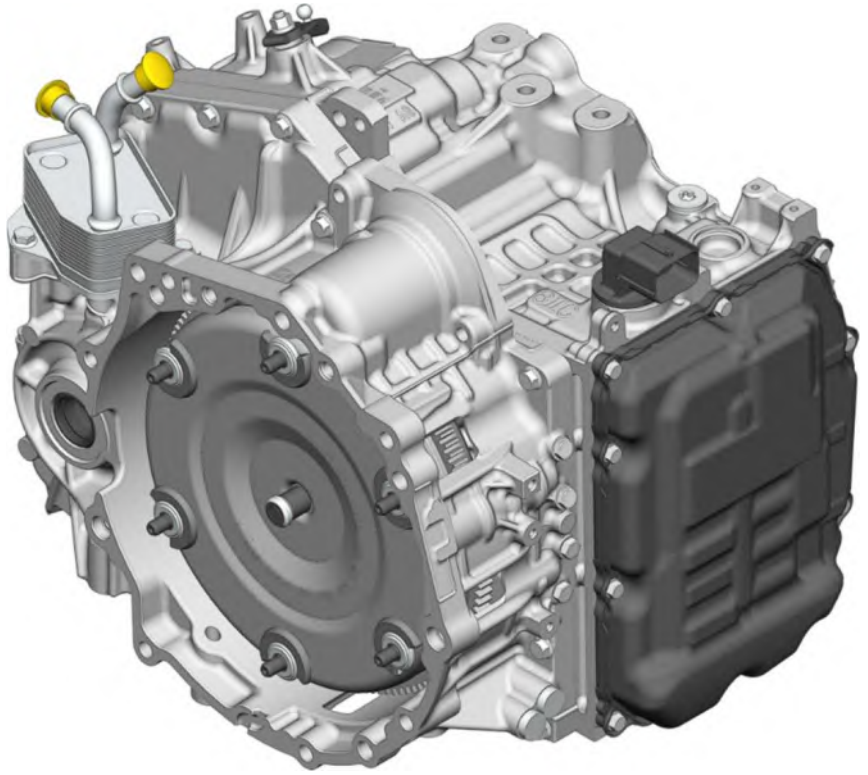
VOLKSWAGEN
GROUP

SSP769

8-speed Automatic gearbox 09S (Generation 2)



Learning tool

INTERNAL

VOLKSWAGEN GROUP

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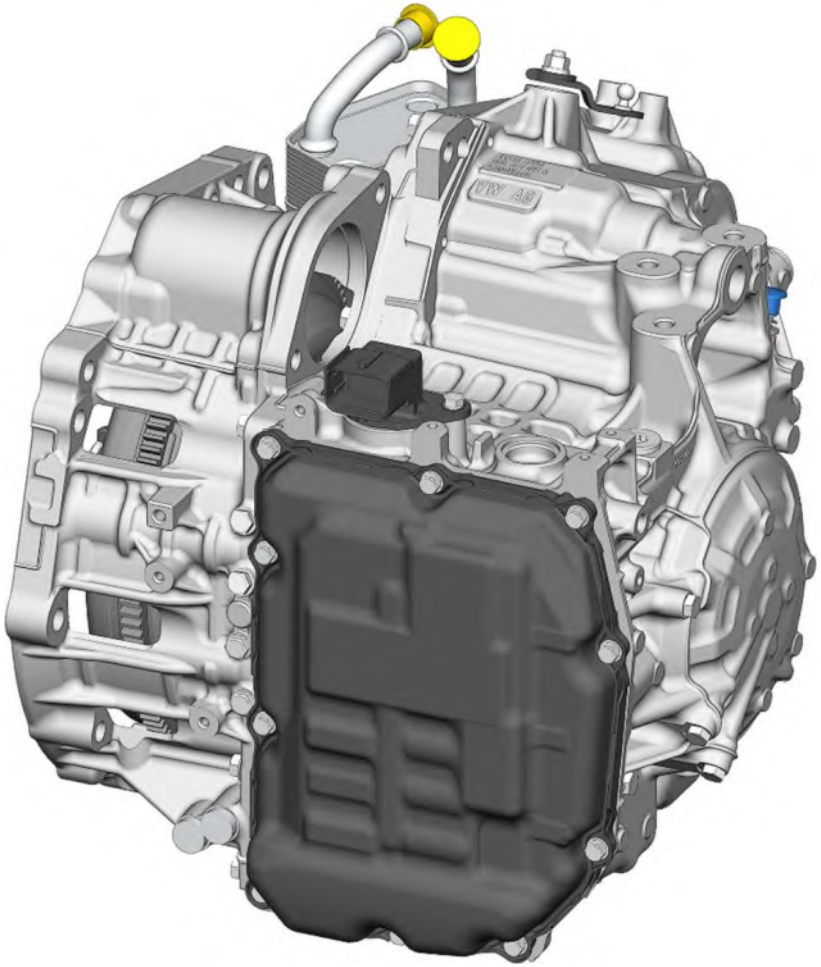
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7.1 Emergency gearbox release 55

1. Introduction

- The AQ300 generation 2 is an 8-speed automatic gearbox with planetary gearbox manufactured by AISIN, Japan.
- The gearbox is used only with EA211 three cylinders engine 1,0l (85 kW or 94 kW with torque 200 Nm) or four cylinders engine 1,4l (110 kW with torque 250 Nm).
- Fixation of the gearbox to the engine is the exactly the same as for the generation one.
- Compared with the first generation fuel consumption is reduced in second generation.



INTERNAL

1.1 Technical information

Manufacturer	AISIN AQ CO., LTD. Japan
Gearbox code	AQ300 – 8F
Filling quantity gear oil	6,2 liters lifetime filling
ATF specification	Always check ETKA
Code letters	1,4l – VQD 1,0l - VVD
Gearbox ratios	1st gear: 5,07 2nd gear: 2,97 3rd gear: 1,95 4th gear: 1,47 5th gear: 1,23 6th gear: 1,00 7th gear: 0,81 8th gear: 0,67 Reverse gear: 4,00
Gear spread	7,54
Torque capacity	250 Nm
Turbine max. torque (D/R)	D: 360 Nm, R: 270 Nm

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2. Comparison with the first generation

- Second generation produces up to 0,4 g/km less CO2 than first generation.
- Main changes compared to the first generation of AQ300 are as follows:

Fuel eco improvement

Friction discs
- Groove shape optimization

Seal ring
- Shape change

MQB Base line (CAN FD)

CU
- New microcontroller with CAN-FD

Quality improvement

Rattle noise
- Torque converter damper

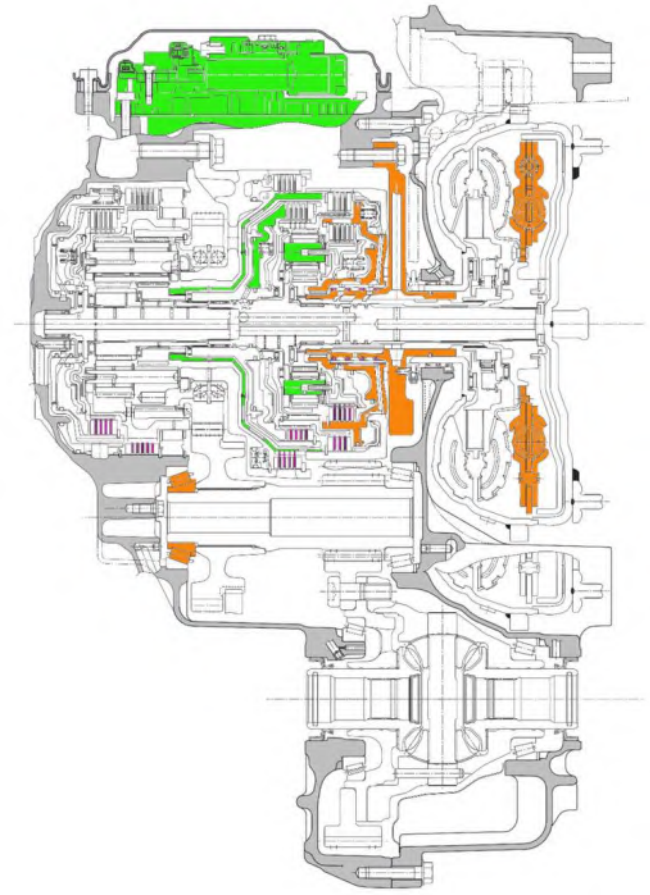
Clutch 3 drift on
- Specification improvement

Cost optimisation

Material change
- Clutch 1 piston: Steel -> Aluminium

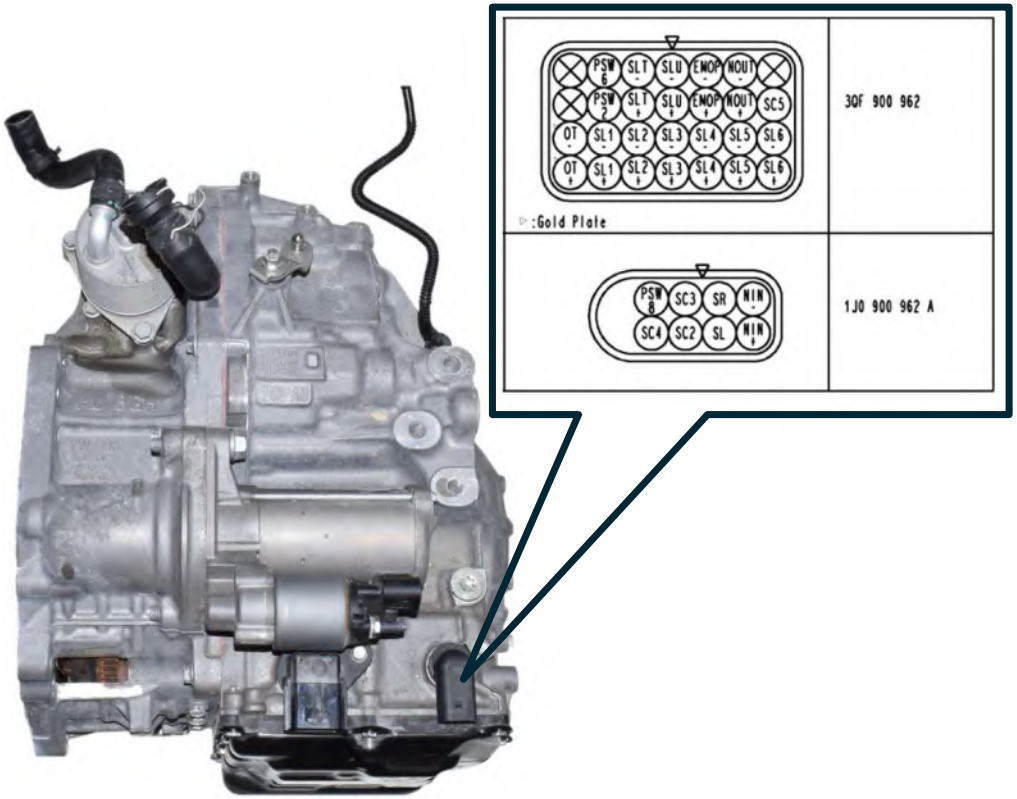
Machining decrease / removal
- Drum sun gear input

Specification change
- Valve body hydraulic circuit optimization
- Oil pressure switch removal

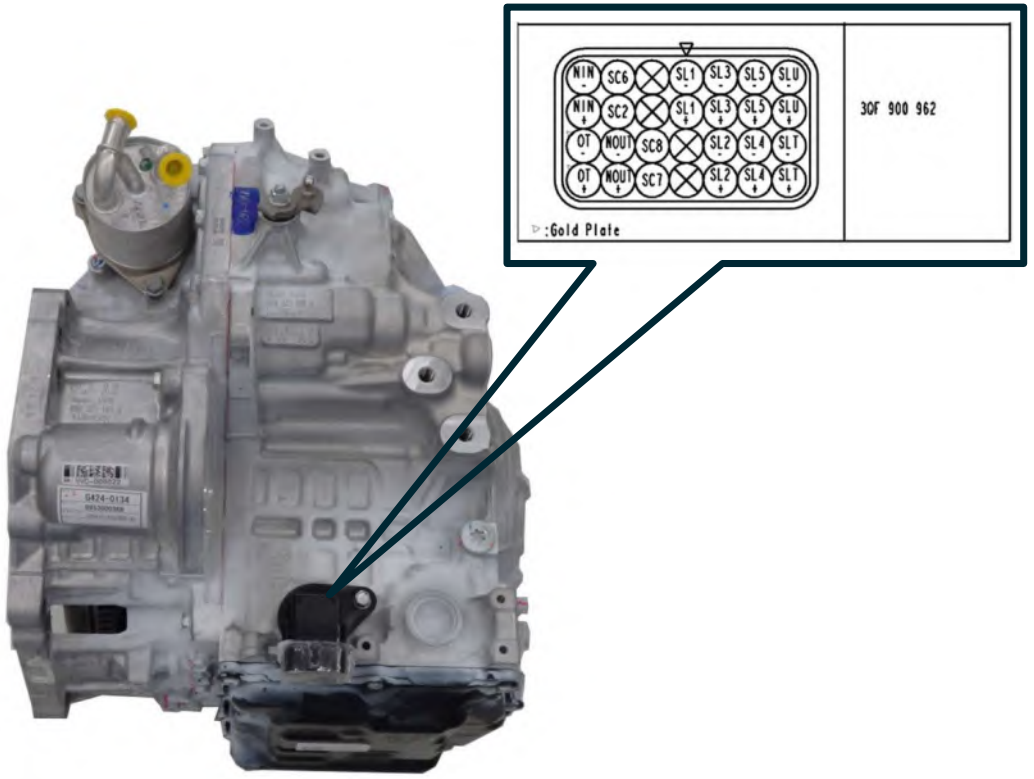


INTERNAL

- The first generation has one 28pins connector and one 8pins connector.



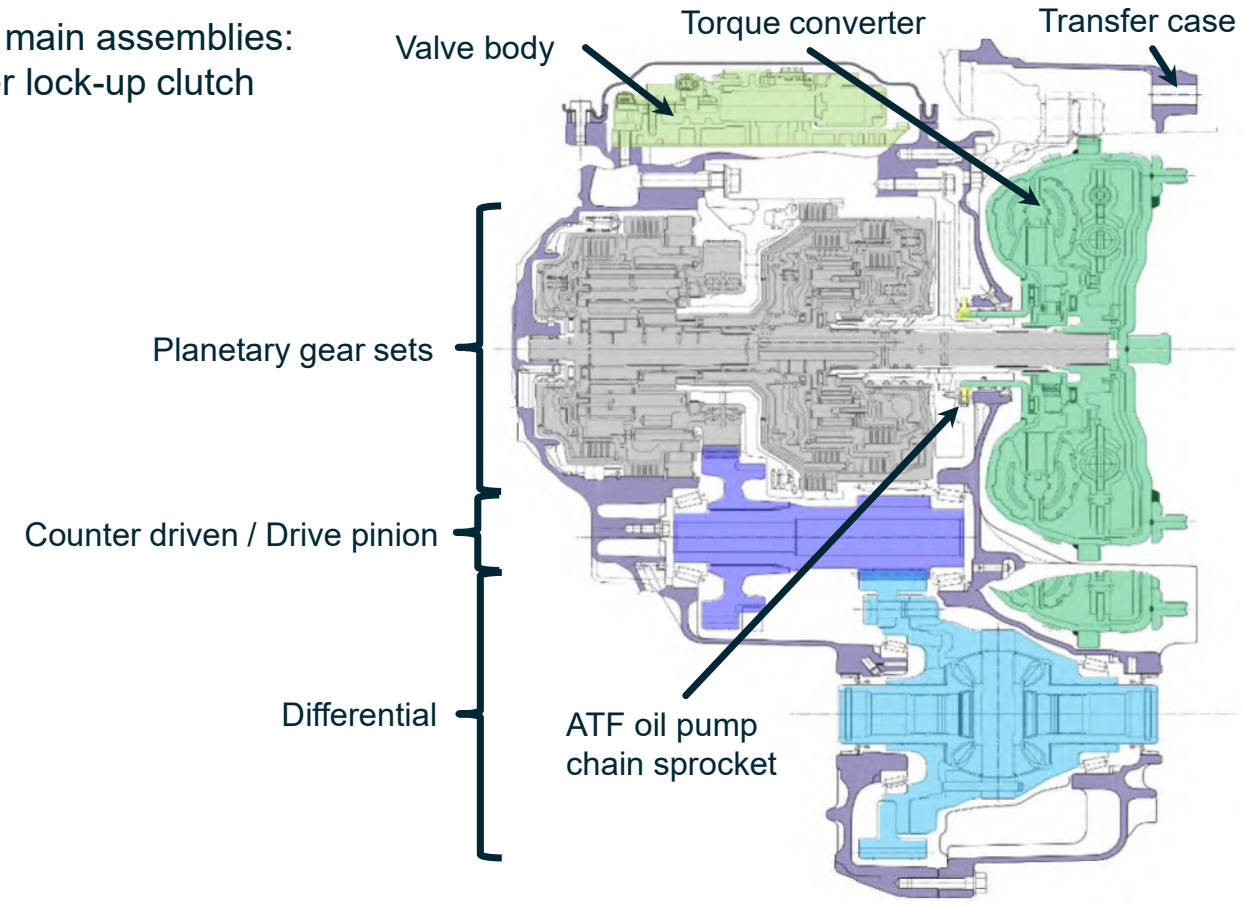
- Second generation has only one 28pins connector.



