulation =>Page 162 .

12 Evaporator

- ♦ Removing and installing air conditioner => Page 206 .
- ♦ Dismantling and assembling air conditioner, design "1" =>Page 213 .
- ♦ Removing and assembling air conditioner, design "2" =>Page 224 .

Note:

As of June 1997, AC version "1" has been gradually phased out of production and AC version "2" gradually phased in.



13 Cap

- ♦ With seal, must always be fitted.

14 Service connection

- ♦ Low-pressure end
- ♦ For measuring and draining with service station.

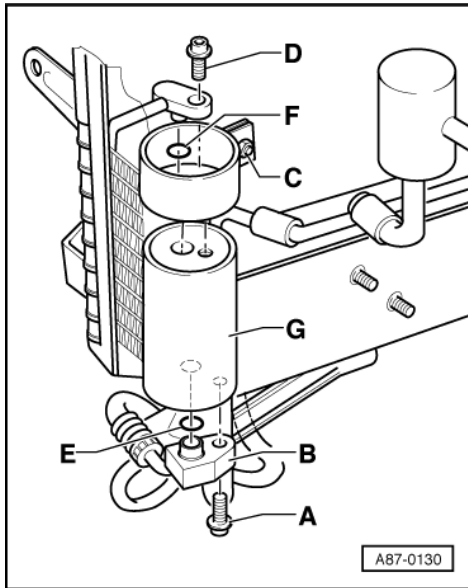
Warning!

The service connections may be removed only if the refrigerant circuit is empty - the connection is not supplied with a valve.

15 Pre-volume

- ♦ Installed in the refrigerant line from the expansion valve to the compressor.
- ♦ Pressure shocks that could arise on the low-pressure end when the compressor is running are reduced in the pre-volumes.

9.2 - Removing and installing fluid reservoir



- Drain the refrigerant circuit.

=> Air conditioner with refrigerant R134a

- -> Remove bolt -A- (tightening torque 15 Nm).
- Remove refrigerant lines -B-.
- Remove hexagon nut -C-.
- Remove bolt -D- (tightening torque 15 Nm).
- Remove fluid reservoir -G- from the retainer downward.

Notes:

- ◆ Replace both O-ring seals -E- and -F- (10.8 mm; 1.8 mm).
- ◆ Keep the fluid reservoir closed for as long as possible, only remove the caps immediately before installation (the fluid reservoir contains a desiccant bag which soon becomes saturated with moisture and hence unusable when the fluid reservoir is open).
- ◆ Replace fluid reservoir.

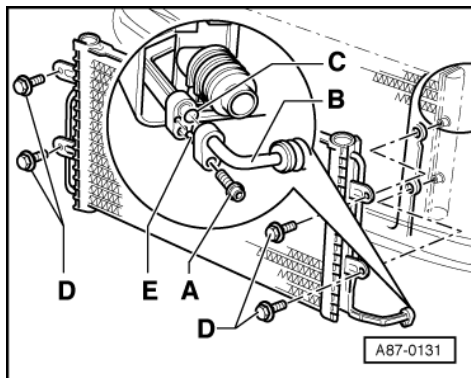
=> Air conditioner with refrigerant R134a

- The removed fluid reservoir contains refrigerant oil that has to be returned to the refrigerant circuit (with a new fluid reservoir).
- The correction of the oil quantity is governed by the complaint.
 If the fluid reservoir has been merely damaged in an accident, for example (no refrigerant has escaped and no moisture or dirt has entered the refrigerant circuit), the air conditioner can be repaired without extensive repair work by weighing the old and new fluid reservoir (fill the new reservoir with refrigerant oil until it reaches the weight of the removed reservoir).

9.3 - Removing and installing condenser

- Drain the refrigerant circuit.

=> Air conditioner with refrigerant R134a



- Remove the complete bumper.

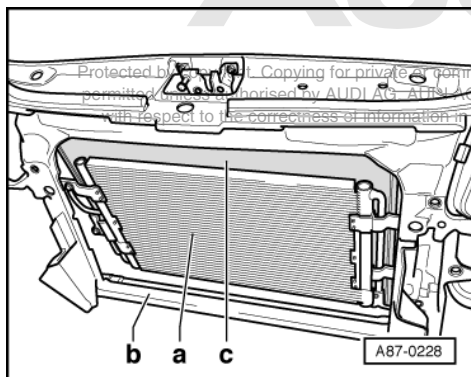
=> Outer Body Assembly; Repair group 63; Front bumper Front bumper

- Detach fluid reservoir => Page 201 .
- -> Remove bolt -A- (tightening torque 15 Nm).
- Remove refrigerant lines -B-.
- Remove bolt -D- (tightening torque 8 Nm).
- Remove radiator fan with retainer.

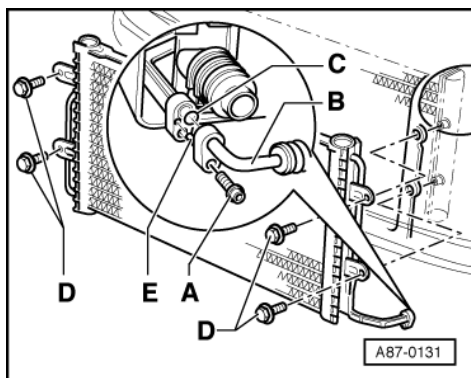
=> Relevant Workshop Manual Engine; Mechanical Components; Repair group 19

- Loosen radiator from lock carrier and tilt to the rear.

=> Relevant Workshop Manual Engine; Mechanical Components; Repair group 19



- Remove condenser -a- downward between lock carrier -b- and radiator -c-.



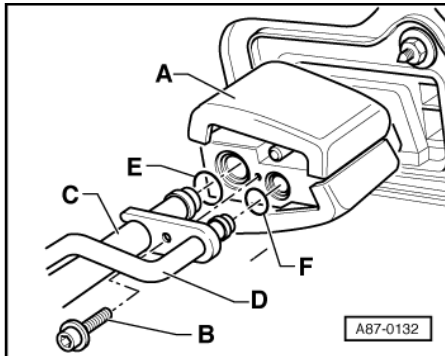
Notes:

- ♦ -> Replace O-ring seal -C- (10.8 mm; 1.8 mm).
- ♦ When installing the refrigerant line, ensure that locking pin -E- is properly positioned.

- ◆ Replace condenser.

=> Air conditioner with refrigerant R134a

9.4 - Detach and re-attach refrigerant lines from/to expansion valve



- Drain the refrigerant circuit.

=> Air conditioner with refrigerant R134a

- Remove heat insulation -A- =>Page 162
- -> Remove bolt -B- (tightening torque 8 Nm).
- Remove refrigerant lines -C- and -D-.

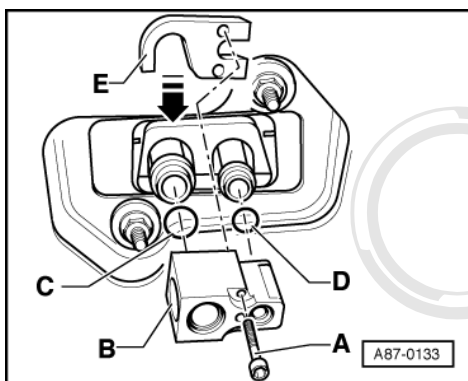
Notes:

- ◆ Replace both O-ring seals -E- (17.0 mm; 1.85 mm) and -F- (8.2 mm; 1.85 mm).
- ◆ Seal off open refrigerant lines and connections to expansion valve.
- ◆ Install refrigerant pipes so that they are tension-free.

9.5 - Removing and installing expansion valve

- Drain the refrigerant circuit.

=> Air conditioner with refrigerant R134a



- Detach refrigerant lines from expansion valve => Page 203 .
- -> Remove bolt -A- (tightening torque 8 Nm).
- Remove expansion valve -B-.
- Remove threaded plate -E-.

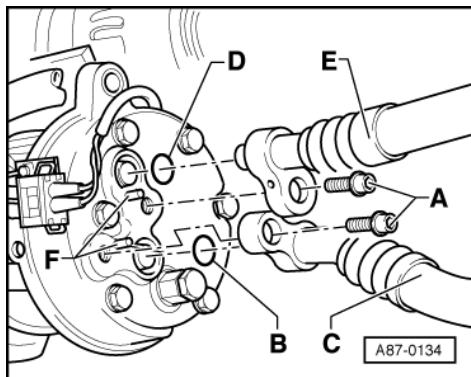
Notes:

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- ◆ Replace both O-ring seals -C- (14.0 mm; 1.8 mm) and -D- (10.8 mm; 1.85 mm).
- ◆ Seal off open connections at the evaporator.

- ♦ If no heat insulation has been installed or if it has been improperly installed, the air conditioner capacity may be adversely affected (pre-set regulatory curve change due to heat radiation).

9.6 - Detach and re-attach refrigerant lines from/to compressor



- Drain the refrigerant circuit.

=> Air conditioner with refrigerant R134a

- -> Remove bolts -A- (tightening torque 20 Nm).
- Replace both O-ring seals -B- (10.8 mm; 1.8 mm) and -D- (14.3 mm; 2.4 mm).

Notes:

- ♦ Refrigerant line -C- leads to the condenser.
- ♦ Refrigerant line -E- comes from the expansion valve.
- ♦ When installing the refrigerant line, ensure that locking pins -F- are properly positioned.
- ♦ Seal off open refrigerant pipes and connections at the compressor.

9.7 - Removing and installing compressor

- Drain the refrigerant circuit.

=> Air conditioner with refrigerant R134a

- Detach refrigerant pipes from the compressor.
- Removing and re-attaching compressor from/to bracket:
 - 4 cyl. petrol engine=>Page 138 .
 - 4 cyl. diesel engine => Page 138 .

Notes:

- ♦ Replace compressor.

=> Air conditioner with refrigerant R134a.

- ♦ Following installation, turn the compressor approx. 10 revolutions by hand before the first start.
- ♦ When first starting the compressor:
 - Start engine with compressor switched off ("OFF" mode)
 - Wait until the idle speed has stabilised.
 - Following the above steps, switch on the compressor and allow to run at least 10 minutes at idle speed.
- ♦ Removing and installing ribbed belt.

=> Relevant Workshop Manual Engine; Mechanical Components; Repair group 13

9.8 - Filling quantities

Refrigerant R134a

=> Air conditioner with refrigerant R134a.

Note:

Always fill the refrigerant circuit right up to the upper tolerance limit (some refrigerant remains in the filling hoses).

Refrigerant oil

=> Air conditioner with refrigerant R134a.

Notes:

- ◆ The refrigerant circuit may only be filled with approved refrigerant oils.

=> Parts List

- ◆ Refrigerant oil from containers which have been open for a long time is unusable (PAG oil absorbs moisture).
- ◆ Additional notes.

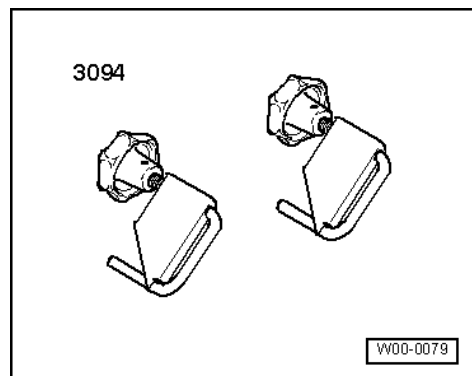
=> Air conditioner with refrigerant R134a

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10 - Tools

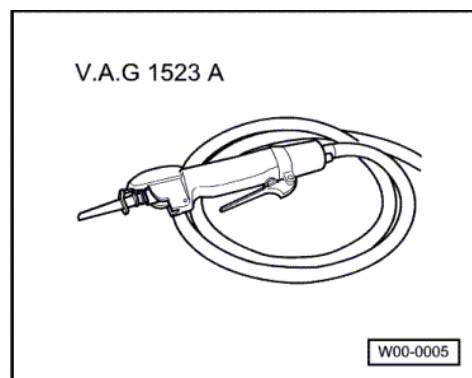
10.1 - Tools

10.2 - Special tools, testers, measuring instruments and auxiliary items required



- ◆ -> Special tool 3094

To remove air conditioner





- ♦ -> Body saw V.A.G.1523 A

To remove air conditioner

11 - Removing and installing air conditioner (complete)

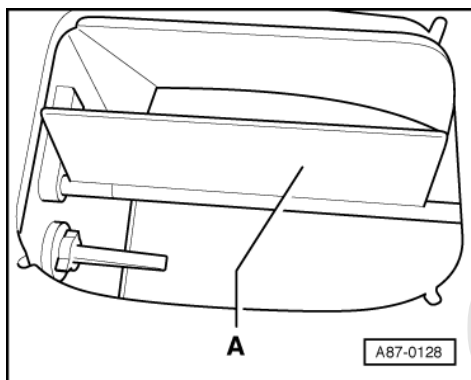
11.1 - Removing and installing air conditioner (complete)

Note:

As of June 1997, AC version "1" has been gradually phased out of production and AC version "2" gradually phased in.

- Dismantle and assemble design "1" =>Page 213 .
 - Dismantle and assemble design "2" =>Page 224 .
- Drain the refrigerant circuit.

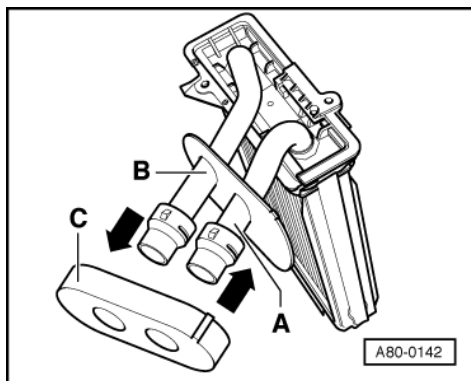
=> Air conditioner with refrigerant R134a



- Removing dust and pollen filter =>Page 113 .
- Switch ignition on.
- Press recirculated-air button on the operating and display unit.
- -> Wait until air flow flap -A- is closed (the fresh/recirculated air flap is set to "air recirculation mode").
- Switch off ignition with air flow flap closed.
- Disconnect battery.

