

Service.



Self-Study Programme 271

The Phaeton Heating and Air Conditioning System

Design and Function



An outstanding climate

As a luxury performance saloon, the Phaeton is fitted with a four-zone cabin climate as standard. Using the 4C (4 Corner) Climatronic, both driver and passengers can set their own personal climate regardless of the climate in the other seats.

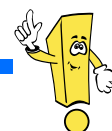
The automatic control for each individual climate zone is provided by the Climatronic control unit, which also activates a large number of control motors for vents and temperature flaps.

The adaptive control includes, for example, sunlight penetration, air quality and air humidity. All in all, the air conditioning system improves driving safety, as concentration and reaction speed drop as temperature increases.



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NEW



**Important
Note**

The Self-Study Programme involves the design and function of new developments. The contents are not updated.

Please always refer to the relevant Service Literature for all inspection, adjustment and repair instructions.

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Introduction



Operating concept

The functions of the Climatronic are activated via the operating unit of the Infotainment system. The Infotainment is a central electronic system that manages the wide range of different functions in the vehicle such as the heating and air conditioning system, car phone, navigation, radio, television etc.

Front information display and operating unit

The core of the Infotainment system is the front information display and operating unit in the dash panel. It can be used to make all the settings for the heating and air conditioning system for the front and rear seats.

The operating elements for climate control are highlighted in the adjacent illustration.

In the Service Literature, the operating unit is referred to as the "Front information display and operating unit control unit".



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Rear information display and operation unit

In the version illustrated, this is for adjusting temperatures and air distribution in the rear compartment as well as for blower settings.

In the Service Literature, the rear compartment operating unit is referred to as the "Rear Climatronic control and display unit."



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Although the optional extras "sunroof" and "auxiliary heater" are also adjusted using the front information display and operating unit, they are not described in this Self-Study Programme.

Ventilation concept

In order to ensure a pleasant climate in the passenger compartment, the ventilation concept is split into four basic functions.

- indirect ventilation
- direct ventilation
- defrost function with window fogging detection
- automatic and manual air recirculation function

With this concept, the ventilation and temperature can be adjusted separately for each seat.



As the ambient conditions can change considerably during a journey as regards temperature or sunlight penetration, it is possible that, when the air conditioning mode is running, the basic functions of indirect ventilation, direct ventilation and defrost may merge or run simultaneously.



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Introduction



Indirect ventilation

A direct flow of air is frequently regarded as unpleasant or draughty. This is why the Phaeton offers the possibility of diffuse, indirect ventilation via generously dimensioned vents on the upper side of the dash panel and in the B pillar.

When the automatic climate control is active, the Climatronic control unit decides whether the desired interior climate can be achieved by means of indirect ventilation.
If a change in ambient conditions makes it necessary, for example through warming from sunlight penetration, other vents can be opened by the control unit.

Besides automatic climate control, vents can be opened or closed for indirect ventilation via the two upper function keys in the air conditioner main menu.



Function keys

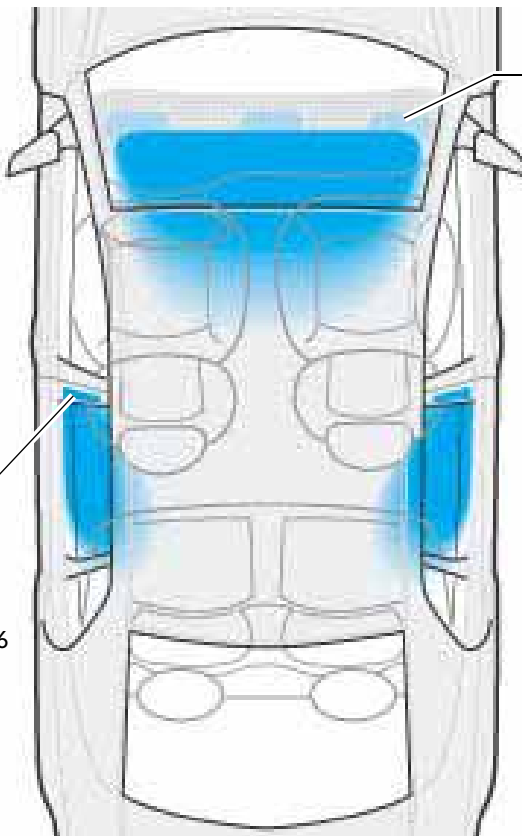


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Vent in the left B pillar



Vent for indirect ventilation in the dash panel



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Direct ventilation

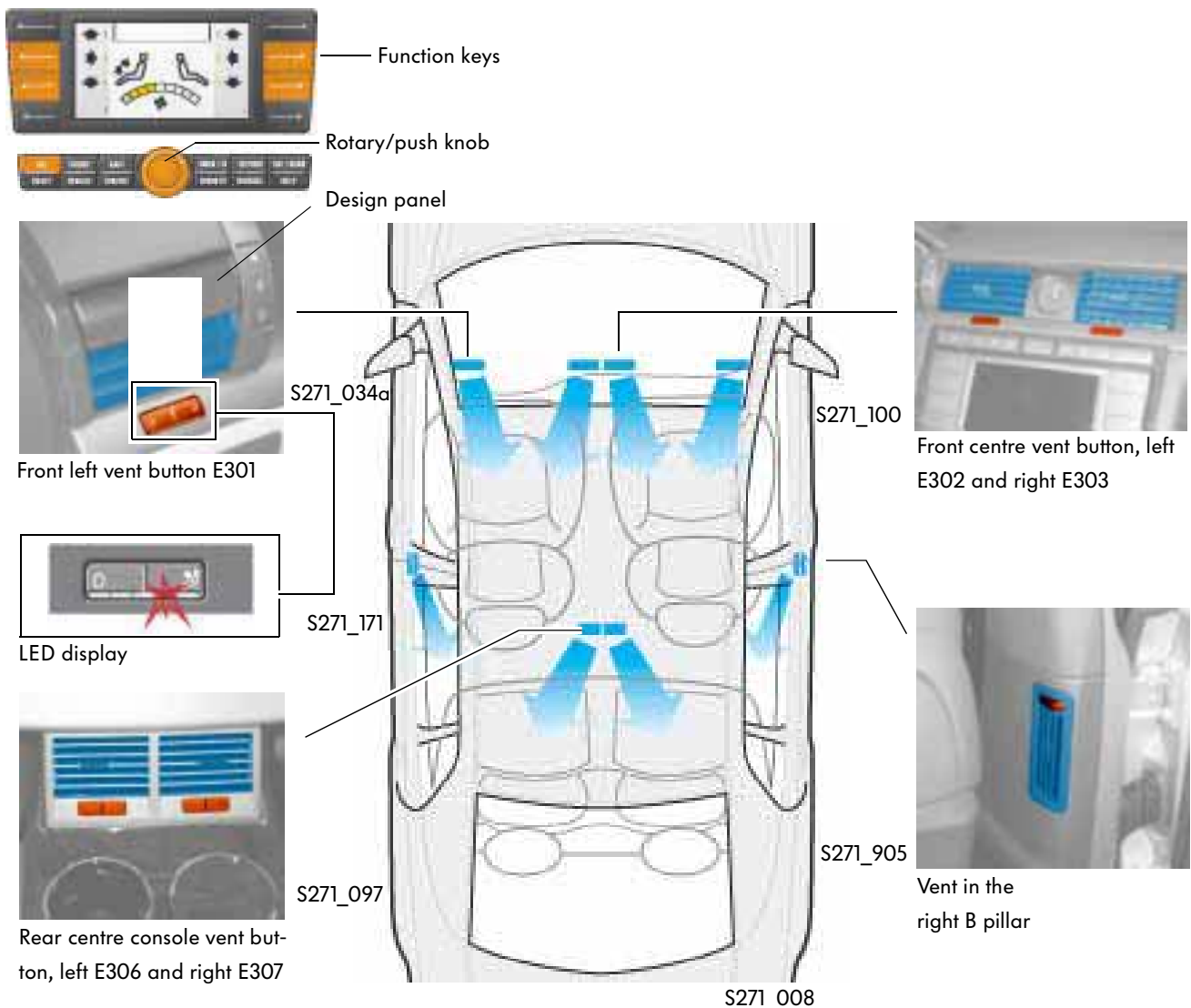
The function keys on the Infotainment system can be used to select the various outflow directions of the ventilation.

The direct ventilation is via chest vents concealed in the rear design panels in the dash panel, vents on the rear information display and operation unit, as well as vents in the B pillars. The design panels open after the relevant function keys have been actuated or under certain conditions in automatic air conditioning mode. Simultaneously, the motors of the flaps for chest vents are activated.

When the design panels are open, the buttons on the vents can be used to reduce the air flow with a uniform blower setting.

This does not close the design panel, but rather changes the opening cross-section of the flap. Here, the LEDs on the button indicate the degree to which the flap is open.

The blower setting is adjusted for all vents steplessly with the rotary/push knob.



Introduction



Defrost function

The heating and air conditioning system offers not only a manual defrost function but also an automatic defrost function.

This prevents fogging of the windows and thus actively contributes to driving safety.

- The automatic defrost function with window fogging detection

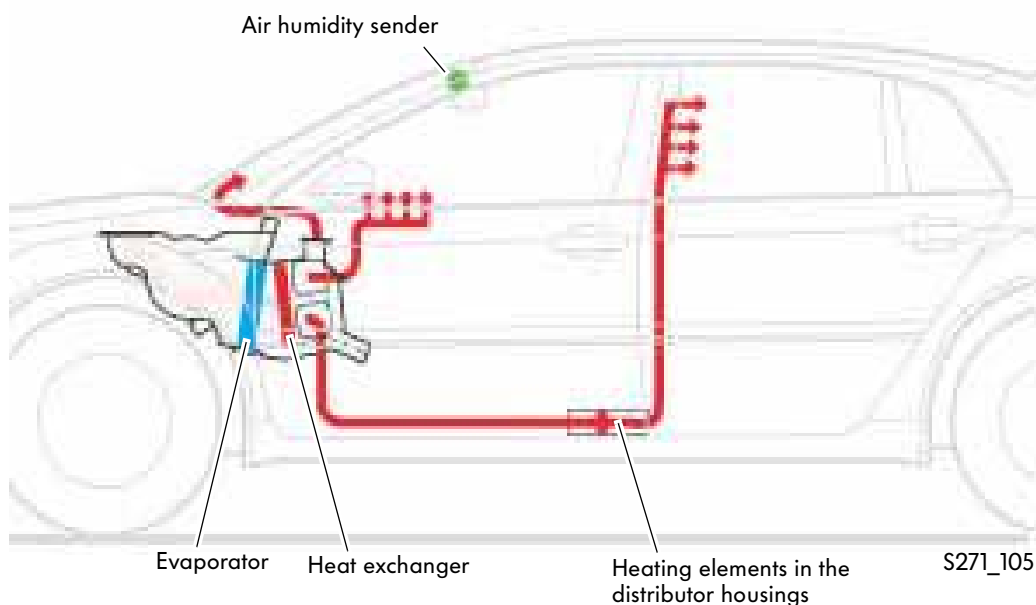
Fogging of the windscreen is detected by the climate control by measuring the windscreen temperature, the air humidity as well as the associated interior temperature at the place where the moisture is measured.

All three signals are supplied by the air humidity sender in the base of the rear-view mirror.

Additional heating elements in the distributor housings below the front seats heat the air for the defroster vents of the rear side windows.

For a more detailed description of the function of the air humidity sensor, please refer to the chapter "Sensors and actuators".

If there is a danger that water vapour from the air of the vehicle interior condenses on the windows, the power output of the air conditioner compressor and the blower speed are automatically increased and the defroster flap is opened further. Dry air is then fed via the evaporator and heat exchanger from the open defroster vents to the windscreen and front side windows.



● Manual defrost function

The windows can fog up quickly, especially at low ambient temperatures or high air humidity in the vehicle interior, e.g. caused by wet clothing.

With weather and temperature conditions of this kind, the automatic defrost function may not be sufficient, making it necessary to select the defrost function manually via the defroster button in the row of climate controls.

When the defroster button is actuated, all the vents except for the defroster vents are closed. The compressor and the air blower run at high power output.



If the Phaeton is equipped with an electrical windscreen heater as optional extra, this is also switched on or off via the defroster button.

Defroster button

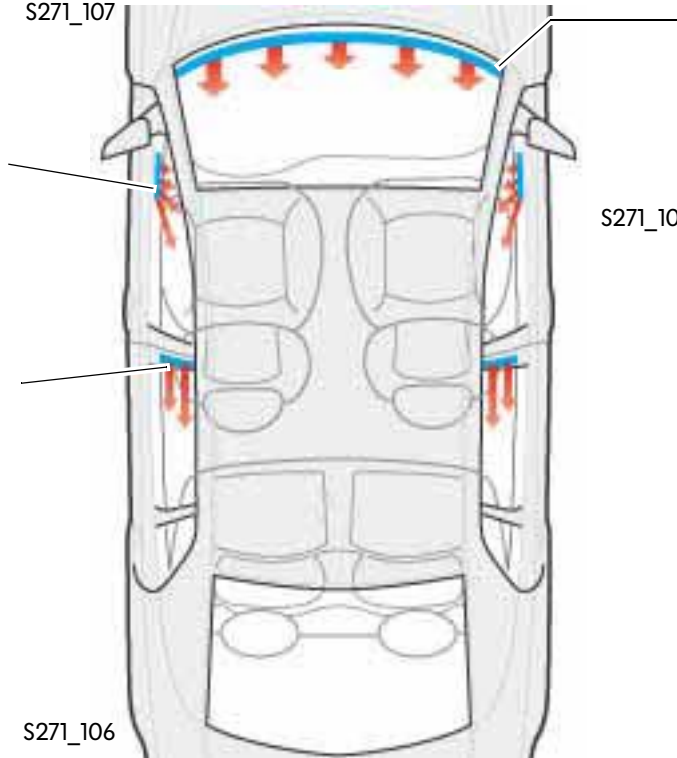


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Defroster vent in the doors

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Defroster vent in the dash panel



Defroster vent in the B pillar

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Introduction



Manual and automatic air recirculation function

The Climatronic also has an automatic air recirculation function in addition to the manual air recirculation function, which is activated via the air recirculation button in the row of climate controls,

● Manual air recirculation function

Pressing the air recirculation button in the row of climate controls switches the climate control to air recirculation mode. The air flow flap is closed and simultaneously the air recirculation flap is opened. This prevents unpleasant odours in the ambient air from entering the vehicle interior. Pressing the button once again stops the air recirculation mode.

Row of climate controls



Air recirculation button



The manual air recirculation mode is not switched off automatically. As no fresh air enters the vehicle interior, this function should not be in operation for a longer period.

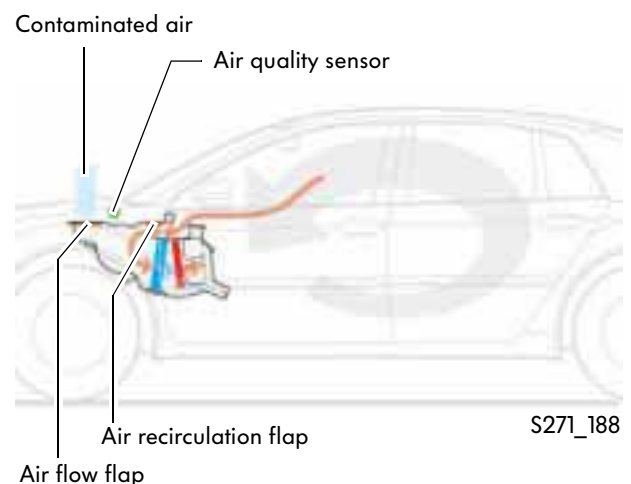
● Automatic air recirculation function

An air quality sensor in the plenum chamber permanently checks the pollutant concentration in the fresh air.

If an increased amount of pollutants is detected in the air, when reversing or when the wipe/wash function is activated, the climate control switches automatically to air recirculation mode to prevent the vehicle's own exhaust gases, for example, from entering the vehicle interior.

As soon as there is no more pollution, the air recirculation mode is terminated automatically.

As standard, the automatic air recirculation function is switched off. Using the climate submenu "Other", the function can be switched on using the "Auto recirculation" function key.



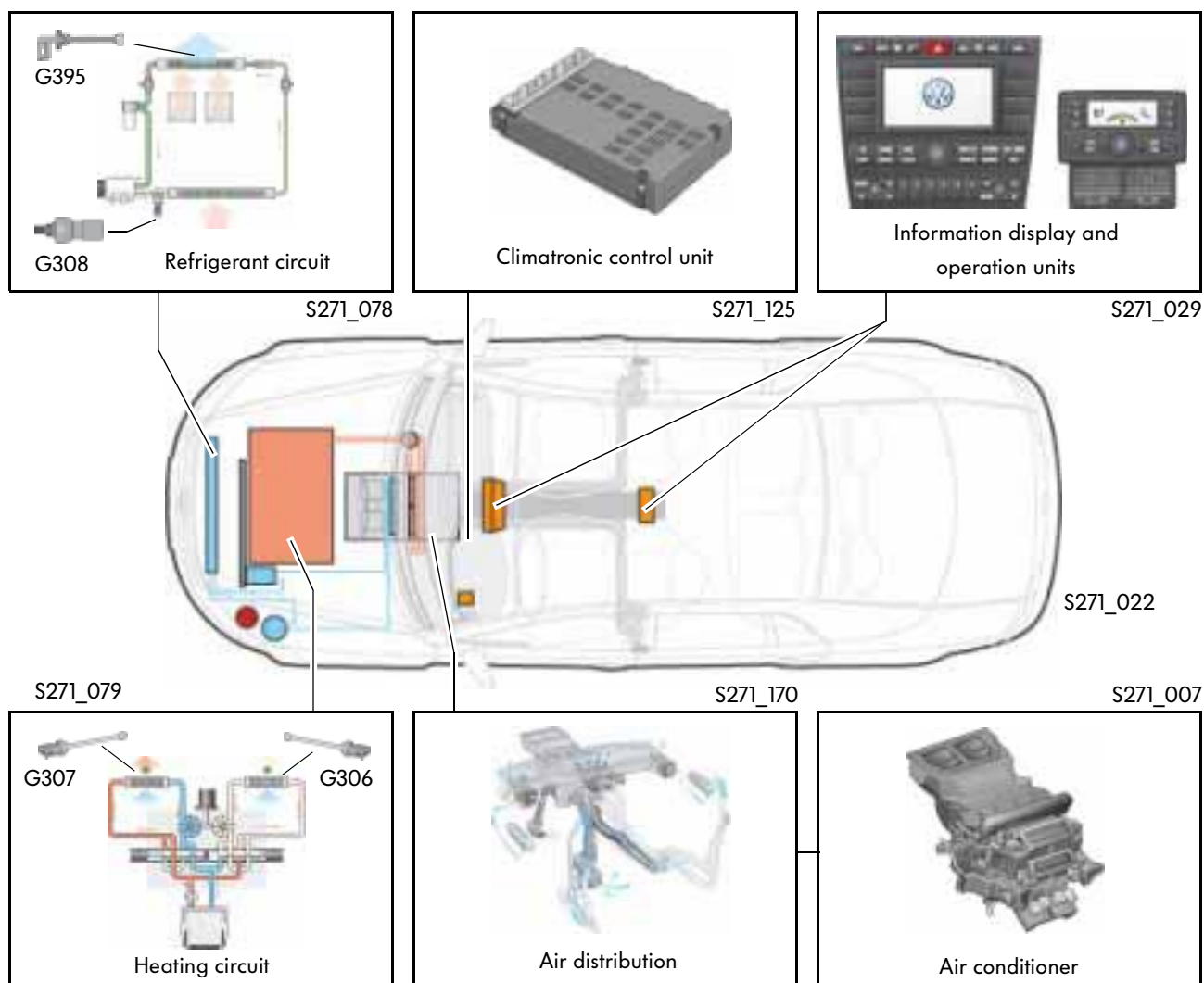
Overview of climate system components

The heating and air conditioning system can be divided into function groups.

- Refrigerant circuit with the refrigerant pressure/temperature sender G395 and the evaporator temperature sender G308
- Heat circuit with pump valve unit, two independent, water valve heating systems as well as the two heat exchanger temperature sensors, left G306 and right G307
- Assemblies for air distribution with an air conditioner for implementing the four climate zones
- Information display and operation units, front and rear
- Climatronic control unit



You will find an overview of the sensors and actuators of this complex climate control system in the system overview.



Design features

Refrigerant circuit

The design of the refrigerant circuit is based on that of the Passat W8.

The difference is that the refrigerant pressure and temperature are detected by a sensor. The control unit can use the two signals to calculate a gradual loss of refrigerant. The fitting location of the new refrigerant pressure/temperature sender G395 is on the high-pressure side.

The following components also belong to the refrigerant circuit:

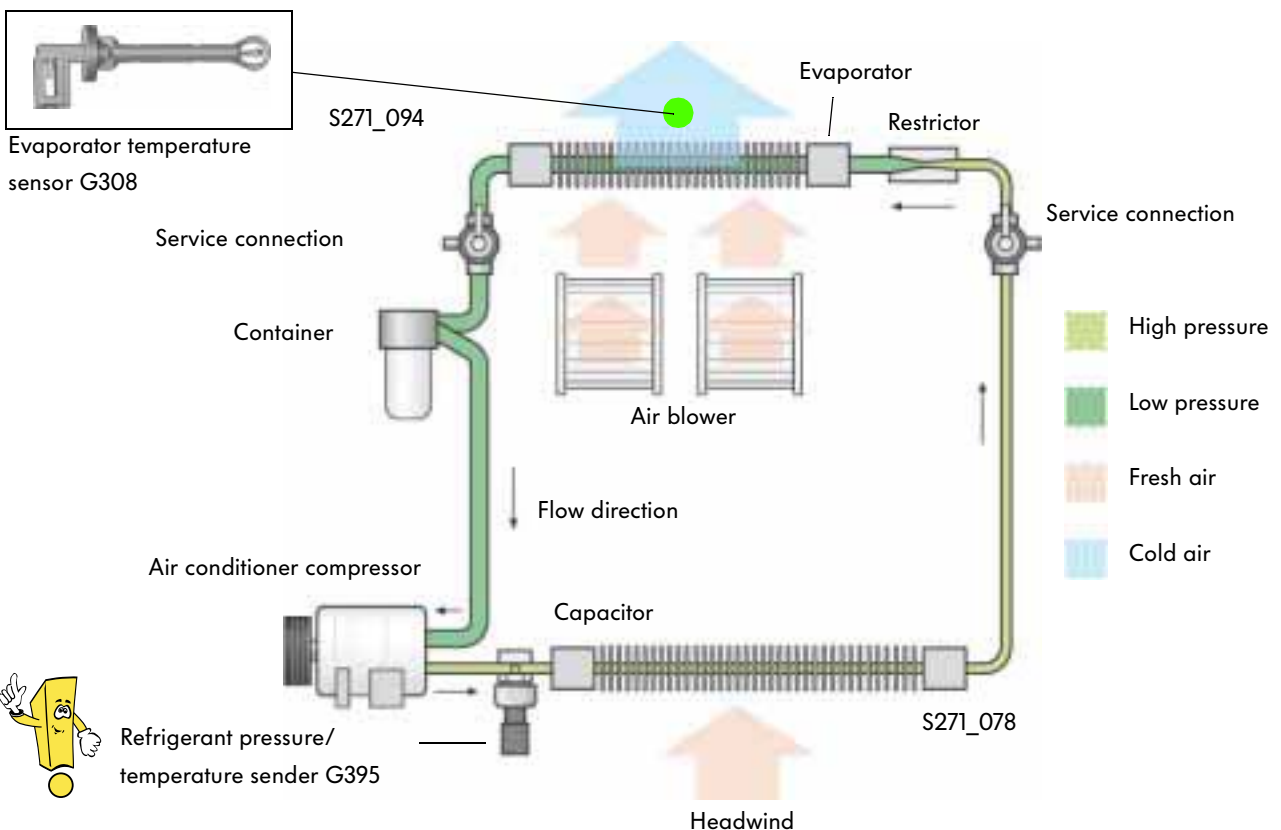
- Restrictor
- Externally regulated compressor
- Capacitor
- Evaporator
- Container

The vent temperature downstream of the evaporator is detected by the evaporator temperature sensor G308. It ensures that the cooling function is switched off at 0°C and, in conjunction with the externally regulated compressor, the vent temperature can be adaptively controlled to between 0°C and approx. 12°C downstream of the evaporator.

As a result, less heat output is required in the heat exchangers in order to heat the air to the desired temperature after it exits the evaporator. This saves energy and fuel.



More information on the basic function of the refrigerant circuit can be found in SPP 208 "Vehicle Air Conditioning Systems".

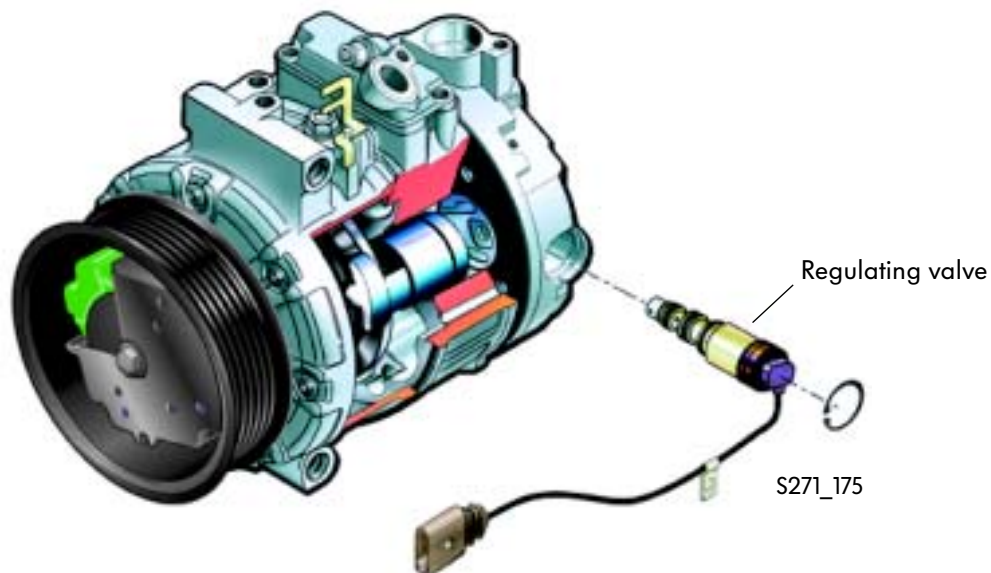


Externally regulated air conditioner compressor

A 7-piston swash plate compressor working on one side is used to compress the refrigerant.

Other features of the compressor are:

- Variable displacement to adapt to demand for refrigerating capacity
- Hollow pistons
- Belt pulley drive with integrated overload protection and without magnetic clutch
- External regulating valve N280 for adaptive control of the pressure conditions in the compressor.



Function

The Climatronic control unit J255 activates the compressor regulating valve steplessly. Depending on the variables entry of desired temperature, exterior and interior temperature, evaporator temperature and refrigerant pressure as well as refrigerant temperature, a gate voltage causes a change in pressure conditions in the compressor crankcase. The inclined position of the swash plate changes and thus defines the displacement and the generated cooling output.

The compressor also continues to run via the ribbed V-belt drive when the cooling function has been switched off.

The volumetric flow of the refrigerant is adaptively controlled to below 2% here.

Design features

Protective functions

A mechanical defect in the compressor or insufficient lubrication due to missing refrigerant can lead to blocking of the compressor drive shaft.

This can cause damage to the belt drive and thus to the engine.

