

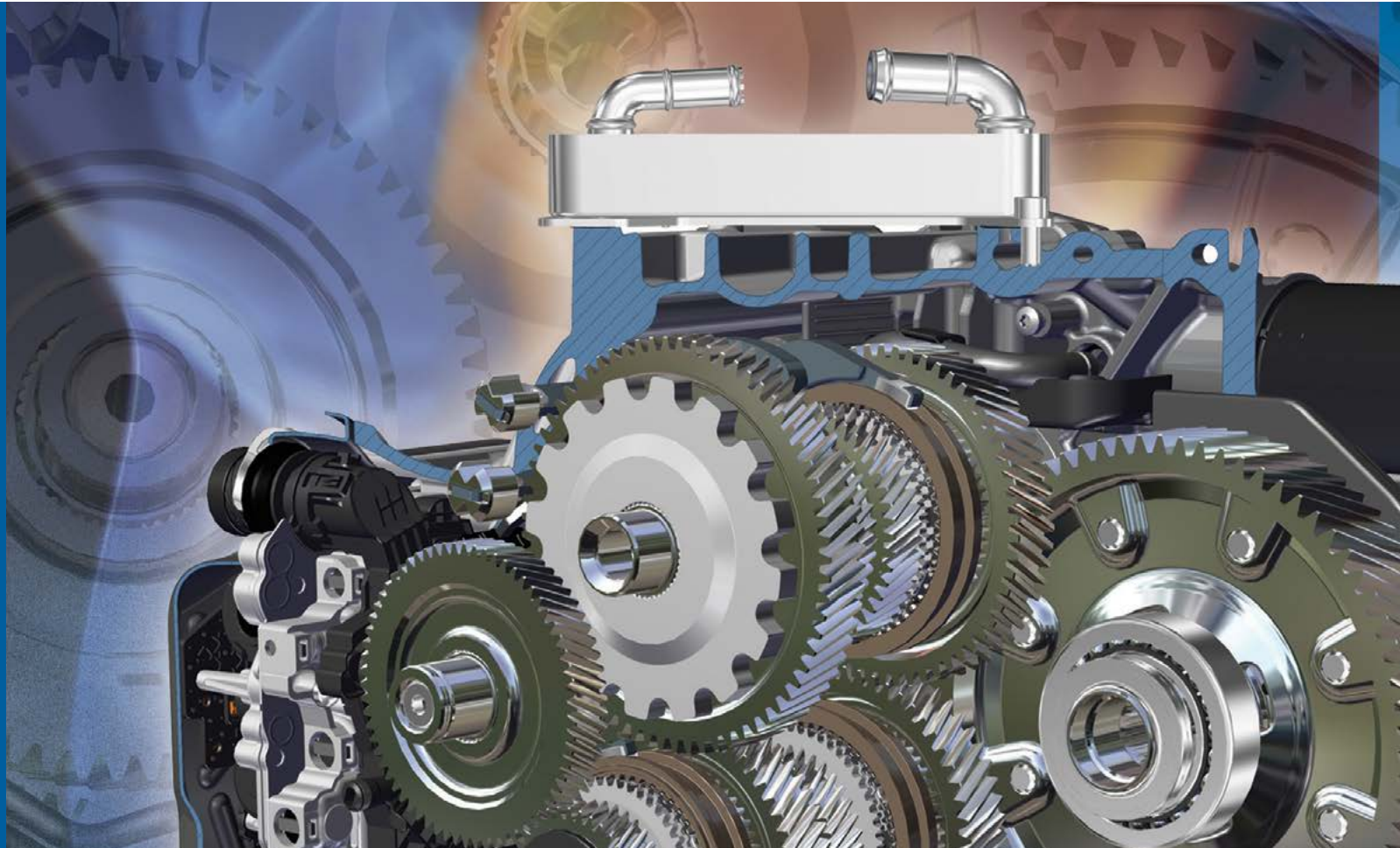
Self Study Program 850183

The 7-speed Dual Clutch Transmission OGC

Design and Function - Tablet Format, Version 1.1



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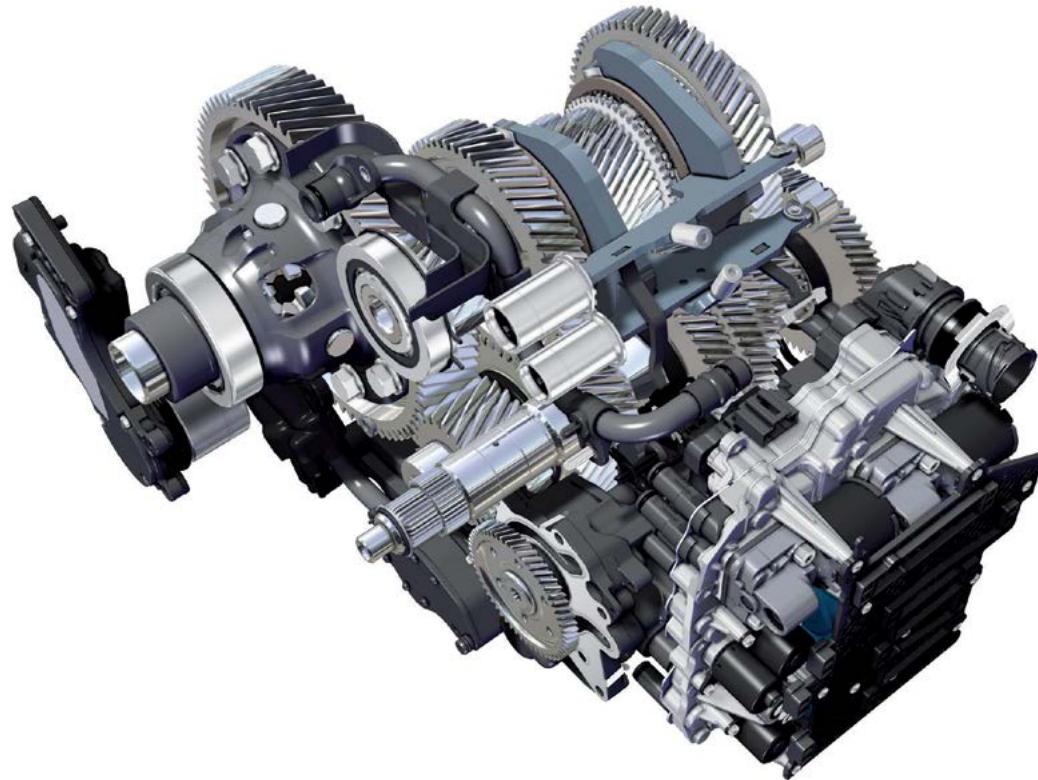
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Introduction

The development story behind the new 7-speed dual clutch transmission OGC:

- The dual clutch transmission 0BT made its debut at Volkswagen Commercial Vehicles with the T5 model year 2010
- The 0BT was used in the 2011 Tiguan with the designation 0BH (not for the North American Region)
- A new transmission production site was set up in China. The 0BH transmission was slightly altered for that factory and was given the designation ODE
- Further developments have allowed fuel consumption and CO2 reduction, increasing efficiency. The result is the dual clutch transmission OGC



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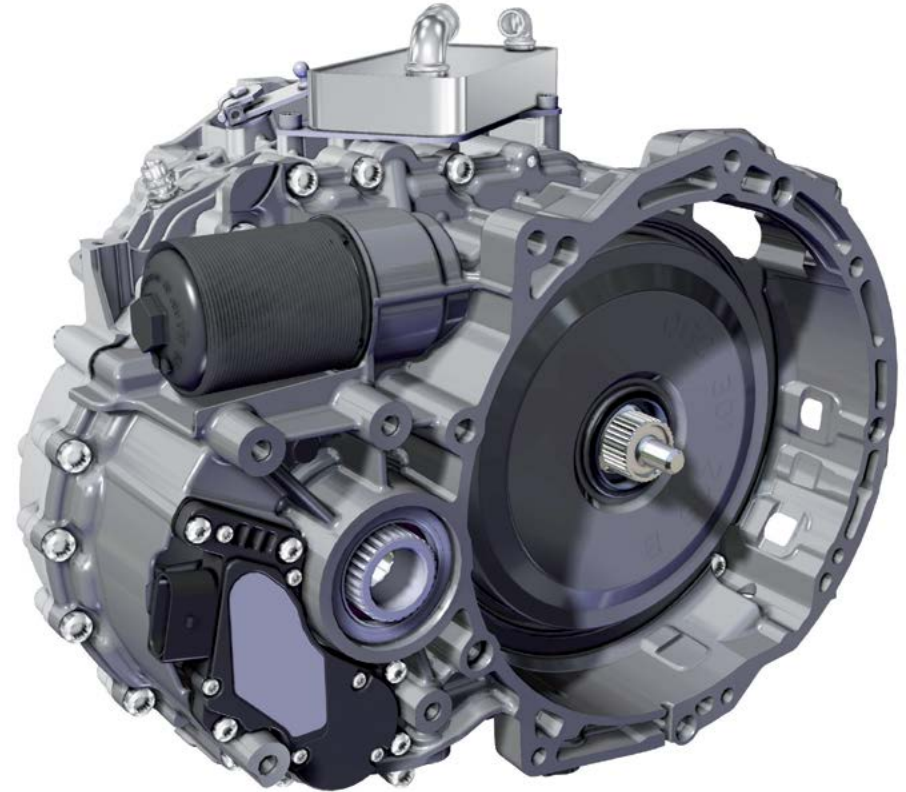
Introduction

The Development Goal for the 7-speed Dual-clutch Transmission OGC

The main priority during the development of the 7-speed dual clutch transmission OGC was CO₂ emission reduction. The following technical modifications have cut CO₂ emissions by 6g/km compared with the dual clutch transmission ODE:

- Low-friction shaft bearings and differential bearings
- Low-friction seals on the shafts
- A new oil pump concept
- A low-leakage hydraulic system
- Low-friction transmission oil

A further 1g/km of CO₂ is saved with the start/stop system. Compared with the dual clutch transmission O2E/OD9, an additional CO₂ reduction of 3g/km is achieved due to the 7th forward gear in the OGC.

