Service Training

Commercial Vehicles

Self-Study Programme Technology 507

Amarok 2012
The 8-speed automatic gearbox 0CM
Design and function

The 8-speed automatic gearbox in the Amarok

With a combustion engine, it is necessary to have a moving-off element that permits rotation speed differences between the engine speed and drivelines speed. In contrast to manual gearboxes and increased gearboxes, a converter operates with almost no wear, because the powerflow is only via the gearbox when moving off. The advantages of the converter are thus its low wear and the fact that its design causes the torque to be boosted beyond the engine torque. Specifically for the Amarok, the converter therefore represents the ideal moving-off element, because the very low ratio and torque increase provide a significant improvement in off-road and towing properties. This is in comparison to the Amarok with a manual gearbox, without step-down box. After the moving-off phase, the hydraulic slip of the converter is eliminated by the controlled lock-up clutch. This improves efficiency significantly.

S507_003

Key data

- Engine: 2.0 l bi-TDI with 132 kW
- Gearbox: 0CM
- can be combined with start/stop system

The automatic gearbox in the Amarok is a completely newly developed 8-speed automatic gearbox, in which the greatest importance has been placed on efficiency, gearshift comfort and speed, low weight and reliability.
The gearshifts are performed without interruption in traction, and the gearshift speeds are at the level of a DSG.

**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 service literature.

Important note

At a glance



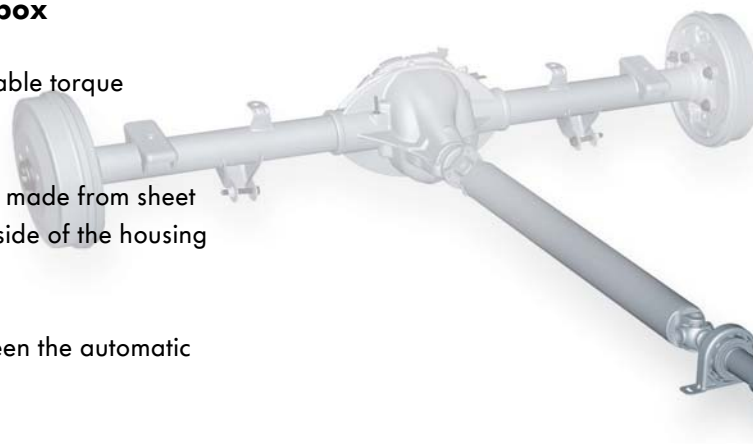




The driveline

The Amarok has a modular driveline in which the individual components such as automatic gearbox, front final drive, transfer box and rear final drive are each independent modules. The drive combination designed especially for the Amarok comprising permanent four-wheel drive and an automatic gearbox is configured for ideal traction on any surface.

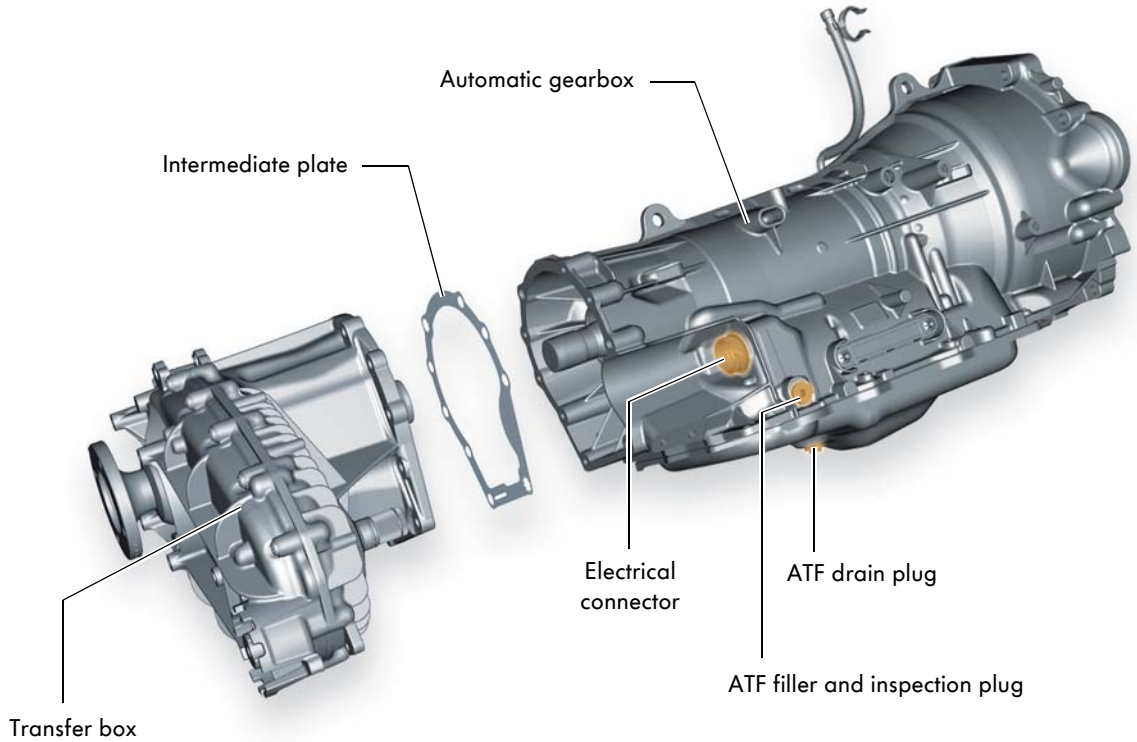
Connection of transfer box to automatic gearbox



Transfer box with self-locking centre differential and variable torque distribution.

The ATF drain plug is located at the bottom of the oil pan made from sheet steel. The ATF filler and inspection plug is located on the side of the housing (ATF = Automatic Transmission Fluid).

The intermediate plate prevents dirt from getting in between the automatic gearbox and the transfer box.



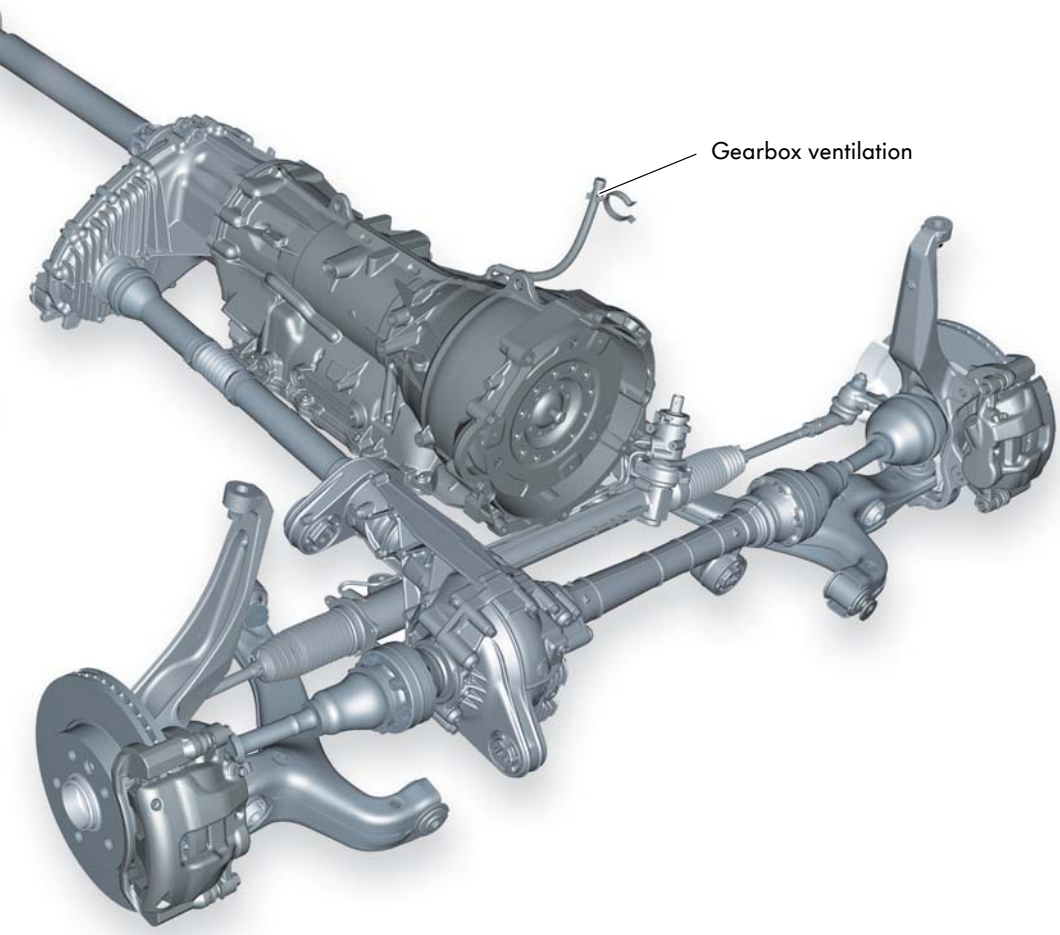
The transfer box

The design of the transfer box installed in the Amarok with a self-locking centre differential is based on the transfer box in the Audi Q7 and the Touareg 2011. It has been adapted for use in the Amarok.

Characteristics

- Modern "four-wheel drive" technology in the Amarok
- Sturdy system that operates purely mechanically
- Suitable for onroad and offroad use
- Permanent four-wheel drive
- Differential compensation between the front and rear axles
- Full ESP suitability in four-wheel drive and locked-up rear axle differential

For more information, refer to SSP 464.

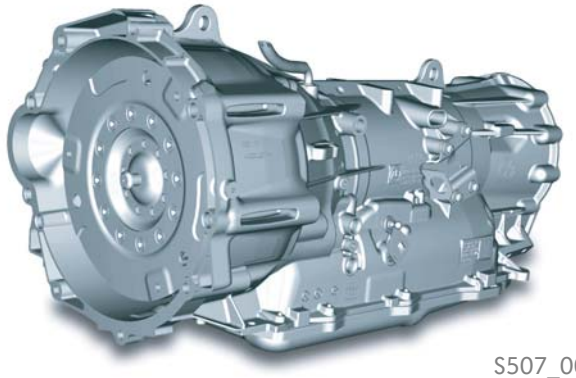


S507_005

Design features

The 8-speed automatic gearbox 0CM

- Two-damper converter
- Lightweight construction by design measures
- 1st gear as a short moving-off gear for offroad driving and towing a trailer.
  (No additional low-range box required.)
- 8th gear with a longer ratio for reducing the engine speed and fuel consumption.



S507_004

Technical data

Developer/manufacturer	**ZF Friedrichshafen AG**
Designation	at ZF: 8HP45 at VW: AL450-8A in Service: Automatic gearbox 0CM
Gearbox features	Electrohydraulically controlled 8-speed planetary gearbox with hydrodynamic torque converter and torque converter lock-up clutch with controlled slip.
Control	Mechatronic unit (integration of the hydraulic control unit with the electronic control unit to make a single unit).
Torque	max. 450 Nm
Achieving maximum speed	in 7th gear
Operating modes	Automatic, S and Tiptronic mode
Gear ratios	8 forward gears, 1 reverse gear
Spread	7.071
First fill by manufacturer	approx. 9 l
Fill volume of ATF cooling system	approx. 0.6 l
Emergency running properties	The emergency running and default programmes are state-of-the-art as far as technical possibilities are concerned, meaning that a high level of operational readiness is guaranteed even in the case of a fault. The hydro-mechanical emergency mode, for example, allows the vehicle to continue to be driven in 6th and reverse gear even if there is a total electrical failure of the mechatronic unit, until the engine is switched off or the selector lever is moved to the "P" position.

