8 Heating/Climate Control

General

All Cayenne Models have a heating and air conditioning system that meets maximum comfort demands. The design, functions and special qualities of the ventilation, air conditioning and heating systems are detailed in the section “Climate Control”.

85 Ventilation

Air flow (Air Ducts)

All Cayenne models have a charcoal filter that filters particles and pollen out of the outside air before the air enters the vehicle. The filter is integrated into the heating unit. It is located in front of the evaporator and can be pulled out of the heating unit, in the passenger side floor, for service purposes.

Should the outside air quality worsen, circulating air can be manually switched on. The 2 or 4-zone climate controls also have an air quality sensor that has standard values for “automatic switch to circulating air” (AUTO Circulating Switch, see section “Climate Control”). Based on these standard values, if the air quality worsens, circulating air will be automatically switched on.

The outside air that goes into the heating unit and is heated to the desired temperature is directed into the passenger area. A system of fixed and moveable vents provides the air flow. There are vents in the control panel that distribute the air to the driver and passenger sides. These also dehumidify and defrost the front windshield. Extra and individual personal vents are also in the rear middle console and in the B-column covering. Floor vents are also located under the front seats.

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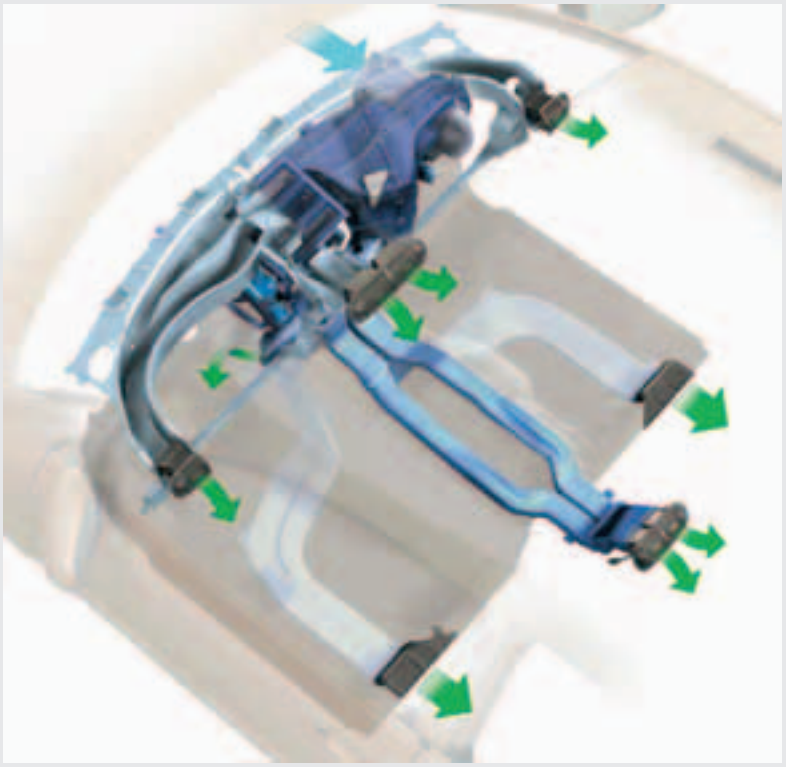
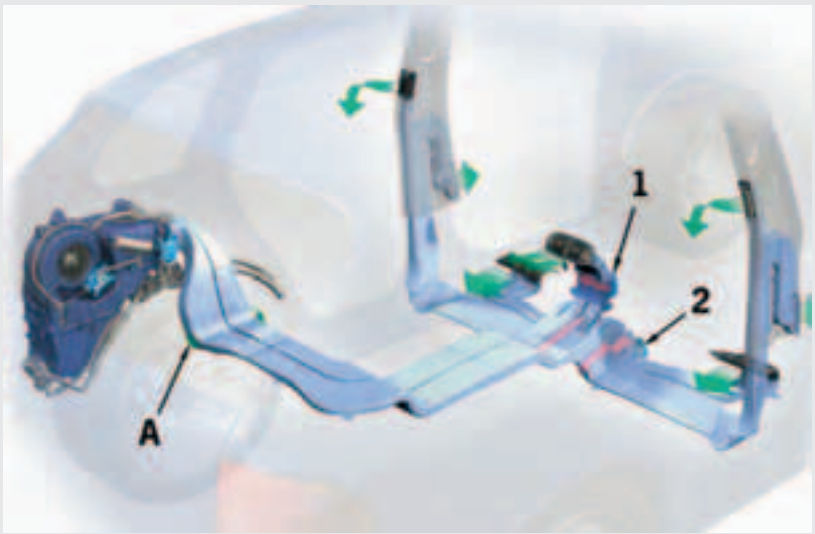
2-Zone Climate Control



8_02_03

With 4-Zone Climate Control, the following diagram shows the additional air ducts that enable air distribution in all zones.



8_03_03

1 – Motor Operator for the Middle Vent (covered, right side)

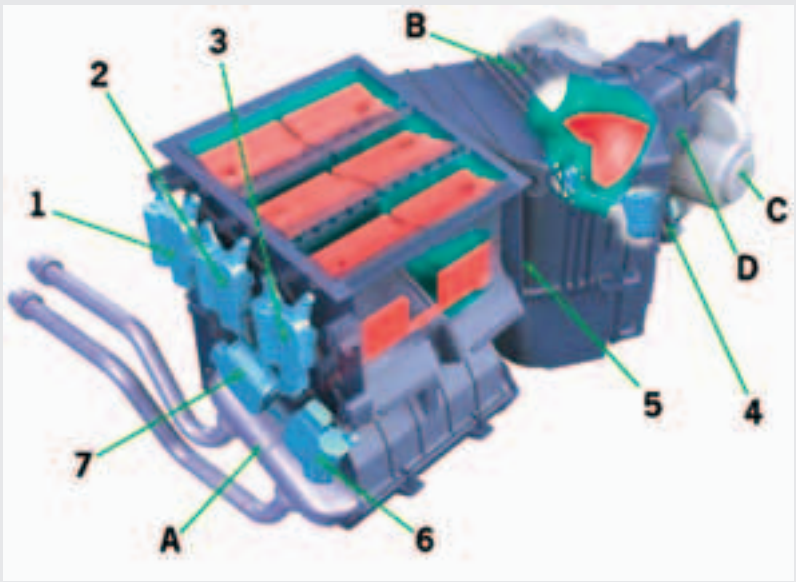
2 – Motor Operator for the Floor and B-column vents (right side)

A – Air Duct for Temperature Sensor (right side)

The heating unit for the additional climate control (4-zones) is located behind the left side wall covering in the trunk area. Only the front driver side and passenger side vents will receive air flow from the standard climate control. The vents for the second row seats will receive air flow only from the trunk air conditioning. The air distribution to the vents of the B-columns, the middle console and the floor will be controlled by this additional climate control. The separate rear air ducts run underneath the trunk floor. They fan out and replace the air distribution over the door coverings and the middle console.

Air and Valve Control (Heating Unit)

Before the outside or circulating air can flow into the various air ducts and be distributed into the passenger area, the entire air flow will be blown through the evaporator by the fans. When the air conditioning is on, the air is cooled and dehumidified. Following this, depending on the setting on the heating or air conditioning control panel, the entire flow of air, or only part of this air (depending on the setting) will flow through the heat exchanger in the heating unit. This air will then, through the motor operator for the separate valves in the heating unit (air mixing area), be directed to the air ducts and distributed.



8_04_03

With the 2-zone and 4-zone automatic climate control, there is also a potentiometer on the motor operator for the fresh and circulating air valve. This sends the current valve position to the control device.

1 – Motor Operator
for the Distribution Valve Defrost

2 – Motor Operator
for the Distribution Valve Side Vent

3 – Motor Operator
for the Distribution Valve Mid-Vent

4 – Motor Operator
for the Fresh/Circulating Air Valve
(partly hidden in the diagram)

5 – Motor Operator Temperature Mixing Valve (right side, hidden in diagram)

6 – Motor Operator
Distribution Valve Floor Vent

7 – Motor Operator
Temperature Mixing Valve (left side)

A – Heat Exchanger

B – Evaporator Housing

C – Fan Motor

D – Fan Control

The geometric design of the front heating unit housing is almost identical for the 4-zone or 2-zone climate control. With 4-zone climate control, the valves for the mid and side vents as well as the floor vents (please see the block diagram) can be controlled independently of each other. There are also three additional motor operators. They can be found on the right side of the air mixing area across from the motor operators in positions 2, 3 and 4 (see diagram 8_04_03).