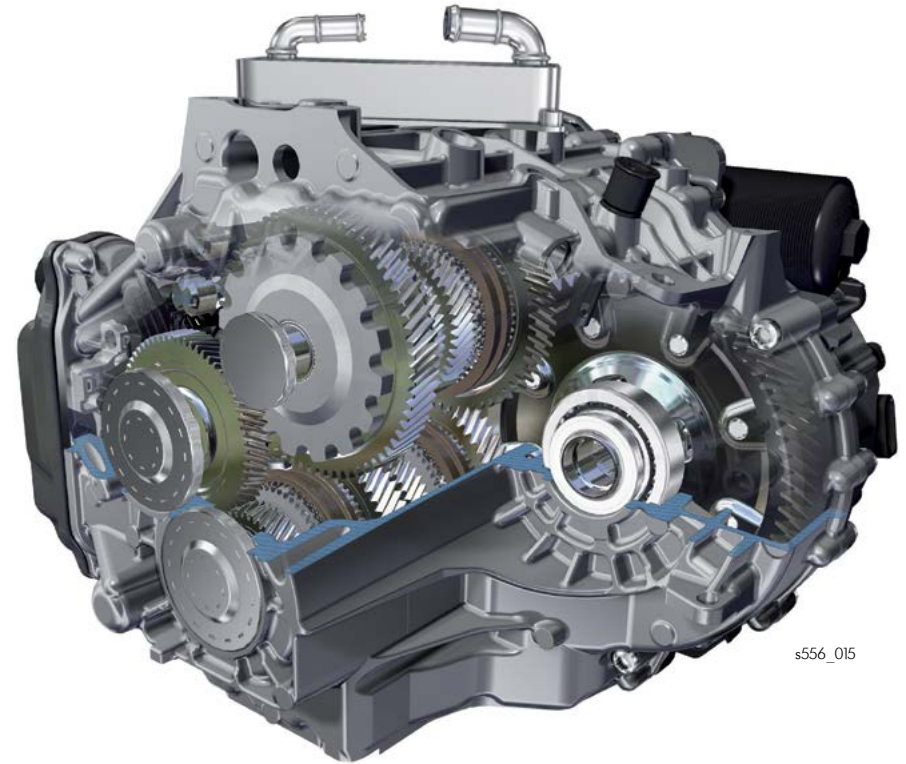


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Introduction

Technical Data

Type of Transmission	Hydraulic dual clutch transmission
Number of Gears	7 forward gears and 1 reverse gear
Number of Drive Shafts	2 concentric drive shafts
Number of Output Shafts	2 output shafts
Number of Clutches	2 wet clutches
Maximum Torque	420Nm (309 lb/ft)
Weight	85kg (+ 2kg auxiliary hydraulic pump)
Number of Hydraulic Pumps	2 hydraulic pumps
Oil Volume	7 liters



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Transmission Design

Transmission Bearings

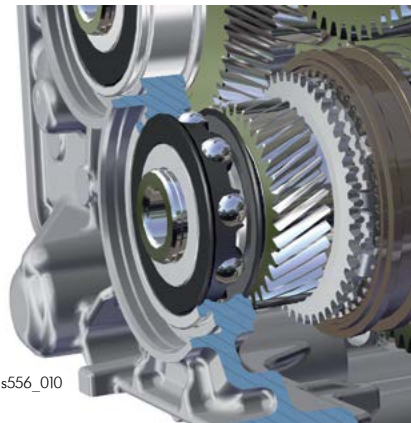
Fixed and floating bearings are used for the output shafts in the dual clutch transmission OGC. The shafts are installed in way that ensures low friction and no preload. Advantages of using fixed and floating bearings:

- Heat expansion of the shaft is not critical
- Changing axial loading is not critical

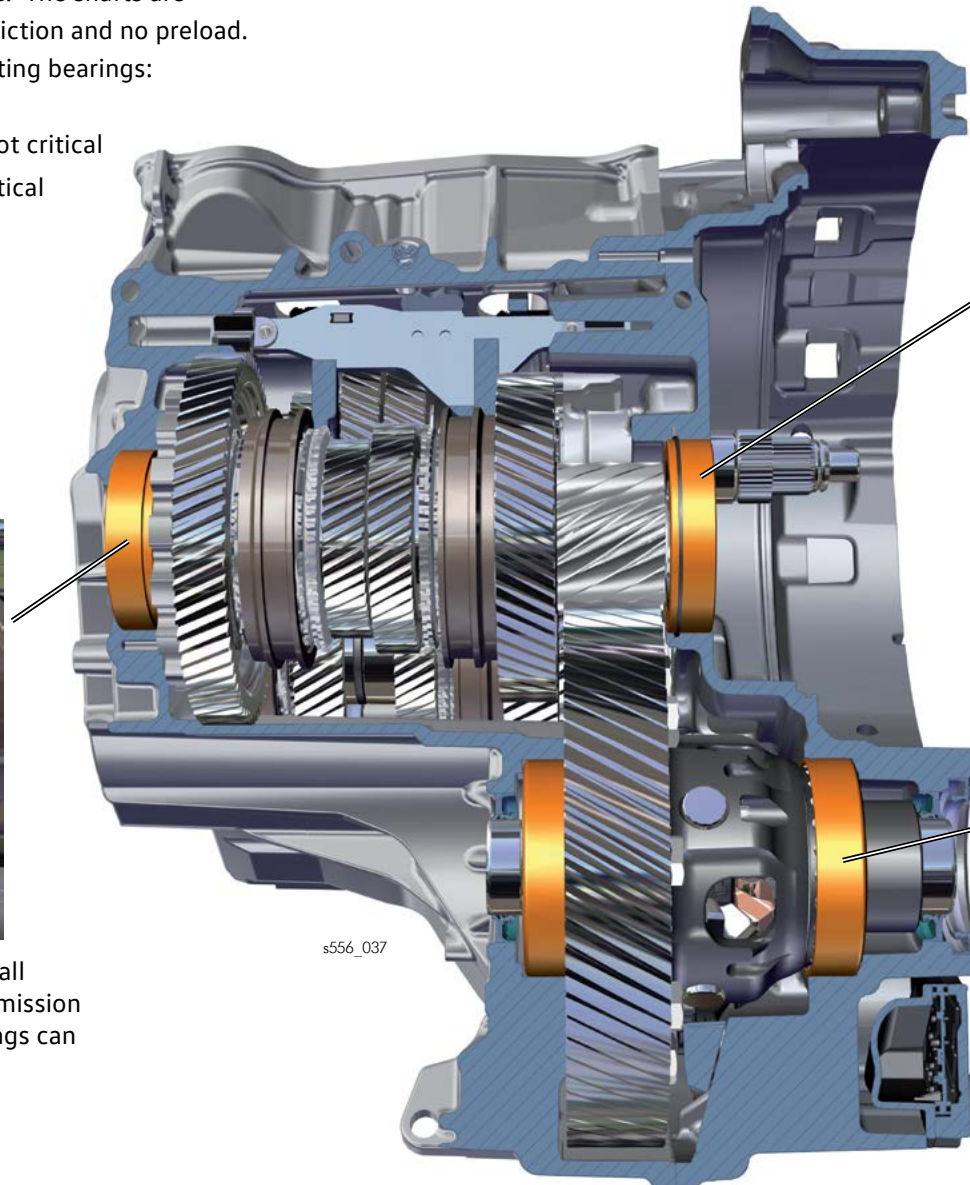


All gears use single synchromesh and are carbon-coated.

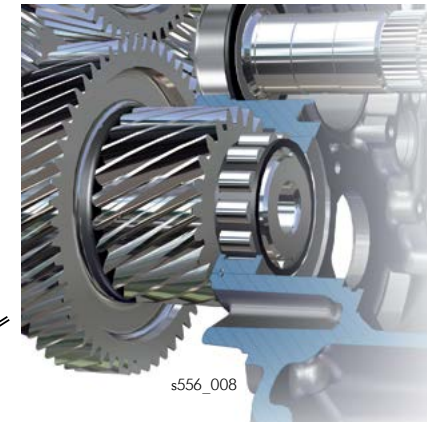
Fixed Bearings



The fixed bearings are deep groove ball bearings and are located in the transmission housing. The deep groove ball bearings can absorb radial and axial forces.



Floating Bearings



The floating bearings are cylindrical roller bearings and are located in the clutch housing. The cylindrical roller bearings can absorb radial forces.