The new 2.0 l 132 kW TDI engine

Special features

- Biturbo
- Common rail injection system with solenoid valve injectors
- Controlled EGR cooling system
- Torque adapted to the automatic gearbox

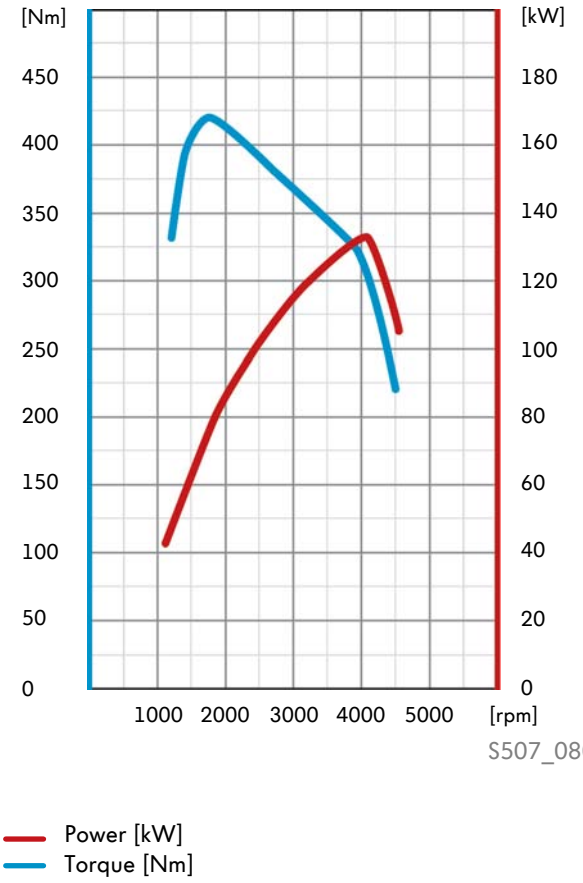
The new 132 kW TDI engine will be used together with the 8-speed automatic gearbox.

S507_007

Technical data

Engine code	CSHA
Cubic capacity	1968 cm^3
Number of cylinders	4
Bore	81.0 mm
Stroke	95.5 mm
Valves per cylinder	4
Compression ratio	16.0:1
Max. power	132 kW at 4000 rpm
Max. torque	420 Nm at 1750 rpm
Engine management	EDC 17CP 20
Turbocharging	Biturbo
Exhaust gas recirculation	Yes
Diesel particulate filter	Euro 5/PL6
Emissions standard	Euro 3/4/5/PL6

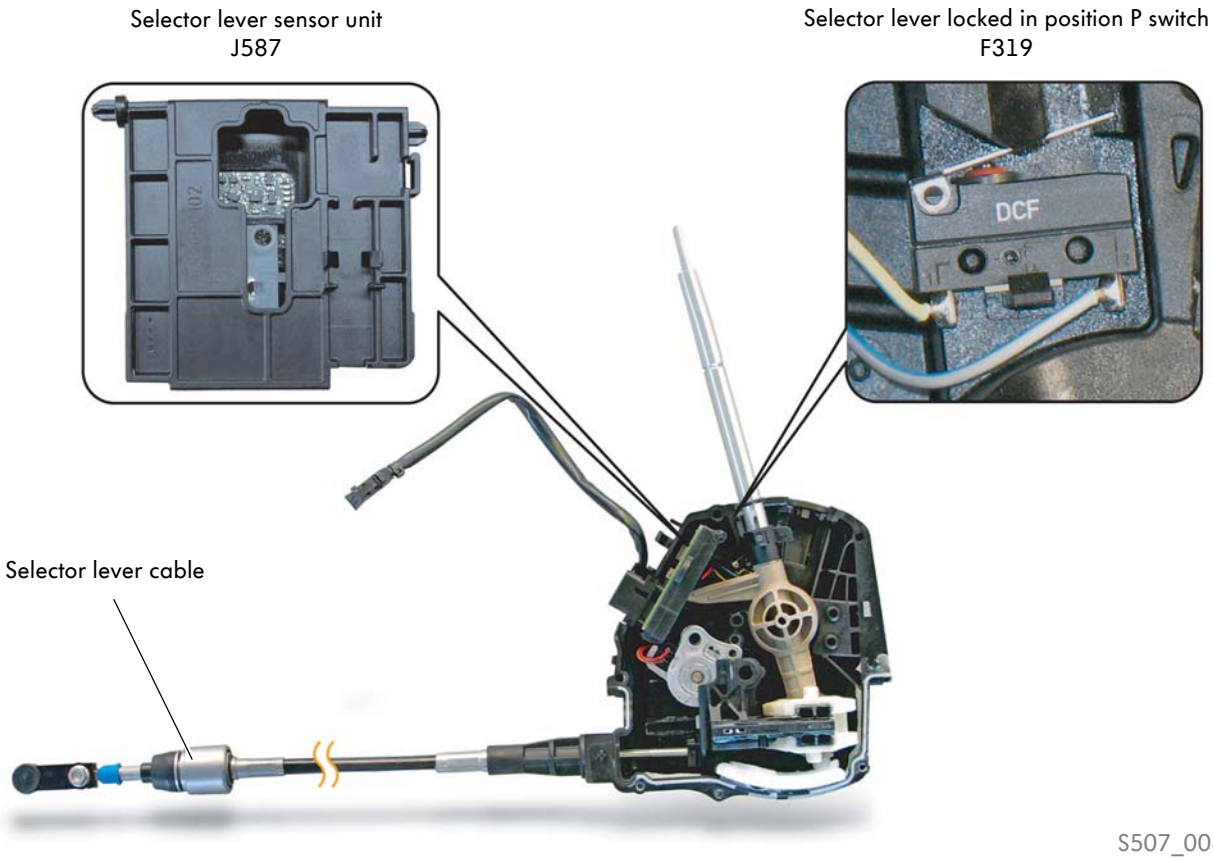
Power and torque curve



S507_080

Selector lever

The selector lever module



S507_008

The selector mechanism operates using the selector lever module. It has both a mechanical connection to the automatic gearbox via a cable and an electrical connection to the gearbox control unit. The drive range is selected by the cable. Only the special drive programmes Manual (tip) and S are sent to the gearbox control unit by the selector lever electronic control unit by means of a modulated square-wave signal.

Functions of the cable connection

- Operation of the parking lock
- Operation of the selector slide of the hydraulic control unit in the mechatronic unit
- Operation of the gear sensor in the gearbox

Electric functions

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

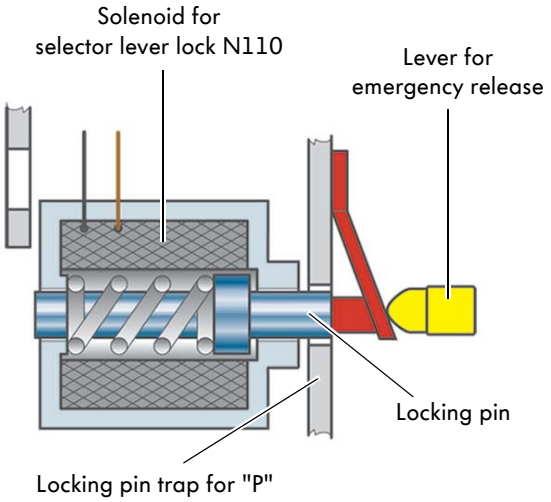
The selector lever actuation

The change from drive ranges D to S (or from S to D) is performed by tipping the selector lever backwards once out of the D/S position. The selector lever always springs back into the D/S position. When the selector lever is tipped back from the D/S position, the selector lever sensor unit J587 sends the tip signal to the gearbox control unit. In response, the changeover to special gearshift programme S takes place, or back to driving program D. This makes it possible to reach the Tiptronic gate both from the special gearshift programme S and from the normal driving programme D.
(Special gearshift programme S - shift programme adapted for offroad driving)

S507_011

Selector lever position display Y6

Information about the selector lever position comes directly from the gearbox control unit as a modulated square-wave signal. The selector lever sensor unit in the selector lever evaluates the signal and activates the corresponding light-emitting diode on the display unit Y6.



S507_010

Selector lever lock solenoid N110

Solenoid N110 blocks the selector lever in positions "P" and "N". The solenoid is controlled by the gearbox control unit. If the selector lever is in "P" in de-energised condition (ignition off) then the locking pin is in the locking pin trap "P". This prevents the selector lever from moving automatically and stops the parking lock from being unlocked.

After the ignition has been switched on and the brake pedal is pressed then the gearbox control unit energises the solenoid N110. This means the locking pin is withdrawn from the locking pin trap "P". The selector lever can now be moved into the drive position. Once the selector lever has left position "P", the magnet is de-energised and unlocked. In driver range "N" it is energised and locked.

For more information about the selector lever lock solenoid, refer to SSP 454, pages 8 and 9.

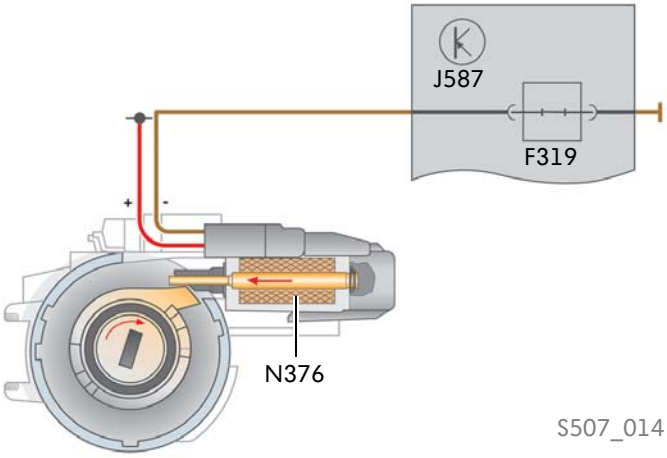
Selector lever

The ignition key removal lock

S507_013

The ignition key removal lock prevents the ignition key from being removed when the parking lock is not engaged. It functions electromechanically and is locked in "P" by the selector lever switch F319.

When switch F319 is closed, the solenoid for the ignition key removal lock N376 is energised and presses the locking pin against the spring force into the locking position. In the locking position, the locking pin prevents the ignition key from being removed.



S507_014

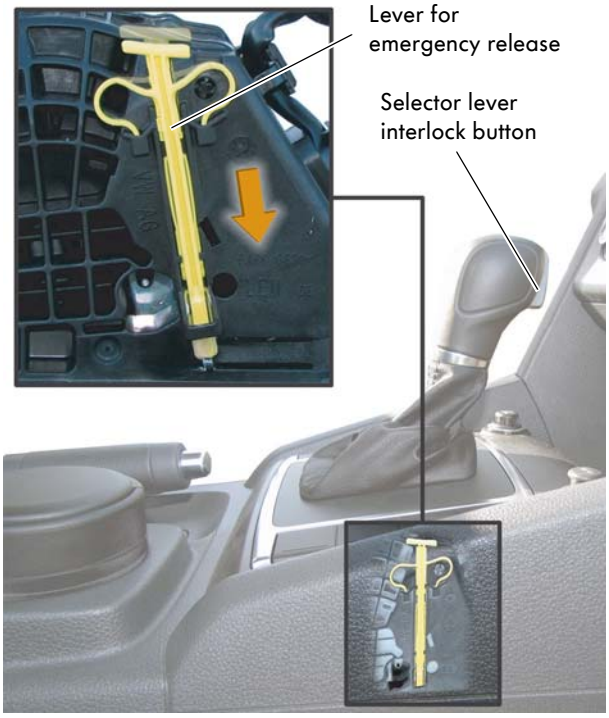
The "selector lever locked in position P switch" does not open until the selector lever is moved into the park position, and the selector lever electronic control unit de-energises the solenoid. Following this, the locking pin is pushed back by the compression spring. The ignition key can be turned further and withdrawn.

