ATU Audi Technical Updates

8 Speed Automatic Gearbox

Content
Gearbox

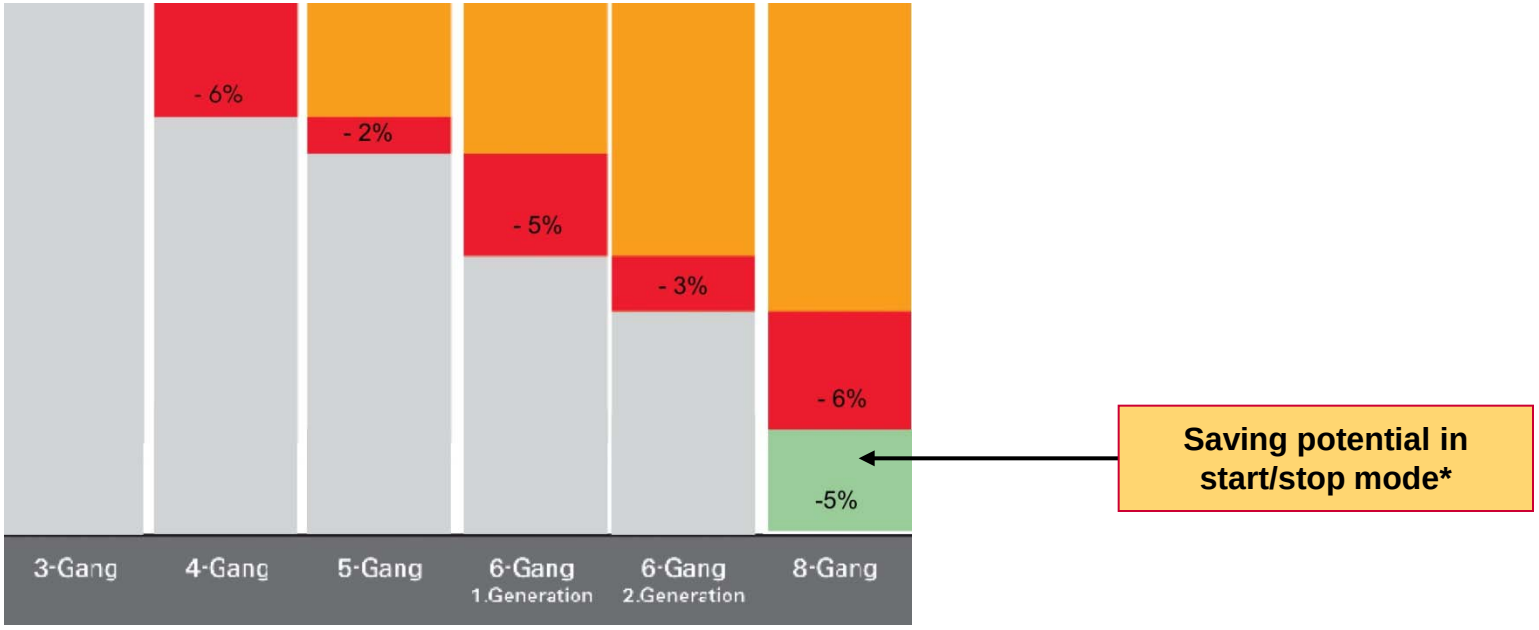
No.	Event	Topic	Type/model
1	03/10	Introduction of 8-speed automatic gearbox	A8 (D4)
2	03/10	Sport differential technology	B8, A8 (D4)

Content

- **Development objectives**
- **A8 drivetrain improvements (D4 to D3)**
- **New selector lever concept (shift-by-wire)**
  - Operating concept
  - Selector lever sensors control unit
  - Components
  - Gear-change indicator
  - Automatic parking lock function
  - Manual release
- **Improvements to the 8-speed automatic gearbox (0BK, 0BL)**
  - Overview of improvements
  - Torque converter/ATF pump
  - Planetary gearbox (gearshift matrix, gearshift pattern)
  - Oil supplies/innovative thermal management system (ITM)
  - Mechatronic unit
  - Parking lock
  - Neutral idle control, start/stop system, adaption
  - Shifting strategy based on navigation data

Development objectives

- **Reduced fuel consumption** by means of lower speeds and less drag loss
  - Increased stepping value
  - Reduced drag torque (only two open selector elements in each gear)
  - Efficiency-optimised ATF pump
  - Improved torsional damper system in the torque converter (less torque converter clutch slip)
- **Optimum driving performance** (fewer gear steps, direct gear changes)
- **Design freedom** for the vehicle interior resulting from the shift-by-wire concept



A8 drivetrain improvements (D4)