Notes:

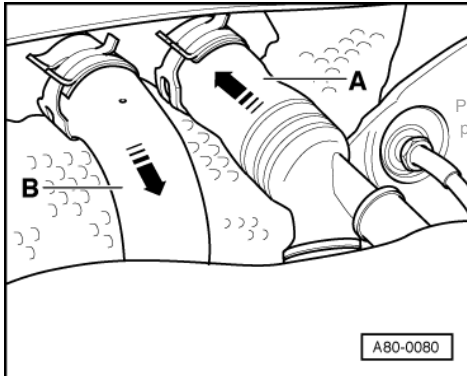
- ♦ If necessary, obtain radio code before disconnecting battery.
- ♦ In vehicles with electrically adjustable seats, move the seats back as far as possible before disconnecting the battery.
- ♦ The heat exchanger has been installed in vehicles with map-controlled cooling (to be introduced gradually as of model year 1999 vehicles with 1.6 l engine) which has been adapted to the different usage conditions. The following must be noted for this heat exchanger:



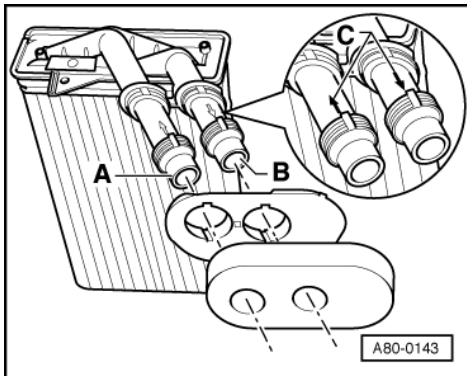
- -> The flow direction of the refrigerant in the heat exchanger is not marked at the refrigerant connections (observe feed and return flow).
- The heat exchanger can be recognised when installed by the metal refrigerant pipes (as opposed to plastic pipes as in other versions).
- Reduce pressure in cooling system by opening the lock on the refrigerant expansion tank.
- Unclamp and disconnect both refrigerant hoses to heat exchanger of air conditioner (e.g. using special tool V.A.G 3094).

Notes:

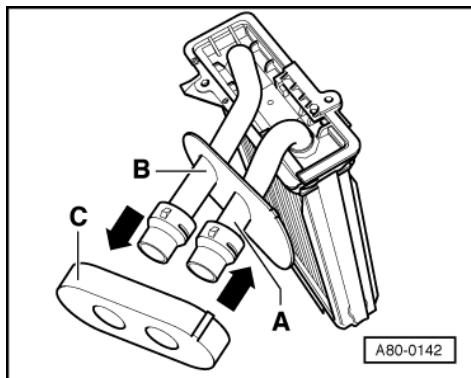
- ◆ Mark both refrigerant hoses before disconnection.



- ◆ The refrigerant hoses are to be connected on the correct side. Different connection and flow direction of the refrigerant dependent on the type of heat exchanger.
- ◆ -> Arrangement in a vehicle without map-controlled cooling and a heat exchanger without quick release couplings:
 - Refrigerant hose -A-: supply hose from cylinder head
 - Refrigerant hose -B-: return hose to water pump
 - The flow direction is marked by an arrow at the connection pipes of the heat exchanger (not visible when installed).



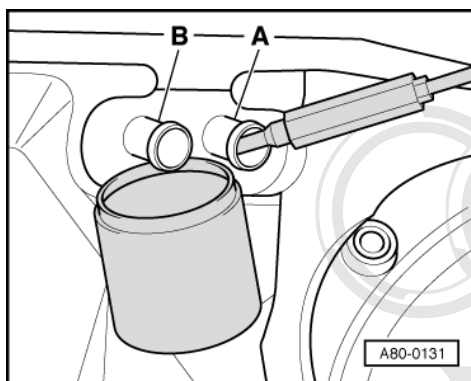
- ◆ -> Arrangement in a vehicle without map-controlled cooling and a heat exchanger with quick release couplings:
 - Refrigerant hose -A-: supply hose from cylinder head
 - Refrigerant hose -B-: return hose to water pump
 - The flow direction is marked by the arrows -C- at the connection pipes of the heat exchanger (visible when installed).



- ♦ -> Arrangement in a vehicle with map-controlled cooling:
 - Refrigerant hose -A-: supply hose from cylinder head
 - Refrigerant hose -B-: return hose to water pump
 - The connection pipes of the heat exchanger are made of metal, the flow direction of the refrigerant is not marked.

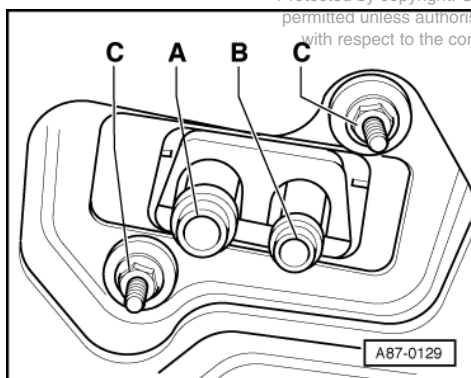
- ♦ Bleeding refrigerant circuit

=> Relevant Workshop Manual Engine; Mechanical Components; Repair group 19



- -> Position a container under connection -B- and carefully blow out the refrigerant from the heat exchanger (using compressed air) via connection -A-.
- Remove expansion valve =>Page 203 .

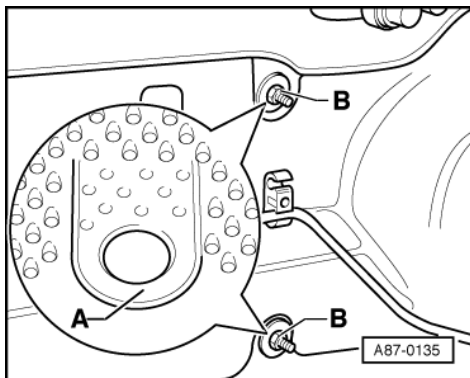
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- -> Seal refrigerant lines and open connections -A- and -B- at evaporator.
- Remove two hexagon nuts with washer -C- (tightening torque 15 Nm).

Note:

A fitting must accompany the seal at the hexagon nut washers.



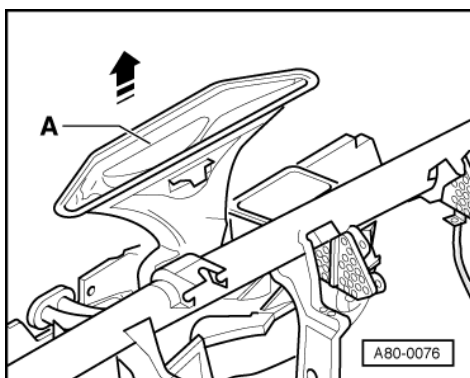
- -> Fold up pre-punched points -A- of the thermal insulation mat and remove the hexagon nuts located behind with washer -B- (tightening torque 15 Nm).
- Remove glove compartment.

=> Inner Body Assembly; Repair group 68

- Remove driver's storage compartment, centre console and dash panel fascia.

=> Inner Body Assembly; Repair Group 70

- Removing footwell vent =>Page **181**



- -> Remove air duct -A- to defroster vent.
- Remove passenger side complete airbag unit with left bracket to dash panel cross member.

=> Electrical System; Repair group 96

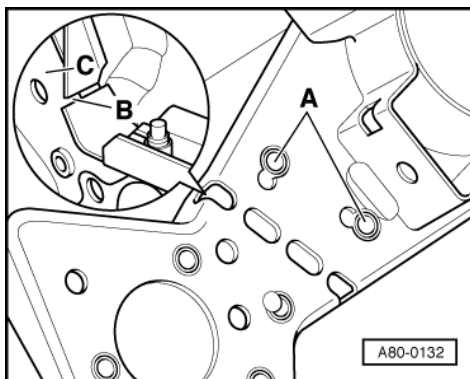
- Disconnect earth connection from the air conditioner to pillar-A right bottom earthing point.

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=> Current Flow Diagrams, Electrical Fault Finding and Fitting Locations

- Cover all open connectors and air conditioner air ducts to protect metal particles from entering.

=> Electrical System; Repair group 96



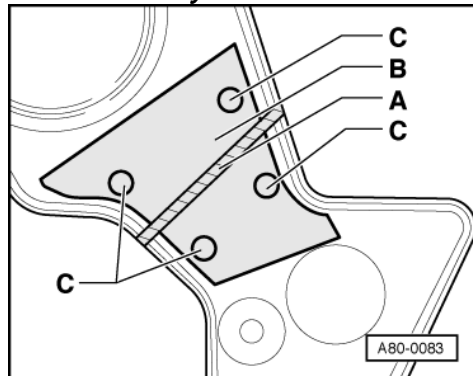


- -> Drill a 7 mm diameter hole at each of the points on the dash panel support (weld points) designated by - A- (drill through both panels at the weld points).
- Use a saw to cut through support at point designated by -B- (e.g. use body saw V.A.G 1523 A).

Note:

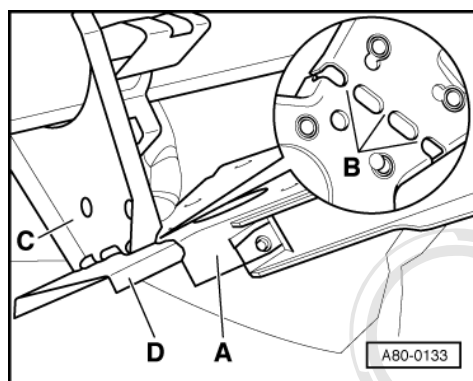
Do not saw through section -C- of the support (reinforcement plate).

Note for model year 1997 vehicles

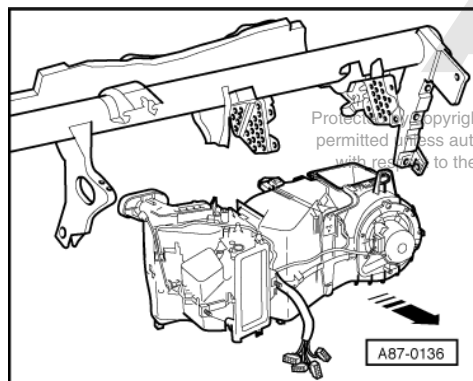


Vehicles at the start of production still have dash panel cross members installed without a break section - proceed as follows for these vehicles:

- -> Cut to size a section of bodywork panel -B- (shaded in grey in the drawing) over 2.5 mm thick to conform with contour -B- (deburr edges).
- Drill 4 holes -C- (according to drawing) in the bodywork panel and in the support and deburr (drill upper holes so that bolts to be installed do not contact bracket for the passenger airbag unit, or use flat-head bolts).
- Use a suitable saw to cut through support at the point marked -A-.
- After the air conditioner is installed, screw together both sections of the support and bodywork panel -B- (e.g. using 4 M 6 x 10 mm bolts) at holes -C-.



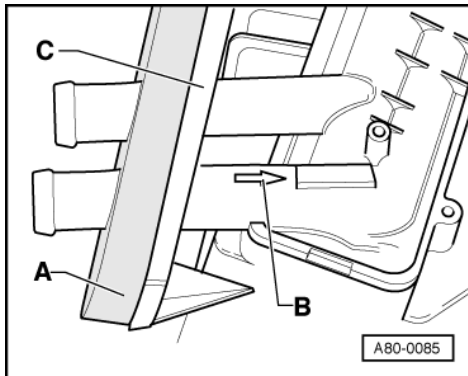
- Remove tunnel brace.
- -> Bend aside or break off section -A- of support at break section -B-.
- Deburr holes drilled in sections -C- and -D- of the support.
- Mask over all resulting sharp edges e.g. with adhesive tape so that is no possibility of injury.



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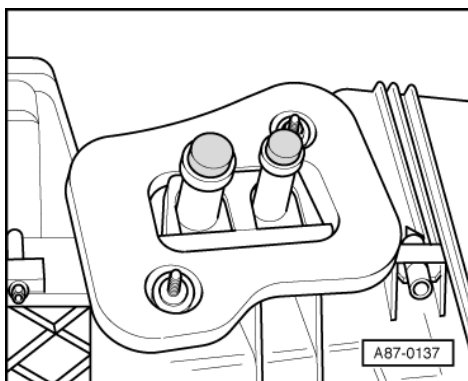
- Disconnect all the electrical connections between body and air conditioner at the connectors.
- -> Remove air conditioner towards passenger's side.

Installation notes:

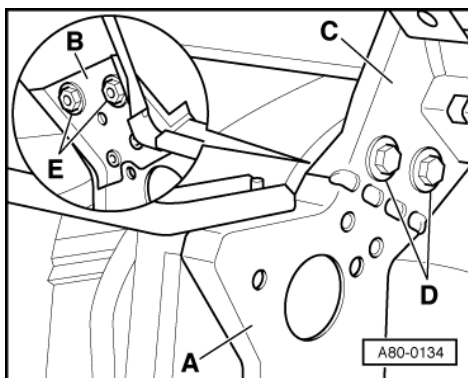


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- ◆ Check all seals on the air conditioner for damage before installation and replace any damaged seals.
- ◆ When installing the air conditioner, ensure that the intake duct gasket makes contact the vehicle body.
- ◆ -> Replace gasket -A- and check for correct positioning on contact surface -C-.
- ◆ The refrigerant hoses are to be connected on the correct side. Different connection and flow direction of the refrigerant dependent on the type of heat exchanger => Page 206. The illustration shows a heat exchanger for a vehicle without map-controlled cooling and without quick release couplings (flow direction marked with arrow -B-).



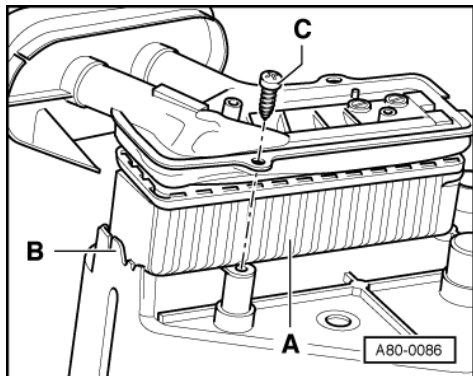
- ◆ After assembling, all cable ties that were removed in order to take out the air conditioner must be refitted in their original positions.
- ◆ Replace both O-ring seals for the refrigerant lines and expansion valve.
- ◆ Install refrigerant pipes so that they are tension-free.
- ◆ Ensure that condensation drain and condensation drain valve are properly positioned.
- ◆ -> Replace seal and ensure correct seating on evaporator connector flange.



- ◆ -> After the air conditioner is installed:
 - Bend back section -A- of the support.
 - Screw together section -B- (welded to support -A-) and section -C- of the support using two bolts -D- (e.g. M 6 x 10) and two combi nuts -E-.