Double Groove Ball Bearings



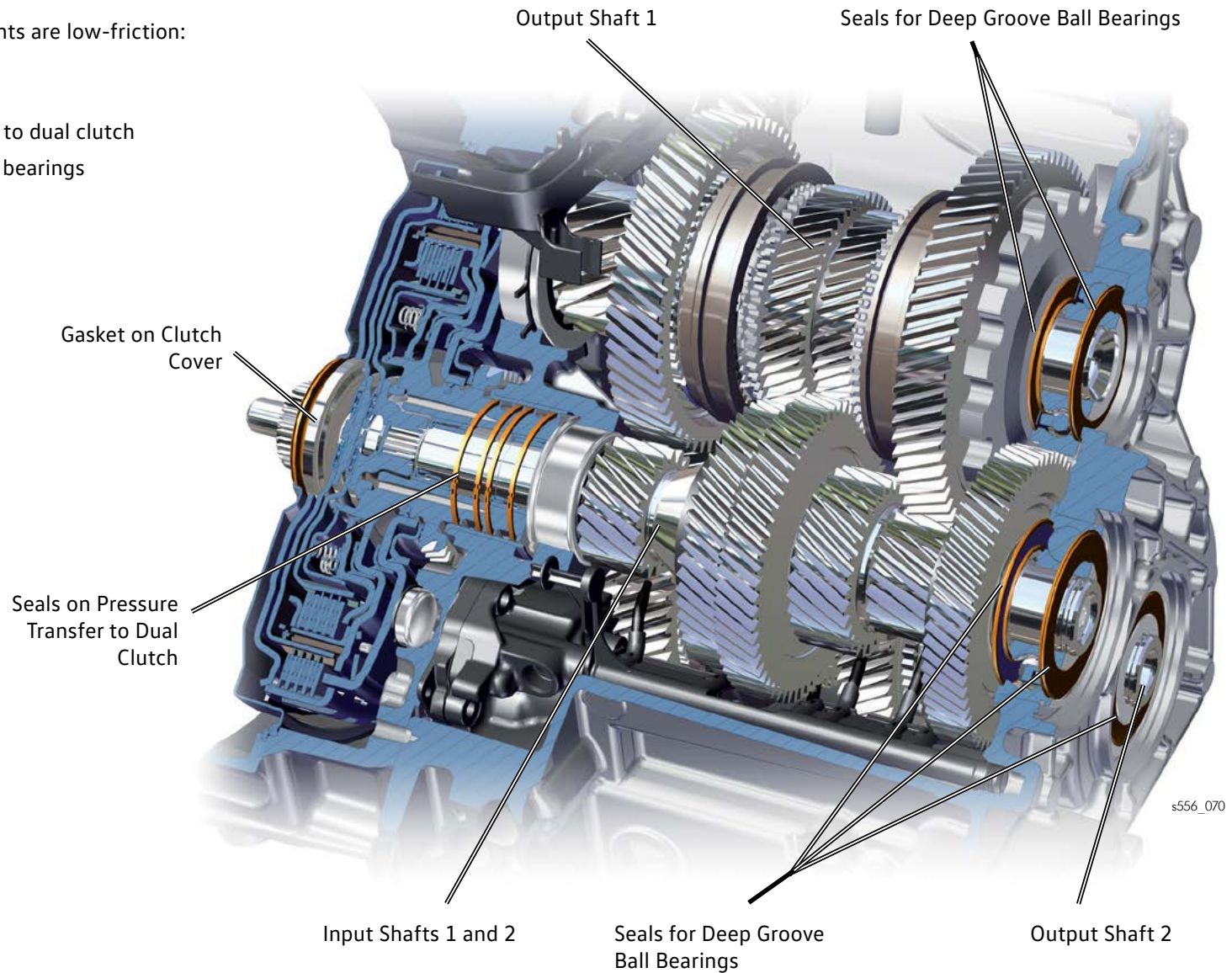
The double groove ball bearings in the differential can absorb radial and axial forces. The small contact surfaces between the balls and the bearing races reduce the rolling resistance.

Transmission Design

Seals

The seals on these components are low-friction:

- Gasket on clutch cover
- Seals on pressure transfer to dual clutch
- Seals for deep groove ball bearings



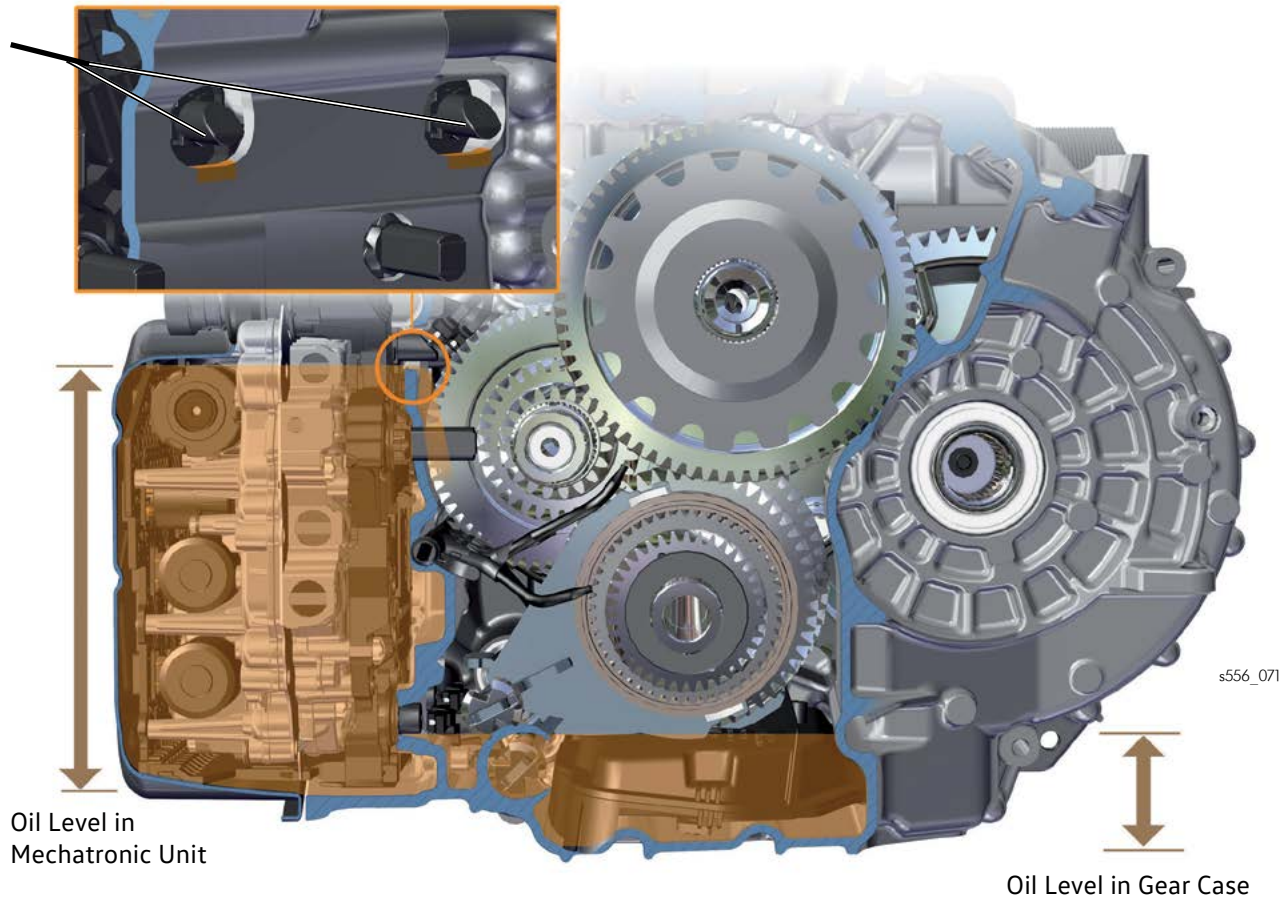
Oil Circuit

Oil Management

Oil Levels

A low-friction gear oil is shared between the gears, the dual clutch and the J743 Dual-Clutch Transmission Mechatronic. The mechatronic unit has its own oil chamber. The oil cools the valve coils and reduces the operating noise. The oil level in the gear case is reduced to a minimum to avoid unnecessary churning/drag losses.

G487 and G489
Gear Position
Distance Sensor 1
and 3



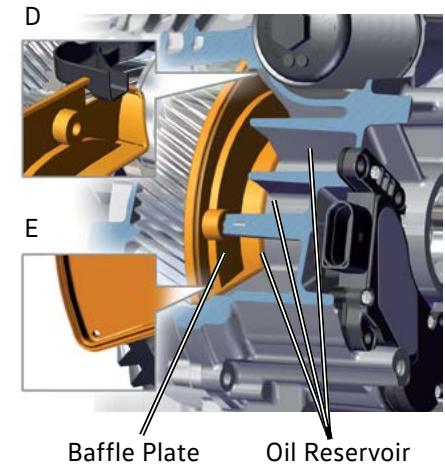
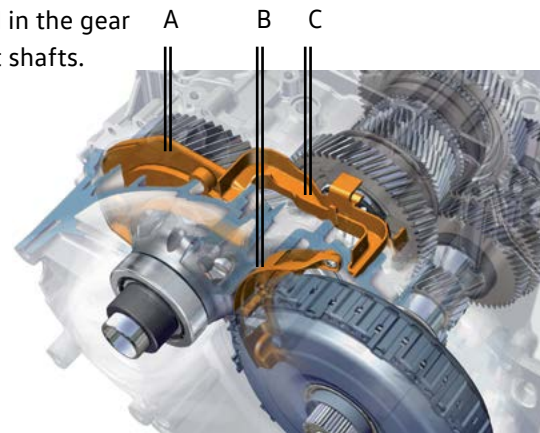
Oil Circuit

Oil Distribution in the Gear Case

The oil is distributed in the gear casing by the following components:

- Baffle plate (A)
- Oil guide with oil pick-ups (B)
- Oil channel (C)

The baffle plate and the oil channel ensure a consistently low oil level in the gear casing. An oil guide ensures lubrication of the bearings on the output shafts.



