

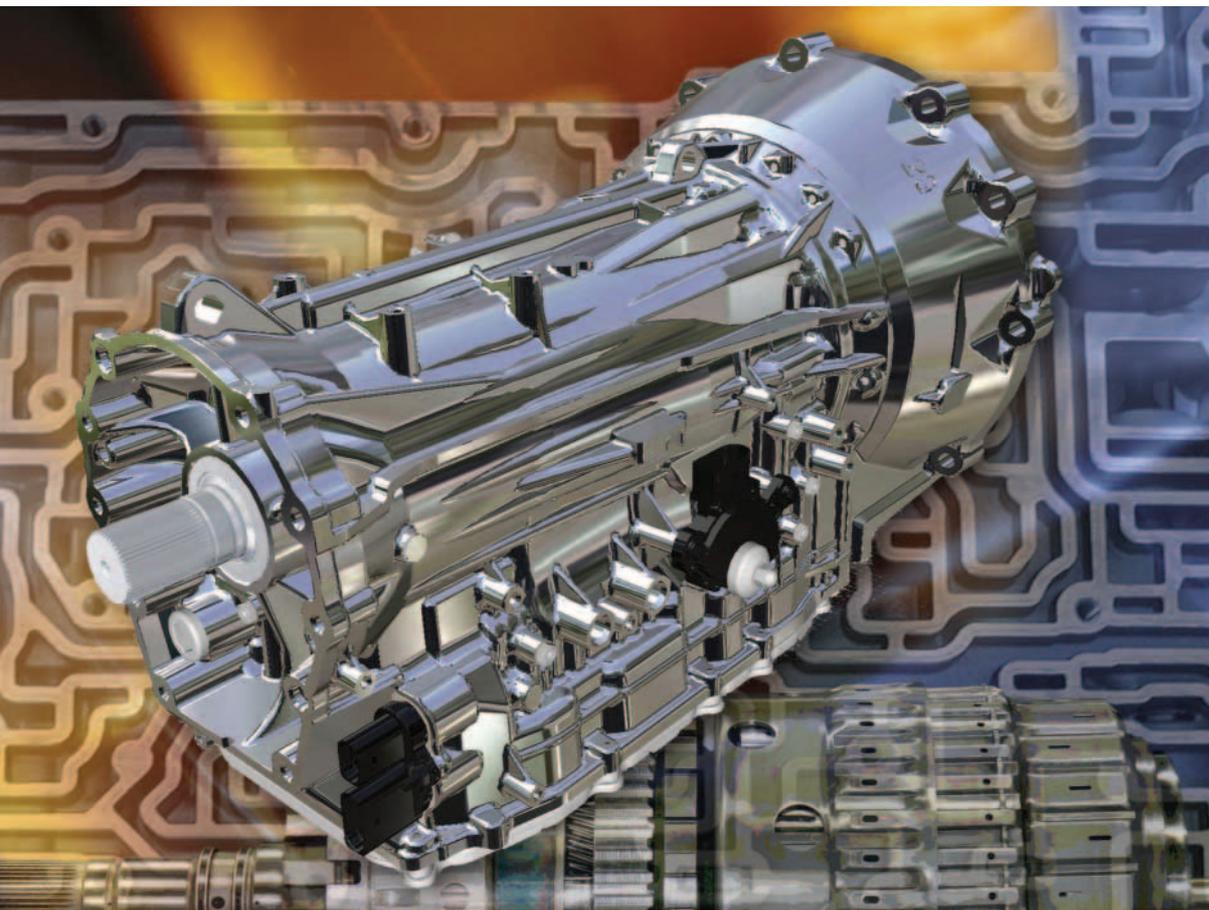
Service Training



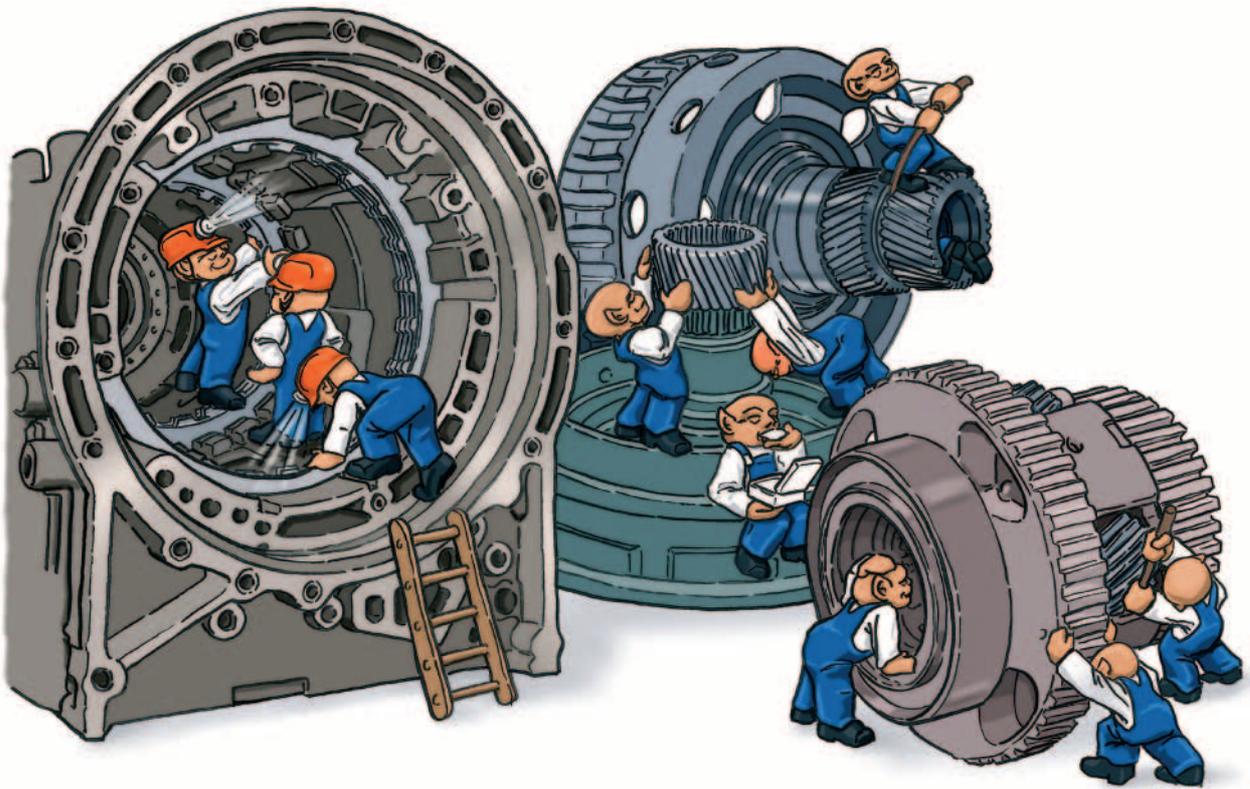
Self-study Programme 466

The 8-speed Automatic Gearbox 0C8

Design and Function



An 8-speed automatic gearbox will be introduced for the first time at Volkswagen in the Touareg 2011. The 8-speed automatic gearbox 0C8 is a further development of the 6-speed automatic gearbox 09D from the Japanese gearbox company AISIN AW CO LTD. Together with the extensive know-how provided by the Volkswagen engineers, success has been achieved in adapting the gearbox to the Volkswagen technologies' increased requirements.



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The self-study programme explains the design and function of new developments!
The contents will not be updated.

For current testing, adjustment and repair instructions, refer to the relevant service literature.



**Attention
Note**



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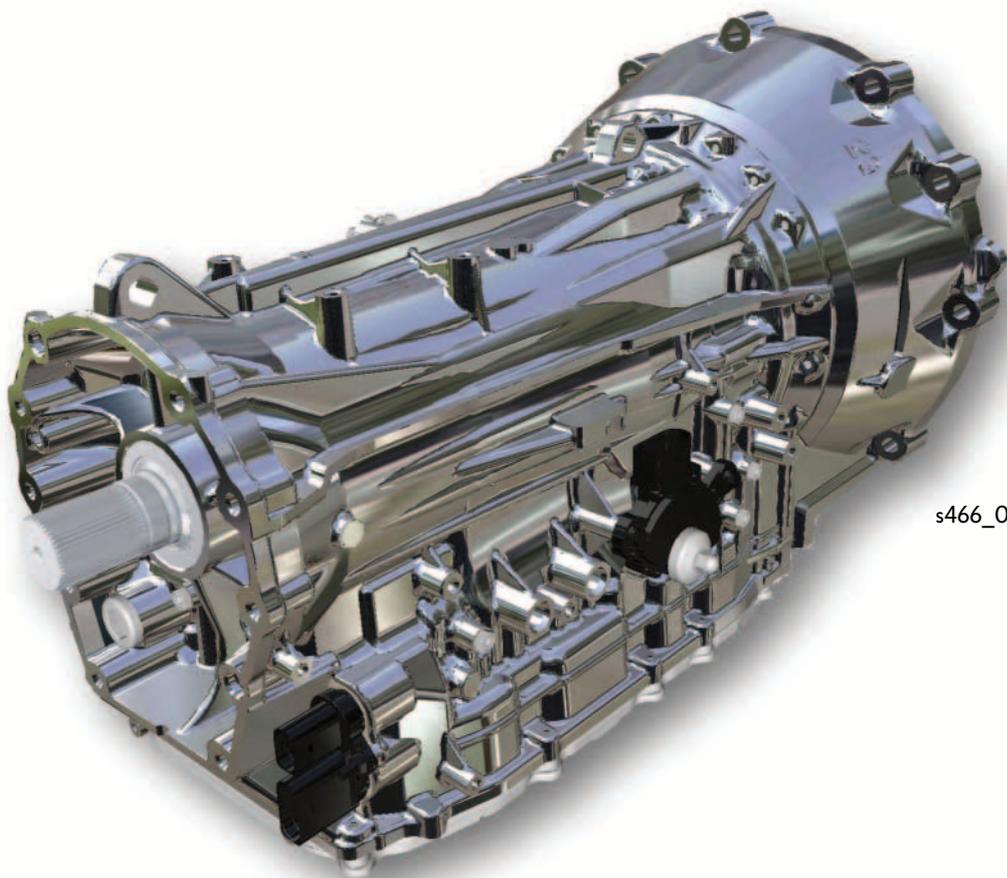
Introduction



Thanks to the eight forward gears and the closer gear ratio steps, consumption values and emission values have been reduced even further in comparison with the automatic gearbox 09D. Once again, the eight forward gears are made possible using the tried-and-tested Lepelletier gear set concept. The automatic gearbox 0C8 can be supplied together with the start/stop system, and is also designed for the hybrid drive. All engine variants in the Touareg are available exclusively with this gearbox.

The self-study programme describes the design and function of the 8-speed automatic gearbox 0C8 as it is installed in the Touareg.

The function and design of those components which are required in the gearbox for the start/stop system and the hybrid drive are described.



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Technical data

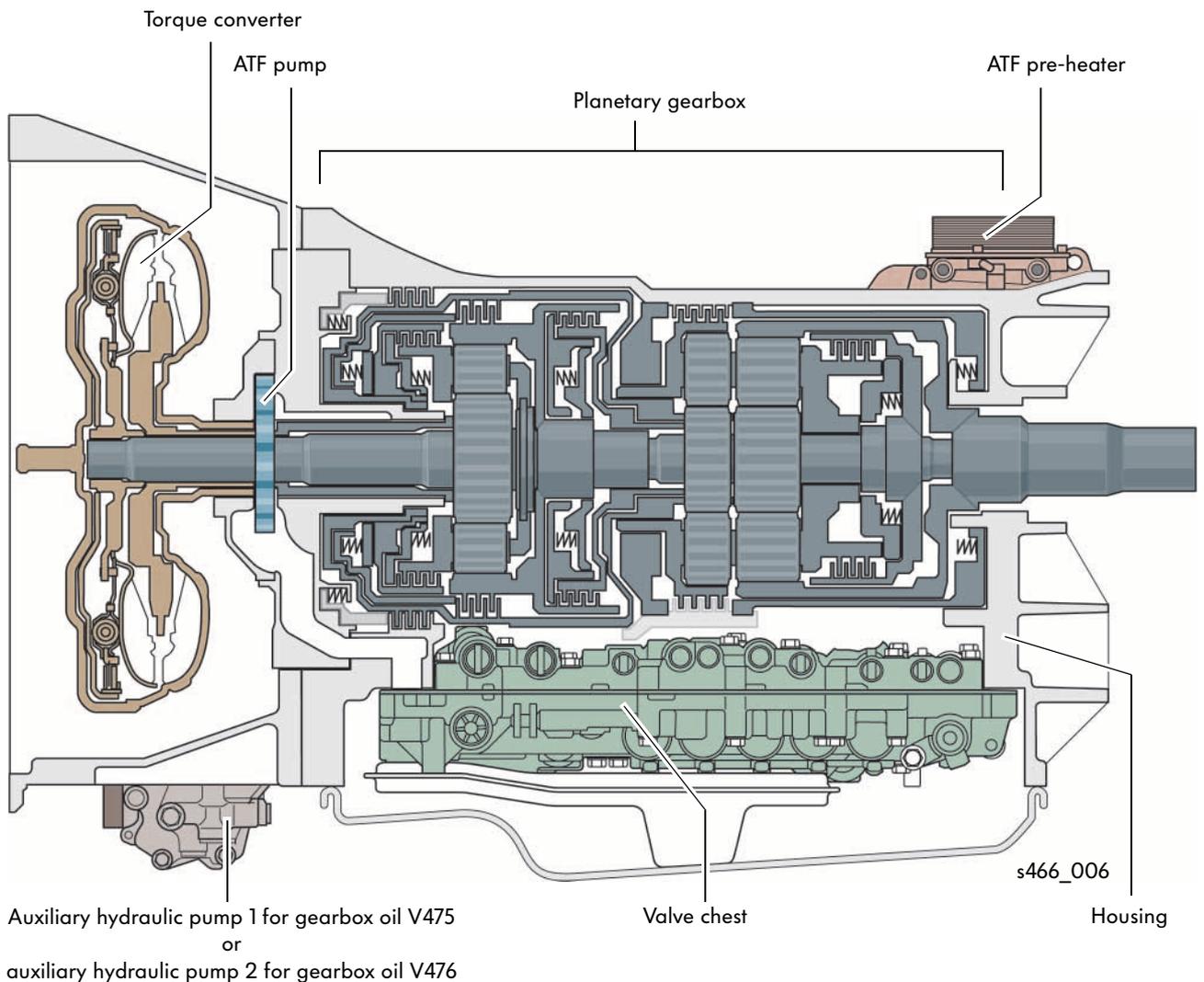


Developer/manufacturer	AISIN AW CO. LTD Japan
Designation	Automatic gearbox OC8
Gearbox features	<p>Electrohydraulically controlled 8-speed planetary gearbox with a single primary planetary gear set and a downstream Ravigneaux planetary gear set as a secondary planetary gear set (planetary gearbox concept according to Lepelletier)</p> <p>Hydrodynamic torque converter with slip-controlled torque converter lock-up clutch</p> <p>Design for longitudinal mounting in combination with a transfer box</p>
Control system	<p>Hydraulic control unit (valve chest) in the sump with an external electronic control unit</p> <p>Dynamic shift program DSP with separate sports programme in "position S" and the "Tiptronic" shift programme for changing gear manually</p> <p>Special feature: Starting off in 2nd gear is possible in Tiptronic mode</p>
Torque	Depending on version, up to 1000Nm
Achievement of top speed	Depending on the engine, in either 6th or 7th gear
Spread	7.17 to 7.25
ATF service	ATF: Refer to ELSA for service intervals
Weight	Depending on gearbox adaptation to the engine, between 91kg and 108kg
Emergency operation characteristics	<p>In the case of faults which arise during vehicle operation:</p> <p>in gears 1-4 = 3rd gear</p> <p>in gears 5-8 = 7th gear</p> <p>as of restarting the vehicle, 3rd gear and reverse gear only</p>

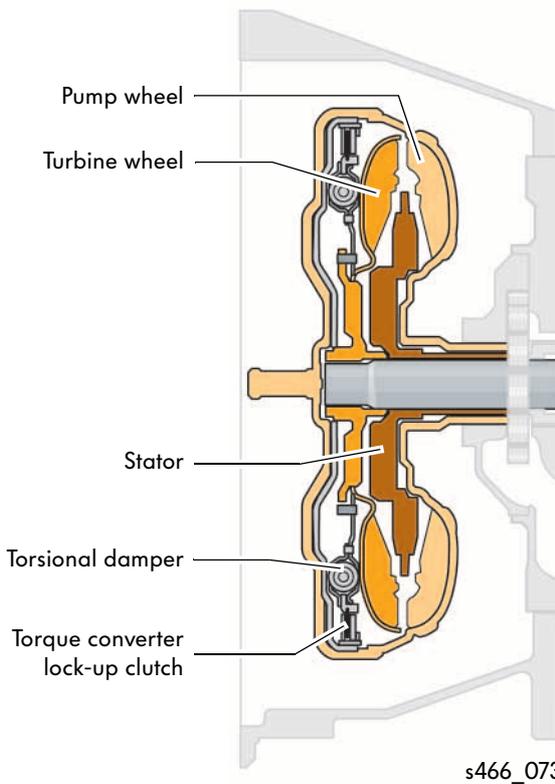
Gearbox design

The 8-speed automatic gearbox consists of:

- The torque converter with torque converter lock-up clutch
- The ATF pump
- The valve chest
- The planetary gearbox according to Lepelletier
- The gearbox housing
- Auxiliary hydraulic pump for gearbox oil
- ATF pre-heater



The torque converter

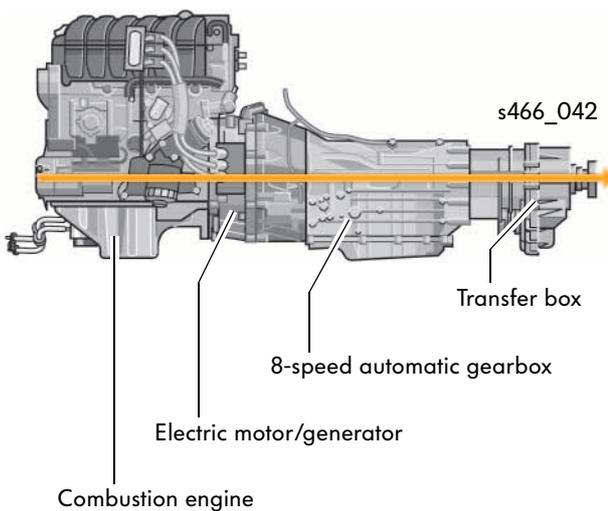


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The hydromechanical torque converter is a fluid clutch. It is used as a starting-off element and increases the torque in the conversion range. In addition to the turbine and pump wheel and the stator, a torque converter lock-up clutch is installed in the torque converter.

Optimised torsional dampers are fitted in all torque converters. As a result of this, isolation of the engine's torsional vibrations is further improved.

In vehicles with a combustion engine, the torque converter is driven directly by the engine.



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In hybrid vehicles with combined electric motor and combustion engine, the combustion engine drives the torque converter via a shaft.

This shaft runs centrally through the electric motor (electric motor/generator). If the electric motor is used to drive the hybrid vehicle, the torque converter is driven directly by the electric motor.

Different torque converters will be fitted in the Touareg 2011.

These are adapted to the various engines and their torques.