3. Gearbox construction

The transmission is divided into the following main assemblies:

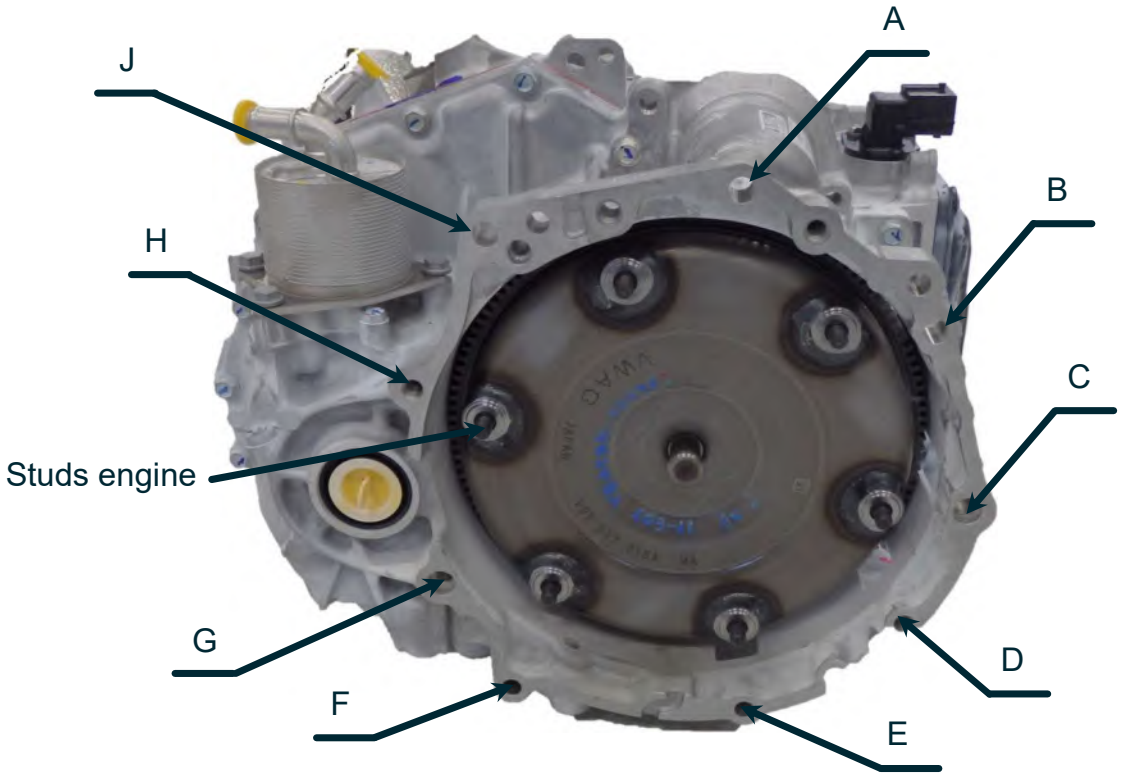
- The torque converter with torque converter lock-up clutch
- The ATF oil pump
- The planetary gear sets
- The valve body
- The transfer case



INTERNAL

3.1 Technical information

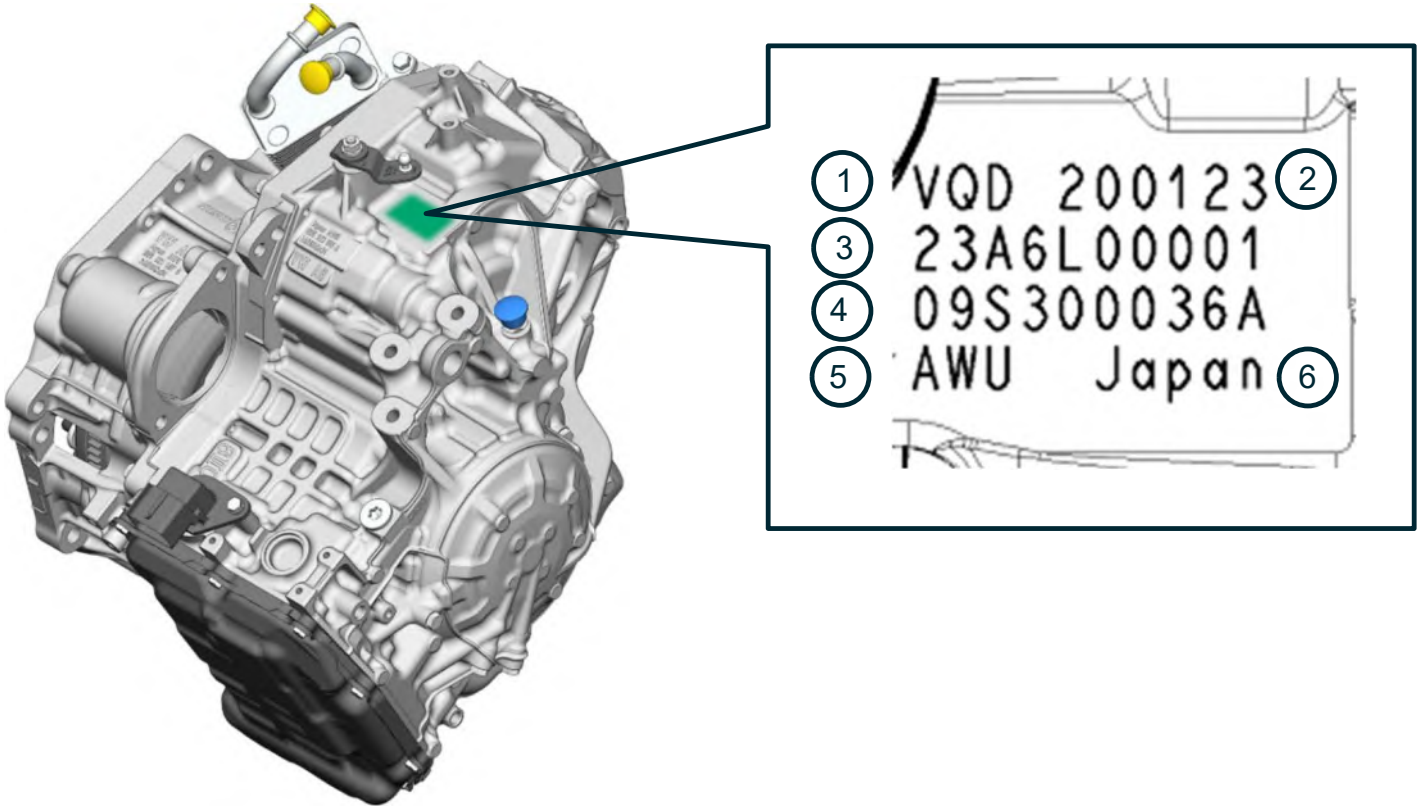
- The mounting sequence for screws A - J is arbitrary.
- Fixation points are exactly the same for both generations.



INTERNAL

3.2 Identification

- Gearbox marking lasered on the gearbox – see picture.

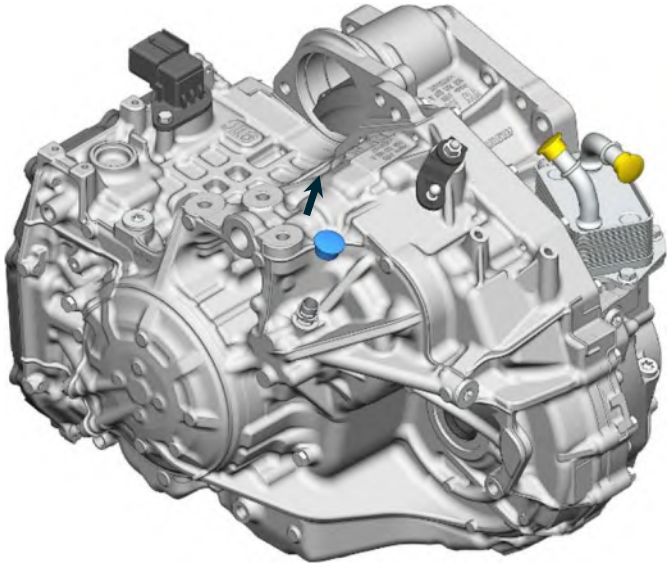


1 – Gearbox code letters
2 – Date identification
3 – Gearbox serial number
4 – Part number
5 – Manufacturer
6 – Country of origin

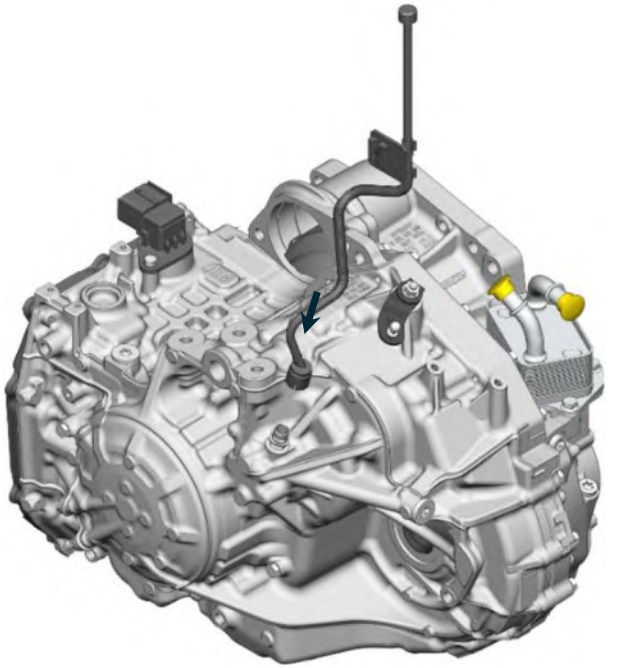
3.3 Breather

- Assembling of the breather.

1 Removing the protection cap.

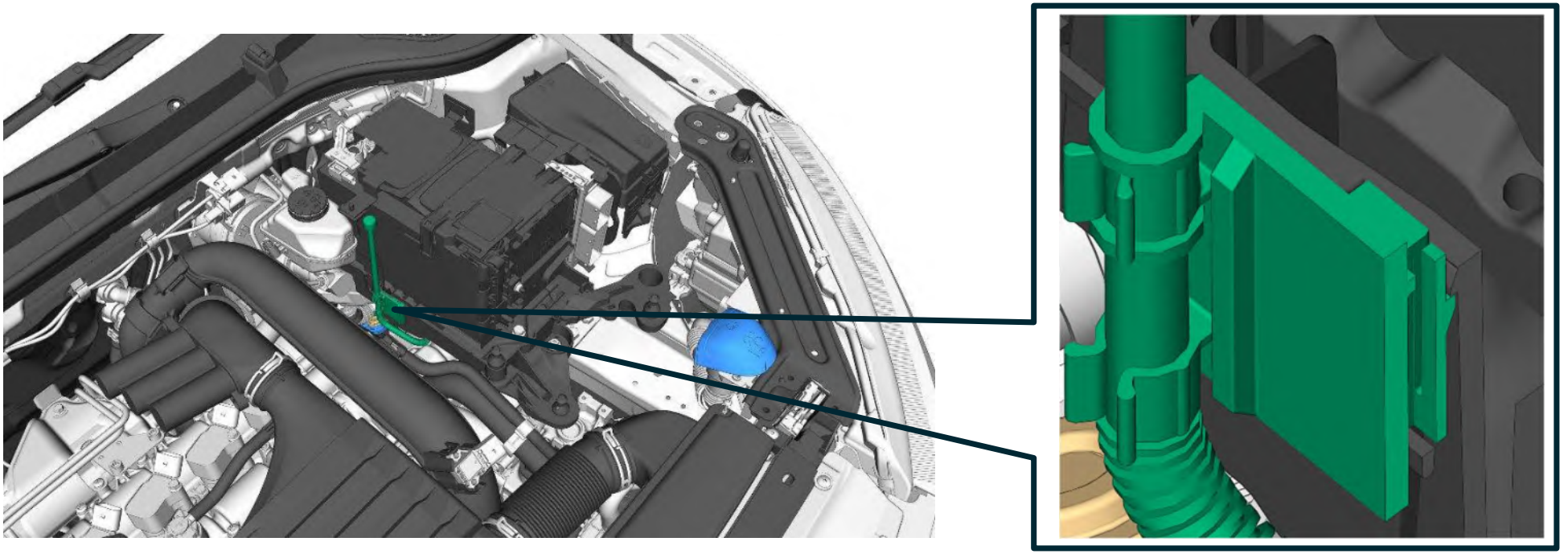


2 Implementing hose on gearbox.



INTERNAL

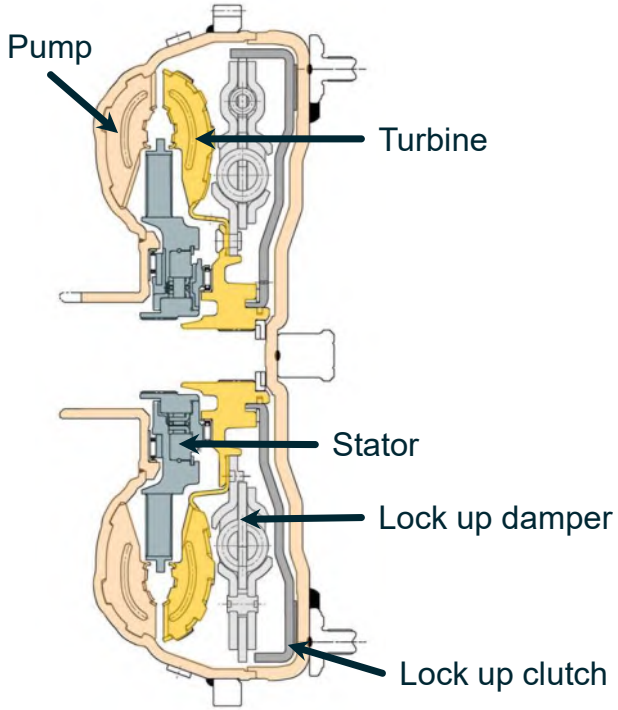
3 Assembling breather on the battery tray.



3.4 Torque converter

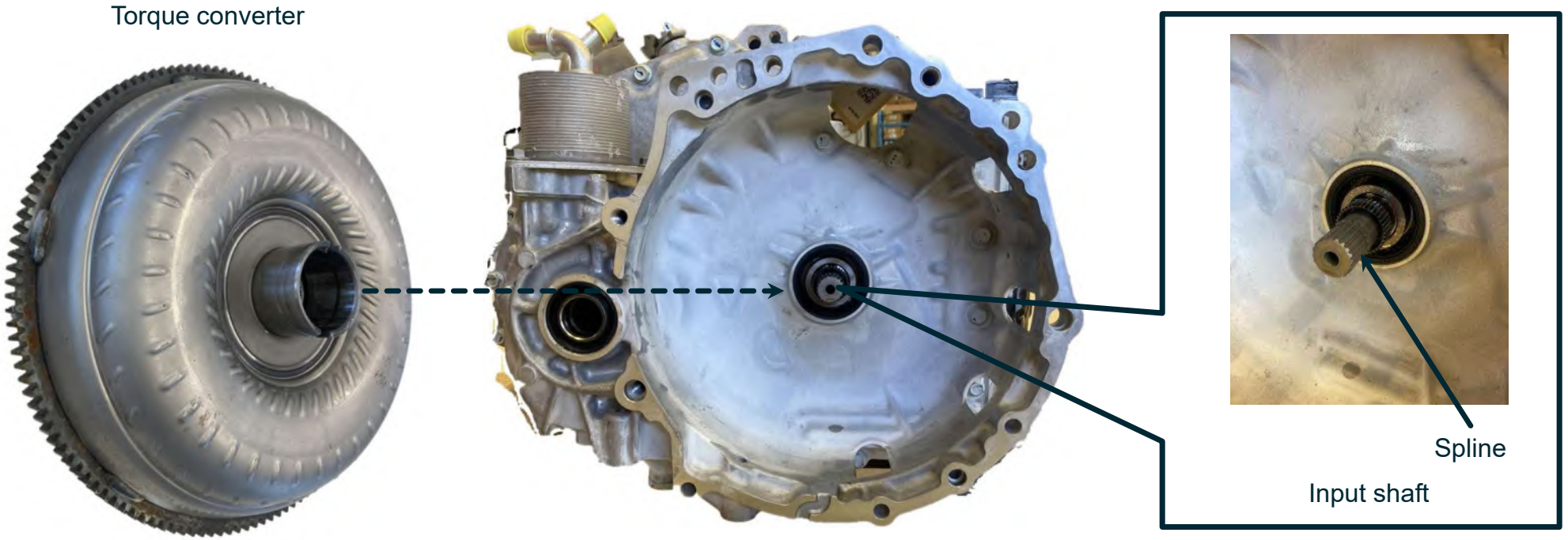
- The hydromechanical torque converter is a fluid coupling.
- The torque converter is connected to the engines through driving plate with six studs, which are permanently connected to the torque converter.
- Alongside the turbine wheel, pump wheel and stator, a torque converter lock up clutch and lock up damper are fitted in the torque converter.





INTERNAL

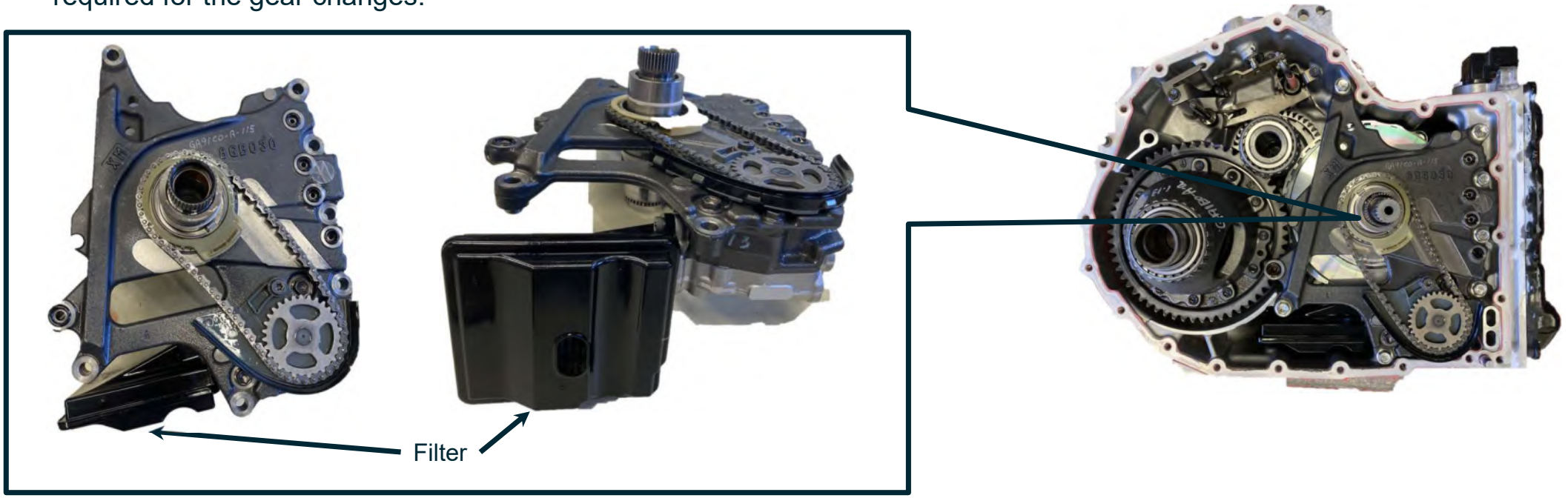
- The torque converter is installed on the input shaft, which is also the spline to hold the stator of torque converter.



