

Convenience electronics

Displays on "opening" the roof

To guarantee a high level of safety, roof movement is accompanied, depending on the equipment variant, by optical, acoustic and/or text displays/indications. The acoustic indication is a gong, which is sounded once.



	Low-line		Mid-line			High-line		
Situation	Indication (Optical/ acoustic)		Indication (Optical/acoustic/text)			Indication (Optical/acoustic/text)		
Open sliding roof and side windows					Convertible roof operation			Convertible roof operation
Open C segment					Convertible roof operation			Convertible roof operation
Open rear lid					Rear lid pivots out!			Rear lid pivots out!
Stow roof package					Convertible roof operation			Convertible roof operation
Close rear lid					Convertible roof operation			Convertible roof operation
End "opening" process					Convertible roof open			Convertible roof open
On interruption of convertible roof movement					Continue convertible roof operation			Continue convertible roof operation

Displays on "closing" the roof



Note for vehicles in North America.

During convertible roof movement, a gong is sounded several times here. Reaching the relevant end position is indicated via the single gong, as in the other countries.

	Low-line		Mid-line			High-line		
Situation	Indication (Optical/ acoustic)		Indication (Optical/acoustic/text)			Indication (Optical/acoustic/text)		
Open side windows					Convertible roof operation			Convertible roof operation
Open rear lid					Rear lid pivots out!			Rear lid pivots out!
Stow roof package					Convertible roof operation			Convertible roof operation
Close rear lid					Convertible roof operation			Convertible roof operation
Open C segment					Convertible roof operation			Convertible roof operation
Close sliding roof					Convertible roof operation			Convertible roof operation
End "closing" process					Convertible roof closed			Convertible roof closed
On interruption of convertible roof movement					Continue convertible roof operation			Continue convertible roof operation



Convenience electronics

Sensors and hydraulic system

The function of the CSC roof involves complex interaction between the roof hydraulics and roof sensors. As described above, the entire roof movement sequence, with the exception of the sliding roof module, is carried out via 8 hydraulic cylinders, which are actuated in pairs by a hydraulic unit. This actuation is carried out via three solenoid valves in the hydraulic unit's valve block.

So that the roof control system can monitor the current positions of all moving assemblies, the roof system is equipped with 12 Hall senders. A microswitch in the luggage compartment registers the correct position of the luggage cover.

A temperature sensor on the hydraulic pump monitors the temperature of the pump drive.

Timeouts, which indicate failure of the roof function due to

- a leak in the hydraulic system,
- mechanical damage,
- blocked movements,
- implausible convertible roof position messages or
- communication faults between the linked control units

are additionally integrated into the roof control electronics.

These timeouts also serve to protect the system, etc., by limiting convertible roof operation following continuous operation or stoppage in an intermediate position for 8 minutes.

Legend

Hydraulic cylinders:

- 1 In the left main hinge
 - 2 In the left roof side member (C-pillar)
 - 3 In the left rear lid hinge
 - 4 In the left rear lid securing frame
 - 5 In the right main hinge
 - 6 In the right roof side member (C-pillar)
 - 7 In the right rear lid hinge
 - 8 In the right rear lid securing frame
- a Sliding roof module
b M segment
c C segment
d Roof side member
e Rear lid
f Side flap

J256 Convertible roof actuation control unit

Hydraulic unit

- G555 Hydraulic pump temperature sender
N272 Power operated convertible roof valve 1
N341 Power operated convertible roof valve 2
N342 Power operated convertible roof valve 3
V118 Convertible roof actuation hydraulic pump

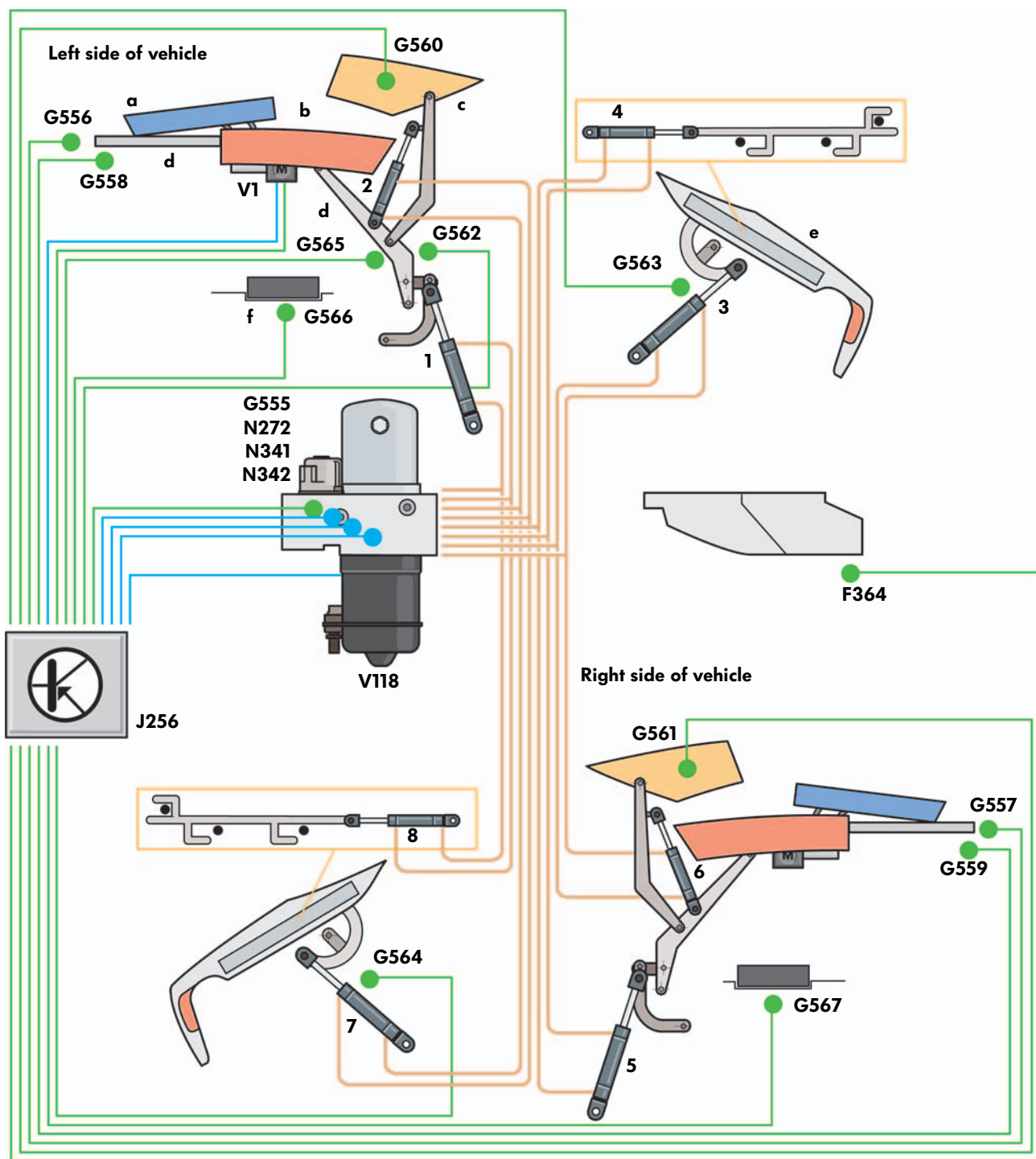
Sensors

- F364 Luggage cover contact switch
G556 Front sender for position of left roof member
G557 Front sender for position of right roof member
G558 Sender for left roof member locked
G559 Sender for right roof member locked
G560 Left sender for rear window frame locked
G561 Right sender for rear window frame locked
G562 Sender for rear window frame open
G563 Left sender for rear shelf locked
G564 Right sender for rear shelf locked
G565 Sender for roof stowed
G566 Sender for left roof member flap open
G567 Sender for right roof member flap open

Sliding roof module

- V1 Sliding sunroof motor





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Convenience electronics

Convertible roof sensors

The Eos is equipped with an extensive roof sensor system.