Note: For details, see SSP

Other improvements/special features

- **New selector mechanism using shift-by-wire technology**

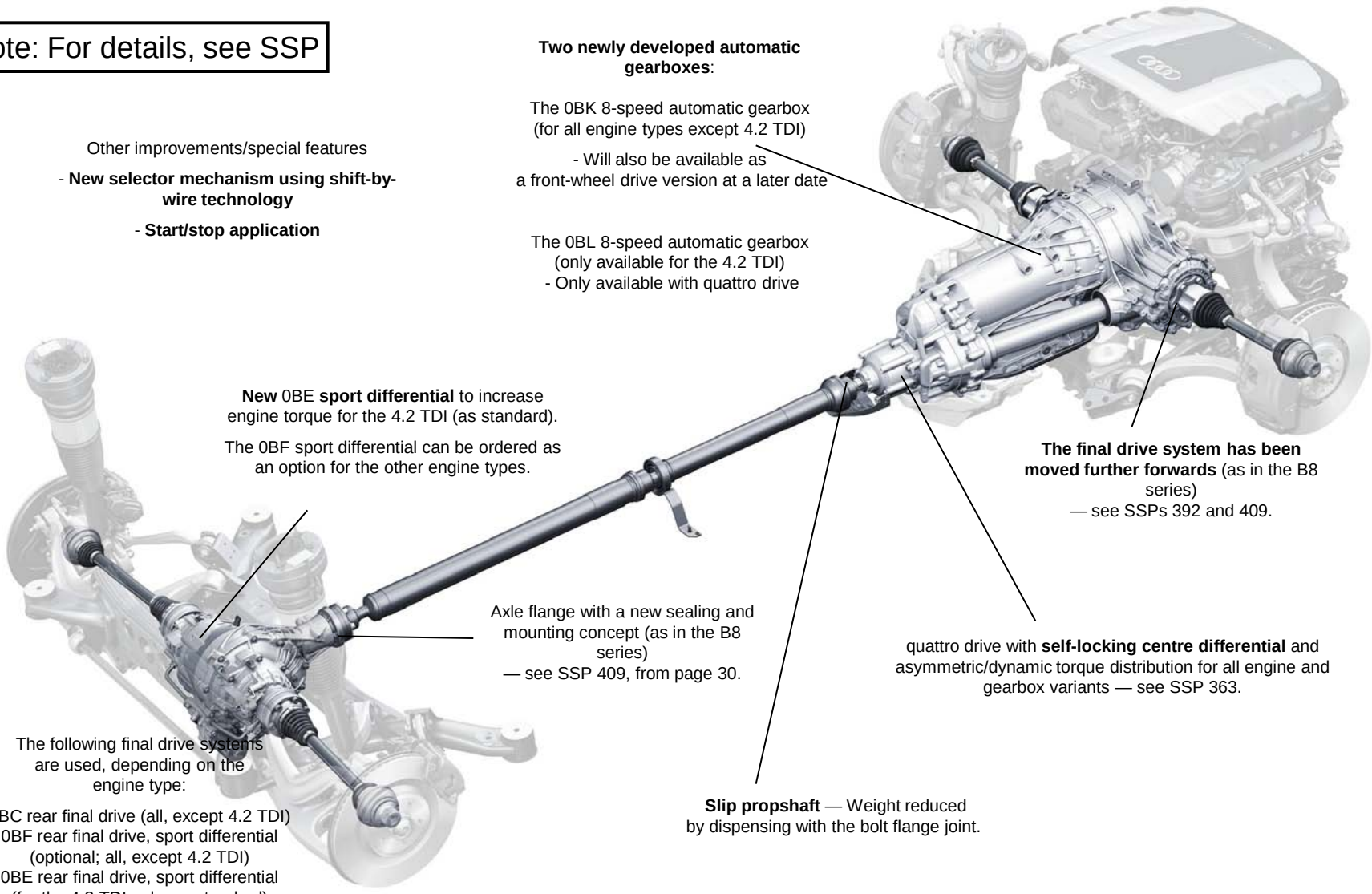
- **Start/stop application**

Two newly developed automatic gearboxes:

The 0BK 8-speed automatic gearbox
(for all engine types except 4.2 TDI)

- Will also be available as
a front-wheel drive version at a later date

The 0BL 8-speed automatic gearbox
(only available for the 4.2 TDI)
- Only available with quattro drive



New 0BE **sport differential** to increase engine torque for the 4.2 TDI (as standard).

The 0BF sport differential can be ordered as an option for the other engine types.

The final drive system has been moved further forwards (as in the B8 series)
— see SSPs 392 and 409.

Axle flange with a new sealing and mounting concept (as in the B8 series)
— see SSP 409, from page 30.

quattro drive with **self-locking centre differential** and asymmetric/dynamic torque distribution for all engine and gearbox variants — see SSP 363.

The following final drive systems are used, depending on the engine type:

0BC rear final drive (all, except 4.2 TDI)
0BF rear final drive, sport differential (optional; all, except 4.2 TDI)
0BE rear final drive, sport differential (for the 4.2 TDI only; as standard)

Slip propshaft — Weight reduced by dispensing with the bolt flange joint.

New selector lever concept (shift-by-wire)

"Full" implementation of shift-by-wire for the first time in the Audi A8 '10.

This means:

- No mechanical connection between the selector lever and the gearbox
- The parking lock is actuated by an electro-hydraulic mechanism; manual release is a mechanical mechanism

Benefits of the "full" shift-by-wire concept

- **New possibilities** for the selector mechanism, e.g. in terms of design, size, positioning
- **New convenience and safety functions** can be implemented, e.g. automatic parking lock selection
- **Simplified assembly** of the selector mechanism and gearbox; adjustment is no longer necessary
- **Improved acoustics** in the vehicle interior through decoupling of the selector mechanism and gearbox)

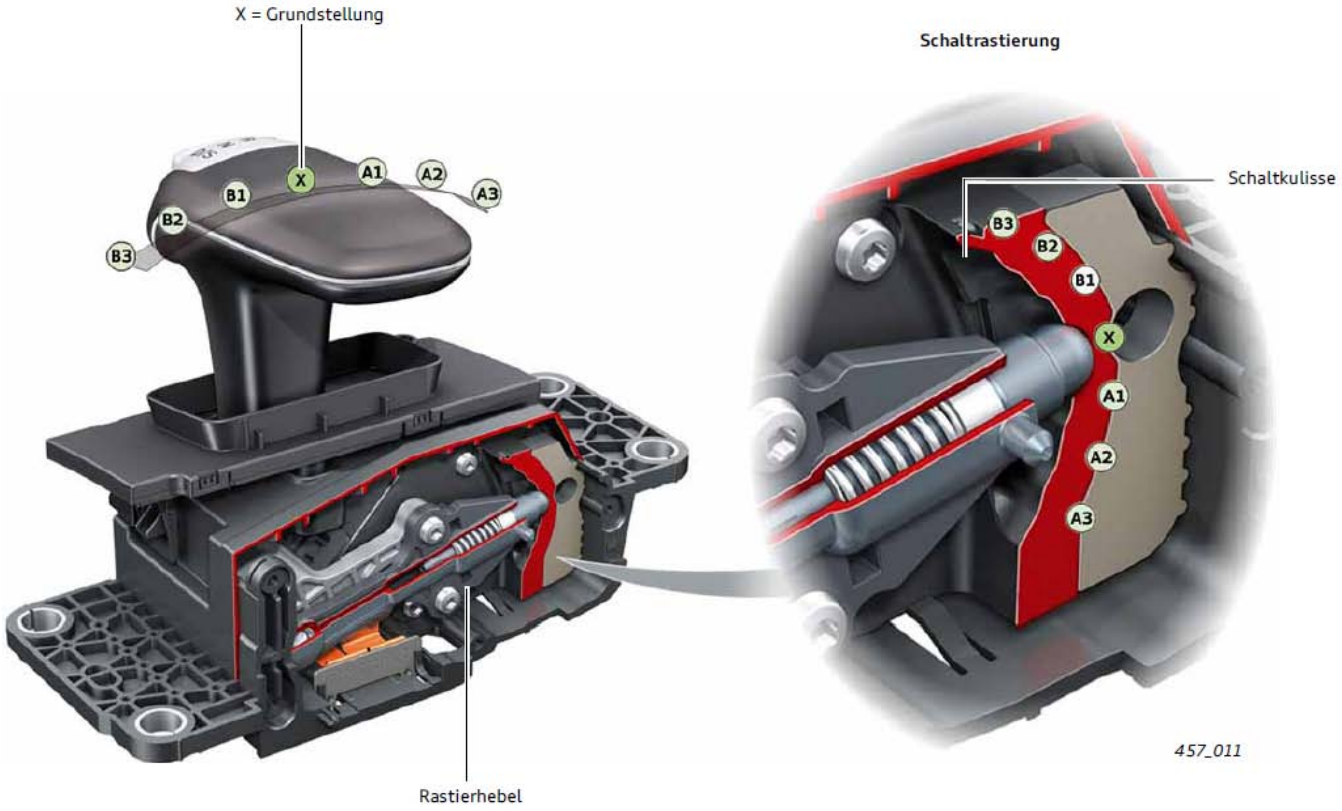
New selector lever concept (shift-by-wire)

- **Operating concept**

- The selector lever does not follow a selector gate based on the gear selected.