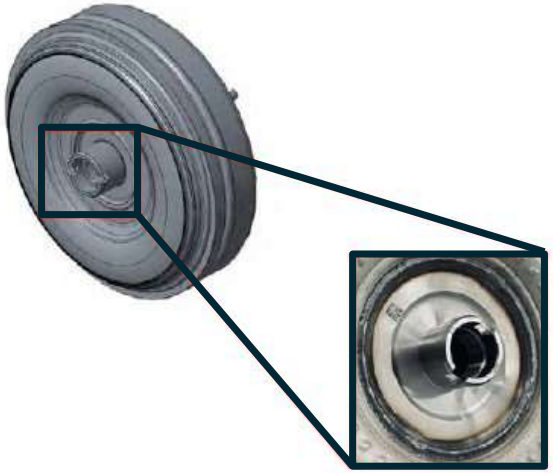
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GROUP

3.5 ATF oil pump module

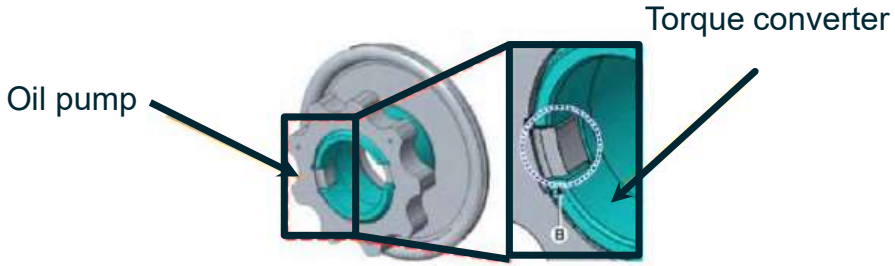
- ATF oil pump (Automatic Transmission Fluid) is responsible for the supply of hydraulic oil to the gearbox. It is driven directly by the engine via the hub at the housing of the torque converter.
- The ATF oil pump module includes ATF pump with gears and oil filter.
- It draws the ATF oil from the oil sump, builds up the oil pressure and supplies the valve body with the hydraulic fluid required for the gear changes.



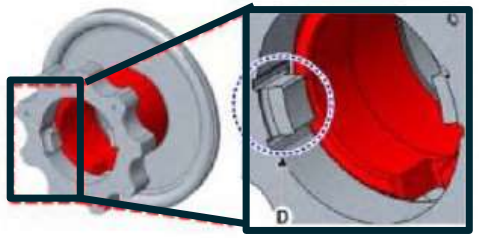
- When installing the transmission, always make sure that it’s in the line to the engine block. The torque converter is keyed to the oil pump. If the key is not in the right position, the transmission will not be flush against the engine block. Tightening the transmission bolts will push the torque converter into the oil pump and damaging it.



Torque converter key



Torque converter properly keyed to the Oil pump



Torque converter incorrectly keyed to the Oil pump

- **Examples of failure:**

Breaking oil pump drive gear

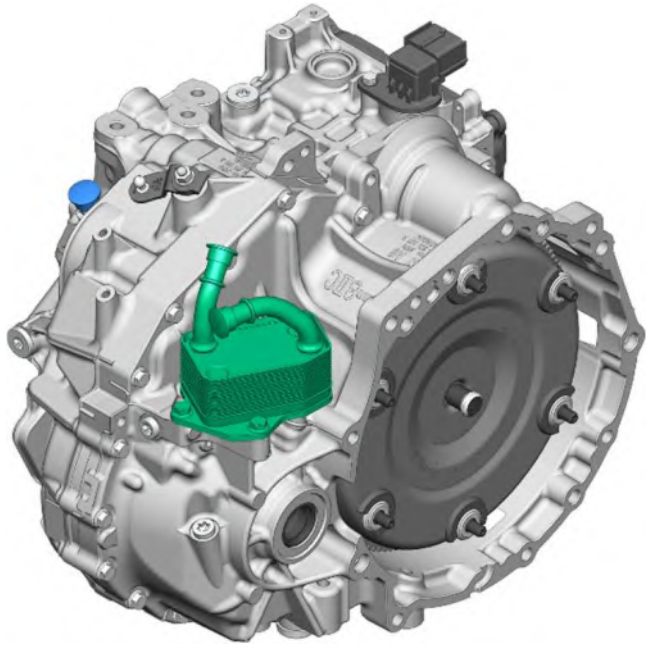


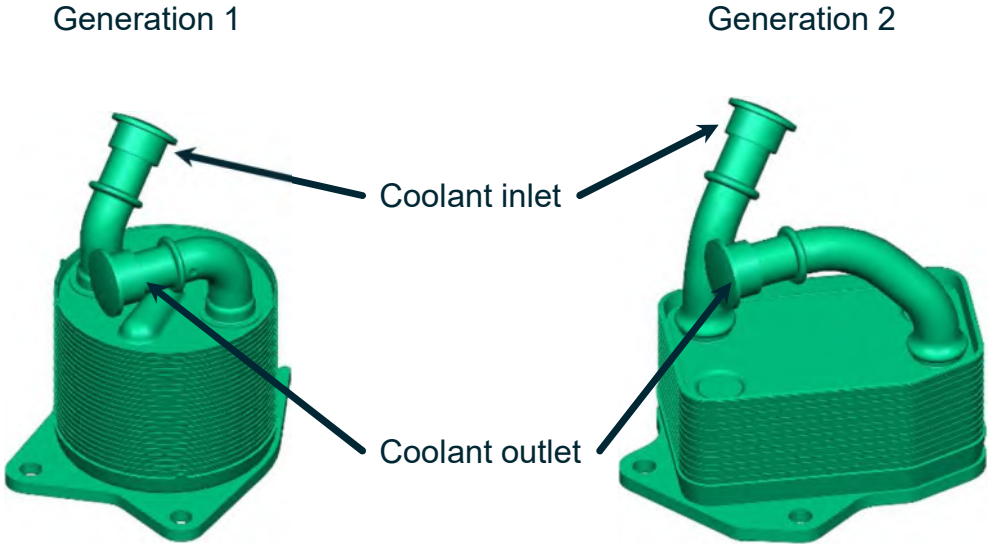
Oil pump drive gear teeth broken



3.6 ATF cooler

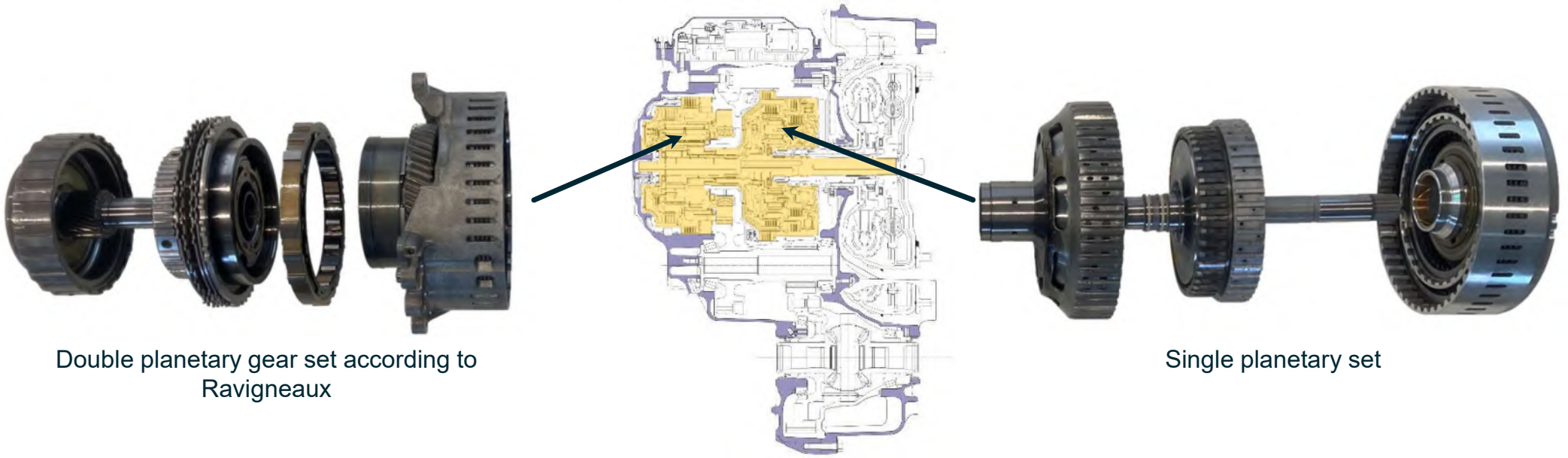
- An ATF cooler is an auxiliary transmission fluid cooler that helps to regulate the temperature of the transmission fluid in a vehicle. It is designed to prevent the transmission fluid from overheating, which can lead to transmission damage and failure.
- With generation 2 gearbox comes new design of ATF cooler. It has the same fixation points.
- The radiator is integrated in the engine coolant circuit.





3.7 Planetary set

- The gearbox AQ300 generation 2 has two planetary planetary sets arranged one behind the other. The first planetary gear set is a single planetary gearbox with double pinion planetary gears. This allows the drive torque to be increased again similar to a reduction step, before transmission to the second planetary gear set. The second planetary gear set is a double planetary gearbox based on the Ravigneaux principle.
- Due to this special design, it is possible to implement a maximum of 9 gears.



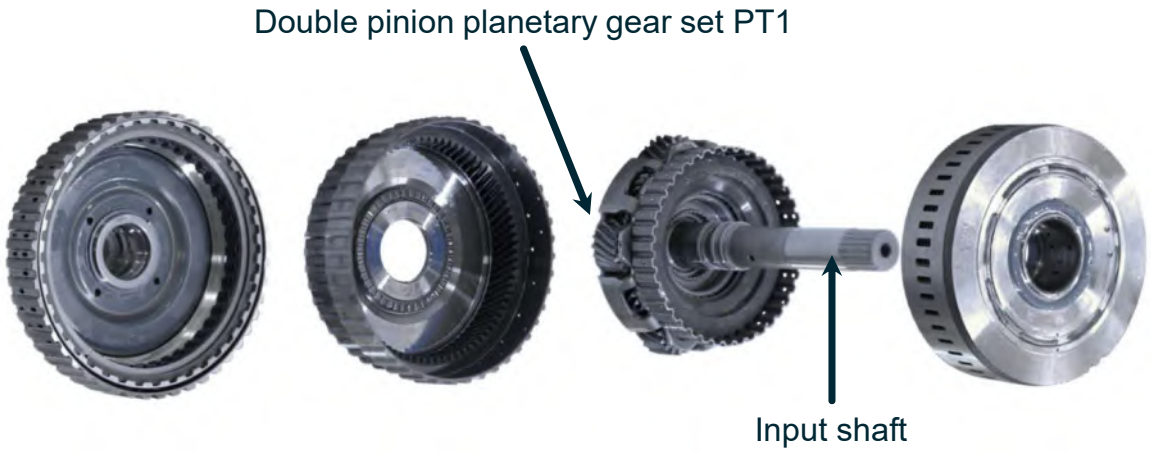
Double planetary gear set according to Ravigneaux

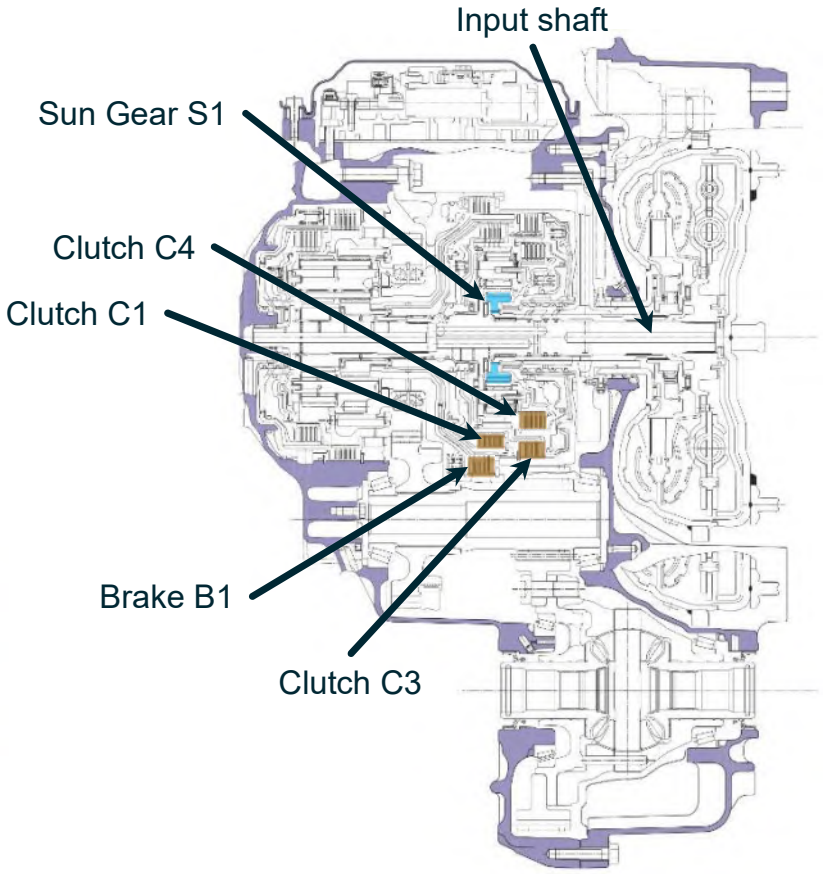
Single planetary set

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GROUP

The single planetary gear set

- Engine torque is transmitted from the torque converter to the transmission input shaft. From there it passes to the planetary gear carrier PT1. The sun gear S1 is permanently connected to the ATF oil pump. This means it cannot rotate freely. The double pinion planetary gear set PT1 transfers the torque to the annulus H1. The single planetary gear set is integrated into the transmission using the clutches C1, C3 and C4 as well as the brake B1.

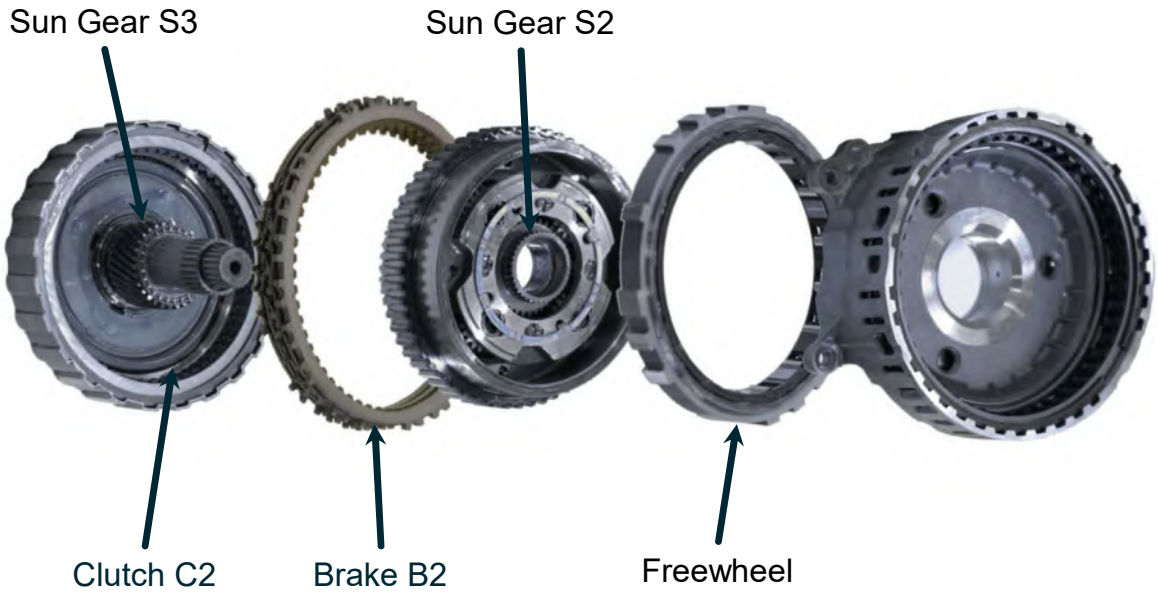


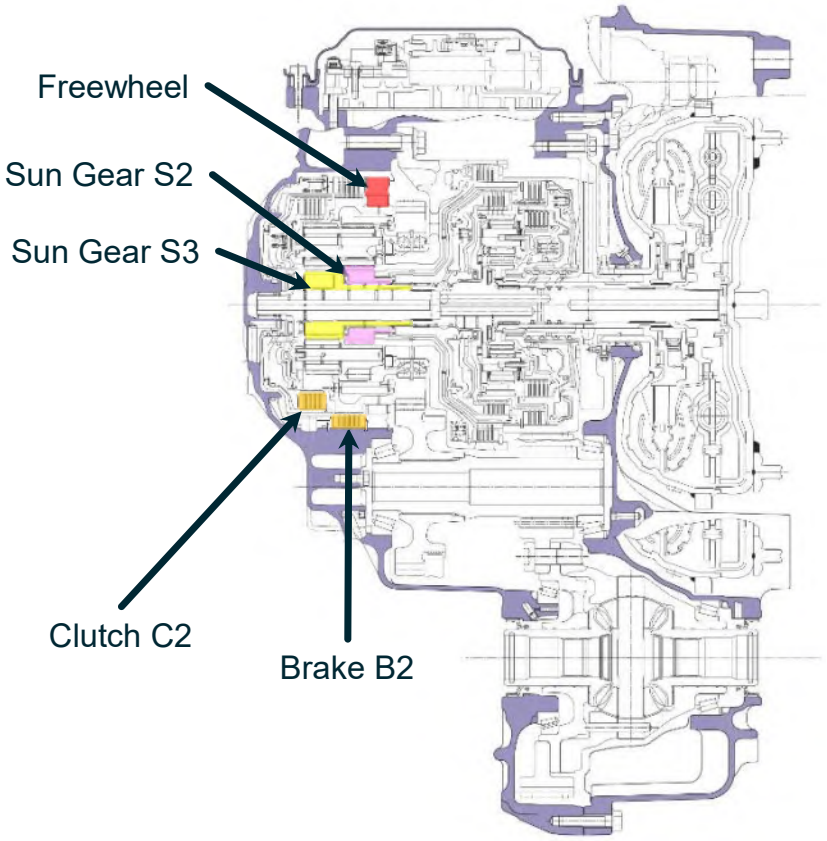


INTERNAL

The double planetary gear set (Ravigneaux)

- The clutches C1, C3, and C4 on the single planetary gearbox or the clutch C2 on the Ravigneaux planetary gearbox, transmit engine torque to this double planetary gearbox. The two sun gears, S2 and S3, can rotate at different speeds.





INTERNAL

3.8 Clutches

- The electrical solenoid valves inside the valve body open or close the clutches.



Multi-disc Clutch C1



Multi-disc Clutch C2



Multi-disc Clutch
C3 (top) and C4 (bottom)

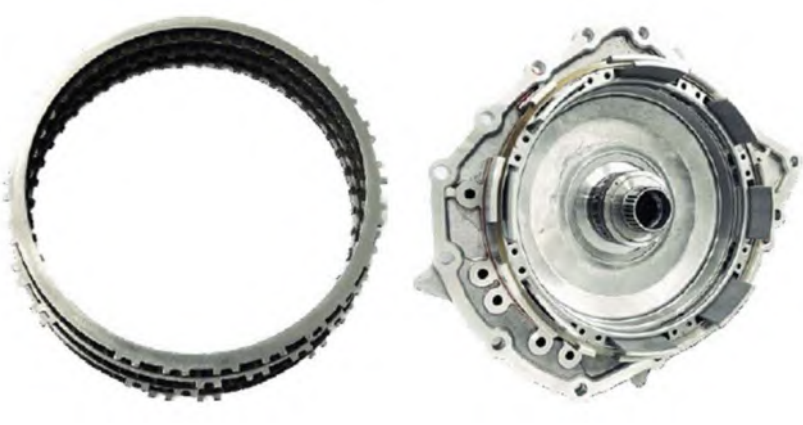
INTERNAL

3.9 Brakes

- Gearbox has the multi-disc Brake B1 and B2.
- Brake B1 is controlled using the automatic gearbox pressure regulating valve 2 (N216).
- When the solenoid valve 1 (N88) is energised, the hydraulic oil pressure compresses the disc of the brake.



