Service Training

Commercial
Vehicles

Self-study programme 454

The 7-speed dual clutch gearbox 0BT in the T5 2010

Design and function

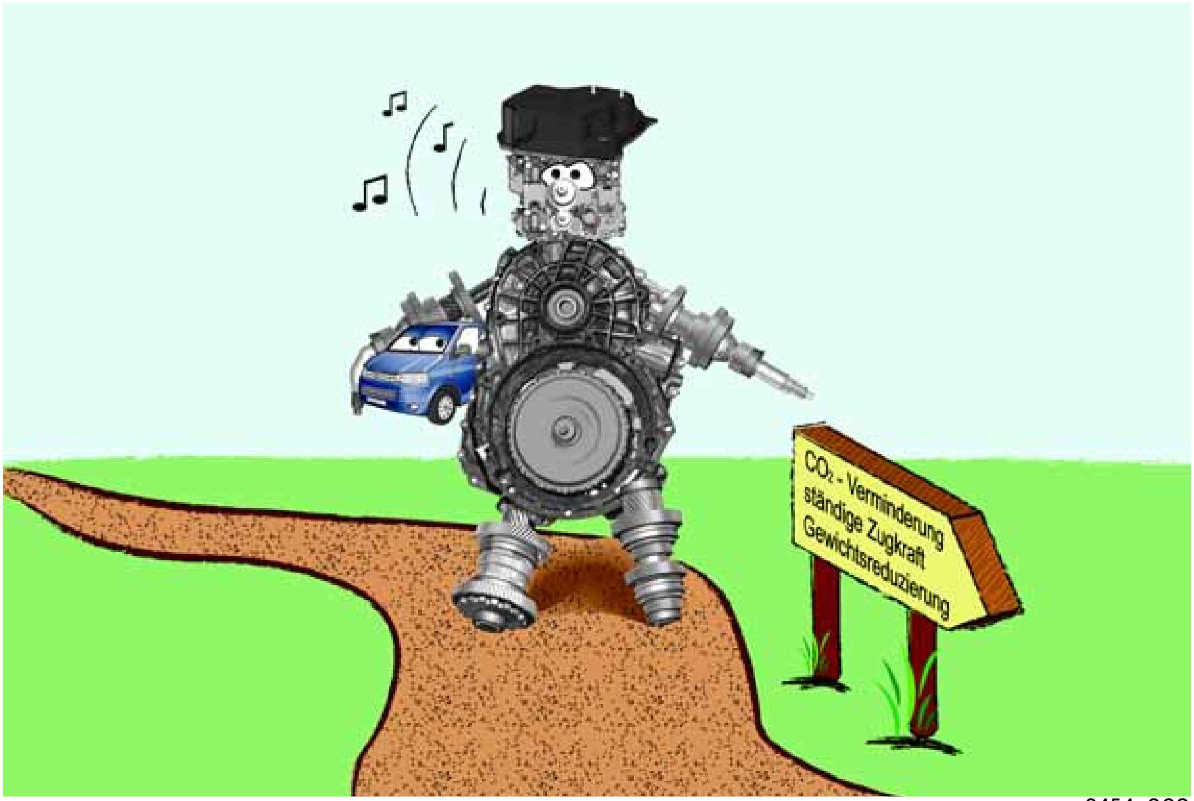
In 1940, Rudolf Franke registered a patent for a four-speed dual clutch gearbox. Franke's objective was to eliminate the interruption in tractive force during gear changes. It seems that Franke's patent application was the very first time that the term "interruption in tractive force during the gearshift" had been used.
The gearbox already contained almost all the features of modern designs, but it was not used - yet.

30 years later, Porsche developed a dual clutch gearbox with a dry clutch. This gearbox was used in the 962C racing car, and at Audi in the shortened rally Quattro.

Once again, decades were to pass until the state of the art technology enabled Volkswagen to mass produce the 6-speed dual clutch gearbox 02E in 2003.
The 6-speed DSG was exclusively used in the passenger car segment. The application range was first extended to the Transporter segment with the new 7-speed dual clutch gearbox 0BT.

This self-study programme aims to tell you what technical innovations and highlights were achieved.

We hope you enjoy reading it.



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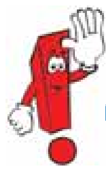
The self-study programme presents the design and function of new developments!
The content will not be updated.

Current testing, setting and repair instructions can be found in the provided After sales literature.

NEW



Important note

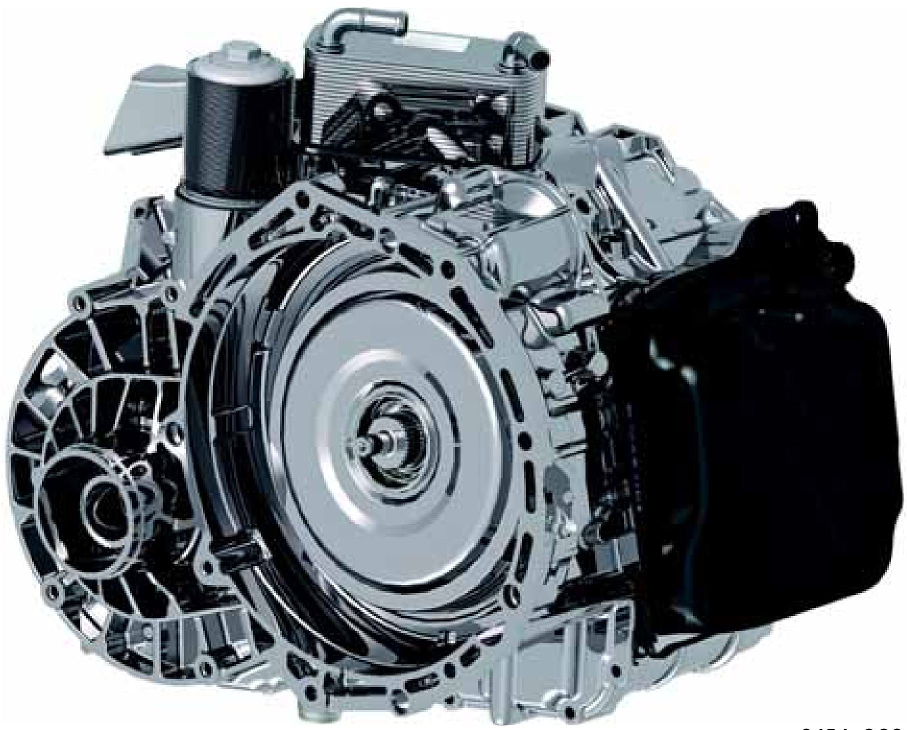
At a glance

The new 7-speed dual clutch gearbox 0BT

The 7-speed dual clutch gearbox 0BT is the logical development of the familiar and very successful 6-speed dual clutch gearbox 02E from Volkswagen.
The objective was to develop a gearbox that would not only combine the advantages of manual and automatic gearboxes, but also be able to transmit high torques with optimum use of space in order to permit subsequent use in passenger cars. Aspects such as fuel consumption reduction and lowering CO_2 emissions were also objectives in developing the 7-speed DSG 0BT.

Comfortable shifts without interruption in tractive force in the Transporter segment are now possible for the first time in the T5 2010. Initially, the 7-speed DSG will exclusively be used in conjunction with the 103 kW and 132 kW TDI engines, and it has been possible to combine it with 4MOTION four-wheel drive since March 2010.

The design for a maximum torque of 600 Nm means that it can also be used in heavy vehicles up to a gross vehicle weight rating of 3.2 tonnes.



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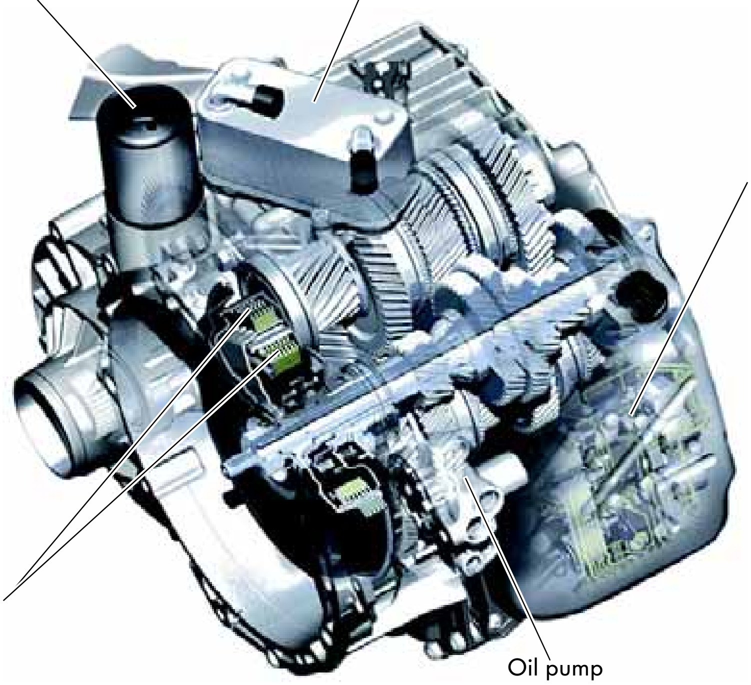
The gearbox was developed by Volkswagen, with the exception of a few components. It is completely produced in the Kassel plant. As a result, Volkswagen has achieved an increased proportion of in-house development expertise and depth of production.
The 7-speed dual clutch gearbox 0BT represents a milestone in the gearbox strategy of the Volkswagen Group, and contributes to further extending Volkswagen's technological lead.
No other automobile manufacturer is currently offering a dual clutch gearbox for commercial vehicles, and by this means Volkswagen Commercial Vehicles will continue to guarantee its market leadership in the Transporter segment.

Design features

- Design for a high input torque
- Two wet multi-disc clutches
- 7 forwards gears with overdrive (optimized for CO2) and one reverse gear; the T5 achieves maximum speed in 6th gear
- Discontinuation of the reverse shaft for the reverse gear
- Lower fuel consumption values and lower emissions values
- Preparation for tachograph as standard
- Can be combined with four-wheel drive (for more information about this, see SSP 453 "The T5 2010")



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Technical data

Designation	Dual clutch gearbox 0BT
Weight	95.6 kg (front-wheel drive), 123 kg (4MOTION)
Torque	600 Nm
Clutch	Two multi-disc wet clutches
Number of shafts	3
Gear ratios	7 forwards, 1 reverse gear
Spread	max. 7.45; 7.3 in the T5
Operating mode	Automatic and Tiptronic mode
Gearbox oil volume	7.5 l DSG oil (first fill) in the T5; "7.0 l in the Tiguan"
Oil change volume	Approx. 6.0 l in the T5 - oil specification G 052 182
Oil change interval	60,000 km
Oil filter	Lifetime-capable (no provision for changes in service)

Selector lever

Actuation

The selector lever is operated like a vehicle with an automatic gearbox. The 7-speed DSG also offers the possibility of gearshifts with Tiptronic.

For reasons of operational safety, the selector lever has a selector lever lock and an ignition key withdrawal lock, precisely like vehicles with an automatic gearbox. The functions of the locks are as before. The selector lever has a new design.

The selector lever positions are:

P - **P**ark
In order for the selector lever to be moved out of this position, the ignition must be "on" and the brake pedal pressed. In addition, the unlocking button on the selector lever must be pressed.

R - **R**everse gear
The unlocking button must be pressed in order for this gear to be engaged.

N - **N**eutral
The gearbox is in neutral in this position. If the selector lever is left in this position for some time, it is necessary to press the brake pedal again in order to move the selector lever out of the neutral position.

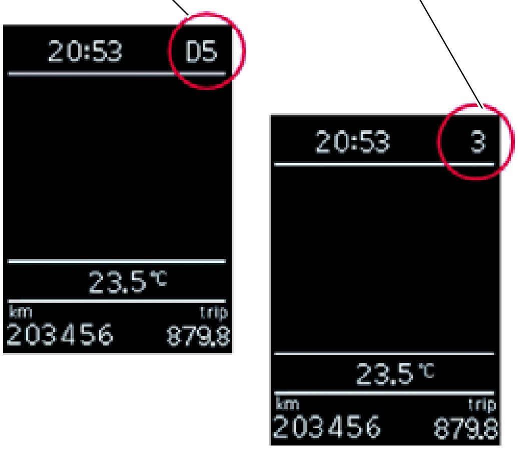
D - **D**rive
(driving forwards in the normal programme)
The forwards gears are shifted automatically in this drive position.

S - **S**port
Automatic gear selection is based on a "sporty" characteristic stored in the control unit.

+ and **-**
The Tiptronic functions can be performed in the right selector lever gate.

S454_005

The selector lever E313 communicates with the mechatronic unit for dual clutch gearbox J473 and with the control unit in dash panel insert J285 via the powertrain CAN.
The selector lever position and engaged gear are shown on the display of the dash panel insert.



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Structure of the selector lever

Selector lever E313

Hall sensors in the selector lever electronic control unit detect all selector lever positions and provide this information to the mechatronic unit via the powertrain CAN databus. A ball head connected to the selector lever uses a plastic slide to push the permanent magnet over the sensor system in synchronization with the selector lever. This means the control unit knows the selector lever position. In case of a fault, it is only possible to replace the complete selector lever.

Selector lever lock solenoid N110

The solenoid locks the selector lever in positions "P" and "N". The solenoid is controlled by the selector lever electronic control unit.

Intermediate sensor

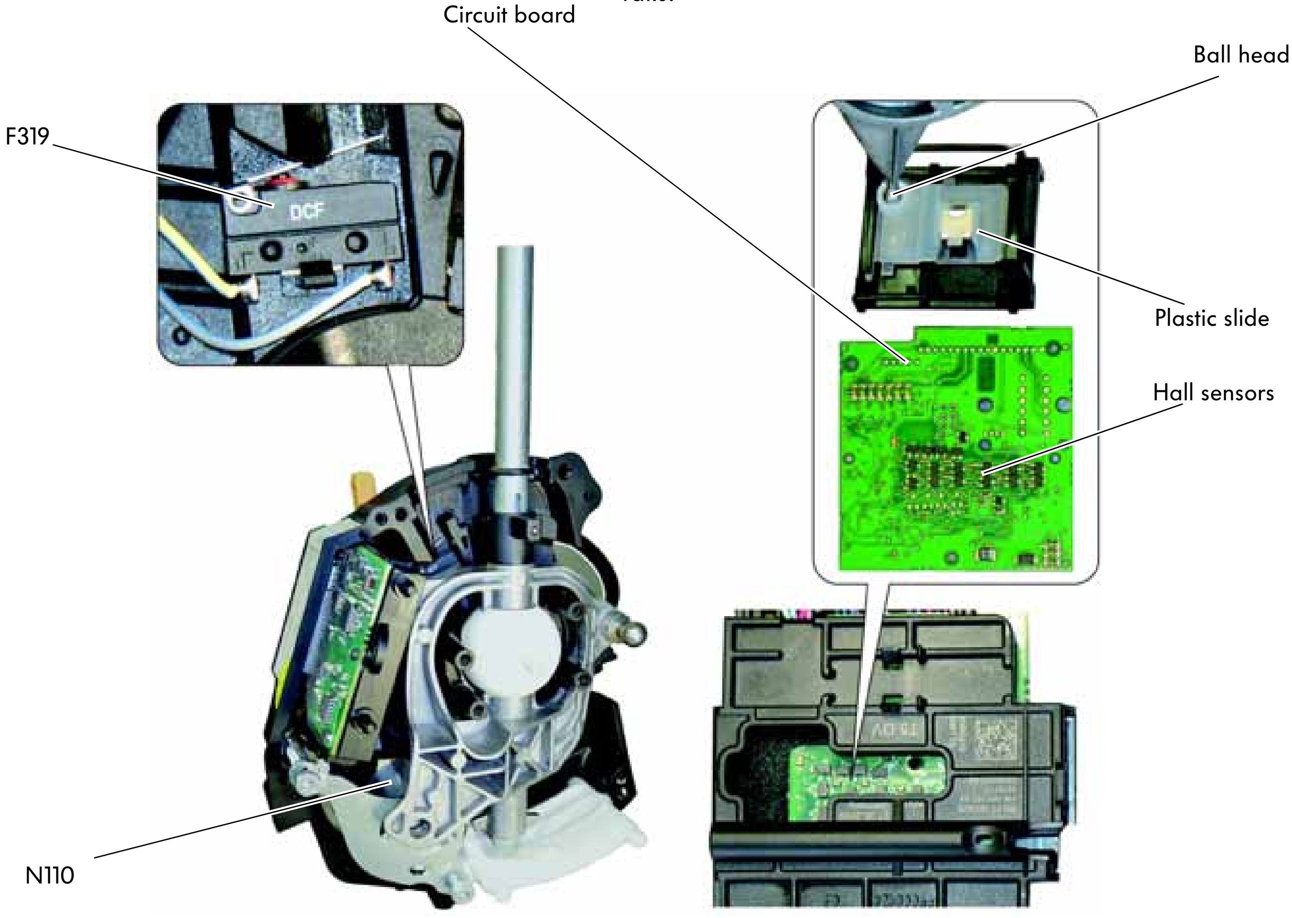
An intermediate sensor detects the selector lever position between "P" and "R". The intermediate position is detected in order to avoid mis-interpretations of the selector lever position, that would lead to malfunctions in the gearbox control unit.

Selector lever in "P" lock switch F319

If the selector lever is in the "P" position, the switch sends the signal - selector lever in "P" position - to the selector lever electronic control unit. The selector lever electronic control unit requires this signal for controlling the ignition key withdrawal lock.

Emergency unlocking

Mechanical emergency unlocking makes it possible to move the selector lever if the electrical power supply fails.



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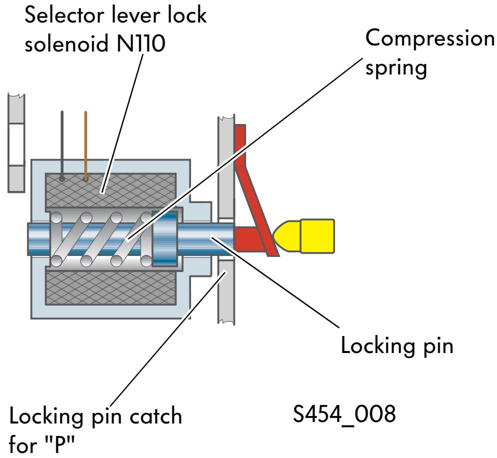
Selector lever lock solenoid N110

This is how it functions:

Selector lever locked in "P":

If the selector lever is in "P" then the locking pin is in the "P" locking pin catch.
This prevents the selector lever being moved inadvertently.



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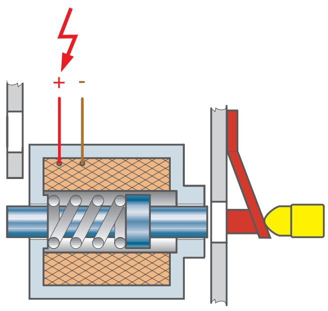
Selector lever unlocked:

After the ignition has been switched on and the brake pedal pressed, the selector lever electronic control unit energises solenoid N110.
This pulls the locking pin out of the locking pin catch "P".

The selector lever can now be moved into the drive position. Once the selector lever has moved out of the P position, solenoid N110 is deenergised.



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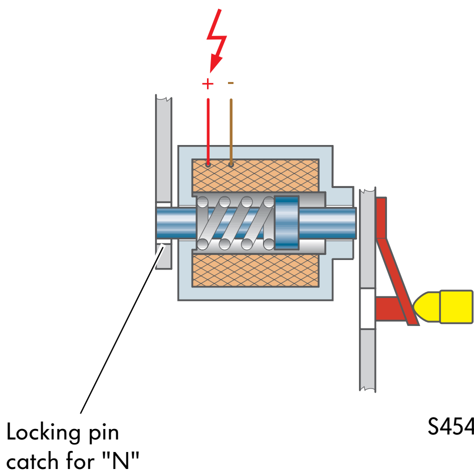
Selector lever locked in "N":

If the selector lever is left in the "N" position for longer than 2 seconds, the selector lever electronic control unit energises solenoid N110.
This means the locking pin is pushed into the locking pin catch "N". The selector lever can no longer be moved into a drive range inadvertently. The locking pin is released when the brake pedal is pressed.



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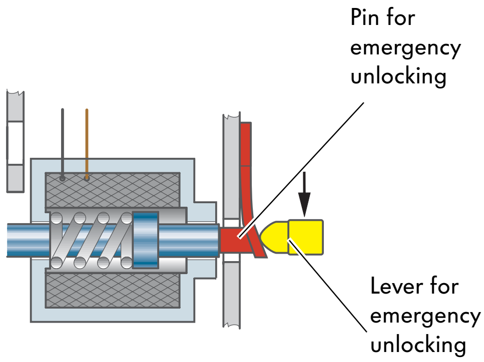
Emergency unlocking

In case of a failure of the electrical power supply to the selector lever lock solenoid N110, the selector lever can no longer be moved because the selector lever lock "P" remains activated due to the return force of the compression spring when there is no electrical power supply.

Operating the lever for emergency unlocking enables the lock to be released, and the selector lever can be moved to any drive range.

The selector lever sleeve must be pulled upwards in order to do this. After this, the lock button on the selector lever grip must be pressed. By pulling the lever for emergency unlocking at the same time, the locking pin for the selector lever lock is mechanically unlocked. The lever can now be moved out of the park locking position. This means the vehicle can once again be moved.



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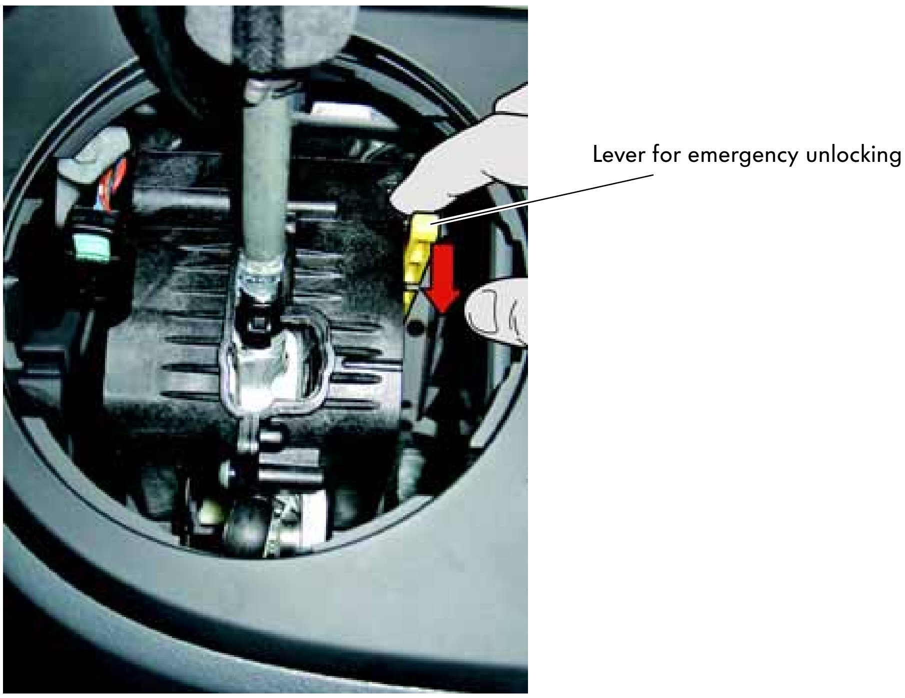

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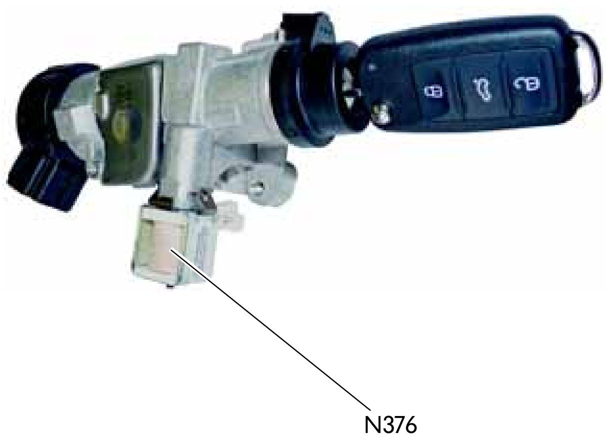
Ignition key withdrawal lock

The ignition key withdrawal lock prevents the ignition key from being turned back to the withdrawal position if the parking lock is not engaged.

It functions electromechanically and is controlled by the selector lever E313.

The selector lever electronic control unit detects the position of the selector lever by the signal from the "selector lever locked in position P switch" F319.

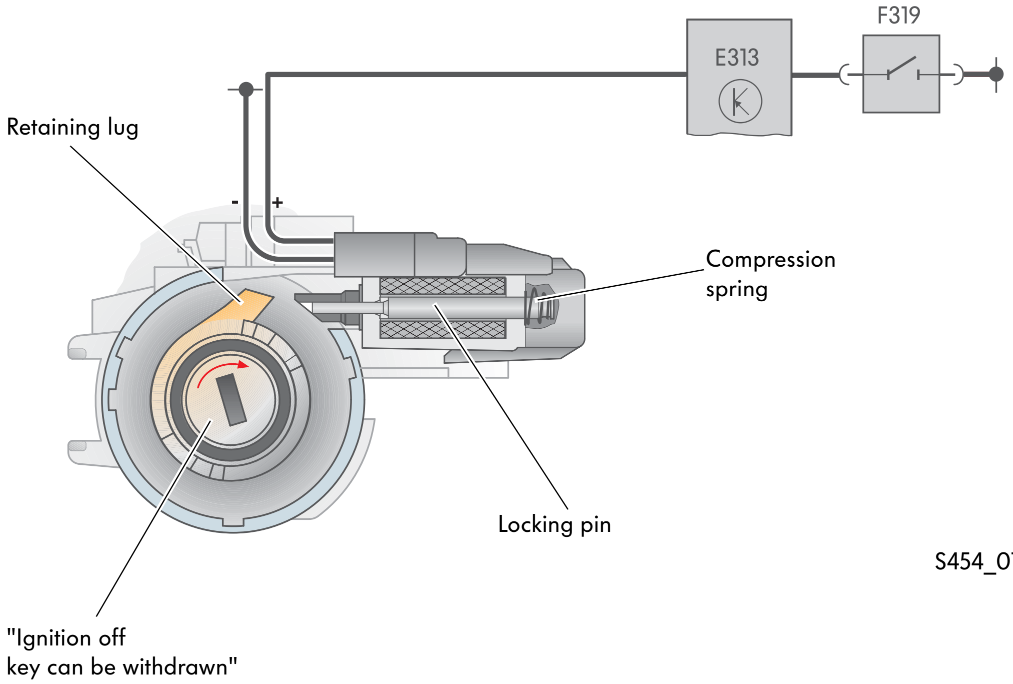
The solenoid for the ignition key withdrawal lock N376 is activated directly by the selector lever according to the switch signal.



This is how it functions:

Switch F319 is open if the selector lever is in the park position.
The selector lever electronic control unit detects when switch F319 is open. The solenoid for the ignition key withdrawal lock N376 is not energised, and the compression spring in the solenoid presses the locking pin into the release position.

The ignition key can be withdrawn.



S454_013

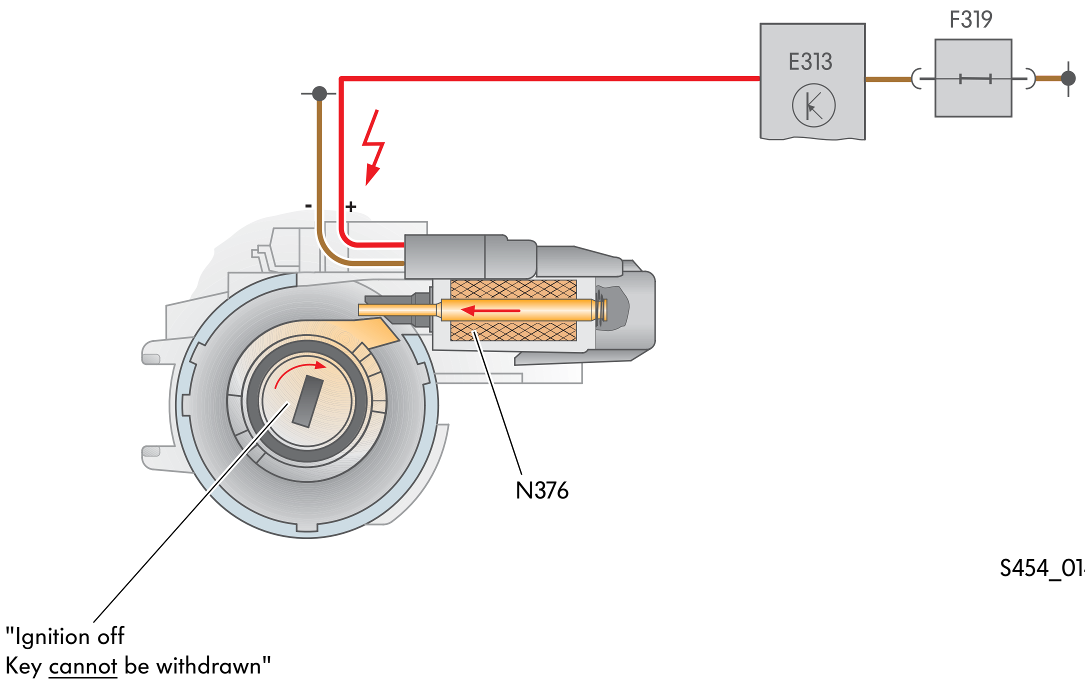
This is how it functions:

Switch F319 is closed if the selector lever is in the drive position.
The selector lever electronic control unit detects that switch F319 is closed, the solenoid for the ignition key withdrawal lock N376 is energised and presses the locking pin against the spring force into the lock position.

