Self Study Programme 649

For internal use only

Audi Q7 e-tron quattro (type 4M)

Audi

Service Training

Audi presents the Q7 e-tron quattro - its second model to feature a high-performance plug-in hybrid drive. The electric current provided by the lithium-ion battery allows the large SUV to run for up to 56 km solely on electric power – quietly, powerfully and emission free. Together with the diesel engine, this gives a total range of 1410 km.

The Audi Q7 e-tron quattro is the world's first plug-in hybrid with a 6-cylinder diesel engine and full-time quattro all-wheel drive. In some countries, it is also available with a 2.0l TFSI engine.

According to the ECE standard for plug-in hybrid vehicles, the Audi Q7 e-tron quattro with 3.0l V6 TDI can cover 100 km on only 1.7 l of diesel, which works out at CO_2 emissions of 46 g/km. The standard thermal management system with integrated heat pump was developed specially for the Q7 e-tron quattro.

The Q7 e-tron quattro sets a new benchmark with the display and operating concept of the standard Audi virtual cockpit and the newly developed MMI system.

The standard MMI Navigation plus system, with Audi connect internet module, is integrated in tthe hybrid management system on the Audi Q7 e-tron quattro.

The new electromechanical power steering system is highly efficient and responsive. The likewise newly developed five-link wheel suspensions on the front and rear axles are more than 60 kg lighter than the axles on the preceding model and are a major factor contributing towards high driving dynamics.

Comfort is further enhanced by the optional adaptive air suspension. The driver can control the suspension via the standard Audi drive select dynamic handling system, which offers up to seven modes and integrates further technical components such as steering, active accelerator pedal and automatic gearbox.

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Service

Appendix

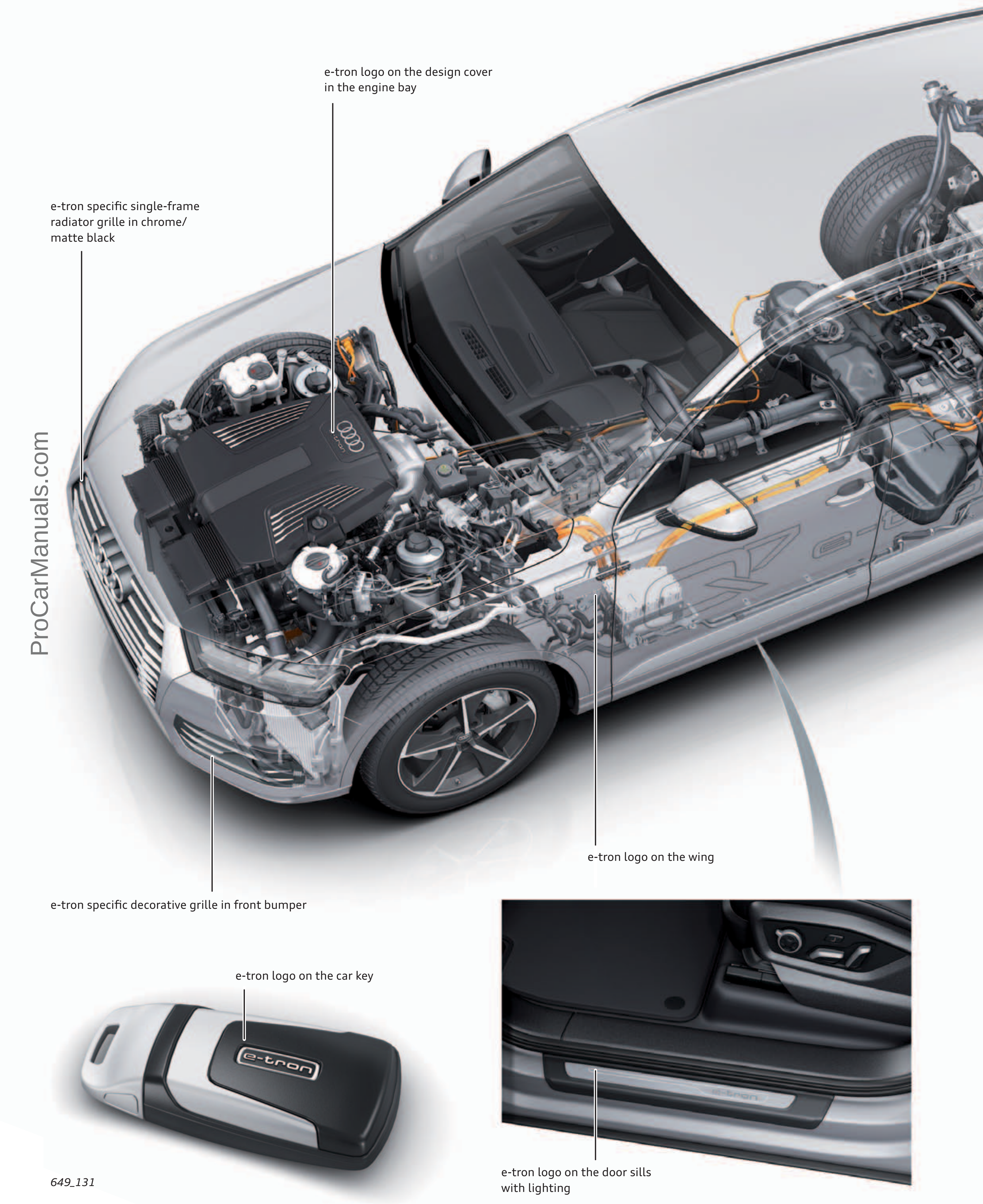
The self study programme teaches a basic understanding of the design and mode of operation of new models, new automotive components or new technologies.
It is not a repair manual! Figures are given for explanatory purposes only and refer to the data valid at the time of preparation of the SSP.
This content is not updated.
For further information about maintenance and repair work, always refer to the current technical literature.

Note

Reference

Introduction

Vehicle distinguishing features



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e-tron alloy wheels

At rear end of vehicle

e-tron logo on the boot lid

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Charger socket 1 for high-voltage battery charging UX4 behind a flap

e-tron specific rear bumper with diffusor without visible exhaust tail pipes

In vehicle interior

Dash panel insert of Audi virtual cockpit with power meter and e-tron displays

MMI system with e-tron displays

Switch for EV mode

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Dimensions

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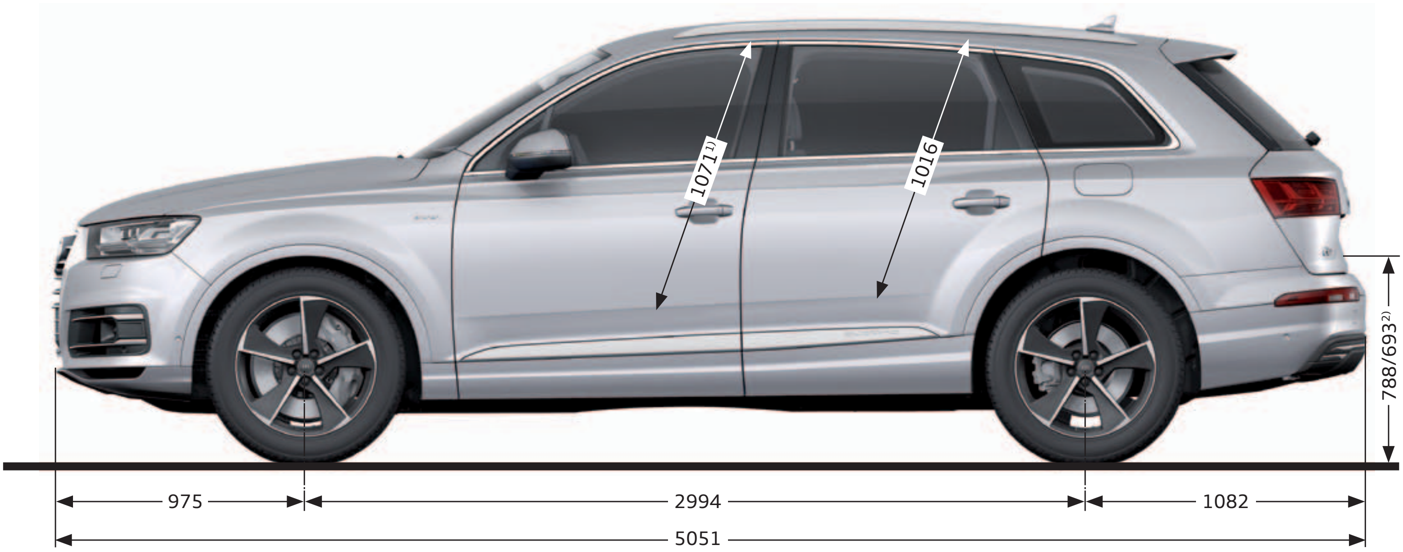
649_054



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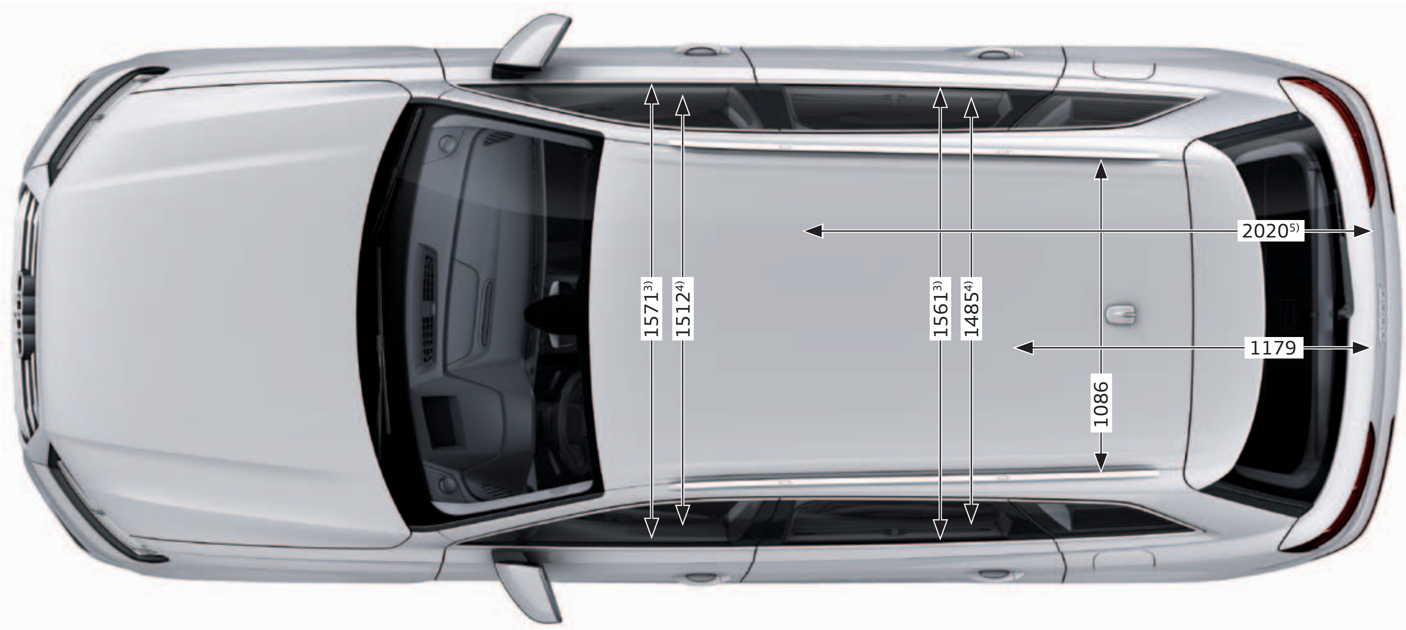

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Exterior dimensions and weights

Length in mm	5051
Width (not including exterior mirrors) in mm	1968
Width (including exterior mirrors) in mm	2212
Height in mm	1741
Front track width in mm	1679
Rear track width in mm	1690
Wheelbase in mm	2994
Kerb weight in kg	2520[6), 7)]
Gross vehicle weight in kg	3185[7)]
Drag coefficient c_w	0.34

Inner dimensions and other specifications

Front headroom in mm	1071[1)]
Front shoulder width in mm	1571[4)]
Rear headroom in mm	1016[1)]
Rear shoulder width in mm	1561[4)]
Through-loading width in mm	1216
Load sill height in mm	788/693[2)]
Boot capacity in l	650/1835[5)]
Capacity of fuel tank in l	75

[1)] Maximum headroom
[2)] Air suspension at loading height
[3)] Elbow room width
[4)] Shoulder room width
[5)] With rear seat folded down
[6)] Including driver (75 kg)
[7)] with 3.0l V6 TDI engine

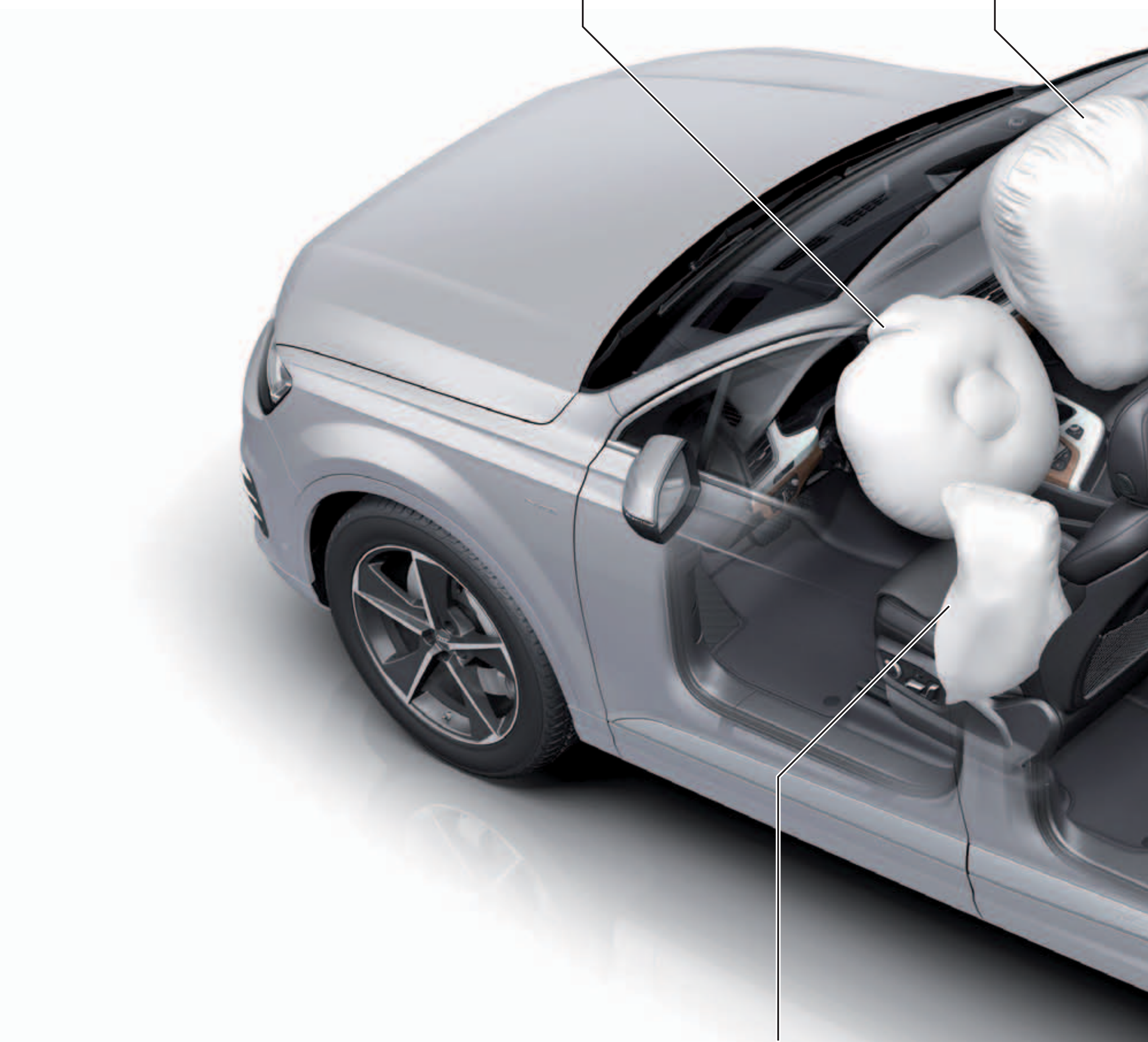
All dimensions are given in millimetres and refer to the unladen weight of the vehicle.

Passive safety

Overview

On the following pages you will find a summary of the occupant protection system in the Audi Q7 e-tron quattro.

In-car airbags



Components

Depending on country version and trim level, the passive occupant and pedestrian protection system in the Audi Q7 e-tron quattro may comprise the following components and systems:

- Airbag control unit
- Adaptive driver airbag
- Adaptive front passenger airbag (front passenger airbag, two-stage country version)
- Front side airbags
- Rear side airbags (equipment option)
- Head airbags
- Front airbag crash sensors
- Crash sensors for side impact detection in the doors
- Crash sensors for side impact detection in the C posts
- Crash sensor for side and longitudinal impact detection
- Centre pedestrian protection crash sensor (acceleration sensor, country version)
- Left and right pedestrian protection crash sensors (pressure sensors, country version)
- Front inertia-reel seat belts with pyrotechnic belt tensioners
- Front inertia-reel seat belts with electrical belt tensioners
- Front inertia-reel seat belts with active belt force limiters
- Inertia-reel seat belts for 2nd seat row with pyrotechnic belt tensioners, driver and front pass. sides (country version)
- Front lap belt tensioner (country version)
- Seat belt warning for all seats (country version)
- Seat occupancy sensor in front pass. seat
- Front pass. airbag disabling switch (country version)
- Front pass. airbag OFF and ON warning lamp
- Driver and front pass. seat position sensors
- Pedestrian protection trigger (country version)
- Battery isolator, 12-volt electrical system
- Battery isolator of high-voltage system

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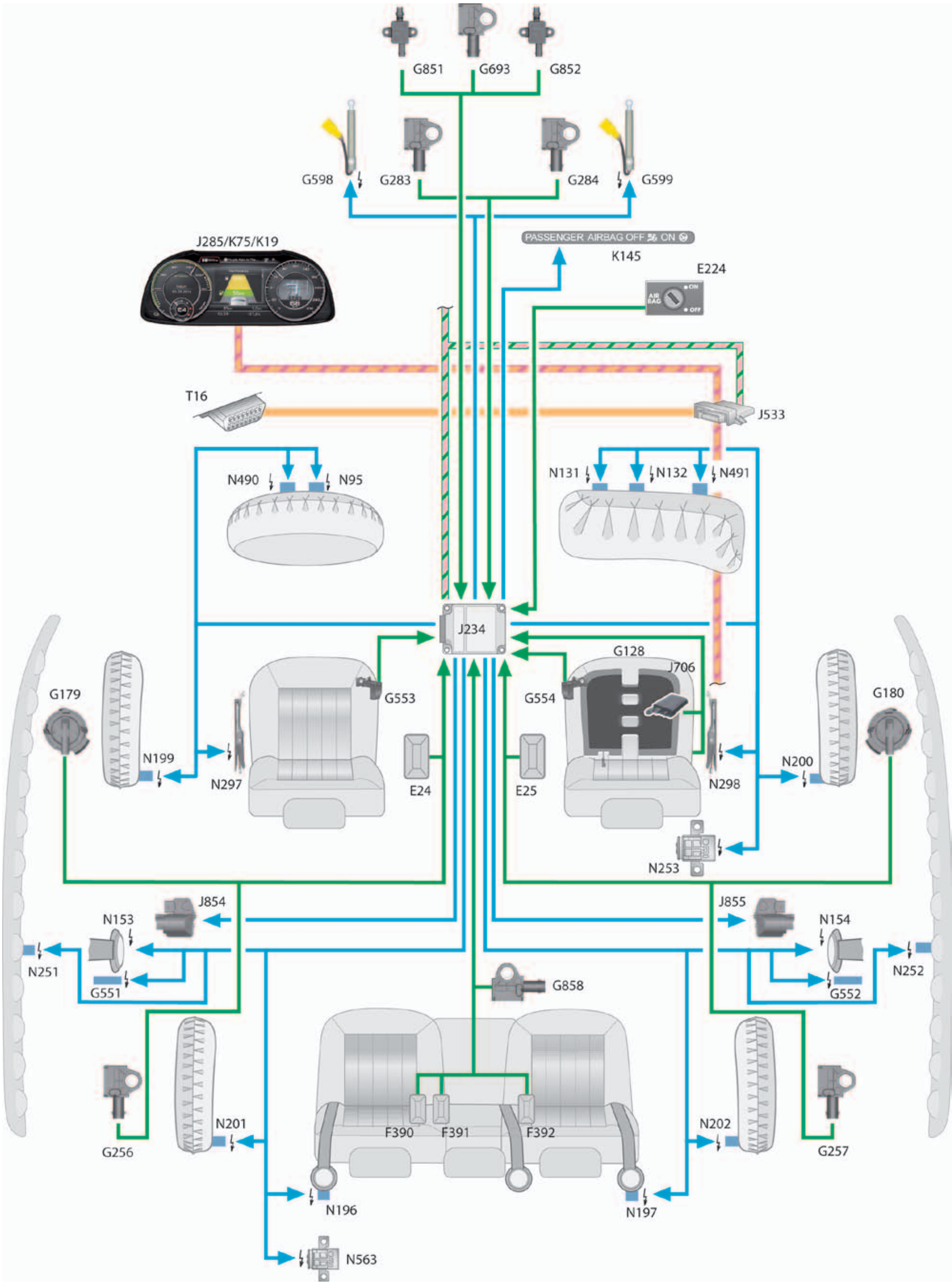
Note
The diagrams in the chapter "Passive occupant safety" are schematic diagrams designed to aid understanding.

System overview

The system overview shows the components for all markets. Keep in mind that this constellation is not possible in a production model.



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Additional equipment

Equipment specifications may vary due to the different requirements and statutory provisions which apply to vehicle manufacturers in the various markets.

Key to figure on page 10:

E24 Driver side seat belt switch
E25 Front pass. side seat belt switch
E224 Airbag disabling switch, front pass. side

F390 Driver side seat belt switch, 2nd seat row
F391 Centre seat belt switch, 2nd seat row
F392 Front pass. side seat belt switch, 2nd seat row

G128 Seat occupied sensor, front pass. side
G179 Side airbag crash sensor, driver side
G180 Side airbag crash sensor, front pass. side
G256 Side airbag crash sensor, rear driver side
G257 Side airbag crash sensor, rear pass. side
G283 Front airbag crash sensor, driver side
G284 Front airbag crash sensor, pass. side
G551 Driver side seat belt force limiter
G552 Front pass. side seat belt force limiter
G553 Driver side seat position sensor
G554 Front pass. side seat position sensor
G598 Pedestrian impact mitigation trigger 1
G599 Pedestrian impact mitigation trigger 2
G693 Centre crash sensor for pedestrian impact mitigation
G851 Driver side crash sensor for pedestrian protection 2
G852 Front pass. side crash sensor for pedestrian protection 2
G858 Centre crash sensor for X/Y axis

J234 Airbag control unit
J285 Instrument panel control unit
J533 Data bus diagnostic interface J533 (gateway)
J706 Seat occupancy recognition control unit
J854 Front left belt pretensioner control unit
J855 Front right belt pretensioner control unit

K19 Seat belt warning system warning lamp
K75 Airbag warning lamp
K145 Front pass. airbag OFF warning lamp (ON and OFF status of front pass. airbag is indicated)

N95 Driver side airbag igniter
N131 Front pass. side airbag igniter 1
N132 Airbag igniter 2, front pass. side
N153 Driver seat belt pretensioner igniter 1
N154 Front passenger seat belt pretensioner igniter 1
N196 Rear seat belt pretensioner igniter on driver side
N197 Rear seat belt pretensioner igniter on front pass. side
N199 Side airbag igniter, driver side
N200 Side airbag igniter on front pass. side
N201 Rear side airbag igniter on driver side
N202 Rear side airbag igniter on front pass. side
N251 Driver side curtain airbag igniter
N252 Front pass. side curtain airbag igniter
N253 Battery isolation igniter
N297 Seat belt tensioner igniter 2, driver side (lap belt pretensioner)
N298 Seat belt tensioner igniter 2, front pass. side (lap belt pretensioner)
N490 Igniter for exhaust valve for driver airbag
N491 Igniter for exhaust valve for front pass. airbag
N563 High-voltage battery isolator igniter

T16 16-pin connector, diagnosis connection

Wire colours:

Diagnostics CAN
Infotainment CAN
FlexRay
Input signal
Output signal

Airbag control unit J234

Crash signal

The airbag control unit J234 registers a crash based on the information supplied by internal and external crash sensors. The airbag control unit classifies a crash as "minor" or "severe" depending on crash severity. A minor crash is further subdivided into multiple crash levels depending on severity.
A severe crash is registered if restraint systems, e.g. seat belt tensioners and airbags, are deployed. The airbag control unit sends a signal indicating the crash severity and crash level to the data bus. Other bus subscribers receive this crash signal and can then take the appropriate action, e.g. shut off fuel supply.

Airbag control unit J234

649_012

Response of hybrid battery to crash signal

If the airbag control unit has detected a relevant crash, the hybrid battery is deactivated for safety reasons. In the event of a crash, the airbag control unit sends to a crash signal to the data bus. The gateway (data bus diagnostic interface J533) relays the signal to the battery regulation control unit J840.

Minor crash

In the event of a minor crash with a sufficiently high crash level, the battery regulation control unit J840 isolates the hybrid battery. A hybrid battery isolated by a minor crash can be reactivated by switching terminal 15.

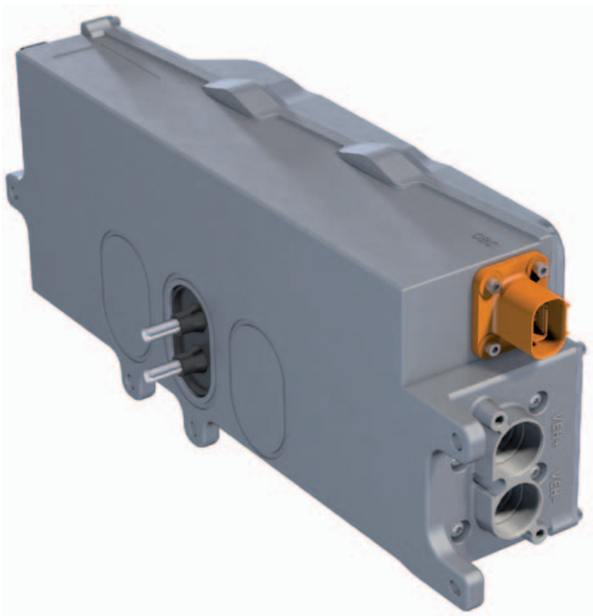
Severe crash

In the event of a severe crash, the signal to isolate the hybrid battery is transmitted by two different pathways. This provides redundant (multiple) backup for signal transmission.

- **Pathway 1:** As with a minor crash of sufficient intensity, the battery regulation control unit J840 isolates the hybrid battery.

- **Pathway 2:** The airbag control unit J234 is wired discretely to the high-voltage battery isolator igniter N563. The igniter is installed in the switch box of the high-voltage battery SX6. The igniter and the switch box form a unit. Contrary to what the name might suggest, the high-voltage battery isolator igniter N563 does not have any pyrotechnics. In the event of a severe crash, the airbag control unit activates the igniter and isolates the hybrid battery.
  An electric current of between approx. 1.75 A and 2 A is used for signal transmission.

High-voltage battery isolator igniter N563
High-voltage battery switch box SX6



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Reference
For more information about the hybrid battery, refer to Self Study Programme 650 "Audi Q7 e-tron quattro (type 4M) high-voltage system and vehicle electrics".

Response to crash signal: online roadside assistance or Audi emergency call

Depending on crash severity, online roadside assistance or an Audi emergency call is activated.

Online roadside assistance

Online roadside assistance is activated after the following events:

- The airbag control unit has detected a minor crash.
- A collision with a pedestrian is detected and the pedestrian impact mitigation system has deployed.

The signal to activate online roadside assistance is transmitted via the data bus systems. In this case, the airbag control unit signals the ascertained crash level to the gateway (data bus diagnostic interface J533) which activates online roadside assistance.

Audi emergency call

An Audi emergency call is activated if the airbag control unit has detected a severe crash.
The signal to activate Audi emergency call is transmitted in two different ways. This provides redundant (multiple) backup for signal transmission.

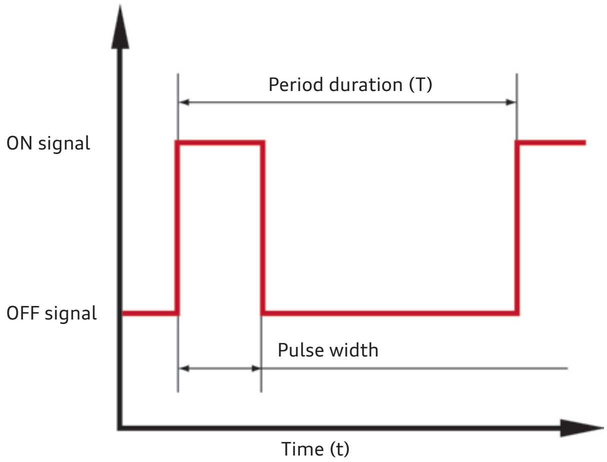
- **Pathway 1:** The airbag control unit sends the crash signal (severe crash) to the gateway (data bus diagnostic interface J533) which activates the Audi emergency call.
- **Pathway 2:** The airbag control unit J234 is also wired discretely to the gateway (data bus diagnostic interface J533). In the event of a severe crash, a pulse-width-modulated signal is transmitted across this line. The gateway evaluates the signal and activates the Audi emergency call.

Pulse width modulation (PWM)

In the pulse width modulation (PWM) process, a technical variable, e.g. electrical voltage, alternates between 2 values. This means that, in principle, the voltage is switched on and off in quick succession.

The on and off times (pulse width) can be changed while maintaining a constant period duration (T). This means that the pulse width is modulated. The PWM signal must be demodulated (made readable) so that it can be utilised.

PWM signal 1



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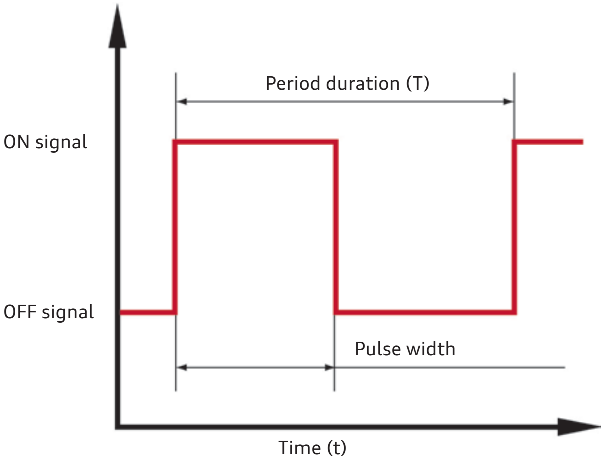
PWM signal 2



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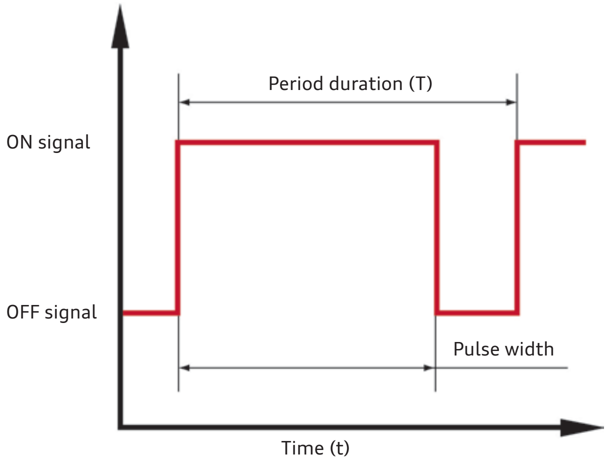
PWM signal 3



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Reference
For more information about online roadside assistance and the Audi emergency call, refer to Self Study Programme 647 "Audi A4 (type 8W) Infotainment and Audi connect".

Internal combustion engines

3.0l V6 TDI engine Gen.2 evo (EA897)

Features and characteristics

- Starter generator
- Active accelerator pedal module
- Double belt tensioner for the poly V-belt
- Electrically driven AC compressor
- Engine is braked in start-stop mode by the starter generator after the ignition is turned off
- Active engine and gearbox mounting system
- Exhaust flap in left tail pipe
- Reduction of compression ratio from 16.8 to 16.0 by modification of the piston recess geometry
- 2-stage exhaust gas recirculation system with EGR precooler
- Ceramic glow plugs
- Particulate sensor
- NO_x oxidising catalyst with SCR coated diesel particulate filter

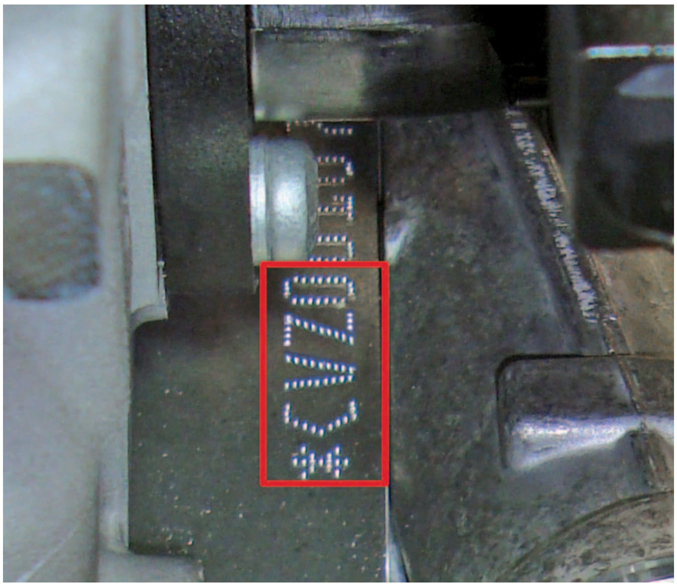
649_005

Reference
For more information about the 3.0l V6 TDI engine and the SCR system, refer to Self Study Programmes 479 "Audi 3.0l V6 TDI engine (second generation)", 622 "Second-generation Audi clean diesel" and 632 "Audi Q7 (type 4M)".

Specifications

Torque/power curve of 3.0l V6 TDI engine CVZA

Power output of internal combustion engine in kW
Torque of internal combustion engine in Nm



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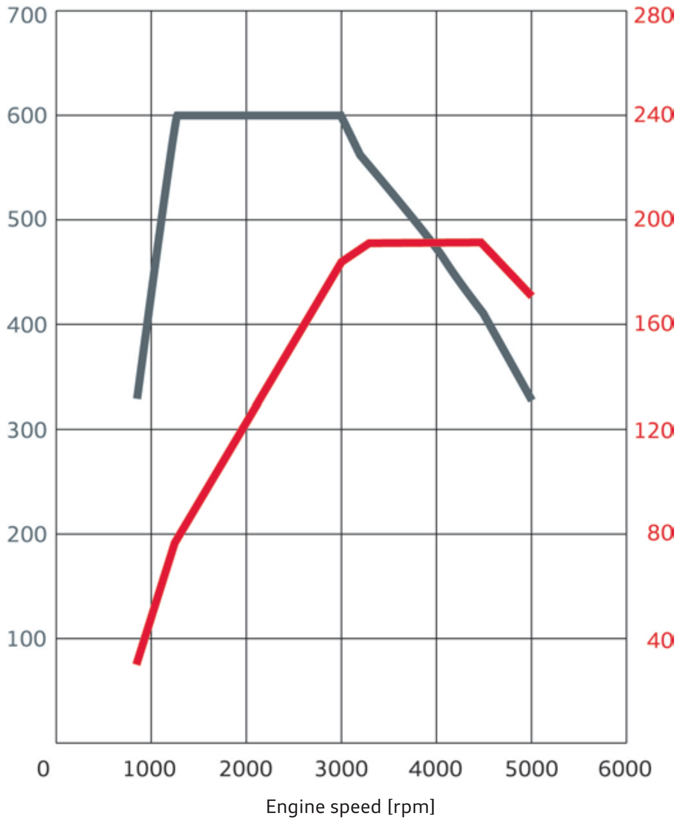
The engine code is, as seen in the direction of travel, located at the front left below the cylinder head on the protruding edge of the engine block.



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Features	Specifications
Engine code	CVZA
Type	6-cylinder V-engine with 90° V angle
Displacement in cm³	2967
Stroke in mm	91.4
Bore in mm	83.0
Number of valves per cylinder	4
Firing order	1-4-3-6-2-5
Compression ratio	16.0 : 1
Power output in kW at rpm	190 at 3250 – 4500
Torque in Nm at rpm	600 at 1250 - 3000
Fuel type	Diesel to EN 590
Engine management	Bosch EDC 17 with start-stop and recuperation
Maximum injection pressure in bar	2000
Fuel injectors	8-port piezo injectors
Exhaust gas treatment	NO_x oxidising catalyst, SCR coated diesel particulate filter, particulate sensor, oxygen sensor
Emission standard	EU 6 (W)

Third-generation 2.0l R4 TFSI engine (EA888)

Features and characteristics

- Elimination of the belt drive (electrical AC compressor, no conventional generator)
- Polymer-coated main bearings, conrod bearings and stop discs in the crank mechanism. These are needed to meet the demand for improved emergency running properties, due to frequent cold-starting and starting from electric mode (engine speed is higher than during a normal engine start).
- Simos 18.4 engine management system with engine control unit interface to the FlexRay bus system
- Audi valvelift system (avs) on the exhaust side
- Reconfiguration of the crankcase ventilation flow over the balancer shafts in the area of the engine block
- Currently available in Japan, Singapore, Korea and China only.

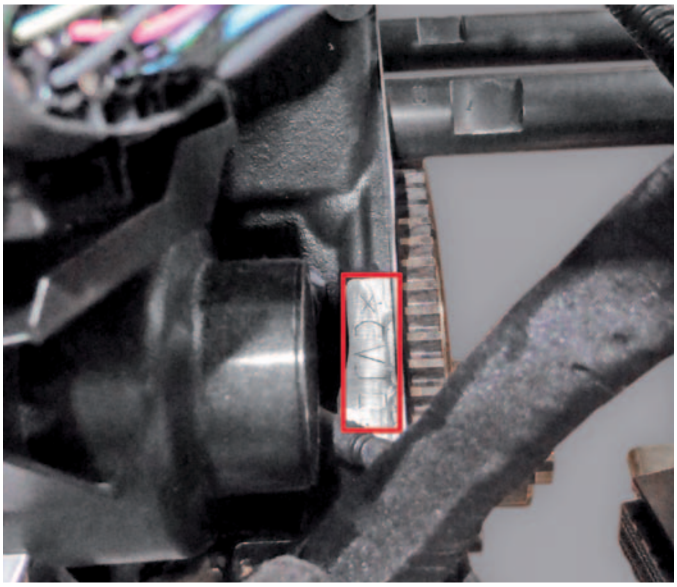
649_007

Reference
For more information about the Gen. 3 2.0l TFSI engine, please refer to Self Study Programmes 606 "Audi 1.8 and 2.0l TFSI engines of EA888 series (third generation)" and 645 "Audi 2.0l TFSI engines of EA888 series".

Specifications

Torque/power curve of 2.0l TFSI engine CVJA

Power output in kW
Torque in Nm



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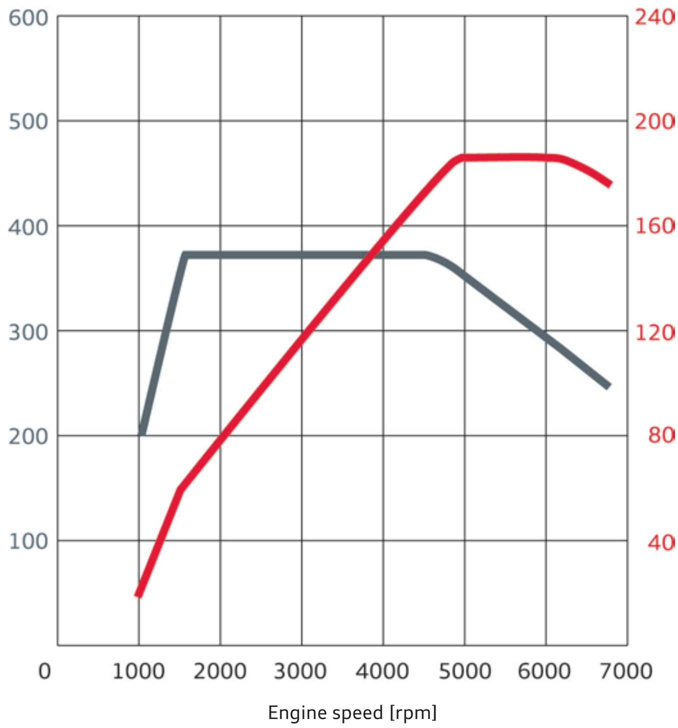
Engine code on the engine block



649_003

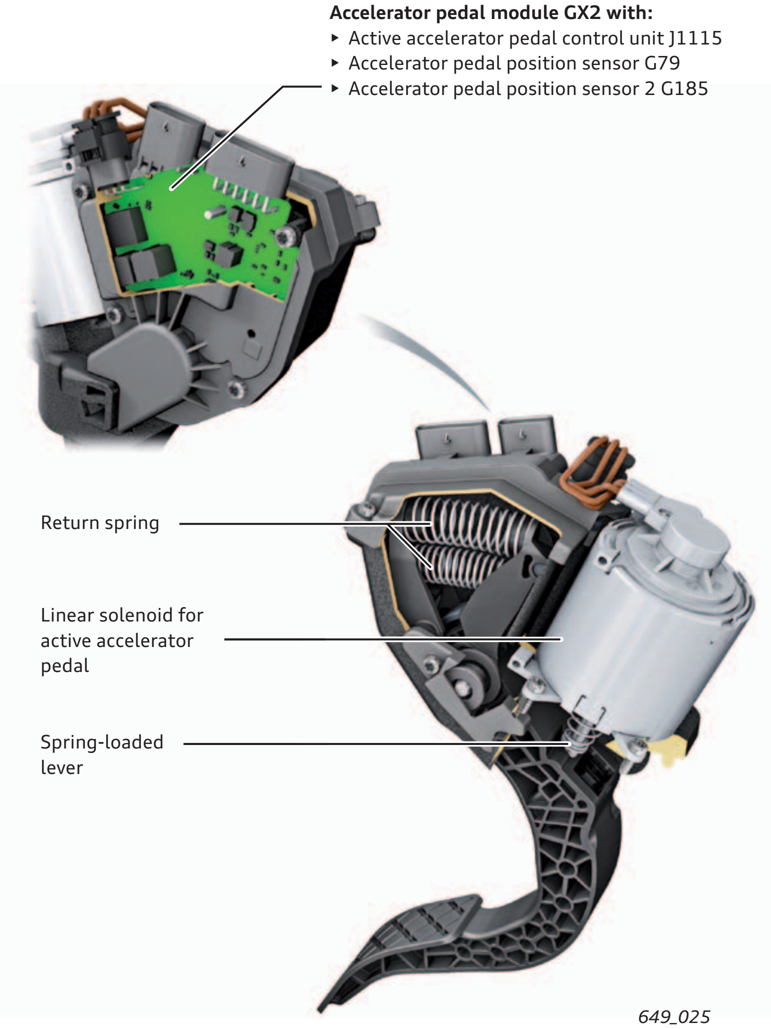
Features	Specifications
Engine code	CVJA
Type	4-cylinder inline engine
Displacement in cm³	1984
Stroke in mm	92.8
Bore in mm	82.5
Number of valves per cylinder	4
Firing order	1-3-4-2
Compression ratio	9.6 : 1
Power output in kW at rpm	185 at 5000 - 6000
Torque in Nm at rpm	370 at 1600 - 4500
Fuel type	Premium unleaded 95 RON
Engine management	SIMOS 18.4
Maximum injection pressure in bar	Adaptive lambda control, adaptive knock control
Fuel injectors	Sequential (dual) direct injection (FSI) and multipoint injection (MPI) with adaptive idle charge compensation
Exhaust gas treatment	Close-coupled ceramic catalyst, oxygen sensors before and after catalytic converter
Emission standard	EU 6 (W)

Technical features

Active accelerator pedal

The Audi Q7 e-tron quattro usually starts in electric-only mode. The driver's power requirement are indicated to the system via the active accelerator pedal. To activate the internal combustion engine, the driver must press the active accelerator pedal beyond a defined point of resistance. The point at which the resistance occurs is dependent on the requirements of the hybrid management system. The linear solenoid for the active accelerator pedal in the accelerator pedal module produces a variable pressure point by means of a spring-loaded lever. When the pressure point is exceeded, the internal combustion engine is engaged. The integrated active accelerator pedal control unit J1115 receives the relevant information from the hybrid management system.

The pressure point varies depending on the charge state of the hybrid battery. Depending on the state of charge of the hybrid battery, the driver canconsciously avoid engagement of the internal combustion engine and run in electric-only drive mode. To generate boost, where both engines deliver their maximum power output, a pressure point must be overcome.



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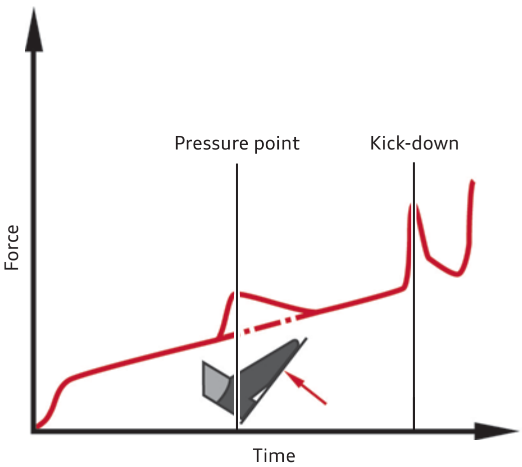
Efficiency assist

If efficiency assist is installed, the driver is prompted to ease off the accelerator by a signal tone, in addition to the visual display in the instrument cluster. If the driver continues to depress the accelerator pedal, the kick-down mode is activated as usual.

Internal combustion engine engagement signal

A pressure point can be felt when the active accelerator pedal is pressed. If this pressure point is "exceeded", the internal combustion engine is engaged to provide the driver with the required engine power.



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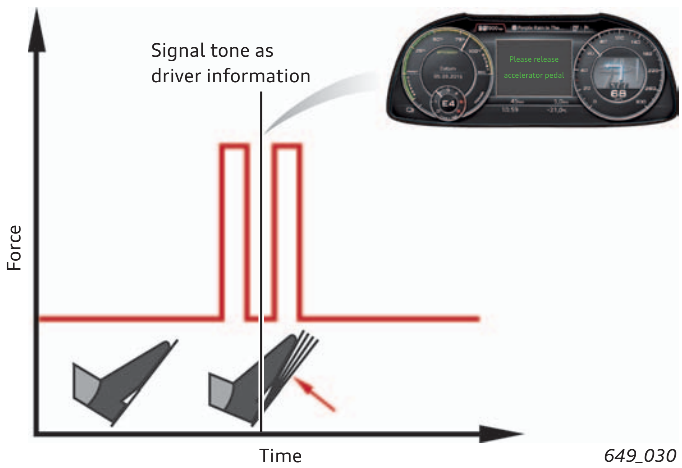
Signal tone before starting of the internal combustion engine

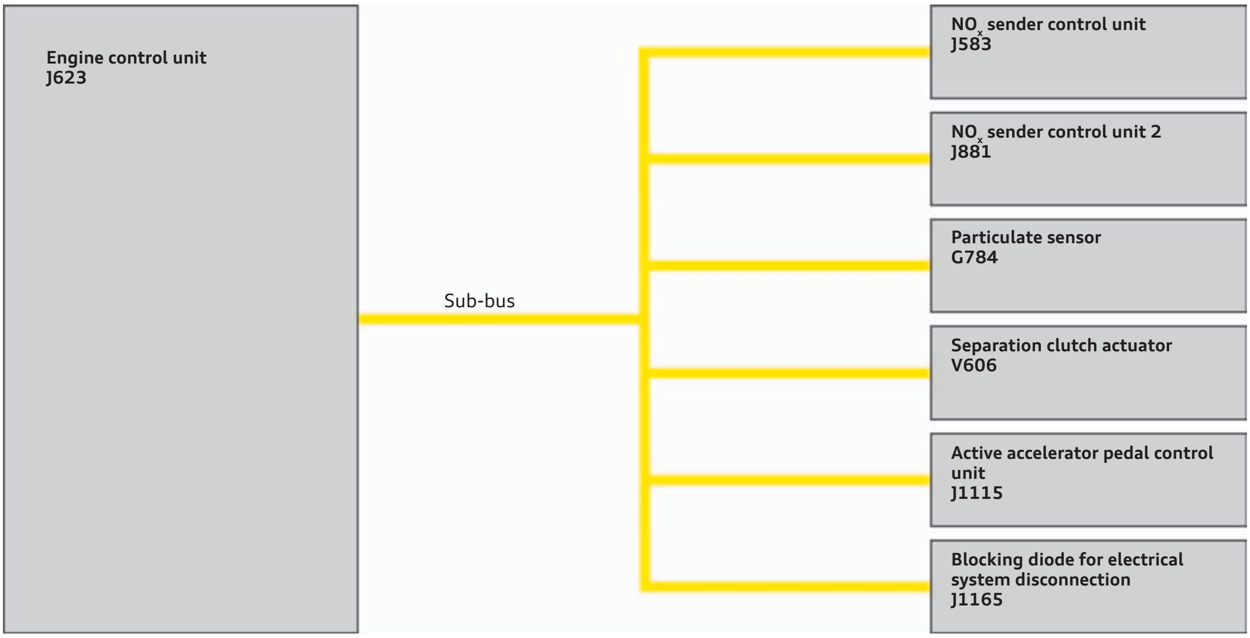
Shortly before the engagement of the internal combustion engine due to the charge state of the hybrid battery and the driver's current driving style, a counter-force is briefly produced by the active accelerator pedal.
In addition, a corresponding text message is displayed in the instrument cluster. This indicates the driver that he needs to ease off the accelerator, in order to continue driving in electric-only drive mode.



649_030

Start scenario of the diesel and petrol engines

If the engine start button is pressed at the same time as the brake pedal, the drive system is activated. e-tron READY mode is displayed in the Audi virtual cockpit. The vehicle uses the e-machine for drive if the hybrid battery has sufficient charge. If the hybrid battery is not sufficiently charged, the internal combustion engine is started.



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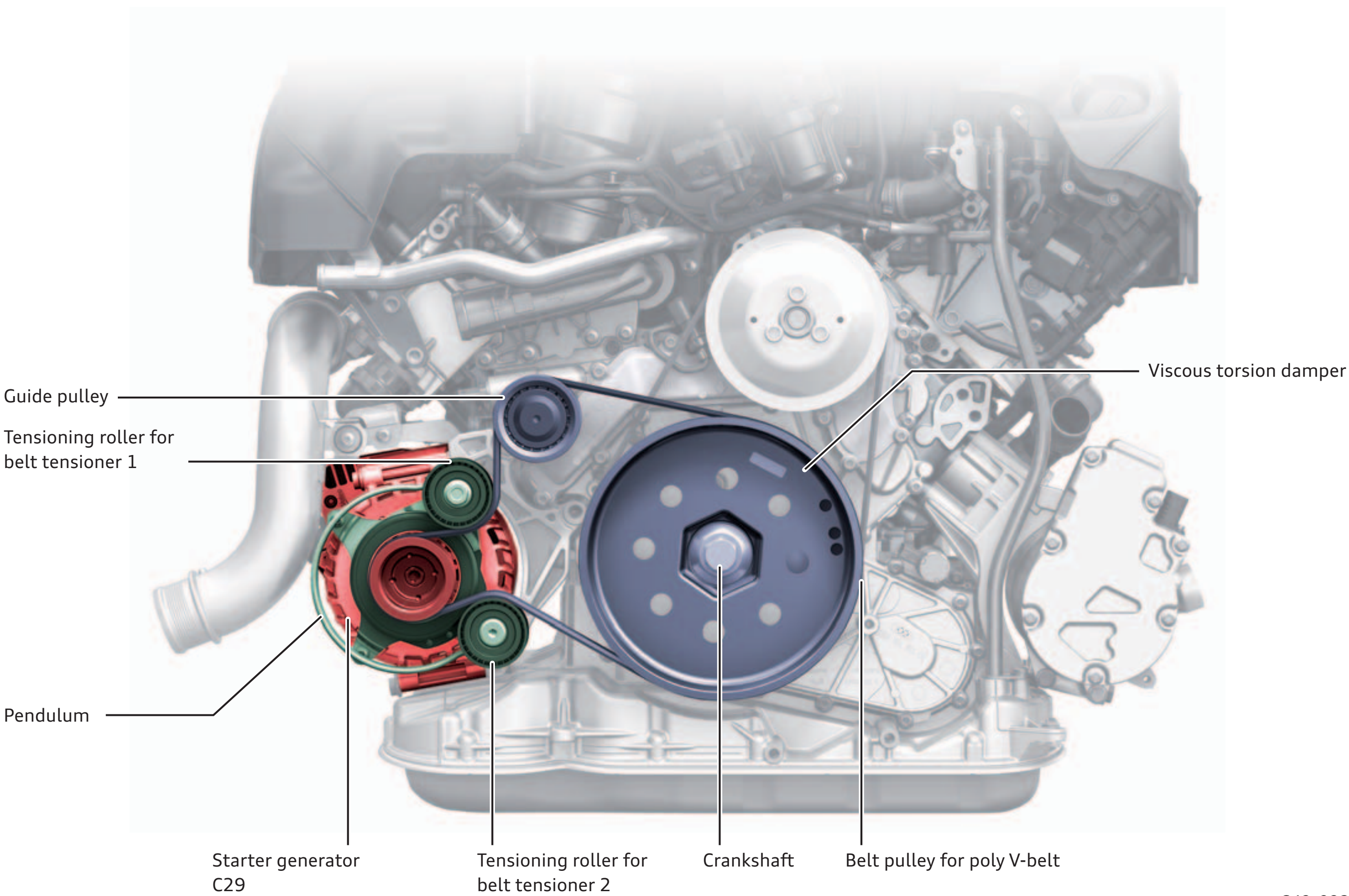
Starting of the internal combustion engine via the starter generator C29 (12-volt starting)

3.0l V6 TDI models are equipped with a starter generator C29, which is used for starting the internal combustion engine under defined conditions.