The illustration shows the approximate positions of the individual sensors within the overall convertible roof. An initial breakdown of the tasks and installation locations of the sensors is available in the form of an overview in the following tables. More detailed information can be found in the chapter entitled "Electrical components".

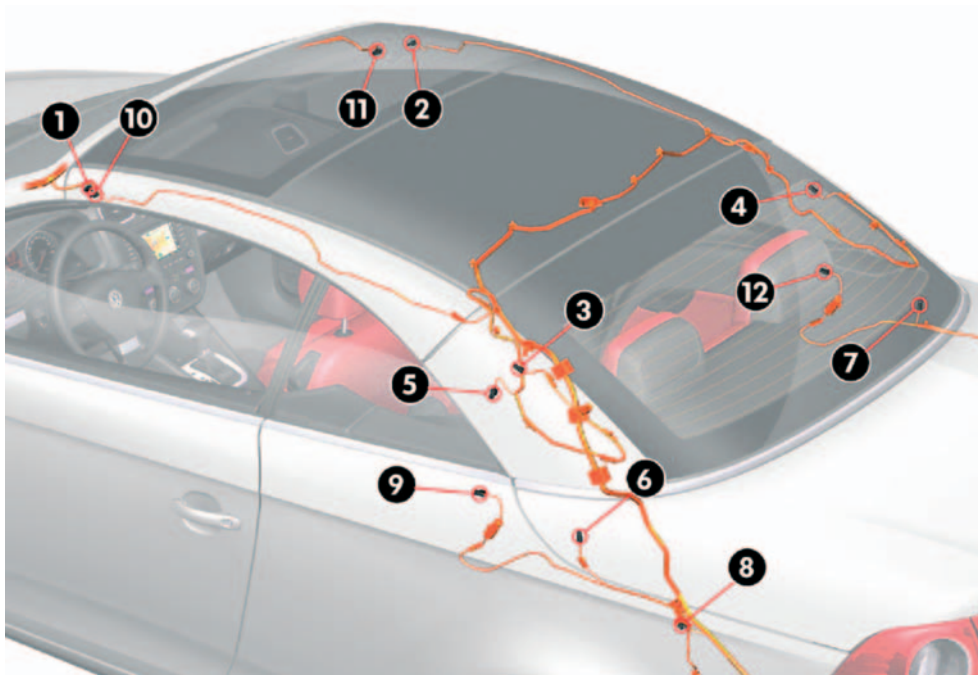
With one exception, the sensors are all Hall senders. Only the sensor which determines whether the luggage cover is in position is a microswitch. This is the luggage cover contact switch F364, located on the left-hand luggage cover mounting.

Three types of Hall sender are fitted:

- Hall elements with integrated reference magnet,
- Hall elements with an external reference magnet and
- Hall elements with two external reference magnets.

These do not register the entire course of a movement, but only one or more end points of the movements of individual components and locks. The convertible roof actuation control unit cannot therefore determine the intermediate position in which a roof segment is located at an arbitrary point in time, only whether it is located in one of the end positions.

To guarantee maximum possible operating safety, the majority of sensors are fitted twice (1 sensor per side of the vehicle). These are also referred to as redundant sensors.



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No.	Short designation	Name	Task
1	G556	Front sender for position of left roof member	This indicates that the convertible roof has docked onto the cowl panel on the left-hand side of the vehicle.
2	G557	Front sender for position of right roof member	This indicates that the convertible roof has docked onto the cowl panel on the right-hand side of the vehicle.
3	G560	Left sender for rear window frame locked	This indicates that the C segment is closed on the driver's side and is locked to the M segment.
4	G561	Right sender for rear window frame locked	This indicates that the C segment is closed on the front passenger's side and is locked to the M segment.
5	G562	Sender for rear window frame open	This indicates that the C segment is open.
6	G563	Left sender for rear shelf locked	This indicates that the left-hand rear lid has been released and is locked for the "luggage compartment" function.
7	G564	Right sender for rear shelf locked	This indicates that the right-hand rear lid has been released and is locked for the "luggage compartment" function.
8	G565	Sender for roof stowed	This indicates that the roof package is stowed in its end position in the luggage compartment.
9	G566	Sender for left roof member flap open	This indicates that the roof side member flap on the driver's side is open.
10	G558	Sender for left roof member locked	This indicates that the roof side member on the driver's side is locked to the A-pillar.
11	G559	Sender for right roof member locked	This indicates that the roof side member on the front passenger's side is locked to the A-pillar.
12	G567	Sender for right roof member flap open	This indicates that the roof side member flap on the front passenger's side is open.



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Hall senders in the roof sensor system

As in the case of other vehicle systems, Hall senders are also suitable for position detection. The roof sensor system in the Eos is equipped with three different types of Hall sender:

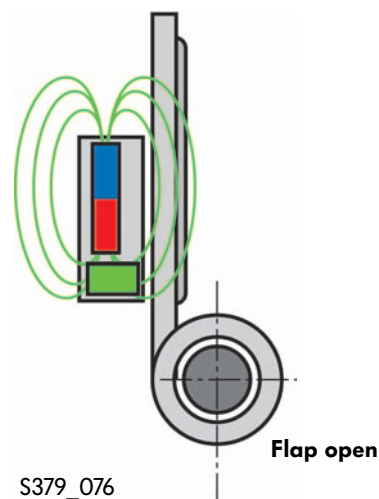
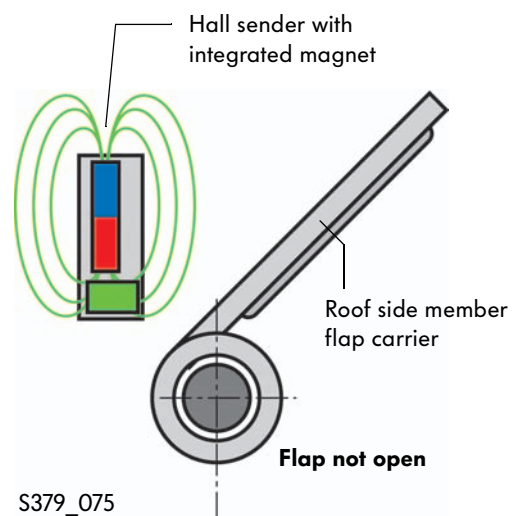
- Hall senders with integrated magnet
- Hall senders with an external magnet
- Hall senders with two external magnets.