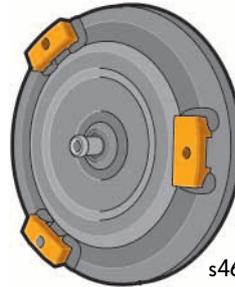


In the Touareg Hybrid, the vehicle is started by the electric motor. Further information can be found in SSP 450 "The Touareg Hybrid".

Gearbox design

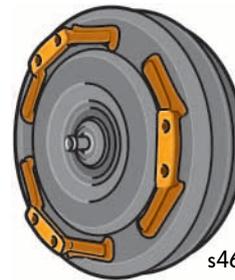
The connection from the engine to the torque converter

The torque converter is connected to the different engines via three lugs which are attached to the torque converter. Depending on the engine, 3 or 6 bolts are required to connect the lugs to the engine.



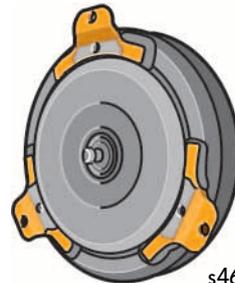
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Securing via three lugs e.g. in the V6 FSI engine in the Touareg 2011



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Securing via three lugs, each with 2 threaded holes, e.g. in the V6 TDI in the Touareg 2011



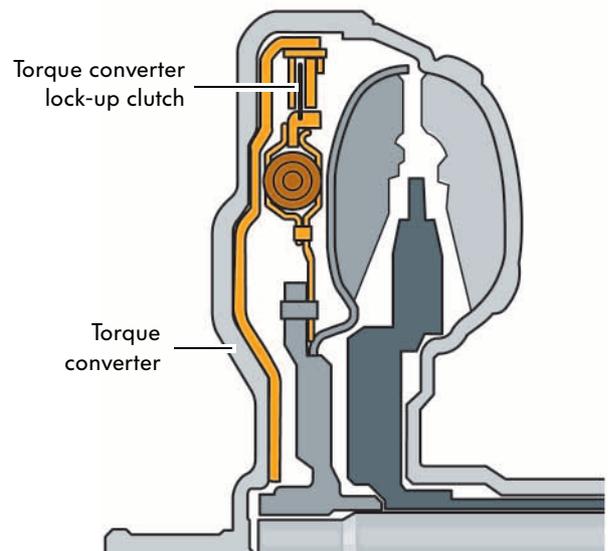
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Securing via three lugs in the Touareg Hybrid

The torque converter lock-up clutch

The torque converter lock-up clutch is a hydraulic multi-plate clutch. It joins the torque converter's pump and turbine wheels to form a solid block without slip.

Depending on vehicle operating status, this is carried out at an engine speed of over 1000rpm when the vehicle is driven by the combustion engine.

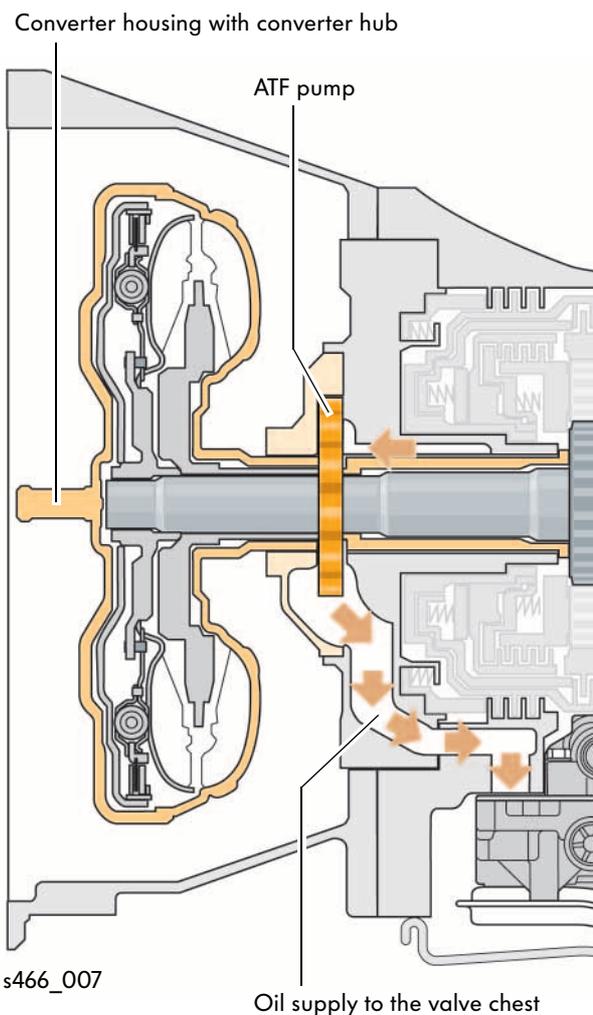


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The oil supply

Depending on drive concept, the 8-speed automatic gearbox is equipped with the following to build up the required oil pressure:

- The ATF pump within the gearbox in vehicles with combustion engine
- The ATF pump and the electric auxiliary hydraulic pump 1 for gearbox oil V475 in vehicles with hybrid drive (combination of a combustion engine with electric motor/generator)
- The ATF pump and the electric auxiliary hydraulic pump 2 for gearbox oil V476 in vehicles with combustion engine and start/stop system



The ATF pump

In vehicles with combustion engine, the mechanical ATF pump (Automatic Transmission Fluid) is exclusively responsible for supplying the gearbox with hydraulic oil. It draws the ATF out of the oil pan, builds up the oil pressure and supplies the valve chest with the hydraulic oil required for changing gears.

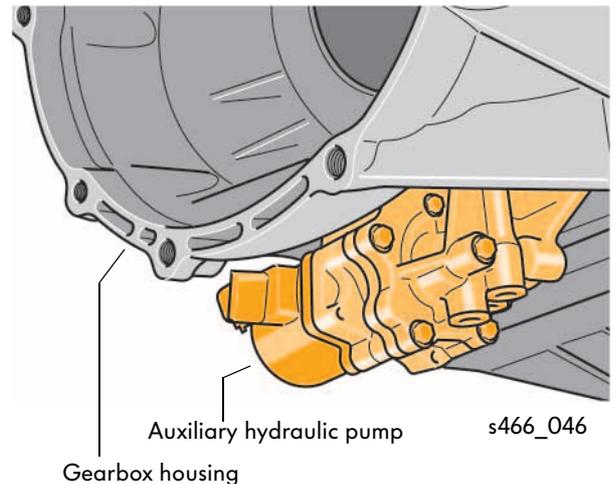
The oil pump is a crescent pump (duocentric oil pump). It is driven directly by the engine via the converter housing and the converter hub. In this case, the ATF pump pinion's drive plates engage in two grooves on the converter hub.

In hybrid vehicles, the pump is driven by either the combustion engine and/or the electric motor/generator.

Gearbox design

The auxiliary hydraulic pumps for gearbox oil

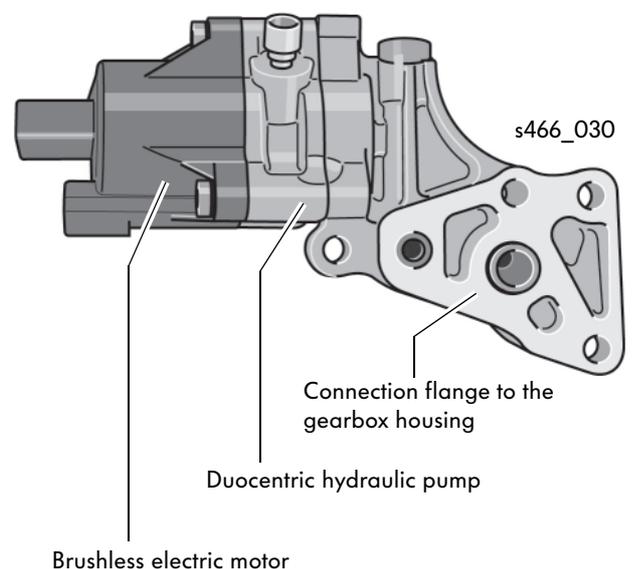
Depending on the vehicle's equipment, two different auxiliary hydraulic pumps are fitted. If the vehicle is equipped with a start/stop system, auxiliary hydraulic pump 2 V476 is fitted. If the vehicle is equipped with a hybrid drive, auxiliary hydraulic pump 1 V475 is fitted instead of auxiliary hydraulic pump 2 V476. Both versions are mounted beneath the torque converter bell housing.

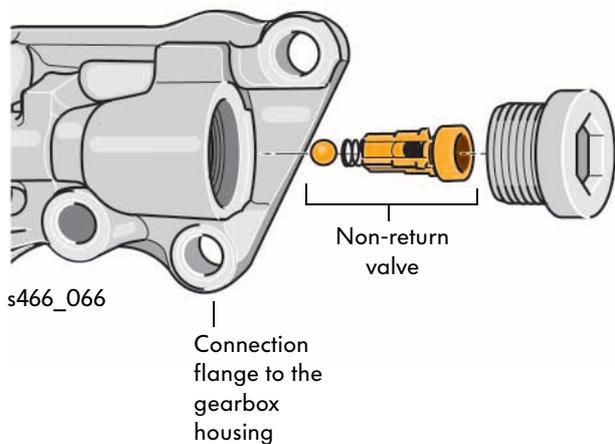


Design and task

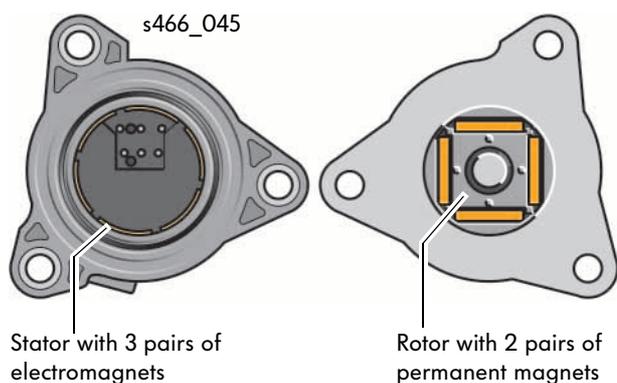
The auxiliary hydraulic pumps consist of an electric motor which drives the hydraulic pump. The electric motor is a brushless DC motor. It consists of a stator and a rotor.

The auxiliary hydraulic pumps are crescent pumps (duocentric pumps). They have the task of drawing the ATF oil out of the oil pan via an ATF screen and building up oil pressure. Via the pressure side, the volumetric flow of oil enters the valve chest via a non-return ball valve.





The non-return ball valve within the auxiliary hydraulic pump prevents the oil pumped by the mechanical ATF pump from flowing back into the oil pan from the valve chest.



Auxiliary hydraulic pump 2 for gearbox oil V476

Task

The auxiliary hydraulic pump 2 for gearbox oil V476 compensates leakages within the gearbox, and a holding pressure is built up at multi-plate clutch K1. Consequence: When the combustion engine starts up, the vehicle can be accelerated with very little delay. When the combustion engine starts up, supplying oil is delivered by the mechanical ATF pump again.

Function

A magnetic field is generated in the electromagnet pairs by supplying current to the coils. A rotating magnetic field occurs by applying current to the coils in succession. Depending on the position of the rotor, an attraction or repulsion torque acts on each permanent magnet's north and south poles. The result: The rotor rotates.

Design

The brushless DC motor for the start/stop system consists of a rotor with two pairs of permanent magnets and a stator comprising three pairs of electromagnets.

Effect in the event of failure

In the event that the auxiliary hydraulic pump fails, the start/stop system is de-activated.

Gearbox design

Auxiliary hydraulic pump 1 for gearbox oil V475

Task:

Supplies the gearbox with oil pressure in addition to the oil pressure supplied by the ATF pump. The V475 may also start up to support the ATF pump.

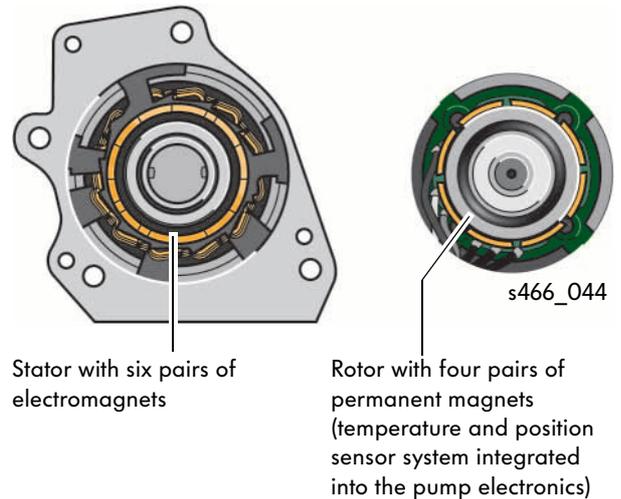
Design:

The brushless DC motor for the hybrid function consists of a rotor with four pairs of permanent magnets and a stator with six pairs of electromagnets. Oil temperature sender 2 G664 is located within the auxiliary hydraulic pump.

The sender provides the automatic gearbox control unit J217 with information on the pump's operating temperature.

Function:

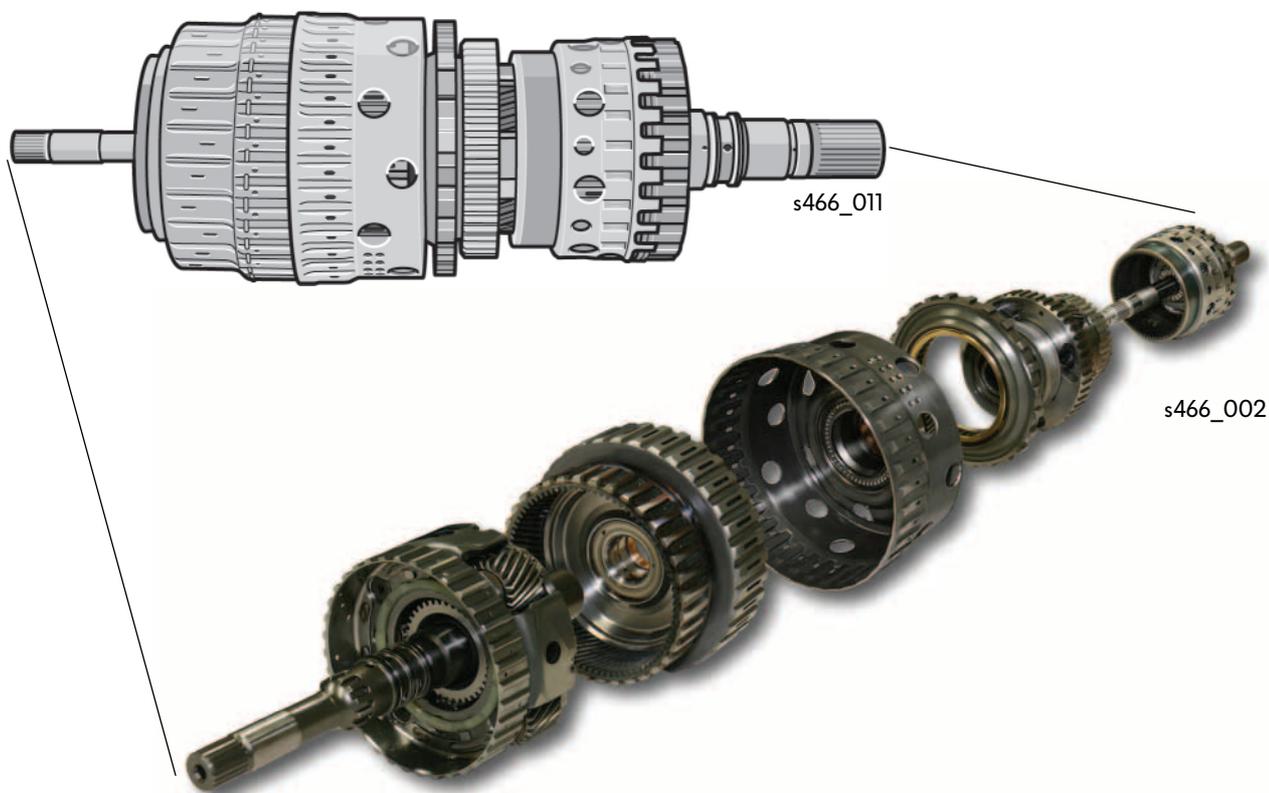
Identical to that of the auxiliary hydraulic pump for start/stop operation. Note: The increased number of magnet pairs leads to increased torque, resulting in an increased oil delivery rate. The position sensors enable the precise position of the permanent magnets to be determined. The electromagnets are specifically actuated in order to immediately set the motor in motion.



Effect in the event of failure

Based on the rotational speed of the DC motor, the position sensors detect whether a malfunction is present. The malfunction is reported to the gearbox control unit. Automatic gearbox control unit J217 tells the engine control unit to start up the mechanical ATF pump via the combustion engine or the electric motor.

The planetary gearbox



Design

The planetary gear set concept according to Lepelletier is implemented in the planetary gearbox. It is based on a single planetary gear set (primary planetary gearbox) and a downstream, double planetary gear set according to Ravigneaux (secondary planetary gearbox) with freewheel.

The special feature of the Lepelletier planetary gearbox is the fact that the double planetary gear set's sun gears and planet carrier are driven at different rotational speeds. These different input speeds into the planetary gearbox with the double planetary gear set result in a large number of possible gear ratios.

In this gearbox, the double planetary gear set's sun gears are optionally driven by the output speeds of the planet carrier or the annulus of the single planetary gear set. At the same time, the double planetary gear set's planet carrier runs at the gearbox input speed. This constellation has enabled the implementation of two additional forward gears.

Four multi-plate clutches, two multi-disc brakes and the freewheel are used to change the eight forward gears and one reverse gear.

Gearbox design

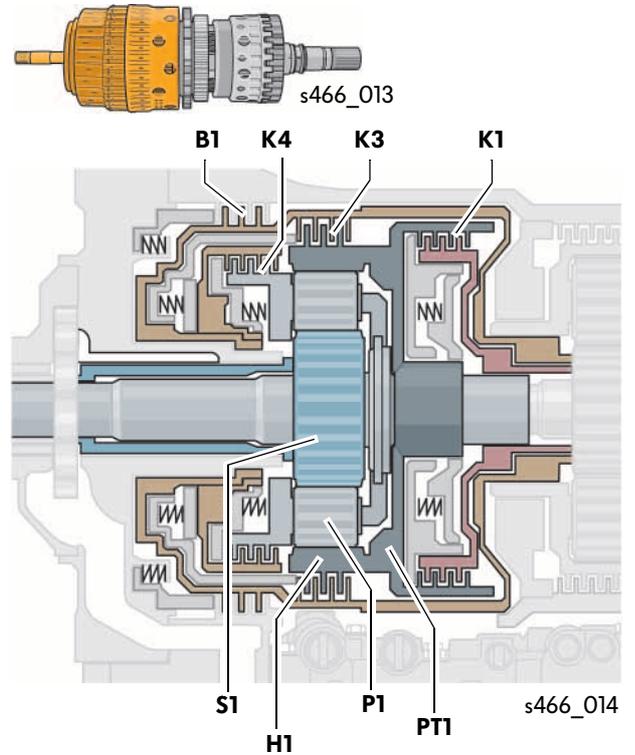
The single planetary gear set

The single planetary gear set is positioned upstream of the double planetary gear set.