The selector lever emergency release

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

The selector lever trim must be removed in order to operate the emergency release for selector lever lock.

The emergency release lever is located on the right side of the selector mechanism. When the emergency release lever is operated, the locking pin of the solenoid N110 is pushed against the spring force (see Fig. S507_010, page 9).
The selector lever interlock button must be operated at the same time in order to unlock the selector lever.



S507_016

Towing

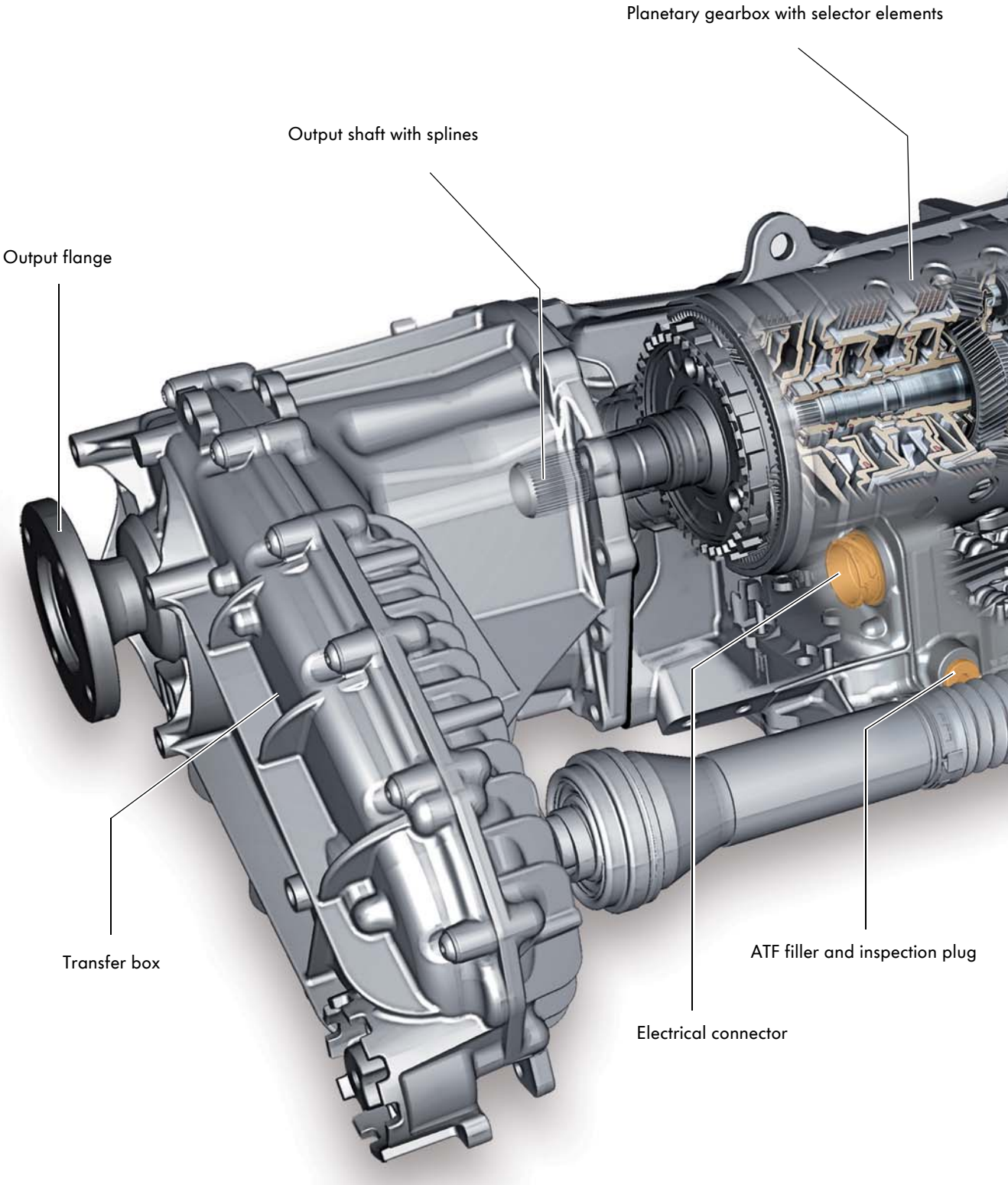
If it is necessary to tow a vehicle that is fitted with an 0CM gearbox then the usual restrictions for automatic gearboxes must be observed:

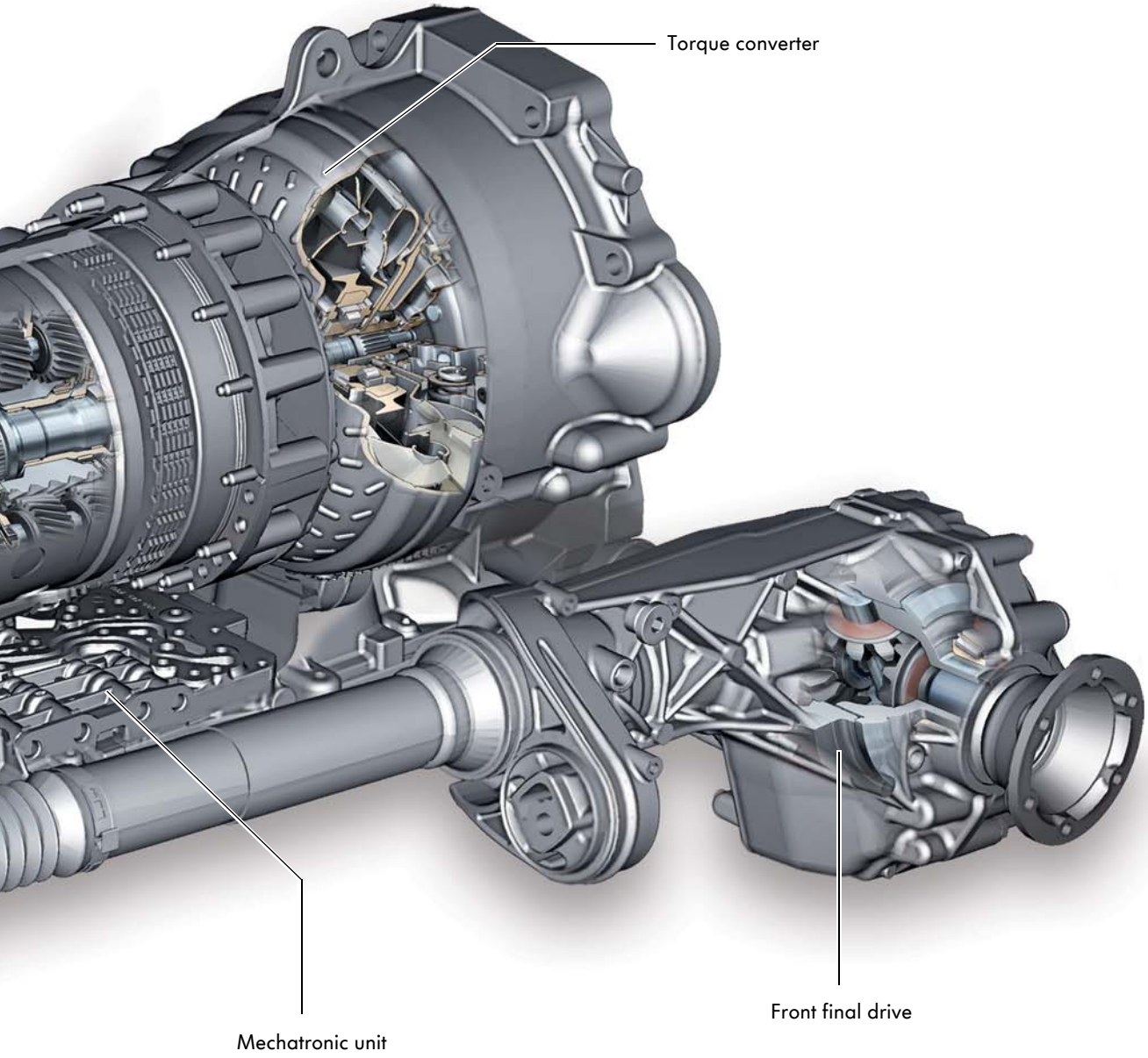
- Engage selector lever position "N", which may require using the emergency release function of the selector lever.
- Do not exceed the towing speed of 50 km/h.
- Do not exceed the maximum towing distance of 50 km.

The rear axle differential lock is not allowed to be engaged at any time during towing.

Gearbox structure

The overview



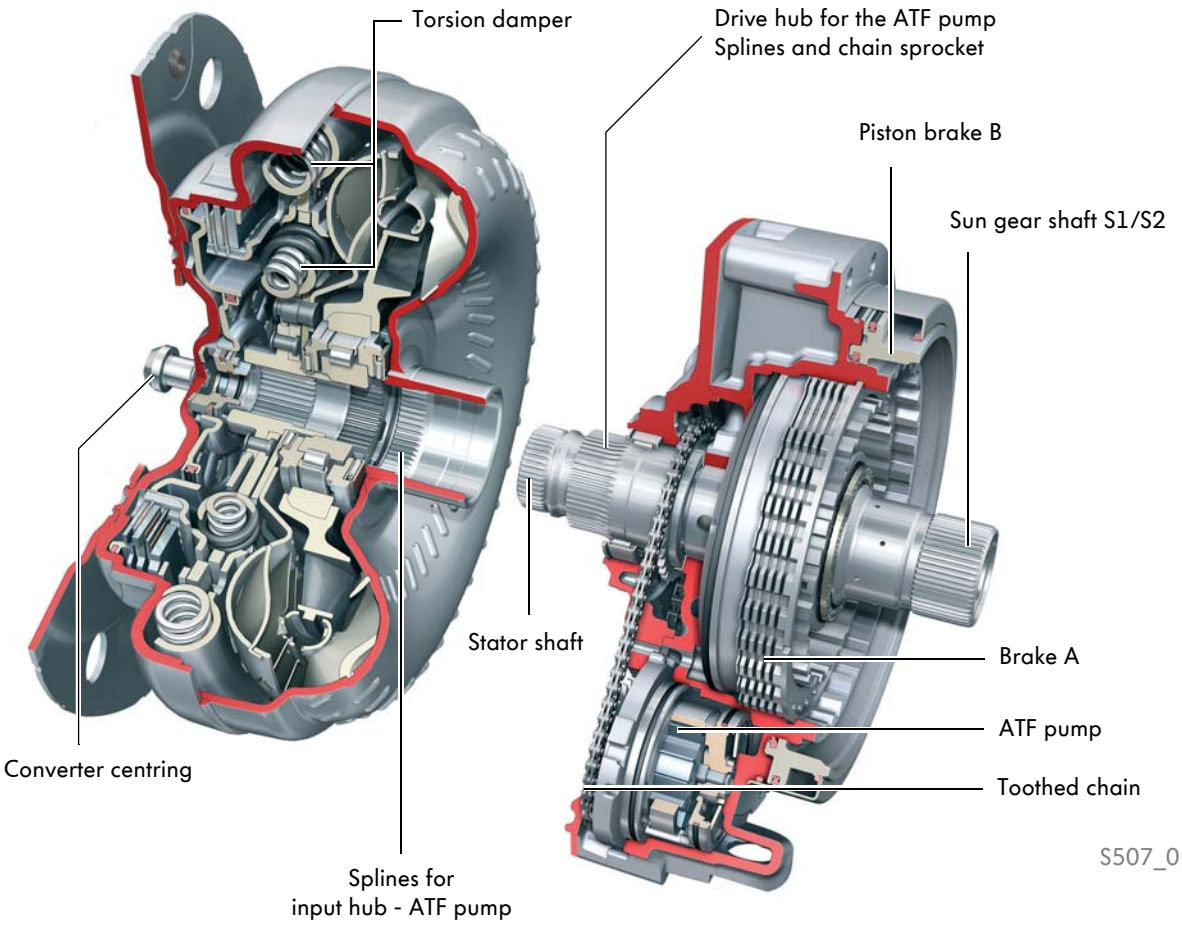


S507_017

Gearbox structure

The torque converter

A torque converter with torsion dampers is used for effectively damping the torsional vibrations of the engine. It is a "two-damper torque converter" with a torque converter lock-up clutch. Basic information about how torque converters function can be found in SSPs 300 and 309, amongst others.