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Engine start

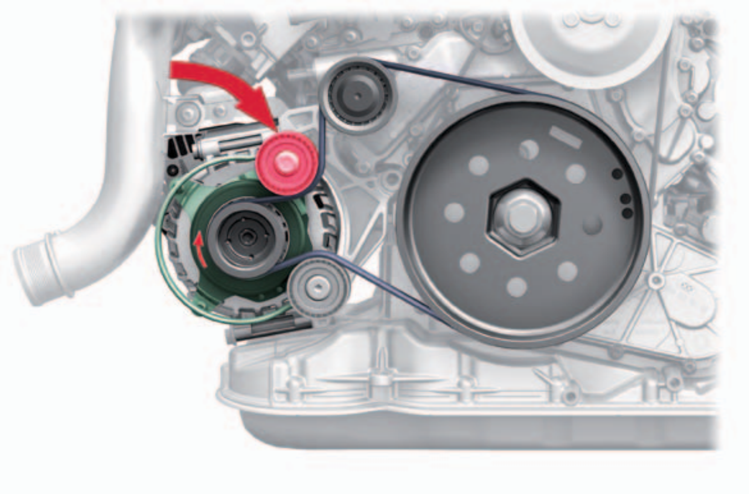
Starting with starter generator C29 is also referred to as 12-volt starting. During 12-volt starting, the separation clutch K0 in the gearbox is opened. The lower belt section is fully tensioned at start and pushes the lower roll down. This pressure is transferred via the pendulum bar to the upper roll, which tensions the poly V-belt.

If a 12-volt supply is available for the starter generator C29, the internal combustion engine is started via the belt under the following conditions:

- **Belt start**
  If the capacity of the e-machine is utilised in electric drive mode to such an extent that smooth slip-starting cannot be achieved via the e-machine, the internal combustion engine is started by the starter generator C29.

- **Change of mind**
  In hydrid drive mode, the e-machine and the internal combustion engine deliver power to the gearbox. If the internal combustion engine is shut off after the driver eases off the accelerator, the engine can be restarted after the driver presses the accelerator again by activating the ignition and the injection system in the engine control unit as long as the engine has the required starting speed. If the engine speed is too low for restarting, the engine is brought up to starting speed and started by the starter generator C29.

If the internal combustion engine has been started and is running in sync with the gearbox input shaft, the separation clutch K0 in the gearbox is closed.



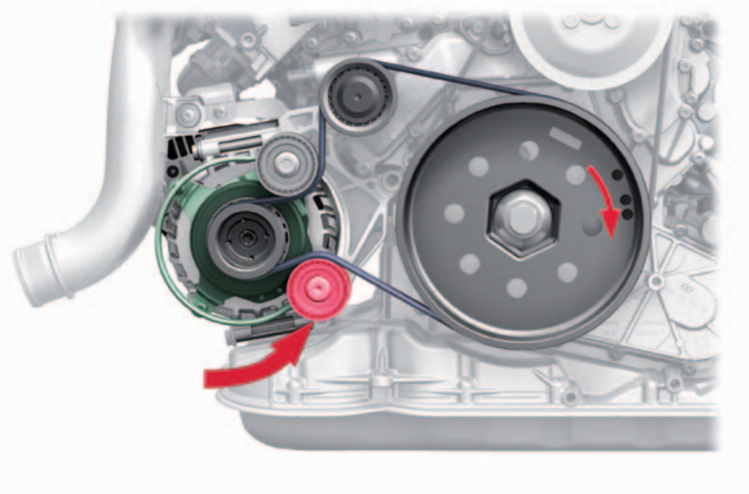
649_115

Controlled shut-off

If the internal combustion engine is shut off in start-stop mode, the starter generator C29 brakes the engine to a stop, in order to prevent judder at shut-off.

Generator mode

The starter generator is supplied with voltage by the 12-volt electrical system while the internal combustion engine is running. It is running in generator mode but is delivering electrical current. In this operating state the poly V-belt is highly tensioned because the generator is in braking mode. Therefore the lower roll is pushed up by the pendulum bar and feeds the poly V-belt.



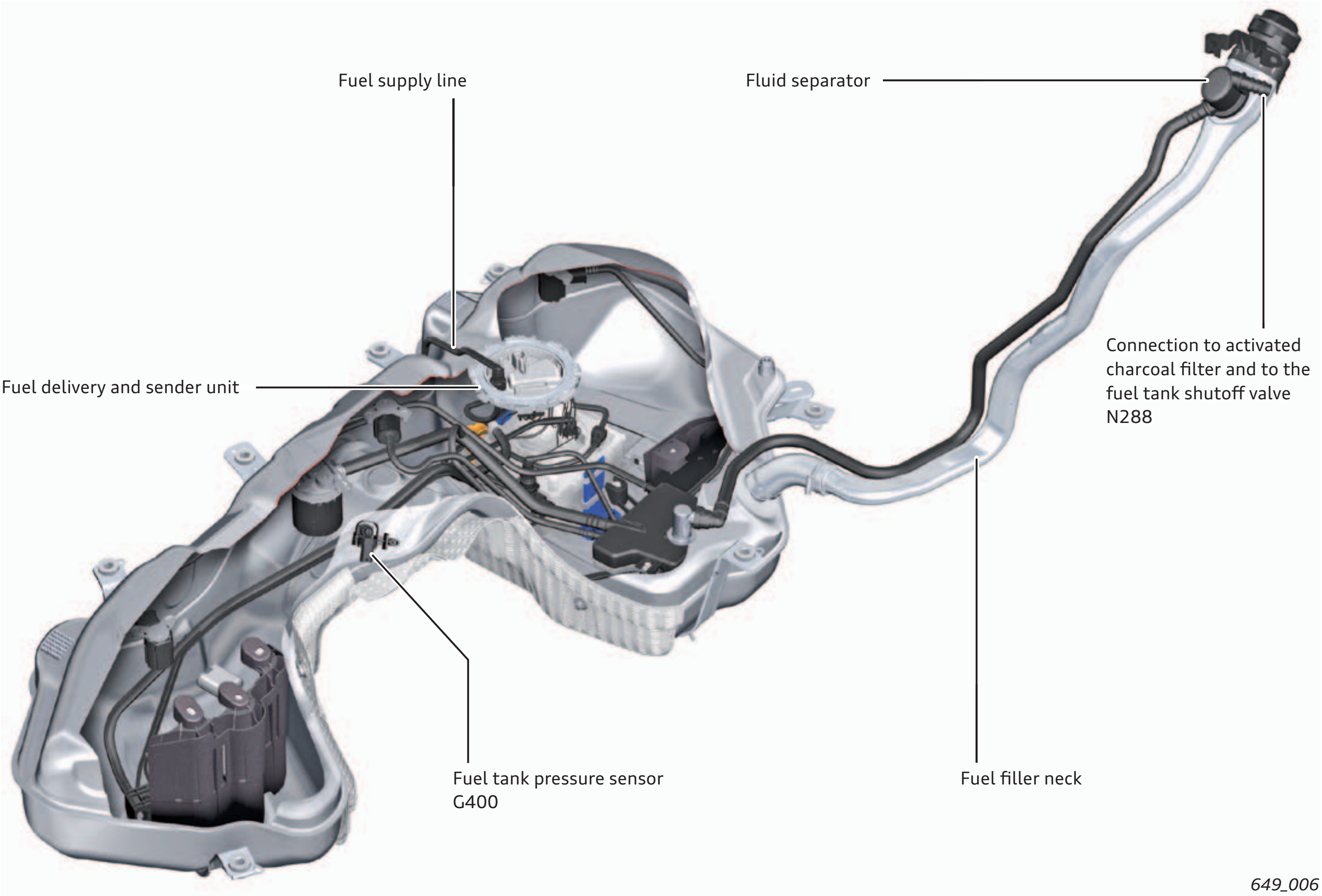
649_116

Reference
For more information about the third-generation 2.0l TFSI engine, refer to Self Study Programme 650 "Audi Q7 e-tron quattro (type 4M) high-voltage system and vehicle electrics".

Fuel system of petrol-engined models

Since hydrocarbons also form in electric-only drive mode, there is the danger of overloading the activated charcoal filter, with the result that the hydrocarbons can no longer be bound. The Audi Q7 e-tron quattro therefore has a pressure reservoir.

In electric-only drive mode, the line leading to the activated charcoal filter is closed by closing the fuel tank shutoff valve N288. This increases the pressure inside the fuel tank to approx. 0.3 bar. The actual pressure is indicated to the engine control unit by the fuel tank sensor G400.



649_006

Unlocking the fuel tank flap

The fuel tank flap is permanently locked and cannot be opened by hand. The filler flap cannot be opened until the pressure inside the fuel tank has dropped. If the driver has actuated the fuel filler flap release button E319, the engine control unit opens the fuel tank shutoff valve N288. The reduction in pressure is detected by the fuel tank pressure sensor G400. The fuel tank flap is then opened automatically by the onboard power supply control unit J519. The status of the fuel filler flap is indicated in the dash panel insert.

649_057

Note
The diesel fuel tank in the Audi Q7 e-tron quattro with 3.0l V6 TDI engine has a capacity of 75 l and is a carryover from the conventional model.

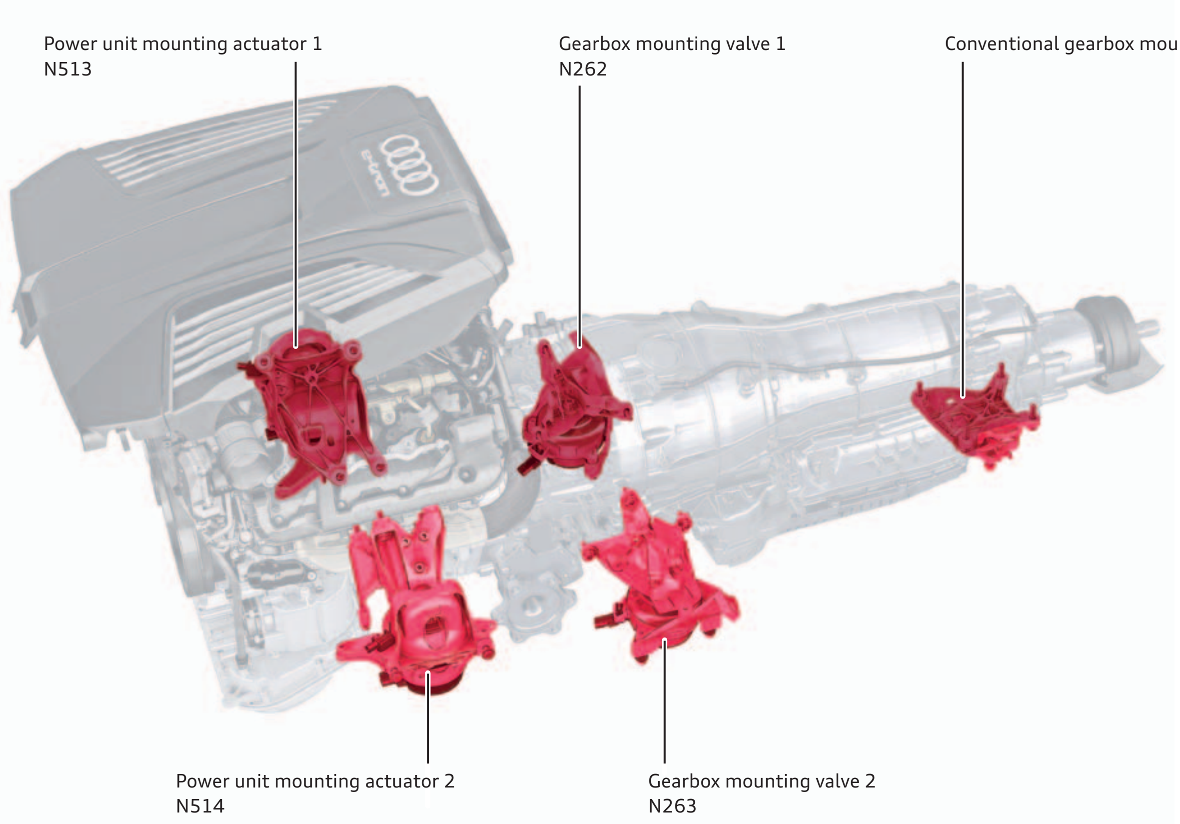
Power unit mounting system on 3.0l V6 TDI engine

The Audi Q7 e-tron quattro with 3.0l V6 TDI engine has a five-point power unit mounting system. These include the active engine mounting, two switchable gearbox mountings and a conventional gearbox mounting.

This system provides enhanced ride comfort by performing the following functions:

- Reduction of vibration across a wide frequency band
- Positioning of the power unit in the vehicle
- Reaction against drive torque
- Damping of power unit vibration

In addition, support mounting are located on the front left and right of the engine due to the absence of a torque reaction member.

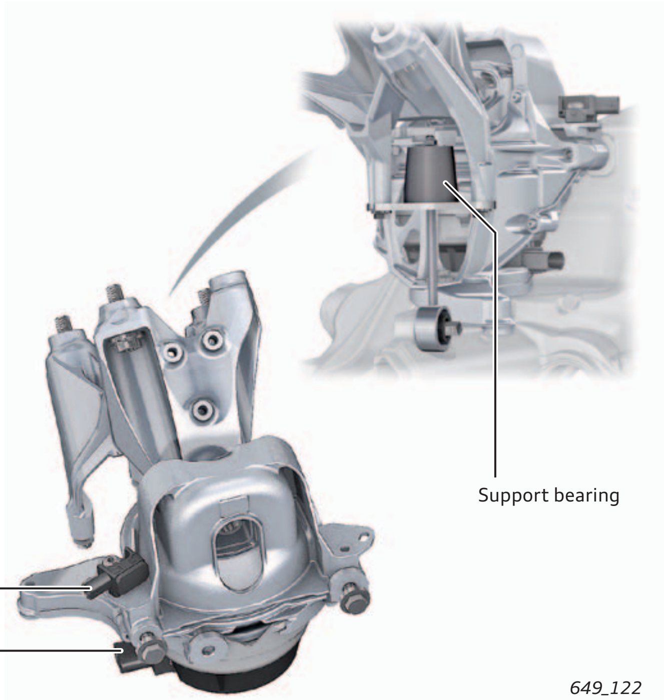


649_117

Active engine mountings

The vibration transmitted from the engine is measured by power unit mounting sensors G748 and G749. They are installed on the body-side engine mounting.
The measurement data converted in the sensors is sent to the power unit mounting control unit J931. This data is factored in when calculating the characteristic map. The engine speed information from the engine control unit is another important input variable.

The power unit mounting control unit J931 sends the calculated control signal to power unit mounting actuators N513 and N514. Counter-vibration is produced by the active engine mountings.

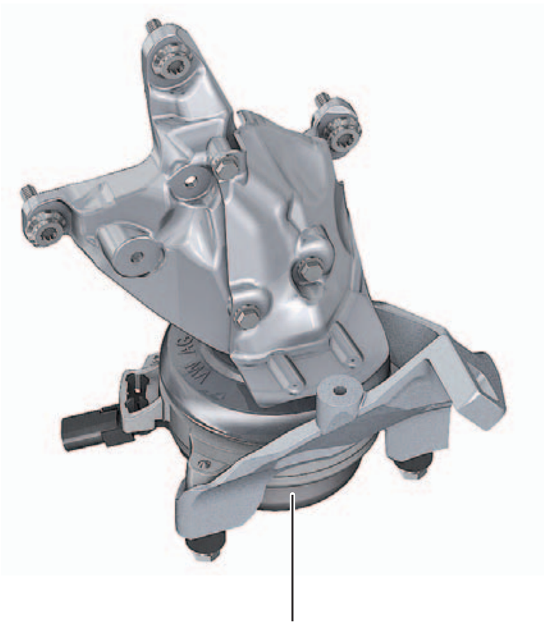


649_122

Reference
For more information about the starter generator C29, refer to Self-Study Programme 650 "Audi Q7 e-tron quattro (type 4M) high-voltage system and vehicle electrics".

Hydraulically switchable gearbox mounting

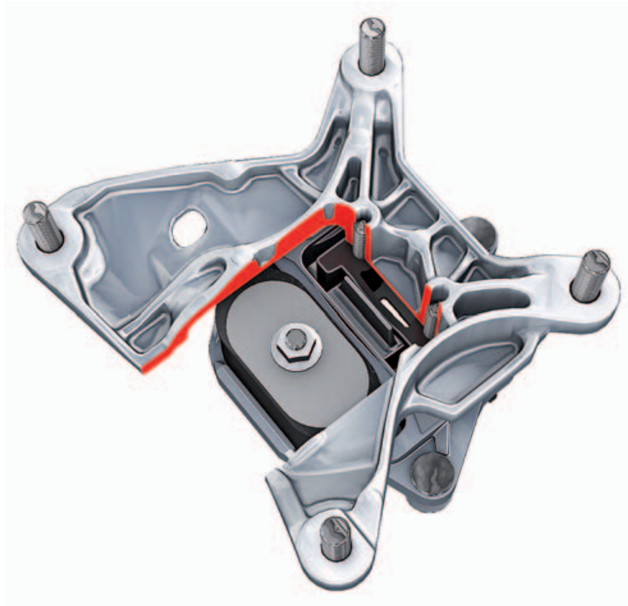
The hydraulically switchable gearbox mounts, gearbox mounting valve 1 N262 and gearbox mounting valve 2 N263 are laterally mounted to the gearbox and counteract the torsional vibration of the power unit. They switch between a soft characteristic in internal combustion mode and a soft characteristic if the e-machine is used for drive.



649_123

Conventional gearbox mounting system

The conventional gearbox mount is installed in the rear section of the gearbox and counteracts the load reversal and tilt functions.



649_132

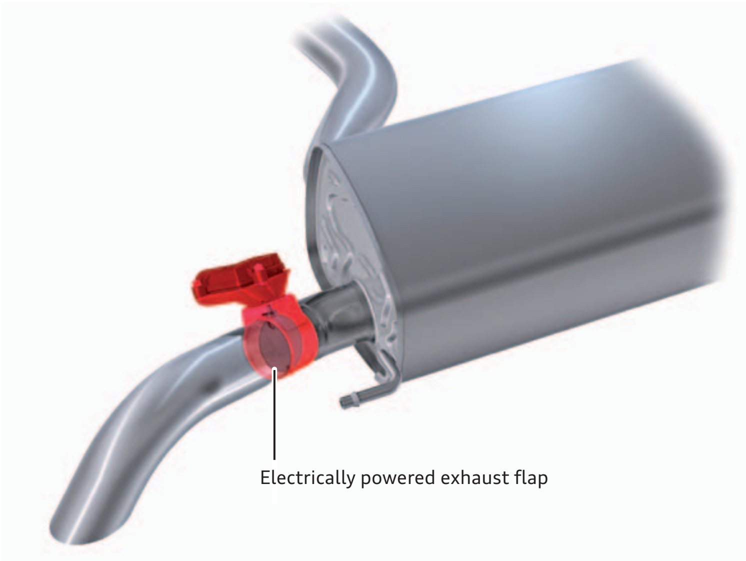
Exhaust flap on the rear silencer of the 3.0l V6 TDI engine

For acoustic reasons, an electrically driven exhaust flap is integrated in the left tail pipe.

The exhaust flap is closed under the following conditions:

- Whenever the internal combustion engine is started
- When start-stop mode is active
- When the hybrid battery charge level is low

The exhaust flap is closed when the hybrid battery charge level is low, in order to dampen the acoustic transition from electric drive to the drive by internal combustion engine.
This is done by slowly opening the exhaust flap thereby damping the muffled noise of the diesel engine.

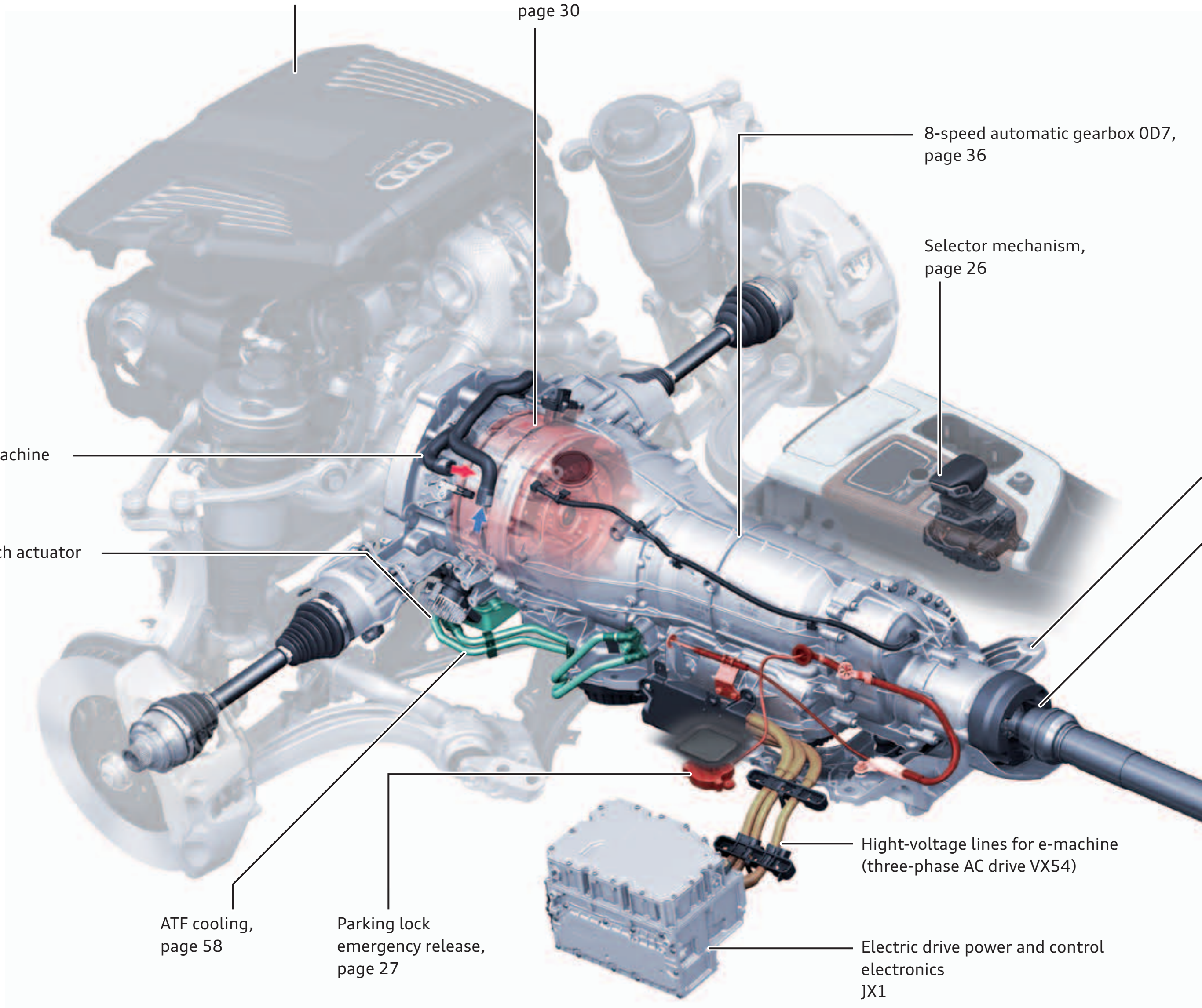


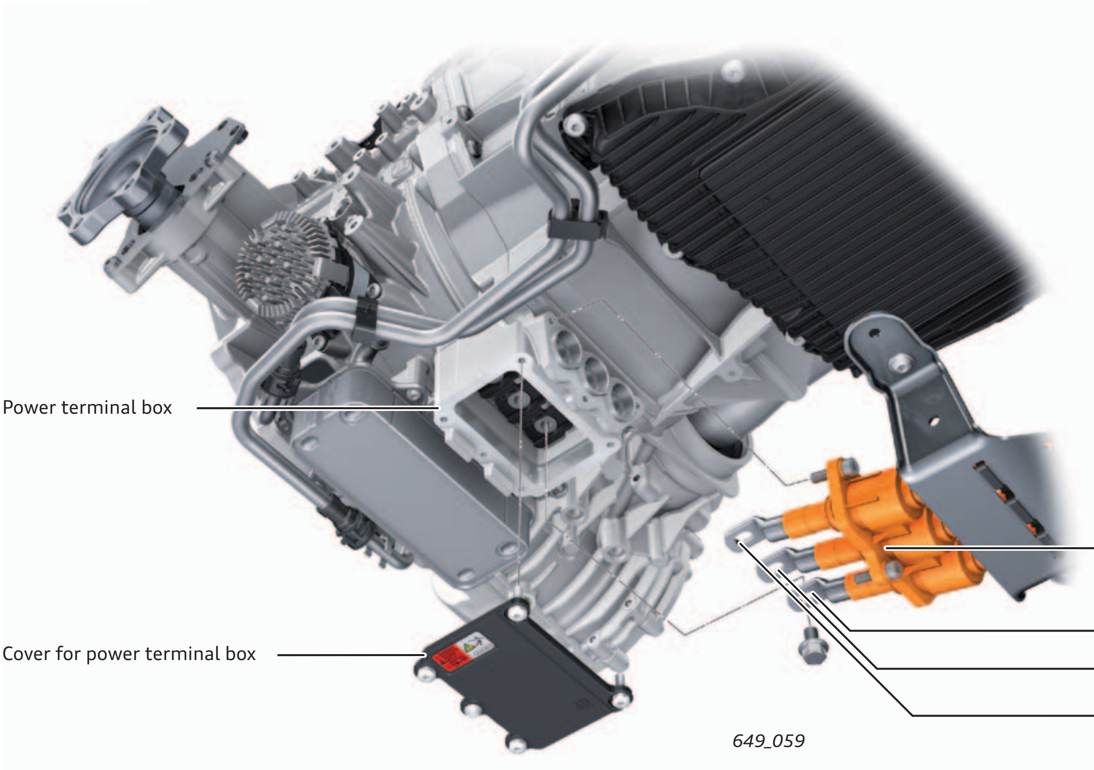
649_109

Reference
For more information about the exhaust flap with electric drive, refer to Self-Study Programme 607 "Audi 4.0l TFSI Engine with Biturbo Charging".

Power transmission

Overview





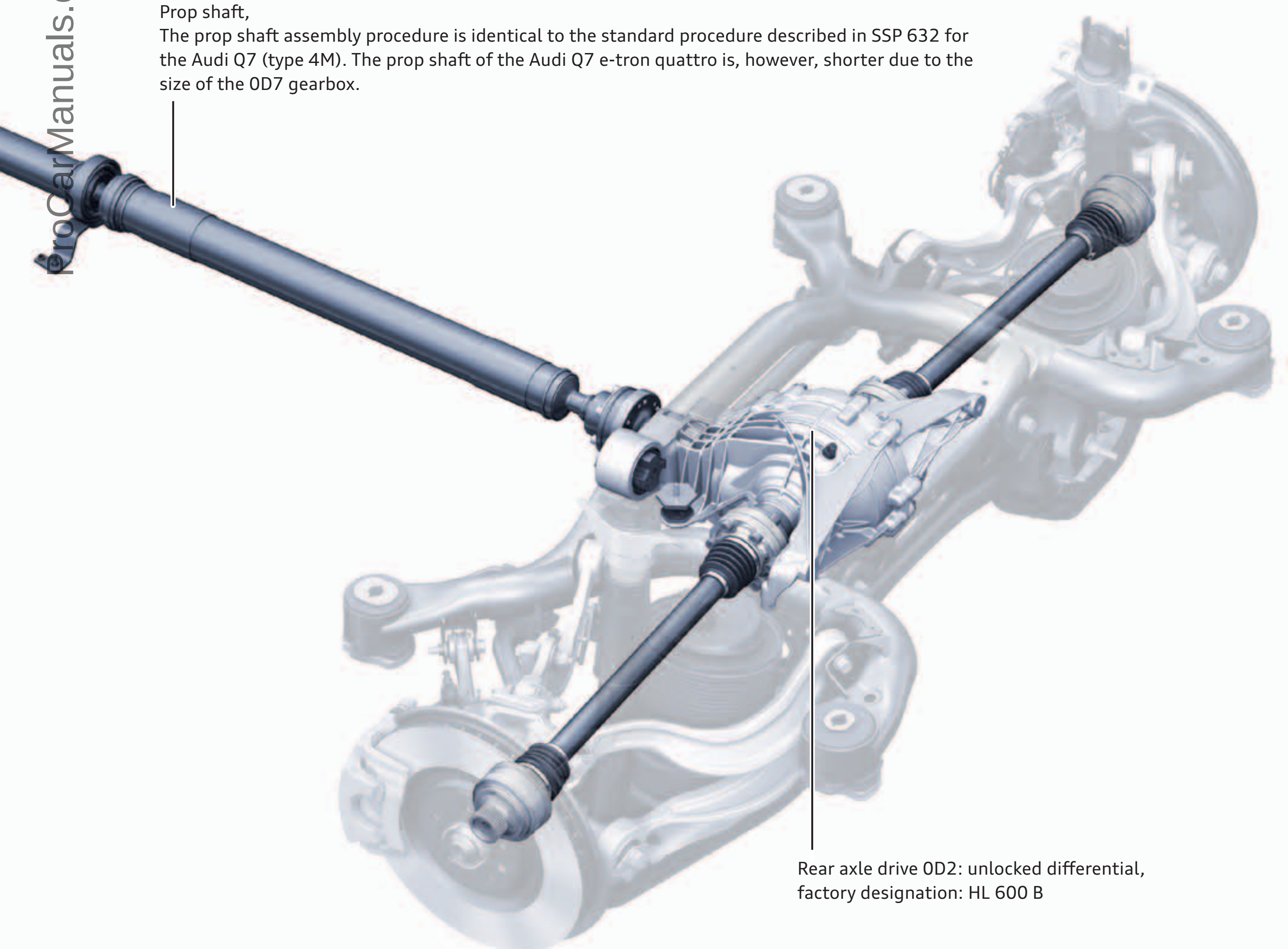
649_059

Key power transmission components of the plug-in hybrid drive in the Audi Q7 e-tron quattro are the 8-speed automatic gearbox 0D7, the prop shaft and the rear axle drive 0D2 together with the internal combustion engine.
The eight-speed automatic gearbox 0D7 is a conventional 8-speed automatic gearbox for quattro drive paired with the hybrid module. The hybrid module is seated between the internal combustion engine and the conventional automatic gearbox.
The core element of the hybird module is the e-machine, with a peak power output of 94 kW and peak torque of 350 Nm.
The internal combustion engine and the e-machine can be coupled by separation clutch K0 (refer to page 32).

Both drives, in combination with the 3.0l V6 TDI engine, deliver a total system output of 275 kW to the gearbox. Total output is 270 kW in combination with the third-generation 2.0l R4 TFSI engine. Both versions of the internal combustion engine transmit a maximum system torque of 700 Nm to the gearbox.

The prop shaft is a shortened version of the prop shaft used on the Audi Q7 (type 4M); this same goes for the rear axle drive 0D2, which is also used on the Audi Q7 (type 4M).

You can find detailled information about the prop shaft and the rear axle drive in Self Study Programme 632 "Audi Q7 (type 4M)".



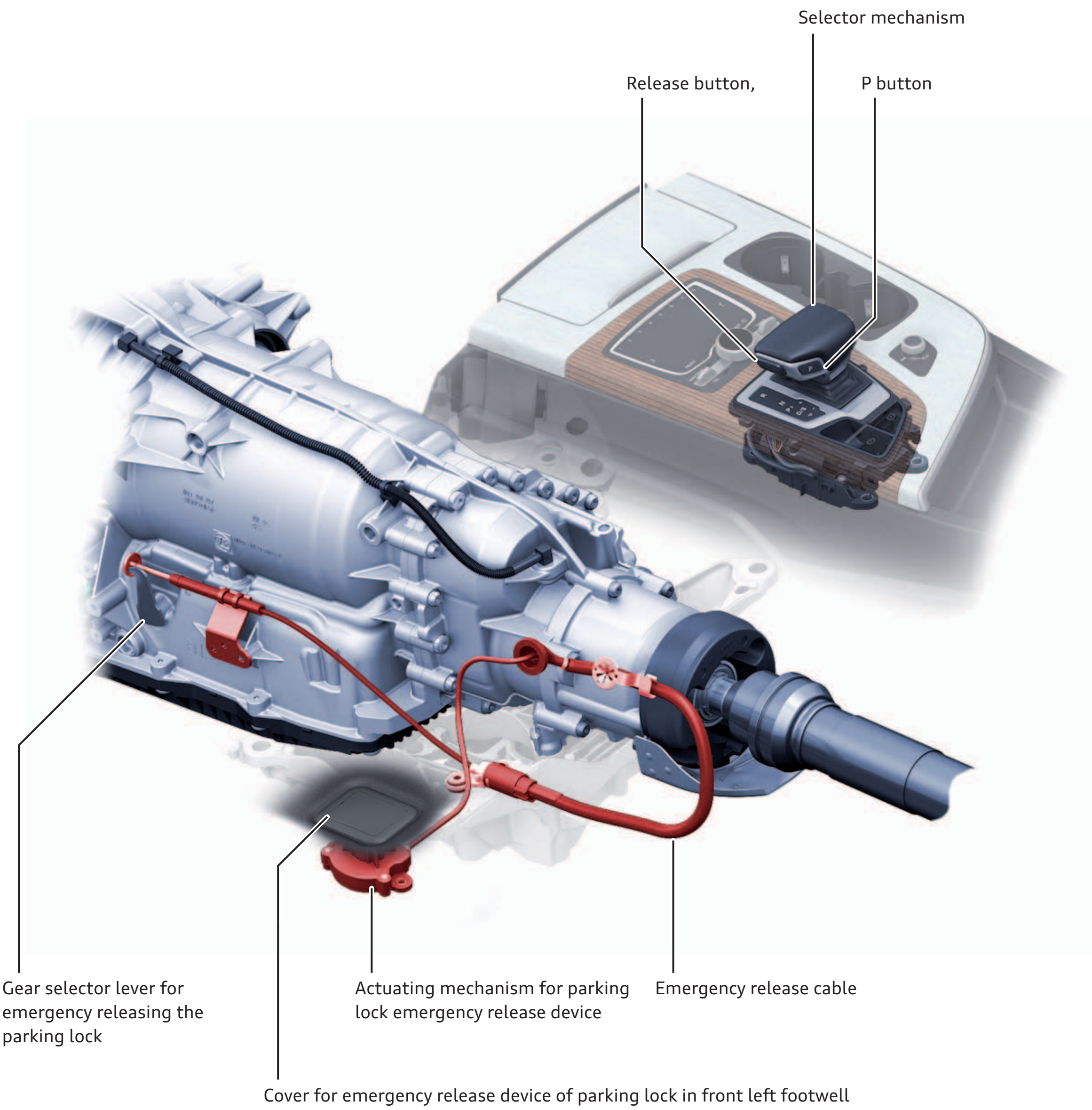
649_058

Note
All work on the high-voltage system must be referred to a qualified high-voltage technician (refer to safety information in Self Study Programme 650 "Audi Q7 e-tron quattro (type 4M) high-voltage system and vehicle electrics".

Selector mechanism

The selector mechanism and operating concept of the Audi Q7 e-tron quattro with 100 % shift-by-wire technology is identical to that of the Audi Q7 (type 4M).

- There is no mechanical connection between the selector lever and the gearbox.
- It operates by registering driver inputs without a mechanical fallback level.
- The parking lock is electrohydraulically actuated and automatically engaged/disengaged, Auto P function ((P-ON-/P-OFF position).
- In the event of a fault, a mechanical emergency release device allows the parking lock to be released in order to move the vehicle.
- Only speeds **R**, **N**, **D** and **S** are selected via the automatic gate.
- The parking lock can only be activated manually using the P button.
- To operate the tiptronic function (manual mode **M**), the selector lever must be moved into the tiptronic gate (this is only possible if selector position **D** or **S** is active). To use the "tip-shifting in D/S" function, the tiptronic steering wheel must be operated.
- As before, the release button (selector lever release button E681) is integrated in the selector lever and configured for redundancy.

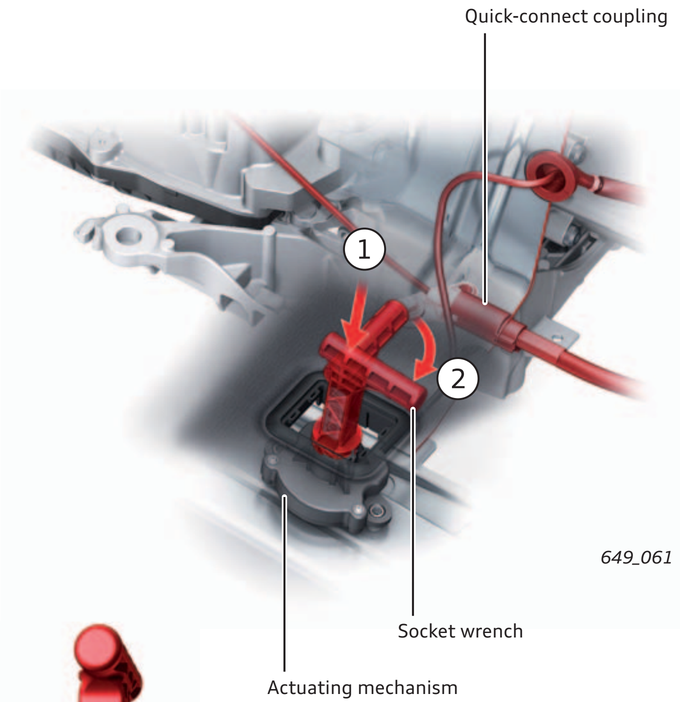


649_060

Reference
For more information about the selector mechanism and operating concept of the Audi Q7 e-tron quattro, refer to Self Study Programme 632 "Audi Q7 (type 4M)", page 40 ff.

Emergency release, parking lock

The emergency release device of the parking lock in the Audi Q7 e-tron quattro is identical to the emergency release device of the Audi Q7 (type 4M), as described in SSP 632, page 48 ff.



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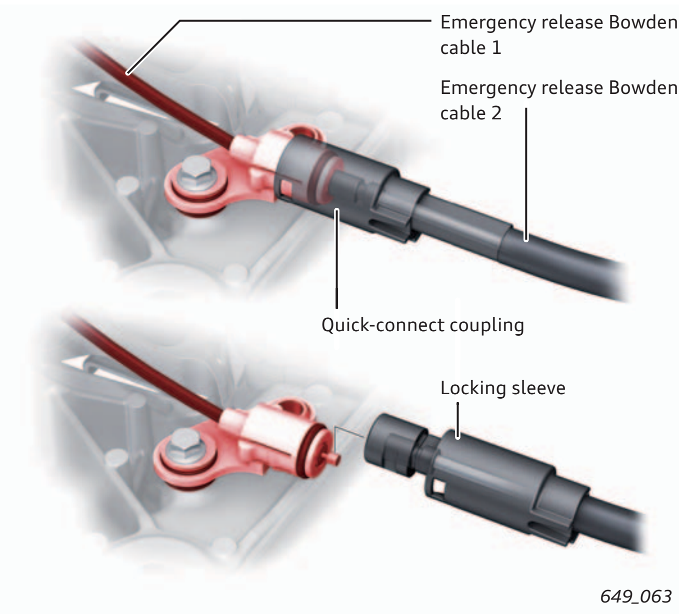
649_062



649_063

If it is necessary to hold the parking lock in the P-OFF position for longer, the emergency release device serves to release the parking lock and should be actuated in the following situations:

- To tow the vehicle
- If the parking lock cannot be released electro-hydraulically due to a malfunction.
- If the vehicle cannot be manoeuvred or moved due to insufficient onboard voltage.
- If the engine is not running and it is necessary to manoeuvre or move the vehicle, e.g. in the workshop.

If it is no longer necessary to hold the parking lock in the P-OFF position, it should be released again and moved back into the P-ON position.
It is necessary to check the emergency release device after assembly work on its component parts.

Warning!
Before actuating the emergency release device of the parking lock, the vehicle must be secured to prevent it from rolling away.

Emergency-releasing the parking lock (P-OFF position)

- Remove cover.
- Insert the socket wrench insert for emergency release into the actuating mechanism as shown under position 1 in Fig. 649_061.
- Push down the socket wrench insert and turn it clockwise through 90° until the socket wrench insert noticeably engages the actuating mechanism (position 2 in Fig. 649_061).

Locking the parking lock (P-ON position)

- Simply pull the socket wrench insert upwards out of the actuating mechanism (position 3 in Fig. 649_062).

Note:
The socket wrench insert must not be turned back, as this will damage the actuating mechanism of the emergency release device.

- Fit the cover.

Quick-connect coupling

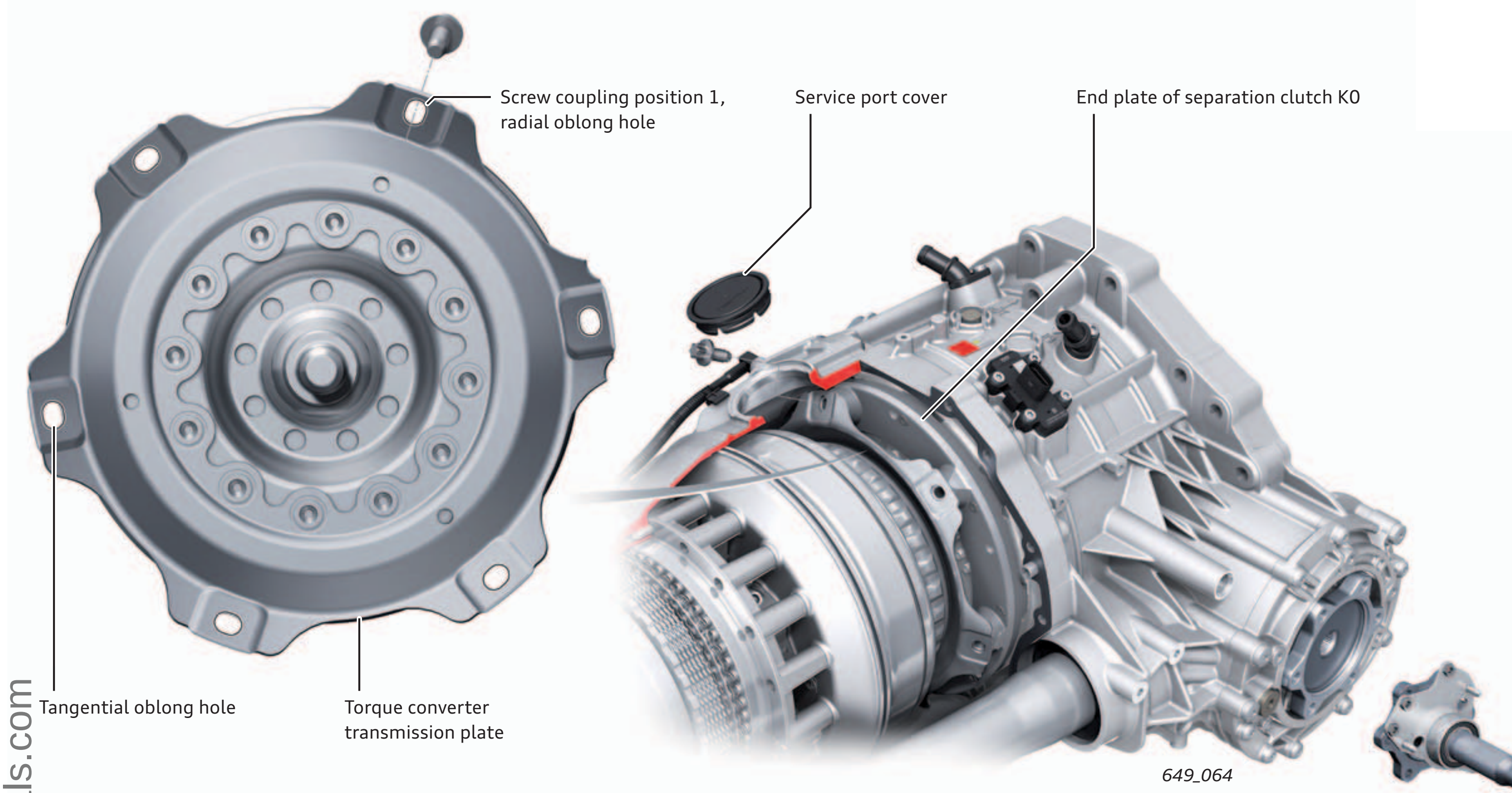
To simplify removing and installing the gearbox, the emergency-release Bowden cable consists of two parts, which are interconnected by a quick-release coupling. Refer to Workshop Manual.

When the parking lock emergency release device is actuated, the yellow gearbox warning lamp and the gear drive position indicator **N** light up in the instrument cluster.
The following message is also displayed in the instrument cluster: "Vehicle may roll away! P cannot be selected. Please apply parking brake."

Reference
For more information about the parking lock emergency release device in the Audi Q7 e-tron quattro, refer to Self Study Programme 632 "Audi Q7 (type 4M)", page 48 ff.

Plug-in hybrid drive

The internal combustion engine and the eight-speed automatic gearbox 0D7 with hybrid module are key components of the hybrid drive.



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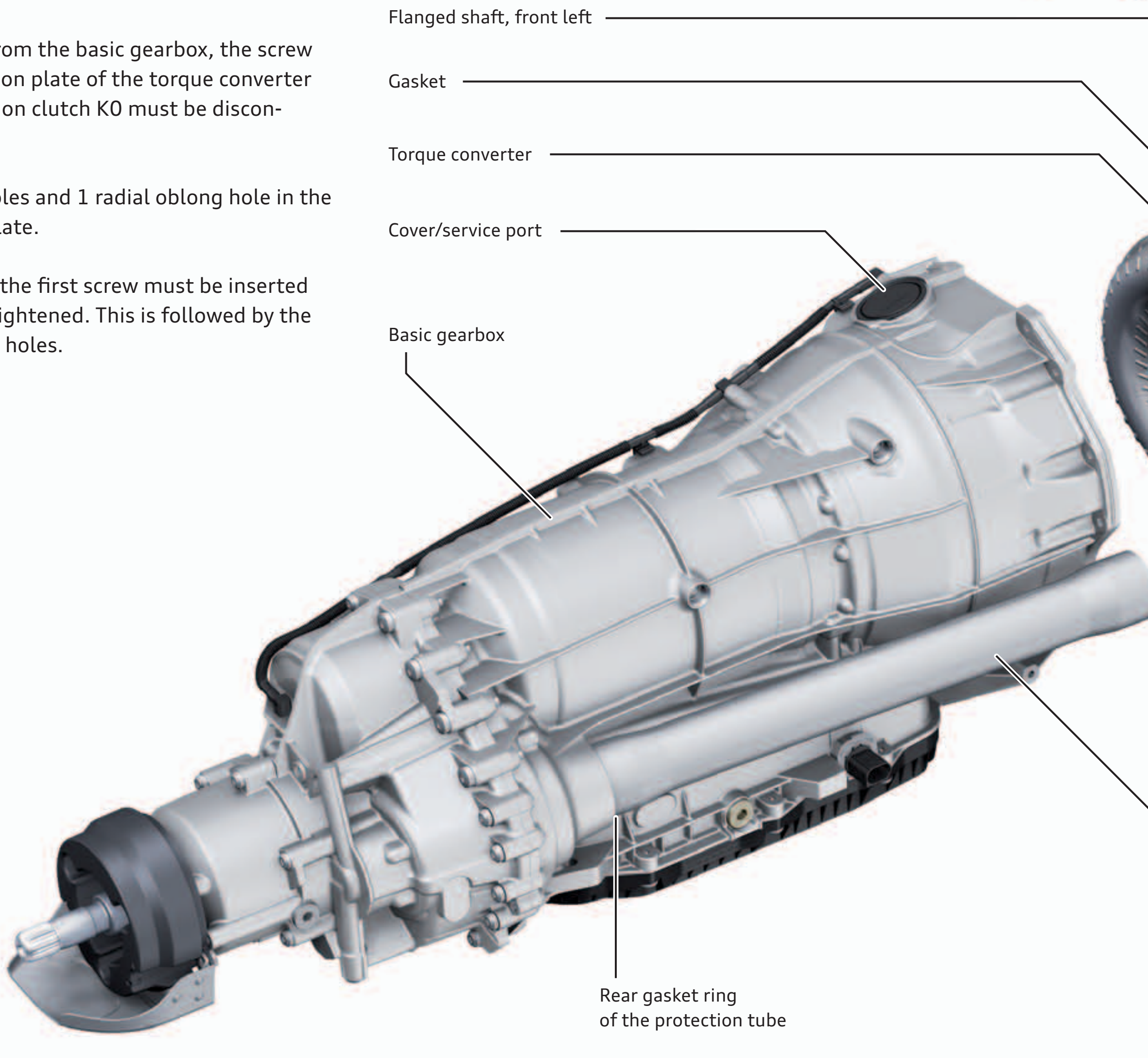
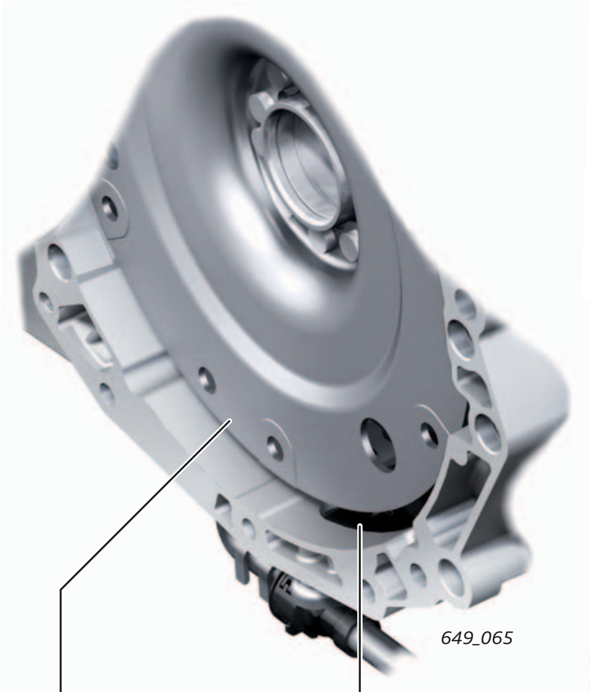


To separate the hybrid module from the basic gearbox, the screw coupling between the transmission plate of the torque converter and the end plate of the separation clutch K0 must be disconnected via the service port.

There are 5 tangential oblong holes and 1 radial oblong hole in the torque converter transmission plate.

To assemble the hybrid module, the first screw must be inserted into the radial oblong hole and tightened. This is followed by the screws for the tangential oblong holes.

As has been the case since the launch of the Audi A5 (type 8T), the torsion damper transmission plate must be disconnected from the engine flywheel via the service port in order to remove the 0D7 gearbox. See SSP 392.



