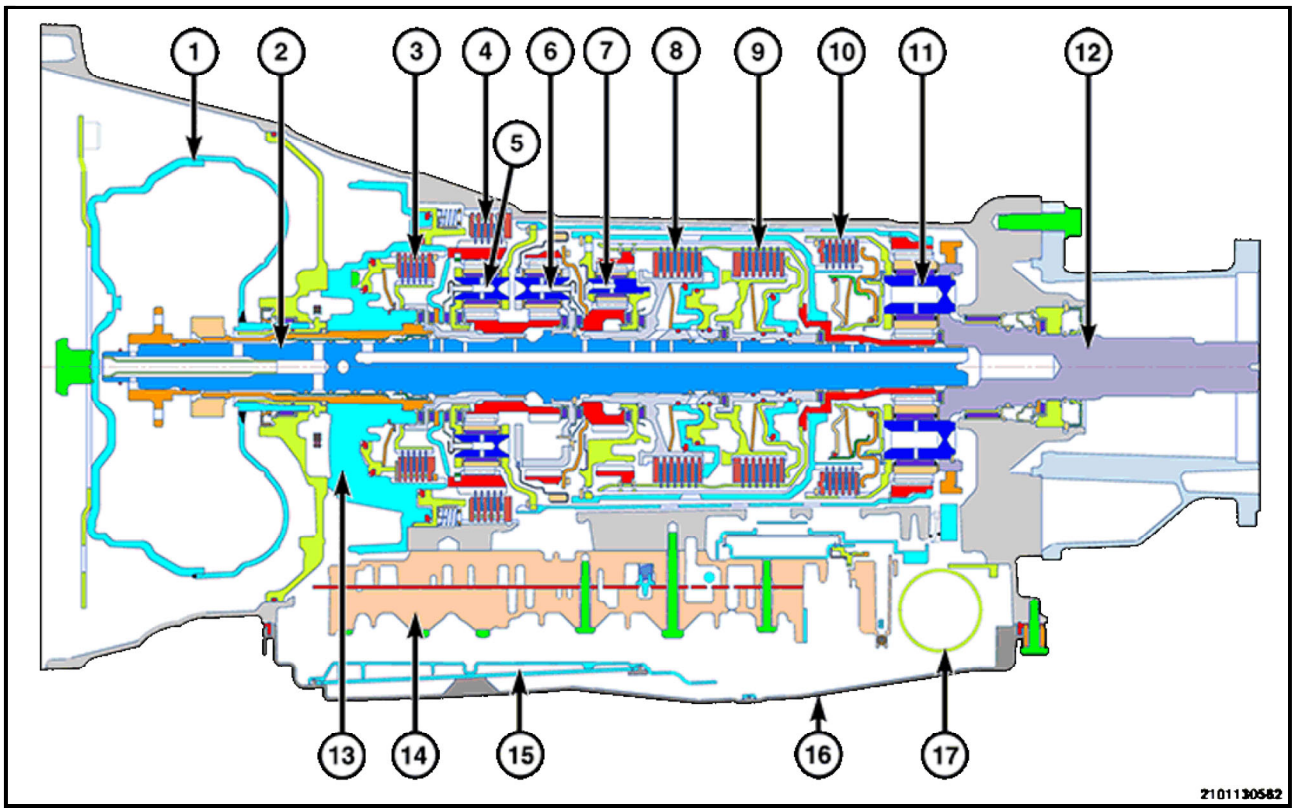
21 - Transmission and Transfer Case/Automatic - 8HP50/850RE/Description and Operation

DESCRIPTION AND OPERATION

DESCRIPTION



1 - TORQUE CONVERTER	10 - D CLUTCH
2 - INPUT SHAFT	11 - P4 PLANETARY
3 - A CLUTCH	12 - OUTPUT SHAFT
4 - B CLUTCH	13 - OIL PUMP
5 - P1 PLANETAR	14 - VALVE BODY
6 - P2 PLANETARY	15 - TRANSMISSION OIL FILTER

7 - P3 PLANETARY	16 - TRANSMISSION OIL PAN
8 - E CLUTCH	17 - HIGH IMPULSE SOLENOID (H.I.S.)
9 - C CLUTCH	

CAUTION:

A unique transmission fluid has been developed for this transmission. This fluid is NOT compatible with ATF+4 or any other current FCA US LLC transmission fluid. For specifics about this unique fluid see FLUIDS, LUBRICANTS AND GENUINE PARTS.

The transmission case is a single-piece unit. The starter pocket, cooler line fittings, and manual park release lever are located on the driver's side of the case. The electrical connector and oil fill plug are located on the passenger side of the case. The 850RE uses a sealed, externally-splined output shaft to form a dry connection between the adapter plate and the transfer case.

OPERATION

- The 850RE is an electronic eight-speed automatic transmission.
- The Transmission Control Module Assembly (TCMA), which is integrated into the valve body, provides fully synchronized clutch-to-clutch shifting through four planetary gear sets.
- The TCMA includes a mounting plate that holds the Transmission Control Module (TCM) and a molded wiring harness for connection to various transmission sensors and solenoids.
- The valve body assembly contains all the sensors and solenoids required for operation, completely inside the transmission.
- Eight speeds allow the engine to maintain its optimal rpm range, increasing fuel economy and performance.
- Transmission control is performed by the TCM based on hard-wired and Controlled Area Network (CAN) bus signals from sensors and modules.
- The TCM receives driveability data from the Powertrain Control Module (PCM) and other modules over the CAN-Chassis (CAN-C) bus.
- The TCM receives shift lever position information from the Electronic Shift Module (ESM) over a dedicated transmission CAN bus.
- The TCM processes this input data and controls operation of the Torque Converter Clutch (TCC), park lock system, solenoid valves, and pressure regulating valve.
- The Input and Output Speed Sensors (ISS and OSS) are Hall-effect sensors that measure shaft rotational speed.
- The ISS is located at the top, near the center, of the of the TCMA and reads input shaft speed from the magnetic ring on the P2 carrier.
- The OSS is located at the back of the TCMA and reads output shaft speed from the P4 carrier.