In order to prevent this, there are two protective functions:

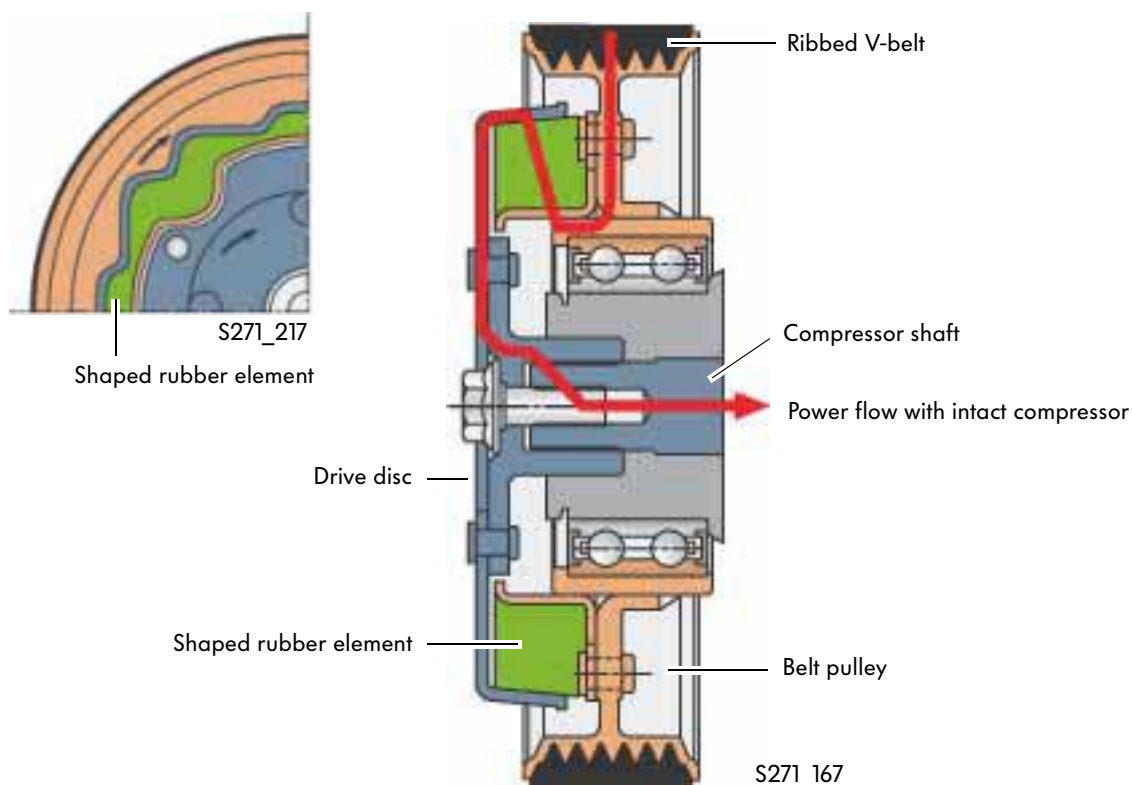
- The control unit for Climatronic uses the signal from the refrigerant pressure/temperature sender G395 to detect a possible loss of refrigerant. If a complete loss occurs, the cooling function is switched off.
- Belt pulley with integrated overload protection.

Overload protection

Compressor in function

The ribbed V-belt pulley and the driving disk are form-fitted by a rubber shaped element.

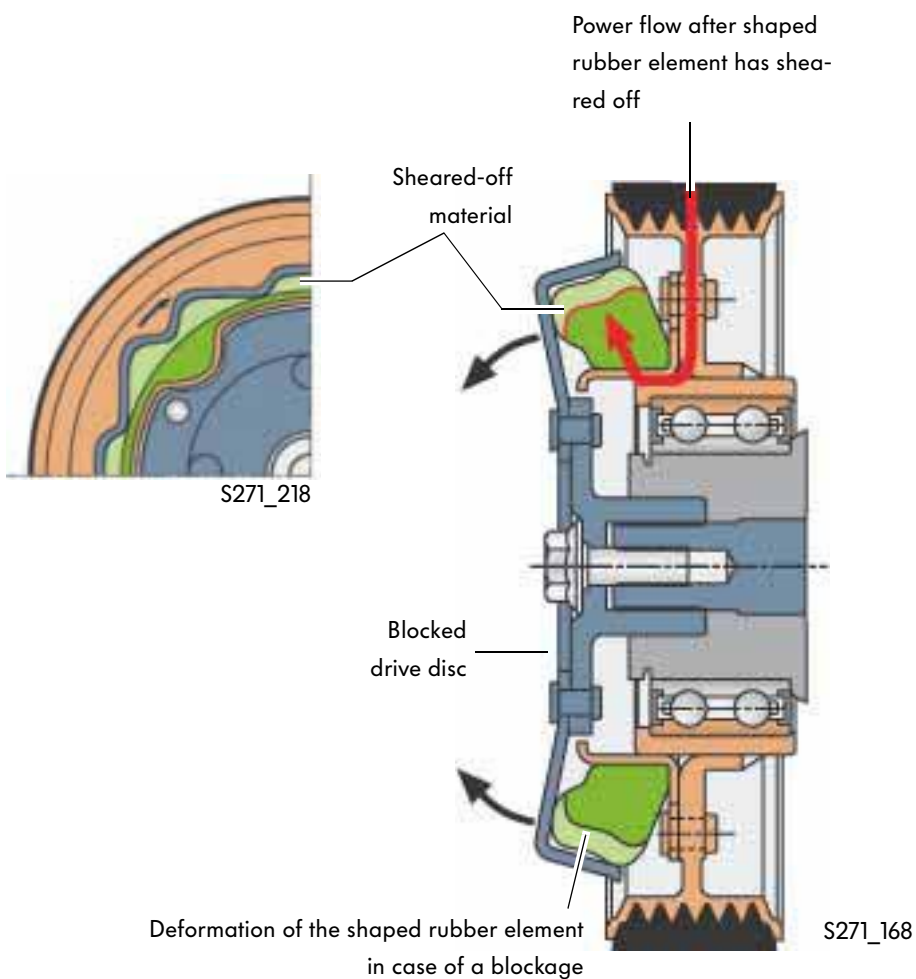
When compressor is running, both disks rotate in the same ratio to one another.



Compressor blocked

The drive disc comes to a standstill.
As a result, the transmission forces between the belt and drive disc increase considerably.
The shaped rubber element is pressed onto the blocked drive disc by the belt pulley in the direction of rotation.

The deformations on the shaped rubber element are sheared off and the connection between the belt pulley and drive disc is cut. The belt pulley now continues to rotate without hindrance.
This prevents damage to the ribbed V-belt and excludes the possibility of engine damage.

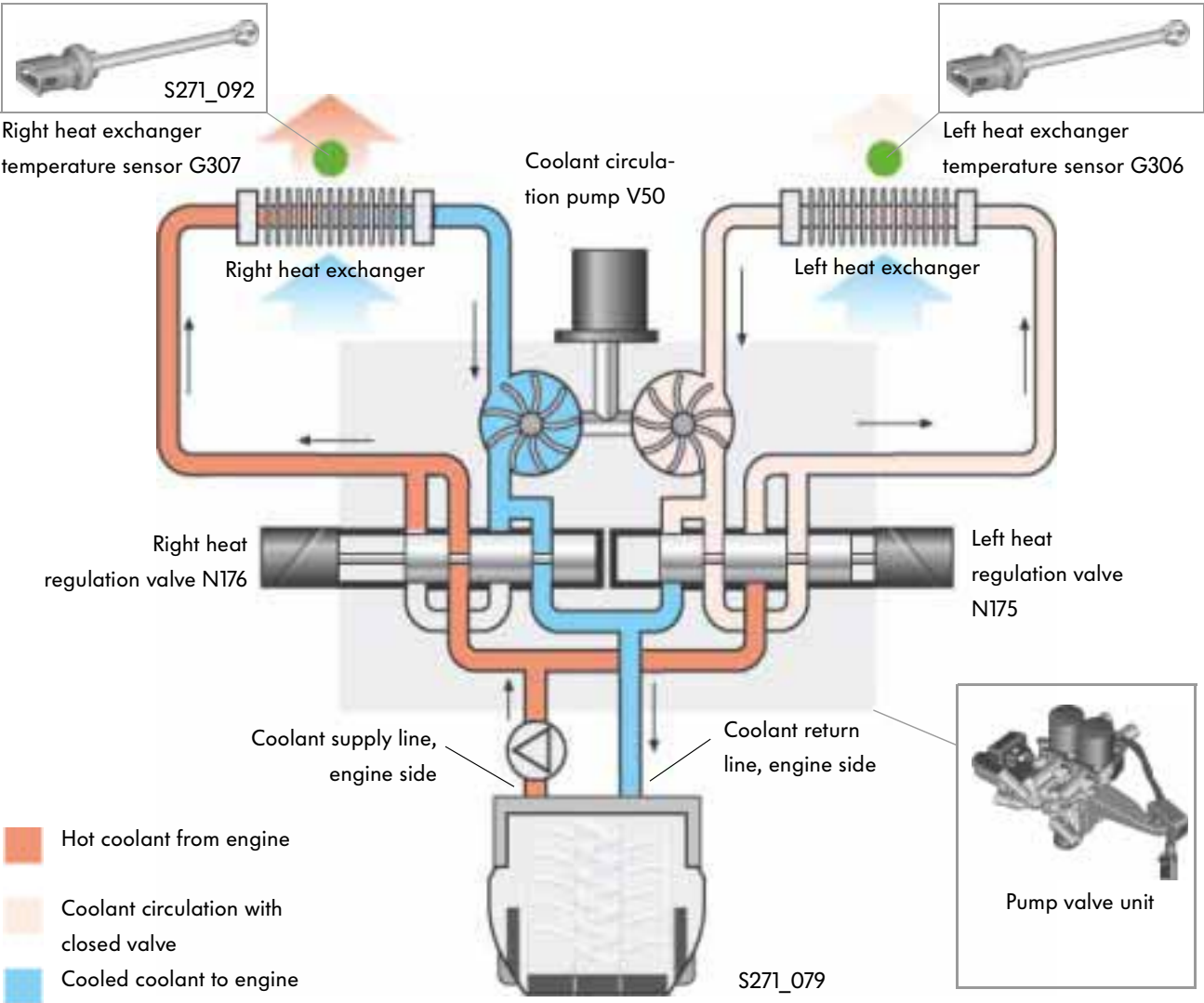


Design features

Heating circuit

The heat circuit comprises the two heat exchangers, the pump valve unit and the coolant circuit of the engine. It has the function of heating the cooled and dried air exiting from the cooling circuit evaporator to the desired temperature. This is why it is necessary to detect the air temperature exiting from the heat exchangers by means of temperature sensors.

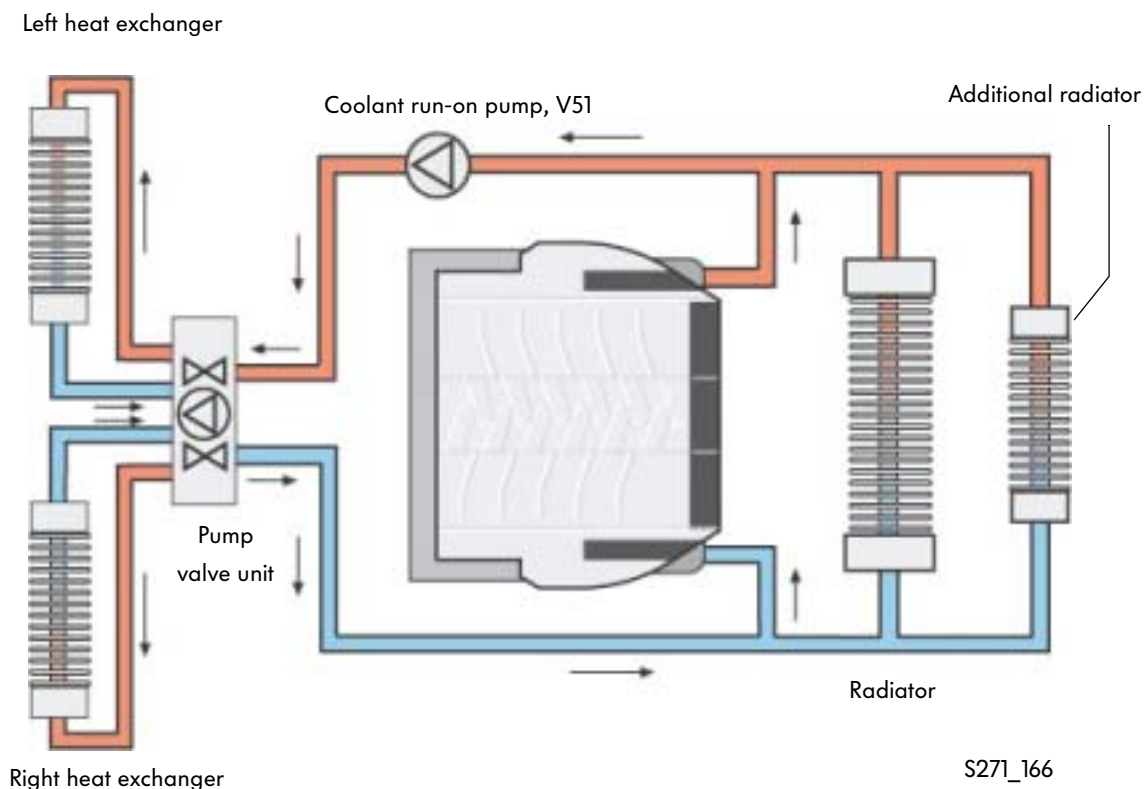
The pump valve unit forms an assembly in which two sequencing valves and a coolant pump are grouped together. The coolant pump has two pump wheels that are driven by a common motor.



Residual heat function using the W12 engine as an example

At a later date, the heating and air conditioning system of the Phaeton will have a residual heat function. This function makes it possible to maintain the desired temperature for the vehicle interior when the engine has been switched off, as long as there is sufficient warm coolant.

For this reason, the residual heat function also drives the coolant circulation pump V50 in the pump valve unit in order to maintain the volumetric flow of the coolant, together with the electrical coolant run-on pump V51 of the W12 engine. If there is no longer sufficient residual heat in the cooling circuit, the air conditioner control unit switches the function off.



Design features

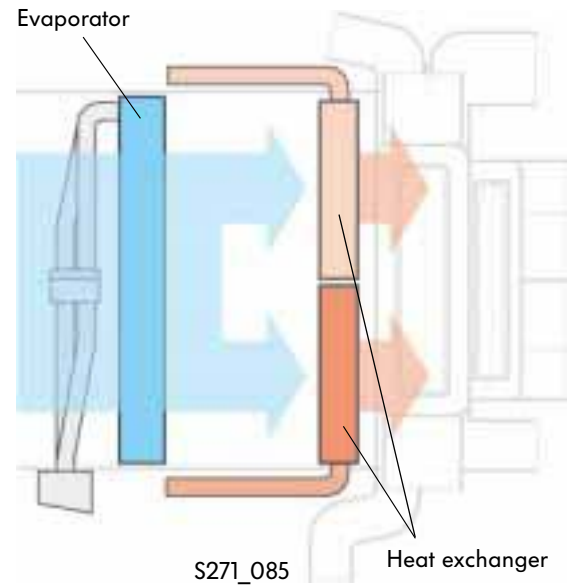
Heat exchangers

Once the air has passed through the evaporator, part of the air flow is fed through two heat exchangers positioned side by side for temperature control.

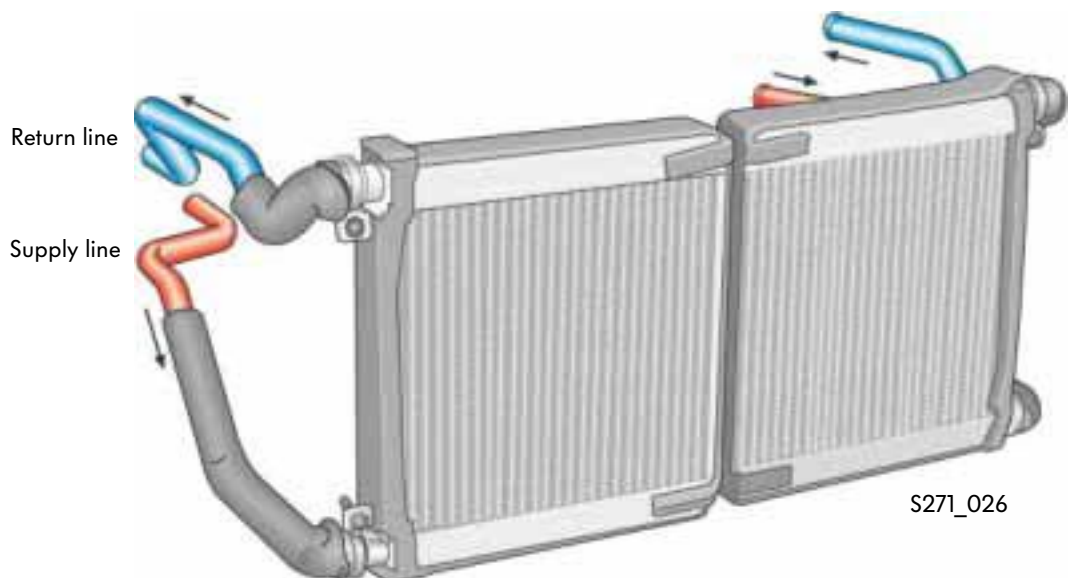
In order to heat the air, hot coolant flows through the heat exchangers. The flow rate here can be adjusted separately for each heat exchanger in the pump valve unit via two solenoid valves.

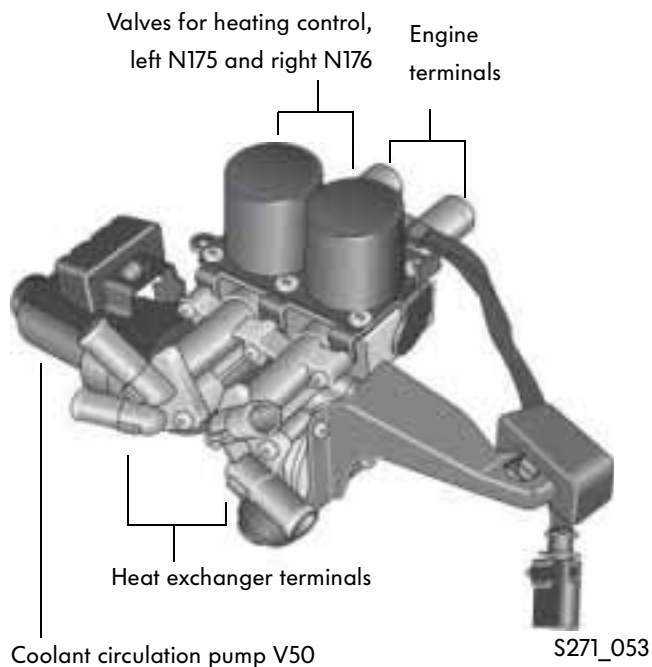
As a result, the temperature values for the left and right of the vehicle interior can be regulated independently of one another.

The heat exchangers are made of aluminium.



A lot of work is necessary to remove and install the heat exchangers. Please observe the instructions in the Workshop Manual.



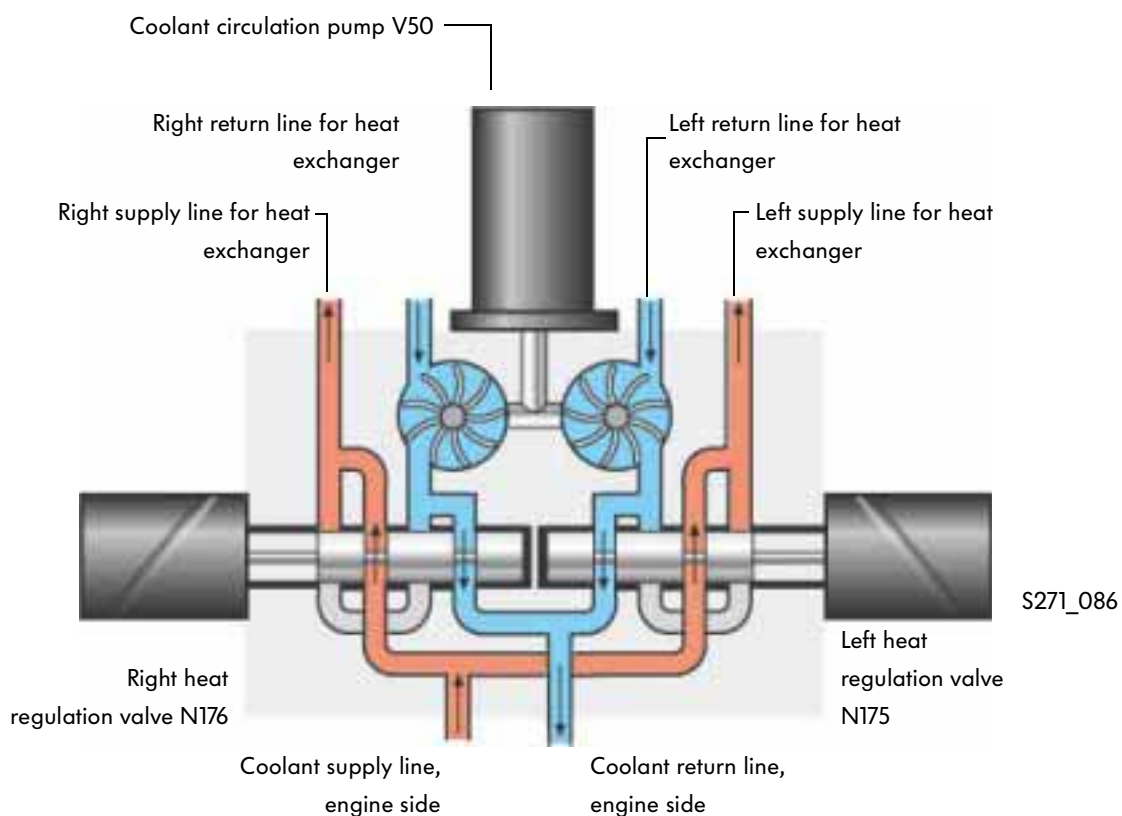


Pump valve unit

This is fitted in the plenum chamber on the right and it supplies the two heat exchangers with water from the engine cooling circuit. The pump valve unit comprises the left and right heat regulation valves N175 and N176 respectively as well as the coolant circulation pump V50.

The solenoid valves control the water flow rate for the heat exchangers, and the electrical pump ensures that the coolant circulates continuously in the cooling circuit.

The valve unit has a total of six terminals, two of which are connected to the engine and four of which are connected to the heat exchangers.



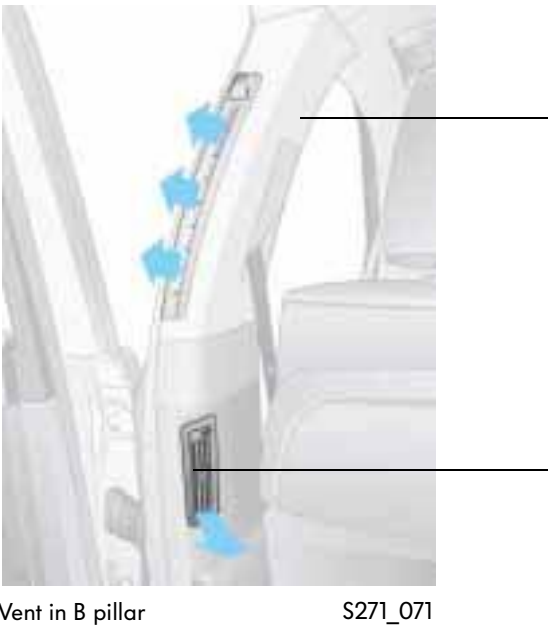
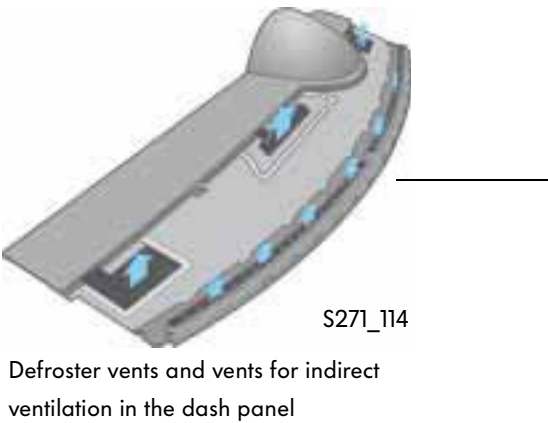
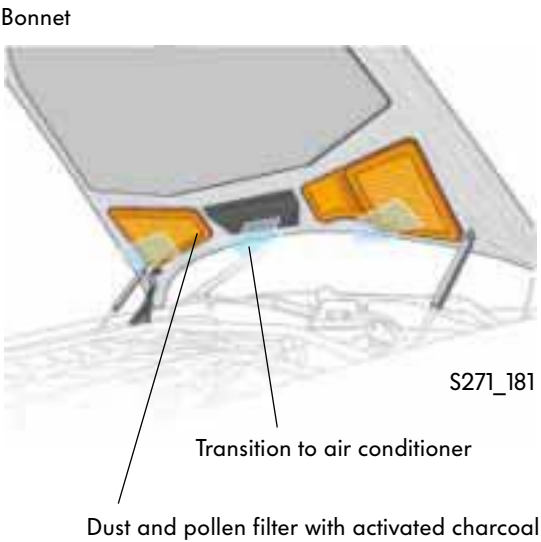
Design features

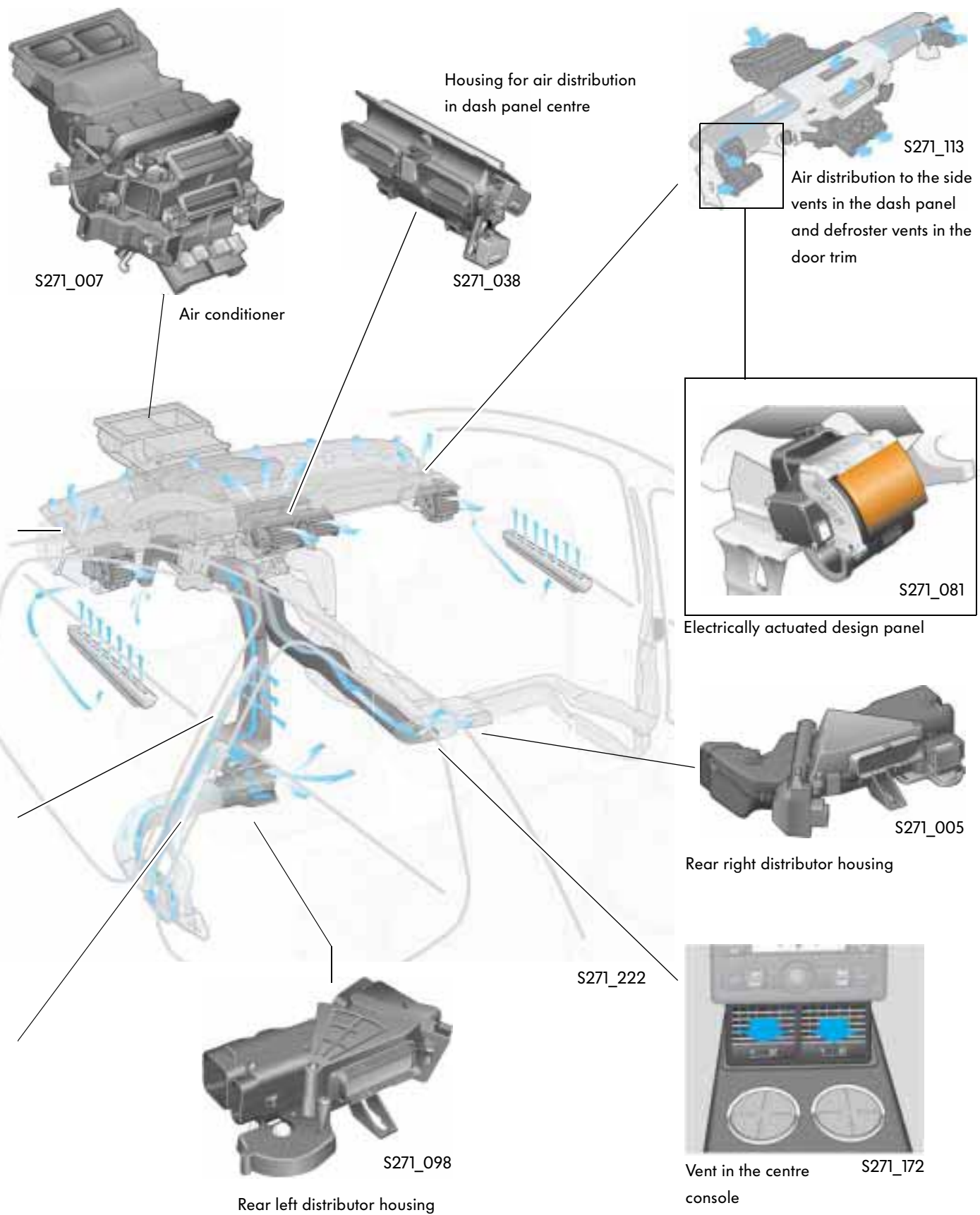
Assemblies for air distribution



This overview shows the main components for air distribution.
Moulded plastic parts connect the individual components with one another and serve as air ducts.
All in all, this feeds the entire air flow from its entry via the dust and pollen filter to the individual vents.

