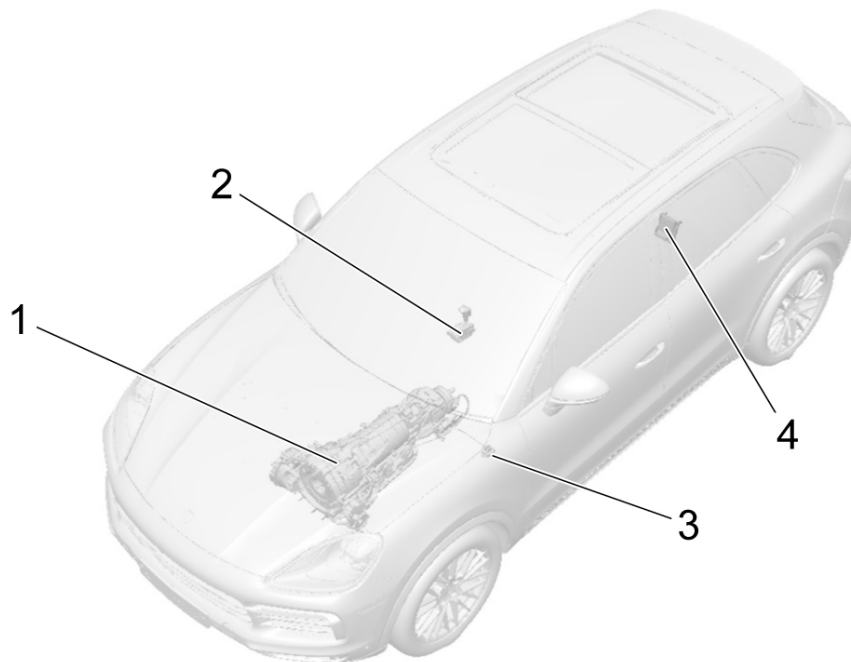




PORSCHE

System description of automatic transmission - 8HP65AX

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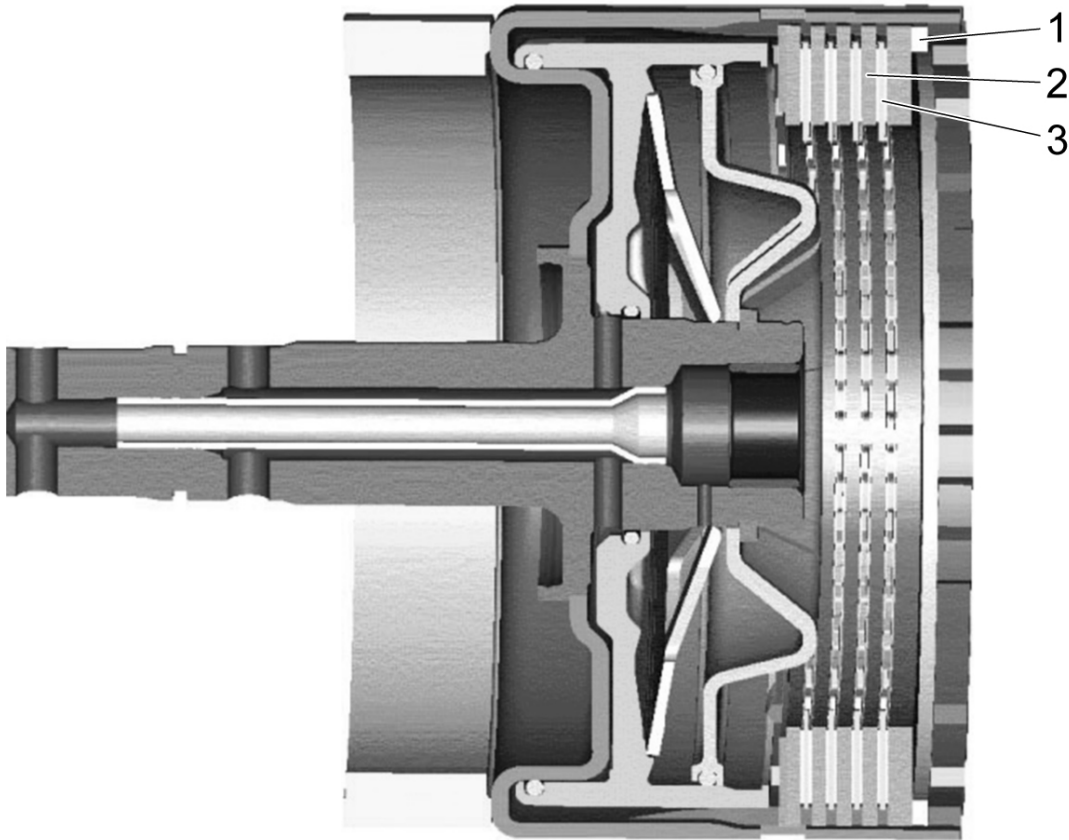
Overview of automatic transmission installation position