- ♦ When inserting bolts -D- into holes, ensure that bolts do not come into contact with the airbag unit bracket.

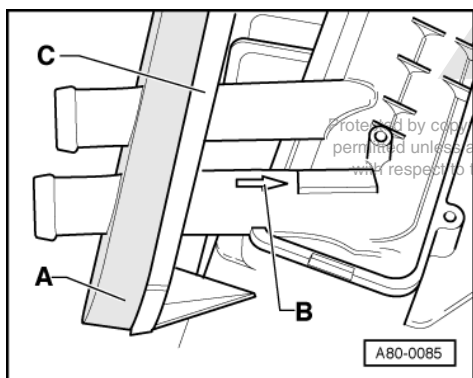
11.2 - Removing and installing the air conditioner heat exchanger



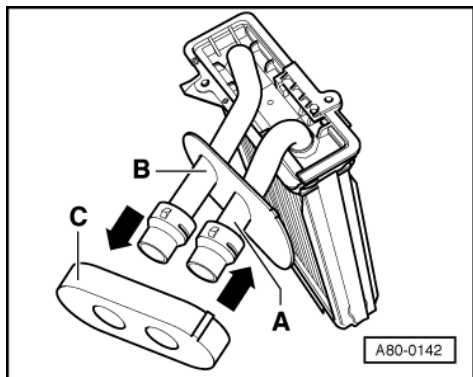
- -> Remove air conditioner => Page 206 .
- Press back catches -B- and remove the heat exchanger -A- from the heater.

Notes:

- ♦ Secure the installed heat exchanger in the heater flap unit using 2 suitable screws -C- (e.g. 3.2 x 20 mm self-tapping screws).
- ♦ The heat exchanger is installed in the heater flap unit without an all-round seal (vehicles without map-controlled cooling).
- ♦ The refrigerant hoses are to be connected on the correct side. Different connection and flow direction of the refrigerant dependent on the type of heat exchanger => Page 117 .



- ♦ -> Replace gasket -A- and check for correct positioning on contact surface -C-.

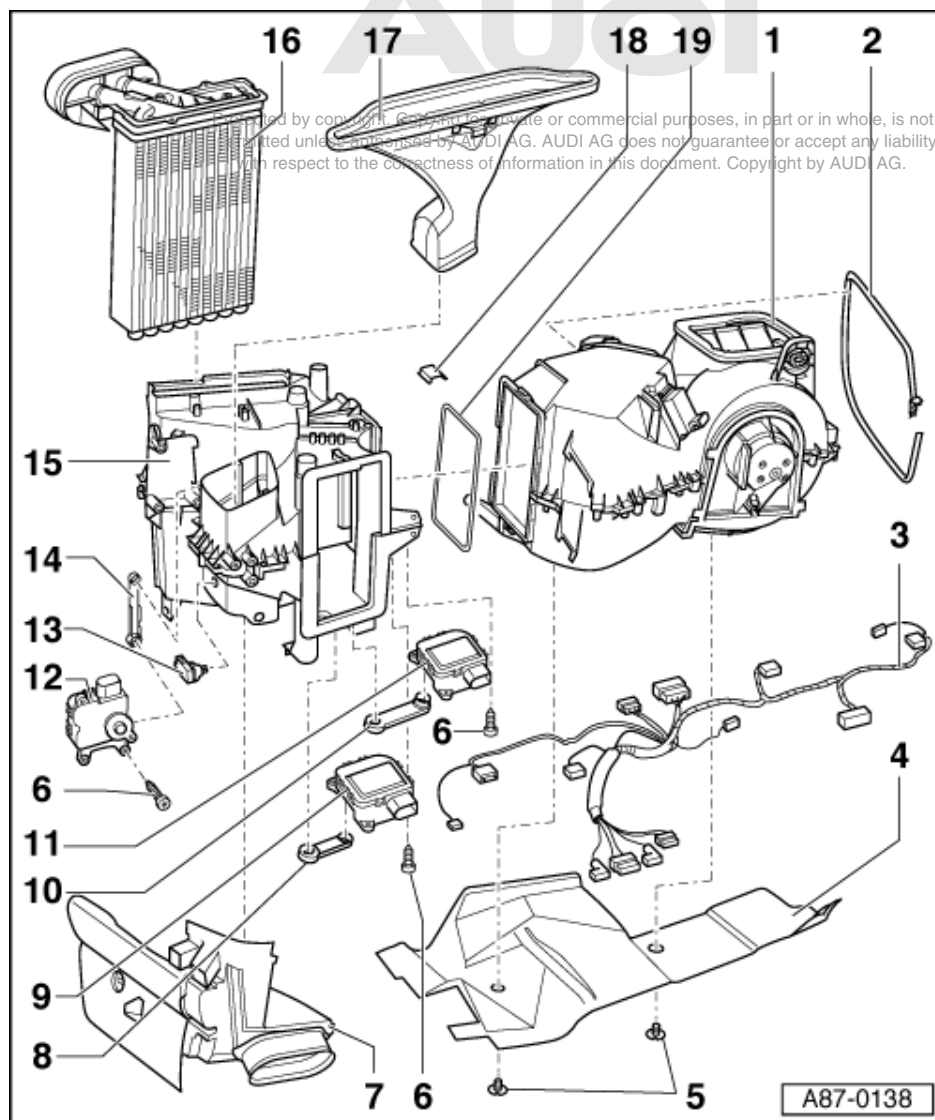


- ♦ The heat exchanger has been installed in vehicles with map-controlled cooling (to be introduced gradually as of model year 1999 vehicles with 1.6 l engine) which has been adapted to the different usage conditions. The following must be noted for this heat exchanger:
 - -> The flow direction of the refrigerant in the heat exchanger is not marked at the refrigerant connections (observe feed and return flow).
 - The heat exchanger components carrying refrigerant are produced entirely from metal due to the higher feed refrigerant temperature.

=> Parts List

12 - Dismantle and assemble air conditioner (version 1)

12.1 - Dismantle and assemble air conditioner (version 1)



Notes:

- ♦ As of June 1997, AC version "1" has been gradually phased out of production and AC version "2" gradually phased in.

♦ Dismantle and assemble air conditioner, design "2"=> Page 224 .

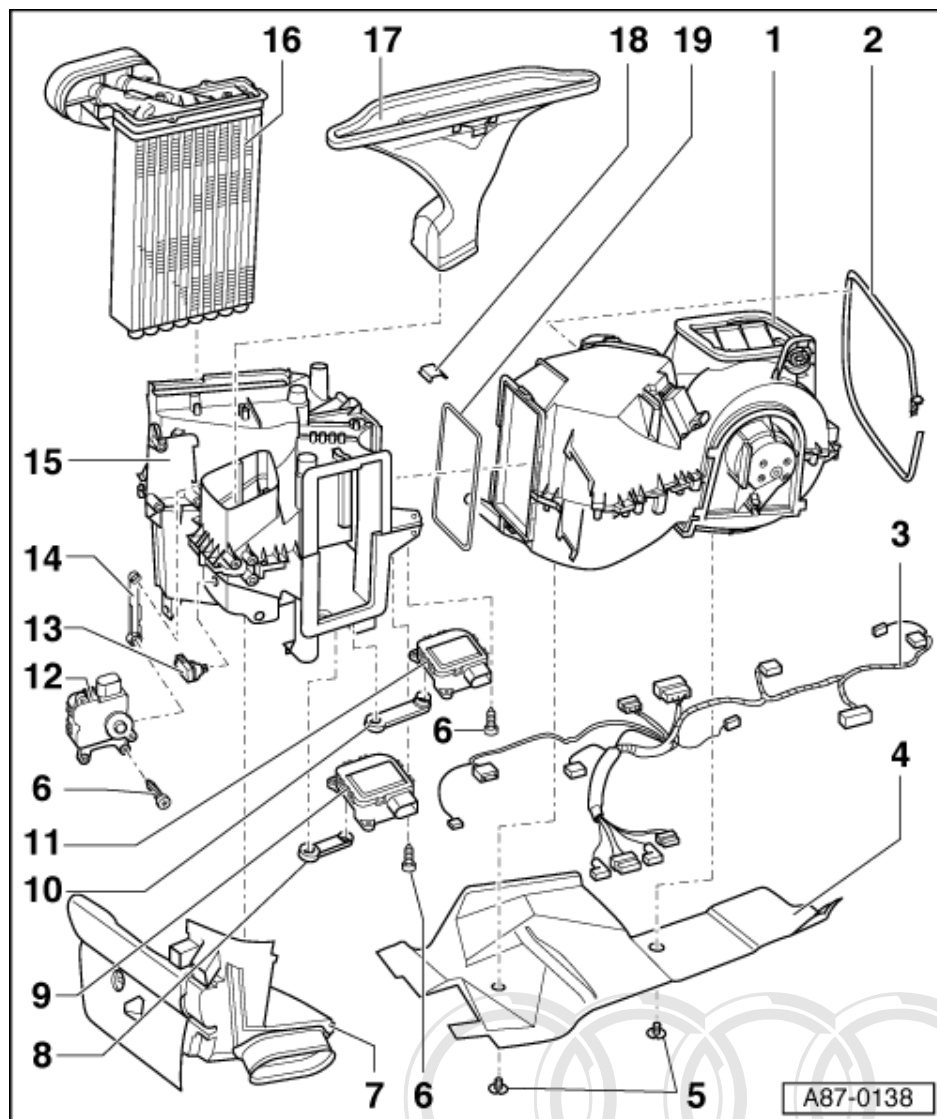
- Remove air conditioner =>Page 206 .

1 Evaporator housing

♦ Dismantling and assembling => Page 218 .

2 Tensioning strap

♦ Ensure correct routing => Fig. 1 .



3 Air conditioner wiring harness

♦ Ensure clearance to moving components is maintained when installing => Fig. 2 .

4 Cover

♦ Fastened to the evaporator housing via tensioning strap Item 2 and both bolt clips Item 5.

5 Bolt clip

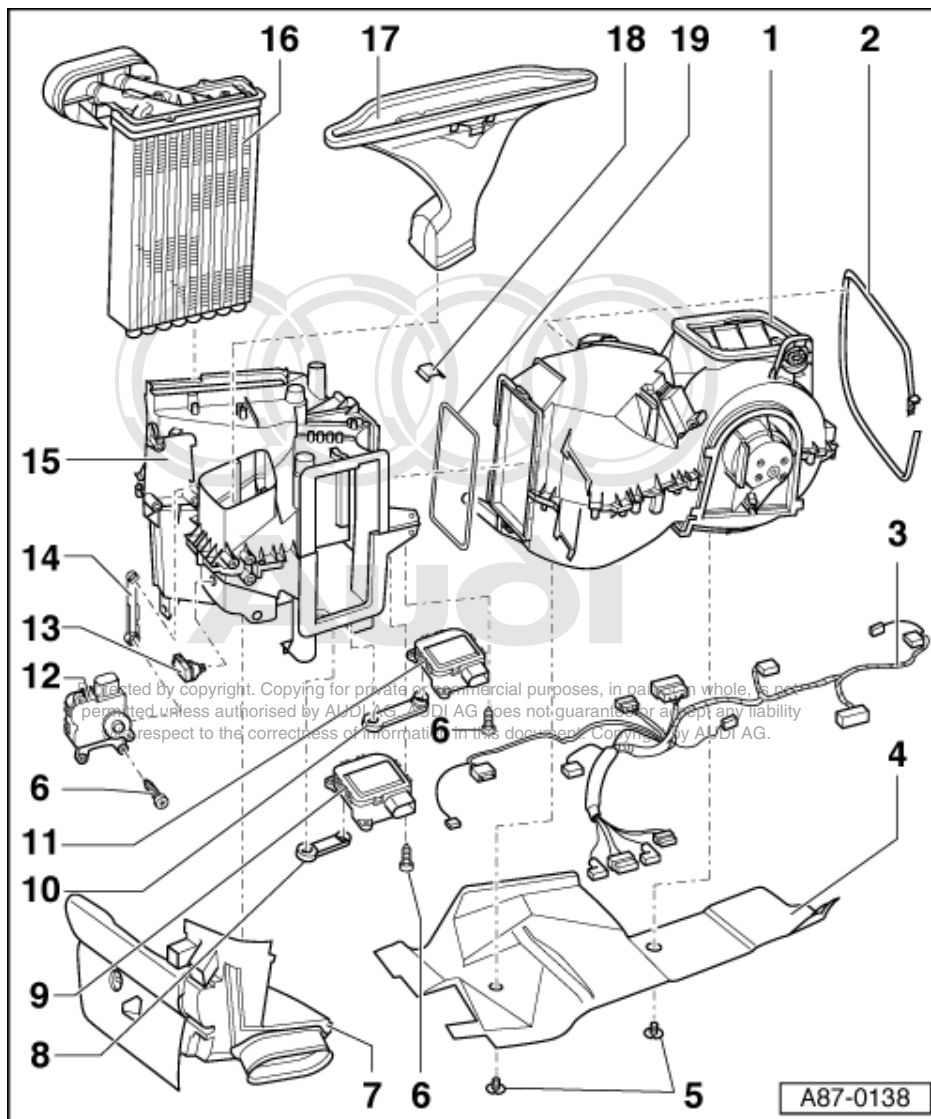
6 Bolt

7 Footwell vent

♦ Removing and installing =>Page 181 .