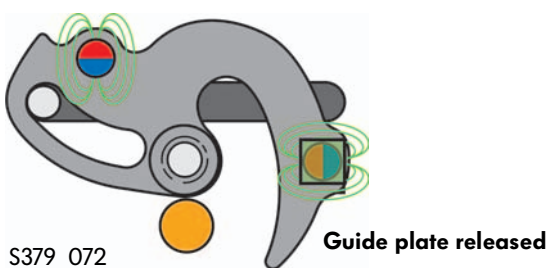
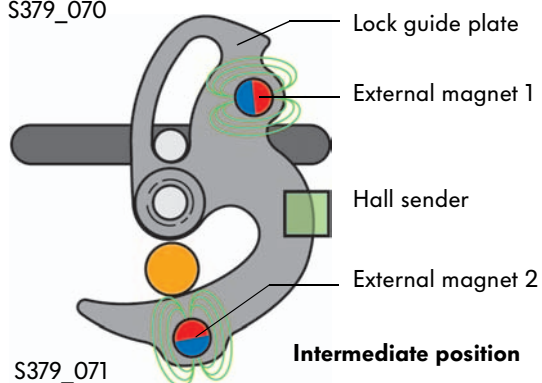
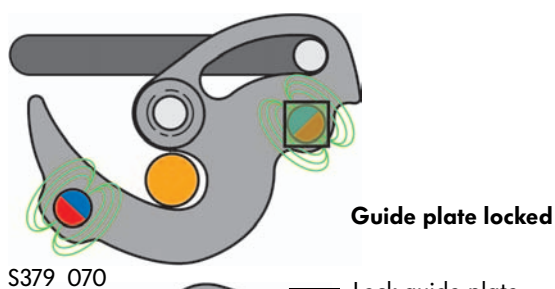
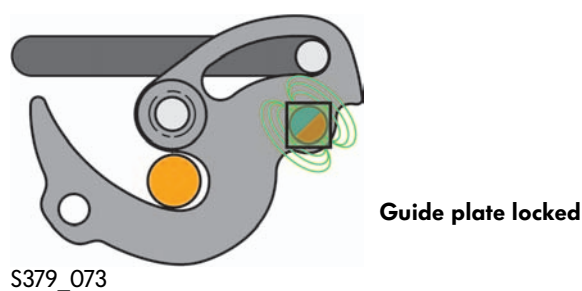
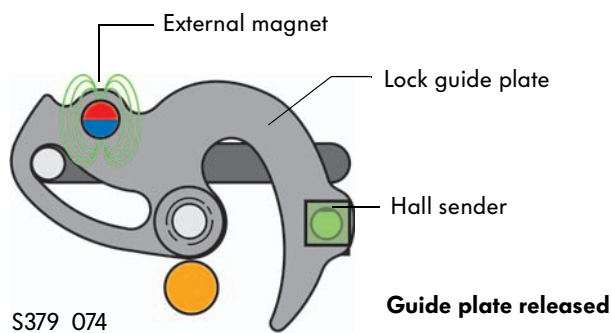


● Example: Sender with integrated reference magnet

In this design, as e.g. in the case of the senders for opening the roof side member flaps, the sender's signal voltage changes when the roof side member's carrier moves into the integrated magnet's field. By positioning the sender accordingly, the monitored component's reaching a defined end position can be determined. Due to this structure, however, the sensor electronics are unable to distinguish between whether the monitored component is located in the other end position or between the two end positions.

The disadvantage of this design is that the sender and the sensed component have to be positioned very precisely in relation to each other, so that the sensed component is able to adequately influence the signal voltage when it moves through the integrated magnet's magnetic field. This means that precise adherence to these distances has to be ensured during repair work.





- Example: Sender with external reference magnet

In comparison with Hall senders with integrated magnets, Hall senders with external magnets have the advantage that they permit greater installation dimension tolerances in the spatial layout between the sender and sensed component, in order e.g. to carry out adjustments within certain limits. One example of the design with an external magnet are the senders for locking the rear window frame to the M segment. In these, the lock guide plates carry a magnet. The Hall sender is therefore able to determine the positions "guide plate locked" and "guide plate not locked".



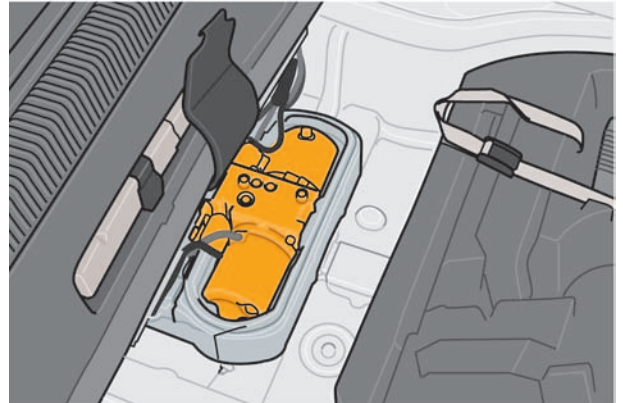
- Example: Sender with two external reference magnets

To determine whether a lock, e.g. that of the rear lid, is located in one of the defined end positions or between the two, the design with two external magnets is appropriate. In this case, both magnets are mounted on the moveable lock guide plate in such a way that one of the two is located above the stationary sender when the monitored component is in one of its two end positions. This enables the convertible roof actuation control unit to distinguish between released and locked. It can additionally determine whether the sensed component is located in an intermediate position.

Convenience electronics

Hydraulic unit

The 8 hydraulic cylinders for the convertible roof and the rear lid are supplied with hydraulic fluid by just one hydraulic unit. This is installed beneath the floor cover in the luggage compartment and is encapsulated in a foam jacket.



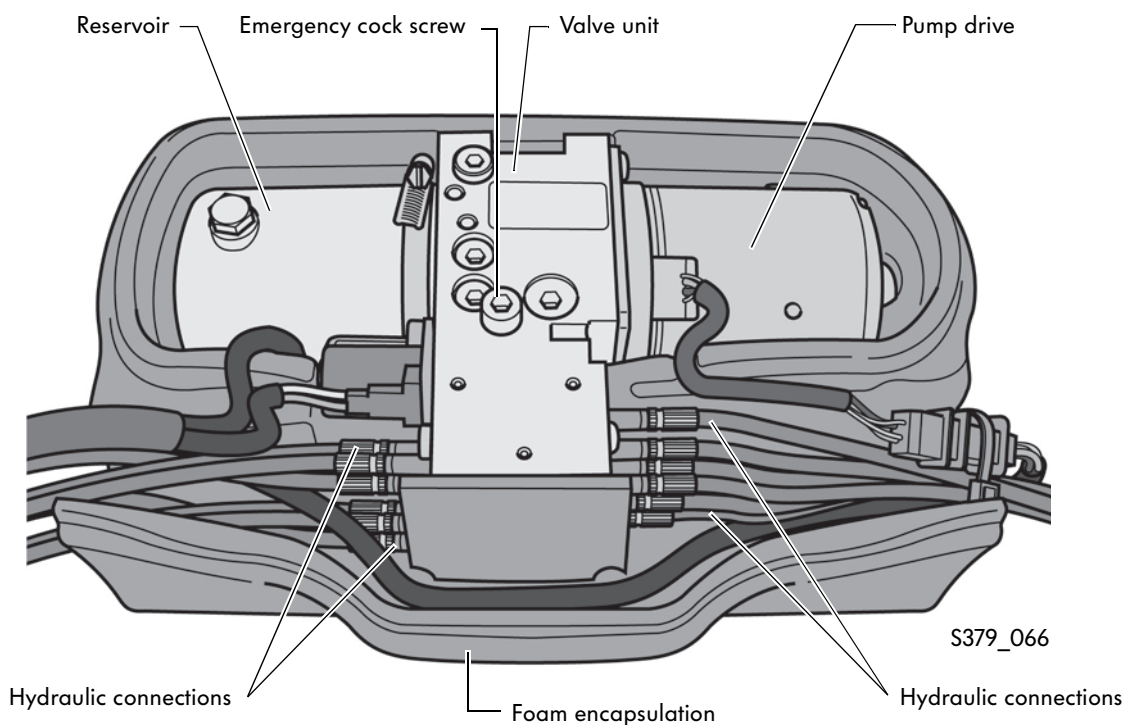
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Structure of the hydraulic unit