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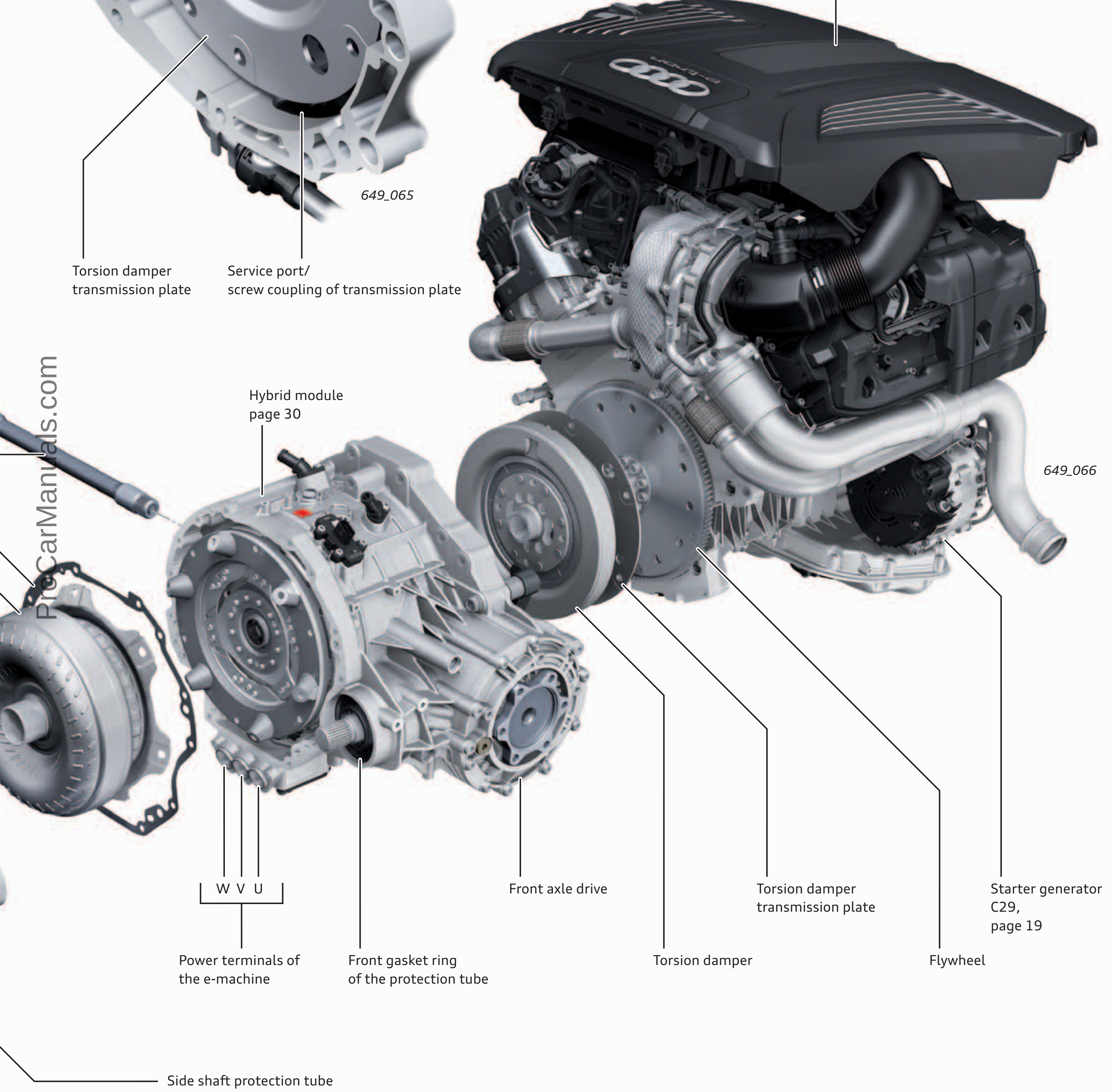


649_066

When the hybrid module is separated from 0D7 gearbox, the side shaft protection tube is hanging loosely in the rear gasket ring and can drop down.

Note
For removal and installation of the basic gearbox and the hybrid module as well as all other components, the instructions given in the workshop manual must be followed.

Hybrid module (separation clutch actuator, sensors)

The hybrid module housing accommodates the front axle drive. The torsion damper is on the internal combustion engine side and the e-machine with separation clutch K0 is on the basic gearbox side.
The e-machine is a permanently excited synchronous machine and serves as both a drive motor and as a generator. The e-machine is also referred to in the service literature as three-phase AC drive VX54 or as electric drive motor V141.
As the rotor of the e-machine is an outer rotor, the maximum possible leverage is utilised. Compared to an internal rotor, less phase current is required during engine operation to generate the same amount of torque.

The three-phase AC drive VX54 consists of:

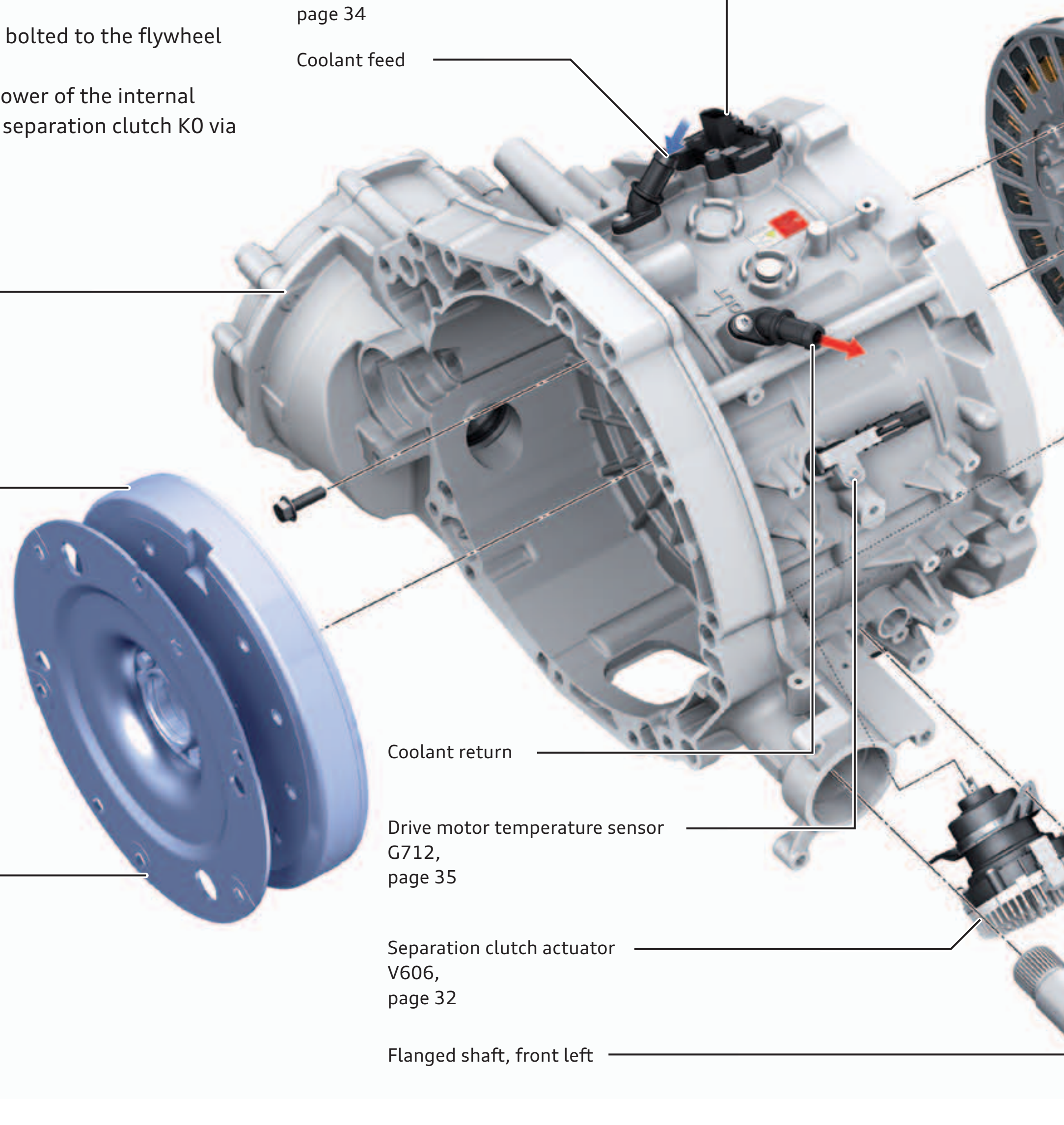
- Electric drive motor V141
- Separation clutch actuator V606
- Drive motor temperature sensor G712
- Drive motor rotor position sensor 1 G713

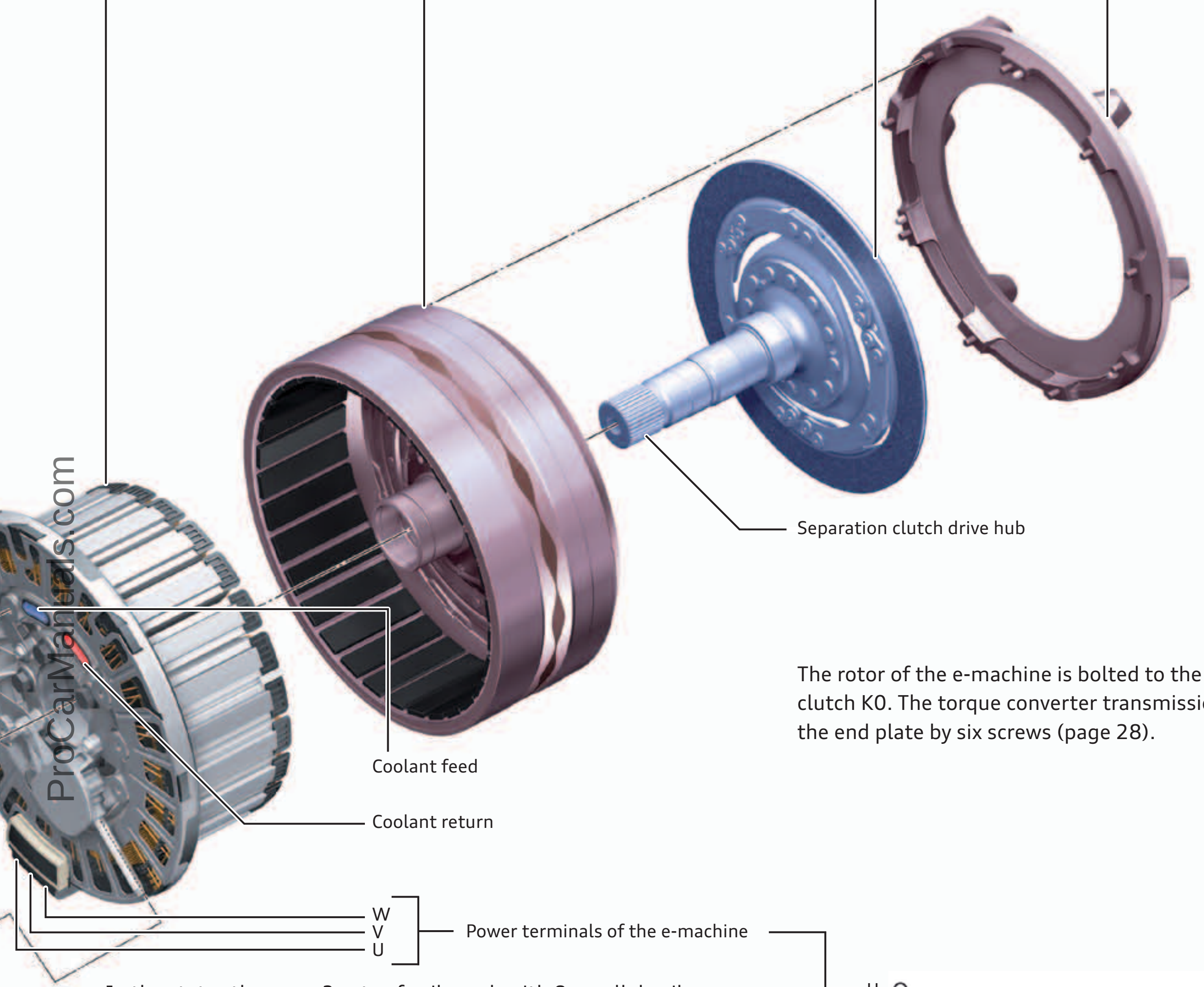
This means that a short-time torque peak of 350 Nm and a peak power output of 94 kW are available within a very small package space. Thanks to the highly effective cooling connection, a peak torque of 200 Nm and a peak power output of 60 kW can be utilised for continuous operation.
In cooling mode, internal stator cooling system ensures a high degree of heat dissipation despite the very small cooling area (refer to page 35).

The torque converter transmission plate is bolted to the flywheel of the internal combustion engine.
The torque converter transmits the drive power of the internal combustion engine to the drive hub of the separation clutch K0 via a spline.

In generator mode, the rotor of the e-machine is driven by the internal combustion engine or by the recuperation system via the closed separation clutch K0. Refer to "Operating modes" on page 48.

Short-time peak power ouput in kW	94
Short-time peak torque in Nm	350
Current consumption at max. power output in A	450
AC voltage at max. power output in V	3 x 310
Continuous power output in kW	60
Torque at 60 kW continuous power output in Nm	200
Current consumption at 60 kW contin. power output in A	240
AC voltage at 60 kW continuous power output in V	3 x 280
Maximum generator power output in kW	80





649_067

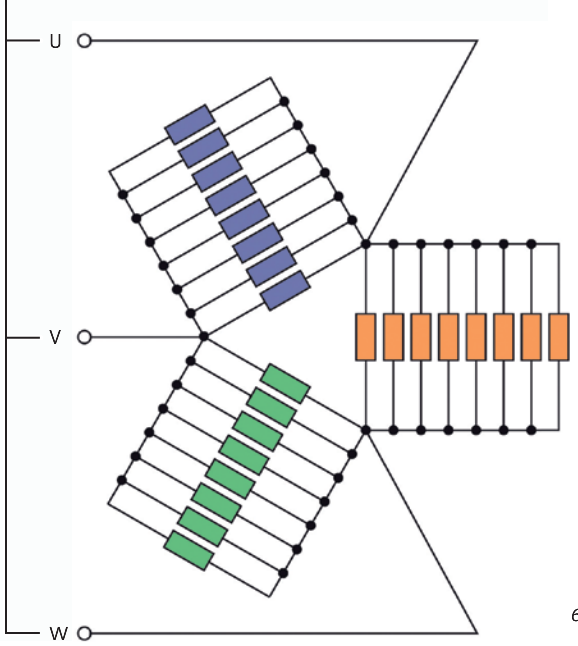
The rotor of the e-machine is bolted to the end plate for separation clutch K0. The torque converter transmission plate is attached to the end plate by six screws (page 28).

In the stator there are 3 sets of coils each with 8 parallel coils interconnected by a delta circuit configuration.

In total, 24 coils are distributed over the circumference of the stator in such a way that every third coil belongs to the same set of coils. In this configuration the e-machine can run on three-phase current. For this purpose, the electric drive power and control electronics module JX1 activates the coil sets by applying three-phase AC voltage.

To ensure that the rotor starts to run in the desired direction and with maximum torque despite the extremely low current input, it is important that the control electronics activate the three phases in correct sequence. For this purpose, the control electronics needs to know the exact position of the rotor and therefore the position of the pole pairs relative to the coils.

The electric drive power and control electronics JX1 calculate the exact position of the pole pairs relative to the coils from the signals generated by drive motor rotor position sensor 1 G713 (refer to page 34).

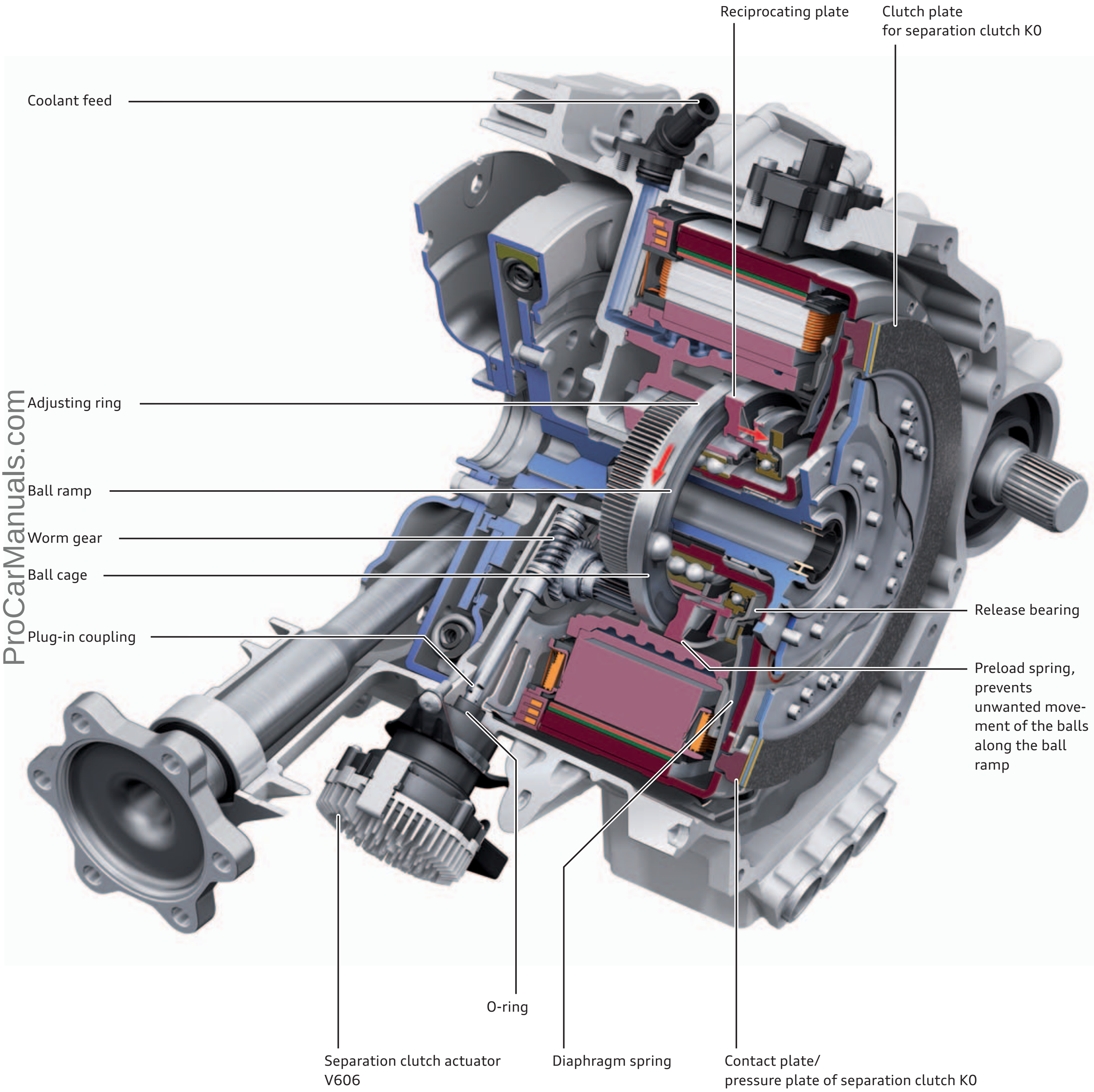


649_068

Actuation mechanism for separation clutch K0 – separation clutch actuator V606

The separation clutch K0 is a dry plate clutch and is engaged in the idle state. It works in exactly the same way as the starting clutch of a manual gearbox. The separation clutch couples the internal combustion engine to the e-machine.

The separation clutch K0 is actuated by the separation clutch actuator V606, irrespective of hydraulic pressure supply to the automatic gearbox.



649_069

Note
For more information about the tasks of the separation clutch and power flow through the gearbox, refer to "Gearbox schematic, gear set and shift elements" on page 44. The shift states of clutch K0 are shown in the shift matrix on page 46.

Actuation mechanism of separation clutch K0

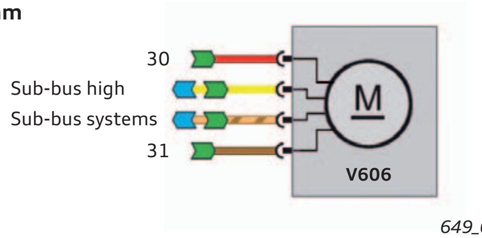
The separation clutch actuator drives the worm gear shaft via the shaft slip-on coupling. The worm gear is connected to the spur gear drive of the adjusting ring. When the clutch disengages, the adjusting ring is rotated about 120° in the direction of the arrow. The ball cage holds three balls in position and evenly distributed over its circumference. By rotating the adjusting ring, the balls push the reciprocating plate against the disengagement bearing over the ball ramps in the adjusting ring and in the reciprocating plate. Longitudinal guides stop the reciprocating plate from rotating.

The separation clutch otherwise functions in the same way as a convetional frictional clutch with diaphragm spring and contact plate.

If the actuator is deactivated in the event of a fault, or if the maximum allowable temperature is exceeded, the separation clutch K0 is engaged because the clutch actuating mechanism is not self-locking. In this case, the vehicle can only run in hybrid mode where drive is provided by both the internal combustion engine and e-machine.

Separation clutch actuator V606

Function diagram



649_070

The separation clutch actuator V606 is a brushless DC motor. It is supplied with power through the 12-volt electrical system. Terminal 30 is protected by a 30A fuse.
The engine control unit J623 instructs the actuator via a sub-bus to control the clutch. For this purpose, the engine control unit uses clutch control software which is ancillary to the hybrid management system.

Temperature protection

The actuator electronics measure the temperature via an integrated temperature sensor. If the temperature of the actuator exceeds a value of 125 °C, the electronics indicate the actual temperature to the engine control unit J623.
The clutch control software thereupon activates the separation clutch K0 as little as possible, to allow the actuator to cool down again. If this fails and the temperature rises to a value of 135 °C, the actuator will not be activated any further until it has cooled down to a temperature of 110 °C. Once this temperature level is reached, operation of the actuator, and hence separation clutch K0, is again unrestricted.

Actuator diagnostics

Actuator diagnostics are provided by the engine control unit J623 (address code 01). If the vehicle is raised on a hydraulic lift and the engine cover has been removed, the actuation of the clutch by the actuator is distinctly audible.

Note:
Actuator diagnostics are not possible with the actuator removed. The reason for this is that the actuator cannot be zero-calibrated when removed. This is necessary because the actuator cannot recall its position after a change of terminal status (terminal 15 off).
The software in the actuator electronics requires that a zero calibration be performed immediately after starting (terminal 15 on). The actuator rotates the worn gear shaft through an angle of about 300° and moves the adjusting ring up against its mechanical stop. The actuator identifies its zero position by the resistance and begins to open the clutch from this starting point.
When the actuator is removed, there is no resistance. After about 60 turns, the fault is registered in the event of memory of the engine control unit J623 as a "referencing error" and the actuator is not activated any further. The actuator stops rotating. The system is restored to full functionality by deleting the event memory entry and after a change of terminal status.

Adaption and basic setting

The actuator has a rotor position sensor, which measures angle of rotation and speed.
The electronics calculate the stroke of the disengagement bearing from the angle of rotation of the actuator shaft. The electronics are able to determine the force-distance characteristic and the clutch pressure point from the power input, which corresponds to the force acting on the disengagement bearing as a function of angle of rotation and travel.
To factor in the clutch pressure point shift resulting from clutch lining wear, the clutch control software adapts the force-distance characteristic after the change of terminal status (terminal 15 off). However, this takes place at ever increasing intervals over the life of the clutch.
If the engine control unit software is updated or if the engine control unit or the hybrid module or the separation clutch actuator V606 is replaced, the force-distance characteristic must be reprogrammed using the "Basic setting" guided function on the diagnostic tester.

Fault diagnostics

The electronics of the separation clutch actuator V606 determine the speed and current input of the actuator via a rotor position sensor. An excessively high power input is indicative of an actuator overload. Classic faults sich as open circuit and short circuit to positive or ground are also detected. The irregularities are stored in the event memory of the engine control unit.

Measured values

The measured value for disengagement bearing travel, which can be read out using the diagnostic tester, is simply a theoretical value calculated by means of actuator speed and gear ratio. This measurement value is not an absolutely reliable guide to the actual travel of the disengagement bearing.

Updating software

If necessary, the software of the separation clutch actuator V606 can be updated via the engine control unit J623 using an SVM code.

Drive motor rotor position sensor 1 G713

The drive motor rotor position sensor 1 G713 is seated in the hybrid module housing and operates contactlessly. When the vehicle is opened (wake-up), the electric drive power and control electronics module JX1 calculates the exact position of the rotor from the signals generated by G713.
The control electronics JX1 must know exactly how the permanent magnets of the rotor are positioned relative to the stator coils even when stationary.

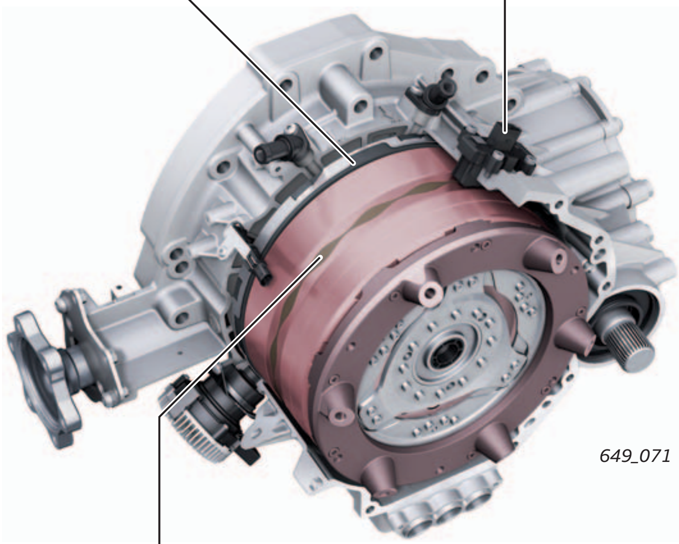
The power electronics require this information to control the three-phase AC current in such a way that the rotor starts up in the desired direction with minimum power consumption and maximum torque.
In addition to determining the exact rotor position, the electric drive power and control electronics module JX1 determines the direction of rotation and speed of the rotor from the signals generated by G713.

Function

The sensor works on the induction principle. It has 2 signal outputs (sine wave and cos wave) and 2 supply lines (positive and ground). A DC voltage of 5 volts is applied by the electric drive power and control electronics module JX1 and converted to a high-frequency AC voltage by the sensor electronics. 4 coils integrated in the sensor are supplied with this high-frequency AC voltage.

The rotation of the rotor alters the width of the copper track in relation to the sensor, and thus the inductance in relation to each coil. The wider the track under a coil, the greater the voltage available to the signal. When this voltage is plotted by the sensor electronics as a function of the angle of rotation of the rotor, the result is a sine-wave curve. The same functional principle applies to all 4 coils. The sensor coils are positioned over the copper track in such a way that the sensor electronics identify 4 sine-wave signals phase-shifted 90° relative to one another. The sensor electronics utilise two of these signals to compensate for variation in sensor distance relative to the rotor and temperature. Two sine-wave signals phase-shifted 90° relative to one another are sent to the electric drive power and control electronics module JX1.

The electric drive power and control electronics module JX1 is able to identify the exact position of the rotor relative to the stator coils from the voltage difference between both signals, even when the rotor is at standstill. To find out how this works, please refer to page 35 of Self Study Programme 601.



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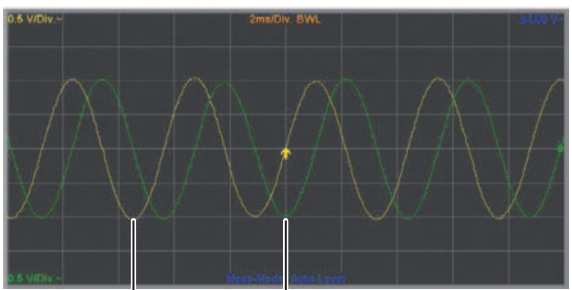
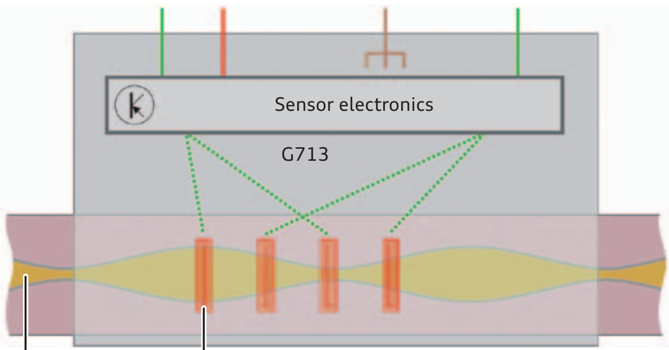


649_072



649_148

Effects of failure of the sensor

If the sensor fails, the hybrid system warning lamp comes on in the dash panel insert. The vehicle can be driven with the internal combustion engine until the ignition is turned off. It is not possible to restart the vehicle as the e-machine only runs in generator mode.

Drive motor temperature sensor G712

The drive motor temperature sensor G712 is seated between 2 magnetic coils, in order to ensure better signal acquisition. It is an NTC sensor and indicates the temperature to the electric drive power and control electronics module JX1. This signal is required in order to prevent overheating of the e-machine. The measured value can be read out as a measured value using the diagnostic tester. If the stator is not sufficiently cooled, the e-machine is restricted by the power electronics upwards of a measured temperature of about 185 °C[1] and energised without load upwards of 215 °C[1].

In this case, the e-machine operates neither as a motor nor as a generator. An entry is made in the event memory of the electric drive power and control electronics module JX1. To avoid heating of the stator coils through voltage indication to a temperature in excess of 215 °C, the electric drive power and control electronics module JX1 energises the stator coils with a three-phase current which does not produce torque at the rotor (0 Nm control). In this way, no voltage is induced in the stator coils by the magnetic fields of the rotating rotor.
The e-machine will function again as a motor and generator as soon as the measured temperature drops below approx. 210 °C[1], or the status of the terminals changes.

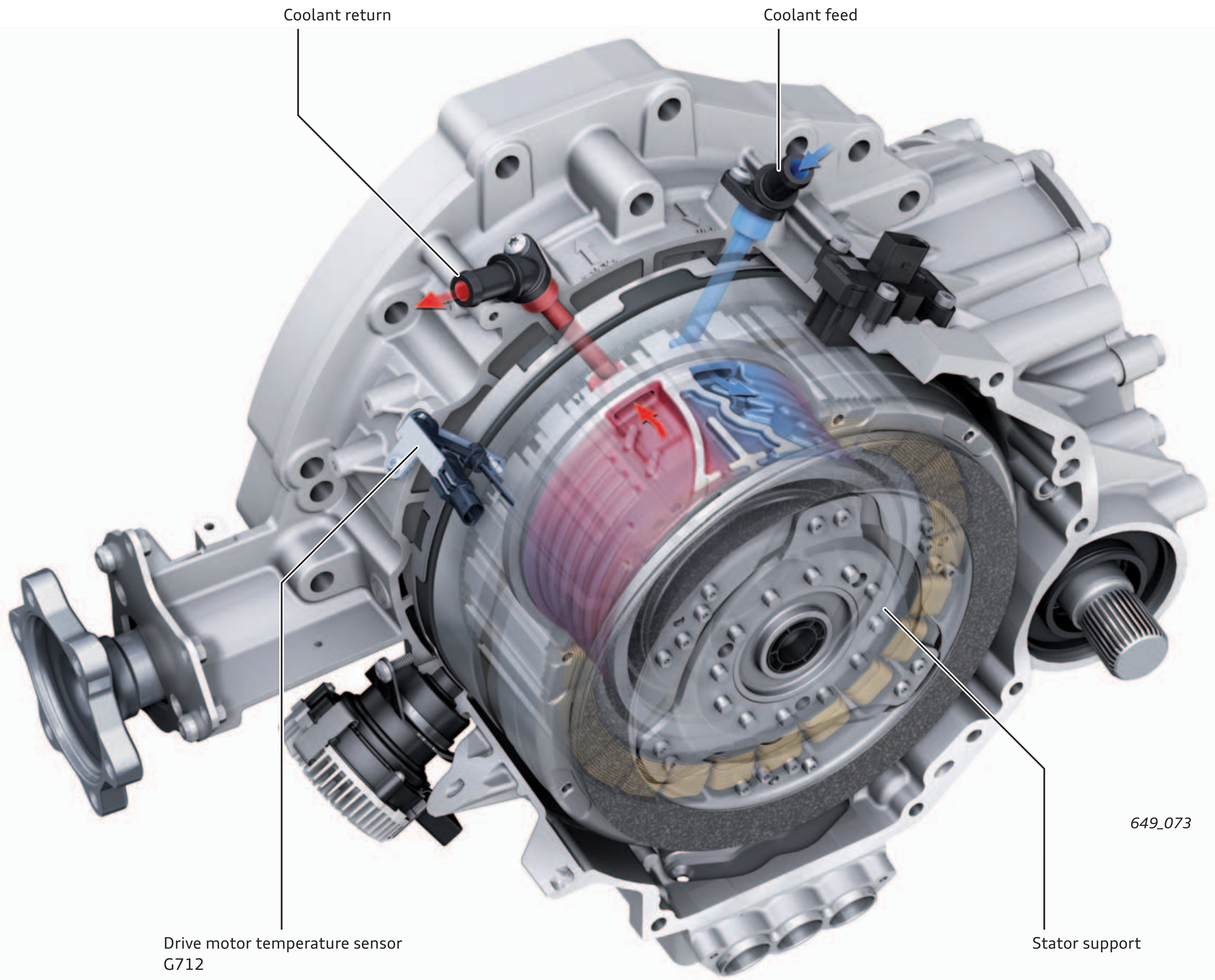
Stator cooling

The stator is cooled via the die-cast aluminium stator support. The cooling ducts are integrated in the stator support. Coolant flows through the cooling ducts forming a coolant jacket. The die-cast aluminium has the advantage of low weight in addition to having high thermal conductivity. This highly effective cooling connection allows a continuous peak power output of 60 kW and a continuous peak torque of 200 Nm.
The low-temperature circuit for the high-voltage system in which the stator cooling system is integrated is explained on page 84.

Effect of failure

If the sensor fails, the hybrid system warning lamp appears in the dash panel insert. The vehicle can still be driven, albeit with very limited hybrid drive.

[1] The given values provide a guideline and are not binding. They may deviate depending on model version.

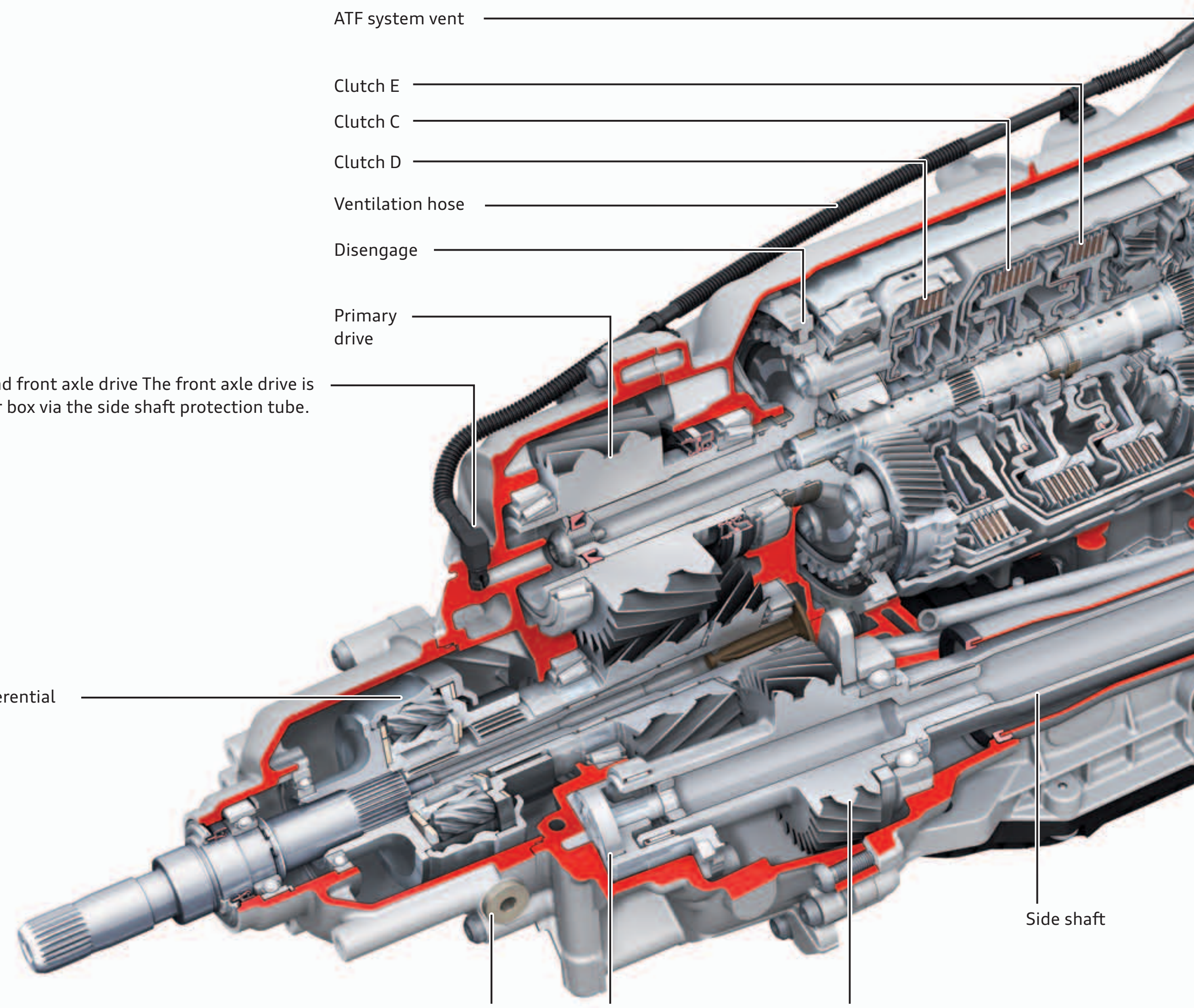


649_073

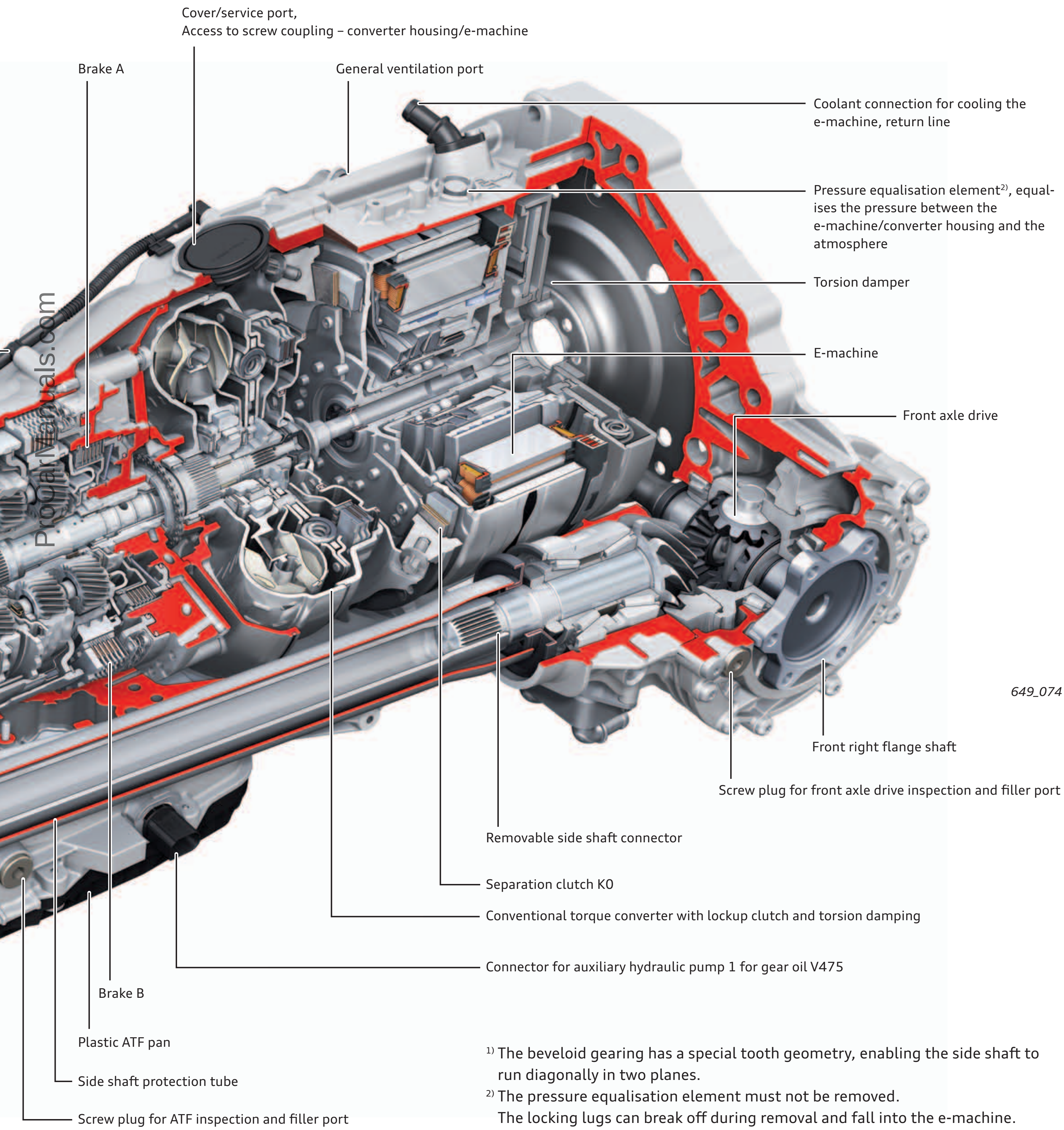
8-speed automatic gearbox 0D7 (cutaway view, ATF and MTF systems, ATF supply)

Specifications

Development/manufacturer	ZF Friedrichshafen AG
Service designation	0D7
Audi-internal designation	AL552E-8Q
Manufacturer's designation	8HP65APH
Gearbox type	Electrohydraulically controlled eight-speed planetary gearbox for all-wheel drive with torque converter and e-machine. It also functions as a generator. During engine operation it delivers a maximum power output of 94 kW. As a generator, it charges the hybrid battery with a charging power of up to 80 kW (refer to "Operating modes" on page 48). The separation clutch K0 for coupling the internal combustion engine is activated electro-mechanically via a servomotor, the separation clutch actuator V606, and therefore is independent of the gearbox hydraulics.
Control system	▸ The hydraulic control unit and the electronic control unit are integrated in the mechatronic module as a unit. The selector lever position is signalled electrically (shift-by-wire). The parking lock function is electro-hydraulically actuated. The mechatronic module has the internal ZF designation "E26/29". ▸ Dynamic shift program with separate sport program "**S**" and "tiptronic" shift program for manual gear-shifting.
Type	▸ Gearbox for vehicles with longitudinally-mounted engine and all-wheel drive ▸ Front axle drive fore of the e-machine ▸ Order of components: torsion damper, e-machine, converter, gear set ▸ Two separate oil systems: an ATF system and a gear oil system for the transfer box and front axle drive



Force distribution Front axle/rear axle	Self-locking centre differential with 40:60 asymmetrical-dynamic torque split
Weight including oil and three-phase AC synchronous motor in kg	210
Gear ratios	1st gear: 4.714; 2nd gear: 3.143; 3rd gear: 2.106; 4th gear: 1.667; 5th gear: 1.285; 6th gear: 1.000; 7th gear: 0.839; 8th gear: 0.667; R gear: -3.317
Kingpin inclination	7.07
Peak torque in Nm	700



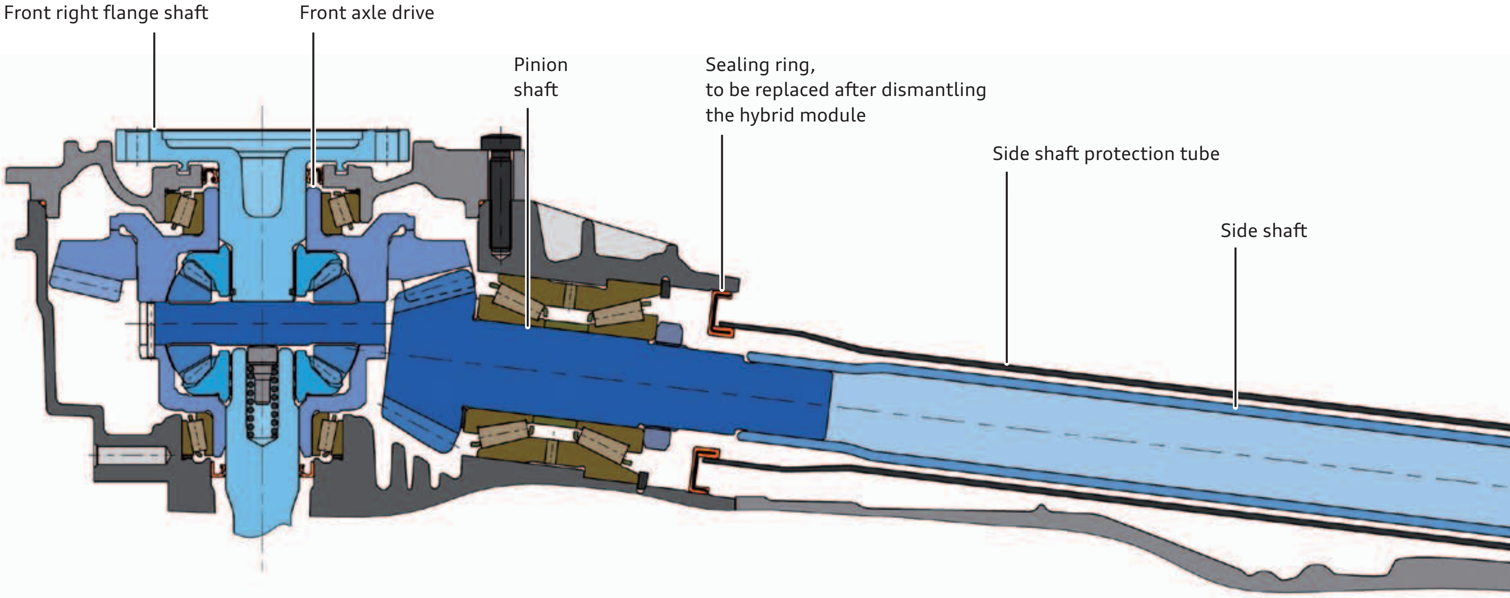
649_074

[1] The beveloid gearing has a special tooth geometry, enabling the side shaft to run diagonally in two planes.

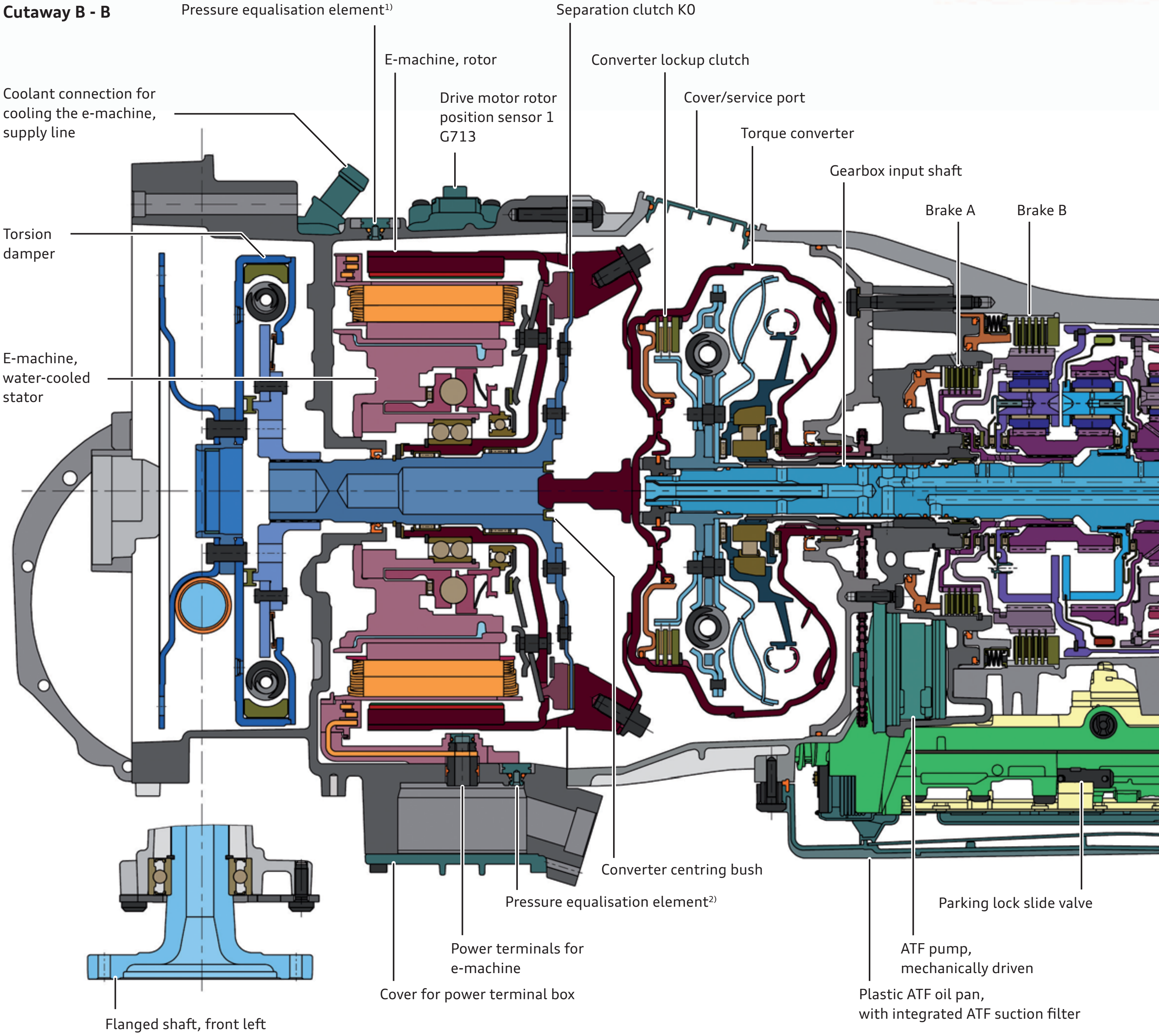
[2] The pressure equalisation element must not be removed.
The locking lugs can break off during removal and fall into the e-machine.
The pressure equalisation element is not available as a spare part.