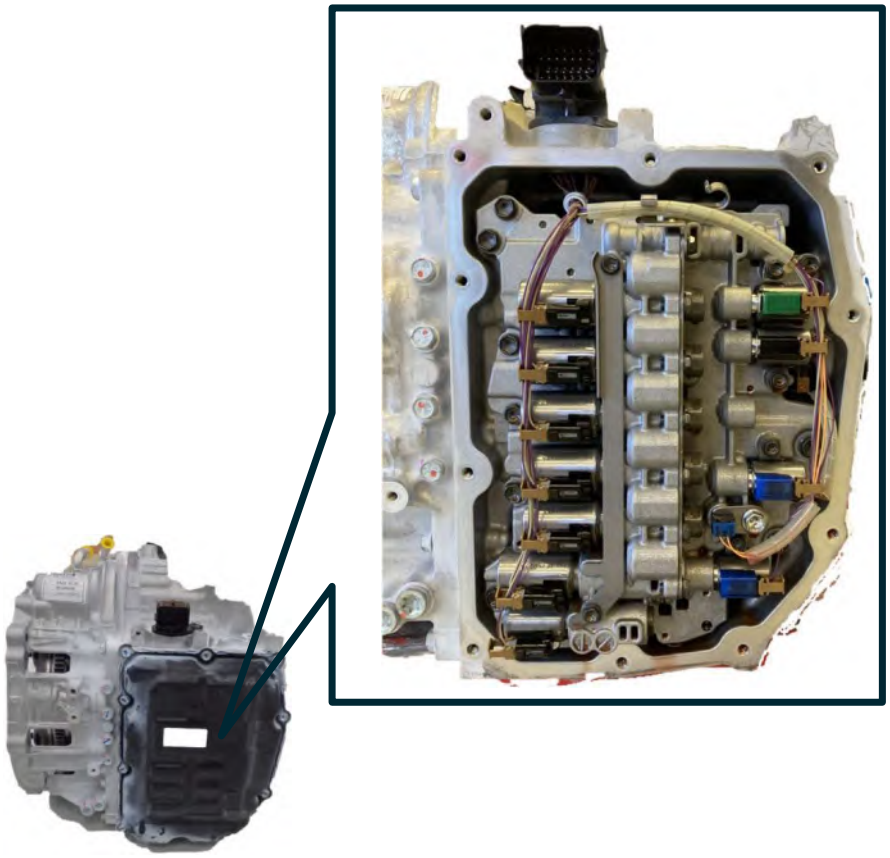
Multi-disc Brake B2 mounted on Center Support



Multi-disc Brake B1 mounted on Rear Cover

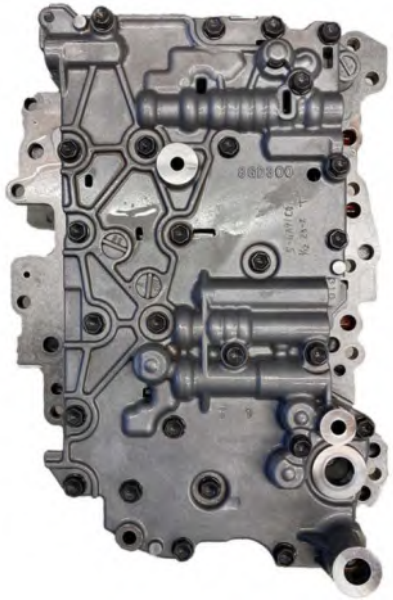
3.10 Valve body

- The valve body is screwed into the gearbox under the oil pan.





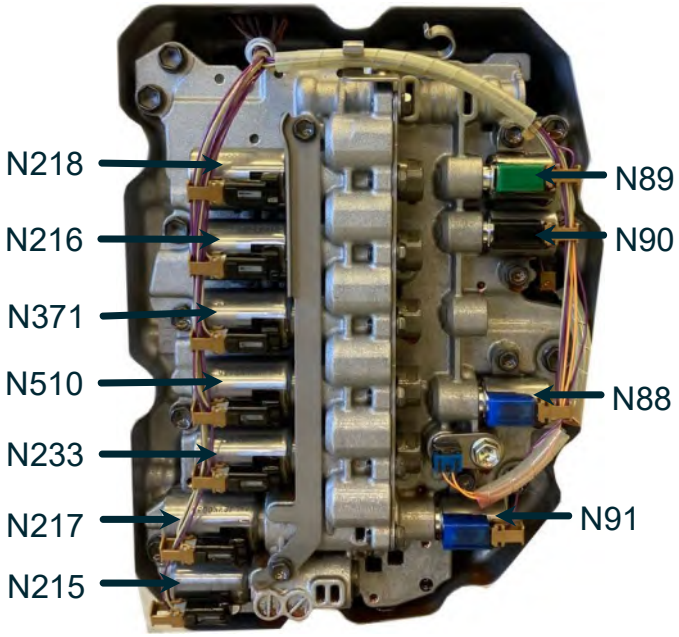
Front side



Back side

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- Description of the each valve.

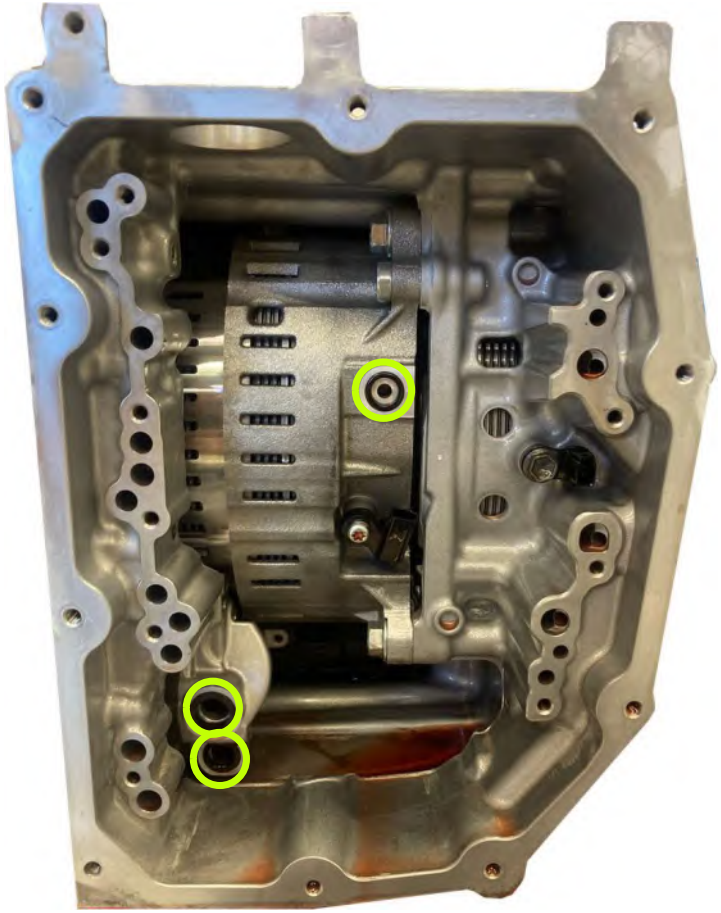


Solenoid	Connector color	Wire color
Pressure regulating valve 4 for automatic gearbox N218	Light gray	Purple, Yellow
Pressure regulating valve 2 for automatic gearbox N216	Light gray	Purple, Yellow
Pressure regulating valve 6 for automatic gearbox N371	Light gray	Purple, Yellow
Pressure regulating valve 8 for automatic gearbox N510	Light gray	Purple, Yellow
Pressure regulating valve 5 for automatic gearbox N233	Light gray	Purple, Yellow
Pressure regulating valve 3 for automatic gearbox N217	Light gray	Purple, Yellow
Pressure regulating valve 1 for automatic gearbox N215	Light gray	Purple, Yellow
Solenoid valve 2 N89	Black	Purple
Solenoid valve 3 N90	Black	Yellow
Solenoid valve 1 N88	Black	Yellow
Solenoid valve 4 N91	Black	Purple

INTERNAL

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- When removing the valve body, pay attention to the O-rings between the valve body and the case (green circled areas below).

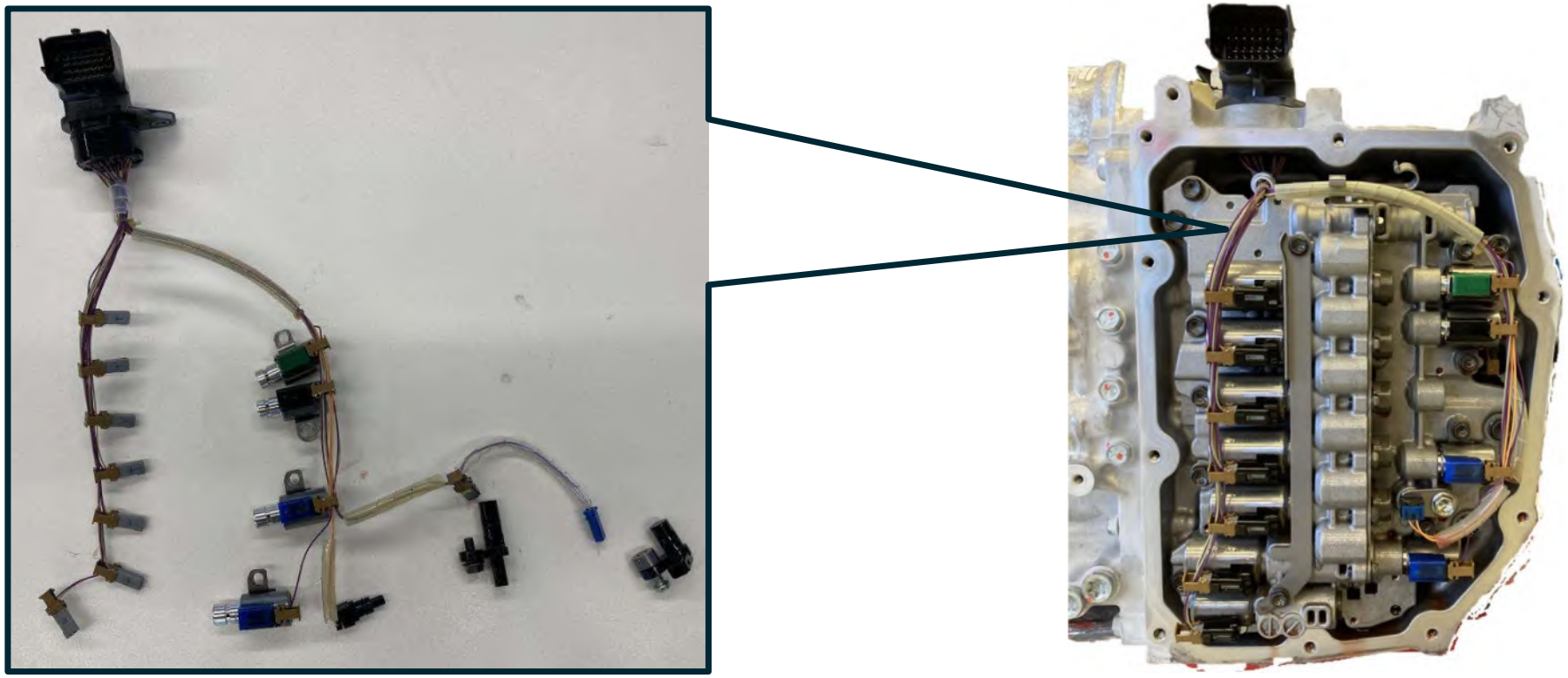


INTERNAL

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3.11 Gearbox harness

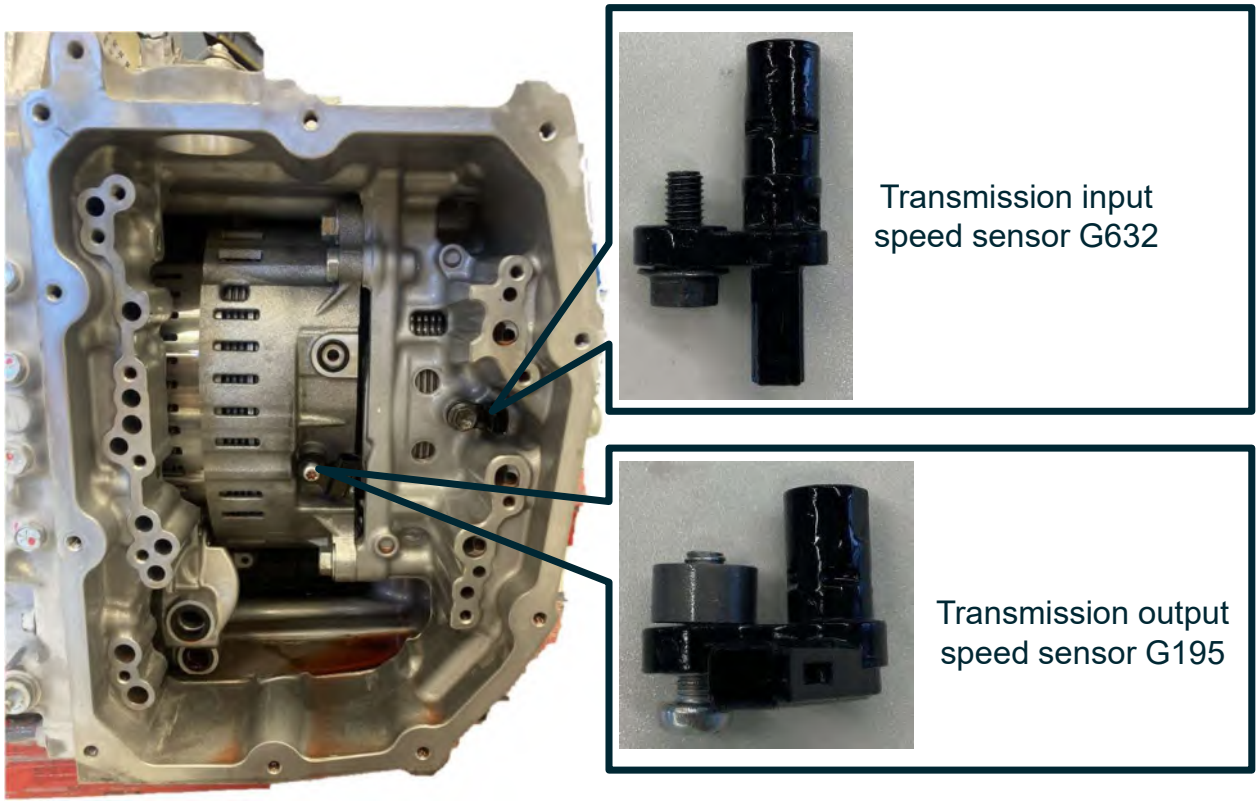
- Harness connects main connector with all gearbox electrical components.
- It’s situated under the oil pan and fixed on the valve body.



INTERNAL

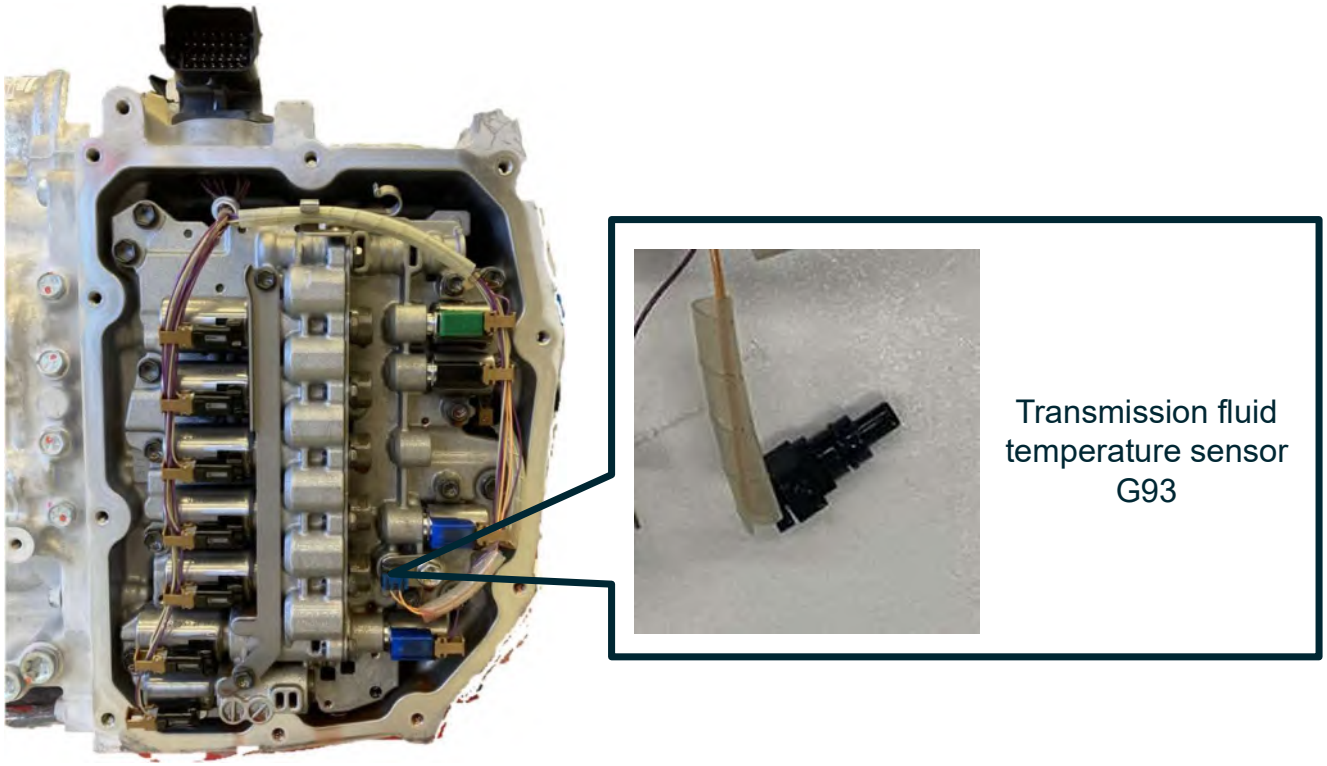
3.12 Sensors

- Gearbox has three sensors – two speed sensors (input and output) and one oil temperature sensor.
- Speed sensors are situated under the valve body.