The hydraulic unit is comprised, amongst other elements, of the reservoir, the pump drive (convertible roof actuation hydraulic pump V118) and the valve unit with three 3/2-way solenoid valves. The hydraulic pump temperature sender G555 is integrated into the pump drive, and monitors its temperature to prevent overheating.

The convertible roof actuation hydraulic pump V118 is initialised to the left and right by the convertible roof actuation control unit J256.

All hydraulic connections are marked with a numerical code, so that they can be easily distinguished during installation work.



Structure of the valve unit

The valve unit is comprised of three 3/2-way solenoid valves, two mechanical shuttle valves, a number of non-return valves, a mechanical dual pressure valve and an emergency cock screw. The solenoid valves are called:

Power operated convertible roof valve 1 N272,

Power operated convertible roof valve 2 N341 and

Power operated convertible roof valve 3 N342.

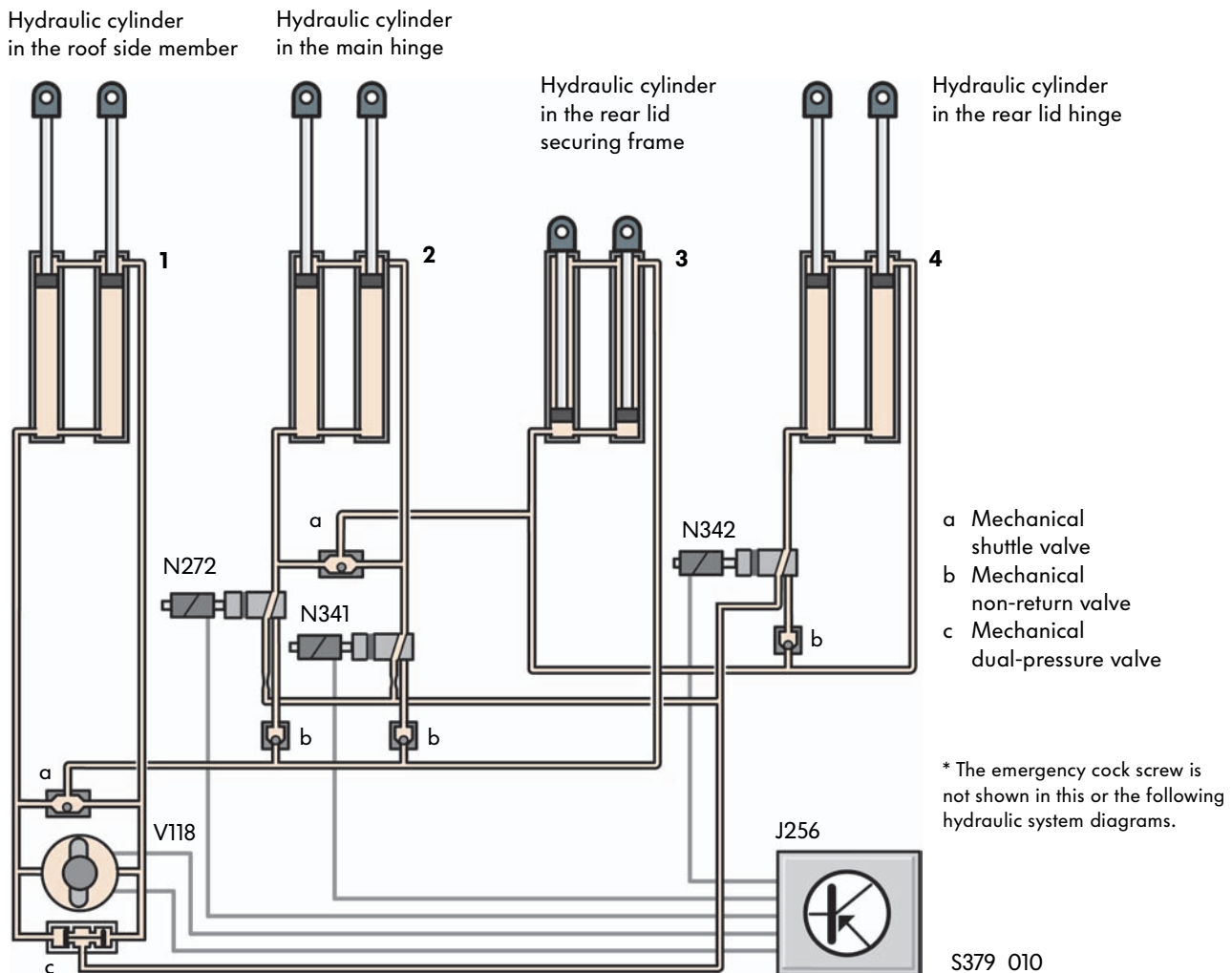
An emergency cock screw * is used to open a bypass which depressurises the system. In an emergency, the convertible roof can therefore also be moved manually.

If a valve is supplied with current, it allows the delivery pressure through. If it is not supplied with current, hydraulic fluid is able to flow in the opposite direction back to the pump reservoir (return flow position). Due to the special layout of the valves and integration of the pump's operating direction, the four cylinder pairs can be actuated independently of one another.

In the following, the entire roof opening and closing movement will be broken down into individual stages in order to clarify the valve control system's interaction.



Illustration with roof closed



Convenience electronics

Opening the convertible roof

1.

The pump is initialised to the right. The hydraulic fluid passes to solenoid valves N272, N341 and N342 via the shuttle valve (a). These are supplied with current and open. Valve N342 is supplied by the second shuttle valve (b).

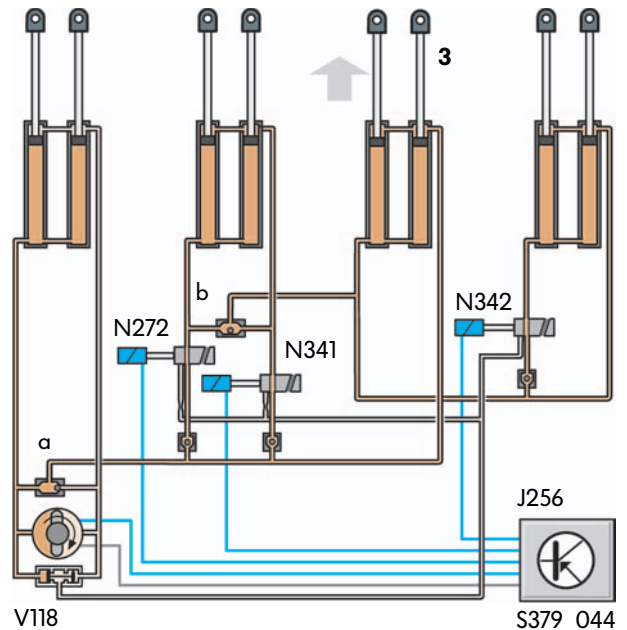
The hydraulic cylinders in the rear lid securing frames (3) extend, because the operating pressure beneath the plungers acts on a larger plunger surface than above the plunger.