- | | | | |
|---|--------------------------|---|---|
| 1 | Automatic transmission | 3 | Transmission parking lock emergency release |
| 2 | Automatic selector lever | 4 | Control unit for rear axle transmission |

The 8HP65AX 8-gear automatic transmission was developed for vehicles with longitudinal engines and all-wheel drive. The main automatic transmission of the 8HP65AX is a further development of the Audi AL552 (8HP65A) transmission. The rear axle transmission and cardan shaft are further developments of the corresponding components from the Cayenne E2. The Hang-On transfer case is a further development of the component used in the Macan. The manufacturer of the automatic transmission is ZF-Getriebe GmbH in Friedrichshafen.

In contrast to its predecessor AL552, the 8HP65AX from Porsche has a Hang-On transfer case for four-wheel drive, which is supplied by Magna. The new gear wheel set concept, consisting of four planetary gear sets with five shifting elements, minimises drag losses and increases transmission efficiency.

The basic transmission is also fully hybrid-capable. The modular system developed by ZF Friedrichshafen AG makes it possible for micro and full hybrid systems to be equipped with the basic transmission of the automatic transmission.



Cutaway view of clutch

- 1 Circlip
- 2 Multi-disc brakes
- 3 Ondular washers

Clutch

The wet multi-disc clutch is actuated using a ball ramp system and an electric actuator with integrated control unit.

The drive and front axle output use two coaxial shafts: drive outside and front axle output drive inside. The clutch is operated in continuous slip and has a capacity of 1200 Nm \pm 10% in continuous operation. Short-term peak torques of 1400 Nm are possible, with a maximum of 100 instances over the entire service life. The direction of rotation of the rear axle output drive is clockwise when viewed in the direction of travel.

Switching elements

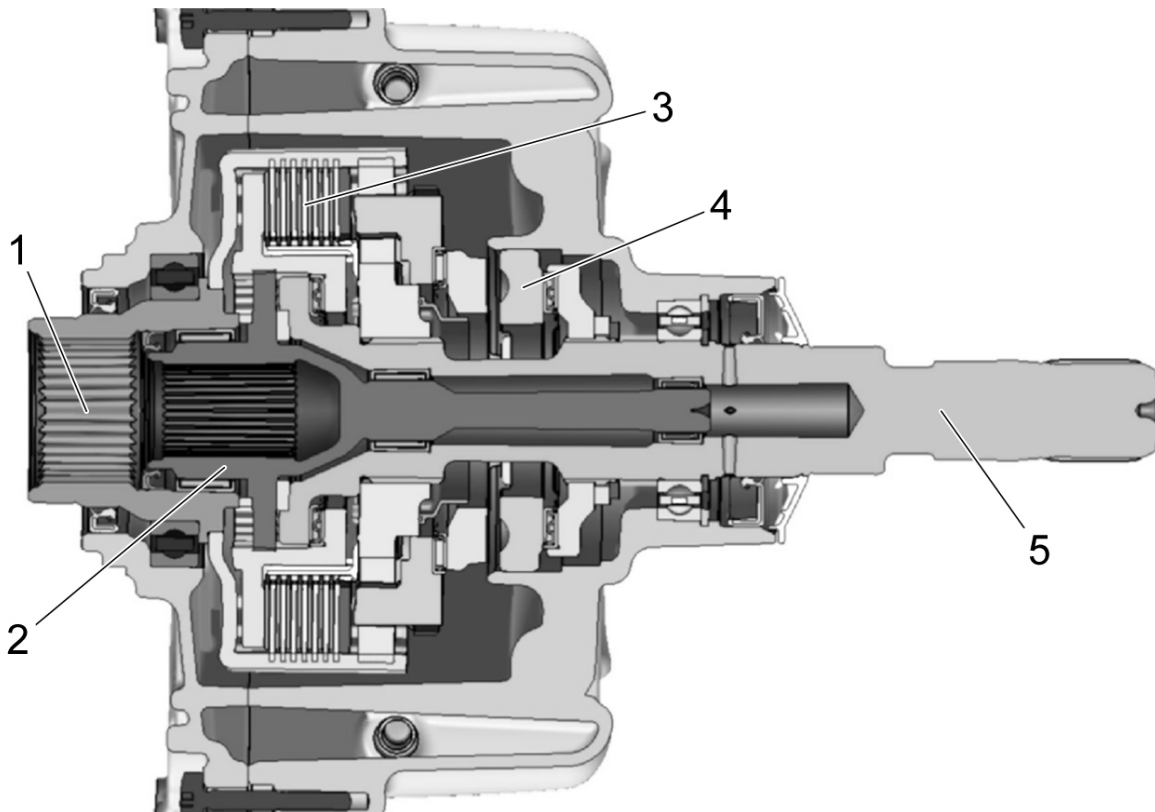
The 8-speed 8HP65AX automatic transmission consists of 5 switching elements in the form of 3 revolving clutches (C, D and E) and 2 fixed brakes (A and B).