The single planetary gear set consists of:

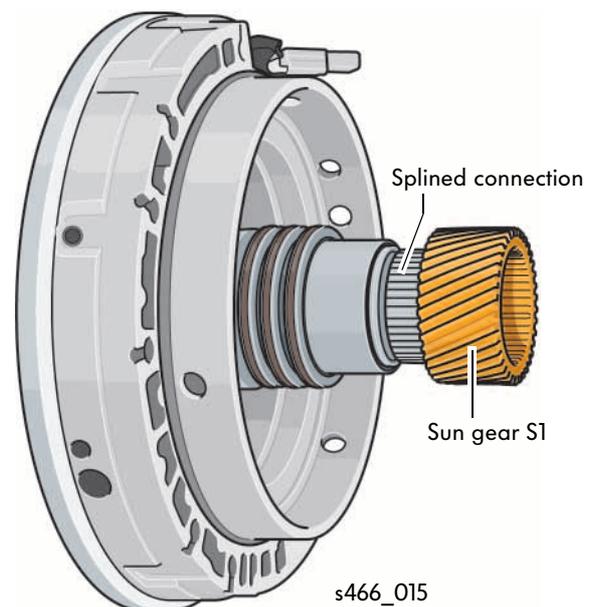
- The stationary sun gear S1
- The planetary gears P1
- The planet carrier PT1
- The annulus H1
- The multi-plate clutches K1, K3 and K4
- The multi-disc brake B1

Either 4 or 5 planetary gear pairs are installed depending on the engine. These make the connection to the sun gear S1 and the annulus H1. The engine torque is transmitted into the single planetary gear set via the gearbox input shaft.

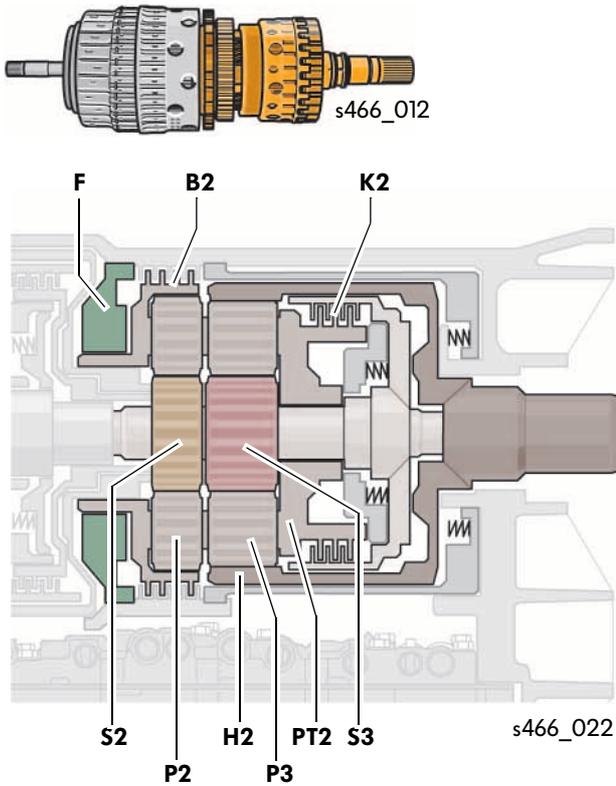


The sun gear S1

This is firmly joined to the mechanical ATF pump via a splined connection. As a result of this joint, the sun gear S1 is unable to rotate.



The double planetary gear set



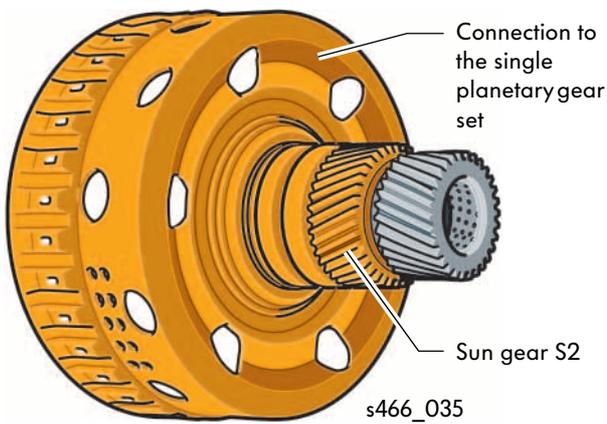
The double planetary gear set is fitted onto the single planetary gear set.

The engine torque is transmitted into the double planetary gear set via two routes:

To sun gears S2 and S3 via the single planetary gear set and from the gearbox input shaft, without a change in ratio, via clutch K2 to the planet carrier PT2. Output is carried out from the annulus H2 via the gearbox output shaft to the transfer box.

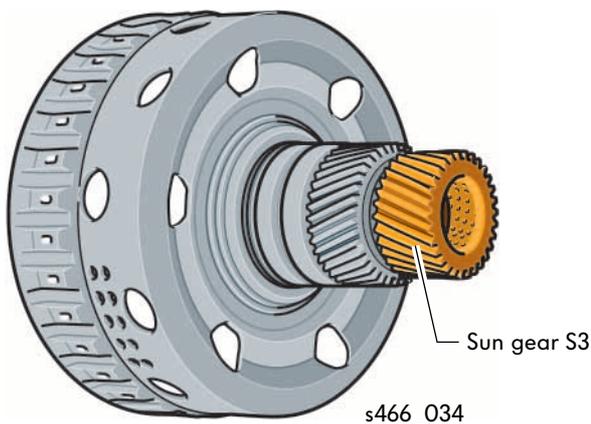
The double planetary gear set consists of:

- The sun gears S2 and S3
- The planetary gear sets P2 and P3
- The planet carrier PT2
- The annulus H2
- The multi-plate clutch K2
- The multi-disc brake B2 and
- The freewheel F



The sun gears S2 and S3

Both sun gears can be rotated independently of each other. The axle of sun gear S3 runs through sun gear S2. Both sun gears can be driven at different rotational speeds.



Gearbox design



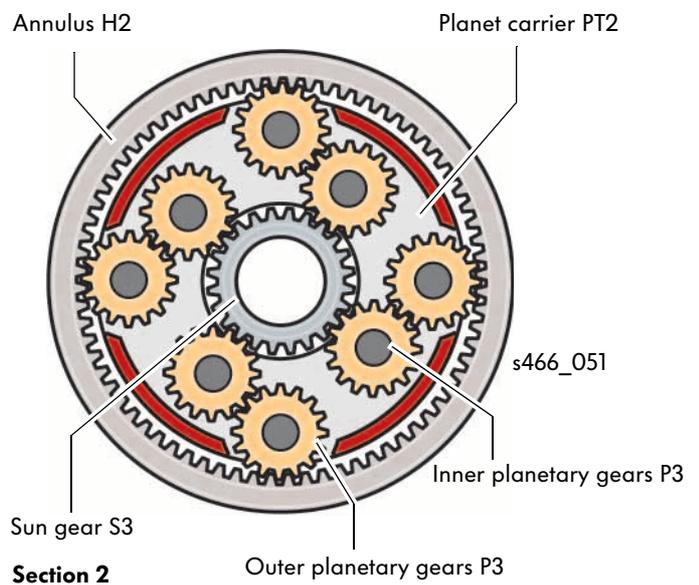
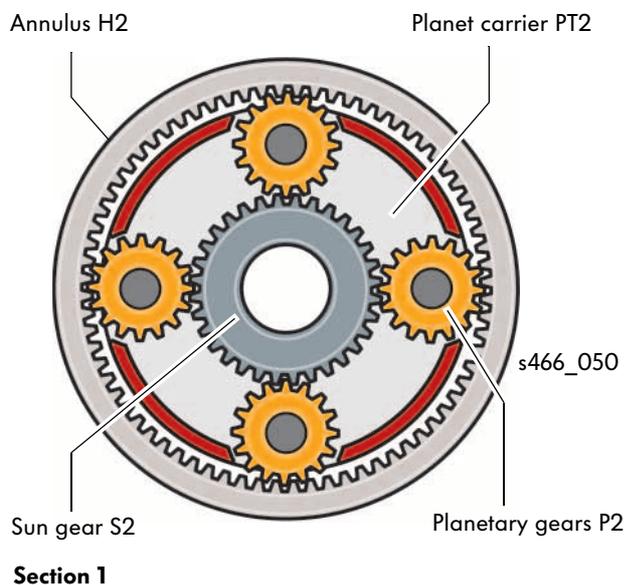
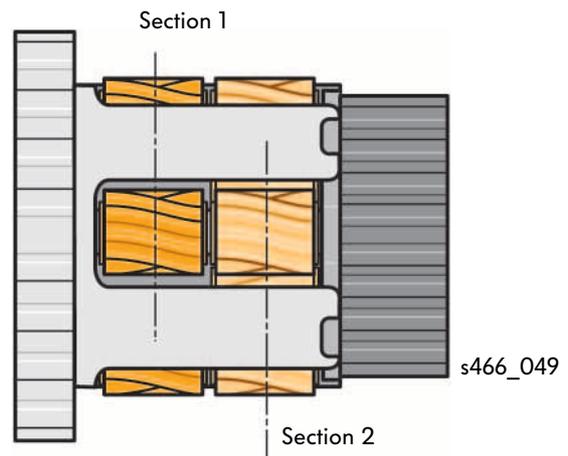
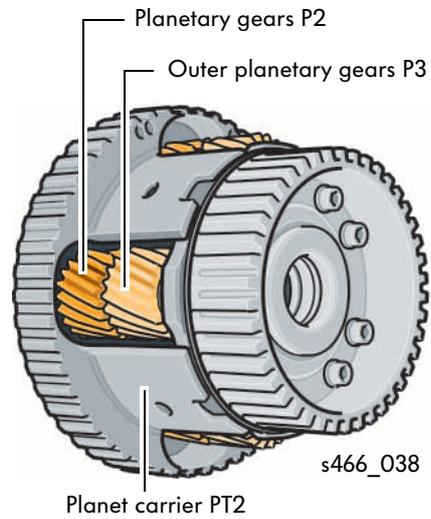
The planetary gears P2 and P3

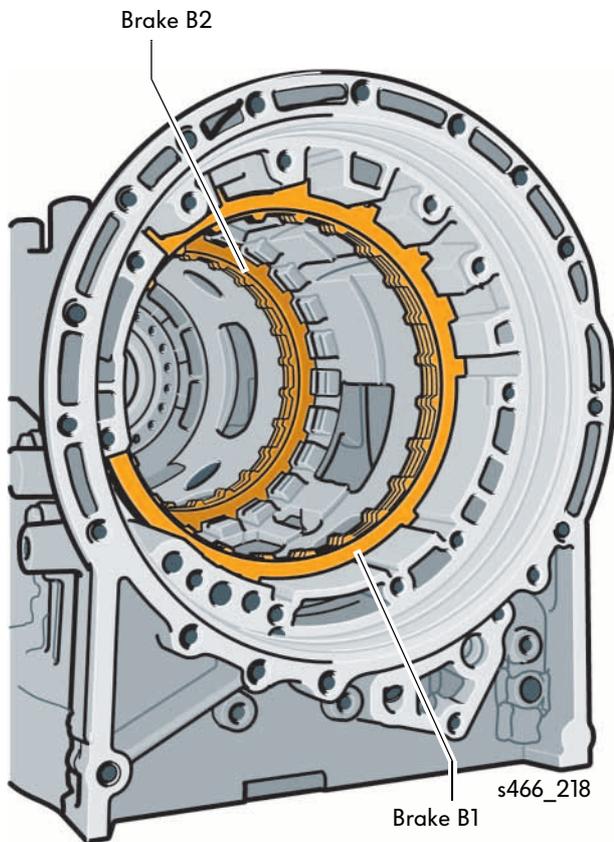
Planetary gears P2 and outer planetary gears P3 are fitted together on one single shaft and are joined firmly together.

The torque from sun gear S2 is transferred to planetary gears P2 and thus to the outer planetary gears P3. Only the outer planetary gears P3 are joined to annulus H2; these conduct the torque from sun gear S2 to annulus H2.

The torque from sun gear S3 to the annulus H2 is first transmitted to the inner planetary gears P3. From the inner planetary gears P3, the torque is conducted on to the outer planetary gears P3 and thus to annulus H2.

Depending on the engine, 3 or 4 P2 planetary gears plus inner and outer P3 planetary gears are installed.





Gearbox housing with the discs of brakes B1 and B2 inserted

Brake B1

Brake B1 is connected to the gearbox housing. If automatic gearbox pressure regulating valve N216 is supplied with current, the brake's discs are pressed together due to the hydraulic oil pressure. Sun gear S2 is gripped as a result of this.



Brake B2

Brake B2 is connected to the gearbox housing. It is hydraulically actuated via the valve chest. No pressure regulating valve is required to control brake B2. When closed, it grips planet carrier PT2.



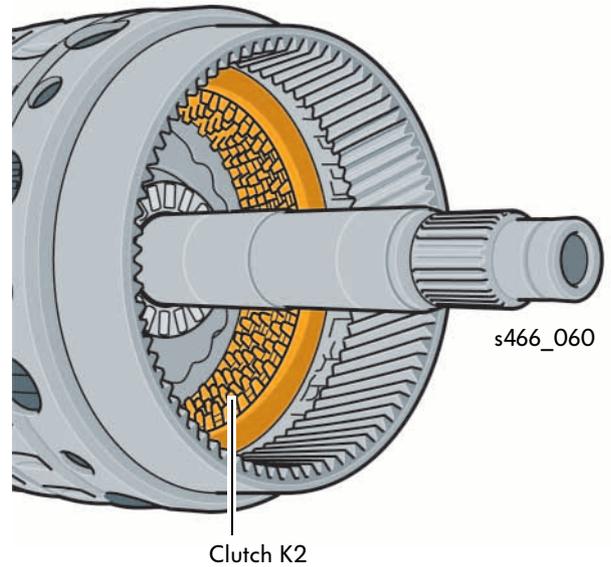
The engine determines the number of discs in the brakes. The number of discs lies between 4 and 7 per brake.

Gearbox design

Clutches K1, K2, K3 and K4

The clutches are opened or closed via the solenoid valves within the valve chest. The following list shows which function the individual clutches perform in closed condition:

1. K1 connects annulus H1 to sun gear S3.
2. K2 connects the turbine shaft to planet carrier PT2.
3. K3 connects annulus H1 to sun gear S2.
4. K4 connects planet carrier PT1 to sun gear S2.



The engine determines the number of plates in the clutches.
The number of plates lies between 4 and 7 per clutch.

The valve chest

The valve chest is bolted into the gearbox housing from below. The clutches and brakes (selector elements) are controlled by the valve chest by means of hydraulic selector valves (so-called slide valves).

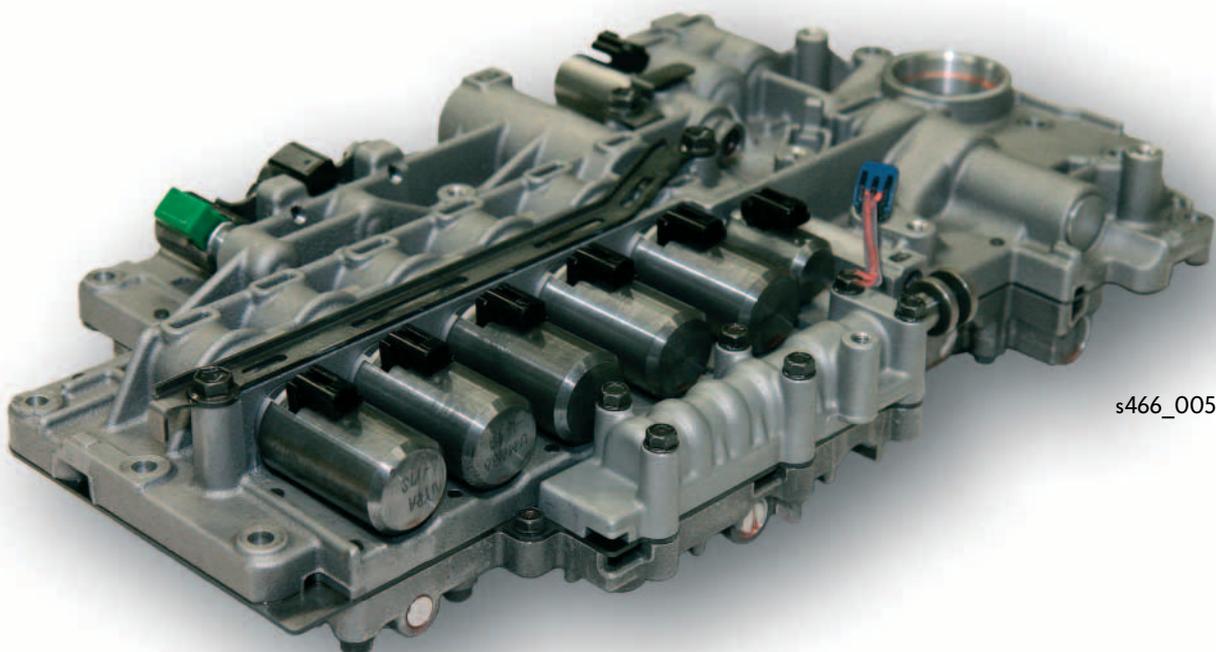
The slide valves are controlled by solenoid valves which are actuated by the automatic gearbox control unit J217.

In addition to the selector elements, the valve chest controls the torque converter clutch and the various pressures throughout the entire gearbox (e.g. main pressure, control pressure, converter pressure, lubrication pressure, etc.).

The valve chest is responsible for the entire oil supply and therefore for the flawless function of the gearbox.

The valve chest contains the following components:

- The mechanically actuated spool valve
- The hydraulic selector valves
- Two electrically controlled solenoid valves (3/2-way directional control valves)
- Seven electric pressure regulating valves (modulation valves) and
- The gearbox oil temperature sender

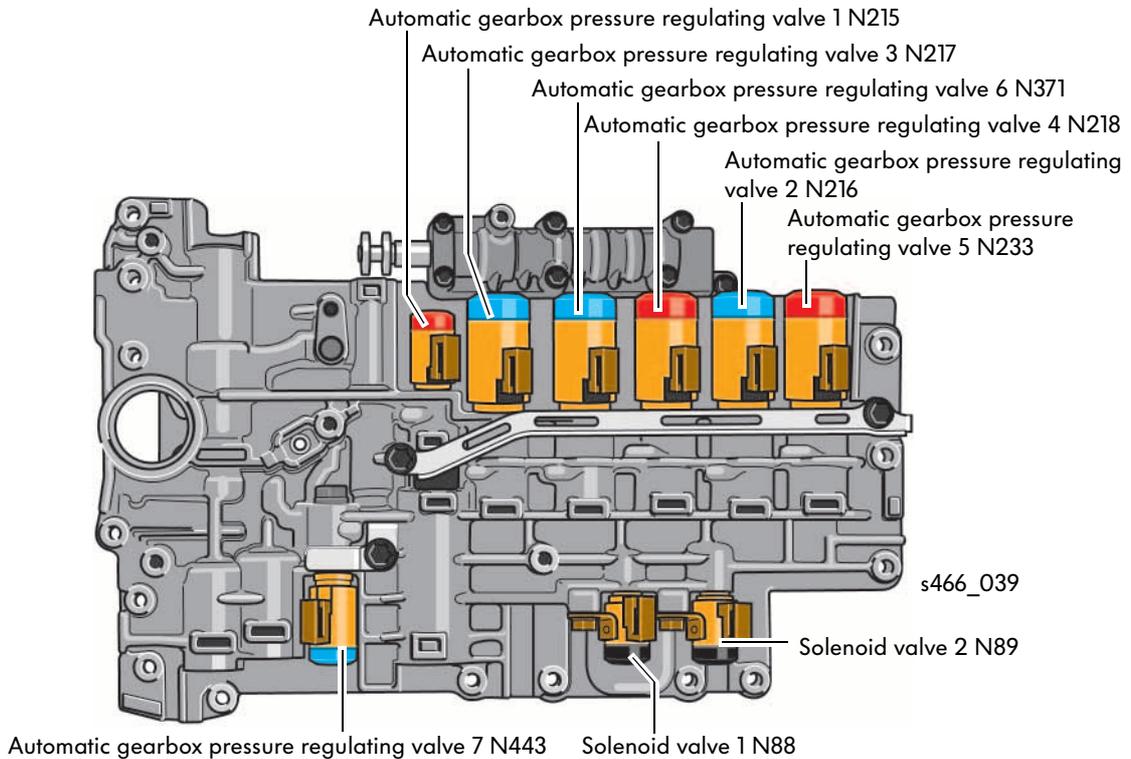


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Gearbox design

The valves

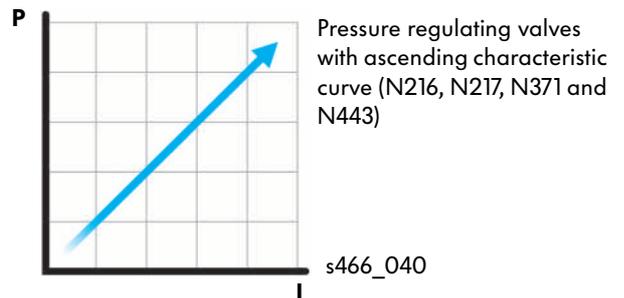
The valve chest contains three different types of solenoid valve.