Cutaway view

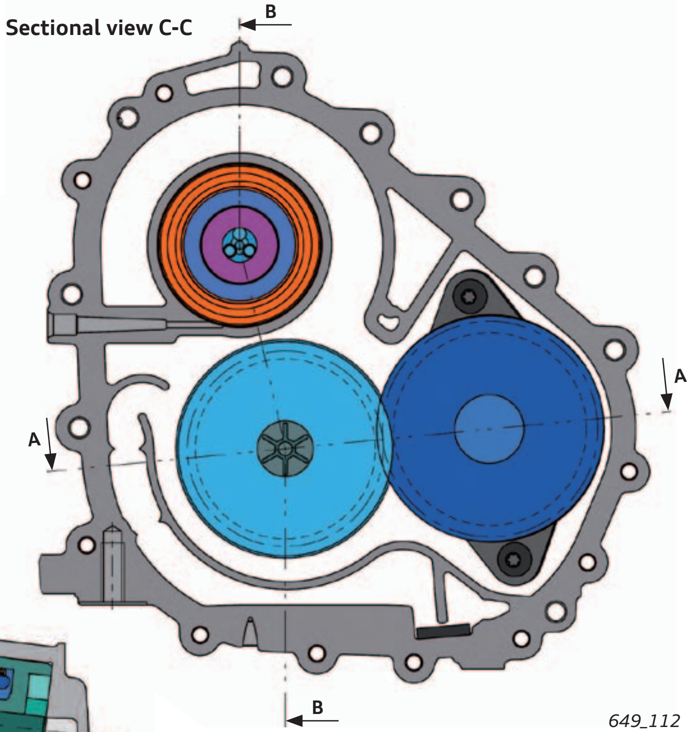
Cutaway A-A



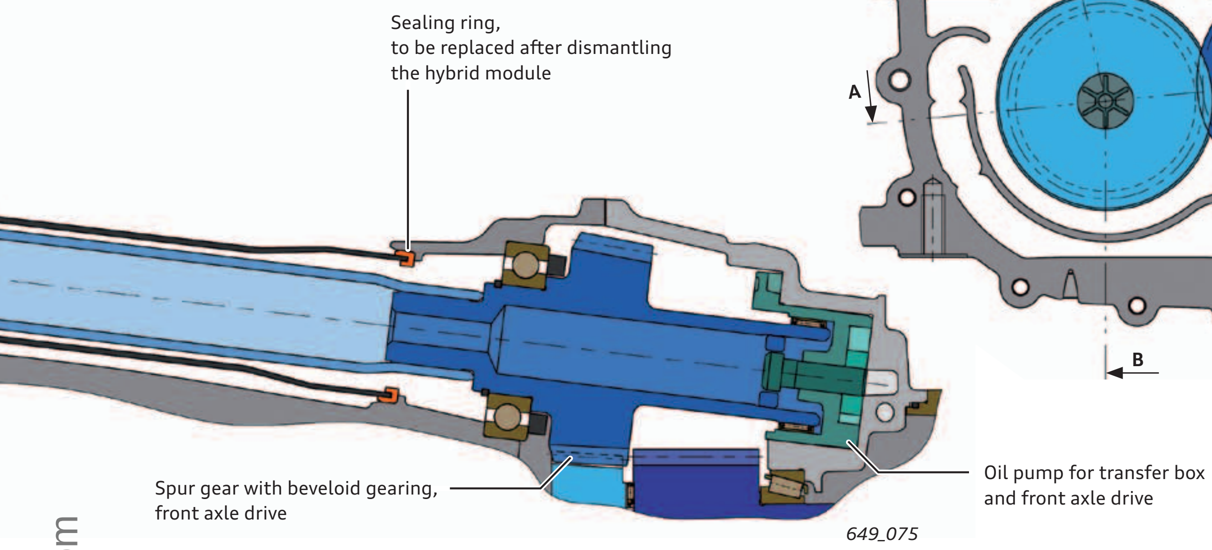
Cutaway B - B



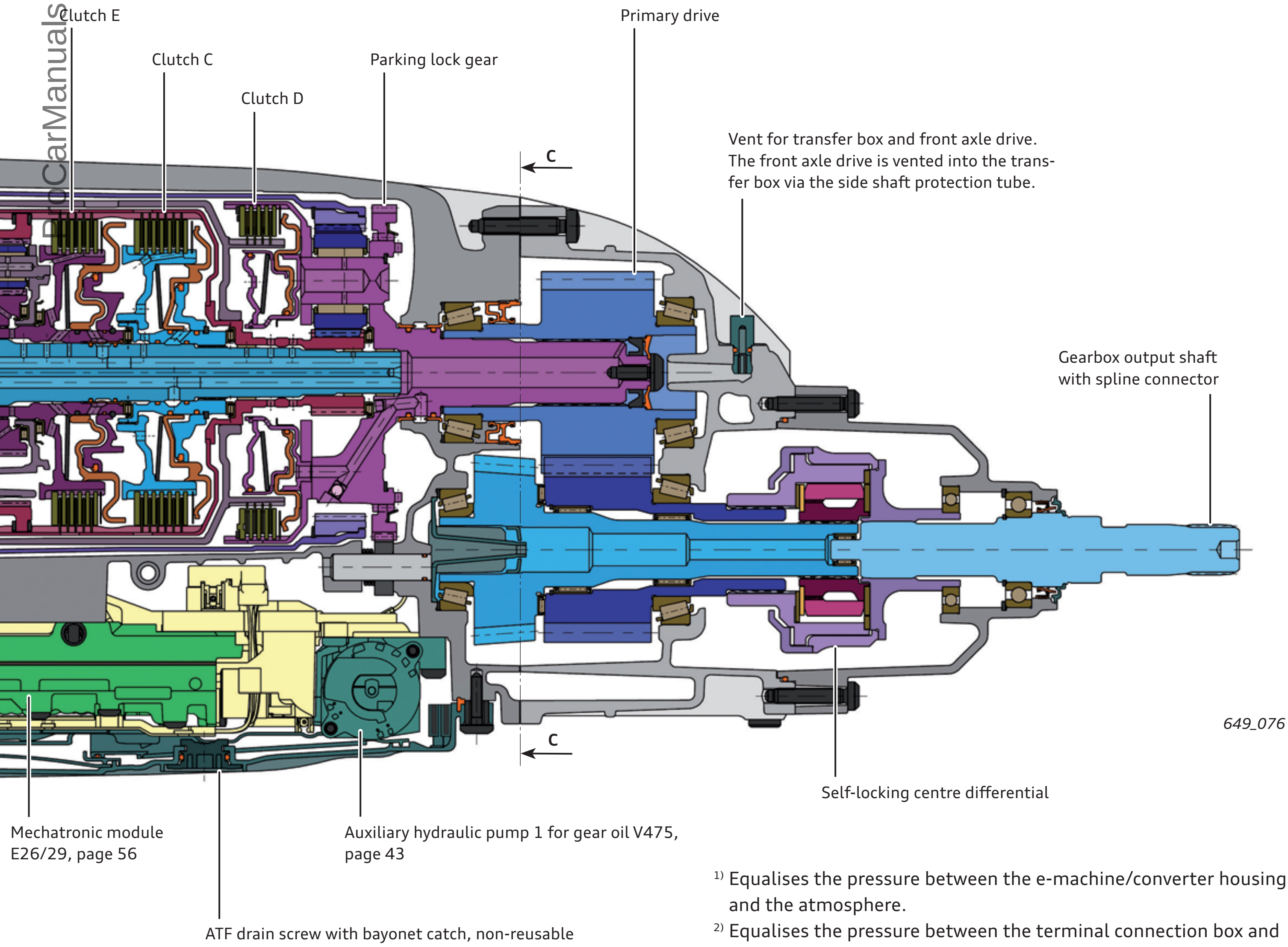
Sectional view C-C



649_112



649_075



649_076

[1] Equalises the pressure between the e-machine/converter housing and the atmosphere.

[2] Equalises the pressure between the terminal connection box and the e-machine/converter housing.

Systems for ATF and gear oils, lubrication, sealing

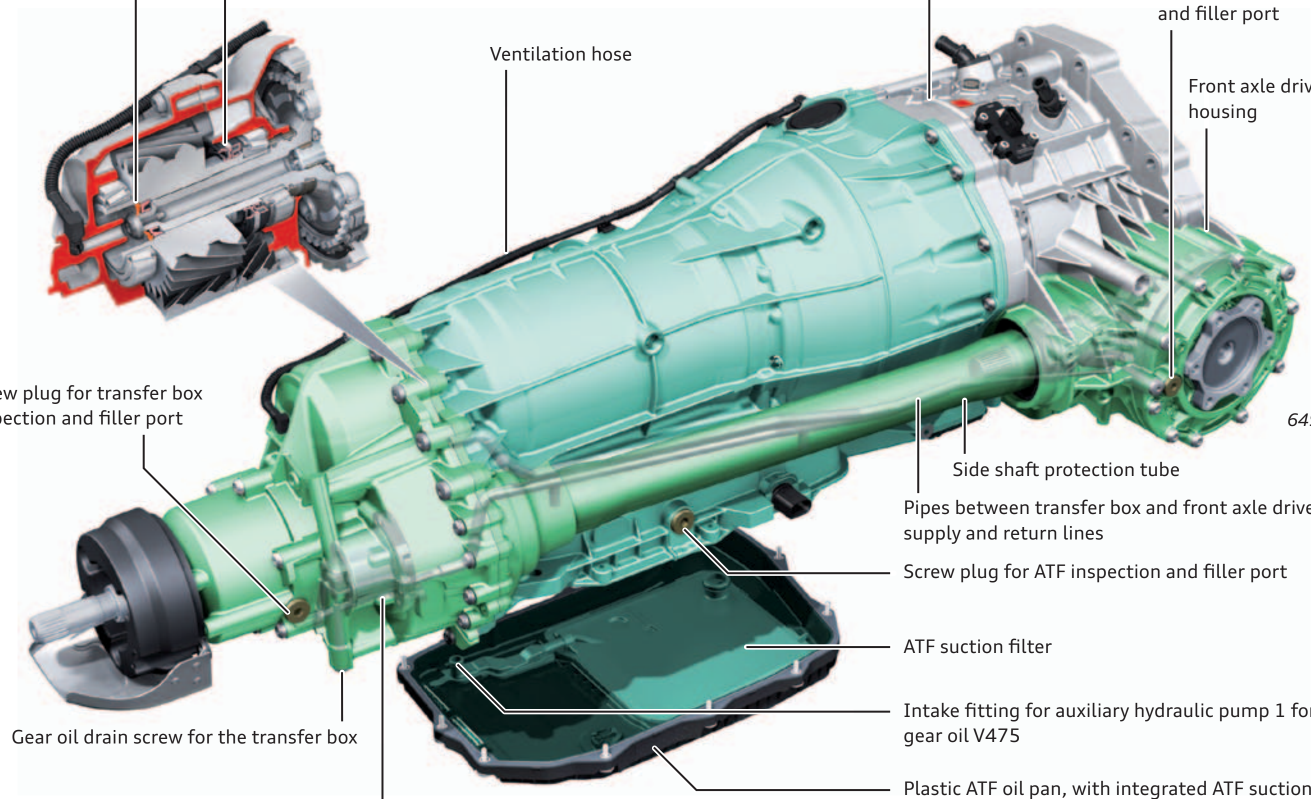
Two separate systems

The 0D7 gearbox of the Audi Q7 e-tron quattro has two separate systems.
One for the **A**utomatic **T**ransmission **F**luid, or ATF for short, and one for the **M**echanical **T**ransmission **F**luid, or MTF for short, for the transfer box and the front axle drive.

ATF system for the planetary gearbox and the hydraulic control unit (lifetime)

MTF system for the transfer box and the front axle drive (gear oil with **STURACO**[1)], lifetime)

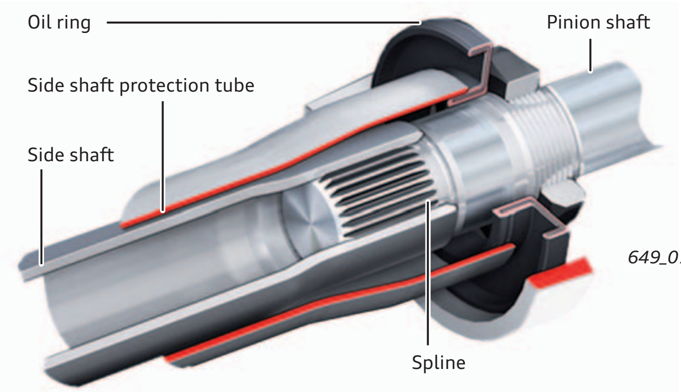
The MTF system and the ATF system are separated from one another by a double shaft oil seal and a sealing disc.
The leak oil drainage port for the shaft oil seal is located on the left-hand side of the gearbox, at the same height as the shaft oil seal (refer to Fig. 649_079 on page 41).



649_077

Dismantling the hybrid module

When the hybrid module is dismantled, the pinion shaft of the front axle drive remains in the differential case. The side shaft and the pinion shaft are separated at the spline. The side shaft protection tube is held in place on both sides by sealing rings. When the hybrid module is removed, it slips out of its mountings and hangs loosely on the side shaft.

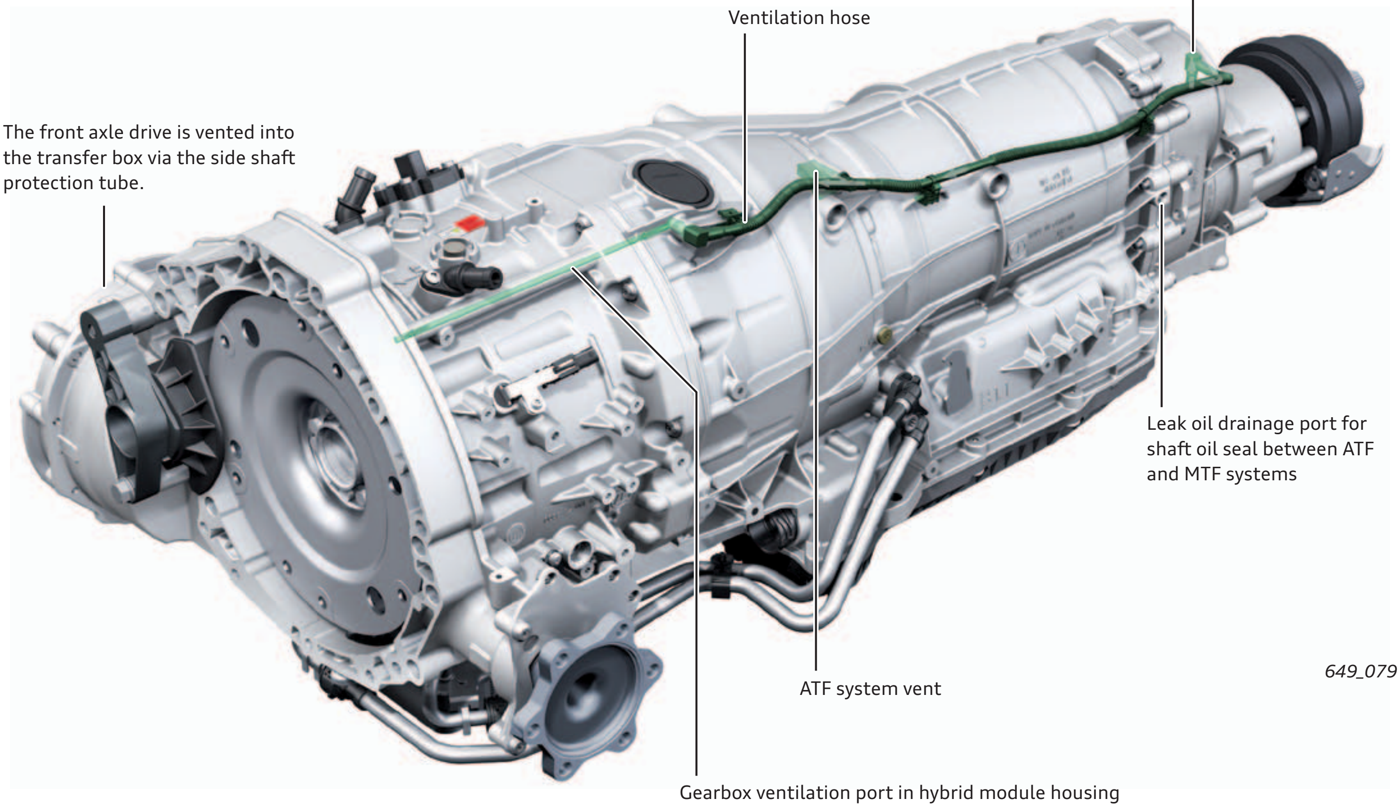


649_078

Note
The common oil system necessitates a special procedure when filling and checking the gear oil in the front axle differential and transfer box. Gear oil levels may differ depending on the driving situation. When checking the oil level, therefore, it is important to always set the oil level at both check points. Follow the instructions given in the Workshop Manual.

Combined gearbox ventilation

When heating or cooling the gearbox, the pressure is equalised via the gearbox vent.



ATF oil pan

The plastic ATF oil pan saves weight. It forms a unit together with the ATF suction filter.
The gearbox must not be set down onto the ATF oil pan. When the gearbox is set down, it settles on the e-machine power terminals and on the ATF oil pan at two points.
The ATF oil pan is not designed to withstand this load. After setting down the gearbox, observe the instructions for transportation in the Workshop Manual.
The ATF drain screw has a bayonet catch in place of the usual thread. It may not be reused and must be replaced after checking the oil level.

Oil pump for transfer box and front axle drive

The design of the transfer box oil pump and the front axle drive was first used in the 09E gearbox. The pump of the 09E gearbox differs only slightly from the pump in the 0D7 gearbox.
The functional principle of the pump is described in greater detail in SSP 283 (page 70 ff.) and in SSP 457 (page 37).
The oil pump is driven by the side shaft and provides targeted and reliable lubrication of all bearings and gears in the transfer box and in the front axle drive.
Two pipes integrated in the gear case are used for exchange between the MTF of the front final drive and the MTF of the transfer box.
This design allows for highly efficient lubrication with a minimum oil level. This significantly reduces churning losses and minimises foaming of the oil.

[1)] **STURACO** is an oil additive protects against excessive stresses in the centre differential and thus helps to enhance ride comfort. Pay attention to exact assignment of gear oils in accordance with the parts numbers in the electronics parts catalogue (ETKA).

Note
During transportation and when carrying out work on the gearbox, the gear oils (MTF and ATF) may mix via the common gearbox vent if the gearbox is tilted too far. Furthermore, the gearbox must not be set down onto the ATF oil pan. The ATF oil pan is not designed to withstand this load. Follow the instructions given in the Workshop Manual.

ATF supply

The supply of ATF to the eight-speed automatic gearbox 0D7 is ensured by two pumps: a mechanically driven ATF pump and the electrically driven auxiliary hydraulic pump 1 for gear oil V475. Both pumps draw in the ATF via the ATF intake filter. The auxiliary hydraulic pump V475 is seated behind the mechatronic module (refer to page 57). When the vehicle is started, it assists the mechanically driven ATF pump up to a gearbox input speed of approximately 500 rpm. During vehicle operation, the mechanically driven ATF pump ensures the supply of ATF.

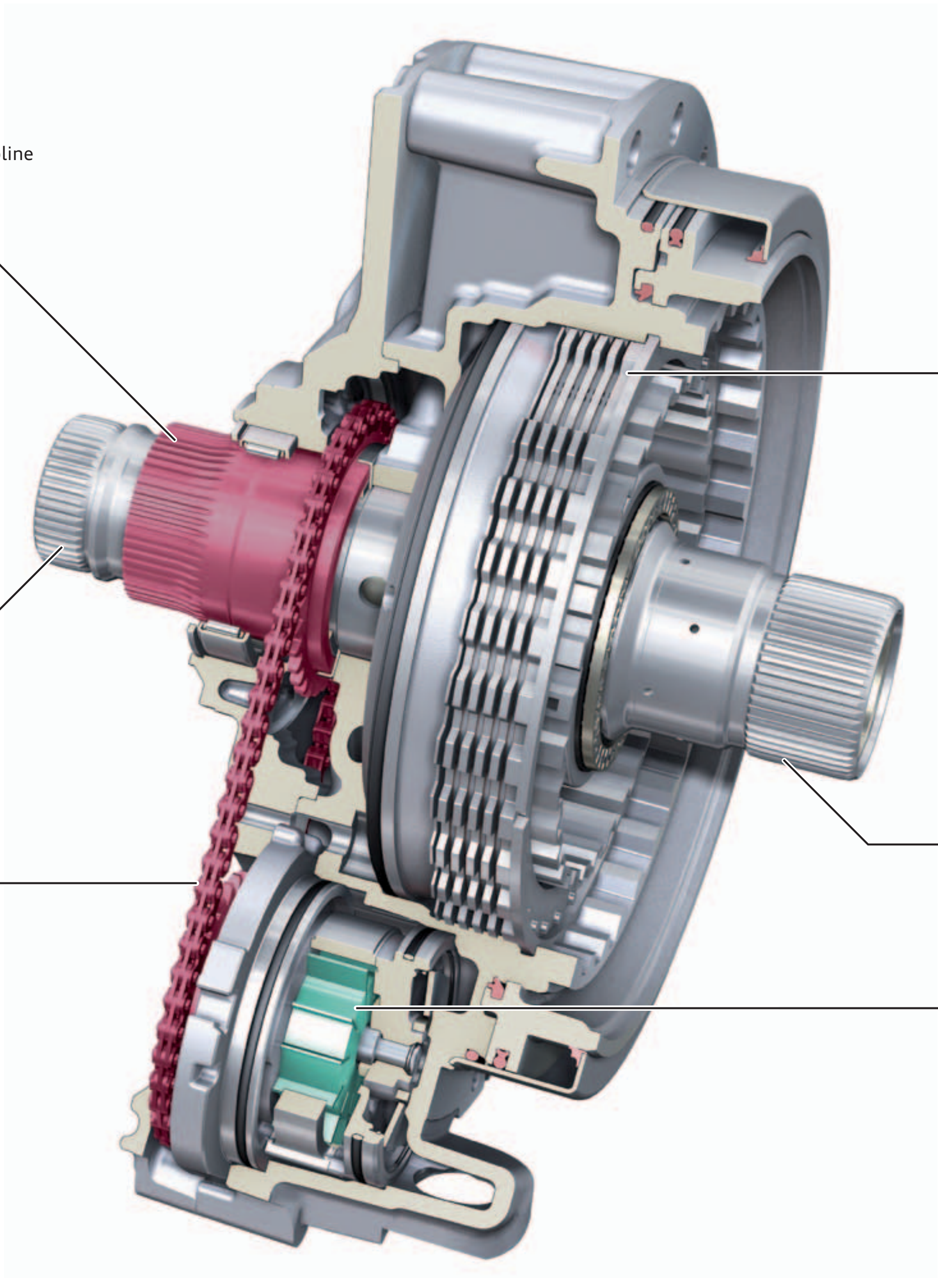
The mechanically driven ATF pump is driven by the e-machine and/or by the internal combustion engine via the converter housing. The internal combustion engine can only provide drive if the separation clutch K0 is closed. If the ATF pump is running at the required speed, it is able to provide system pressure without any need for the auxiliary hydraulic pump.

The hydraulic energy results from the system pressure and the associated volumetric flow rate. It is the prerequisite for gearbox operation and allows the gearbox control elements (brakes and clutches) to be controlled, actuated, lubricated and cooled, and therefore allows the vehicle to be driven.

Mechanically driven ATF pump

This ATF pump is identical to the twin-stroke vane pump used in the 0BK gearbox.
For more information about the mechanically driven ATF pump, refer to page 25 of SSP 457. The mechanically driven ATF pump is connected to the pump drive hub via a chain drive.

The hub spline engages the spline of the converter housing (refer to cutaway view on page 38). For the sake of clarity, the chain drive, drive hub and rotor are shown in red in the diagram.



649_080

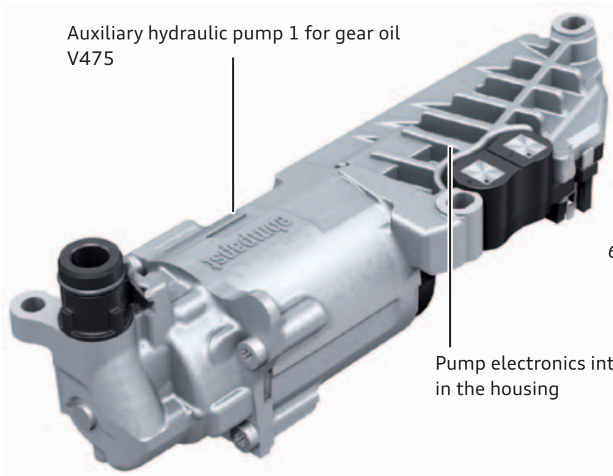
Auxiliary hydraulic pump 1 for gear oil V475

The auxiliary hydraulic pump V475 is capable of conveying ATF on 3 output levels within an ATF temperature range from 0 °C to 125 °C. The pump communicates with the automatic gearbox control unit J217 via a LIN bus line.
The ignition is turned on by pressing the "START ENGINE STOP" button, and the gearbox control unit instructs the pump via the LIN bus to convey ATF on the lowest output level. If the selector lever is engaged in **D** or **R**, the pump receives the instruction to convey ATF on the highest output level. The auxiliary hydraulic pump ensures the supply of ATF. This aids disengagement of the parking lock and allows deceleration-free start-up.
If the mechanically driven ATF pump reaches the required speed and is capable of supplying system pressure by itself, the auxiliary hydraulic pump receives the instruction via LIN bus to stop conveying ATF. Communciation between the pump and the gearbox control unit is maintained via the LIN bus line.

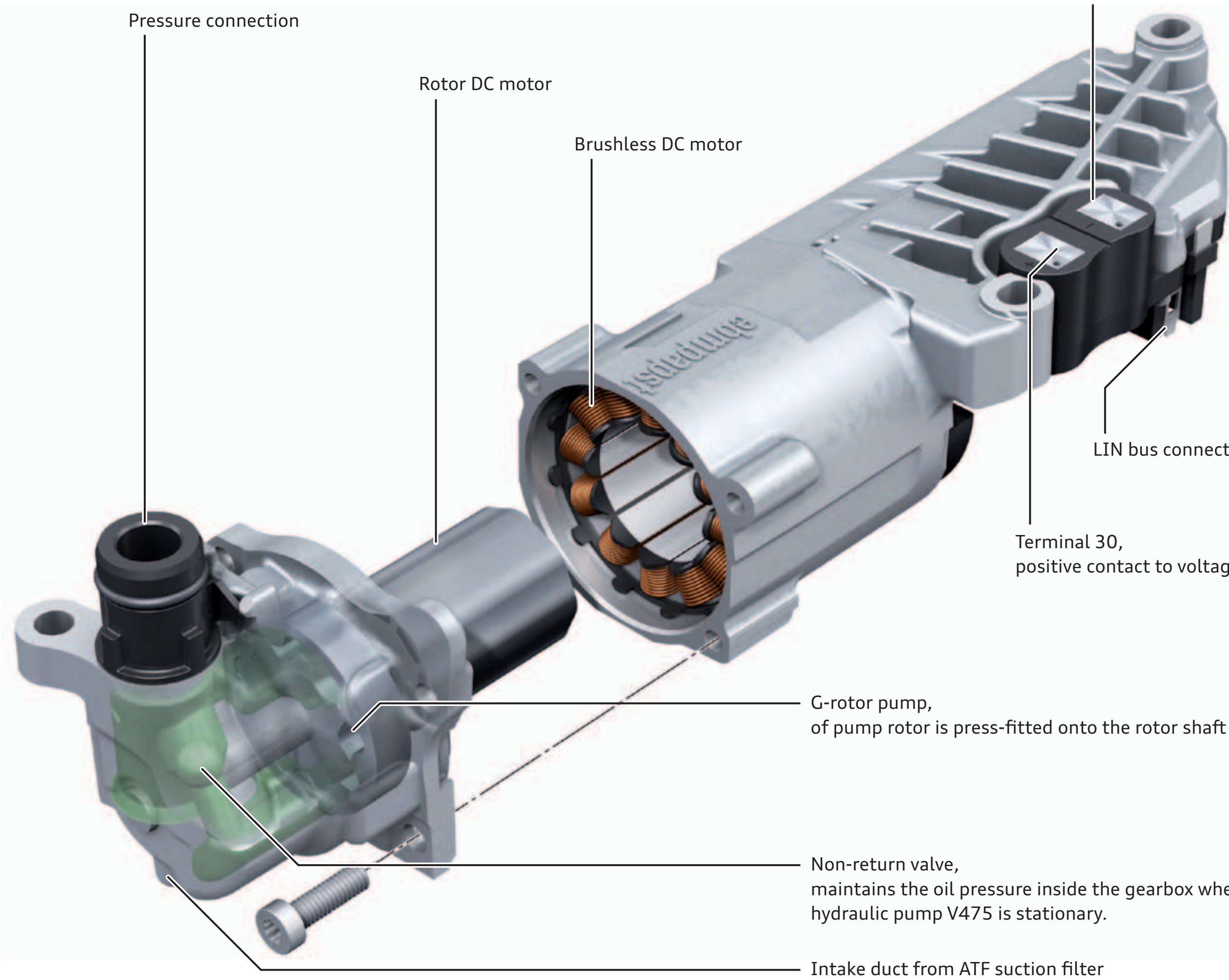
The pump electronics of the auxiliary hydraulic pump V475 signal the condition of the pump to the gearbox control unit. There is no pressure sensor. In addition, the pump electronics diagnose electrical faults and cyclically confirm to the gearbox control unit via the LIN bus the supply of voltage through terminal 30. Any irregularities which occur are indicated to the gearbox control unit. Depending on the type of irregularity, an entry is made in the event memory of the gearbox control unit.

Actuator diagnostics can be performed using the diagnostic tester. Basically, it is possible to update the pump software. However, this function will not be available at the time of market launch.

If the temperature is outside limits or if the auxiliary hydraulic pump V475 fails, ATF is supplied by the mechanically driven ATF pump only. The ATF pump is driven by the e-machine.

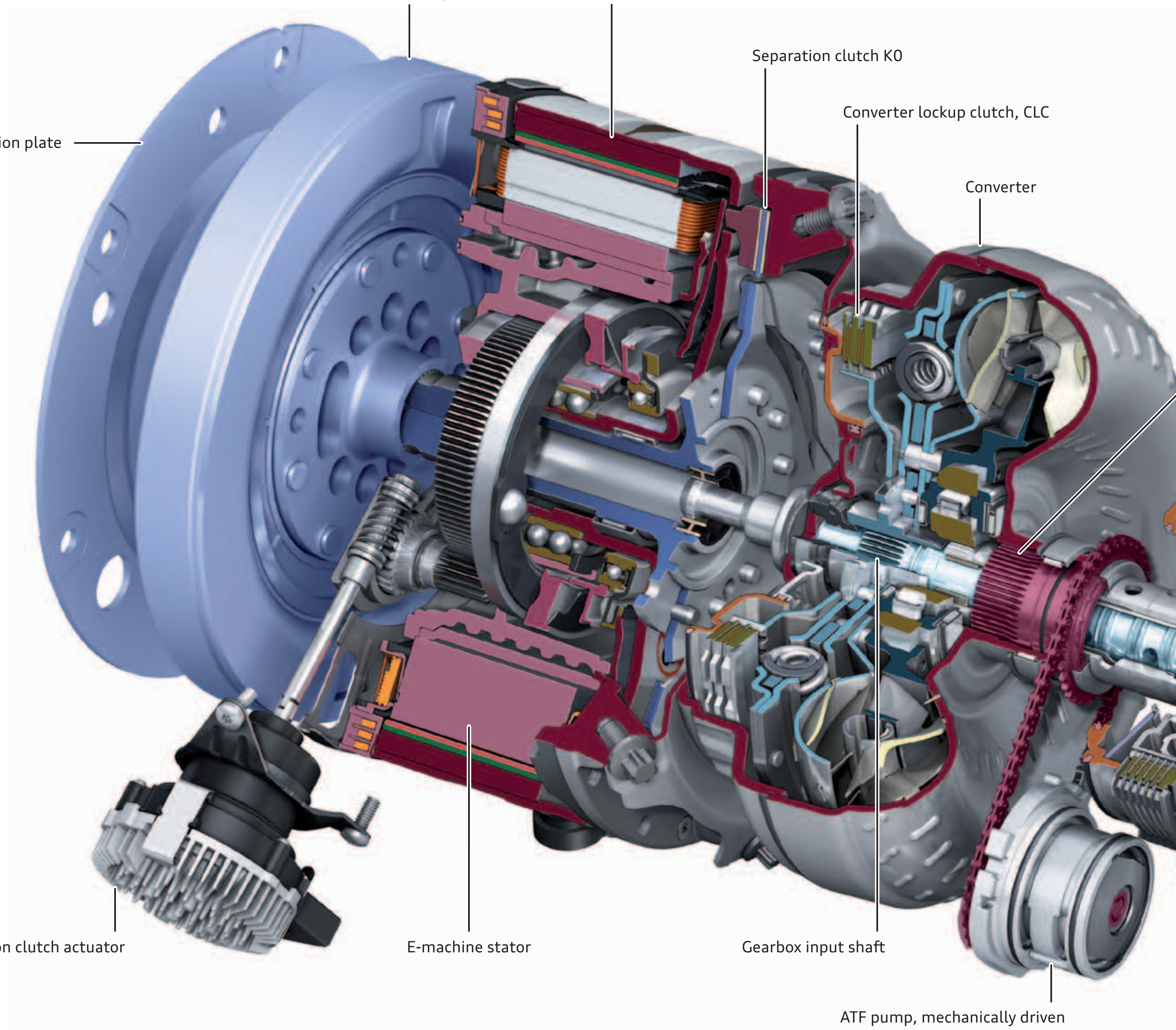


649_081

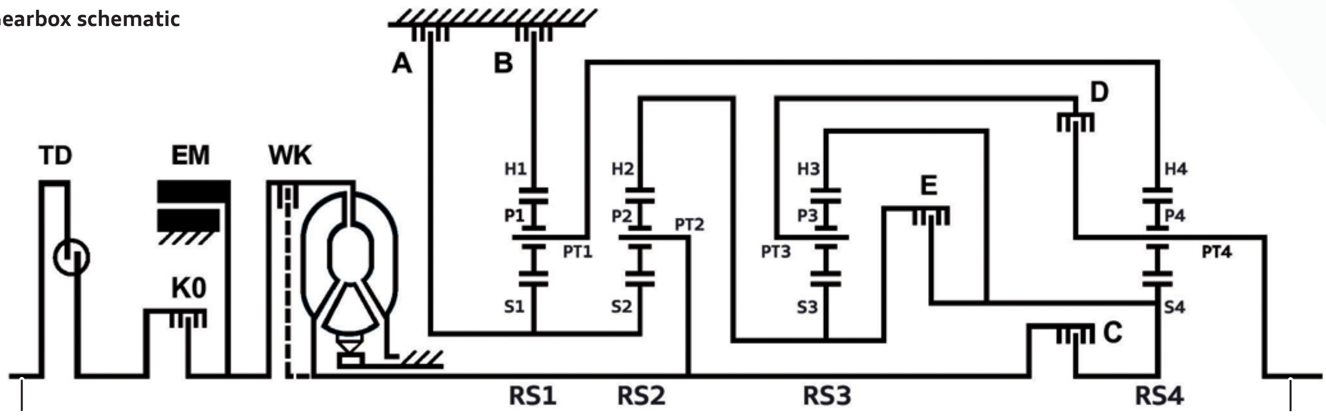


649_082

Gearbox schematic, gear set, shift elements



Gearbox schematic



649_084

Key:

RS1 (2, 3, 4)	Planetary gear set 1 (2, 3, 4)
PT1 (2, 3, 4)	Planetary gear carrier 1 (2, 3, 4)
S1 (2, 3, 4)	Sun gear of planetary gear set 1 (2, 3, 4)
P1 (2, 3, 4)	Planet gears of planetary gear set 1 (2,3,4)
H1 (2, 3, 4)	Ring gear of planetary gear set 1 (2, 3, 4)

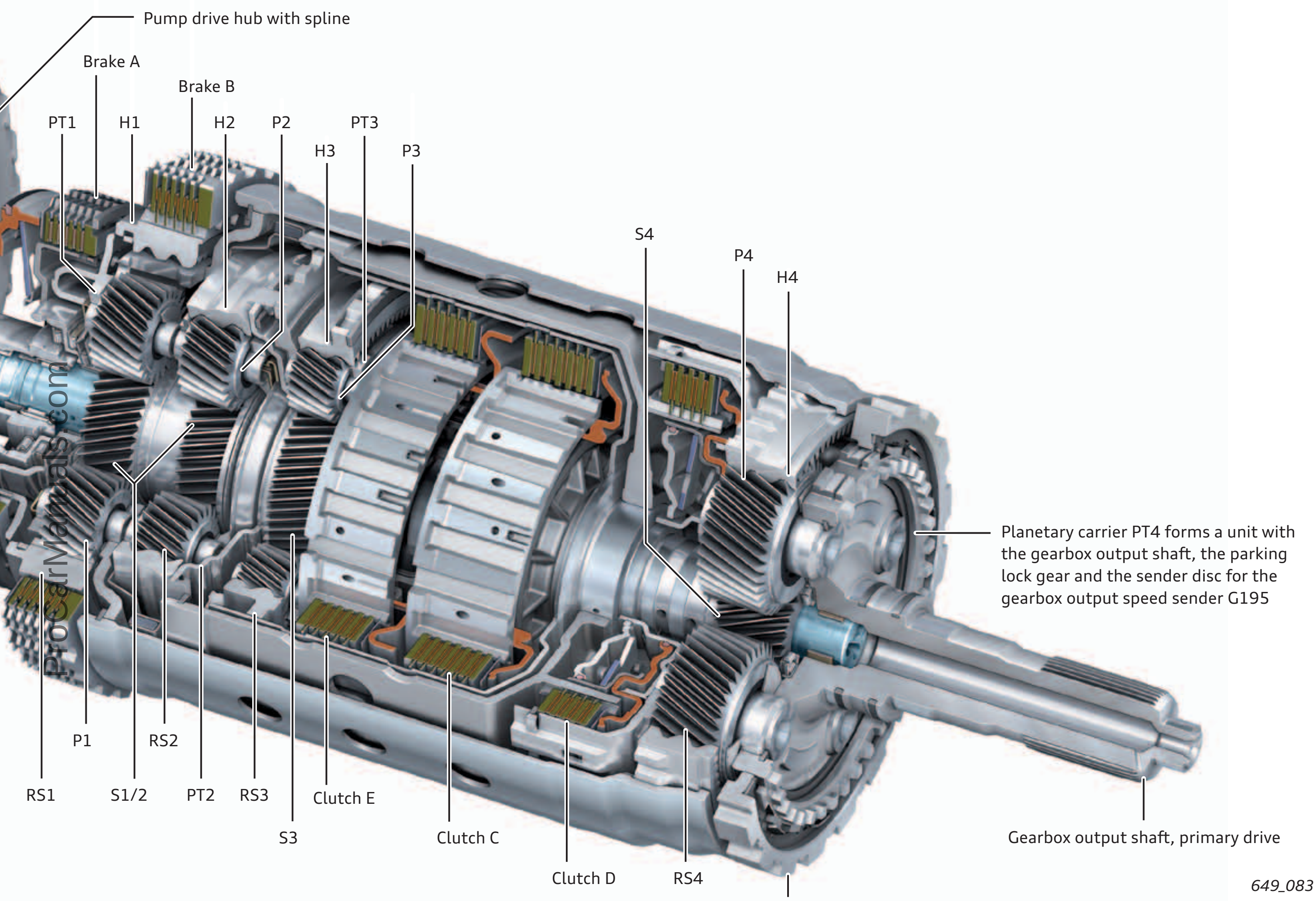
TD	Torsion damper
EM	E machine (electric drive motor V141)
A, B	Multi-disc brakes
C, D, E	Multi-plate clutches
CLC	Converter lockup clutch
K0	Separation clutch

Start-up

As is the case with a standard automatic gearbox, the torque converter is utilised for start-up. The torque output to the converter lockup clutch by the e-machine or the internal combustion engine is transferred to the gearbox input shaft by the converter. The use of the converter for start-up protects the shift elements and the ATF which, as a result, lasts for the life cycle of the gearbox. It is not necessary to change the ATF. In addition, the torsional vibration of the internal combustion engine is insulated by the converter, and is not transmitted to the gearbox.

Gear set

The gear set is identical to that of the 0BK gearbox as described in SSP 457 (page 26 ff.) The eight forward gears and reverse gear are realised by linking four simple single-web planetary gear sets. The two front gear sets have a common sun gear. Output is via the planetary carriers of the fourth gear set.



649_083

Shift elements

Five shift elements shift eight gears. The separation clutch K0 couples the internal combustion engine to the e-machine. The converter lockup clutch prevents converter slip and increases the efficiency of the automatic gearbox.

- 2 multi-disc brakes (A and B)
- 3 multi-disc brakes (C, D and E)
- 1 converter lockup clutch
- 1 separation clutch K0, dry plate clutch

Shift elements A, B, C, D and E as well as the converter lockup clutch are activated by the mechatronic module and closed hydraulically (refer to page 56).
The operating principle of the shift elements and the converter lockup clutch, e.g. resetting and dynamic pressure equalisation, is described in SSP 457 and is identical to that of the 0BK and 0BL gearboxes. The individual gears are obtained by using 3 closed shift elements of groups A, B, C, D and E.

The shift matrix on page 46 depicts the interaction of the shift elements and the converter lockup clutch in the various operating modes of the hybrid drive.
These operating modes, e.g. drive by electric motor or drive by internal combustion engine, are controlled via separation clutch K0. The separation clutch K0 is a dry plate clutch and is engaged in the idle state. It works in exactly the same way as the starting clutch of a manual gearbox. The separation clutch couples the blue-coloured components in the diagram, which are connected to the internal combustion engine, to the dark-red-coloured components, which are connected to the e-machine. The separation clutch K0 is actuated via the separation clutch actuator V606. The shift states of clutch K0 are also shown in the shift matrix on page 46.

Shift matrix, operating modes, mechatronic module

The shift elements (brakes and clutches) are controlled by means of actuators, pressure control valves and solenoid valve N88 of the mechatronic module. The parking lock solenoid N486 serves the electrohydraulic parking brake function.
The separation clutch K0 is a dry plate clutch and is engaged in the idle state. It is not activated by the mechatronic module, but rather is actuated via the separation clutch actuator V606 (refer to page 32).

This means that actuation of the separation clutch is not dependent of the ATF supply system pressure.
In selector position **N** or **P**, the internal combustion engine can be started and the e-machine operated as a generator by closing the separation clutch K0.
If the operating mode of the vehicle changes from power to coasting while the internal combustion engine is running and the separation clutch K0 is closed, the hybrid management system decides situatively whether the separation clutch K0 stays closed or not. In this case, recuperation can take place while the separation clutch K0 is closed.

Shift matrix

The shift matrix shows the interaction between the actuators and shift elements in each of the operating states and gears.

Operating modes		Shift elements/magnets/solenoid valves/pressure control valves								
		N486	MV-Pos N88	EDS-Sys N443	K0	WK EDS-F N371	A EDS-A N215	B EDS-B N216	C EDS-C N217	
Parking lock function	Engage parking brake	0	0	X	0 - 1	0	1	1	1	
	Disengage parking brake	1	1	X	0 - 1	0	1	1	1	
	Hold parking brake released	1	0	X	0 - 1	0	1	1	1	
Gearbox in selector positions **N** and **P**		0	0	X	0 - 1	0	1	1	1	
Gearbox in **P** or **N**: start ICE with e-machine		0	0	X	1	0	1	1	1	
Gearbox in **P** or **N**: ICE drives e-machine as generator		0	0	X	1	0	1	1	1	
Vehicle is running: start ICE with e-machine		0	0	X	1	0 - 1	1	1	0	4th gear
Vehicle is running: start ICE with starter generator		0	0	X	0	0 - 1	1	1	0	1st gear
Electric drive mode		0	0	X	0	0 - 1	1	1	0	1st gear
Drive by ICE		0	0	X	1	0 - 1	1	1	0	1st gear
Drive by ICE, ICE uses e-machine as generator		0	0	X	1	0 - 1	1	1	0	1st gear
Use of both drive systems for drive, boost function		0	0	X	1	0 - 1	1	1	0	1st gear
Recuperation under braking and acceleration		0	0	X	0 - 1	1	1	1	0	1st gear
Coasting mode		0	0	X	0	1	1	1	0	1st gear

	A	B	C	D EDS-D N218	E EDS-E N233
2nd gear	1	1	1	0	1
3rd gear	0	1	0	0	1
4th gear	0	1	1	1	1
5th gear	0	1	0	1	0
6th gear	0	0	0	1	1
7th gear	1	0	0	1	0
8th gear	1	0	1	1	1
R gear	1	1	1	1	0

649_085

Key:

Clutch closed
Clutch open/closed dependent on operating status

Brake closed
Brake with minimal torque at clutch kiss point

ICE Internal combustion engine

Pressure control valves/solenoid valve

1 Active (energised)
0 Inactive (a low basic control current is always present)
01 = active / inactive dependent on operating status
X Active control current is dependent on operating status
EPC Electric pressure control valve
SV Solenoid valve

Clutches **D** and **E** are not required for 1st gear.
If an operating state is selected, the other gears are shifted by shift elements A, B, C, D and E.

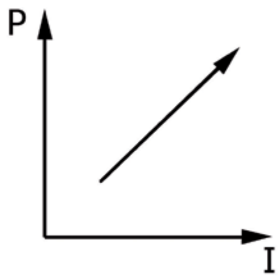
Pressure control valves N215, N216, N217, N218, N233, N371 and N433

Pressure control valves, also known as EPC (electric pressure control valve), convert a control current to a hydraulic control pressure. They are activated by the gearbox control unit and control the hydraulic valves (slide valves) belonging to the shift elements (brakes and clutches).

There are two types of pressure control valve:

- Pressure control valves with rising pressure curve
- Pressure control valves with falling pressure curve

Pressure control valves with rising pressure curve



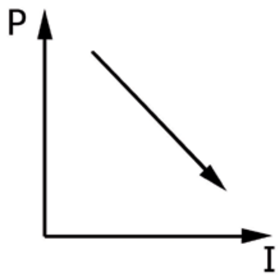
Pressure range [bar]	0 – 4,7
Operating voltage [V]	12
Resistance at 20 °C [Ω]	5,05

649_086

- Automatic gearbox pressure control valve 1 N215 – brake A
- Automatic gearbox pressure control valve 2 N216 – brake B
- Automatic gearbox pressure control valve 4 N218 – clutch D
- Automatic gearbox pressure control valve 5 N233 – clutch E
- Automatic gearbox pressure control valve 6 N371 – converter lockup clutch

If the valves with a falling pressure curve are energised, the control pressure decreases with the control current. The activated shift elements (brakes and clutches) are closed. In the de-energised state, the valves of the shift elements are open, i.e. not engaged to transmit power.

Pressure control valves with falling pressure curve



Pressure range [bar]	4,7 – 0
Operating voltage [V]	12
Resistance at 20 °C [Ω]	5,05

649_087

- Automatic gearbox pressure control valve 3 N217 – clutch C
- Automatic gearbox pressure control valve 7 N443 – system pressure

If the valves with a falling pressure curve are energised, the control pressure decreases with the control current. The activated clutch C is opened. The system pressure is reduced. When the valves are de-energised, clutch C is closed and the system is at maximum pressure.

Solenoid valve N88 open/closed

Solenoid valve N88 controls the parking lock valve. The parking lock valve controls the system pressure to the parking lock slide valve (refer to SSP 457, page 48).

Operating voltage in V	up to 16
Pickup voltage in V	> 6 (valve closed)
Dropout voltage in V	< 5 (valve open)
Resistance at 20 °C in Ω	9 – 13

Parking lock solenoid N486

The parking lock solenoid N486 is for holding the parking lock slide valve in position "parking lock disengaged" (refer to SSP 457, page 48).

Operating voltage in V	up to 16
Pickup voltage in V	> 8 (hold parking lock slide valve)
Resistance at 20 °C in Ω	23 – 27

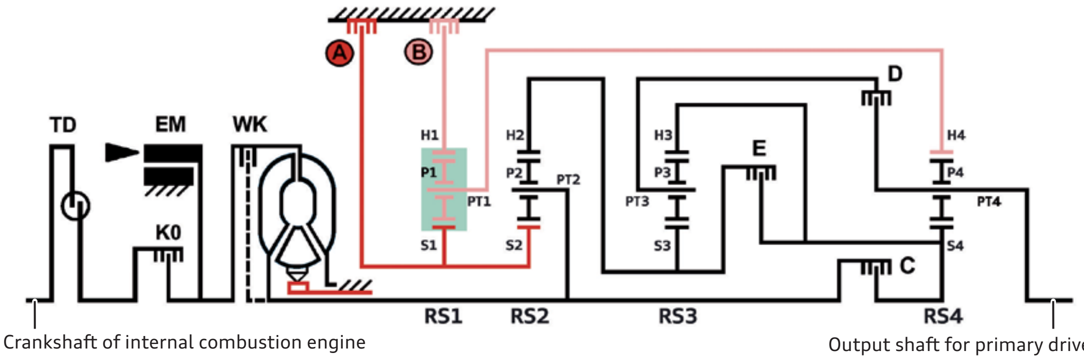
Reference
For more information about the shift schematic, the valves and the mechatronic module, refer to Self Study Programmes 457 "Audi A8 ’10 Power Transmission" and 603 "Audi A6 Avant ’12".

Operating modes

Vehicle is ready for operation, selector position P or N

The vehicle is ready for operation. This is indicated to the driver as soon as "e-tron READY" is displayed in the dash panel insert (refer to page 39 of SSP 650).

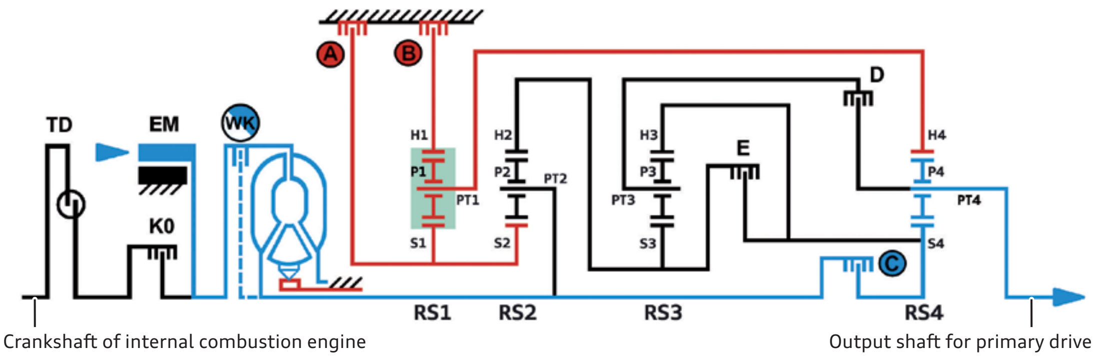
A supply of ATF pressure is ensured. Selector position **P** or **N** is selected.



649_088

Electric drive mode (starting with CLC open / driving with controlled CLC)

1st gear



649_089

The gearbox schematic shows the power flow while driving in electric mode or in 1st gear.
The converter is used for starting. The converter lockup clutch is open at start-up, in order to utilise the increased torque of the converter. Operation of the converter lockup clutch is controlled while driving.
The separation clutch K0 is open while driving in electric mode. The internal combustion engine is shut off. A prerequisite for driving in electric mode is that the hybrid battery has sufficient charge (refer to page 9 on SSP 650).

When driving in electric mode, the e-machine or the electric drive motor V141 delivers a peak power output of 94 kW (refer to page 30).
The other gears are shifted by activating the shift elements as described in the shift matrix on page 46.

Key:

RS1 (2, 3, 4)	Planetary gear set 1 (2, 3, 4)
PT1 (2, 3, 4)	Planetary gear carrier 1 (2, 3, 4)
S1 (2, 3, 4)	Sun gear of planetary gear set 1 (2, 3, 4)
P1 (2, 3, 4)	Planet gears of planetary gear set 1 (2,3,4)
H1 (2, 3, 4)	Ring gear of planetary gear set 1 (2, 3, 4)
TD	Torsion damper
EM	E-machine (electric drive motor V141)
A, B	Multi-disc brakes
C, D, E	Multi-disc brakes
CLC	Converter lockup clutch
K0	Separation clutch

Torque curve/power flow
Stationary parts (locked by brake(s))
Brake applied, braked parts (non-locked)
Rotating parts which do not contribute to power flow
Planetary gear set in blocking mode and/or blocked

WK Controlled converter lockup clutch

A Brake A closed

B Brake B closed

Neutral idle control (starting with and without neutral idle control)

If the internal combustion engine is in operation, the internal combustion engine and the gearbox are disconnected by the neutral idle control system when the vehicle is at a standstill. As a result, the driveline is isolated acoustically and vehicle noise is reduced. The torque load for the internal combustion engine is also reduced, as the engine no longer has to counteract the usual converter torque produced by a torque converter automatic gearbox.

Neutral idle control in 1st gear

As soon as the vehicle is ready for operation (refer to page 39 of SSP 650) and the ATF pressure supply is available (refer to page 42), brake A is closed and brake B is applied (kisspoint). The neutral idle control system is still not active (selector position **P** or **N**) at this point.
The neutral idle control system is active if the applicable conditions are met, the driver has applied the brake and selector position **D** is selected. If selector position **D** is selected, clutch C of 1st gear is not initially closed.
As soon as the driver has released the brake, brake B and clutch C are closed. Brake B, which is already at the kisspoint, is closed with a steep rise in pressure, while clutch C is closed with a gentle rise in pressure. Traction can be comfortably established in this way. The remainder of the start-up operation is performed using the torque converter.

Neutral idle control when start-stop mode is active

If the internal combustion engine is shut off as a result of start-stop mode and then the instruction to restart is issued, the neutral idle control system is reactivated when selector position **D** is engaged. To speed up ATF pressure buildup, the auxiliary hydraulic pump 1 for gear oil V475 assists the closing of brake A and the application of brake B.
The rest of the sequence follows the neutral idle control function described above.

Stopping with the neutral idle control system

The neutral idle control function, which is used exclusively by the Audi Q7 (type 4M) with internal combustion engine, is not available for the Audi Q7 e-tron quattro.

Conditions which allow neutral idle control to be activated

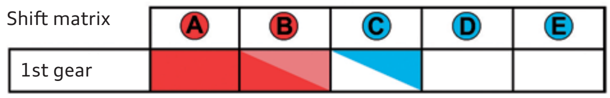
- The internal combustion engine is in operation.
- Full adaption of the shift elements (brakes, clutches)
- ATF temperature > approx. 20 °C[1]
- Road gradient < 4 %[1] (the gradient is determined by the longitudinal acceleration sensor of the brake electronics.)
- Selector position **D** engaged
- Accelerator not pressed
- Foot brake pressed

Switch-off conditions

- Selector position **S**[2], **R**[3] or tiptronic mode selected
- Brake released
  (unless the vehicle is secured by the electro-mechanical parking brake or hill start assist is active.)
- Accelerator pressed

Shift matrix

The shift matrix illustrates, in excerpts, the activation of the shift elements for 1st gear. For more information about the shift matrix of the 0D7 gearbox, refer to page 46.



649_090

Brake closed
Brake at kisspoint
Open/closed dep. on clutch status

The neutral idle control system can be activated or deactivated with the diagnostic tester by selective adaptation (refer to page 64).

[1] The given values provide a guideline and are not binding. They may deviate depending on model version.
[2] In selector position **S** neutral idle control is not activated in order to allow more direct drive-away. Without neutral idle control, clutch C is immediately closed if selector position **S** is selected. This is why it is possible to notice traction after selecting 1st gear and traction reversal after shifting from 1st gear to **R** gear (or vice versa). Traction is barely noticeable after selecting 1st gear in selector position **D**, because clutch C is open when neutral idle control is active and traction cannot be established until the brake has been released.
[3] Unlike the Audi Q7 (type 4M) powered exclusively by the internal combustion engine, neutral idle control is not implemented in **R** gear.