The chest vents in the dash panel are located behind the electric motor driven design panels.





Design features

Air distribution in the vehicle

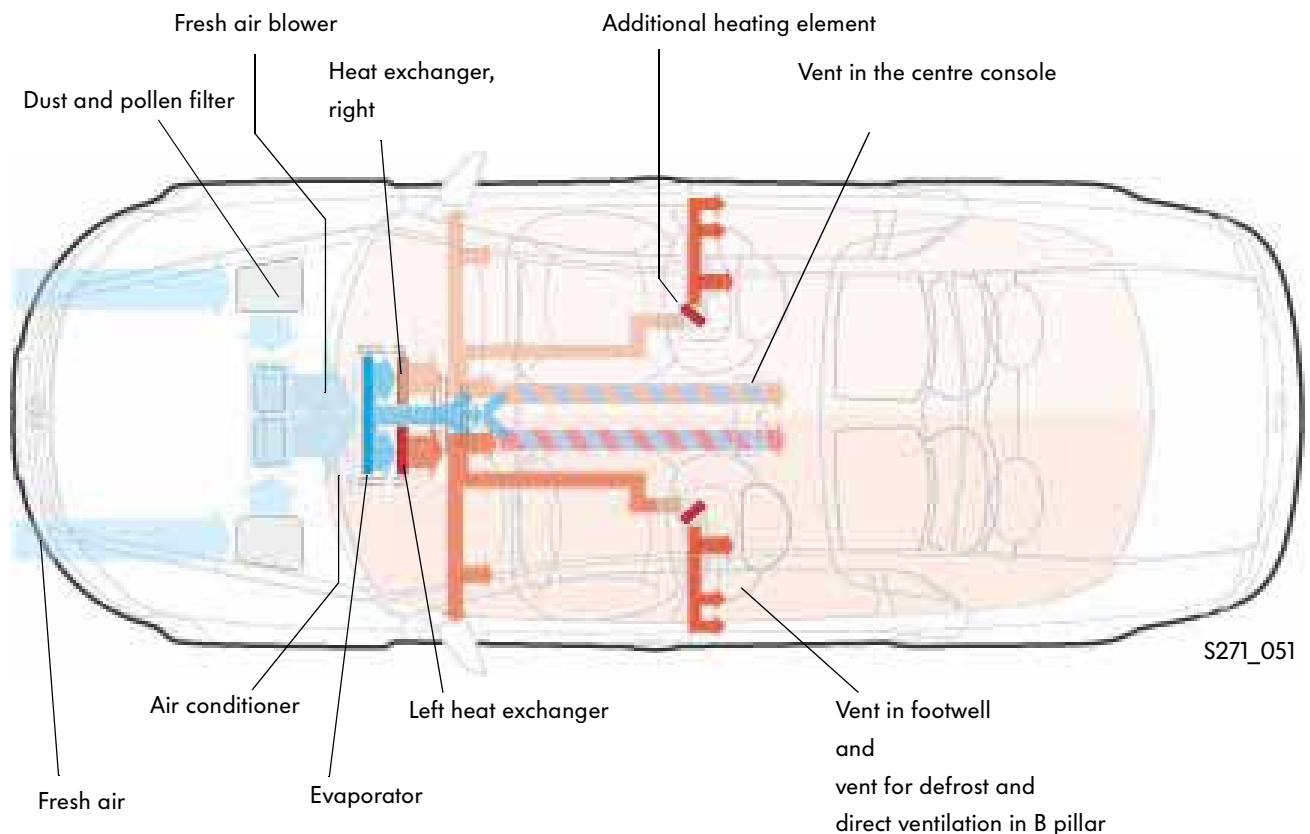
The fresh air blower induces the fresh air through the dust and pollen filters and feeds it to the evaporator. Behind the evaporator, the air flow is split for the first time in the air conditioner: the larger proportion flows through the heat exchangers and a smaller proportion is fed past the heat exchangers to the cold air flaps in the air conditioner.

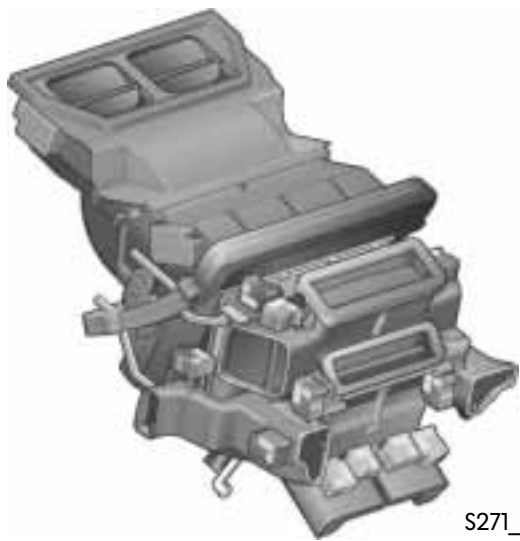
The design with two side-by-side heat exchangers produces a right-left split to ventilate the vehicle interior.

The temperature of these two air flows for the left and right vehicle halves is mainly defined by the temperature settings at the front seats.

Behind the heat exchangers, electric motor driven flaps on the air conditioner and in the dash panel then further distribute the air to the individual vents.

In the process, the air for the vents in the B pillars and for the rear footwell vents can be heated by means of additional heating elements.





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Air conditioner

This forms the main component in the air distribution assembly. The fitting location is beneath the centre of the dash panel.

The components of the air conditioner are used for air distribution and temperature control. The most important are:

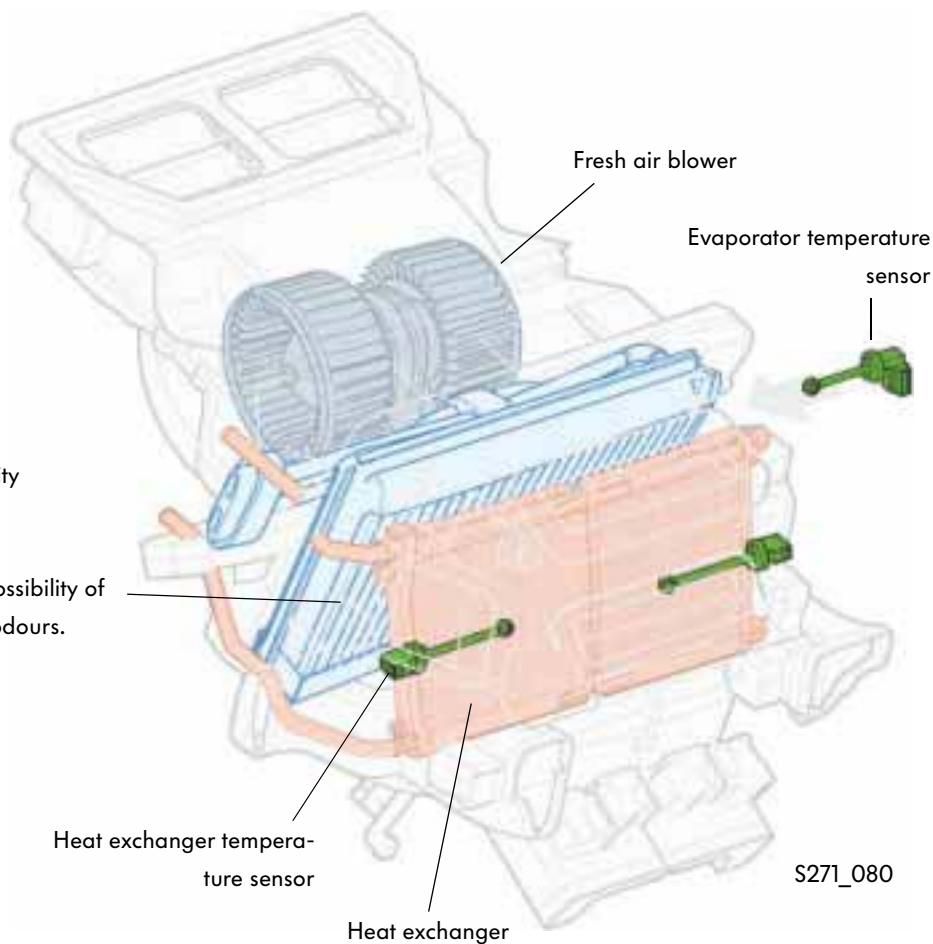
- fresh air blower and control unit
- evaporator
- left and right heat exchangers
- 15 control motors for actuating the various air flaps,
- 2 temperature sensors behind the heat exchangers, and
- 1 temperature sensor downstream of the evaporator



Evaporator

A special coating on the fins reduces the possibility that bacteria can collect on the evaporator.

This provides another possibility of preventing unpleasant odours.



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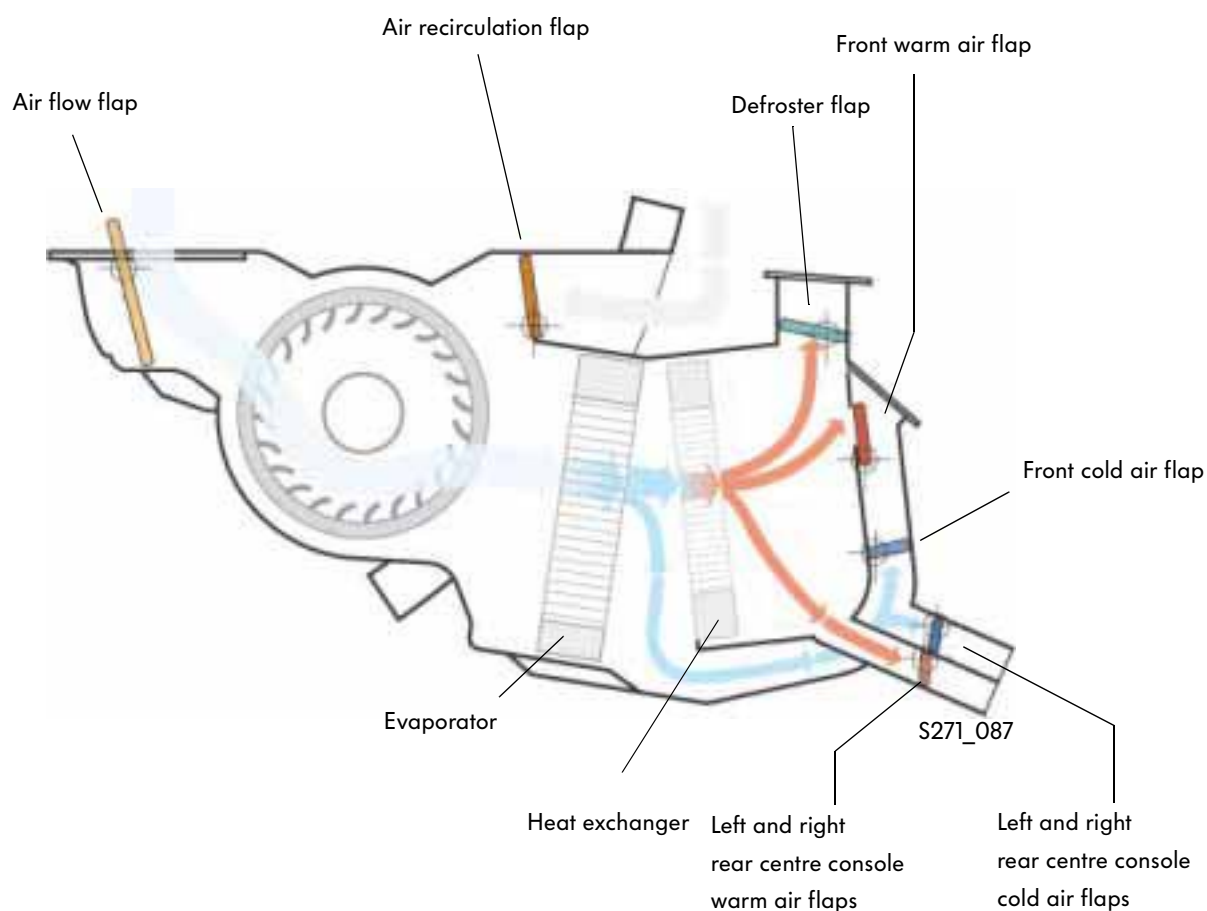
Design features

Air flaps on the air conditioner

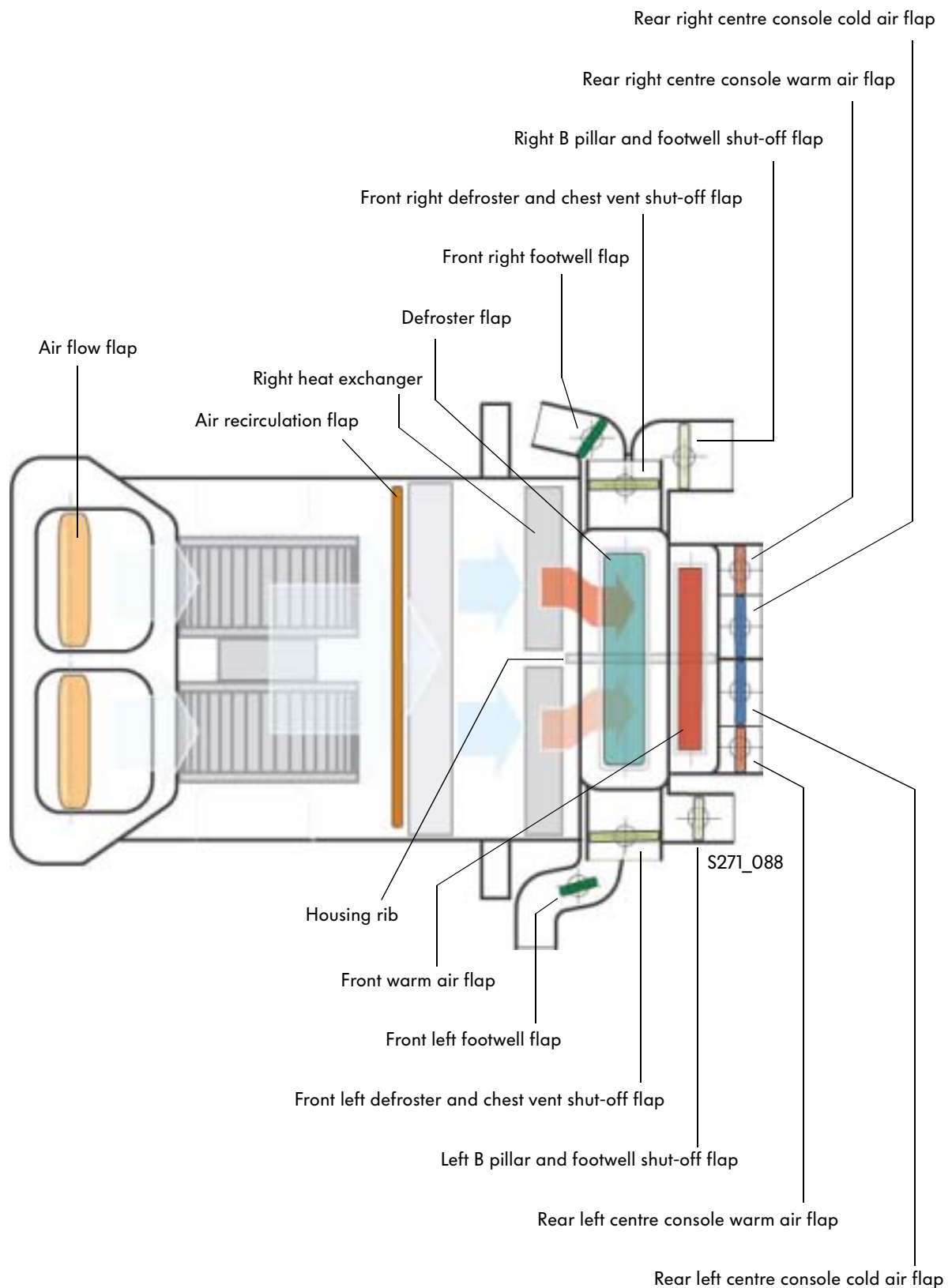
Air is fed to the air ducts and the vents via the air flaps on the air conditioner.

Here, the position and opening cross-section of each flap determine the amount of air flowing out as well as the temperature mixing ratio.

The following figures depict all the air flaps of the air conditioner.



A housing rib behind the heat exchangers prevents the air flows to the right and left vehicle interior from mixing.



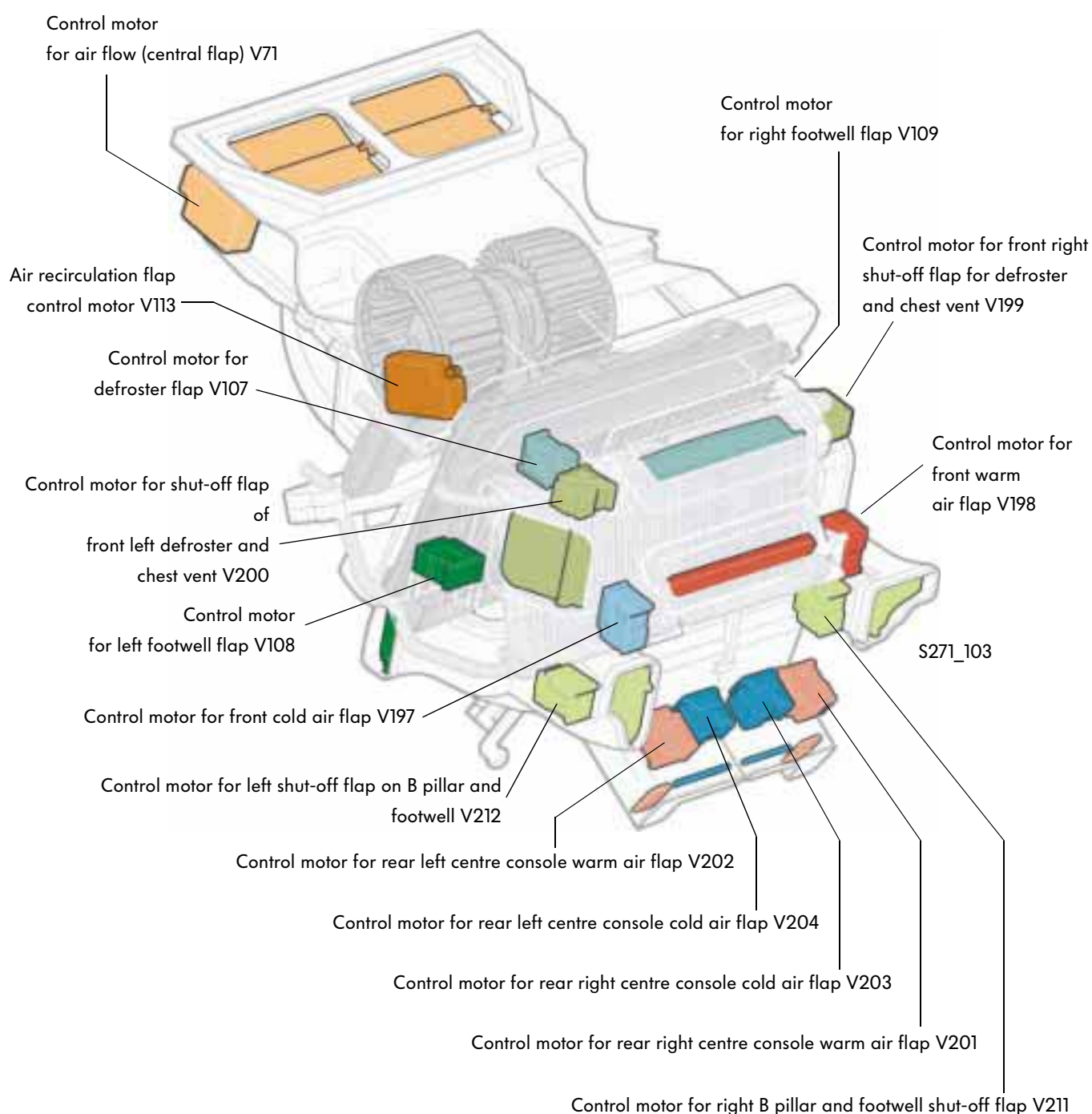
Design features

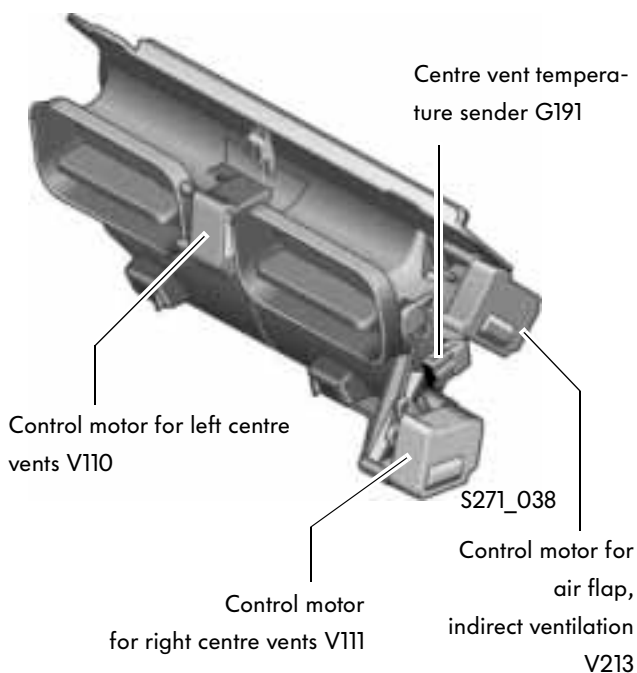
Control motors on the air conditioner

All air flaps on the air conditioner are actuated using electric control motors.

Potentiometers in the control motors report the position of the motor to the Climatronic control unit and thus the position of the corresponding flap.

For reasons of confined space and due to different torque requirements, two different sizes of control motor are used.

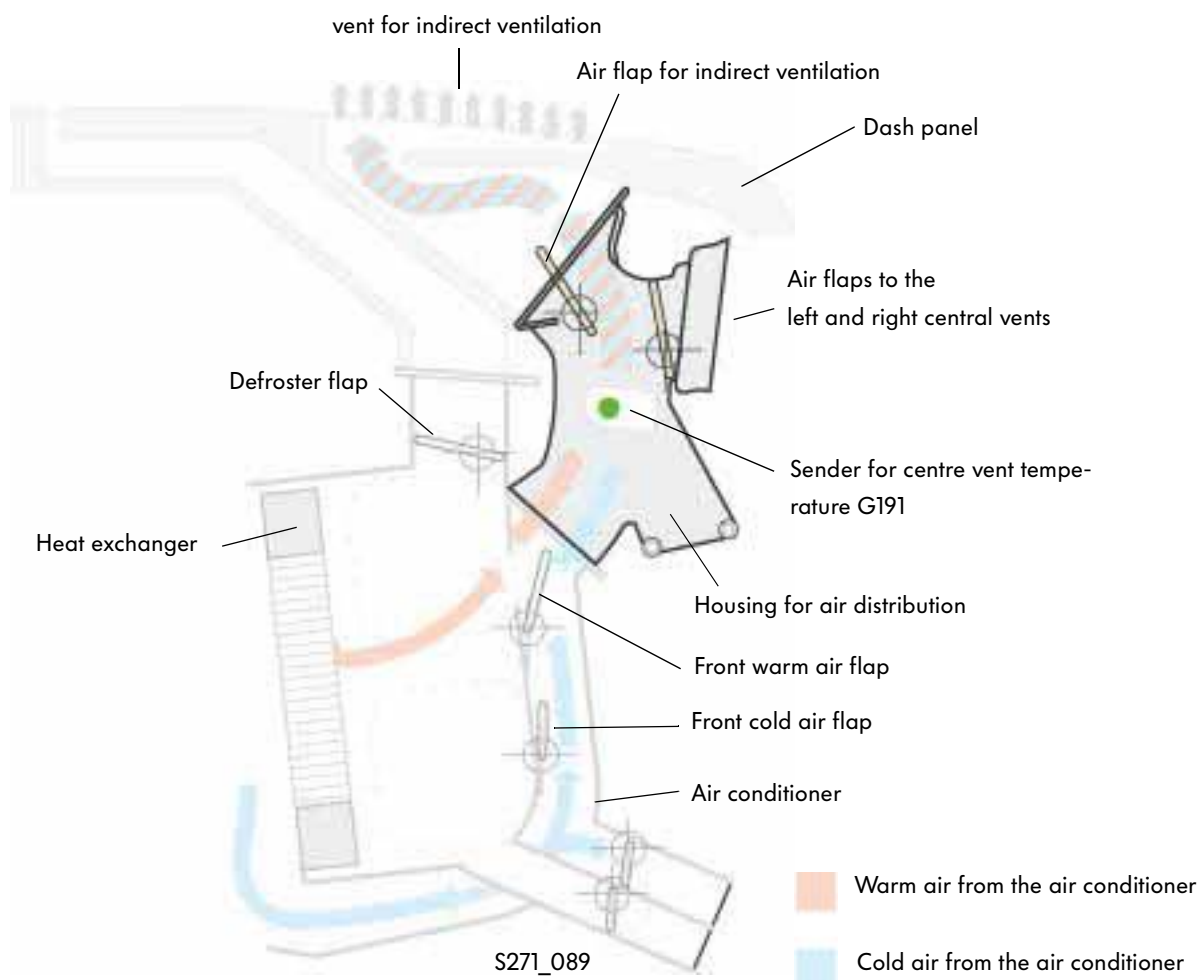




Housing for air distribution in the dash panel centre

This is mounted directly behind the warm air flap on the air conditioner and is secured to the dash panel.

The air coming from the air conditioner is mixed in the air distribution housing. Depending on the flap position, air then reaches the two central vents for direct ventilation as well as the vents for indirect ventilation on the upper side of the dash panel. The temperature is detected by the sender for vent temperature G191.