- Pressure regulating valves with ascending characteristic curve
- Pressure regulating valves with descending characteristic curve
- Selector valves (open/close valves)

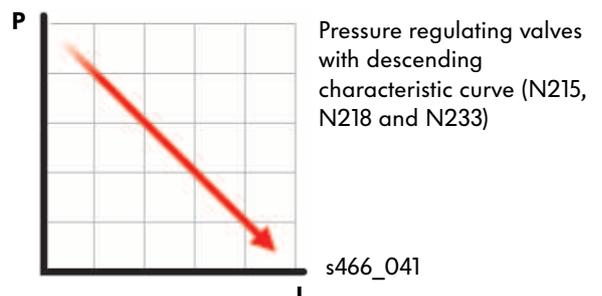
Pressure regulating valve with ascending characteristic curve

The more the pressure regulating valve is supplied with current, the higher the hydraulic pressure. If the pressure regulating valve is not supplied with current, no hydraulic pressure is present.



Pressure regulating valve with descending characteristic curve

The more the pressure regulating valve is supplied with current, the lower the hydraulic pressure. If the pressure regulating valve is not supplied with current, full hydraulic pressure is present.



The tasks which the valves in the valve chest carry out are summarised in the following table.

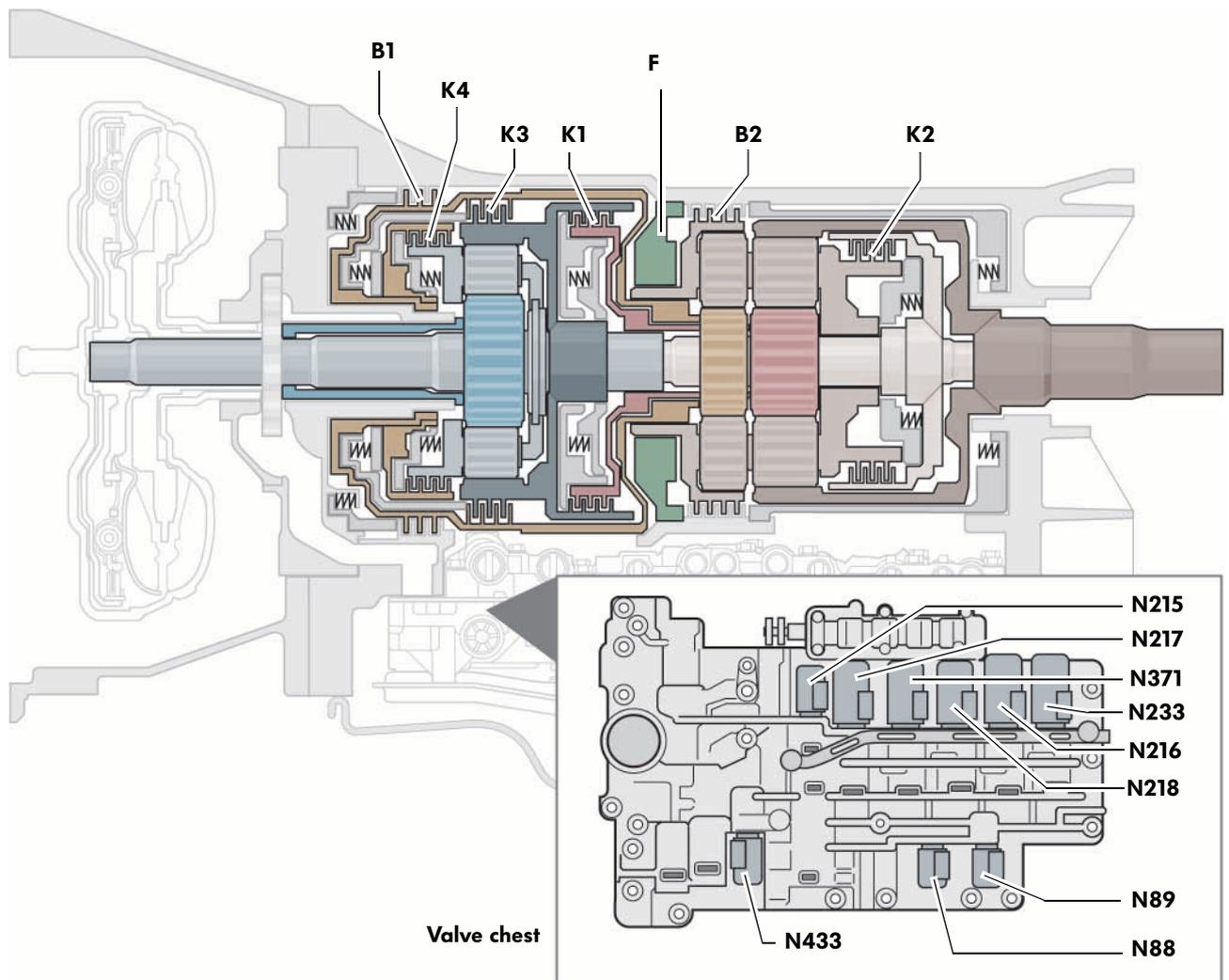
Valve	Function on application of current	Direct access to	Responsible for gears
Automatic gearbox pressure regulating valve 1 N215	Regulates the ATF pressure and forwards it either directly to clutches K2 and K3 or via solenoid valves N217, N371 and N216 to clutches K1 and K4 and to brake B1	Main pressure	R, 1st to 8th
Automatic gearbox pressure regulating valve 3 N217	Supplies the ATF pressure to the plates of clutch K1, and the clutch is closed	Clutch K1	1st to 5th
Automatic gearbox pressure regulating valve 4 N218	The ATF pressure on clutch K2 is relieved, and the clutch opens	Clutch K2	1st, engine brake, 5th to 8th
Automatic gearbox pressure regulating valve 5 N233	The ATF pressure on clutch K3 is relieved, and the clutch opens	Clutch K3	R, 3rd, 7th
Automatic gearbox pressure regulating valve 6 N371	Supplies the ATF pressure to the plates of clutch K4, and the clutch is closed	Clutch K4	4th and 6th
Automatic gearbox pressure regulating valve 2 N216	Supplies the ATF pressure to the plates of brake B1, and the brake is closed	Brake B1	2nd and 8th
Automatic gearbox pressure regulating valve 7 N443	Make ATF pressure available for the torque converter lock-up clutch		
Solenoid valve 1 N88	Partially supplied with current, supports pressure reduction in clutches K2 and K3		
Solenoid valve 2 N89	Only supplied with current in reverse gear when $v > 7$ km/h or 1st gear is engaged in Tiptronic. Prevents pressure reduction in clutches K2 and K3. Both valves operate in alternation		



Gearbox function

The flow of power

Based on this extremely simplified sectional diagram of the gearbox, the torque paths of the individual gears will be described in the following. The valve chest illustration shows which solenoid valves are actuated for the relevant gear.

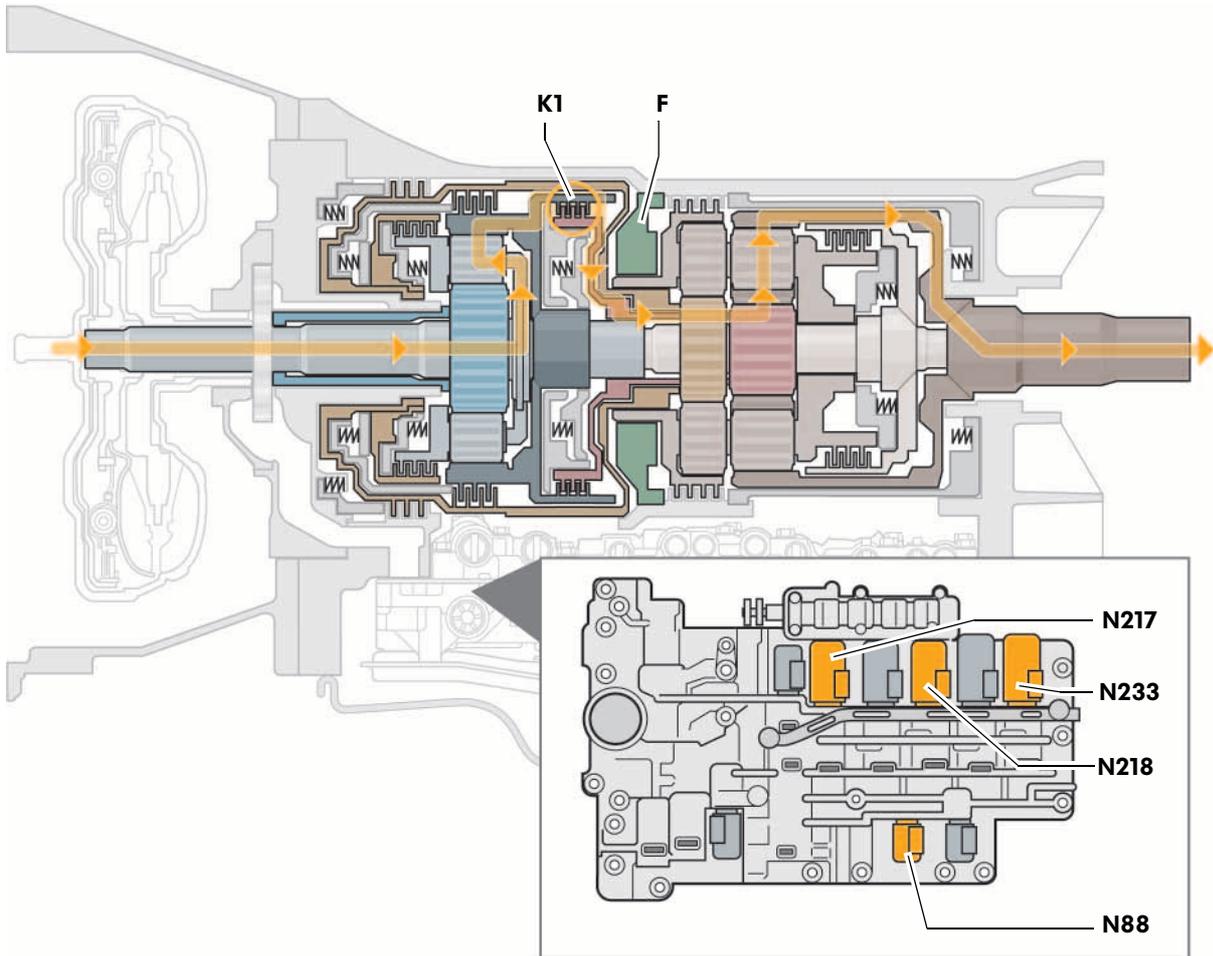


Legend

- | | |
|--|---------------|
| N88 - Solenoid valve 1 | K1 - Clutch 1 |
| N89 - Solenoid valve 2 | K2 - Clutch 2 |
| N215 - Automatic gearbox pressure regulating valve 1 | K3 - Clutch 3 |
| N216 - Automatic gearbox pressure regulating valve 2 | K4 - Clutch 4 |
| N217 - Automatic gearbox pressure regulating valve 3 | B1 - Brake 1 |
| N218 - Automatic gearbox pressure regulating valve 4 | B2 - Brake 2 |
| N233 - Automatic gearbox pressure regulating valve 5 | F - Freewheel |
| N371 - Automatic gearbox pressure regulating valve 6 | |
| N443 - Automatic gearbox pressure regulating valve 7 | |

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The 1st gear



Clutch K1 and freewheel F

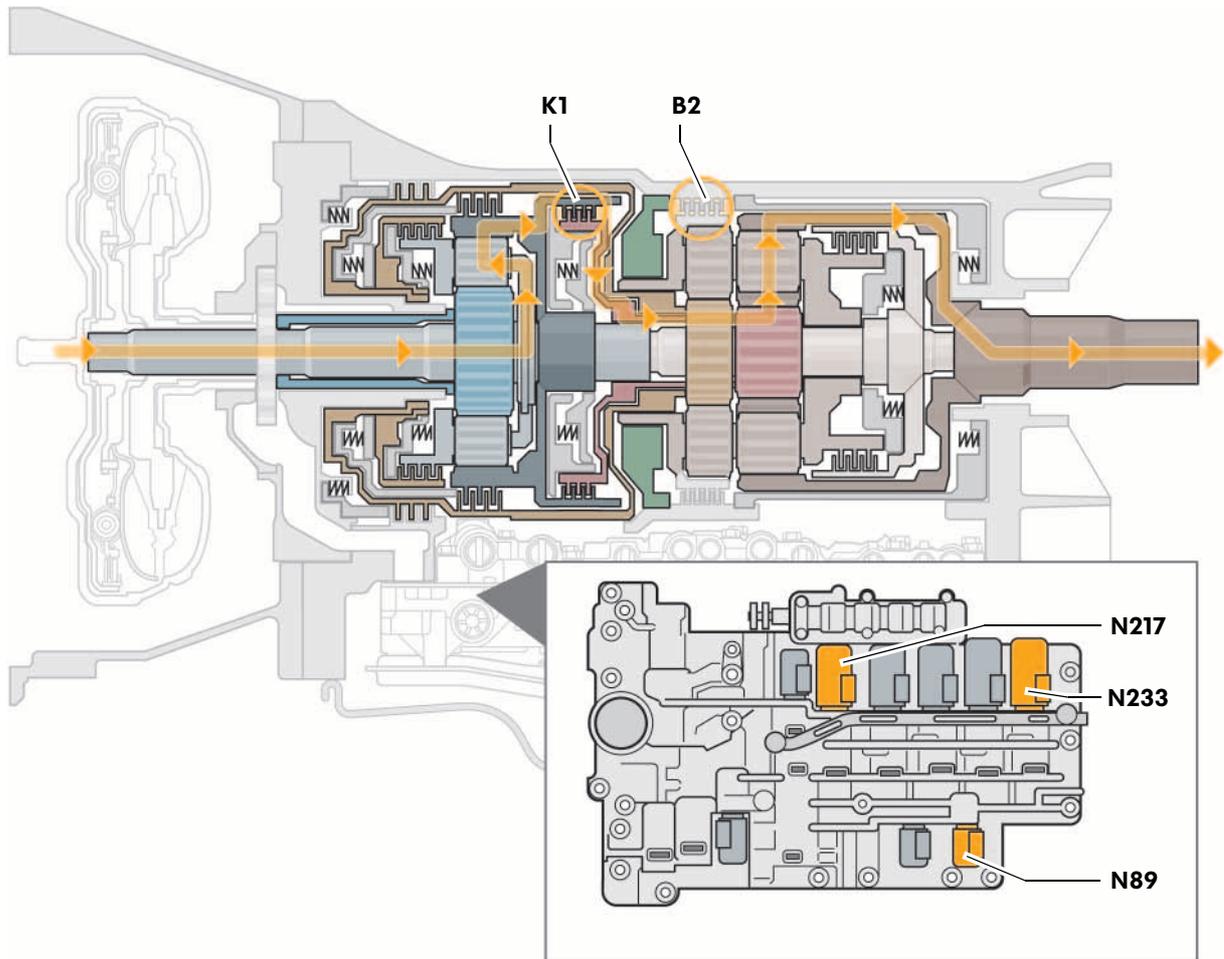
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The turbine shaft drives the single planetary gear set's planet carrier PT1. Planet carrier PT1 drives planetary gears P1, which roll and are supported on stationary sun gear S1. Annulus H1 is driven as a result of this. Clutch K1 connects annulus H1 to sun gear S3 and therefore transfers the torque into the double planetary gear set. The freewheel blocks planet carrier PT2. From sun gear S3, the torque is transferred to the inner planetary gears P3 and from there to the outer planetary gears P3. Supported by planet carrier PT2, the torque is transferred to annulus H2. Annulus H2 is connected to the gearbox output shaft.



Gearbox function

The 1st gear (Tiptronic)



Clutch K1 and brake B2

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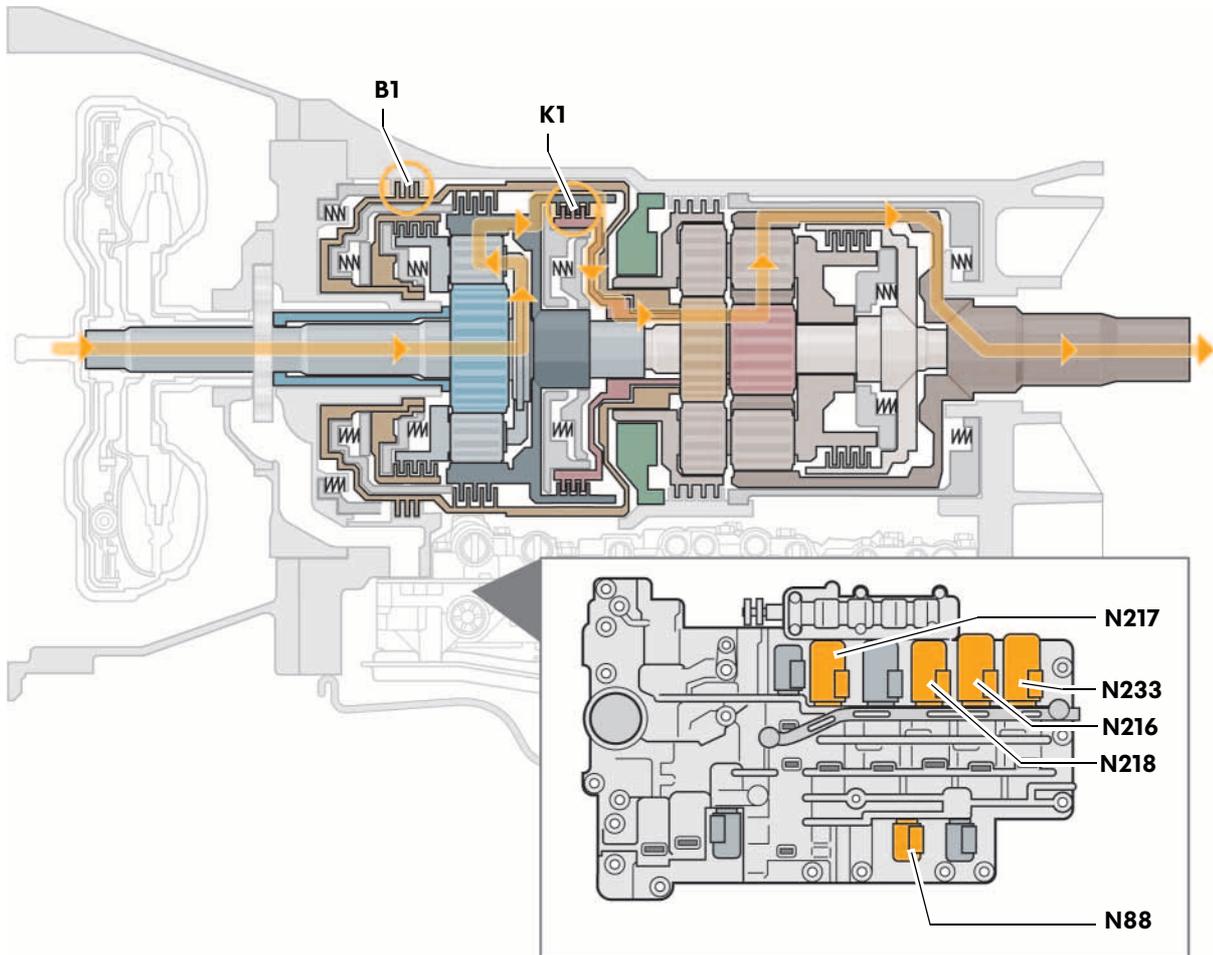
In certain driving situations, the engine braking effect can be used by selecting 1st gear in Tiptronic mode.