FILTER SERVICE

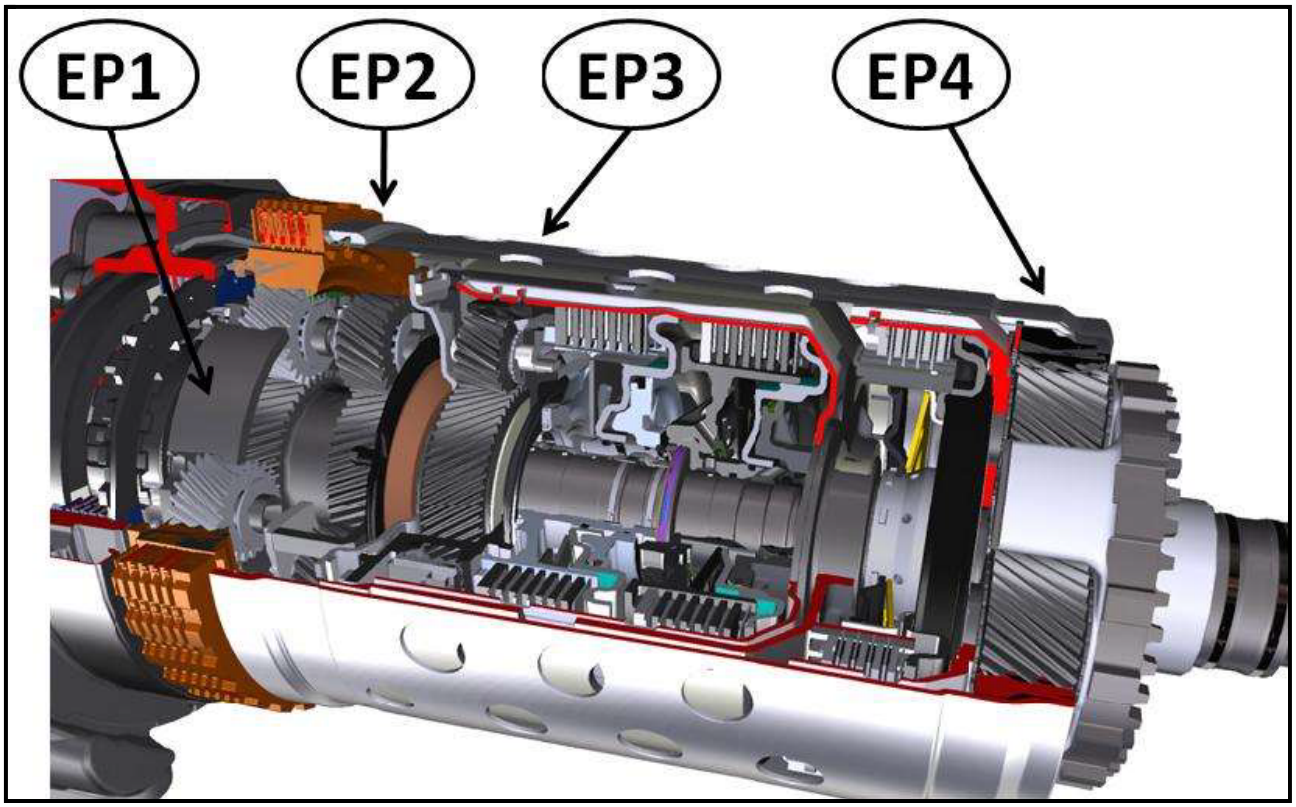
- The 850RE has a conventional fluid sump design with a independent transmission fluid filter.
- The transmission oil pan gasket is reusable providing it is not damaged during removal.
- If the gasket is damaged the transmission oil pan and gasket are replaced as an assembly.

FLUID CHECK AND FILL

- A transmission fluid fill tube and indicator are not provided.

- All work is performed under the vehicle while raised on a hoist. In the event of a transmission shift quality concern, a fluid leak, or in conjunction with a transmission repair, the transmission fluid level must be validated and topped off as necessary.
- The procedure involves the use of a scan tool to monitor transmission fluid temperature.
- Specific service procedures are necessary to check and fill the transmission with fluid (Refer to 21 - Transmission and Transfer Case/Automatic/FLUID and FILTER/Standard Procedure) .

Epicyclic Gear Sets

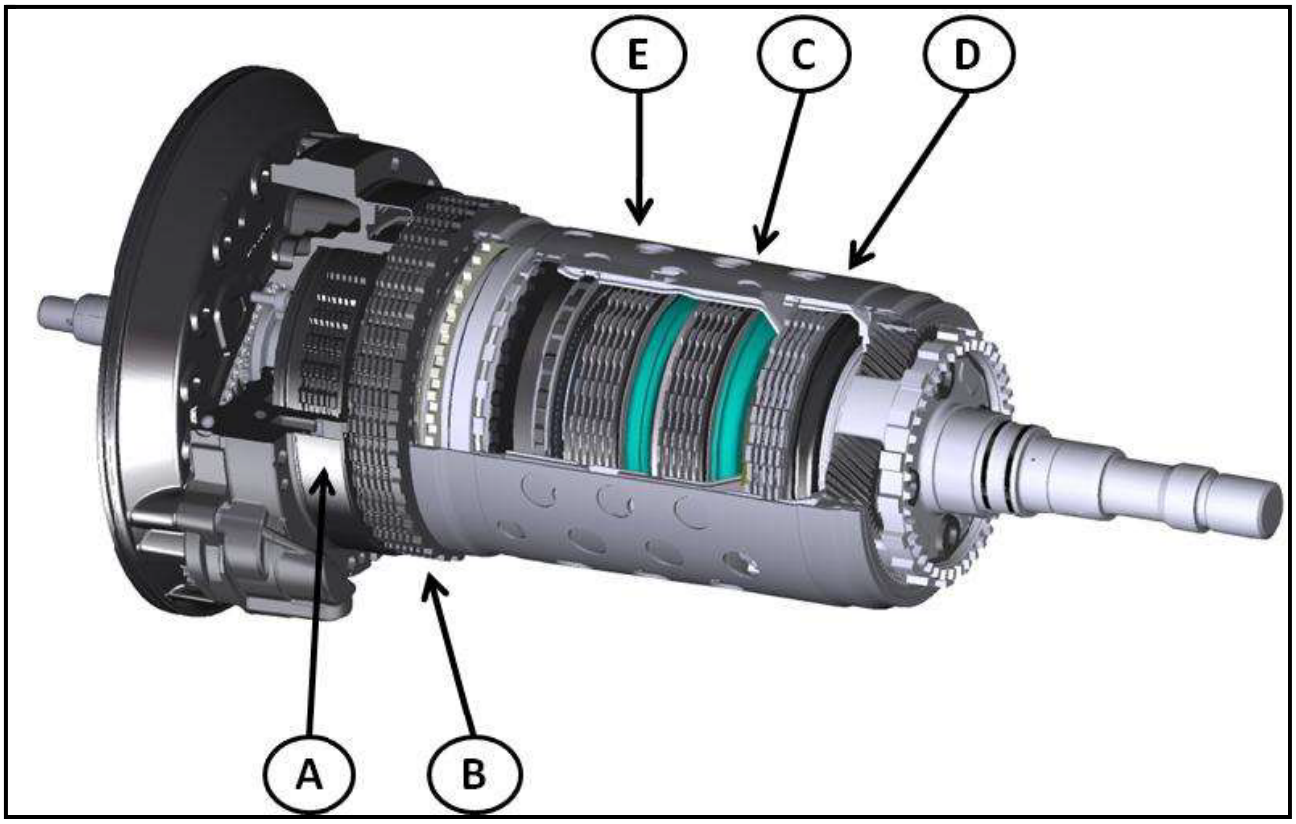


Epicyclic gear train (EP1, EP2, EP3, EP4)

The eight forward gears and the reverse gear are implemented by connecting four single-arm epicyclic gear trains.

The two front gear trains have a common sun gear, while the power is always output through the fourth epicyclic gear train planet carrier.