8 Connecting link

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9 Central flap positioning motor -V70

- ◆ With potentiometer -G112
- ◆ Removing and installing =>Page 182 .
- ◆ "Green" pivot arm

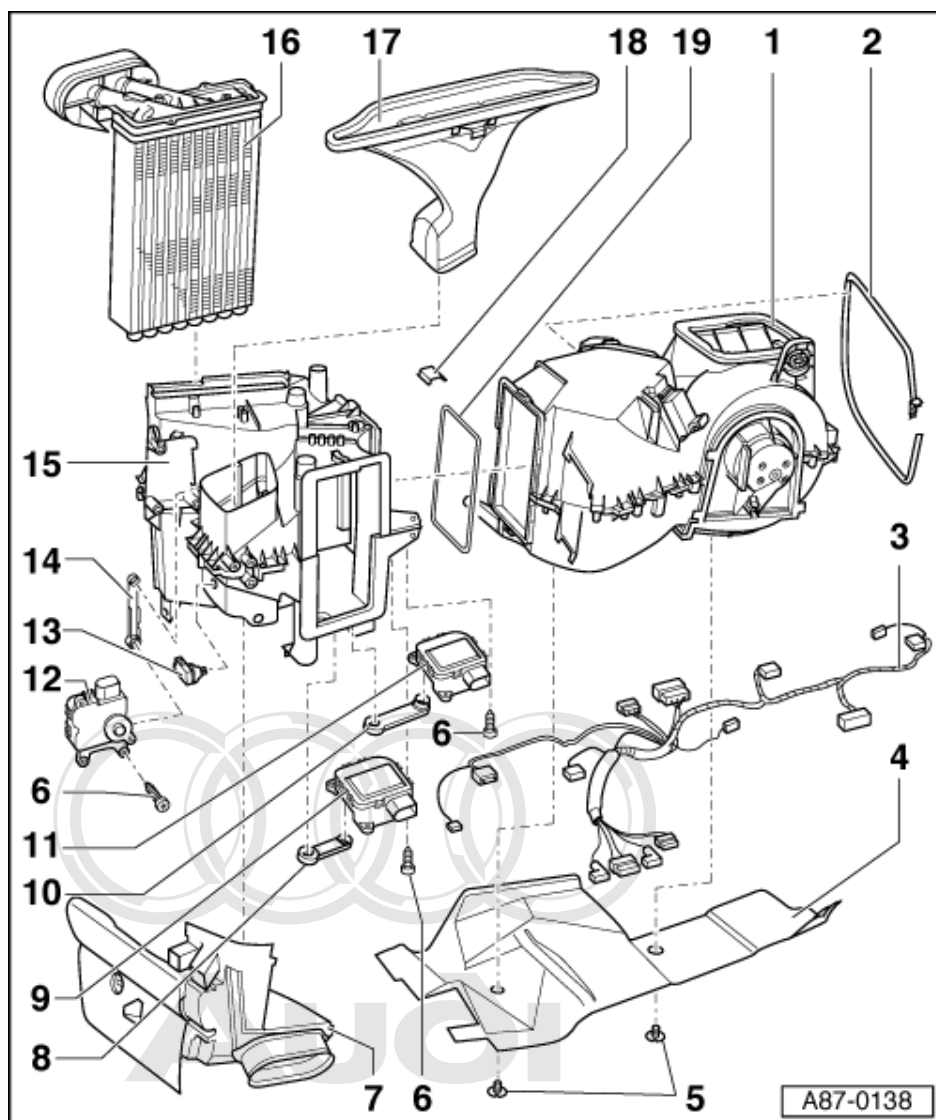
10 Connecting link

11 Temperature flap positioning motor -V68

- ◆ With potentiometer -G92
- ◆ Removing and installing =>Page 182 .
- ◆ "Black" pivot arm

12 Footwell/defroster flap positioning motor -V85

- ◆ With potentiometer -G114
- ◆ Removing and installing =>Page 181 .
- ◆ "yellow" pivot arm



13 Footwell vent temperature sender
-G192

- ♦ Removing and installing =>Page 178 .

14 Connecting link

15 Heater flap unit

- ◆ Do not dismantle.

16 Heat exchanger

- ♦ Removing and installing => Page 212 .

17 Air duct to defroster vent

- ◆ Removing and installing =>Page 94 .

18 Bracket

- ◆ Use a screwdriver to prise off.

19 Gasket

- ◆ Install in evaporator => Fig. 3.

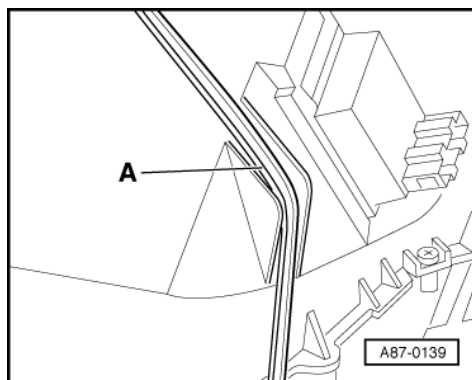


Fig.1 -> Routing securing strap

Notes:

- ◆ Ensure that tensioning strap -A- is properly fitted around evaporator housing.
- ◆ The tensioning strap keeps the cover secured to the evaporator housing.

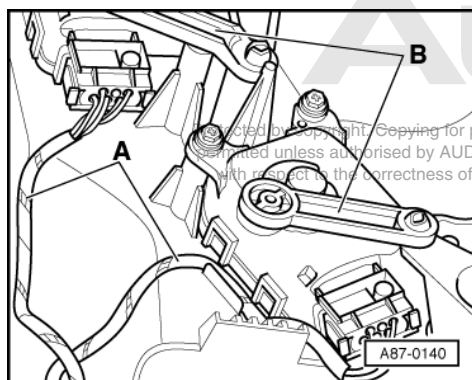


Fig.2 -> Installing air conditioner wiring harness

Notes:

- ◆ Install wiring harness -A- so that it cannot come into contact with moving parts (e.g. positioning motor lever -B-).
- ◆ Route wiring harness so that it does not rattle.

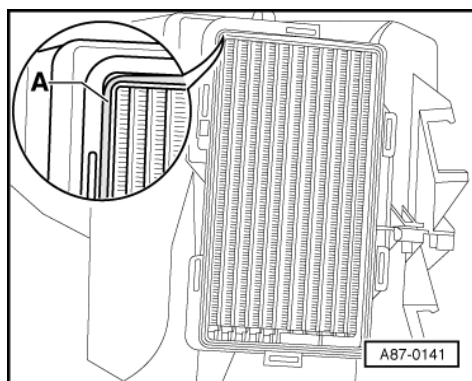
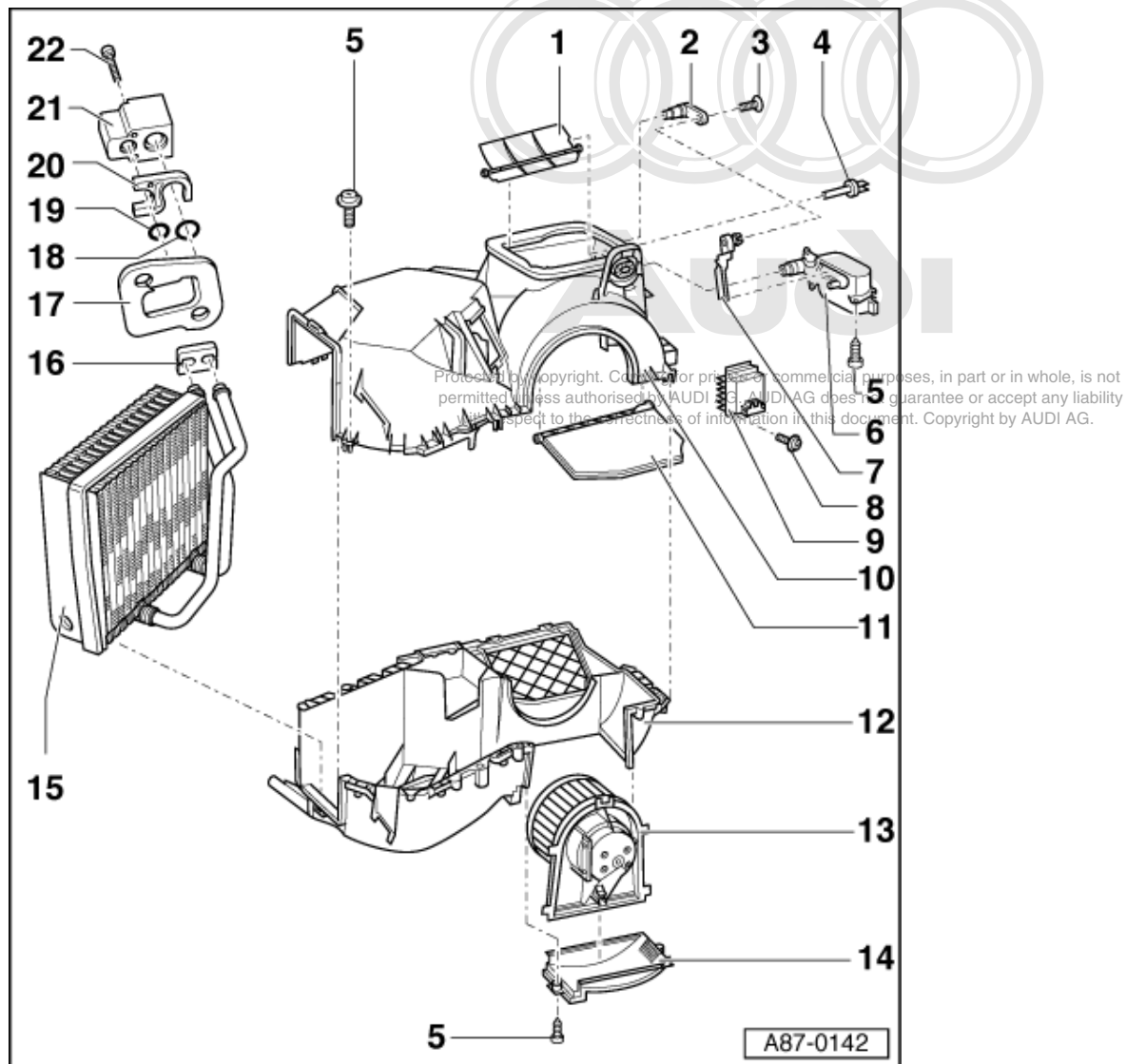


Fig.3 -> Installing gasket on evaporator housing

Note:

Seal -A- must be fitted in the groove all around the evaporator housing.

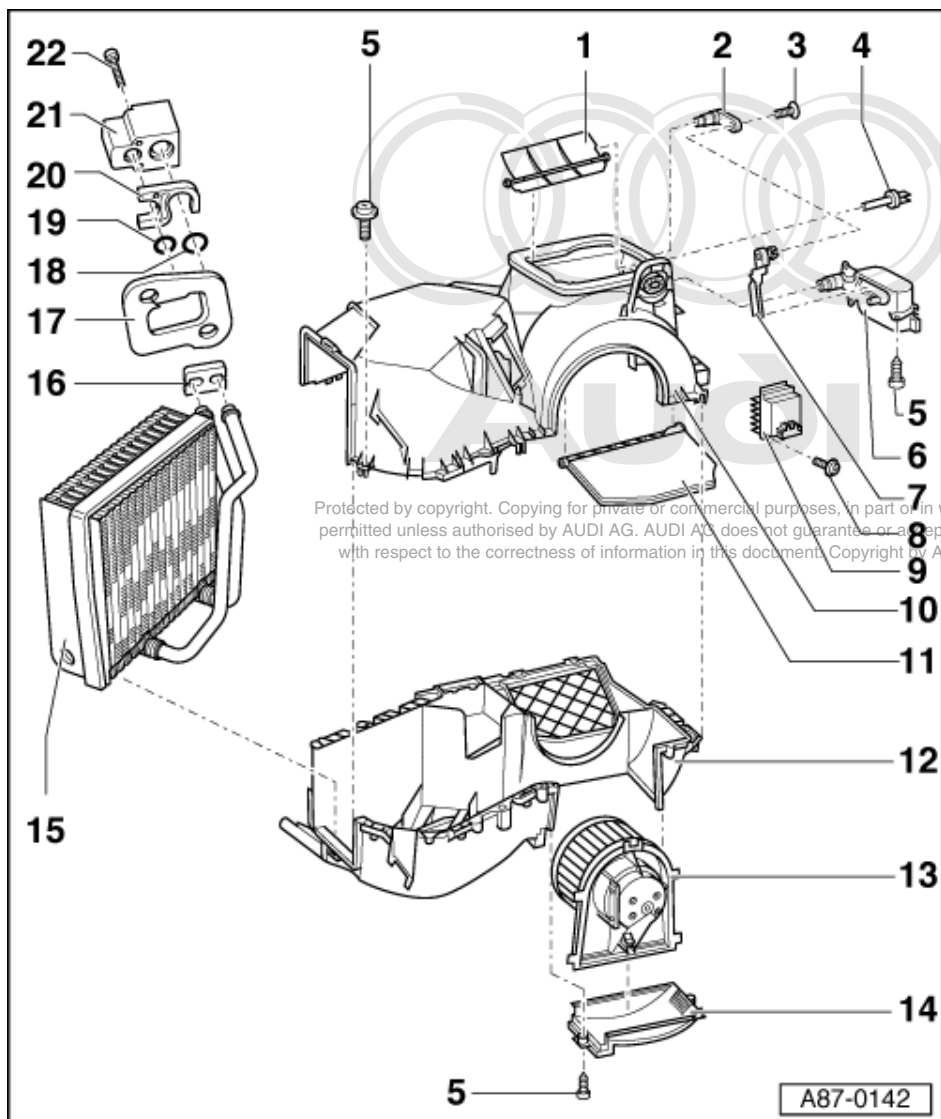
12.2 - Disassembling and assembling evaporator housing



- Dismantling and assembling air conditioner => Page 213 .

- 1 Air flow flap
- 2 Lever
- 3 Bolt
- 4 Temperature sensor for fresh air intake duct -G89
 - ♦ Removing and installing =>Page 185 .
- 5 Bolt
- 6 Air flow flap positioning motor -V71
 - ♦ Actuates the air flow flap and fresh/recirculated air flap

- ♦ With potentiometer -G113



- ♦ Removing and installing =>Page 185 .

7 Connecting link

- ♦ To air flow flap

8 Bolt

9 Blower control unit -J126

- ♦ Removing and installing =>Page 178 .