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Baffle Plate

The baffle plate is located in the transmission on the clutch housing.

Design

The baffle plate is a plastic cover plate with an inlet opening and a drain hole. It is bolted onto the clutch housing creating an oil reservoir.

Task

The baffle plate ensures a low oil level when the vehicle is moving and at higher transmission temperatures. This reduces oil churning by the gear wheels and increases the efficiency. The oil level is increased by the baffle plate being empty when the transmission is cold and the vehicle moves off. This helps the intake of oil by the pumps.

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Function

The oil for the clutches is supplied to the baffle plate via an oil channel. The oil temperature influences the filling quantity in the oil reservoir. If the oil is warm, more oil flows in than can drain out of the drain hole. The oil level in the baffle plate increases, compensating for the expansion of the oil in the gear casing.

Result

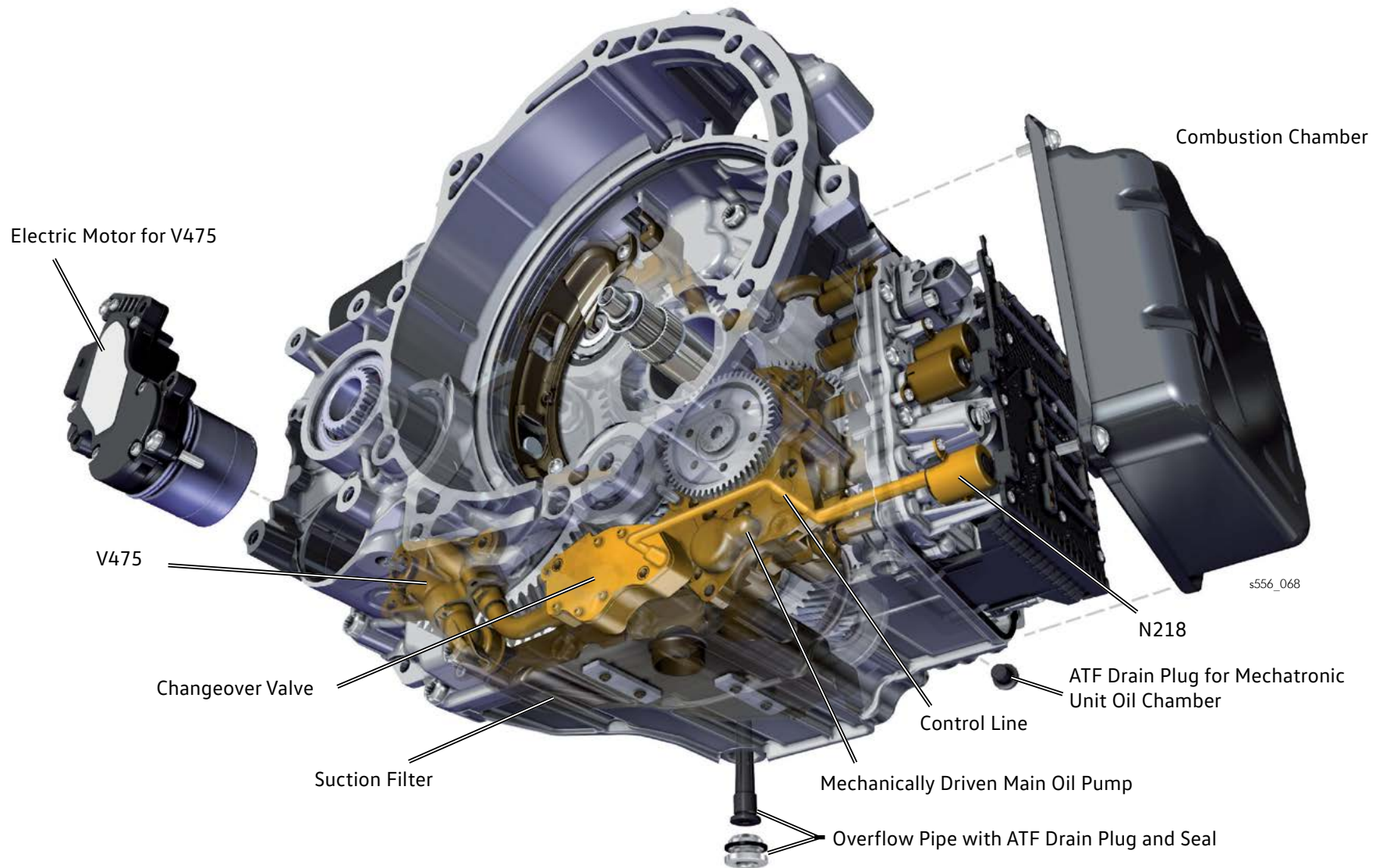
Unnecessary oil churning losses are avoided.

Oil Circuit

Oil Pumps

The 7-speed dual clutch transmission has one mechanically driven hydraulic pump and one electrically driven hydraulic pump. The electrically driven hydraulic pump is the V475 Transmission Fluid Auxiliary Hydraulic Pump 1. It is driven by a brushless direct current motor. There is a changeover valve between the pumps.

The Automatic Transmission Pressure Regulating Valve 4 N218 regulates the position of the piston in the changeover valve via a control line.



Oil Circuit

Mechanically Driven Main Oil Pump

The mechanically driven Main Oil Pump (MOP) is a vane pump. It is driven by gear teeth on the clutch pack.

Task

Supply of low-friction gear oil for:

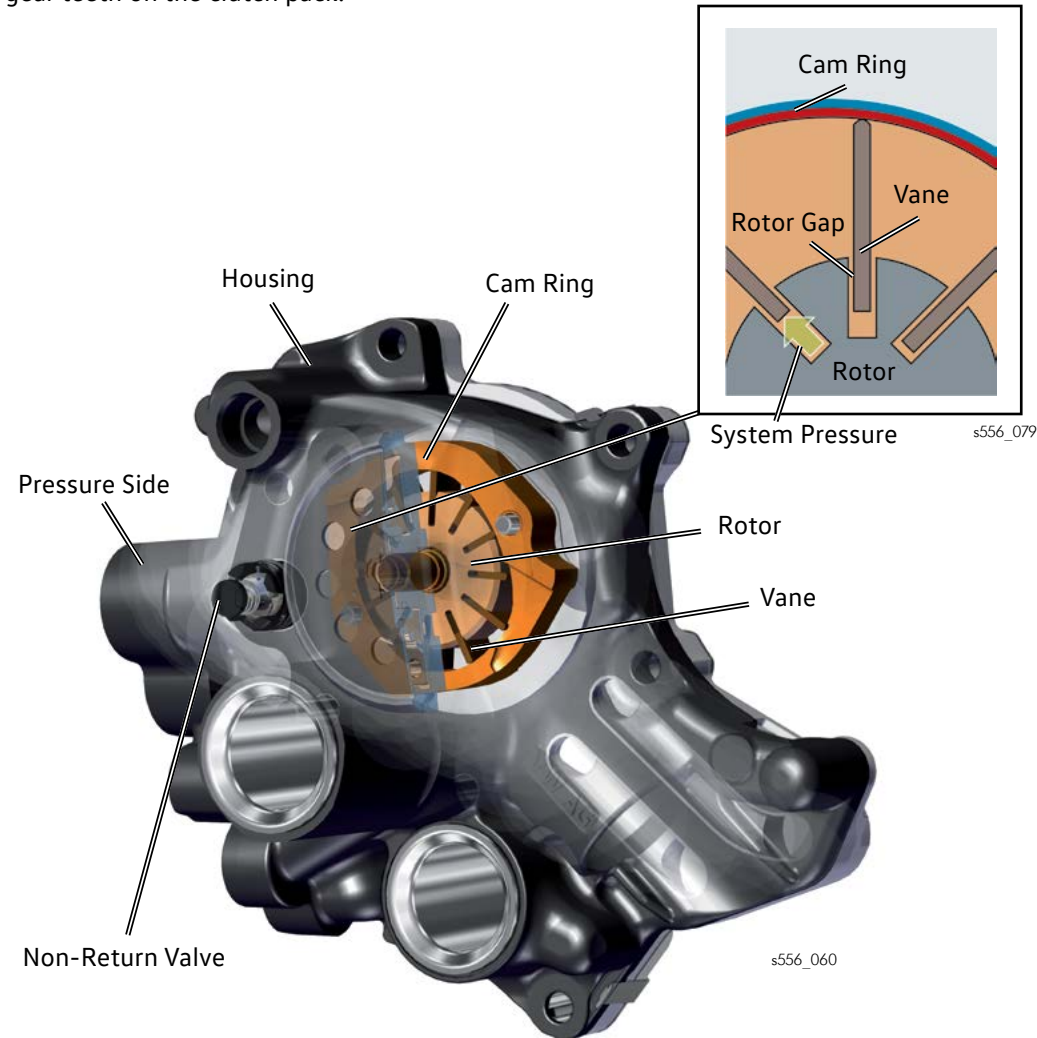
- Oil supply to the mechatronic unit
- Cooling and actuation of the dual clutches
- Cooling and lubrication of shafts and gears

Design

There are movable vanes on the rotor. The vanes create 12 chambers inside a magnetic cam ring. There is a non-return valve in the pump housing.