In the lock position, the locking pin prevents the ignition key from being turned back to the withdrawal position and from being withdrawn.

The "selector lever locked in position P switch" does not open until the selector lever is moved into the park position, and the selector lever electronic control unit deenergises the solenoid.

Following this, the locking pin is pushed back by the compression spring. The ignition key can be turned further and withdrawn.



S454_014

The basic principle

The 7-speed DSG is designed as a fully synchronised, locking collar change gearbox with 3 shafts. Basically, it is composed of two mutually independent sub-gearboxes.

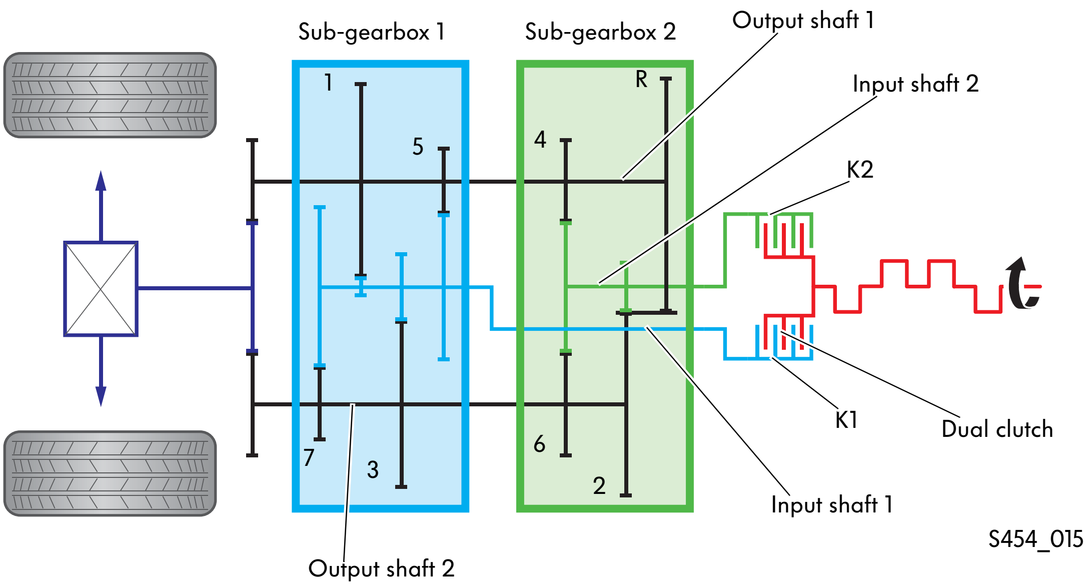
Each sub-gearbox is structured to function as a conventional manual gearbox. A multi-disc clutch is assigned to each sub-gearbox.

Both multi-disc clutches run in DSG oil.
They are opened and closed by the mechatronic unit, according to the gear which is to be engaged.

When 1st, 3rd, 5th or 7th gear is engaged, the powerflow is via clutch K1.

When 2nd, 4th, 6th or reverse gear is engaged, the powerflow is via clutch K2. Mechanically, two gears are always engaged at the same time. Whilst driving, only one sub-gearbox at a time is connected to the powerflow via clutch K1 or K2. This permits a gearshift without interruption in tractive force.

The other sub-gearbox has the next-higher or next-lower gear engaged, depending on the driving situation, whereas the corresponding clutch is still open. A conventional synchronisation and selector unit as used in a manual gearbox is assigned to each gear.



S454_015

The torque input

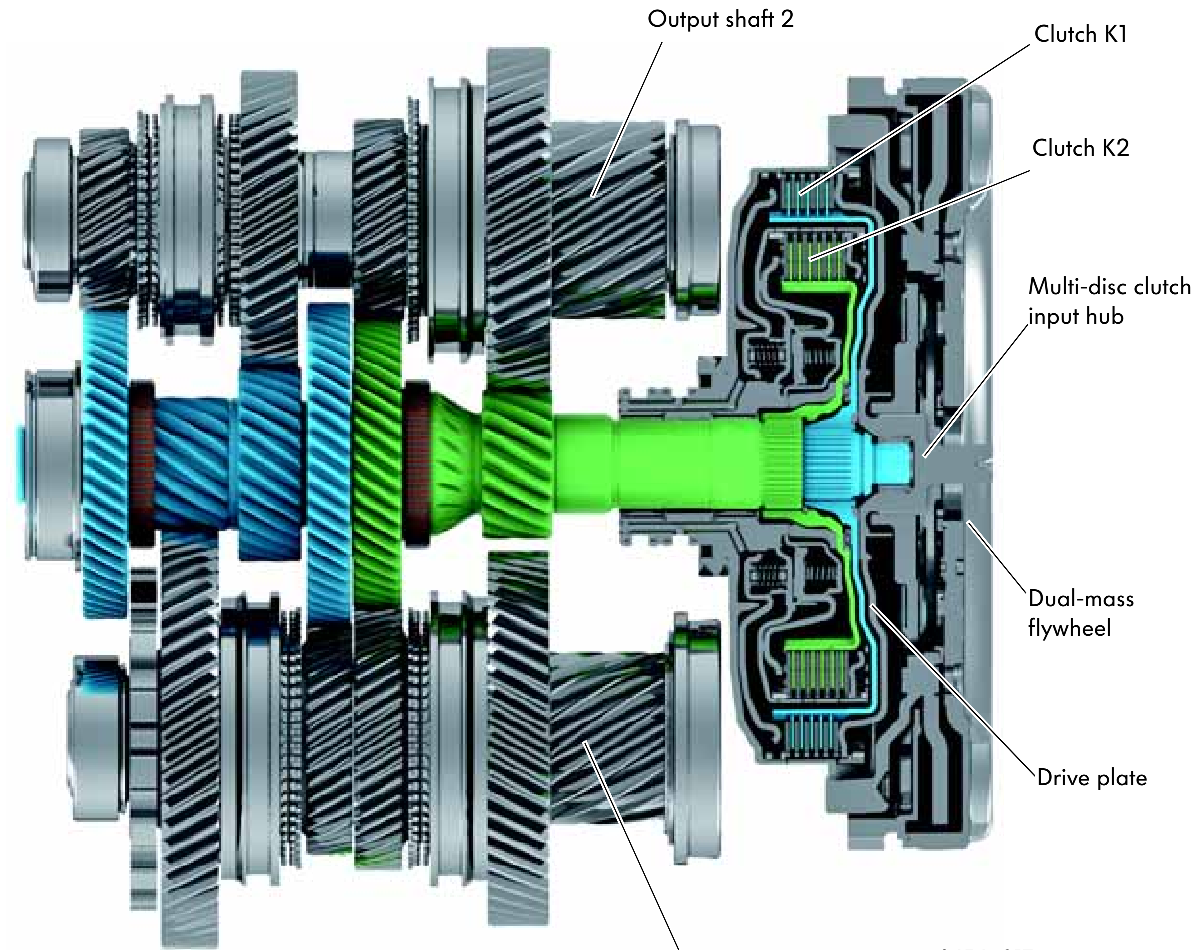
The engine torque is transferred from the dual-mass flywheel onto the input hub of the multi-disc clutch by means of splines.

The input hub is welded onto the drive plate. The drive plate is connected to the outer disc carrier of clutch K1, and thus transmits the engine torque into the dual clutch.

S454_016

The outer disc carrier of clutch K1 and the outer disc carrier of clutch K2 are both welded onto the main hub, and are therefore always in the powerflow.

The inner disc carrier of clutch K1 is connected to input shaft 1 by means of splines. The inner disc carrier of clutch K2 is connected to input shaft 2.



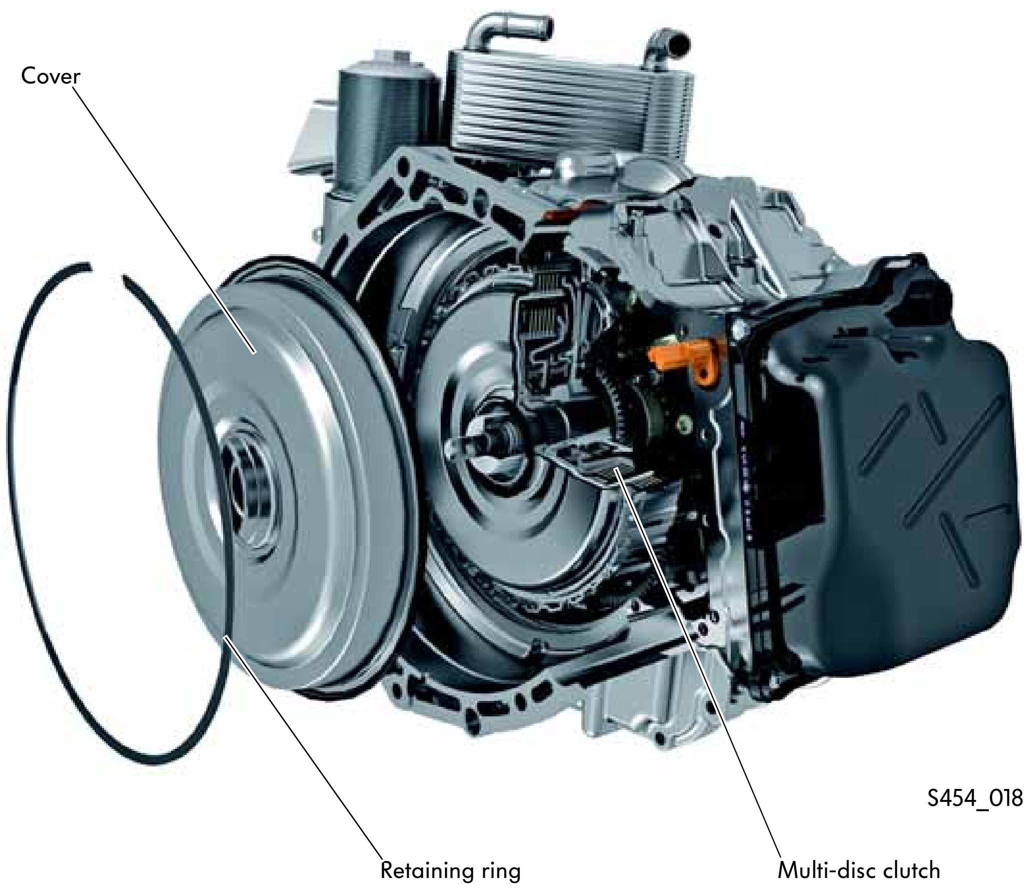
S454_017

Structure of the gearbox

The multi-disc clutches

The dual clutch of the 7-speed DSG is a wet multi-disc clutch. It runs continuously in DSG oil. It is operated hydraulically by the electrohydraulic control unit. It is cooled with DSG oil depending on the current gear oil temperature. The clutch housing is sealed against the engine by means of a cover. The cover is secured in the clutch housing with a retaining ring.

A new dual clutch is used in the 7-speed DSG 0BT. It has a larger diameter and is flatter overall. An additional lined disc in clutch K1 and two additional lined discs in clutch K2 increase the overall friction surface of the clutch.



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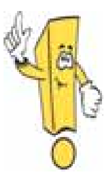


The hydraulic pump is driven directly off the multi-disc clutch by means of an input gear.
For more information, refer to the "The hydraulic pump" chapter

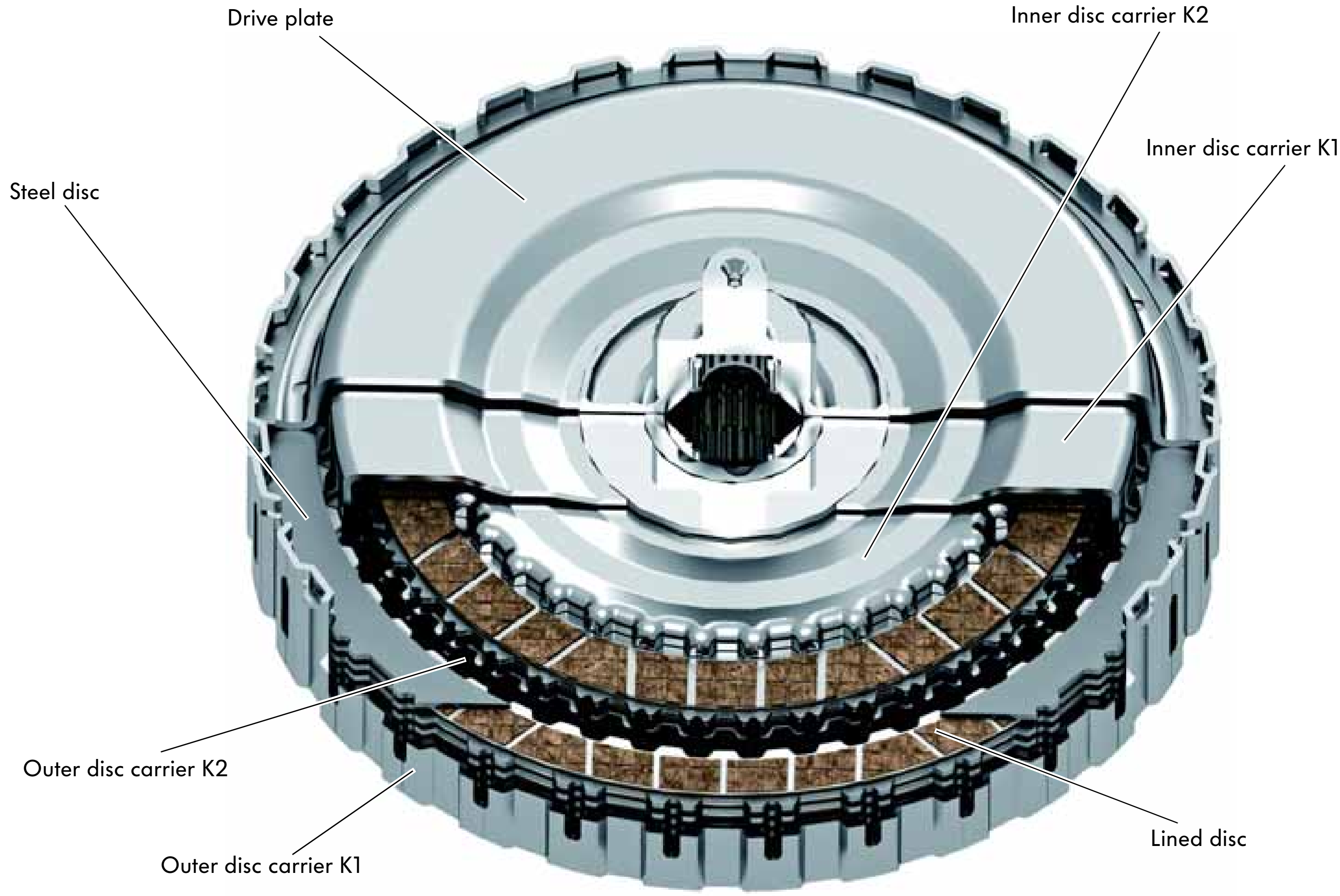
Structure of the multi-disc clutch

The engine torque is transferred into the outer disc carriers of both clutches via the drive plate.
The outer disc carriers are welded onto the main hub of the multi-disc clutch, which means they are always in the powerflow.

Each clutch pack is made up of steel and lined discs; when a particular clutch is in the powerflow, torque is transmitted onto the inner disc carrier of clutch K1 or clutch K2.

The steel discs are in a positive connection with the outer disc carriers of the clutches. The lined discs are in a positive connection with the inner disc carriers.

The disc packs are pressed together hydraulically, and the torque from the inner disc carrier is transmitted via splines to the corresponding input shaft.
The inner disc carrier of clutch K1 is connected to input shaft 1, the inner disc carrier of clutch K2 is connected to input shaft 2.



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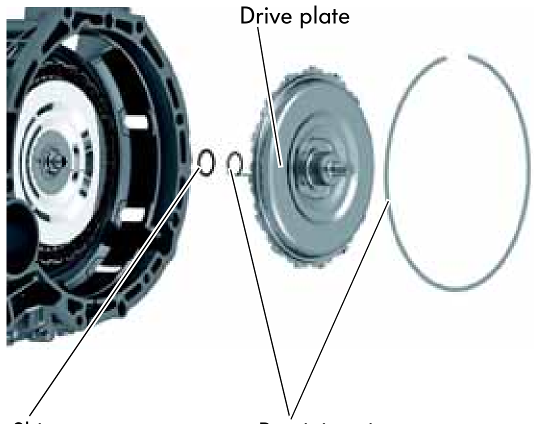
Structure of the gearbox

Assembly work on the multi-disc clutch

The drive plate must be removed in order for the multi-disc clutch to be removed from the gearbox. It is secured in the outer disc carrier of clutch K1 by means of a retaining ring.
The clutch is fixed onto the input shafts by means of a retaining ring and a shim.

Refer to the workshop manual for information about finding the thickness of the shim.



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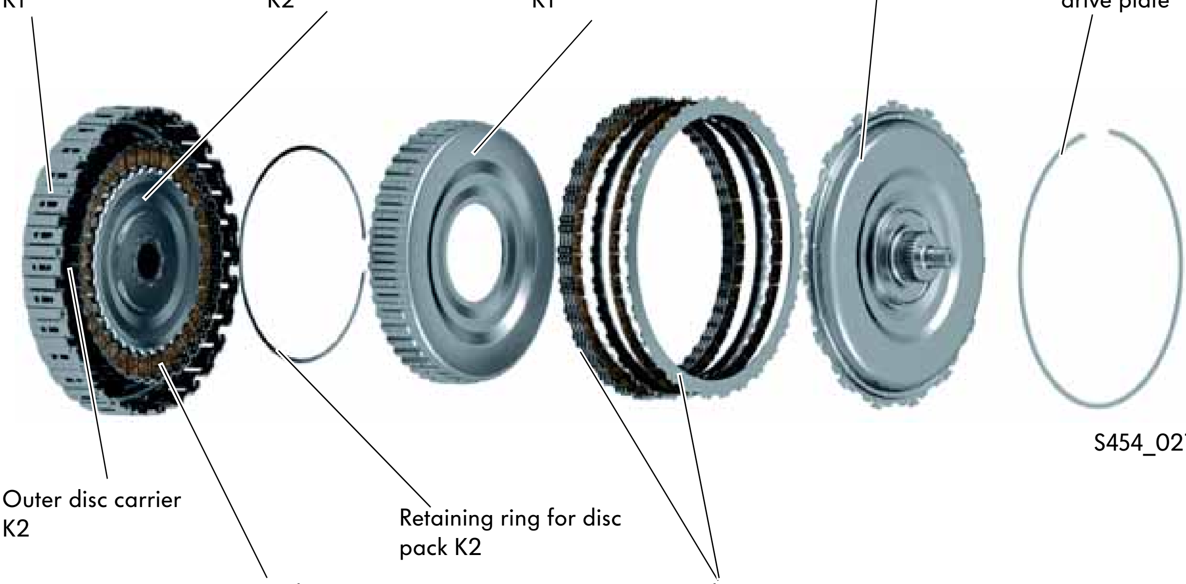
The steel discs are subject to component tolerances in the material structure. Therefore, the disc packs are aligned with one another in the factory according to a defined order, and inserted into the clutch.
If the steel and lined discs fall out during work in the workshop area and are not reinstalled in the correct position, this will lead to malfunctions of the clutch - starting jolts, for example. The clutch must be renewed.
The disc pack of clutch K2 is secured against its outer disc carrier by means of a retaining ring.

The disc pack of clutch K1 is not additionally secured with a retaining ring. If the drive plate is removed, the steel and lined discs can drop out of the clutch! The different disc thicknesses mean that reassembly by hand in the workshop is not possible.



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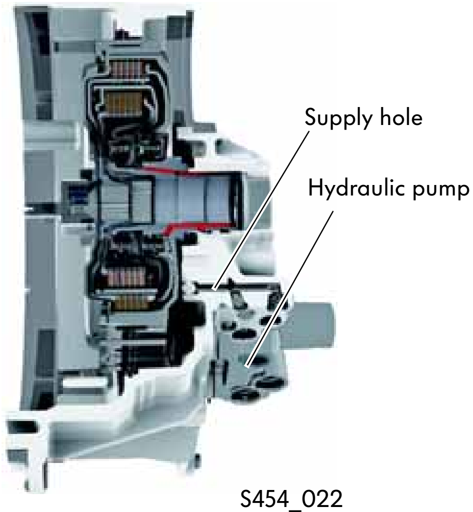
Oil supply to the multi-disc clutch

The compressed oil supply to the clutches comes via the main hub using two rotating unions. One rotating union supplies clutch K1 with oil, the second supplies clutch K2. Four rectangular rings ensure radial sealing between the gearbox housing and main hub.



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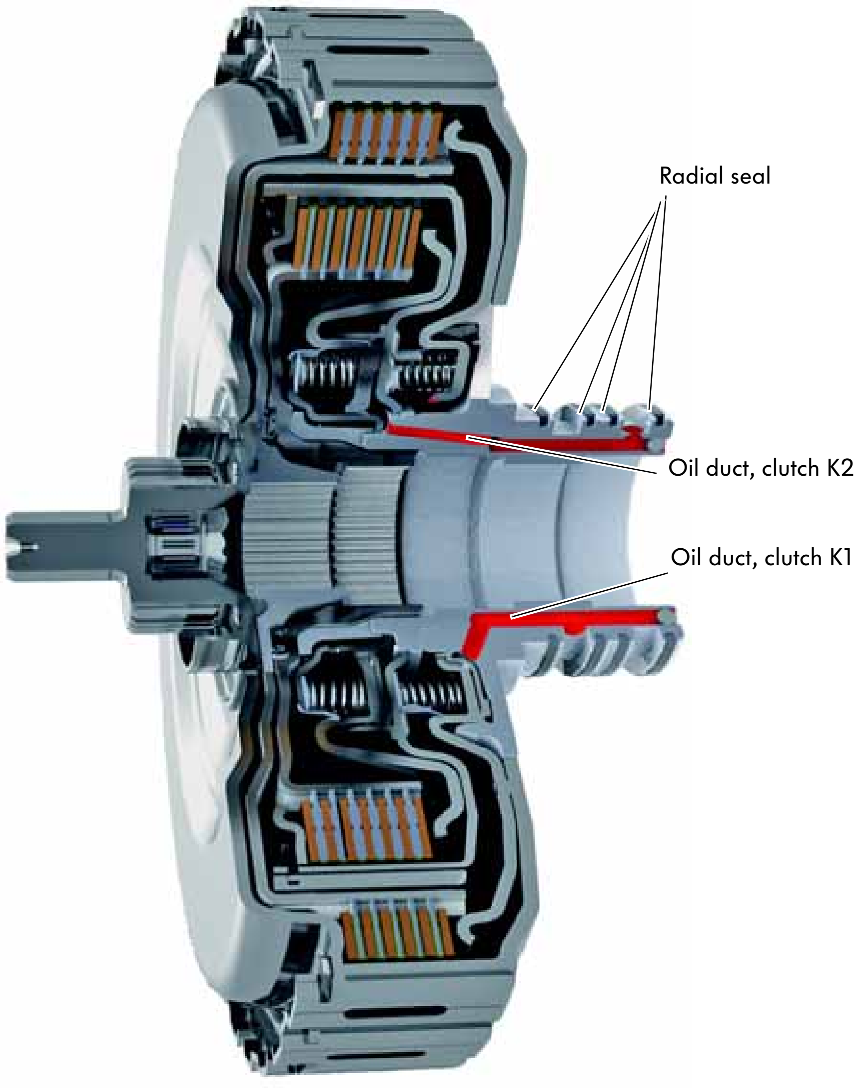

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Multi-disc clutch K1

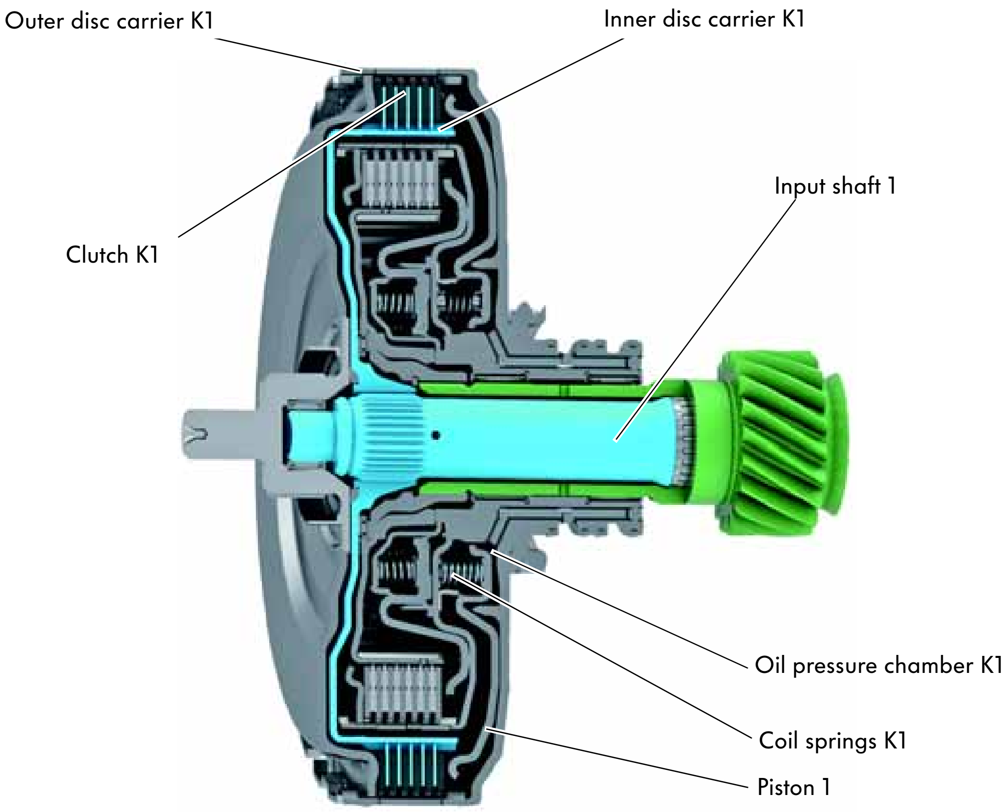
Clutch K1 is the outer clutch and transmits the torque onto input shaft 1 for gears 1, 3, 5 and 7.

The torque is transferred into clutch K1 by the outer disc carrier. The gear oil in the oil pressure chamber of the clutch is pressurised in order to close the clutch.

This displaces piston 1 and presses the disc pack of clutch K1 together.

The torque is transmitted via the disc pack onto the inner disc carrier and from there to input shaft 1.

When the clutch is opened, the coil springs force piston 1 back into its starting position.



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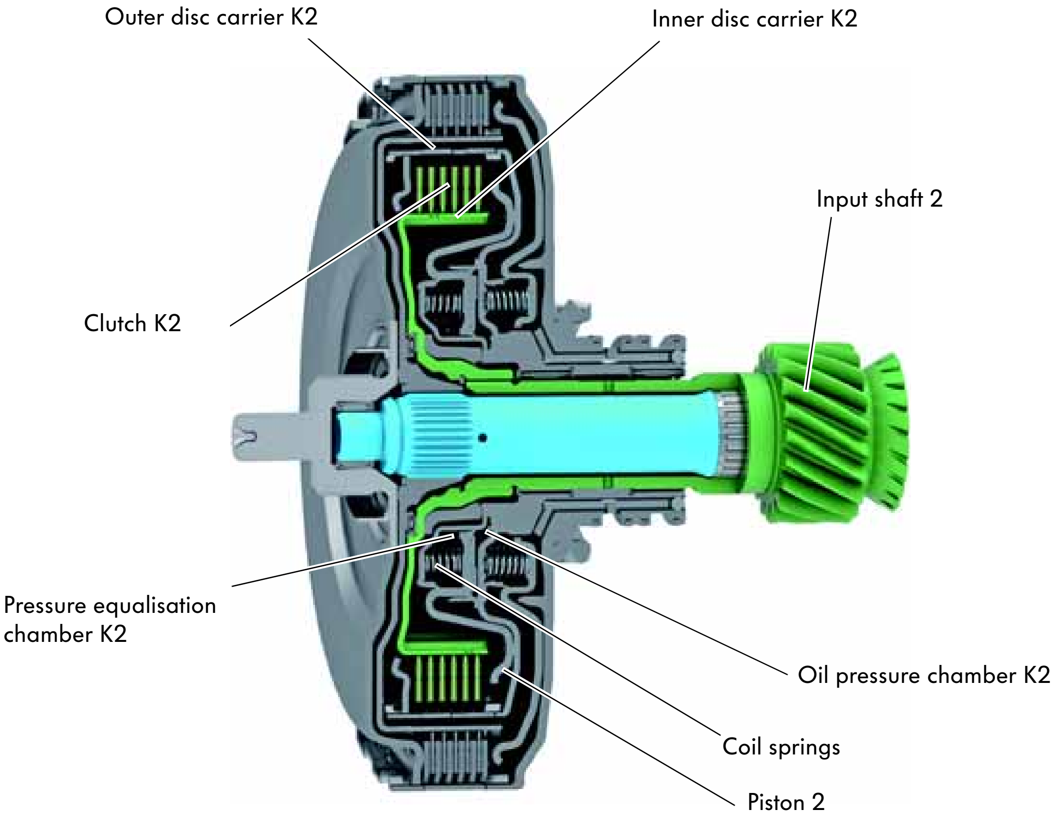
Multi-disc clutch K2

Clutch K2 is the inner clutch and transmits the torque onto input shaft 2 for gears 2, 4, 6 and reverse gear.