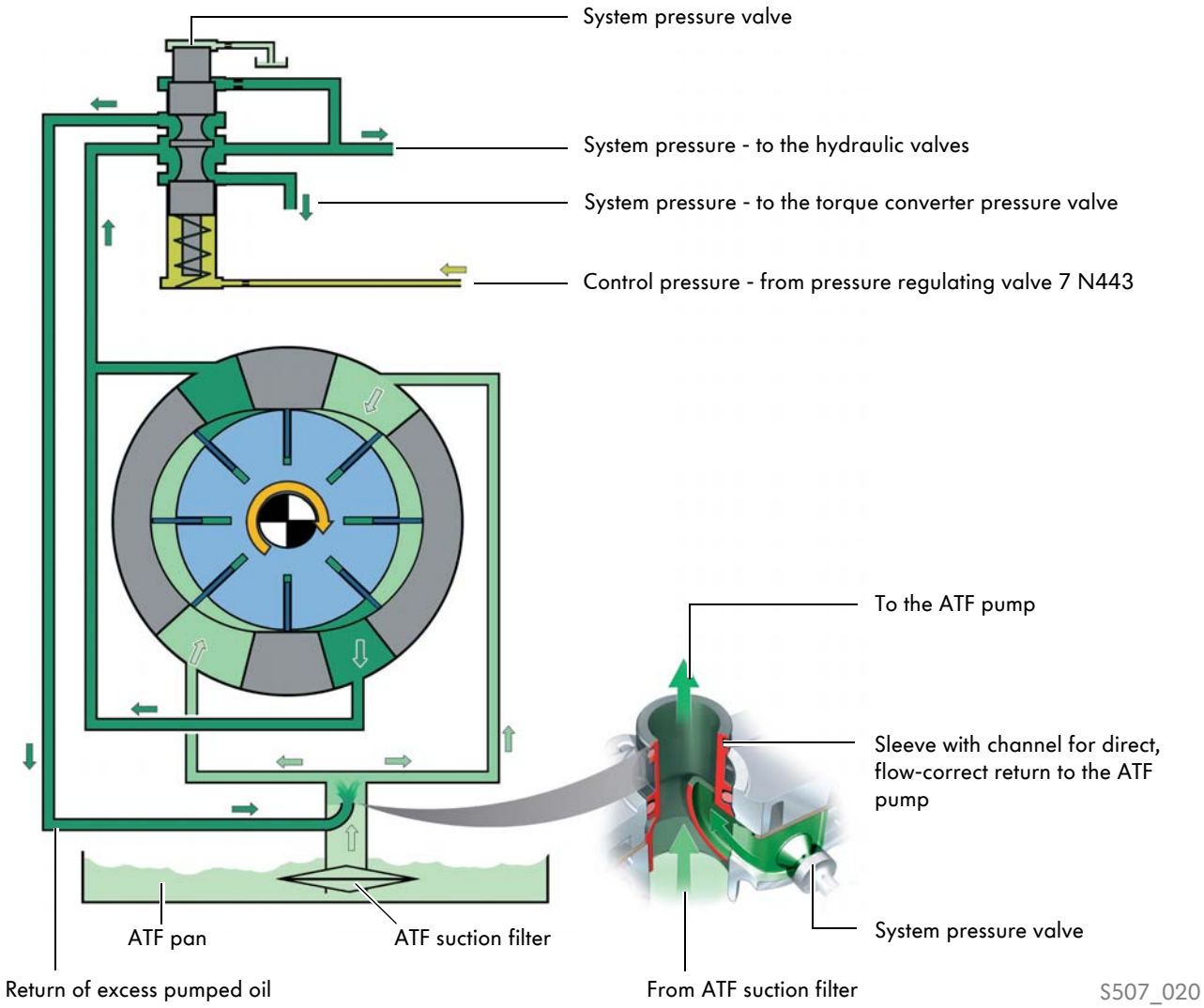


Effective damping systems and exact control of the torque converter lock-up clutch permit a further minimization in the torque converter slip even from 1st gear.

Neutral idle control ensures that the converter torque loss is reduced even when the vehicle is stationary in drive range "D".

The torque converter lock-up clutch pressure is closed by pressure regulating valve 6 N371 and the corresponding hydraulic control valves in the mechatronic unit.

The oil supply



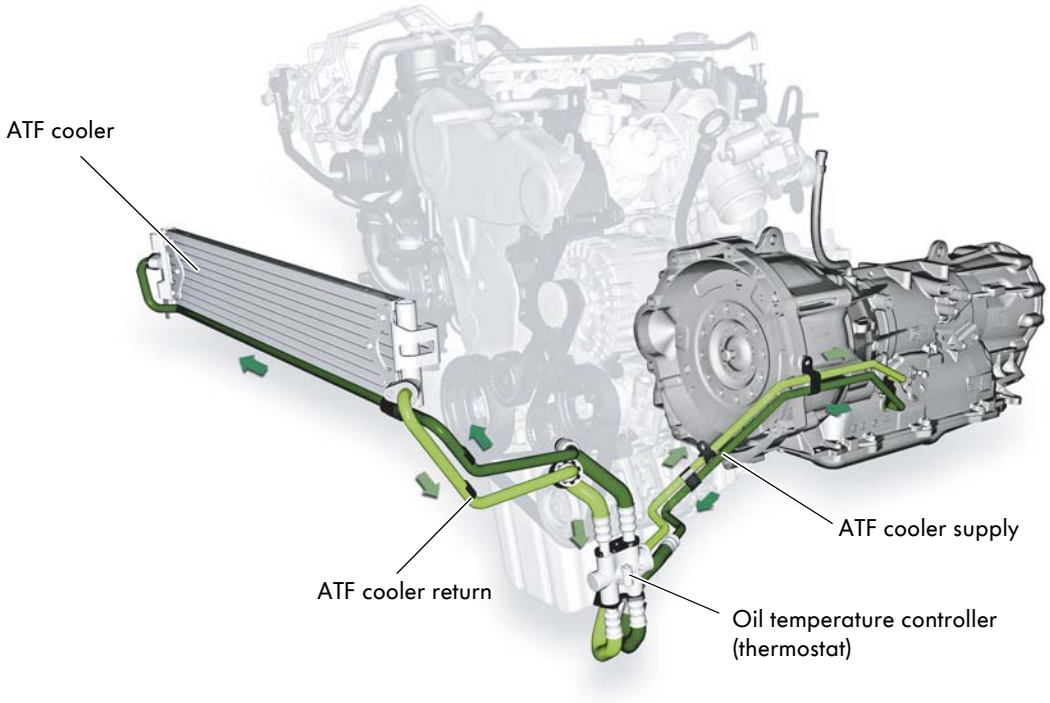
ATF pump

One of the most important components of an automatic gearbox is the ATF pump. It has the special features of a side-by-side arrangement with parallel shafts, and the chain drive. The ATF pump is a highly efficient, double-stroke vane pump.

The ATF pump sucks in the ATF through a filter and channels the pressurised oil to the system pressure valve in the hydraulic gearshift unit of the mechatronic unit. This is where the system pressure for operating the gearbox is set. If too much oil is pumped then the excess is returned to the ATF pump in a hydrodynamically efficient fashion in the intake port.

Oil cooling / ATF cooling

ATF cooling takes place with thermostat control by means of an oil/air heat exchanger (ATF cooler). The ATF cooler is positioned in front of the radiator and in front of the condenser, as seen in the direction of travel.



S507_021

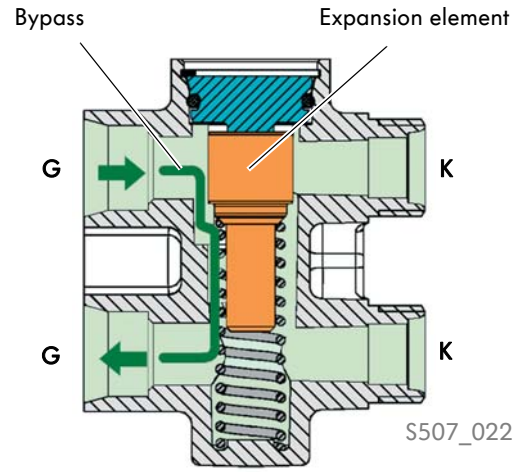
Oil temperature controller (thermostat)

The thermostat is integrated into the supply and return of the ATF cooling system. An expansion thermostat with integrated bypass (bypass thermostat) is used.

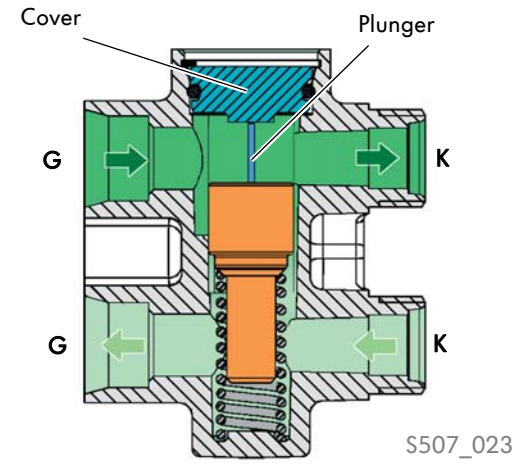
Please note that impurities in the ATF (e.g. abrasion, chips) will be distributed around the ATF cooling system and will be deposited there. If necessary, the cooling system must be rinsed carefully during a gearbox repair or prior to a gearbox renewal. For this purpose, it is necessary to remove the lines from the thermostat and from the cooler in order to rinse the individual components. Make sure that all impurities are cleaned out. If in doubt, renew components such as the ATF cooler or thermostat. Residual impurities will result in further complaints and/or damage to the gearbox!
Please always comply with the relevant valid workshop manual!

Thermostat function

Thermostat closed



Thermostat opened



G = from or to gearbox
K = from or to radiator

The expansion element is also the valve element of the thermostat and regulates the flow into the cooler.

In closed condition, a small amount of ATF always flows through the bypass as a result of which the expansion element is warmed up.

From a temperature of about 75 °C onwards, the plunger starts to push the expansion element downwards against the spring force. This opens up the flow to the cooler (see next fig.).

The thermostat is fully open from a temperature of about 90 °C onwards.

Impurities can block the bypass of the thermostat, thereby disrupting the function of the thermostat or preventing it from functioning. This can result in the gearbox overheating! At an ambient temperature of 25 °C and during normal driving, the ATF temperature will scarcely ever exceed 110 °C.

If the cooling system was opened during a repair (meaning that the ATF cooler is drained) then the ATF temperature must be raised to at least 90 °C by a test drive in order for the ATF level to be set correctly. This ensures that the ATF cooler is filled. Set the ATF level after cooling down to the normal test temperature (see Workshop Manual).