Engagement Elements



There are five engagement elements divided as follows:

Brakes	A	B	
Clutches	C	D	E

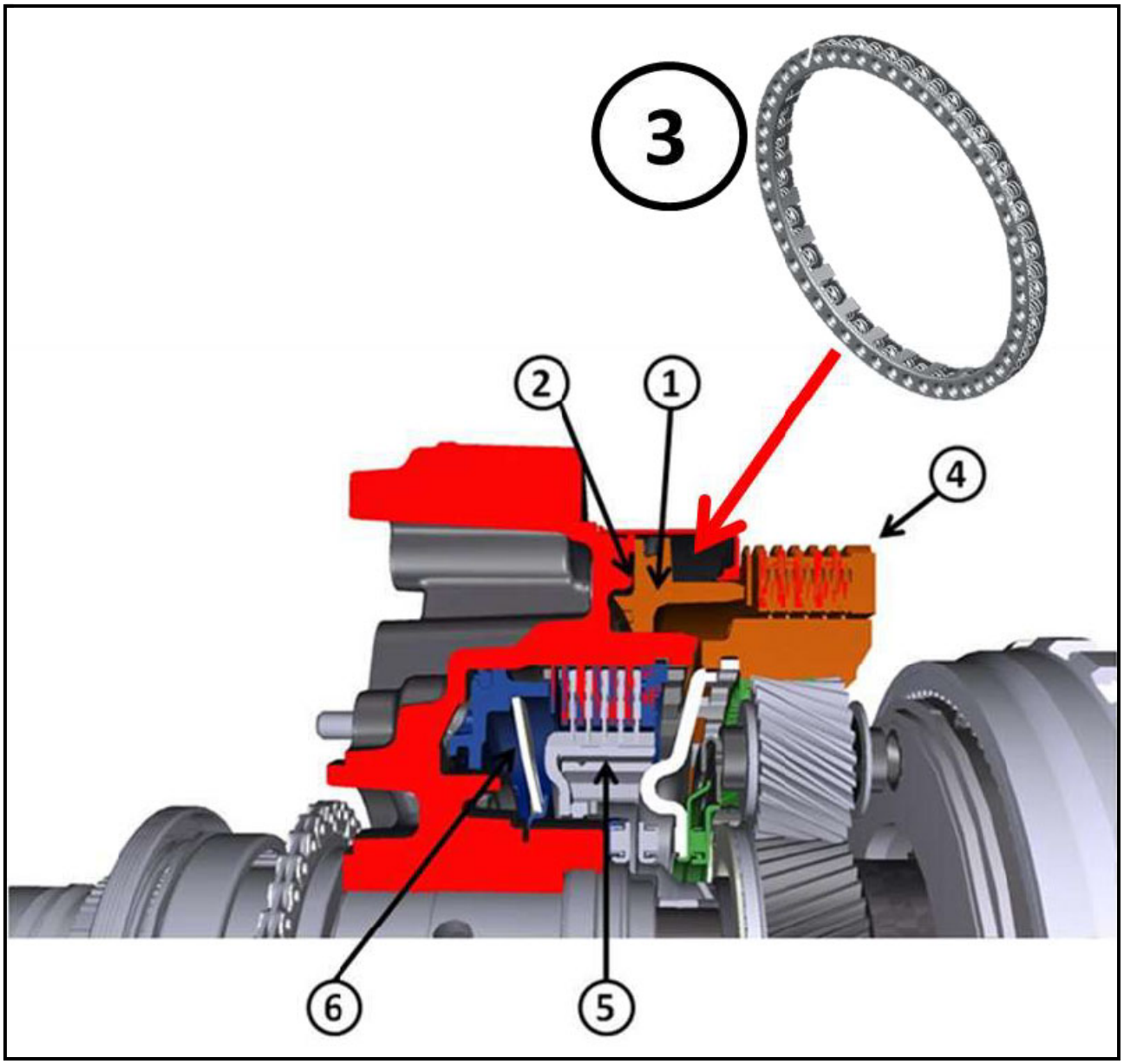
Multiple-disc clutches C, D and E transmit the engine torque to the epicyclic gear train, while brakes A and B offload the engine torque to the transmission housing.

The engagement elements are hydraulically closed. The fluid pressure compresses the disc pack to engage the clutch. When the hydraulic pressure decreases, the diaphragm spring pushes the piston into its rest position.

The engagement elements serve to engage the gears under load without interrupting the traction force.

For each gear, three engagement elements are always closed, therefore two engagement elements always remain open. Each open engagement element creates drag torque, so this configuration allows an increase in transmission efficiency.

Brakes

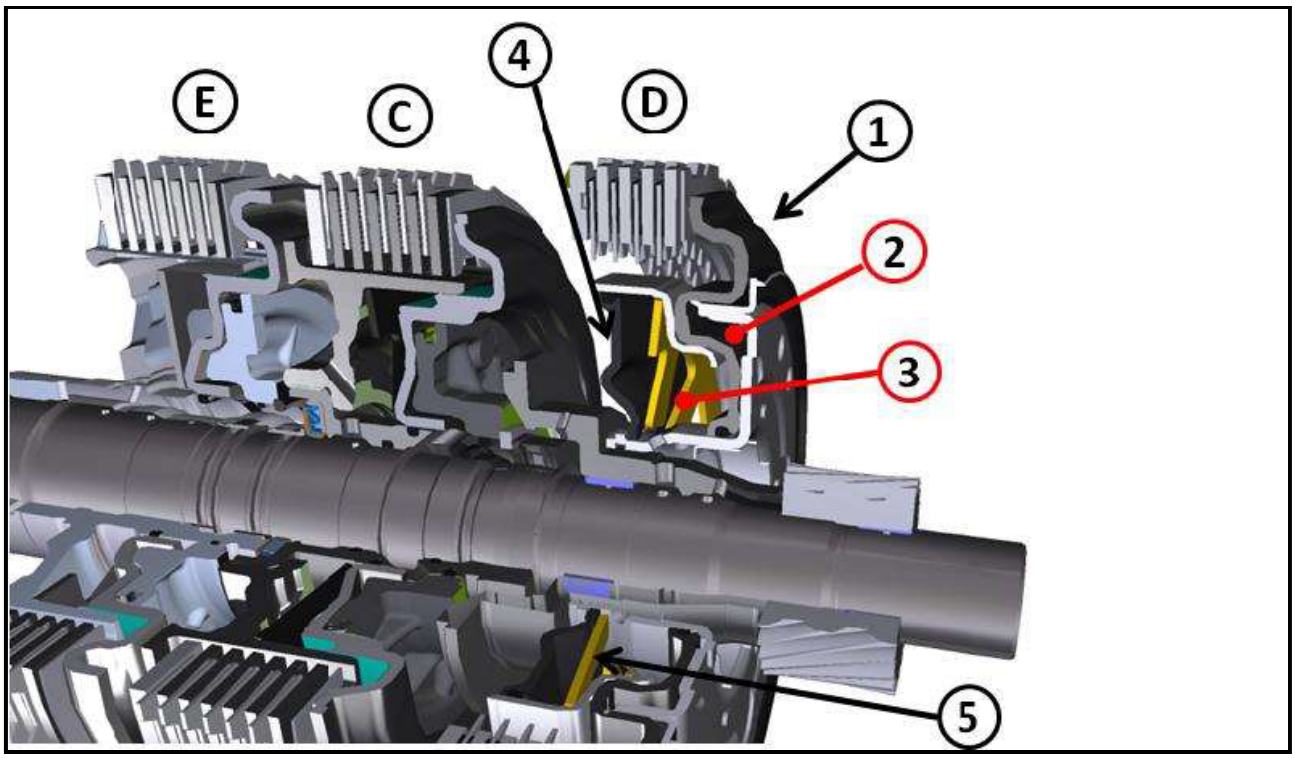


1	Brake B Piston
2	B1 Chamber
3	Return Spring
4	Brake B
5	Brake A
6	Return Spring

Brake B has a spring pack to return the piston into position.