In the rear heating unit the motor operators for air volume (fan) and the temperature mixing valve are integrated. Because the heating unit is designed symmetrically, the motors for the right and left sides are directly across from each other. The motor operators for the mid vents are directly on the air duct, right before the vent openings in the rear mid console. The motor operators for the floor/B-columns vents are located on the separators (see section “Air Distribution”, diagram 8_03_03) for each separate air duct.

After removing both screws (in “a”), the rear heating unit can be tipped slightly forward. In this position one can reach the fan motor or the motor operators for the left side.

1 – Motor Operator Air Volume (right side)

2 – Motor Operator Temperature Mixing Valve (right side)

A – Heat Exchanger

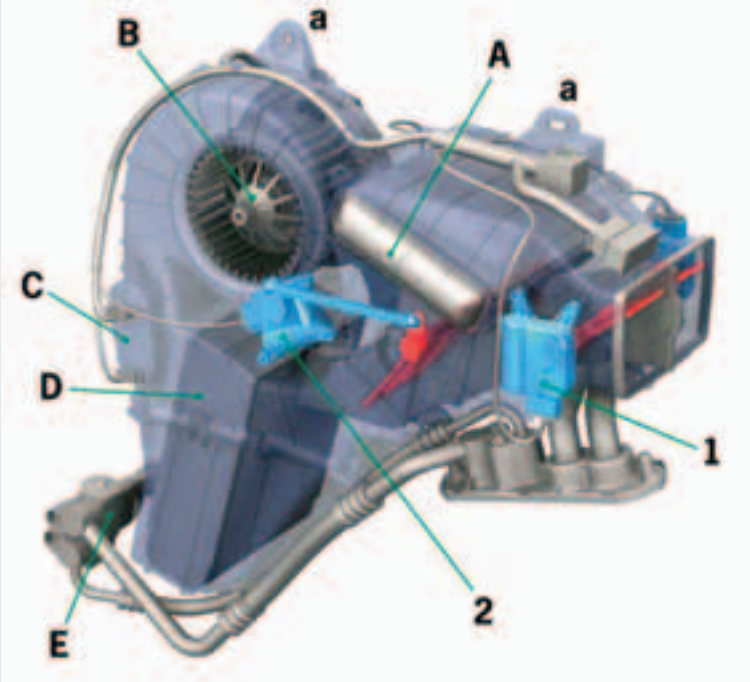
B – Fan Motor (motor on rear side)

C – Fan Control

D – Evaporator Housing

E – Expansion Valve

a – Screw Hole



8_05_03

All Cayenne Models have standard air conditioning that operates with the environmentally friendly cooling agent R134a. The following varieties of climate control are available:

– 2-zone climate control (Cayenne S series and Cayenne Turbo)
– 4-zone climate control (optional for all models)

Because the manual climate control will not be available until a later date in the US market and markets in the rest of the world, the descriptions in this Service Information Technology are focused mainly on the automatic climate control and the special characteristics of the 4-zone climate control.

2-Zone Climate Control

Functionality

With 2-zone climate control, the temperature for the driver and the passenger can be set separately and the volume of air (fan) for each side can be set the same. The two arc-shaped buttons are used that border the control/button panel. The button panel is under a hinged covering. The volume of air is controlled by the outside buttons. This is the same for the right and left side. The buttons on the inside control the temperature separately for the passenger and the driver.

An auto button is integrated in the control panel for the climate control – in the button bar over the liquid crystal display – that can switch on automatic operation. An LED in the button confirms that automatic operation is on. Depending on various factors (for example, amount of sun light, external temperature, air quality, etc.) the climate control will automatically control the chosen internal temperature.

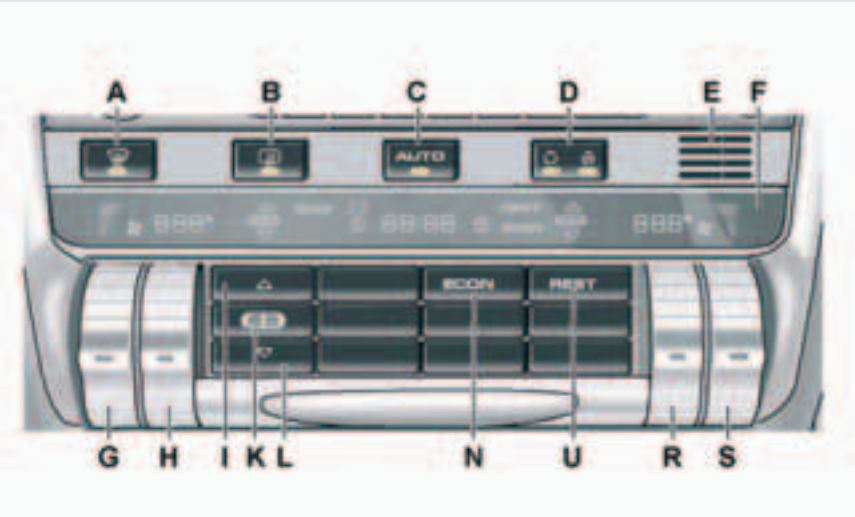
If the volume of air is turned down so far that the display shows “OFF” the flow of air will be interrupted because the fan is still (OFF operation). The temperature mixing valves will also close.

The internal temperature can be anywhere between 16 °C to 29.5 °C or 61 °F to 85 °F. If a lower or higher temperature is set the display will show the words “LO” or “HI”. The climate control is now operating at maximum cooling or heating capacity. Automatic operation is turned off and circulating air is activated.

After the vehicle is turned off, the 2-zone climate control has an extra button that will use heat left in the motor to further heat the passenger area for a maximum of 20 minutes. This is displayed with the word “REST”.

Should the outside air quality become extremely bad, one can manually switch over to circulating air. There is also an air quality sensor located in the external air entrance duct that has standard values for “automatic switch to circulating air” (AUTO Circulating Switch). Based on these standard values, if the air worsens (exhaust gases), the circulating air will be automatically switched on.

Operation (2-zone Climate Control)



8_07_03

A – Defost Front Windshield

B – Defrost Rear Window

C – Auto Button (Automatic Operation)

D – Automatic Circulating Air, Circulating Air

E – Temparature Sensor is ventilated by a motor (behind the slits)

F – Climate Control Display

G – Button for Air Volume (fan), left side

H – Button for Temperature, left side

I – Air Distribution for Front Windshield

K – Air Distribution for Middle and Side Vents

L – Air Distribution for Floor

N – ECON Button (Climate Compressor off/on)

U – REST Button (residual heat from the motor used with vehicles with 2-zone climate control)

R – Button for Temperature right side

S – Button for Air Volume (fan), right side

The following functions can be shown in the liquid crystal display:

- Individual temperature for left and right side
- Air volume (fan setting) for the left and right side
- Air distribution for the left and right side
  (symbol for air distribution shows only in the left side display)
- Time synchronized to the PCM/instrument cluster
- OFF (word only displayed on the left side)

The following section details various operating features:

A – Defrost Front Windshield

a) If the button is pressed once, the air conditioning goes on (intake temperature > 3 °C) and if selected, circulating air is used. The motor operator for the distributor valve for the defrost directs all air to the windows (mainly the front windshield) and the fan runs at maximum level (triggering at 12 Volts). The fan level can be manually controlled with both buttons.

The defrost function changes all previously active settings. They are, however, saved and can be activated by pressing the button “A” (deactivate the defrost function).

B – Defrost Rear Window

a) The length of time that the rear window defrost runs depends on the external temperature. At a temperature between 4 °C and 10 °C, the maximum heating time is about 16 minutes. After this time frame, the defrost will automatically shut off. When the temperature is over 10 °C, the defrost is not active.

C – Auto Button (Automatic Operation)

a) If the auto button is pushed – the integrated diode will light up – the air volume (fan), the air distribution and the individual temperature for the driver and passenger will be controlled. If something is manually changed with regards to the air volume or the air distribution setting, automatic operation will no longer function.

b) If the auto button is held down for 2 seconds or longer, the temperature choice of the driver will also be used for the passenger zone. If the temperature on the driver side is then changed, this will also change for the passenger side.

If the climate compressor is manually or automatically turned off, circulating air operation will end after about 3 minutes. This will avoid fogging of the windows (for the country code “JAPAN” circulating air remains on).

D – Auto Circulating Air, Circulating Air

a) The button for circulating air must be pressed once – the right integrated diode will light up – in order to select automatic circulating air. The external air flow will be controlled depending on the air quality.

b) If the button for circulating air is pressed two times – the left integrated diode lights up – the operating mode (manual) circulating air is active and only internal air will be recycled. To deactivate, push the button again.