Design features

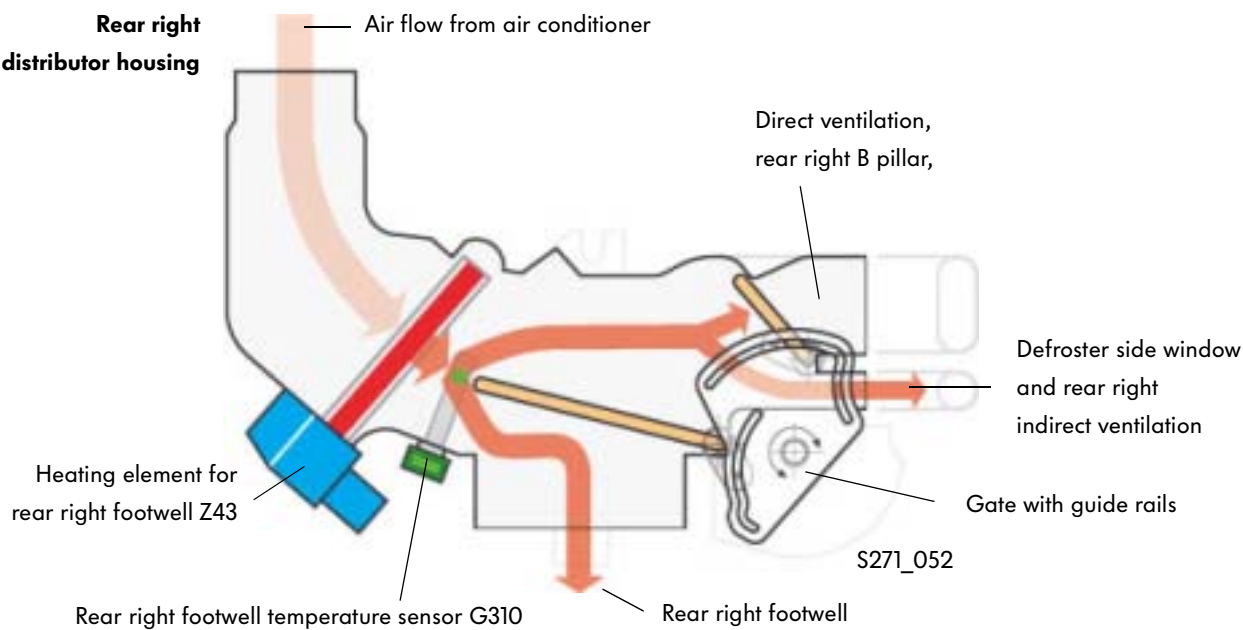
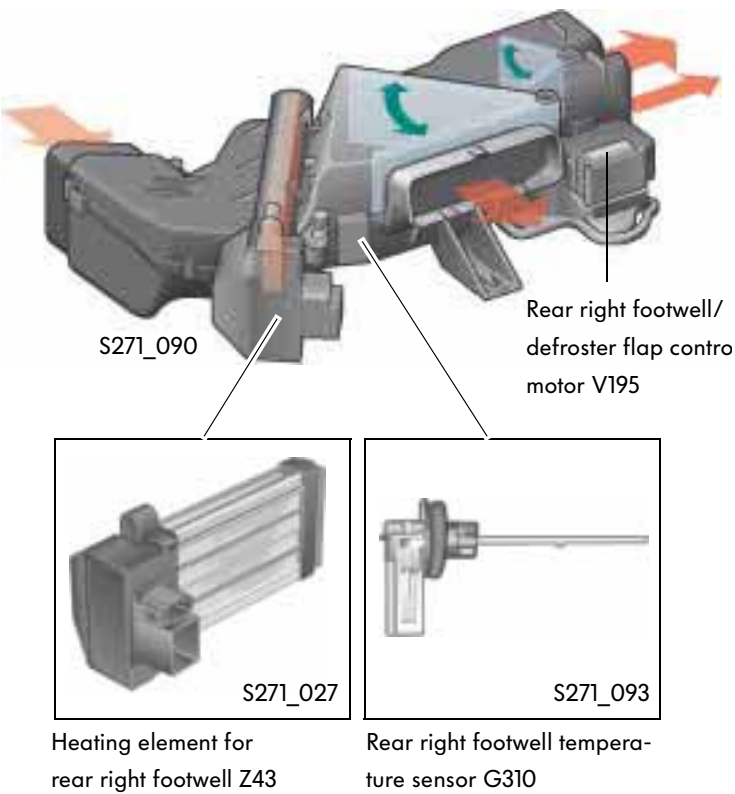
Distributor housing in the rear footwell

They are located under the front seats. In the distributor housing, the air coming from the air conditioner is fed via two air flaps to the vents for the rear footwell, the defroster vent for rear side windows and to the B pillar for direct ventilation at the rear.

Here, the air flaps are actuated by a gate with guide rails by a control motor.

A heating element in the distributor housing permits additional heating of the air. The temperature of the air flow behind the heating element is detected by the temperature sensor for temperature control in the rear footwell.

The figures show the distributor housing for the rear right footwell.



Operating the air conditioning system

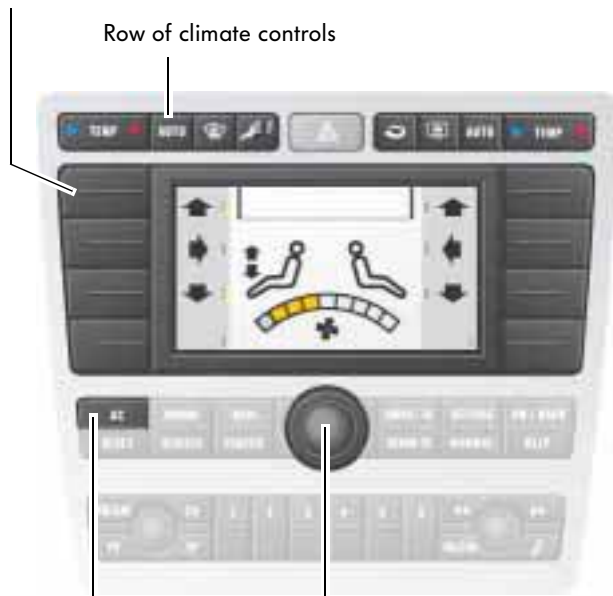
The settings for all climate zones with regard to air distribution, amount of air and temperature, can be made centrally using the front information display and operation unit.

Front information display and operation unit



Function keys

Row of climate controls



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Rotary/push knob in main menu row

Main menu key 'AC'

The operating elements for the above-mentioned settings are highlighted in the figure.

On the whole, the operating elements are divided into operating fields:

- row of climate controls
- function keys with display, and
- main menu row

For the 4-seater version of the Phaeton, the heating and air conditioning system also has an information display and operation unit in the rear.

It can be used to adjust the settings for both rear climate zones.

Functional features

Front information display and operation unit

Row of climate controls

The '**TEMP**' rocker switches for the temperature setting on the driver's and front passenger's side can be used to adjust the temperature in steps of 0.5 °C. Pressing the red point on the key increases the temperature and the blue point reduces it. The temperature setting is shown on screen.

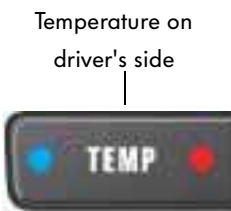
The '**AUTO**' key switches on the automatic climate control. The air temperature, the amount of air and the air distribution are regulated in such a way that the selected temperature is reached as quickly as possible and is also kept constant when outside influences change.

Pressing the '**Air Conditioner Synchronisation**' key applies the settings of the driver's zone to all climate zones.

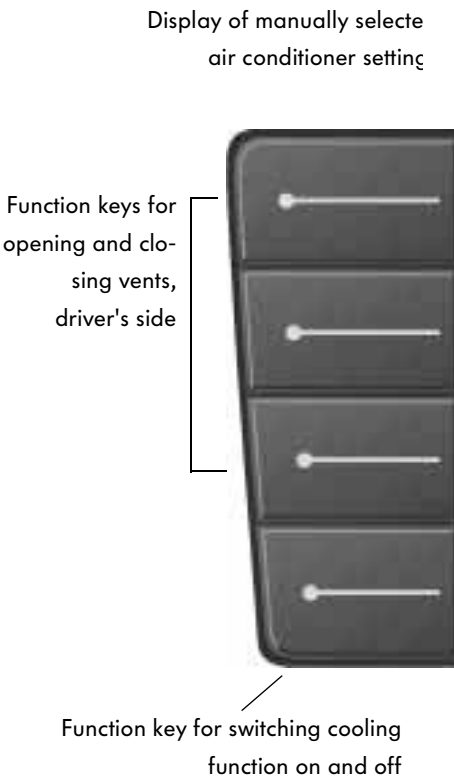
Air conditioner main menu

When the '**AC**' key in the main menu row is actuated, the air conditioner main menu appears on screen. The arrows beside the function keys show the various directions of the ventilation. When these function keys are pressed, the vents for the selected ventilation are opened or closed. When a vent is open, the display field lights up beside the arrow.

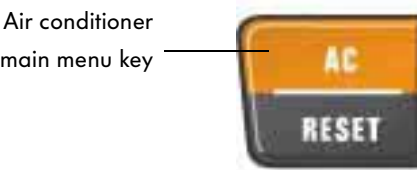
Row of climate controls

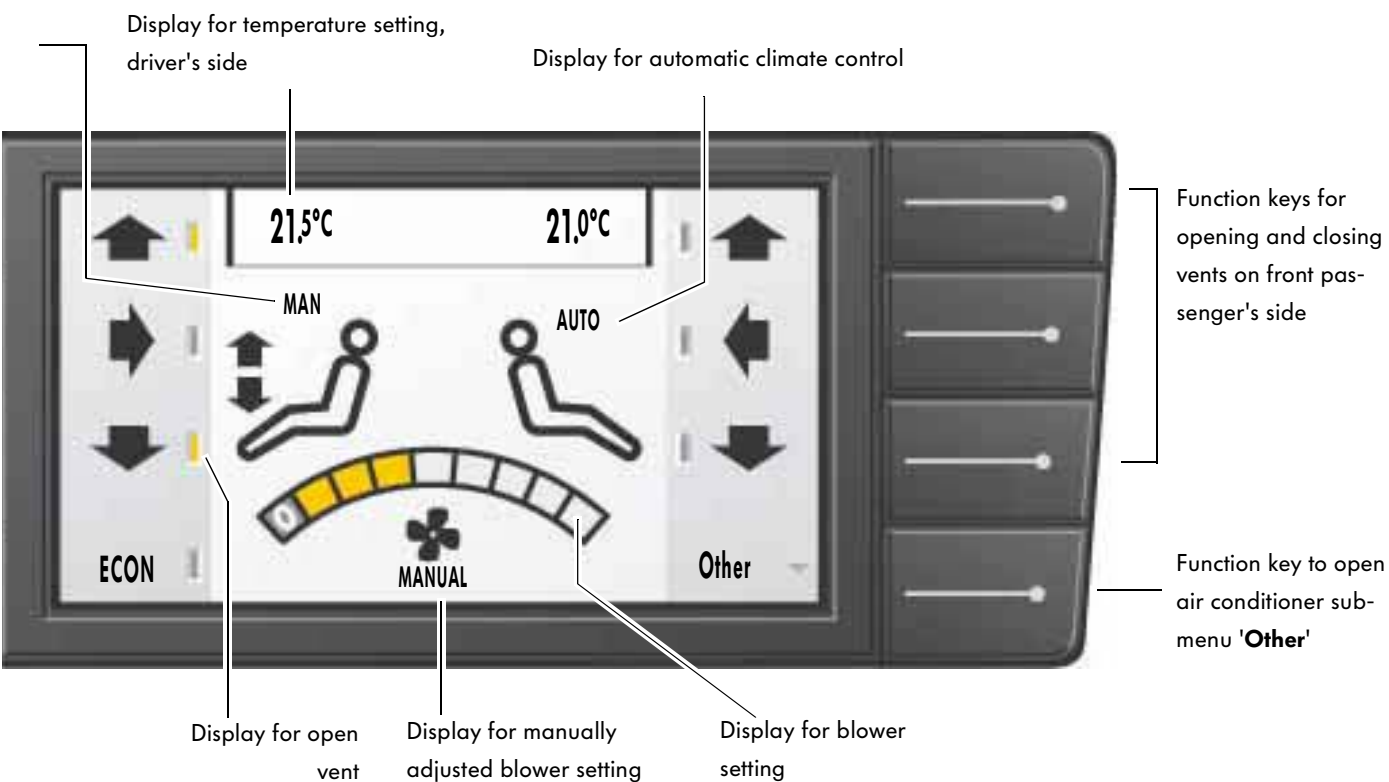
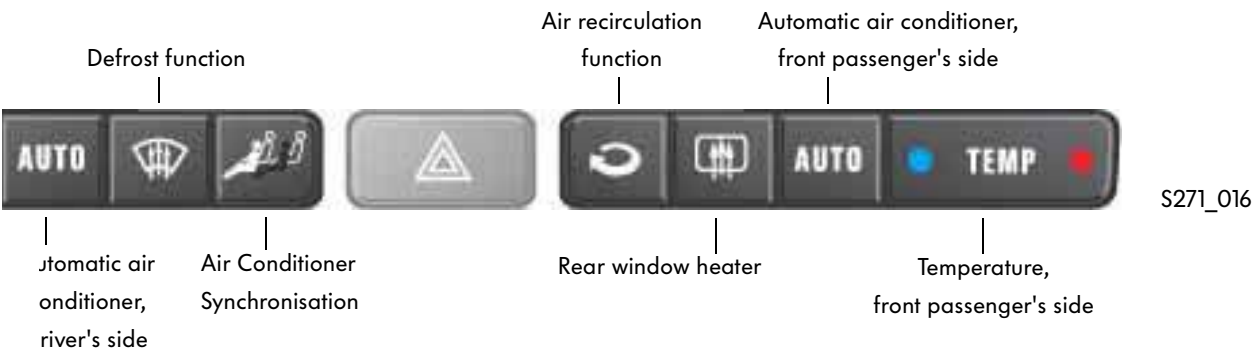


Function keys with screen



Main menu row





Rotary/push knob for adjusting blower setting in air conditioner main menu



Functional features

Air conditioner submenu 'Other'

Additional functions are displayed in the air conditioner submenu.

The function key for '**Automatic Recirculation**' can be used to switch the automatic air recirculation function on or off.

The '**Solar ventilation**' function key can be used for ventilating the vehicle interior when the engine is switched off if a solar sliding roof is fitted as an option.

The '**Auxiliary Heater**' function key leads to a submenu in which the auxiliary heater can be switched on or off manually and the switch-on time / period of operation can be programmed.

The '**Back**' function key returns you to the higher level air conditioner main menu previously displayed.

The rotary/push knob can be used to switch off the climate control for the two climate zones in the rear.
The temperature setting for these climate zones can be made using the '**Temp**' function keys.

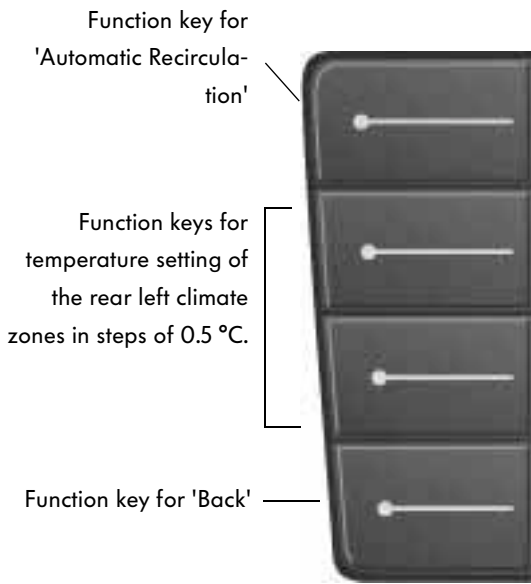


By pressing the reset button in the main menu row, the temperatures and the blower setting are reset to the factory values (22 °C). The air distribution is set to 'Auto' and the air recirculation function to 'off'.

Row of climate controls

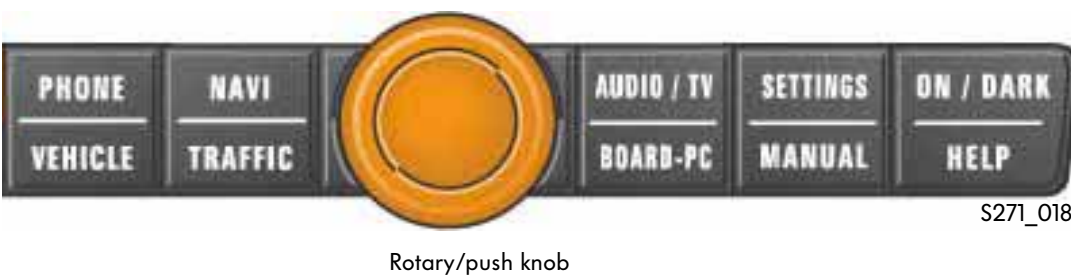
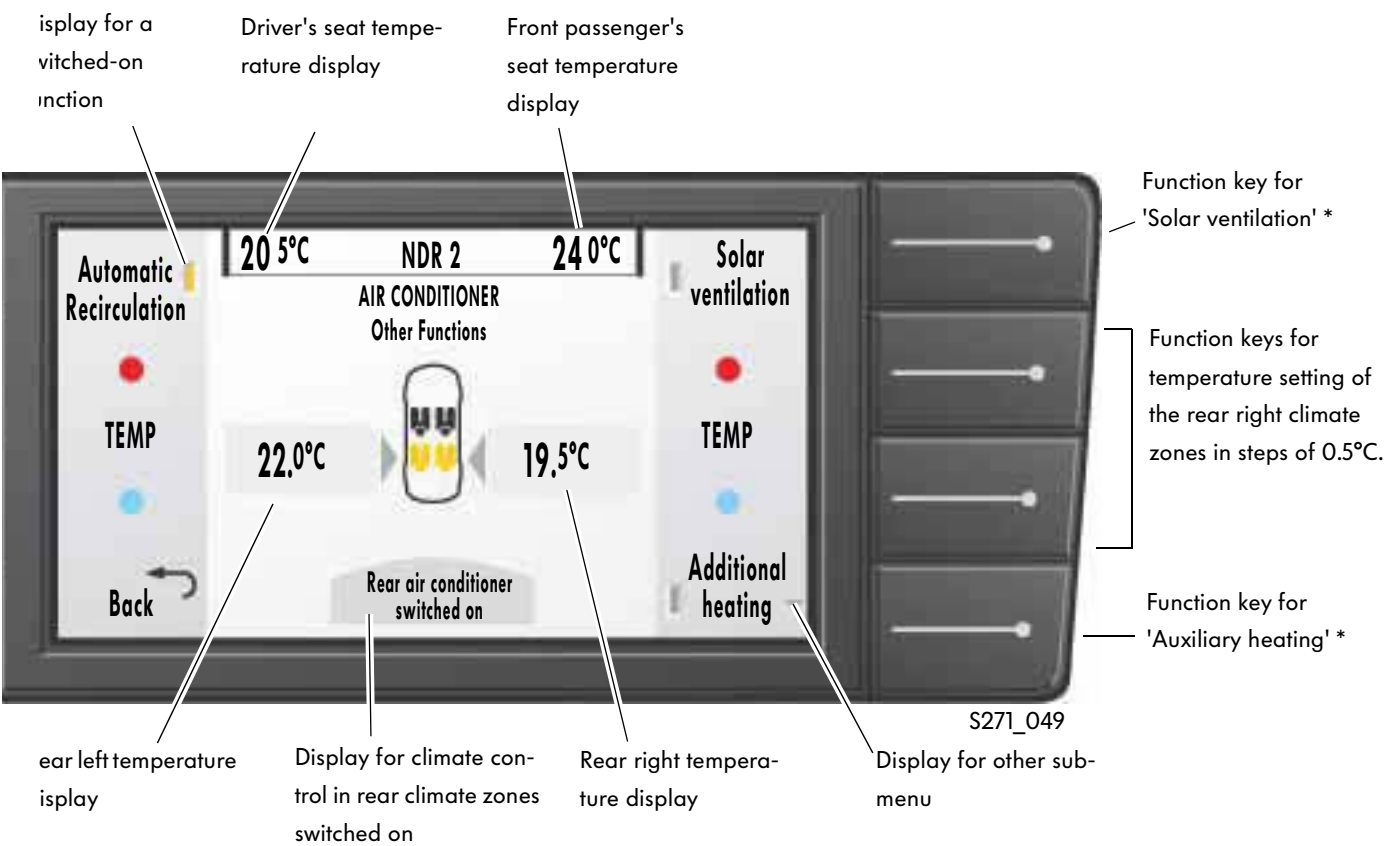
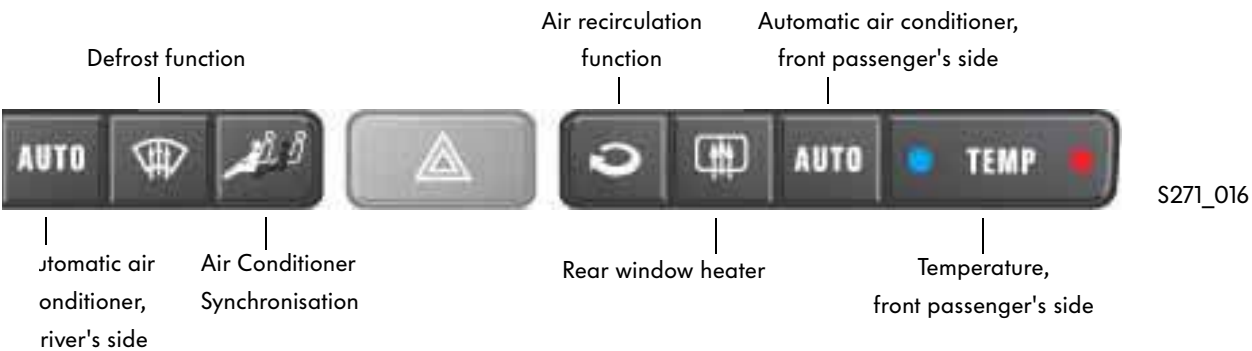


Function keys with display



Main menu row





* Optional extra



Functional features

How does the 4-zone climate control work?

The climate control of the 4C Climatronic lies on the whole in a temperature range between 18 °C and 28 °C. However, the possibilities for adjusting the climate for each individual seat must be viewed against the background that the climate zones are not physically separate.

We would like to use an example to illustrate the 4-zone regulation.

Passengers with different requirements regarding temperature and air distribution are seated in each of the 4 climate zones.

The following pages provide a simple illustration of the functional relationship between the operating unit and the air distribution components involved for each climate zone.

The ambient temperature in this example is 12 °C and the sky is clouded over.

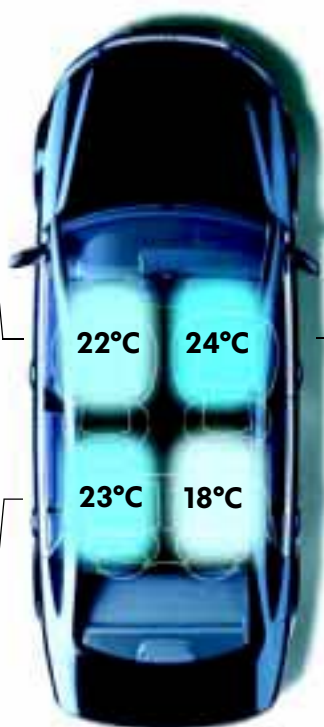
Starting situation:

'Driver' climate zone
The driver selects the temperature of 22°C and actuates the Auto button in the row of climate controls.

'Front passenger' climate zone
The front passenger enters the vehicle. He has cold feet and would like to increase the temperature by 2°C in relation to the 'driver' climate zone using the footwell vent.

'Rear left passenger' climate zone
This passenger would like to have things a little warmer than the driver. The temperature for this climate zone is set to 23°C.

'Rear right passenger' climate zone
This passenger would like to receive colder air from the centre console vents. He sets a temperature of 18°C.



S271_083

'Driver' climate zone

In the selected Automatic function, the Climatronic uses the sensor system to determine how strongly the air has to be heated for this climate zone in order to ensure a temperature of 22°C.

Here, the Climatronic control unit defines the flow rate of the engine coolant through the heat exchangers. The Climatronic decides, for example, that the warm air is to be fed to the footwell vents on the driver's side for ventilation and to the dash panel vents for indirect ventilation.



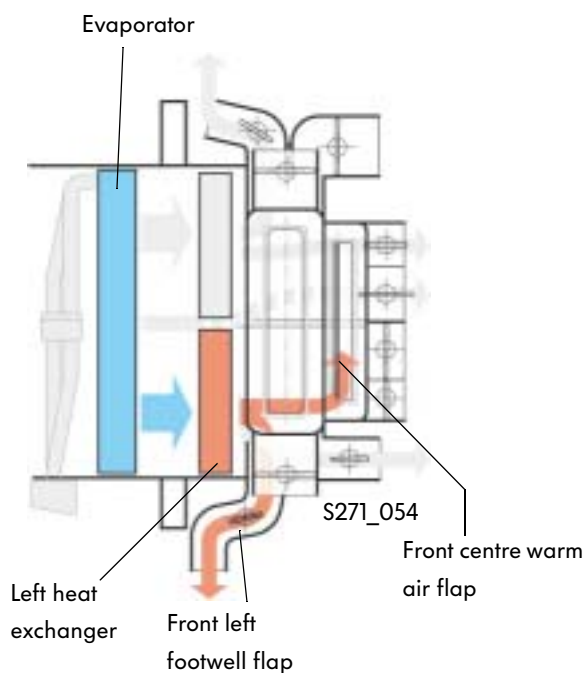
Operation



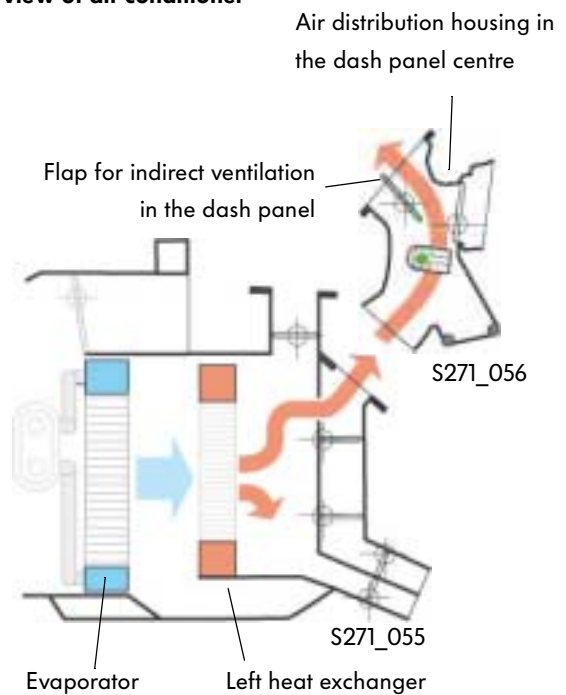
S271_193

Functional sequence

Top view of air conditioner



Side view of air conditioner



Functional features





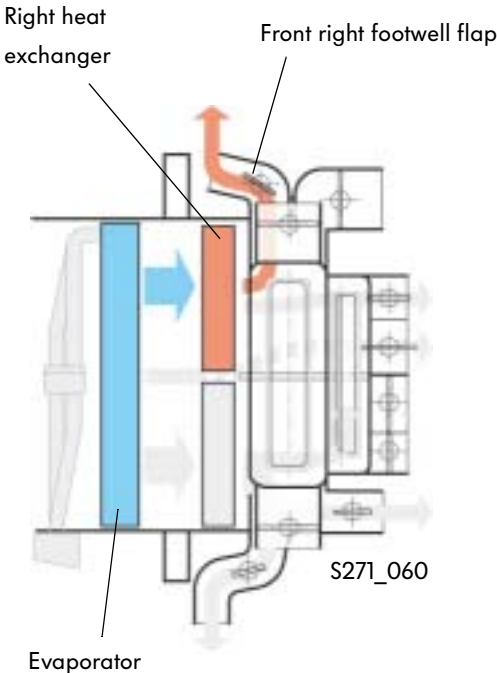
'Front passenger' climate zone

In order to increase the temperature of his climate zone by 2°C, especially in the footwell, the front passenger first actuates the button for the temperature setting.
In steps of 0.5°C, he sets the temperature from 22°C to 24°C for his climate zone.

He then selects the right-hand footwell vent via the function key. Here, the symbol 'MAN' for manual appears on screen. At the same time, the chest vents for the front passenger's side are closed.