The torque path corresponds to that described for the 1st gear.

Use of the engine braking effect in 1st gear can only be enabled by closing brake B2.

Like the freewheel F, brake B2 blocks planet carrier PT2. In contrast to the freewheel F, however, brake B2 grips planet carrier PT2 in both rotational directions. This is necessary for the reverse gear and for use of the engine braking effect in 1st gear.

The 2nd gear



Clutch K1 and brake B1

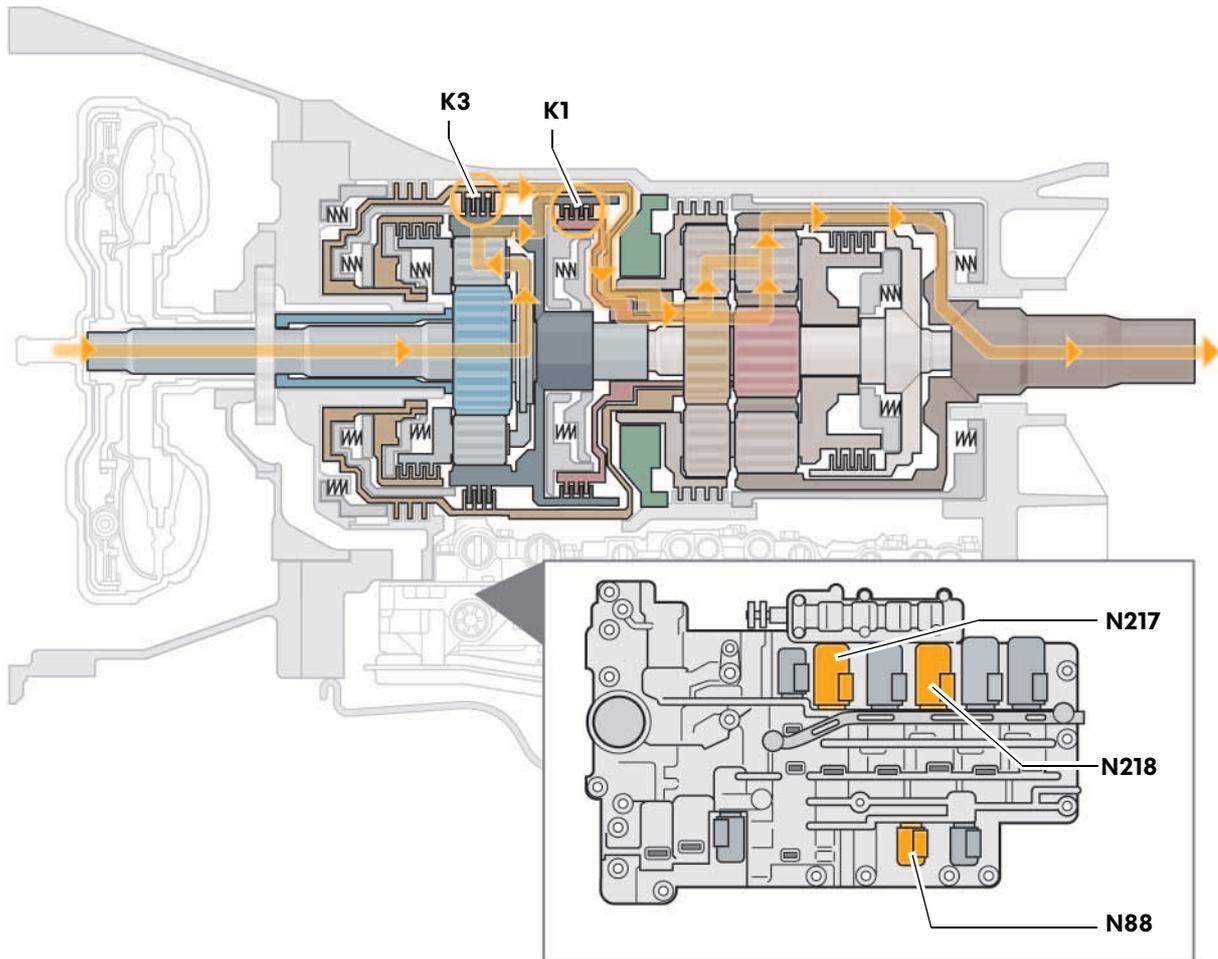
s466_019

The turbine shaft drives the single planetary gear set's planet carrier PT1. Planet carrier PT1 drives planetary gears P1, which roll and are supported on stationary sun gear S1. Annulus H1 is driven as a result of this. Clutch K1 connects annulus H1 to sun gear S3 and therefore transfers the torque into the double planetary gear set. Brake B1 blocks sun gear S2. From sun gear S3, the torque is transferred to the inner planetary gears P3 and from there to the outer planetary gears P3. The planetary gears P2 roll on sun gear S2 and, together with the outer planetary gears P3, drive annulus H2.



Gearbox function

The 3rd gear



Clutches K1 and K3

s466_020

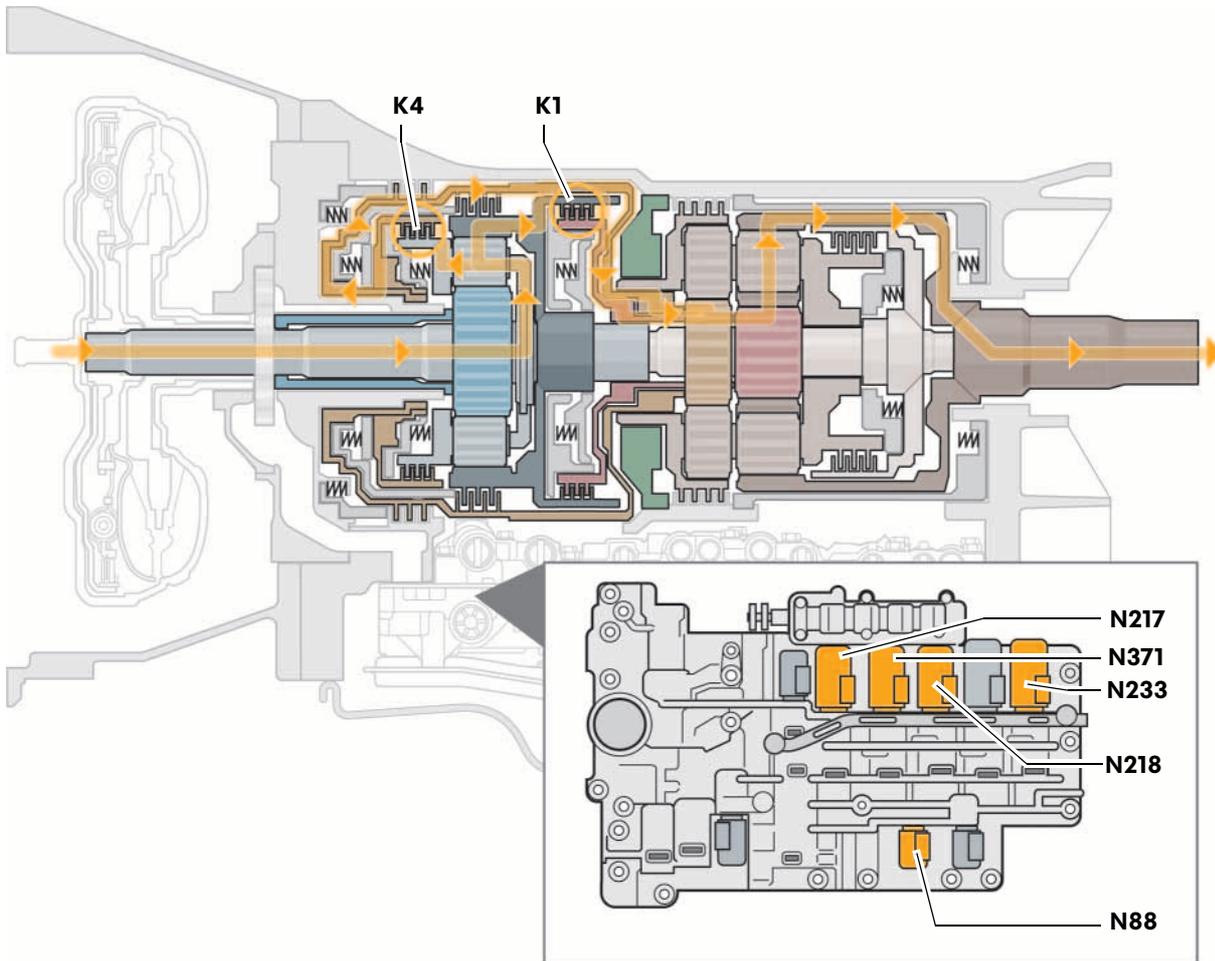
The turbine shaft drives the single planetary gear set's planet carrier PT1. Planet carrier PT1 drives planetary gears P1, which roll and are supported on stationary sun gear S1. Annulus H1 is driven as a result of this.

Clutch K1 connects annulus H1 to the small sun gear S3 and therefore transfers the torque into the double planetary gear set.

Clutch K3 connects annulus H1 to the large sun gear S2 and therefore transfers the torque into the double planetary gear set.

Planetary gears P2 and P3 are blocked by closing the two clutches K1 and K3. Planet carrier PT2 rotates along with sun gears S2 and S3. The torque is thus transferred by sun gears S2 and S3 to the annulus H2 via planet carrier PT2.

The 4th gear



Clutches K1 and K4

s466_021

The turbine shaft drives the single planetary gear set's planet carrier PT1. Planet carrier PT1 drives planetary gears P1, which roll and are supported on stationary sun gear S1. Annulus H1 is driven as a result of this.

Clutch K1 connects annulus H1 to sun gear S3 and therefore transfers the torque into the double planetary gear set.

Clutch K4 connects planet carrier PT1 to sun gear S2 and therefore transfers the torque into the double planetary gear set.

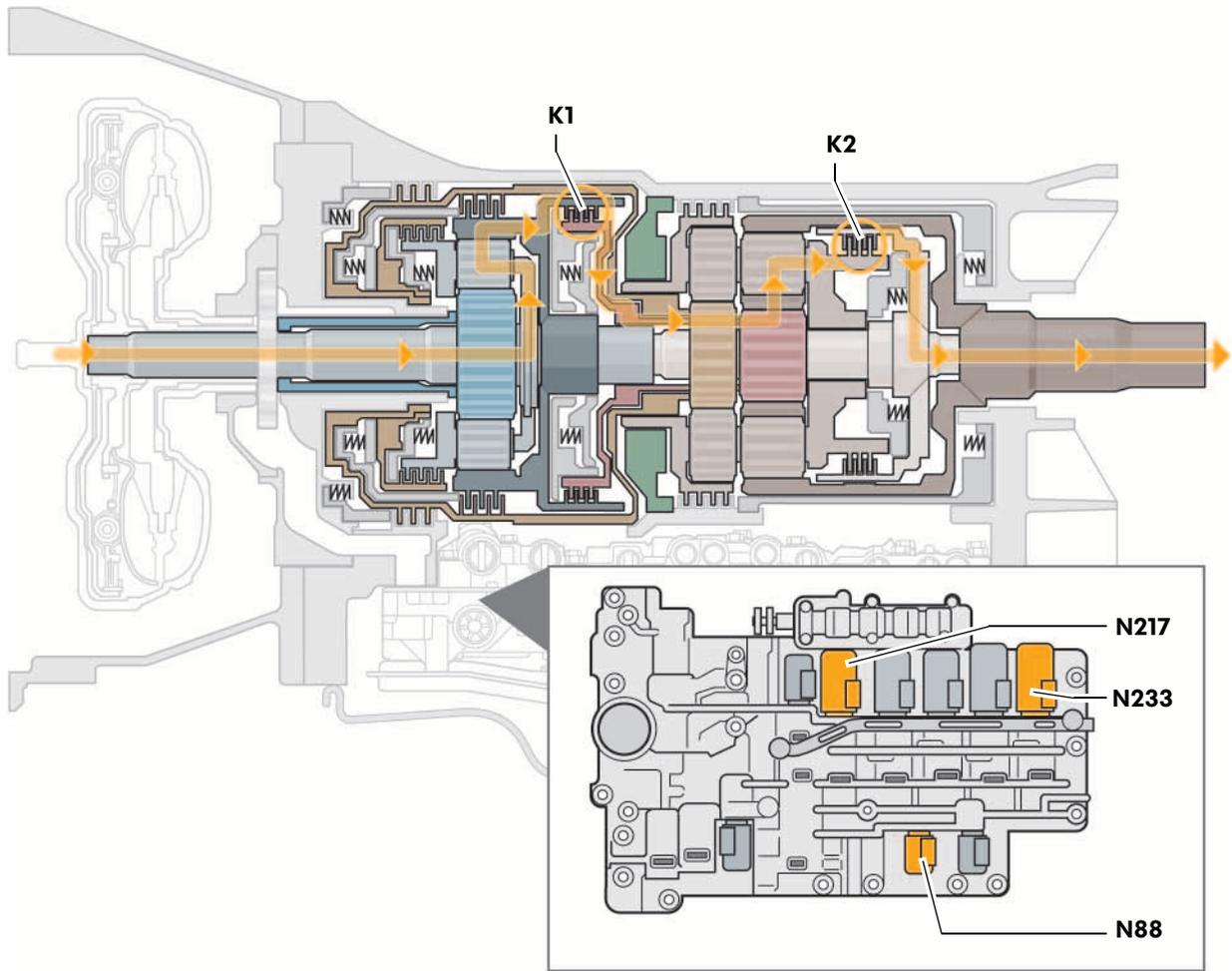
Sun gear S3 is driven more slowly than sun gear S2.

Planetary gears P2 and P3 roll on sun gear S2, which is rotating faster, and drive annulus H2.



Gearbox function

The 5th gear

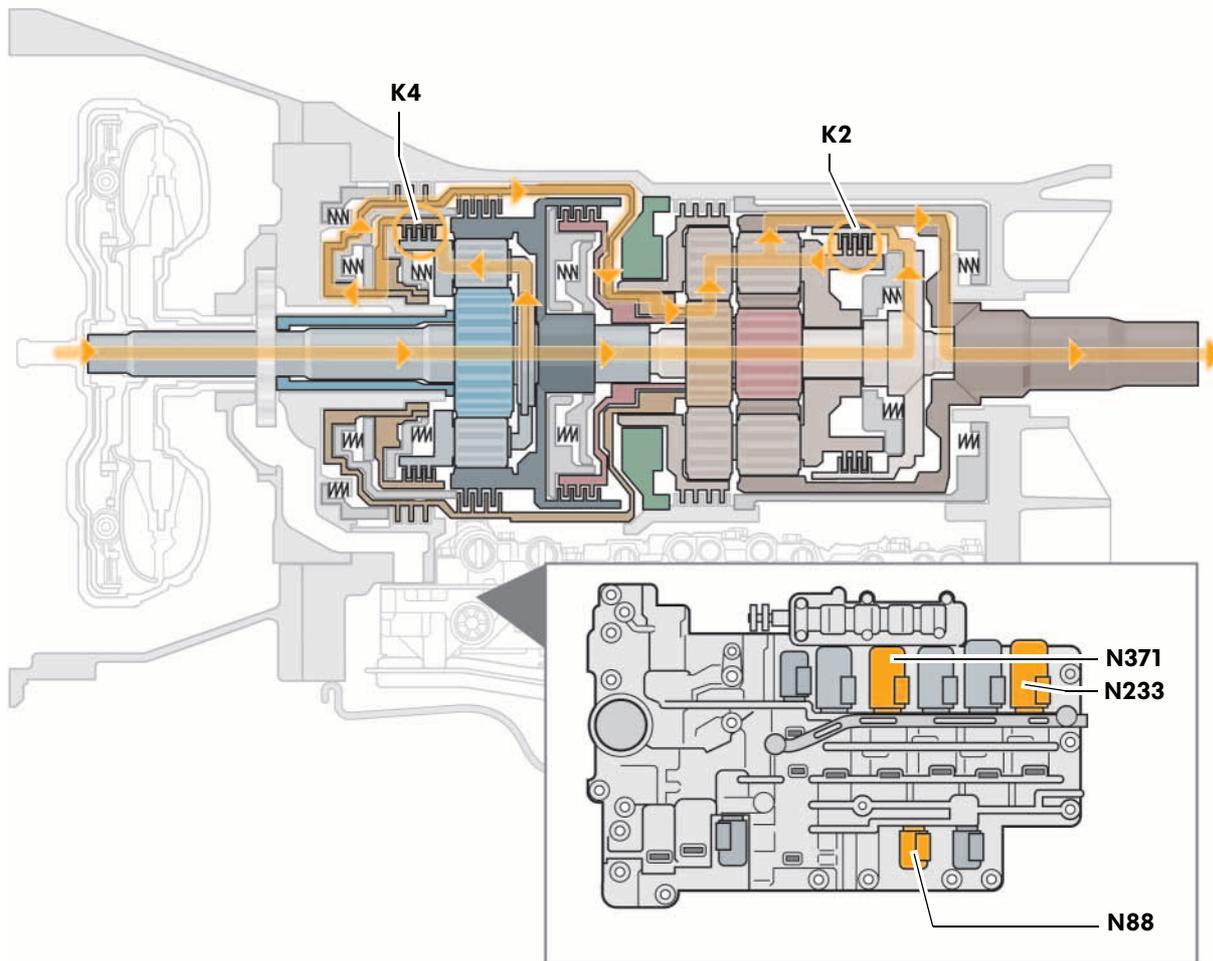


Clutches K1 and K2

s466_023

The turbine shaft drives the single planetary gear set's planet carrier PT1 and clutch K2's outer plate carrier. Planet carrier PT1 drives planetary gears P1, which roll and are supported on stationary sun gear S1. Annulus H1 is driven as a result of this. Clutch K1 connects annulus H1 to sun gear S3 and therefore transfers the torque into the double planetary gear set. Clutch K2 connects the turbine shaft to planet carrier PT2 and therefore also transfers the torque into the double planetary gear set. The inner planetary gears P3, which are meshed with the outer planetary gears P3, together with planet carrier PT2, drive the annulus H2.