The climate compressor will be automatically turned off at external temperatures under 2 °C and cannot be turned on manually by pushing the Auto button.

N – ECON Button (Climate Compressor On/Off)

a) If the ECON button is pressed – the display shows the word “ECON” – the climate compressor will turn off. In ECONomy operation no cooling under the external temperature is possible. By pushing the button again the compressor will be turned on – for external temperatures over about 2 °C.

In REST operation the temperature and air distribution will continue as closely as possible to the previous settings. The controller will thus open the temperature valves more and more as the cooling agent cools down. At the same time the fan will decrease the air volume (PWM signal). During REST operation the electronic water pump will be triggered.

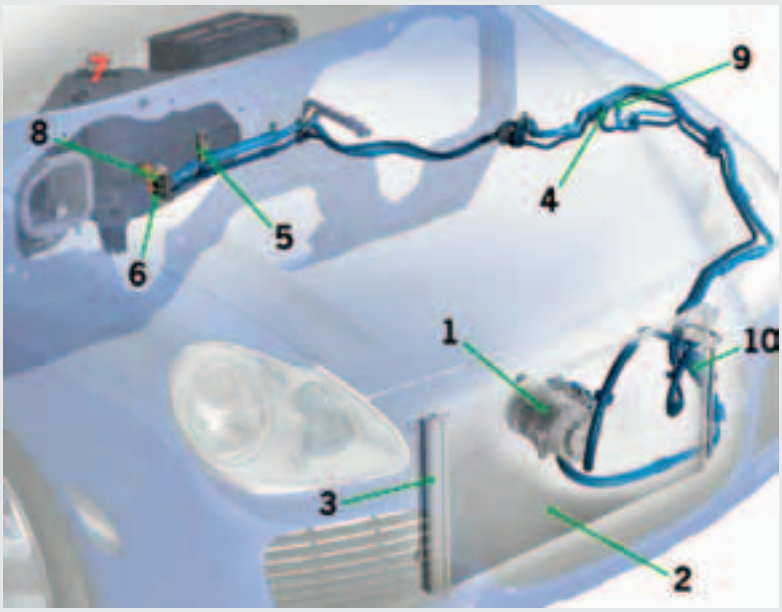
If the battery is running low, REST operation will not be possible.

U – REST Button (Residual Heat from the Motor for Vehicles with 2-zone Climate Control)

a) After the vehicle is turned off (clamp 15), if the REST button is pushed, residual heat from the motor can be used for a maximum of about 20 minutes to heat the inside of the vehicle. The display shows the word “REST”. If the REST operation is not turned on until 15 minutes after the ignition is turned off, only the 5 minutes left will be available. The settings of the climate control cannot be changed in REST operation. By pushing the REST button again, the function is shut off.

Cold Air Circulation (2-Zone Climate Control)

The cold air circulation in the Cayenne is set up so that the compressor and the expansion valve are the classic separations between upper and lower pressure sides.



8_08_03

The following sections/components are built in and shown in the direction of the cold air circulation:

1. (Regulator) Climate compressor (front side of the motor)
2. Capacitor (sandwich design with radiator)
3. Receptacle (pipe) for the drying cartridge (replaceable cartridges, integrated on the right outside of the capacitor)
4. Service connection (high pressure)
5. Pressure sensor is on the high pressure side
6. Expansion valve (flow)
7. Evaporator (evaporator cannot be seen in diagram)
8. Expansion Valve (return)
9. Service connection (low pressure)
10. Pressure damper (low pressure side right in front of the compressor near the left wheel housing)

Compressor

The Cayenne is equipped with a swash plate (regulated) compressor controlled on the air side that is similar in function and design to a compressor in a sports car. The gas-like cooling agent has a pressure of 10 – 30 bar after exiting the compressor and a temperature of about 100 °C. The compressor runs whenever there are RPMs and is not turned on until the clutch makes contact.

8_16_03

1 – Compressor

2 – Plug for Electronic Control Valve

3 – Oil Filter

If the temperature of the cooling agent is T < 118 °C the DME over the CAN Bus, near the controller of the climate control, will force the climate operation to be stopped. Over the electronic control valve, the zero request for the compressor will be set (both radiator vents running).

Through an electronic control valve, integrated into the compressor, the intake pressure (low pressure of the cold circulation about 1 – 3 bar) in the compressor housing has an effect on the swash plate. The control valve is triggered by a PWM signal from the control module of the climate control. The basis for the triggering of the control valve is taken from the signal of the evaporator temperature sensor. The basis frequency for the valve is 400 Hz.

Changeable PWM Signal (400 Hz)

Electricity Strength (Ampere)	Compressor Status
0.0 – 0.3	Off (no burden)
0.3 – 0.8	Continuous adjustment
> 0.8	Regulated

The piston stroke can be continuously varied, based on the electricity strength change of the PWM signal. A large stroke for large (cooling agent) capacity demands and a smaller stroke for smaller capacity demands. The higher the pressure, the further the swash plate can swing out in the direction of the zero request and can decrease the capacity demand of the compressor. Because the compressor works with a variable capacity demand, it is not necessary to control the cooling capacity of the climate control over the on and off switch of a compressor relay. This means that the compressor is turning when enough cooling capacity is there, but can also work with zero requests. In this case the compressor will turn with no burden.

The climate compressor is turned off at external temperatures of under about 2 °C and cannot be turned on manually by pushing the Auto button.

Pressure Damper

The pressure damper decreases noise. It is a simple cylindrical holder and is built into the low pressure side between the expansion valve and the compressor. It ensures that the working noise of the piston compressor cannot be heard in the passenger area. As can be seen in the following diagram, the damper is in front of the left wheel housing cover.

If the system pressure is critical at about 40 ± 4 bar the excess pressure valve is opened in order to protect the pipes from damage. After the pressure is regulated, the valve closes. The valve can be found on the left of the compressor next to the wiring exit on the high pressure side.

8_17_03

1 – Pressure Damper

2 – Wheel Housing Cover, left front

Capacitor

Le condenseur est intégré dans le module de radiateur (construction sandwich).

8_18_03

1 – Capacitor

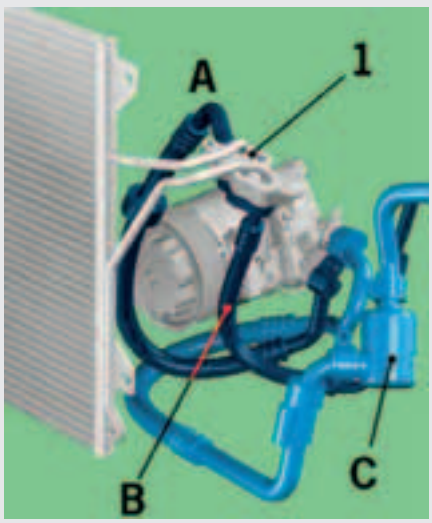
2 – Drying Cartridge Receptacle (Pipe)

3 – Transmission Oil Cooler

4 – Steering Oil Cooler

5 – Radiator (right external side)

The following diagram shows the connecting flange to the capacitor.



8_26_03

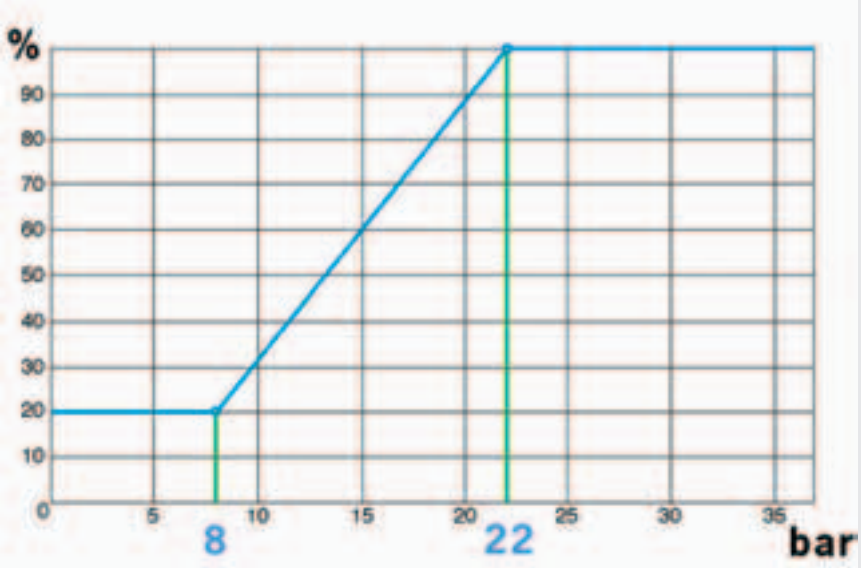
1 – Connecting Flange

A – Entrance pipe for capacitor flange

B – Exit pipe for capacitor flange

C – Pressure damper in the return pipe (low pressure)

The vertical direction of the capacitor pipes cools the entrance temperature from 100 °C to about 60 °C. In order to make this jump in temperature possible at any time, the smaller cooler vents are triggered (see the diagram in section DME, Cooler Vents). The following triggering of the cooler vents is possible, depending on the pressure sensor of the climate control.