The torque is transferred into clutch K2 by the outer disc carrier. The gear oil in oil pressure chamber K2 is compressed to close the clutch.

Piston K2 then completes the powerflow through the multi-disc pack and onto input shaft 2.

The coil springs press piston 2 back into its starting position when the clutch opens.



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Structure of the gearbox

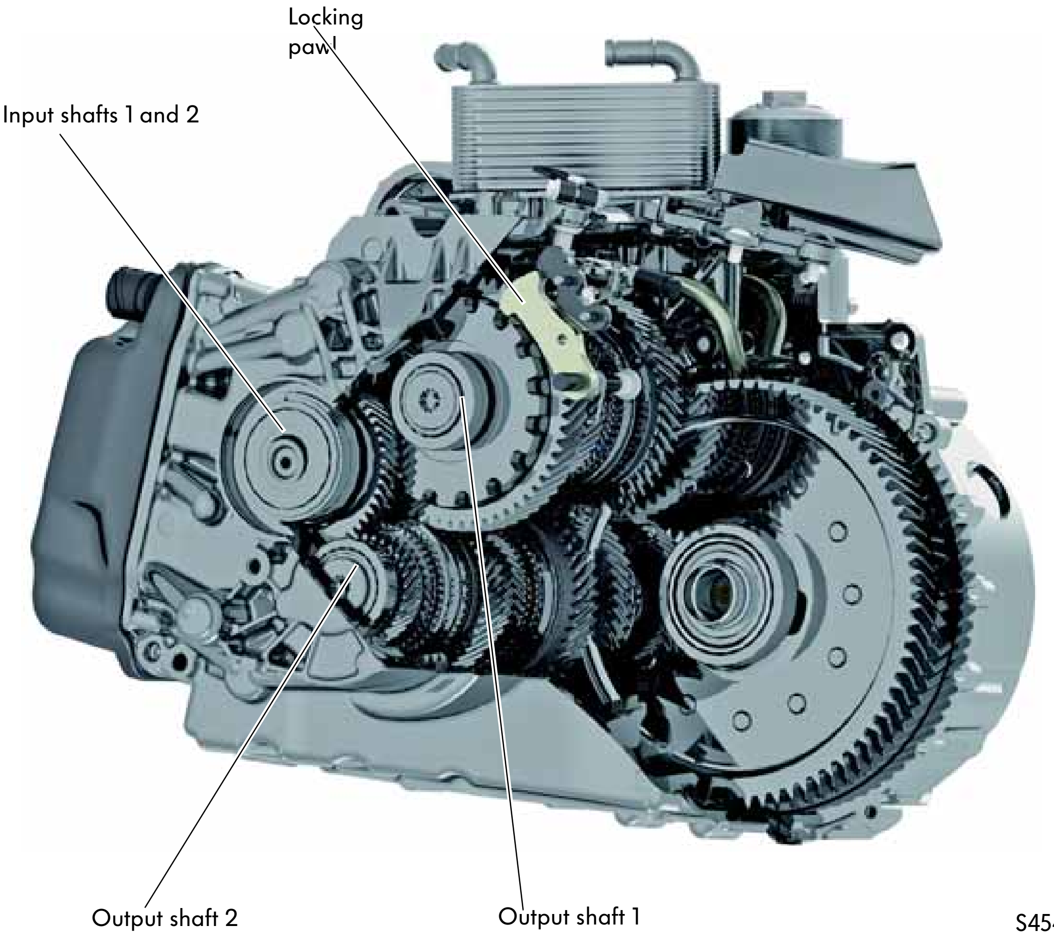
The gearbox shafts

The 7-speed DSG is a 3-shaft gearbox. The input shaft consists of two independent shafts which are grouped together as a compact unit.

There is an axial and two radial bearings between the two input shafts. Each of the input shafts is mounted in an anti-friction bearing in the gearbox housing.

The synchromeshed gears (idler gears) and the synchro-hubs are located on both output shafts. Each of the shafts is mounted in the gearbox housing in two tapered roller bearings.

The parking lock splines are located on output shaft 1 in the form of a fixed gear. The actuation mechanism has been incorporated in the gearbox housing. Output shaft 1 is locked when the parking lock is engaged.



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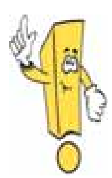


The reverse shaft for changing direction to reverse driving has been discontinued. The change of direction function in the 7-speed DSG 0BT is carried out by the 2nd gear synchromeshed gear. Refer to the "The reverse gear" and "The 2nd gear" chapters to find out how it works and what design changes had to be made

The input shafts

The input shafts are arranged as a compact unit in the gearbox housing.

Input shaft 2 has been drilled out hollow. Input shaft 1 is inserted into the drilled-out input shaft 2.

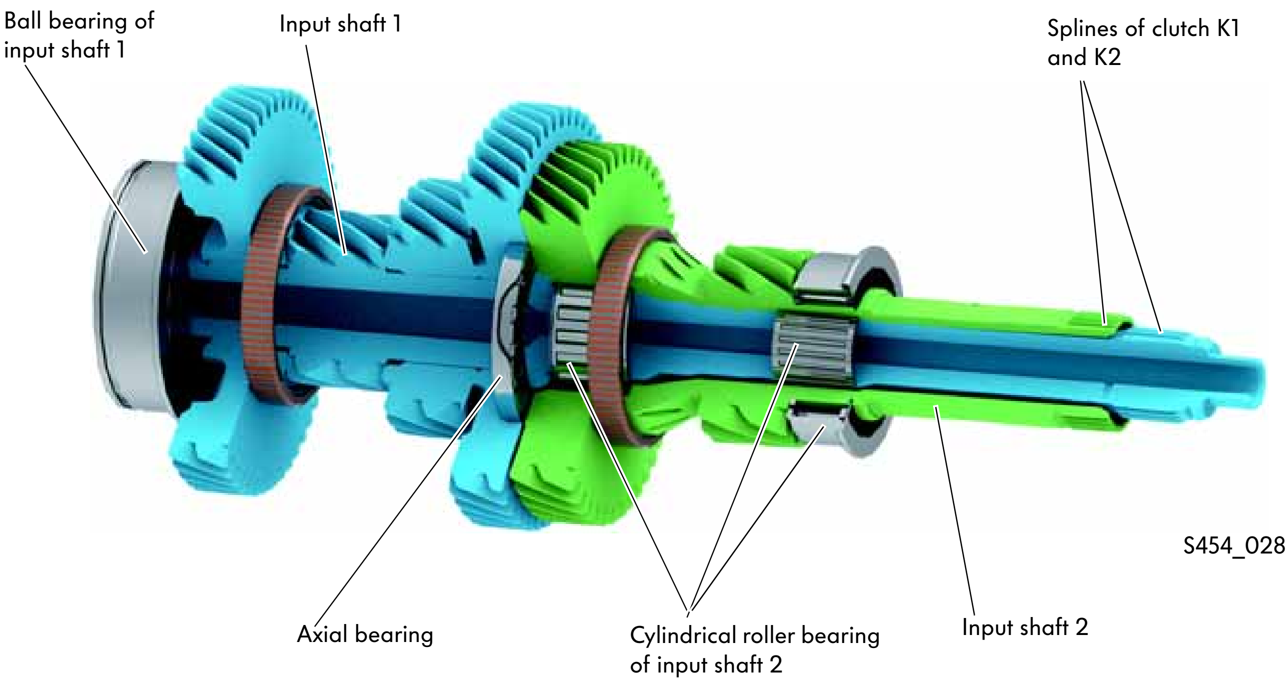
Input shaft 1 is connected to a clutch by means of splines. It carries the torque from the engine to the output shaft according to which gear is engaged.

Anti-friction bearings are located on each shaft, by means of which the input shafts are guided in the housing.

Input shaft 1 is mounted in a ball race, input shaft 2 in cylindrical roller bearings. There is an axial bearing installed between both input shafts in order to absorb axial forces.

S454_027

For a better view, the gearbox shafts are not shown in their actual position, but in one plane.



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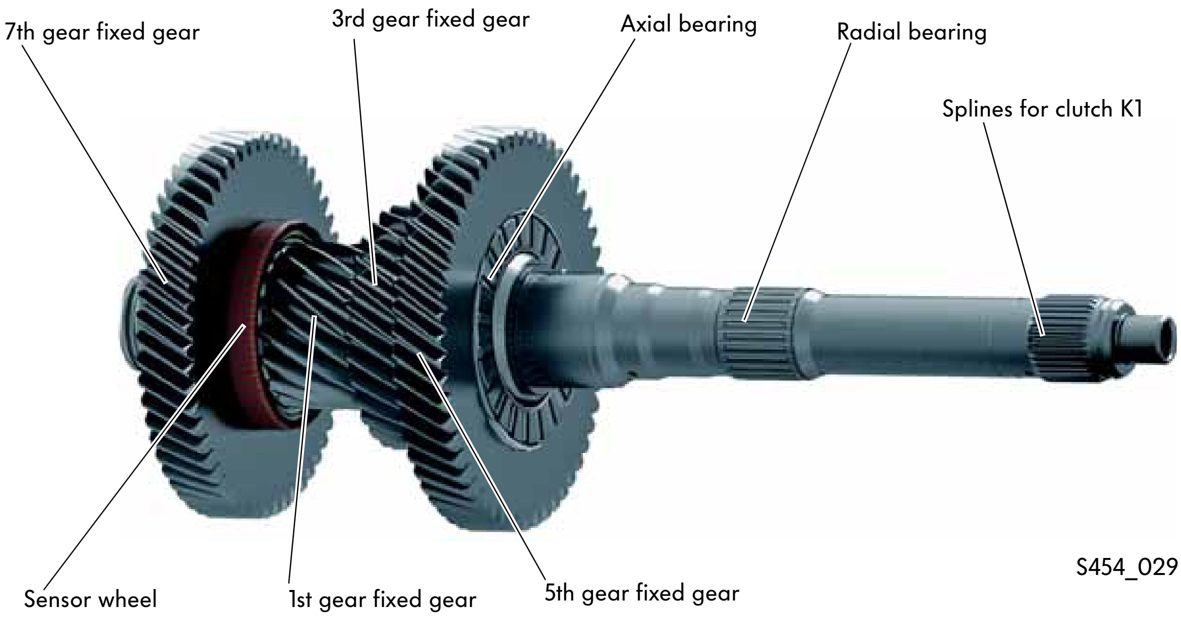
Input shaft 1

Input shaft 1 is connected to clutch K1 by means of splines. It is used for engaging gears 1, 3, 5 and 7.

There is a sensor wheel on the input shaft for the input shaft speed sender 1 G501 in order to detect the rotation speed of the input shaft.

Two radial bearings and one axial bearing guide input shaft 2 and support it against input shaft 1.



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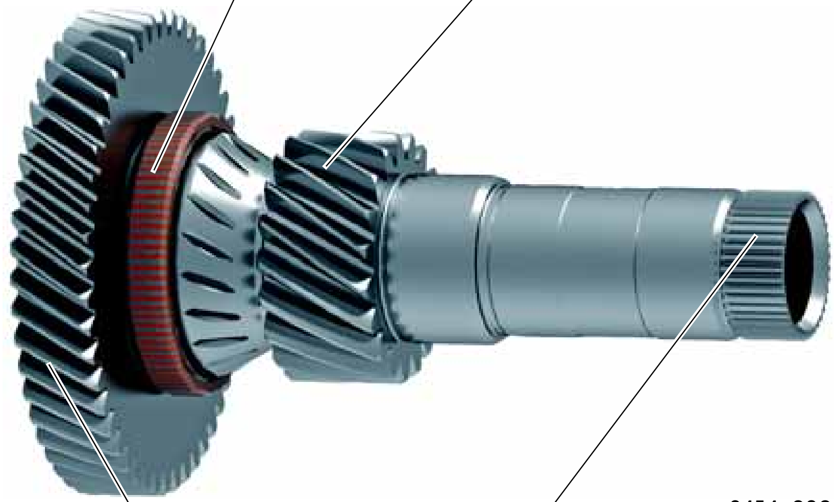
Input shaft 2

Input shaft 2 is manufactured as a hollow shaft. It is connected to clutch K2 by means of splines. Input shaft 2 is used for engaging gears 2, 4, 6 and reverse gear.

The sensor wheel for input shaft speed sender 2 G502 is located on this shaft in order to detect the rotation speed of the output shaft.



S454_030

Structure of the gearbox

The output shafts

There are 2 output shafts in the gearbox housing. Depending on which gear is engaged, the engine torque is transmitted from the input shafts onto the output shafts.

Synchromeshed gears are located on each output shaft, by means of which the torque is transmitted to the final drive gear via the output gear. (The corresponding gearwheels have been shown in sections in order to clarify the view).

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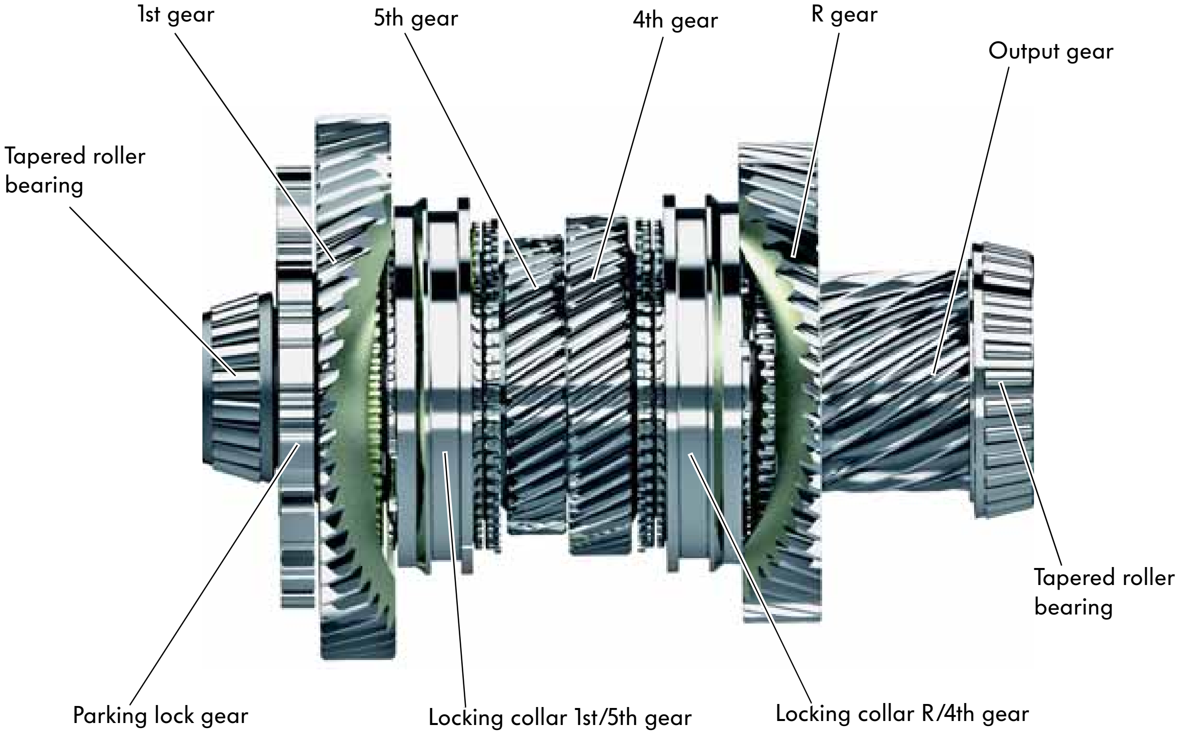
Output shaft 1



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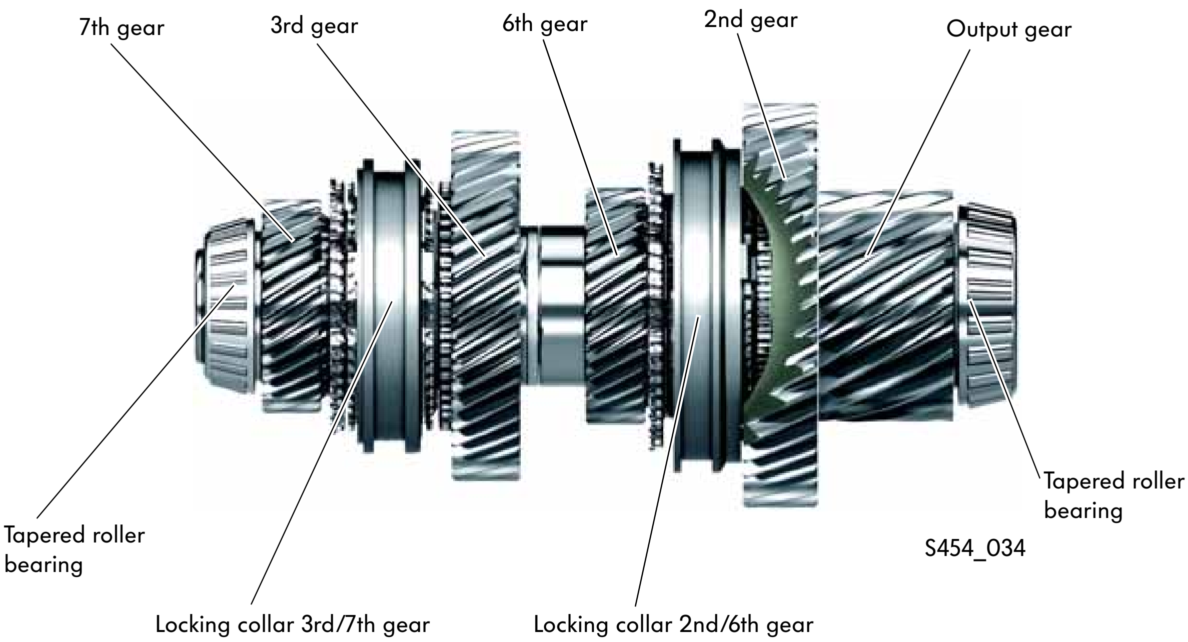
The following are located on output shaft 1:

- Synchromeshed gears for gears 1, 4, 5 and reverse gear
- Synchronisers for 1st gear and reverse gear (triple synchronisation)
- Synchronisers for gears 4 and 5 (single synchronisation)
- Parking lock gear

In order to optimise space and weight, the gearing of the clutch body for gears R, 1 and 2 have been transferred to the inside of the corresponding synchromeshed gears.

S454_033

Output shaft 2



S454_034

The following are located on output shaft 2:

- Synchromeshed gears for gears 2, 3, 6 and 7
- Synchronisers for gears 2 and 3 (triple synchronisation)
- Synchronisers for gears 6 and 7 (single synchronisation)

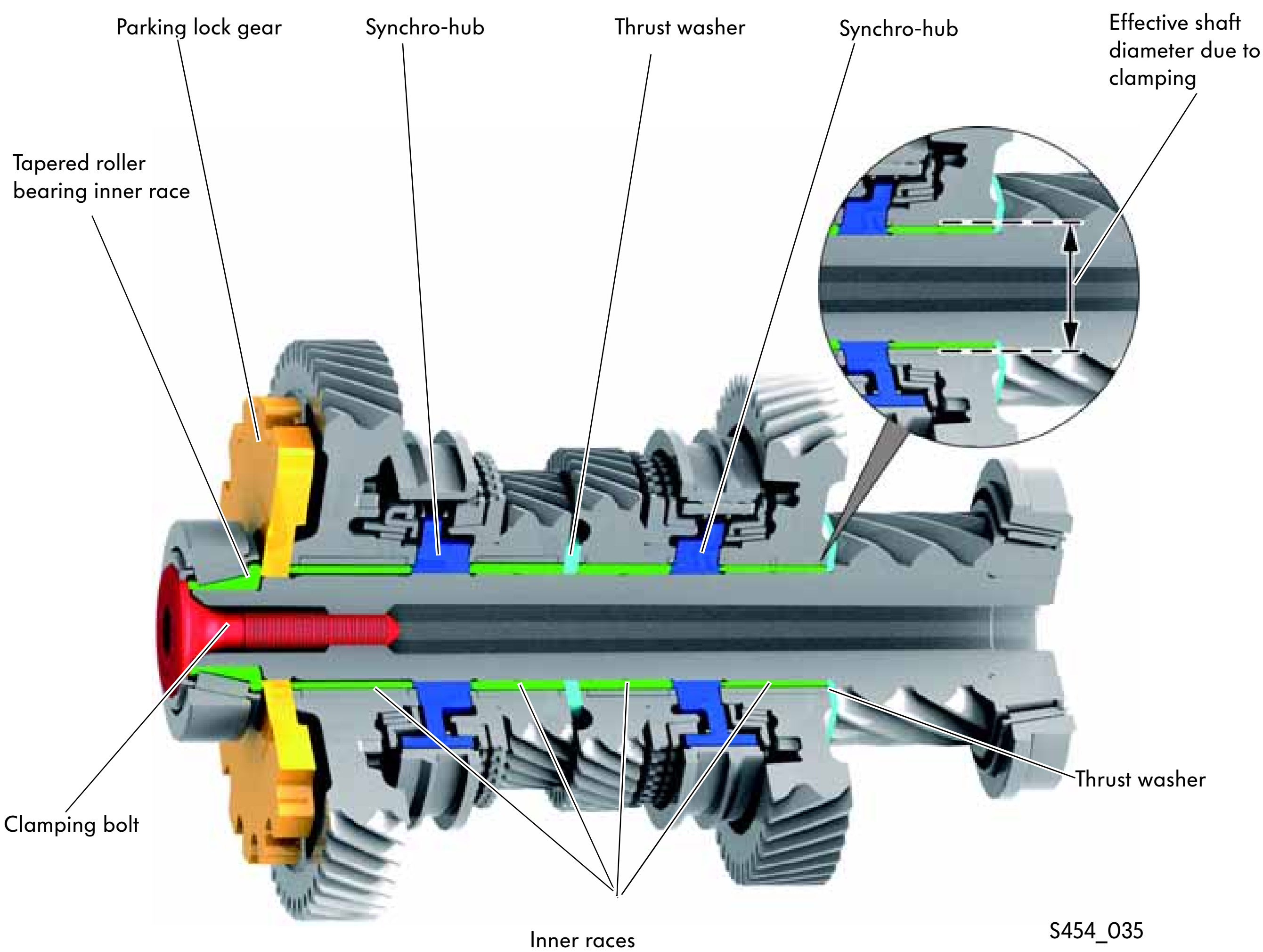
The clamped shaft assembly

A clamped shaft assembly is used in the new 7-speed DSG. In order to be able to transmit a high engine torque without increasing the material thickness of the shafts - and therefore the overall weight of the gearbox, a force-locking connection is established between the inner races of the bearings for the synchromeshed gears and the input shaft.

The tensile force of the clamping bolt increases the effective shaft diameter. This means more torque can be transmitted.

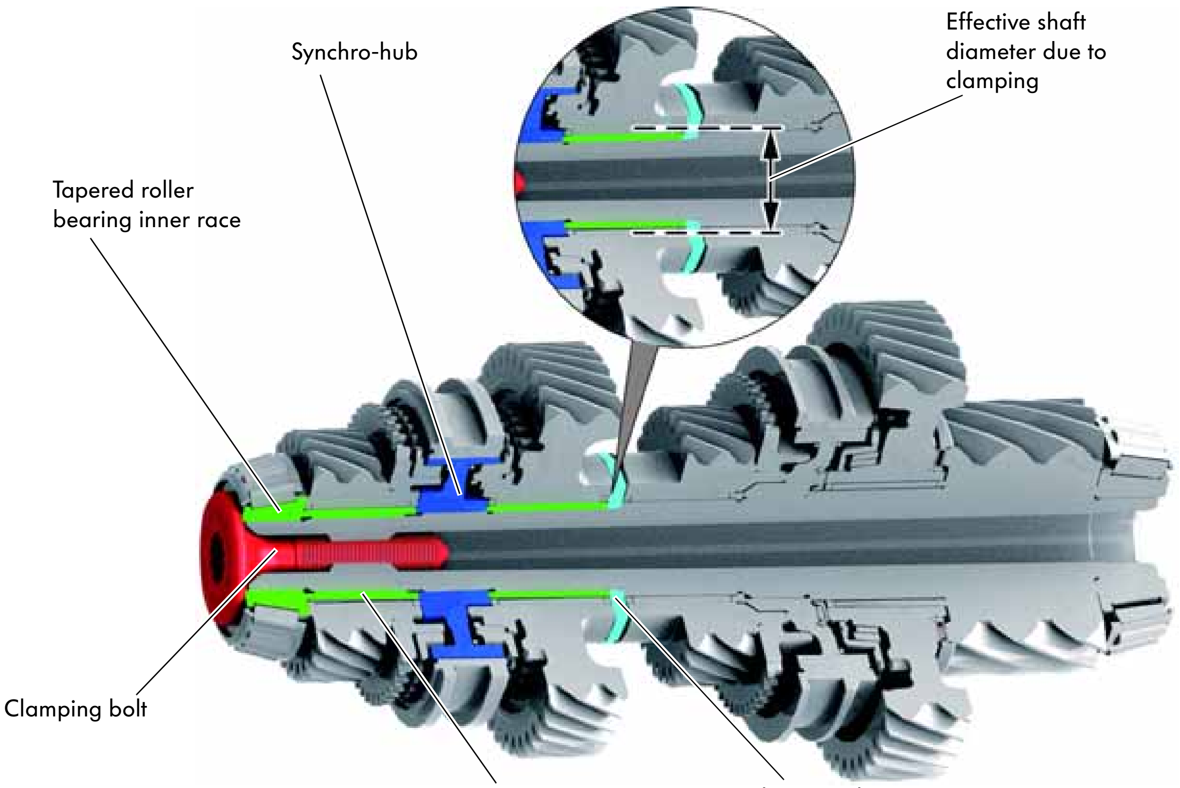
Output shaft 1:

The clamped shaft assembly of output shaft 1 acts from the inner race of the outer tapered roller bearing via the parking lock, all bearing inner races, thrust washers and synchroniser bodies. The assembly is directly supported on the output gear by means of a thrust washer.



Output shaft 2:

The clamped shaft assembly of input shaft 2 acts from the inner race of the outer tapered roller bearing, as far as the thrust washer on the synchromeshed gear of 3rd gear. This is supported on output shaft 2.



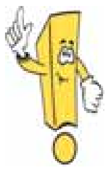
S454_036

The differential

Both output shafts transmit the torque onto the input gear of the differential. This transmits the torque to the wheels via the input shafts.

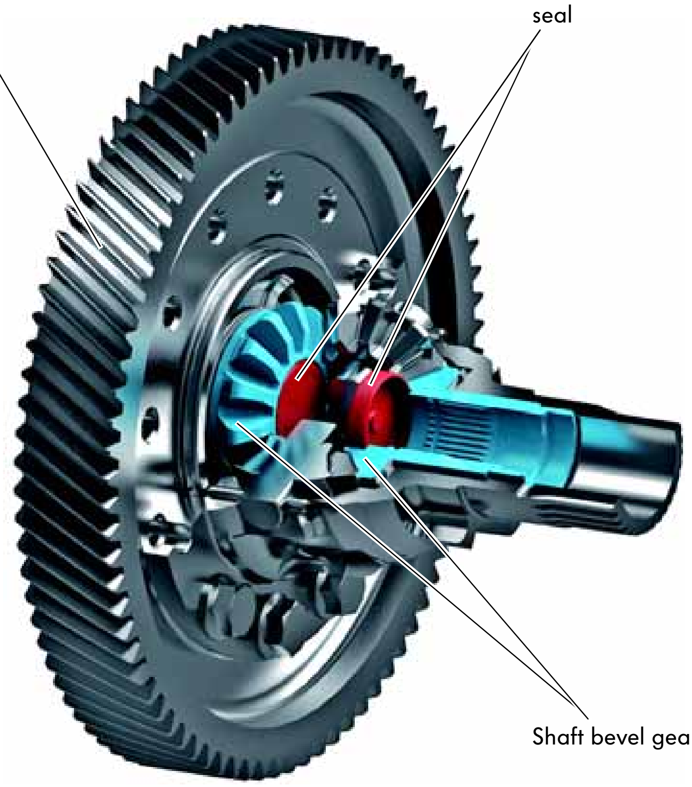
The input shafts are fitted using internal splines, and are not bolted on with a flange. The internal splines must be greased when the input shafts are installed.

S454_037



For the first time, Volkswagen is using a differential with shaft bevel gears in the new 7-speed DSG. The shaft bevel gears are provided with seals. The seals inserted in the shaft bevel gears - two rubber/metal caps - prevent any oil leaking out of the differential.

If the metal/rubber seal is defective then the differential is also defective and it is necessary to renew the differential.



S454_038

The tachograph

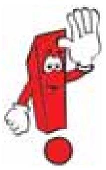
According to EU legislation, vehicles with a gross vehicle weight rating in excess of 3.5 t must be fitted with a tachograph if the vehicles are used for commercial purposes and it maybe obligatory for the driving and rest times to be recorded in order for these vehicles to be used legally.