Due to the arrangement of the planetary gear sets, two switching elements are always open and three are always closed for each gear (see table): clutch logic.

Brakes A and B are fitted with ondular washers between the vanes. When open, they allow the clearance necessary to reduce the drag torque as much as possible. This reduces fuel consumption by about 1.5% while also reducing CO₂ emissions. Since the switching elements have no freewheel and only one clutch changes, gear shifts are always carried out without interrupting the flow.

Gang	Bremsen		Kupplung			Über- setzung i	Gang- sprung
	A	B	C	D	E		
1	●	●	●			4,714	1,50
2	●	●			●	3,143	1,49
3		●	●		●	2,106	1,26
4		●		●	●	1,667	1,30
5		●	●	●		1,285	1,28
6			●	●	●	1,000	1,19
7	●		●	●		0,839	1,26
8	●			●	●	0,667	Gesamt
R	●	●		●		-3,317	7,071

Clutch logic



Torque flow in rear axle output drive

- 1 Input shaft and output to rear axle (input torque)
- 2 Output to front axle
- 3 Multi-plate clutch (output torque of front axle drive)
- 4 Ball ramp
- 5 Transmission of input torque to rear axle

Transfer case (Hang-On)

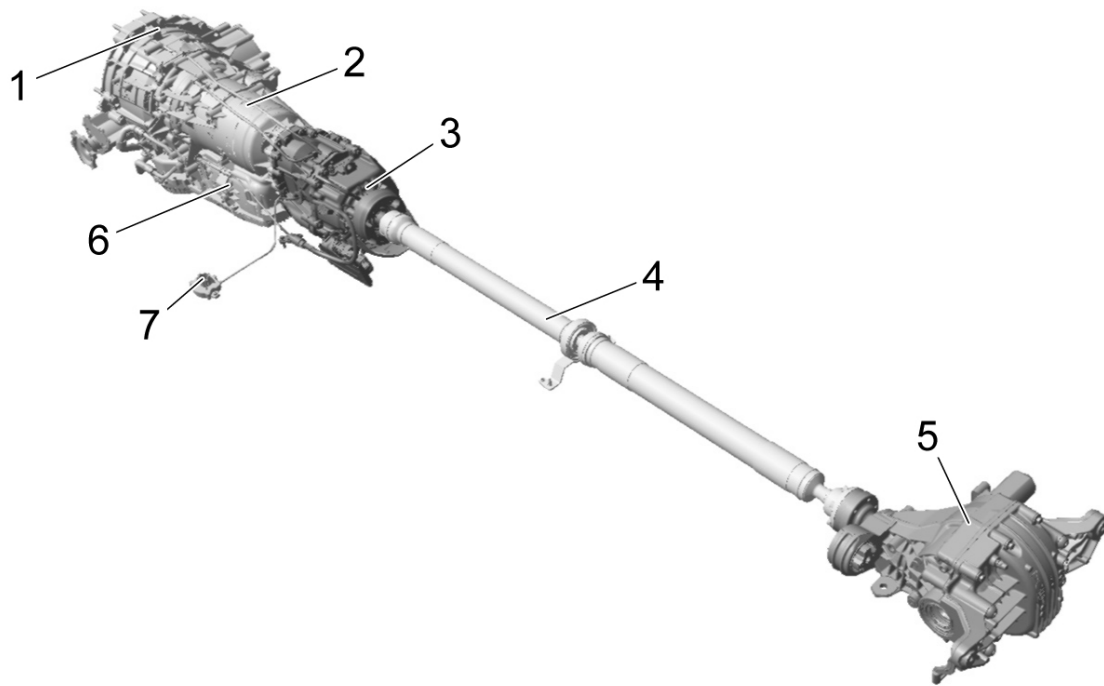
The flange-mounted Hang-On transfer case with bolted damper and heat shield is required for all-wheel drive. It is supplied by a separate oil supply. Porsche has also given the new transmission housing a modified flange contour for the converter bell. There is also a reinforced differential cover and further changes to the interior. Among other things, ventilation tubes, bore holes and bearings were revised. The former hydraulic oil reservoir has been replaced by an electric control unit which, together with the actuator, controls the multi-disc clutch.

When the multi-plate clutch is open, the input torque is transmitted directly to the rear axle. Closing the clutch controls the percentage distribution of the input torque to the front and rear axles. The input torque is transmitted back to the transmission via the internal shaft and from there to the front axle final drive via the output unit and the side shaft.