8_23_03

X-axis: Pressure sensor value in “bar”

Y-axis: Triggering of the Cooler Vents in “%”

Drying Cartridge

The replaceable drying cartridge is in a special receptacle (pipe). This receptacle pipe is integrated into the right side of the capacitor (see section “Capacitor”). Should the cartridge need to be changed, it can be reached over the right side of the motor area (in the height of the main headlights) and over a service opening in the hood lock cover. The exact entrance, as well as the depth, can be found in the Technical Manual.

8_19_03

Cayenne

8_20_03

The drying cartridge does not have a set maintenance time frame.

To change the drying cartridge, the cooling agent must be emptied using a climate service device. After the rubber cover is removed, the safety ring (colored green in the following diagram) can be removed with special pliers. With a special tool out of the Porsche “slide hammer pulling kit”, the sealing covers can be pulled up and removed.

After the covers have been removed, the drying cartridge can be pulled out on the spacer stick. The cartridge unit is approximately 380 mm long. It is composed of a spacer and a sleeve with a netted insert that contains a moisture binding material. Until saturated, the drying cartridge can chemically bind 6 – 12 grams of water.

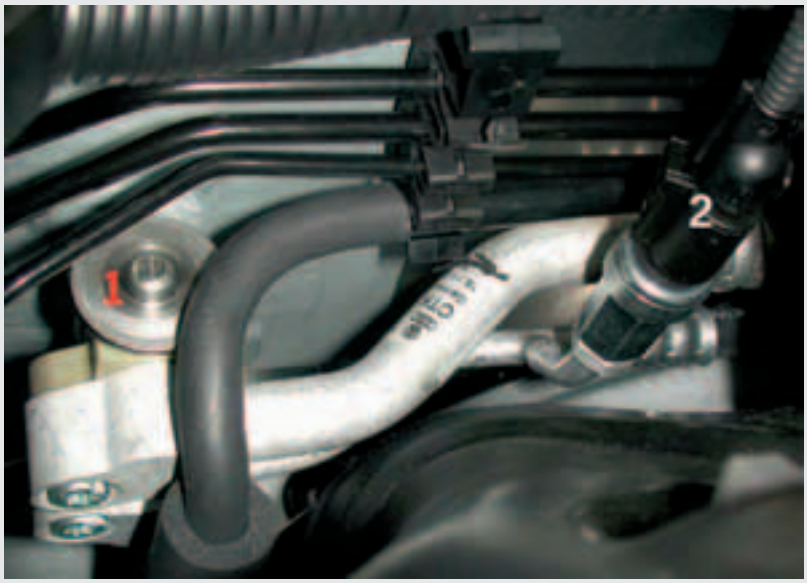
8_22_03

1 – Sleeve with netted insert

2 – Spacer stick

Expansion Valve (front)

The main duty of the expansion valve is to keep the pressure of the liquid cooling agent down to 1 – 3 bar. The valve is built in as a classical H valve with a membrane case on the upper side and can be used to change the volume of the gas-like cooling agent that is allowed to flow back to the compressor.



8_21_03

1 – Expansion Valve (Membrane Case)

2 – Pressure Sensor (High Pressure Pipe)

The pressure sensor shown in the diagram is described in section “Pressure Sensor Climate Control”.

Evaporator (front)

The evaporator can be found in the middle of the heating unit. The design is similar to that of the capacitors and has vertical piping. The evaporator will remove warmth from the air in order to vaporize the cooling agent. This will condense the humidity on the damper. This condensed water will then be directed through a run-off hose. The evaporator temperature sensor is positioned in the heating unit housing right behind the evaporator (see section “Evaporator Temperature Sensor”).

System Overview/Block Diagram (2-Zone Climate Control)

The block diagram below shows the most important actuators and sensors that are used for controlling the automatic climate control.

Actuators and Sensors
Motor Operator Distributor Valve Fresh Air/Circulating Air
Motor Operator Valve Defrost
Motor Operator Valve Middle Vent
Motor Operator Distributor Valve Side Vents
Motor Operator Distributor Valve Floor
Fan Controller (Air Volume Control), front
Signal Evaporator Temperature Sensor
Signal Intake Air Temperature Sensor (only 2 and 4-zone climate control)
Signal Air Quality Sensor (only 2 and 4-zone climate control)
Signal Pressure Sensor Climate Control
Climate Compressor (control of the electronic control valve)
Relay for the circulation pump (control line)
AC Valve Supply (free-wheeling arm)
AUX
CAN comfort HIGH
CAN comfort LOW

2-zone Climate Control (Control Device)
Signal Internal Temperature Sensor (behind the slits)

Actuators and Sensors; left side
Motor Operator Temperature Mixing Valve
Signal Temperature Sensor Middle/Side Vents
Signal Temperature Sensor Floor Vents
Signal Sun Sensor

Actuators and Sensors; right side
Motor Operator Temperature Mixing Valve
Signal Temperature Sensor Middle/Side Vents
Signal Temperature Sensor Floor Vents
Signal Sun Sensor

Actuators and Sensors (2-Zone Climate Control)

For the control of the fan and valves the following actuators and sensors are in the front heating unit and are used in 2-zone climate control:

– **Evaporator Temperature Sensor**

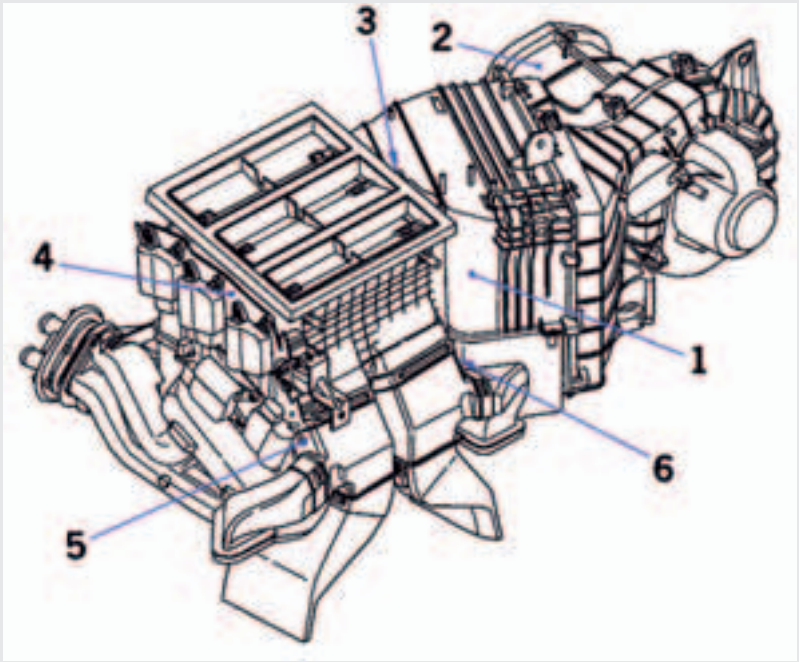
The evaporator temperature sensor will help avoid icing up of the air conditioning unit. The sensor is about 20 mm behind the evaporator. With this distance to the evaporator, a homogenous air flow temperature can be measured at all temperature levels. The temperature behind the evaporator will be used as the basis for the electronic control valve. The cooling capacity of the compressor will thus be influenced depending on the “standard value” of the evaporator temperature sensor.

These standard values can be between 3 °C and maximum 12 °C and will be calculated using the following influences:

– lowest desired outgoing temperature and

– external temperature

The following diagram shows the position of the various temperature sensors.



8_06_03

The evaporator temperature sensor receives some foreign warmth due to the warmth emanating from the heating unit housing so that the temperature measured there will be up to 3 °C different than the actual evaporator temperature. This temperature difference is compensated for by a performance characteristic that is set in the control unit.