Instead: The selector lever always returns to the starting position (basic position); this is similar to the way a joystick functions

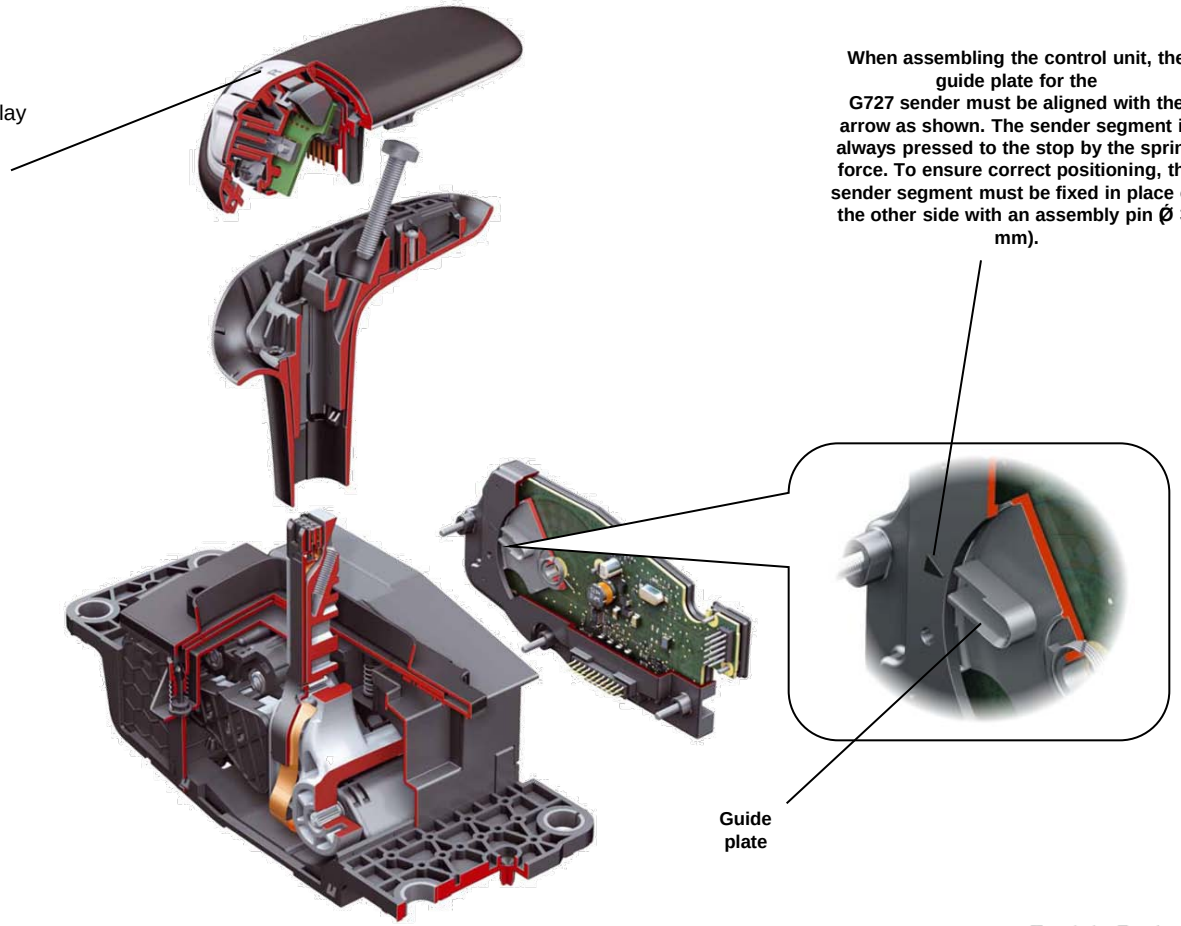
> The selector lever position and gearbox gear do not match as was previously the case



New selector lever concept (shift-by-wire)

- **Service notes**
  - Assembling the selector lever sensors control unit (customer service no. 3785)
  - Disassembling the selector lever handle (customer service no. 3704)

Illuminated selector lever position display in the selector lever handle



When assembling the control unit, the guide plate for the G727 sender must be aligned with the arrow as shown. The sender segment is always pressed to the stop by the spring force. To ensure correct positioning, the sender segment must be fixed in place on the other side with an assembly pin (Ø 3 mm).

Guide plate

New selector lever concept (shift-by-wire)

- **Gear-change indicator in the instrument cluster**

457_079

Gearshift pattern display pop-up for 5 secs when the selector lever or release tab are actuated

Note that pulling back the selector lever take you back to automatic mode (as does actuating the M button on the steering wheel).

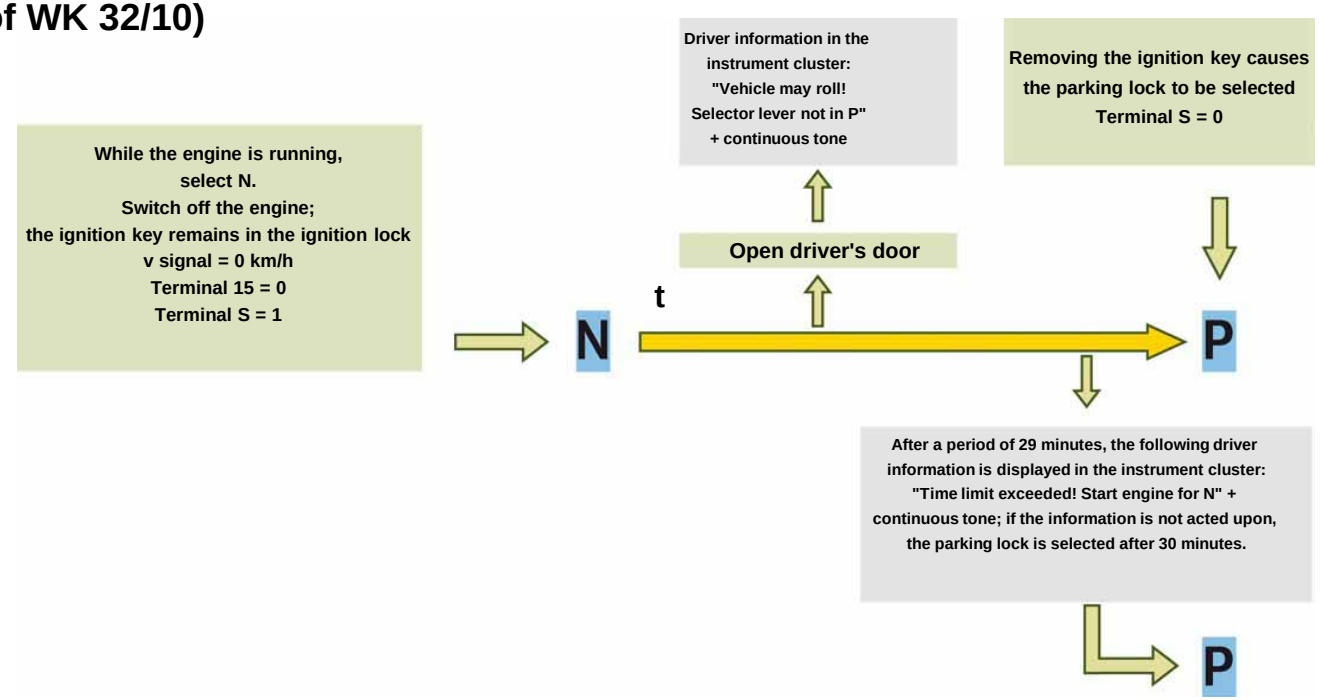
M = manual gearshifting (tiptronic mode)