Due to the hydraulic cylinders' movement, the rear lid is released from the body and the C segment.

The securing frame is locked to the rear lid so that the rear lid is able to pivot out to the rear during the further process.



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2.

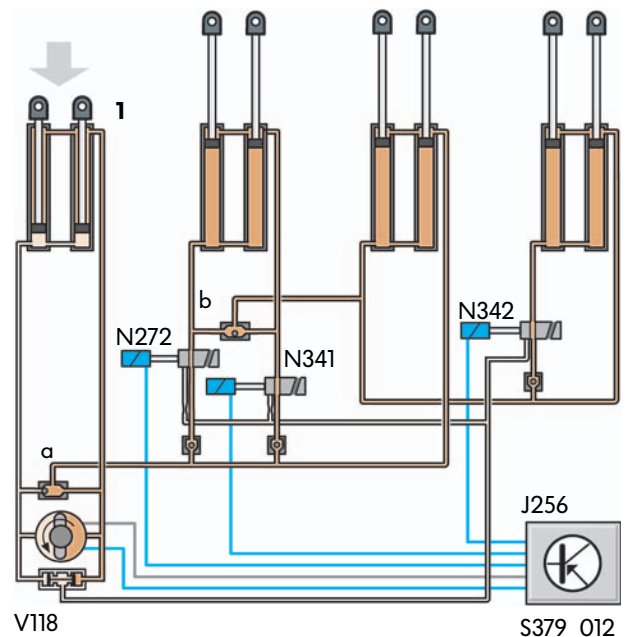
The pump's delivery direction changes; the three valves N272, N341 and N342 continue to be supplied with current.

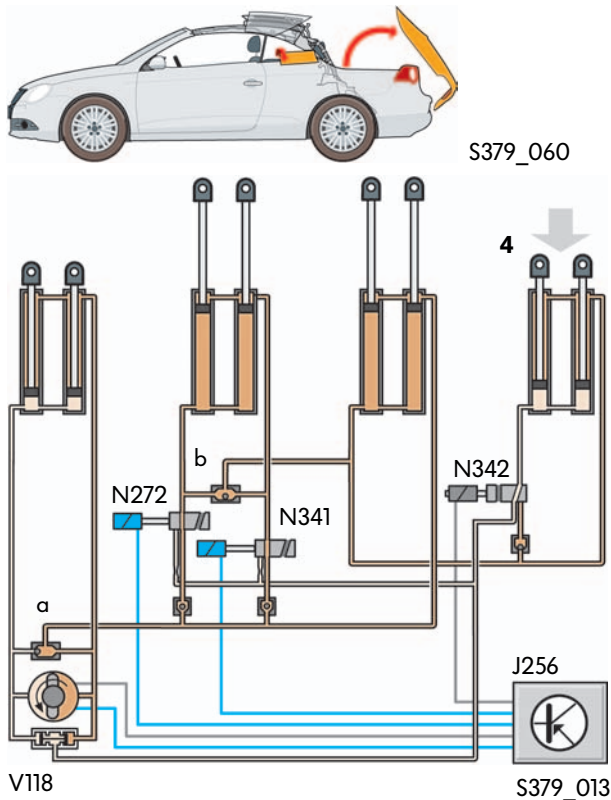
In this position, the pump's delivery current is forced into the hydraulic cylinders in the roof side members (1), so that these are retracted. Due to this movement, the upper C segment is released and is then pivoted over the middle segment. The roof side members are additionally released from the A-pillars.

The shuttle valve (a) over the hydraulic pump closes versus the return flow from the roof side members' hydraulic cylinders, with the result that the remaining cylinders are held in position.



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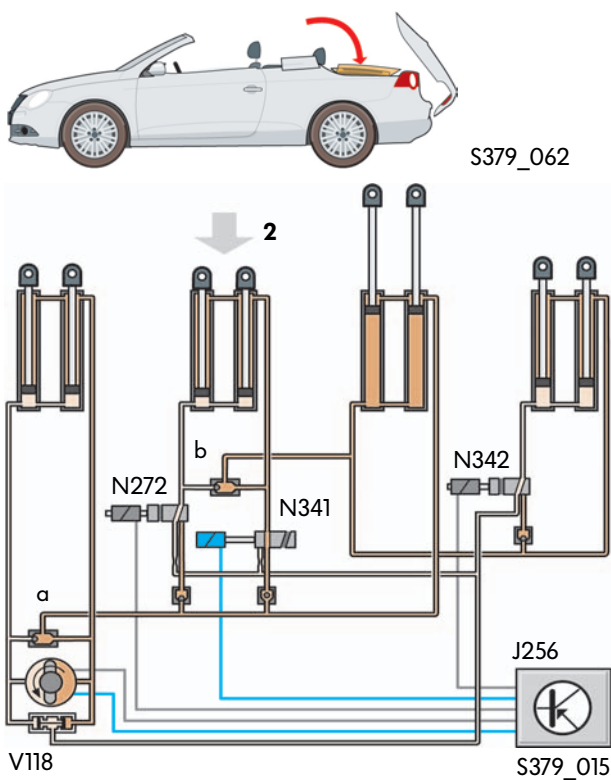
3.

The pump continues to deliver to the left.

Valve N342 switches to the return flow position.

The pump's delivery current now flows to the hydraulic cylinders in the rear lid hinges (4) and moves the plungers into the cylinders. Due to this movement, the rear lid is pivoted open to the rear, and the roof side member flaps open.

The roof package can now be stowed in the luggage compartment. The hydraulic cylinders in the roof side members remain under pressure, so that they hold the C segment in position above the M segment.



4.

Now, valve N272 is also switched to the return flow position. Only valve N341 is now supplied with current, and allows the delivery current to pass.

In this valve position, the hydraulic fluid from the pump compresses the two hydraulic cylinders in the main hinges (2).