Hot coolant flows through the right-hand heat exchanger to achieve the desired temperature; ventilation with warm air takes place via the vents for the right-hand footwell.



Operation	<div data-bbox="293 1122 802 1196"></div> <div data-bbox="711 1167 802 1196">S271_194</div> <div data-bbox="847 1115 909 1178">+</div> <div data-bbox="967 1048 1474 1247"></div> <div data-bbox="1410 1247 1501 1274">S271_195</div>
Functional sequence	<div data-bbox="296 1312 585 1339">Top view of air conditioner</div> <div data-bbox="435 1426 933 2096"></div> <div data-bbox="764 1980 863 2007">S271_060</div>

'Rear left passenger' climate zone

In order to increase the temperature for this climate zone, the function key 'Other' must be pressed first.

A new menu then appears on the display. By pressing the 'TEMP' function key, the temperature can be increased to 23°C.

To achieve this, the air is fed through the heating element in the distributor housing on the rear left to the vents for the footwell and the B pillar. Here, the heating element is activated by the Climatronic until the temperature sensor reports the desired temperature.



The rear climate zones can also be ventilated via the chest vents of the rear centre console. However, by adding cold air, the temperature can only be reduced via these vents, not increased.

Operation	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> </div> </div> <div style="display: flex; justify-content: space-around; align-items: center;"> S271_196 S271_197 </div>
Functional sequence	<p>Top view of air conditioner</p> <p>Left heat exchanger</p> <p>Shut-off flap for rear left B pillar and footwell</p> <p>S271_063</p> <p>Rear left distributor housing</p> <p>Additional heating element</p> <p>Rear left footwell temperature sensor</p> <p>Rear left footwell</p> <p>S271_064</p> <p>Rear left B pillar</p>



Functional features

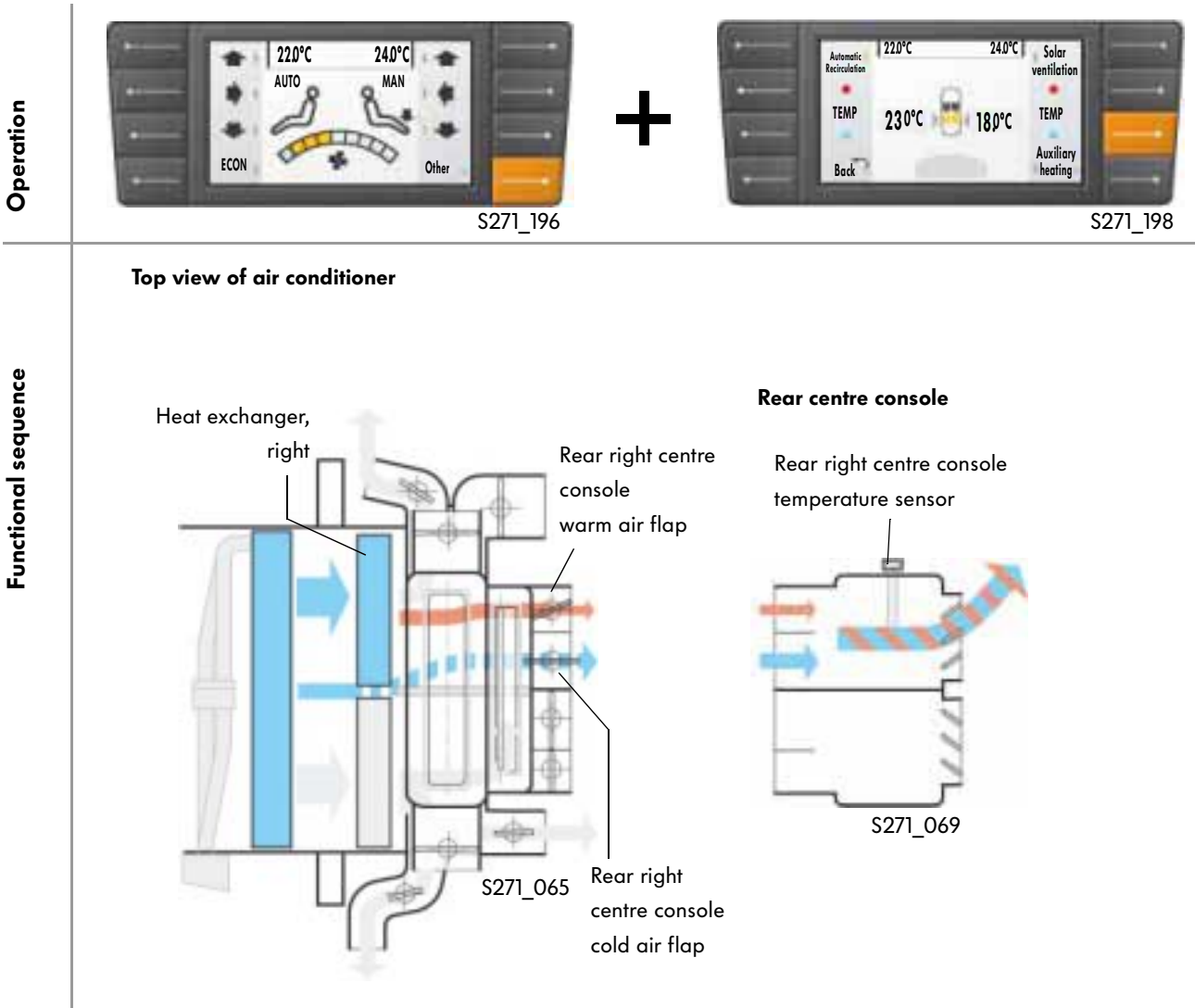
'Rear right passenger' climate zone

The passenger in this climate zone wants ventilation with colder air.
Here, the 'Other' button must be pressed first. A new display appears. The 'TEMP' function key can now be used to set the temperature to 18°C.

The Climatronic guides the air flow via the warm and cold air flaps of the air conditioner to the vent in the rear centre console.
Here, colder air is added until the temperature sensor reports that the desired temperature has been reached.



If a rear information display and operation unit has been fitted as an optional extra, the settings for temperature and air distribution for the rear climate zones can also be made using this unit.



A reminder

Controlling and Adaptive Controlling

● Controlling

The expression 'control' is used to describe a process in which a selected nominal value is adjusted in a previously defined procedure. In this case, there is no detection of the current actual value, which means that the ambient conditions have no influence on the control procedure.

Example:

Classical heating control:

On earlier heating systems, no concrete room temperature was selected, only the maximum heat output between 0 and 100% was set by opening a control valve to a greater or lesser extent.

The current room temperature was not detected in order to close the valve when the desired room temperature was reached. As a result, the heater continuously warmed the room without switching off when the desired room temperature was reached.

● Adaptive Controlling

The expression 'adaptive control' describes an interactive process. In this context, reference is also made to open loop control circuits. In an open loop control circuit, the system reacts to external influences. To achieve this, it is necessary to detect the ambient conditions and take account of changes in these conditions in the adaptive control process.

This means that a set nominal value is compared to the actual value detected by sensors. If the actual value deviates from the nominal value due to external influences, an actuator is activated until the actual value matches the nominal value once again. The external influences in the open loop control circuits are referred to as disturbance variables.

Example:

Modern heating adaptive control:

On modern heating systems, you set a fixed temperature value, e.g. 20°C.

Via temperature sensors, the adaptive control system records the current room and ambient temperature and then decides on the extent to which the regulating valve has to be opened. Once 20°C room temperature has been reached, the regulating valve is closed again by the system. If the room temperature drops once again, the open control loop circuit runs through again automatically.



System overview



G355 Air humidity sender

Temperature sensor of the
air distribution

see Page 42

G134 Photosensor 2 for
sunlight penetration

G56 Dash panel temperature sensor

G17 Ambient temperature
sensor

G89 Fresh air intake
duct temperature sensor

G238 Air quality sensor

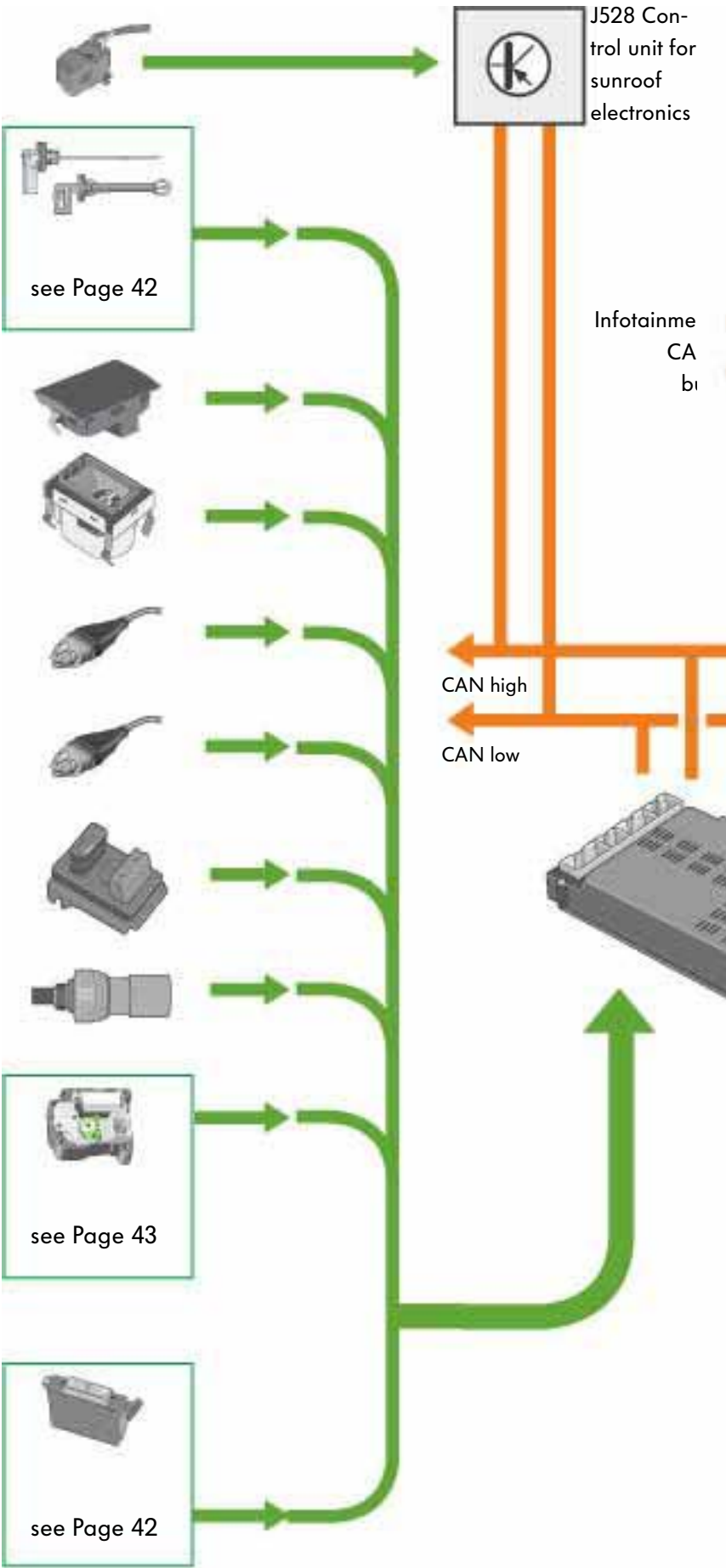
G395 Refrigerant pressure/
temperature sender

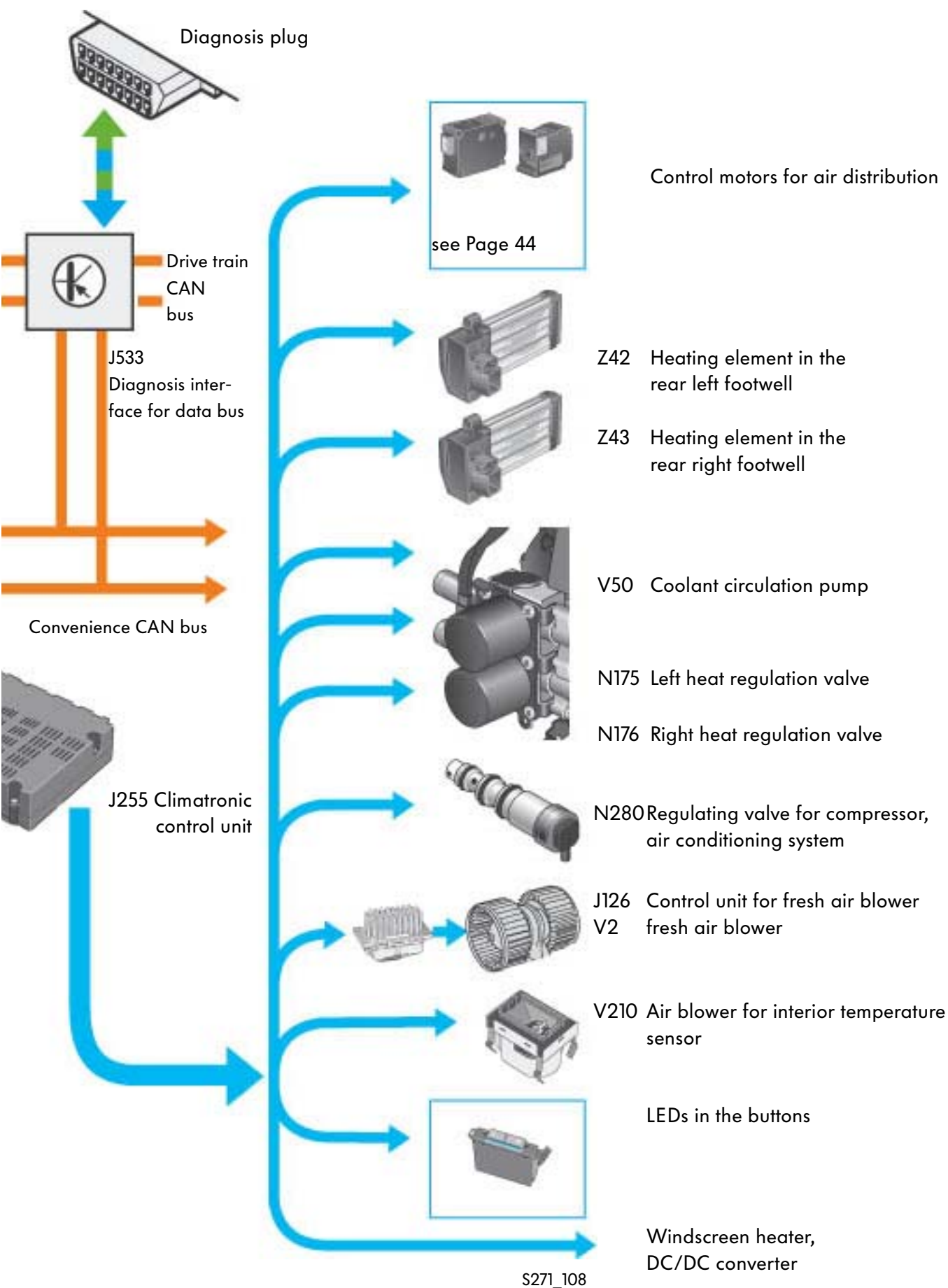
Potentiometers in control motors

see Page 43

Rocker switch on the vents

see Page 42





S271_108



System overview

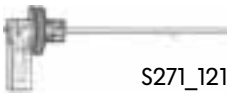
Temperature sensor, air distribution



S271_092



S271_094



S271_121

Temperature sensors on air conditioner

- G306 Left heat exchanger temperature sensor
- G307 Right heat exchanger temperature sensor
- G308 Evaporator temperature sensor

Front climate zone temperature sensor

- G191 Sender for centre vent temperature

Rear climate zone temperature sensor

- G309 Rear left footwell temperature sensor
- G310 Rear right footwell temperature sensor
- G311 Rear left centre console temperature sensor
- G312 Rear right centre console temperature sensor



S271_120

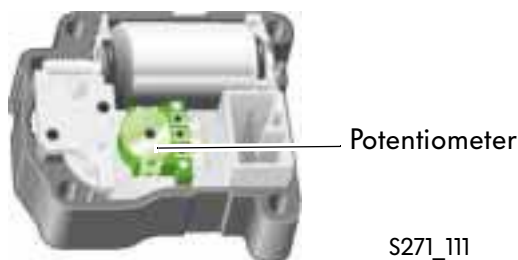
Rocker button

Buttons for the front climate zones

- E301 Button for front left vent
- E302 Button for front left centre vent
- E303 Button for front right centre vent
- E304 Button for front right vent
- E305 Button for footwell/head area temperature difference

Button for the rear climate zones

- E299 Button for rear left defrost
- E300 Button for rear left defrost
- E306 Button for rear left centre console vent
- E307 Button for rear right centre console vent



Potentiometers in the control motors

On the air conditioner

- G113 Potentiometer - air flow flap control motor
- G135 Potentiometer in the defroster flap control motor
- G142 Potentiometer in the air recirculation flap control motor
- G315 Potentiometer - control motor for front cold air flap
- G316 Potentiometer - control motor for front warm air flap

- G139 Potentiometer in the control motor for left footwell flap
- G140 Potentiometer in the control motor for right footwell flap
- G317 Potentiometer - control motor for front right shut-off flap of defroster and chest vent
- G318 Potentiometer - control motor for front left shut-off flap for defroster and chest vent
- G319 Potentiometer - control motor for rear right centre console warm air flap
- G320 Potentiometer - control motor for rear left centre console warm air flap
- G321 Potentiometer - control motor for rear right centre console cold air flap
- G322 Potentiometer - control motor for rear left centre console cold air flap
- G328 Potentiometer - control motor for right B pillar and footwell shut-off flap
- G329 Potentiometer - control motor for left B pillar and footwell shut-off flap

In the dash panel

- G323 Potentiometer - control motor for right defroster/chest vent flap
- G324 Potentiometer - control motor for left defroster/chest vent flap
- G330 Potentiometer - control motor for indirect ventilation air flap
- G387 Potentiometer for front left centre vent
- G388 Potentiometer for front right centre vent

- G325 Potentiometer - control motor for left design panel
- G327 Potentiometer - control motor for right design panel
- G326 Potentiometer - control motor for centre design panel

In the rear distributor housings

- G313 Potentiometer - rear right footwell/defroster flap control motor
- G314 Potentiometer - Rear left footwell/defroster flap control motor



System overview



S271_109

Control motors

On the air conditioner

- V71 Air flow flap control motor
- V107 Defroster flap control motor
- V113 Air recirculation flap control motor
- V197 control motor for front cold air flap
- V198 control motor for front warm air flap

- V108 Control motor for left footwell flap
- V109 Control motor for right footwell flap
- V199 Control motor for front right defroster
and chest vent shut-off flap
- V200 Control motor for front left defroster
and chest vent shut-off flap
- V201 Control motor for rear right centre console warm air flap
- V202 Control motor for rear left centre console warm air flap
- V203 Control motor for rear right centre console cold air flap
- V204 Control motor for rear left centre console cold air flap
- V211 Control motor for right B pillar
and footwell shut-off flap
- V212 Control motor for left B pillar
and footwell shut-off flap

In the dash panel

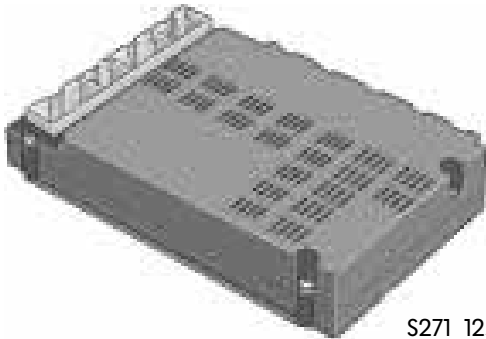
- V110 Left centre vents control motor
- V111 Right Centre vents control motor
- V205 Control motor for right defroster/chest vent flap
- V206 Control motor for left defroster/chest vent flap
- V213 Control motor for indirect ventilation air flap

- V207 Control motor for left design panel
- V208 Control motor for centre design panel
- V209 Control motor for right design panel

In the rear distributor housings

- V195 Rear right footwell/defroster flap control motor
- V196 Rear left footwell/defroster flap control motor

Climatronic control unit J255



S271_125

This is fitted behind the dash panel insert near the footwell on the driver's side.

In the onboard power supply, the control units communicate via the three CAN networks:

- Infotainment CAN bus
- Convenience CAN bus
- Drive train CAN bus.

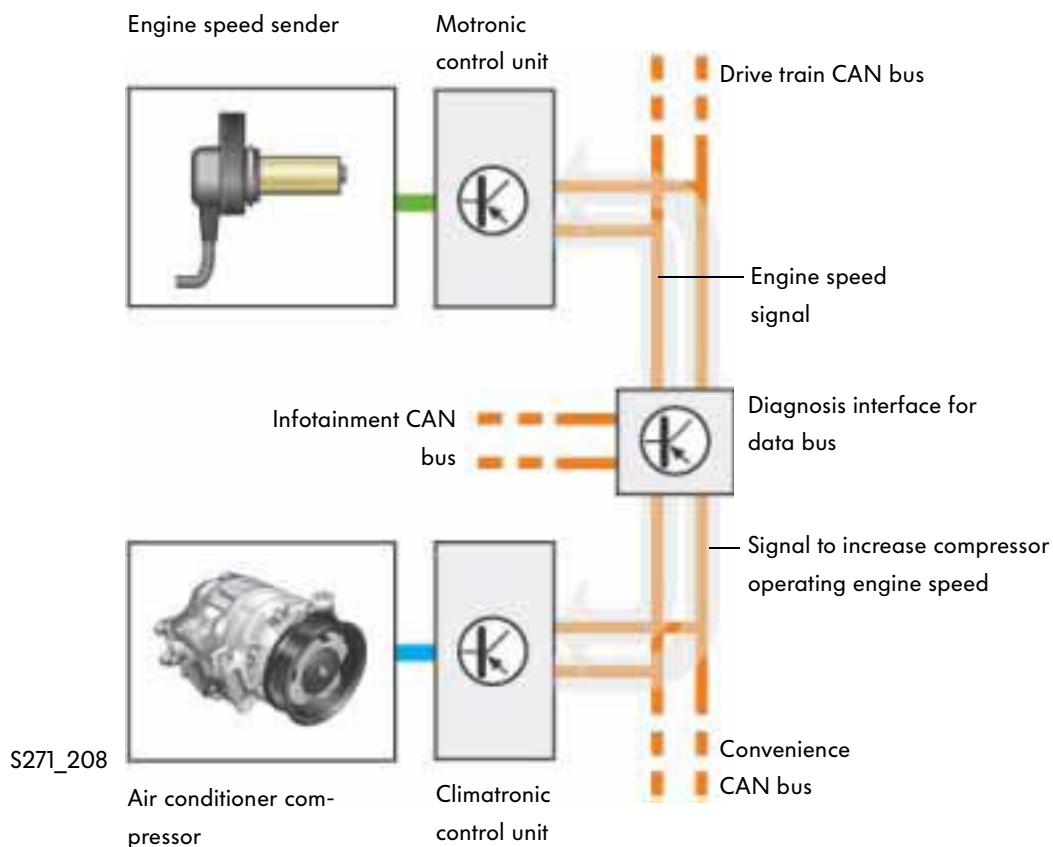
Data interchange takes place via the diagnosis interface for the data bus.



Failure strategies

If the device fails, the heating and climate control are no longer available.

Example of information exchange between convenience CAN bus and the drive train CAN bus



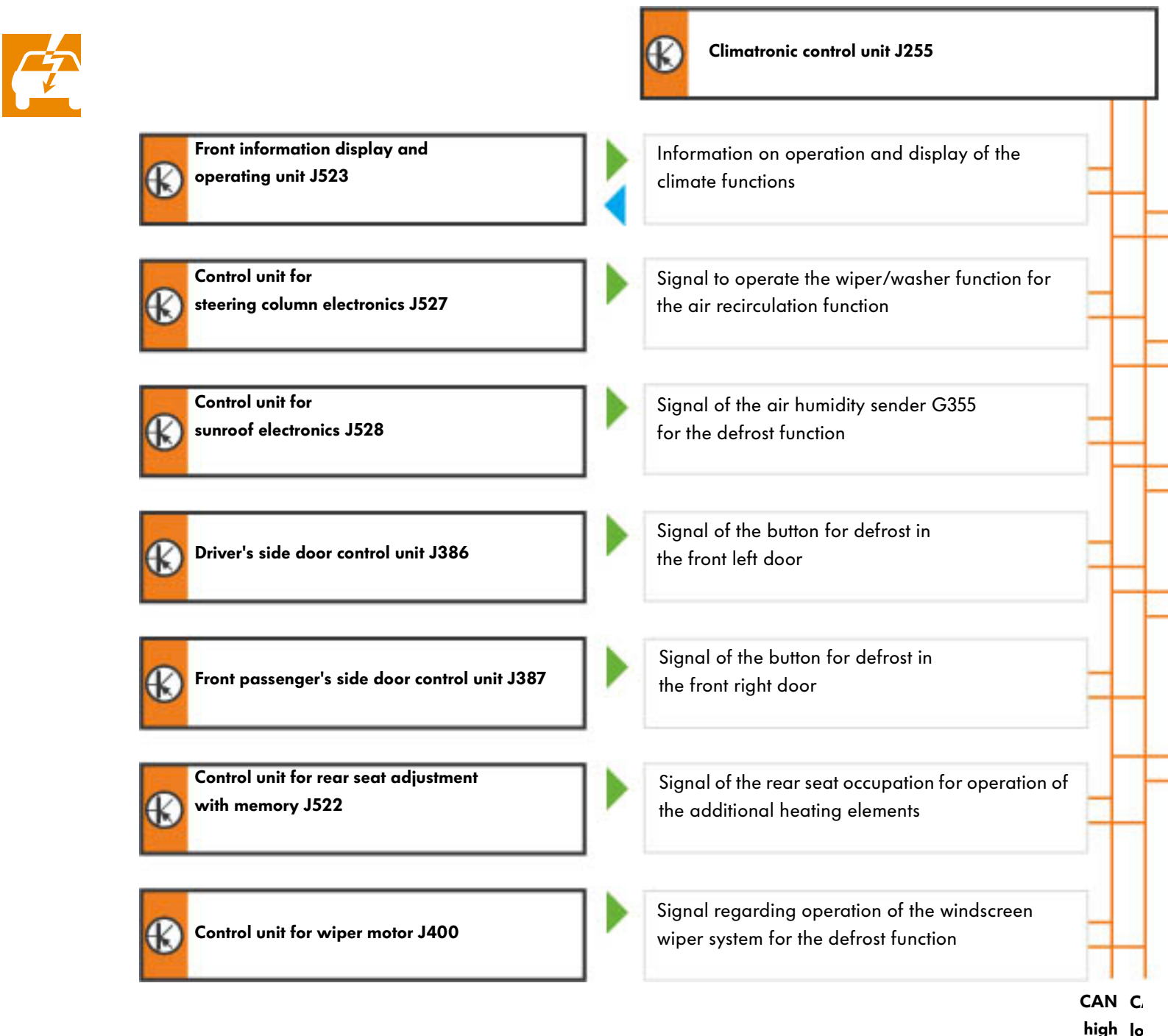
Control unit

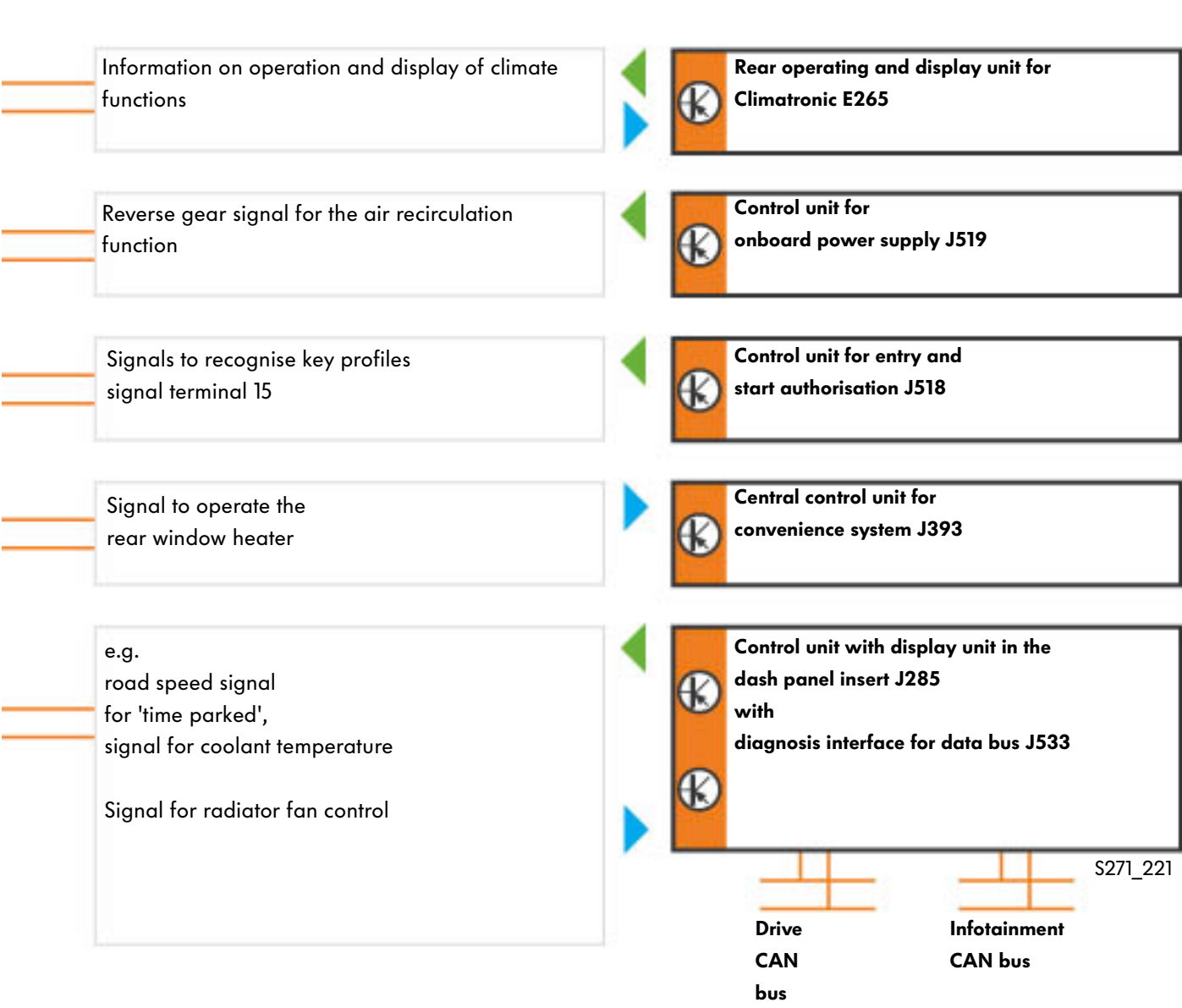
Climatronic control unit in the CAN bus

In the Convenience CAN bus, the control units shown exchange all the information necessary to control the four climate zones with the Climatronic control unit.