1 – Evaporator Temperature Sensor

2 – Intake Air Temperature Sensor

3 – Temperature Sensor Mid/Side Vents (right side, position not visible in diagram)

4 – Temperature Sensor Mid/Side Vents (left side)

5 – Temperature Sensor Floor Vents (left side)

6 – Temperature Sensor Floor Vents (right side, position not visible in diagram)

Should the external temperature sensor not function, the function of the automatic climate control will still be maintained, but will use only the value of the intake air temperature sensor.

Sensor and vent motor are one unit.

– **Intake Air Temperature Sensor**

The intake air temperature sensor is located directly in the intake pipe of the heating unit. Over the intake air sensor and the external temperature sensor, located near the front bumper, system external air is calculated. This (theoretical) external air temperature is taken into consideration in the automatic climate control. Using this temperature value the – as detailed in section “Compressor” – compressor turns off at T < 2 °C (zero request) and the air volume (fan) changes. The front fan tension will be slightly increased at low system external temperatures.

– **Internal Temperature Sensor**

The temperature sensor, ventilated by a motor, is located right behind the slits in the control panel for the climate control and sucks air out of the internal area. It is used as a control value with the vent temperature sensors (see the System Overview/Block Diagram) for the control of the climate in the vehicle. The integrated air motor stops the measurement of residual heat. If the sensor or the ventilation motor is defective, an error will display in the error memory of the control module.

– **Air Quality Sensor**

An air quality sensor (ceramic element) in the intake duct provides information with regards to hazardous values in the external air. It can be found in the motor area under the cover of the windshield wiper motor, right behind the air intake on the left side. The sensor reacts to nitrogen oxide (NO_X), Carbon Monoxide (CO) and Sulphur Dioxide (SO_2), in other words, vehicle exhaust gases. The sensor prompts a switch over to circulating air.

– **Pressure Sensor Climate Control**

The pressure sensor is absolutely necessary as a measuring tool to evaluate the cooling system. It calculates the current pressure in the system and provides a PWM signal to the climate control module.

This signal is mainly used as a safety device to turn off the compressor when critical pressure exists.

External Temperature	Low Pressure Turn Off	High Pressure Turn Off
T > 5 °C	p < 1.4 bar	p > 32 bar
T < 5 °C	p < 0.5 bar	p > 32 bar

This signal is also used to cause a capacitor cooling for the DME. The need for the triggering of the capacitor vent and the capacitor cooling capacity is linearly based on the value received by the pressure sensor (see section “Capacitor”).

Cooling Agent Pressure	Vent Status	Vent Capacity
p = 0 > 8 bar	On	About 20 %
p = 15 bar	On	About 60 %
p > 22 bar	On	About 100 %

– **Vent Temperature**

The system offers the possibility of having a side blowing control along with the internal temperature control cycle. The control module will calculate the various current values of the vent temperatures. The calculation of the temperatures will take place for each side separately over the temperature sensors (middle/side and floor vents) – shown in the block diagram. For these sensors there is a standard value in the control module that will be determined depending on the current position of the air distribution valves. This will create a standard value for each side blowing and a current value. If the difference between the standard and the current value is too high, the position of the temperature mixing valves will be corrected.

– **Sun Sensor**

The sensor can be found in the middle of the dashboard and is a stereo-solar sensor. This means that the sun shining in the left and the right side can be measured separately and sent to the control module. The stereo sensor has a reference voltage of 5.0 Volt. The measured values have 2 different time constants, so that system chaos does not result, should the sun intensity only change for a moment (for example short tunnels, trees, etc). This means that a reaction only takes place after this set amount of time goes by. The middle time constant is different for increasing or decreasing sunshine.

increasing sun intensity: τ = 50 Sekunden

decreasing sun intensity: τ = 200 Sekunden

The valuation of this change of intensity is used to correct the air volume (Fan correction).

– **Electronic Control Valve Climate Compressor** (Control Line)

See section “Compressor”.

– **Relay Circulation Pump** (Control Line)

This relay supplies the additional circulation pump with voltage and will be activated for the following functions from the control panel of the climate control or over the control module of the DME:

a) Function Auxiliary Heat
(Control Panel Climate Control; see section “Auxiliary Heat”).

b) When using residual motor heat. Through this the heat exchanger throughput will be guaranteed when the motor is off (control panel climate control; a wiring plan is shown in section “Auxiliary Heat”).

c) If the heat capacity is too low, the relay is activated through the control panel to increase the heat exchanger throughput.

d) To cool off the turbos (after motor is turned off) the circulating pump is triggered over the relay (DME control module; see section “Cooling”).

When the circulating pump is activated, the heating cycle and the cool water cycle can be separated from each other over 3/2 way valves.

– **Motor Operators**

All motor operators have acknowledgement potentiometers that provide information about current valve position. The potentiometer is between a reference voltage of 5.0 Volts and the signal mass (0 Volt). This means that between 0 and 5.0 Volts, theoretically, an infinite number of valve positions are possible. An acknowledgement voltage of 5.0 volts is interpreted as a maximally opened valve. The voltage 0 Volt means that the valve is closed. The control module can recognize each end stroke by the increase of the electricity intake. The valve system can be diagnosed using a standard/current value comparison.

If a new motor operator is built in, this must be calibrated over the PST2 Tester. The new standard positions are saved based on the valve movements.

Unlike previous designs, the motor operator for fresh air/circulating air has a position acknowledgement capability, like all of the other motors. This signal is used for automatic air circulating operation, because the return to fresh air operation should happen smoothly.

– **Fan control** (control of air volume)

The air throughput in the heating control unit for the fresh air fan is set by a control module (fan control). The triggering takes place over a PWM signal. The controller changes the fan flow to the desired value and provides the filtered voltage to the low terminal of the fan motor for diagnostic purposes.

Fan Voltage [V]	**Fan Triggering [%]**
0	0
2	16
4	31
6	42
8	55
10	70
12	74
14	100

– **Capacitor Cooling** (Triggering)

See section “Capacitor”.

– **AC Valve Supply** (Free Wheeling Arm)

This free wheeling arm (free wheeling diode) is connected to the electronic control valve and functions as a reset device to suppress opposing inductions.

– **AUX**

This entrance is not yet used (wiring used later).

– **CAN-Bus Comfort HIGH and LOW**

The control panel of the climate control is connected to the CAN Bus. Over the CAN Bus the control unit receives information and values from the sensors that are not directly wired to the control panel.

What information is provided over the CAN Bus?

– Ignition on (Clamp 15) (basic pre-requisite for function of the climate control)

– Auxiliary heat (operation) on or off (signal recognized remotely)

– Country versions (realization of country specific fresh/circulating air control)

– Unité de la température (affichage en °C ou °F)

– External temperature
(sensor near bumper measures system external temperature)

– Dimming (signal from the instrument cluster)

– Driving speed (correction calculation of the system external temperature at high speeds = taking wind into consideration)

- Motor RPMs (decreases RPMS of the vent fan if the motor RPMs change)
- Time (the time is provided by the instrument cluster and displayed in the operating unit)
- Motor temperature (forced suppression of the compressor at critical cooling agent temperatures T > 118 °C)
- Off and reduction requests (for example, if the electricity is grounded, the compressor can be suppressed. This can also turn off the rear window heater or reduce the fan standard value.)

What information is provided by the control module of the climate control to the CAN Bus?

- Increased RPMs (to stabilize neutral when climate compressor is in use)
- Rear window heating (impulse to turn on for the control module of the central comfort electricity in the rear area when the button for rear window heating is pressed)
- Compressor (status of the compressor release)
- Heat off (status announcement when both front temperature valves are closed)
- Cooling agent pressure (cooling agent pressure, that is received from the pressure sensor as PWM signal)
- Command for capacitor cooling (the cooler vent control is linearly controlled, for climate control functions, by the value received by the sensor for cooling agent pressure)
- ECON function (ECON button pressed and compressor off = Zero request)
- Status of the motor residual warmth function

The additional climate control for the rear passengers is a “circulating air climate control” and uses internal air during operation.

The 4-zone climate control also has an air quality sensor – located in the external air duct of the climate control – that provides values for the “automatic circulating air control” (AUTO Circulating Air Button in the Button Bar). Using these values, should the air worsen, the vehicle automatically switches from external to circulating air.