Three-line converter

The new three-line converter built into the 8HP65AX 8-speed automatic transmission is an optimised hydrodynamic torque converter. The converter lockup clutch is supplied through third control line (at 5-6 bar operating pressure). The first and second lines are used for oil supply and return.

The torque converter is equipped with a slip-controlled converter lockup clutch. By using a turbine torsional damper and a speed adaptive damper with centrifugal pendulum, torsional vibrations between the engine and transmission are decoupled, providing greater shifting comfort.



Component overview of automatic transmission

- 1 Front-axle final drive (VAG integrated)
- 2 Automatic transmission (main transmission)
- 3 Transfer gear with Hang-on
- 4 Cardan shaft (inserted in front, bolted in rear)
- 5 Rear axle differential
- 6 Transmission parking lock operating cable
- 7 Transmission parking lock emergency release



Vane pump

The new mechanical hydraulic pump from manufacturer Ixetic GmbH, used in the transfer case of the 8HP65AX 8-speed automatic transmission, has been given a more efficient housing with an oval design for the delivery chamber. This means that the vane pump conveys twice on each turn. The pump is operated with a timing chain from the central drive shaft.

Advantages of the new vane pump:

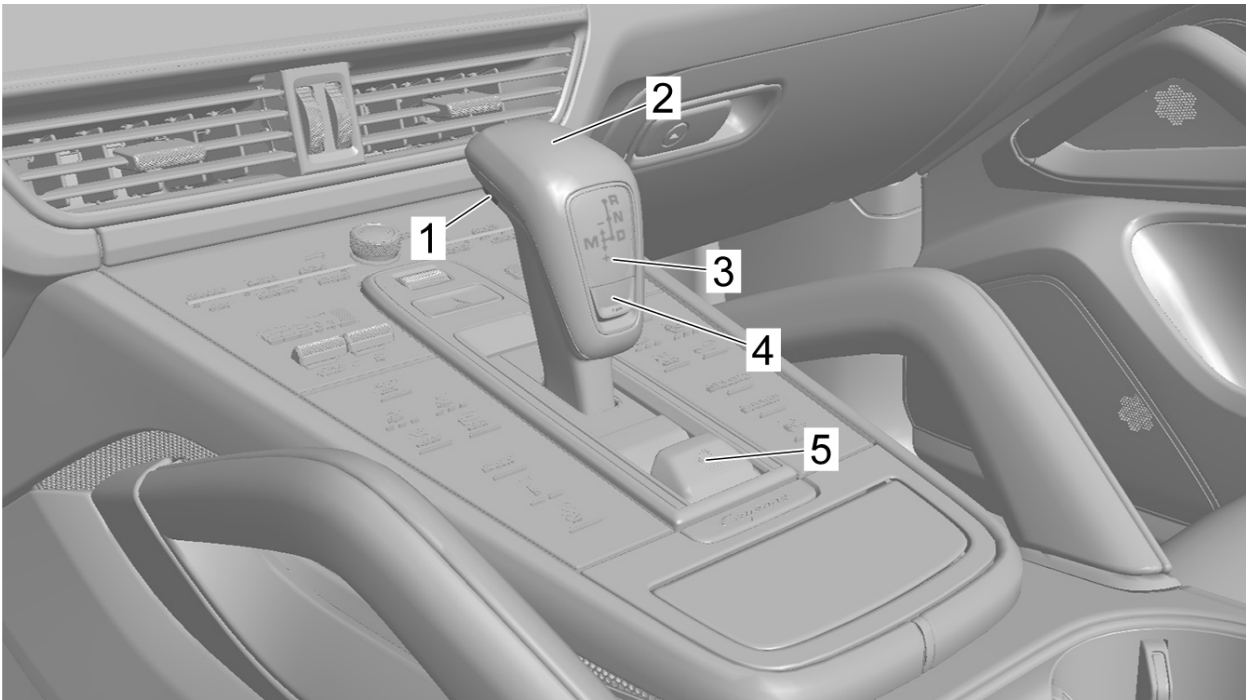
- Lighter and smaller than before
- The drivers can no longer be damaged
- Driving by timing chain

Mechatronics

The hydraulic control unit and the electronic transmission control unit are integrated into a single unit: the mechatronics. This is installed in the transmission near the ATF pan.