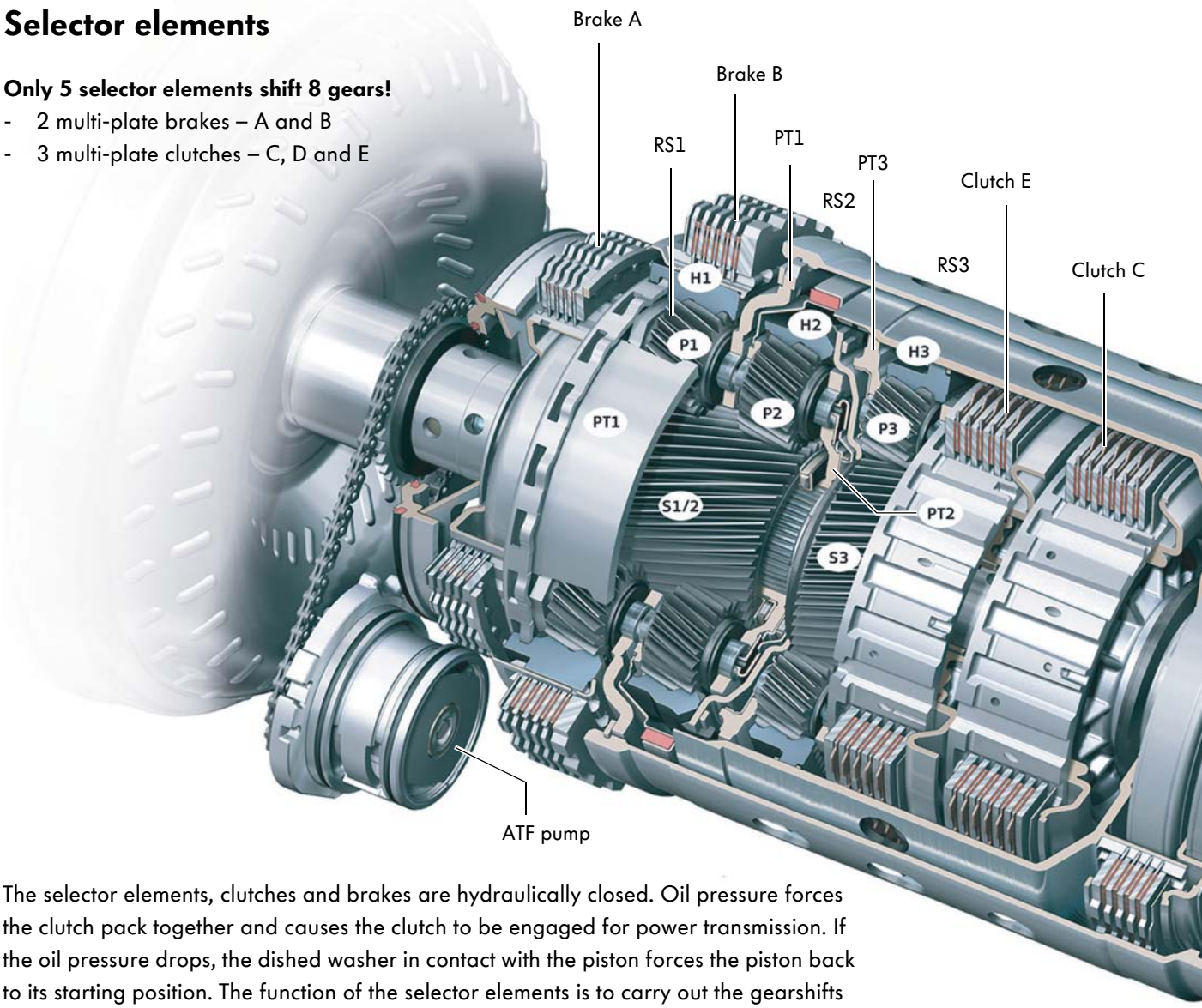
Gearbox structure

The planetary gearbox

The 8 forward gears and the reverse gear are created by corresponding link-ups between four single planetary gearboxes. The two gear sets at the front have a shared sun gear.
The output is always via the planet carrier of the 4th gear set.

Selector elements

Only 5 selector elements shift 8 gears!
- 2 multi-plate brakes – A and B
- 3 multi-plate clutches – C, D and E



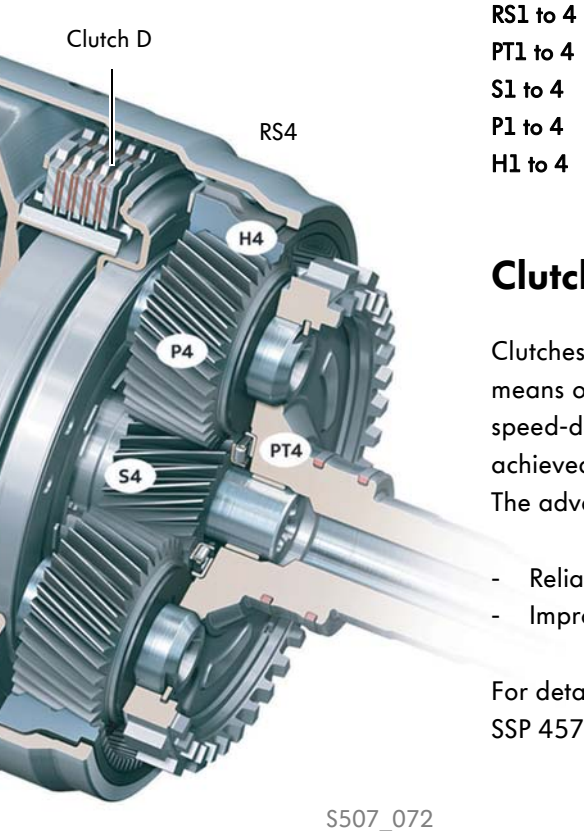
The selector elements, clutches and brakes are hydraulically closed. Oil pressure forces the clutch pack together and causes the clutch to be engaged for power transmission. If the oil pressure drops, the dished washer in contact with the piston forces the piston back to its starting position. The function of the selector elements is to carry out the gearshifts under load, as well as without any interruption in traction.
The multi-plate clutches C, D and E transmit the engine power into the planetary gearbox. The multi-plate brakes A and B brace the torque against the gearbox housing.

When achieving the individual gears, three selector elements are always closed and two selector elements are open.

Braking

Brake A is equipped with a return spring. Brake B has a special design. The piston of brake B does not have a return spring; this function is carried out by a second piston space.

Brake B is operated with slip in neutral idle control. The size of brake B has been selected to enable it to withstand the requirements of neutral idle control on a sustained basis. In addition, it receives specific cooling from the hydraulic gearshift unit when activated.



S507_072

For a clear display of the selector elements and the planetary gearboxes, some parts are not shown.

Legend for planetary gearbox

RS1 to 4	Planetary gearbox 1 to 4
PT1 to 4	Planet carriers 1 to 4
S1 to 4	Sun gear of planetary gearbox 1 to 4
P1 to 4	Planetary gears of planetary gearbox 1 to 4
H1 to 4	Annulus of planetary gearbox 1 to 4

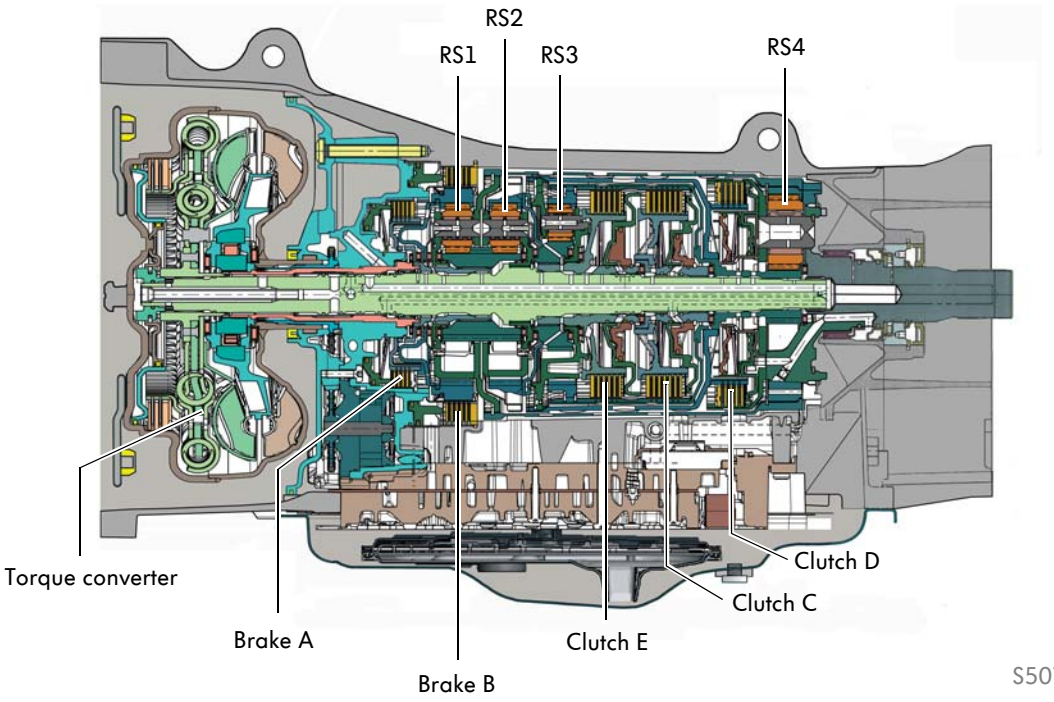
Clutches

Clutches E, C and D are balanced with regard to the dynamic pressure. This means oil pressure acts on both sides of the clutch piston in order to avoid a speed-dependent pressure build-up in the clutch. This compensating effect is achieved by a second piston space, called the pressure equalisation space. The advantages of dynamic pressure equalisation are:

- Reliable opening and closing of the clutch in all speed ranges
- Improved gearshift comfort

For detailed information about the brakes and clutches, refer to SSP 457 page 27.

Gearbox structure

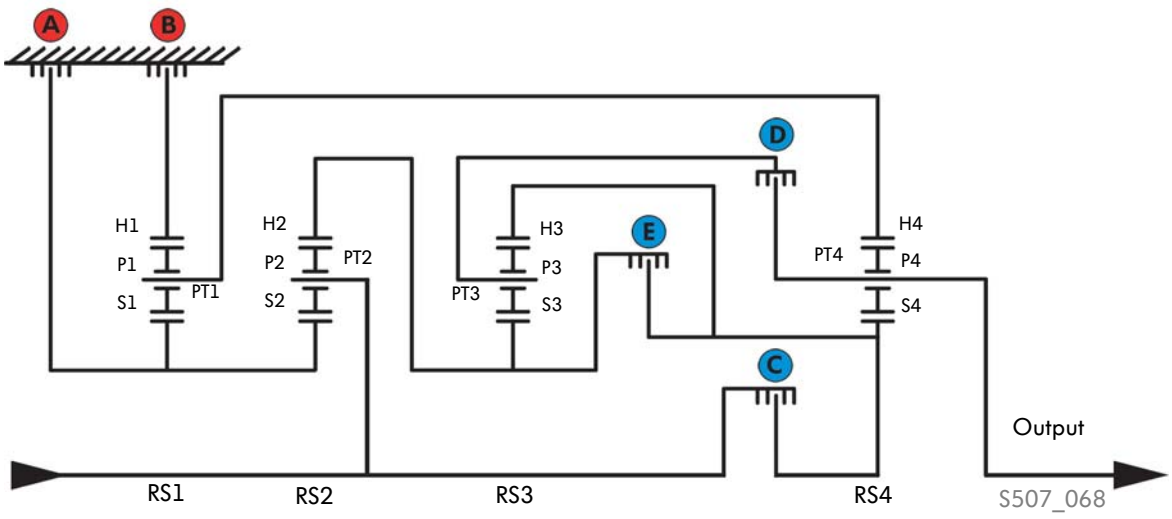


S507_035

Legend for planetary gearbox

RS1 to 4	Planetary gearbox 1 to 4
PT1 to 4	Planet carriers 1 to 4
S1 to 4	Sun gear of planetary gearbox 1 to 4
P1 to 4	Planetary gears of planetary gearbox 1 to 4
H1 to 4	Annulus of planetary gearbox 1 to 4

The ratios in the individual gears are obtained by inputting the torque via various elements of the planetary gearbox while other elements are braked.