Brake A has a diaphragm return spring.

Clutches



1	Piston
2	Pressure chamber
3	Hydraulic compensation chamber
4	Diaphragm
5	Diaphragm spring

The dynamic pressure of clutches C, D and E is compensated.

The increase in dynamic hydraulic pressure at high speeds is due to the fact that the transmission fluid in the clutch cylinder is subject to considerable centrifugal forces created by the rotation. As a result, the pressure in the clutch cylinder increases in the direction of the maximum radius.

The “dynamic pressure generation” is an undesirable phenomenon because it fruitlessly increases the pressure and obstructs the defined increase or decrease in the pressure chamber.

To ensure the best clutch control even at high speeds, oil is supplied to both sides of the clutch piston, creating a pressure chamber and a pressure compensation chamber.

The transmission fluid in the pressure compensation chamber comes from the lubrication ducts and is therefore at low pressure.

However, once rotating, it is subject to the same dynamic pressure increase due to the centrifugal forces.

In this way, the clutch piston contact pressure is balanced, the shift comfort is significantly improved and safe opening and closing of the clutch is ensured at all speeds.

Brake / Clutch Engagement Matrix

All the gear shifts from the first to the eighth speed and vice versa, are called overlapping engagement/disengagement because during the shift, one clutch must maintain the ability to transmit torque with a reduced pressure, until the other clutch is able to take on the torque.

The gear shift is supported by a brief reduction in torque when shifting up or a brief increase in torque when shifting down. Due to the crossed movements, the freewheel clutches have been replaced by hydraulic clutch control creating a savings in weight and size.

GEAR	Brake A	Brake B	Clutch C	Clutch D	Clutch E
REVERSE	X	X		X	
1st	X	X	X		
2nd	X	X			X
3rd		X	X		X
4th		X		X	X
5th		X	X	X	
6th			X	X	X
7th	X		X	X	
8th	X			X	X
PARK/NEUTRAL	X	X			

Engaged = X

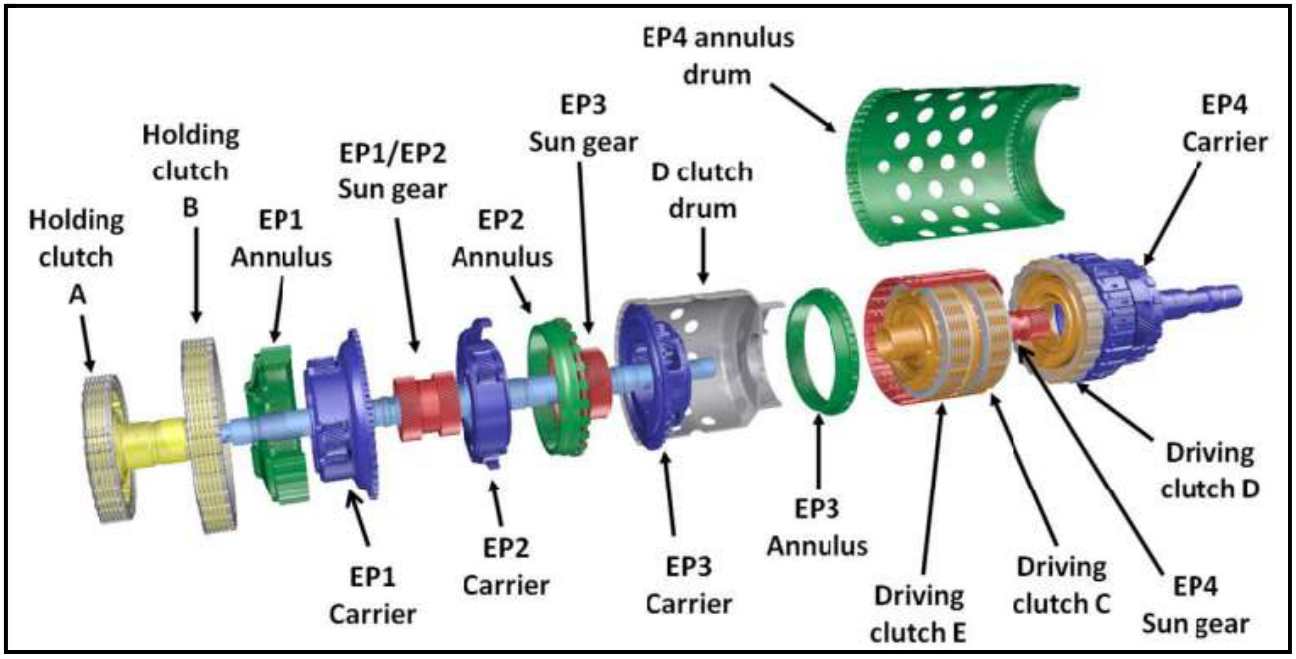
Brake/clutch engagement control solenoid valves

GEAR	Brake A	Brake B	Clutch C	Clutch D	Clutch E
NEUTRAL			X	X	X
REVERSE	X	X	X		X
1st	X	X		X	X
2nd	X	X	X	X	
3rd		X		X	
4th		X	X		
5th		X			X