The tachograph records

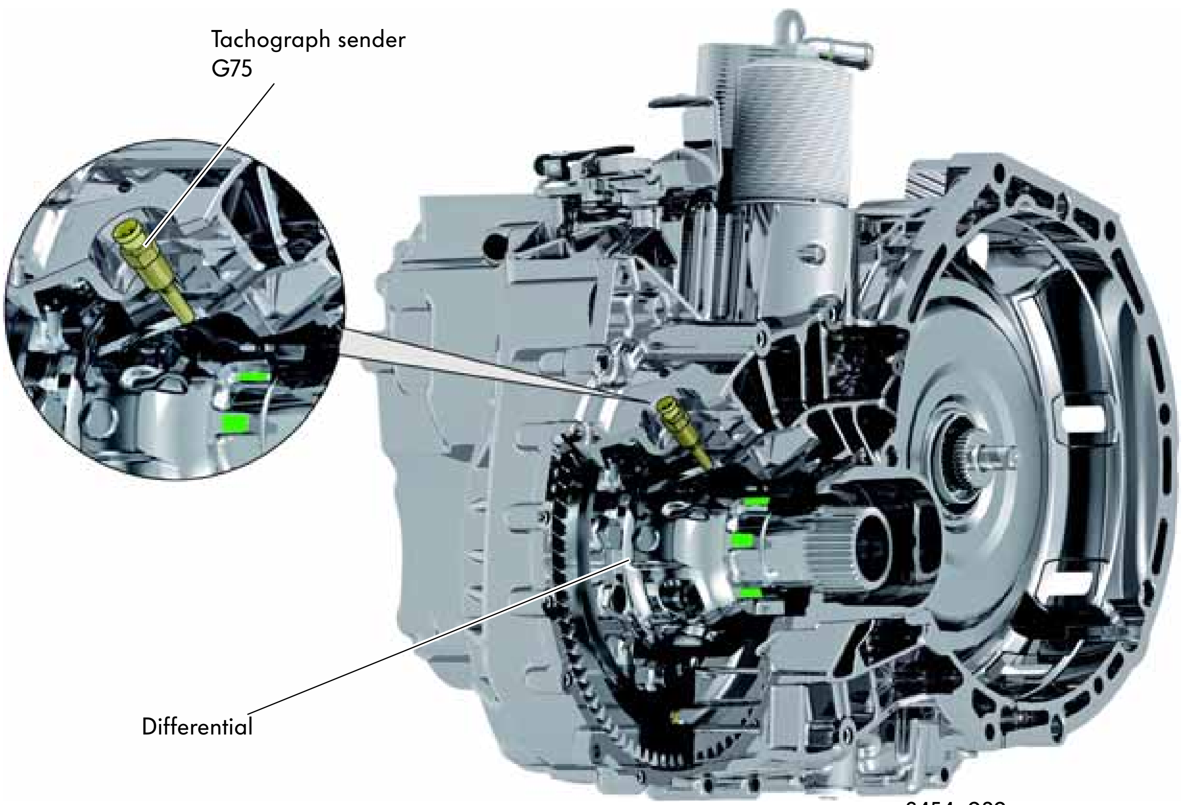
- Maximum speed driven
- Maximum driving time every day
- Duration of breaks during the driving time
- Rest times at night

This is how it functions:

The tachograph sender G75 is an inductive sender, and scans the rotation speed of the differential. This signal is used by the tachograph control unit J621 to calculate the speed driven.



In the T5 2010, the gearbox is prepared for the tachograph as standard.
Further information about retrofitting a tachograph can be found in the workshop manual.



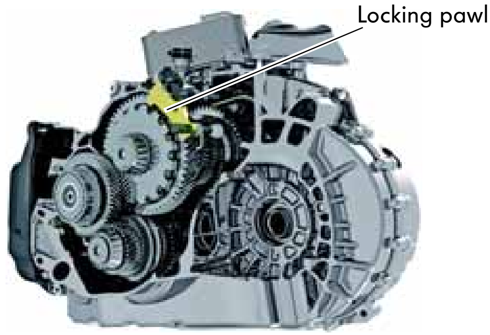
S454_039

Structure of the gearbox

The parking lock

When the engine is stopped, there is never any powerflow.
Both clutches, K1 and K2, are open.

In order to allow the vehicle to be parked safely and to prevent it rolling away inadvertently if the parking brake is not applied, the 7-speed DSG 0BT requires a parking lock, as is usual with automatic gearboxes.

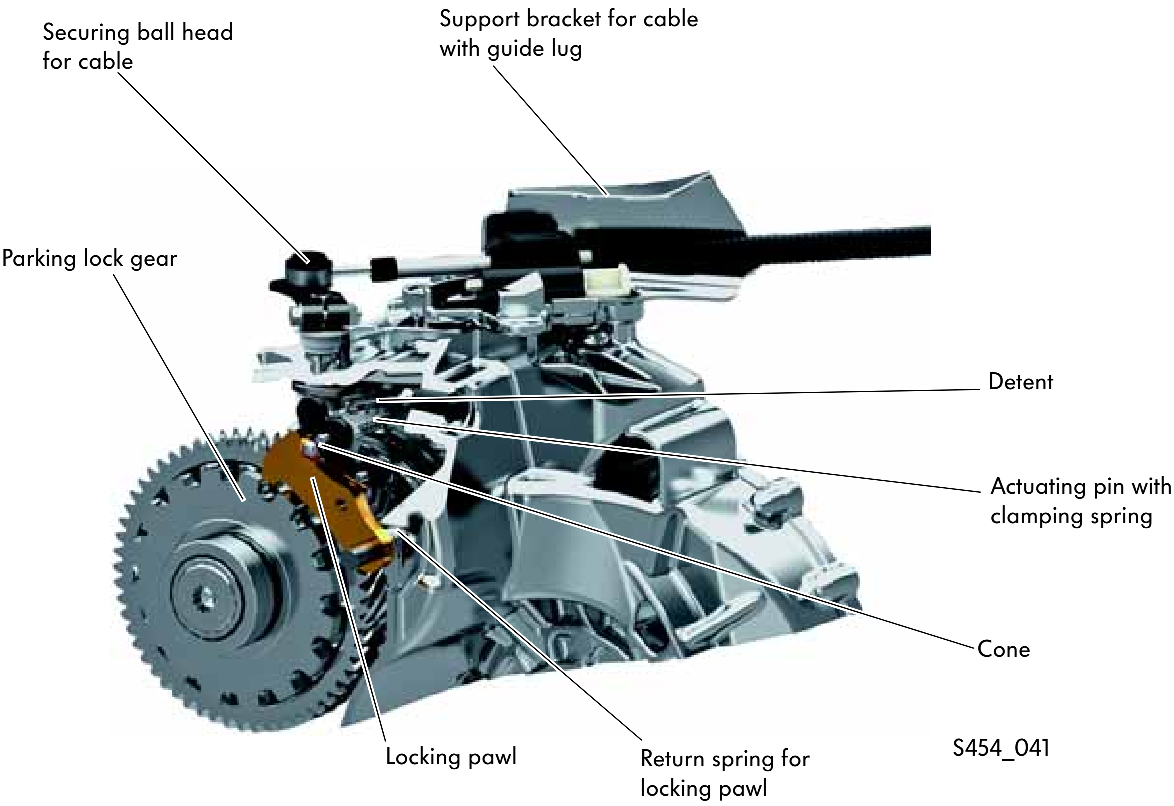


S454_040

The parking catch is engaged purely mechanically by means of a cable between the selector lever and the lever for the parking lock on the gearbox.

The cable is exclusively used for operating the parking lock, and is the only mechanical connection between the selector lever and the gearbox.

The cable is secured on the gearbox using a support bracket. The guide lug makes it possible for the cable to be operated smoothly.

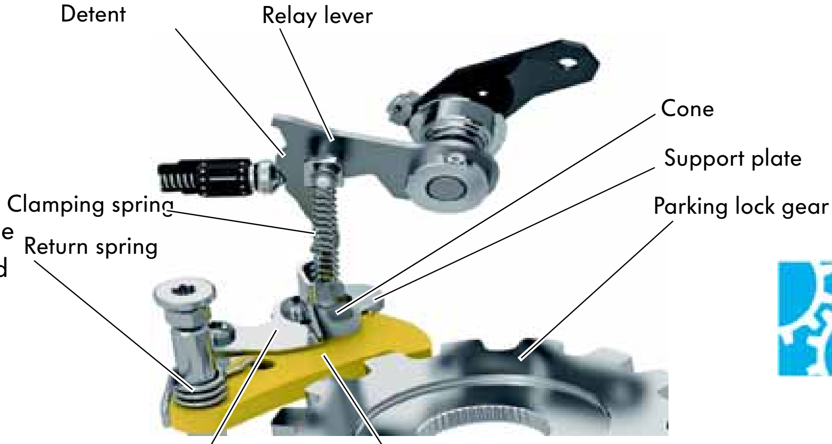


S454_041

This is how it functions:

Parking lock not applied
(selector lever position R, N, D, S)

When the parking lock is not applied, the cone of the actuating pin is in contact with the support plate and the locking catch.
The return spring holds the parking lock in the unactuated position.



S454_042

Parking lock applied, locking catch not engaged
(selector lever position P)

Actuating the parking lock causes the cone of the actuating pin to be pressed against the support plate and the locking catch. The support plate is fixed, therefore the locking catch moves downwards.
If it encounters a tooth of the parking lock gear there, the clamping spring is tensioned. The actuating pin is held in this position due to the detent.

S454_043

Parking lock applied, locking catch engaged
(selector lever position P)

If the vehicle moves any further, the parking lock gear also rotates.
The actuating pin is preloaded, therefore it automatically presses the locking catch into the next tooth gap of the parking lock gear.


S454_044

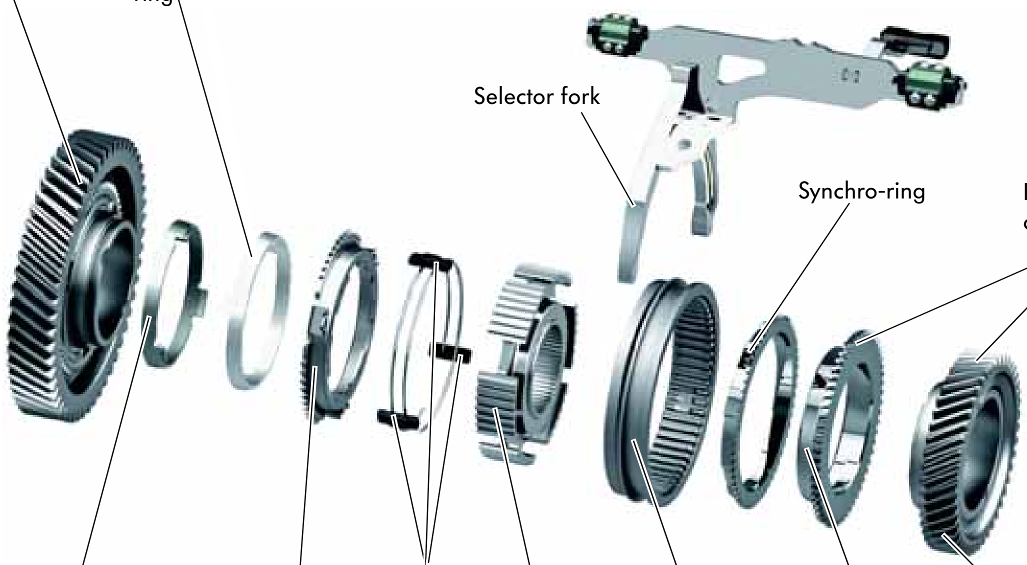
For safety reasons, the shape and the flank angle of the locking catch as well as of the tooth of the parking lock gear and the press-in force of the locking catch are all designed so that the locking catch no longer engages at a speed of about 5 km/h or more. If the parking lock is operated by mistake at higher speeds, the locking catch will be heard to rattle over the tooth tips of the parking lock gear.

Synchronisation of gears

The locking collar must be pushed onto the clutch splines of the synchromeshed gear in order for a gear to be engaged.
The function of the synchronisation is to establish synchronous rotation between the gears that are to be engaged and the locking collar.

For this purpose, one or more coated synchro-rings are pushed against a friction cone at the start of the gearshift. The resulting friction equalises the rotation speeds of the gears, and the gear is engaged.

All friction surfaces of the synchronisers are carbon-coated.



S454_045

Gear	Synchronisation	Synchro-ring material
1st, 2nd, reverse	Triple	Carbon-coated steel sheet
3rd	Triple	Carbon-coated brass
4th, 5th, 7th	Single	Carbon-coated brass
6th	Single	Carbon-coated steel sheet

Single and triple synchronisation

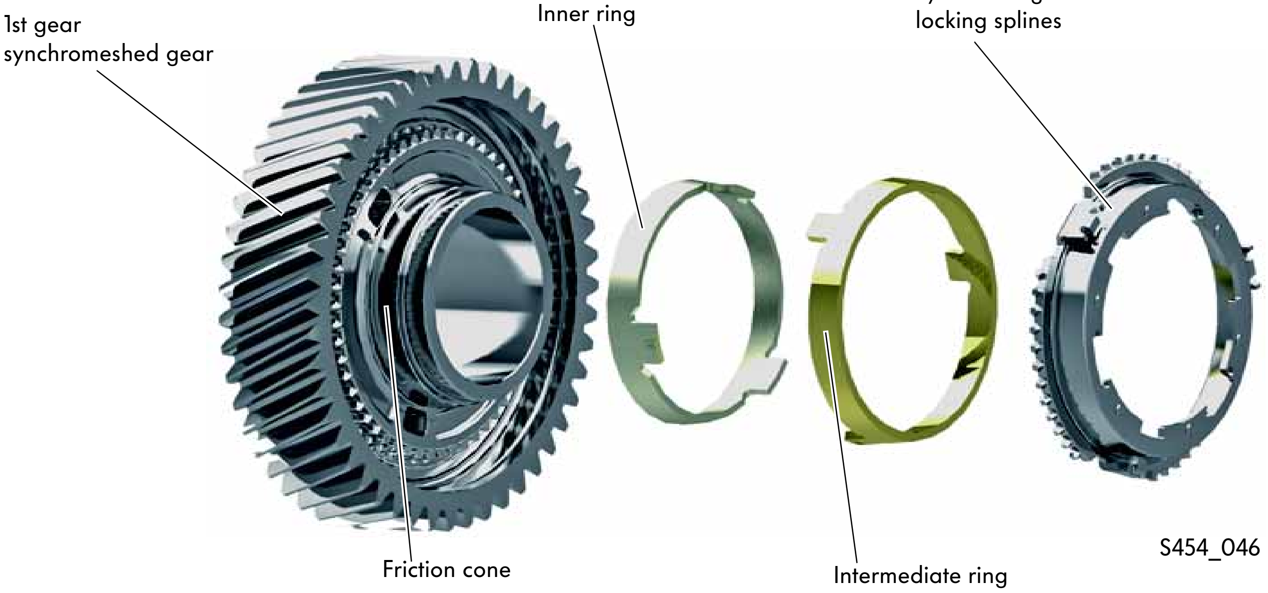
The rotation speed differentials between the synchromeshed gears to be synchronised are greater in the lower gears than in the higher gears.

Therefore, gears 1, 2 and 3 are equipped with triple synchronisation.
This provides a significantly greater friction surface compared to a single cone system. The synchronisation effect is increased because there is a greater heat transfer surface area.
Adaptation of the wide rotation speed differentials between the different synchromeshed gears takes place faster in the lower gears. Gearwheels with a large diameter and high mass are fitted in the lower gears. Synchronisation needs to overcome the high mass moment of inertia of these gearwheels.

Gears 4, 5, 6 and 7 have a single cone system.
In this case, the rotation speed differentials on gearshifts are lower. Therefore, the rotation speed adaption is faster. The synchronisation does not need such a high level of complexity.

Reverse gear is equipped with triple synchronisation. The direction of rotation reversal no longer takes place using a reverse shaft, but instead via the non-engaged 2nd gear synchromeshed gear, therefore the mass to be synchronised is greater.

S454_047



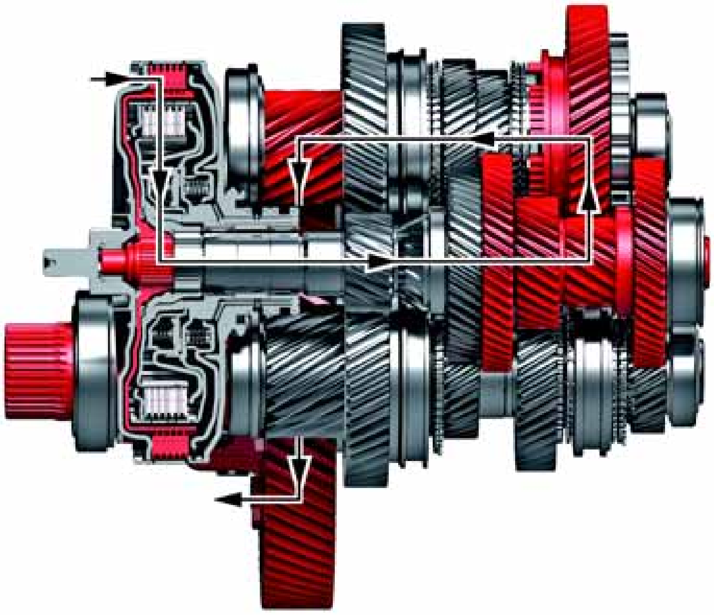
S454_046

The powerflow in the gears

1st gear:

Sub-gearbox 1

Clutch K1
Input shaft 1
Output shaft 1, 1st gear synchromeshed gear
Final drive

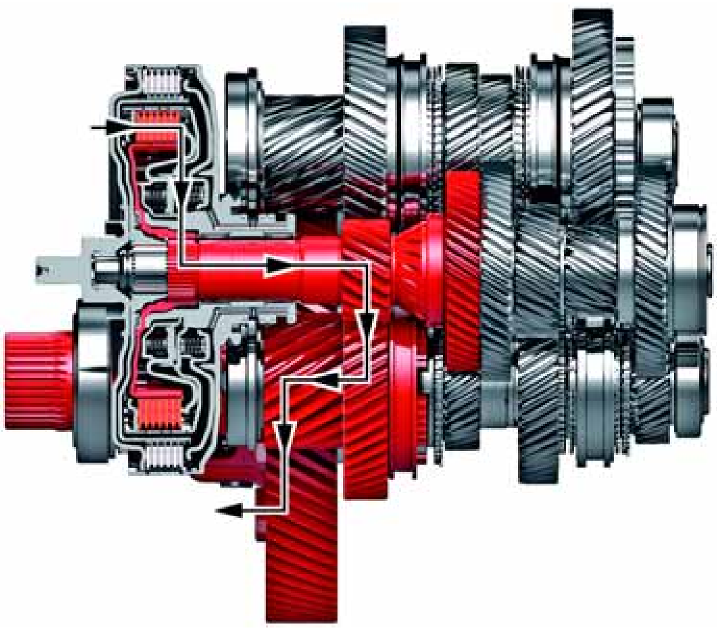


S454_049

2nd gear:

Sub-gearbox 2

Clutch K2
Input shaft 2
Output shaft 2, 2nd gear synchromeshed gear
Final drive

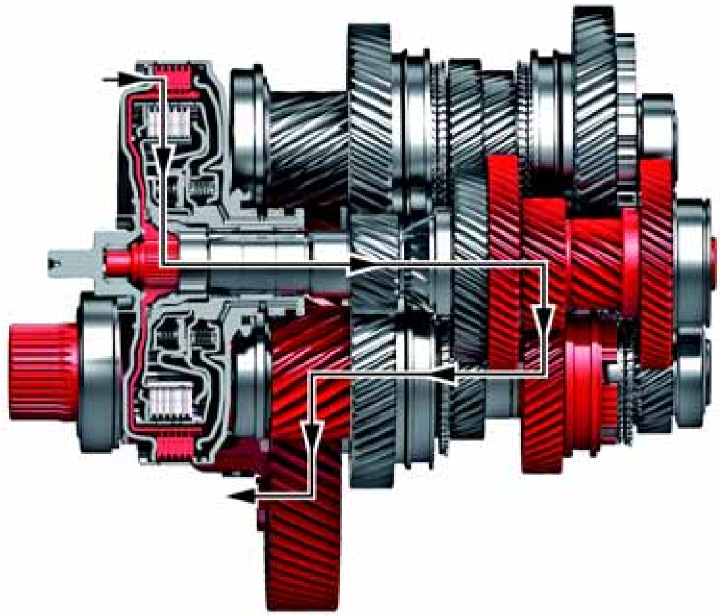


S454_050

3rd gear:

Sub-gearbox 1

Clutch K1
Input shaft 1
Output shaft 2, 3rd gear synchromeshed gear
Final drive

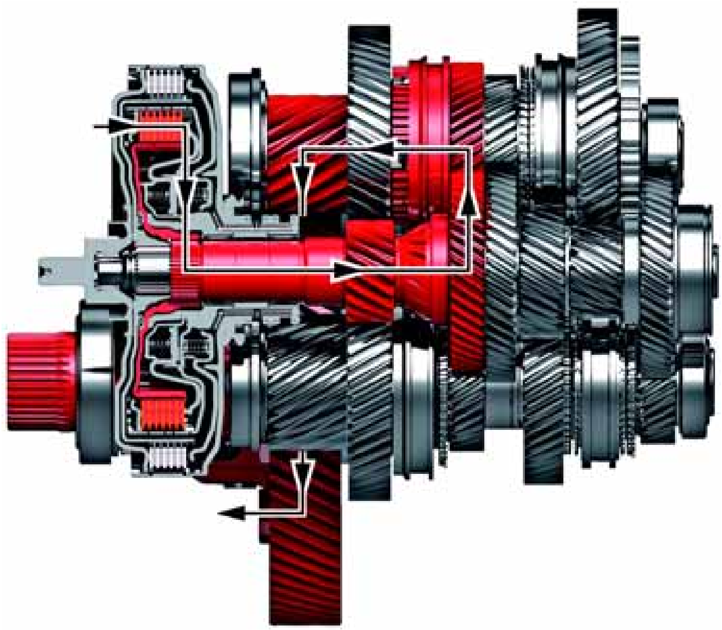


S454_051

4th gear:

Sub-gearbox 2

Clutch K2
Input shaft 2
Output shaft 1, 4th gear synchromeshed gear
Final drive



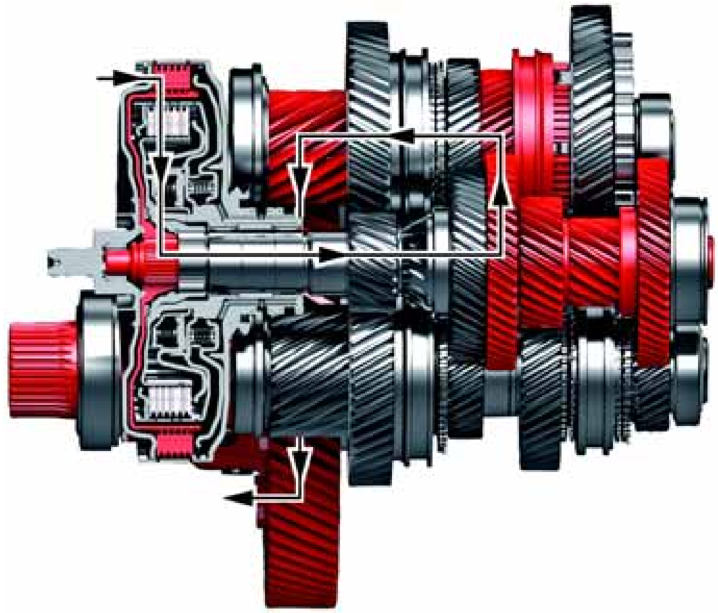
S454_052

Structure of the gearbox

5th gear:

Sub-gearbox 1

Clutch K1
Input shaft 1
Output shaft 1, 5th gear synchromeshed gear
Final drive

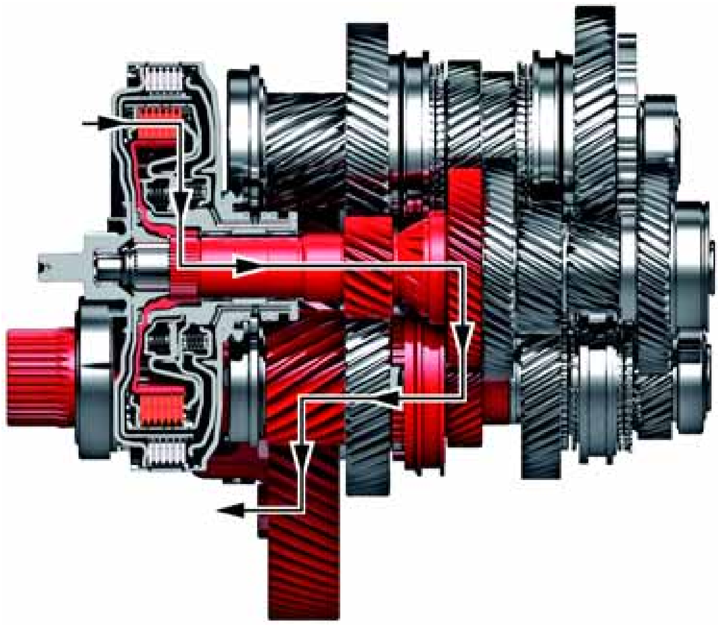


S454_053

6th gear:

Sub-gearbox 2

Clutch K2
Input shaft 2
Output shaft 2, 6th gear synchromeshed gear
Final drive

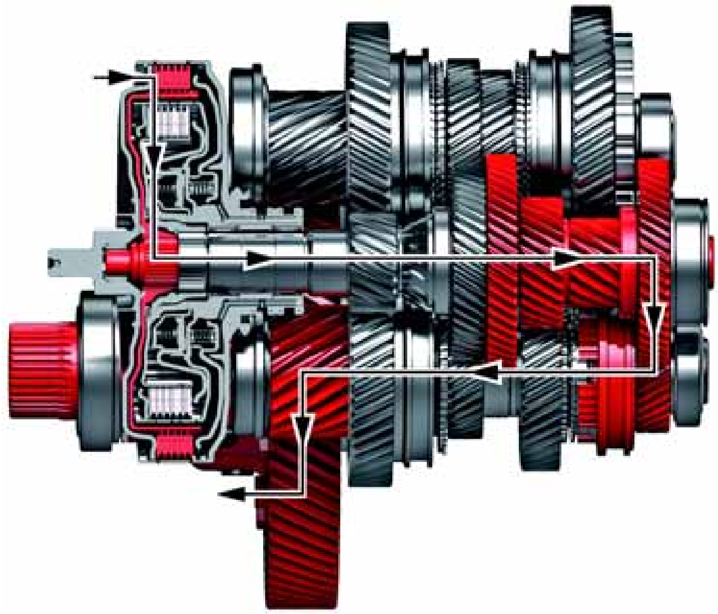


S454_054

7th gear:

Sub-gearbox 1

Clutch K1
Input shaft 1
Output shaft 2, 7th gear synchromeshed gear
Final drive

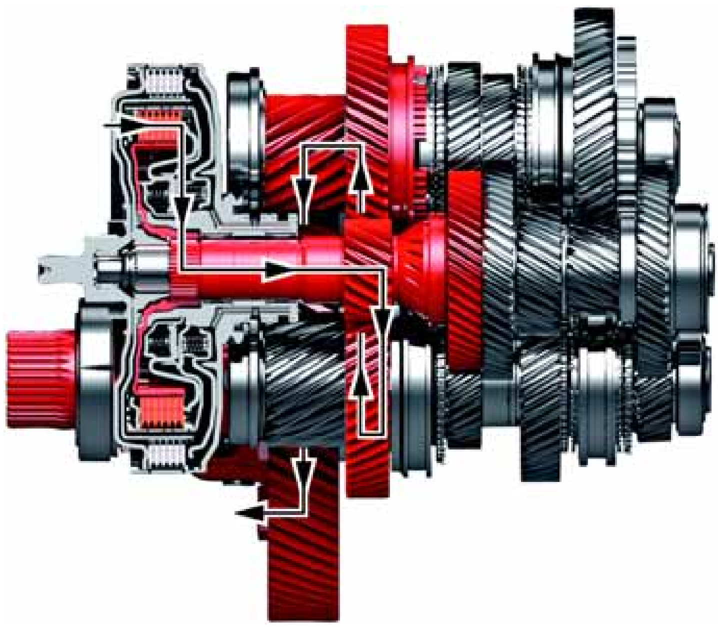


S454_055

Reverse gear:

Sub-gearbox 2

Clutch K2
Input shaft 2
Output shaft 2, 2nd gear synchromeshed gear
Output shaft 1, reverse gear synchromeshed gear
Final drive



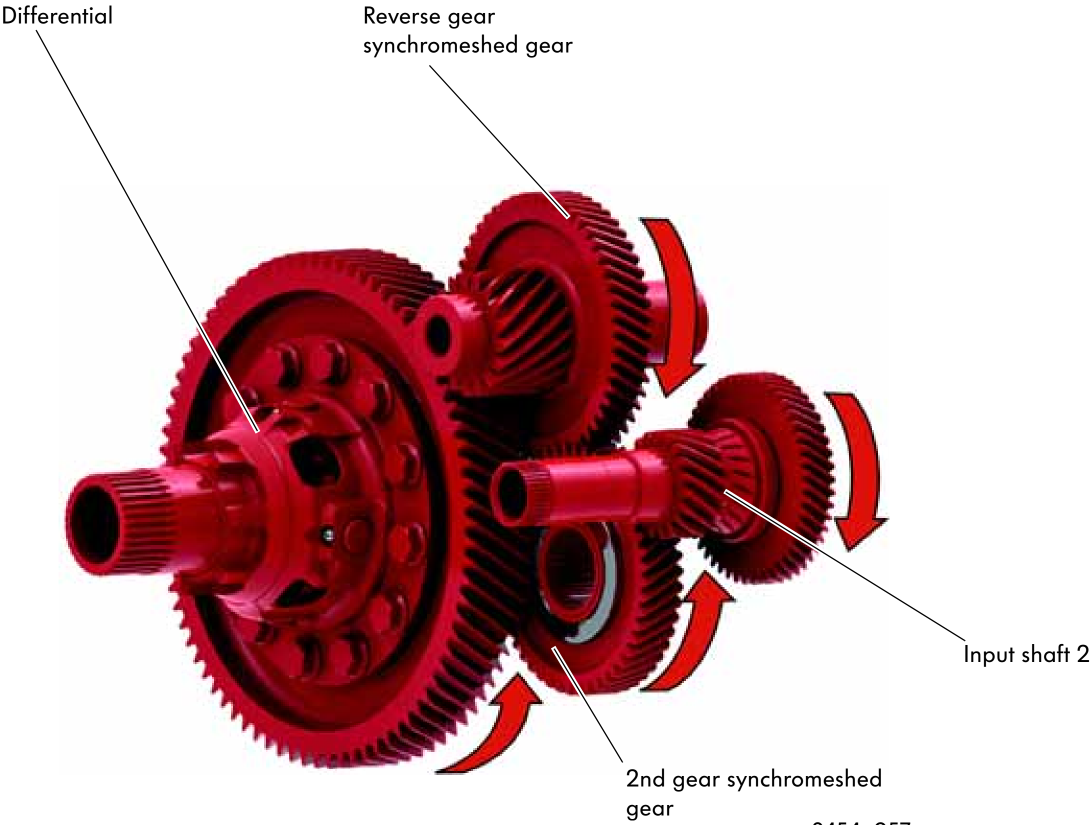
S454_056

The reverse gear

The reverse gear has been redesigned in the 7-speed DSG gearbox 0BT. The direction of rotation reversal in the gearbox is no longer performed using a reverse shaft. This saves space and weight.