Function

During pumping operation, the vanes are pressed against the cam ring by the system pressure. The centrifugal forces on the vanes help seal the individual chambers. The chamber sealing is controlled according to the pump load and this optimizes the efficiency of the main oil pump. There is no system pressure when the engine is started. The slightly magnetic cam ring pulls the vanes outwards and improves the pump start-up and pressure build-up. The delivery rate per revolution is 8 cubic centimeters.

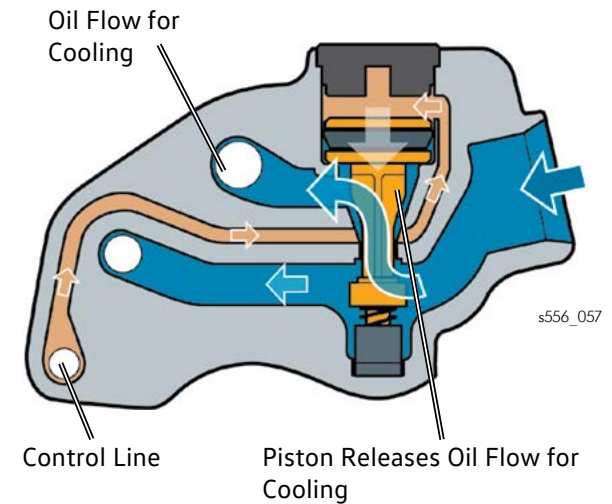
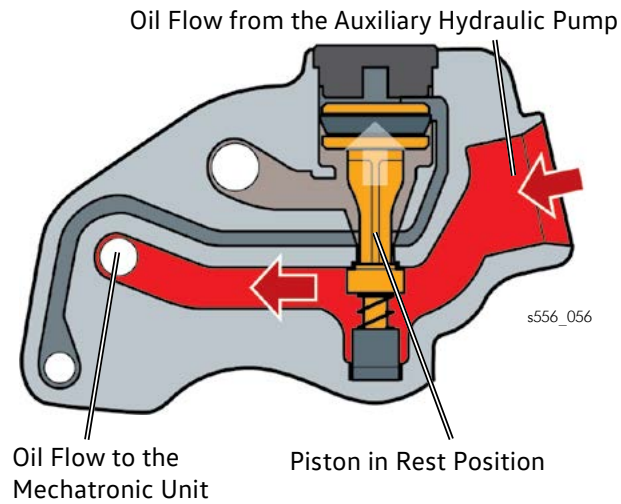
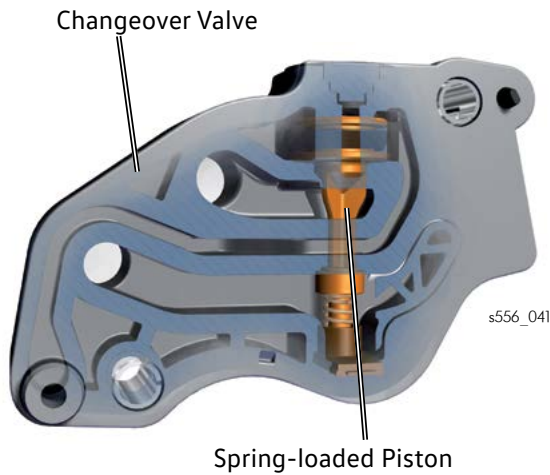


Oil Circuit

Changeover Valve

The changeover valve is located between the main oil pump and V475 Transmission Fluid Auxiliary Hydraulic Pump 1.

Task	Design	Function
The changeover valve distributes the oil flow from the auxiliary hydraulic pump.	There is a spring-loaded piston in the changeover valve.	When the piston is in the rest position, the oil flow is used to supply the mechatronic unit.



If oil is forced against the piston via the control line, the oil flow is directed to cool the clutches. The non-return valve in the main oil pump prevents oil flowing to the pressure supply.

Oil Circuit

Transmission Fluid Auxiliary Hydraulic Pump 1 V475

The Transmission Fluid Auxiliary Hydraulic Pump 1 V475 is an annular gear pump (duocentric pump). It is activated on-demand and driven by an electric motor.

Task

The auxiliary hydraulic pump supports the mechanically driven main oil pump with the pressure supply and with cooling, during the following conditions:

- When there is a high load requirement in the low rev range
- In stop-and-go traffic
- In start/stop mode
- During idling drag

Design

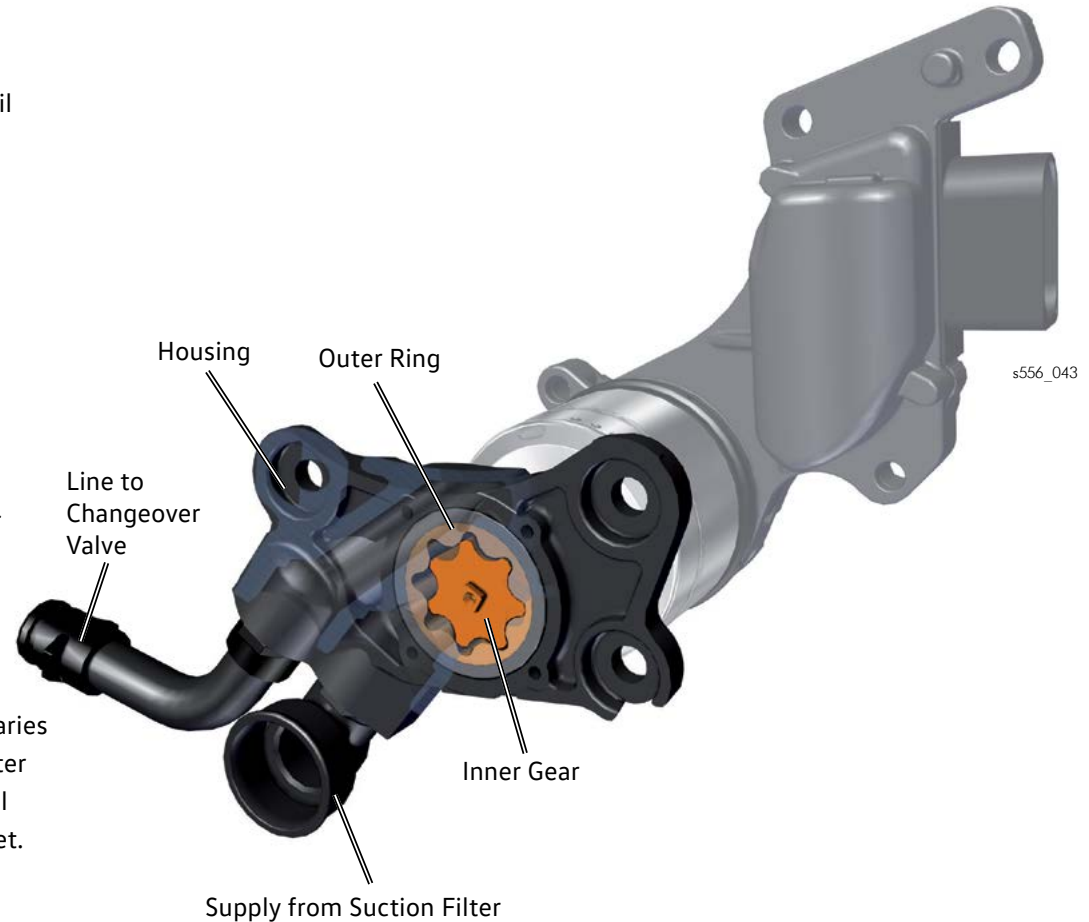
The outer ring has one more tooth than the inner gear. The inner gear and outer ring have different centering points.

Function

The outer ring and the inner gear rotate in one direction. The cavity varies during rotation due to the offset centering of the inner gear to the outer ring. When the cavity becomes larger past the suction opening, the oil is drawn in. The cavity is reduced as the pump turns towards the outlet. The oil is pushed out of the pump at the outlet and is delivered to the changeover valve.

Technical data

Delivery rate: approx. 3 cubic centimeters per revolution



Oil Circuit

Transmission Fluid Auxiliary Hydraulic Pump 1 V475

This electric motor is bolted to the outside of the clutch housing. It can be replaced without opening the Transmission.

Task

The motor drives the auxiliary hydraulic pump.