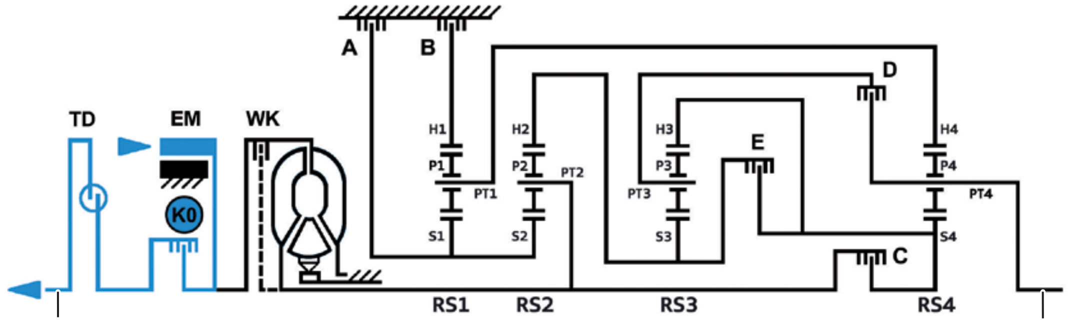
Starting of the internal combustion engine via drag starting, slip starting or comfort starting

Depending on the driver's power requirements, the internal combustion engine is started after selecting selector position **S**[1], the Audi drive select mode **dynamic**[1] or by the hybrid management system in dependence on the charge level of the hybrid battery (refer to page 9 of SSP 650).
The driver's power requirements are indicated to the system via the active accelerator pedal (refer to page 18).
Based on an engine speed of 0 rpm, the e-machine starts the internal combustion engine by **drag starting** after the separation clutch K0 has closed ($n_{engine} = 0$; $n_{e\text{-}machine} = 0$).

[1] Provided that the driver is wearing a seat belt, and the doors and bonnet are closed.

To start the internal combustion engine neutrally by **slip starting**, the torque generated by the e-machine is increased by the amount of torque required for starting after the separation clutch K0 closes. The internal combustion engine is brought up to an ignitable speed and fired. If the rpm levels of the internal combustion engine and e-machine are in sync, the separation clutch K0 is completely closed.
For **comfort starting**, the internal combustion engine is dragged up to the speed of the e-machine by the separation clutch K0 and is not fired until the separation clutch K0 has closed completely. The basic choice of starting option is dependent on the driver's power requirements and on the speed conditions.

Vehicle stationary



Crankshaft of internal combustion engine
Output shaft for primary drive

649_091

Starting of the internal combustion engine via the starter generator C29 (12-volt starting)

3.0l V6 TDI models are equipped with a starter generator. Under given conditions, the internal combustion engine is started by the starter generator.

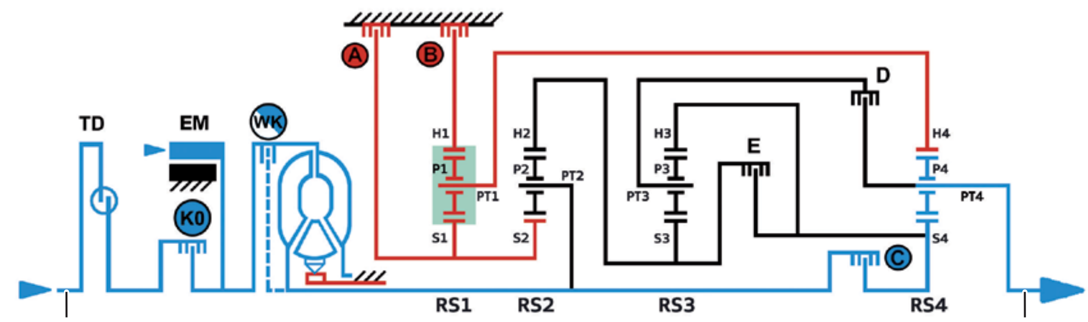
Starting with starter generator C29 is also referred to as 12-volt starting. During 12-volt starting, the separation clutch K0 is open. For more information, please refer to page 19.

Hybrid drive mode: Use of both drive systems for drive, boost function

The gearbox schematic shows the power flow in 1st gear when using both drive systems for drive. The separation clutch K0 is closed.

The other gears are shifted by activating the shift elements as described in the shift matrix on page 46.

1st gear



Crankshaft of internal combustion engine
Output shaft for primary drive

649_094

Key:

RS1 (2, 3, 4) Planetary gear set 1 (2, 3, 4)
PT1 (2, 3, 4) Planetary gear carrier 1 (2, 3, 4)
S1 (2, 3, 4) Sun gear of planetary gear set 1 (2, 3, 4)
P1 (2, 3, 4) Planet gears of planetary gear set 1 (2,3,4)
H1 (2, 3, 4) Ring gear of planetary gear set 1 (2, 3, 4)
TD Torsion damper
EM E-machine (electric drive motor V141)
A, B Multi-disc brakes
C, D, E Multi-disc brakes
CLC Converter lockup clutch
K0 Separation clutch

Torque curve/power flow
Stationary parts (locked by brake(s))
Brake applied, braked parts (non-locked)
Rotating parts which do not contribute to power flow
Planetary gear set in blocking mode and/or blocked

WK Controlled converter lockup clutch
A Brake A closed
B Brake B closed

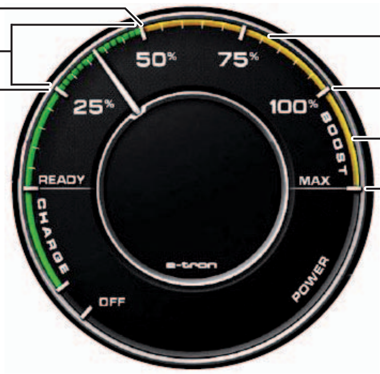
Driving with both drive systems

The Audi Q7 e-tron quattro usually starts a trip in electric-only mode. If the internal combustion engine is started unser certain conditions, it is possible to use both drive systems (refer to page 50). This mode of driving is known as "hybrid driving".

Power meter

The power meter shows the ranges of various operating modes. Depending on the requirements of the hybrid management system, the internal combustion engine is engaged within the starting range. At the latest, however, the internal combustion engine starts when the driver's power requirements exceed 50 % of the power specified by the power meter and the yellow band is reached.

Definite starting of the internal combustion engine
Starting range
Start of starting range



Hybrid drive mode
100 % power output of the internal combustion engine
Boost range
Maximum system power output

Key:
- Electric drive mode
- Starting range
- Hybrid drive mode

649_095

The starting range is indicated in the power meter by a broken green line. It varies between 0 % and 50 %, depending on the operating strategy of the hybrid management system.

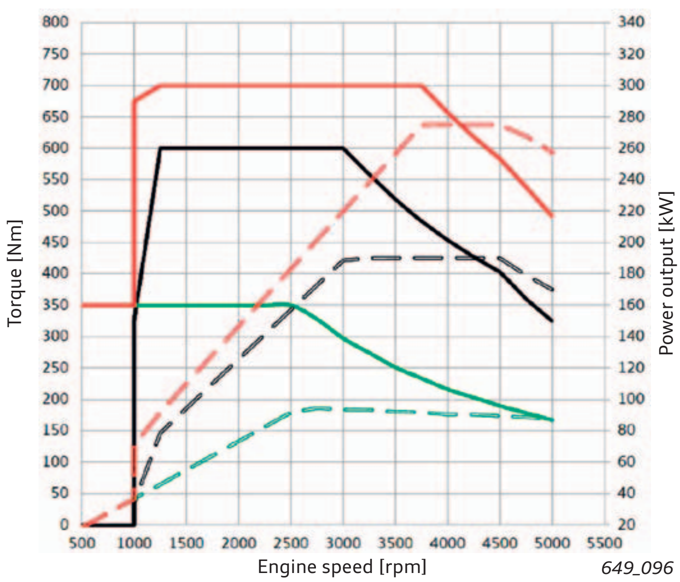
When defining the starting range, the hybrid management system factors in the state of charge of the hybrid battery and e-tron mode.

Boost function

The boost function is available as of an absolute hybrid battery charge level, defined by the hybrid management system. The boost function utilises the maximum system power of the hybrid drive. The boost function is activated when a defined pressure point is exceeded in the travel of the active accelerator pedal (refer to page 18). When the boost function is active the e-machine and the internal combustion engine deliver their maximum power output in accordance with the engine speed characteristic whereby both power outputs add up to a total value (Fig. 649_096).
For example, the 3.0l V6 TDI engine in the Audi Q7 e-tron quattro delivers a maximum power output of 190 kW. It is capable of delivering up to 600 Nm of torque. The e-machine is capable of delivering a short-time maximum power output of 94 kW. The maximum torque of the e-machine is 350 Nm.

As both drives deliver their maximum power at different engine speeds, the result is not the expected maximum system power output of 284 kW but rather a slightly lower maximum system power output of 275 kW.
The engine speeds at which both engines develop their maximum torque overlap. A system torque of 950 Nm is physically possible. Howwever, as the 8-speed automatic gearbox 0D7 can only handle 700 Nm of torque, the maximum system torque is limited to this value. The maximum system torque is available at about 1250 rpm or higher.

Performance data of the Audi Q7 e-tron quattro with 3.0l V6 TDI engine



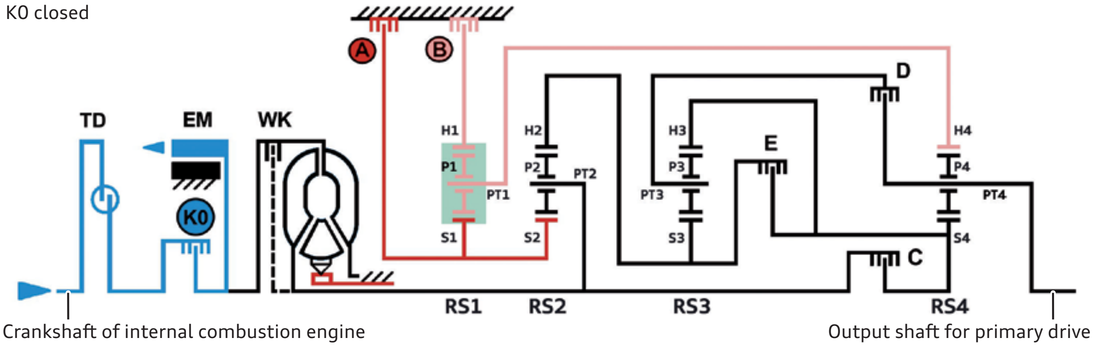
649_096

Torque-power curve

- Torque of the internal combustion engine in Nm
- Torque of the e-machine in Nm
- System torque in Nm
- Power output of the internal combustion engine in kW
- Power output of the e-machine in kW
- Power output of the overall system in kW

Internal combustion engine idling, e-machine running in generator mode, selector in P or N

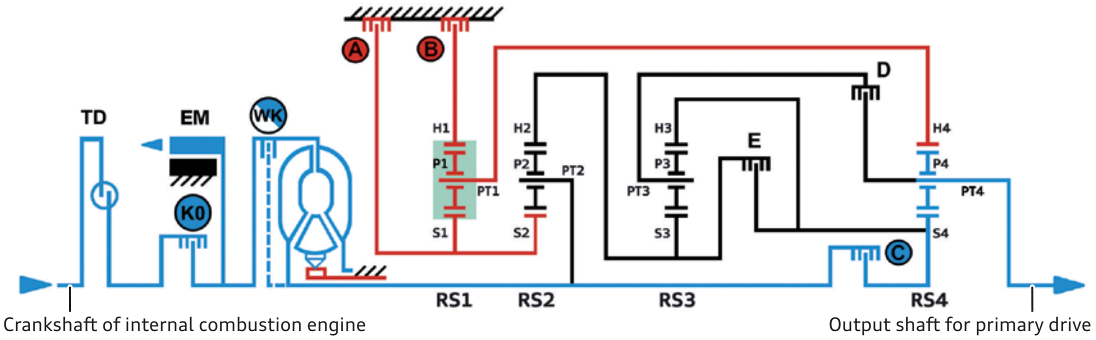
Stationary charging
Separation clutch K0 closed



649_097

Drive by internal combustion engine and e-machine running in generator mode

1st gear



649_098

The gearbox schematic shows the power flow while driving with the internal combustion engine in 1st gear. The separation clutch K0 is closed. The other gears are shifted by activating the shift elements as described in the shift matrix on page 46.

The hybrid battery is charged when driving with the internal combustion engine, provided that the e-machine is not being used as an additional drive.
For this purpose, the e-machine functions as a generator and is driven by the internal combustion engine. The battery regulation control unit J840 indicates the state of charge of the hybrid battery to the hybrid management system in the engine control unit. The hybrid management system activates the hybrid management system for generator mode when required. In addition, the internal combustion engine can produce up to 20 kW of generator power during the charging cycle. If the upper limit defined by the battery regulation control unit J840 for absolute state of charge is reached, generator mode is deactivated.

Flow of power from the generator is ensured by increasing engine load in a fuel-efficient way. The hybrid management system in the engine control unit selects a load range with the lowest possible specific fuel consumption [grammes of fuel per kWh] by selectively shifting the load point.
The power output of the generator results from the power consumption of all current loads and the charging capacity of the batteries. Loads include all loads of the 12-volt electrical system, the electrical AC compressor and the high-voltage heater (PTC) Z115. Batteries include the hybrid battery A38 and the 12-volt battery A.
The voltage converter A19 in the electric drive power and control electronics module JX1 is used to supply the 12-volt electrical system and charge the 12-volt car battery (refer to SSP 650).

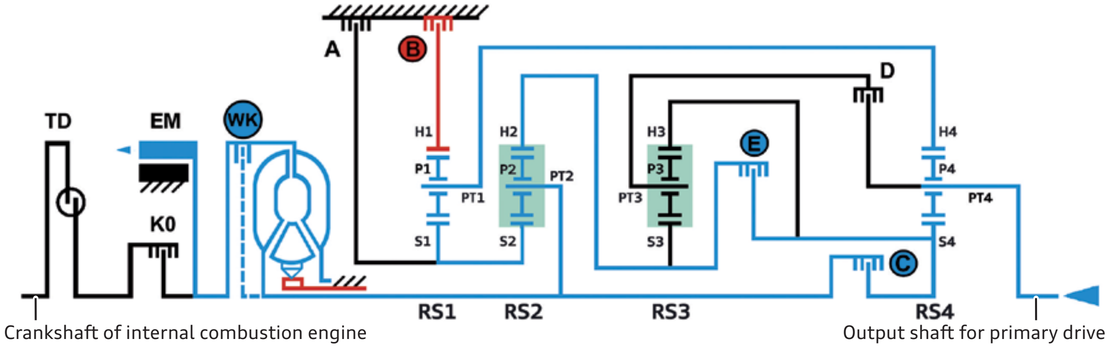
Key:

RS1 (2, 3, 4)	Planetary gear set 1 (2, 3, 4)
PT1 (2, 3, 4)	Planetary gear carrier 1 (2, 3, 4)
S1 (2, 3, 4)	Sun gear of planetary gear set 1 (2, 3, 4)
P1 (2, 3, 4)	Planet gears of planetary gear set 1 (2,3,4)
H1 (2, 3, 4)	Ring gear of planetary gear set 1 (2, 3, 4)
TD	Torsion damper
EM	E-machine (electric drive motor V141)
A, B	Multi-disc brakes
C, D, E	Multi-disc brakes
CLC	Converter lockup clutch
K0	Separation clutch

- Torque curve/power flow
- Stationary parts (locked by brake(s))
- Brake applied, braked parts (non-locked)
- Rotating parts which do not contribute to power flow
- Planetary gear set in blocking mode and/or blocked
- WK Controlled converter lockup clutch
- A Brake A closed
- B Brake B closed

Coasting mode (coasting, gliding)

3rd gear



649_099

The gearbox schematic shows the power flow in 3rd gear in coasting mode. The separation clutch K0 is open and the internal combustion engine is shut off. The converter lockup clutch is closed. The e-machine runs in sync with the gearbox input shaft and applies a low thrust torque of < 5 Nm to the gearbox input shaft. The reduces noise and enhances comfort.

Only selector position **D** or **E** is displayed in the gear indicator; the gears are not shown. The gearbox preshifts into a gear according to the speed of the vehicle.

Coasting mode is initiated in the following vehicle settings and operating conditions as soon as the driver eases off the accelerator without braking.

Vehicle settings

- In selector position **D**, one of the Audi drive select modes **allroad**, **effiency**, **comfort** or **auto** is selected.
- One of the e-tron modes **EV**, **Hybrid** or **Battery Hold** is selected.

Operating conditions

- Vehicle speed < 160 kph.
- Internal combustion engine is off.
- The driver eases off the accelerator pedal and does not press the accelerator pedal again.
- Gradient < 1 %[1]. Gradients do not affect function. The road gradient is measured by the longitudinal acceleration sensor of the brake electronics.

Switch-off conditions

- The internal combustion engine is started.
- Pressing the brake pedal. Coasting mode is not resumed after the braking operation is interrupted.
- Pressing the accelerator pedal.
- Gradient > 1 %[1]
- Selector position **S** is selected.
- tiptronic mode is selected via the tiptronic gate or the Tip- tiptronic selector.
- The Audi drive select mode **dynamic** is activated.
- Cruise control active – if the cruise control system is on but not activated, this is not a switch-off condition. Exception: ACC (adaptive cruise control) with PEA (Predictive Efficiency Assist). PEA utilises the route data provided by the navigation system. Together with ACC, PEA is able to suppress activation of coasting mode depending on the situation. This takes place regardless of the vehicle's speed, e.g. if the vehicle is approaching a built-up area or a roundabout. Coasting mode is also suppressed when the vehicle approaches other road users.

Change-over to overrun recuperation

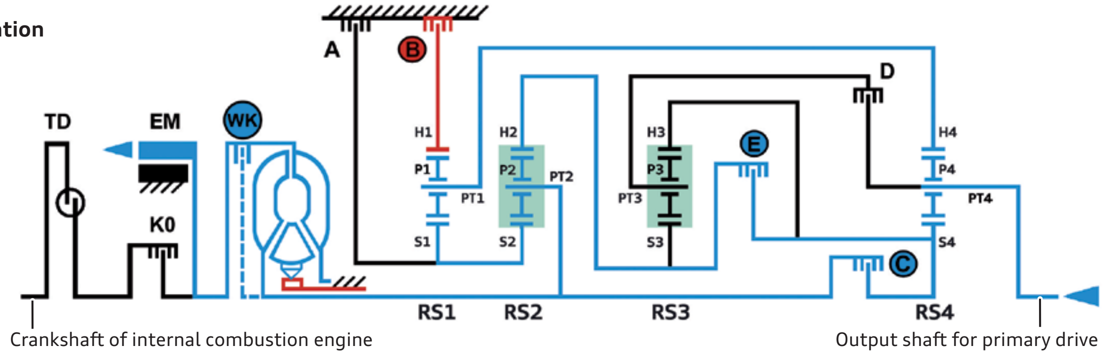
If the coasting mode is suppressed by a switch-off condition and if the operating conditions for overrun recuperation are met, the hybrid management system initiates overrun recuperation mode (page 54).

[1] The given values provide a guideline and are not binding. They may deviate depending on model version.

Recuperation

Overrun recuperation

3rd gear



649_100

The gearbox schematic shows the power flow during brake energy recuperation in 3rd gear. The separation clutch K0 is open and the internal combustion engine is shut off. The converter lockup clutch is closed. Depending on the speed at which the vehicle is travelling, the relevant gear is preselected. Overrun recuperation initiated up to a speed of 160 kph as soon as the driver eases off the brake pedal without braking under the operating conditions listed below.

Vehicle settings:

- Selector lever is engaged in **S** or
- Audi drive select mode **dynamic** is selected or
- The gearbox is in tiptronic mode, the driver can gradually influence the degree of deceleration using the shift paddles on the steering wheel, or
- One of the coasting mode switch-off conditions is met (refer to page 53).

The overrun recuperation function utilises the overrun energy (kinetic energy) of the vehicle for energy recovery purposes. The overrun energy drives the-machine, which operates in a controlled generator mode. Thus, the loads are supplied with power and both the hybrid battery and, indirectly, the 12-volt car battery are charged up to the hybrid battery charge level defined by the battery regulation control unit J840.
While overrun recuperation is in progress, the braking power - from 3 kW to 25 kW - is converted to electrical energy and the braking effect of the internal combustion engine in overrun mode is simulated. At the same time, the relevant gear is selected in the gearbox depending on the speed at which the vehicle is travelling. If the hybrid battery no longer has the capacity to accept electrical charge, the electric drive supplies only the active power demand in its capacity as a generator. If the e-machine is used neither as a generator nor for drive, the electric drive power and control electronics module JX1 energises the stator coils by applying a three-phase current which does not result in torque at the rotor. This avoids heating of the stator coils through voltage induction (refer to page 35).
The drag torque of the internal combustion engine, simulated by the generator mode, is not required when the hybrid battery is fully charged and is compensated when the driver indicates that he/she wishes to decelerate by applying the hydraulic brake.

In overrun the internal combustion engine assumes the braking function

In the case of the Audi Q7 e-tron quattro, the internal combustion engine does not assume the braking function in overrun mode, as was the case with the Audi Q5 hybrid quattro, Audi A8 hybrid and Audi A6 hybrid after the hybrid battery was sufficiently charged.

Key:

RS1 (**2**, **3**, **4**)	Planetary gear set 1 (2, 3, 4)
PT1 (**2**, **3**, **4**)	Planetary gear carrier 1 (2, 3, 4)
S1 (**2**, **3**, **4**)	Sun gear of planetary gear set 1 (2, 3, 4)
P1 (**2**, **3**, **4**)	Planet gears of planetary gear set 1 (2,3,4)
H1 (**2**, **3**, **4**)	Ring gear of planetary gear set 1 (2, 3, 4)
TD	Torsion damper
EM	E-machine (electric drive motor V141)
A, B	Multi-disc brakes
C, D, E	Multi-disc brakes
CLC	Converter lockup clutch
K0	Separation clutch

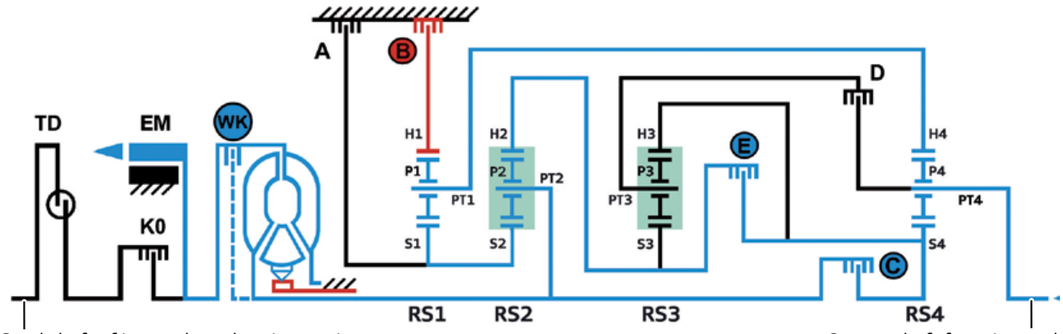
Torque curve/power flow
Stationary parts (locked by brake(s))
Brake applied, braked parts (non-locked)
Rotating parts which do not contribute to power flow
Planetary gear set in blocking mode and/or blocked

WK Controlled converter lockup clutch

B Brake B closed

Brake energy recuperation

3rd gear



649_102

The gearbox schematic shows the power flow during brake energy recuperation in 3rd gear. The separation clutch K0 is normally open and the internal combustion engine is shut off.
The converter lockup clutch is closed. Depending on the speed at which the vehicle is travelling, the relevant gear is selected.

As with overrun recuperation, the brake energy recuperation system utilises the overrun energy (kinetic energy) of the vehicle for energy recovery purposes. The overrun energy drives the-machine, which operates in a controlled generator mode. Thus, the loads are supplied and the batteries are charged up to a charge level defined by the battery regulation control unit J840.

Brake energy recuperation is initiated regardless of vehicle speed as soon as the driver presses the brake pedal, and provided that the hybrid battery can still accept electrical energy.

The brake servo control unit J539 uses the data generated by the brake pedal position sensor G100 to calculate the braking power requested by the driver by brake pedal input and sends this information to the hybrid management system in the engine control unit J623 via FlexRay bus.
The hybrid management system carries out a check to determine how much of this braking power can be converted to electrical energy by brake energy recuperation and sends this value to the brake electronics.

The hybrid management system initiates the controlled conversion of of up to 80 kW of braking power into electrical energy by brake energy recuperation.

If the hybrid battery has sufficient charge, the electric drive supplies only the active power demand in its capacity as a generator. In this case, or if the braking effect of brake energy recuperation is insufficient to provide the required amount of deceleration, the electrical braking effect is harmoniously enhanced or replaced by the hydraulic brake.

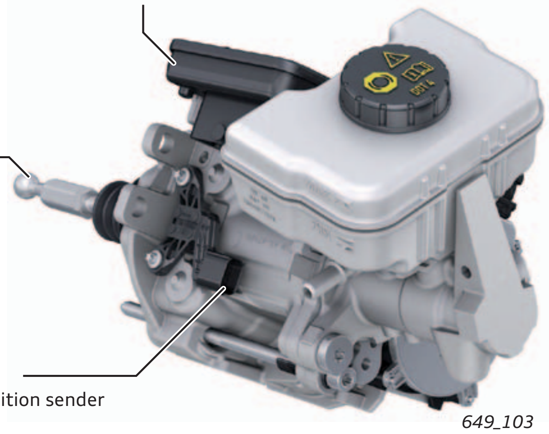
If the e-machine is used neither as a generator nor for drive, the electric drive power and control electronics module JX1 energises the stator coils by applying a three-phase current which does not result in torque at the rotor. This avoids heating of the stator coils through voltage induction (refer to page 35).

Brake pedal position sender G100

The brake pedal position sensor G100 is integrated in the brake servo.
It senses the position and actuation rate of the brake pedal. It also supplies the signals for activation of the brake light thereby eliminating the need for brake light switch F.
Since the data generated by the brake pedal position sensor G100 is used to calculate the braking effect requested by the driver, no brake energy recuperation will take place if this sensor fails. In this case, a message appears on the display in the dash panel insert.

Electro-mechanical brake servo

The electro-mechanical brake servo can be found in the current flow diagram and in the service literature under the term "brake servo NX6". For more information about the electro-mechanical brake servo, refer to page 70.

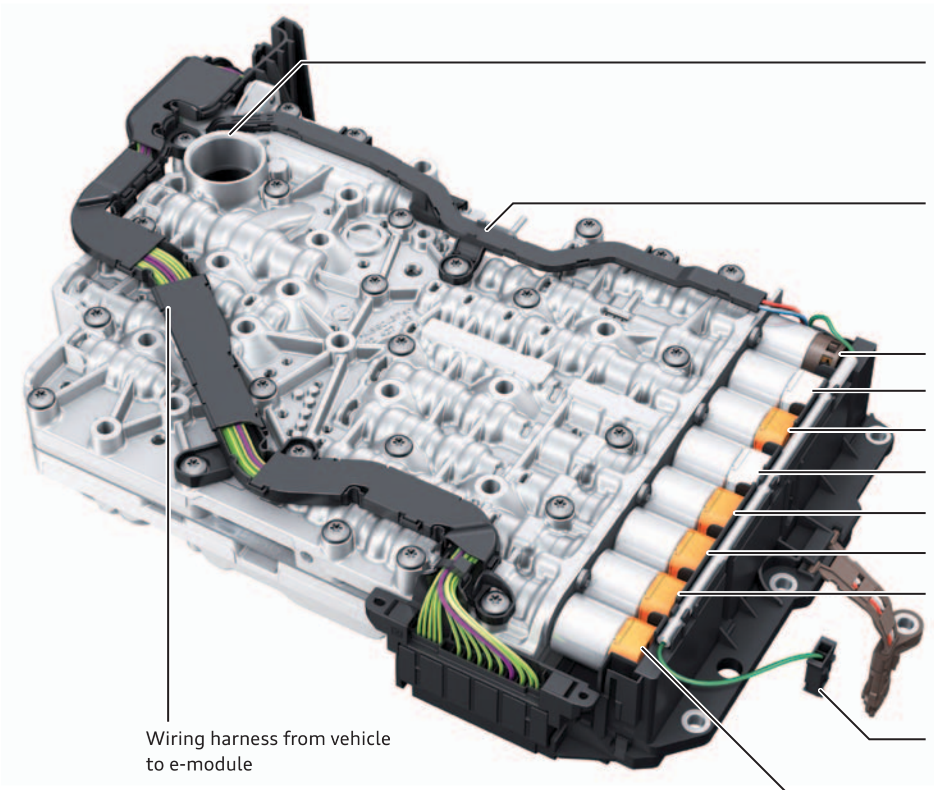


649_103

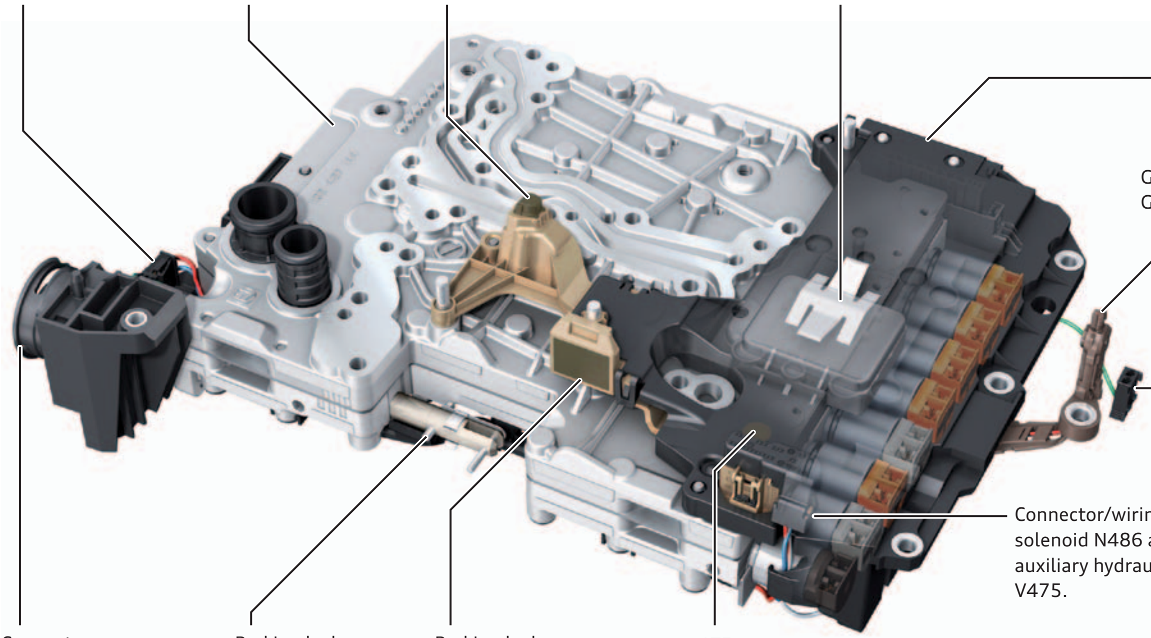
Mechatronic module E26/29 for selector mechanism with shift-by-wire technology

In the case of the Audi Q7 e-tron quattro, shift by wire technology is used for communication between the selector mechanism and the 0D7 gearbox as well as for actuation of the parking lock. The mechatronic module of the 0D7 gearbox is designated E26/29 by its manufacturer, ZF Friedrichshafen AG.

Mechatronic module E26/29 is identical to the mechatronic module used in the 0D5 gearbox of the Audi Q7 (type 4M) (refer to SSP 632).
Mechatronic module E26/29 is a further development of mechatronic module E26/6, which is used in the 0BK gearbox of the Audi A8 (type 4H) (refer to SSP 457 for more information).



649_104

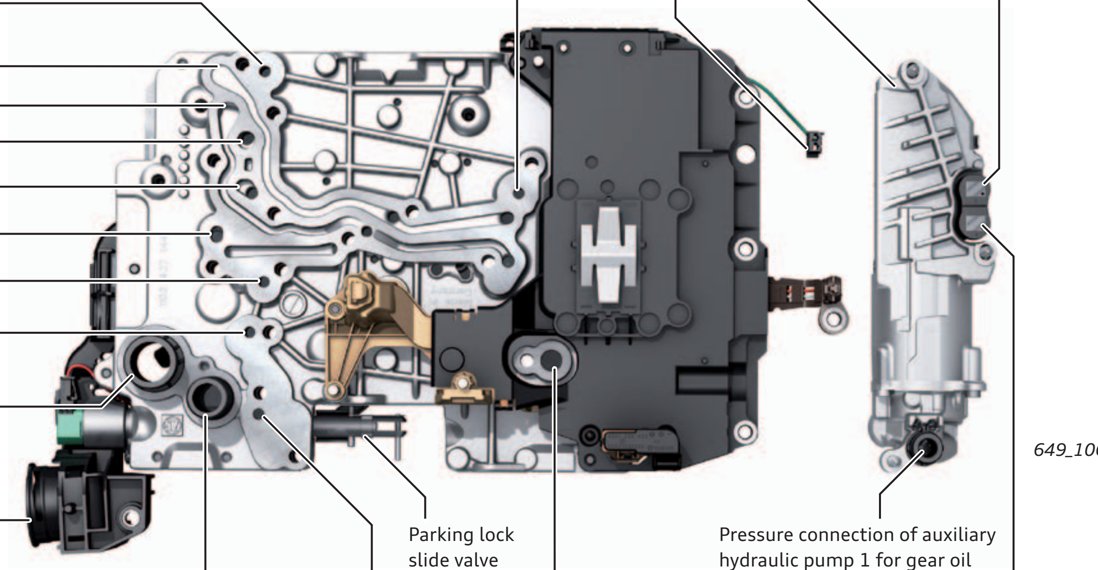


649_105

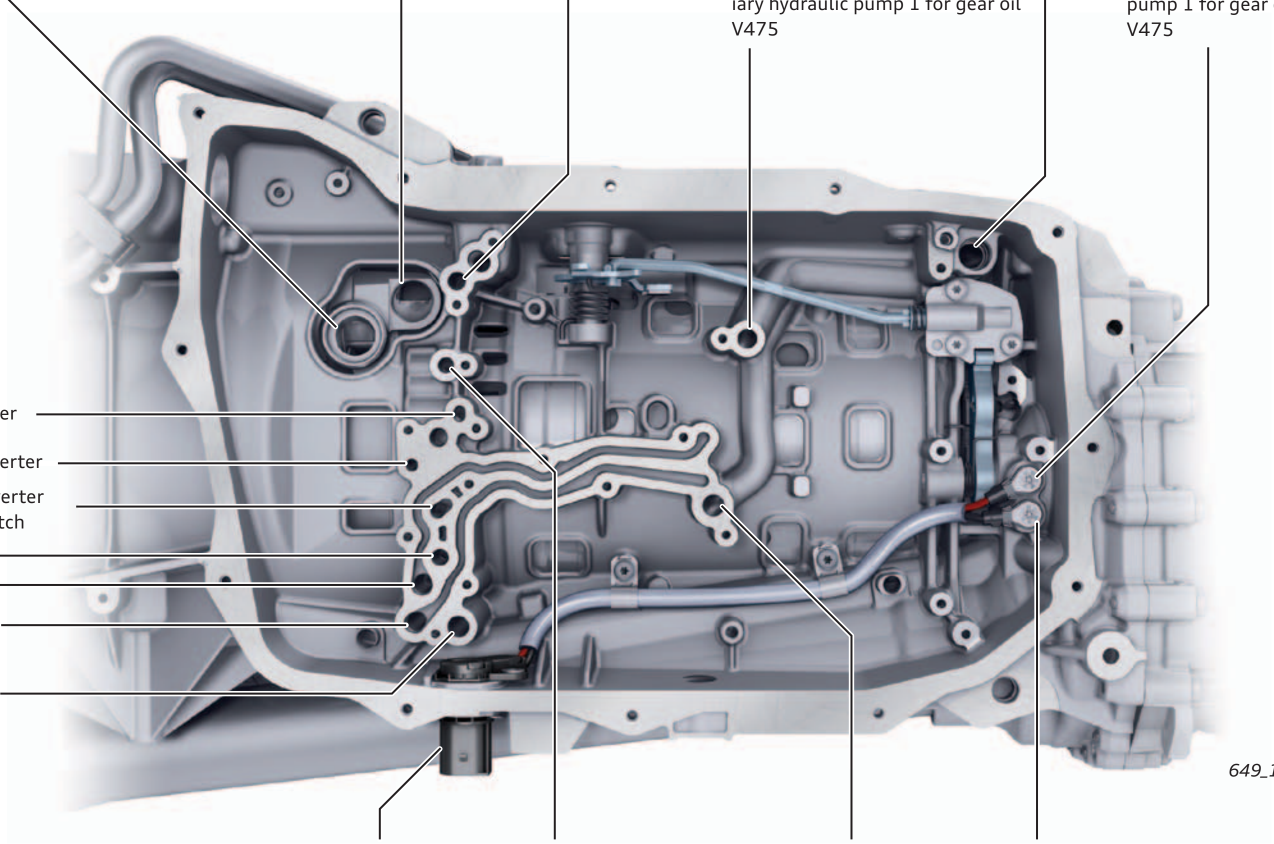
Note
Protect the mechatronic module against electrostatic discharge.
Please refer to the guidelines provided in SSP 284 "6-speed automatic gearbox 09E in the Audi A8 ’03 part 2", page 6, and in the Workshop Manual.

The mechatronic module used in the 0D7 gearbox has a LIN bus line to auxiliary hydraulic pump 1 for gear oil V475, which replaces the control line for the hydraulic impulse storage system (HIS) as used in the 0D5 gearbox or 0BK gearbox.

The sensors, actuators and design configuration of the electrohydraulic parking lock, as well as the method of activation of the shift elements in the mechatronic module of the 0D7 gearbox, are identical to those of the mechatronic modules used in the 0D5 and 0BK gearboxes (refer to SSP 457 and SSP 632 for more information).



649_106



649_107

ATF cooling

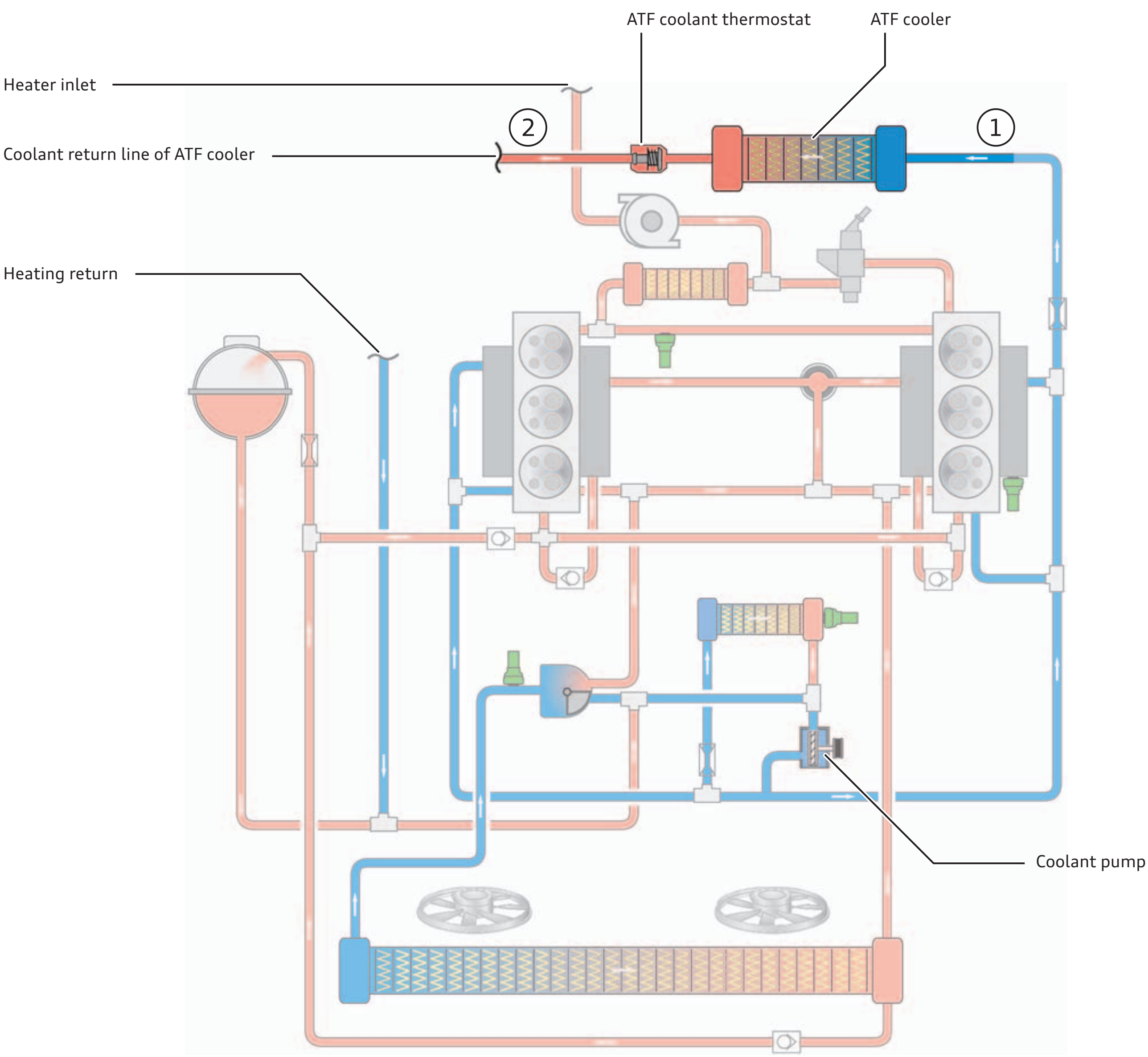
The ATF cooling system is integrated in the cooling circuit of the internal combustion engine in a parallel configuration. In 3.0l V6 TDI models the ATF cooler is flushed by the coolant flow from the coolant pump.
If the Audi Q7 e-tron quattro is equipped with a third-generation 2.0l R4 TFSI engine, the ATF cooler is flushed by the coolant run-on pump V51.
In both cases, the rate of coolant flow is controlled by the ATF coolant regulator in dependence on the temperature.

If the ATF cooler is leaking, coolant (glycol) will mix with the ATF. Even the smallest quantities of coolant in the ATF can have a detrimental effect on clutch control.
A gylcol test will show up even trace quantities of glycol and can, therefore, be used to rule out this cause.
If the coolant lines have been disconnected in order to carry out repairs, the coolant circuit can be bled using the "coolant circuit bleeding routine", available under address code 01 on the diagnostic tester.

Integration in the coolant circuit

The diagram shows a section of the coolant circuit of the 3.0l V6 TDI engine (refer to page 25 of SSP 632).

The connections for coolant return from the ATF cooler as well as heating feed and return are shown on page 83.



649_110

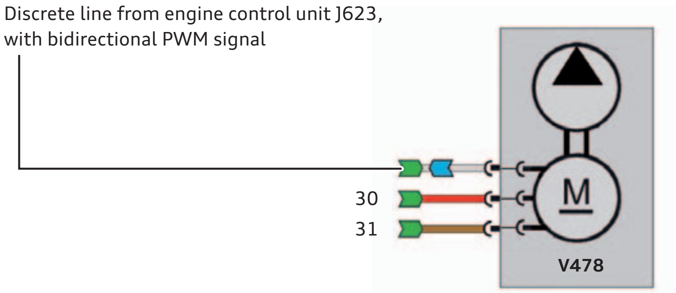
Key:

Cooled coolant

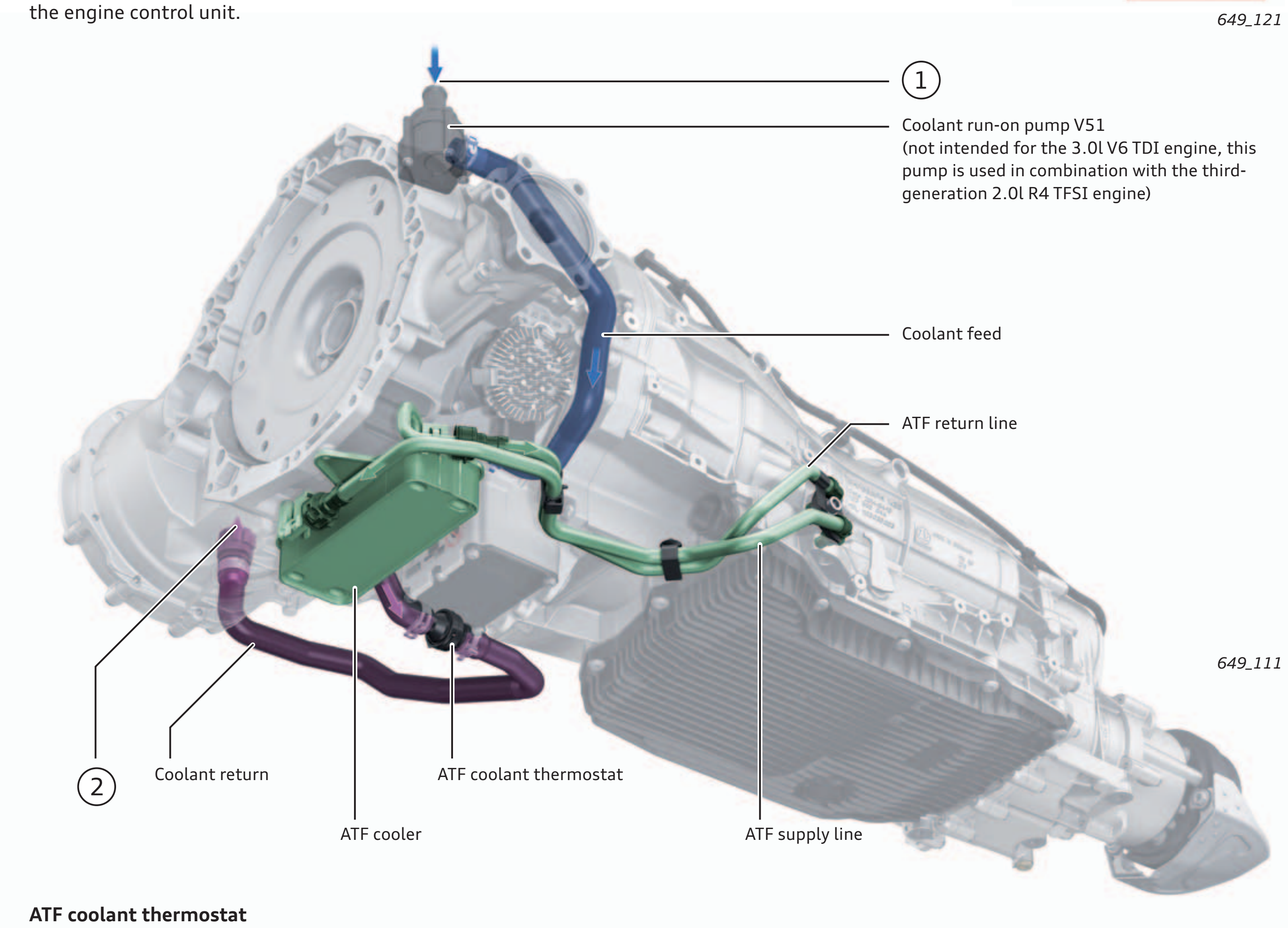
Heated coolant

Coolant run-on pump V51

The coolant run-on pump V51 is used in combination with the third-generation 2.0l R4 TFSI engine.
The pump electronics are provided with a continuous supply of voltage via the 12-volt electrical system. Pump output is controlled by the engine control unit according to ATF temperature. The PWM signal used for this purpose is also used, conversely, by the pump electronics in order to indicate any irregularities to the engine control unit. This information is stored in the event memory. The pump can be checked by running an actuator test via the engine control unit.

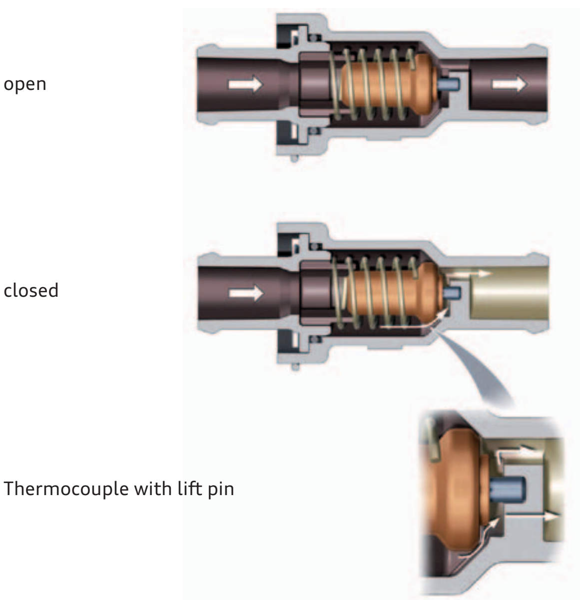


649_121



649_111

ATF coolant thermostat



649_114

The coolant thermostat is integrated in the coolant return line of the ATF cooler.
A groove in the valve seat ensures a continuous trickle flow of coolant. When the coolant temperature increases, the wax in the thermocouple heats up and expands.
As a result, the valve seat opens via the lift pin at a temperature of above 80 °C, and the coolant circuit is opened.

Note:
When installing the coolant thermostat, always pay attention to direction of flow. This is indicated by an arrow on the housing. Fitting the coolant thermostat in the wrong position will adversely affect temperature regulation and impair ATF cooling.

Clogging of the groove in the valve seat will disrupt the continuous trickle flow of coolant. In this case, the thermocouple will not be heated to the required level. The valve seat remains closed and the ATF is not cooled.
In case of complaints concerning excessively high ATF temperature, check the coolant circuit and the oil circuit to the ATF cooler, as well as the coolant thermostat.

Function diagram, information and data exchange

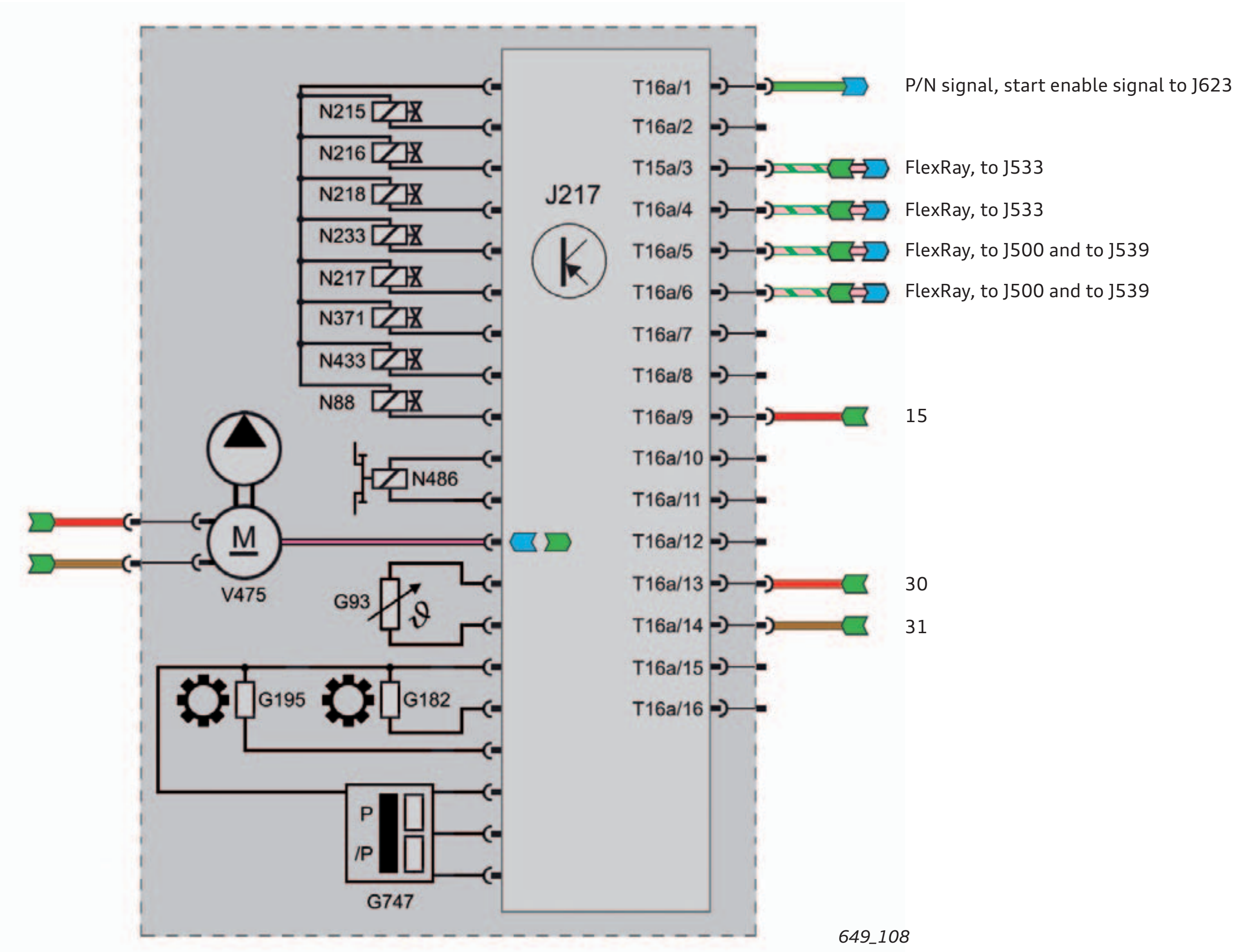
Information and data exchange

The control unit of the 0D7 gearbox communicates with the vehicle via FlexRay bus. Since the instructions for the separation clutch actuator are decided by the engine control unit, a great deal less information is required for gearbox control purposes. The separation clutch actuator V606 actuates the separation clutch K0.