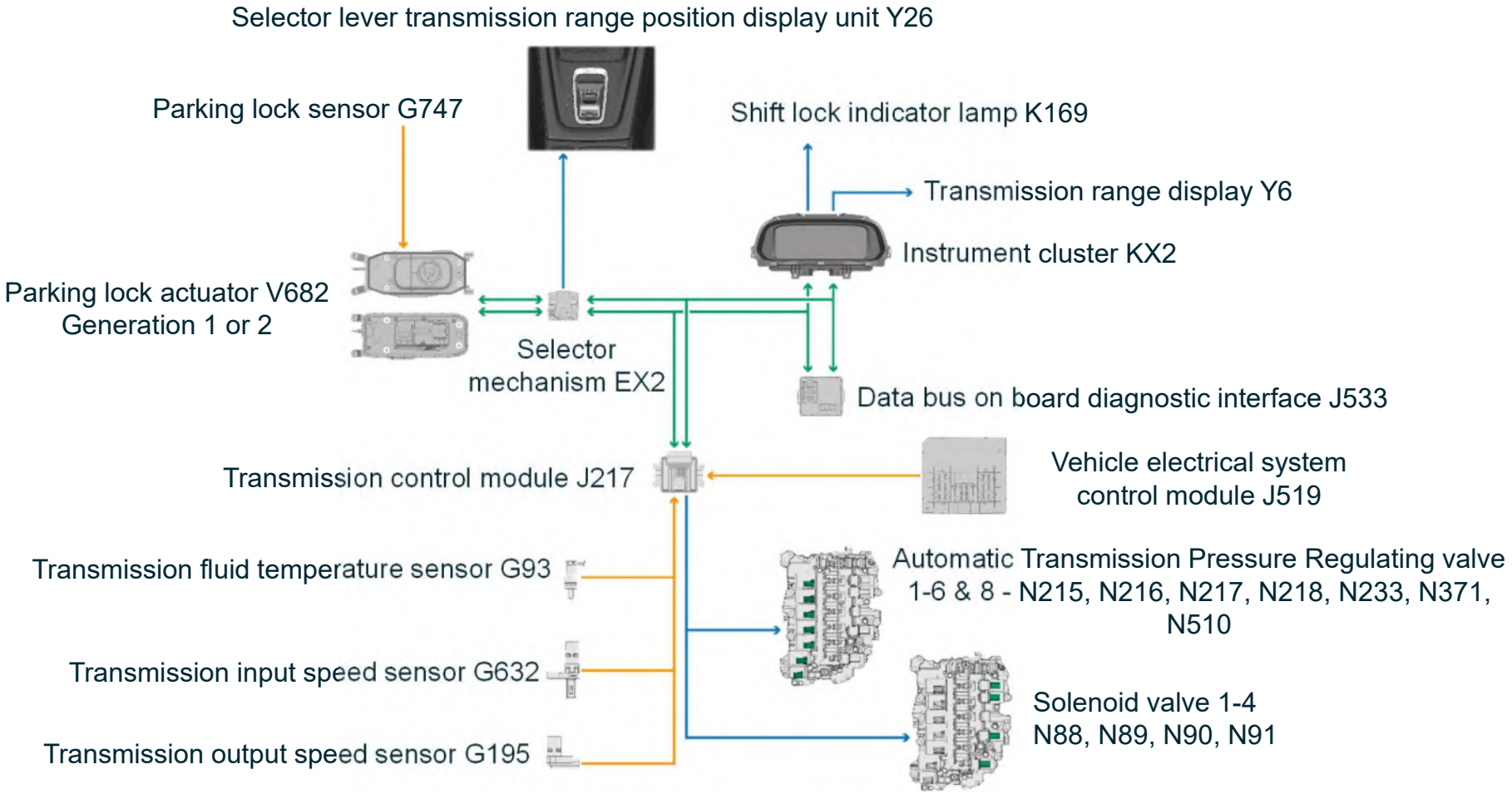
INTERNAL

- Oil temperature sensor is on the valve body and is secured with the clamp.

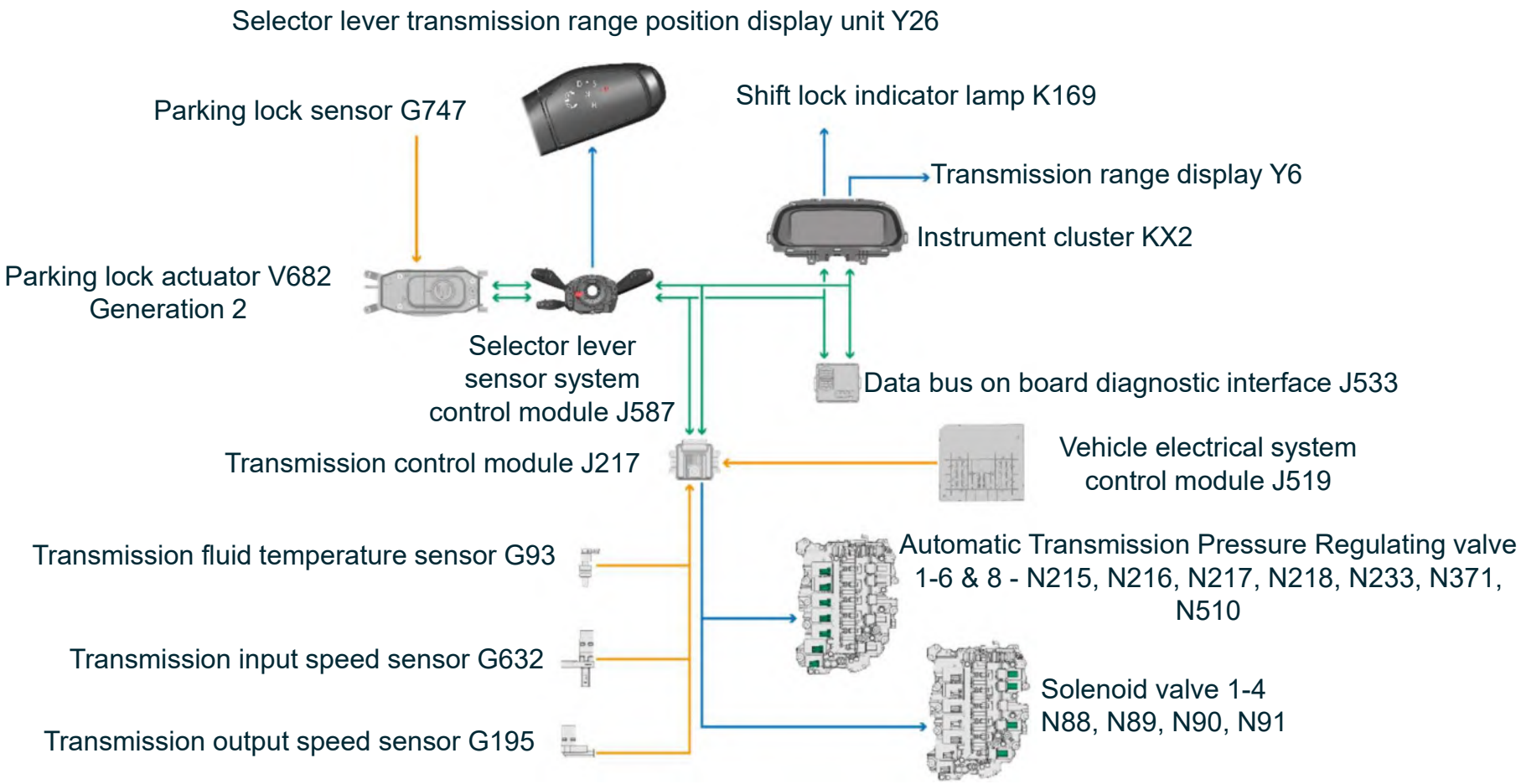


4. Gearbox management

4.1 System overview



INTERNAL

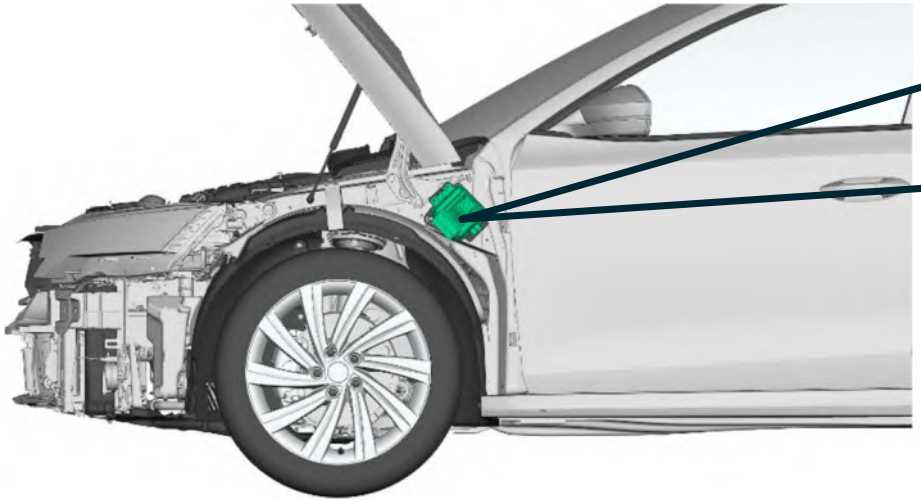

Selector lever transmission range position display unit Y26
Parking lock sensor G747
Shift lock indicator lamp K169
Transmission range display Y6
Instrument cluster KX2
Parking lock actuator V682
Generation 2
Selector lever
sensor system
control module J587
Data bus on board diagnostic interface J533
Transmission control module J217
Vehicle electrical system
control module J519
Transmission fluid temperature sensor G93
Automatic Transmission Pressure Regulating valve
1-6 & 8 - N215, N216, N217, N218, N233, N371,
N510
Transmission input speed sensor G632
Solenoid valve 1-4
N88, N89, N90, N91
Transmission output speed sensor G195

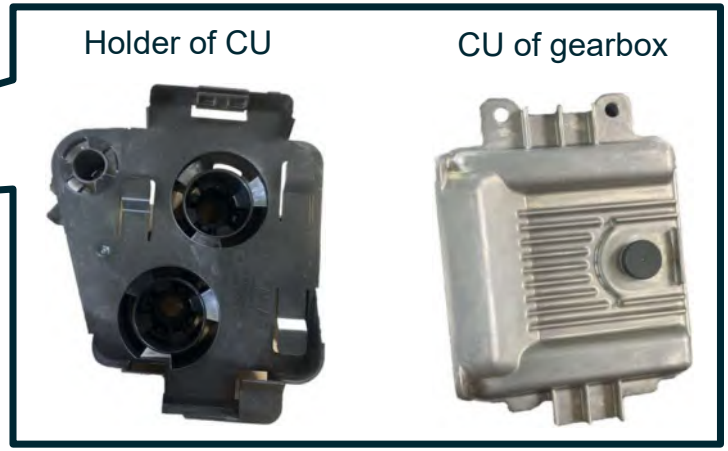
INTERNAL

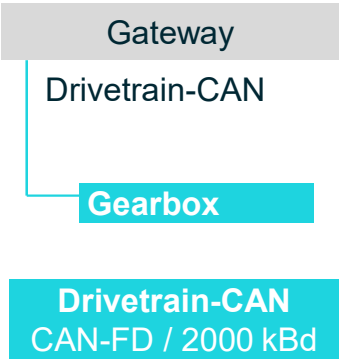
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4.2 The Transmission Control Module J217

- The control unit for gearbox is placed in front left area under the fender.
- CU is connected to getaway through CAN bus FD.
- Controls of solenoid valves in gearbox goes directly from CU.
- Information from the gearbox sensors is transmitted directly to CU.







4.3 Application chart

● = applied

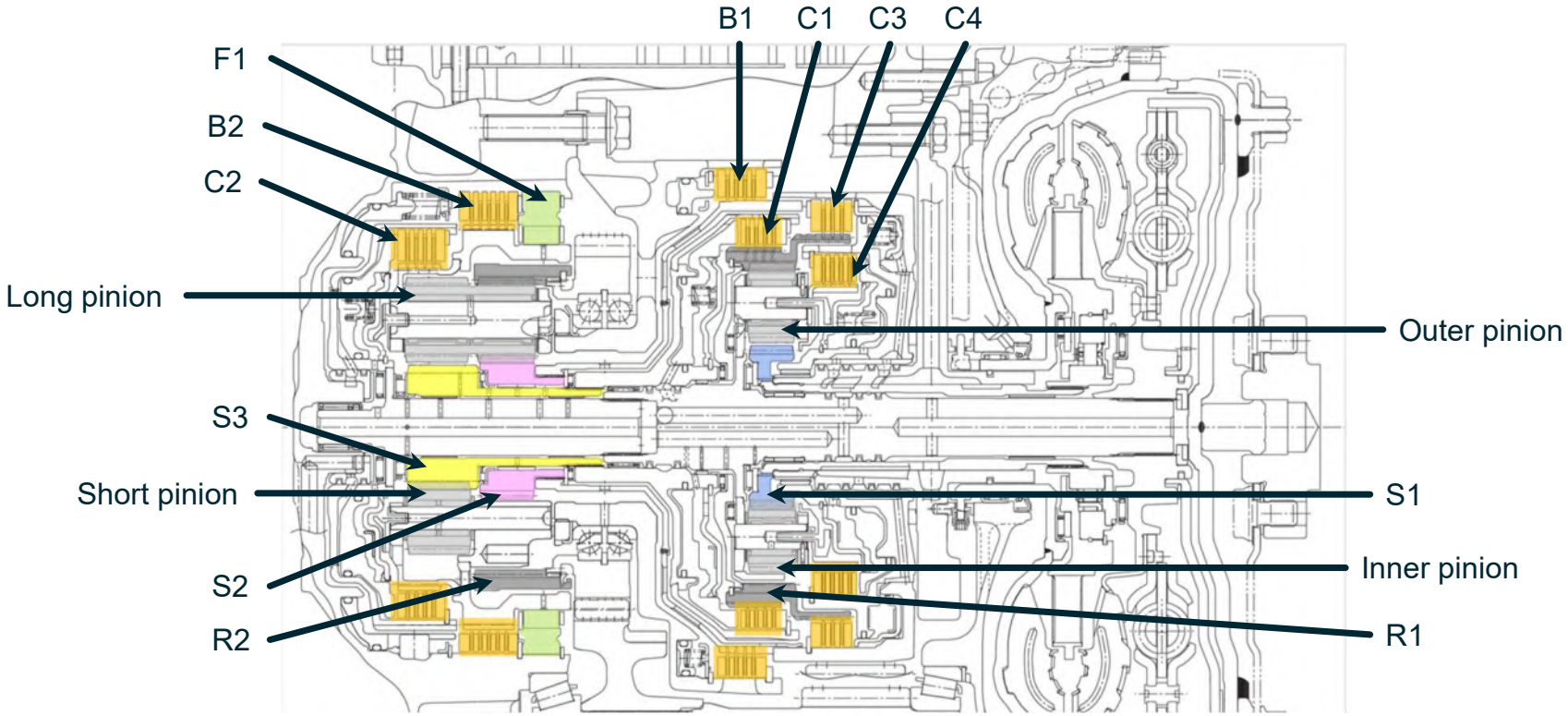
Solenoid								
	N217	N218	N233	N371	N216	N88	N89	N90	N91
1st	●					●			●
2nd	●				●	●	●		
3rd	●		●			●	●		
4th	●			●		●	●		
5th	●	●					●		
6th		●		●			●		
7th		●	●				●		
8th		●			●		●		
Rev.		●	●				●	●	●

Clutch/Brake							
	Clutch 1	Clutch 2	Clutch 3	Clutch 4	Brake 1	Brake2	Freewheel 1
1st	●						●
2nd	●				●		
3rd	●		●				
4th	●			●			
5th	●	●					
6th		●		●			
7th		●	●				
8th		●			●		
Rev.			●			●	

INTERNAL

4.4 Power flow

- The torque curves of the individual gears are shown in the following simplified sectional view of the gearbox.
- The illustration of the valve body shows which solenoid valves are actuated for each gear.



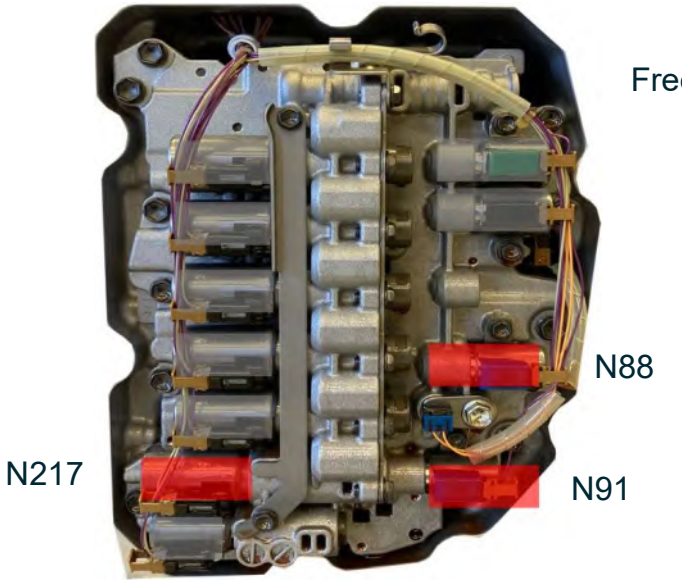
Legend
C1, C2, C3, C4: Clutch
B1, B2: Brake
F1: Freewheel
S1, S2, S3: Sun gear
R1, R2: Ring gear

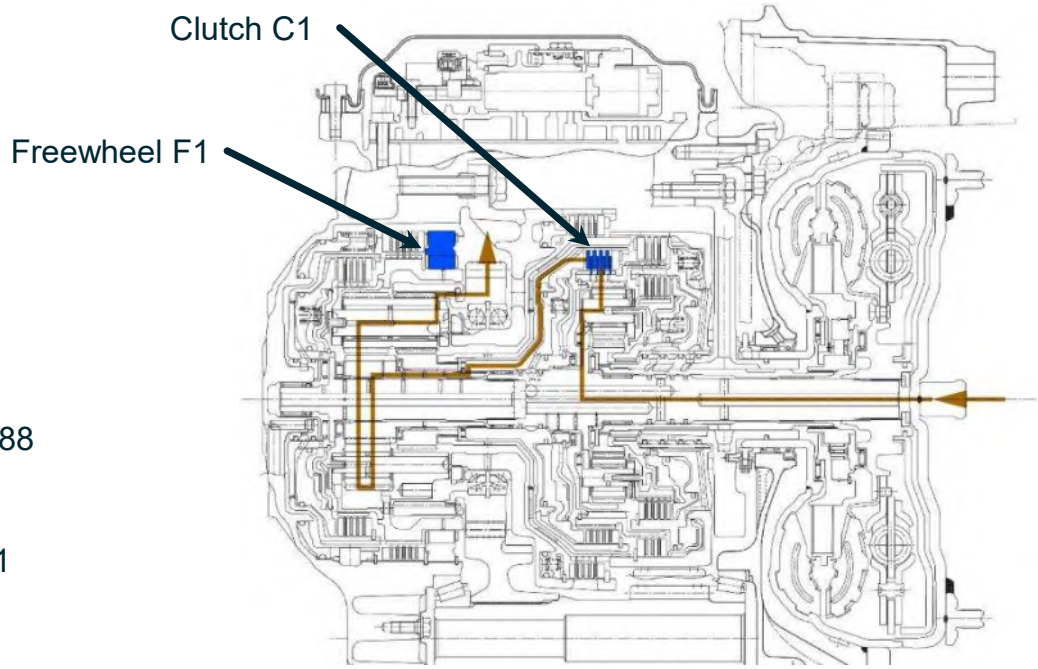
INTERNAL

VOLKSWAGEN
GROUP

1st gear

- The transmission input shaft transmits the engine torque to the planetary gear carrier PT1 of the single planetary gear set. The planetary gears P1 roll around supported on the fixed sun gear S1 and drive the annulus H1. Clutch C1 connects the annulus H1 to the sun gear S3, transferring the torque to the double planetary gear set. The freewheel locks the planetary gear carrier PT2. From the sun gear S3, the torque is transferred to the planetary gears P3. Supported by the planetary gear carrier PT2, the torque is transferred to the annulus H2. Annulus H2 is connected to the transmission output shaft.