Design

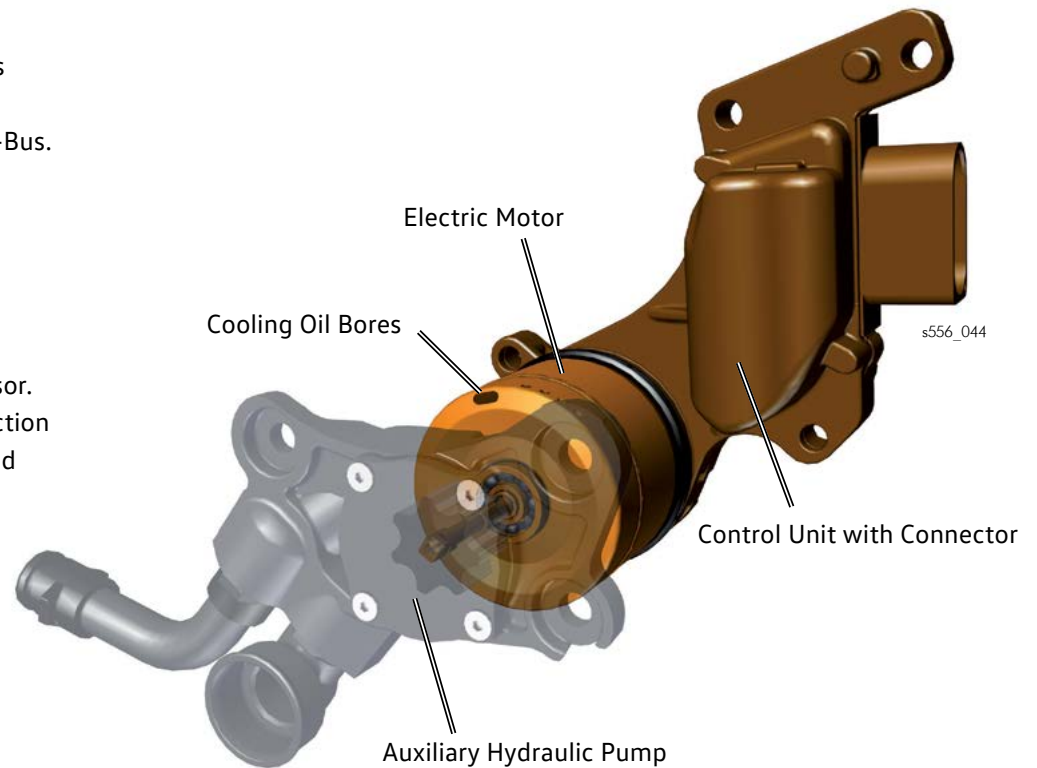
The motor is a brushless direct-current motor with control electronics and a position sensor on the rotor. There are cooling oil bores in the motor housing. This component is connected to the Powertrain CAN-Bus.

Function

The speed demand signal is sent from the Powertrain CAN-Bus to the Mechatronic unit, then on to the motor. The motor control module activates the motor and measures speed using the rotor position sensor. Among other things, this allows for motor seizure detection. Low-friction gear oil flows through the bores in the motor housing to the inside and cools the motor.

Technical data

Max. speed:	4,000rpm
Control range:	from 100 to 4,000rpm
Start-up time:	50 ms



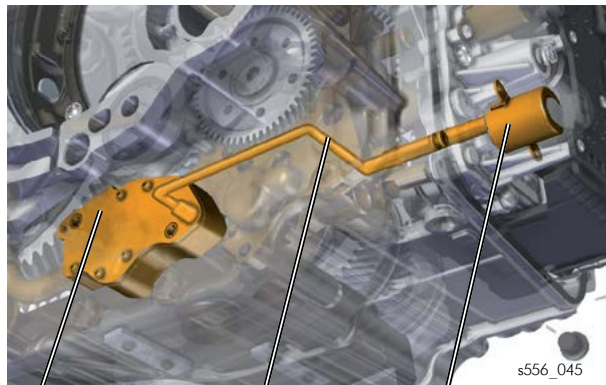
Oil Circuit

Interaction of Hydraulic Pumps

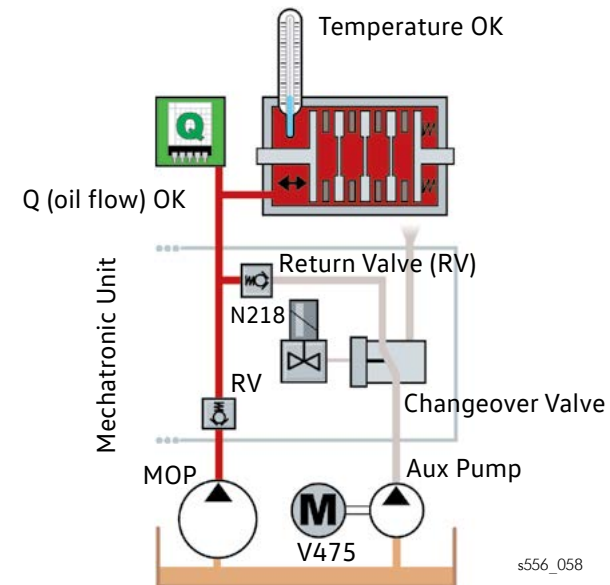
While driving, the mechatronic unit recognizes the oil demand for different driving situations. It regulates the interaction of the pumps so that sufficient oil is always available. The four operating states are:

- Oil supplied by the mechanically driven main oil pump
- Support of the oil supply by the auxiliary hydraulic pump
- The cooling function of the auxiliary hydraulic pump
- Activation of the auxiliary hydraulic pump in start/stop mode

The mechatronic unit controls the changeover valve with the Automatic Transmission Pressure Regulating Valve 4 N218. The position of the piston in the changeover valve is varied using the control line.



Changeover Valve Control Line N218



Oil Supply from the Mechanically Driven Main Oil Pump

The mechanically driven Main Oil Pump (MOP) delivers the oil flow (Q) for the mechatronic unit.



The following applies to all regulating modes: The oil supply to the clutches and gear actuators always takes priority over the cooling of the clutches and the gears.

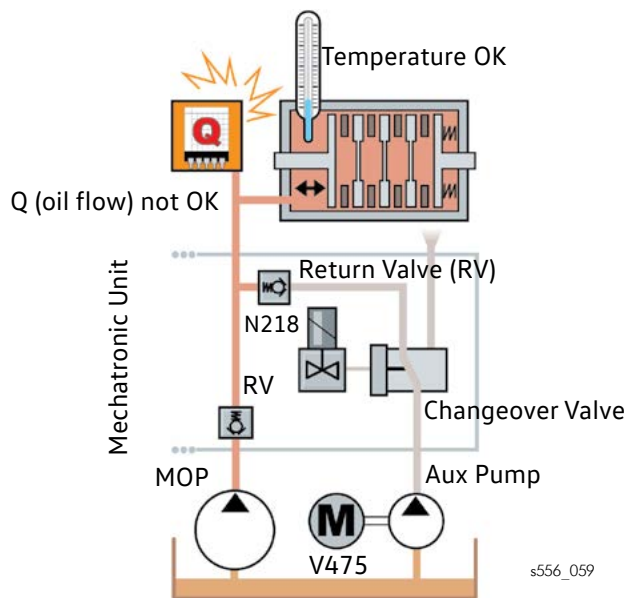
Oil Circuit

Support of the Oil Supply by the Auxiliary Hydraulic Pump

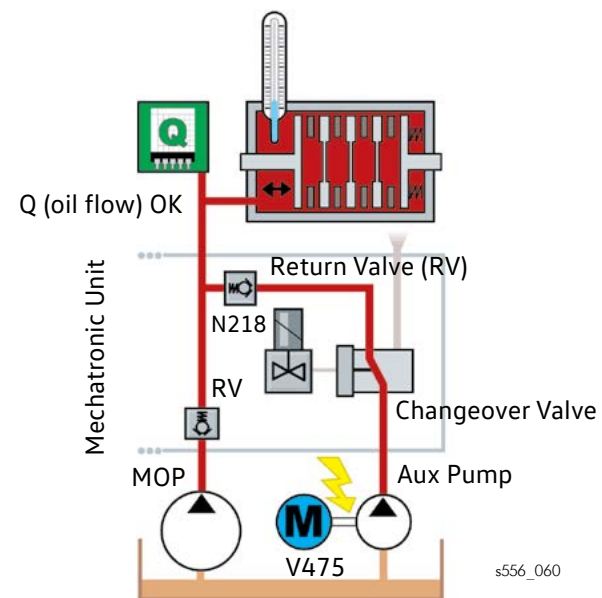
The auxiliary hydraulic pump is activated when the mechanically driven main oil pump (MOP) is not delivering enough oil. This can occur in the following driving situations:

- When there is a high load requirement in the low rev range
- In stop-and-go traffic
- In start/stop mode

The additionally delivered oil flow passes through the changeover valve (CV) to the non-return valve (RV). The non-return valve is lifted and the oil flow from both pumps is used to supply oil.



The mechatronic unit detects when the oil flow rate through the mechanically driven main oil pump is too low.

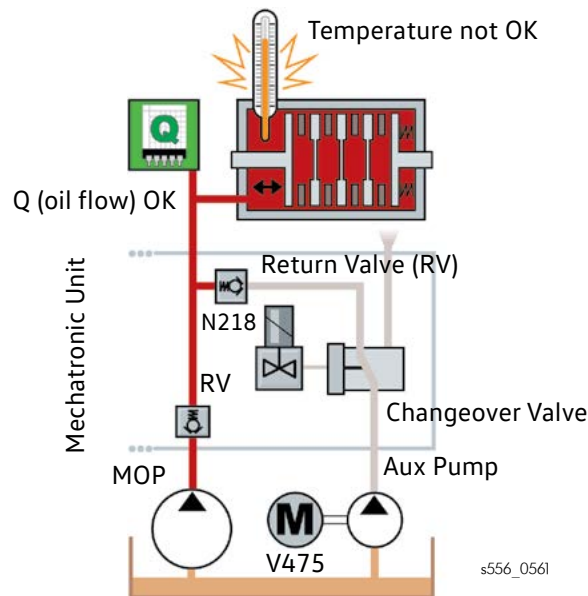


The motor drives the auxiliary hydraulic pump. The oil supply is safeguarded together with the mechanical main oil pump.