The following components are integrated into the mechatronics:

- Transmission control unit
- Solenoid valve
- Yellow pressure control valves: rising characteristic from 0 to 4.7 bar
- Blue pressure control valves: falling characteristic from 4.7 to 0 bar
- Magnet for transmission parking lock
- Transmission input speed sensor
- Transmission output speed sensor
- Temperature sensor for control unit
- Sensor for transmission parking lock



Selector lever for automatic transmission (basic)

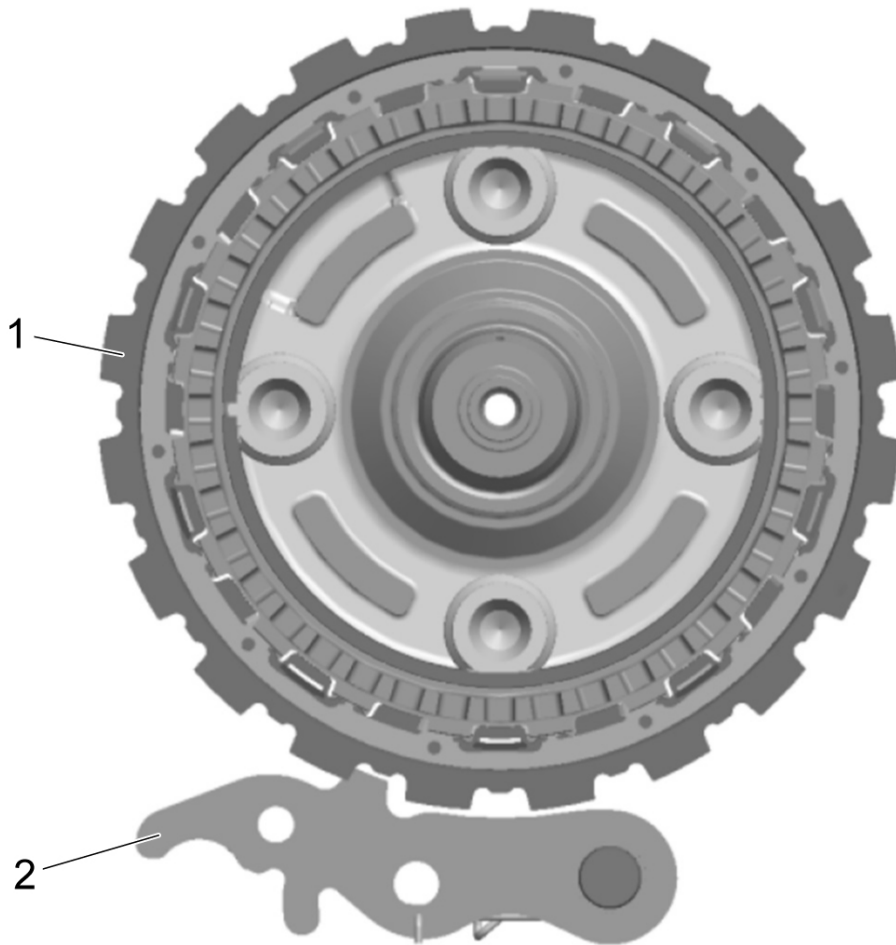
- | | | | |
|---|--------------------|---|--------------------------------------|
| 1 | Unlocking button | 4 | P-button (transmission parking lock) |
| 2 | Selector lever | 5 | Electric parking brake |
| 3 | Drive mode display | | |

Thanks to complete shift-by-wire technology, there is no longer any mechanical connection between the selector lever and the transmission. This enables short shifting paths in the automatic gear-selection gate and reduces shifting forces. The comfortable operation is thus purely registration of driver requests, with no mechanical fallback level. Transmission ranges D, R and M are available for selection.

In order to use the Triptronic S function on the steering wheel, manual mode M must be used. The release button on the selector lever prevents unwanted switching operations. It must be pressed in order to be able to move the gear lever in the automatic gear-selection gate. The selector lever returns to the middle starting position after each operation. You can only switch to operating mode M from operating mode D. The transmission reaches top speed in sixth gear. The seventh and eighth gears are used for the most efficient driving style possible, increasing long-distance comfort. The low engine speed further reduces interior noise levels and fuel consumption.

Start/stop operation

The Auto-Start/Stop function has also been refined further, and now switches the engine off when approaching a traffic light. This increases comfort and reduces fuel consumption. While the Audi AL552 transmission still has a pressure accumulator, the Porsche 8HP65AX transmission has an electric auxiliary pump for the oil pressure, which regulates the oil supply during start/stop operation if required.