The selector lever position display in gear "D" can be activated or deactivated with the vehicle diagnostic tester (adjustment to function), see page 63. In manual mode "M" (tiptronic mode) the current gear is always displayed.

New selector lever concept (shift-by-wire)

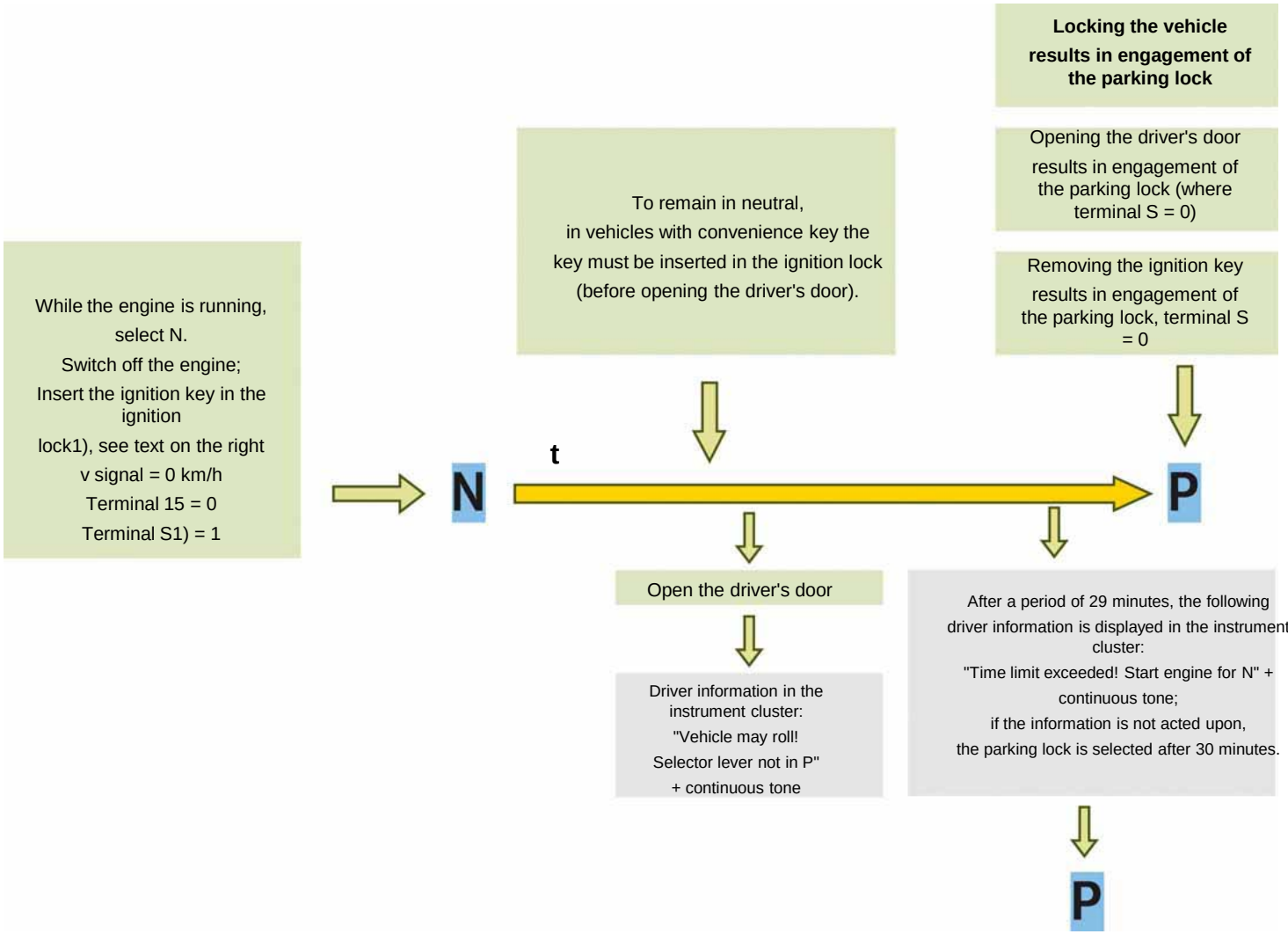
- **Automatic parking lock function**
  - Electro-hydraulic parking lock mechanism
  - Conditions for activation:
    - Switching off the engine (with the ignition key or the engine start/stop button)
    - Opening the door while the engine is running

- **Automatic parking lock function without the convenience key (ignition lock no longer required as of WK 32/10)**



New selector lever concept (shift-by-wire)

Automatic parking lock function with the convenience key

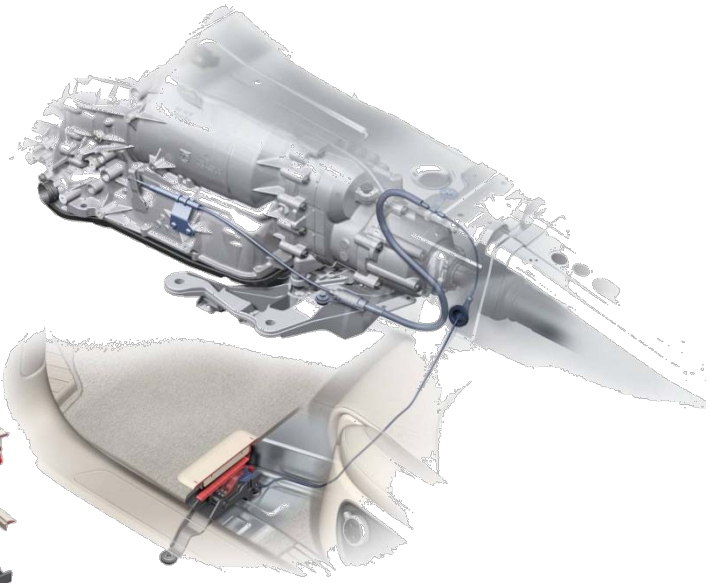


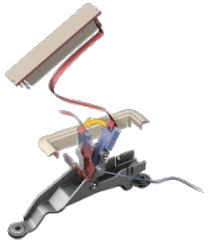
New selector lever concept (shift-by-wire)