88 4-Zone Climate Control

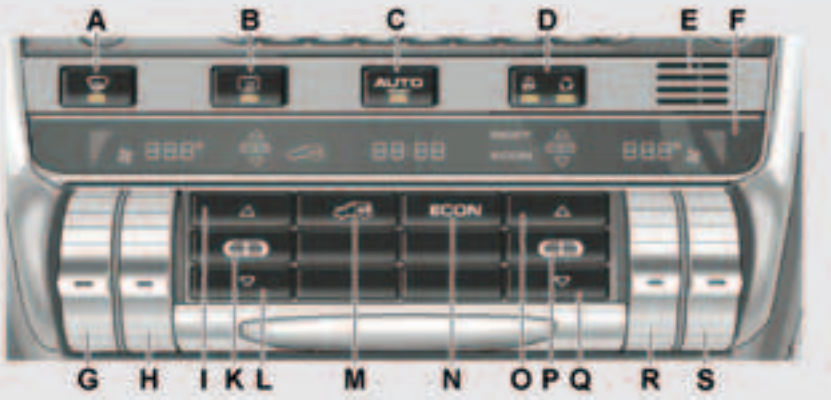
Functionality

If so desired, all Cayenne models can also have a climate control for the rear passenger area.

The additional climate control functions independently of the front climate control. The temperature, air volume (fan) and air distribution can be set individually for the left and right sides (zones). In combination with the 2-zone climate control in front, the climate in the inside of the vehicle can be set separately for all 4-zones.

Setting all 4-zones can be done from the front control panel. For both rear zones there is an extra button, under the hinged cover, on the front control panel. After shortly pressing this button, the settings for the rear area can be carried out.

It is also possible to control the rear climate from the back seats on the rear control panel (see rear control panel in the next section).



8_09_03

A – Defrost Front Windshield

B – Defrost Rear Window

C – Auto Button (automatic operation), REST Button (motor residual warmth for vehicles with 4-zone climate control)

D – Automatic Circulating Air

E – Temperature Sensor is Ventilated by a Motor (behind the slits)

F – Climate Control Display

G – Button for Volume of Air (fan), left side

H – Button for Temperature, left side

I – Air Distribution for the Front Windschield

K – Air Distribution for the Middle and Side Vents

L – Air Distribution for Floor, left side

M – Setting for Additional Climate Control for Rear Passengers

N – ECON Button (Climate Compressor off/on)

O – Air distribution to Front Windshield, right

P – Air Distribution for Middle and Side Vents, right side

Q – Air Distribution to Floor, right side

R – Button for Temperature, right side

S – Button for Air Volume (fan), right side

The front liquid crystal display can show the following functions:

- Selected temperature, individually for the left and right side, front and back
- Air Volume (fan setting), individually for the left and right side, front and back
- Air distribution, individually for the left and right side, front and back
- Time is synchronized to the PCM or instrument panel

The following section details various operating functions:

C – Auto Button (automatic operation), REST Button (motor residual warmth with vehicles with 4-zone climate control)

a) For the front and rear climate zones, automatic operation can be selected independently of each other. If the auto button is pressed in front or in back, the integrated diode will light up (for further functions see “Auto Button” in section, “2-zone Climate Control”).

b) In vehicles with 4-zone climate control, using the Auto button after the ignition is turned off, motor residual warmth can be used to heat the inside of the vehicle for a maximum of 20 minutes. Press the Auto button one time shortly (ignition is off). In the display the word “REST” can be seen. In REST operation, the climate control settings cannot be changed. If the Auto button is pushed again, this function will turn off (for further functions see “REST Button” in section “2-zone Climate Control”).

If the battery is low,
REST operation cannot be used.

D – Automatic Circulating Air

See section “2-zone Climate Control”.

G – Buttons for Air Volumes ((Fan), left side
(This example is valid for all possible settings)

a) The volume of air can be selected individually for all four climate zones.

H – Button for Temperature, left side
(This example is valid for all possible temperature settings)

a) The temperature can be selected individually for all 4 climate zones.

I – Air Distribution to the Front Windshield, left side
(This example is valid for all possible air distribution settings)

a) The air distribution can be selected individually for all 4 climate zones.

M – Setting the Extra Climate Control for Rear Passengers

a) Press the button one time (display will show that the additional climate control is on). The rear climate zones can now be set or controlled using the front control panel.

N – ECON Button (climate compressor on/off)
See section “2-zone Climate Control”.

The four buttons (on the inside) for auxiliary heat are described in the section “Auxiliary Heat”.

Rear Operation (4-zone Climate Control)

The control panel for the rear climate control can be found for all rear passengers between the front seats on the back of the middle console. The control panel is similar to the front 2-zone control panel and has the following extra buttons:

– Auto function

– Turn on seat heater

– Turn off seat heater

C – Auto-Button (automatic operation)

F – Climate Control Display (including display for the rear seat heating mode)

G – Button for Volume of Air (Fan), left side

H – Button for Temperature, left side, Seat Heater, left side

I – Air Distribution to the Vent in the Door on the Left Side

K – Air Distribution to the Middle Vent, left side

L – Air Distribution to the Floor, left side

O – Air Distribution to the Vent in the Door on the Right Side

P – Air Distribution to the Middle Vent, right side

Q – Air Distribution to the Floor, right side

R – Button for Temperature, right side, Seat Heater, right side

S – Button for Air Volume (Fan), right side

T – Seat Heater On/Off

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The following functions can be seen in the rear liquid crystal display:

– Desired temperature, individually for the left and right side
– Individual air volume (fan settings) for the left and right side
– Individual air distribution for the left and right side
– Seat heating mode, left and right side

The following section details various operating functions:

H – Temperature Button, left side

Seat Heater, left side (examples are for left rear)

a) Button for setting the temperature

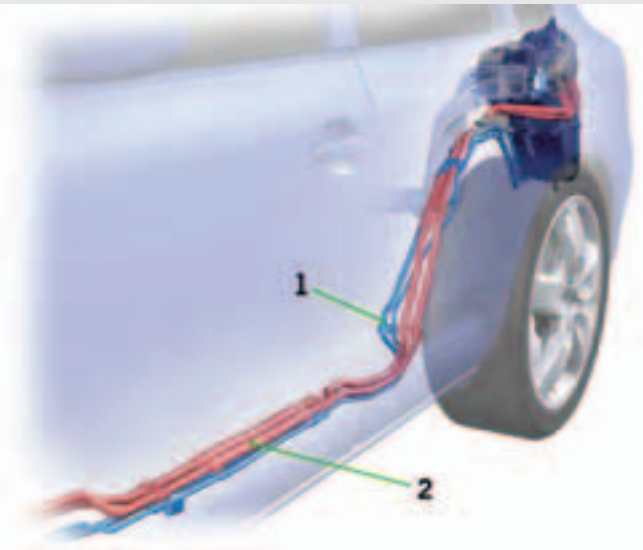
b) After the seat heater is turned on with the ON button (button “T”), the “H” button can set the warmth continuously. The “H” button can be pressed up for hot or down for cool. The warmth intensity will be shown in the display (horizontal bar).

The seat heater is functional when the ignition is on. When the seat heater is turned on (Button “T”) the display will switch over to seat heater mode for about 10 seconds.

Further functions on the rear control panel are identical to those on the front control panel and can be thus explained.

When the child safety lock is active, nothing can be changed or set on the rear control panel (display is off).

Cooling Cycle (4-Zone Climate Control)



8_11_03

1 – Cooling acknowledgement for the rear evaporator

2 – Line for the heating circulation for the rear heat exchanger

The wiring connection of the cooling and heating circulations to the rear heating unit can be seen in section “Air and Valve Control” and in diagram 8_05_03.

The rear cooling circulation is directly connected to the high and low pressure sides of the frontal cooling circulation through T-pipes. The T-pipes are located in front of the left front wheel housing cover near the pressure damper (for the position of the pressure damper see section “2-zone Climate Control” diagram 8_17_03). The cooling agent flows in the direction of the circulation through the following parts:

1. T-pipe (flow)
2. Expansion Valve (flow)
3. Evaporator (rear)
4. Expansion Valve (return)
5. T-pipe (return)

Expansion Valve, Rear (4-Zone Climate Control)

The position of the expansion valve can be seen in section “Air and Valve Control” in diagram 8_05_03. For valve functionality, see section “Expansion Valve (front)”.

Evaporator, Rear (4-Zone Climate Control)

The position of the evaporator can be see in section “Air and Valve Control” in diagram 8_05_03. For evaporator functionality, see section “Evaporator (front)”.

System Overview/Block Diagrams (4-Zone Climate Control)

The block diagram shown here for the front control module shows the most important actuators and sensors that are necessary for the control of the 4-zone climate control. Many of the actuators and sensors that are used are similar to those in the 2-zone climate control but have a different wiring scheme in the control module.