Communication between the CAN buses runs via the data bus diagnosis interface integrated in the control unit for the display unit in the dash panel insert.

Overview of the Convenience CAN bus





Sensors and actuators

Evaporator temperature sensor G308

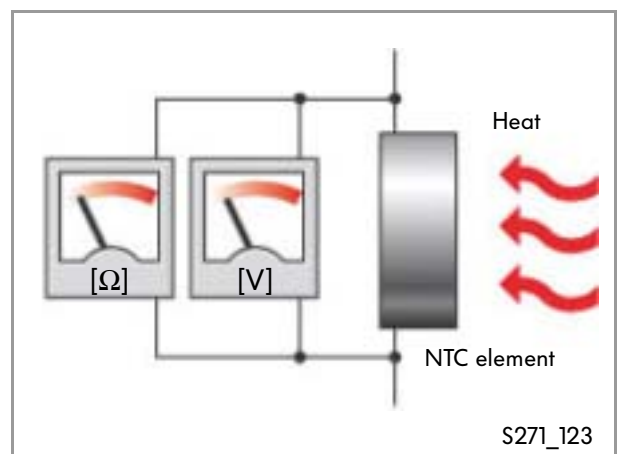
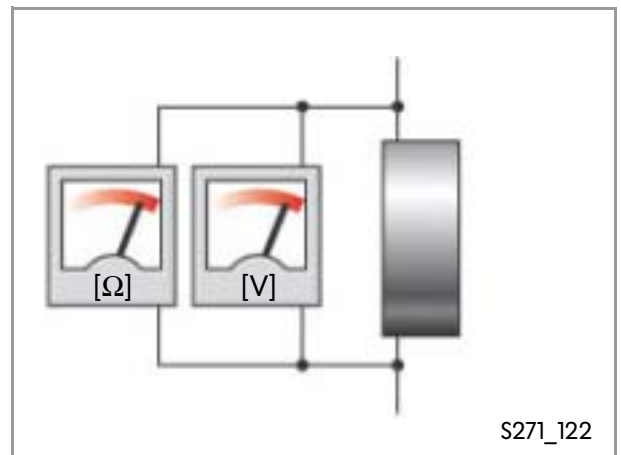
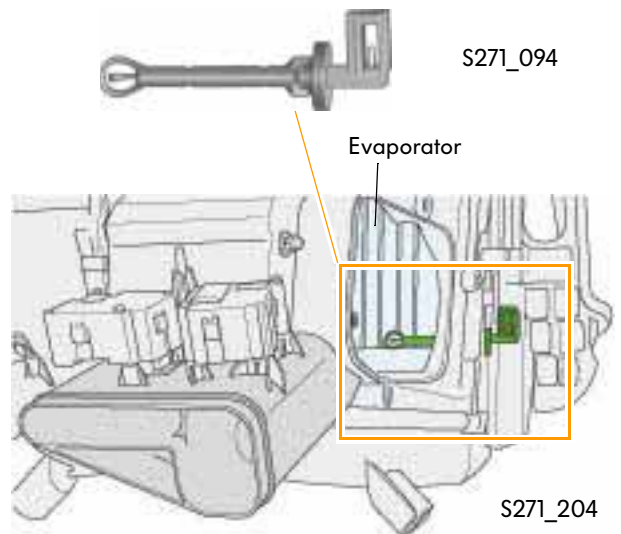
This is plugged into the air conditioner behind the evaporator and detects the air temperature downstream of the evaporator. Using this signal, the Climatronic control unit can adapt the compressor output precisely to the requirements of the occupants.

Function

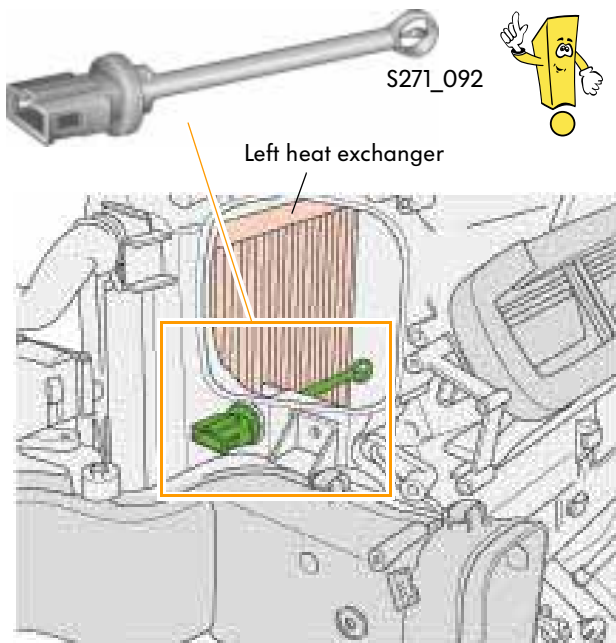
This temperature sensor is an NTC sensor. The designation NTC means 'Negative Temperature Coefficient'. The term describes the physical properties of the conductor element in the sensor. If the NTC element is heated, its resistance is reduced considerably. The sensor electronics convert the measured resistance into a voltage signal. That means that the signal voltage is a measure of the detected temperature.

Failure strategies

Without the signal from this sensor, the control unit does not know how high the air temperature is behind the evaporator, which means that adaptive control of the air conditioner compressor is not possible. In this case, the power output of the compressor is reduced to a temperature that does not permit the evaporator to ice up.

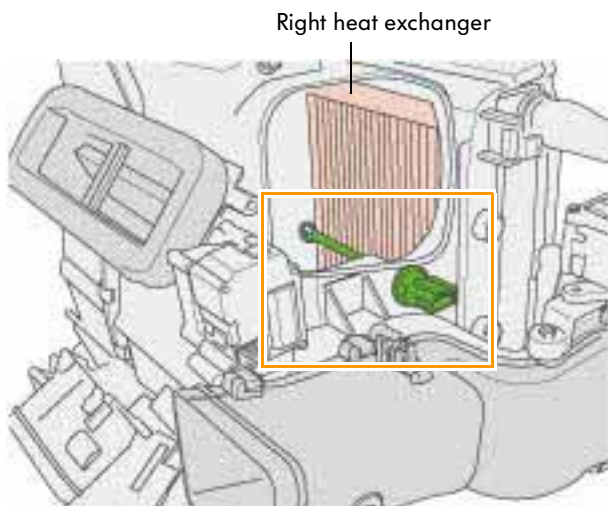


Left heat exchanger temperature sensor G306 and the right heat exchanger temperature sensor G307



Fitting location G306

S271_203



Fitting location G307

S271_202

They are inserted from both sides of the air conditioner in such a way that they detect the temperature of the air flowing out of the heat exchangers. Two sensors are necessary for independent adaptive control of the two heat exchangers.

This means that the signals of the two sensors are necessary to measure how much water is fed from the coolant supply line into each heat exchanger in order to attain the required heat output.

Function

They are also NTC sensors that work according to the same principle as the evaporator temperature sensor G308.

Failure strategies

Without the signal from the two senders, the air temperature behind the heat exchanger can no longer be detected. The temperature control fails. Instead, the heat output is controlled in default temperature steps.



Sensors and actuators

The ambient temperature sensor G17 and the fresh air intake duct temperature sensor G89

Fitting location and task

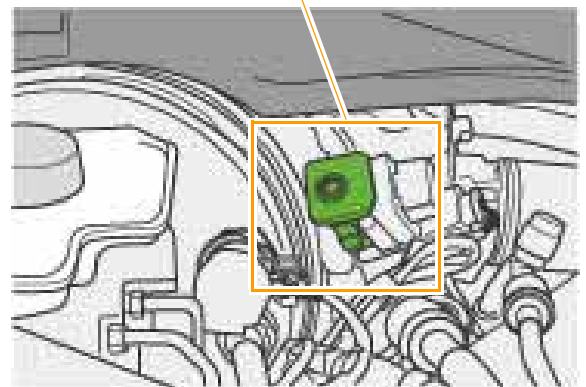
The temperature sensor G17 is fitted in the bumper, whereas the temperature sensor G89 is located directly beside the air quality sensor in the plenum chamber.

The signals of both NTC sensors are used for climate control.

Here, the Climatronic control unit uses the lower value in each case as ambient temperature.

G89

S271_134



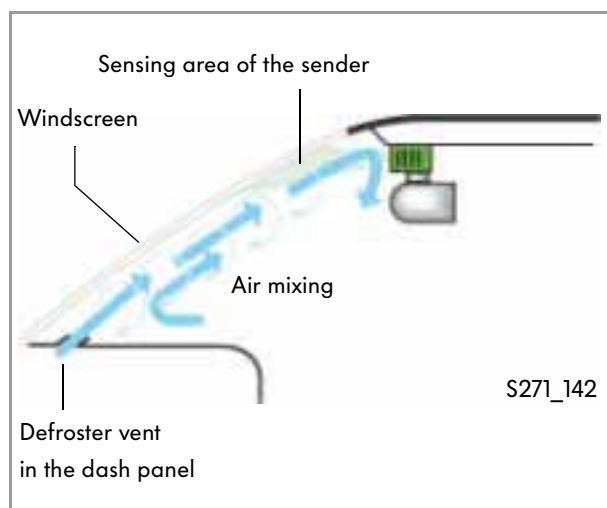
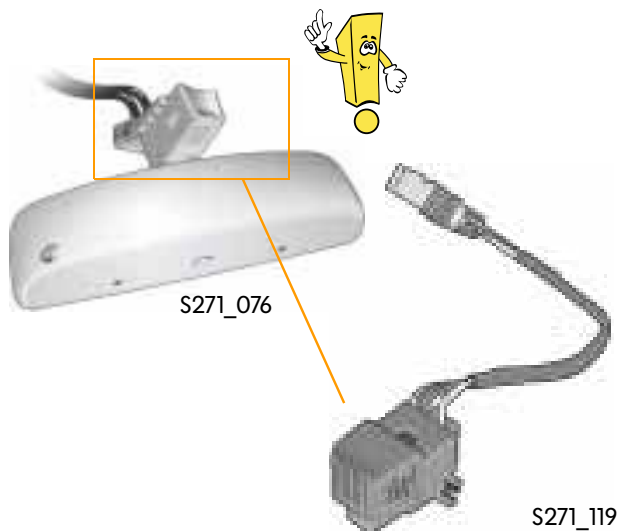
S271_183

Failure strategies

If a sensor fails, the control unit uses the signal of the intact sender.

If both sensors fail, the cooling function is switched off and a fixed substitute value of 10°C is used for the ambient temperature.

Air humidity sender G355



Fitting location and task

Various test methods have shown that, especially in the case of low ambient temperatures, the upper third of the windscreen becomes very cold and therefore tends to fog over. In order to reach this area, the air humidity sender G355 is fitted in the foot of the rearview mirror.

A continuous and small air flow from the defroster vents ensures good mixing of the air at the sensing point of the sender so that it can be assumed that the measured air humidity at this position on the windscreen also comes close to that of the remaining areas of the windscreen.

The air reaches the sensor surface through air slits in the sender housing. Soiling in these air slits can lead to a malfunction of the sensor.

To permit adaptive control of the automatic defrost function, the sensor detects three measured values:

- air humidity
- associated temperature at the sender, and
- windscreen temperature

All functions are combined in the sender housing.



Failure strategies

Without the signal from the sensors, the control unit can no longer calculate the point at which moisture forms on the windows. The automatic defrost function fails.

Sensors and actuators

Measuring air humidity

- Basic physical principles

When air humidity is measured, the proportion of gaseous water (water vapour) in the cabin air is determined. The capability of the air to absorb water vapour is dependent on the air temperature. This is why the associated temperature of the air must be determined as well as the level of humidity.

The warmer the air, the more water vapour it can absorb.

If this water-vapour-enriched air cools, the water begins to condense. Fine droplets form and attach themselves to the windscreen.

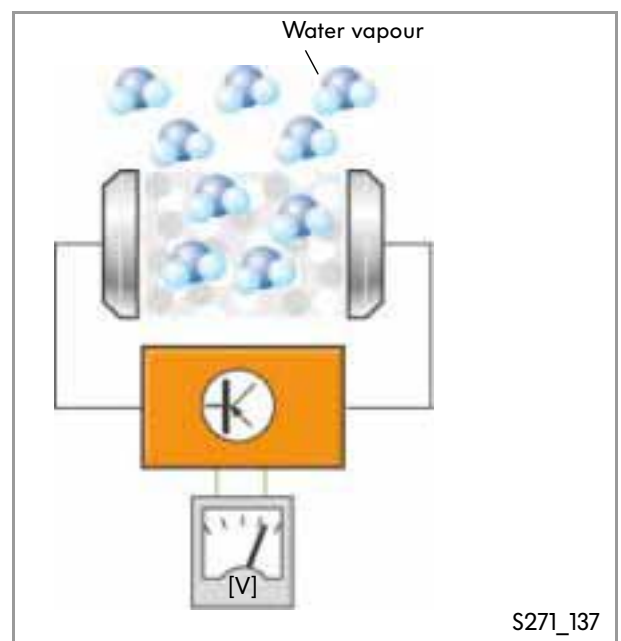
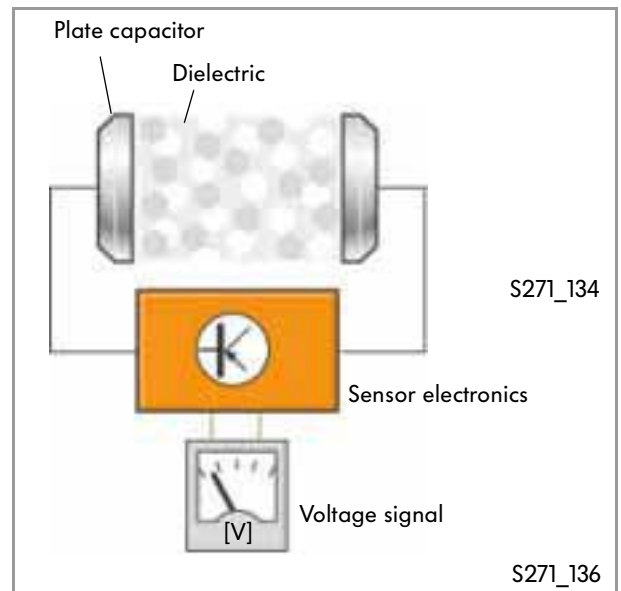
- Function

Moisture is measured using a capacitive thin-layer sensor. The mode of functioning of this sensor is equivalent to that of an electric plate capacitor.

The capacitance of a capacitor, that is, the capability to store electrical energy, is dependent on the surface of the capacitor plates, their spacing and the electrical properties of the filler material located between the two plates. This material is referred to as a dielectric.

This special capacitor can absorb water vapour. The absorbed water changes the electrical properties of the dielectric and thus the capacitance of the capacitor.

This means that measuring capacitance indicates air humidity. The sensor electronics convert the measured capacitance to a voltage signal.



Measuring the associated temperature at the sensor

- Basic physical principles

In order to determine air humidity, the temperature has to be determined in the vicinity of the moisture measurement. This associated temperature is important, as air humidity is strongly dependent on air temperature.

If the location of the moisture measurement is too far away from the location of the temperature measurement, the air humidity can no longer be correctly measured because there can be a difference in the temperature and thus the moisture between the two locations.

Measuring windscreen temperature

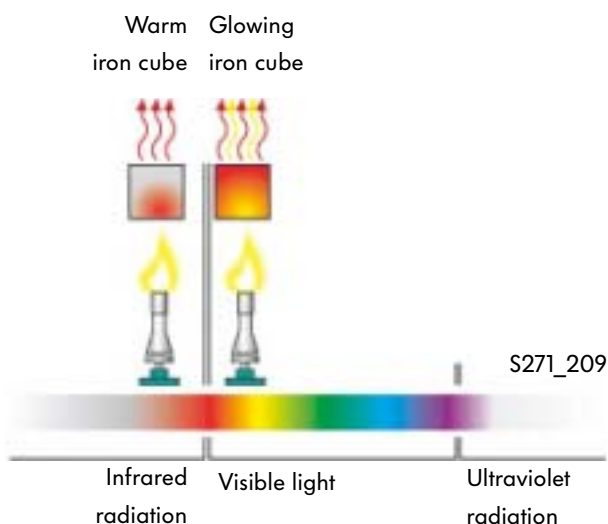
- Basic physical principles

Each body interchanges heat with its environment in the form of electromagnetic radiation. This electromagnetic radiation can comprise heat radiation in the infrared range, visible light or also ultraviolet parts. The three ranges, however, are only a very small part of the overall electromagnetic spectrum. Radiation is 'absorbed' and 'emitted'.

A piece of iron, for example, can absorb infrared heat radiation. It becomes warm, which means that the iron also re-emits infrared radiation. If you heat up the piece of iron further, it begins to glow. It then emits electromagnetic radiation in the range of visible light as well as infrared radiation.

Depending on the temperature of the body itself, the composition of the emitted radiation can change. If the temperature of the body changes, for example, the infrared portion of the emitted radiation also changes.

This means that by measuring emitted infrared radiation, the temperature of the body can be measured contactlessly.



Sensors and actuators

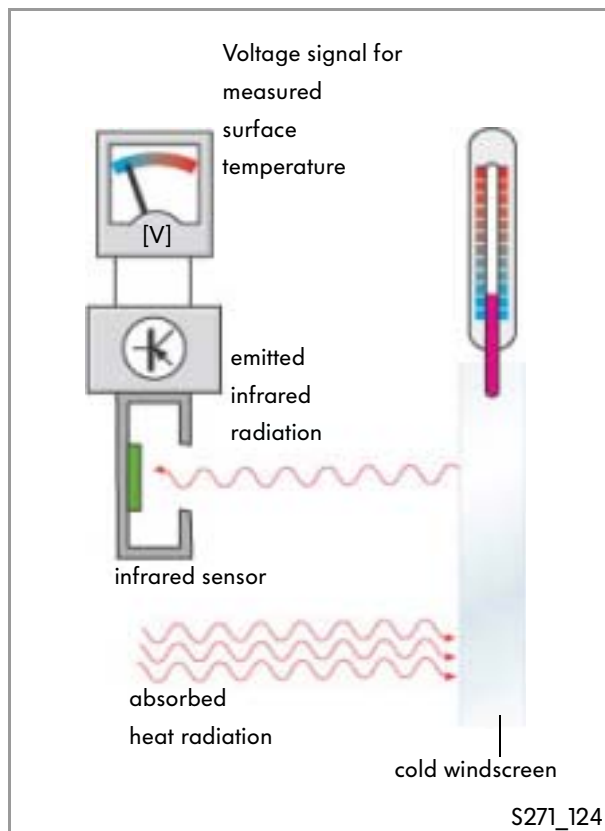
- Function

Measuring infrared radiation emitted by a body, in this case the windscreen, is performed using a highly sensitive infrared radiation sensor.

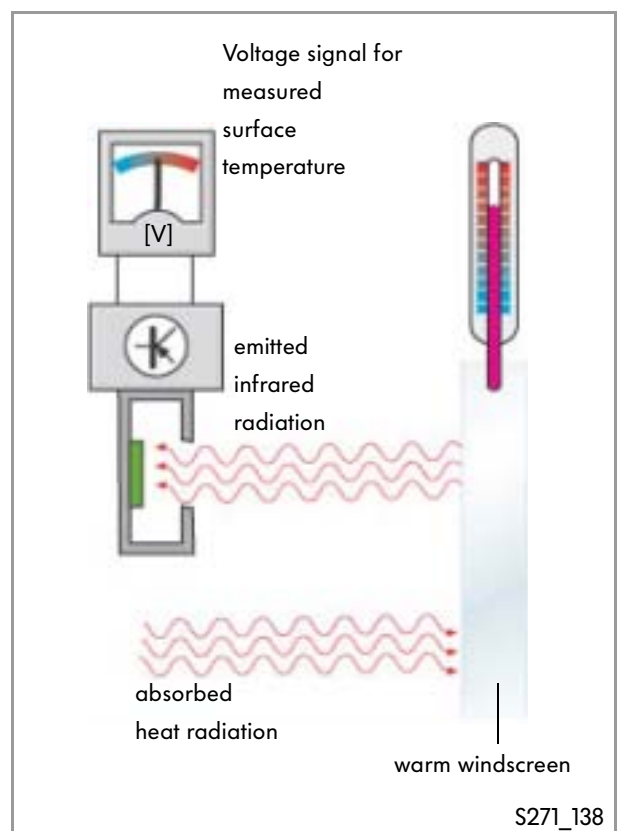
If the temperature of the windscreen changes, the infrared portion of the heat radiation emitted by the plain washer also changes. This is detected by the sensor and the sensor electronics convert it into a voltage signal.



Measurement with cold windscreen



Measurement with heated windscreen



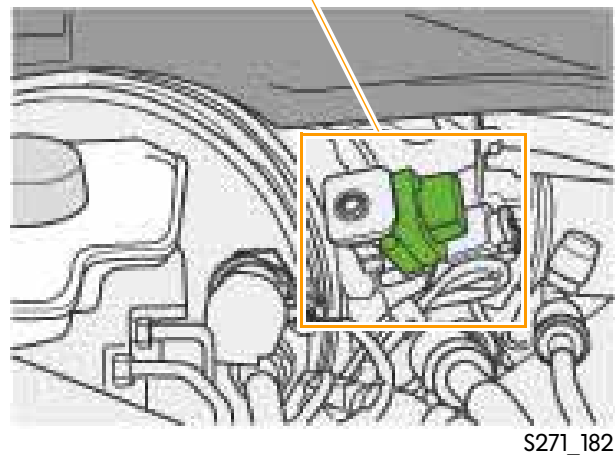
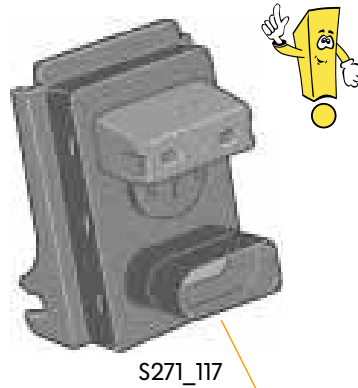
Air quality sensor G238

Fitting location and task

The sensor is fitted in the area of the fresh air intake in the plenum chamber together with the fresh air intake duct temperature sensor G89.

It has the task of detecting pollutants in the ambient air. When the sensor was developed, it was assumed that pollutants in the air occur in the form of oxidisable or reducible gases.

The sensor signal is required by the Climatronic control unit for the automatic air recirculation function. If this function is switched on, the air flow flap is closed automatically and the air recirculation flap opens if the sensor detects pollutants in the fresh air intake.



Function

Detecting pollutant concentration is based on resistance measurement.

If the measured resistance deviates from a default value, the air conditioner control unit concludes that the ambient air is contaminated and starts up the automatic air recirculation function.

Failure strategies

If the sensor fails, the automatic air recirculation function is no longer available.

Sensors and actuators

- Basic physical and chemical principles

The core of the sensor consists of an oxide mixed with tungsten or tin mixed oxide.

Both compounds change their electrical properties when they come into contact with oxidisable or reducible gases.

In simple terms, oxidation takes place when an element absorbs oxygen and reduction is when a compound emits oxygen.

Oxidisable gases therefore attempt to absorb oxygen and bind it. Reducible gases, on the other hand, want to pass on oxygen to other elements or compounds.

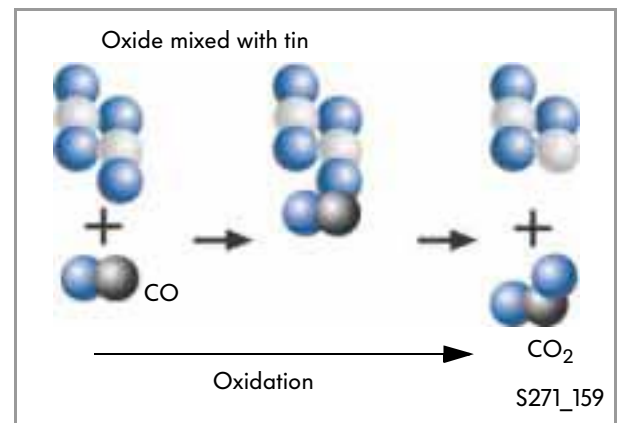
Oxidisable gases include, for example:

carbon monoxide (CO), benzene vapours, petrol vapours, hydrocarbons and unburned or incompletely burned fuel components.