Manual release

- During normal operation, the parking lock is actuated by an electro-hydraulic mechanism
- To release the parking lock, the engine must be running and the selector lever must be in the "N" position
- If the parking lock manual release mechanism is actuated, this will be indicated in the instrument cluster by

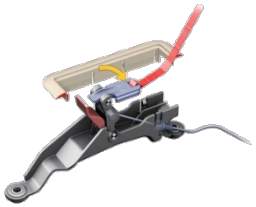
- Situations in which the parking lock may need to be released:
  - If the vehicle needs to be **towed**
  - If the electro-hydraulic mechanism **fails**
  - If the **vehicle voltage is too low**
  - If the engine is not running and the vehicle needs to be moved



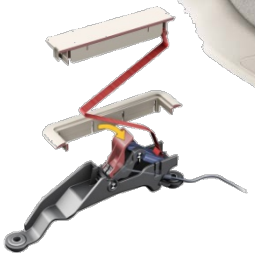


Releasing the parking lock

1. Remove the cover using the vehicle tool kit. Use the strap to pull out the manual release lever until it is engaged and clamped into a vertical position.



2. The manual release lever comprises two parts. The top part must be folded down so that the lever cannot be actuated accidentally by your foot.
The cover is designed in such a way that it cannot be assembled if the lever is not folded down; it should be placed to one side.



Locking the parking lock

The manual release lever can be unclamped using the release lever (shown here in red) to allow the parking lock to be selected again. To do this, push the release lever against the manual release lever and set it back to its basic position. The cover is designed in such a way that it can only be assembled when the manual release lever is folded down.

Improvements to the 8-speed automatic gearbox (0BK, 0BL)

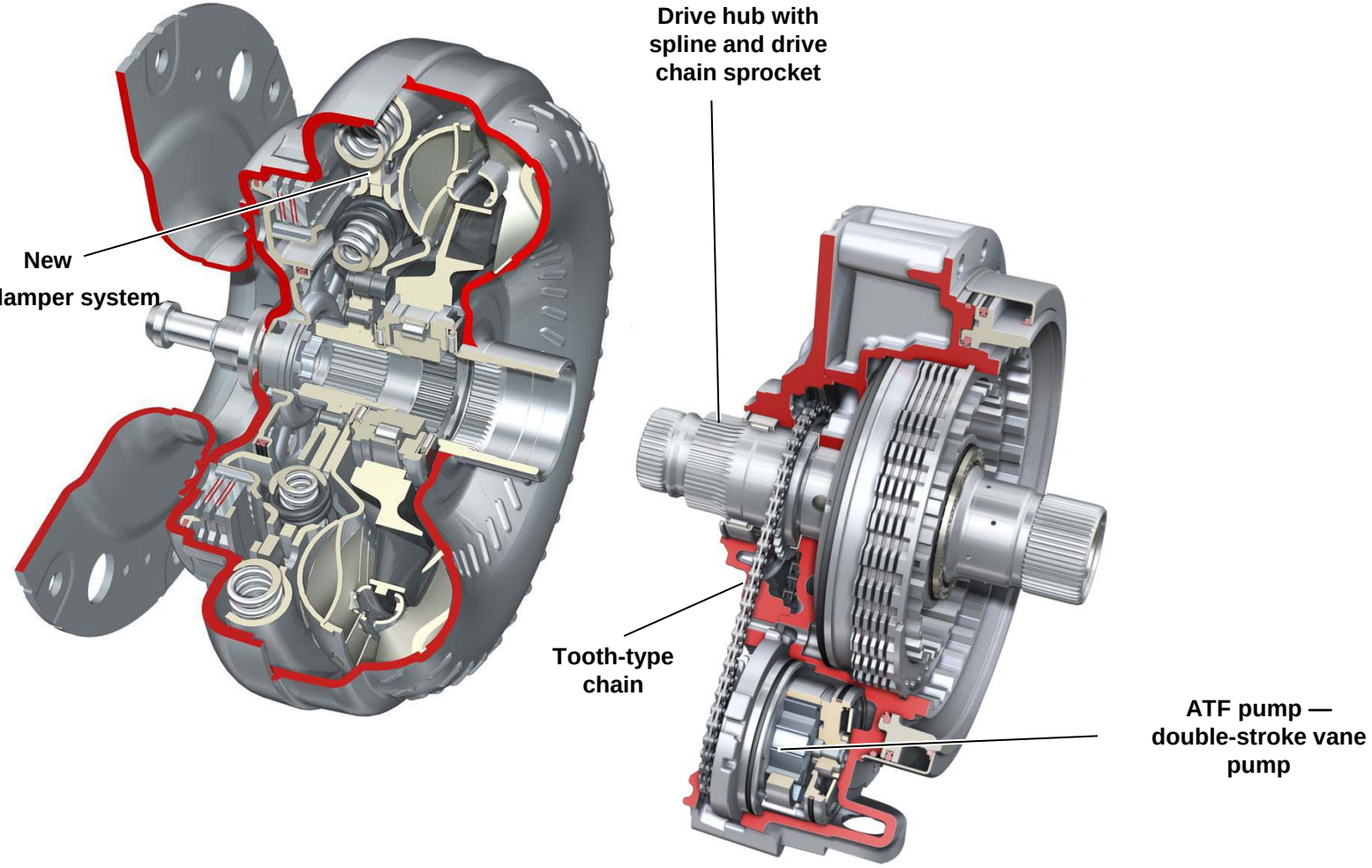
- **Improvements to the 8-speed automatic gearbox**
  - Overview of improvements
  - Torque converter, ATF pump
  - Planetary gearbox (gearshift matrix, gearshift pattern)
  - Oil supplies
  - Innovative thermal management system (ITM)
  - Mechatronic unit
  - Parking lock
  - Neutral idle control, start/stop system
  - Adaption
  - Shifting strategy based on navigation data

Improvements to the 8-speed automatic gearbox (0BK, 0BL)

- **Overview of improvements:**
  - Differential upstream of the torque converter
  - The 8 forward gears and the reverse gear have been achieved using 4 planetary gearboxes and 5 selector elements
  - Reduced drag loss as three selector elements are closed in each gear
  - Mechatronic unit for shift-by-wire with electro-hydraulic parking lock
  - 8 speeds at a stepping value of 7.03 results in smaller gear steps, a powerful starting ratio and a low engine speed level at increased speeds
  - ATF oil supply by means of a vane pump driven by a chain
  - Transfer box lubrication via the oil pump
  - Neutral idle control when the vehicle comes to a standstill and when the engine is idling
  - Slip propshaft
  - Centre differential with asymmetric torque distribution (60/40)