The 6th gear



Clutches K2 and K4

s466_024

The turbine shaft drives the single planetary gear set's planet carrier PT1 and clutch K2's outer plate carrier. Clutch K4 connects planet carrier PT1 to sun gear S2 and therefore transfers the torque into the double planetary gear set.

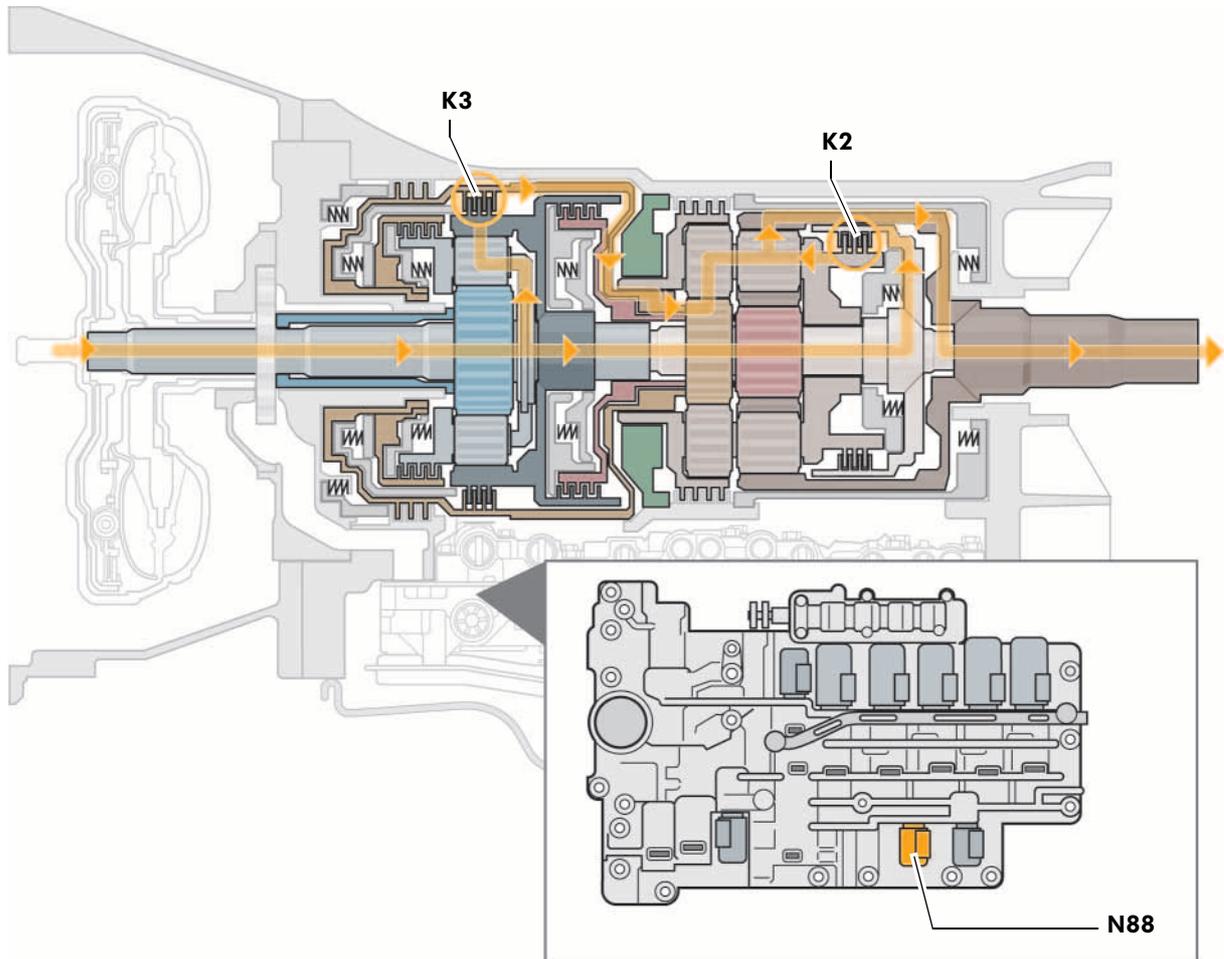
Clutch K2 connects the turbine shaft to planet carrier PT2 and therefore also transfers the torque into the double planetary gear set.

Sun gear S2 transfers the torque to planetary gears P2. Via planet carrier PT2, the torque is transferred to the inner and the outer planetary gears P3. Together with planetary gears P2, the outer planetary gears P3 drive the annulus H2.



Gearbox function

The 7th gear

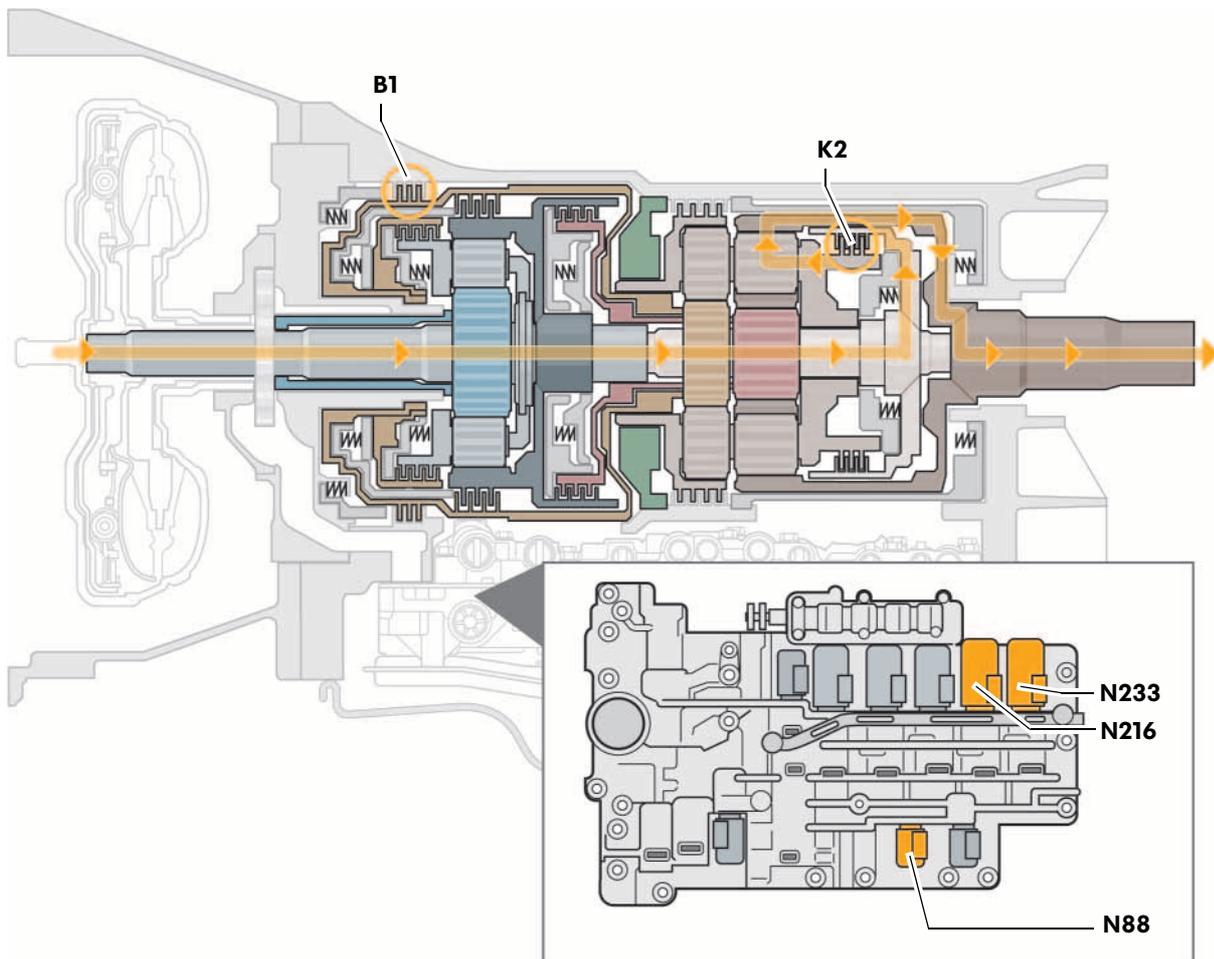


Clutches K2 and K3

s466_025

The turbine shaft drives the single planetary gear set's planet carrier PT1 and clutch K2's outer plate carrier. Planet carrier PT1 drives the planetary gears P1, which roll and are supported on stationary sun gear S1. The annulus H1 is driven as a result of this. Clutch K3 connects annulus H1 to sun gear S2 and therefore transfers the torque into the double planetary gear set. Clutch K2 connects the turbine shaft to planet carrier PT2 and therefore also transfers the torque into the double planetary gear set. The planetary gears P2, which are jointly driven by sun gear S2 and planet carrier PT2, together with the firmly linked outer planetary gears P3, drive the annulus H2.

The 8th gear



Clutch K2 and brake B1

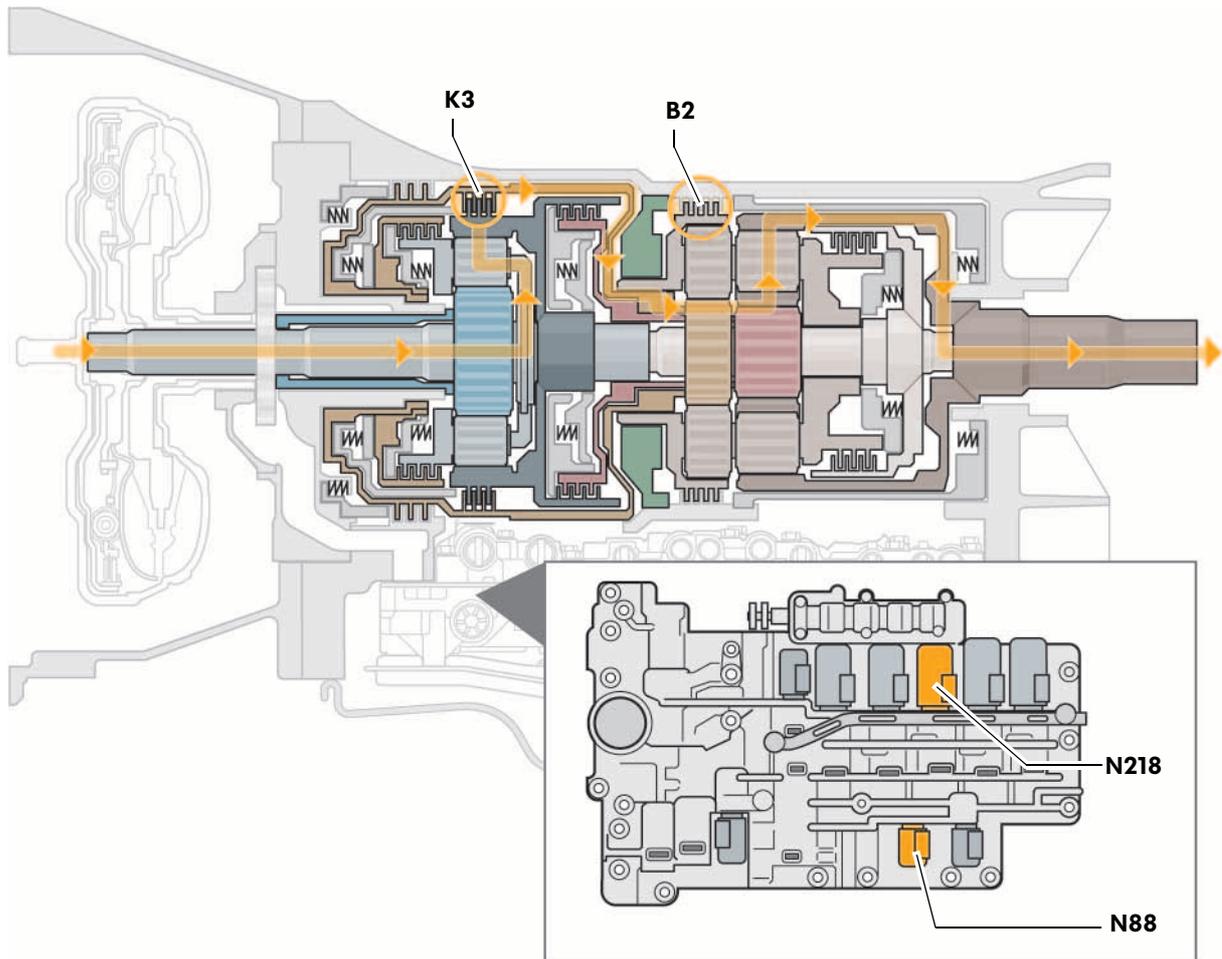
s466_026

Brake B1 blocks sun gear S2. Clutch K2 connects the turbine shaft to planet carrier PT2 of the double planetary gear set, and therefore transfers the torque into the double planetary gear set. The long planetary gears P2 roll on stationary sun gear S2 and, together with the outer planetary gears P3, drive annulus H2.

Clutches K1 and K3 are open. The single planetary gear set is not involved in power transmission.

Gearbox function

The reverse gear



Clutch K3 and brake B2

s466_027

The turbine shaft drives the single planetary gear set's planet carrier PT1. Planet carrier PT1 drives the planetary gears P1, which roll and are supported on stationary sun gear S1. The annulus H1 is driven as a result of this. Clutch K3 connects annulus H1 to sun gear S2 and therefore transfers the torque into the double planetary gear set. In the double planetary gear set, brake B2 blocks planet carrier PT2. The torque is transferred from sun gear S2 to planetary gears P2 and thus to the outer planetary gears P3. Supported by planet carrier PT2, the torque is transferred to the annulus H2, which is connected to the output shaft. In this case, the annulus H2 is driven counter to the direction of engine rotation.

In summary

The table shows which valves are supplied with current by the automatic gearbox control unit J217 for the individual gears and which clutches and brakes are closed as a result.

Gear	N217	N218	N233	N371	N216	N88	N89	K1	K2	K3	K4	B1	B2
1st	X	X	X			X		X					
1st Tiptr.	X		X				X	X					X
2nd	X	X	X		X	X		X				X	
3rd	X	X				X		X		X			
4th	X	X	X	X		X		X			X		
5th	X		X			X		X	X				
6th			X	X		X			X		X		
7th						X			X	X			
8th			X		X	X			X			X	
R		X				X				X			X

- Pressure regulating valves with ascending characteristic curve
- Pressure regulating valves with descending characteristic curve
- Selector valves

N88 Solenoid valve 1
 N89 Solenoid valve 2

N216 Automatic gearbox pressure regulating valve 2
 N217 Automatic gearbox pressure regulating valve 3
 N218 Automatic gearbox pressure regulating valve 4
 N233 Automatic gearbox pressure regulating valve 5
 N371 Automatic gearbox pressure regulating valve 6

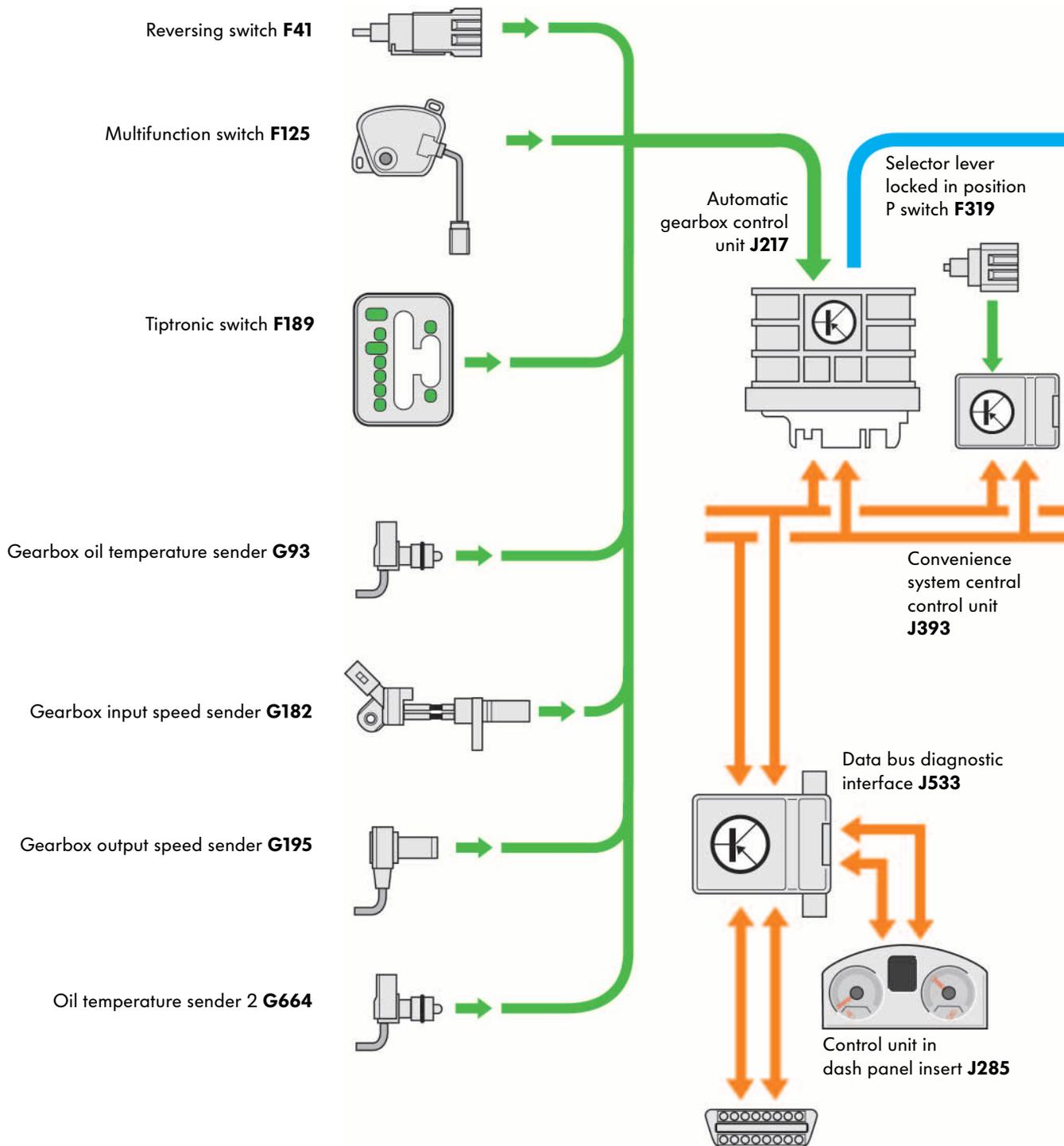
K1 to K4 - Clutches 1 to 4
 B1, B2 - Brakes 1 and 2