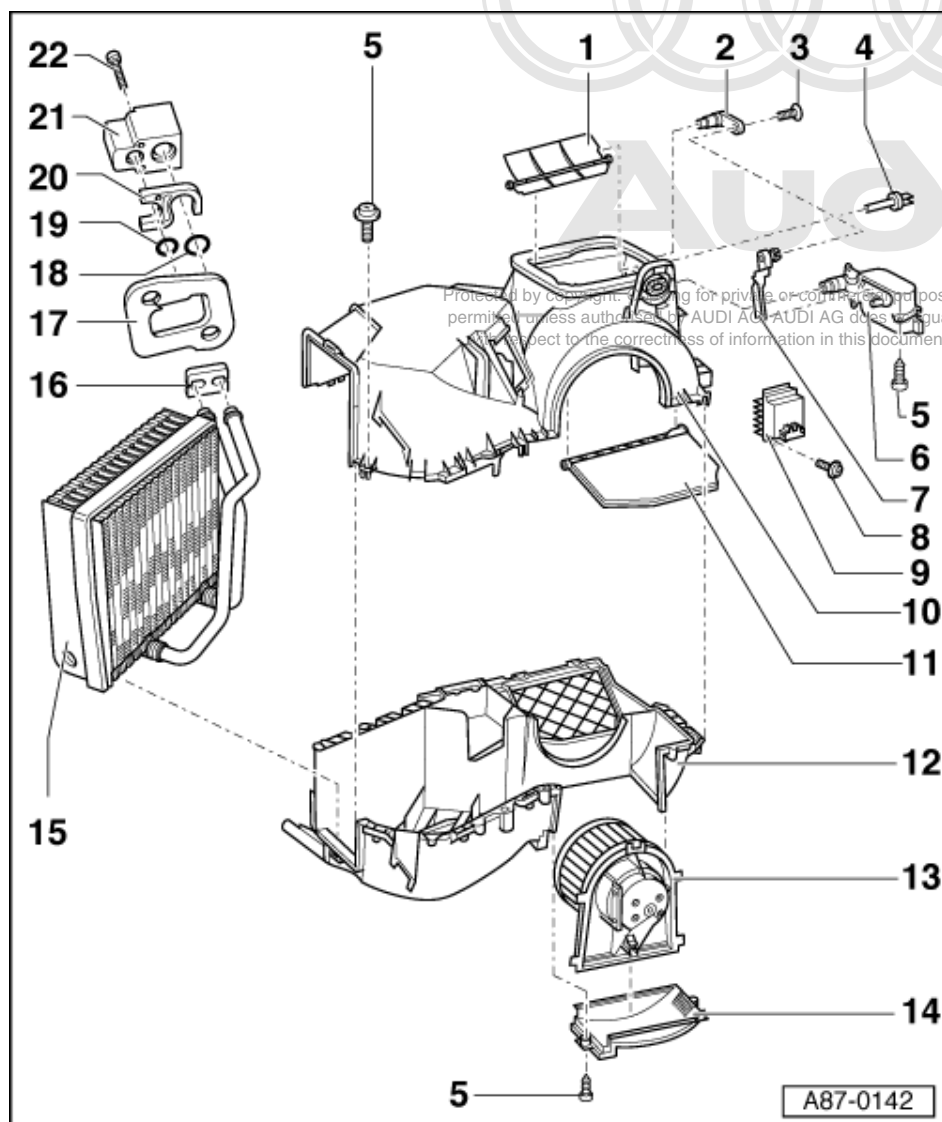
10 Top half of evaporator housing

- ♦ Assembling evaporator housing =>Fig. 1 .
- ♦ Check intake duct gasket - replace if damaged (seals off the intake duct from the passenger compartment).

11 Fresh/recirculated air flap

12 Bottom half of evaporator housing

- ♦ Assembling evaporator housing =>Fig. 1 .



13 Fresh air blower -V2

- ♦ Removing and installing => Page **179** .

14 Cover

15 Evaporator

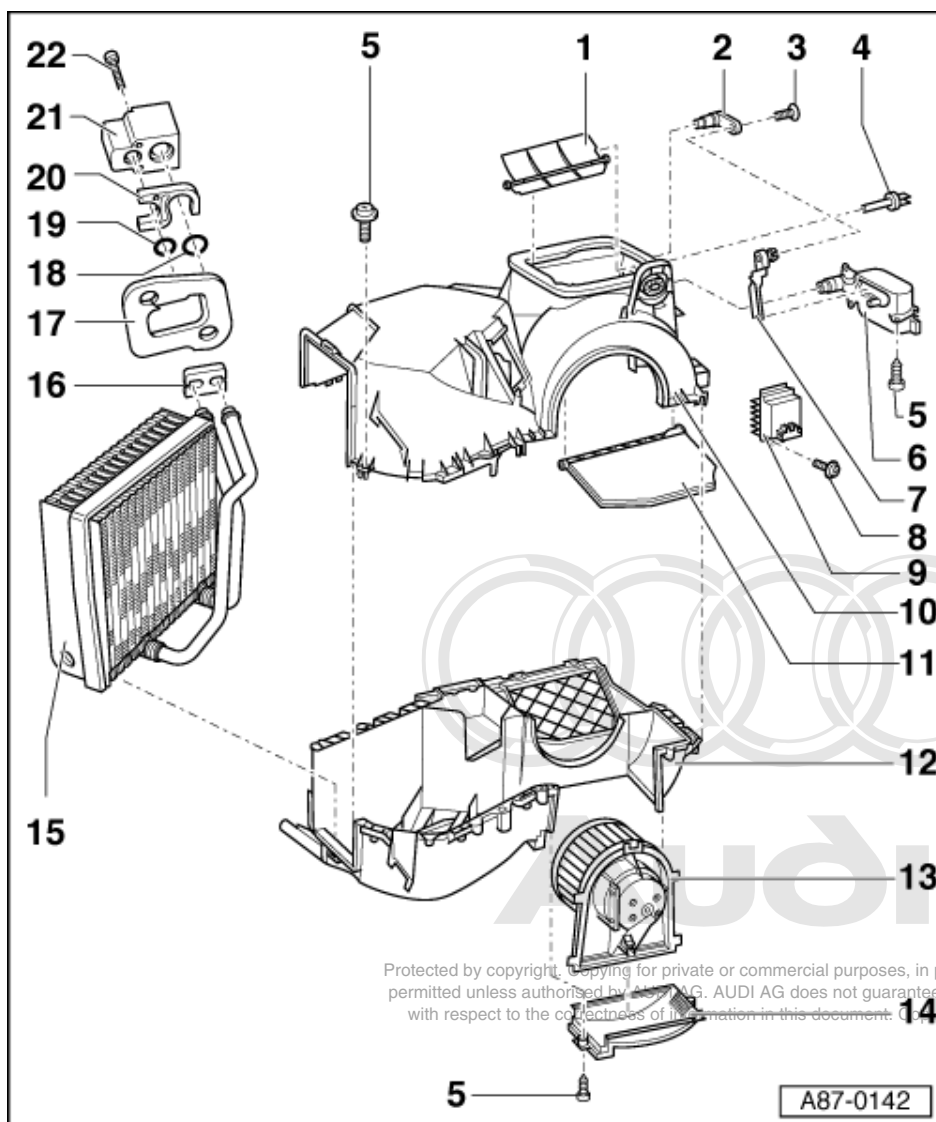
- ♦ Attaching seal to refrigerant lines =>Fig. **2** .
- ♦ Attaching seal to evaporator =>Fig. **3** .

16 Seal

- ♦ Attaching seal to refrigerant lines =>Fig. **2** .

17 Seal

- ♦ Renew
- ♦ Attaching seal to evaporator housing =>Fig. **4** .
- ♦ Seals off connection area of refrigerant lines from engine compartment.



18 O-ring seal

- ♦ Removing and installing =>Page 203 .

19 O-ring seal

- ♦ Removing and installing =>Page 203 .

20 Threaded plate

21 Expansion valve

- ♦ Disconnecting and connecting refrigerant lines =>Page 203 .
- ♦ Removing and installing =>Page 203 .
- ♦ Removing and installing heat insulation =>Page 162 .

22 Bolt

- ♦ Tightening torque: 8 Nm

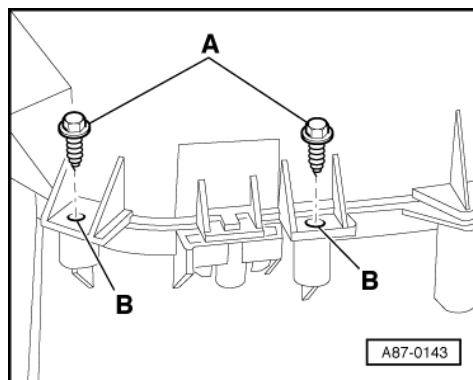


Fig.1 -> Assembling evaporator housing

- Screw together the two halves of the housing at points -B- with suitable bolts -A-.

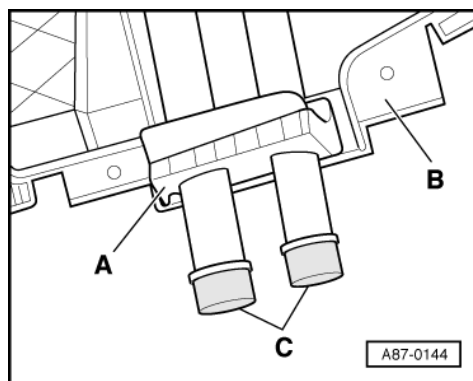


Fig.2 -> Attaching seal to evaporator refrigerant lines

- Seal refrigerant lines -C- to the two halves of housing -B- with seal -A-.

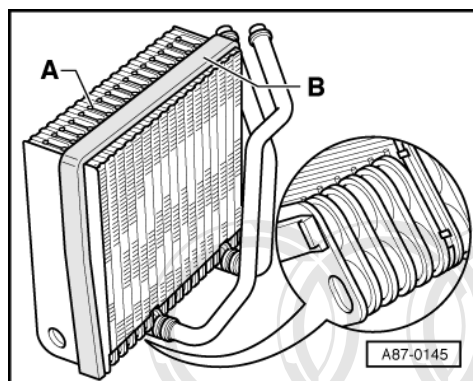


Fig.3 -> Attaching seal to evaporator

- Seal top and both sides of evaporator -A- to evaporator housing with seal -B-.

Note:

The underside of the evaporator must not be sealed (so that condensation water can drain off).

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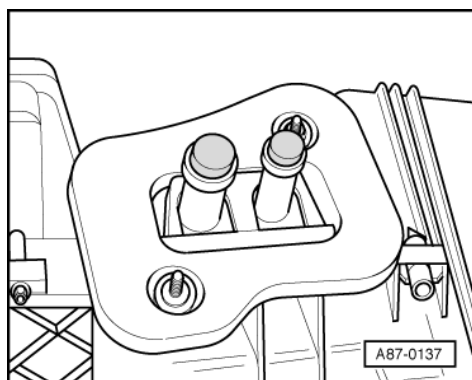
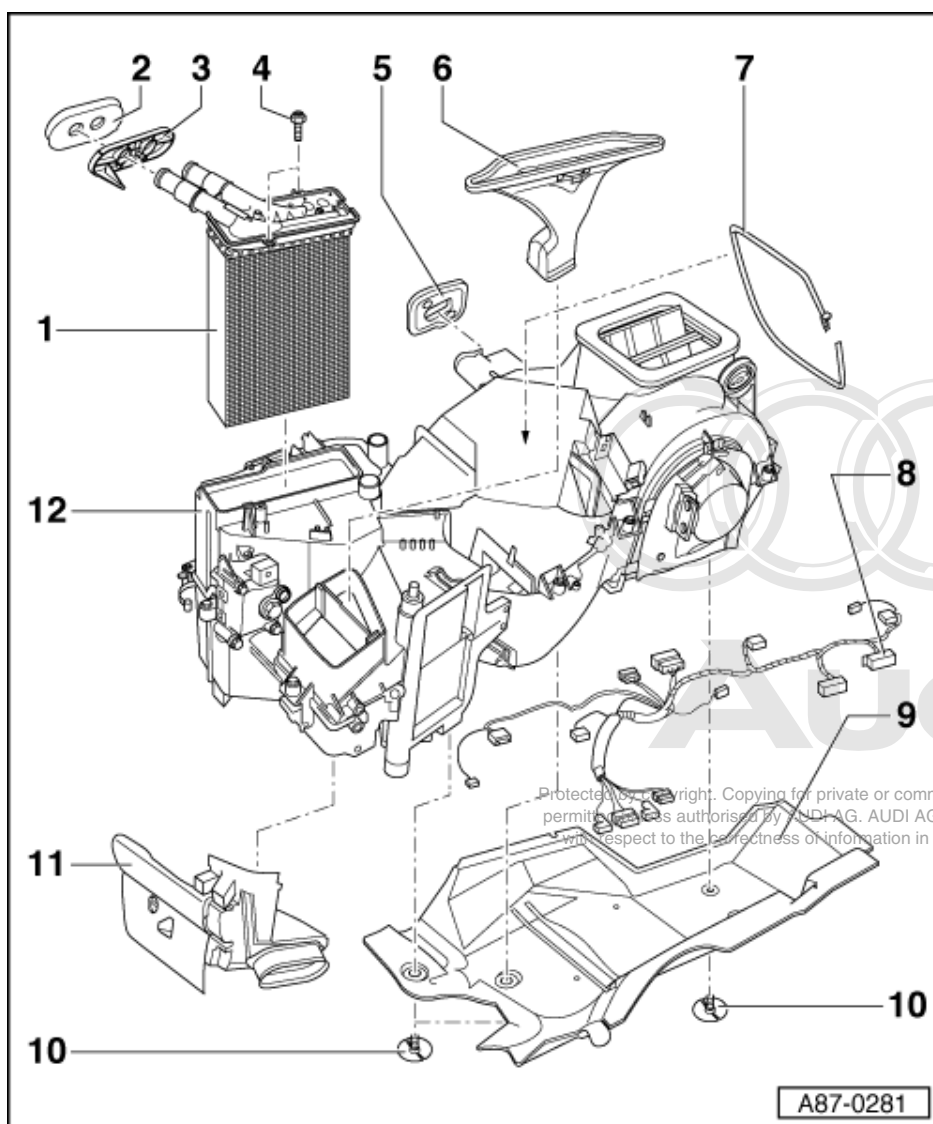


Fig.4 -> Attaching seal to evaporator housing

- Replace seal and ensure proper positioning on the evaporator connector flange.