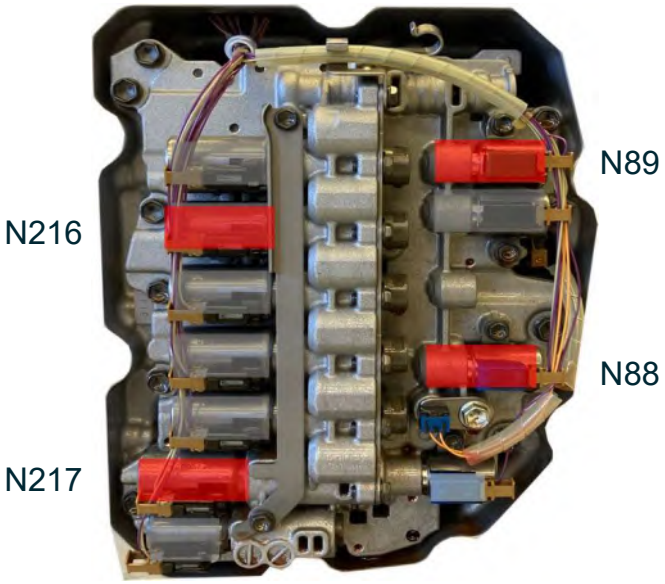


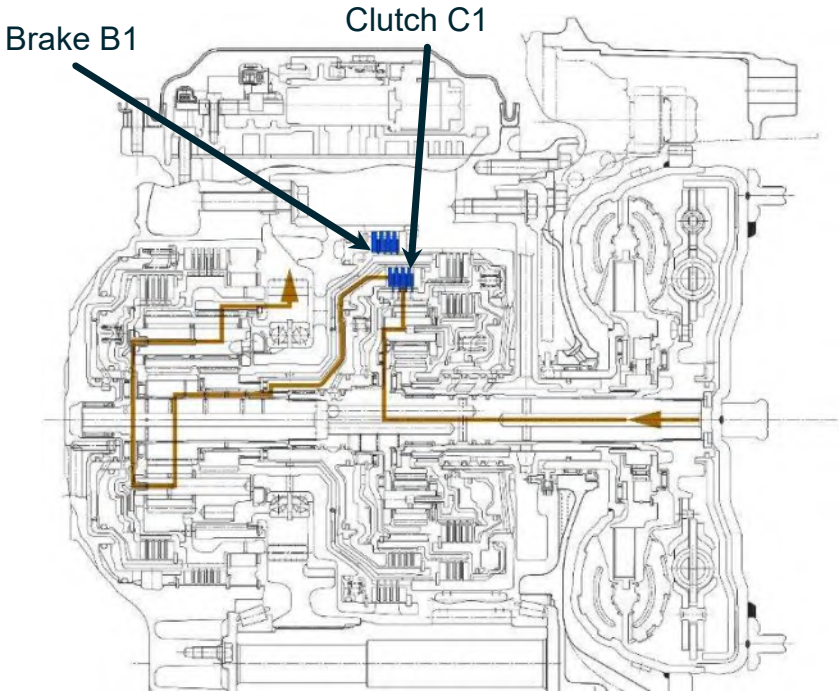


INTERNAL

2nd gear

- As with first gear, engine torque is introduced into the double planetary gear set via the annulus H1 of the single planetary gear set. Clutch C1 connects annulus H1 to sun gear S3 for this purpose. Brake B1 locks sun gear S2. From sun gear S3, the torque is transferred to planetary gears P3. Planetary gears P2 roll around sun gear S2 and, together with planetary gears P3, drive annulus H2.



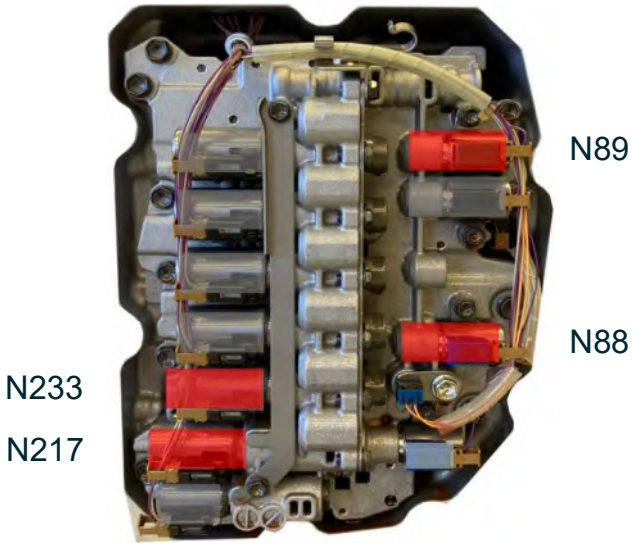


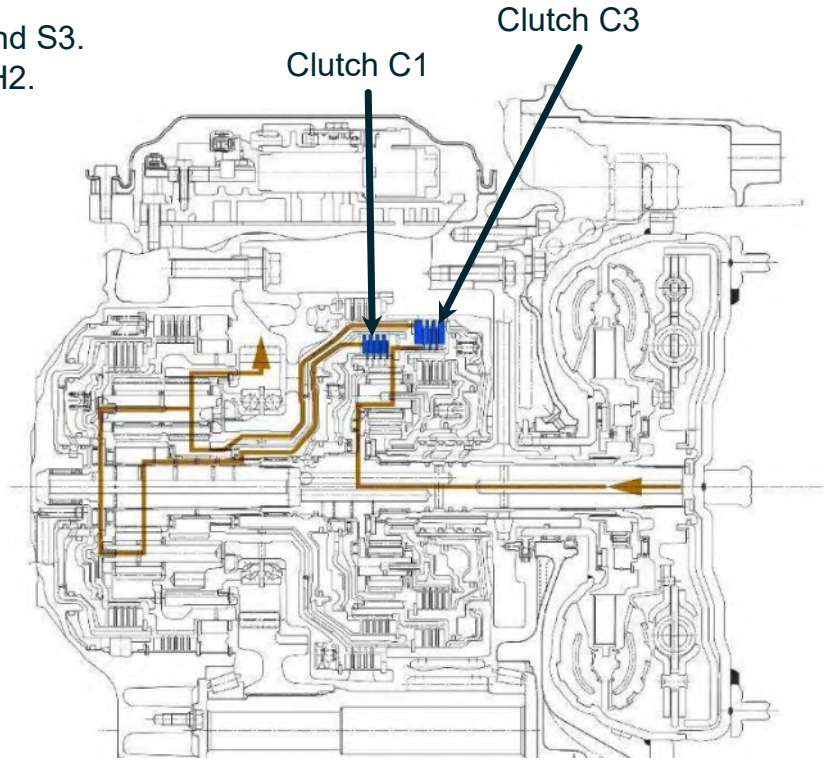
INTERNAL

VOLKSWAGEN
GROUP

3rd gear

- As before, clutch C1 connects annulus H1 to sun gear S3.
- Clutch C3 additionally connects annulus H1 to the large sun gear S2.
- Planetary gears P2 and P3 are locked by C1 and C3.
- Planetary gear carrier PT2 now rotates together with sun gears S2 and S3.
- Torque is transmitted through planetary gear carrier PT2 to annulus H2.

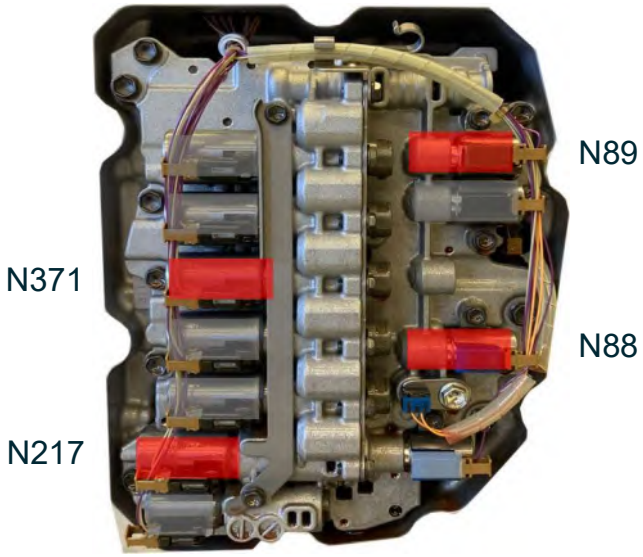


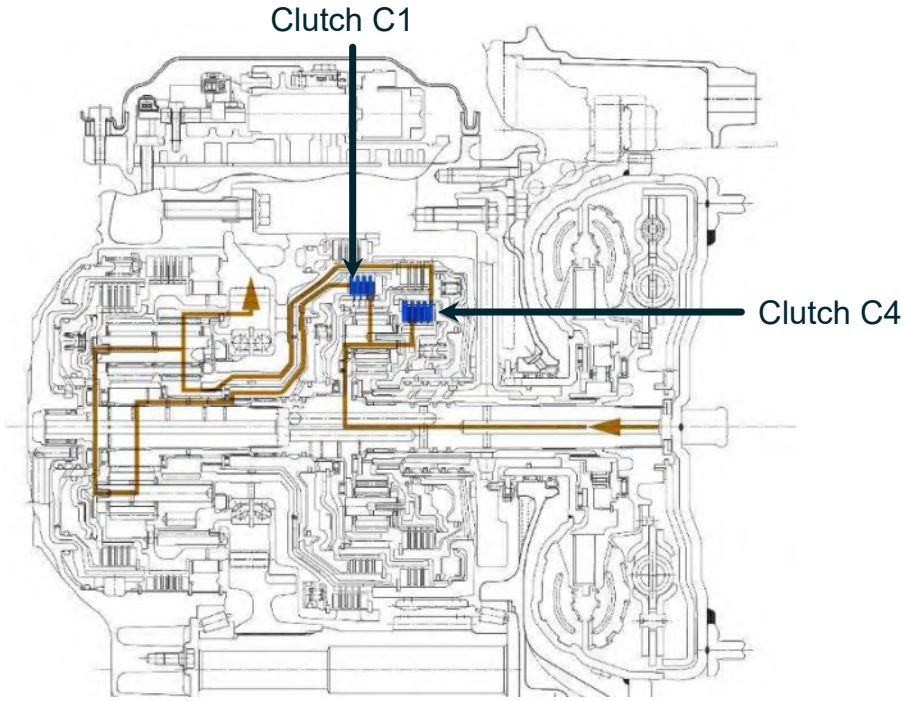


INTERNAL

4th gear

- Once again, clutch C1 connects annulus H1 to sun gear S3 and transmits torque to the double planetary gear set.
- Clutch C4 connects planetary gear carrier PT1 to sun gear S2 and also transmits torque to the double planetary gear set, although with different input speeds.
- Sun gear S3 is driven more slowly than sun gear S2. Planetary gears P2 and P3 roll around the faster-rotating sun gear S2 and drive annulus H2.

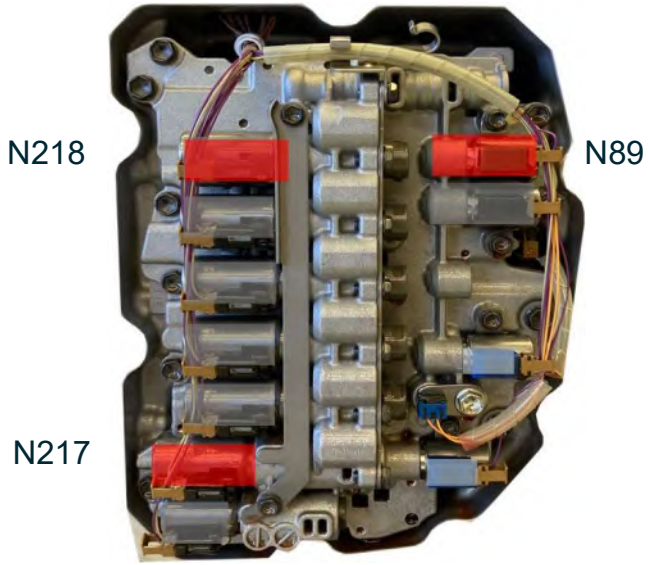


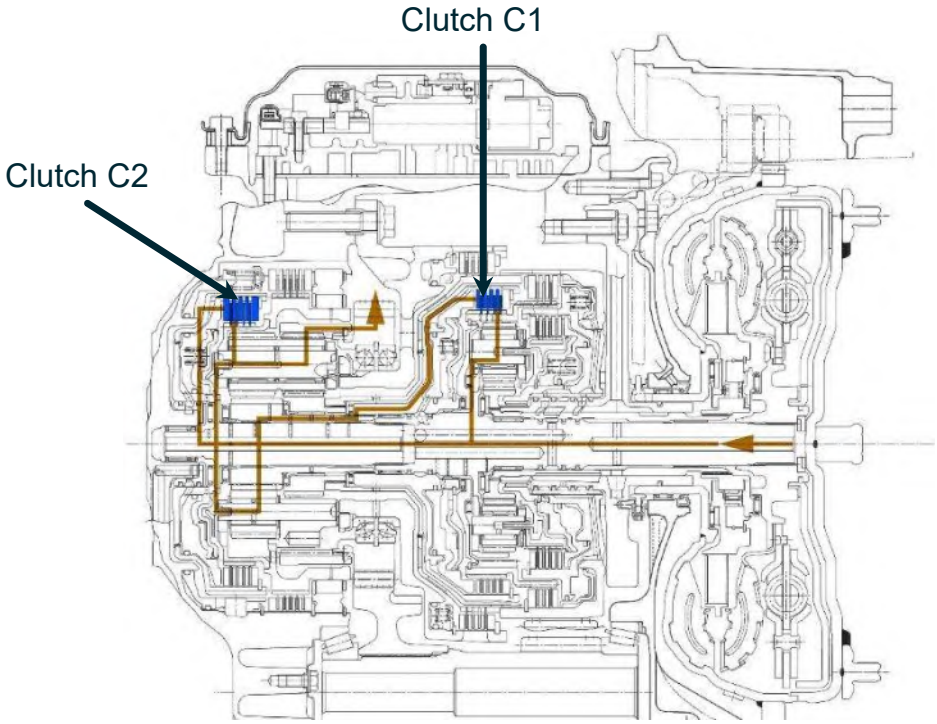


INTERNAL

5th gear

- Clutch C1 connects annulus H1 to sun gear S3 and transmits torque to the double planetary gear set. Clutch C2 connects the turbine shaft to planetary gear carrier PT2 and also transmits torque to the double planetary gear set.
- Together with planetary gear carrier PT2, planetary gears P2 and P3 drive annulus H2.

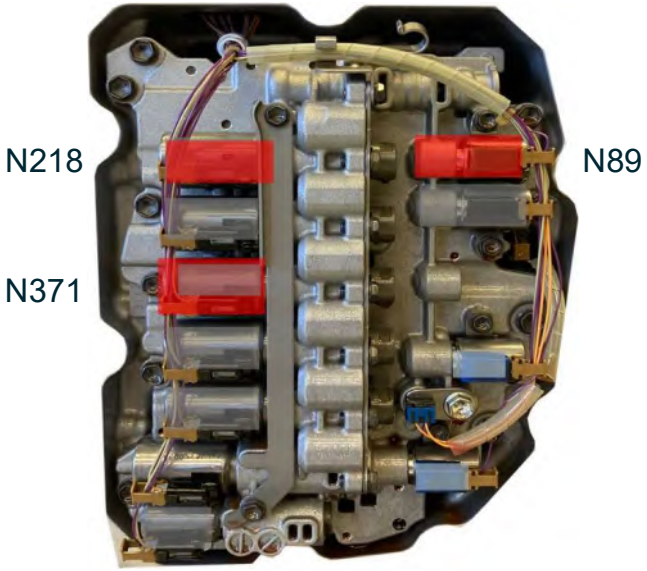


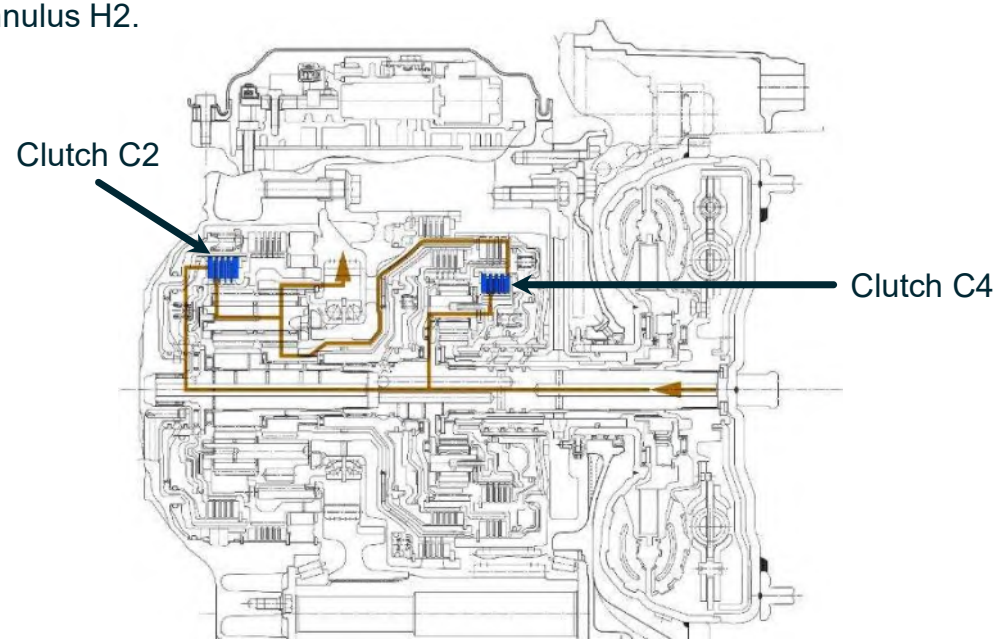


INTERNAL

6th gear

- The turbine shaft drives planetary gear carrier PT1 of the single planetary gear set and the outer disc carrier of clutch C2. Clutch C4 connects planetary gear carrier PT1 to sun gear S2, transmitting torque to the double planetary gear set.
- Clutch C2 connects the turbine shaft to planetary gear carrier PT2 and also transmits torque to the double planetary gear set.
- Sun gear S2 transmits torque to planetary gears P2. Torque is then transmitted to planetary gears P3 via planetary gear carrier PT2. Together with planetary gears P2, planetary gears P3 drive annulus H2.