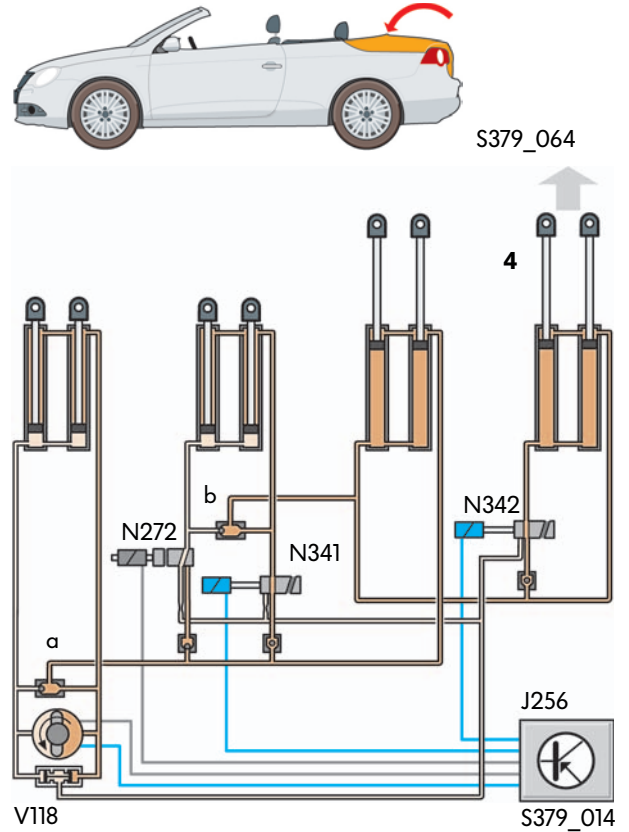
The roof package is stowed in the luggage compartment, whereby the roof side members are compelled to move outwards via a sliding guide rail.

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5.

Now, valves N341 and N342 are also supplied with current by the convertible roof actuation control unit J256.

The hydraulic pump continues to deliver to the left. The two hydraulic cylinders in the rear lid hinges (4) extend again, so that the rear lid and the roof side member flaps are closed again.



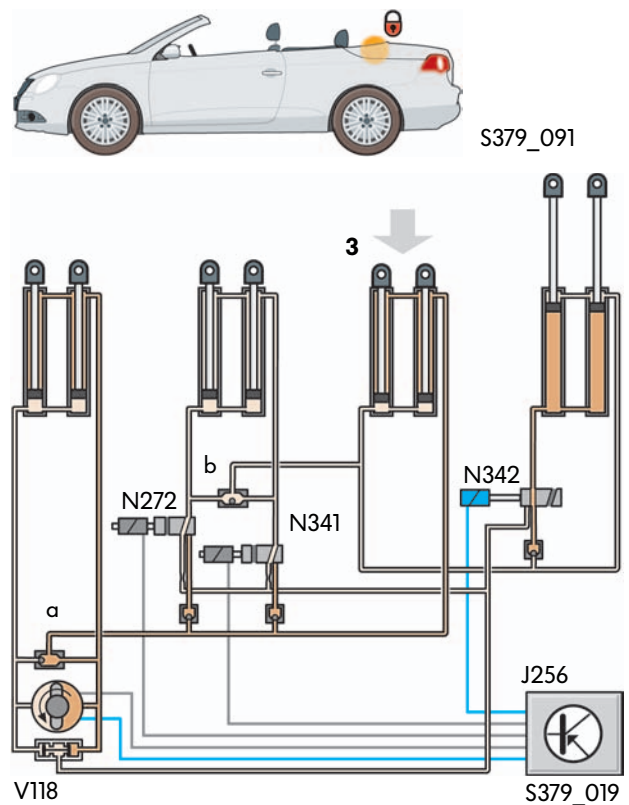
6.

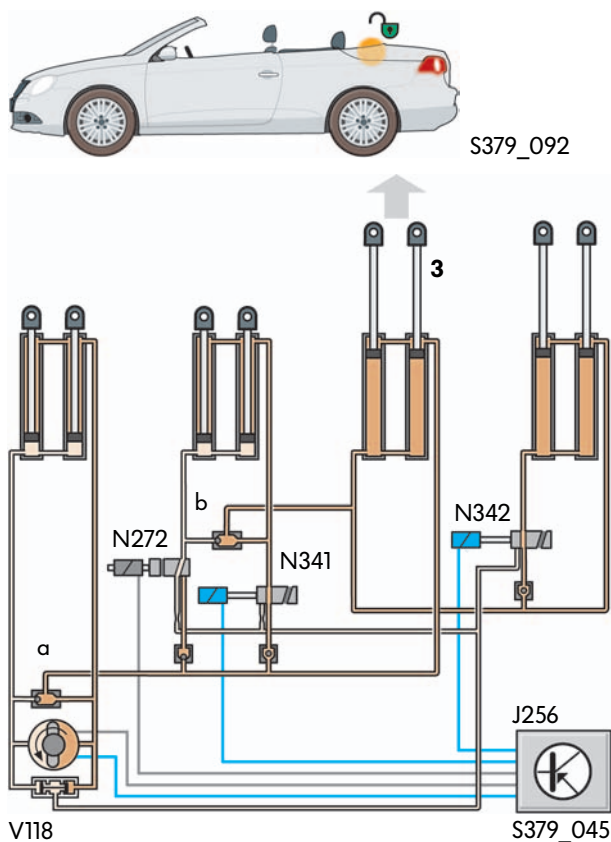
When the pump is operating to the left, valve N342 causes the securing frame to be locked to the body and the securing frame to be released from the rear lid by compressing the hydraulic cylinders in the rear lid securing frame (3) again.

The C segment is locked in position in the luggage compartment with the aid of rubber buffers.

When valve N342 is currentless and the convertible roof actuation control unit's hydraulic pump is switched off, convertible roof movement is completed.

The system is once again pressureless.



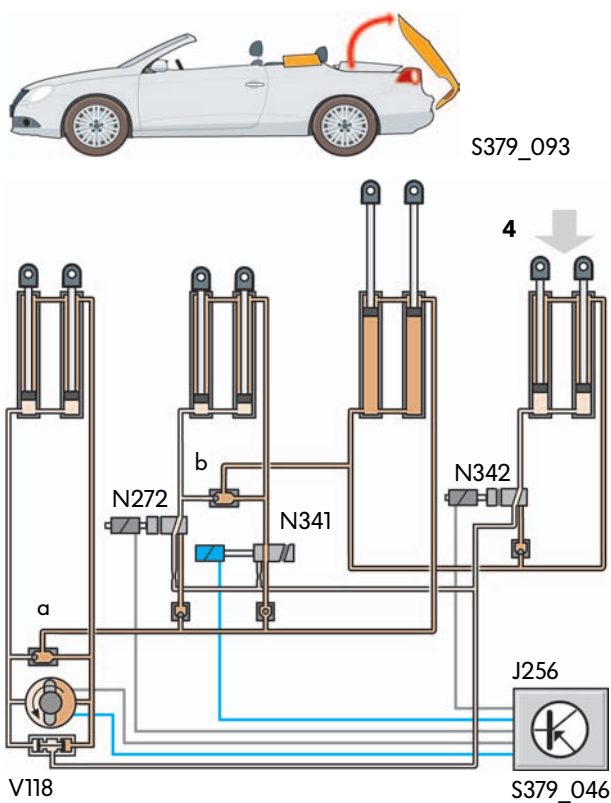


Closing the roof

1.

The hydraulic pump starts up to the left and valves N341 and N342 are supplied with current. The hydraulic cylinders in the rear lid securing frames (3) extend, because the operating pressure in the chamber below the plungers acts on a greater plunger area than in the chamber above the pistons.

The securing frame locks move into the position for opening the rear lid.



2.

The pump continues running to the left and only valve N341 is supplied with current. In this manner, the delivery current passes via the second shuttle valve (b) to the hydraulic cylinders in the rear lid hinges (4). As valve N342 is located in the return flow position, the two cylinders are compressed again, so that the rear lid and the roof side member flaps open.