In addition to the usual information used by an automatic torque converter, the automatic gearbox control unit J217 requires requires the following supplementary data for gearbox control purposes:

- Speed of e-machine
- System torque at gearbox input shaft

Function diagram of 8-speed automatic gearbox 0D7



649_108

Key:

- Ground cable
- Positive cable
- Signal line
- LIN bus
- Transmitted signal
- Received signal

G93 ATF temperatur sensor
G182 Gearbox input speed sender
G195 Gearbox output speed sender
G747 Parking lock sender

J217 Automatic gearbox control unit
J500 Power steering control unit
J533 Data bus diagnostic interface
J539 Brake servo control unit
J623 Engine control unit

N88 Solenoid valve 1
N215 Pressure control valve 1, brake A
N216 Pressure control valve 2, brake B
N217 Pressure control valve 3, clutch C
N218 Pressure control valve 4, clutch D
N233 Pressure control valve 5, clutch E
N371 Pressure control valve 6, converter lockup clutch
N433 Pressure control valve 7, system pressure
N486 Parking lock solenoid

V475 Auxiliary hydraulic pump 1 for gear oil

Functions influencing gearbox control (Audi drive select, e-tron modes)

Functions such as the Audi drive select modes, the e-tron modes and downhill assist influence gearbox control.

Audi drive select

The Audi drive select button can be used to select between different vehicle configurations (modes). The gearbox control unit responds differently to these modes.
Gearbox setups are tailored to the customer's requirements in a country-specific way. For this reason, only typical differences between the various modes can be shown here.

offroad mode – for models with steel spring suspension
lift / offroad – for models with air suspension
If the **lift / offroad** mode is activated in models with air suspension, the internal combustion engine is started. This means that electric drive is unavailable in this mode. When a speed of 30 kph is exceeded, the vehicle exits this mode and switches to **allroad** mode. On models with steel spring suspension, electric drive is possible in **offroad** mode. A maximum speed of 30 kph does not apply to these vehicles.
In **offroad** mode the gearbox control unit assists driving in rough terrain by using adapted functions. Gear selection follows a fixed shift program without driver type recognition. As in selector position **S**, the gears are held for longer, particularly 1st gear. Selector position **S** is unavailable, but manual shifting is possible in tiptronic mode (manual mode **M**). Automatic upshifting of the gearbox is deactivated in tiptronic mode. The engine runs up to the speed limiter without shifting up in order to prevent undesirable up-and-down shifting. The deactivation of automatic upshifting allows the engine to stop on a hill at full engine speed. Even if brief loss of traction occurs, the gear is held to ensure that full drive torque is available when the wheels regain full traction. The deactivation of automatic upshifting allows the full braking effect of the engine to be utilised when driving downhill. To protect the engine against overspeeding, the gearbox shifts up before a defined engine speed is reached.

allroad mode
The **allroad** mode does not have any effect on the gearbox setup.

efficiency mode
Selector position **E** is displayed by the gear indicator. In **efficiency** mode the gearbox setup follows a defined shift program with no driver type recognition. Upshifts are performed as early as possible and downshifts are performed late in order to save fuel and reduce CO_2 emissions.
In addition, the engine power output is reduced, allowing the gearbox control unit to reduce the clutch pressure. This, in turn, has a positive effect on fuel consumption and CO_2 emissions.
The **efficiency** mode allows the driver to shift into tiptronic mode **M** and back as well as to shift into selector position **S** and back.

Individual gear indicator
The following applies to all Audi drive select modes on the Audi Q7 e-tron quattro: the individual gear indicator is only available in selector position **S** and in tiptronic mode.

In this case, the Audi drive select modes and the e-tron modes interact with selector positions **D** and **S** to generate defined combinations.

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comfort mode
The **comfort** mode does not have any effect on the gearbox setup.

auto mode
Driver type recognition in drive positions D and S:
In selector positions **D** and **S** driver type recognition is carried out on the basis of the driver's driving style. Criteria for driver type recognition include the mode of actuation of the brake and accelerator pedals, the speed of the vehicle as well as transverse and longitudinal acceleration of the vehicle within defined periods. Accordingly, an economical driving style leads to early upshifts and late downshifts. A sporty driving style is facilitated by late upshifts and early downshifts.
The driving phases in which the driver adopts an efficient, economical, sporty or manual driving style can be read out using the diagnostic tester.
Selector position **D**:
Gearshifts are comfort-oriented and shift point selection is adapted to the driver's driving style with the assistance of driver type recognition.
Selector position **S**[1)]:
If selector position **S** is selected, the gearbox control unit is running the sport program. In this program, the shift points are sporty and adapted to the engine power range. Shift points are configured with the assistance of driver type recognition. Shift times and shift points vary according to setup, the range being from the standard sport program to a handling course setup with short, noticeable shift cycles.

dynamic **mode**
If **dynamic** mode is selected, the gearbox control unit activates the sport program (selector position **S**). In **dynamic** mode, both the tiptronic functions and selector position **D** are available. If selector position **D** is activated before shutting off the engine, selector position (**D**) is again activated when the engine is subsequently started[1)]. If the driver wishes to have selector position **S**, he must select this.

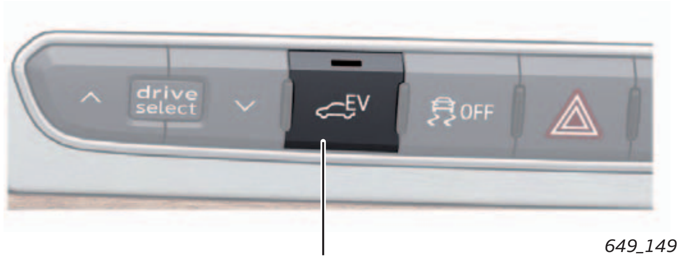
individual **mode**
In **individual** mode, the driver can freely select the gearbox setup irrespective of other vehicle systems.

[1)] After a change of terminal status, a combination of Audi drive select mode **auto**, e-tron mode **EV** and selector position **D** is always used for restarting the vehicle.

e-tron modes

e-tron modes **EV**, **Hybrid** and **Battery Hold** can be freely selected one after the other in a loop using the electric drive button E656 (EV button) or using the rotary pushbutton of the MMI.
The e-tron Modi are adapted to meet country-specific legislation and customer requirements.

For more information about the e-tron modes, refer to SSP 650 (page 26).



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EV mode

The **EV** mode prioritises electric drive mode. In this mode the vehicle runs with the minimum possible CO_2 emission within the e-range, provided that the driver's power requirements do not exceed the capacity of the e-machine. The driver's power requirements are indicated to the system via the active accelerator pedal (refer to page 18).

Battery Hold mode

During vehicle operation, the hybrid battery charge is held at a constant level. The vehicle runs in hybrid mode. This means that both drives are active. Only a small proportion of the battery charge is utilised. The battery charge is saved for later operation in **EV** mode.

Hybrid mode

In **Hybrid** mode, the hybrid management system selects the most favourable drive mode. The vehicle is operated as fuel-efficiently as possible beyond its pure e-range.
If Predictive Efficiency Assist (PEA) is activated via the MMI and route guidance is started, the e-tron **Hybrid** mode is set automatically and once only in the driving cycle if the distance exceeds the maximum electrical range of the vehicle. Taking into account the navigation data, the system operates in such a way that the electrical energy of the hybrid battery will ideally be used up when the vehicle reaches its destination. This helps keep CO_2 emission to a minimum.

Downhill assist

The downhill assist functions aids the driver on downhill gradients. It is activated in selector positions **D** and **S** when the foot brake is pressed or after the cruise control system is activated.
The gearbox selects a gear appropriate to the gradient. The task of downhill assist is to maintain the reduced speed within the bounds of its physical and drive limitations. It may be necessary to additionally correct the vehicle's speed with the foot brake.

Downhill assist cuts out again as soon as the gradient lessens or the accelerator pedal is pressed.
Downhill assist cannot overcome the physical limitations of the vehicle and therefore cannot maintain a set speed in all conditions. The driver must always be ready to apply the brakes!

Combinations of selector positions and e-tron modes within the Audi drive select modes

The possible combinations of Audi drive select, the e-tron modes and the gears are defined. These combinations are key factors determining the drive characteristics of the Audi Q7 e-tron quattro. In the **individual** mode of Audi drive select, one of the listed Audi drive select modes can be selected for the engine/gearbox regardless of the other vehicle systems.

Since Audi drive select affects other systems in addition to the hybrid drive, its combination options rank ahead of the selectable e-tron modes.

Key:

Change e-tron modes

Shift from D/S

e-tron modes	EV		Hybrid[2]		Battery Hold	
Audi drive select Modi	Selector position	e-tron mode	Selector position	e-tron mode	Selector position	e-tron mode
offroad[1] (with steel spring suspension) **lift / offroad[1] (with air suspension)**	**D**[1]	EV	**D**	CAN	**D**	Battery Hold
allroad	**D**	EV	**D**	CAN	**D**	Battery Hold
	S		**S**	CAN	**S**[3]	Battery Hold[4]
efficiency	**E**	EV	**E**	CAN	**E**	Battery Hold
	S		**S**	CAN	**S**[3]	Battery Hold[4]
comfort	**D**	EV	**D**	CAN	**D**	Battery Hold
	S		**S**	CAN	**S**[3]	Battery Hold[4]
auto[5]	**D**[5]	EV[5]	**D**	CAN	**D**	Battery Hold
	S		**S**	CAN	**S**[3]	Battery Hold[4]
dynamic	**D**	EV	**D**	CAN	**D**	Battery Hold
			S	CAN	**S**[3]	Battery Hold[4), 6)]

[1] In the **offroad** or **lift / offroad** mode of Audi drive select, selector position **S** is not available.
If the **lift / offroad** of Audi drive select is activated in models with air suspension, the internal combustion engine is started. In models with air suspension, therefore, electric drive is unavailable in this mode. When a speed of 30 kph is exceeded, the vehicle exits this mode and switches to **allroad** mode.
Electric drive is possible in models with steel spring suspension. A maximum speed of 30 kph does not apply here.

[2] If Predictive Efficiency Assist (PEA) is activated via the MMI and if route guidance is started, the e-tron mode **Hybrid** is set automatically and once only during the driving cycle. The condition for this is a distance which exceeds the maximum electrical range.

[3] If selector position **S** is selected, the resultant combination is **S-Battery Hold**. If the combination **S-Battery Hold** is engaged from selector position **D**, the last combination of selector position and e-tron mode is restored, provided that the e-tron mode has not been changed in the interim.

[4] Starting from the S-Battery Hold combination, S-Hybrid can be accessed via D-EV by pushing the electric drive button E656 in quick succession. D-EV can be set by pushing the electric drive button E656 in slow succession. The e-tron modes can be freely selected using the rotary pushbutton.

[5] After a change of terminal status, a combination of Audi drive select mode **auto**, e-tron mode **EV** and selector position **D** is always used for restarting the vehicle. The combinations **D-Hybrid**, **D-Battery Hold** and **D-EV** can be selected in sequence using the electric drive button E656. The e-tron modes can be freely selected using the rotary pushbutton on the MMI.

[6] If the **dynamic** mode of Audi drive select is selected, the resultant combination is **S-Battery Hold**. If a new Audi drive select mode is selected from the **dynamic** mode of Audi drive select, the last combination of selector position and e-tron mode is restored, provided that the e-tron mode has not been changed in the interim.

Moving the selector from **D** to **M** or from **S** to **M** and back does not change the modes of Audi Drive select or the e-tron drive.

Service

Using the diagnostic tester

The diagnostic functions of address codes 02 – Gearbox electronics, 01 – Engine electronics and 81 – Selector lever are available for power transmission in the Audi Q7 e-tron quattro.

Address code 02 Gearbox electronics

The electrical components and control operations of the 0D7 gearbox are diagnosed. Components and event memory entries can be assessed based on measurement data and the diagnostic results queried via the address code 02 – Gearbox electronics. The following key diagnostic functions can be executed to assess and handle the 0D7 gearbox.

- **Adaptation**

  The following functions can be activated or deactivated using the adaption function of the diagnostic tester.

  - **Individual gear indicator**
    The gear indicator for selector positions **D** and **S** can be separately shown or hidden in the instrument cluster by adapting the individual gear indicator. The gear indicator is always active in manual mode **M** (tiptronic mode).
  - **Route data**
    Route data can be activated or deactivated. However, the 0D7 gearbox does not support navigation data-based gear selection.
  - **Automatic upshifting**
    This adaption function is not available in the Audi Q7 e-tron quattro
  - **Neutral idle control**
    Navigation based gear selection can be activated or deactivated using this adaption function (refer to page 49).
  - **tiptronic switch**
    This adaption function can be used to activate or deactivate tip shifting in **D**.

- **Actuator diagnostics**

  The following actuator diagnostic routines are available via the diagnostic tester:

  - **Selector lever lock solenoid N110**
    Actuator diagnostics cannot be performed under address code 02. The selector lever solenoid can be checked via address code 81 – Selector lever.
  - **Open converter lockup clutch**
    Unwanted torsional vibration of the internal combustion engine can be selectively isolated from the driveline by opening the converter lockup clutch.
  - **Coolant shut-off valve**
    The gear oil cooling valve N509 is not used in the Audi Q7 e-tron quattro.
  - **Auxiliary hydraulic pump 1 for gear oil V475**, refer to page 43.

- **Basic setting**

  The following adaption processes can be performed using the basic setting function.

  - **Quick adaption when vehicle is stationary**
    While carrying out quick adaption, you receive the instruction to start the internal combustion engine via the diagnostic tester. To do this, move the selector into **S**[1]. For example, quick adaption must be performed after replacing a gearbox, after updating the software of the gearbox control unit, after changing the ATF; and after replacing the brakes, clutches or mechatronic module.
  - **Reset all programmed values**
    The adaption values of the clutches can be read and collectively reset. It is not possible to reset individual adaption values.
  - **Cancel adaption**

[1] Provided that the driver is wearing a seat belt, and the doors and bonnet are closed.

Address code 01 Engine electronics

The following components related to power transmission can be assessed on the basis of measurement data, event memory entries and actuator diagnostics via address code 01– Engine electronics.
The following diagnostic functions of importance to power transmission can be executed.

- Separation clutch actuator V606
  Actuator diagnostics: Separation clutch actuator
  Guided Function: Seperation clutch adaption,
  is performed if:
  - the hybrid module was replaced
  - the separation clutch actuator was replaced
  - the engine control unit J623 was replaced
  - new software has been installed in engine control unit J623
- Coolant run-on pump V51,
  in combination with third-generation 2.0l R4 TFSI engine
  Actuator diagnostics: Electrical coolant pump
- Gearbox mounting valve 1 N262
  Actuator diagnostics: R/H gearbox mounting valve
- Gearbox mounting valve 2 N263
  Actuator diagnostics: L/H gearbox mounting valve
- Coolant circuit ventilation routine
  The high-temperature circuit of the internal combustion engine is vented via this guided function. The ATF cooling system is integrated in this circuit (refer to page 58).

Address code 81 Selector lever

The electrical components of the selector lever (refer to page 26) are diagnosed. The diagnostic results can be queried using address word 81.
An actuator test is available for the following components:

- Selector lever position display Y5
- Selector lever lock solenoid N110
- Transverse selector lever lock motor V577

Towing

If a vehicle with an 0D7 gearbox needs towing, the usual restrictions on automatic gearboxes apply:

- Emergency-releasing the parking lock, refer to page 27.
- Max. towing speed 50 kph.
- Max. towing distance 50 km.
- Do not tow the vehicle with the front or rear axle raised off the ground.

Reason
When the internal combustion engine is at standstill, the oil pump is not driven and certain parts of the gearbox are not lubricated. Failure to comply with the towing conditions can lead to serious gearbox damage.

Gearbox warning lamps

If the red gearbox warning lamp appears in the instrument cluster, the driver is instructed not to drive any further.

If the yellow gearbox warning lamp appears in the instrument cluster, it is normally possible to continue driving the vehicle. Driver information is displayed informing the driver what to do.
For detailed and up-to-date information, please refer to the vehicle owner's manual.

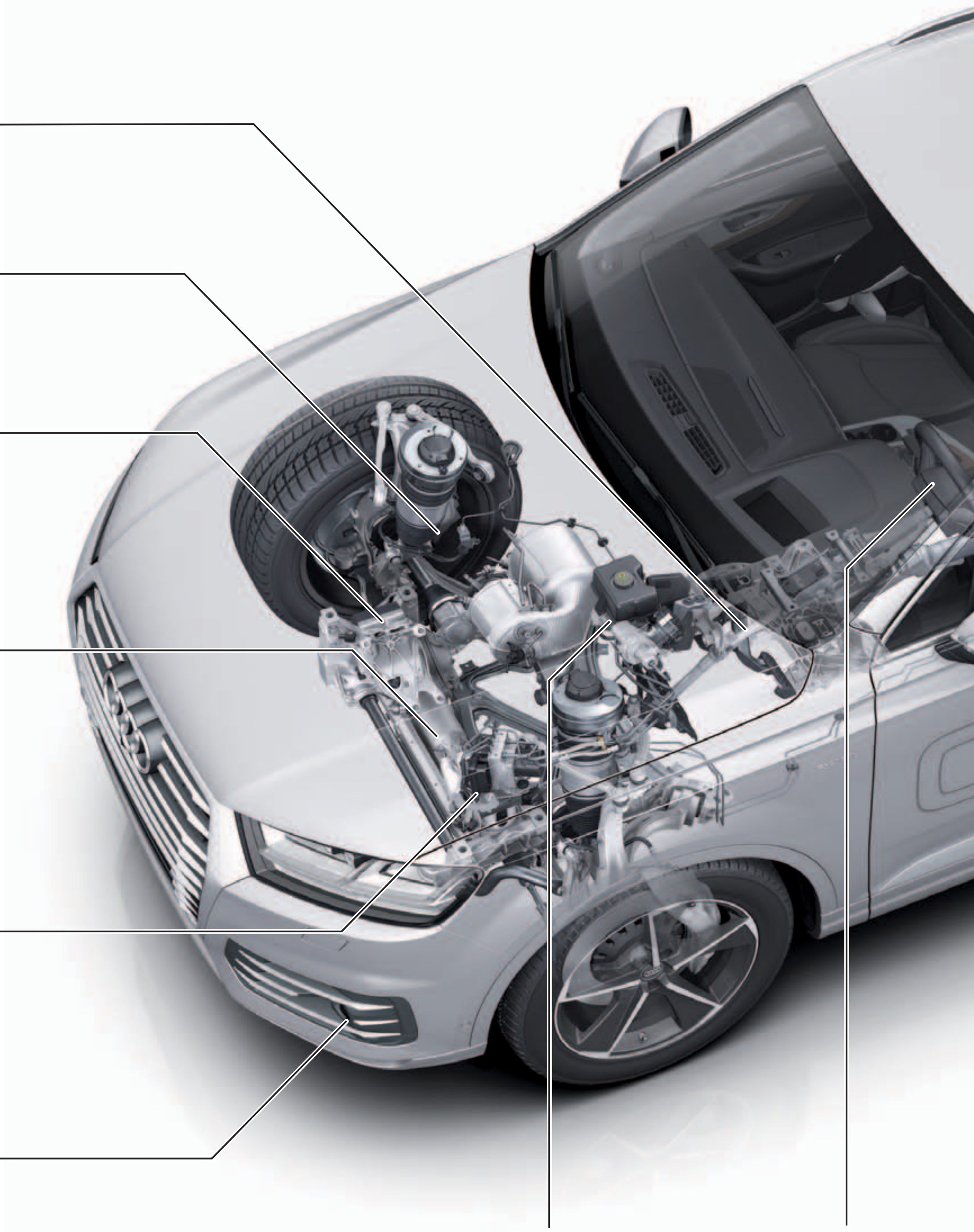
Note
Note the other descriptions and notes on the topic of tow-starting and towing in the owner's manual.

Chassis

Overall concept

The Audi Q7 e-tron quattro adopts key chassis components from the Audi Q7 (type 4M). There are however several minor differences due to functional requirements (electric drive, blended braking etc.) and the modified package (location of hybrid battery). On account of the differences in axle load compared with Audi Q7 (type 4M) and the modified axle load distribution, the chassis systems have been reconfigured using special springs, dampers and anti-roll bars. All-wheel steering will not be available for the Audi Q7 e-tron quattro at launch. The chassis alignment and setup procedures are identical to those for the Audi Q7 (type 4M).

Overview



Steering column
- Adopted from Audi Q7 (type 4M)

Front wheel brakes
- Dependent on engine type
- Refer to overview on page 68

Front axle
- Adopted from Audi Q7 (type 4M)

Electromechanical power steering (EPS)
- Technology adopted from Audi Q7 (type 4M) including maps

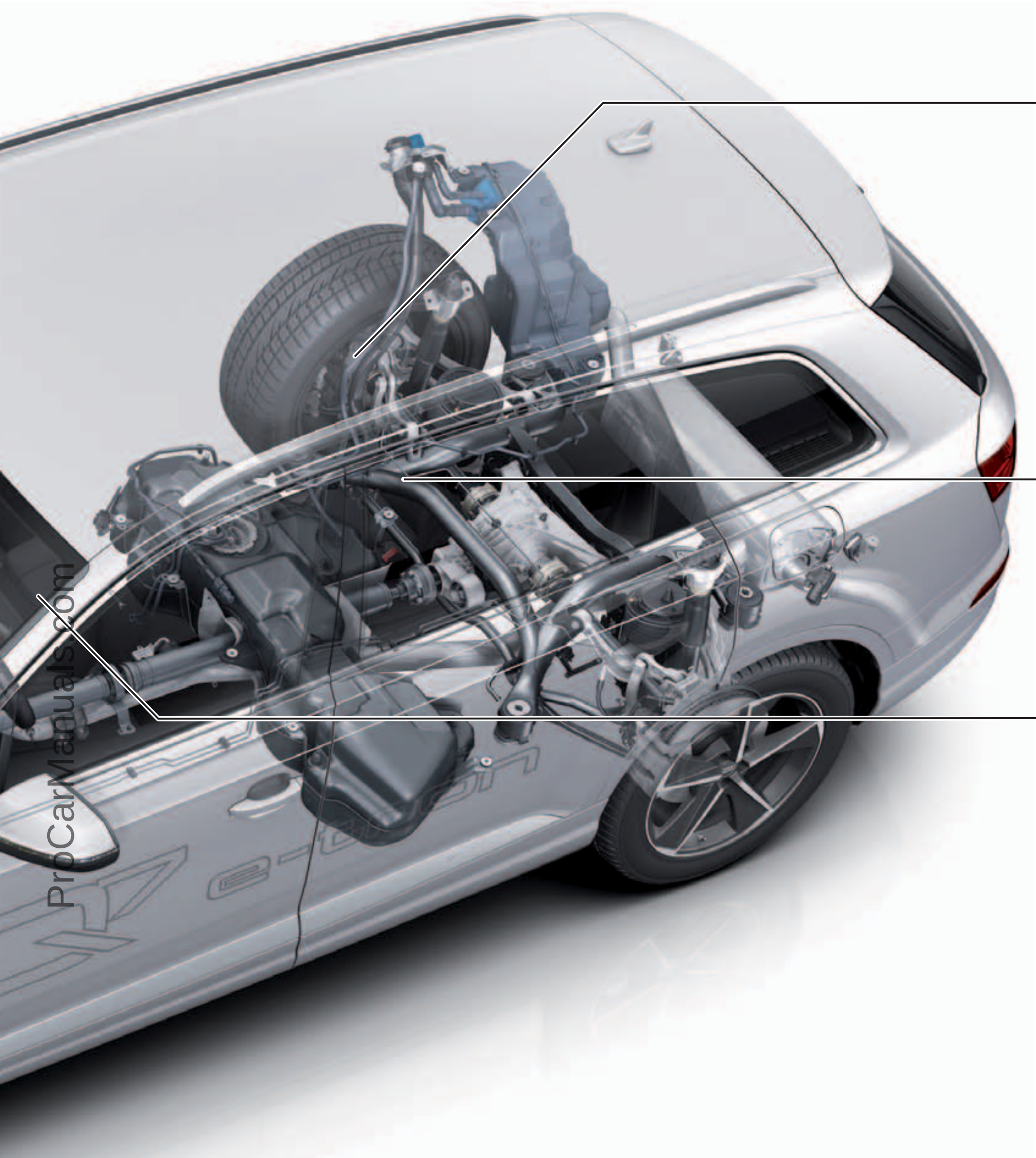
ESC
- Adopted from Audi Q7 (type 4M)
- To improve control quality, general use is made of the hydraulic unit with 3 pressure sensors to check for the plausibility of changes in brake pressure due to recuperation

ACC (optional)
- Adopted from Audi Q7 (type 4M)
- Brake pressure for ACC-based control operations is provided by the electro-mechanical brake servo
- ACC-based driver assistance systems/ functions are the same as in the Audi Q7 (type 4M)

Electro-mechanical brake servo with brake system pressure accumulator VX70 (refer to page 69)

Steering wheels
- Adopted from Audi Q7 (type 4M)

Reference
For detailed information about the chassis system of the Audi Q7 (type 4M), refer to Self Study Programmes 632 "Audi Q7 (type 4M)" and 633 "Audi Q7 (type 4M) Chassis".



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Only chassis systems with a quattro drivetrain are used for the Audi Q7 e-tron quattro.
The following chassis versions are available:

Suspension variants	Features
Standard suspension (1BA)[1]	The standard suspension as basic equipment features steel springs and non-adaptive air suspension.
Chassis with air suspension and adaptive air suspension 1BK[1]	This chassis version is optional. For detailed information about the design, function and service operations of the chassis with air suspension, refer to Self Study Programme 633 "Audi Q7 (type 4M) Chassis".
Chassis with air suspension and adaptive air suspension 2MA[1]	The sport chassis with air suspension is optional, too. The sport version of the chassis differs from chassis 1 BK in that it has a more sporty setup This is accomplished by using modified damper hydraulics, special spring characteristics (provided by special roll pistons) and a special control characteristic (special control software for suspension control unit J775). The control software is loaded into the control unit as a data set from a data container prior to initial use.

[1] Production control number

Brake system

The Audi Q7 e-tron quattro is equipped with a generously dimensioned brake system which offers a high performance reserve in all driving situations. The front axle wheel brakes have lightweight aluminium calipers and lightweight discs. Increased brake caliper rigidity conveys a direct and sporty braking feel. All brake pads already meet the highest environmental standard (copper free), which will not become mandatory until 2021.

The electrical parking brake (EPB) is a carryover from the Audi Q7 (type 4M). The foot controls and the brake servo are new developments designed with a strong emphasis on weight saving. The new ESC system (ESP 9) by Robert Bosch AG is a high-performance stability control system.

Front axle wheel brake system

Engine type	3.0l V6 TDI (190 kW)	2.0l R4 TFSI (185 kW)
Minimum wheel size	19“	18“
Brake type	AKE fixed caliper brake	AKE fixed caliper brake
Number of pistons	6	6
Piston diameter	30/36/38 mm	30/36/38 mm
Brake disc diameter	400 mm	375 mm

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Rear axle wheel brake system

Engine type	3.0l V6 TDI (190 kW) 2.0l R4 TFSI (185 kW)
Minimum wheel size	18“
Brake type	TRW PC44HE
Number of pistons	1
Piston diameter	44 mm
Brake disc diameter	350 mm

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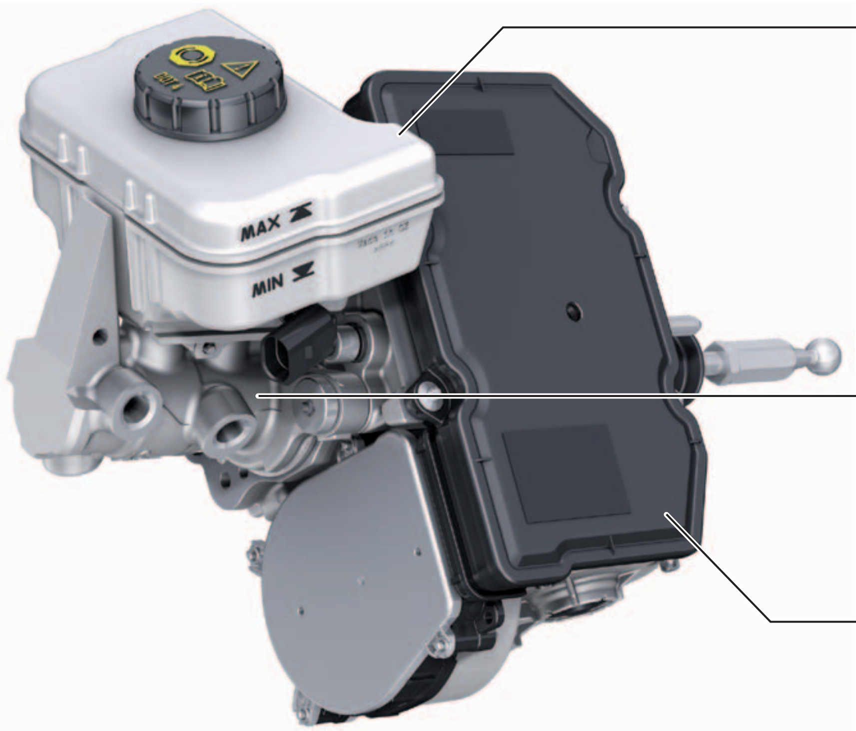
Electro-mechanical brake servo

Even in electric-only mode, it is necessary to boost brake pressure when braking is applied by the driver. The intake manifold vacuum of the internal combustion engine cannot be utilised, because it is only available during conventional vehicle operation. The use of the electro-mechanical brake servo makes it possible to dispense with an additional vacuum pump in combination with a pneumatic brake servo.

The electro-mechanical brake servo offers the following key advantages over a conventional pneumatic brake servo:

- Vacuum-independent brake servo
- High pressure generation dynamics
- High pressure regulation accuracy
- Constant brake pedal characteristic/pedal force

Overview



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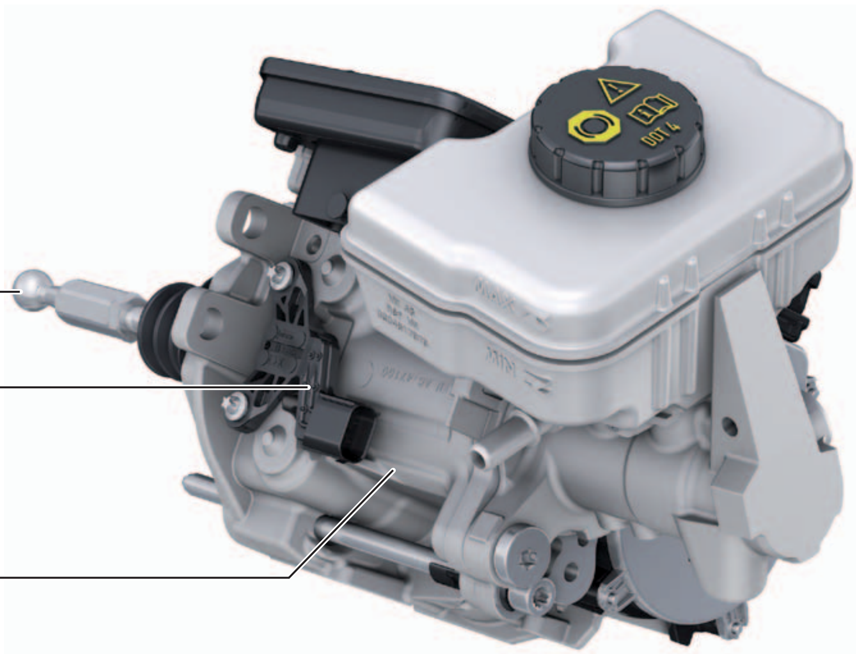

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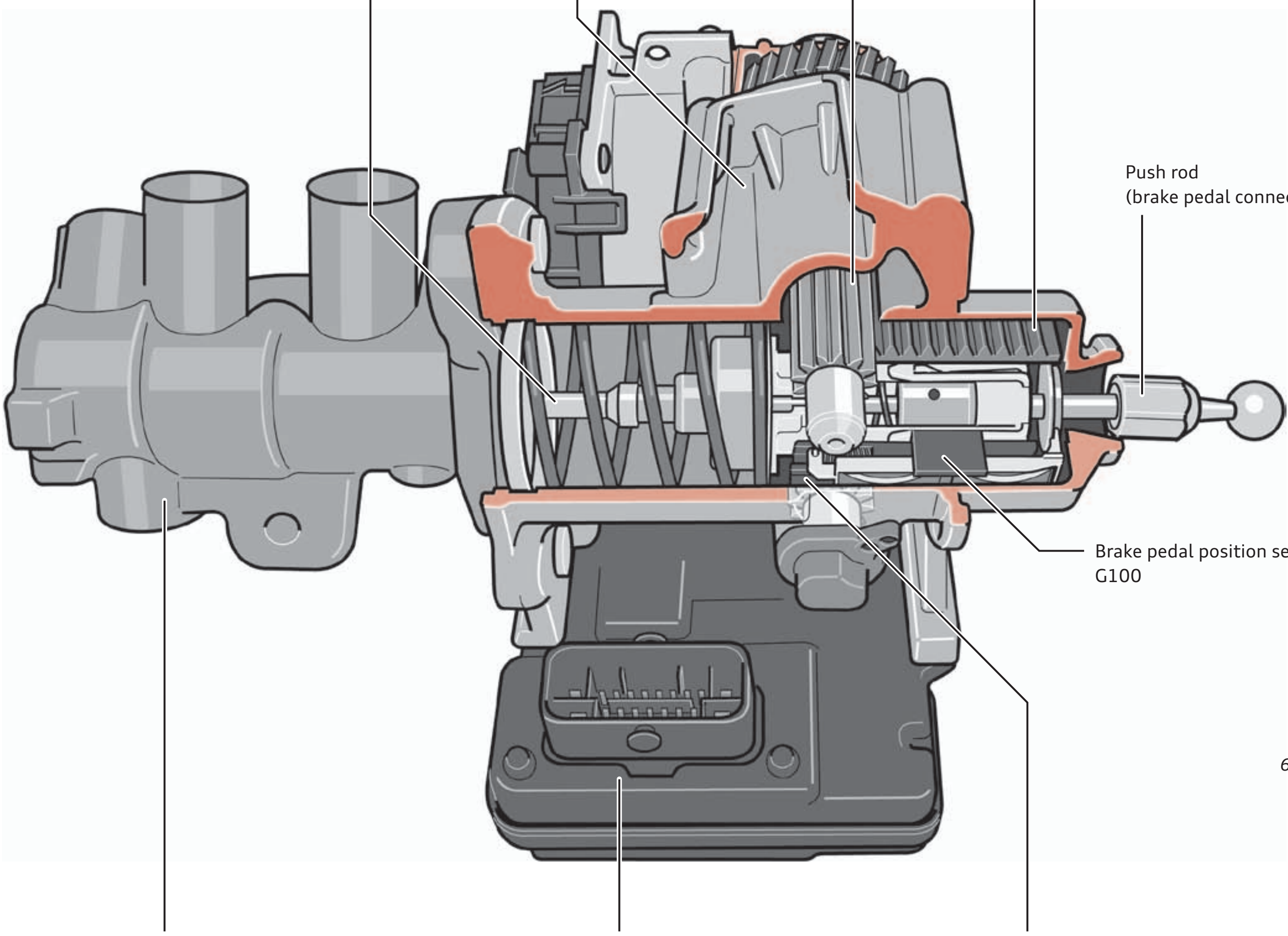
Design and functional principle



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The brake pressure applied by the driver is boosted by the engine-gearbox unit. An AC motor drives 2 pinion shafts through a reduction ratio. The splines of the pinion shafts are in mesh with the spline on the booster sleeve. The rotary motion of the pinion shafts is translated into a longitudinal motion of the booster sleeve.

To increase the brake pressure, the booster sleeve is moved towards the tandem master brake cylinder (to the left in the diagram). The electric motor is activated by the brake servo control unit J539. The control unit receives information on the position of the brake pedal and the push rod (= driver input) from the integrated brake pedal position sender G100.

The position of the electric motor rotor and hence, indirectly, the position of the booster sleeve is monitored by a rotor position sensor (Hall sender) in the electric motor.

The sliding assembly of the booster sleeve on the push rod, and the resultant separation of both components, ensures that the driver can apply brake pressure even if the boost function fails.

Control unit J539 provides for terminal 15 run-on. If the vehicle is stationary and the driver is not applying the service brake, the run-on time is approximately 60 seconds. If the vehicle is actively braked by the driver after terminal 15 is switched off, brake boost is maintained for up to approx. 360 seconds.
After approx. 180 seconds and after 360 seconds, the driver is instructed to secure the vehicle against rolling and informed that brake boost is about to be deactivated.

The signals from the brake pedal position sender G100 of the electro-mechanical brake servo are used for activating the brake light.

Brake system pressure accumulator VX70

If required, the electric drive/AC motor is utilised as a generator in overrun mode to recharge the hybrid battery (recuperation). The electric motor is "driven". As such, it creates drag and thereby generates additional braking torque at the driven wheels.

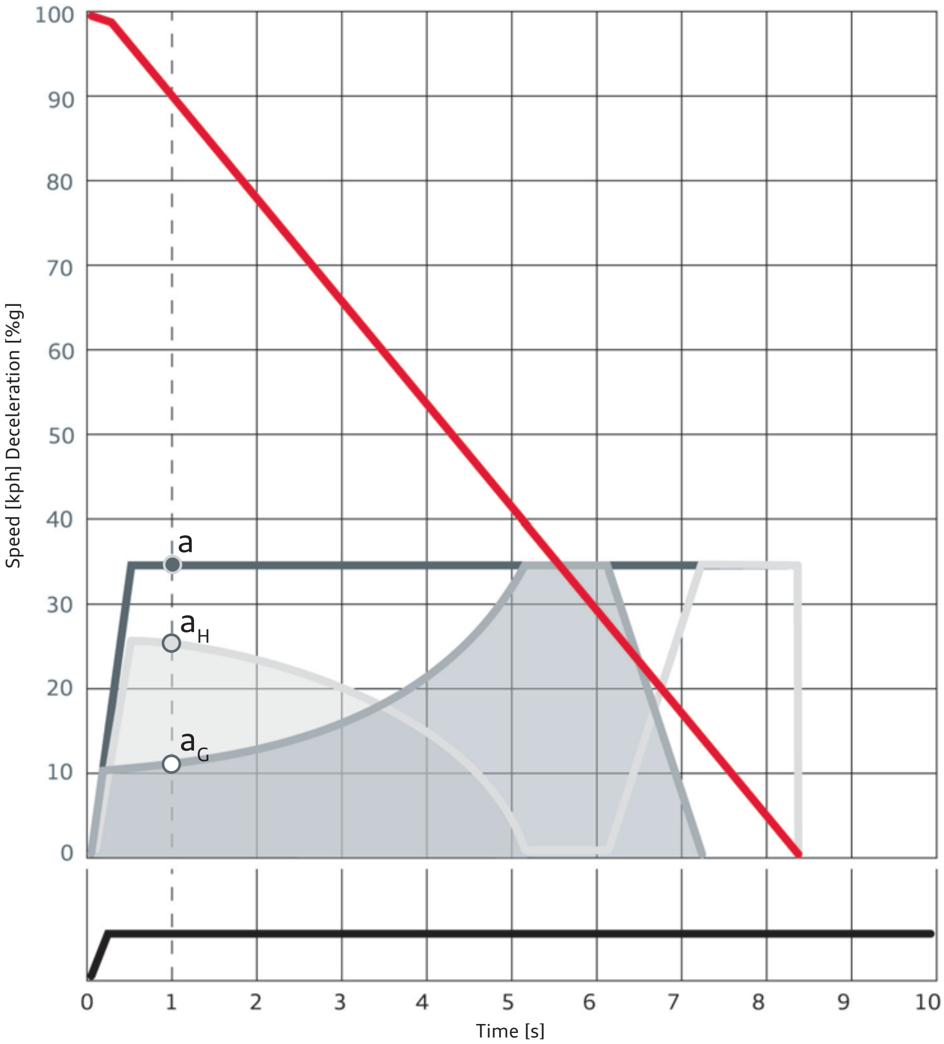
If the driver were to apply the brake, this additional braking torque would immediately provide additional braking. As this process would be independent of driver inputs, it would be more the difficult for the driver to perform anticipatory braking. This is why it is important that a braking torque defined by the driver be available at any time and that the driver be able to gauge the effect of this braking torque.

Hydraulic brake pressure is reduced during recuperation, as this is more efficient. This reduction is made with the aim of matching the total amount of "hydraulic" braking and "electrical" braking to the actual driver input. The brake system pressure accumulator VX70 is used in order to achieve this.

The combination of "hydraulic" braking and "electrical" braking is referred to as "Blended Braking". By way of example, the deceleration at a specific point in time (1 second after commencement of braking) is specially marked in the diagram. The amount of deceleration, a, which the driver wishes to achieve is provided by the total deceleration resulting from hydraulic braking torque a_H plus the deceleration resulting from generator braking torque a_G.

$a = a_H + a_G$

Example of "blended braking"



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Key:

- Deceleration resulting from "hydraulic" braking torque a_H
- Deceleration resulting from the generator braking torque of AC drive a_G
- Requested deceleration through brake pedal actuation by driver a
- Pedal travel
- Vehicle speed

Design and functional principle

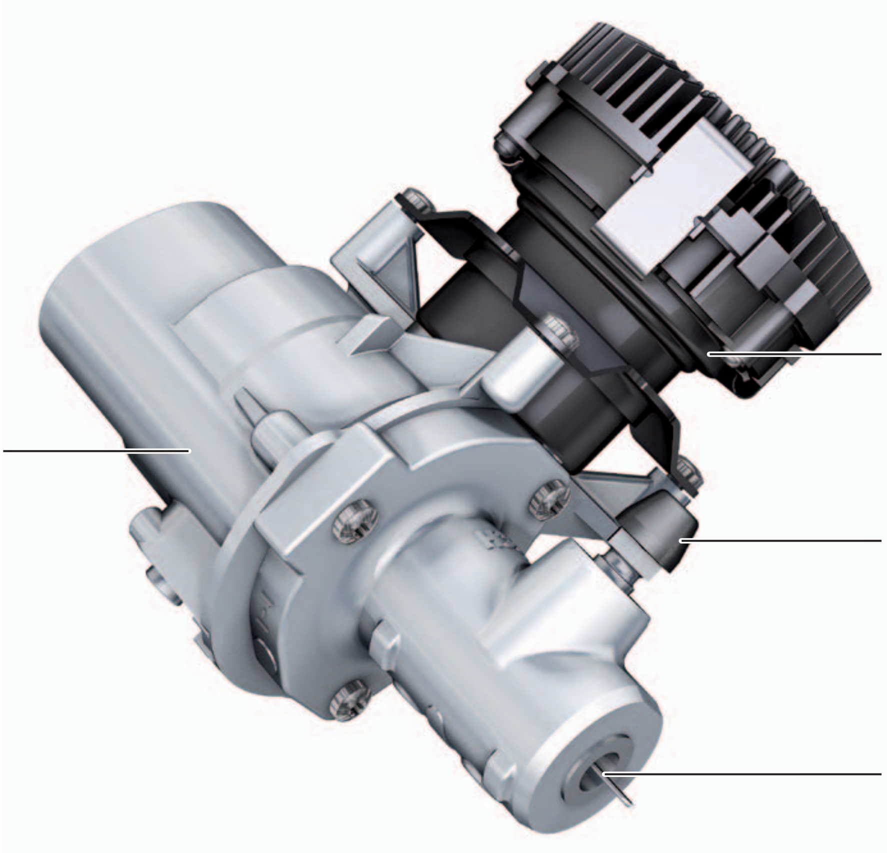
The pressure accumulator is connected directly to the master brake cylinder and thus to the hydraulic braking circuit.

If the brake pressure applied by the driver (dependent on the additional braking torque of the electric drive during recuperation) has to be reduced, the electric motor of the pressure accumulator is activated by the brake servo control unit J539.

The ABS control unit J104 determines the required degree of brake pressure reduction and "instructs" control unit J539 to implement this reduction. The piston performs a lift motion due to the spindle drive in the cylinder, cylinder volume increases and brake fluid is taken in from the braking circuit.

The braking pressure within the system, i.e. in the wheel brakes, decreases. At the same time, the brake boost provided by the electro-mechanical brake servo is reduced in order to ensure that the brake pedal does not "give".

If the additional braking torque of the electric drive decreases again under active braking, or if the generator mode of the electric drive is fully deactivated, the previously reduced braking pressure must be increased again. Control unit J539 re-activates the electric motor of the pressure accumulator. The motion of the piston reduces the cylinder volume, and the brake fluid in the cylinder is returned to the braking circuit. The pressure within the braking system increases accordingly.



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Service operations

The electro-mechanical brake servo (including brake servo control unit J539) and the pressure accumulator can be accessed under diagnostic address 23. If necessary, the components can only be replaced as complete assemblies by service personnel. After replacing the electro-mechanical brake servo (including control unit), online encoding of the control unit must be carried out. For this purpose, it is important to properly bleed the braking system.

After this, the diagnostic tester automatically programs the electro-mechanical brake servo. The basic setting procedure must be performed after the pressure accumulator is replaced. At the same time, the end positions of the pistons are determined. Actuator diagnostics routines have been implemented for function-testing the electro-mechanical brake servo and the pressure accumulator, as well as for activating the warning lamp and the brake lights.

Reference
For more information about the brake system pressure accumulator VX70, refer to Self Study Programme 627 "Audi A3 Sportback e-tron (type 8V)".

Wheels and tyres

In basic trim, Audi Q7 e-tron quattro will feature a size 19" wheel at market launch. 19" to 20" wheels are optional. The range of tyres extends from 255/55 R19 to 285/45 R20.

The "Tire Mobility System" is standard equipment. A size 6.5Jx20 collapsible aluminium spare wheel is optional. The vehicle comes with a jack if ordered factory-fitted with winter wheels and if equipped with a collapsible wheel.

Basic wheel		Optional wheel		Winter wheels (option)	
	8.0J x 19 ET28 Lightweight forged wheel Suitable for snow chains 255/50 R19		9.0J x 20 ET22 Flow form cast wheel 285/45 R20		8.0J x 20 ET28 Flow form cast wheel 255/50 R20 XL M+S
					9.0J x 20 ET33 Flow form cast wheel 285/45 R20 XL M+S

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Low tyre pressure indicator

The established second-generation low tyre pressure indicator is also offered as basic equipment for the Audi Q7 e-tron quattro.

Tyre pressure monitoring system

As previously for the Audi Q7 (type 4M), a third-generation direct tyre pressure monitoring system is optional. For detailed information, refer to Self Study Programme 633 "Audi Q7 (type 4M) Chassis".

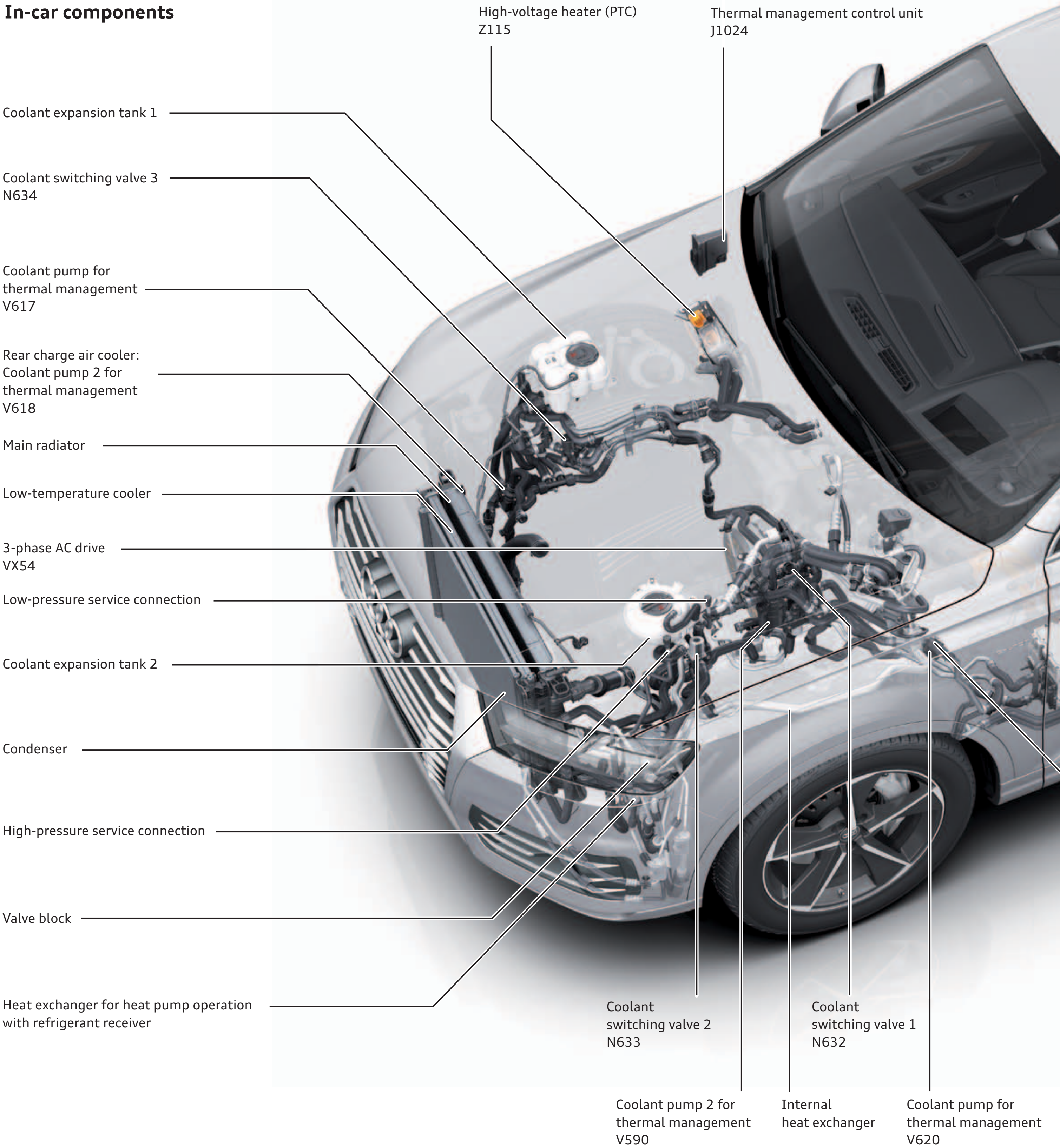
Air conditioning and cooling

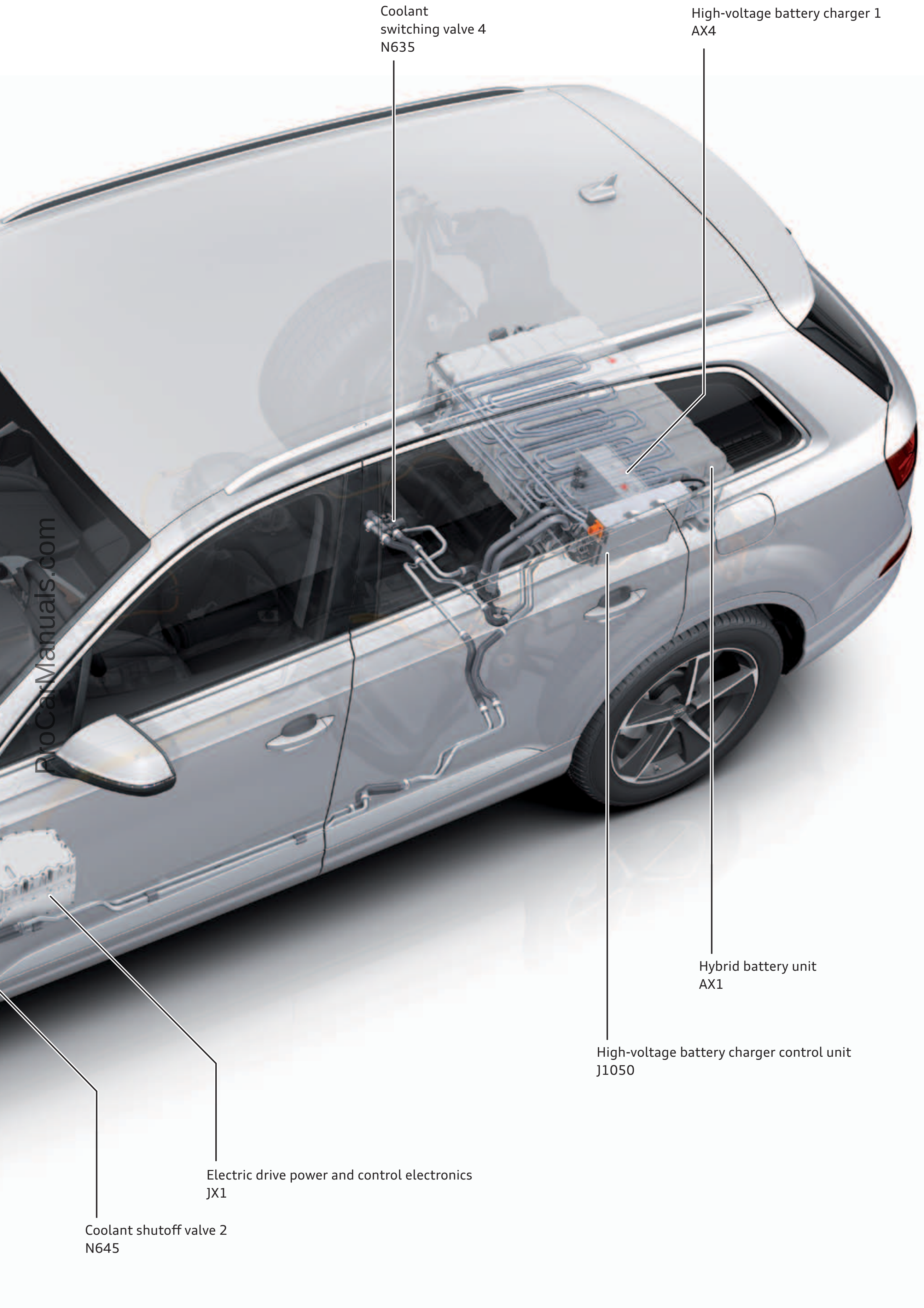
Thermal management and heat pump

The thermal management system in the Audi Q7 e-tron quattro ensures an optimal engine temperature in all operating states, both in the conventional driveline and in the electric driveline. It is also responsible for cooling and heating the cabin. A thermal management system incorporates various cooling circuits for controlling the temperature of drive components, a refrigerant circuit for the air conditioning systenm and the requisite controllers.