6th					
7th	X				X
8th	X		X		

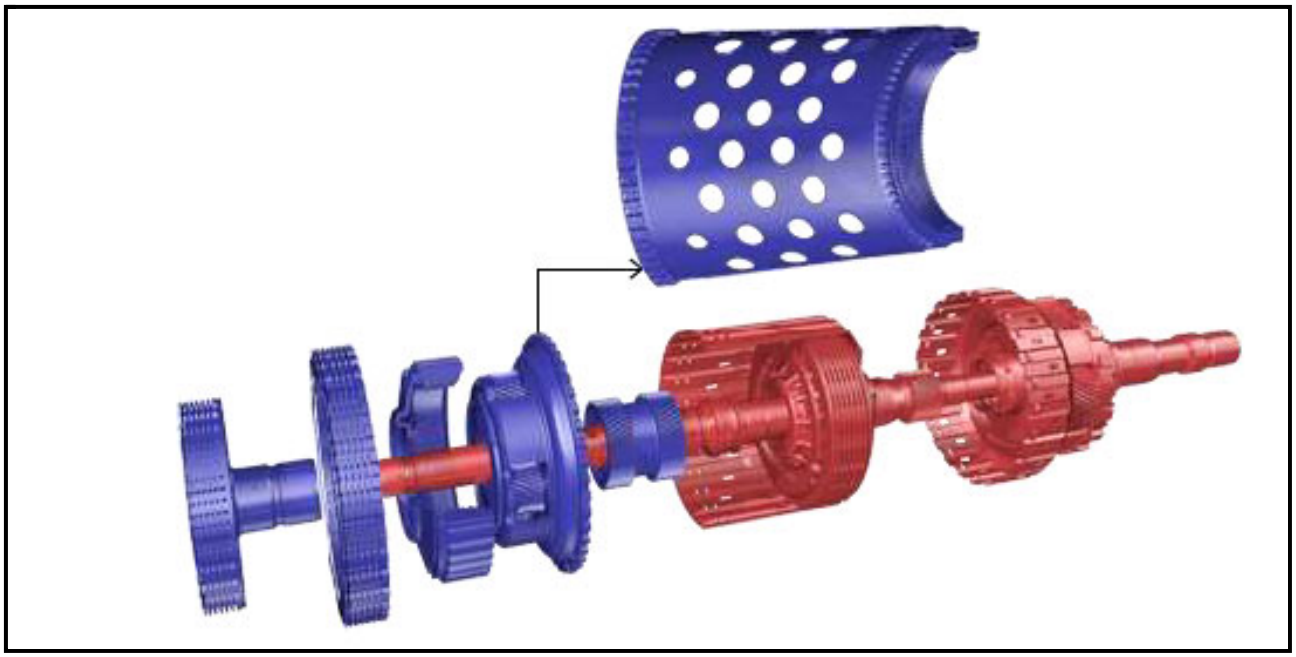
Engaged = X

Transmission Components



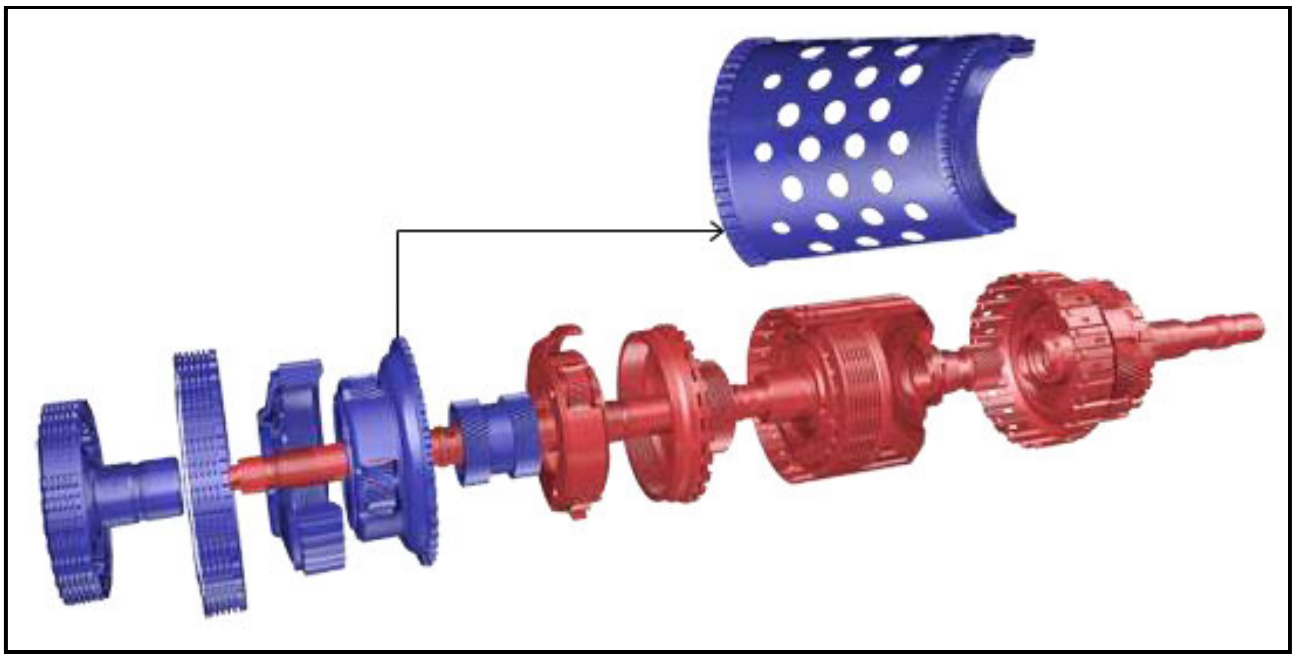
Holding Clutch : Brake (Engagement Element)
Driving Clutch : Clutch (Engagement Element)
Annulus : Internal Crown Gear
Sun Gear : Sun Gear
Carrier : Planetary Carrier
Drum : Drum

1st GEAR



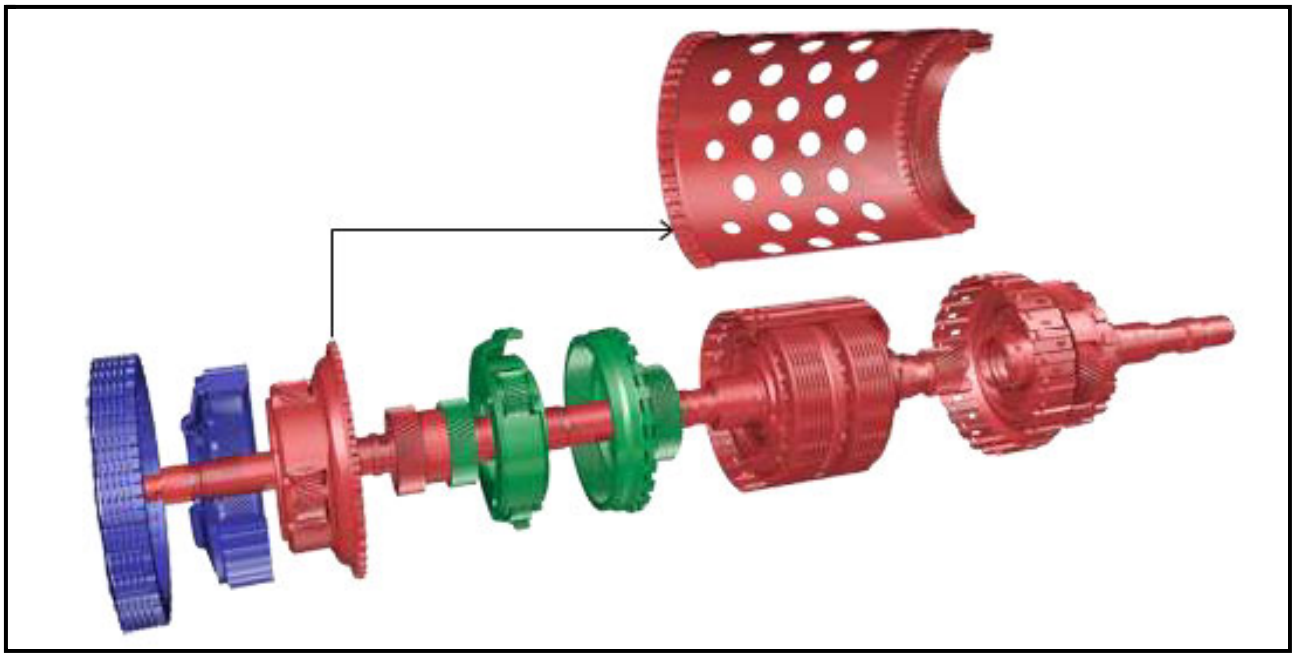
Engagement elements activated: A, B and C Turbine shaft → clutch C → sun gear 4 → planet gears 4 → planet carrier 4.

2nd GEAR



Engagement elements activated: A, B and E Turbine shaft → planet carrier 2 → planet gears 2 → crown gear 2 → clutch E → sun gear 4 → planet gears 4 → planet carrier 4.