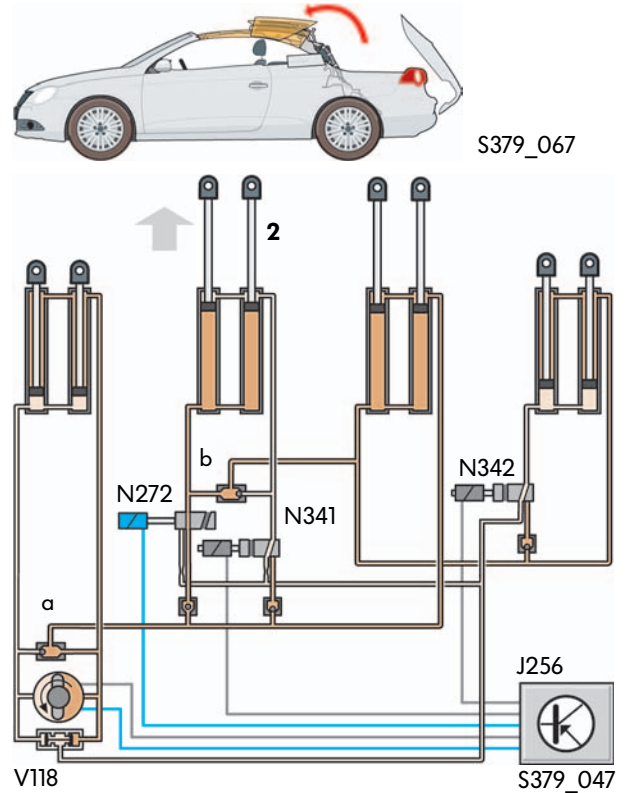
Convenience electronics

3.

Valve N341 switches to the return flow position.

Valve N272 opens and allows the delivery current to pass. As a result of this, the two hydraulic cylinders in the main hinges (2) are extended.

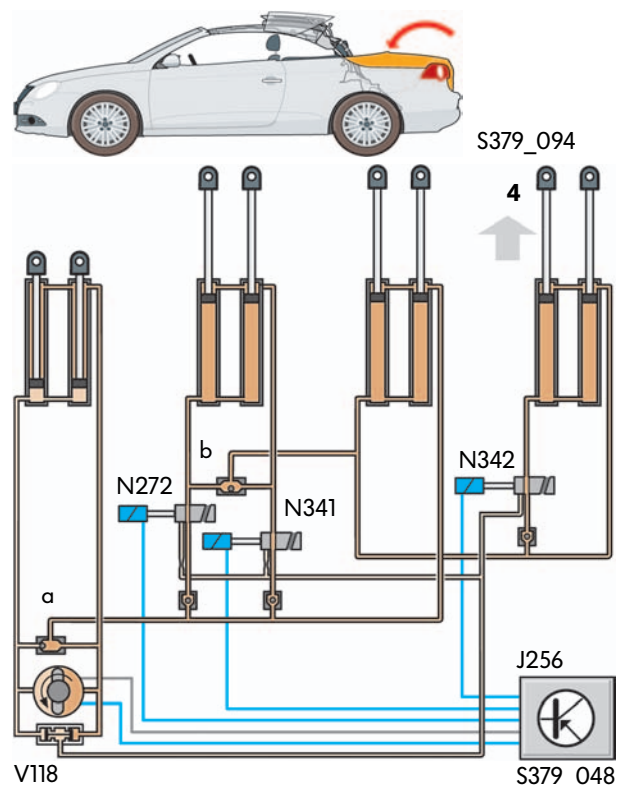
The main drive thereby lifts the convertible roof package out of the luggage compartment. The roof side members are moved inwards again and dock onto the A-pillars.

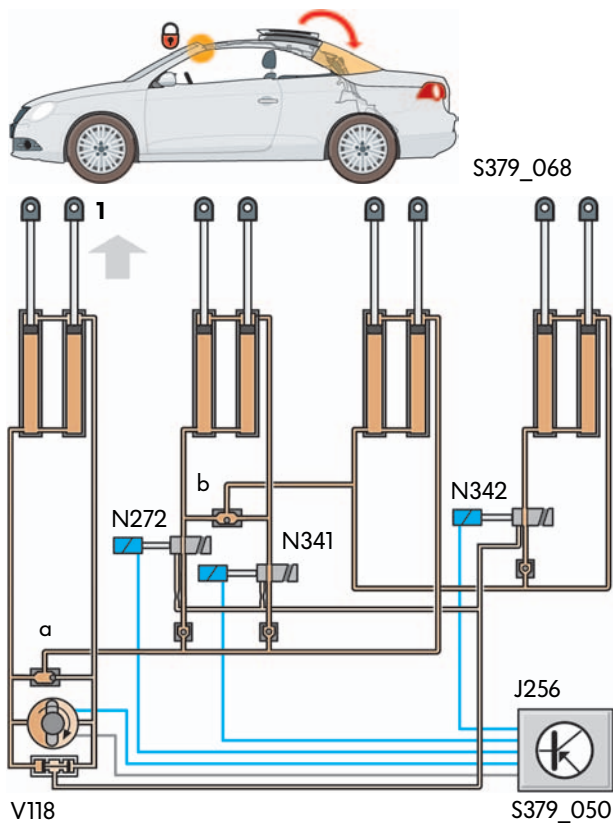


4.

When the pump is operating to the left, all three valves open.

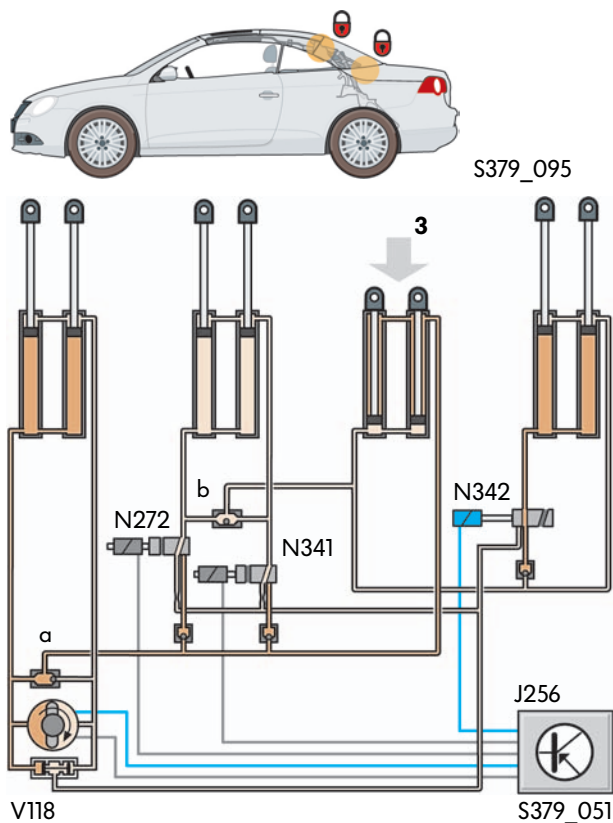
In turn, the delivery current flows to the hydraulic cylinders in the rear lid hinges (4) and moves these apart. The rear lid and the roof side member flaps close.





5.

The hydraulic pump motor's rotational direction changes. The three solenoid valves remain open. In this manner, the pump's delivery current is able to extend the hydraulic cylinders in the roof side members (1). The C segment lowers and is locked to the M segment. At the same time, the roof side members are locked to the A-pillars.