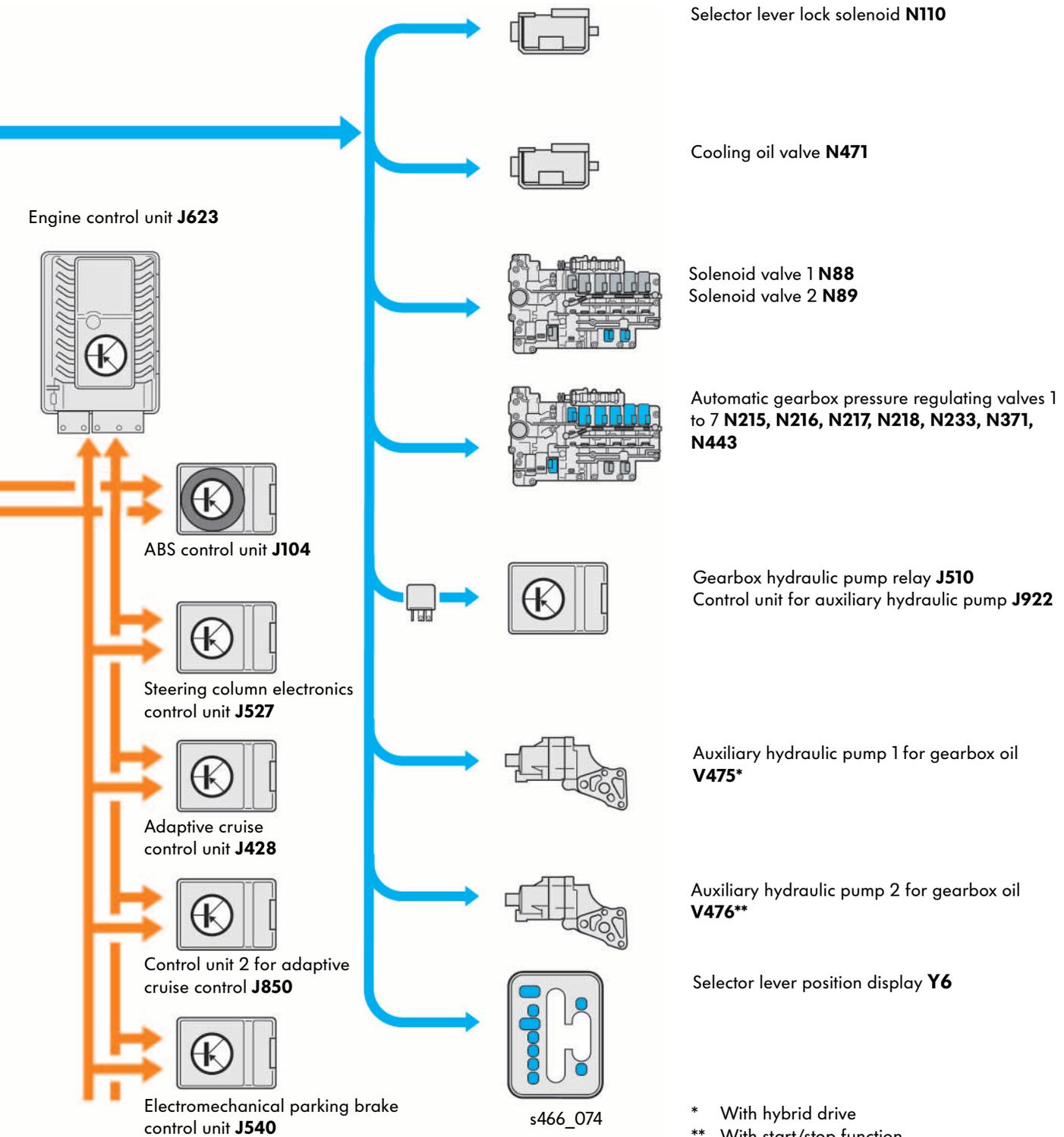
Gearbox management system

System overview

Sensors



Actuators



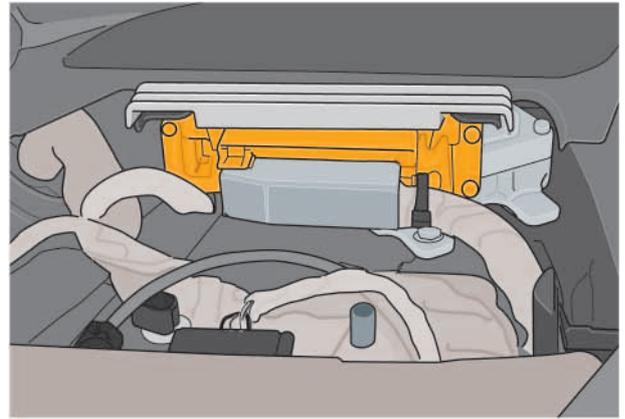
Gearbox management system

The automatic gearbox control unit

The automatic gearbox control unit J217 is located beneath the right front seat. It is connected to the gateway via the powertrain CAN bus.

The automatic gearbox control unit actuates the solenoid valves in the valve chest directly. The information from the sensors in the gearbox is forwarded directly to the automatic gearbox control unit. In the case of auxiliary hydraulic pump 1 for gearbox oil V475, the operating temperature is transmitted directly to the automatic gearbox control unit via oil temperature sender 2 G664.

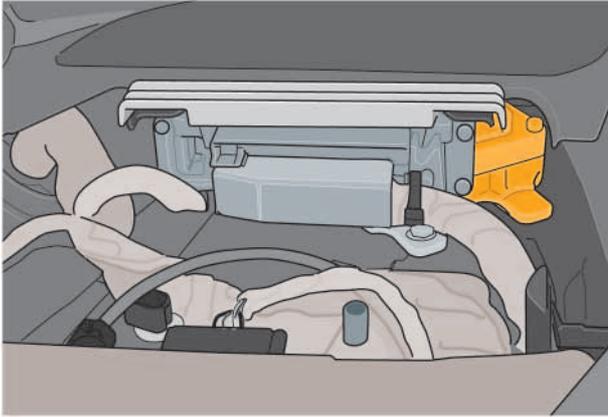
The dynamic shift program is also integrated into the automatic gearbox control unit. The automatic gearbox control unit selects the gear changes based on the operating status (aerodynamic drag and rolling resistance, route profile and driving style).



J217 under the right front seat

s466_061

The control unit for auxiliary hydraulic pump

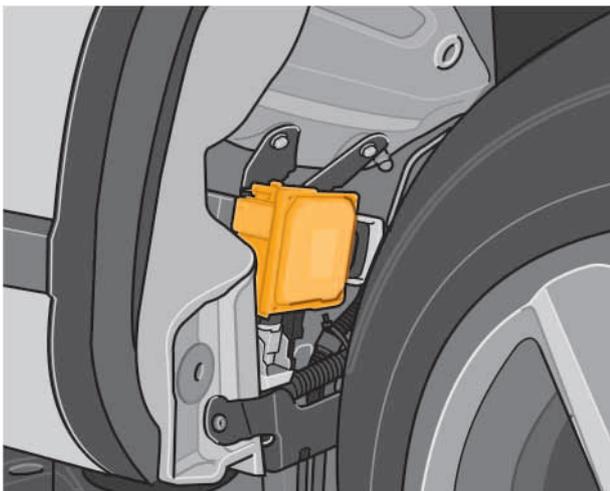


J922 under the right front seat

s466_062

The control unit for auxiliary hydraulic pump J922 may be installed in different locations, depending on which auxiliary hydraulic pump it actuates. If the control unit for auxiliary hydraulic pump is used to actuate auxiliary hydraulic pump 2 for gearbox oil V476, it is located beneath the right front seat together with the automatic gearbox control unit J217.

J922 is subordinate to the automatic gearbox control unit, and activates the auxiliary hydraulic pump 2 for gearbox oil V476 for the start/stop system according to the gearbox control unit's specifications.



J922 in the right wheel housing

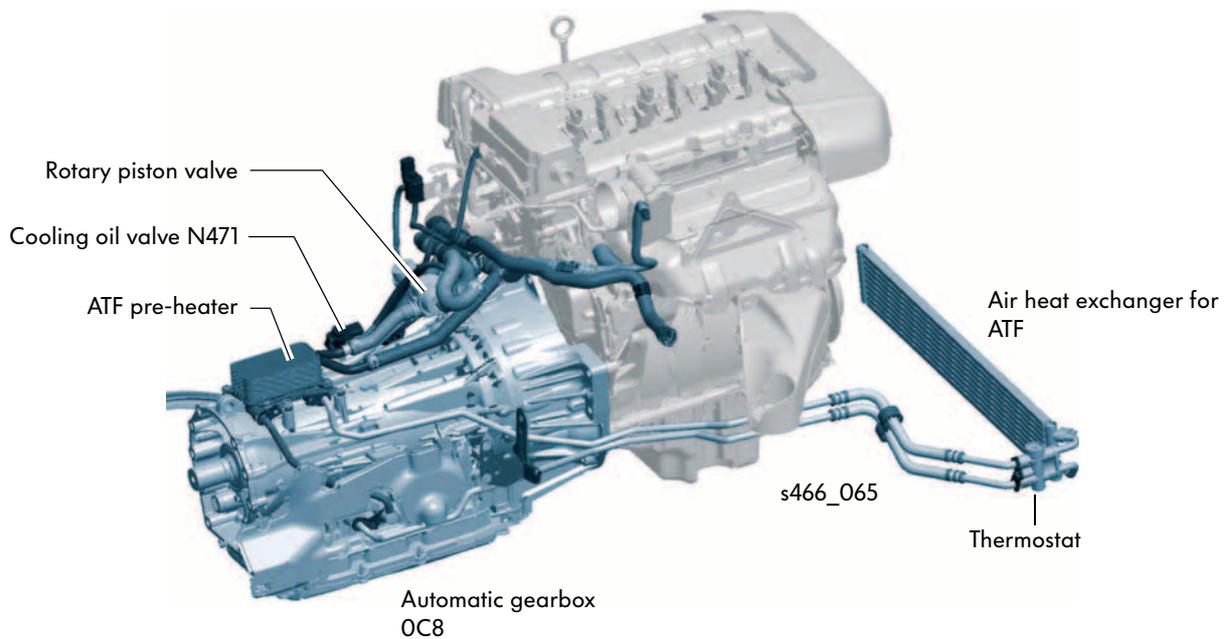
s466_075

If the control unit for auxiliary hydraulic pump J922 controls auxiliary hydraulic pump 1 for gearbox oil V475, then it is located in the right wheel housing. Due to the increased actuation of auxiliary hydraulic pump 1 for gearbox oil V475, better cooling is required for the control unit. This is more readily the case in the wheel housing rather than beneath the front seat in the vicinity of another heat-emitting control unit.

The function of the auxiliary hydraulic pump is monitored by the control unit for auxiliary hydraulic pump J922 and is reported to the automatic gearbox control unit J217.

Gearbox management system

The innovative thermal management system



The cooling system is only used by for other consumers once the combustion engine has reached its operating temperature. Via the CAN data bus, the gearbox control unit receives the information that the gearbox can be heated. The gearbox control unit supplies the cooling oil valve N471 with current; as a result, the pneumatic cut-off valve (rotary piston valve) is opened due to the vacuum which is released, and the warm coolant flows through the ATF pre-heater (plate heat exchanger) mounted on the gearbox.

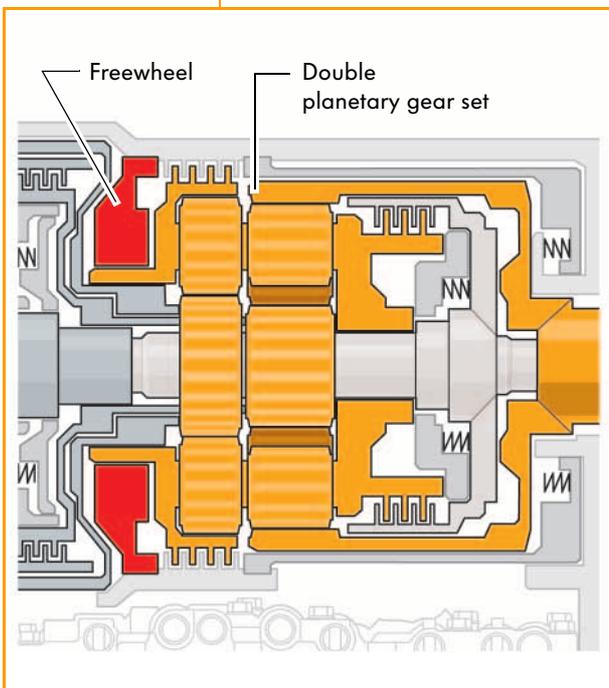
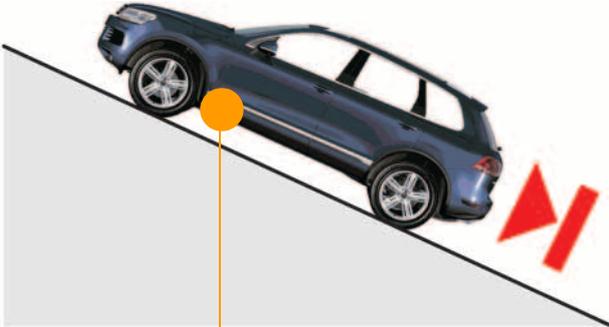
The ATF pre-heater consists of a set of plates soldered together to form a heat exchanger through which coolant and ATF flow.

In a very tight installation space, this leads to a relatively large heat transfer area, by means of which the coolant's heat is transferred to the ATF.



Further information on the innovative thermal management system can be found in SSP 450 "The Touareg Hybrid".

The hill-holder function



s466_077

This secures the vehicle to prevent it from rolling back and enables comfortable starting off on slopes.

In the Touareg 2011, the hill-holder function is undertaken by the electronic parking brake via the ABS control unit at an ATF temperature of less than approx. 10°C.

At temperatures above 10°C, the function is carried out by the gearbox. If the automatic gearbox control unit J217 detects a slope based on the rolling resistance whilst simultaneously detecting a vehicle speed of "zero", it shifts to 2nd gear.

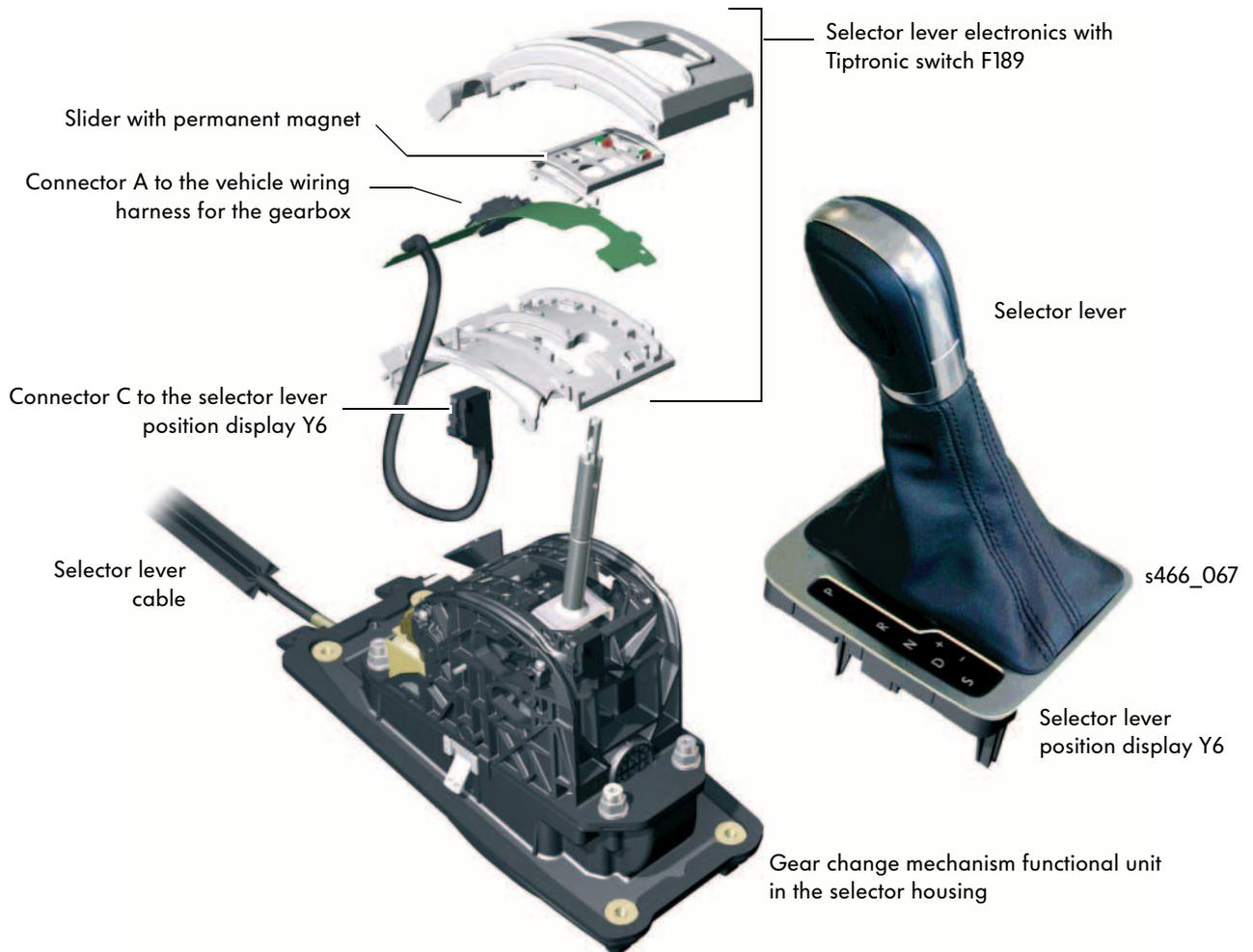
Rolling back is not possible in 2nd gear, because the double planetary gear set's annulus would have to rotate backwards counter to the locking freewheel.

The freewheel is only released when the starting torque is greater than the grade resistance, and the vehicle moves off comfortably.



Electrical components

The selector lever module



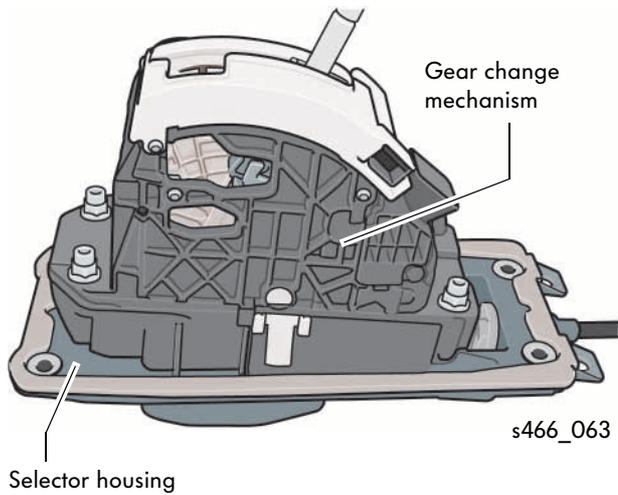
Gear changes are actuated via the selector lever module. This is equipped with both a mechanical connection to the automatic gearbox via a Bowden cable and an electrical connection to the gearbox management system.