The torque is transferred into clutch K2 and from there to input shaft 2, further via the non-engaged 2nd gear synchromeshed gear onto the engaged synchromeshed gear of reverse gear, and from there to the final drive.

The mass to be synchronised is greater, therefore reverse gear has triple synchronisation.



S454_057

2nd gear

2nd gear has a dual function. It is not only involved in the powerflow for 2nd gear, but also has the task of replacing the discontinued reverse shaft. When reverse gear is engaged, the direction of rotation is reversed in the gearbox by means of the non-engaged 2nd gear.
This "double function" and configuration of the gearbox for 600 Nm required additional modifications to the design.

The 2nd gear synchromeshed gear and the reverse gear synchromeshed gear are continuously engaged.

S454_058

The helical gearing of the synchromeshed gears means that axial forces act on the 2nd gear when the reverse gear is engaged.
For this reason, the synchromeshed gear and the synchro-hub of 2nd gear are supported by an additional axial bearing.

S454_059

The mechatronic unit for dual clutch gearbox J743

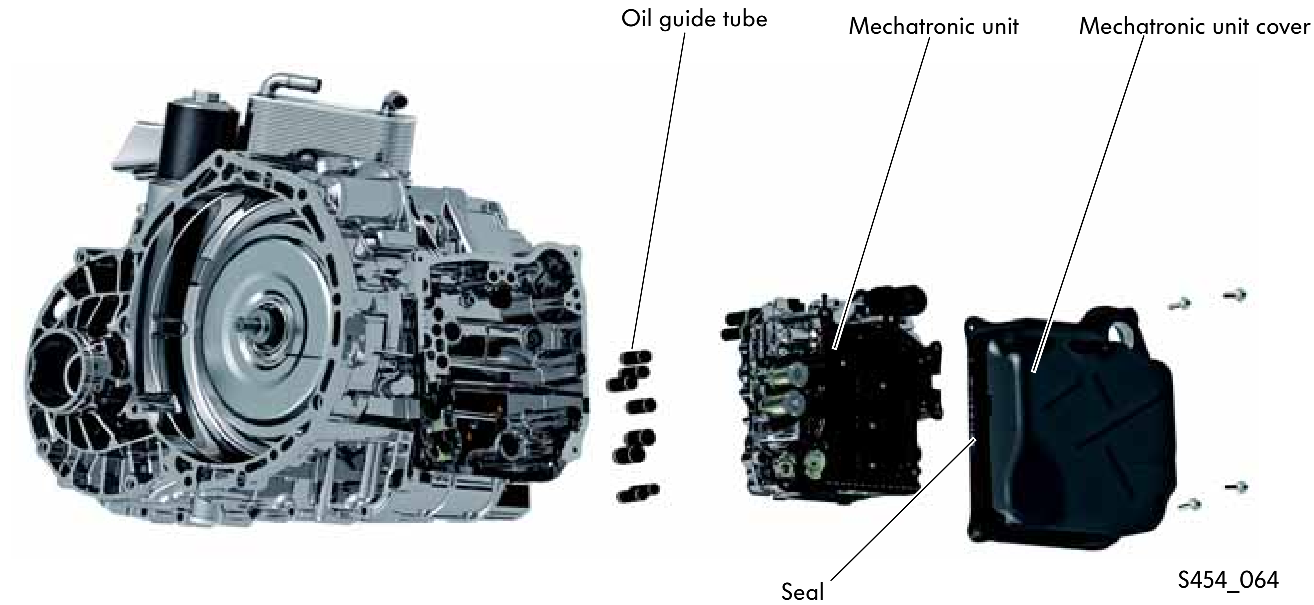
The mechatronic unit is the central control unit of the gearbox. It is located in the gearbox housing and is made of two parts:

- The electrohydraulic control unit
- The gearbox control unit

The electrohydraulic control unit and the gearbox control unit form one unit. The seal and the mechatronic unit cover are glued together.

The mechatronic unit hydraulically controls the main pressure, the pressure in the two sub-gearboxes, the flow rate into the eight gear actuators via pressure modulation valves, the shift valves, the pressure and cooling oil flow through both clutches as well as the load-dependent lubrication.

The control unit of the mechatronic unit detects the positions of the clutches and the positions of the gear actuators when a gear is engaged.



S454_064

All sensor signals terminate in the gearbox control unit that is fitted inside the mechatronic unit for the dual clutch gearbox. All actions in the gearbox are initiated and monitored by it.

Advantages of the mechatronic unit at a glance:

- Integrates the majority of sensors
- Actuators are located directly on the mechatronic unit
- A central connector forms the interface for electrical information required from the vehicle
- Connection to the solenoid valves via a contact plate

The compact structure reduces the number of individual connectors and cables to a minimum.
This results in greater electrical reliability and lower weight. Extremely high thermal and mechanical loads occur in the mechatronic unit. Temperature senders monitor the temperature of the mechatronic unit and instigate appropriate measures if the temperature reaches critical values. 10 oil guide tubes with different diameters provide the oil supply from the mechatronic unit to the gearbox, and from the gearbox to the mechatronic unit.

The control unit for the mechatronic unit

The control unit is the command centre of the mechatronic unit. It records, evaluates and distributes all the information required for operating the 7-speed DSG and adjacent systems.

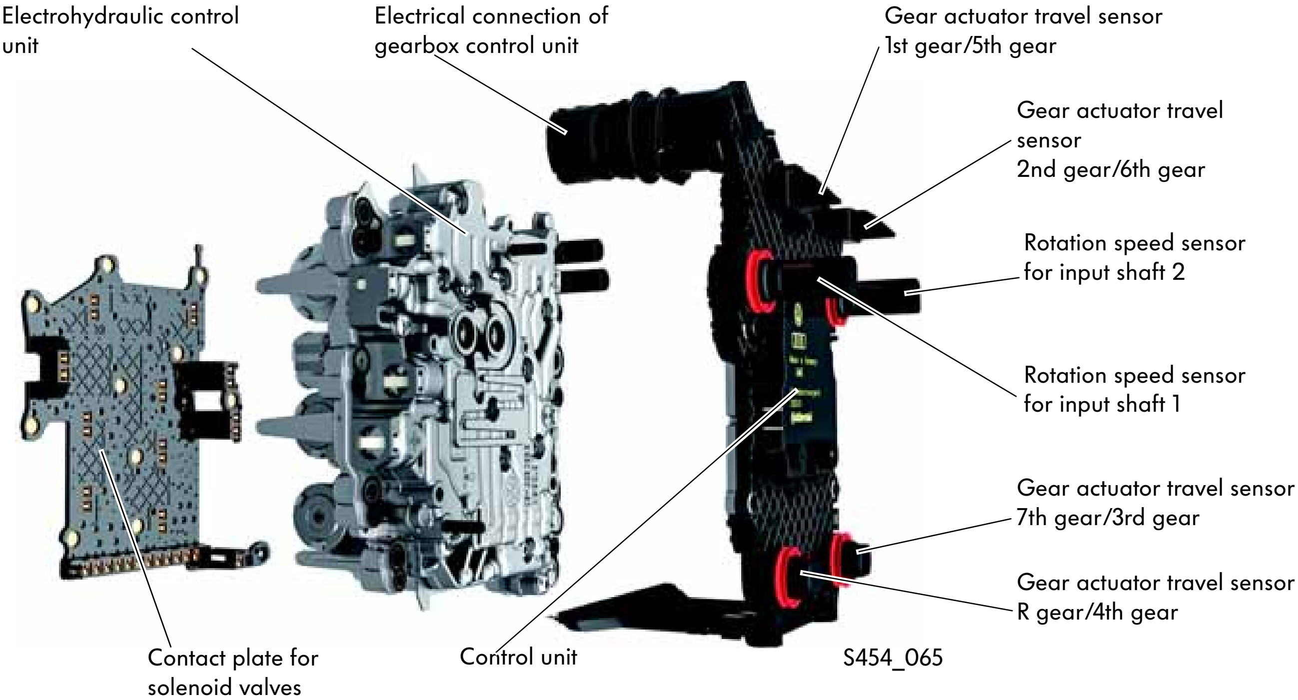
It generates the output signals for the actuators inside and outside the gearbox. Communication with the peripherals is by way of the powertrain CAN databus.

There are two rotation speed sensors on the gearbox control unit for recording the rotation speed in the sub-gearboxes,
4 travel sensors for detecting the gear actuator positions, 2 oil pressure sensors for sub-gearbox pressure and 2 temperature sensors for registering the gear oil and control unit temperature. In addition, a combination sensor is mounted on the multi-disc clutches, and connected to the control unit by a connector, in order to record the gearbox input speed and the gear oil temperature.

There are two temperature sensors (G93/G510) in the gearbox control unit for monitoring the gear oil temperature. They measure the temperature directly of the vulnerable components.

The seals on the travel sensors for the gear actuators for 7th, 3rd and reverse or 4th gears, on the speed sensor of input shaft 1 and speed sensor of input shaft 2 provide two different oil levels in the gearbox.

If the seals are missing or defective then the dammed oil principle is no longer met (see page 45 for more information).



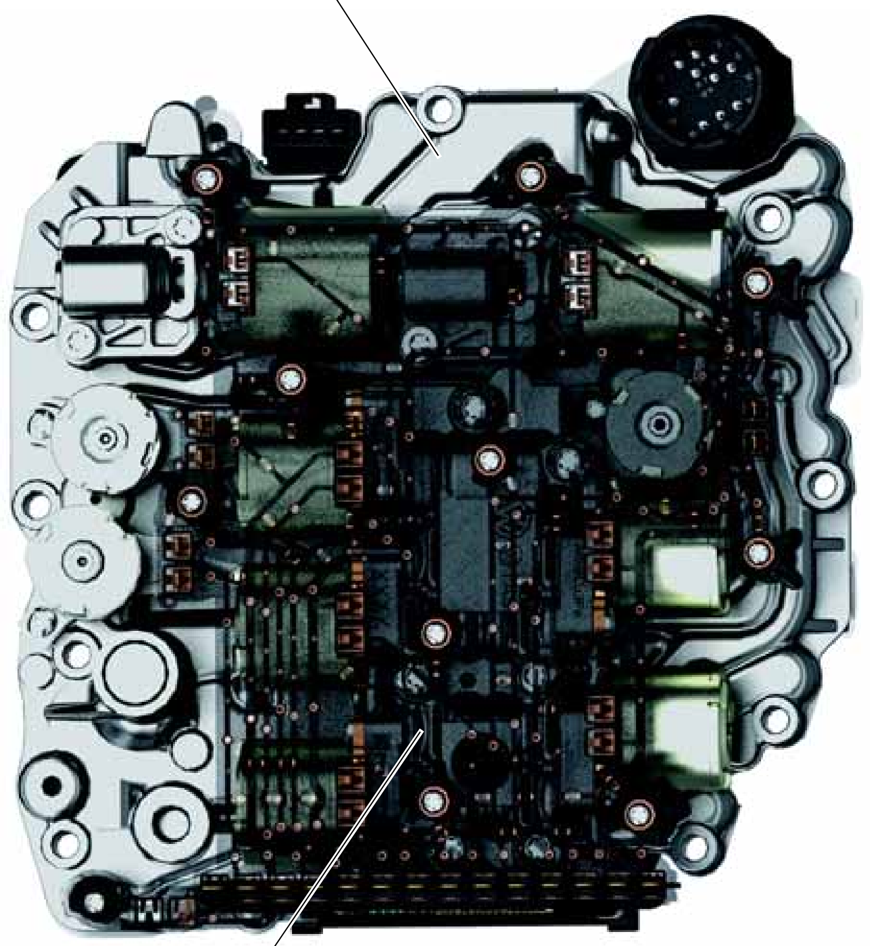
S454_065

Electrohydraulic control unit

The electrohydraulic control unit

The electrohydraulic control unit uses solenoid valves to control the clutch and gearshift procedures as well as clutch cooling in the gearbox.

The solenoid valves are activated by the mechatronic control unit by means of a contact plate with electrical conductor paths. The contact plate is plugged onto the contacts of the solenoid valves.
The compact design means that no wiring harnesses need to be used.

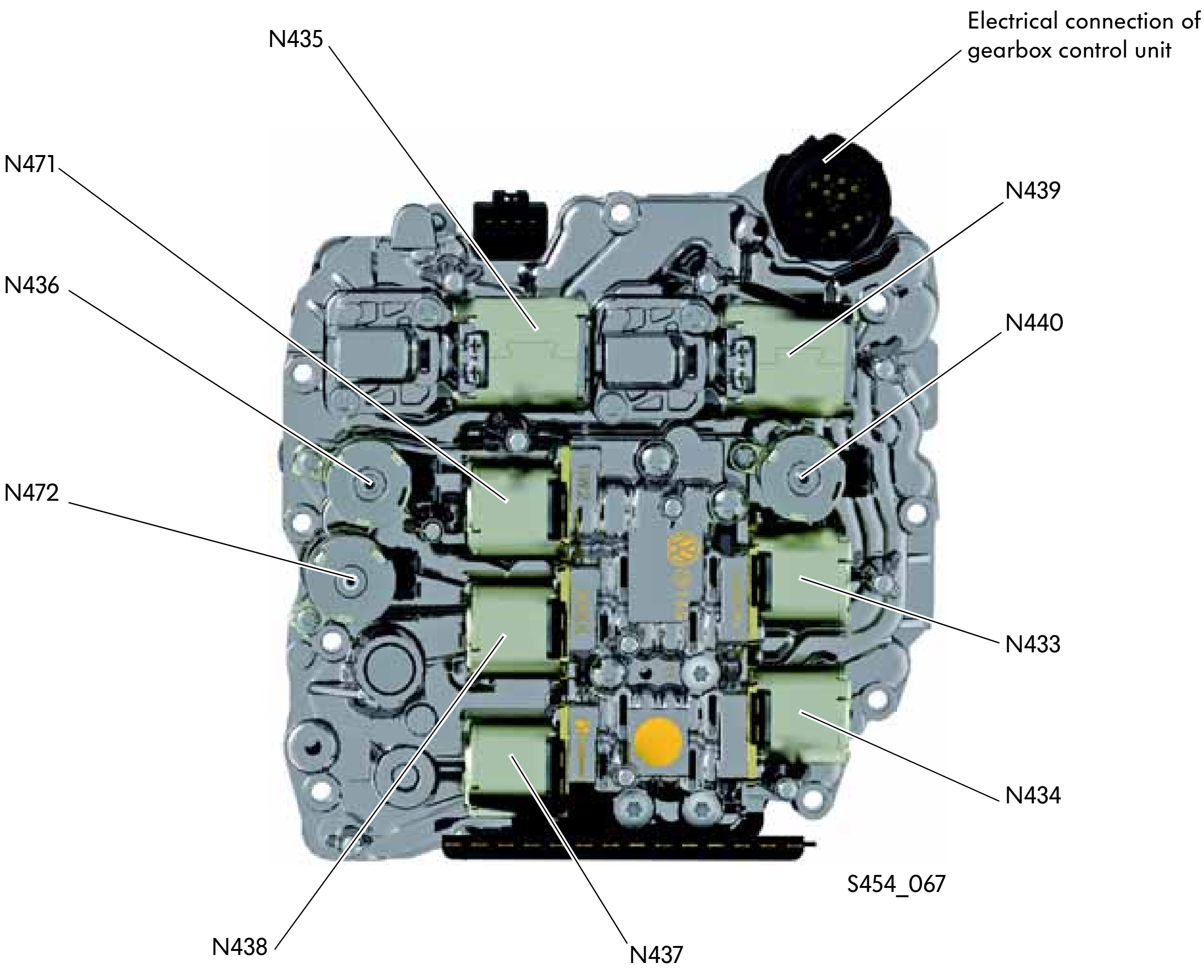


S454_066

The electrohydraulic control unit contains all solenoid valves, pressure control valves as well as the hydraulic valves.

A pressure limiting valve prevents an excessive pressure rise, thus protecting the gearbox against damage due to excessive pressure.

N433 - valve 1 in sub-gearbox 1 (gear actuator valve)
N434 - valve 2 in sub-gearbox 1 (gear actuator valve)
N435 - Valve 3 in sub-gearbox 1 (clutch valve K1)
N436 - valve 4 in sub-gearbox 1 (safety valve 1)
N437 - valve 1 in sub-gearbox 2 (gear actuator valve)
N438 - valve 2 in sub-gearbox 2 (gear actuator valve)
N439 - valve 3 in sub-gearbox 2 (clutch valve K2)
N440 - valve 4 in sub-gearbox 2 (safety valve 2)
N471 - valve for cooling oil
N472 - main pressure valve



S454_067

Oil circuit - hydraulic system

The oil circuit

The 7-speed DSG has a shared oil circuit for all gearbox functions.
This circuit contains 7.5 litres of DSG oil in total. The gear oil change involves about 6.0 litres of DSG oil being renewed, the pressurised oil filter is not renewed, due to its generously sized surface area. It remains in the gearbox throughout the vehicle's service life.

The gear oil needs to cope with the following demands:

- Ensuring clutch control and hydraulic control
- Stable viscosity throughout the entire temperature range
- Configuration for high mechanical loadings
- Not allowing any foaming

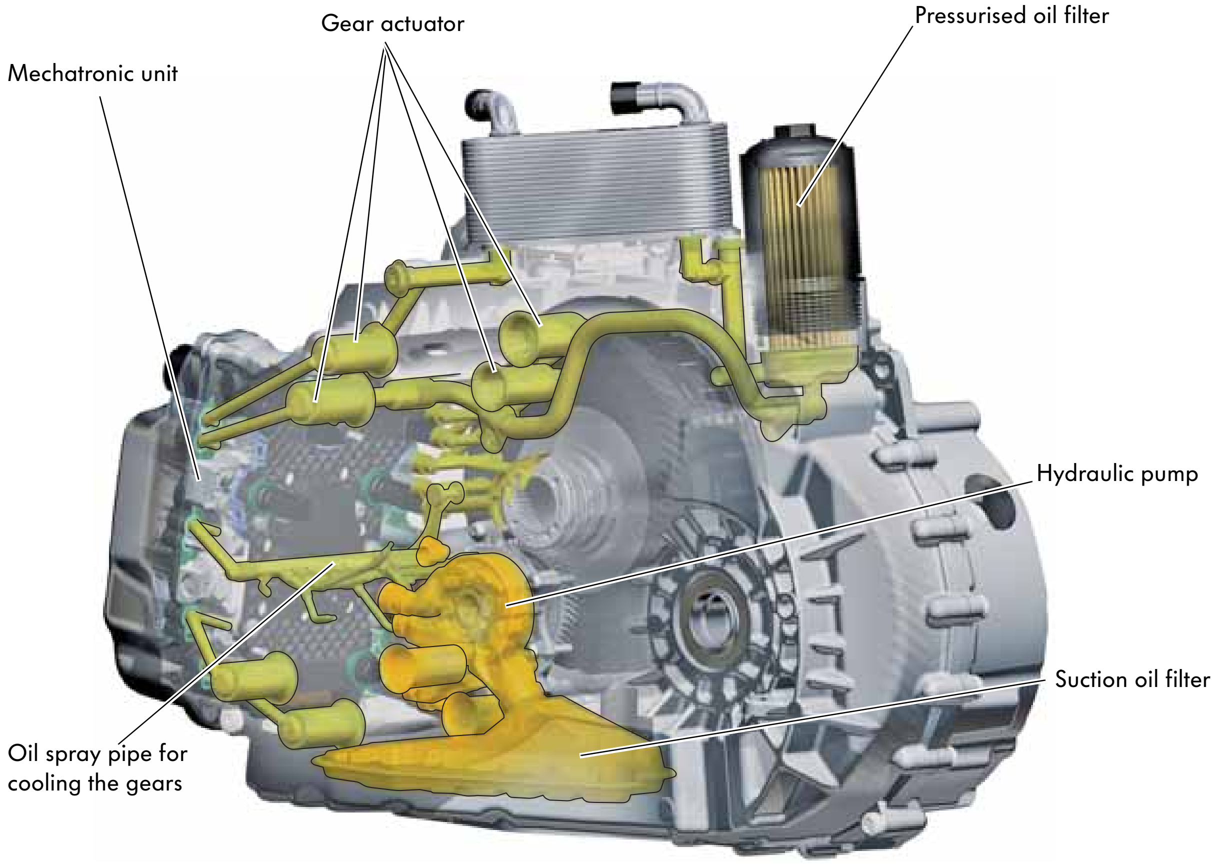
The tasks of the gear oil are:

Lubricating and cooling the dual clutch, the gears, shafts and bearings as well as the synchronisers

Actuating the dual clutch and gear actuator pistons

The oil cooler through which engine coolant flows prevents the oil temperature exceeding 135 °C.

The suction oil filter contains an oil filter mat and magnetic strips in order to hold back impurities and metal particles in the DSG oil.



S454_068

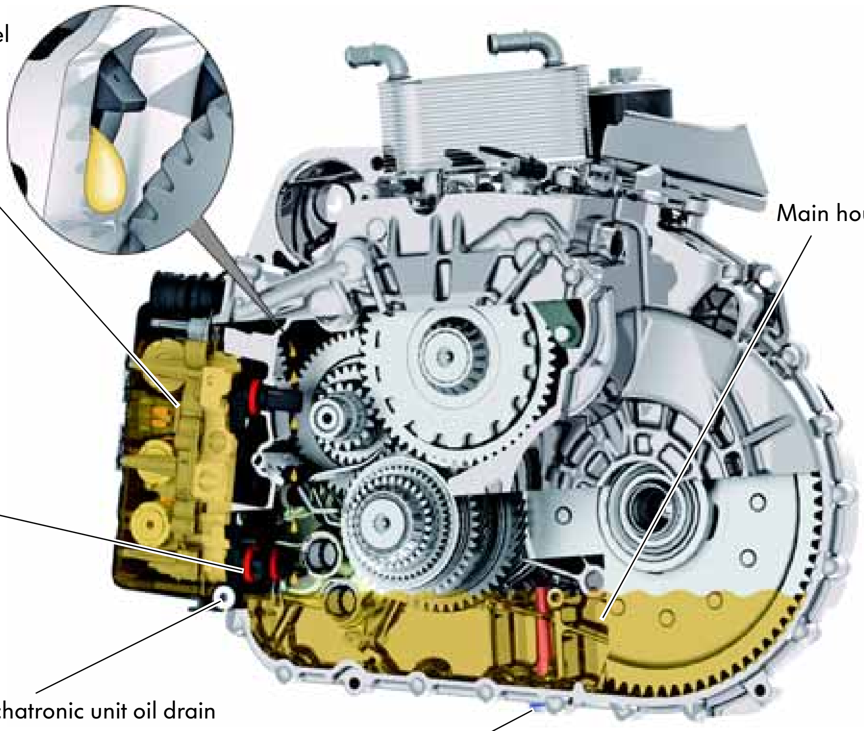
The oil level in the gearbox

The mechatronic unit of the 7-speed DSG is located in dammed oil. This means that all solenoid valves operate completely in the oil bath, thereby ensuring complete air exclusion from the hydraulic system, and that the mechatronic unit always operates under the same physical conditions. The separate oil chambers in the mechatronic unit and the main gearbox mean that there are two different oil levels, with two separate drain plugs.

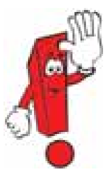
The dammed space in the mechatronic unit remains filled when the engine is stopped. The gearshift procedures result in an exchange between the oil levels in the mechatronic unit and the main housing.

Seals on the input shaft speed senders G501 and G502 and the gear actuator travel sensors G488 and G490 seal the gearbox housing between the mechatronic unit and the main housing. The gear actuator travel sensors G487 and G489 do not have seals, which means the DSG oil can flow through the openings into the main housing.

The DSG oil volume in the dammed chamber is approx. 1.2 litres.



S454_069



When the DSG oil is changed, the gear oil must be drained from the gearbox housing and from the mechatronic unit. When the engine is running, the dammed chamber of the mechatronic unit is filled automatically. The DSG oil flows in through defined leaks at the solenoid valves and through equalisation holes into the dammed space of the mechatronic unit. Please observe the special notes about the oil change in the workshop manual.

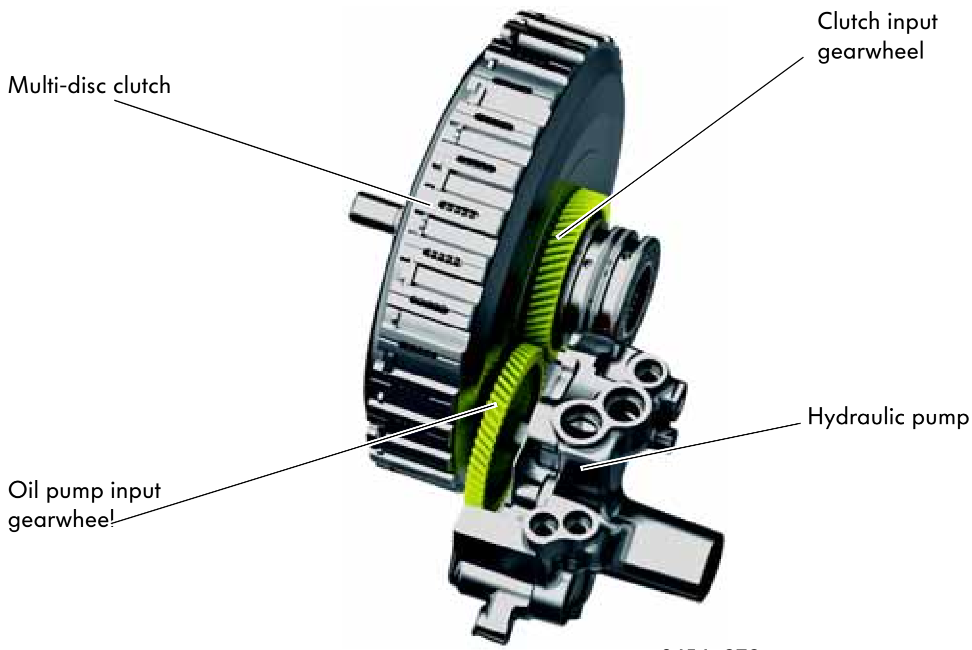
Oil circuit - hydraulic system

The hydraulic pump

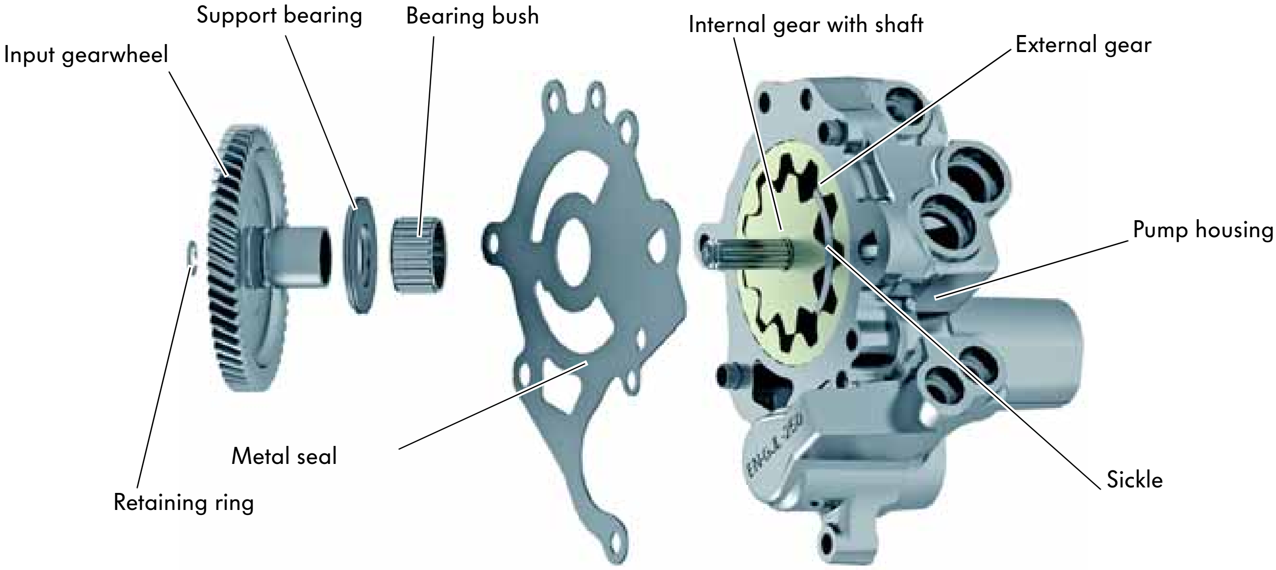
The hydraulic pump is a sickle-cell pump. It is driven directly by the clutch via an input gear. The pump has axial and radial bearings.
It generates the oil pressure that is required for actuating the hydraulic components, and permits a maximum delivery rate of 100 l/min.
Depending on the engine speed and load, its operating pressure is between 5 and 20 bar (max. 3 kW power consumption at full working pressure).