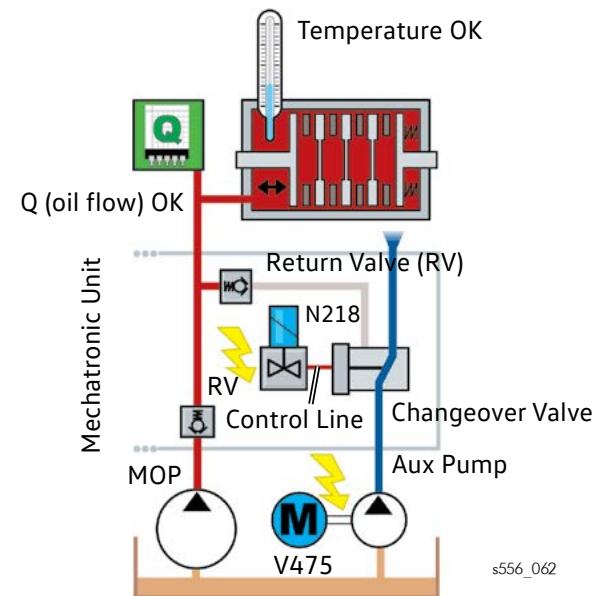
Oil Circuit

Cooling Function of the Auxiliary Hydraulic Pump

If, at low engine speeds, the mechatronic unit calculates a high temperature at the clutches, it will activate the Auxiliary Hydraulic Pump (AP) and Automatic Transmission Pressure Regulating Valve 4 N218. The Changeover Valve is operated by the control line. The oil delivered by the auxiliary hydraulic pump now cools the clutches.



The mechatronic unit calculates a temperature that is too high at the clutches (T not OK).

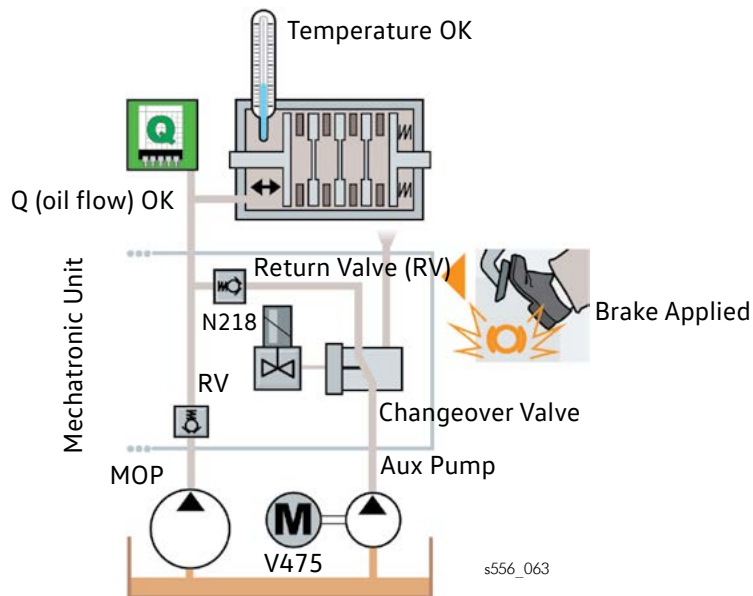


Activating the auxiliary hydraulic pump (AP) and the N218 ensures additional cooling of the clutches (T OK).

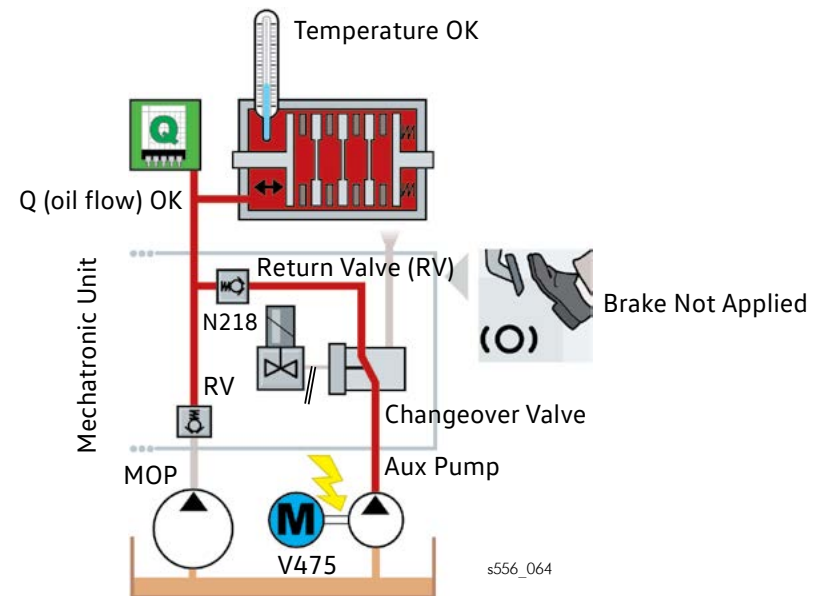
Oil Circuit

Activation of the Auxiliary Hydraulic Pump in Start/Stop Mode

If, at low engine speeds, the mechatronic unit calculates a high temperature at the clutches, it will activate the auxiliary hydraulic pump and the Automatic Transmission Pressure Regulating Valve 4 N218. The changeover valve is operated by the control line. The oil delivered by the auxiliary hydraulic pump now cools the clutches.



No oil is pumped when the combustion engine is switched off.



When the driver releases the brake, the auxiliary hydraulic pump (AP) is activated during the starting procedure.

Mechatronic Unit

Overview of Mechatronic Unit

The following illustrations show the design of the mechatronic unit with the sensors and actuators.

Sensors

Key

- G487 Gear Position Distance Sensor 1
- G488 Gear Position Distance Sensor 2
- G489 Gear Position Distance Sensor 3
- G490 Gear Position Distance Sensor 4
- G612 Transmission Input Speed Sensor 2 (drive shaft 2)
- G632 Transmission Input Speed Sensor 1 (drive shaft 1)

The following two sensors have been integrated into the mechatronic unit and are not visible from the outside:

- G545 Hydraulic Pressure Sensor 1
(measures the actuation pressure on clutch K1)
- G546 Hydraulic Pressure Sensor 2
(measures the actuation pressure on clutch K2)



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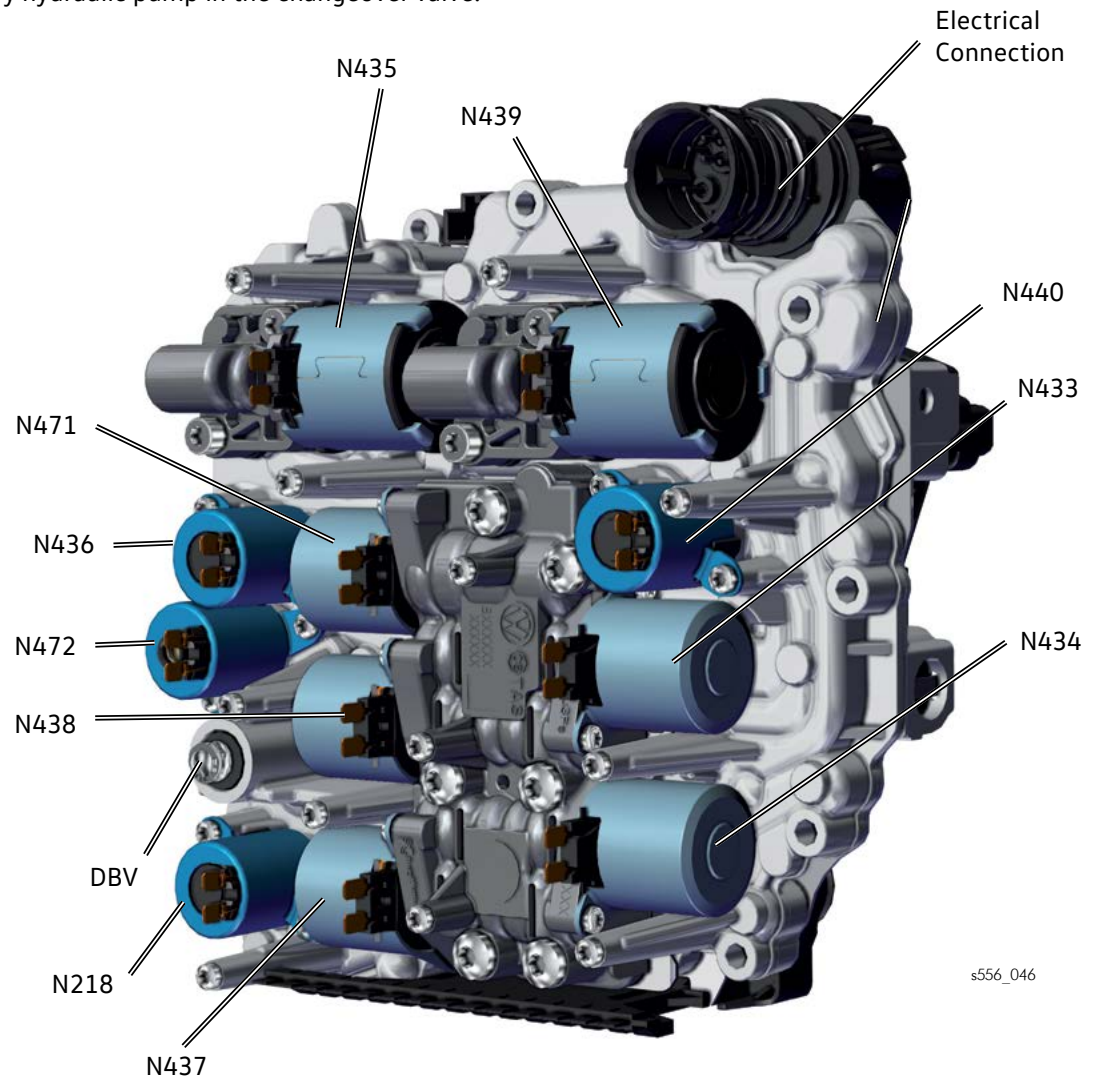
Mechatronic Unit

Actuators

The Sub-transmission Valves N436, N440 and N472 are pilot valves. They regulate the position of a downstream modulating piston. The Pressure Regulating Valve N218 influences the direction of the oil flow from the auxiliary hydraulic pump in the changeover valve.