Improvements to the 8-speed automatic gearbox (0BK, 0BL)

- **Torque converter/ATF pump**



Improvements to the 8-speed automatic gearbox (0BK, 0BL)

- **Planetary gearbox (gearshift matrix, gearshift pattern)**

Gearshift matrix:

- 5 selector elements (connections)
- 4 planetary gearboxes

tmatrix

	Schaltelemente/ Druckregelventile/ Magnetventile							
	A EDS-A N215	B EDS-B N216	C EDS-C N217	D EDS-D N218	E EDS-E N233	MV-Pos N510	EDS-Sys N443	EDS-WK N371
Parksperre	1	1	1	0	0	0	X	0
Neutral	1	1	1	0	0	1	X	0
R-Gang	1	1	1	1	0	1	X	0
1. Gang	1	1[1]	0	0	0	1	X	X
2. Gang	1	1	1	0	1	1	X	X
3. Gang	0	1	0	0	1	1	X	X
4. Gang	0	1	1	1	1	1	X	X
5. Gang	0	1	0	1	0	1	X	X
6. Gang	0	0	0	1	1	1	X	X
7. Gang	1	0	0	1	0	1	X	X
8. Gang	1	0	1	1	1	1	X	X

457_054

Kupplung geschlossen

Bremse geschlossen

Druckregelventile/ Magnetventil

1 aktiv

0 nicht aktiv (ein geringer Grund-Steuerstrom ist immer vorhanden)

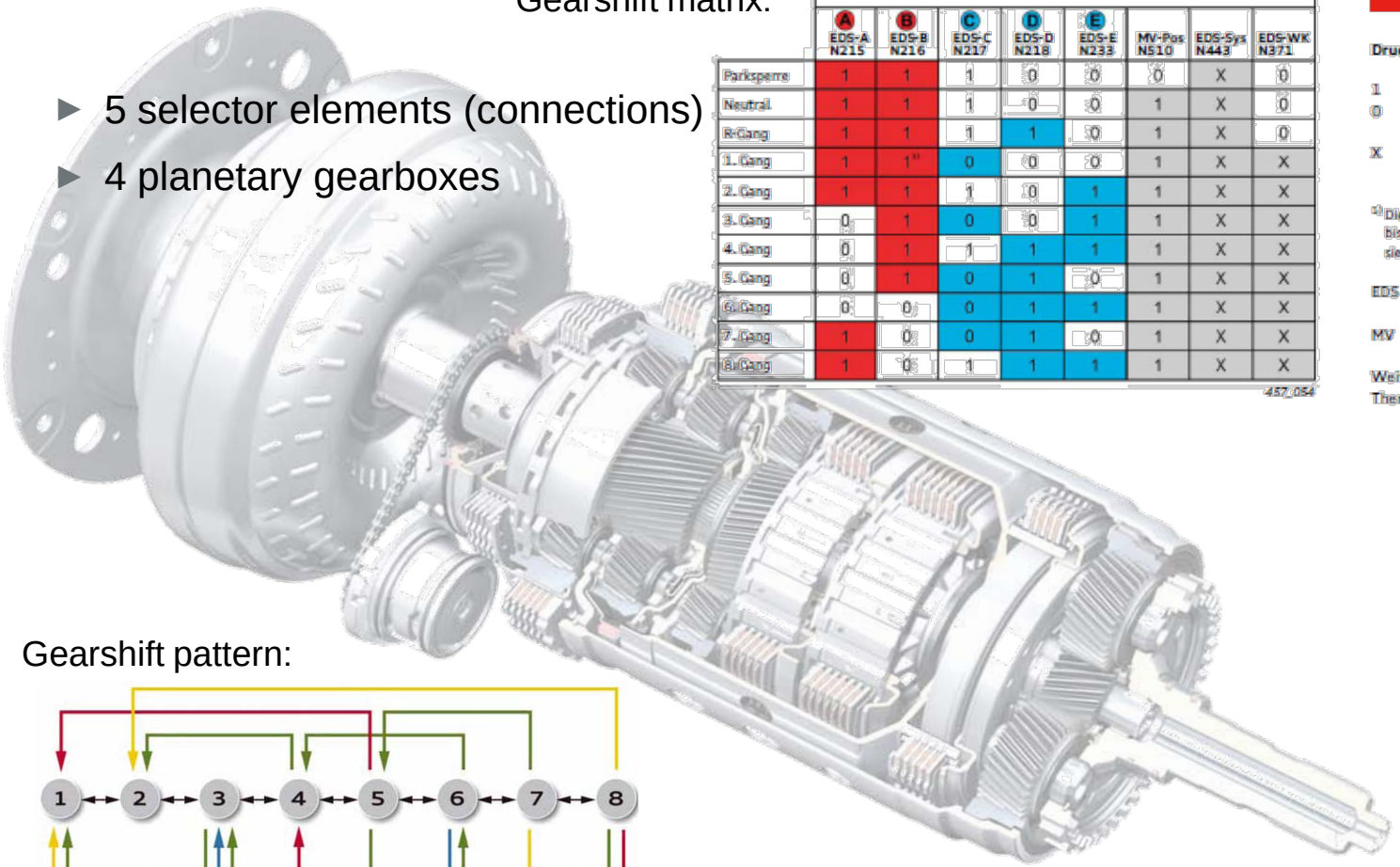
X aktiv – Steuerstrom ist abhängig vom Betriebszustand

[1] Die Bremse B ist bei Standabkopplungsbetrieb bis auf ein geringes Restmoment geöffnet, siehe Seite 52.

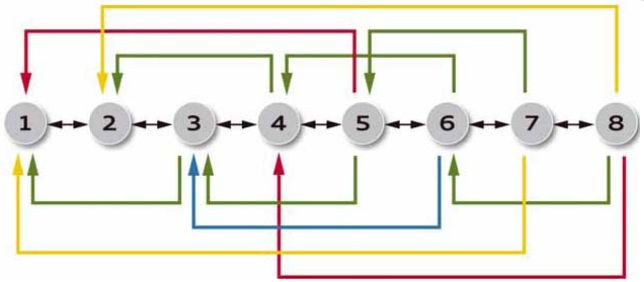
EDS Elektrisches Drucksteuerventil (Druckregelventil)

MV Magnetventil

Weitere Informationen finden sie beim Thema Mechatronik auf Seite 42.