Parking-lock gear

- 1 Parking-lock gear
- 2 Driving dog

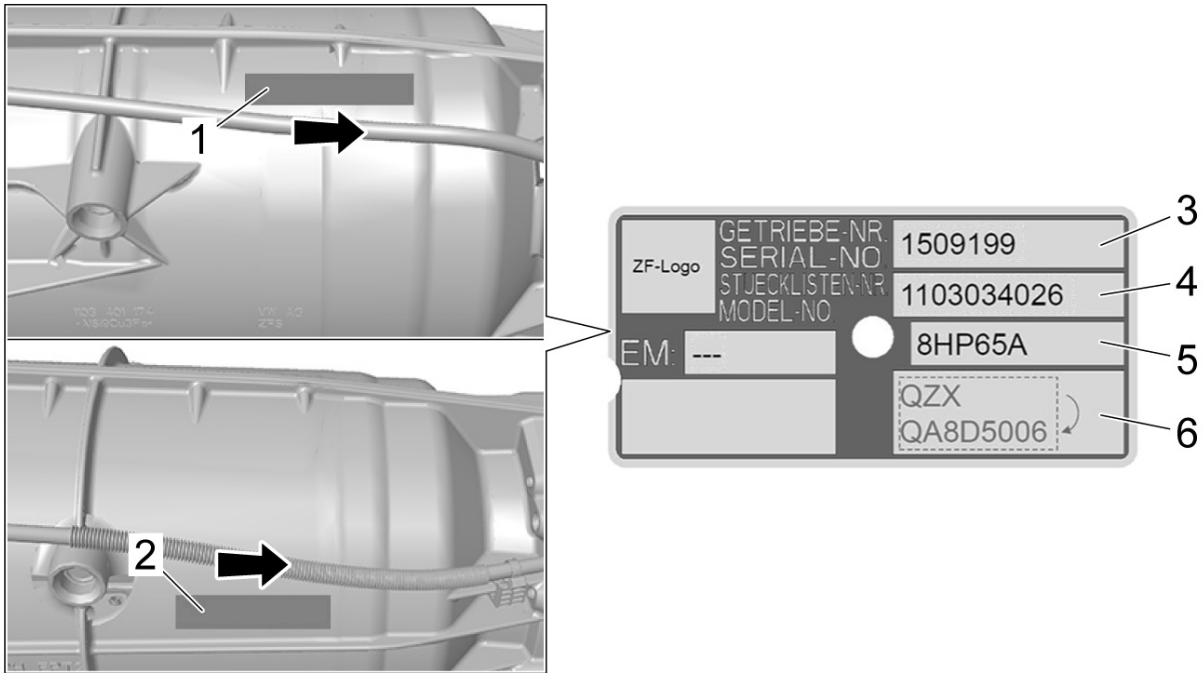
Transmission parking lock

The transmission parking lock is actuated electrohydraulically and is operated via the P-button on the selector lever. When the ignition is switched off or the vehicle is left in the operating modes D, M or R, the transmission parking lock is engaged automatically. The vehicle can also be moved with the driver's door open and the driver's seat belt unfastened if the electric parking brake is released and the D, M or R operating mode is selected. In this case, the transmission parking lock is not activated automatically. An emergency release of the transmission parking lock is also possible when it is activated.

Emergency release of the transmission parking lock

The emergency release is located in the driver's footwell. Using a socket wrench located in the on-board tool kit, the transmission parking lock can be permanently unlocked using an operating cable. This should only be done in the following situations:

- When the vehicle has to be towed
- If the transmission parking lock cannot be unlocked electrohydraulically due to a malfunction
- If the vehicle must be manoeuvred or moved but the on-board voltage is insufficient
- If the engine is not running and the vehicle must be manoeuvred or moved in the workshop, for example