Bowden cable connection functions

- Parking lock actuation
- Actuation of the hydraulic control system's mechanically operated spool valve
- Actuation of the multifunction switch on the gearbox

Electrical functions

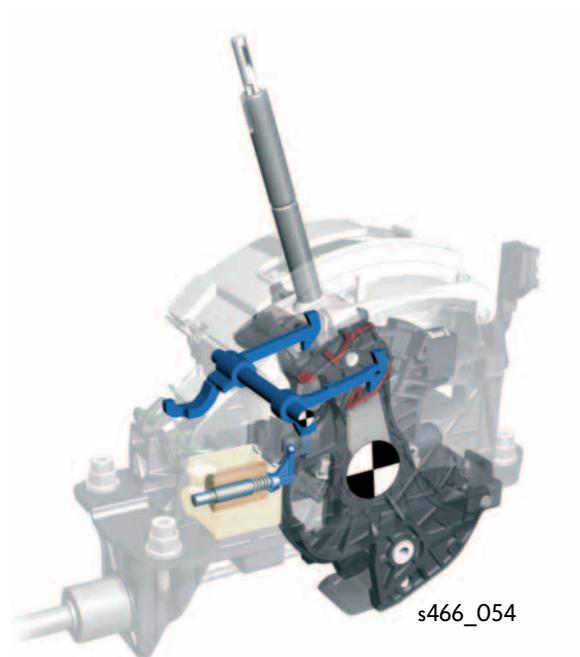
- Ignition key withdrawal lock
- Actuation of the selector lever position display unit (via the gearbox control unit)
- Tiptronic function
- Selector lever lock (P/N lock)



The gear change mechanism

The design and function of the gear change mechanism in the Touareg has been taken from the Audi Q7.

In the Touareg, the gear change mechanism and the selector housing cannot be separated.



Selector lever locks (P lock and P/N lock)

The selector lever lock is actuated when the ignition is switched on and in the P and N positions during vehicle operation. When the ignition key is removed, the system is locked in the P position. The locking mechanism enables the selector lever to be locked both when no current is supplied to the selector lever lock solenoid N110 (P position) and when current is supplied (N position).



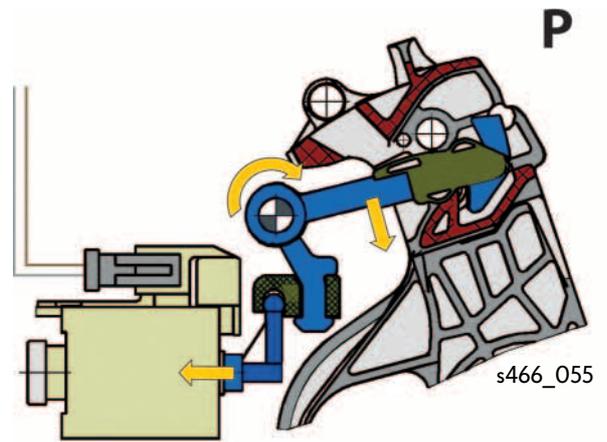
Electrical components

Lock in selector lever position P

The selector lever lock in selector lever position P is guaranteed by the fact that the locking lever automatically locks in this position.

If no current is supplied to selector lever lock solenoid N110, the locking lever automatically drops into the P catch as soon as the selector lever is brought to the P position. This locking lever movement is supported by a spring in the selector lever lock solenoid N110.

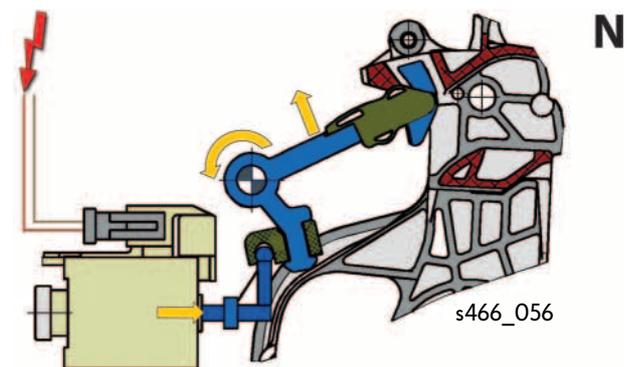
Selector lever lock solenoid N110 is supplied with current for unlocking purposes, as a result of which the solenoid pushes the locking lever out of the P catch. In the event of a defect or a current failure, the selector lever remains locked. An emergency release mechanism is available for such cases; see "emergency release".

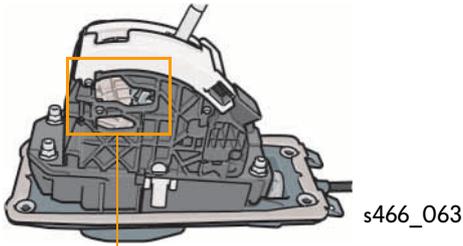


Lock in selector lever position N

If the selector lever is in the N position, selector lever lock solenoid N110 is actuated, whereupon it presses the locking lever into the N catch with its upper hook and locks the selector lever.

In order to release the lock, selector lever lock solenoid N110 is shut off and the locking lever drops down (as described under "Lock in selector lever position P").





P lock emergency release

P lock emergency release is described in the Workshop Manual.

In order to actuate the selector lever lock's emergency release mechanism, the selector lever cover must be pulled off from the centre console trim.

The emergency release mechanism's locking lever is located on the right-hand side of the gear change mechanism. To release the selector lever lock, the locking lever must be pulled up whilst simultaneously pressing the selector lever lock button.



Secure the vehicle to prevent it from rolling away before the selector lever is moved to the N position.



Selector lever position display Y6

The selector lever position information comes directly from the gearbox control unit as a frequency modulated rectangular signal (FMR signal).

The selector lever sensor system evaluates the signal and actuates the corresponding light-emitting diode in the selector lever position display Y6.



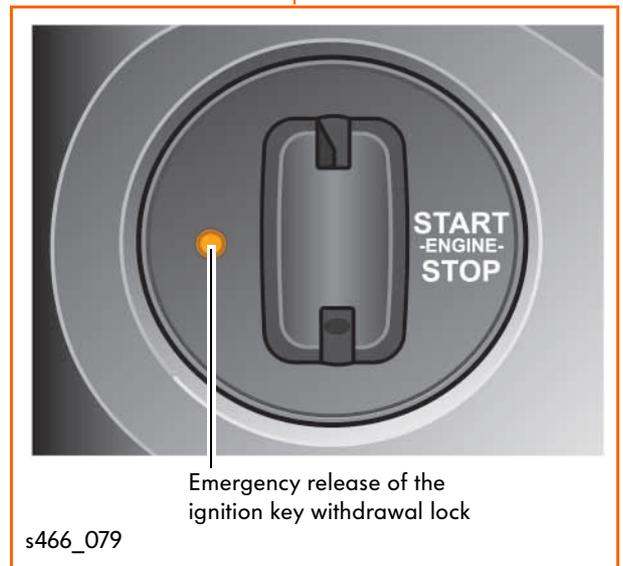
Electrical components

Ignition key withdrawal lock

The ignition key withdrawal lock operates electromagnetically by briefly actuating the ignition key withdrawal lock solenoid N376. To do this, the ignition lock D requires the selector lever position P information.

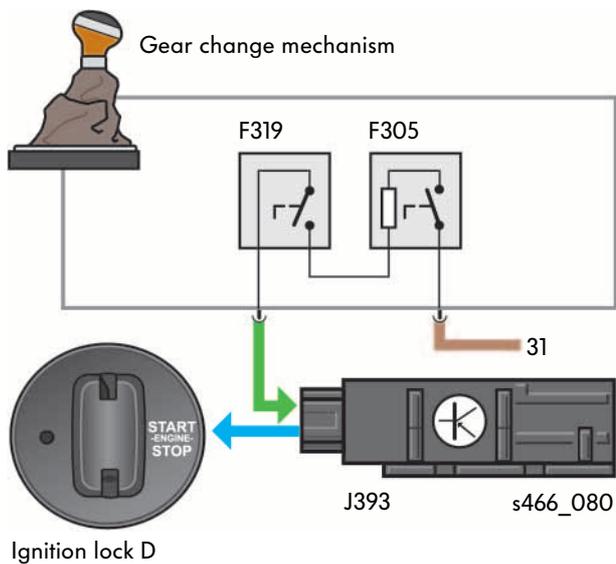
If the selector lever is not in the P position when the engine is switched off in vehicles fitted with a start/stop button, the dash panel insert then triggers an optical and acoustic warning. The driver is requested to move the selector lever to the P position.

In order to release the ignition key in an emergency, press the emergency release button with a pen or a similar object. Whilst the button is pressed, pull the ignition key out of the ignition lock.



Emergency release of the ignition key withdrawal lock





How it works

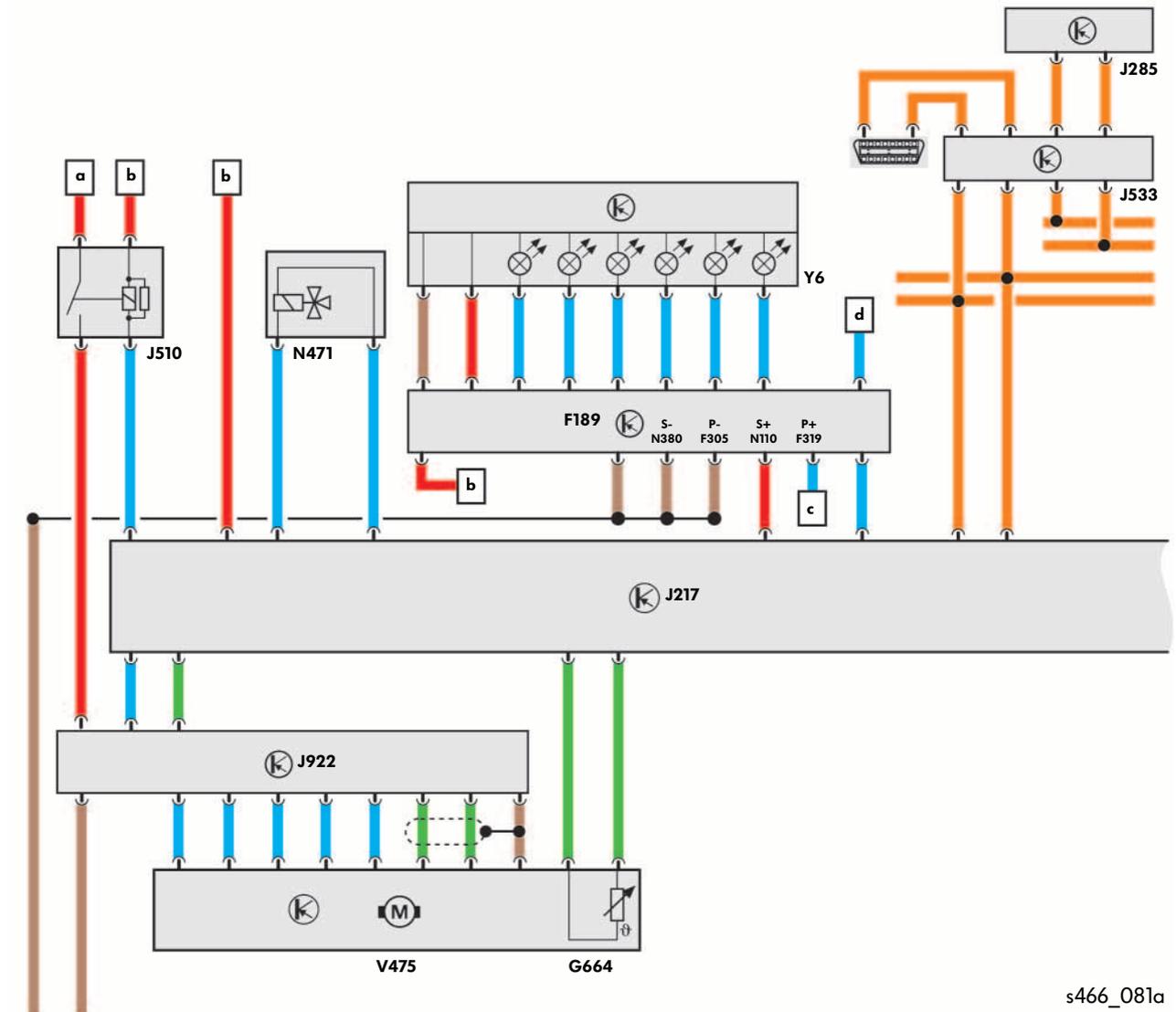
The selector lever position P information is supplied by the two mechanical microswitches F319 (selector lever locked in position P switch) and F305 (gear selector position P switch) to the convenience system central control unit J393. These are connected in series and form a single unit.

The selector lever locked in position P switch F319 is only closed when the selector lever button is released in selector lever position P. The gear selector position P switch F305 is closed when the locking lever for the P/N lock is in its basic position. It indicates selector lever locking in position P.

In selector lever position P, both switches are closed and supply an earth signal directly to the ignition lock D. If the ignition is switched off in this case, the ignition key withdrawal lock solenoid N376 is temporarily supplied with current by the ignition lock D, whereupon a release mechanism releases the ignition key lock.

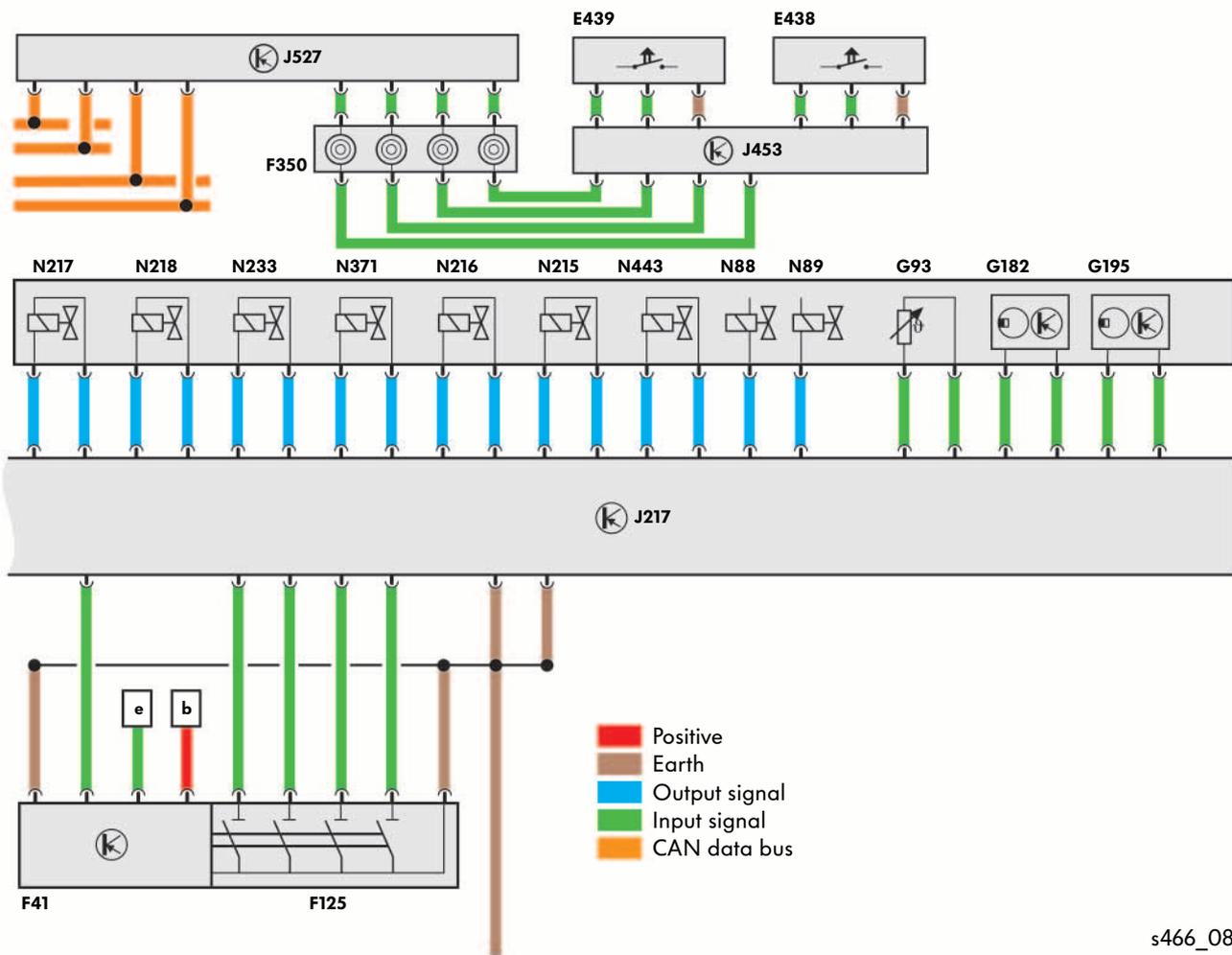


Functional diagram



s466_081a

- | | |
|---|---|
| <p>F189 Tiptronic switch</p> <p>F305 Gear selector position P switch</p> <p>F319 Selector lever locked in position P switch</p>
<p>G664 Oil temperature sender 2</p>
<p>J217 Automatic gearbox control unit</p> <p>J285 Control unit in dash panel insert</p> <p>J510 Gearbox hydraulic pump relay</p> <p>J533 Data bus diagnostic interface</p> <p>J922 Control unit for auxiliary hydraulic pump</p>
<p>N110 Selector lever lock solenoid</p> <p>N380 Selector lever position P solenoid</p> <p>N471 Cooling oil valve</p> | <p>V475 Auxiliary hydraulic pump 1 for gearbox oil</p>
<p>Y6 Selector lever position display</p>
<p>a Fuse holder D</p> <p>b Fuse holder C</p> <p>c Connection to the convenience system central control unit</p> <p>d Connection to the onboard supply control unit</p> <p>e Connection to the convenience system central control unit</p> |
|---|---|



s466_081b

E438 Tiptronic switch in steering wheel to shift up
E439 Tiptronic switch in steering wheel to shift down

F41 Reversing switch
F125 Multifunction switch
F350 Coil connector

G93 Gearbox oil temperature sender
G182 Gearbox input speed sender
G195 Gearbox output speed sender

J453 Multifunction steering wheel control unit
J527 Steering column electronics control unit

N88 Solenoid valve 1
N89 Solenoid valve 2
N215 Automatic gearbox pressure regulating valve 1
N216 Automatic gearbox pressure regulating valve 2
N217 Automatic gearbox pressure regulating valve 3
N218 Automatic gearbox pressure regulating valve 4
N233 Automatic gearbox pressure regulating valve 5
N371 Automatic gearbox pressure regulating valve 6
N443 Automatic gearbox pressure regulating valve 7



Test yourself

Which answers are correct?

One or several of the given answers may be correct.

1. How are the two additional gears in the 8-speed automatic gearbox 0C8 made possible?

- a) Via one additional clutch and one additional pressure regulating valve.
- b) Via two additional clutches and two additional pressure regulating valves.
- c) Via one additional clutch and two additional pressure regulating valves.
- d) Via two double planetary gear sets.

2. What is the task of the non-return ball valve in the auxiliary hydraulic pumps?

- a) It prevents the auxiliary lines from blocking.
- b) It prevents the oil pumped by the mechanical ATF pump from flowing back into the oil pan.
- c) It prevents the torque converter from running empty.
- d) It determines the engine oil's holding pressure.

3. Which of the single planetary gear set's components are connected via clutches to the double planetary gear set's components?

- a) Annulus H1 to sun gears S2 and S3 and planet carrier PT1 to sun gear S2.
- b) Planetary gears P1 to sun gear S2 and annulus H1 to sun gear S3.
- c) Annulus H1 to the inner planetary gears P3 and planet carrier PT1 to the outer planetary gears P3.

4. Name the components of a single planetary gear set.

5. Which control unit is informed of the operating temperature of the auxiliary hydraulic pump 1 for gearbox oil V475 by the oil temperature sender 2 G664?

- a) The automatic gearbox control unit J217.
- b) The control unit for auxiliary hydraulic pump 1 J922.
- c) The engine control unit J623.



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