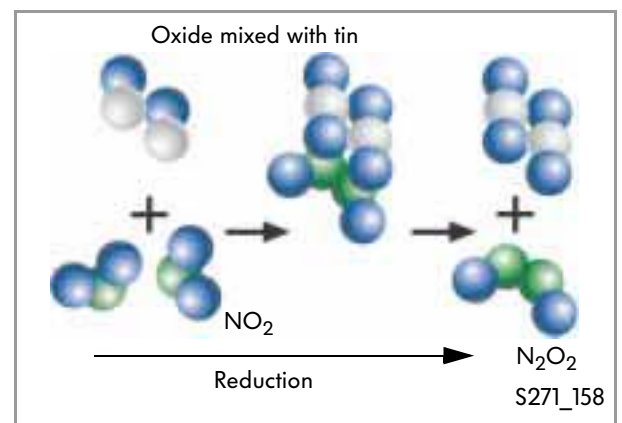
reducible gases are, for example:

nitrogen oxides NO_x .

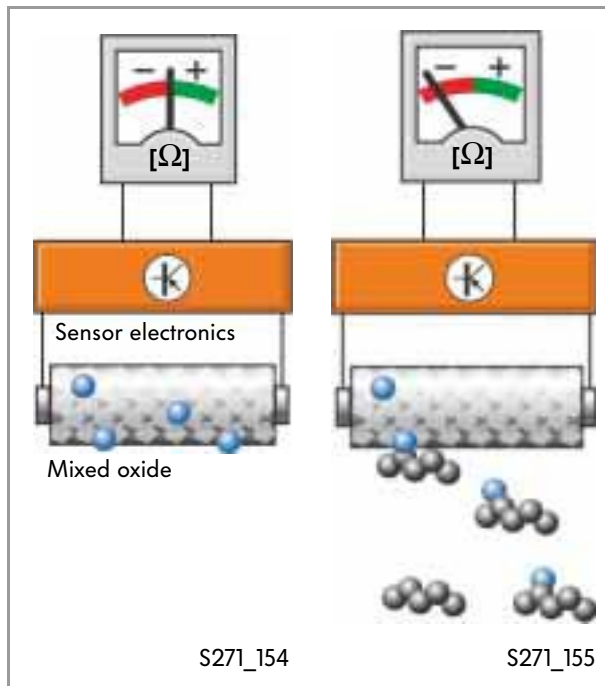
Properties of oxidisable gases



Properties of reducible gases

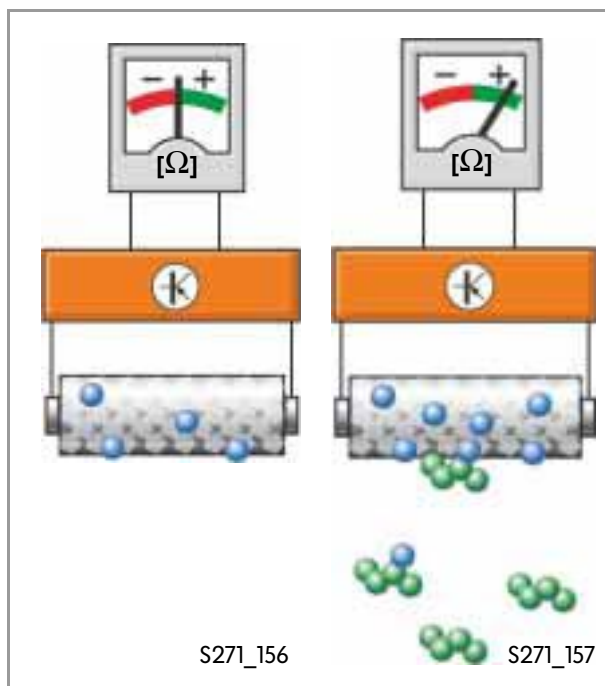


Measuring pollution in oxidisable gases



- Oxygen
- Oxidisable gas

Measuring pollution in reducible gases



- Oxygen
- Reducible gas

● Function

In this example, the function of the sensor is shown in very simplified form, without going into detail of the actual chemical reaction processes:

- If the sensor mixed oxide comes into contact with an oxidisable gas, the gas absorbs oxygen from the mixed oxide. As a result, the electrical properties of the mixed oxide change. Its resistance falls.
- If, on the other hand, if the sensor comes into contact with a reducible gas, the mixed oxide absorbs oxygen from the gas. As a result, the electrical properties of the sensor change. Resistance rises.

Due to the chemical and physical properties of the mixed oxide, it is also possible to detect pollution in oxidisable and reducible gases when both gases occur simultaneously.

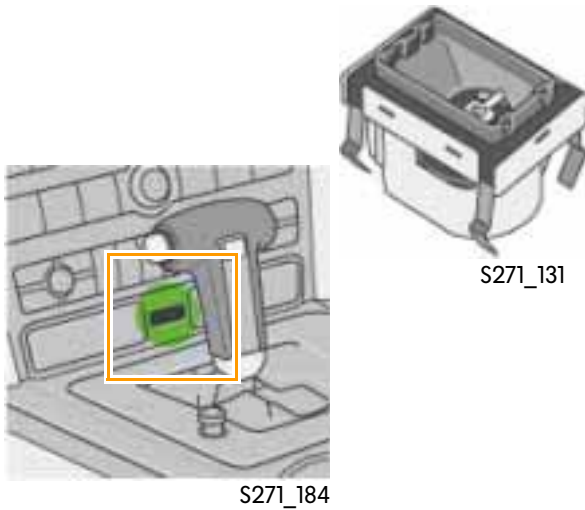


For pollutant detection, this means:

- If the resistance of the sensor rises, there must be oxidisable gases present.
- If the resistance falls, there must be reducible gases present.

Sensors and actuators

Dash panel temperature sensor G56 with the air blower for interior temperature sensor V210

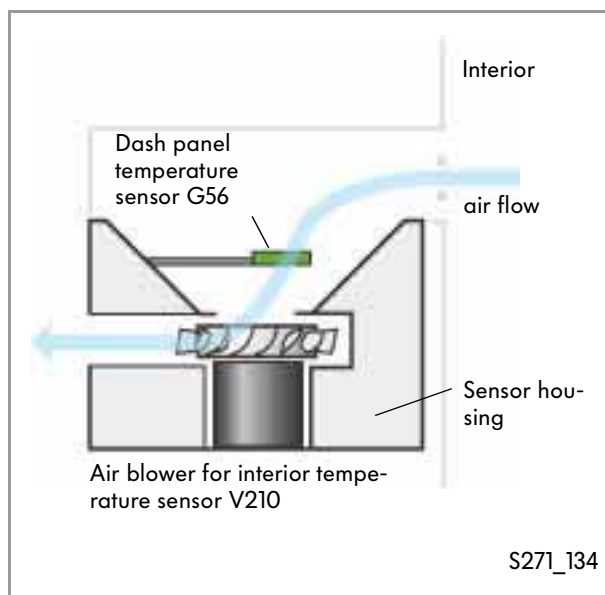


Fitting location and task

This is fitted between the two ashtrays in the centre console behind a covering grille; it detects the air temperature in the central area of the vehicle interior.

Function

The sensor housing contains an NTC temperature sensor, which takes in air from the vehicle interior by means of a small air blower. The sensor measures the temperature of the air flow. This prevents local warming at the temperature sensor which may negatively influence the measurement result. The air blower and sensor element are fitted in a common housing.



Failure strategies

If the sensor is defective, a fixed substitute value of 25°C is used for the interior temperature.

Photosensor 2 for sunlight penetration G134



Fitting location and task

This is fitted under a filter made of dark plastic that lets through sunlight between the defroster vents in the dash panel.

The sensor detects the intensity and direction of sunlight penetration.

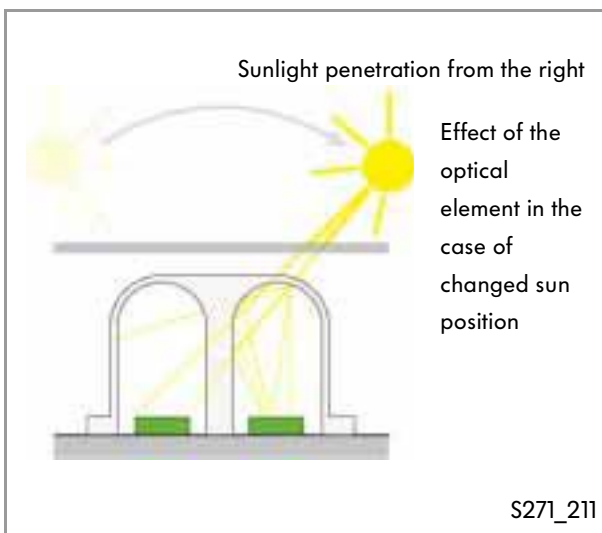
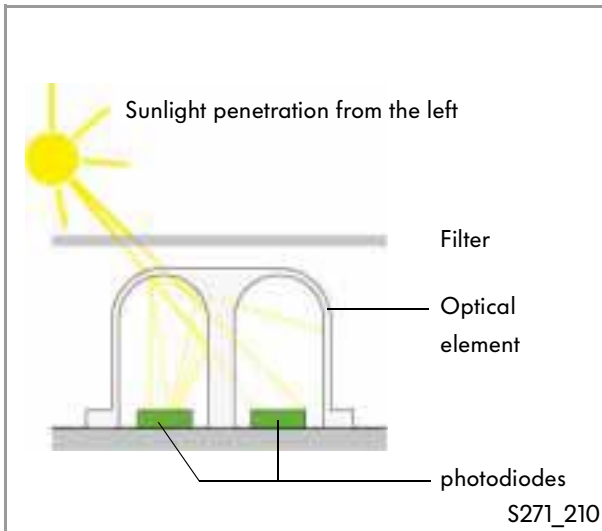
Function

The photosensor housing for sunlight penetration contains two photodiodes and an optical element. The optical element is split into two chambers, each containing a photodiode.

If, for example, sunlight penetrates from the left onto the sensor, the rays are concentrated by the properties of the optical element onto the left photodiode. As a result, the current flow rises significantly in this photodiode compared to the other photodiode.

If the sunlight penetrates from the right-hand side, the photodiode on this side has the higher current flow.

In this way, the Climatronic control unit can determine whether and from which side the vehicle interior is heated up by the sun.



Failure strategies

If a photodiode fails, the value of the other diode is used.

If both photodiodes are defective, a fixed substitute value is used.

Sensors and actuators

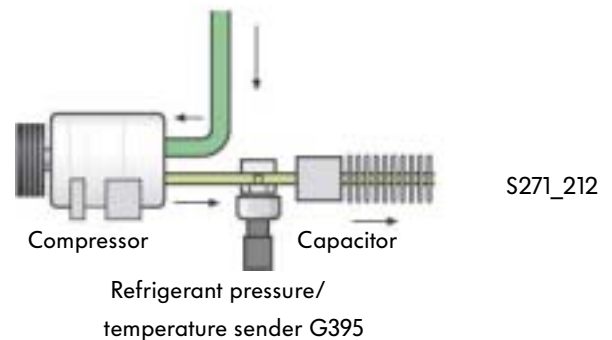
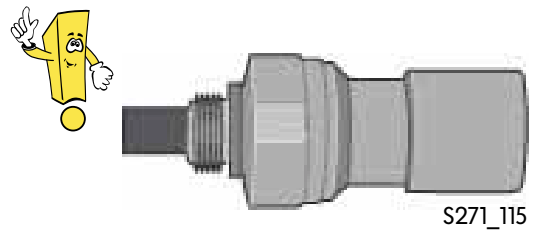
Refrigerant pressure/temperature sender G395

Fitting location and task

This is located in the engine compartment in the high-pressure line between the compressor and the capacitor and sends the refrigerant temperature and the refrigerant pressure to the Climatronic control unit.

The two signals are required:

- to control the radiator fan
- to control the compressor, and
- to detect a loss of refrigerant.



● How is a loss of refrigerant detected?

If the refrigerant escapes through a large leak, a sudden loss of pressure occurs. In this case, the signal from the pressure sensor is sufficient for the control unit to notice the defect.

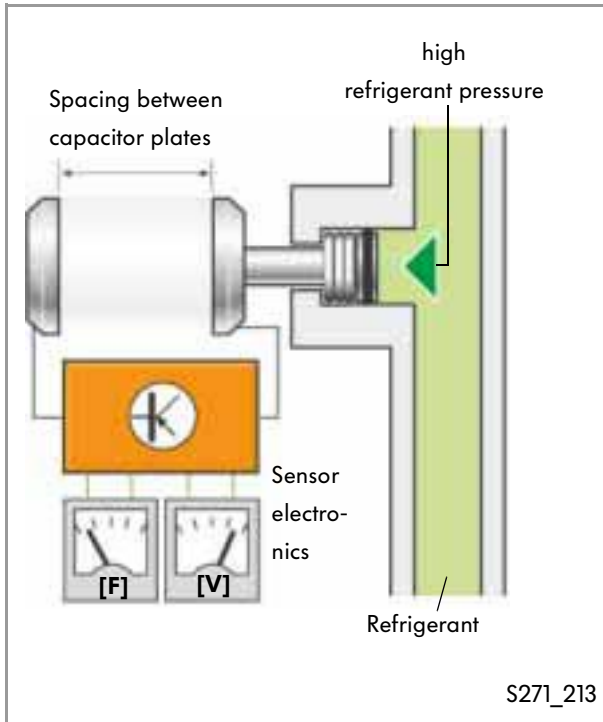
In the case of gradual loss of coolant, this signal is not sufficient, as the pressure in the system does not change to a measurable degree with the loss of a small quantity of refrigerant. However, as the amount of refrigerant is very precisely geared to the volume of the evaporator, a lack of refrigerant will lead to a measurable warming of the expanded coolant gas in the evaporator and thus to a rise in the refrigerant temperature behind the compressor.

The temperature rises because there is less refrigerant to absorb the same amount of heat in order to cool the air to the default value. This temperature rise is detected by the sensor and sent as a voltage signal to the Climatronic control unit.

Failure strategies

If the temperature or pressure signal fails, the cooling function is switched off.

Pressure signal with intact refrigerant circuit



Function

The pressure measuring sensor element operates according to the capacitive principle.

This mode of functioning can be illustrated in simplified form with an electrical plate capacitor.

Here, pressure changes in the refrigerant circuit change the spacing of the capacitor plates in the sensor.

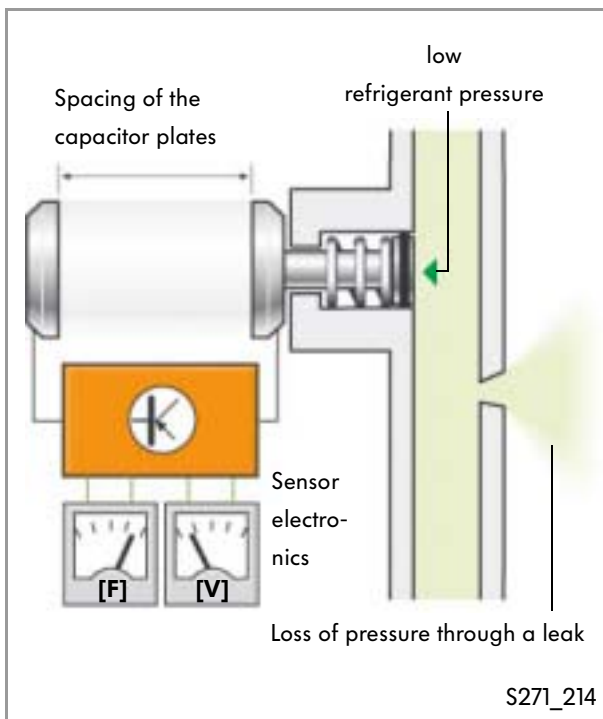
As the spacing of the capacitor plates change, the capacitance also changes, i.e. the capability of the capacitor to store electrical energy. The capacitance of a capacitor is measured in Farads [F].

If the spacing is reduced, capacitance falls; if the spacing increases, the capacitance of the capacitor rises.

This is detected by the sensor electronics and converted into a voltage signal that is proportional to the pressure.



Pressure signal with complete loss of refrigerant



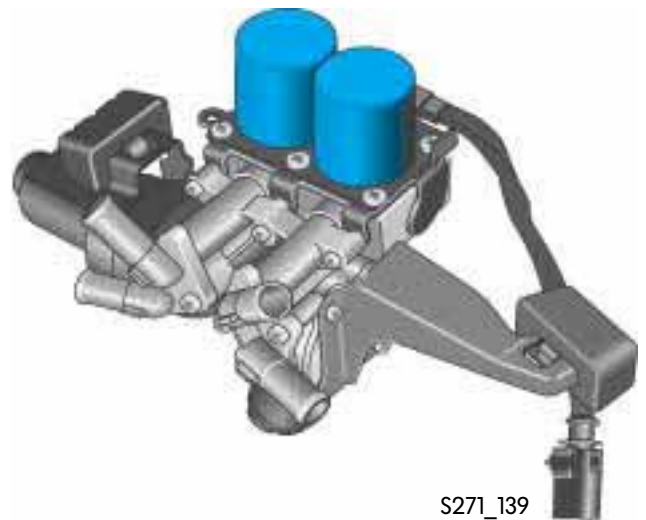
Sensors and actuators

Heat regulating valve (left) N175 and heat regulating valve (right) N176

Fitting location and task

As described in the chapter "Design features", the two valves are part of the pump valve unit in the plenum chamber.

Each valve regulates the amount of coolant fed to the associated heat exchanger from the engine coolant circuit.



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Function

Both valves are sequencing valves.

A 'sequencing' valve means that it is opened or closed by a pulse-width modulated voltage signal from the control unit.

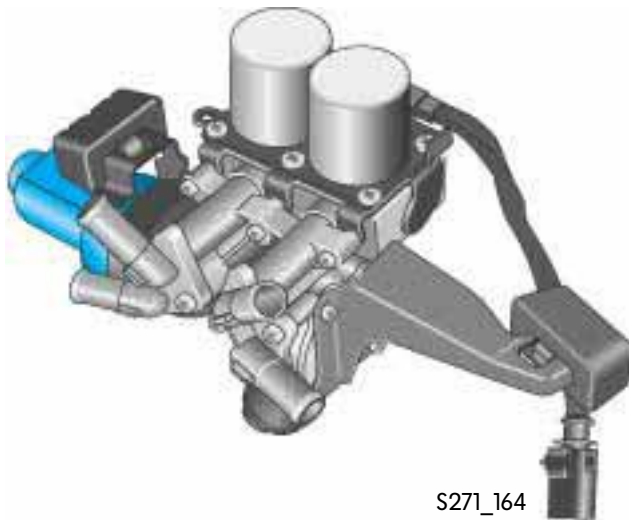
As a result, the flow of coolant to the heat exchanger can be matched exactly to the required heat output.

When de-energised, both valves are open.

Failure strategies

In the case of a defective valve, the associated heat exchanger is completely supplied with coolant, i.e. it has its full heat output.

Coolant circulation pump V50



Fitting location and task

This is also part of the pump valve unit and primarily has the task of preventing heat layering within the heat exchanger.

To achieve this, the coolant is continuously circulated in the heat exchangers.

In addition, the pump is switched on by the Climatronic control unit when the residual heat function has been activated. This occurs, for example, if heat output is requested for the vehicle interior when the engine is off.



Failure strategies

If the pump fails, heat layering can occur in the heat exchangers, which would mean that heating control no longer functions properly.

Mode of functioning

A motor drives two pump wheels to circulate the coolant in both heat exchangers.

The pump is fitted in the return line of the heat exchangers.

Sensors and actuators

Heating element in the rear left footwell Z42 and heating element in the rear right footwell Z43

Fitting location and task

There is a heating element in each of the distributor housings for the rear footwells. The heating elements serve to heat up the air flowing through the housing.

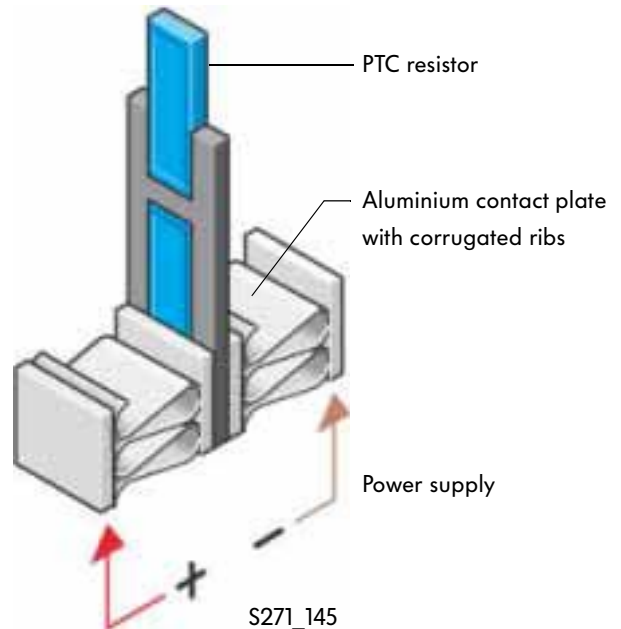


Function

The heating elements are PTC resistors and are also referred to as PTC elements. PTC means 'Positive Temperature Coefficient'. PTC resistors have a self-regulating property.

If the heating element cuts in, electrical current flows through the ceramic PTC resistors. Here, they can heat up to a maximum of 160°C. With increasing temperature, resistance rises. This reduces current flow and prevents overheating.

The control of the heat output is pulse-width modulated. That means that the Climatronic control unit pulses a relay integrated in the heating element, which switches the current for the heating elements on and off. The duration and thus the frequency of the current pulses are based on the required heat output.



Failure strategies

If the PTC elements fail, the amount of air for the rear climate zones cannot be increased compared to those at the front.

Regulating valve for compressor, air conditioning system N280



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Fitting location and task

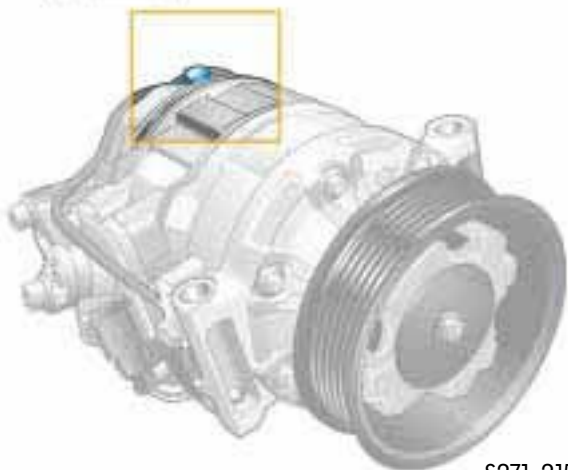
The electrical solenoid regulating valve is fitted in the compressor and is secured by a spring lock washer.

It forms the interface between the low, high and crankcase pressure in the compressor and is a prerequisite for clutchfree operation.

The various pressures adjust the swash plate.



Regulating valve N280



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Function

If, for example, a higher cooling capacity is requested, the regulating valve is activated by the control unit for Climatronic.

A pulse-width modulated voltage signal moves a tappet in the regulating valve.

The duration of the applied voltage defines the amount of adjustment.

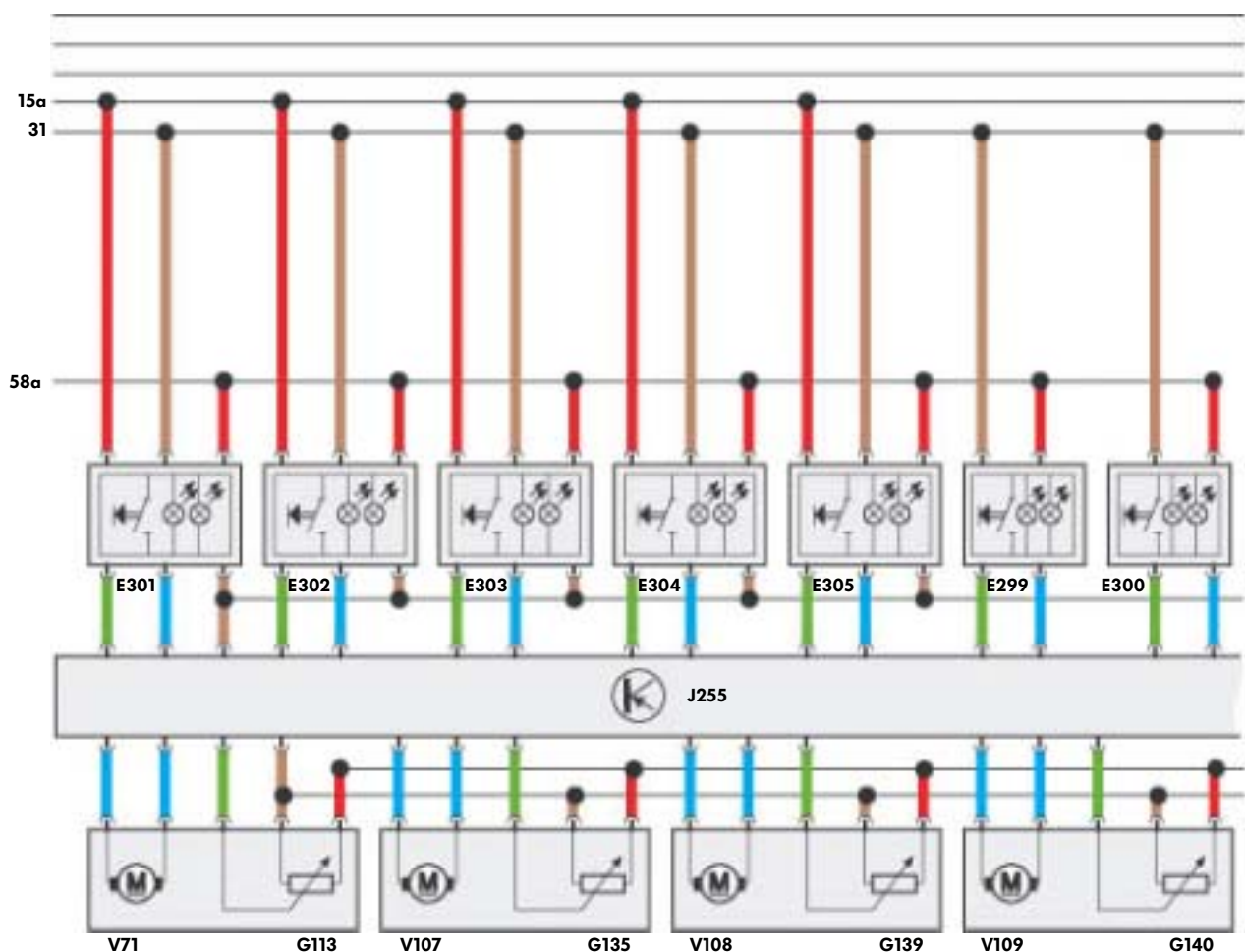
The adjustment changes the opening cross-section between high pressure and the pressure in the compressor crankcase. The crankcase pressure rises and the piston displacement causes a greater inclination of the swash plate.

Failure strategies

If the valve fails, the swash plate moves to a position perpendicular to the longitudinal axis of the compressor so that the cooling function is switched off.