3rd GEAR

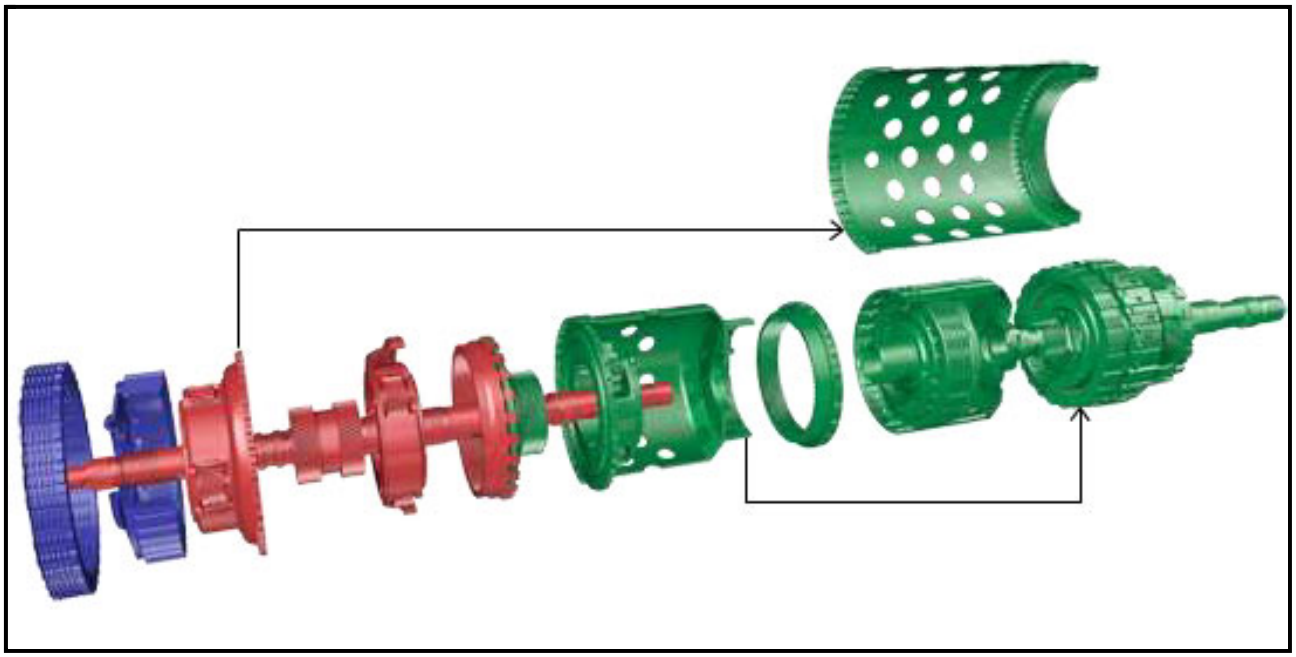


Engagement elements activated: B, C and E.

- Turbine shaft → clutch C → sun gear 4 → planet gears 4 → epicyclic gear train 4.
- Clutch C → clutch E → internal crown gear C2 → planet gears 2 (EP2 is blocked since C2 and PT2 are connected through clutches C and E).
- Turbine shaft → planet carrier 2 (EP2 blocked) → sun gear 1 → planet gear 1 → planet carrier 1 → internal crown gear 4.

The connection from the epicyclic gear train EP1 to the internal crown gear H4 produces a corresponding transmission ratio in the epicyclic gear train EP4 (see force flow in 1st gear).

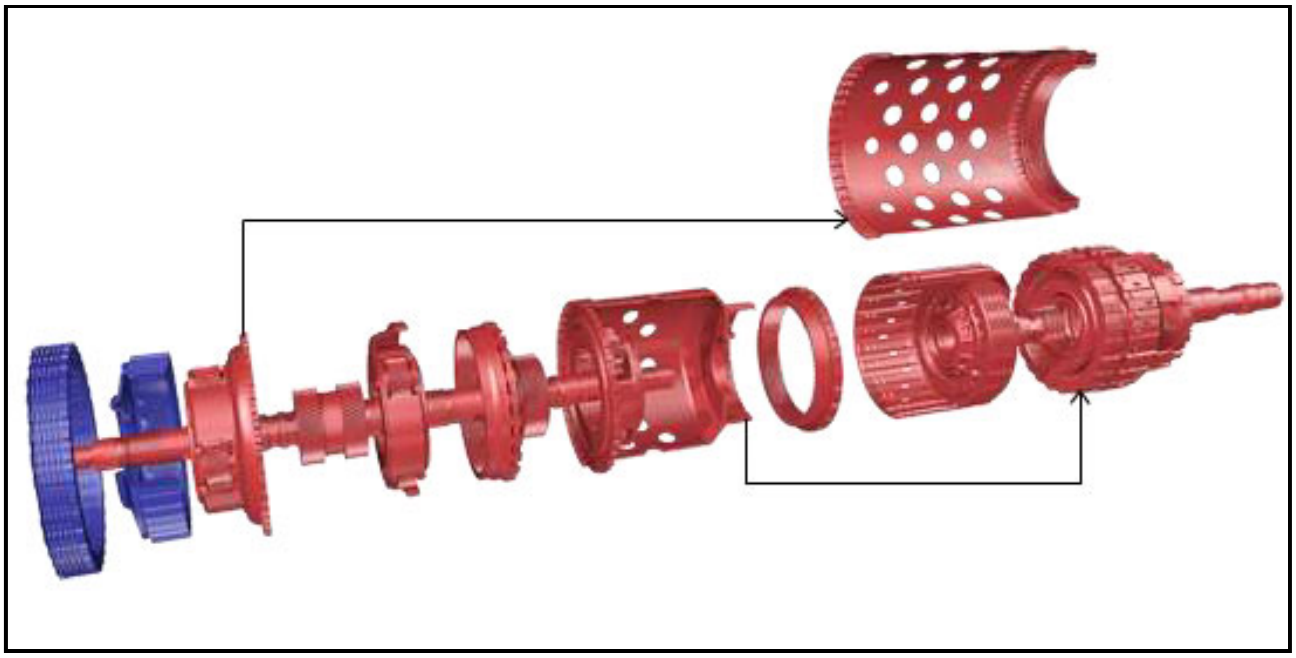
4th GEAR



Engagement elements activated: B, D and E.

- Clutch E blocks the epicyclic gear train EP3 and clutch D and EP3 being blocked cause the epicyclic gear train EP4 to be blocked (gear trains 3 and 4 rotate at the same speed = output.
- Turbine shaft → planet carrier 2 → planet gears 2 → sun gears 1 / 2 → planet gears 1 →planet carrier 1 → internal crown gear 4 → planet gears 4 → planet carrier 4.