6.

When the pump is operating to the right, only valve N342 remains open. The hydraulic cylinders in the rear lid securing frames (3) are compressed. The rear lid and C segment locks close and thereby secure the roof's "closed" end position. The rear lid is released again at the same time. When the hydraulic pump is switched off and valves N272, N341 and N342 are switched to currentless, the roof movement is ended and the system is pressureless again.

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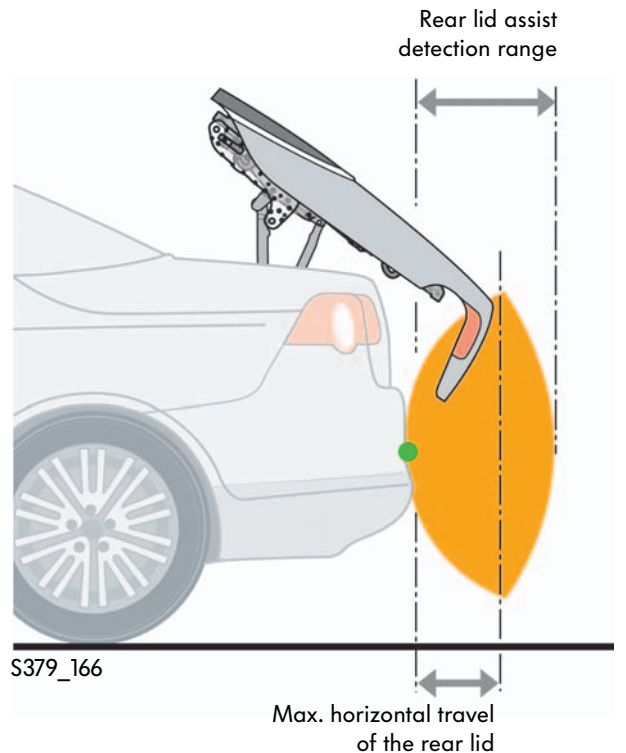
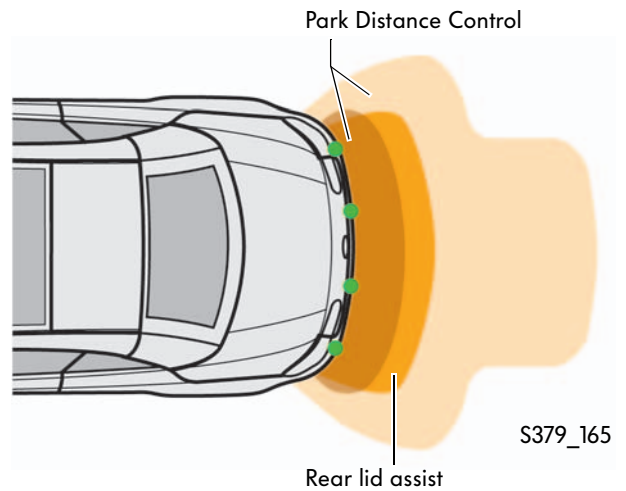
Rear lid assist

If the Eos is fitted with Park Distance Control (PDC), this additionally contains the rear lid assist function. This is a convenience function and serves to avoid damage to the rear lid on movement of the convertible roof.

In achieving this, the rear lid assist system makes use of the vehicle's Park Distance Control sensors, which are installed in the bumper, the convertible roof control system sensors, the convertible roof actuation button, plus the gong and the display in the dash panel insert.

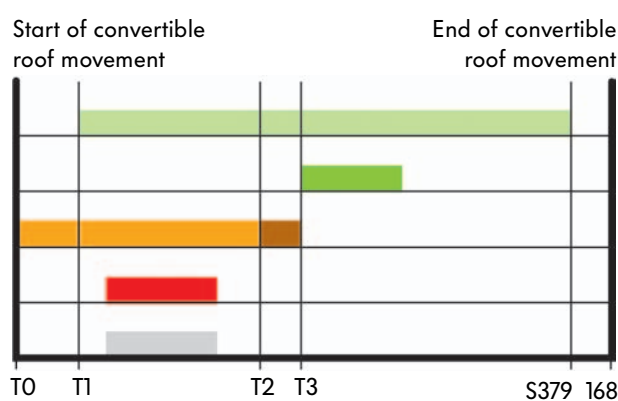
Rear lid assist functions independently of Park Distance Control. Park Distance Control is only active when reverse gear is engaged, whilst rear lid assist is active as soon as the convertible roof actuation button is pressed to move the convertible roof. If reverse gear is engaged at the same time, rear lid assist takes precedence over Park Distance Control.

Whilst Park Distance Control emits a stop warning in the form of a continuous sound if an obstacle is located approx. 30cm behind the vehicle, rear lid assist operates with an alarm distance of approx. 50cm to the rear of the vehicle. This ensures that sufficient space is available to move the rear lid horizontally (approx. 38cm).



If the convertible roof actuation button is pressed, this also simultaneously activates the rear lid assist system. If an obstacle is located within the detection range to the rear of the vehicle at this point in time, the operator is provided with a corresponding warning message via the display, and a corresponding acoustic signal is sounded via the gong. Depending on the convertible roof actuation control unit's coding, convertible roof operation is not started. By pressing the button again for a few seconds, convertible roof movement can be commenced despite the warning message.

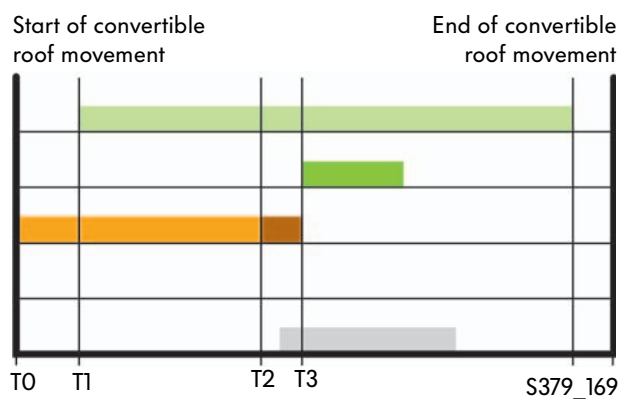
Case example: Obstacle arises after T1



If no obstacle has been detected in the rear area on requesting convertible roof movement, i.e. by pressing the convertible roof actuation button (T0), a calculated time interval starts on release of the rear lid (T1). Within this time interval, rear lid assist remains active and a warning message is issued if a new obstacle is detected.

The time interval ends with the calculated point in time T2. This is the point of time as of which the rear lid moves into the rear lid assist detection range.

Case example: Obstacle arises after T2



As of point in time T2, rear lid assist is switched to passive mode, i.e. no warning message is issued, as rear lid assist is unable to distinguish between the vehicle's own rear and a new obstacle which emerges. The rear lid assist function for this convertible roof movement cycle ends with the roof side member flap senders' message that the roof side member flaps and therefore the rear lid are open (T3).

- Rear lid released
- Rear lid open
- Rear lid assist active
- Rear lid assist passive
- Warning message
- emerging obstacle



The operator is always responsible for convertible roof operation, as only he is able to oversee the entire convertible roof movement range, including the area above the rear lid, which is not detected by the sensors.