Gearshift pattern:



Improvements to the 8-speed automatic gearbox (0BK, 0BL)

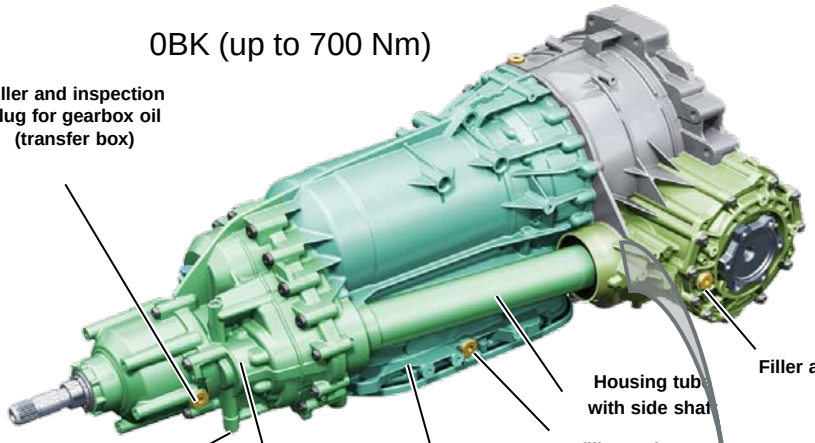
► Oil supplies

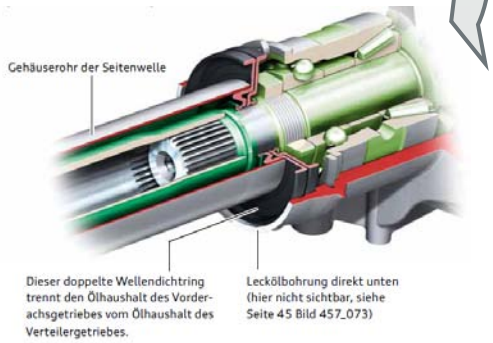
ATF oil supply for the planetary gearbox, the hydraulic control unit and the torque converter

Oil supply for the transfer box (Gearbox oil with STURACO [1])

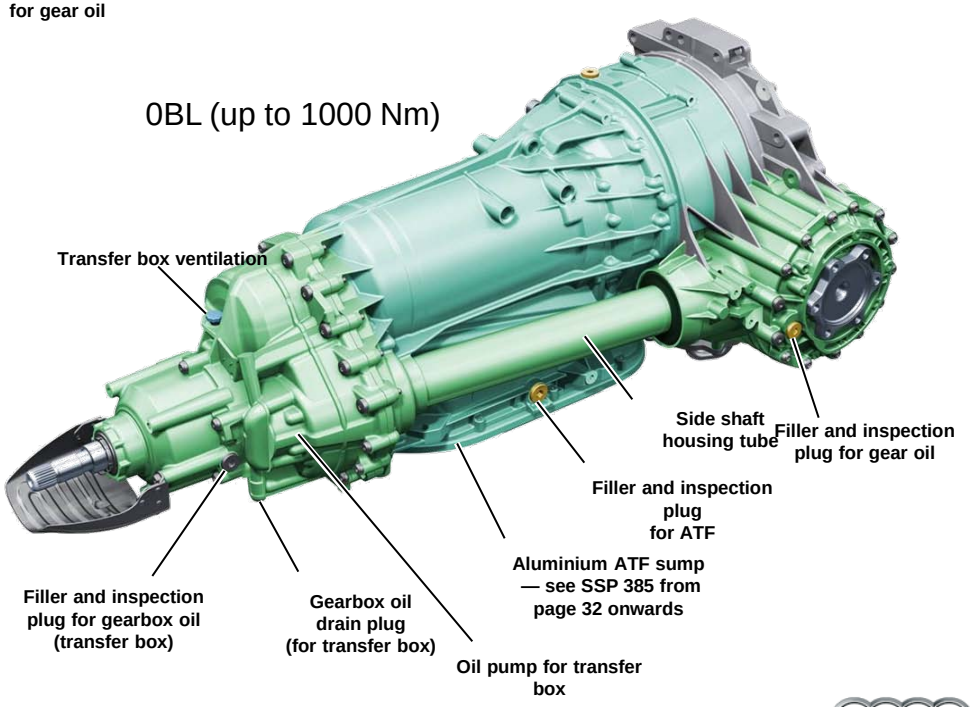
Oil supply for the front final drive (Gearbox oil without STURACO [1])

0BK (up to 700 Nm)





0BL (up to 1000 Nm)



Improvements to the 8-speed automatic gearbox (0BK, 0BL)

- **Innovative thermal management system (ITM)**

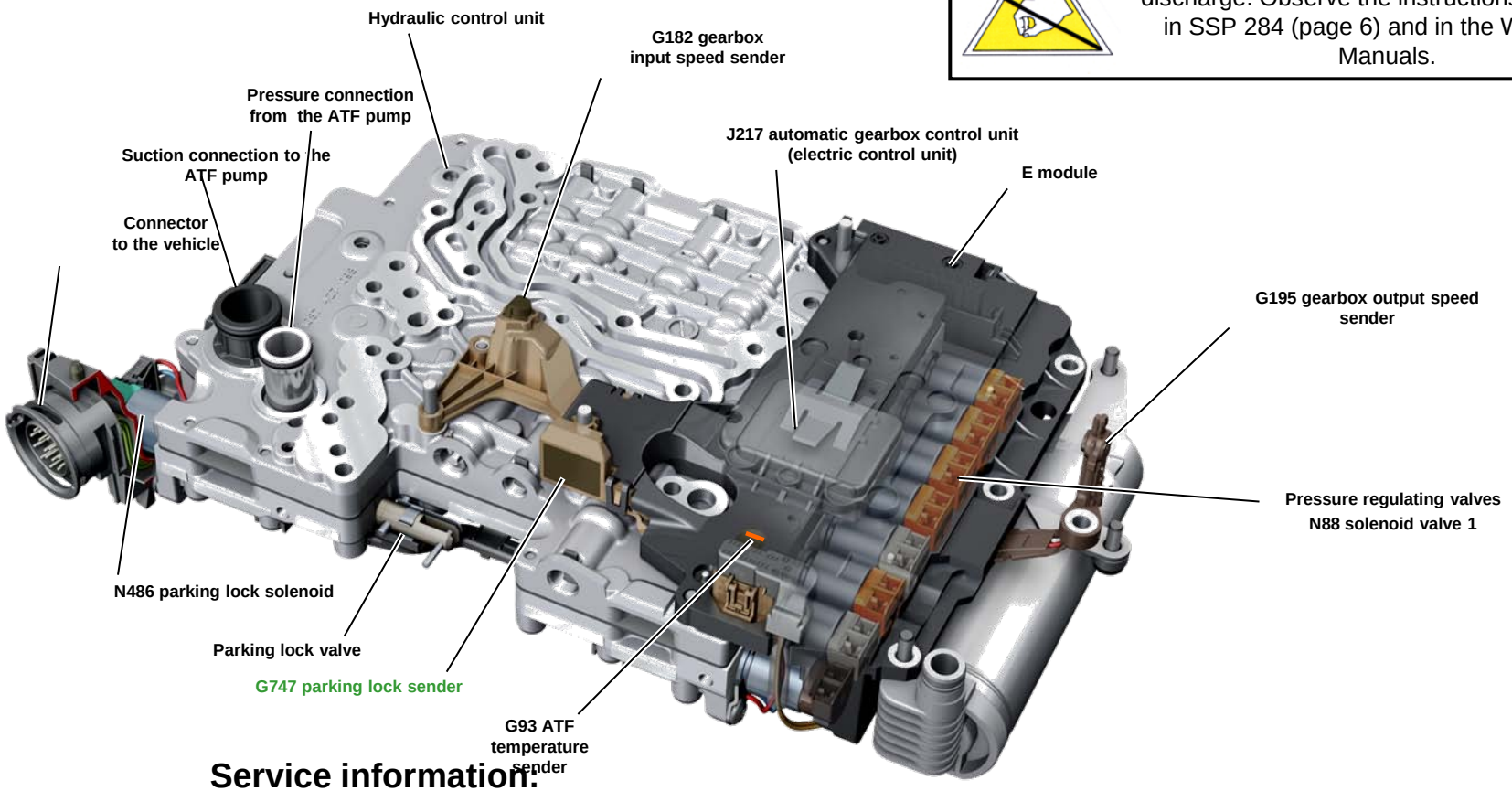
  Objective: To reduce fuel consumption by shortening the engine and gearbox warm-up phase.