The hydraulic pump supplies:

- Multi-disc clutches K1 and K2
- Clutch cooling system
- Gearshift hydraulics
- Lubrication of the gears and shafts



S454_070



S454_071

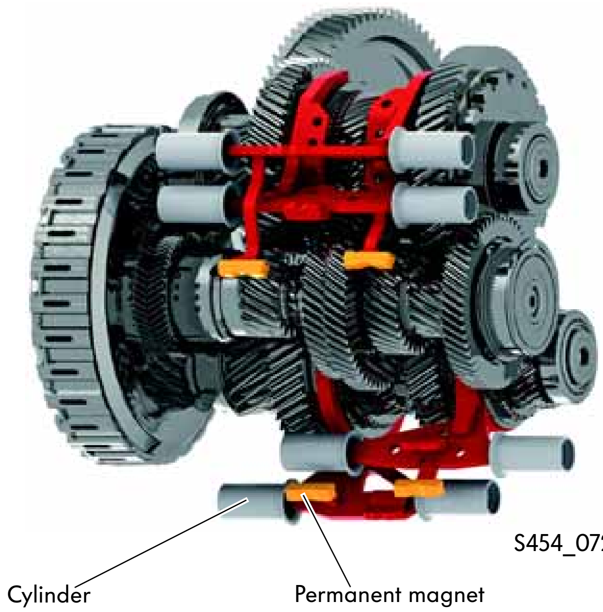
Shifting gears

The shift pressure passes through holes in the gearbox, into the cylinder spaces (hydraulic cylinders) that are open to the rear.

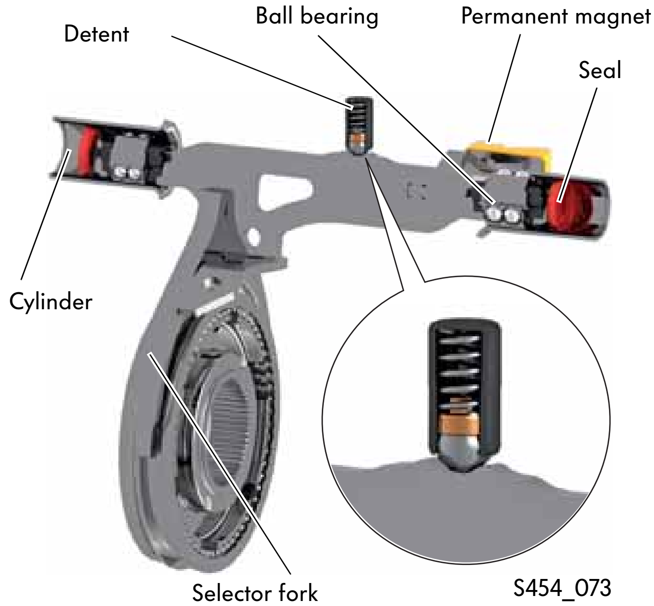
The selector forks are mounted in cylinders using ball bearings. The mechatronic unit channels DSG oil into a cylinder for shifting gear. The second cylinder is depressurised, therefore the selector fork moves and operates the locking collar. This engages the gear.

The next higher or next lower gear is preselected in the DSG gearbox, depending on the engine speed and torque profile of the engine. The gearshift procedure operates with very low wear. The gear actuator is initially activated until the synchronisation point is reached. The gearshift procedure is finalised following the synchronisation. A normal gearshift procedure is completed within about 200 ms.

Once the gear has been engaged, the selector fork is depressurised. The gear remains on the selector fork due to the undercut of the selector gearing and the detent. If the selector fork is not actuated, it is held in the neutral position by a detent arranged in the gearbox housing. There is a permanent magnet on each selector fork which is protected against metal particles from the gearbox by means of a cap on top of it. The permanent magnet means that the travel sensor in the mechatronic unit can detect the precise position of the individual selector forks. In the N drive range and with the vehicle stationary, 1st gear and R gear are preselected



S454_072

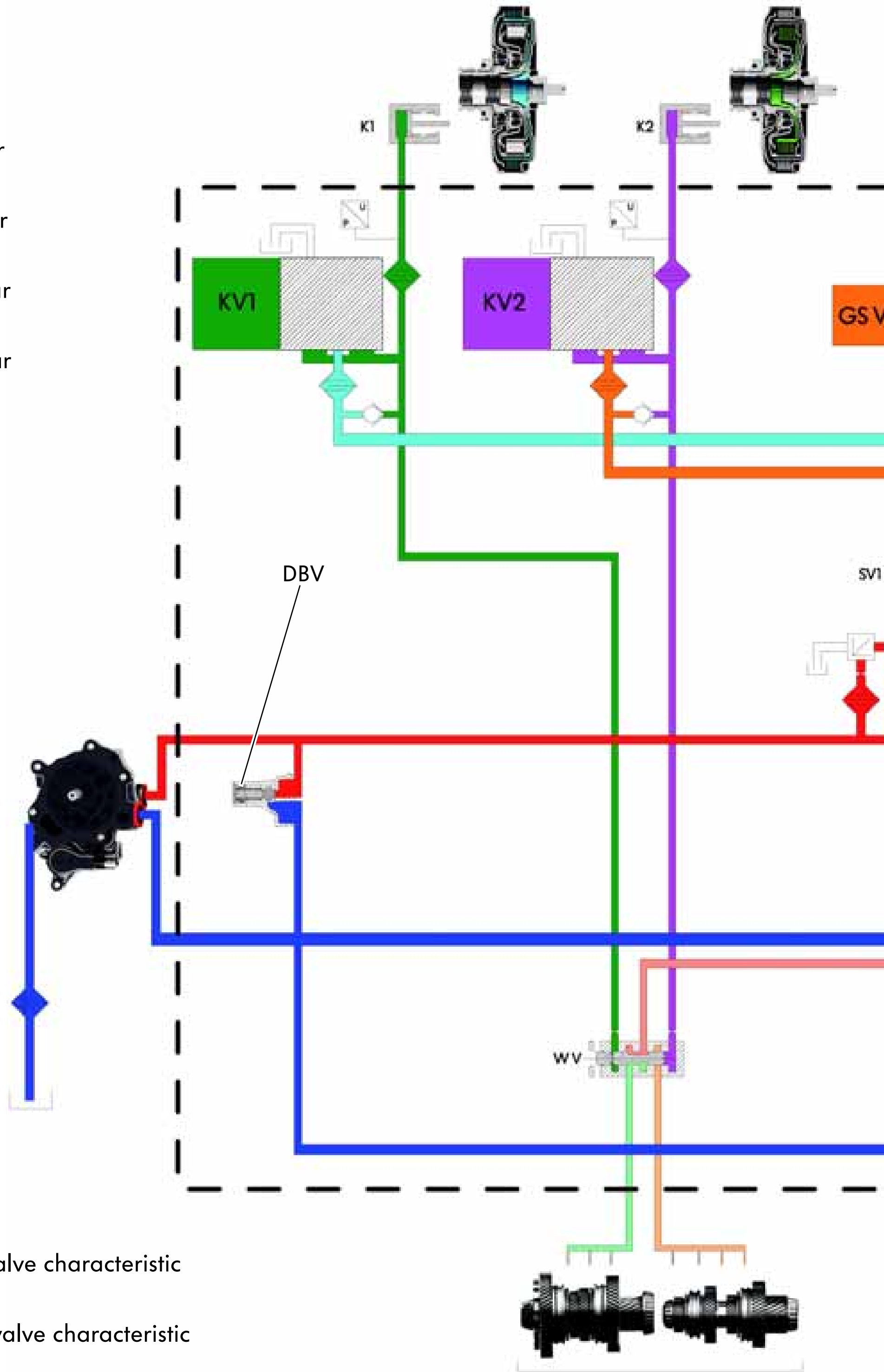


S454_073

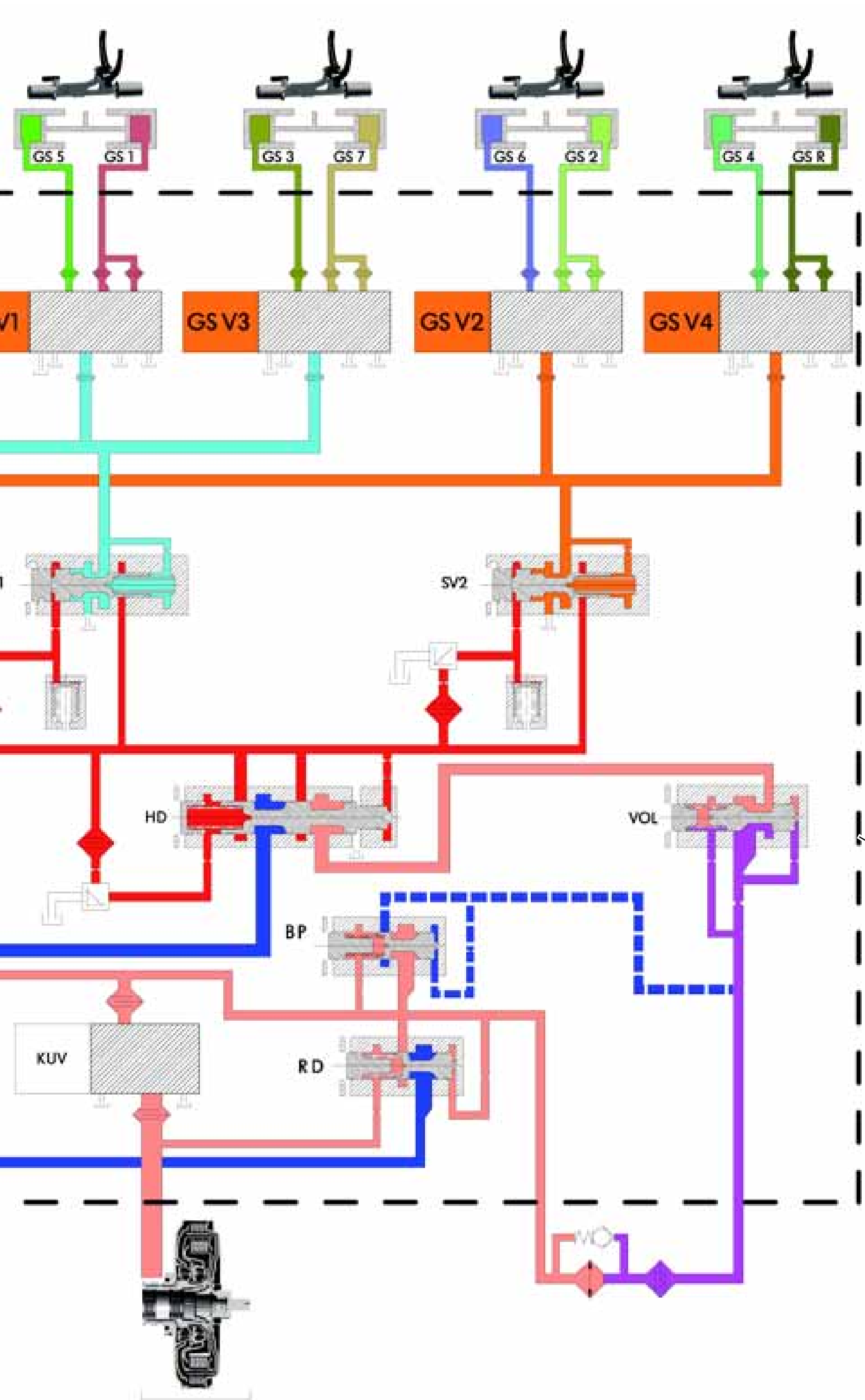
Oil circuit - hydraulic system

Hydraulic diagram

K1	Clutch K1
K2	Clutch K2
GS 5/1	Gear actuator for 5/1 gear
GS 3/7	Gear actuator for 3/7 gear
GS 6/2	Gear actuator for 6/2 gear
GS 4/R	Gear actuator for 4/R gear
KV1	Clutch valve K1
KV2	Clutch valve K2
GSV1	Gear actuator valve 1
GSV2	Gear actuator valve 2
GSV3	Gear actuator valve 3
GSV4	Gear actuator valve 4



U p	Pressure sensor
	Excess pressure valve
	Filter
	Non-return valve
	Overflow in oil level
	Control valve with rising valve characteristic
	Control valve with falling valve characteristic
	Wiring connector



SV1	Safety valve 1
SV2	Safety valve 2
HP	Hydraulic pump
DBV	Pressure relief valve
HD	Main pressure valve
VOL	Flow rate valve
BP	Bypass valve
WV	Changeover valve
KUV	Cooling oil valve
RD	Residual pressure valve

Mechatronic unit

S454_080

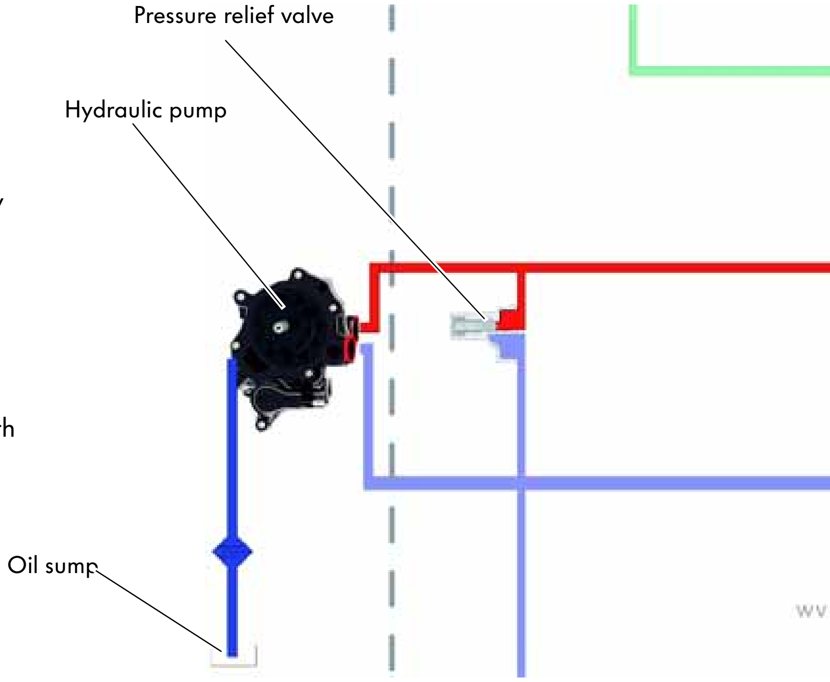
Oil circuit - hydraulic system

Oil circuit diagram: Main pressure

The hydraulic pump sucks the DSG oil out of the oil sump and pumps it under pressure to the main pressure valve.
Its maximum operating pressure is 20 bar.

The pressure limiting valve is located between the hydraulic pump and main pressure valve for safety reasons. It opens at a pressure of 32 bar and channels the DSG oil back to the hydraulic pump.

The main pressure valve sets the pressure in the mechatronic unit. It controls the pressure to safety valves 1 and 2, and supplies the flow rate valve with DSG oil for clutch cooling.



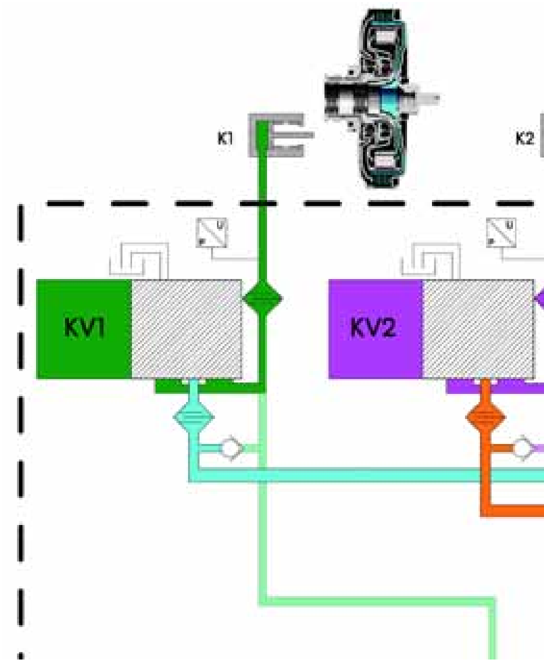
Oil circuit diagram: Sub-gearbox pressure

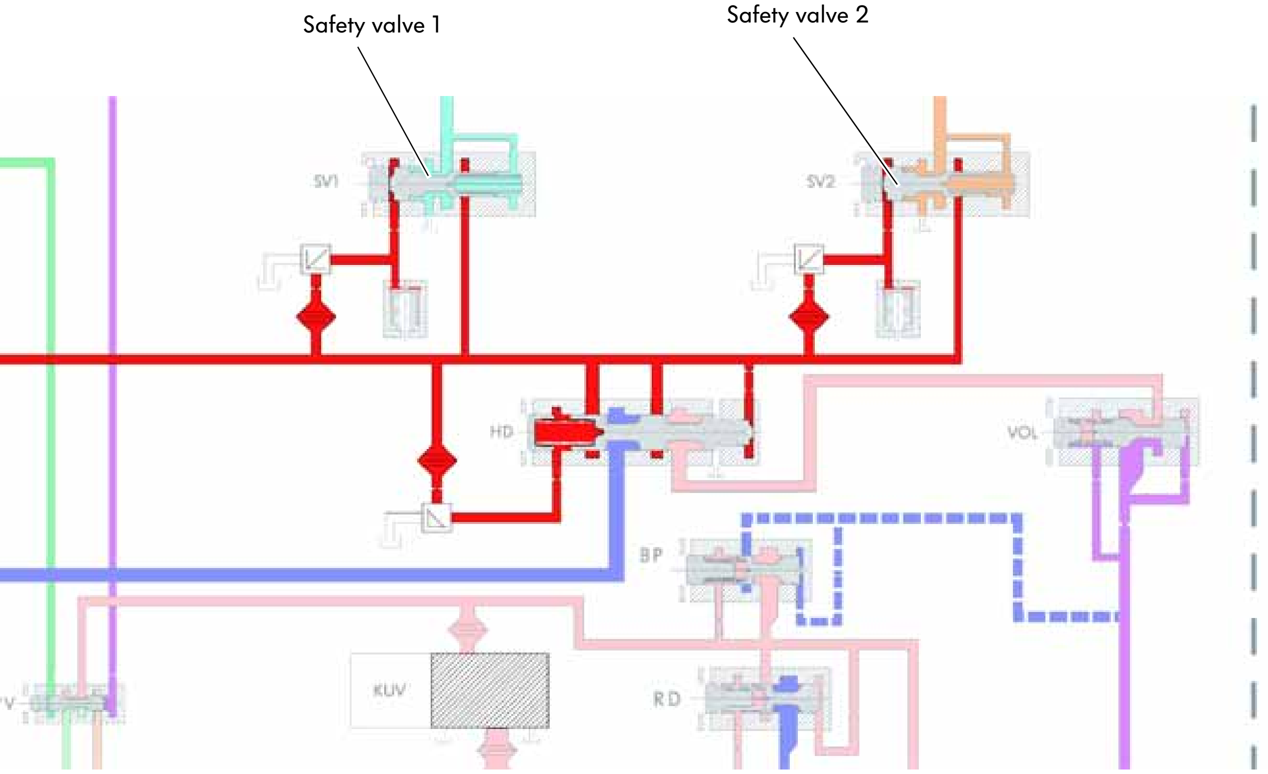
The safety valves set the oil pressure in both sub-gearboxes.

Each safety valve control one sub-gearbox.

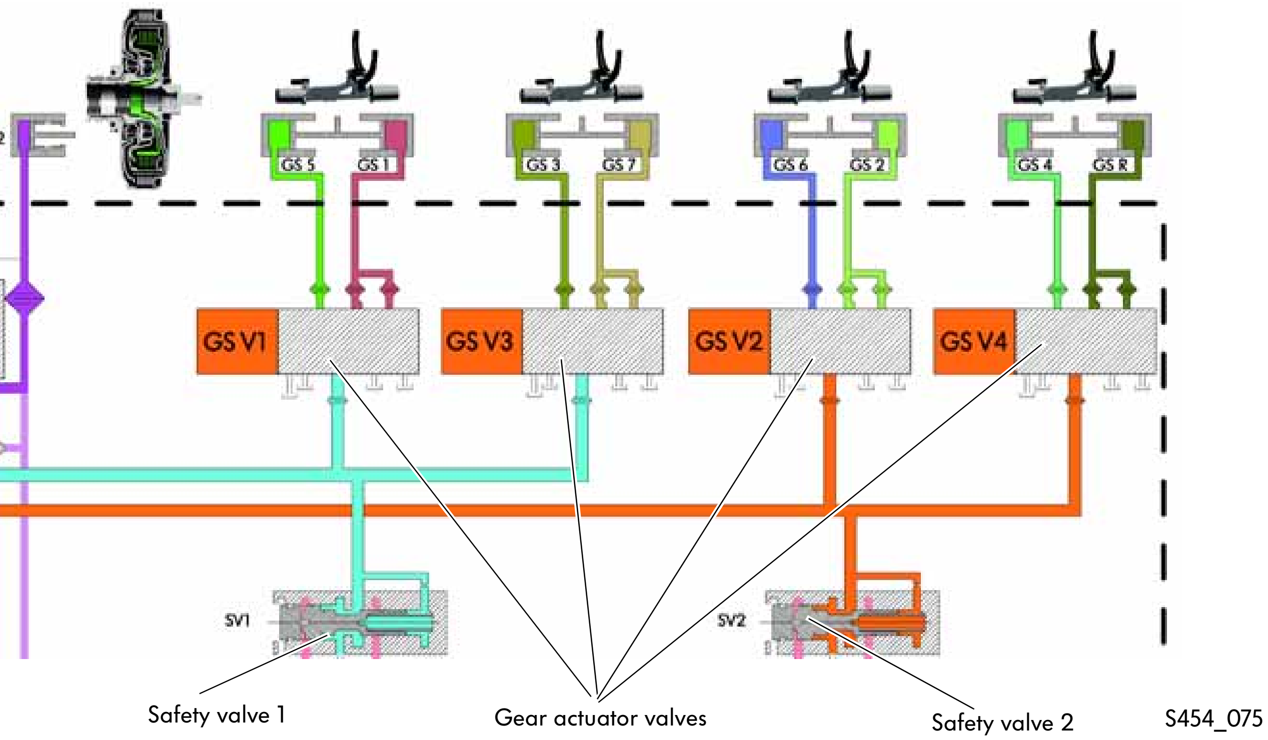
Safety valve 1 controls the operating pressure in sub-gearbox 1. It supplies the clutch valve for clutch K1 and the gear actuator valves for 1st/5th gears and 3rd/7th gears with oil.

The clutch valves also controls the changeover valve in alternation for lubricating the gearbox shafts.
A slide in the changeover valve is moved depending on which clutch is actuated. The corresponding hole in the changeover valve that is opened allows oil to flow into sub-gearbox 1 or sub-gearbox 2 in order to lubricate the gears.





S454_074



S454_075

Oil circuit - hydraulic system

Oil circuit diagram: Clutch cooling

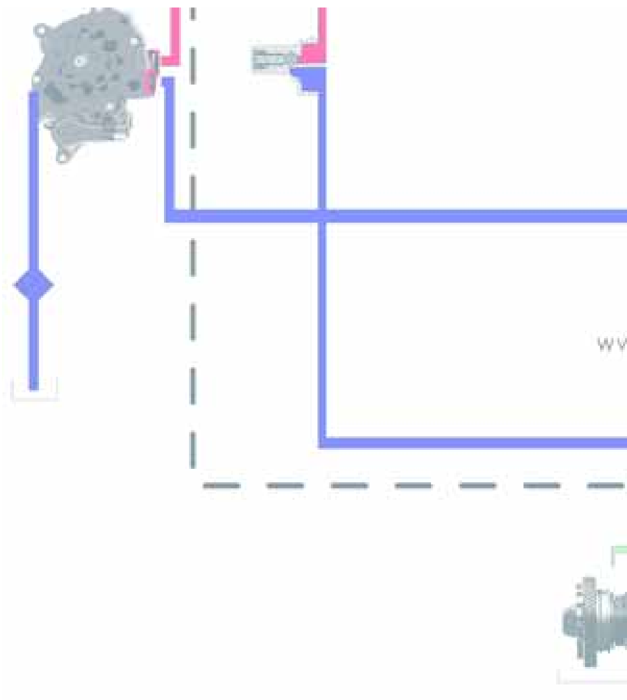
The flow rate valve regulates and limits the cooling oil quantity.
Depending on the clutch temperature, up to 35 litres of oil per minute are initially channelled to the oil cooler for clutch cooling. The cooled oil is passed through the oil filter to the cooling oil valve.

The cooling oil valve regulates the amount of oil for clutch cooling. It is directed through supply ducts through the main hub into the clutch. Once the gear oil has flowed through the clutch, it is flung out at the clutch via openings. The gear oil runs back into the oil sump.

The residual pressure valve maintains a residual pressure of 3 bar for cooling the clutch.

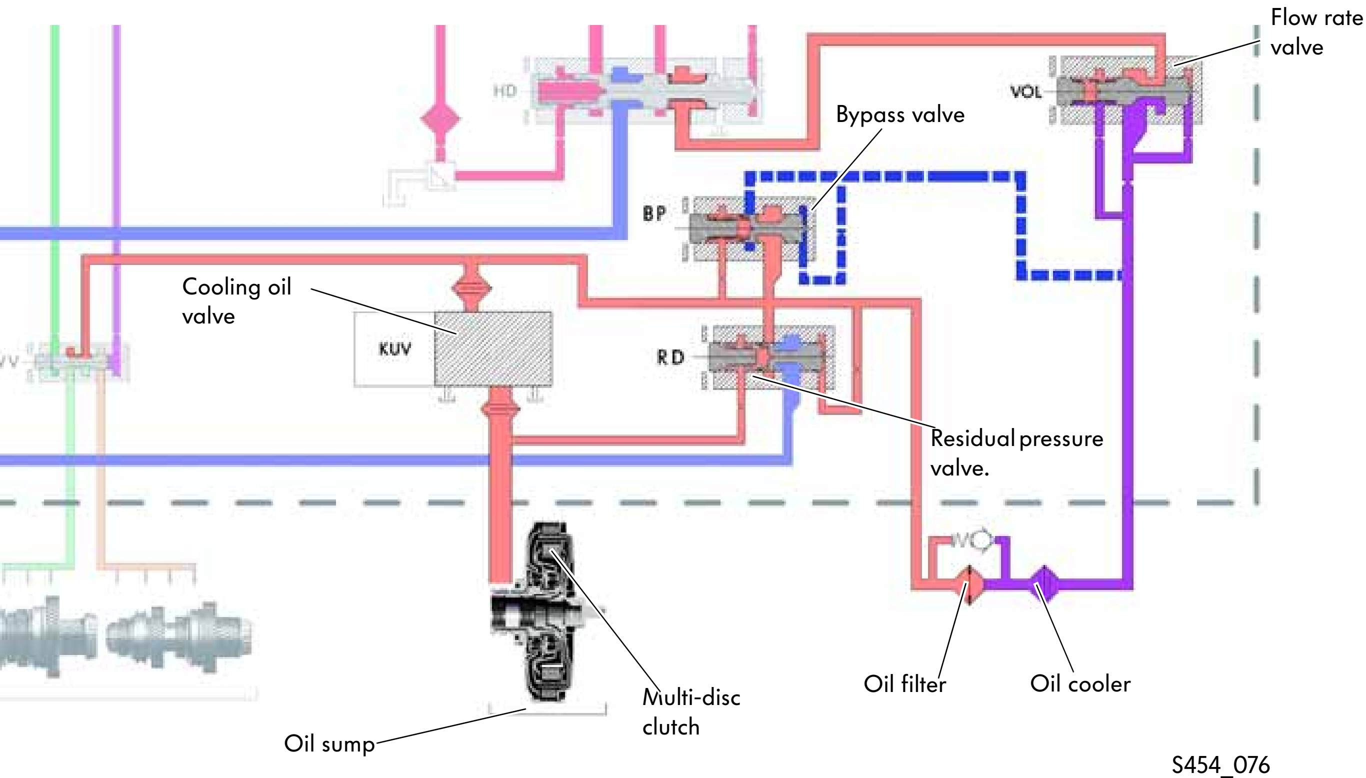
To prevent gearbox damage, a bypass valve makes it possible to lubricate the shafts and to cool the clutch if the oil filter or the oil cooler is blocked.

At outside temperatures below -20° C, the low viscosity of the DSG oil means that it is first passed through the bypass valve to the cooling oil valve during the warming-up phase after the engine starts.