13 - Dismantle and assemble air conditioner (version 2)

13.1 - Dismantle and assemble air conditioner (version 2)



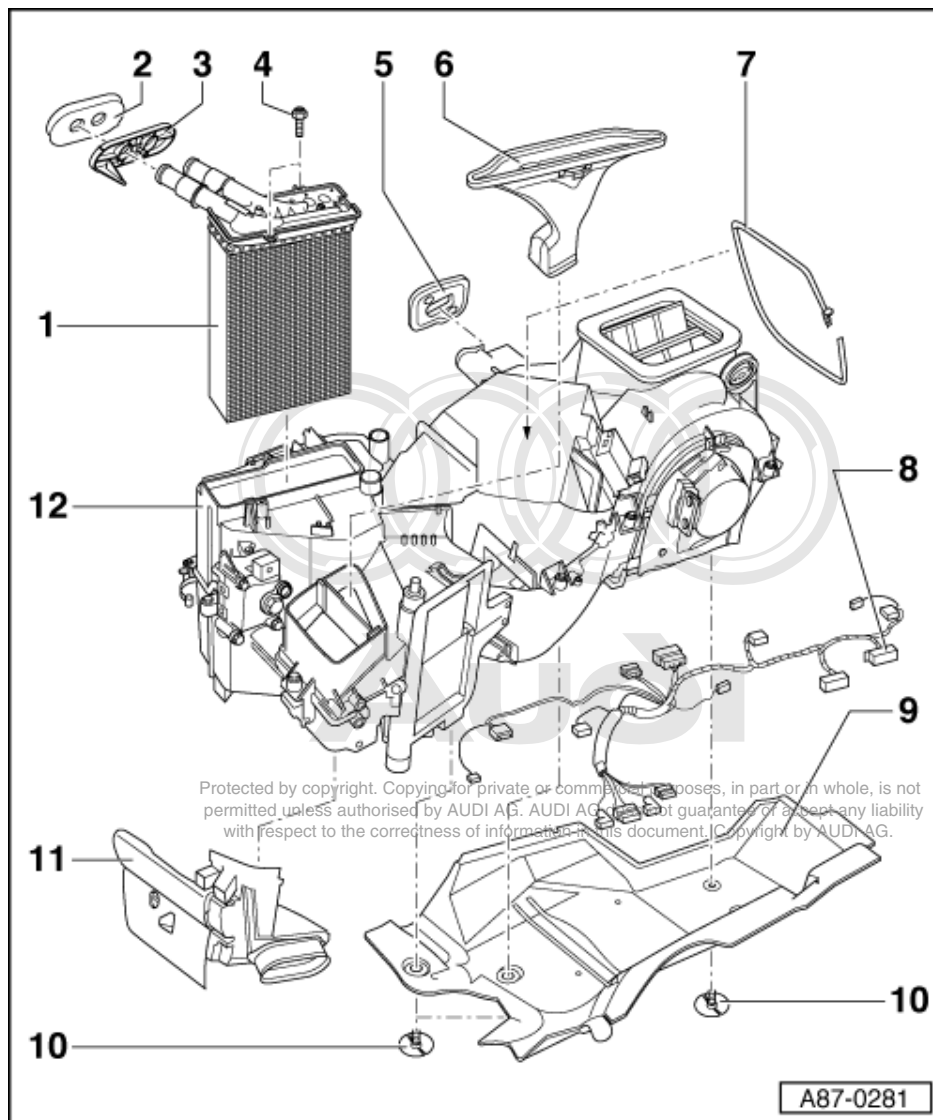
Notes:

- ♦ As of June 1997, AC version "1" has been gradually phased out of production and AC version "2" gradually phased in.
- ♦ Dismantle and assemble air conditioner, design "1"=> Page 213 .
- Removing air conditioner =>Page 206 .

13.2 - Removing and installing air conditioner attachment parts

1 Heat exchanger

- ♦ Removing and installing => Page 212 .



2 Seal

- ♦ Renew
- ♦ Seals off connection area of refrigerant pipes from engine compartment.

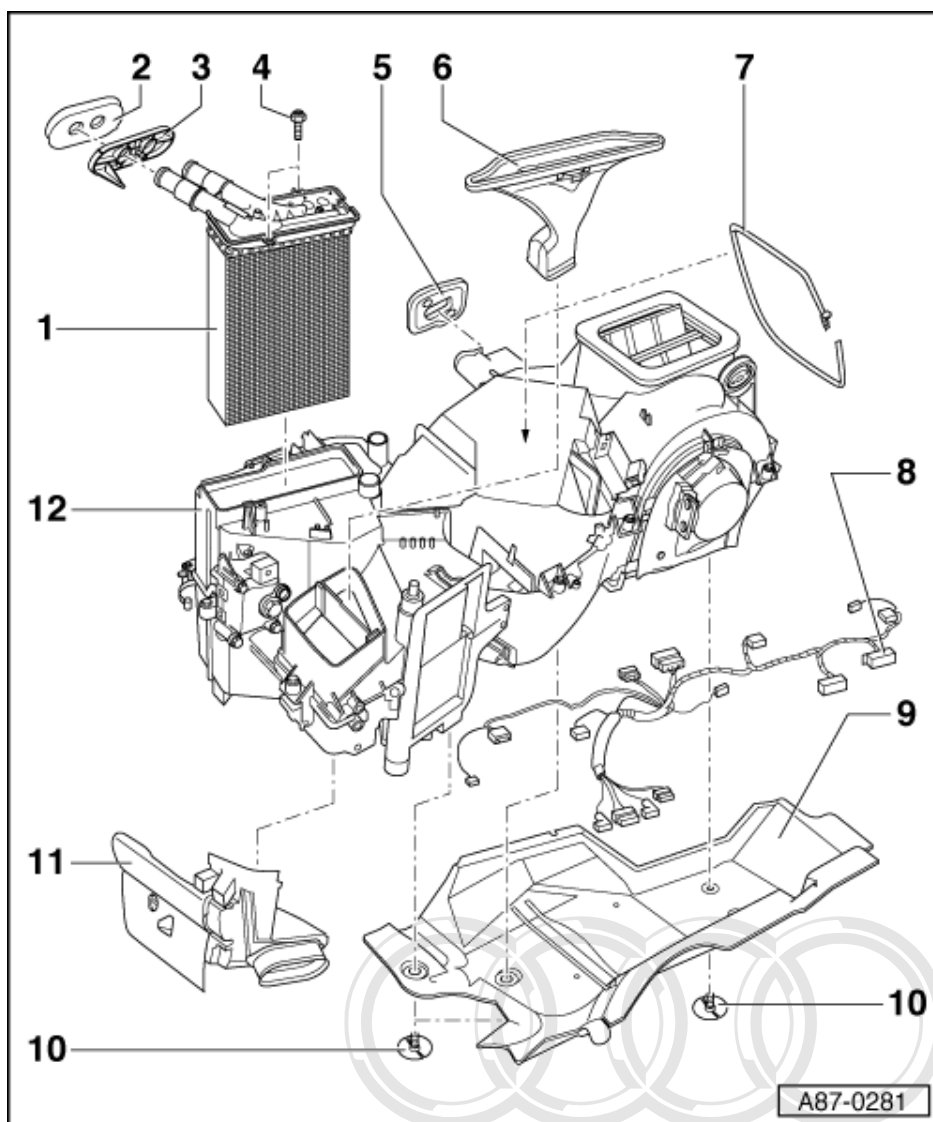
3 Contact surface

4 Bolt

5 Seal

- ♦ Renew
- ♦ Attaching seal to evaporator housing =>Fig. 3 .

- ♦ Seals off connection area of refrigerant lines from engine compartment.
- 6 Air duct to defroster vent**
- ♦ Removing and installing =>Page 94 .



- 7 Tensioning strap**
- ♦ Ensure correct routing => Fig. 1 .
- 8 Air conditioner wiring harness**
- ♦ Ensure clearance to moving components is maintained when installing => Fig. 2 .
- 9 Cover**
- ♦ Fastened to the air conditioner via tensioning strap and bolt clips.
- 10 Bolt clip**
- 11 Footwell vent**
- ♦ Removing and installing =>Page 181 .
- 12 Air-conditioner**
- ♦ With electrical components
 - ♦ Detaching and attaching electrical components from air conditioner =>Page 227
 - ♦ Dismantling and assembling => Page 231 .

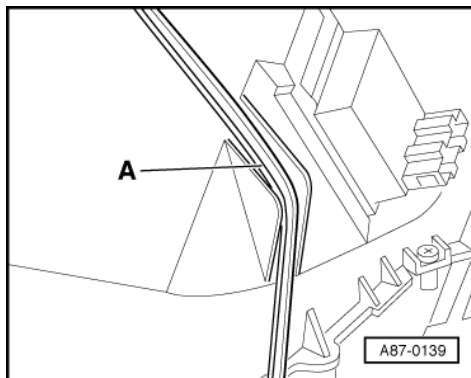


Fig.1 -> Routing securing strap

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Notes:

- ♦ Ensure that tensioning strap -A- is properly fitted around air conditioner.
- ♦ The tensioning strap keeps the cover secured to the air conditioner.

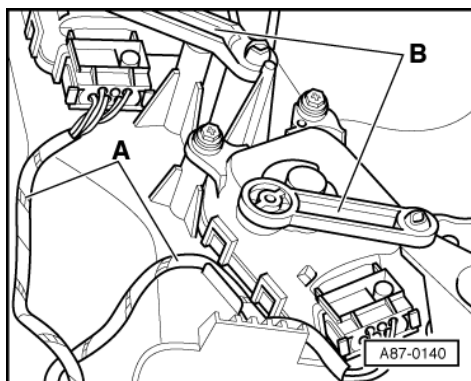


Fig.2 -> Installing air conditioner wiring harness

Notes:

- ♦ Install wiring harness -A- so that it cannot come into contact with moving parts (e.g. positioning motor lever -B-).
- ♦ Route wiring harness so that it does not rattle.

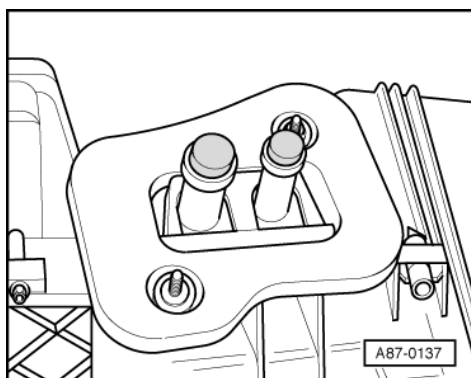
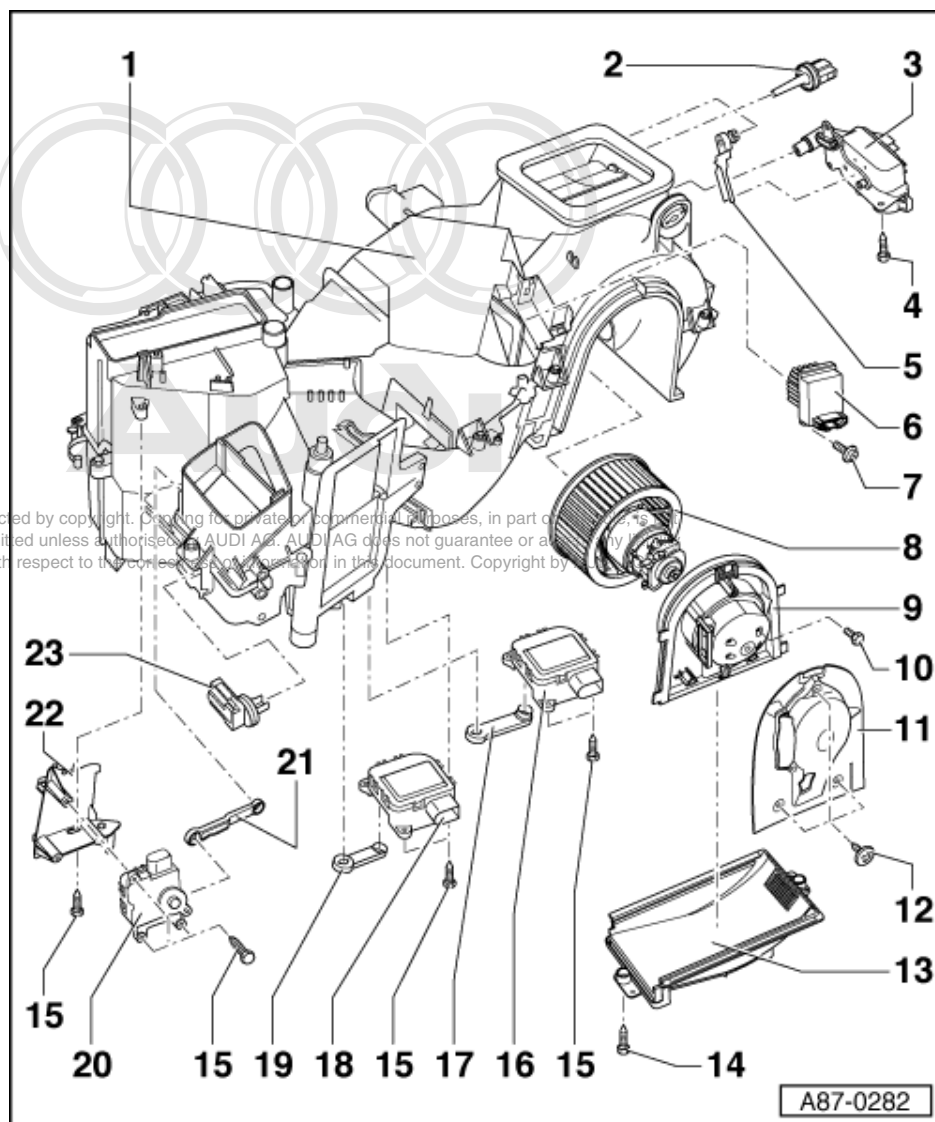