  - The engine control unit co-ordinates the distribution of engine heat (via valves and regulators) between the engine, air conditioning system and gearbox
  - 1st priority: air conditioning system; 2nd priority: engine; 3rd priority: gearbox
  - Once the engine is warm, the **gearbox** can be **actively heated**

Improvements to the 8-speed automatic gearbox (0BK, 0BL)

► Mechatronic unit

Please take special care to ensure that the electronics are protected against electrostatic discharge. Observe the instructions and notes in SSP 284 (page 6) and in the Workshop Manuals.



Service information:

- Do not forget about the oil tube during assembly
- The spring in the electronics generates a 'soft' stop

Improvements to the 8-speed automatic gearbox (0BK, 0BL)

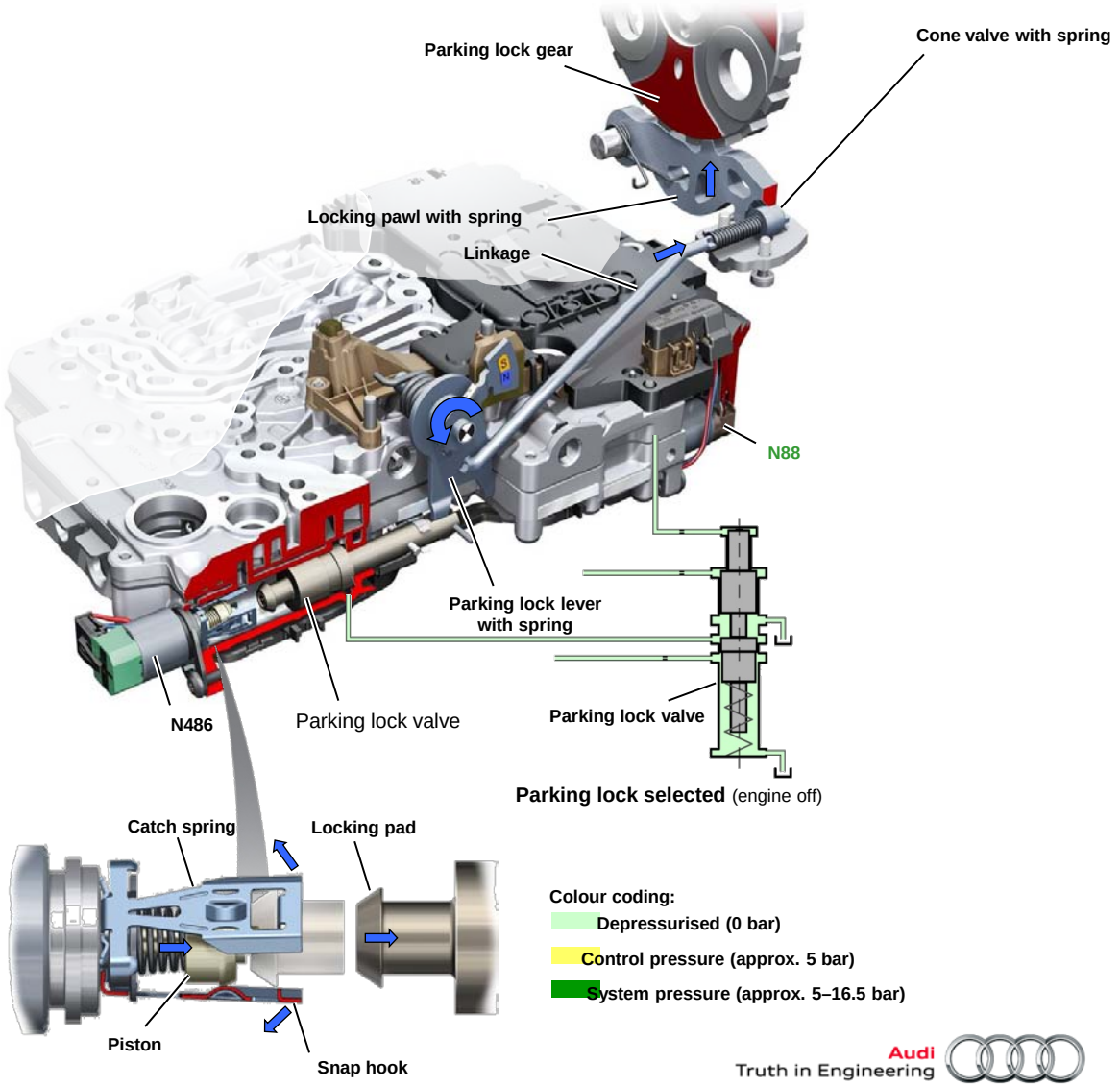
► Parking lock

- The parking lock **emergency operation functions** are designed to prevent the parking lock from being selected when driving as a result of a fault.

- The parking lock operates via an **electric and hydraulic mechanism**. In the event of a fault with one system, the other system ensures correct operation.

- Parking lock emergency operation function:

  1. N88 fault
  2. N486 fault
  3. Interruption to the power supplied to the mechatronic unit



Improvements to the 8-speed automatic gearbox (0BK, 0BL)

- **Neutral idle control** (consumption reduction + acoustics improvement)

Stops the converter loss torque when the engine is idling, in a forward gear, when the vehicle is at a standstill and when the brake pedal is depressed.

Audi
Truth in Engineering

Thank you.