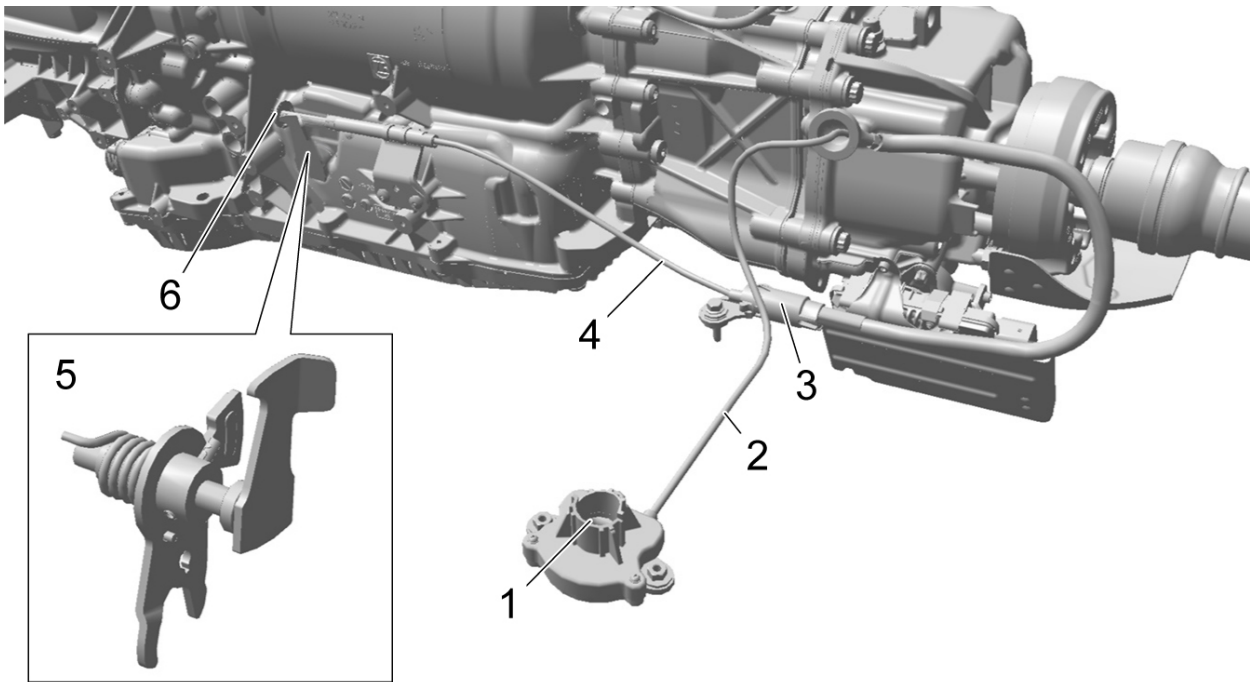


Transmission identification

- 1 Position of identification on vehicles with 4-cylinder and 6-cylinder engines (arrow = reading direction)
- 2 Position of identification on vehicles with 8-cylinder engines (arrow = reading direction)
- 3 Transmission no.
- 4 Parts list no.
- 5 Electric motor no.
- 6 Customer and type name code

The transmission identification 8HP65AX is made up as follows:

- 8 - Gears
- H - Hydrodynamic starting element
- P - Planetary transmission
- 65 - Type designation
- AX - Variant (X for all-wheel drive)
- PH - Hybrid (for hybrid vehicles only)



Overview of transmission parking lock

- | | | | |
|---|--|---|--------------------------------------|
| 1 | Emergency release mechanism (driver's side footwell) | 4 | Operating cable B |
| 2 | Operating cable A | 5 | Selector lever for emergency release |
| 3 | Rapid-action coupling | 6 | Mushroom seat |

Emergency releasing the transmission parking lock

Important: Before activating the emergency release of the transmission parking lock, the vehicle must be secured against rolling away, for example by activating the electric parking brake or depressing the brake pedal.

Note:

There must be some oil pressure to unlock the transmission parking lock.

- 1 Remove the cover in the footwell on the driver's side.
- 2 Insert the emergency release socket wrench into the actuating mechanism.
- 3 Push the socket wrench down and turn it clockwise 90 degrees until it clicks into place.
- 4 Leave the socket wrench inserted.

As soon as the emergency release of the transmission parking lock is actuated, operating mode N is displayed in the instrument cluster.

Locking the transmission parking lock again

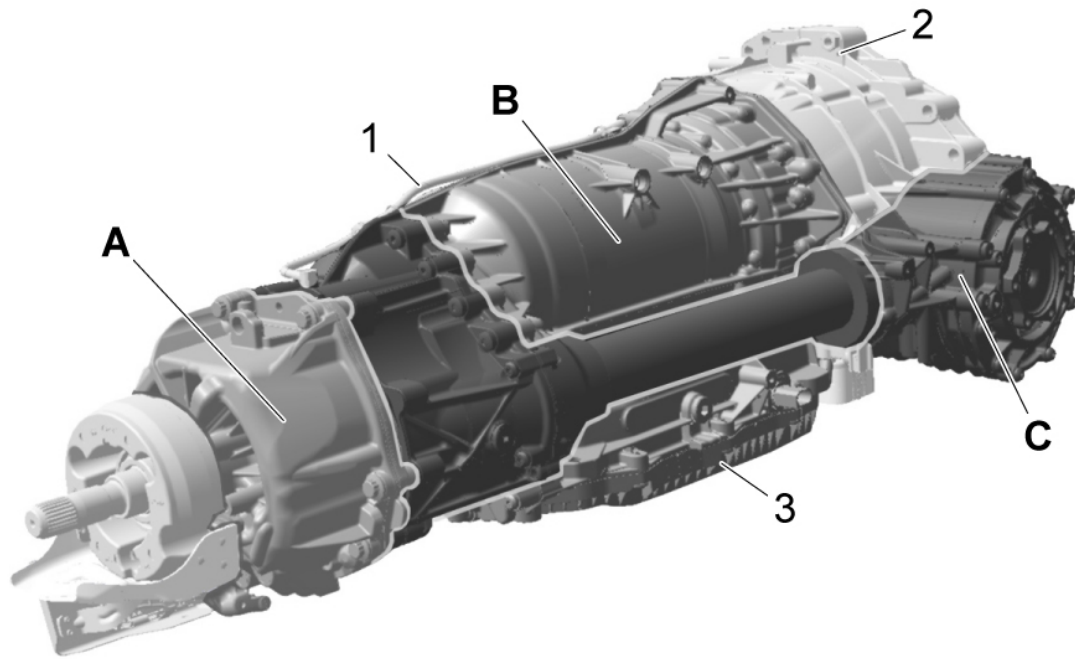
Note:

To remove and lock the transmission parking lock, do not turn the socket wrench back, as this may damage the transmission.