Actuators and Sensors
Motor operator distribution valve fresh air/circulating air
Motor operator distribution valve defrost
Fan Control (control of volume of air) front
Signal Evaporator temperature sensor
Signal intake air temperature sensor (only for 2 and 4-zone climate control)
Signal air quality sensor (only for 2 and 4-zone climate control)
Signal pressure sensor climate control
Climate Compressor (control line for the electronic control valve)
Relay for circulation pump (control line)
AC valve supply (free wheeling arm)
CAN comfort HIGH
CAN comfort LOW

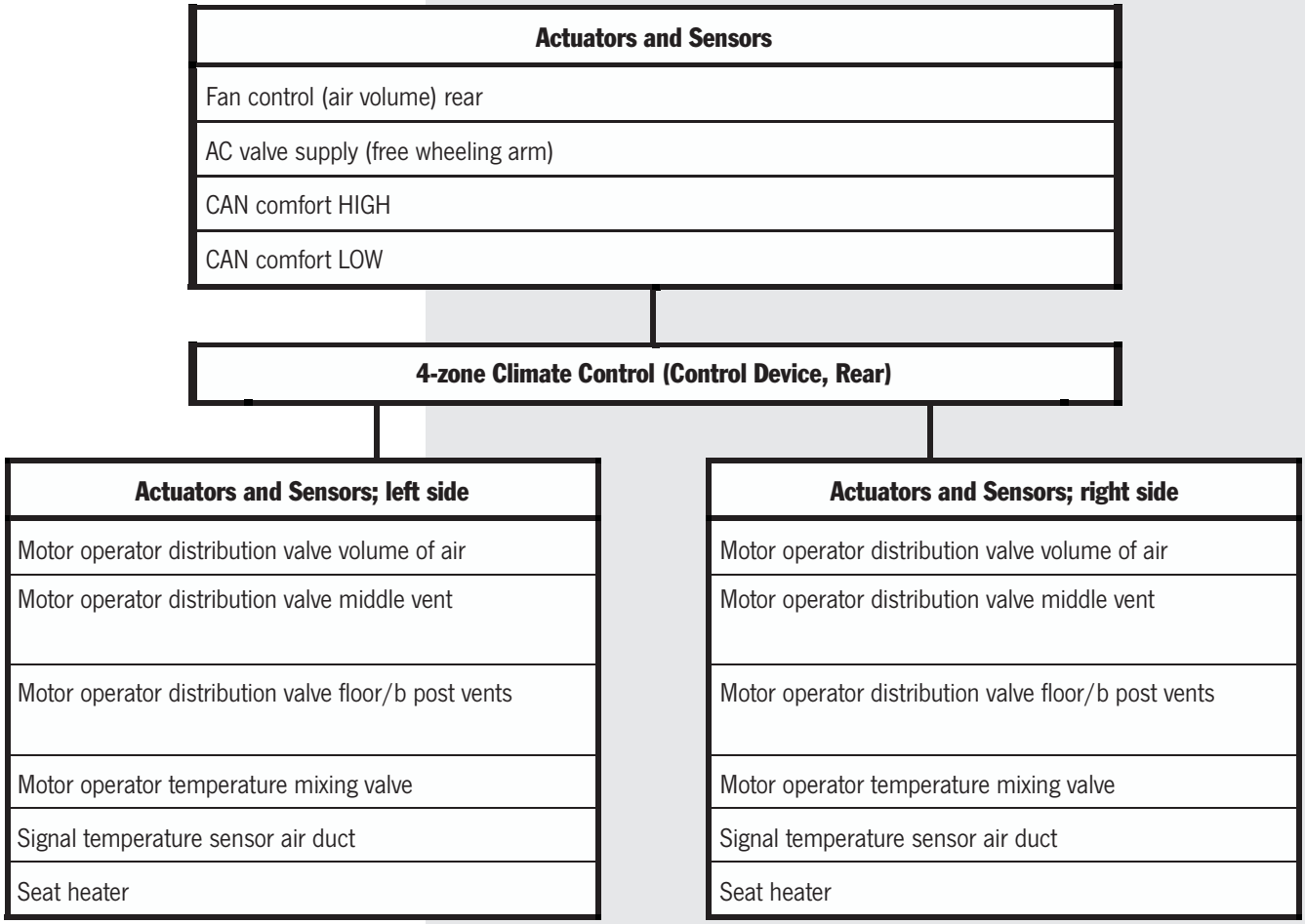
4-zone Climate Control (Control Device, front)
Signal internal temperature sensor (behind the slits)

Actuators and Sensors; left side
Motor operator distribution valve middle vent
Motor operator distribution valve side vent
Motor operator distribution valve floor
Motor operator temperature mixing valve
Signal temperature sensor middle vent
Signal temperature sensor floor vent
Signal sun sensor

Actuators and Sensors; right side
Motor operator distribution valve middle vent
Motor operator distribution valve side vent
Motor operator distribution valve floor
Motor operator temperature mixing valve
Signal temperature sensor middle vent
Signal temperature sensor floor vent
Signal sun sensor

Cayenne

The following block diagram shows the most important actuators and sensors that are connected to the rear control module.



Actuators and Sensors (4-zone climate control)

The same actuators and sensors are used to control the 4 climate zones that were shown in section for 2-zone climate control. Along with the rear fan and valve control, the following sensors are used in the rear zones:

– **Motor Operator Air Volume**

With 4-zone climate control it is possible to distribute the air created by the fan motor both separately and individually to each rear zone. The positions of the two motor operators for this can be see in section “Air and Valve Control” diagram 8_05_03.

– **Motor Operators Middle Vent and Floor/B-Column Vent**

The motor operators for the middle vents can be found directly on the air duct, right in front of the vent openings in the middle console. The motor operators for the floor/b-column vents are located on the separations of each air duct (see section “Air Flow” diagram 8_03_03).

– **Temperature Sensor Air Duct**

For functionality, see section “2-zone Climate Control”. Both sensors are integrated into the air duct approximately 500 mm after the exit pipe of the heating unit. Both ducts are uncoiled here at the same height as the metal from the underbody (see section “Air Flow” diagram 08_03_03).

– **Fan Control (Air Volume Control), rear**

For functionality, see section “2-zone Climate Control”. The position of the control module (fan control) can be seen in section “Air and Valve Control” diagram 8_05_03.

Technical Data for the Air-Conditioning System(s)

Cooling Agent	R 134a (cooling circulation with pressure damper)
Cooling Agent Volume (2-zone)	700 + 50 g
Cooling Agent Volume (4-zone)	1050 + 50 g
Cooling Agent Oil	200 g (+ 100 g for 4-zone climate control)
High Pressure/Low Pressure Switch	Approx. 32 bar/approx. 1 bar (depending on temperature)
Excess Pressure Valve (pressure relief)	40 ± 4 bar
Compressor	Air-side controlled swash plates (regulator) compressor
Cooling Module (sandwich design)	• Capacitor with horizontal piping (integrated drying cartridge) • Radiator • External transmission oil cooler • External steering oil cooler
Dryer	Replaceable drying cartridges (integrated into the right outside of the capacitor)
Expansion Valve, front and rear (4-zone)	Valve controlled by cooling agent return
Evaporator	Horizontal piping
Solar Sensor	Dual sensor for right/left recognition of the direction of shine
Temperature Control (2-zone)	Can be separately controlled for left and right
Temperature, Air Volume, (Fan rear) and Air Distribution Control (4-zone)	Can be separately controller for left and right and front and back
Filter System	Charcoal filter for particle and pollen filtering
Air Quality Sensor	Recognition of fresh air quality

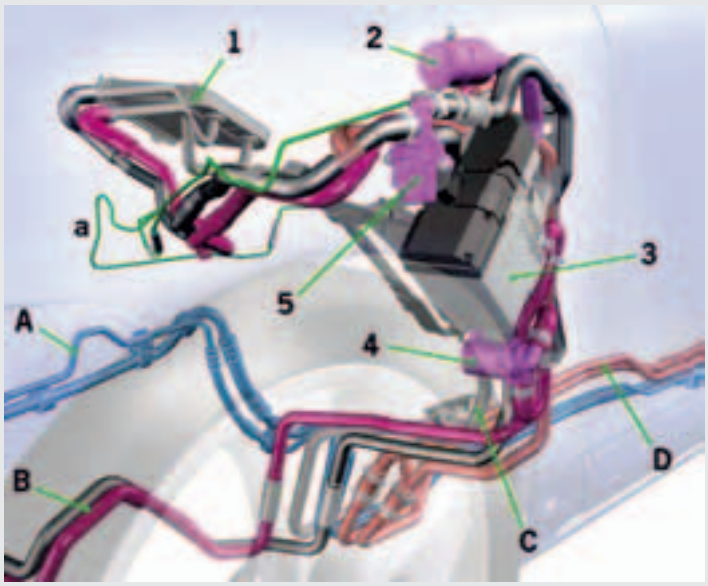
Auxiliary Heater (Water-Added Heat)

Functionality

As an option, the Cayenne can be equipped with auxiliary heater. This water-added heater uses the heating circulation connected to the cooling water circulation of the motor. This water flow is heated by the auxiliary heater when the vehicle is standing still. An electronically controlled valve (3/2 way valve) closes the heating circulation off from the rest of the cooling water circulation when the auxiliary heater is running, in order to stop a warming up of this. Over the heat exchanger of the heating circulation, the hot air is directly sent to the inside of the vehicle through the fan. If the vehicle has 4-zone climate control, the rear heat exchanger is integrated into the auxiliary heating system.