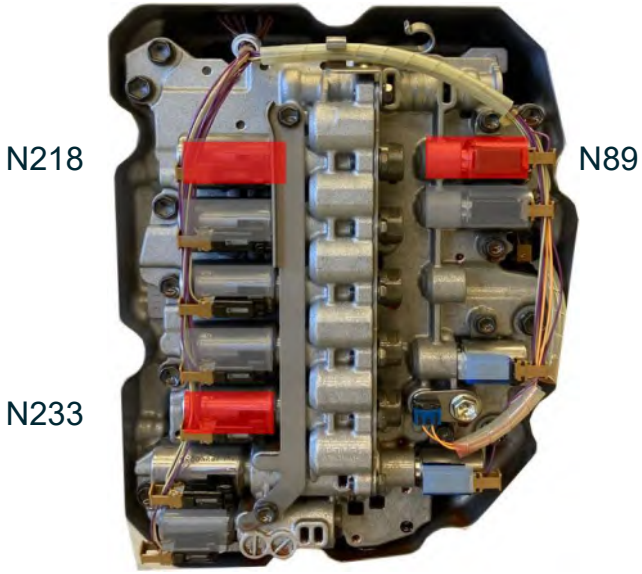


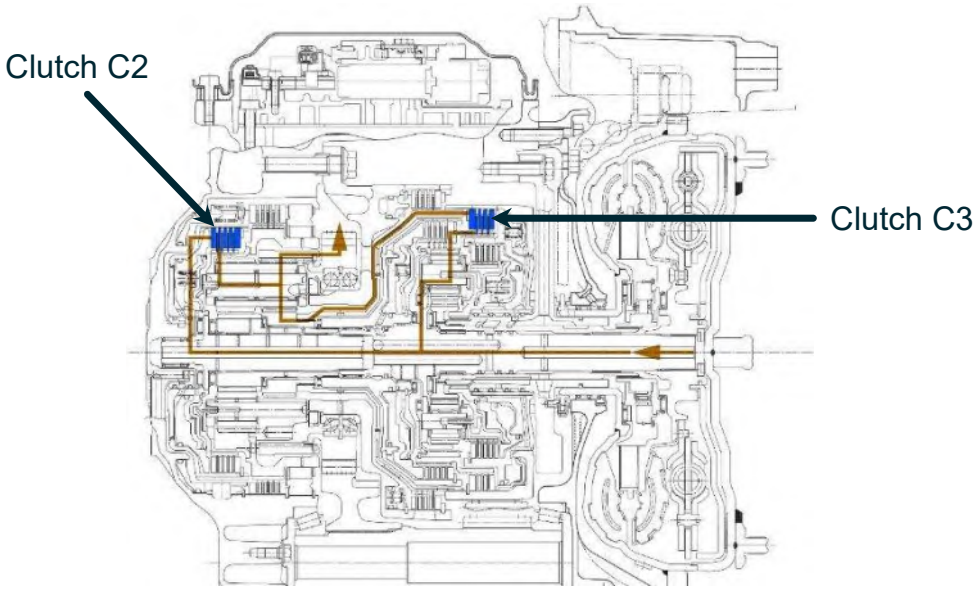


INTERNAL

7th gear

- The turbine shaft drives planetary gear carrier PT1 of the single planetary gear set and the outer disc carrier of clutch C2. Planetary gear carrier PT1 drives planetary gears P1, which roll around the fixed sun gear S1 and drive annulus H1.
- Clutch C3 connects annulus H1 to sun gear S2, transmitting torque to the double planetary gear set.
- Clutch C2 connects the turbine shaft to planetary gear carrier PT2, also transmitting torque to the double planetary gear set. Planetary gears P2, which are jointly driven by sun gear S2 and planetary gear carrier PT2, drive annulus H2 together with the permanently connected outer planetary gears P3.

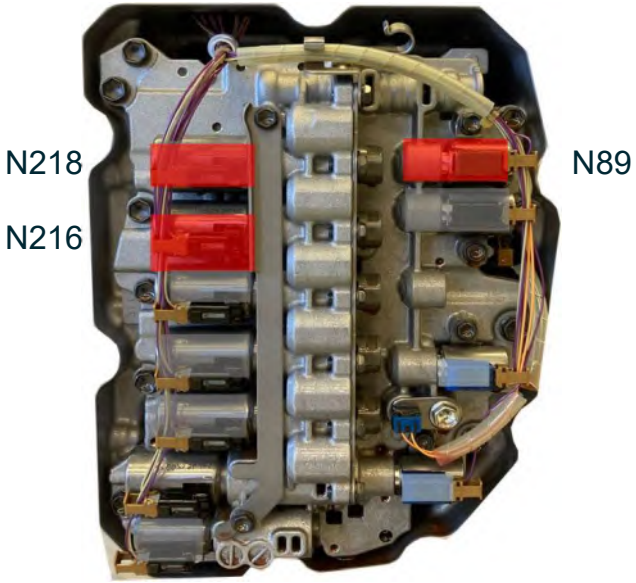


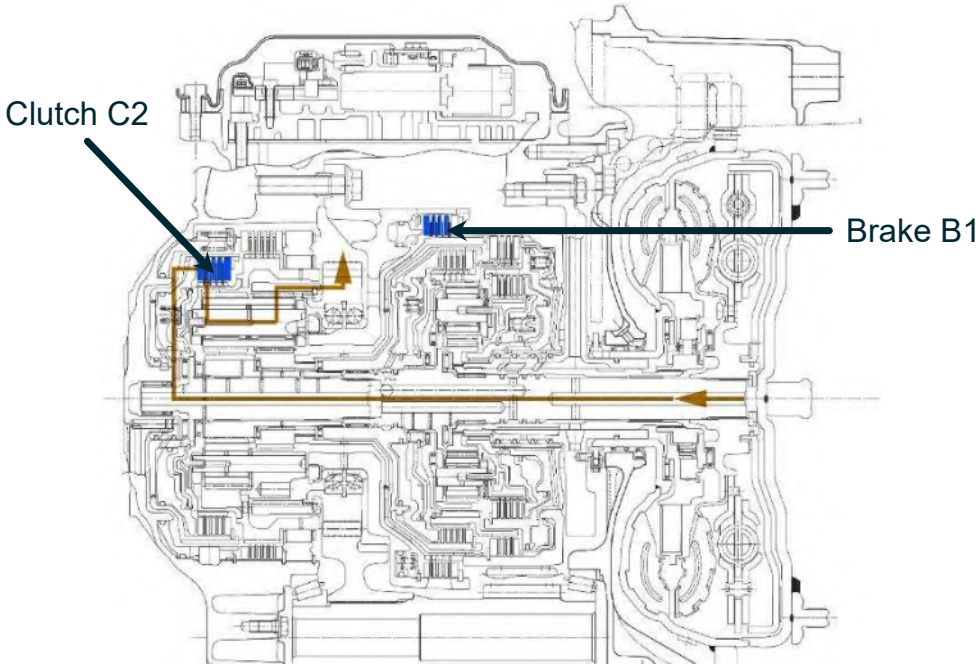


INTERNAL

8th gear

- Brake B1 locks sun gear S2. Clutch C2 connects the turbine shaft to planetary gear carrier PT2 of the double planetary gear set, transmitting torque to the double planetary gear set.
- The long planetary gears P3 roll around the stationary sun gear S2 and, together with planetary gears P2, drive annulus H2. Clutches C1 and C3 are open.
- The single planetary gear set is not part of the power flow.

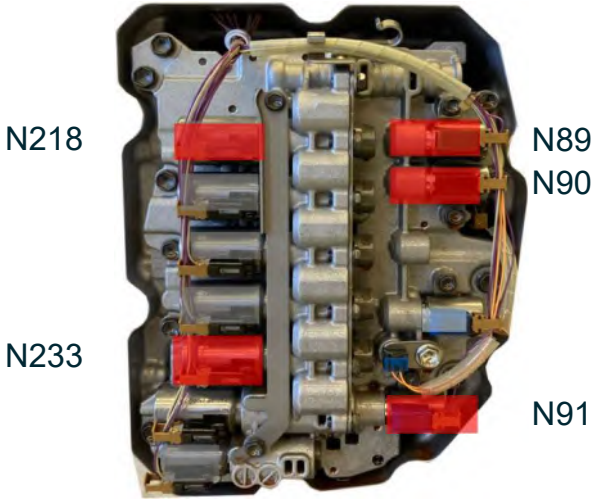


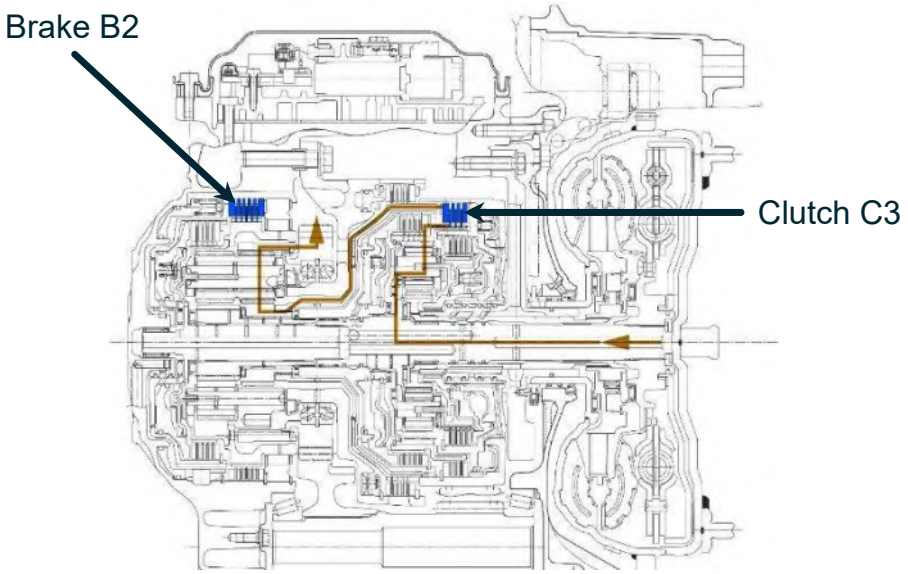


INTERNAL

Reverse gear

- The turbine shaft drives planetary gear carrier PT1 of the single planetary gear set.
  Planetary gear carrier PT1 drives planetary gears P1, which roll around the fixed sun gear S1, driving annulus H1.
- Clutch C3 connects annulus H1 to sun gear S2, transmitting torque to the double planetary gear set.
- In the double planetary gear set, brake B2 locks planetary gear carrier PT2. From sun gear S2, torque is transmitted to planetary gears P2 and P3.
- Supported by planetary gear carrier PT2, the torque is transmitted to annulus H2, which is connected to the output shaft. Annulus H2 is driven against the direction of engine rotation.





INTERNAL

5. Selector lever – Shift by wire

- There are two types of controls for gearbox.
- First is the selector lever. Using the selector lever the driver moves the gear shift lever in the gearbox.
- Second type is the shift-by-wire solution. The driver selects a gear on the selector switch. Electronics give a signal to parking lock actuator and the actuator moves the gear shift lever in the gearbox. There is no mechanical connection between the selector switch and the gearbox.
- Design of the selector lever or selector switch may differ from one vehicle to another.
- Function and connection are the same for all vehicles with AQ300 gen2.

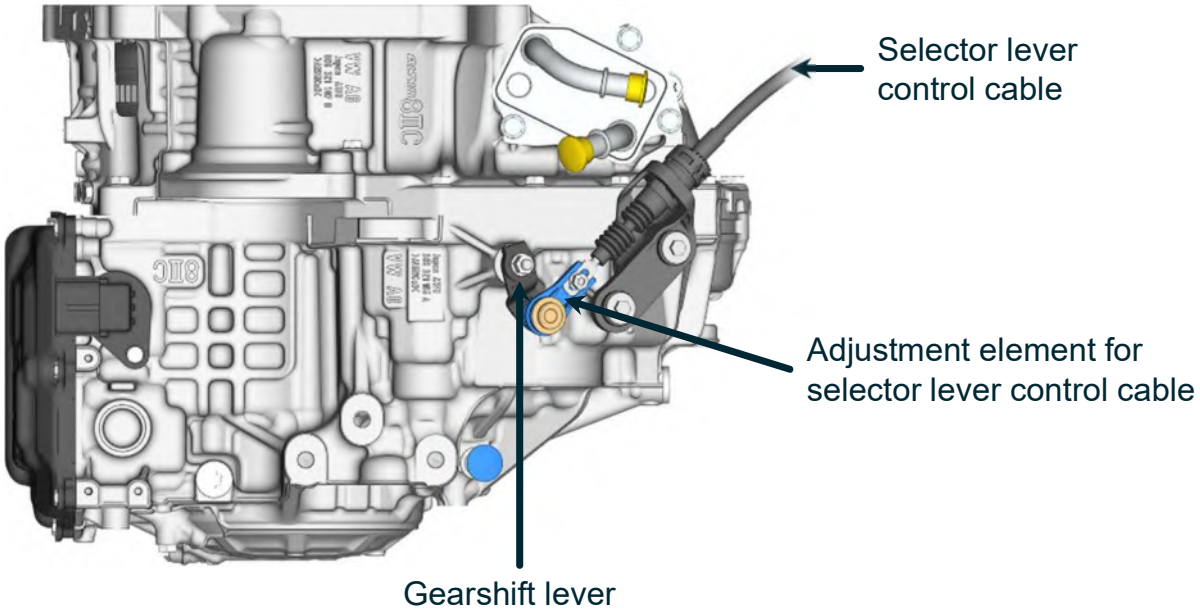
Selector lever



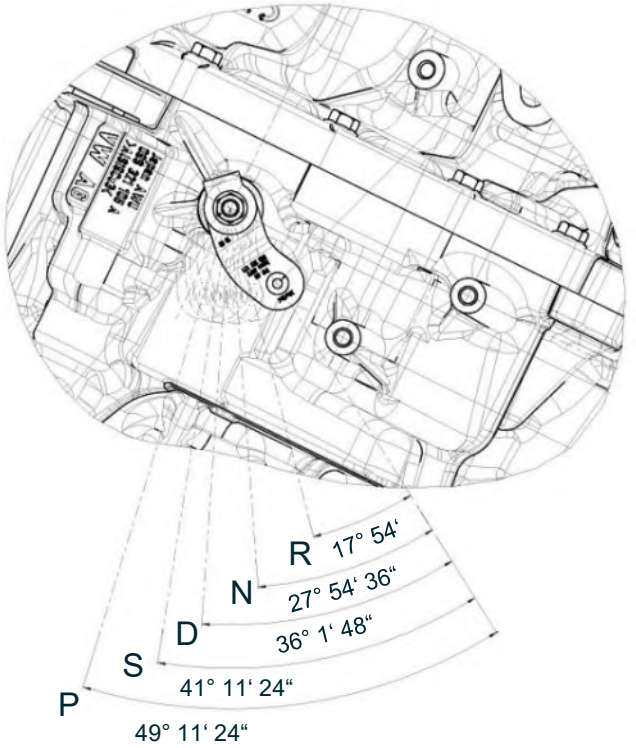
Parking lock actuator



- Connection on gearbox is for both types exactly the same.



Possible rotation angle



- There are two automatic operating modes, „D“ i.e. Drive mode and „S“ i.e. Sport mode.
- In the “D” mode, the gearbox management system selects the most appropriate gear for each situation while at the same time striving for reduction in fuel consumption. The control unit analyses the driving mode and sets the gear change points according to driving conditions (level ground, hills, trailer, etc.).
- In the “S” mode, the gear changes take place at higher rpm with the same throttle opening values, both during acceleration and deceleration.
- In both modes, when the accelerator is pressed down fully (kick-down), the gearbox control unit engages the lowest possible gear.
- Selected mode is displayed e.g. on the instrument cluster, selector switch or at another places. Presentation on instrument cluster may differ from one vehicle or brand to another.

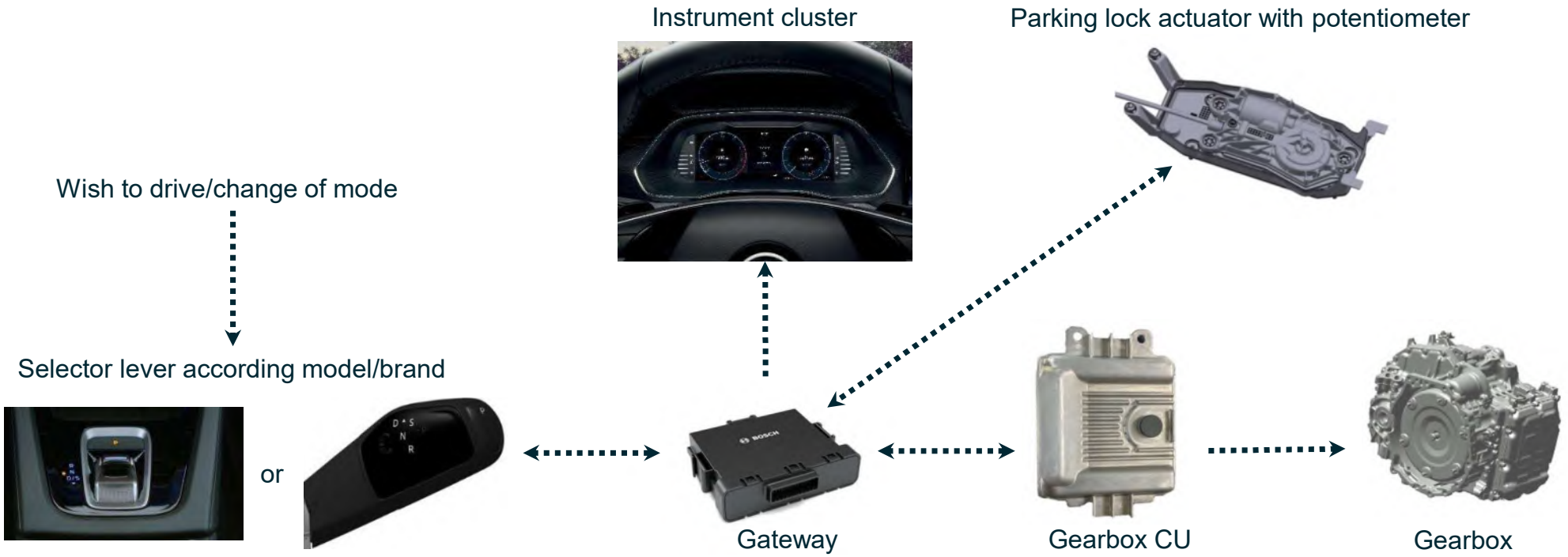






INTERNAL

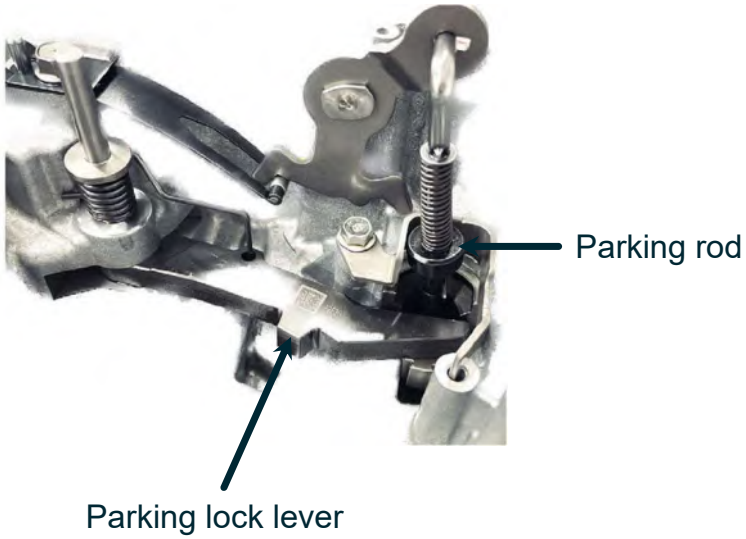
- Driver use selector lever. Signal goes to the gearbox CU through CAN – drivetrain bus. CU evaluates all inputs. If all conditions are safe, signal goes to parking lock actuator. Actuator moves through selector lever control cable with gearshift lever on gearbox to correct position, which was selected on selector lever.