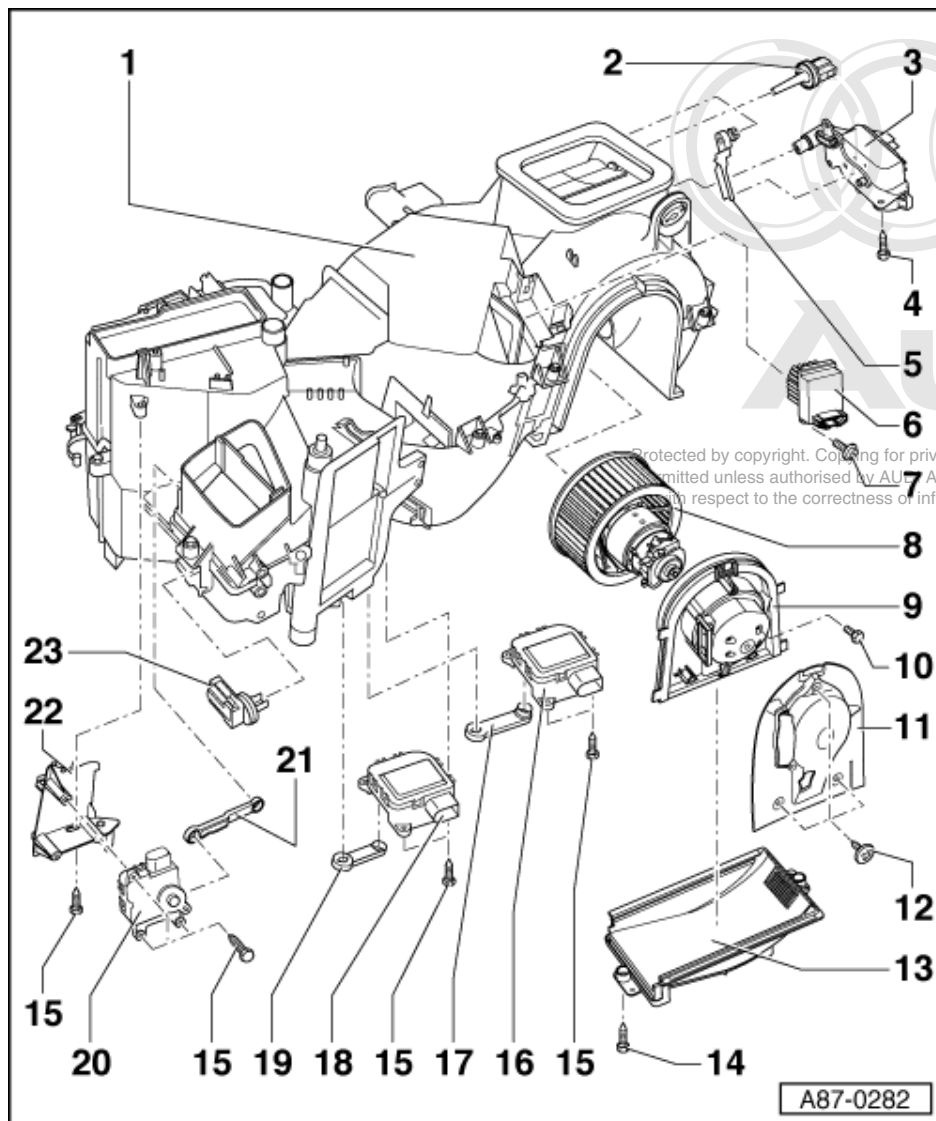
Fig.3 -> Attaching seal to air conditioner

- Replace seal and ensure proper positioning on the evaporator connector flange.

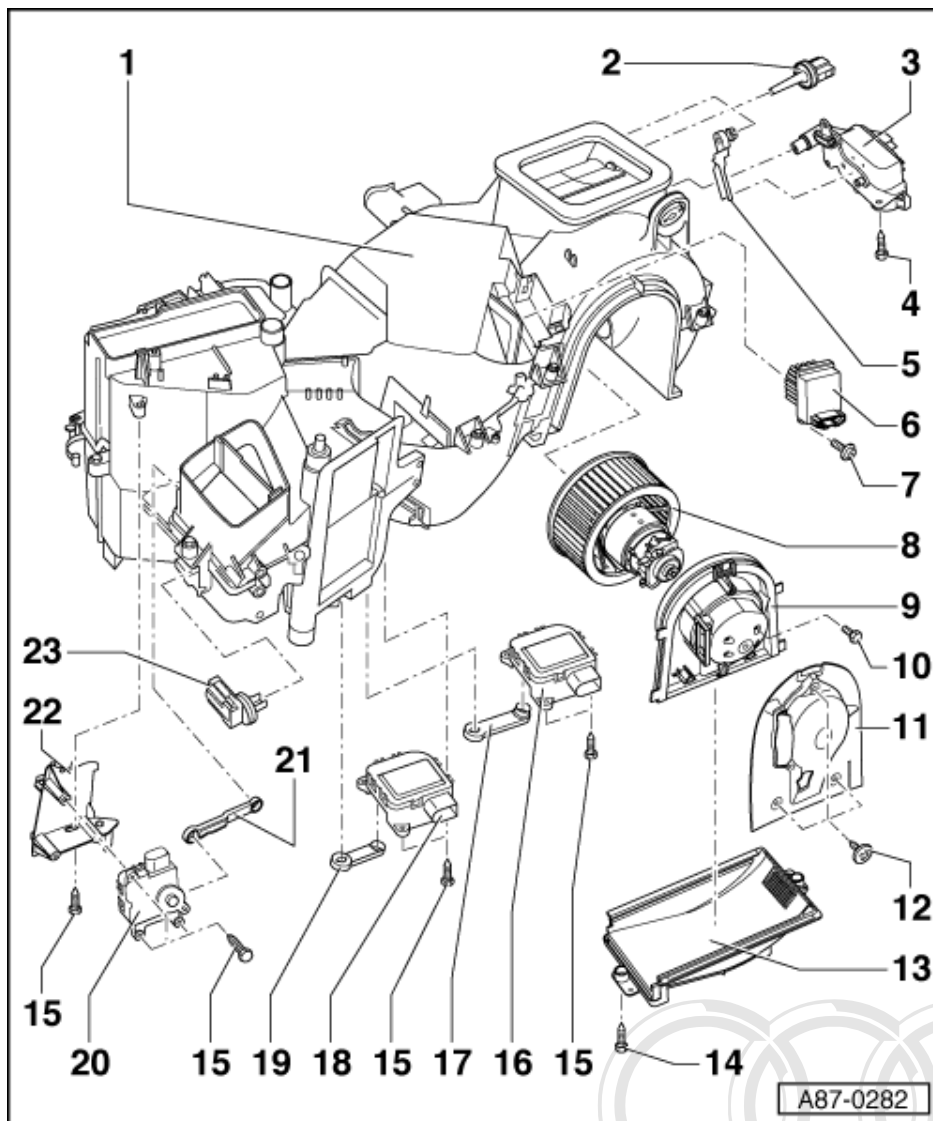
13.3 - Removing and installing air conditioner electrical components



- 1 Air-conditioner**
 - ♦ Dismantling and assembling => Page **231** .
- 2 Temperature sensor for fresh air intake duct -G89**
 - ♦ Removing and installing =>Page **185** .
- 3 Air flow flap positioning motor -V71.**
 - ♦ Actuates the air flow flap and fresh/recirculated air flap
 - ♦ With potentiometer -G113
 - ♦ Removing and installing =>Page **185** .
- 4 Bolt**



- 5 Connecting link**
 - ◆ To air flow flap
- 6 Blower control unit -J126**
 - ◆ Removing and installing =>Page **178** .
- 7 Bolt**
- 8 Fresh air blower -V2**
 - ◆ Removing and installing => Page **179** .
- 9 Mounting plate**
- 10 Bolt**
- 11 Noise insulation**
 - ◆ Not installed in all vehicles.
- 12 Bolt**
- 13 Cover**



14 Bolt

15 Bolt

16 Temperature flap positioning motor -V68

- ◆ With potentiometer -G92
- ◆ Removing and installing =>Page 182 .
- ◆ "Black" or "pink" pivot arm

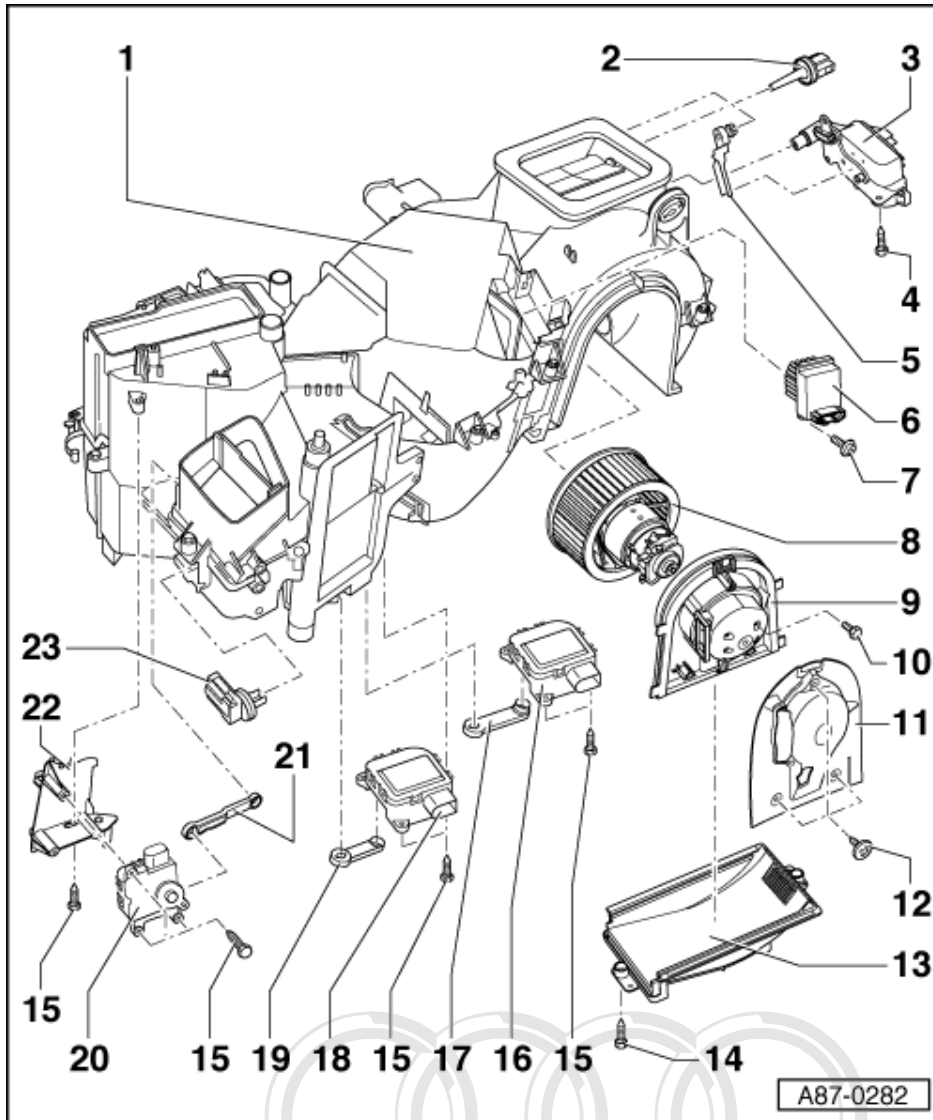
17 Connecting link

18 Central flap positioning motor -V70

- ◆ With potentiometer -G112
- ◆ Removing and installing =>Page 182 .
- ◆ "Green" pivot arm

19 Connecting link

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20 Footwell/defroster flap positioning motor -V85

- ◆ With potentiometer -G114
- ◆ Removing and installing =>Page 181 .
- ◆ "yellow" pivot arm