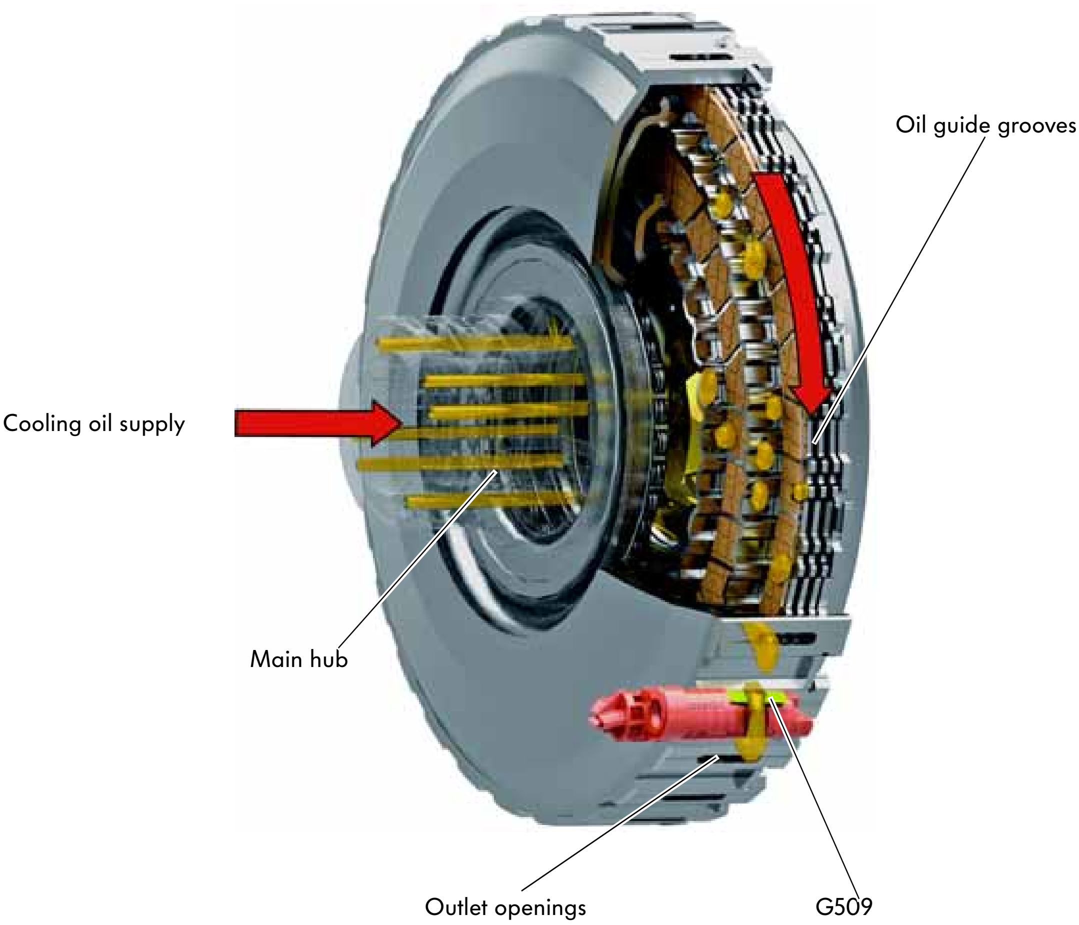
Oil flow through the dual clutch

The cooling oil passes through holes in the main hub into the dual clutch, and is forced out by centrifugal force through oil guide grooves and outlet openings. The clutch temperature sender G509 records the oil temperature there.



Flow rate valve
HD
VOL
Bypass valve
BP
Cooling oil valve
KUV
RD
Residual pressure valve.
Oil filter
Oil cooler
Multi-disc clutch
Oil sump

S454_076



Oil guide grooves
Cooling oil supply
Main hub
Outlet openings
G509

Oil circuit - hydraulic system

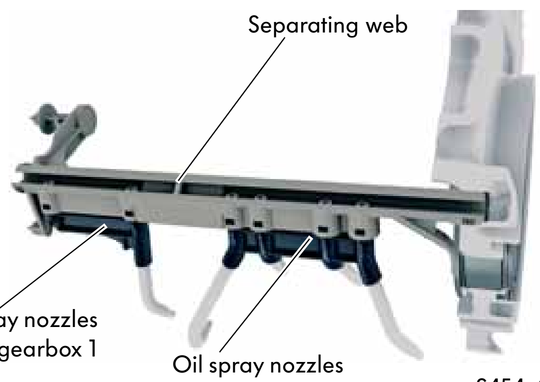
Oil circuit diagram: Lubrication

Lubrication of the shafts and synchromeshed gears is carried out via a split oil spray pipe, according to the load.
Lubrication is only given to the sub-gearbox for which the clutch is currently engaged, and which is therefore transmitting force.
When 1st, 3rd, 5th or 7th gear is engaged, input shaft 1 and therefore sub-gearbox 1 are actively lubricated.
When 2nd, 4th, 6th or reverse gear is engaged, input shaft 2 and therefore sub-gearbox 2 are lubricated.

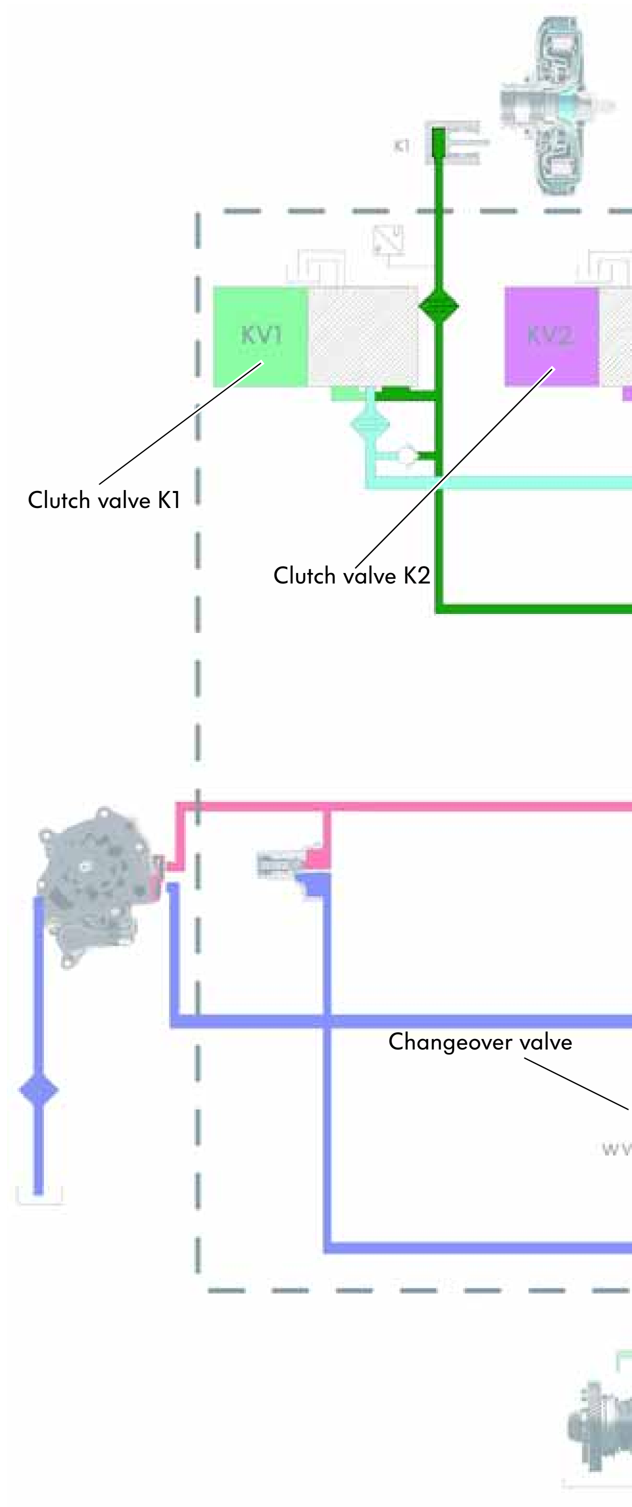
The alternating active lubrication is controlled by the clutch valve of the hydraulically actuated clutch.

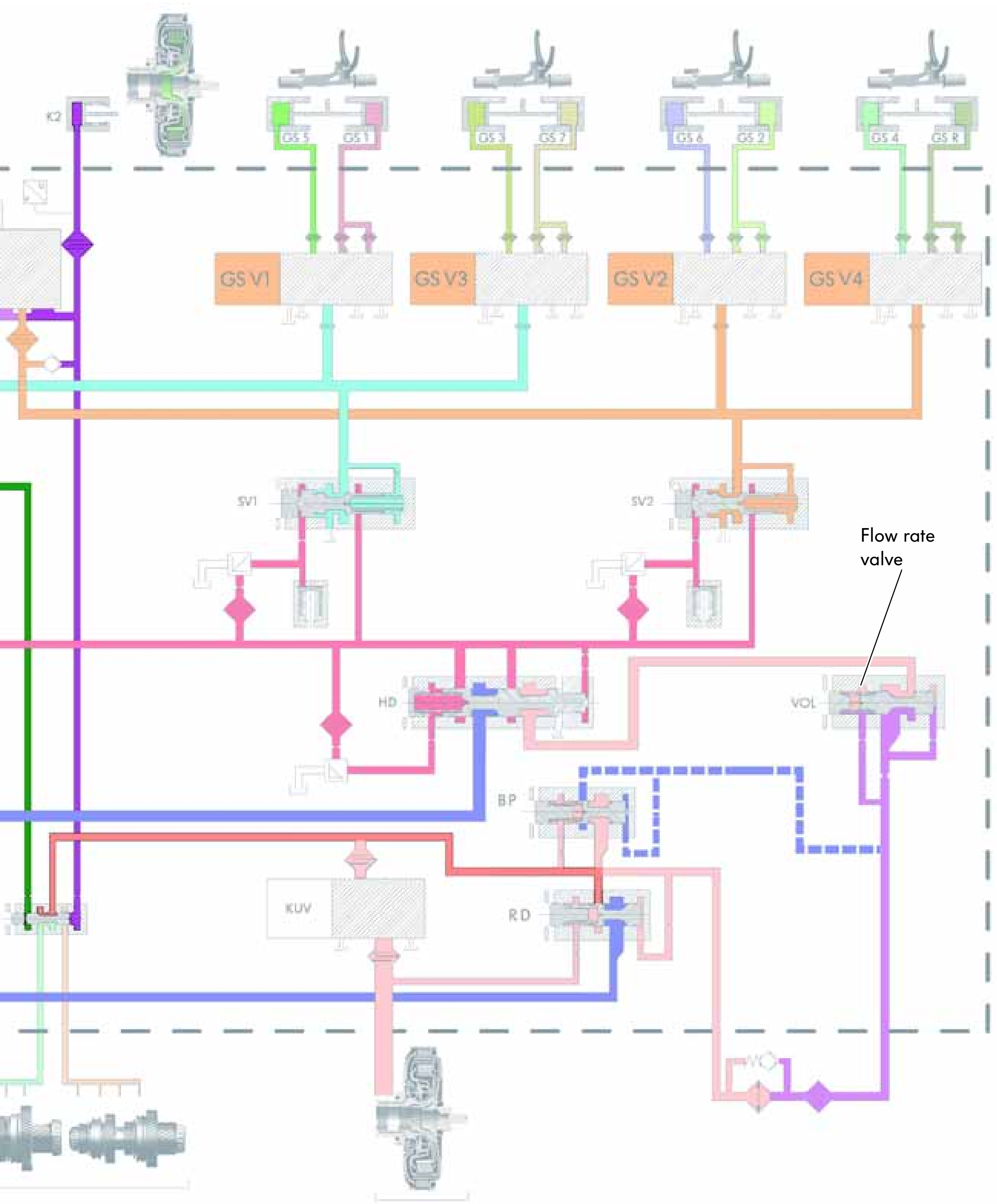
The flow rate valve supplies the changeover valve with oil for lubricating the gear train.

S454_077



S454_078

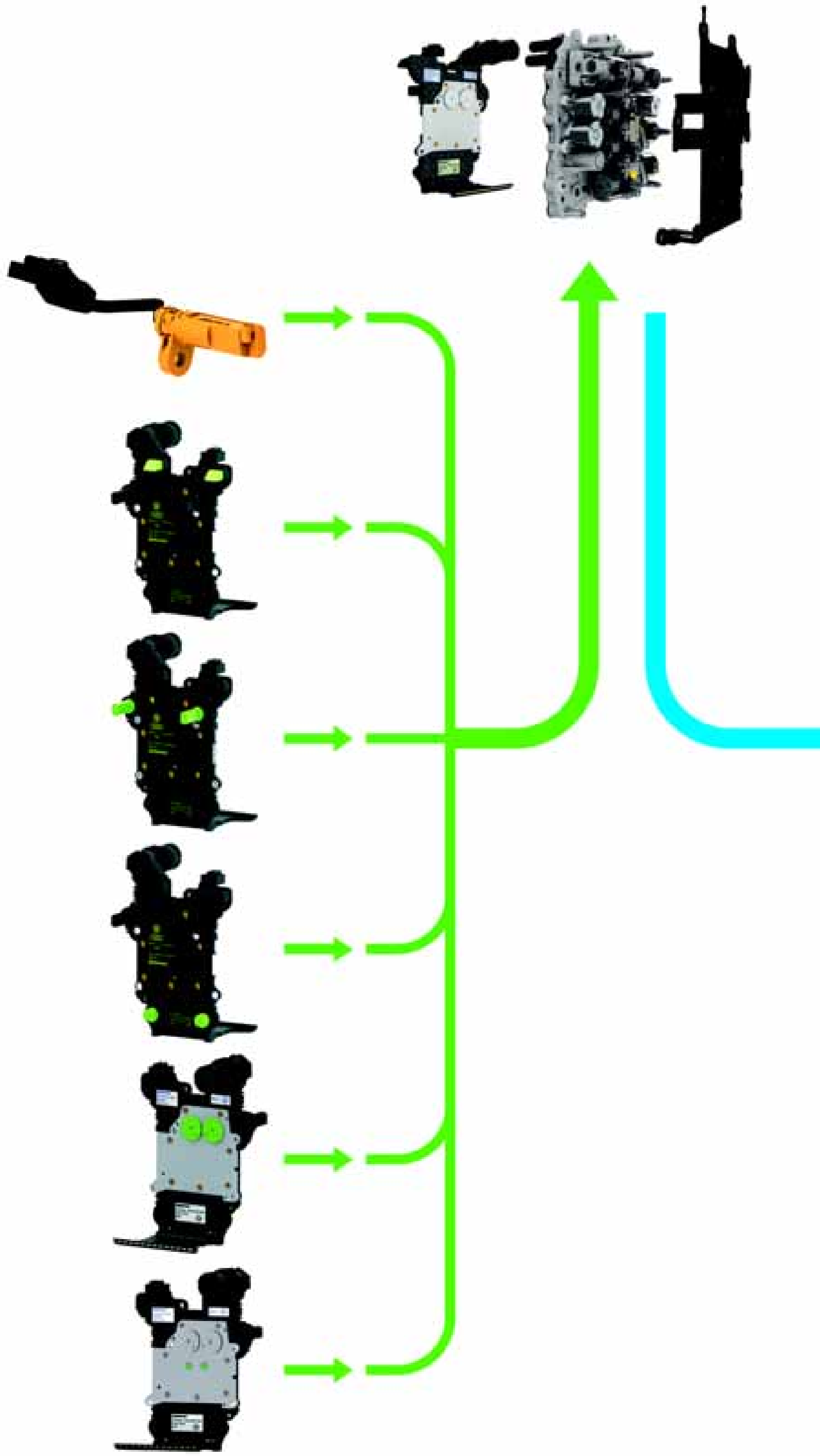



K2
GS 5
GS 1
GS 3
GS 7
GS 6
GS 2
GS 4
GS R
GS V1
GS V3
GS V2
GS V4
SV1
SV2
Flow rate
valve
HD
VOL
BP
KUV
RD

S454_079

System overview

Mechatronic unit for dual clutch gearbox **J743**



Sensors

Gearbox input speed sender **G182**
Clutch temperature sender **G509**

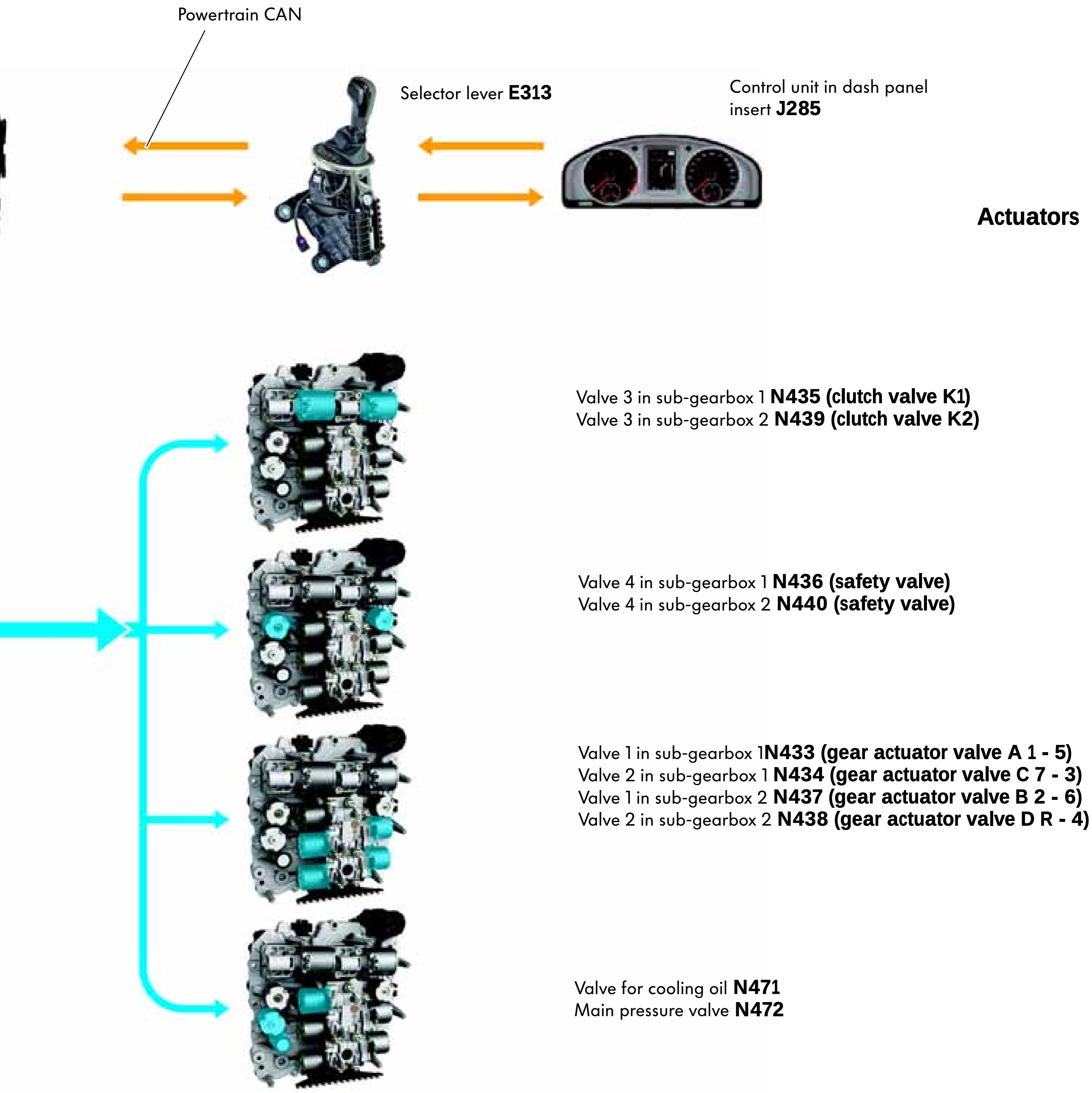
Gear selector movement sensor 1 **G487**
Gear selector travel sensor 3 **G489**

Input shaft speed sender 1 **G501**
Input shaft speed sender 2**G502**

Gear selector movement sensor 2 **G488**
Gear selector travel sensor 4 **G490**

Hydraulic pressure sender 1 **G545**
Hydraulic pressure sender 2 **G546**

Gearbox oil temperature sender **G93**
Temperature sender in control unit **G510**

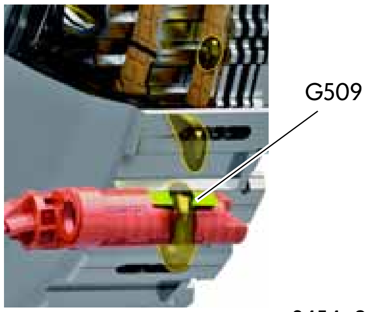

Powertrain CAN
Selector lever E313
Control unit in dash panel insert J285
Actuators
Valve 3 in sub-gearbox 1 N435 (clutch valve K1)
Valve 3 in sub-gearbox 2 N439 (clutch valve K2)
Valve 4 in sub-gearbox 1 N436 (safety valve)
Valve 4 in sub-gearbox 2 N440 (safety valve)
Valve 1 in sub-gearbox 1N433 (gear actuator valve A 1 - 5)
Valve 2 in sub-gearbox 1 N434 (gear actuator valve C 7 - 3)
Valve 1 in sub-gearbox 2 N437 (gear actuator valve B 2 - 6)
Valve 2 in sub-gearbox 2 N438 (gear actuator valve D R - 4)
Valve for cooling oil N471
Main pressure valve N472

S454_081

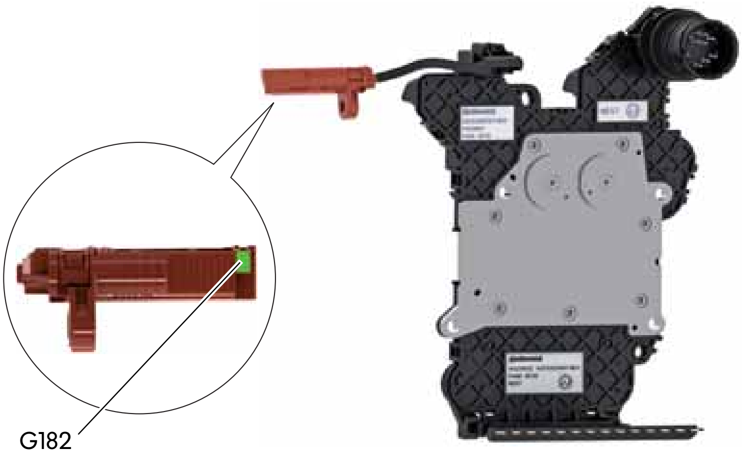
Sensors

Gearbox input speed sender G182

The gearbox input speed senderG182 is inserted into the gearbox housing. It electronically scans the outside of the multi-disc clutch and registers the gearbox input speed.
The gearbox input speed is identical to the engine speed. The speed sender operates according to the Hall principle. Sender G509 is also located in the housing of this sender. Both senders are connected to the mechatronic unit via electrical cables.



S454_082



S454_083

Signal utilisation

The gearbox input speed signal is a parameter for calculating the slip of the multi-disc clutches.
To perform this calculation, the control unit also needs the signals from the input shaft speed sender 1 G501 and input shaft speed sender 2 G502.
The control unit can use the clutch slip for controlling opening and closing of the clutches more accurately.

Effects of a signal failure

If the signal fails, the control unit uses the information from the engine speed sender as a default signal.

Input shaft speed sender 1 G501 and input shaft speed sender 2 G502

Both senders are located on the gearbox control unit.
Speed sender G501 records the rotation speed of input shaft 1.
Speed sender G502 records the rotation speed of input shaft 2.
Both senders are Hall senders.

Each sender scans a sensor wheel on its shaft in order to detect the rotation speed.
The sensor wheel comprises a sheet metal component. A rubber-metal layer is applied to this sheet metal component. This layer forms a circumferential sequence of small magnets with north and south poles.
There is a gap in between the individual magnets.

S454_084

S454_085

Signal utilisation

In conjunction with the signal from the gearbox input speed, the control unit calculates the output speeds of multi-disc clutches K1 and K2, and thereby detects clutch slip.
The control unit detects the opening and closing status of the multi-disc clutches based on the slip.
Furthermore, the signal is used for checking that the gear is engaged.

Effects of a signal failure

If one of the signals fails, the sub-gearbox in question is deactivated. If the sender G501 for sub-gearbox 1 fails then it is only possible to drive in gears 2, 4, 6 and R. If the sender G502 for sub-gearbox 2 fails then it is only possible to drive in gears 1, 3, 5 and 7.

Sensors

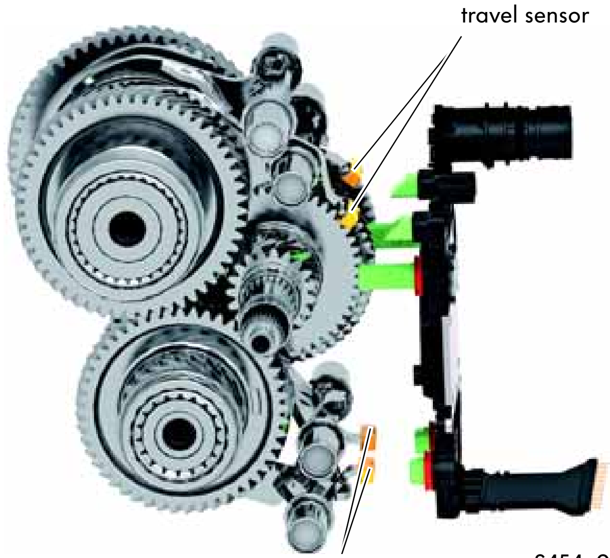
Travel sensors 1 to 4 G487, G488, G489, G490 for gear actuator

The travel sensors are located on the gearbox control unit.
They are Hall senders. In conjunction with the magnets on the selector forks, they generate a signal by means of which the control unit can detect the positions of the gear actuators/selector forks.

Each travel sensor, or one each of the travel sensors, monitor(s) the position of a gear actuator / selector fork by means of which it is possible to select between two gears.

- G487 for gears 1/5
- G488 for gears 3/7
- G489 for gears 4/R
- G490 for gears 2/6

S454_086



S454_087

Signal utilisation

Based on the precise position, the gearbox control unit instructs the gear actuators to shift the gears using oil pressure.

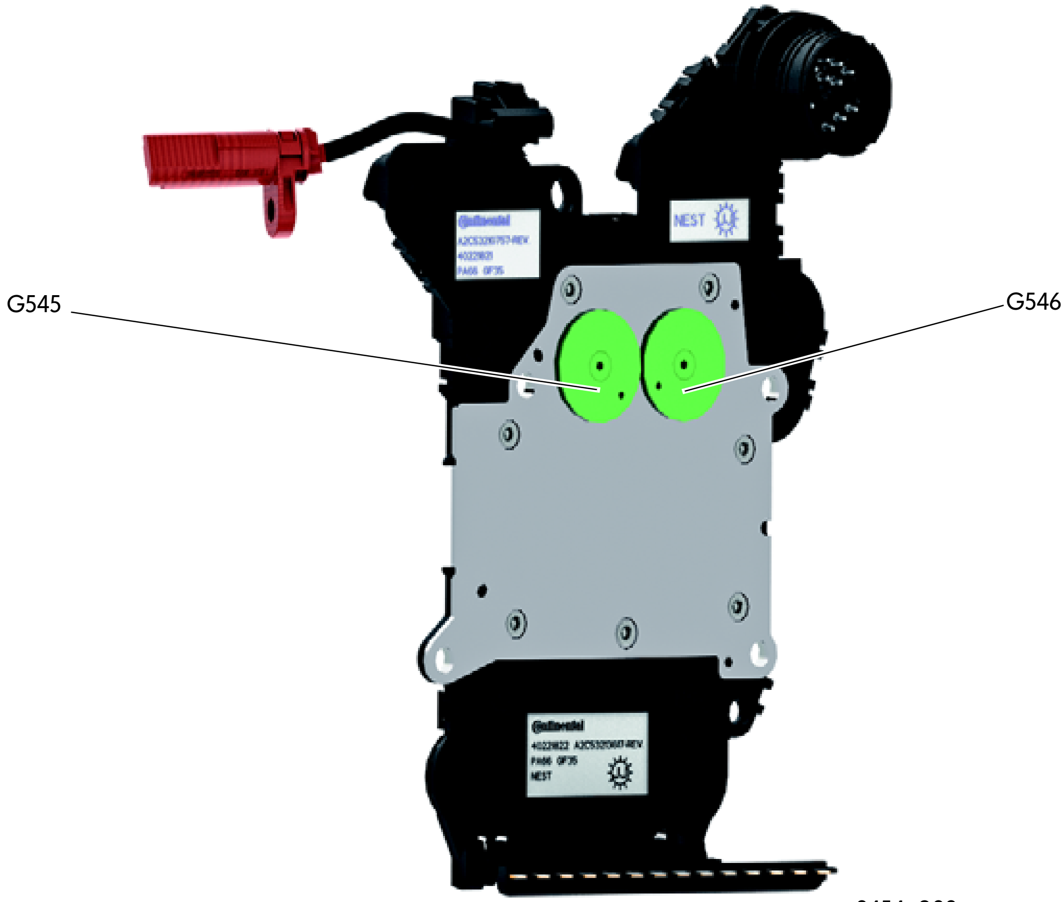
Effects of a signal failure

If a travel sensor no longer supplies any signals then the sub-gearbox in question is deactivated. The gears of the sub-gearbox in question can no longer be used. G487 and G488 monitor gears 1, 3, 5 and 7 in sub-gearbox 1. G489 and G490 monitor gears 2, 4, 6 and R in sub-gearbox 2.

Hydraulic pressure sender 1 G545 and hydraulic pressure sender 2 G546 for hydraulic pressure

Both pressure senders are located in the gearbox control unit.

The same pressure acts on sender 1 G545 as on the multi-disc clutch K1.
The pressure of multi-disc clutch K2 acts on sender 2 G546.



S454_088

Signal utilisation

The gearbox control unit uses the signals to detect the hydraulic pressure that acts on the particular multi-disc clutch.
The control unit needs to know the precise hydraulic pressure in order to control the multi-disc clutch.