INTERNAL

6. Parking lock

- The parking lock secure the vehicle against rolling away and is only allowed to be engaged when the vehicle is stationary.





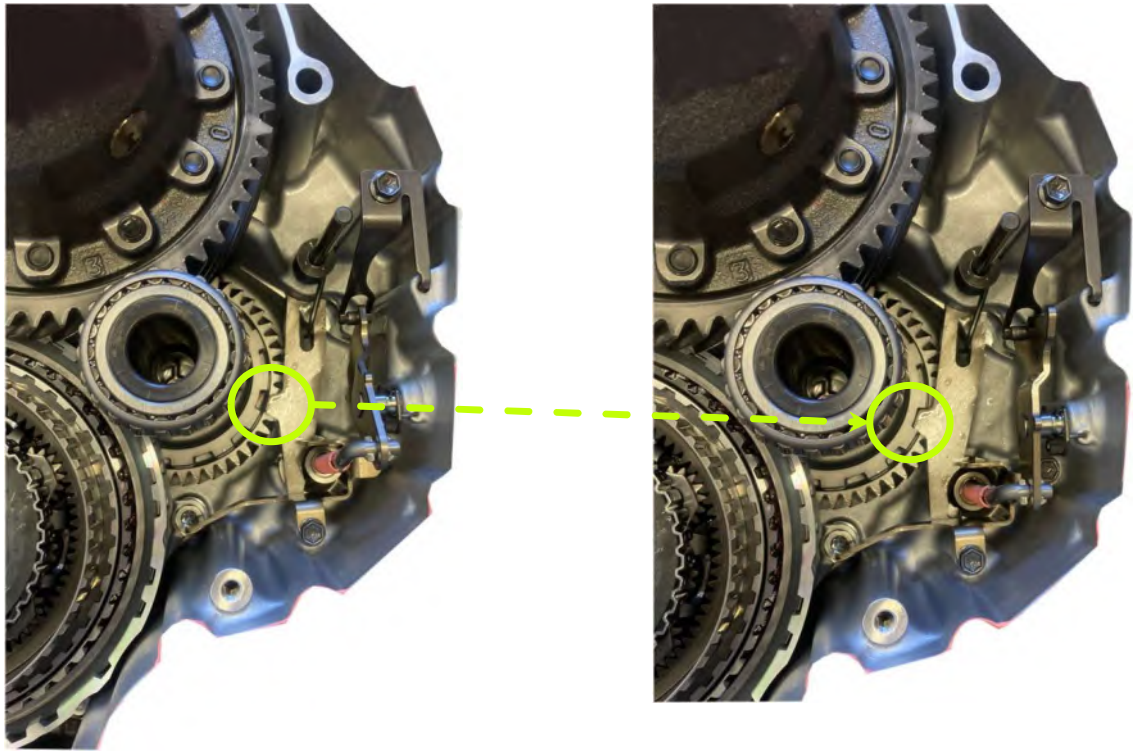
INTERNAL

VOLKSWAGEN
GROUP

- On the screens you can see how the parking lock secure gearbox, when the gear change to the position „P“.

OPEN

CLOSED

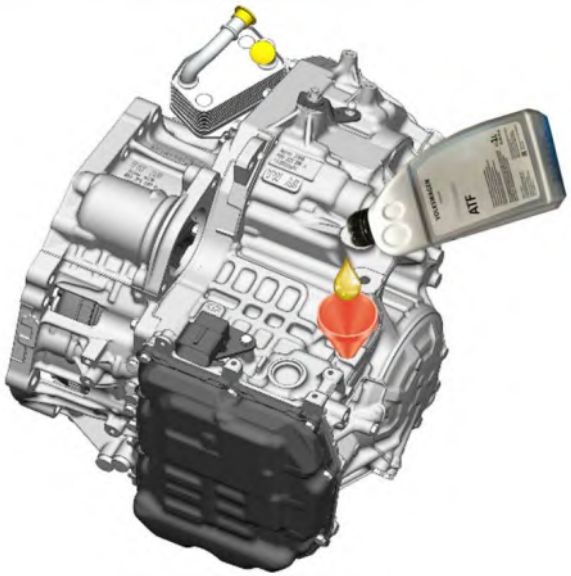


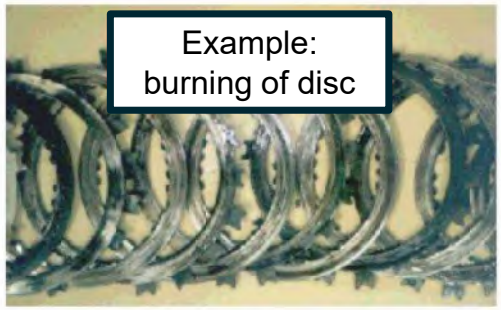
INTERNAL

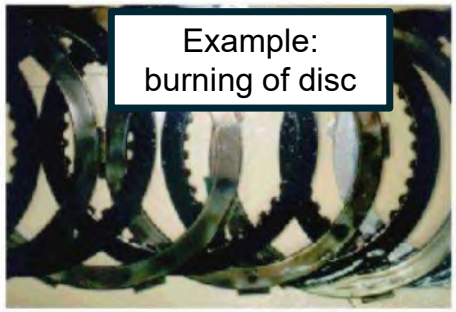
7. Service

- There is no service interval for the gearbox. Gear oil filling is life-time.
- Automatic Transmission Fluid volume – 6,2 liters.
- For specification of Automatic Transmission Fluid (ATF) always check ETKA. Be sure to fill up the automatic transmission with correct specified ATF. Changes in ATF friction characteristics will cause several failure of „Harsh shift“ or „Burning of disc“.

Use only the ATF specified in the ETKA catalog.



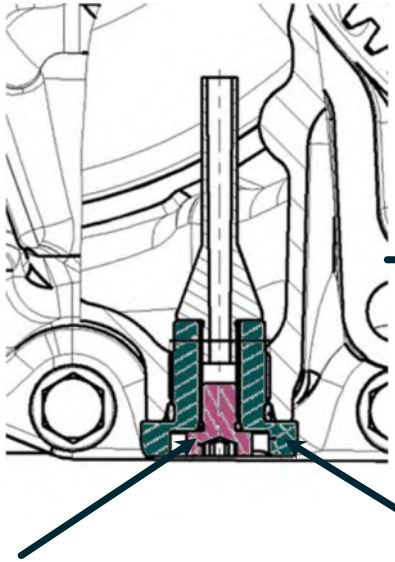


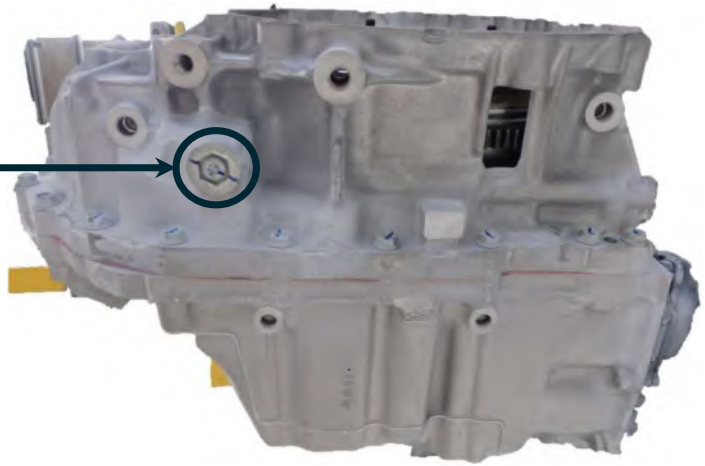


INTERNAL

Filling plug
Tightening torque: 40 Nm







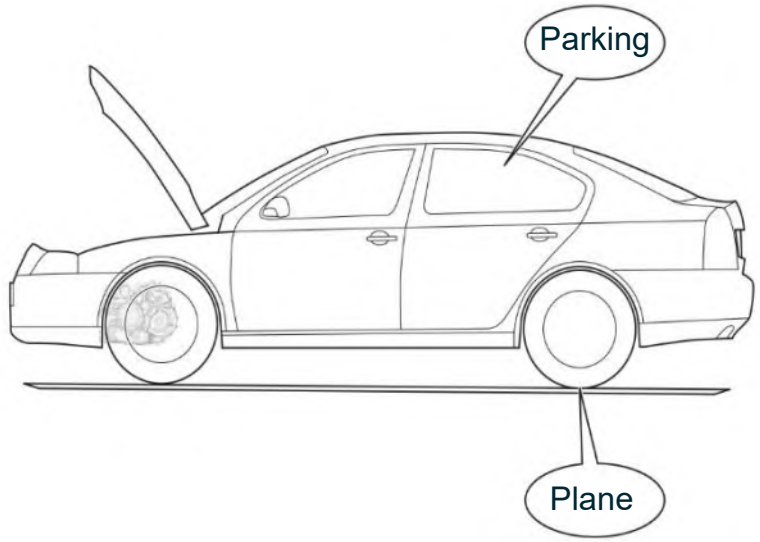
Oil level check plug
Tightening torque: 9 Nm

Drain plug
Tightening torque: 50 Nm

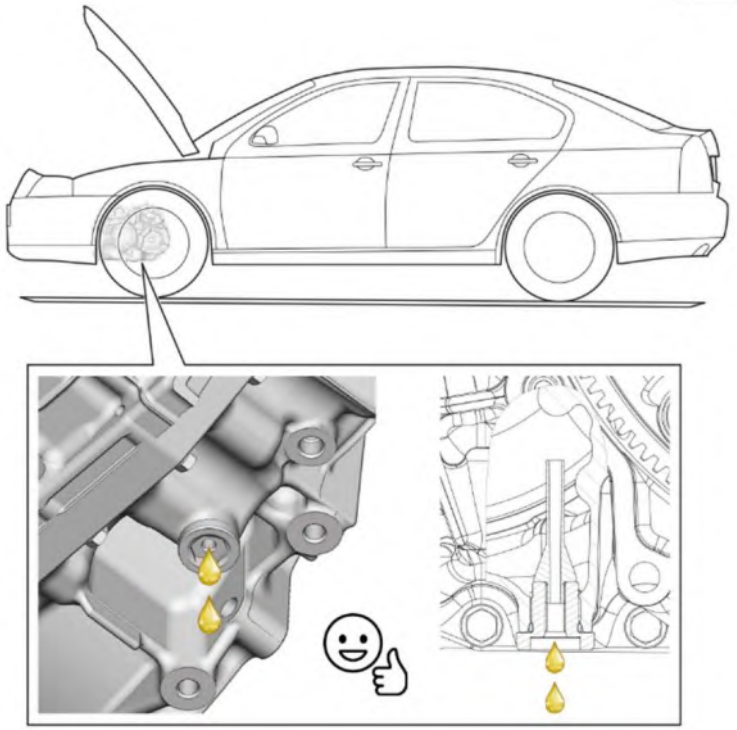
- **How to check oil level (Over Flow type):**

1. Park the vehicle on level place and confirm the shift position "P".
2. Remove the overflow plug to check if ATF drops from the overflow hole. If ATF does not drop, additional ATF is to be filled until ATF drops. Tighten the overflow plug with specified torque.
3. Remove filling plug and add 0, 5 liter ATF from the filling hole. Tighten the filling plug with specified torque.
4. Start engine.
5. To raise ATF in 35°C. (Temperature is not raised by "stall test".)
6. Shift all range from "P" to "D" with the expenditure of more than 2 seconds per each range and return to "P" after performing the 2 times shifting.
7. Check ATF drops from the overflow hole. ATF drops: Confirm the ATF at temperature between 35 - 45°C with oil temperature sensor and wait until ATF does dribble out from overflow hole.
8. Use the new gasket and tighten the overflow plug with specified torque. Be sure to wipe off spilled ATF completely after tighten ATF level check plug.

1

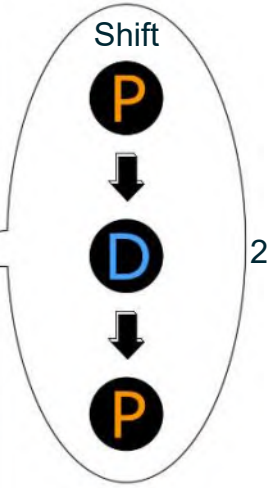


2



6



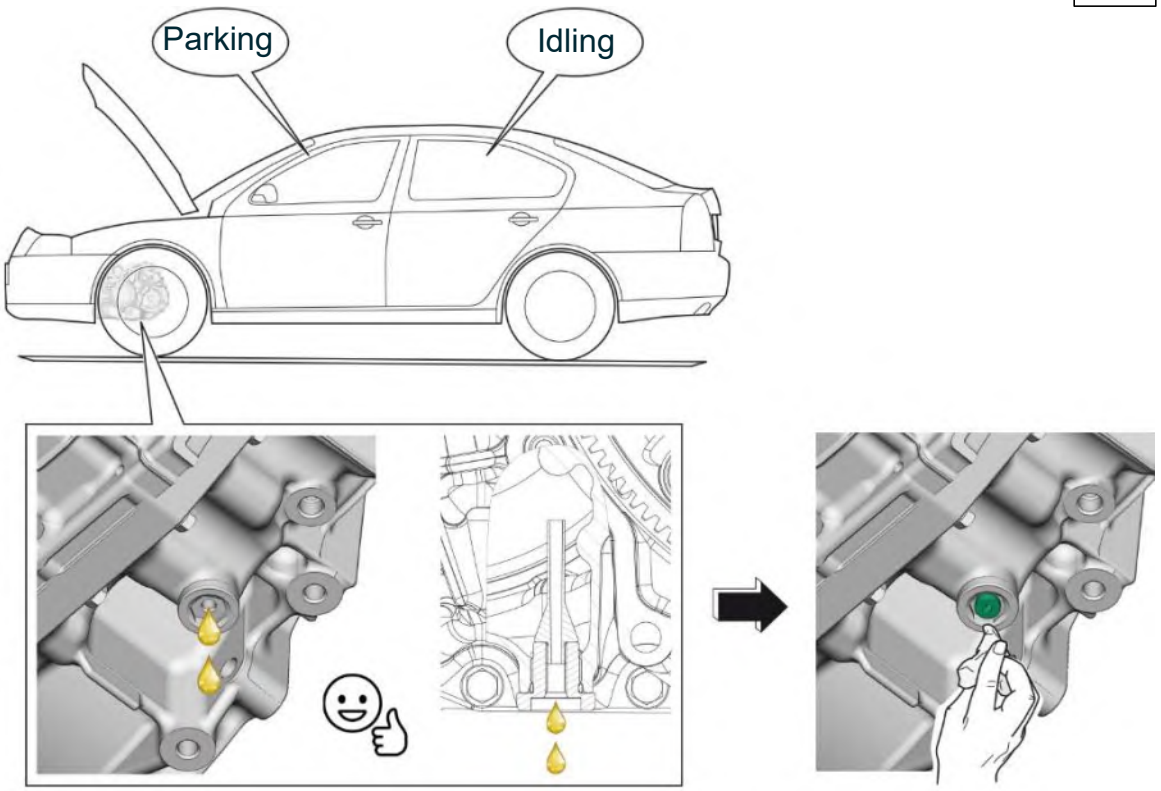


2 Times

Hold 2 sec. on each range

INTERNAL

7-8

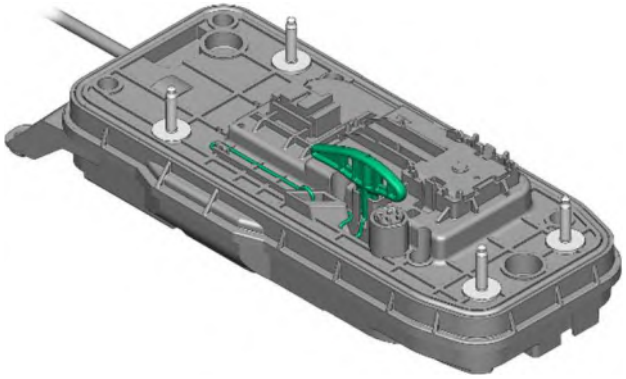


INTERNAL

7.1 Emergency gearbox release

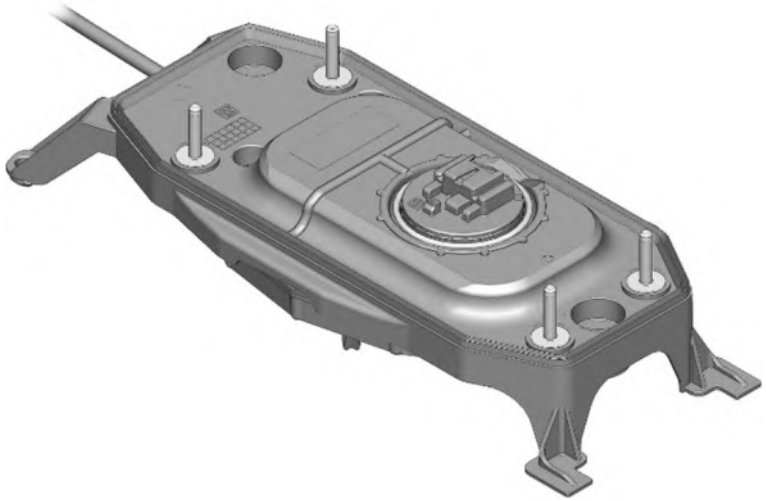
- Emergency release of the selector’s parking position is no more possible with parking lock actuator V682 generation 2. Without power supply the gearbox can’t be released.
- Cable handle in center console is not available for the second generation of the parking locks.

Parking lock actuator generation 1





Parking lock actuator generation 2



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Thank you