S507_068

The mechanical ratio is divided up as follows (values are rounded):

gear:	1st	2nd	3th	4th	5th	6th	7th	8th	R
Ratio:	4.7	3.14	2.11	1.67	1.29	1	0.84	0.67	-3.33
Gear step:	1.5	1.49	1.26	1.3	1.29	1.19	1.25		
Spread:	7.071								

S507_066

Gearshift matrix

	Selector elements / pressure regulating valves						
	A EDS-A N215	B EDS-B N216	C EDS-C N217	D EDS-D N218	E EDS-E N233	EDS-WK N371	EDS-Sys N443
Parking lock	1	1 2)	1	1	1	0	X
Neutral	1	1 2)	1	1	1	0	X
R gear	1	1	1	0	1	0	X
1st gear	1	1 1)	0	1	1	X	X
2nd gear	1	1	1	1	0	X	X
3rd gear	0	1	0	1	0	X	X
4th gear	0	1	1	0	0	X	X
5th gear	0	1	0	0	1	X	X
6th gear	0	0	0	0	0	X	X
7th gear	1	0	0	0	1	X	X
8th gear	1	0	1	0	0	X	X

S507_067

Brake closed
Clutch closed

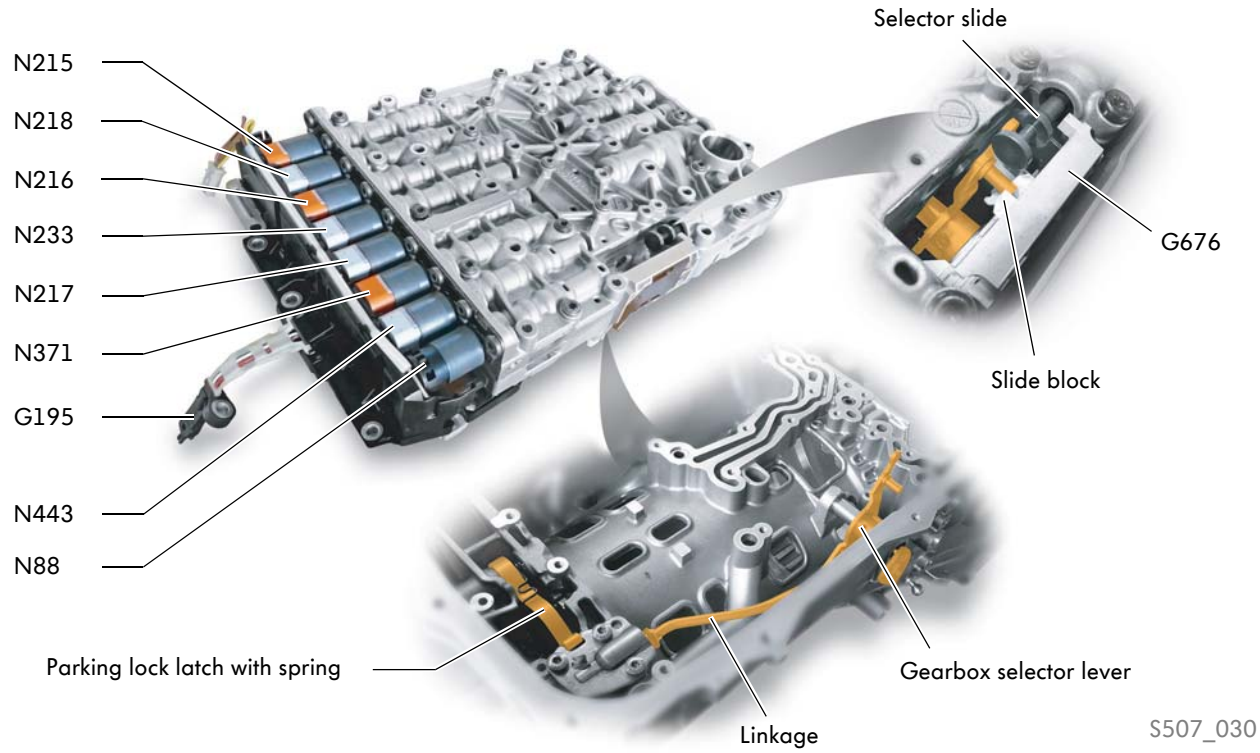
Pressure regulating valves (EDS electric pressure regulating valve)

1 Active
0 Not active (a low basic control current is always present)
X Active (control current depends on operating condition)

1) Brake B is open in neutral idle control except for a small residual torque.
2) Brake B is open in P and N positions except for a small residual torque.

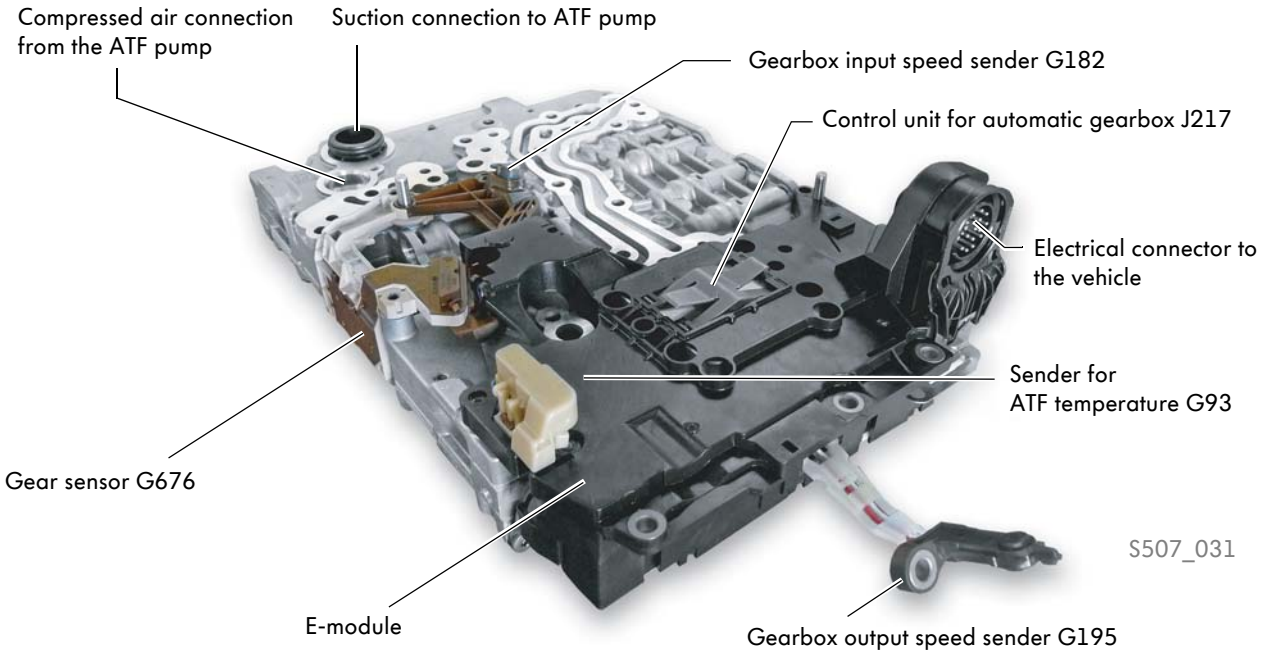
The mechatronic unit

The mechatronic unit is the central control unit of the gearbox. It consists of the hydraulic control unit with solenoid and pressure regulating valves, and the electronic module with sensors and the gearbox control unit. Each selector element has its own electric pressure regulating valve allocated to it, in order to achieve a high level of gearshift dynamics and to implement a variety of gearshift sequences.



G195 Gearbox output speed sender
G676 Gear sensor
N88 Solenoid valve 1 (MV-Pos)
N215 Pressure regulating valve 1 (EDS-A)
N216 Pressure regulating valve 2 (EDS-B)
N217 Pressure regulating valve 3 (EDS-C)
N218 Pressure regulating valve 4 (EDS-D)
N233 Pressure regulating valve 5 (EDS-E)
N371 Pressure regulating valve 6 (EDS torque converter lock-up clutch)
N443 Pressure regulating valve 7 (EDS system pressure)

Particular care must be taken to ensure that the electronics are protected against electrostatic discharge. Please comply with the specifications and instructions in SSP 284 (page 6) and in the Workshop Manual.
When installing the mechatronic unit, make sure that the gearbox selector lever engages in the groove of the slide block and the selector slide (see Fig. S507_030).



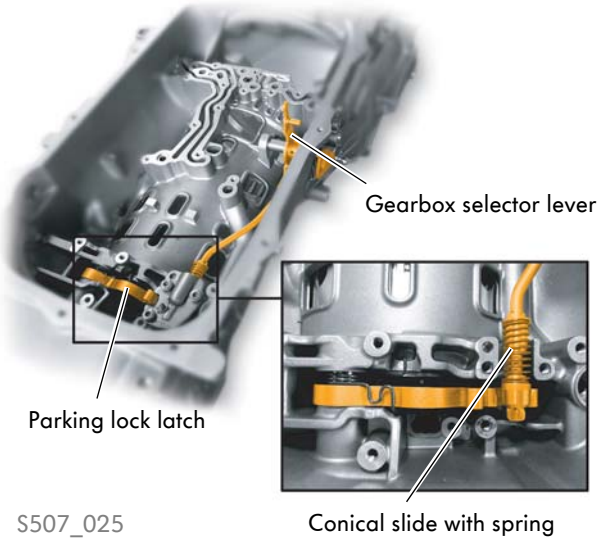
Renewing the mechatronic unit

When renewing the mechatronic unit, make sure that the control unit and electronic components are not damaged by electrostatic discharge. Following an update of the gearbox software or after the mechatronic unit is renewed, check and carry out the following points:

- Code the control unit
- Adaptation of the selector lever position display
- Adaptation of the selector element

Parking lock

The parking lock is operated via the selector lever cable. If the selector lever is pushed into position P, the gearbox selector lever pushes the linkage on the end of which the conical slide with the spring is located. The cone pushes the parking lock latch onto the parking lock gear.



The sensors

Gear sensor G676

The sensor is a component of the electronic module and is operated by the gearbox selector lever together with the selector slide. A solenoid in the slide block of the sensor switches 4 Hall sensors (A, B, C and D) according to the selector lever position. The signals of the Hall sensors are evaluated and thus provide the gearbox control unit with information about the selector lever positions P, R, N and D. The gearbox control unit is notified of the change from D to S or from S to D by the selector lever sensor unit J587.

Gearbox input speed sender G182 and gearbox output speed sender G195

The gearbox input speed sender G182 has a sender wheel with a magnetic ring. The sender wheel is connected to the planet carrier 2. G182 records the speed of the planet carrier of the 2nd planetary gearbox (PT2). Planet carrier 2 is positively connected with the turbine shaft (turbine input speed = gearbox input speed).

The cylinder connects planet carrier 1 to annulus 4 via the magnetic ring sender wheel. The cylinder is made from a high-strength aluminium alloy. This means the material is non-magnetic, and the magnetic fields of the magnetic ring act through the cylinder on sensor G182.

Speed senders G182 and G195 are referred to as intelligent sensors. They detect the direction of rotation and adjust themselves to a change in the magnetic field strength, thereby adapting the tolerances of the air gap between the sensor and sender wheel.