Effects of a signal failure

If a pressure signal fails or if no pressure is built up then the corresponding sub-gearbox is deactivated. If sender G545 fails, it is only still possible to drive in gears 2, 4, 6 und R. If sender G546 fails, it is only still possible to drive in gears 1, 3, 5 and 7.

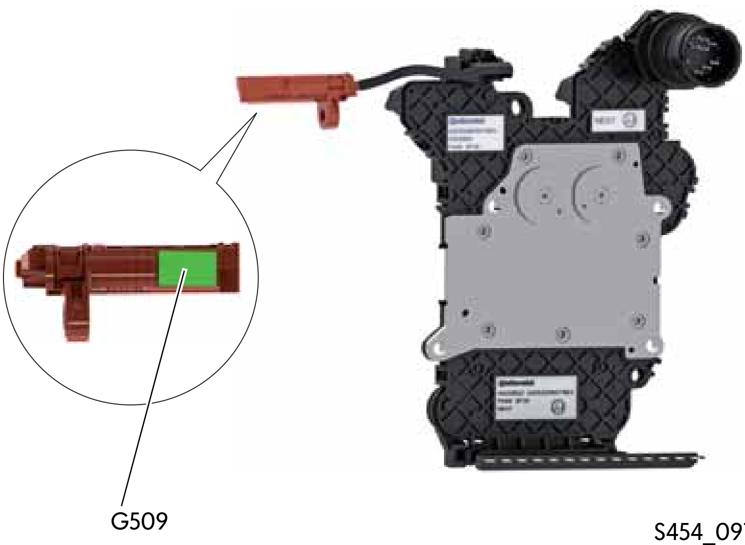
Gearbox management

Sensors

Clutch temperature sender G509

Sender G509 is located in the housing of the gearbox input speed sender G182.
It measures the temperature of the DSG oil emerging from the multi-disc clutches. The oil in the multi-disc clutches undergoes severe thermal stress, therefore it has the highest temperature in the gearbox at this point.

This sender is designed to be able to measure temperatures very quickly and very accurately.
It operates in the temperature range from -55 °C to +180 °C.



S454_091

Signal utilisation

Clutch temperature sender G509 is used for monitoring the clutch. The control unit regulates the amount of clutch cooling oil based on the signals from temperature sender G509, and takes additional thermal protection measures for the gearbox. If the DSG oil temperature exceeds 150 °C, the engine torque is reduced in order to protect the gearbox and to reduce the clutch temperature. In addition, the first warning level is activated on the dash panel insert: a warning message is shown briefly and a warning sounds.

If the DSG oil temperature exceeds 170 °C, the second warning stage is activated, a warning message is displayed continuously and a continuous warning sounds. In addition, an error message is stored in the control unit error memory. The multi-disc clutch remains closed if the DSG oil temperature is excessive.

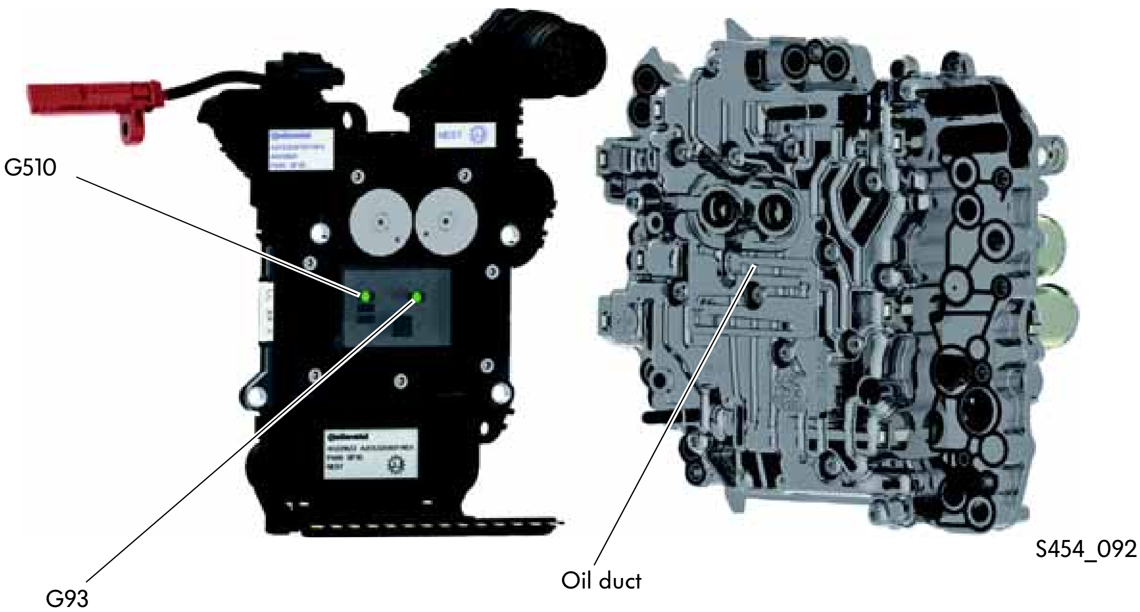
Effects of a signal failure

In case of a signal failure, the gearbox control unit uses the signals from the gearbox oil temperature sender G93 and the temperature sender in control unit G510 as default signals.

Gearbox oil temperature sender G93 and temperature sender in control unit G510

Both senders are arranged on the circuit board in the gearbox control unit.
The DSG oil is directed past the gearbox control unit through an oil duct on the aluminium plate. The two gearbox oil temperature senders G93 and G510 record the temperature of the aluminium plate, and therefore measure the temperature of the DSG oil.

Severe heating can impair the functions of the electronic control unit.
The measurement allows measures to be implemented at an early stage to reduce the oil temperature, and avoid severe heating of the mechatronic unit.



Signal utilisation

The signals from both senders are used for checking the mechatronic unit temperature.
In addition, a warming-up shift programme is started on the basis of the sender signals.
Both senders are cross-checking.

Effects of a signal failure

If G93 fails, the gearbox control unit uses the signal from the temperature sender in control unit G510 as a default signal. If G510 fails, the gearbox control unit uses the signal from gearbox oil temperature sender G510 as a default signal. If the gearbox oil temperature exceeds 138 °C, the mechatronic unit causes the engine torque to be reduced in order to protect the control unit.

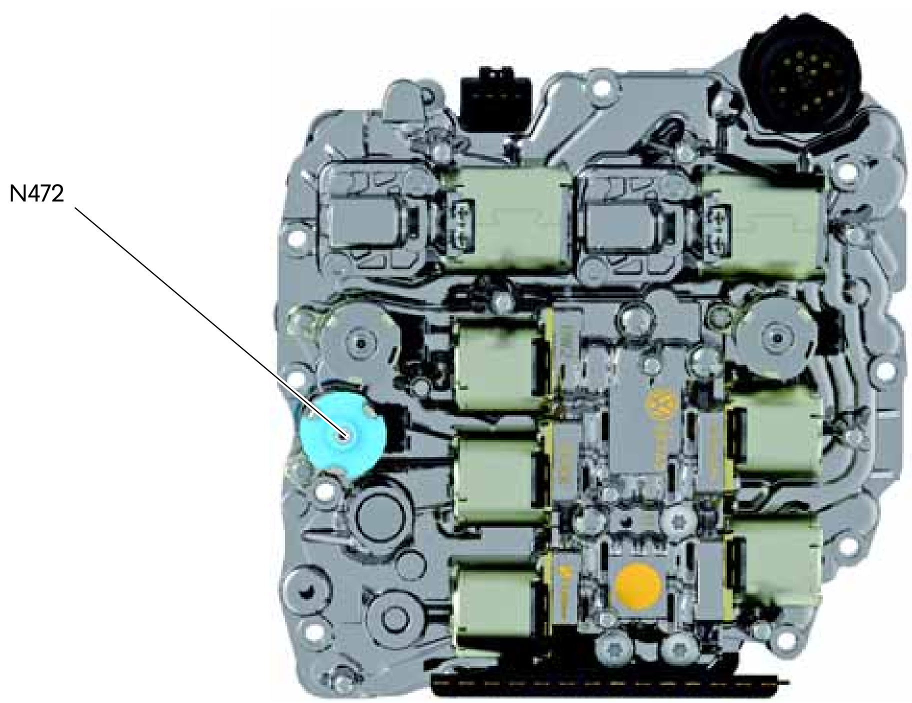
The multi-disc clutch remains closed if the oil temperature is excessive.

Actuators

Main pressure valve N472

The main pressure valve is located in the electrohydraulic control unit of the mechatronic unit. It is a modulation valve. This valve controls the main pressure in the hydraulic system of the mechatronic unit. The main factor for calculating the main pressure is the current clutch pressure that is required for slip-free power transmission. The clutch pressure depends on the engine torque.

The temperature of the mechatronic unit and the engine speed are used as correction parameters for the main pressure.
The gearbox control unit continuously adapts the main pressure to the current operating conditions and torque requirements.



S454_093

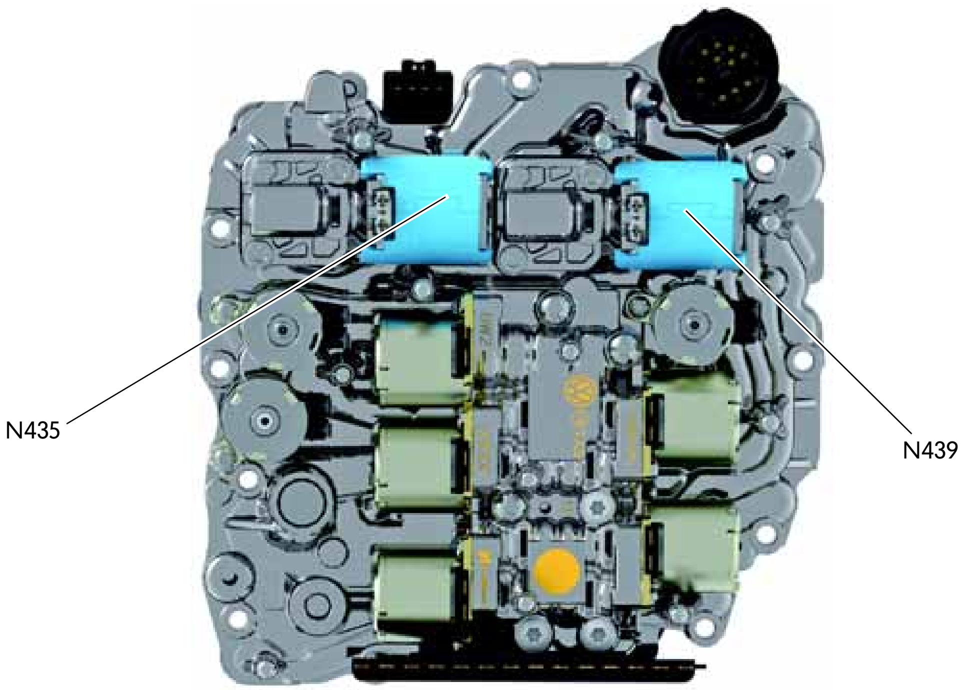
Effects of a signal failure

If the main pressure valve fails, operation continues with the maximum main pressure. The basis for this is the solenoid valves characteristic. This means the fuel consumption can increase and there may be loud gearshifts.

Valve 3 in sub-gearbox 1 N435 and valve 3 in sub-gearbox 2 N439 (clutch valves)

Clutch valves N435 and N439 are arranged in the electrohydraulic control unit of the mechatronic unit. They are modulation valves and generate the control pressure for the multi-disc clutches - clutch valve N435 for multi-disc clutch K1 and clutch valve N439 for multi-disc K2.

The basis for calculating the clutch pressure is the current engine torque.
The gearbox control unit adapts the clutch pressure to the current coefficient of friction of the multi-disc clutches.



S454_094

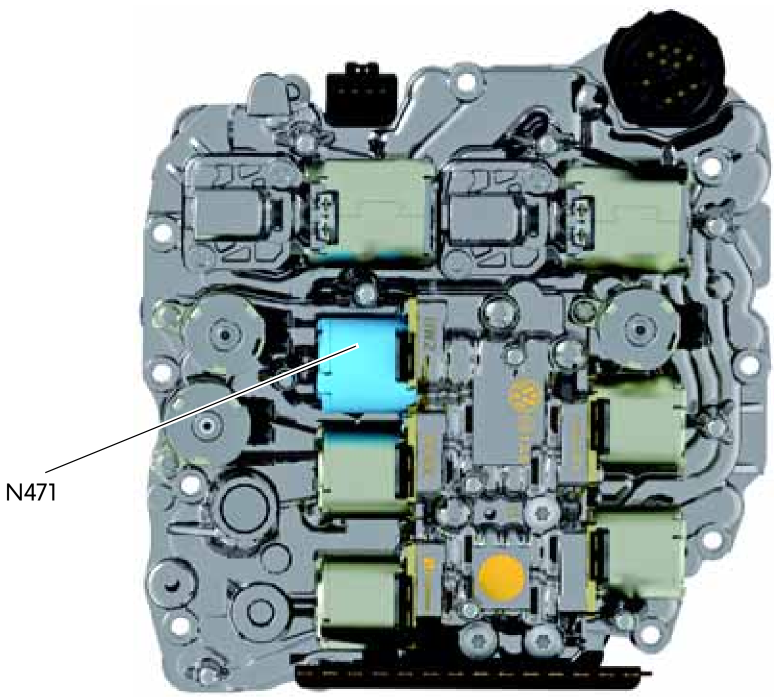
Effects of a signal failure

If a clutch valve fails then the sub-gearbox in question is deactivated. If clutch valve N435 fails, sub-gearbox 1 is deactivated and it is only possible to continue driving in gears 2, 4, 6 and R. If clutch valve N439 fails, sub-gearbox 2 is deactivated and it is only possible to continue driving in gears 1, 3, 5 and 7. This fault is displayed in the dash panel insert.

Actuators

Valve for cooling oil N471

The valve for cooling oil N471 is located in the electrohydraulic control unit.
It is a modulation valve and controls the clutch cooling oil quantity by a hydraulic valve.
The control unit uses the signal from the clutch temperature sender G509 for controlling the valve.



S454_095

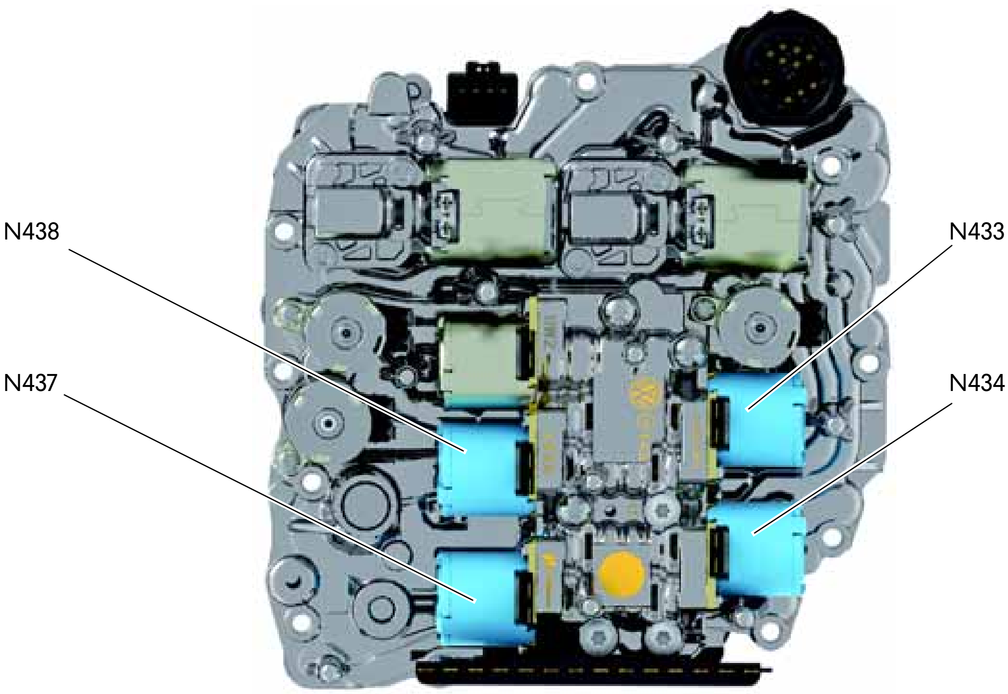
Effects of a signal failure

If the cooling oil valve cannot be controlled then the maximum cooling oil amount flows through the multi-disc clutches.
This can lead to problems when shifting gears at low outside temperatures, as well as causing increased fuel consumption.

Valves 1 and 2 in sub-gearboxes 1 and 2 N433, N434, N437 and N438 (gear actuator valves)

All four solenoid valves are located in the electrohydraulic control unit of the mechatronic unit. A separate solenoid valve is allocated to each gear actuator, and this valve is responsible for all gearshift procedures for the gear actuator to which it is allocated. All gear actuators are configured as proportional valves. According to the sub-gearbox pressure required, the corresponding gear actuator valves are controlled with a variable extent of opening. The variable deflection of the gear actuator causes fast and comfortable gearshifts.

Solenoid valve 1 N433 controls the oil pressure for shifting the 1st and 5th gears.
Solenoid valve 2 N434 controls the oil pressure for shifting the 3rd and 7th gears.
Solenoid valve 3 N437 controls the oil pressure for shifting the 2nd and 6th gears.
Solenoid valve 4 N438 controls the oil pressure for shifting 4th and R gears.



S454_096

Effects of a signal failure

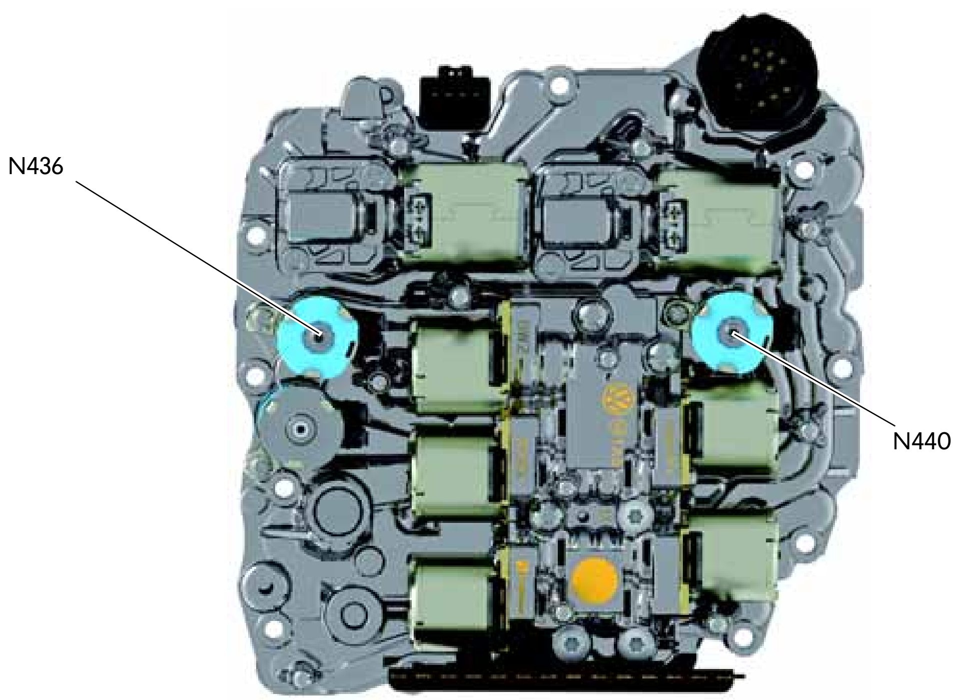
If a solenoid valve fails then the corresponding sub-gearbox in which the gear actuator is located is deactivated.
If solenoid valve N433 or N434 fails, sub-gearbox 1 is deactivated and it is only possible to continue driving in gears 2, 4, 6 and R. If solenoid valve N437 or N438 fails, sub-gearbox 2 is deactivated and it is only possible to continue driving in gears 1, 3, 5 and 7.

Actuators

Valve 4 in sub-gearbox 1 and 2 N436 and N440 (safety valves)

The pressure control valves N436 and N440 are located in the electronic control unit of the mechatronic unit. The safety valves are configured as proportional valves. They adjust the hydraulic pressure in the corresponding sub-gearbox that is required depending on the engine torque. If there is a safety-relevant fault in the sub-gearbox, they depressurise the corresponding sub-gearbox hydraulically.

Safety valves N436 and N440 ensure safe operation of the corresponding sub-gearbox. The solenoid valve characteristic with a rising valve characteristic means that the safety valves do not admit any main pressure into their corresponding sub-gearbox any longer if required. This means the sub-gearbox is hydraulically depressurised with a valve failure or there is a safety-relevant fault.



S454_097

Effects of a signal failure

If a pressure control valve fails then the corresponding sub-gearbox is deactivated. If there is a failure of pressure control valve N436, sub-gearbox 1 is deactivated and it is only possible to continue driving in gears 2, 4, 6 and R. If there is a failure of pressure control valve N440, sub-gearbox 2 is deactivated and it is only possible to continue driving in gears 1, 3, 5 and 7.

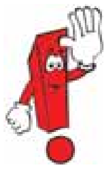
Service

Gear oil change

The DSG gear oil must be changed every 60,000 km.

During service, it is also necessary to drain the DSG gear oil from the mechatronic unit.

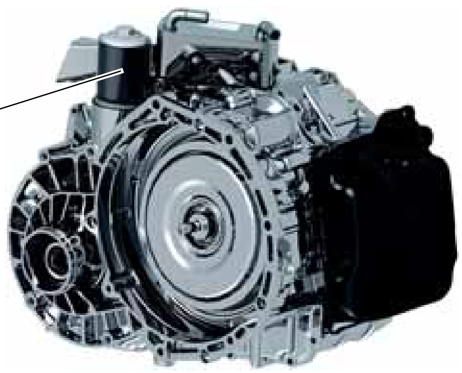
S454_100



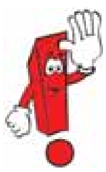
Note manufacturer's regulations!
All the information required for this can be found in the workshop manual.

Oil filter

There is no renewal interval provided for the oil filter of the DSG (lifetime). The oil filter can be changed, but this involves complicated replacement work.



S454_101



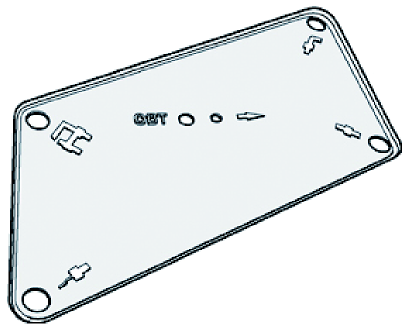
The vehicle is not allowed to be operated without the thermal protection covering on the oil filter!

Without the thermal protection covering, the oil filter cover will be damaged by the heat radiated from the exhaust system. This will damage the gearbox.

Installation work

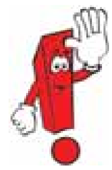
There is a new special tool for removing the gearbox, which is used for aligning the gearbox support 3282 of the engine and gearbox jack V.A.G 1383 A.

Adjustment plate 3282/61



S454_102

Towing the vehicle



In order to avoid damage to the gearbox during towing, the vehicle is only allowed to be towed up to 50 km at a speed not exceeding 50 km/h. Because the lubricating oil circuit in the gearbox no longer functions, towing for a distance significantly longer than 50 km can lead to gearbox damage.

The 1st and R gears are engaged in the 0BT gearbox, and both clutches are open, when the engine is stopped. This results in excessively high rotation speeds in the gearbox during towing operation at speeds in excess of 50 km/h, and can lead to damage.

Adaptation of the selector forks

To ensure perfect function of the gearbox, it is necessary for the gearbox control unit to know the positions of the selector forks precisely. Production tolerances mean that the particular limit positions and synchronisation points of each selector fork need to be adapted in the gearbox control unit.

If the mechatronic unit is exchanged or if error memories are stored relating to the gearshift, it is necessary to perform a basic setting using the diagnostic tester.

Test your knowledge

Which answers are correct?

1. How is the direction of rotation reversal achieved for reverse gear in the gearbox mechanism?

☐ a) The direction of rotation is reversed by a reverse shaft in the final drive.

☐ b) The direction of rotation is changed using the non-engaged synchromeshed gear of the second gear.

☐ c) The direction of rotation is changed using the reverse gear.

2. What measures are initiated by the mechatronic unit for dual clutch gearbox J743 if the DSG oil temperature exceeds 138 °C?

☐ a) A sub-gearbox is deactivated.

☐ b) A gearshift to the next higher gear is performed immediately.

☐ c) An engine torque reduction is initiated.

3. The oil pump in the dual clutch gearbox 0BT is driven by ...

☐ a) by splines on the main hub of the dual clutch.

☐ b) by input shaft 1.

☐ c) electrically.

4. What does the clamped shaft assembly do on output shafts 1 and 2 in the dual clutch gearbox 0BT?

☐ a) The clamped shaft assembly increases the effective shaft diameter of the output shafts for absorbing torque.

☐ b) The clamped shaft assembly establishes a force-locking connection between the synchromeshed gears on one shaft.

☐ c) The clamped shaft assembly sets the flank backlash between the output shafts and the input shafts.

5. How is the ignition key withdrawal lock solenoid energised in the ignition lock of the dual clutch gearbox 0BT?

☐ a) By the steering column electronics control unit J527.

☐ b) Directly by selector lever E313.

☐ c) Directly by the mechatronic unit for dual clutch gearbox J743.

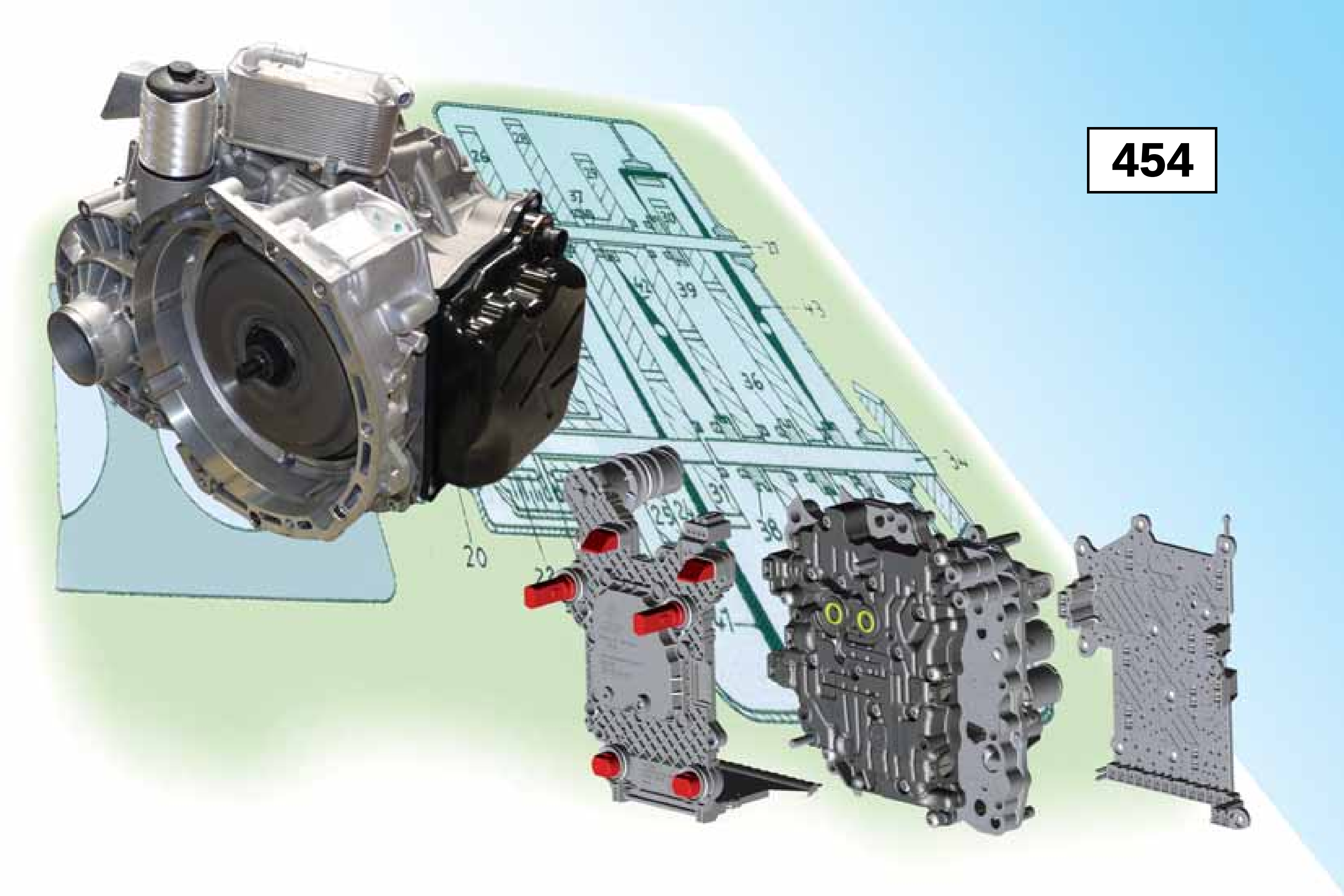
6. What is the effect of a failure of the main pressure valve N472?

☐ a) Sub-gearbox 1 is deactivated for safety reasons. It is only possible to continue driving in gears 1, 5, 7 and 3.

☐ b) Both sub-gearboxes are deactivated in order to avoid damage caused by excessive hydraulic pressure. Continued driving is no longer possible.

☐ c) The mechatronic unit operates continuously with the maximum main pressure if there is a failure. It is still possible to shift all gears.

Answers: 1. b., 2. c., 3. a., 4. a., 5. b., 6. c.



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