The descriptions and overviews provided further below in this chapter refer to a vehicle without conventional auxiliary heating.

In-car components





Coolant switching valve 4 N635
High-voltage battery charger 1 AX4
Hybrid battery unit AX1
High-voltage battery charger control unit J1050
Electric drive power and control electronics JX1
Coolant shutoff valve 2 N645

649_019

Heat pump

The heat pump system has been used in building installations for years, and now finds its way into the world of Audi automobiles through the Audi Q7 e-tron quattro. An electric-powered vehicle develops less waste heat than a vehicle with an internal combustion engine. It is important to make efficient use of the generated thermal energy. This means there is no need to generate energy from waste heat, which can be used for heating the cabin. The use of the heat pump allows the waste heat released by electrical components to be used for heating the cabin. Waste heat can be recovered for heating purposes by extending the refrigerant and coolant circuits. This significantly improves the efficiency of the electric heating system. The heat pump extends the range of the Audi Q7 e-tron quattro. It collects the waste heat from the components in the electric driveline and increases the temperature of the coolant flowing through the heat exchanger. For a detailed description, refer to page 90.

Advantages of the heat pump

Thanks to the electric AC compressor V470 and the high-voltage heater (PTC) Z115, it is possible to pre-cool the cabin in the summer and to preheat the cabin in the winter. The heat pump can subsequently maintain a comfortable temperature of approximately 22 °C without the need for additional heating. This is possible down to an ambient tempeature of about 0 °C. If the ambient temperature drops below 0 °C, the high-voltage heater (PTC) Z115 can provide back-up.

The heat pump has another advantage when it comes to preventing windscreen fogging up in wet weather. With the heat pump, it is possible to initially cool and dehumidify the intake air and subsequently to reheat the intake air efficiently via the heat pump. To achieve this, conventional heating systems of electric-powered vehicles have to consume twice as much energy.

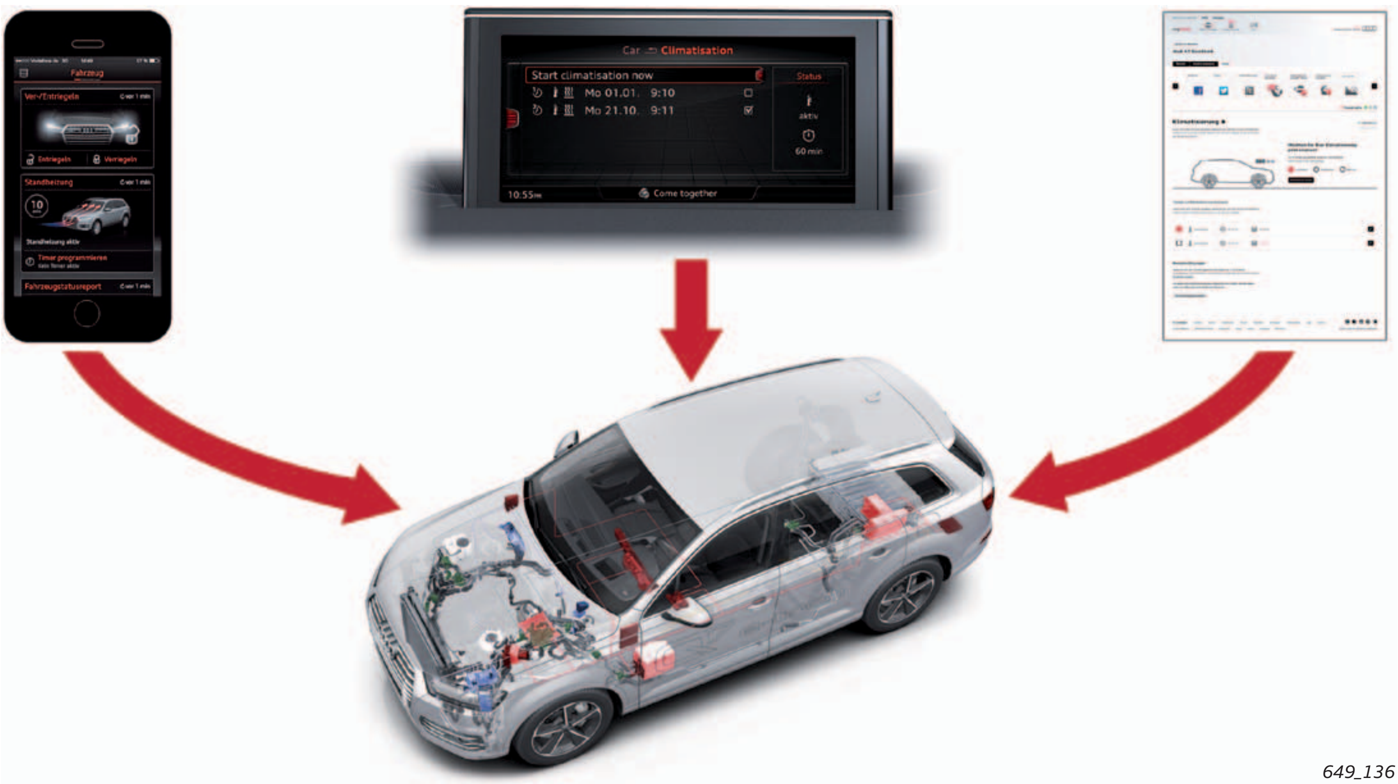
Pre-conditioning

Electrical pre-conditioning can be started directly or programmed for a specific departure time. This function can be operated via the in-car MMI, via the Audi connect app or via myAudi.

The pre-conditioning function is available irrespective of whether the vehicle is currently being charged via the charging infrastructure, or not. A requirement is that the hybrid battery has sufficient charge. A conventional auxiliary heater can be ordered as an option.

Operating options

Audi connect app **In-car MMI** **myAudi**



649_136

Key components

Thermal management control unit J1024

The control unit J1024 co-ordinates the requirements of the components newly added due to the heat pump and the subsystems, and, where possible, sets the energetically most favourable operating points. It is installed under the right wing. The control unit is connected to the data bus diagnostic interface J533 via the hybrid CAN data bus.

To narrow down the possible cause of a malfunction, various routines have been stored in the basic setting of control unit J1024 and include the following functions:

- Cool air conditioning system
- Heat pump
- Cool components of the high-voltage system
- Guided Fault Finding

The thermal management control unit J1024 communicates with the following control units.

- Battery regulation control unit J840
- Electric drive control unit J841
- Air conditioner/Climatronic operating and display unit E87
- Engine control unit J623

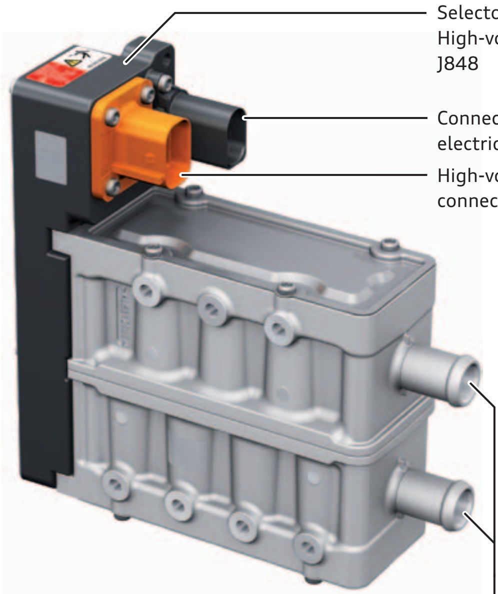
649_031

Depending on requirements, control unit J1024 selects the best out of over 200 possible shift states. In addition, the thermal management control unit J1024 reads in signals from the temperature and pressure sensors and controls pumps as well as valves.

High-voltage heater (PTC) Z115

The high-voltage heater (PTC) Z115 heats the coolant for the heater heat exchanger in the cabin, both in electric drive mode and when preheating the vehicle. The high-voltage line is installed in the plenum chamber.

The high-voltage heater (PTC) Z115 is used when the heating output of the heat pump is not sufficient to heat the cabin.



649_032

Reference
For further information about the high-voltage heater (PTC) Z115, refer to Self Study Programme 650 "Audi Q7 e-tron quattro (type 4M) high-voltage system and vehicle electrics".

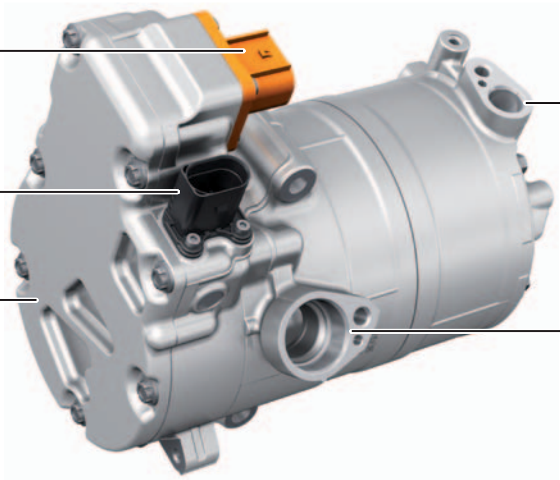
Electrical AC compressor V470

The electrical AC compressor V470 is the core element of the vehicle air conditioning system and has been redeveloped for use in the Audi Q7 e-tron quattro. The electrical AC compressor draws in the cold, gaseous refrigerant at low pressure. The refrigerant is compressed inside the compressor, increasing the pressure. The temperature of the refrigerant increases.
The compressed, hot refrigerant flows in a gaseous form from the AC compressor in the valve block and then, depending on operating state, on to:

- **In cooling mode**: the condenser
- **In heat pump mode**: the heat exchanger for heat pump operation

The electrical AC compressor V470 can, if required, be used both for heating and cooling the cabin and hybrid battery unit AX1.

Type	Scroll compressor
Compression volume	33 cm³
Weight	6.3 kg
Engine speed	700 – 8500 rpm
Max. power consumption	5.3 kW
Operating voltage range	195 – 450 V

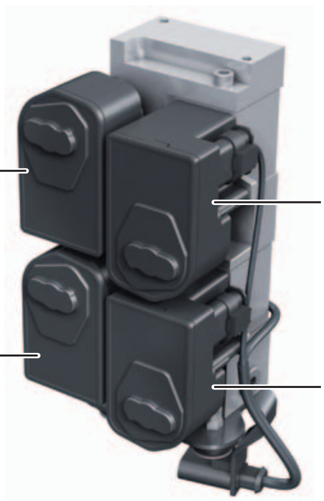


649_033

Refrigerant shut-off valves

Shut-off valves N640, N641, N642 and N643 are arranged in a compact valve block and are activated by control unit J1024 via LIN.
The switching positions of the valves define how the system operates. The following valves are also integrated:

- Electronic expansion valve N636 with LIN interface from thermal management control unit J1024
- Refrigerant shut-off valve V424 for shutting off the evaporator.



649_034

Non-return valves

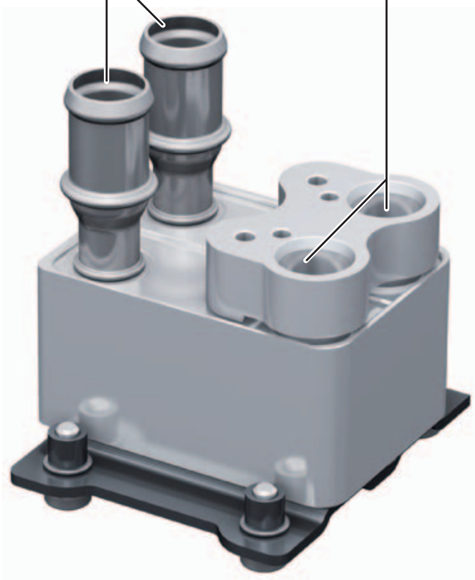
The non-return valves ensure that the refrigerant flows in the right direction in the various operating modes.

649_134

Reference
For more information about cleaning the refrigerant circuit as well as the various function tests on the shut-off valves, please refer to the Workshop Manual.

Hybrid battery heat exchanger (chiller)

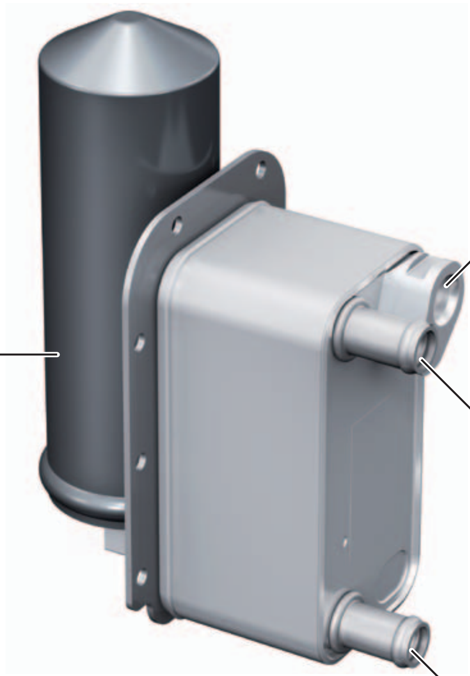
The hybrid battery heat exchanger is a plate heat exchanger within which the refrigerant evaporates. The component is used for cooling the battery circuit and for extracting heat from the low-temperature circuit during heat pump operation.



649_035

Heat exchanger for heat pump operation with refrigerant receiver

The heat exchanger for heat pump operation transfers heat from the refrigerant circuit or the cooling circuit to the heating circuit. This means that the hot, gaseous refrigerant condenses within the plate heat exchanger and dissipates its heat to the heating circuit.



649_036

Refrigerant pressure/temperature sender

The sensors for refrigerant pressure and refrigerant temperature (G395, G826 and G827) are used for regulating the cooling and heat pump systems. The sensors evaluate the pressure and temperature in the refrigerant circuit.

649_045

Note
The sensors for refrigerant pressure and refrigerant temperature currently have a fixed address. All three sensors are identical in design, but must not be interchanged. The part number, address and service component designation can be found on the label marking the electrical connection.

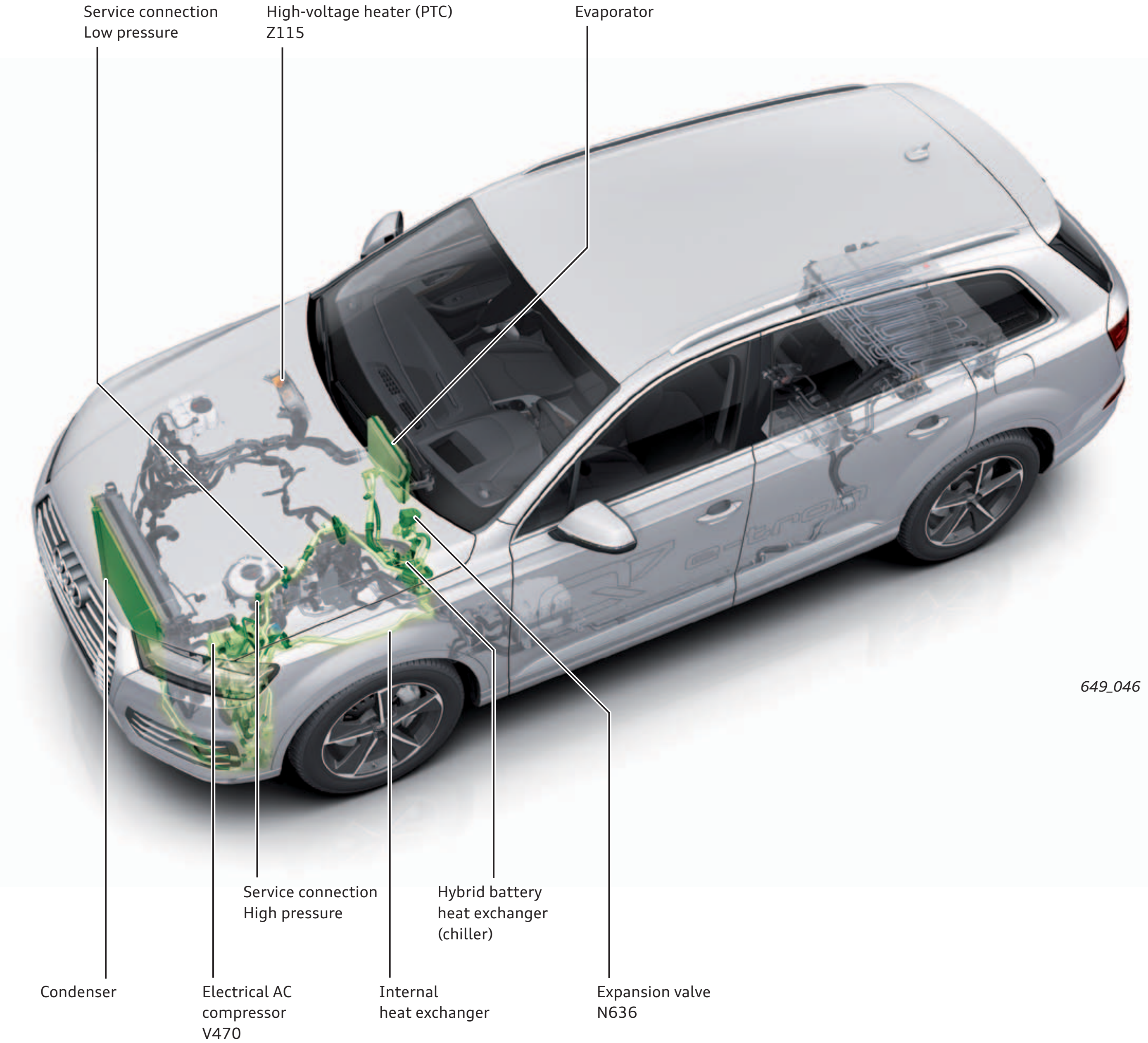
Refrigerant circuit

The refrigerant circuit of the Audi Q7 e-tron quattro differs from that of the Audi A3 e-tron in that it includes additional components for the heat pump.

The two refrigerant circuit service connections (high and low pressure) are located upstream of the AC compressor on the low-pressure side and downstream of the valve block on the high-pressure side.

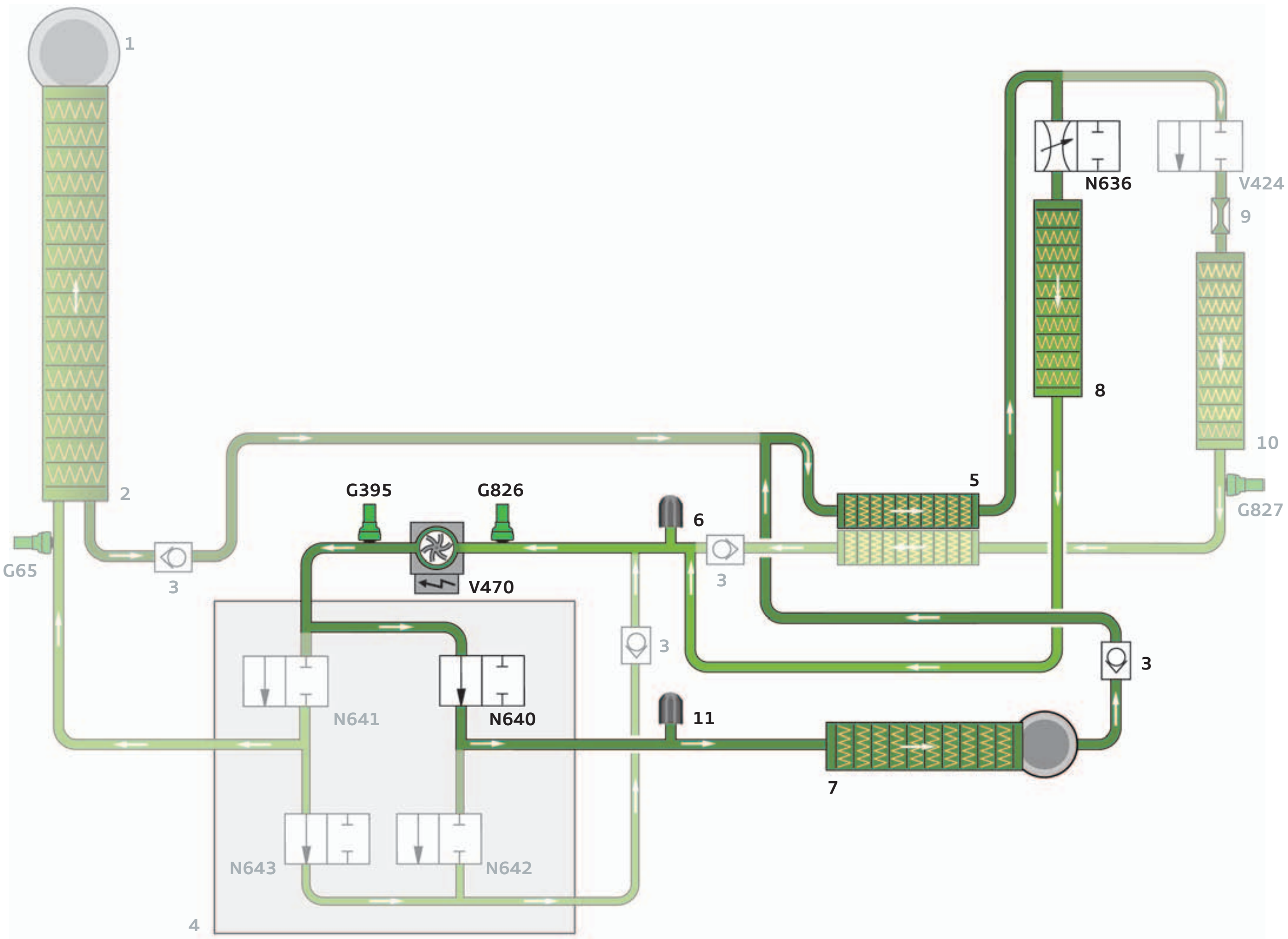
These new components are:

- Valve block with valves V640 – V643
- Heat exchanger for heat pump operation
- 4 non-return valves
- Internal heat exchanger
- Refrigerant expansion valve 1 N636



649_046

System overview of the refrigerant circuit in heat pump mode



649_017

Key:

Refrigerant under low pressure
Refrigerant under high pressure

1 Liquid container with dryer
2 Coolant condenser
3 Non-return valve
4 Valve block
5 Internal heat exchanger
6 Low-pressure service connection
7 Heat exchanger for heat pump operation
8 Heat exchanger for hybrid battery (chiller)
9 Thermal expansion valve
10 Evaporator
11 High-pressure service connection (for heat pump operation only)

G65 High-pressure sensor
G395 Refrigerant pressure and temperature sensor
G826 Refrigerant pressure and temperature sensor 2
G827 Refrigerant pressure and temperature sensor 3

N636 Refrigerant expansion valve 1
N640 Refrigerant shutoff valve 2
N641 Refrigerant shutoff valve 3
N642 Refrigerant shutoff valve 4
N643 Refrigerant shutoff valve 5

V424 Refrigerant shutoff valve (opens only in cooling mode)
V470 Electrical AC compressor

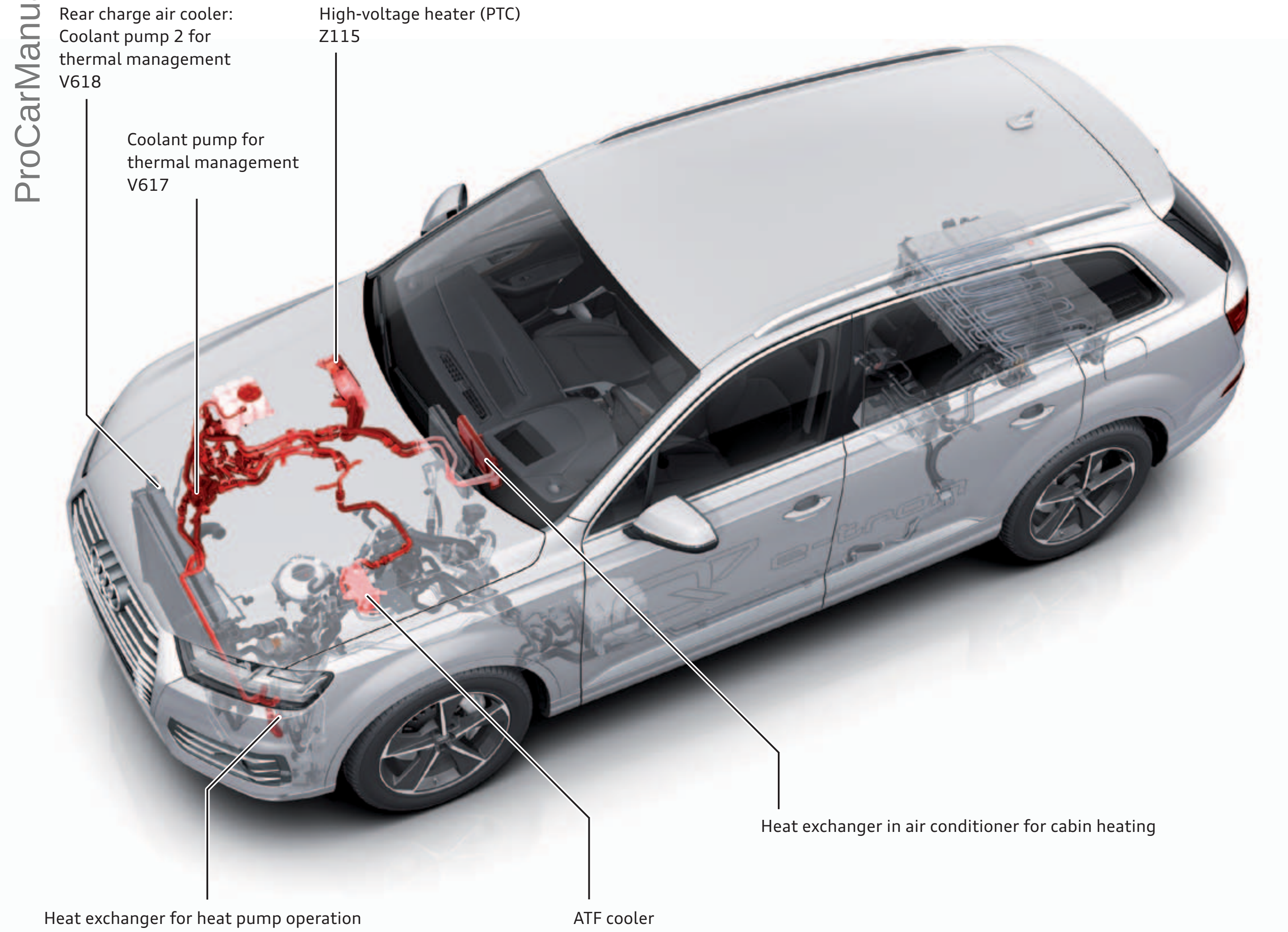
Coolant circuits

In addition to the refrigerant circuit, the Audi Q7 e-tron quattro has high- and low-temperature circuits. They are needed to meet the temperature requirements of all components in a hybrid vehicle. The temperature range extends from –30 °C to +110 °C. The engine coolant circuit is used for cooling the internal combustion engine and the gearbox and for heating the cabin. The coolant circuit of the high-voltage system regulates the temperature of the hybrid battery unit AX1 and high-voltage battery charger 1 AX4. The components of the electric driveline, the three-phase AC drive VX54 and the electric drive power and control electronics module JX1 are also cooled via this circuit. The temperature of the components is controlled via valve circuits. The hybrid battery can be cooled both passively via the atmosphere and actively via the refrigerant circuit. A heat pump integrated in the thermal management system of the Audi Q7 e-tron quattro systematically collects the heat loss of the electrical components. The heat loss flows are heated via the refrigerant circuit. After this, they are fed to the vehicle heating circuit via the heat exchanger for heat pump operation. This ensures highly efficient cabin heating while extending the electrical range of the vehicle.

Cabin heating circuit

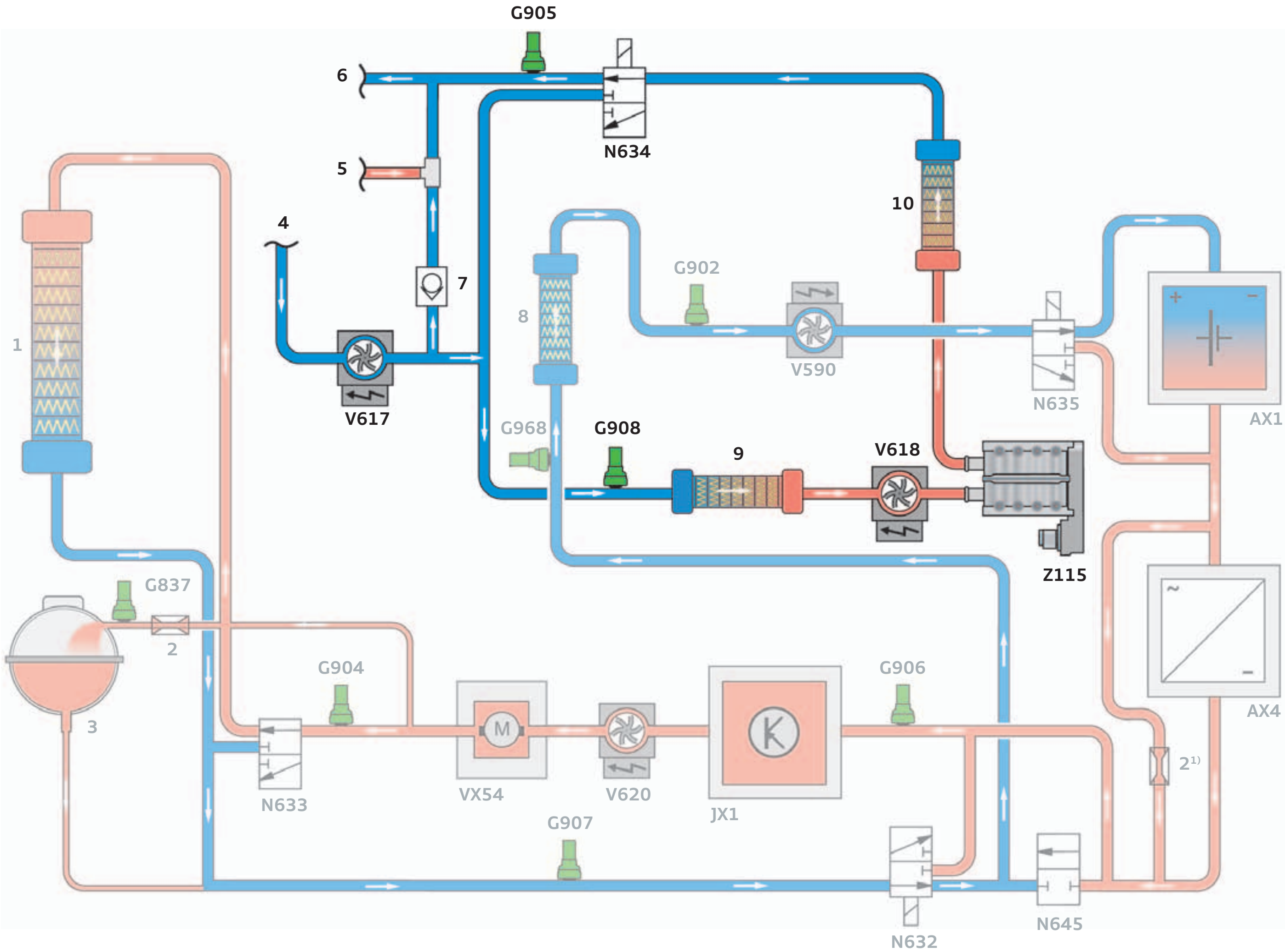
The heating circuit is required for heating the cabin. It is a part of the coolant circuit. It differs from the heating circuit in conventional models in that it also includes the integrated high-voltage heater (PTC) Z115 and the heat exchanger for heat pump operation. These components allow hybrid vehicles to be operated even at low ambient temperatures and without comfort restrictions.

When operating the vehicle in electric mode, the cabin heating circuit is disconnected from the cooling circuit of the internal combustion engine by a valve circuit. In this way, the energy input via the high-voltage heater (PTC) Z115 and the heat exchanger for heat pump operation is made available to the cabin.



649_041

System overview of the cabin heating circuit



[1)] Component of the pipe assembly

Key:

Cooled coolant
Heated coolant

1 Low-temperature cooler
2 Flow restrictor
3 Coolant expansion tank 2 (for high-voltage system)
4 Heating feed line
5 ATF cooler connection
6 Heating return line
7 Non-return valve
8 Heat exchanger for hybrid battery (chiller)
9 Heat exchanger for heat pump operation
10 Heat exchanger in air conditioner for cabin heating

AX1 Hybrid battery unit
AX4 High-voltage battery charger 1

G837 Low coolant level indicator sensor 2
G902 Coolant temperature sensor 1 for thermal management
G904 Coolant temperature sensor 3 for thermal management
G905 Coolant temperature sensor 4 for thermal management
G906 Coolant temperature sensor 5 for thermal management
G907 Coolant temperature sensor 6 for thermal management
G908 Coolant temperature sensor 7 for thermal management
G968 Coolant temperature sensor 8 for thermal management

JX1 Electric drive power and control electronics

N632 Coolant switching valve 1
N633 Coolant switching valve 2
N634 Coolant switching valve 3
N635 Coolant switching valve 4
N645 Coolant shutoff valve 2

V590 Coolant pump for high-voltage battery
V617 Coolant pump for thermal management
V618 Coolant pump 2 for thermal management
V620 Coolant pump 4 for thermal management

VX54 3-phase AC drive
Z115 High-voltage heater (PTC)

Coolant circuit for the high-voltage system

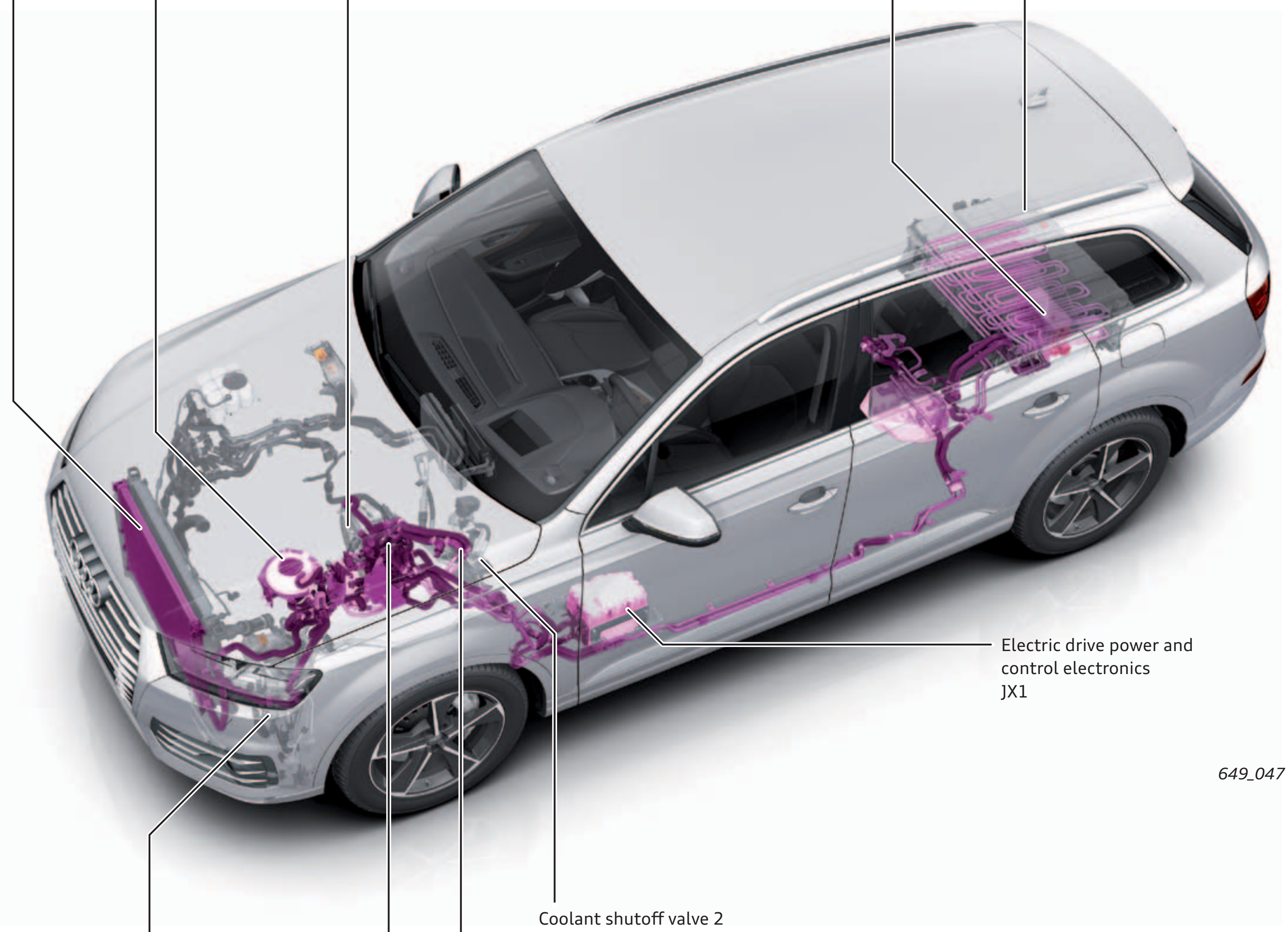
The coolant circuit for the high-voltage system cools the following components:

- Three-phase AC drive VX54
- Electric drive power and control electronics module JX1
- Hybrid battery unit AX1
- High-voltage battery charger 1 AX4

Since these components require a relatively low temperature level, a separate cooling circuit is required.

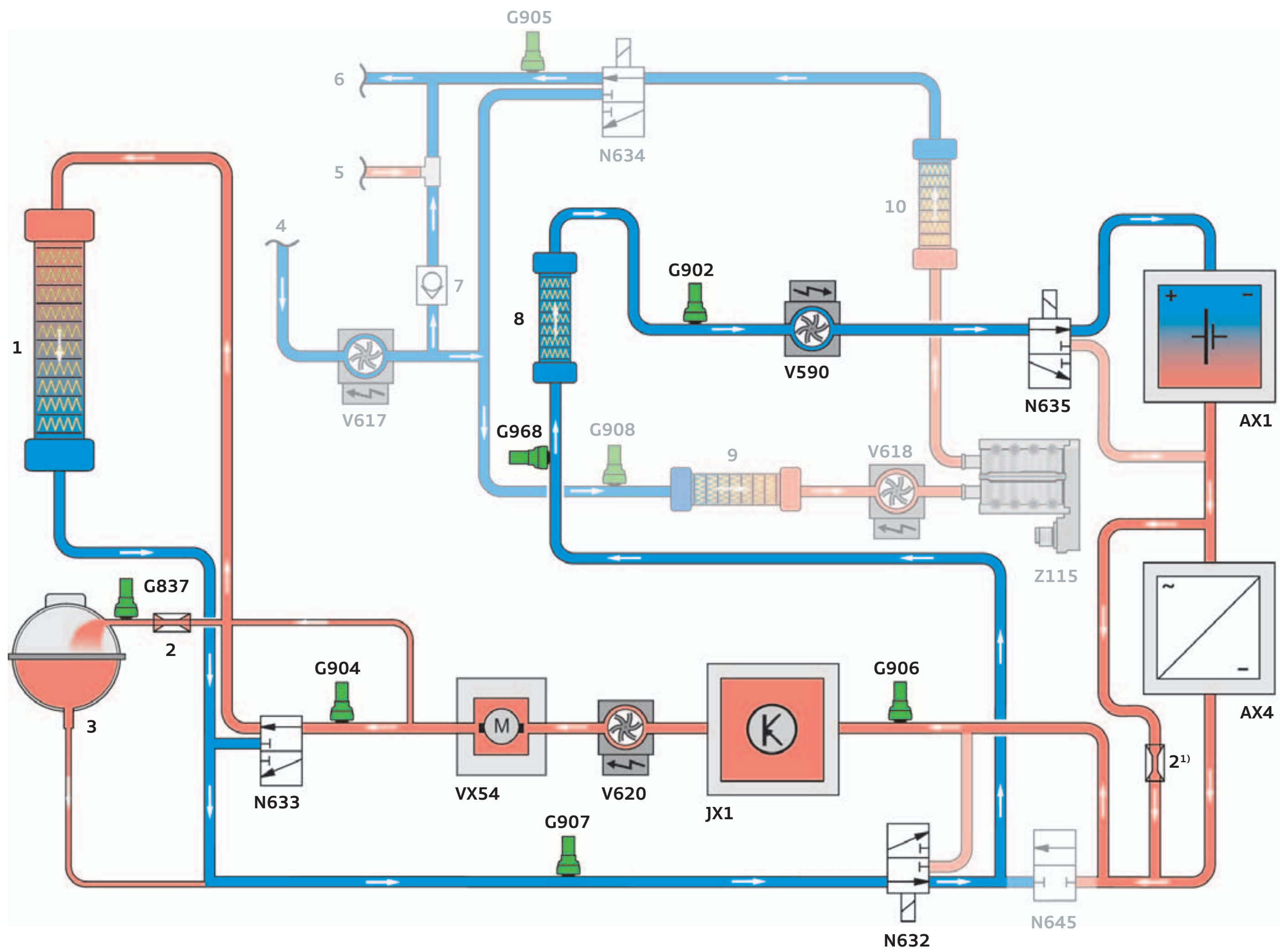
The low-temperature cooler is seated between the main radiator and the condenser.

The switching positions of coolant switching valve 1 N632 and coolant shutoff valve 2 N645 allow the coolant circuit for the high-voltage system to be subdivided into two separate circuits. This is the case when the hybrid battery unit AX1 has a different temperature to the electric driveline.



649_047

System overview of the coolant circuit for the high-voltage system



649_018

¹⁾ Component of the pipe assembly

Key:

Cooled coolant
Heated coolant

1 Low-temperature cooler
2 Flow restrictor
3 Coolant expansion tank 2 (for high-voltage system)
4 Heating feed line
5 ATF cooler connection
6 Heating return line
7 Non-return valve
8 Heat exchanger for hybrid battery (chiller)
9 Heat exchanger for heat pump operation
10 Heat exchanger in air conditioner for cabin heating

AX1 Hybrid battery unit
AX4 High-voltage battery charger 1

G837 Low coolant level indicator sensor 2
G902 Coolant temperature sensor 1 for thermal management
G904 Coolant temperature sensor 3 for thermal management
G905 Coolant temperature sensor 4 for thermal management
G906 Coolant temperature sensor 5 for thermal management
G907 Coolant temperature sensor 6 for thermal management
G908 Coolant temperature sensor 7 for thermal management
G968 Coolant temperature sensor 8 for thermal management

JX1 Electric drive power and control electronics

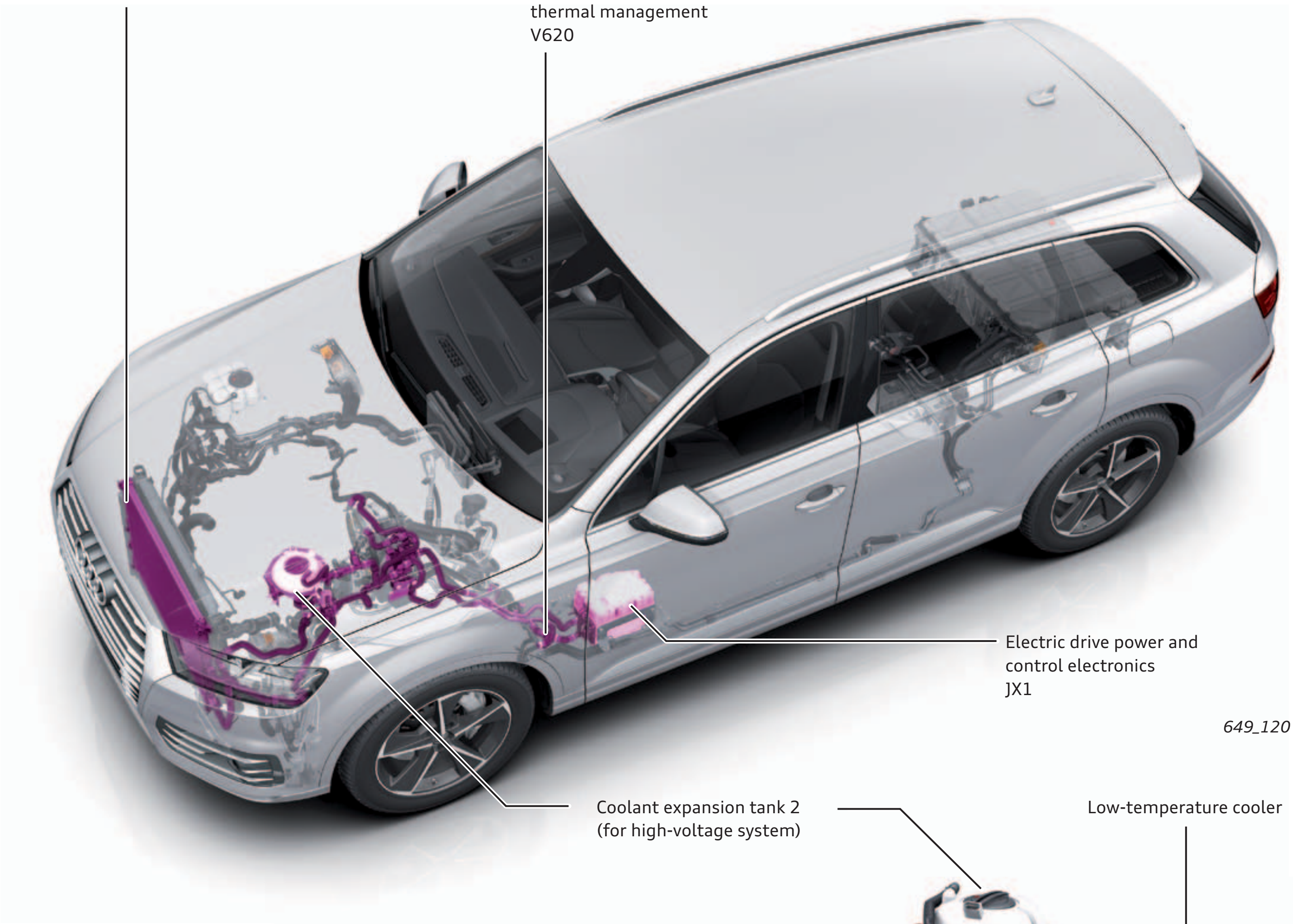
N632 Coolant switching valve 1
N633 Coolant switching valve 2
N634 Coolant switching valve 3
N635 Coolant switching valve 4
N645 Coolant shutoff valve 2

V590 Coolant pump for high-voltage battery
V617 Coolant pump for thermal management
V618 Coolant pump 2 for thermal management
V620 Coolant pump 4 for thermal management

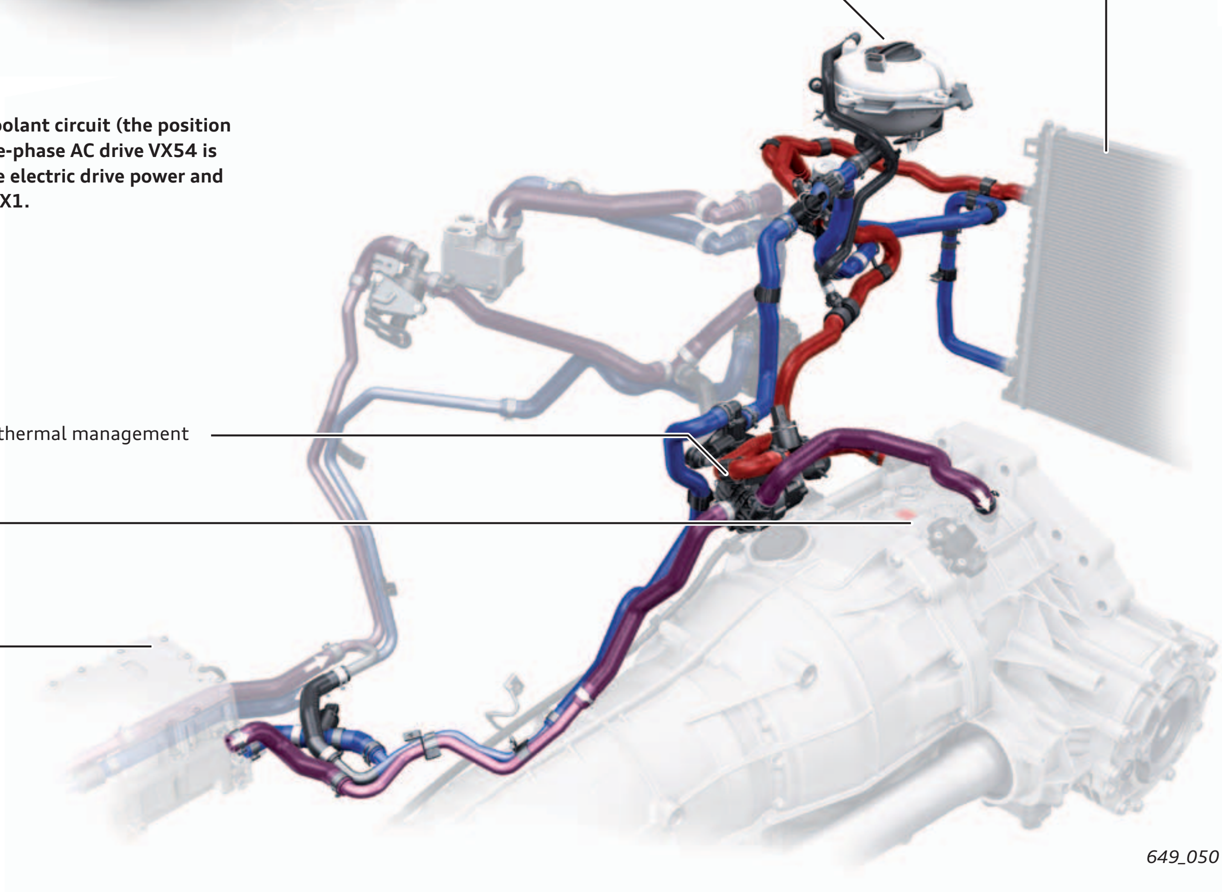
VX54 3-phase AC drive
Z115 High-voltage heater (PTC)

Coolant circuit for the electric driveline

This coolant circuit regulates the temperature of the electric drive power and control electronics module JX1 as well as the three-phase AC drive VX54. These components require a relatively low temperature, necessitating a separate cooling circuit. The low-temperature cooler is positioned fore of the main radiator.