21 Connecting link

22 Bracket for positioning motor -V85

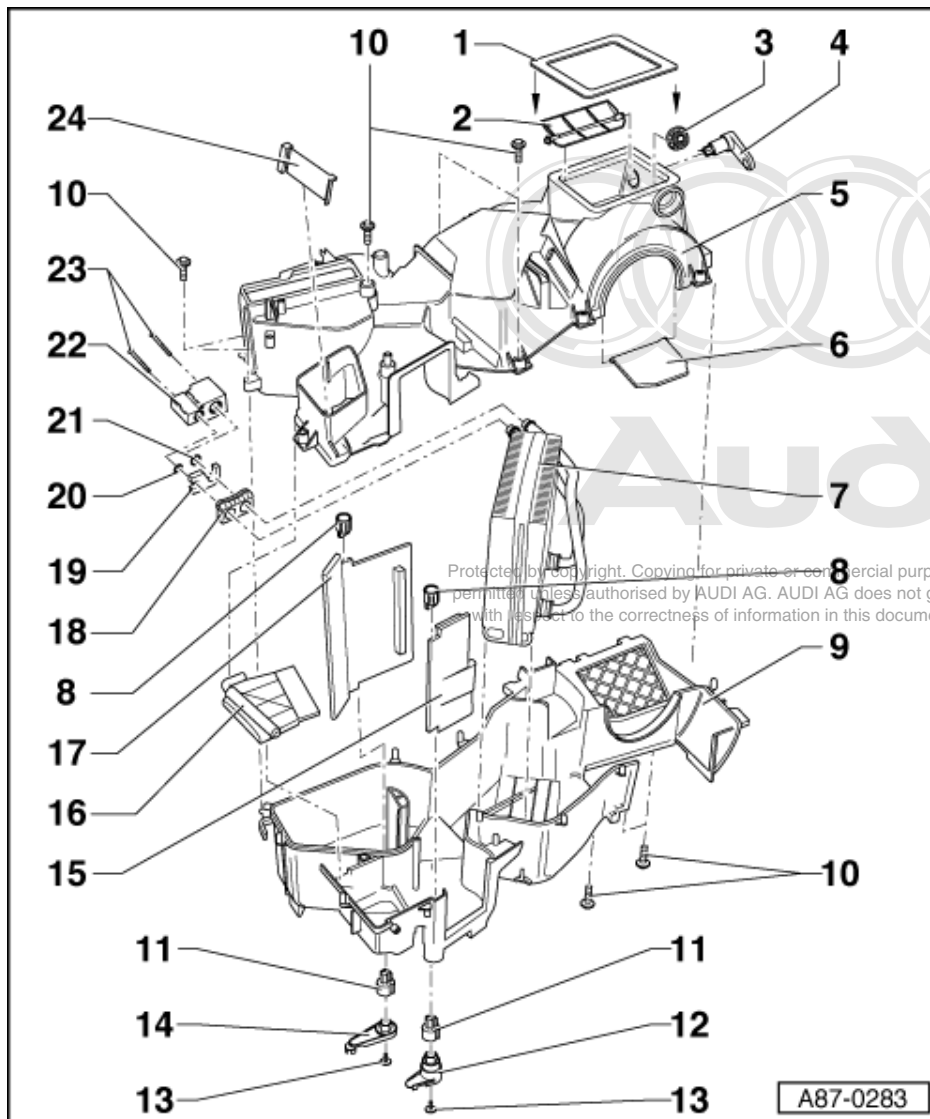
23 Footwell vent temperature sender

-G192

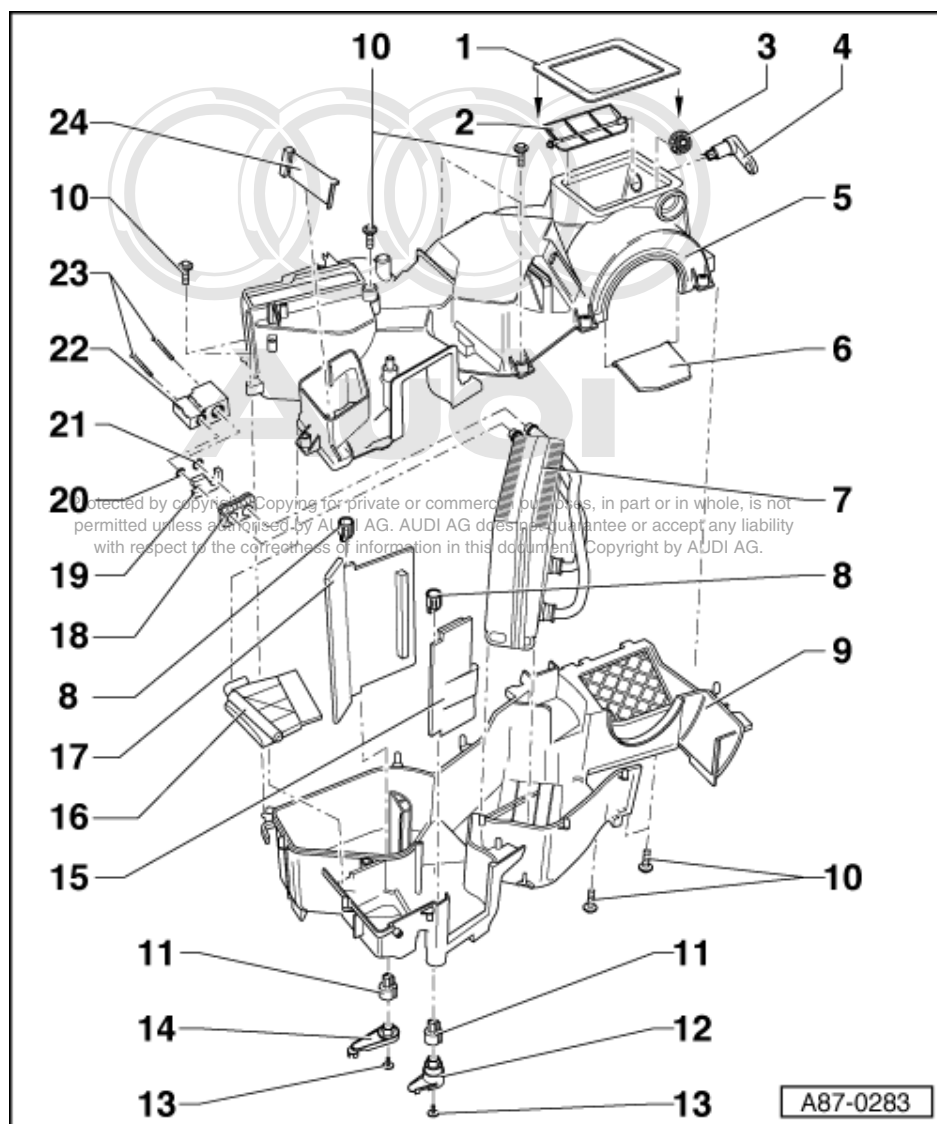
- ◆ Removing and installing =>Page 178 .

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13.4 - Dismantling and assembling air conditioner



- 1 Seal
 - ♦ Check - replace if damaged (seals off the intake duct from the passenger compartment).
- 2 Air flow flap
 - ♦ Apply small amount of grease to bearing points (with G 052 745 A3).
- 3 Grommet
- 4 Lever
- 5 Top half of housing
 - ♦ Assembling housing =>Fig. 1 .
 - ♦ Attaching seal to refrigerant lines =>Fig. 2 .



6 Fresh/recirculated air flap

- ♦ Apply small amount of grease to bearing points (with G 052 745 A3).

7 Evaporator

- ♦ Attaching seal to refrigerant lines =>Fig. 2 .
- ♦ Attaching seal to evaporator =>Fig. 3 .

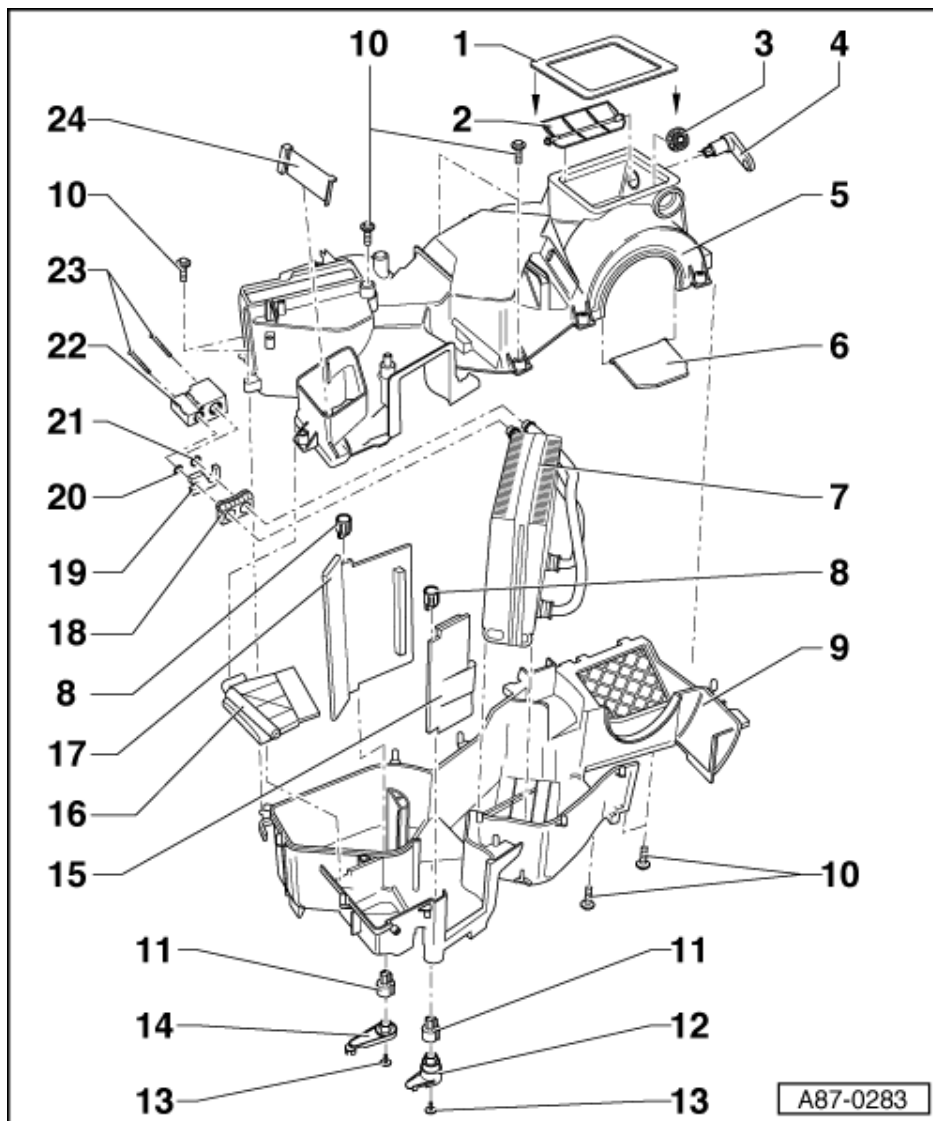
8 Mounting

- ♦ Apply small amount of grease to bearing points (with G 052 745 A3).

9 Bottom half of housing

- ♦ Assembling housing =>Fig. 1 .
- ♦ Attaching seal to refrigerant lines =>Fig. 2 .

10 Bolt



11 Mounting

- ♦ Apply small amount of grease to bearing points (with G 052 745 A3).

12 Lever

- ♦ For central flap

13 Bolt

14 Lever

- ♦ For temperature flap

15 Central flap

- ♦ Install on correct side (shorter section of flap on top).

16 Footwell/defroster flap

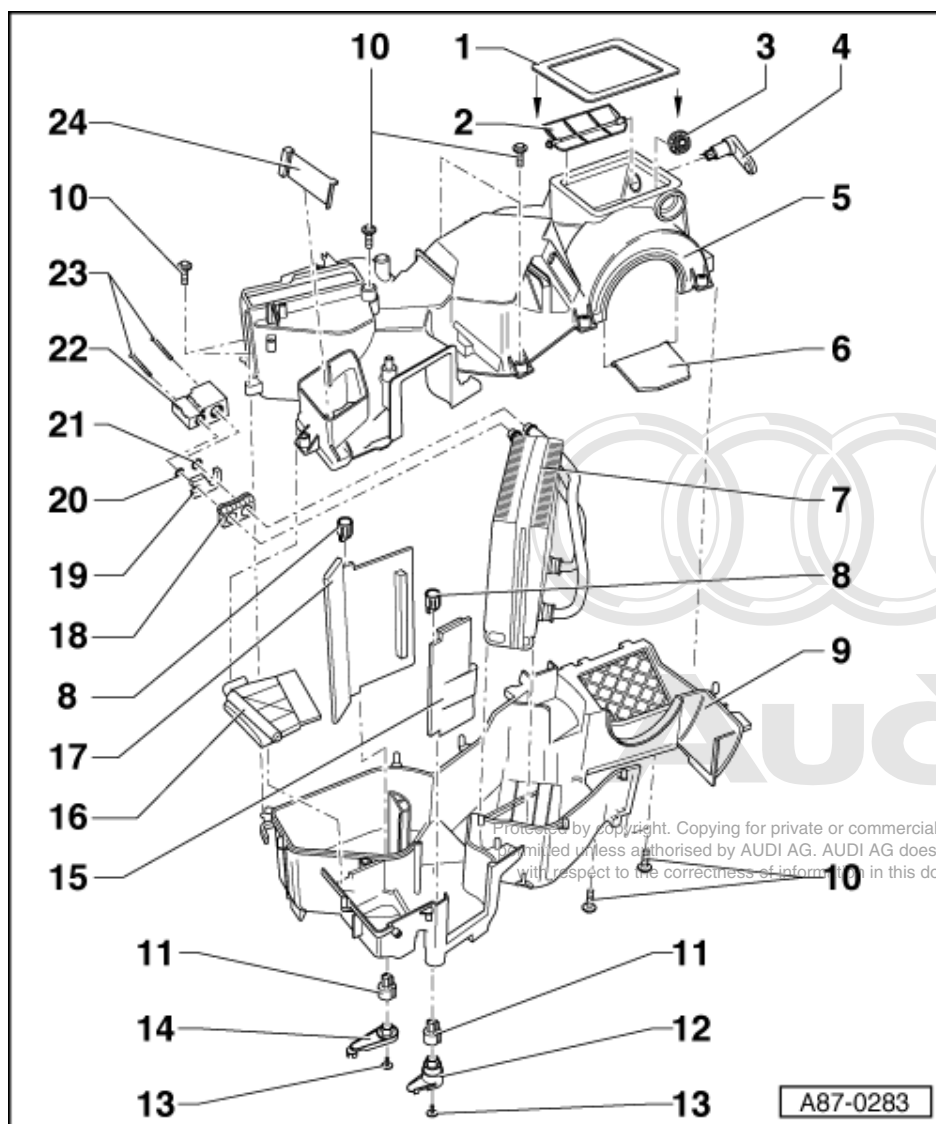
- ♦ Apply small amount of grease to bearing points (with G 052 745 A3).

17 Temperature flap

18 Seal

- ♦ Attaching seal to refrigerant lines =>Fig. 2 .

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19 Threaded plate

20 O-ring seal

- ♦ Removing and installing =>Page 203 .

21 O-ring seal

- ♦ Removing and installing =>Page 203 .

22 Expansion valve

- ♦ Disconnecting and connecting refrigerant lines =>Page 203 .
- ♦ Removing and installing =>Page 203 .
- ♦ Removing and installing heat insulation =>Page 162

23 Bolt

- ♦ Tightening torque: 8 Nm

24 Air duct

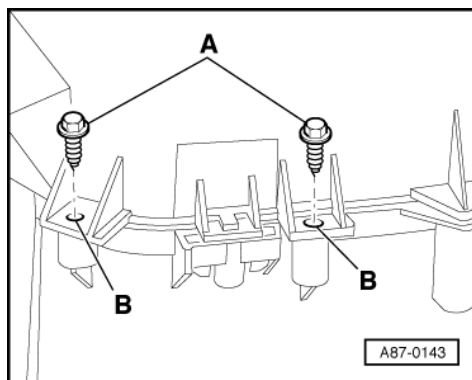


Fig.1 -> Assembling housing

- Screw together the two halves of the housing at points -B- with suitable bolts -A-.

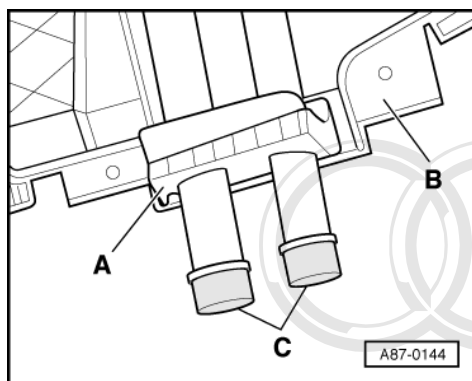


Fig.2 -> Attaching seal to evaporator refrigerant lines

- Seal refrigerant lines -C- to the two halves of housing -B- with seal -A-.
- After assembling both halves of the housing, seal off refrigerant line outlet area with silicone rubber.

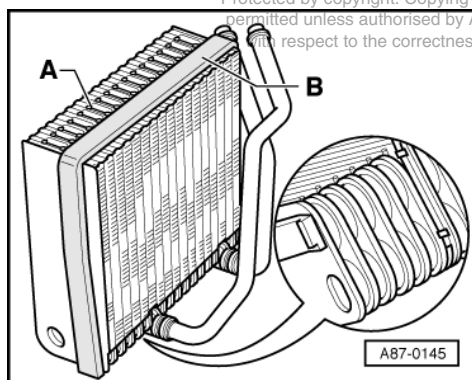


Fig.3 -> Attaching seal to evaporator

- Seal top and both sides of evaporator -A- to housing with seal -B-.

Note:

The underside of the evaporator must not be sealed (so that condensation water can drain off).