Function diagram



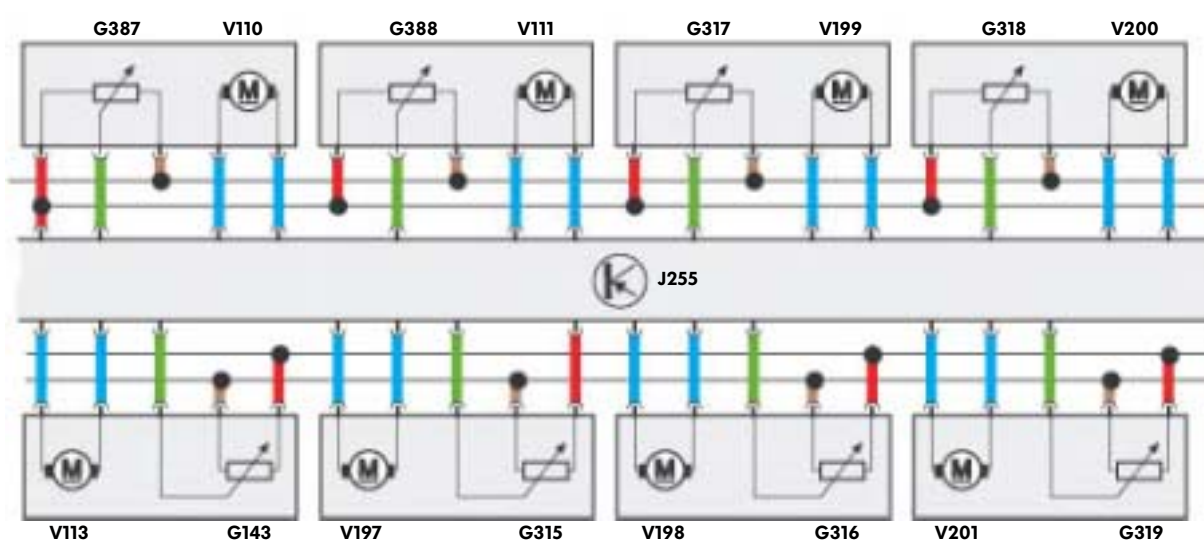
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E299 Button for rear left defrost
 E300 Button for rear right defrost
 E301 Button for front left vent
 E302 Button for front centre left vent
 E303 Button for front centre right vent
 E304 Button for front right vent
 E305 Button for temperature difference
 footwell/head area

J255 Climatronic control unit

V71 Air flow flap control motor
 V107 Defroster flap control motor
 V108 Control motor for
 left footwell flap
 V109 Control motor for
 right footwell flap

G113 Potentiometer -
 air flow flap control motor
 G135 Potentiometer in the
 defroster flap control motor
 G139 Potentiometer in the control motor for
 left footwell flap
 G140 Potentiometer in the control motor for
 right footwell flap



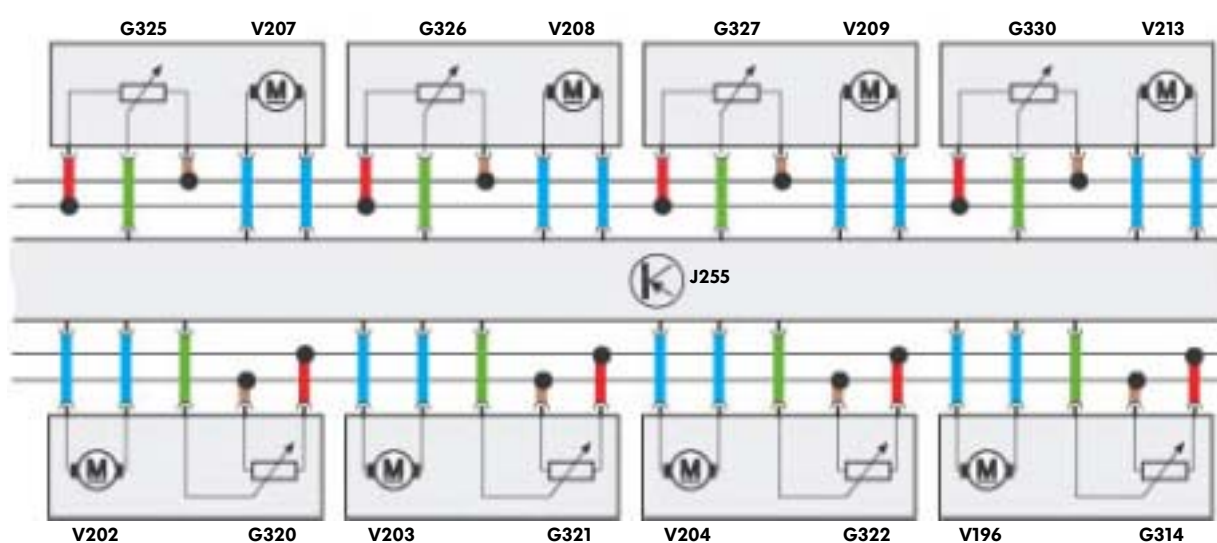
S271 149



- 67

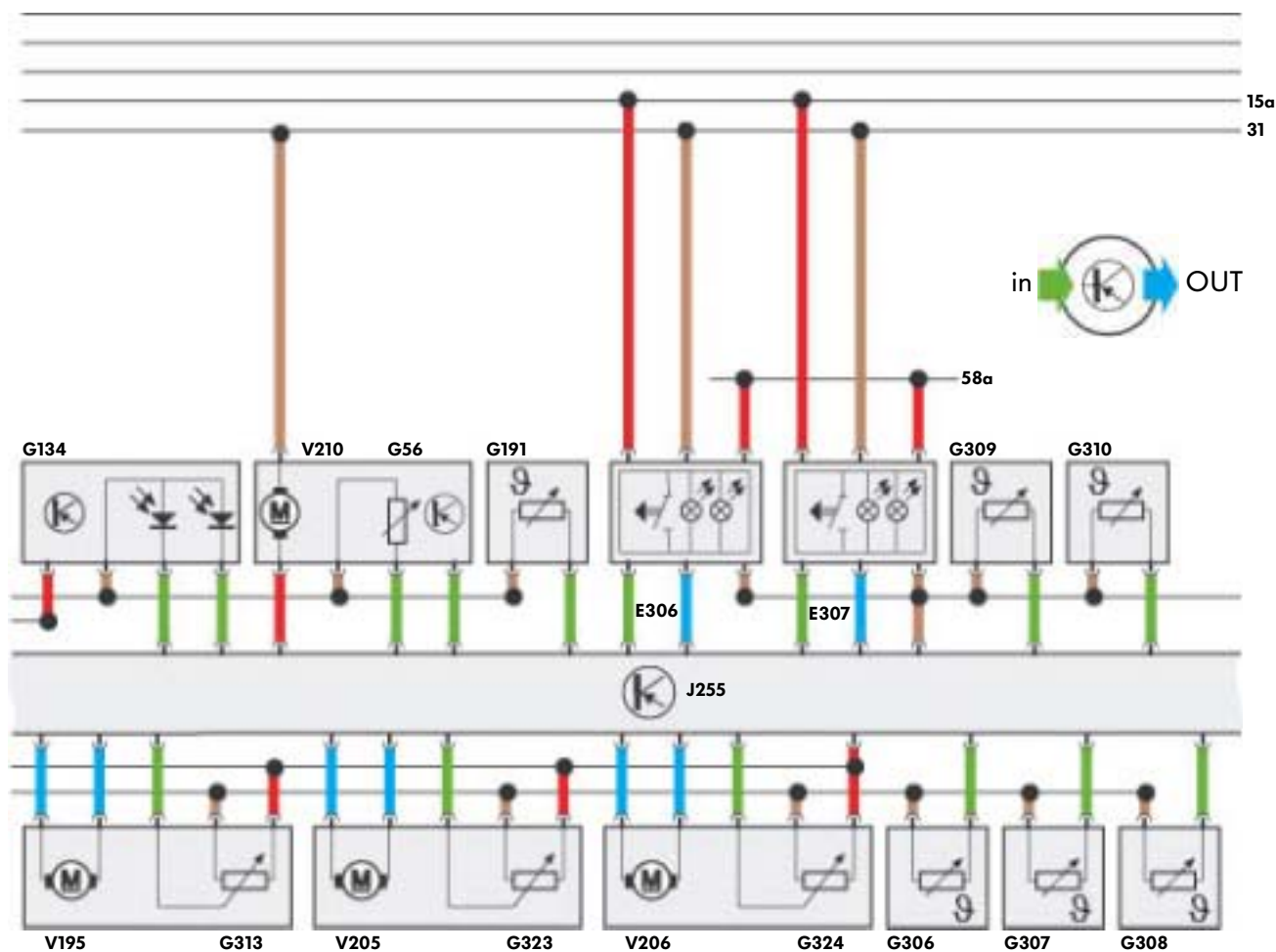
Function diagram

15a
31



S271_150

- | | | | |
|------|---|------|---|
| G314 | Potentiometer - rear left footwell/defroster flap control motor | V196 | Rear left footwell/defroster flap control motor |
| G320 | Potentiometer - control motor for rear left centre console warm air flap | V202 | Control motor for rear left centre console warm air flap |
| G321 | Potentiometer - control motor for rear right centre console cold air flap | V203 | Control motor for rear right centre console cold air flap |
| G322 | Potentiometer - control motor for rear left centre console cold air flap | V204 | Control motor for rear left centre console cold air flap |
| G325 | Potentiometer - control motor for left design panel | V207 | Control motor for left design panel |
| G326 | Potentiometer - control motor for centre design panel | V208 | Control motor for centre design panel |
| G327 | Potentiometer - control motor for right design panel | V209 | Control motor for right design panel |
| G330 | Potentiometer - control motor for indirect ventilation air flap | V213 | Control motor for indirect ventilation air flap |



E306 Button for rear left centre console vent

E307 Button for rear right centre console vent

G56 Dash panel temperature sensor

G134 Photo sensor 2 for sunlight penetration

G191 Sender for centre vent temperature

G306 Temperature sensor for left heat exchanger

G307 Temperature sensor for right heat exchanger

G308 Evaporator temperature sensor

G309 Rear left footwell temperature sensor

G310 Rear right footwell temperature sensor

G313 Potentiometer - rear right footwell/defroster flap control motor

G323 Potentiometer - control motor for right defroster/chest vent flap

G324 Potentiometer - control motor for left defroster/chest vent flap

V195 Rear right footwell/defroster flap control motor

V205 Control motor for right defroster/chest vent flap

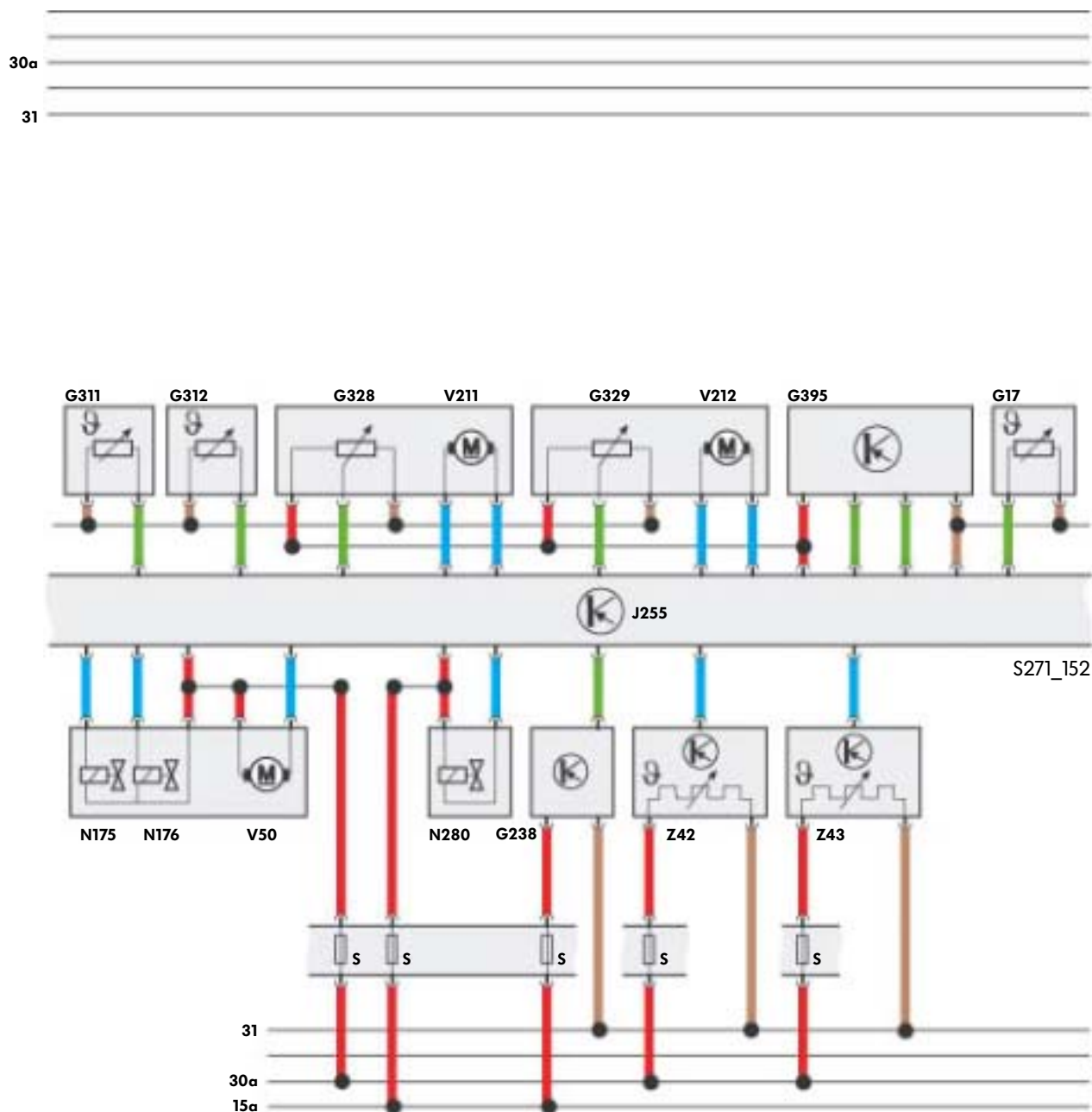
V206 Control motor for left defroster/chest vent flap

V210 Air blower for interior temperature sensor

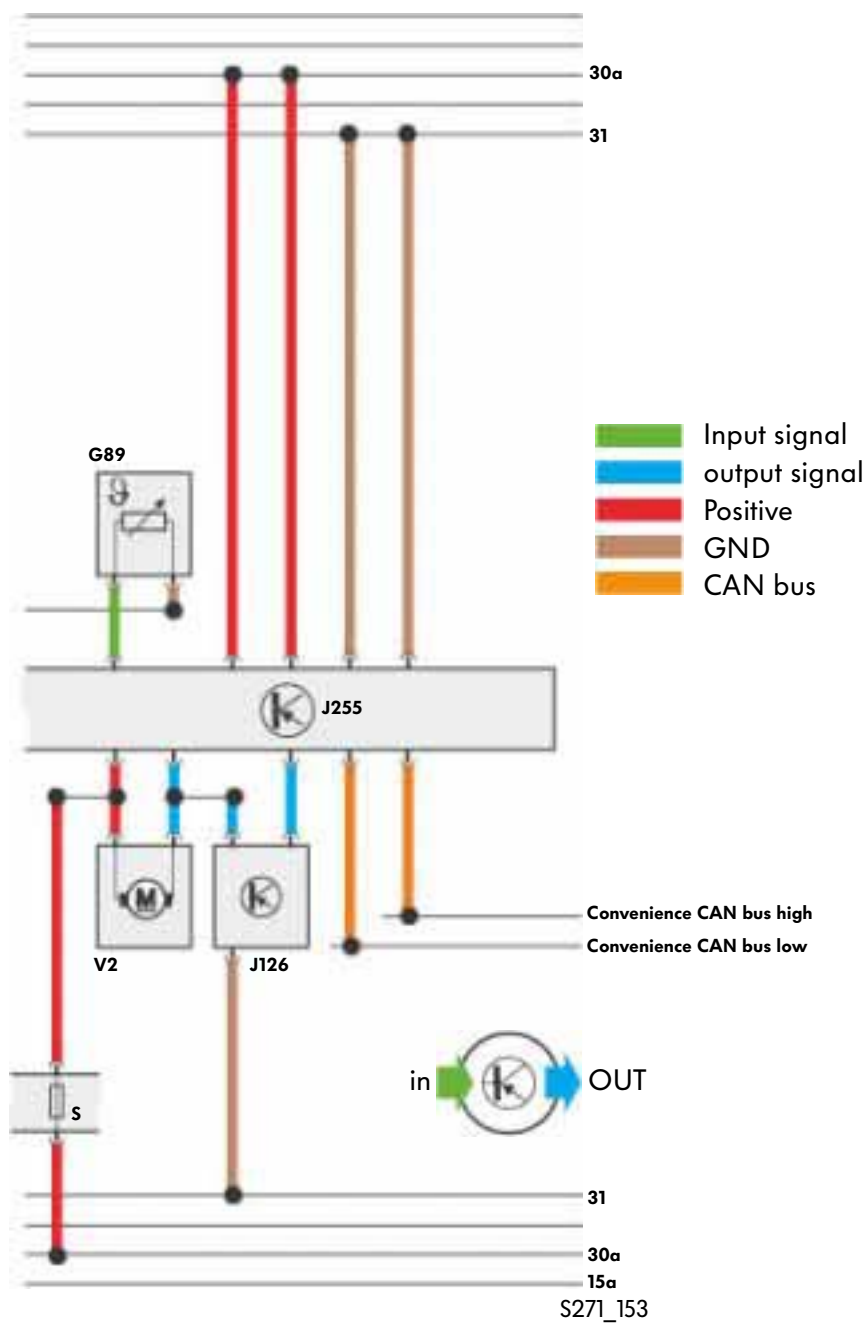
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Function diagram



- | | | | |
|------|---|------|---|
| G17 | Ambient temperature sensor | N175 | Left heat regulation valve |
| G238 | Air quality sensor | N176 | Right heat regulation valve |
| G311 | Rear left centre console temperature sensor | N280 | Regulating valve for compressor, air conditioning system |
| G312 | Rear right centre console temperature sensor | V50 | Coolant circulation pump |
| G328 | Potentiometer - control motor for right B pillar and footwell shut-off flap | V211 | Control motor for right B pillar and footwell shut-off flap |
| G329 | Potentiometer - control motor for left B pillar and footwell shut-off flap | V212 | Control motor for left B pillar and footwell shut-off flap |
| G395 | Sender for refrigerant pressure and temperature | Z42 | Heating element in the rear left footwell |
| | | Z43 | Heating element in the rear right footwell |



G89 Fresh air intake duct temperature sensor

J126 Control unit for fresh air blower

V2 Fresh air blower

S Fuse



Self-diagnosis

Diagnosis

The Vehicle Diagnosis, Testing and Information System VAS 5051 provides you with the operating modes:

- guided fault finding, and
- vehicle self-diagnosis

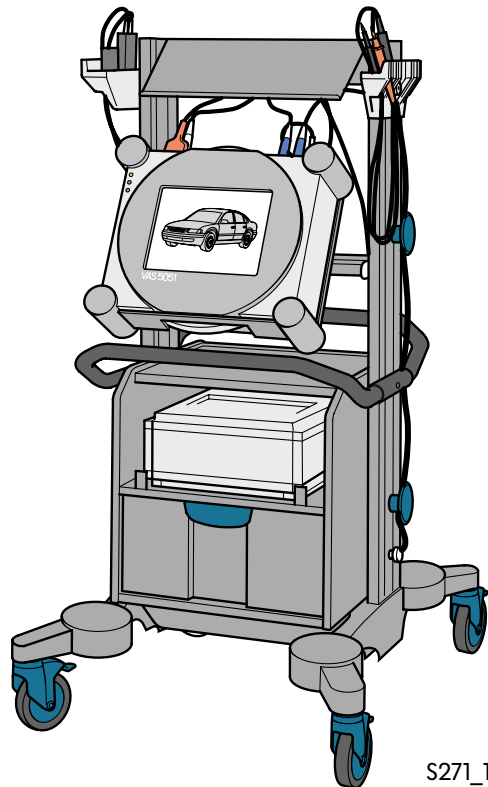
The '**Guided Fault-Finding**' mode tests all fitted control units in a specific vehicle for fault entries and automatically compiles an individual test plan from the results.

In conjunction with ELSA information, for example current flow diagrams or Workshop Manuals, this leads directly to the cause of the trouble.

Independently of this, you can compile your own test plan.

By selecting functions and components, the tests you select are included in the test plan and can be worked through in any order during the remainder of the diagnosis procedure.

Although the '**Vehicle Self-diagnosis**' mode can still be used, ELSA does not provide any supplementary information.



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More detailed information on the procedure and mode of functioning of the Guided Fault-Finding can be found in Chapter 7 of the Operating Manual for VAS 5051.

Test your knowledge

1. Which statements apply to the 4C Climatronic?

- ☐ a) Temperature and air distribution can be adjusted individually for four climate zones.
- ☐ b) The temperature control is in a range between 18°C and 28°C.
- ☐ c) The front information display and operation unit can be used to make all the settings for the heating and air conditioning system for the front and rear seats.
- ☐ d) The sunroof and the additional heating are integral parts of the climate control.

2. The ventilation concept includes:

- ☐ a) defrost function with window fogging detection,
- ☐ b) automatic and manual air recirculation function,
- ☐ c) indirect ventilation,
- ☐ d) direct ventilation.

3. As standard, the automatic air recirculation function is:

- ☐ a) switched on,
- ☐ b) switched off.

4. The automatic air recirculation function closes the air flow flap and opens the air recirculation flap:

- ☐ a) when pollutants are detected in the fresh air supply,
- ☐ b) when the vehicle is driven in reverse gear,
- ☐ c) when an RDS data message from the radio issues a smog warning,
- ☐ d) when the windscreen wipe/wash system is actuated.



Test your knowledge

5. The following signals are necessary for the automatic defrost function:

- ☐ a) air humidity in the vehicle interior,
- ☐ b) air humidity in the ambient air,
- ☐ c) temperature at the location of the air humidity measurement,
- ☐ d) windscreen temperature,
- ☐ e) temperature values of the four climate zones set at the front information display and operation unit.

6. The refrigerant circuit includes:

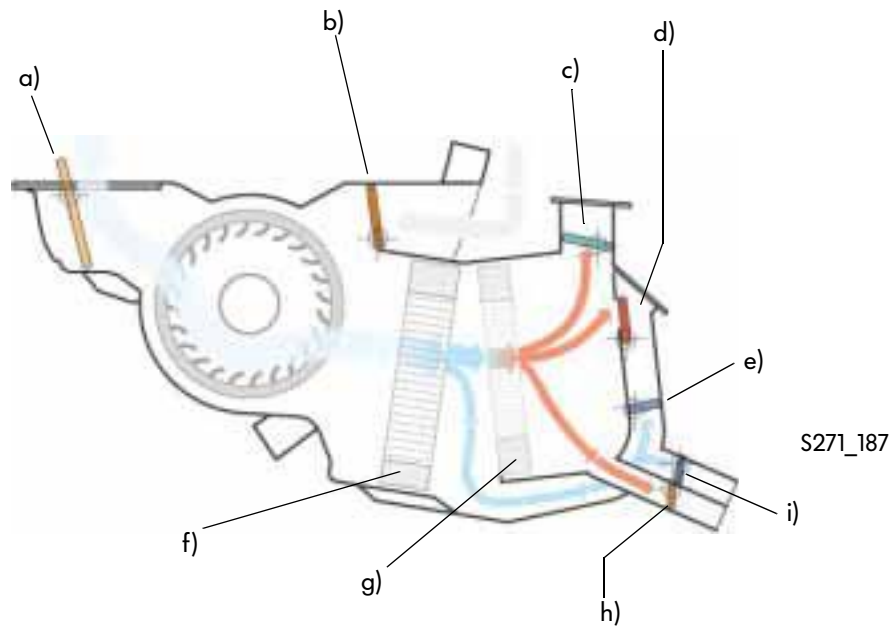
- ☐ a) two water-regulated heat exchangers,
- ☐ b) expansion valve,
- ☐ c) new sender for refrigerant pressure/temperature,
- ☐ d) temperature sensor behind the evaporator.

7. The Climatronic control unit:

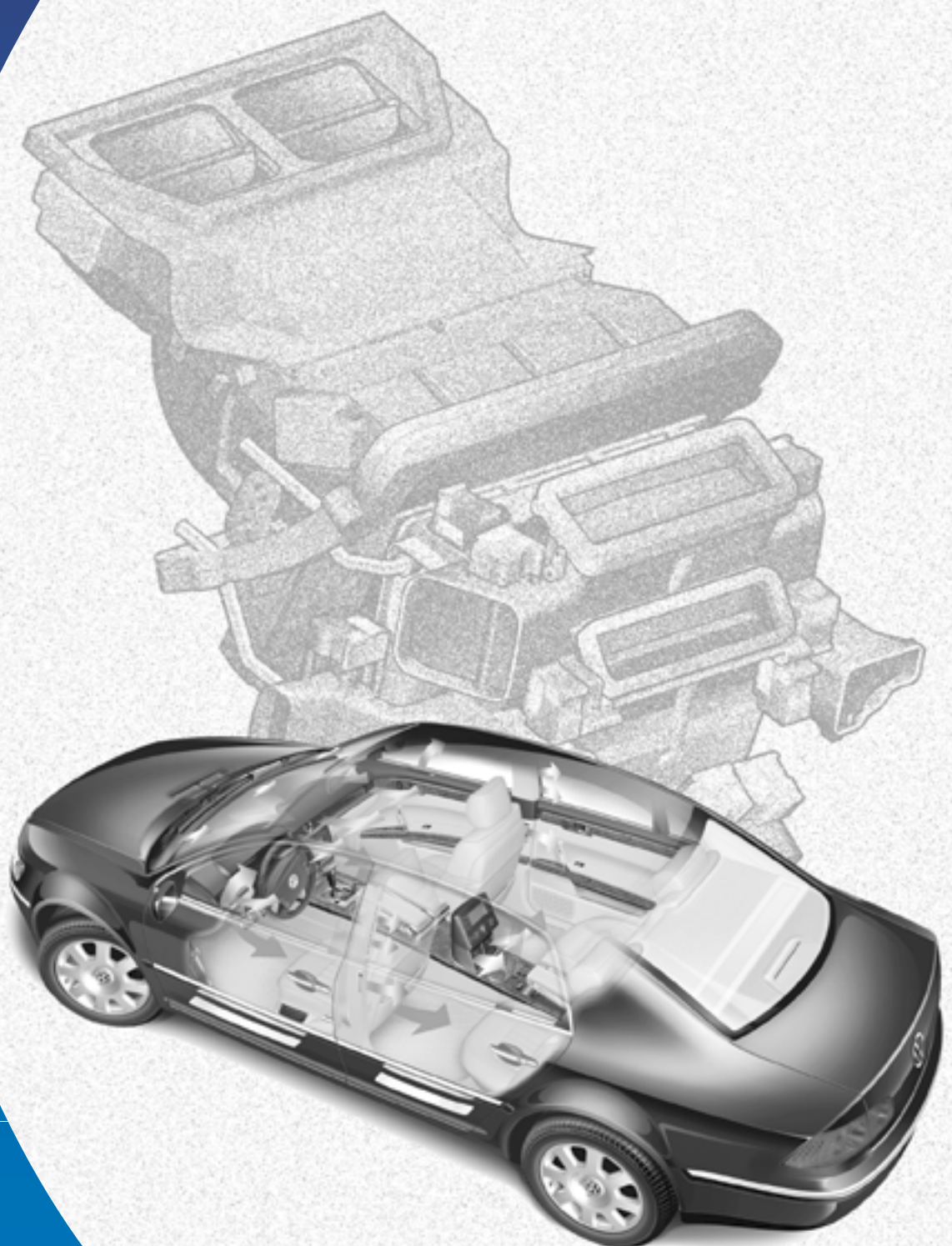
- ☐ a) is an integral part of the Convenience CAN bus,
- ☐ b) receives the signal from the air humidity sender via the control unit for steering column electronics J527,
- ☐ c) exchanges information with the Drive Train CAN bus via the diagnosis interface for data bus.



8. Fill in the following drawing of the air conditioner.




Solutions:
 1. a), b), c);
 2. a), b), c), d);
 3. b);
 4. a), b), d);
 5. a), c), d);
 6. c), d);
 7. a), c);
 8. a) air flow flap, b) air recirculation flap, c) defroster flap, d) front centre warm air flap, e) front centre cold air flap, f) evaporator, g) heat exchanger, h) rear centre warm air flaps, left and right, i) rear centre cold air flaps, left and right



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