The necessary fuel needed for combustion is directed to the auxiliary heater or combustion area through a pipe that is separately connected to the fuel tank. The fuel lines run under the underbody. The auxiliary heater and all parts belonging to it, for example the circulation pump and the 3/2 way valve, can be found under the front left fender behind the wheel housing (extension of the A column). The circulation pump, the air intake muffler and the valve are separate units. The muffler minimizes noise during combustion.

The diagram shows the auxiliary heating components with the connection lines for the rear heat exchanger.
The exhaust that is generated during combustion is released on the drivers side near the extension of the A column.



8_12_03

Do not operate auxiliary heater in closed areas (for example, garages) due to danger of poisoning.

1 – Heat exchanger (front)

2 – Air intake muffler

3 – Auxiliary heater

4 – Circulation pump

5 – 3/2 way valve

a – Fuel lines of the auxiliary heating

A – Cooling acknowledgement for rear evaporator (see diagram 8_11_03)

B – Front and back running lines for the heat circulation (connection to motor)

C – Exhaust line for auxiliary heat

D – Front and back running lines for rear heat exchanger (see diagram 8_11_03)

Operation (Example – Water-Added Heater)

The operation and setting of the auxiliary heater takes place over the front control panel of the climate control (under the cover in the middle console). When the auxiliary heater is running, the remaining running time is shown on the display (see operating device in next section).

A – On/Off button
for auxiliary heat
or auxiliary ventilation

B – MENU button
to choose the functions
of the auxiliary heat

C – “Lower” Setting

D – “Higher” Setting

8_13_03

A programmed “turn on” time (in a saved spot) will not be automatically activated. A time must first be selected and activated in order to use the auxiliary heater. This time can be set up to 24 hours previous.

The menu control and the programming of the “turning on” times for the auxiliary heater are described in detail in the operating manual.

Auxiliary heater can be operated independently of the ignition position. It has three independent save positions for the programming of the “turning on” time. Each save position lets the turning on time as well as the functions of the auxiliary heater or auxiliary ventilation be programmed. The necessary fan operation will turn on slightly later in order to avoid flow of cold air, so that only warm air flows into the vehicle. When the auxiliary heater is running, only one save position can be active (that has been programmed and selected).

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To set auxiliary heater on the control panel of the climate control – you can turn the device on or off with a remote control (only RoW). If the climate control panel was used to turn on the auxiliary heat, the heat cannot be turned off using the remote. Setting using the remote is not possible.

When buttons are pushed on the remote, the vehicle must be in sight.
A light diode will light up signalizing that the signal is being sent.

The remote control has a range of about 500 m. This range may be shorter depending on possible obstructions.

For more on the topic signal reception of the remote control see the section “Integrated Antenna System”.

Wiring Plan for Auxiliary Heater (Water-Added Heater)

The diagram shows the wiring plan for the Cayenne Turbo.
Status: Auxiliary heat on (heating fans running)

1 – Heat Exchanger (front)

2 – Heat Exchanger (rear)

3 – Auxiliary Heater

4 – Circulation Pump

5 – 3/2 Way Valve

6 – Non-Return Valve

7 – Motor

a – Cooling agent distribution valve

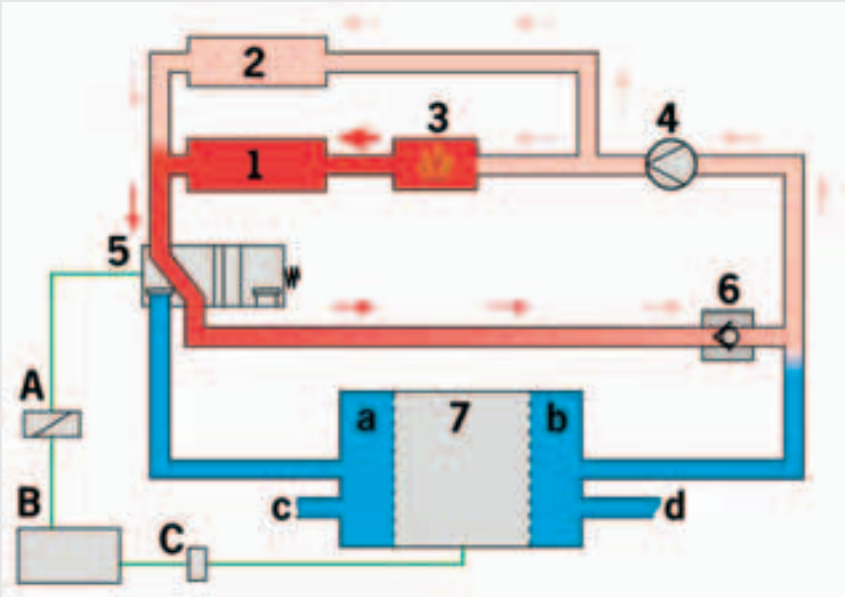
b – Cooling agent collector pipe, motor block

c – Motor coolant return (thermostat not shown)

d – Motor coolant flow

A – Magnet valve

B – Control device of the climate control



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Control line 3/2 way valve

Return stroke valve (vacuum)

Water line (cool)

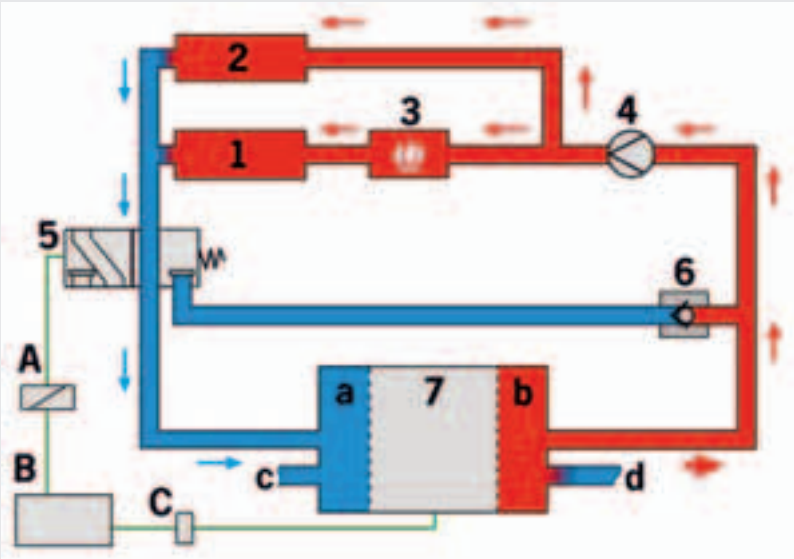
The diagram above shows the wiring plan for the used/warmed heating circulation that is separated by the 3/2 way valve from the cool water circulation. The valve is located above the auxiliary heat module and is impinged on, for auxiliary heat function, by the climate control module (operating device) over a magnet valve with vacuum pressure.

The following diagram shows the wiring plan for the Cayenne Turbo

Status:

1.) Motor residual heat (heating fans running)

2.) Supports heating capacity (motor and heating fans running)



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The diagram shows the wiring plan for the use of the residual motor warmth function combined with the optionally equipped auxiliary heater. To use the residual warmth function, only the circulation pump is needed. For vehicles without residual heat, positions 3 and 5 are not integrated into the return of the heating circulation (components A and B – for the triggering of the 3/2 way valve – are also no longer needed).

The entire cooling circulation (motor cooling) is detailed in section “Cooling”.

1 – Heat exchanger (front)

2 – Heat exchanger (rear)

3 – Auxiliary heat

4 – Circulation pump

5 – 3/2 way valve

6 – Non-return valve

7 – Motor

a – Cooling agent distribution line

b – Cooling agent collector, motor block

c – Motor cooler return (thermostat not shown)

d – Motor cooler flow

A – Magnet valve

B – Control device of the climate control

Control line 3/2 way valve

Water line (heated up)

Water line (cool)