- 1 Pull the socket wrench vertically up and out.
- 2 Fit cover.

Reduction of structure-borne noise transmission

A special feature is the positioning of the emergency release operating cable to the gear shift lever. The end of the operating cable is equipped with a rigid rod and a mushroom-shaped seat which grips around the gear shift lever without contacting it. This largely prevents transmission of structure-borne noise from the transmission to the operating cable and thus its transmission into the vehicle interior. The seat and gear shift lever only come into contact when the emergency release is actuated.

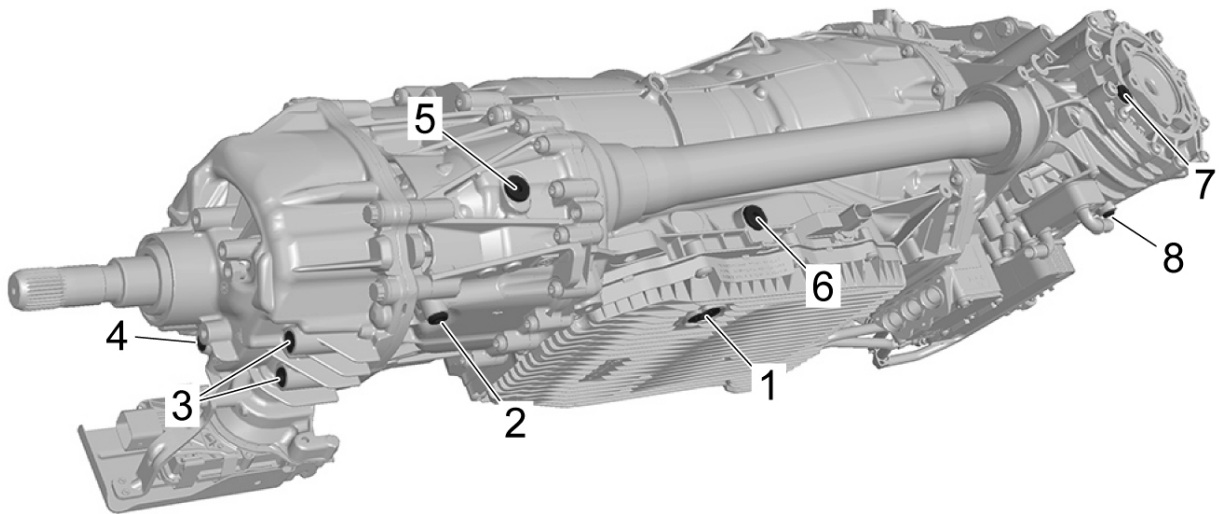


Overview of separate oil supply systems

- | | | | |
|---|--|---|---|
| 1 | Transfer case breather hose | A | Oil system 1: Hang-On |
| 2 | Ventilation bore | B | Oil system 2: Basic manual transmission |
| 3 | Plastic ATF pan with integrated suction filter | C | Oil system 3: FA differential and output drive unit |

Separate oil supply systems

The 8HP8565 has three separate oil supply systems (A, B and C), eliminating the need for a secondary pump in the transfer case.



Overview of oil drain plugs

- 1 ATF drive plug (bayonet lock)
- 2 Oil drain plug on intermediate housing
- 3 Oil drain plug on transfer gear
- 4 Oil drain plug on transfer gear
- 5 Oil drain plug on intermediate housing
- 6 ATF oil filler screw
- 7 Oil filler screw on front final drive
- 8 Oil drain plug on front final drive

Removing the transmission

In general, it must be ensured that all necessary aids are available before starting work. Turn the front wheels to straight-ahead position. Always perform work on the transmission as described in the relevant Workshop Manual.

General instructions on working on the transmission

- When working on the transmission, there is a danger that the transmission control unit (mechatronics) may be destroyed by static discharge.
- When the mechatronics has been removed, make sure that it is only placed with the screw head side down to avoid damaging the sensor on the rear side. When replacing the mechatronics, a second person is required during installation to prevent the unit from tilting.
- Do not support the removed transmission on the ATF cooler or the ATF pan.
- To prevent damage to the transmission after installation, all plugs attached to the ATF lines and transmission must be removed. If these are forgotten, the ATF cooling will no longer work and the transmission will be damaged.
- When transporting and working on the transmission, it is possible that axle oil and ATF may mix via the common transmission vent if the transmission is tilted too much.
- The engine must not be started if there is no longer ATF in the transmission or the mechatronics have been removed.
- The clutch must always be pre-filled to avoid possible air inclusions.
- The clutch clearance can only be adjusted during assembly by using circlips of different thicknesses.
- To simplify transmission removal and installation, the emergency release operating cable consists of two parts connected to one other via a quick connector.

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