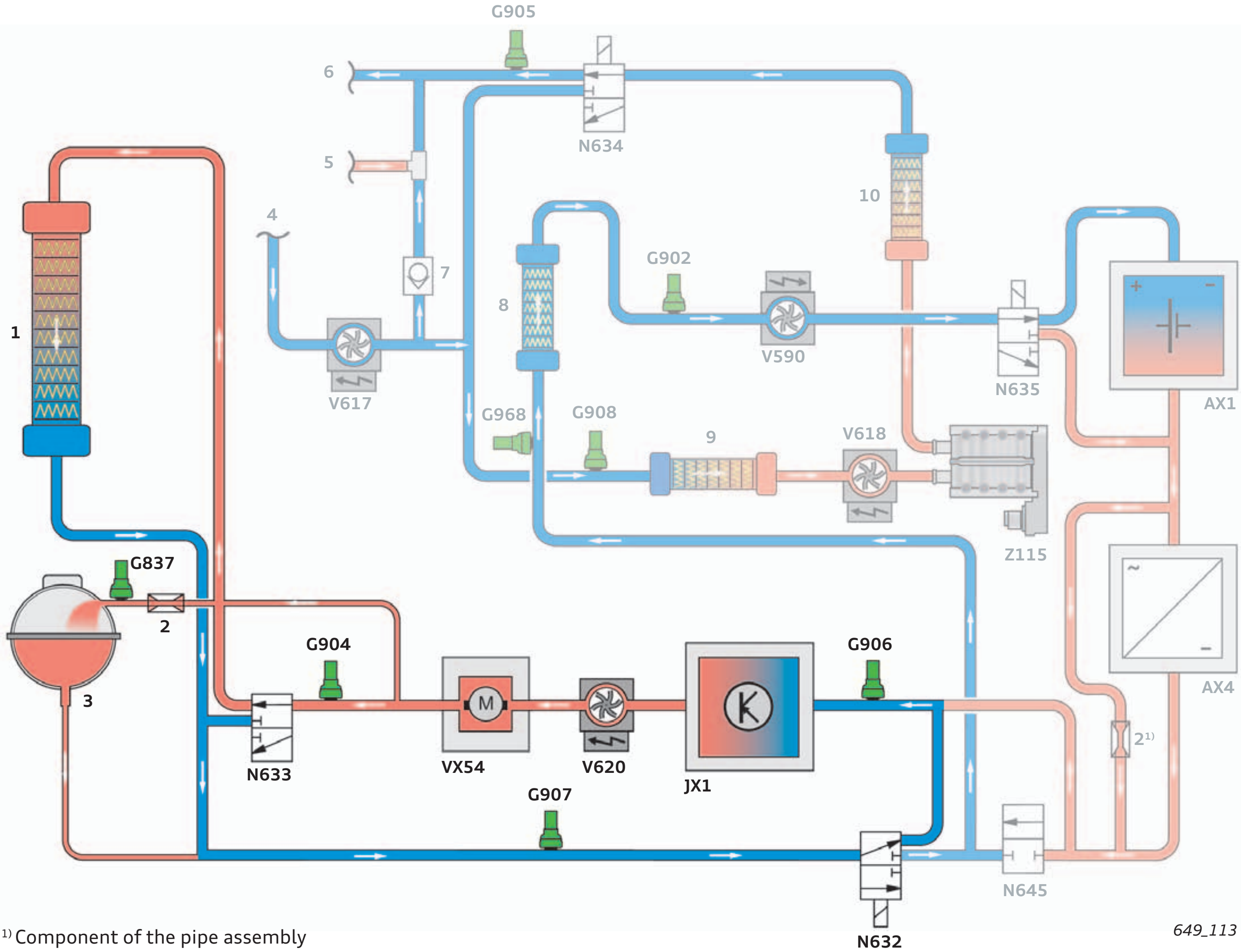
649_120



Low-temperature coolant circuit (the position for cooling the three-phase AC drive VX54 is shown here) and the electric drive power and control electronics JX1.

649_050

System overview of the coolant circuit for the electric driveline



[1] Component of the pipe assembly

Key:

Cooled coolant
Heated coolant

1 Low-temperature cooler
2 Flow restrictor
3 Coolant expansion tank 2 (for high-voltage system)
4 Heating feed line
5 ATF cooler connection
6 Heating return line
7 Non-return valve
8 Heat exchanger for hybrid battery (chiller)
9 Heat exchanger for heat pump operation
10 Heat exchanger in air conditioner for cabin heating

AX1 Hybrid battery unit
AX4 High-voltage battery charger 1

G837 Low coolant level indicator sensor 2
G902 Coolant temperature sensor 1 for thermal management
G904 Coolant temperature sensor 3 for thermal management
G905 Coolant temperature sensor 4 for thermal management
G906 Coolant temperature sensor 5 for thermal management
G907 Coolant temperature sensor 6 for thermal management
G908 Coolant temperature sensor 7 for thermal management
G968 Coolant temperature sensor 8 for thermal management

JX1 Electric drive power and control electronics

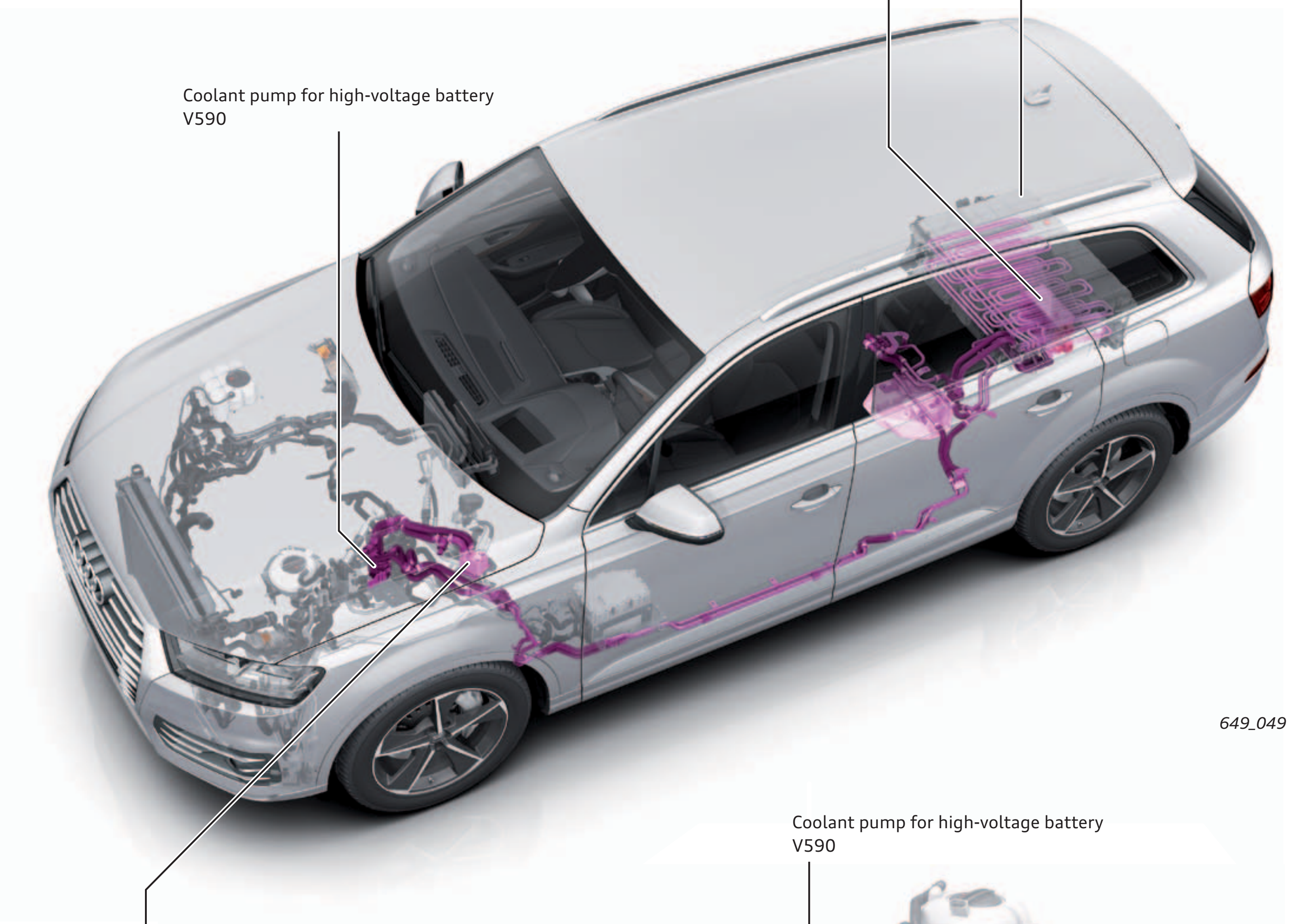
N632 Coolant switching valve 1
N633 Coolant switching valve 2
N634 Coolant switching valve 3
N635 Coolant switching valve 4
N645 Coolant shutoff valve 2

V590 Coolant pump for high-voltage battery
V617 Coolant pump for thermal management
V618 Coolant pump 2 for thermal management
V620 Coolant pump 4 for thermal management

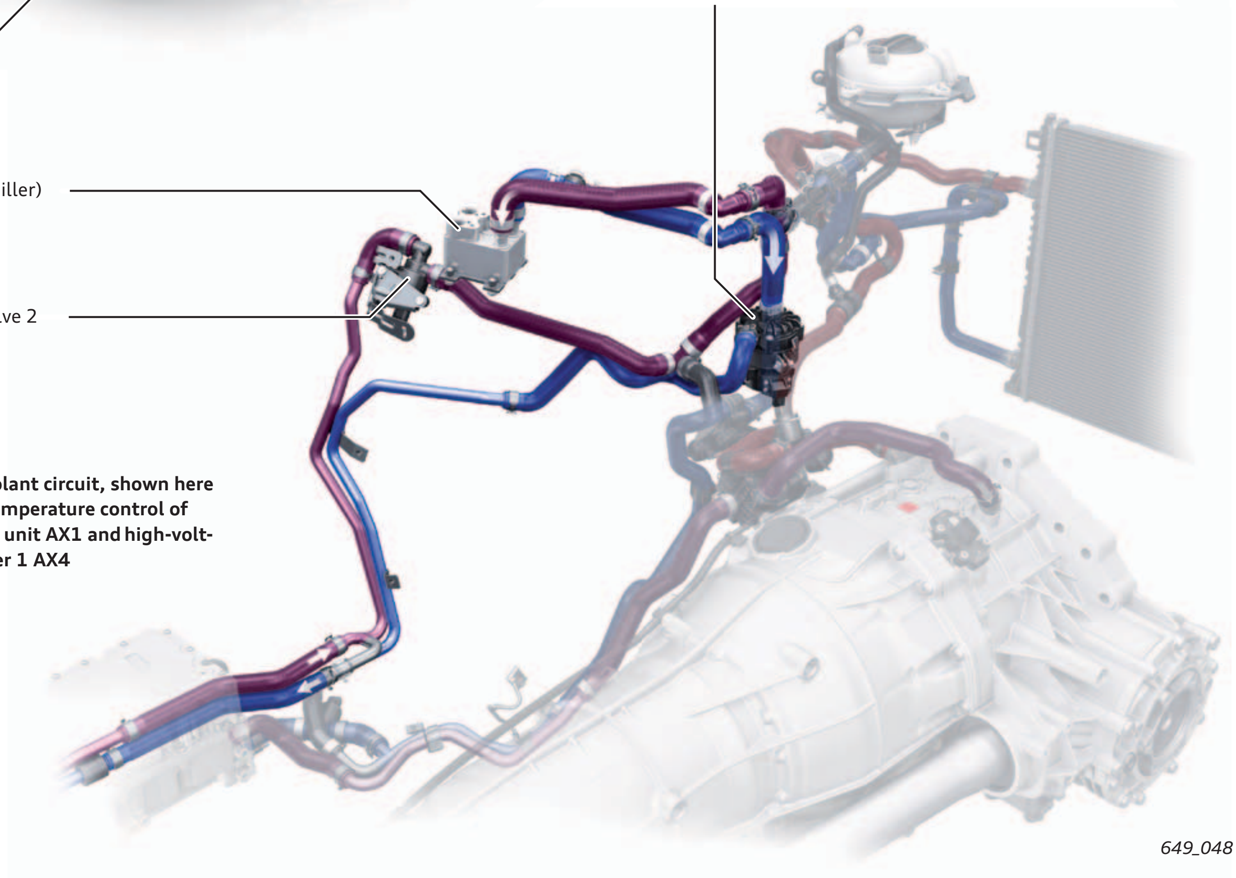
VX54 3-phase AC drive
Z115 High-voltage heater (PTC)

Hybrid battery coolant circuit

The coolant circuit for the hybrid battery regulates the temperature of the hybrid battery unit AX1 and the high-voltage battery charger 1 AX4.
It comprises the hybrid battery heat exchanger, also known as the chiller (refrigerant-coolant heat exchanger), which allows active cooling of the hybrid battery unit AX1 through the refrigerant circuit of the air conditioning system.



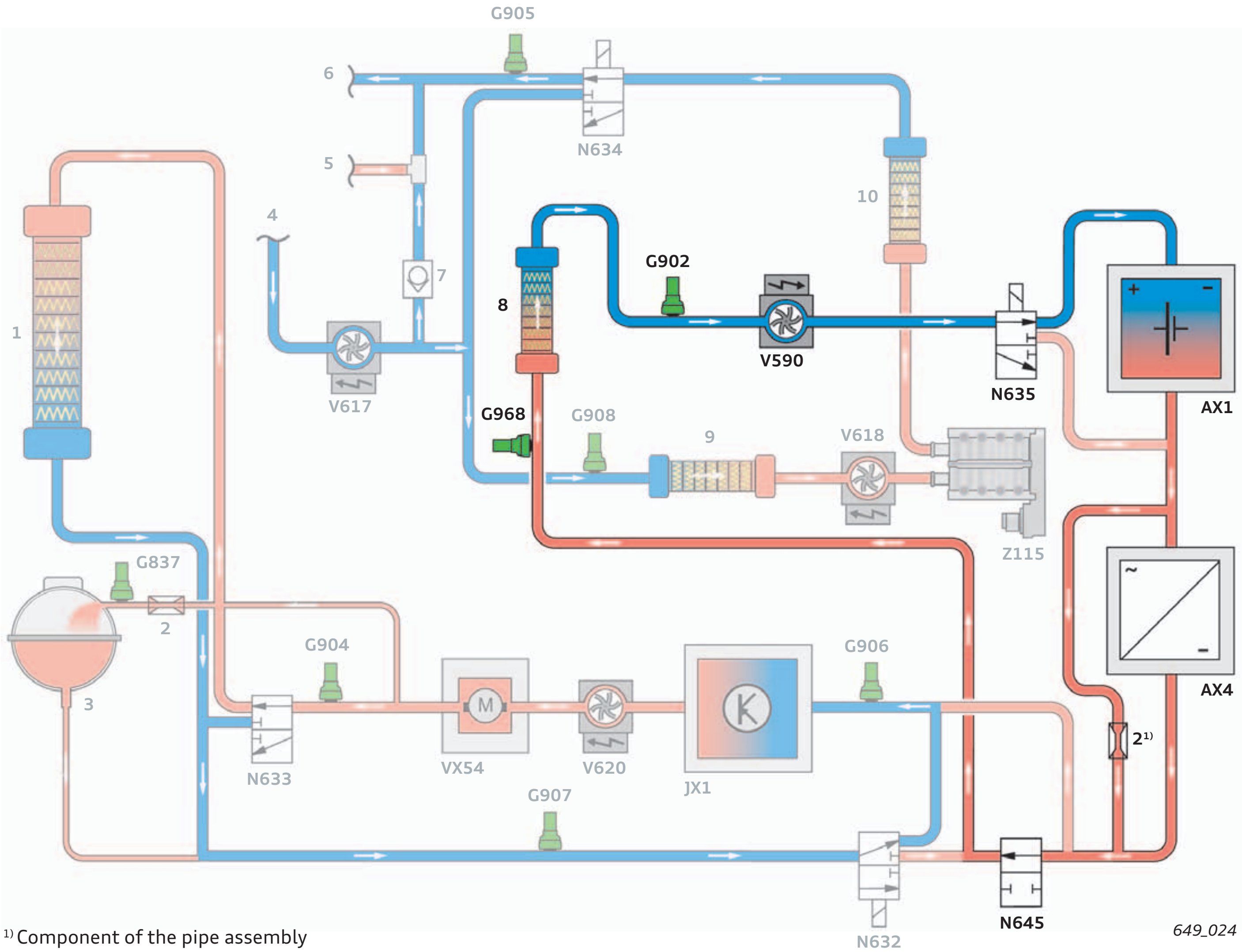
649_049



Hybrid battery coolant circuit, shown here - the setting for temperature control of the hybrid battery unit AX1 and high-voltage battery charger 1 AX4

649_048

System overview of the hybrid battery coolant circuit



[1] Component of the pipe assembly

Key:

Cooled coolant
Heated coolant

1 Low-temperature cooler
2 Flow restrictor
3 Coolant expansion tank 2 (for high-voltage system)
4 Heating feed line
5 ATF cooler connection
6 Heating return line
7 Non-return valve
8 Heat exchanger for hybrid battery (chiller)
9 Heat exchanger for heat pump operation
10 Heat exchanger in air conditioner for cabin heating

AX1 Hybrid battery unit
AX4 High-voltage battery charger 1

G837 Low coolant level indicator sensor 2
G902 Coolant temperature sensor 1 for thermal management
G904 Coolant temperature sensor 3 for thermal management
G905 Coolant temperature sensor 4 for thermal management
G906 Coolant temperature sensor 5 for thermal management
G907 Coolant temperature sensor 6 for thermal management
G908 Coolant temperature sensor 7 for thermal management
G968 Coolant temperature sensor 8 for thermal management

JX1 Electric drive power and control electronics

N632 Coolant switching valve 1
N633 Coolant switching valve 2
N634 Coolant switching valve 3
N635 Coolant switching valve 4
N645 Coolant shutoff valve 2

V590 Coolant pump for high-voltage battery
V617 Coolant pump for thermal management
V618 Coolant pump 2 for thermal management
V620 Coolant pump 4 for thermal management

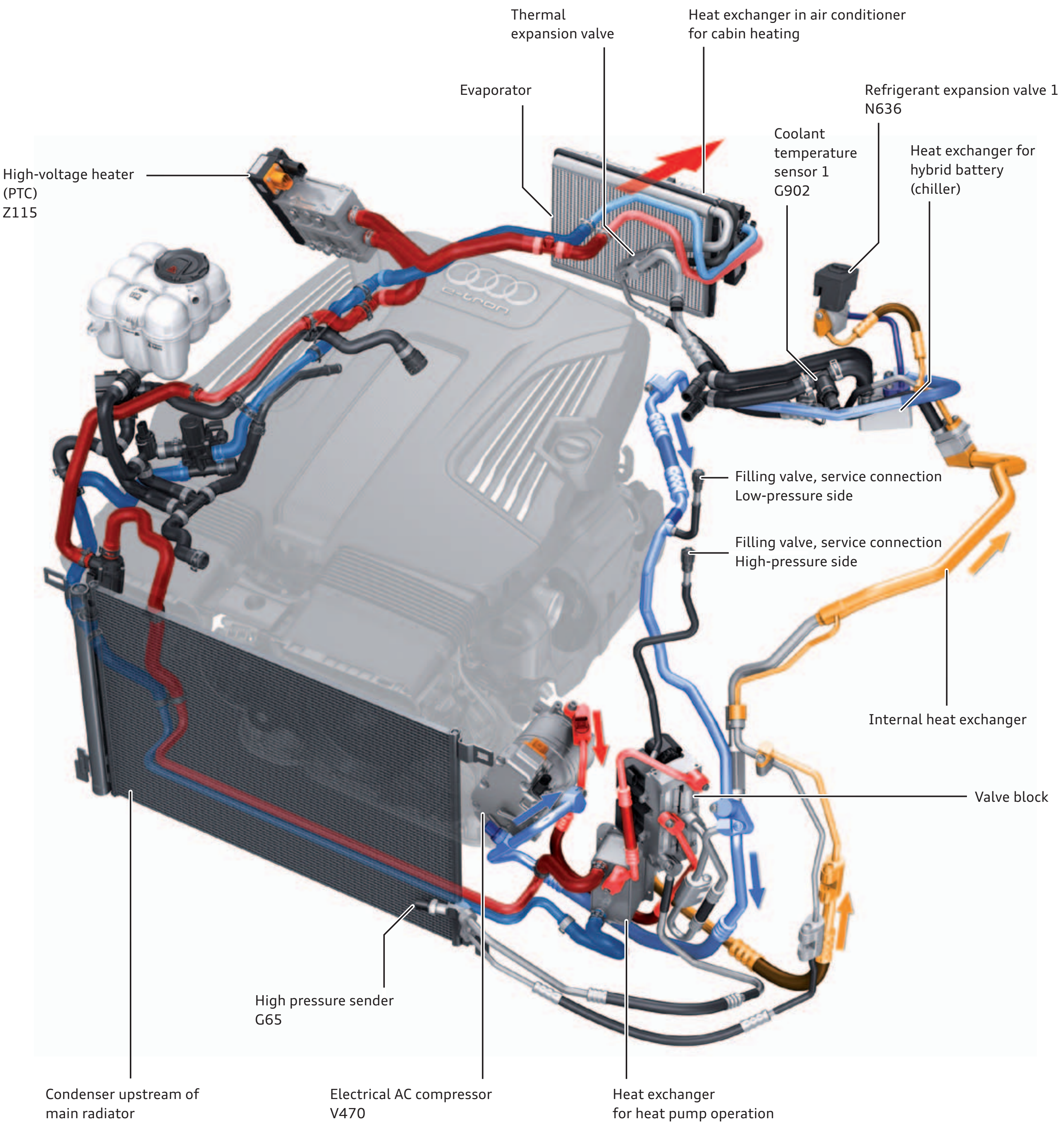
VX54 3-phase AC drive
Z115 High-voltage heater (PTC)

Operating states of the heat pump

The three operating states of the heat pump are heating mode, cooling mode and reheat mode for air dehumidification.

Heating mode

To heat the cabin, the electrical AC compressor V470 compresses gaseous refrigerant thereby heating it to a high temperature. A compact plate heat exchanger, the heat exchanger for heat pump operation transfers the heat of the hot gas to the cabin heating circuit thereby cooling and liquefying the gas. The liquid refrigerant expands via the electrical expansion valve N636 and subsequently evaporates in the hybrid battery heat exchanger. At the same time, the hybrid battery heat exchanger extracts heat from the low-temperature circuit of the electric driveline, with the result that its temperature drops by approx. 3 to 5 °C. In this process, the heat pump utilises the waste heat from the electric driveline for heating the cabin.

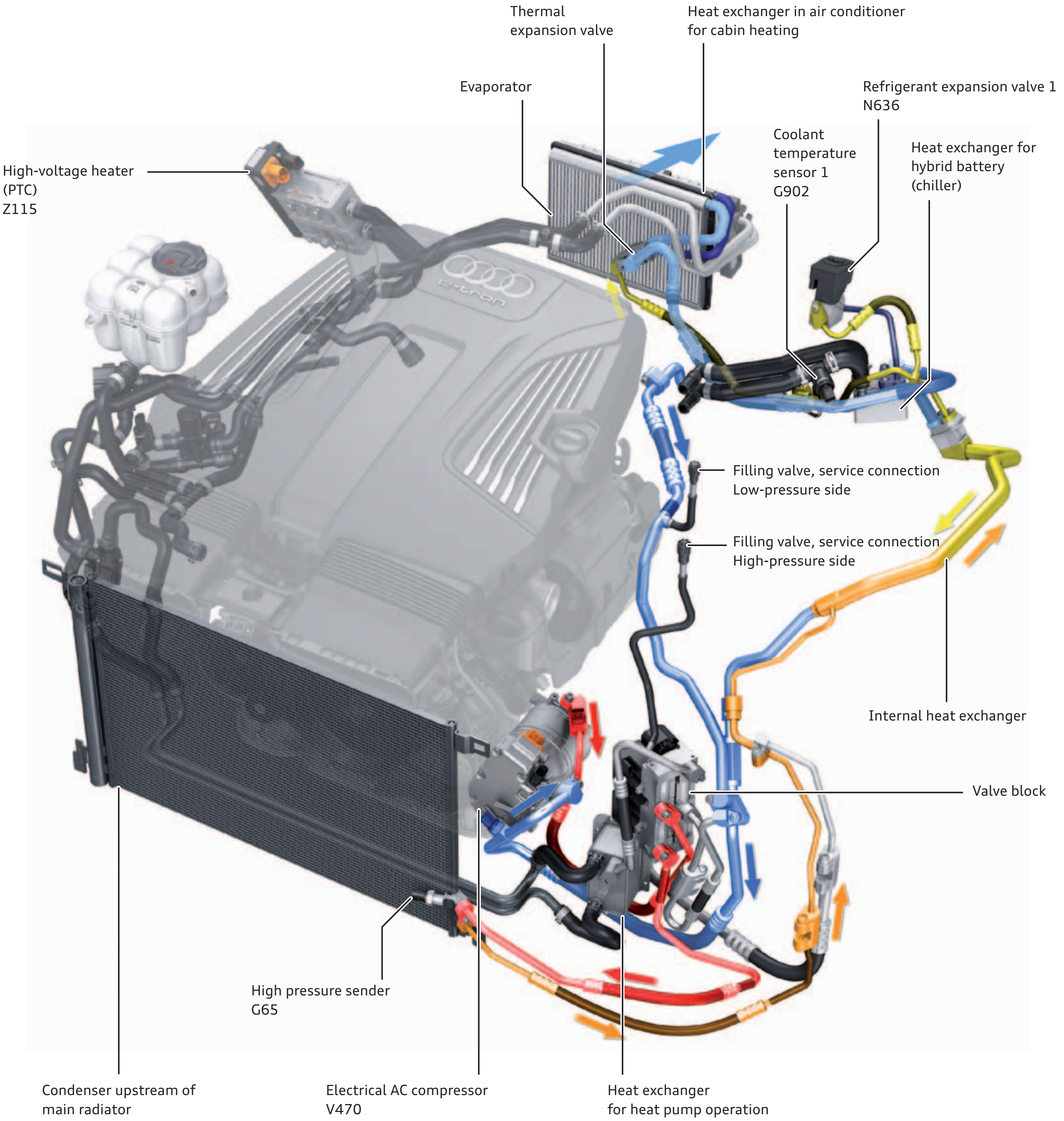


649_038

Cooling mode

The hot, gaseous refrigerant is not liquefied in the heat exchanger like in heating mode, but rather in the large condenser in the front end of the vehicle.

It is expanded via the expansion valve and evaporates in the air conditioner's evaporator thereby cooling the cabin.

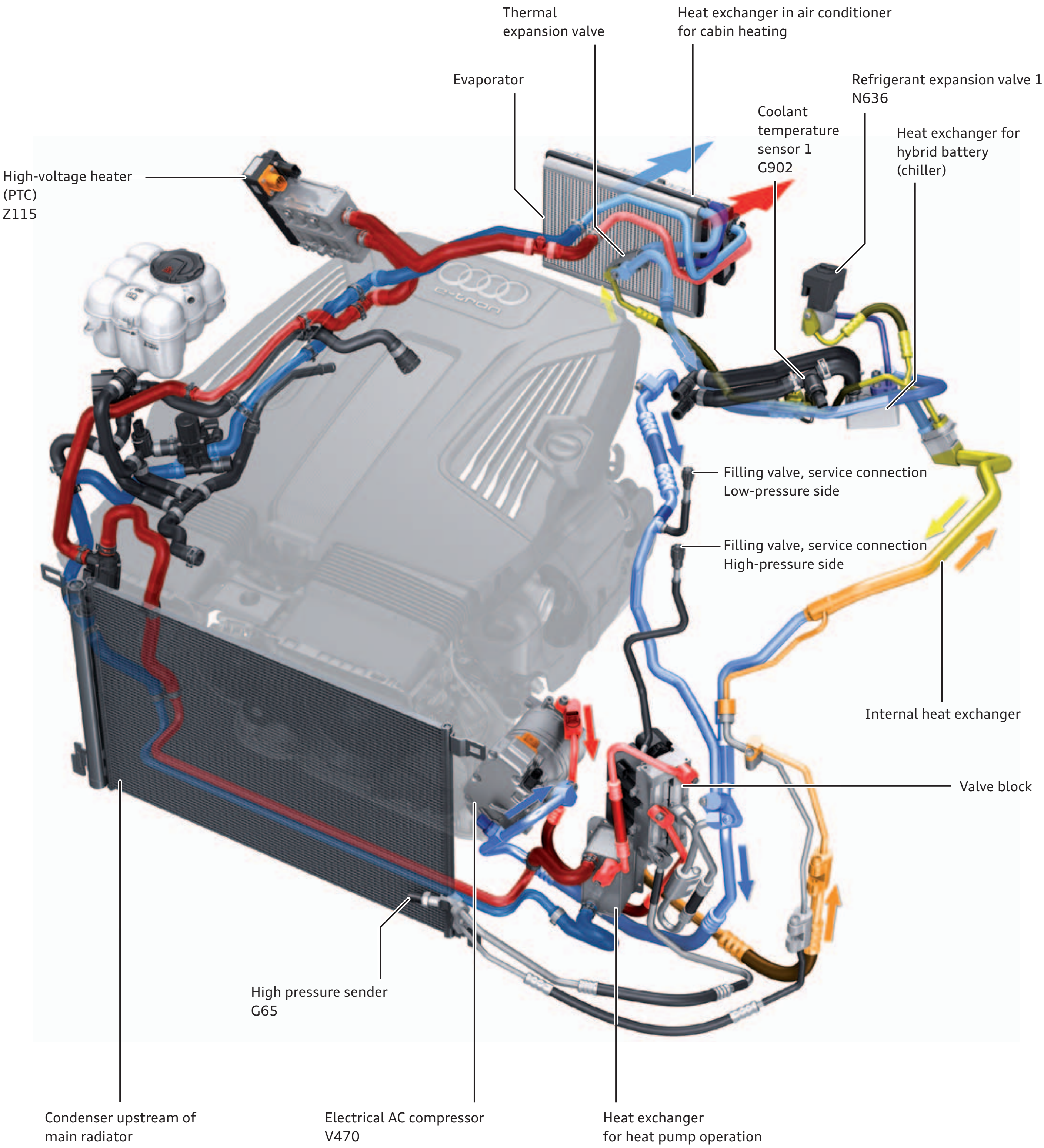


649_040

Reheat mode

In Reheat mode the air is initially cooled and dehumidified, and is subsequently reheated. The heat exchanger for heat pump operation makes the heat absorbed by the refrigerant while cooling the air available to the cabin.

If required, the system can also access the waste heat from the electric driveline via the heat exchanger for the hybrid battery. This operating mode avoids windscreen fogging.



649_039

Air conditioning the vehicle interior

The AC control panels in the Audi Q7 e-tron quattro are already known from the Audi Q7 (type 4M). The front AC control panel, also known as the air conditioner/Climatronic operating and display unit E87, can be accessed in the diagnostic tester under address code 08.

The air conditioning system has a rear air distributor housing and a rear air conditioner/Climatronic operating and display unit E265. The air conditioner/Climatronic operating and display unit of the 3-zone deluxe automatic climate control system has a central LED display for temperature indication in the rear cabin.

Rear AC control panel

Front AC control panel

649_037

Reference
For more information about the AC control panels, air distribution as well as the front and rear air conditioners, refer to Self Study Programme 632 "Audi Q7 (type 4M)".

System overview

Thermal management

Low coolant level indicator sensor 2 G837

Coolant temperature sensor 1 for thermal management G902

Coolant temperature sensor 3 for thermal management G904

Coolant temperature sensor 4 for thermal management G905

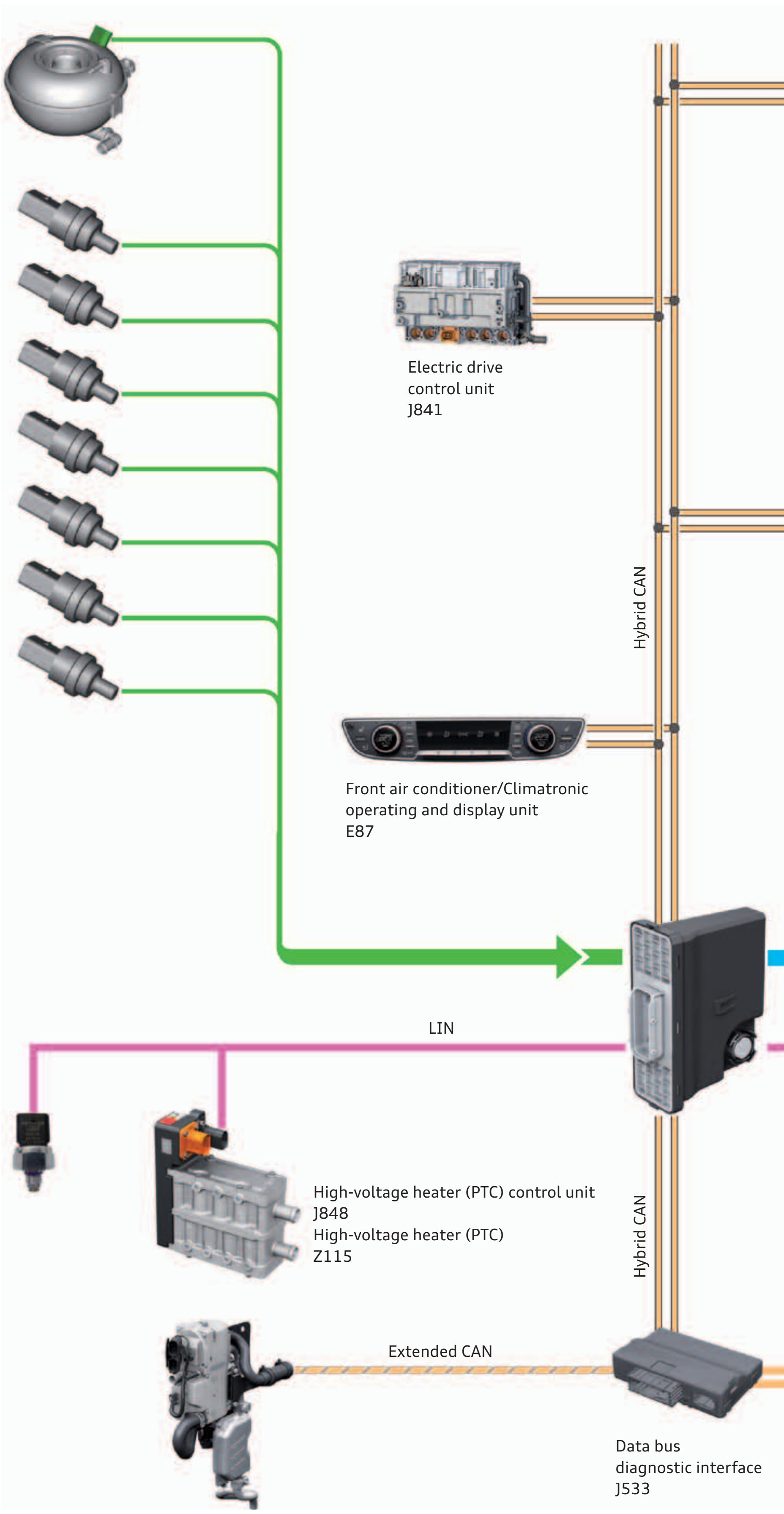
Coolant temperature sensor 5 for thermal management G906

Coolant temperature sensor 6 for thermal management G907

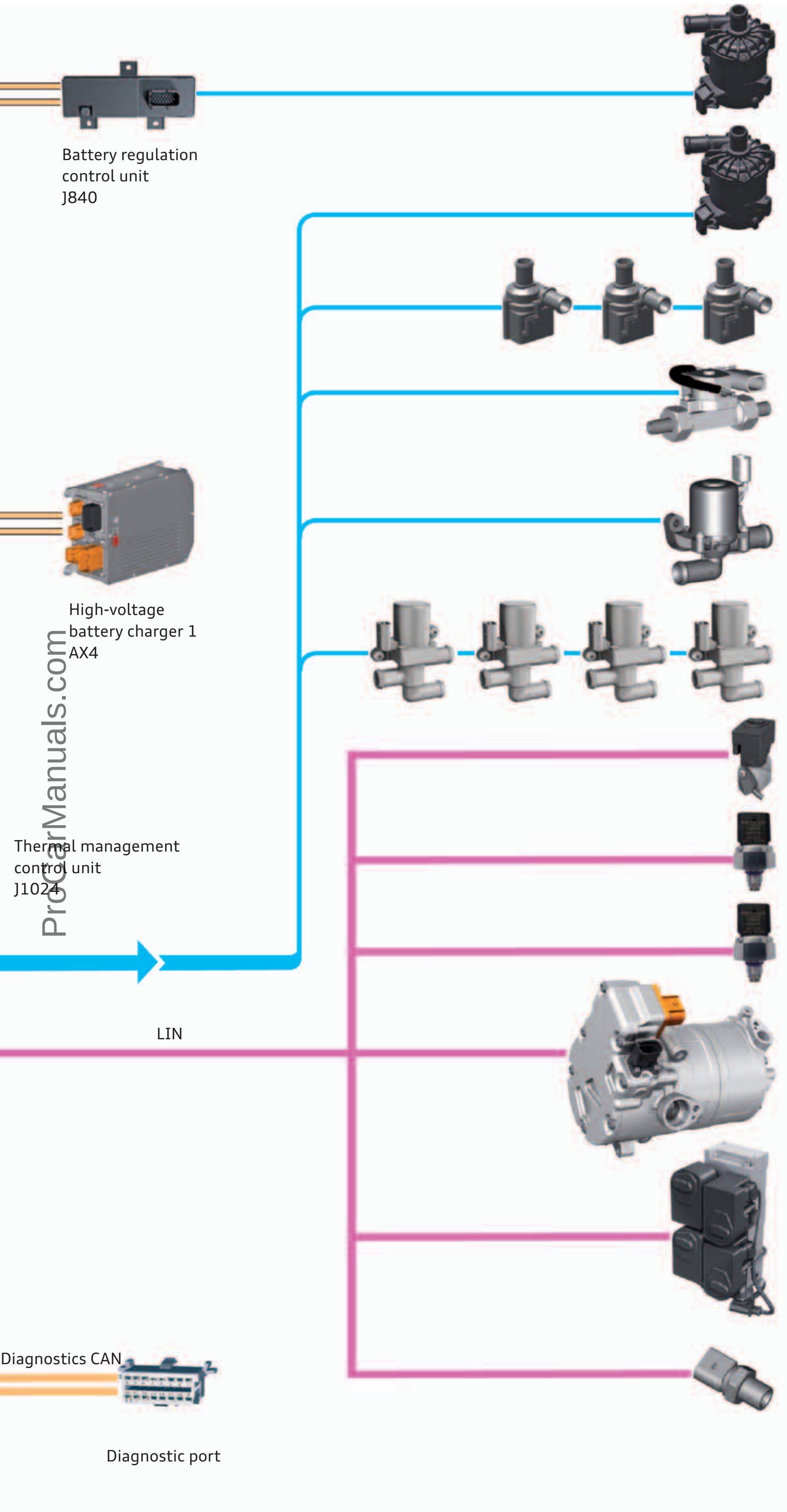
Coolant temperature sensor 7 for thermal management G908

Coolant temperature sensor 8 for thermal management G968

Refrigerant pressure and temperature sensor 3 G827



Auxiliary heating control unit J364



High-voltage battery coolant pump V590

Coolant pump 4 for thermal management V620

Coolant pump for thermal management V617
Coolant pump 2 for thermal management V618
Coolant pump 3 for thermal management V619

Refrigerant shutoff valve V424

Coolant shutoff valve 2 N645

Coolant switching valve 1 N632
Coolant switching valve 2 N633
Coolant switching valve 3 N634
Coolant switching valve 4 N635

Refrigerant expansion valve 1 N636

Refrigerant pressure and temperature sensor G395

Refrigerant pressure and temperature sensor 2 G826

AC compressor control unit J842
Electrical AC compressor V470

In valve block:
Refrigerant shutoff valve 2 N640
Refrigerant shutoff valve 3 N641
Refrigerant shutoff valve 4 N642
Refrigerant shutoff valve 5 N643

High pressure sender G65

649_042

Infotainment

Overview

The Audi Q7 e-tron quattro always has the highest-specification version of the infotainment system from the Audi Q7 (type 4M). This means that MMI Navigation plus is always installed.
The Audi connect emergency call and service package is included as standard.

649_026

8.3" TFT screen (MMI display J685)

649_027

Information electronics control unit 1 J794

MMI Navigation plus (I8H)
Standard equipment
8.3" TFT colour monitor with 1024 x 480 pixel resolution
Audi virtual cockpit (9S8)
3D SSD navigation system (7UG)[1]
MMI touch (UJ1)
7" display in instrument cluster with driver information system (9S7)
AM/FM radio
Jukebox (approx. 10 GB)
DVD drive (audio/video)
2 SDXC card readers
Audi music interface and AUX-IN jack (UE7)
Audi sound system (9VD)
Bluetooth interface (9ZX)
UMTS/LTE data module (EL3)[2]
Audi emergency call & Audi connect vehicle-specific services including Audi connect e-tron services (IW3)
Optional equipment
Audi connect (IT1)
Audi smartphone interface with 2 USB ports and AUX-In jack (UI2)
Audi phone box for 2x HFP and wireless charging (9ZE)[3, 4]
Bose Sound System with 3D sound
Bang & Olufsen Advanced Sound System with 3D sound (8RF)
Digital radio DAB (QV3)[5]
TV tuner (QV1)[5]
DVD changer (6G2)
1 Audi tablet (9WE)
2 Audi tablet (9WF)
Prewiring for Rear Seat Entertainment (9WM)

[1] 7UH for countries without navigation map data
[2] EL0 for markets without Audi connect
[3] 2x HFP (2 mobile phones can be coupled via Hands-Free Profile)
[4] The Audi connect data module will then become a fully fledged telephone module mit SAP (SIM Access Profile).
[5] If digital radio (QV3) and TV tuner (QV1) are ordered together, the PRNR is QU1.

Reference
For more information about the infotainment system, refer to Self Study Programme 637 "Audi Q7 (type 4M) occupant protection and infotainment".
For more information about wireless charging and Audi connect emergency call and service, refer to Self Study Programme 647 "Audi A4 (type 8W) Infotainment and Audi connect".

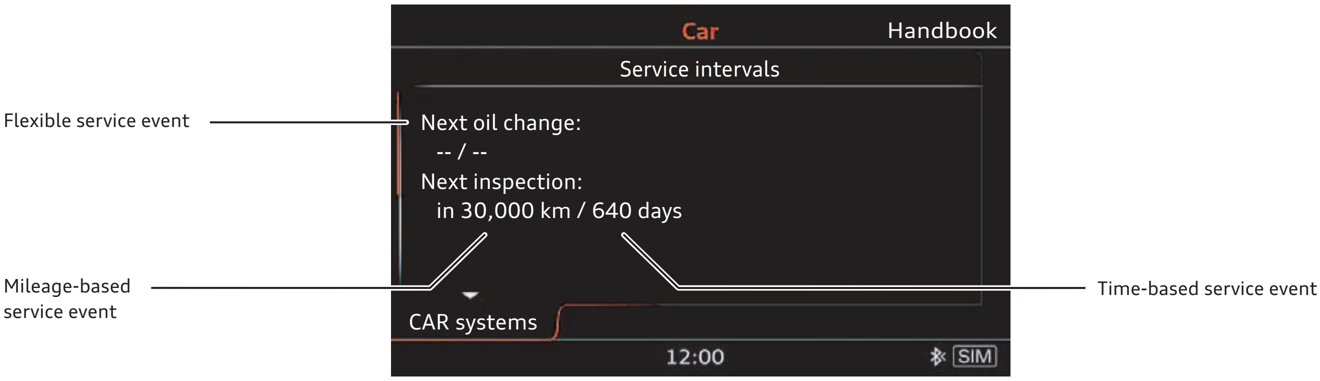
Service

Inspection and maintenance

The following service intervals are displayed:

- Oil change service
- Mileage-based service events
- Time-based service events

Example of a service interval display



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In new vehicles, the next oil change due field (flexible servicing event) is initially blank.
This interval has to be computed from the driving profile and engine load and is not displayed until about 500 km have been covered. The display "Oil change due" then switches to "Next oil change".

The value displayed in the mileage-based servicing events field is now 30,000 km for new vehicles and is decremented in increments of 100 km. The value in the field for the time-based servicing events is now 730 days (2 years) for new vehicles and is updated on a daily basis (upwards of a total mileage of about 500 km).

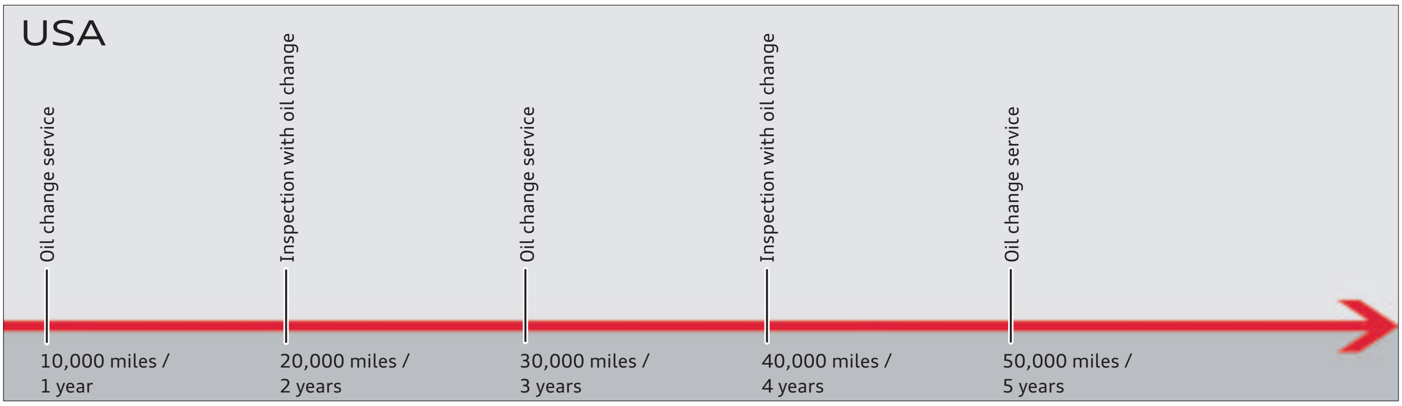
	3.0l V6 MPI	2.0l R4 TFSI[1]
Changing the oil	According to service interval display, between 15,000 km / 1 year and 30,000 km / 2 years depending on driving style and conditions of use.	
Inspection	30,000 km / 2 years	30,000 km / 2 years
Pollen filter change interval	60,000 km / 2 years	60,000 km / 2 years
Air filter change interval	90,000 km	90,000 km
Brake fluid change interval	Change after 3, 5, ... years	Change after 3, 5, ... years
Spark plug change interval	–	60,000 km
Fuel filter change interval	10 minutes	–
Timing gear	Chain (lifetime)	Chain (lifetime)

[1] The 2.0l R4 TFSI engine is currently available in Japan, Singapore, Korea and China only.

Note
The specifications in the current service literature generally apply.

Overview of maintenance intervals for vehicles in the USA

The Audi Q7 e-tron is subject to fixed inspection and maintenance intervals in the US market.



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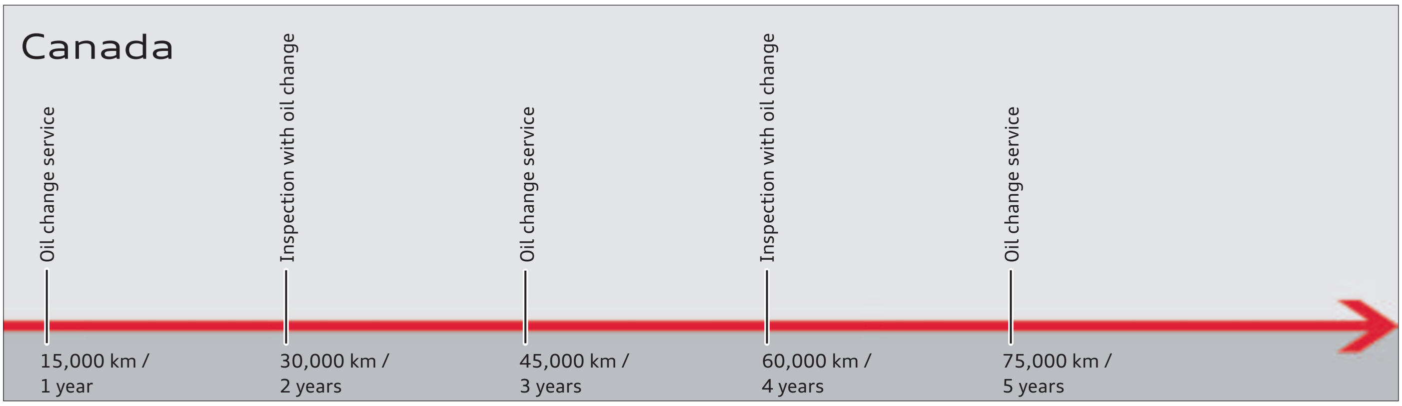
Overview of maintenance intervals for vehicles in Canada

The Audi Q7 e-tron is subject to fixed inspection and maintenance intervals in the Canadian market.



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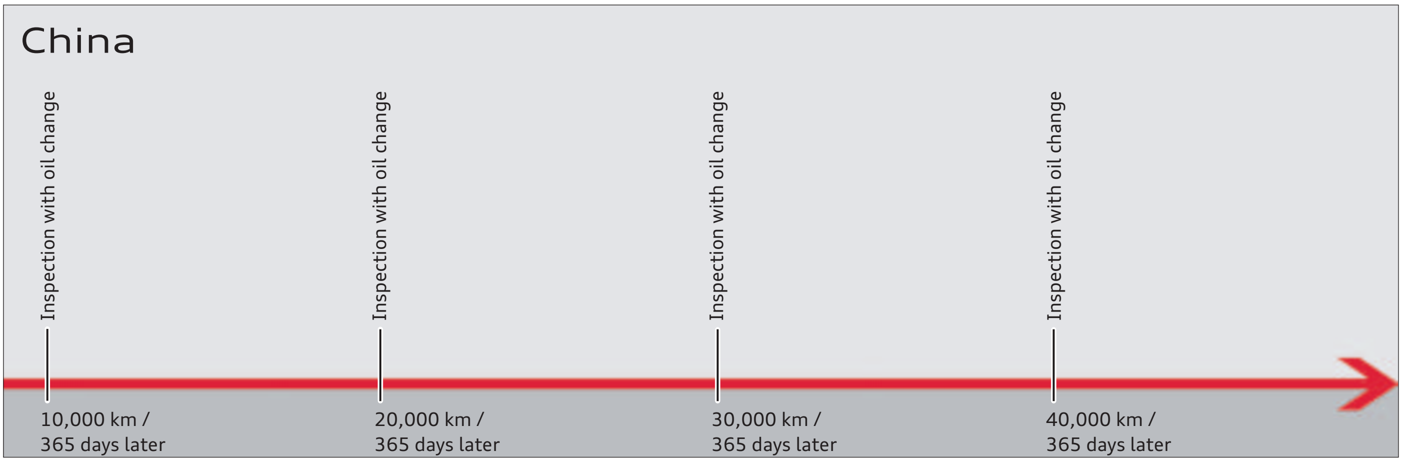
Overview of maintenance intervals for cars in China

The Audi Q7 e-tron is subject to fixed inspection and maintenance intervals in the Chinese market.



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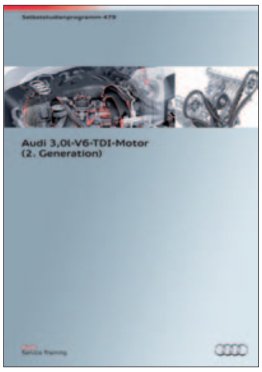
Appendix

Self study programmes

For more information about the technology of the Audi Q7 e-tron quattro, please refer to the following self study programmes:



SSP 479 The Audi 3.0l V6 TDI engine (second generation)

Order number: A10.5S00.72.20

SSP 607 Audi 4.0l V8 TFSI Engine with Biturbo Charging

Order number: A12.5S00.91.20

SSP 622 Second-generation Audi clean diesel

Order number: A13.5S01.06.20

SSP 632 Audi Q7 (type 4M)

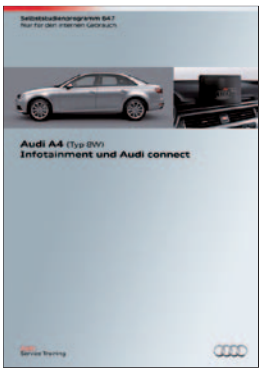
Order number: A15.5S01.16.20

SSP 637 Audi Q7 (type 4M) Occupant protection and infotainment

Order number: A15.5S01.22.20

SSP 645 Audi 2.0l TFSI engines of EA888 series

Order number: A15.5S01.32.20



SSP 647 Audi A4 (type 8W) Infotainment and Audi connect

Order number: A15.5S01.29.20

SSP 650 Audi Q7 e-tron quattro (type 4M) High-voltage System and Vehicle Electrics

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