S507_060

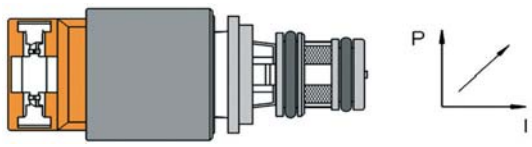
Sender for ATF temperature G93

The ATF temperature sender is located on the electronic module. In conjunction with the temperature measured inside the control unit, measures are taken if necessary to protect both the gearbox mechanism and the gearbox electronics.

The actuators

Pressure regulating valves - solenoid valves

Pressure regulating valves 1, 2, 6 (orange)

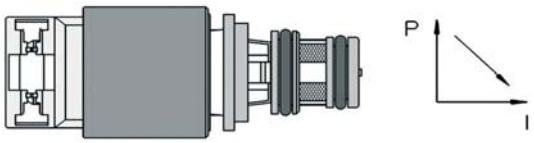


S507_061

1 N215 Pressure regulating valve 1 - brake A
2 N216 Pressure regulating valve 2 - brake B
6 N371 Pressure regulating valve 6 - torque converter lock-up clutch

Pressure regulating valves 1, 2 and 6 have an increasing characteristic. The more strongly they are energised, the higher the hydraulic control pressure.

Pressure regulating valves 3, 4, 5, 7 (white)

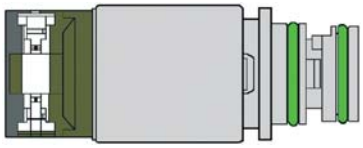


S507_062

3 N217 Pressure regulating valve 3 - clutch C
4 N218 Pressure regulating valve 4 - clutch D
5 N233 Pressure regulating valve 5 - clutch E
7 N443 Pressure regulating valve 7 - system pressure

Pressure regulating valves 3, 4, 5 and 7 have a decreasing characteristic. The more strongly they are energised, the lower the hydraulic control pressure.

Solenoid valve 1 - N88 (black/brown)

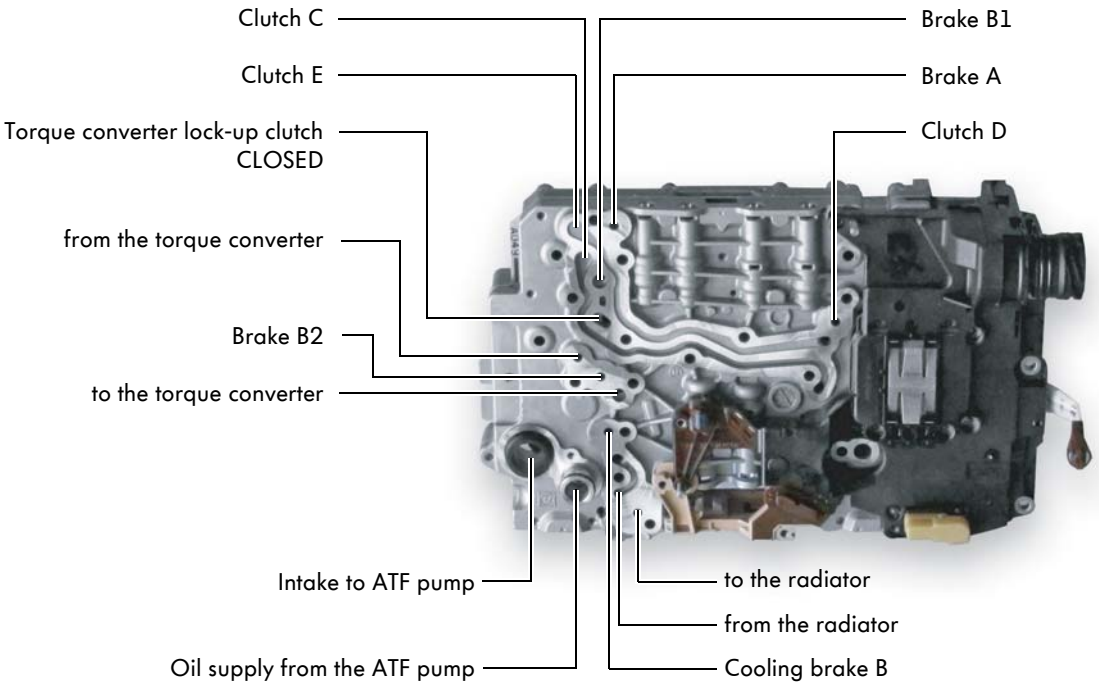


S507_063

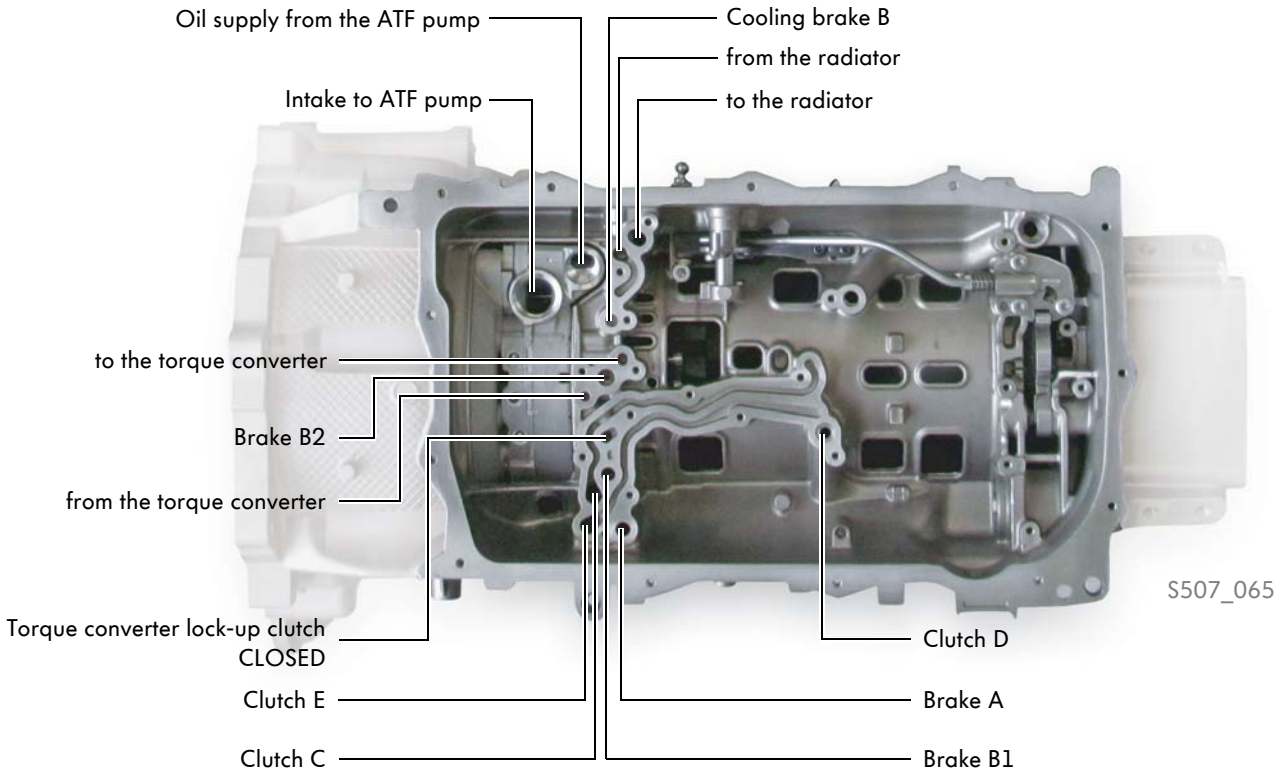
N88 is an electrically switched solenoid valve. It is referred to as a 3/2-way valve, which means it has 3 connections and 2 switch settings (open/closed or on/off).
The N88 is controlled by the gearbox control unit and has a safety function.

If, during forwards travel, the selector lever and with it the selector slide in the mechatronic unit is moved to the reverse gear position then N88 is activated accordingly by the gearbox control unit. This means the hydraulic valves in the mechatronic unit are switched so as to prevent reverse gear being engaged in the gearbox.

The hydraulic interfaces



S507_064



S507_065

The start/stop system

The start/stop system presents a particular challenge for the automatic gearbox. During start/stop mode, it is necessary for the vehicle to be ready to start and move off extremely quickly. The engine and automatic gearbox must be ready to move off after about 350 ms in order to avoid any noticeable delay in moving off. The requirement cannot be met by an automatic gearbox unless it is configured accordingly or measures are taken on the oil supply. This problem is solved by what is referred to as the "hydraulic pulse accumulator" (HPA).

Installation location/connections

S507_051

The installation position of the HPA (hydraulic pulse accumulator) is below the oil level. This means the HPA accumulator cannot run dry, and it always remains filled in the charged condition.

Necessity in start/stop operation:

When the engine is stopped, the oil supply in the gearbox is non-existent. The selector elements of the corresponding gear disengage and the powerflow is interrupted. When the engine is started, the powerflow in the gearbox must be restored, and with it the moving-off readiness. For the 8-speed automatic gearbox, this means that three selector elements have got to be closed (see gearshift matrix). The oil volume pumped by the ATF pump whilst the engine is starting up is not sufficient to pressurise the selector elements within the required time, in order to establish an adequate powerflow. In principle, the ATF pump could be designed to meet this requirement. However, a pump of this kind would result in completely unacceptable losses even at low engine speeds.

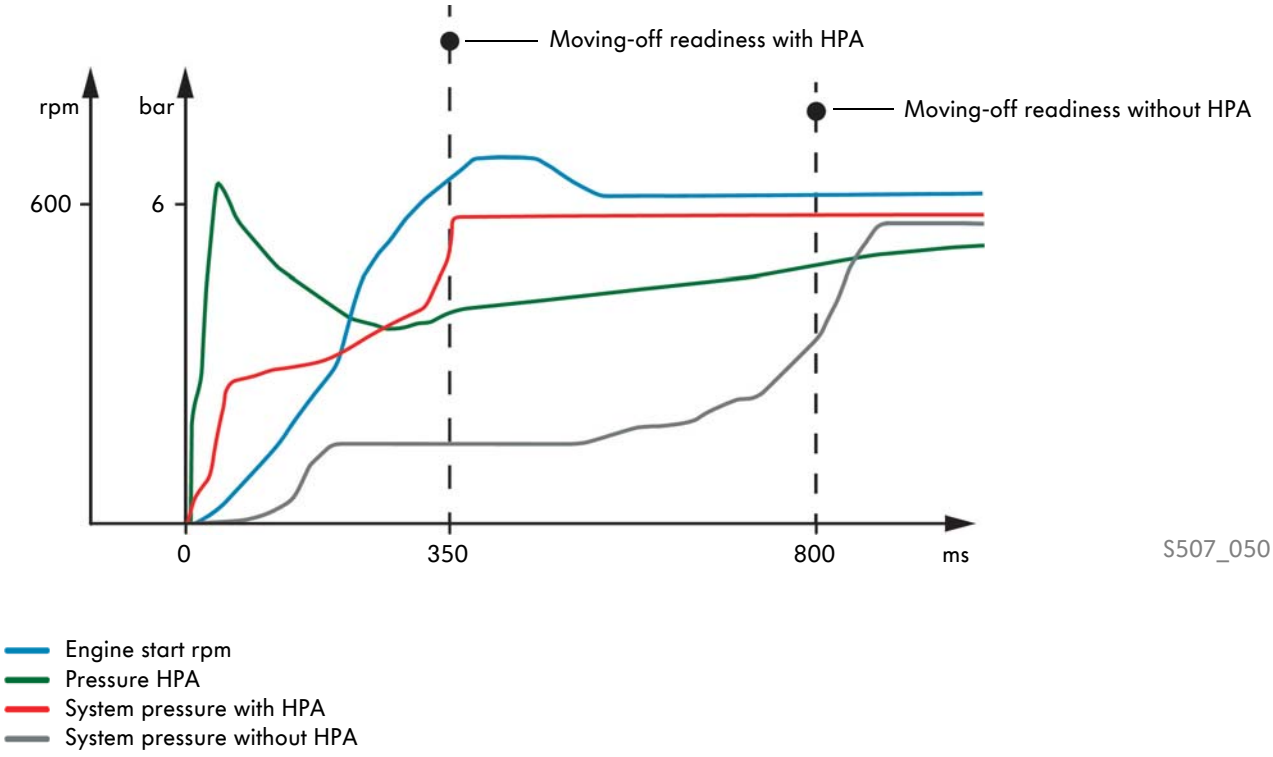
The hydraulic pulse accumulator (HPA)

S507_052

The hydraulic pulse accumulator has a useful volume of about 100 cm^3.