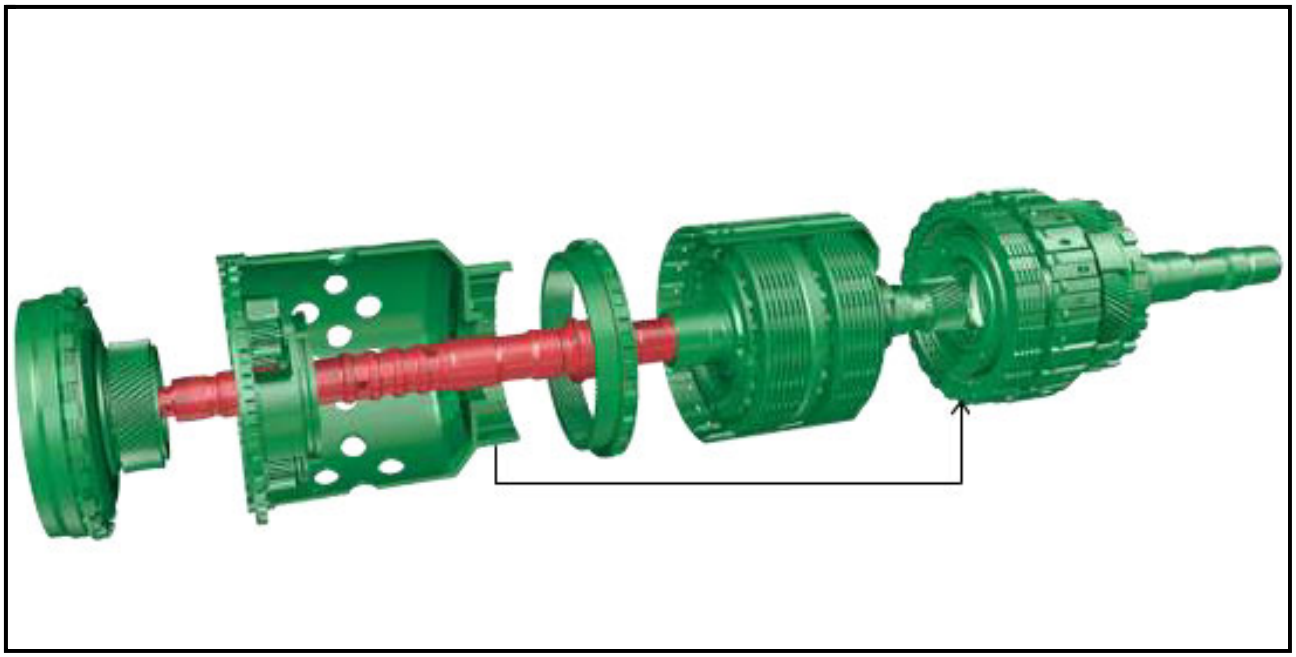
5th GEAR



Engagement elements activated: B, C and D.

- Turbine shaft → clutch C → sun gear 4 + internal crown gear 3 (EP2, C2 and S4 = turbine speed).
- Clutch D connect epicyclic gear train 3 to epicyclic gear train 4 (= output shaft).
- Turbine shaft → planet carrier 2 → planet gears 2 → sun gears 1 / 2 → planet gears 1 → planet carrier 1 → internal crown gear 4 → gives a behaviour that depends on the speed ratio of S4 (= turbine speed) to C4 with the corresponding speed on PT4.

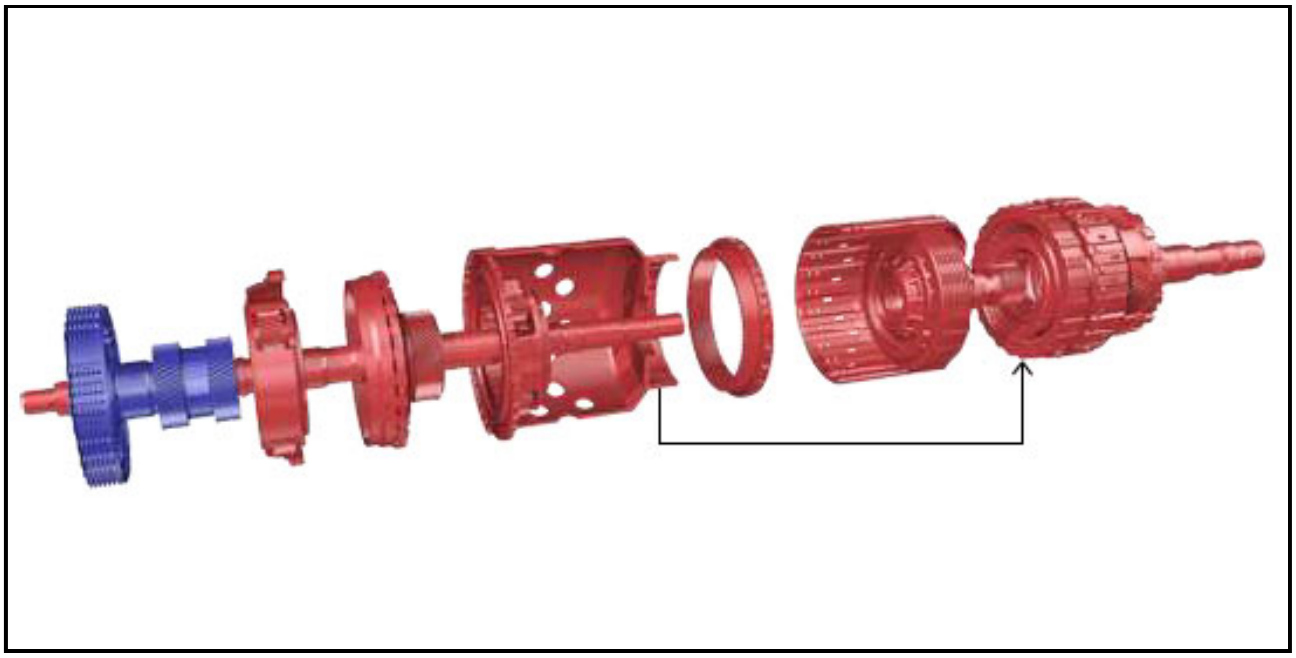
6th GEAR



Engagement elements activated: C, D and E.

- Clutches D and E block epicyclic gear trains EP3 and EP4.
- The torque is applied to the epicyclic gear set through clutch C.
- The whole epicyclic gear set rotates at the same speed as the turbine (blocked).