The HPA is a special oil volume accumulator with an electromechanical locking unit. It is used for providing pressure to the selector elements for force transmission within a fraction of a second. The HPA achieves the required moving-off readiness after only about 350 ms.

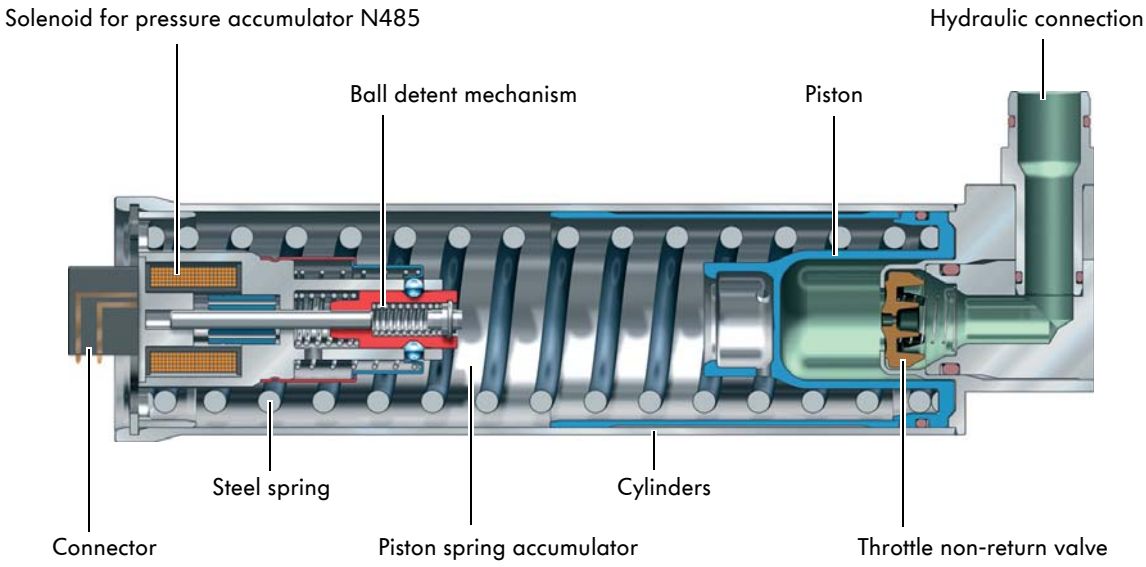
Comparison between moving-off readiness with and without hydraulic pulse accumulator (HPA).



S507_050

Structure and function

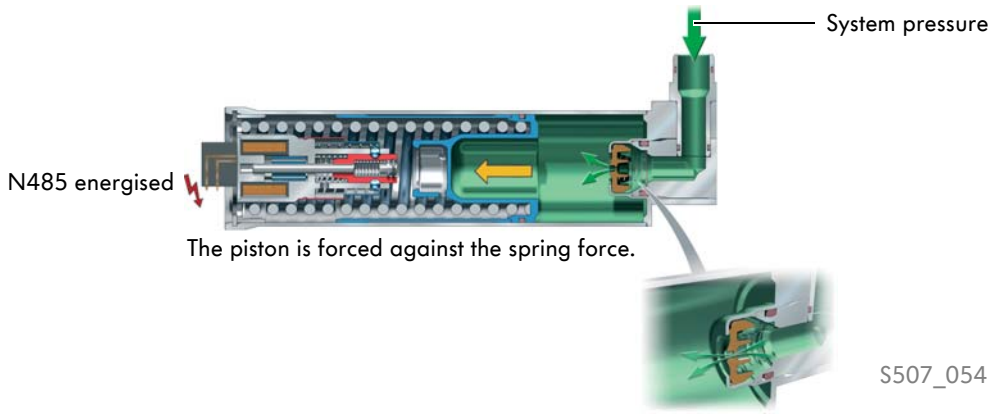
The HPA consists of the piston spring accumulator, an electromechanical locking unit (solenoid for pressure accumulator N485) and a throttle non-return valve. The piston spring accumulator consists of a piston, cylinder and steel spring. Solenoid N485 has the task of holding the piston in a pre-stressed condition (N485 energised). The piston spring accumulator is "charged" when the engine is running. When the engine starts, solenoid N485 is de-energised and the stored oil volume is forced (discharged) into the hydraulic control unit by spring force. This means oil pressure is applied to the selector elements already when the ATF pump is just starting to pump. As a result, the HPA supports the ATF pump and ensures a lightning-fast pressure buildup. The pressure build-up by the HPA and by the ATF pump overlap at the time when the pump is delivering sufficient pressure. The charging procedure of the piston accumulator starts from this point onwards. The supply to the piston spring accumulator is restricted so that the further pressure build-up is not disrupted by the charging procedure. This task is performed by the throttle non-return valve. The charging time of about 5 seconds (at 20 °C) is nevertheless very short and does not impair the start/stop operation.



S507_053

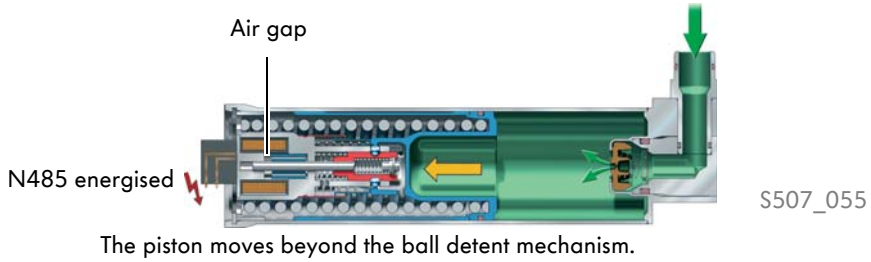
Hydraulic pulse accumulator in drained condition.

Start/stop operation

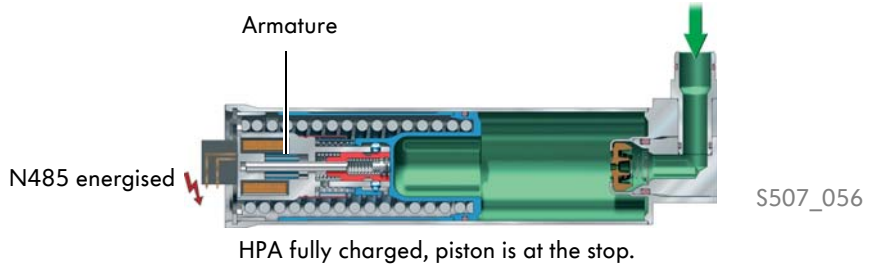


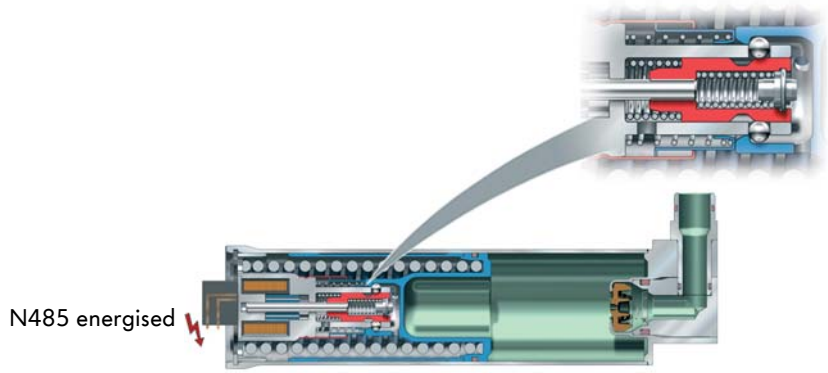
Start of charging

When the engine is running, the piston spring accumulator is filled (charged) via the throttle bore.
The charging time is about 5 seconds.



During charging, the piston is pushed all the way to the left. When this happens, the armature of the holding solenoid is pushed into its end position required for locking, and the air gap is closed[1)]. The balls are pushed out for locking and the solenoid N485 cannot hold the armature so that the piston remains locked. The HPA is now ready for an engine stop.





HPA fully charged, piston locked.

S507_057

HPA is charged (engine stopped)

When the engine stops, the system pressure and the pressure in the HPA both drop. The oil volume in the HPA is depressurised. The piston is now held by the ball detent mechanism

Piston unlocked, HPA drains.

S507_058

HPA is discharged (engine start phase)

When the engine starts, the piston is unlocked by the holding current being switched off. The piston presses the volume of oil into the hydraulic control unit to the selector elements. The throttle non-return valve opens and allows oil to flow through a large cross section.

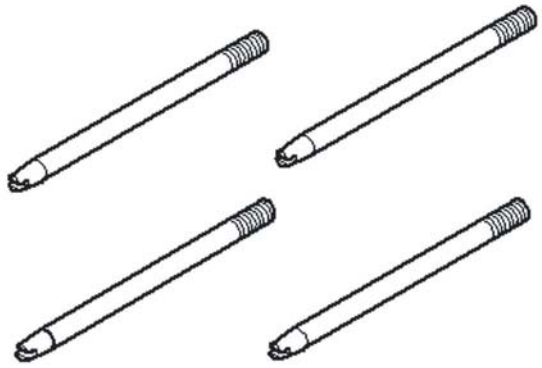
1)

The magnetic field generated by solenoid N485 is unable to pull the armature towards it against the spring force. The magnetic force is only able to hold the magnet independently when the piston pushes the armature all the way to the left as far as the stop (see Fig. 507_056).

The special tool

Special tool for installing the mechatronic unit

The guide pin T40199 means the mechatronic unit can be kept straight when being inserted. This prevents damage to the oil ducts on the rear of the mechatronic unit.



S507_090

Oil level check

This is performed in accordance with the workshop manual using the "Oil level check" function in the Guided Functions / Guided Fault Finding.

The gearbox adaptation

In order to maintain the gearshift quality at a high level over the entire service life of the gearbox, various control parameters are adapted continuously and the measured adaption values are stored. These adaptations and/or this learning process are referred to as adaption.

Adapting the 5 selector elements (brakes A, B and clutches C, D, E) during a service may be necessary in the following cases, for example:

- After the mechatronic unit has been changed
- Gearbox change
- Gear oil change
- Deletion of the adaption values by a software update
- Complaints due to harsh/raw gearshift behaviour

The adaption is performed using the vehicle diagnostic tester as part of an adaption drive. The process is specified exactly in the Guided Fault Finding or Guided Functions, and is self-explanatory.

Irrespective of the individual adaptation values and general adaptation conditions of the 0CM gearbox, you will find detailed information about the principles of gearbox adaptation in SSP 385.

Please always comply with the relevant valid workshop manual!

Notes

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