7th GEAR

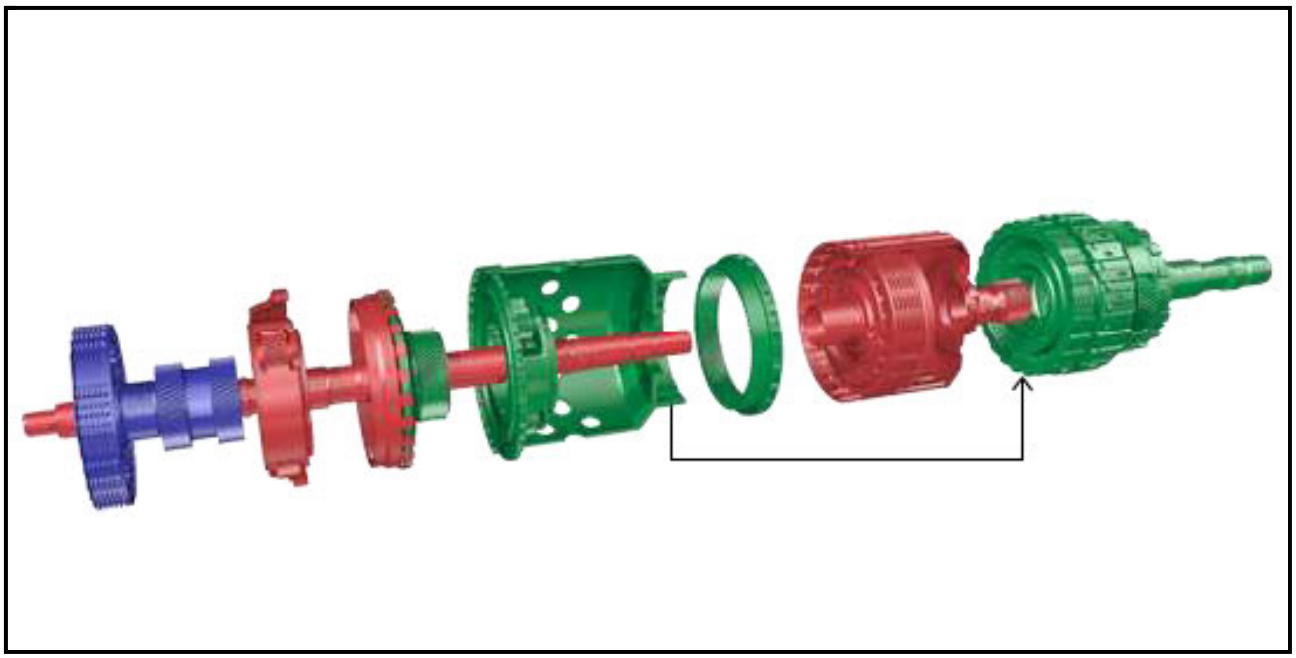


Engagement elements activated: A, C and D

- Turbine shaft → clutch C → sun gear 4 + internal crown gear 3 (= turbine speed).

- Turbine shaft → planet carrier 2 → planet gears 2 → internal crown gear 2 → sun gear 3 → planet gears 3 → planet carrier 3 → clutch D → planet carrier 4.
- Clutch D connects the epicyclic gear train EP3 to planet carrier PT4 (= output shaft).

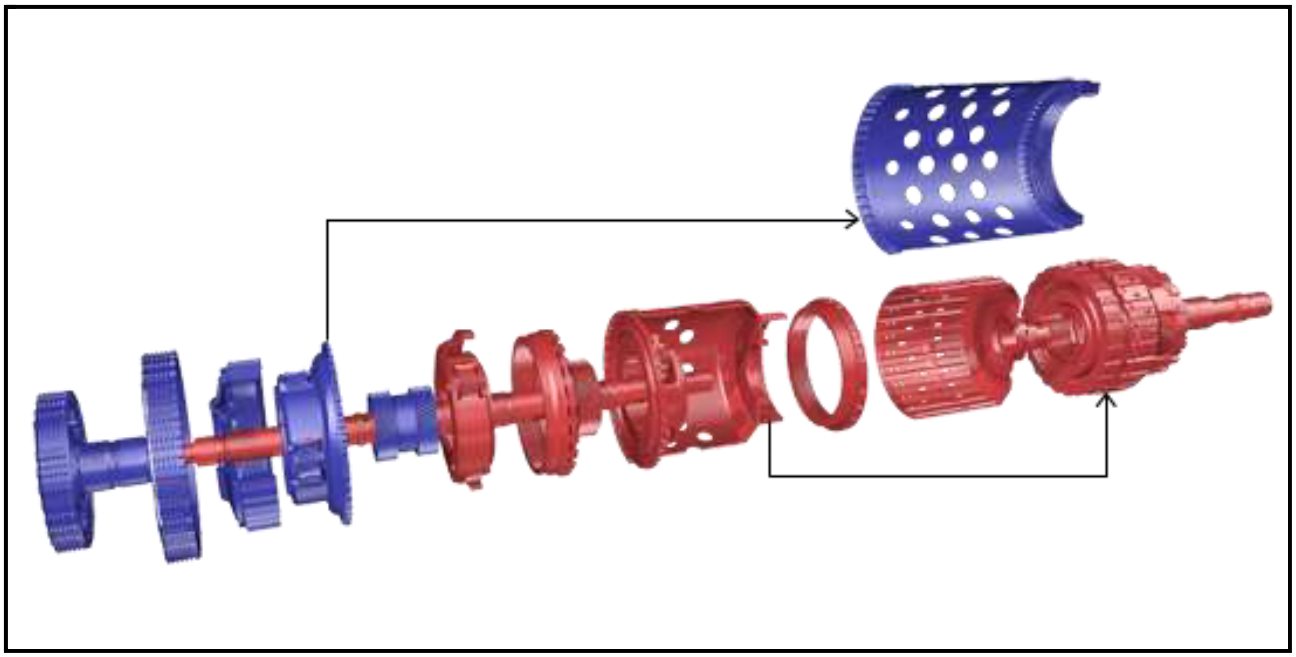
8th GEAR



Engagement elements activated: A, D and E.

- Clutch E blocks epicyclic gear train EP3.
- Turbine shaft → planet carrier 2 → planet gears 2 → internal crown gear 2 → epicyclic gear train EP3 (blocked) → clutch D → planet carrier 4.
- Clutch D connects planet carrier 3 to planet carrier 4 (= output shaft).

REVERSE GEAR



Engagement elements activated: A, B and D.

- Clutch D connects planet carrier 3 to planet carrier 4 (= output shaft).
- Turbine shaft → planet carrier 2 → planet gears 2 → internal crown gear 2 → sun gear 3 → planet gears 3 → planet carrier 3 → clutch D → planet carrier 4.
- Internal crown gear C3 is firmly fixed to sun gear S4.
- S4 drives P4 in the opposite direction to that of the engine.
- Gears P4 roll around fixed C4, rotating PT4 with the transmission ratio indicated, in the opposite direction to that of the engine.

Hydraulic Impulse Solenoid (HIS)

A HIS is installed on the transmission, inserted in the transmission housing close to the mechatronic unit solenoid valves. The HIS provides a hydraulic pressure reserve, to be sent to the mechatronic unit during engine starting due to the Engine Stop Start (ESS) function.

The HIS is used for the ESS function as it allows the gear to be engaged in just 350 milliseconds from starting the engine, so that the driver does not perceive the engagement delay.

The HIS charges when the engine is running, since the pump sends part of the oil to the HIS, in addition to sending it to the mechatronic unit.

The HIS is secured to the transmission housing. The HIS receives and accumulates about one litre of oil from the transmission oil pump through a connector.

The oil sent to the HIS by the pump, must pass through a regulating valve.

The valve is composed of a piston with a small hole and a spring. During accumulation, the oil only passes through the small hole in the piston.

When the oil enters the HIS, the pressure overcomes the force of the spring and the piston withdraws.

The spring is compressed and allows the piston to withdraw and attach to a blocking point controlled by a solenoid valve.

If the solenoid valve is powered or the oil pump is operating, the piston will remain blocked.

During an ESS engine OFF events the solenoid valve is powered in order to keep the piston blocked even when the oil is no longer being pumped.

When the vehicle is restarted, the solenoid valve will no longer be powered and the spring will be able push the piston, which will send the oil under pressure to the mechatronic unit to engage the gear.

When the piston pushes the oil, the regulating valve spring compresses, opening the valve fully to allow the oil at the HIS outlet to pass.