Key

- N218 Automatic Transmission Pressure Regulating Valve 4
(actuates the changeover valve)
- N433 Sub-transmission 1 Valve 1
(operates the gear actuator for gears 1 and 5)
- N434 Sub-transmission 1 Valve 2
(operates the gear actuator for gears 3 and 7)
- N435 Sub-transmission 1 Valve 3 (actuates clutch K1)
- N436 Sub-transmission 1 Valve 4 (safety valve 1)
- N437 Sub-transmission 2 Valve 1
(operates the gear actuator for gears 2 and 6)
- N438 Sub-transmission 2 Valve 2
(operates the gear actuator for gears 4 and R)
- N439 Sub-transmission 2 Valve 3 (actuates clutch K2)
- N440 Sub-transmission 2 Valve 4 (safety valve 2)
- N471 Cooling Oil Valve
(regulates the flow rate for cooling oil requirements)
- N472 Main Pressure Valve (regulates the working pressure)
- DBV Pressure Relief Valve



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Mechatronic Unit

Low-leakage Valve Control

The low-leakage valve control is a combination of a 3/3-way proportional valve (pilot valve) with a downstream modulating piston. When no current is supplied to the pilot valve, the modulating piston opens the return for sub-Transmission 1 (SG1).

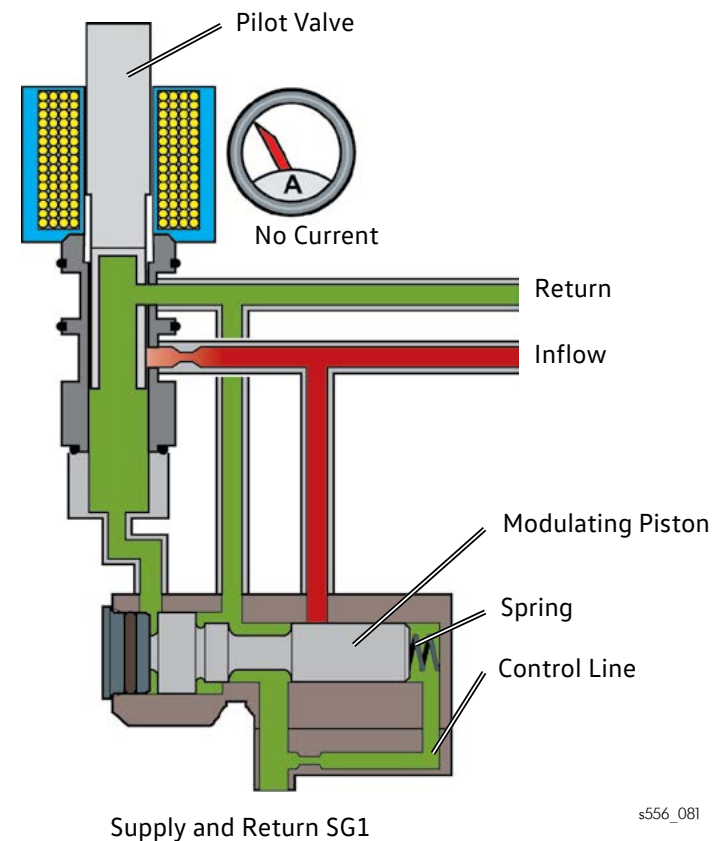
This configuration allows for the working pressure to be regulated by low pressure.

Advantages:

- The solenoid in the 3/3-way proportional valve is small, requiring only a low control pressure to operate the modulating piston. This saves space and weight
- The solenoid has a low power consumption

Further Explanation:

The term oil pressure (control pressure) is used in a closed hydraulic system. If a valve (gear actuator valve) opens the hydraulic system, the term oil flow rate is used. The delivered oil flow rate maintains the oil pressure in the opened system.



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Mechatronic Unit

Pilot Valve (Sub-transmission 1 Valve 4 N436)

Task

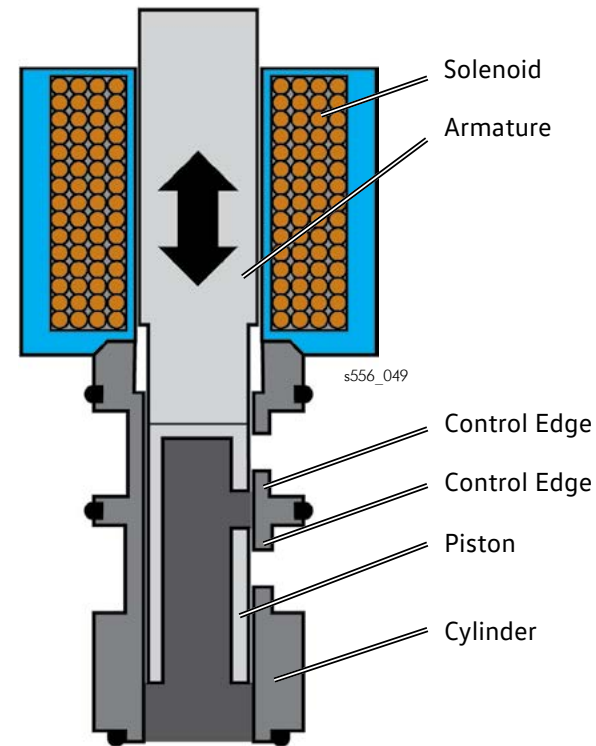
The pilot valve regulates the position of the modulating piston.

Design

The pilot valve contains a solenoid, an armature and a piston.

Function

A magnetic field is created when the solenoid is energized. This moves the armature with the piston up and down inside a cylinder. The position of the piston is set by means of an equilibrium of forces between the strength of the magnetic field and the pressure applied to the modulating piston. The control edges on the cylinder modulate the control pressure acting on the modulating piston.



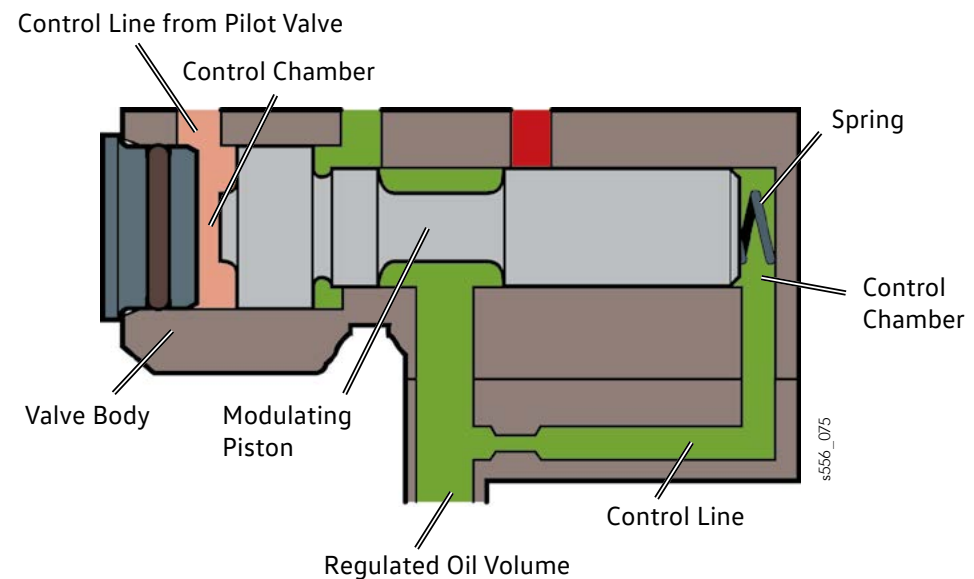
Modulating Piston (SV1)

Task

The modulating piston supplies the gear and clutch actuators in sub-transmission 1 with low-friction gear oil.

Design

The spring-loaded modulating piston is located in the valve body of the mechatronic unit. The modulating piston is located between two control chambers.

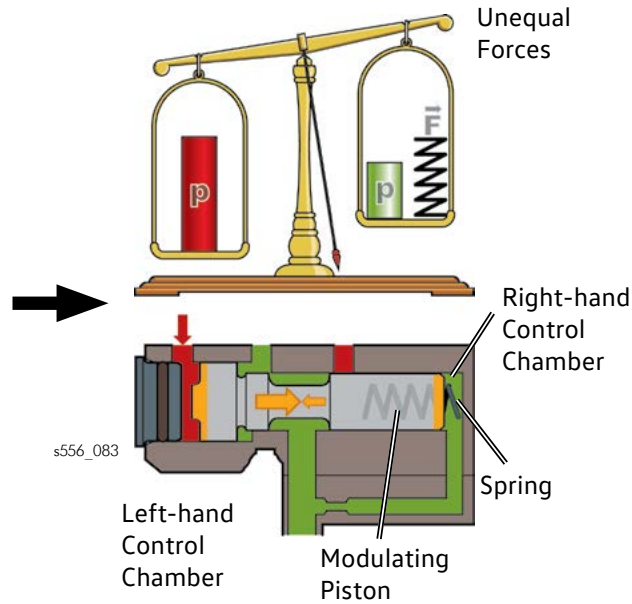


Mechatronic Unit

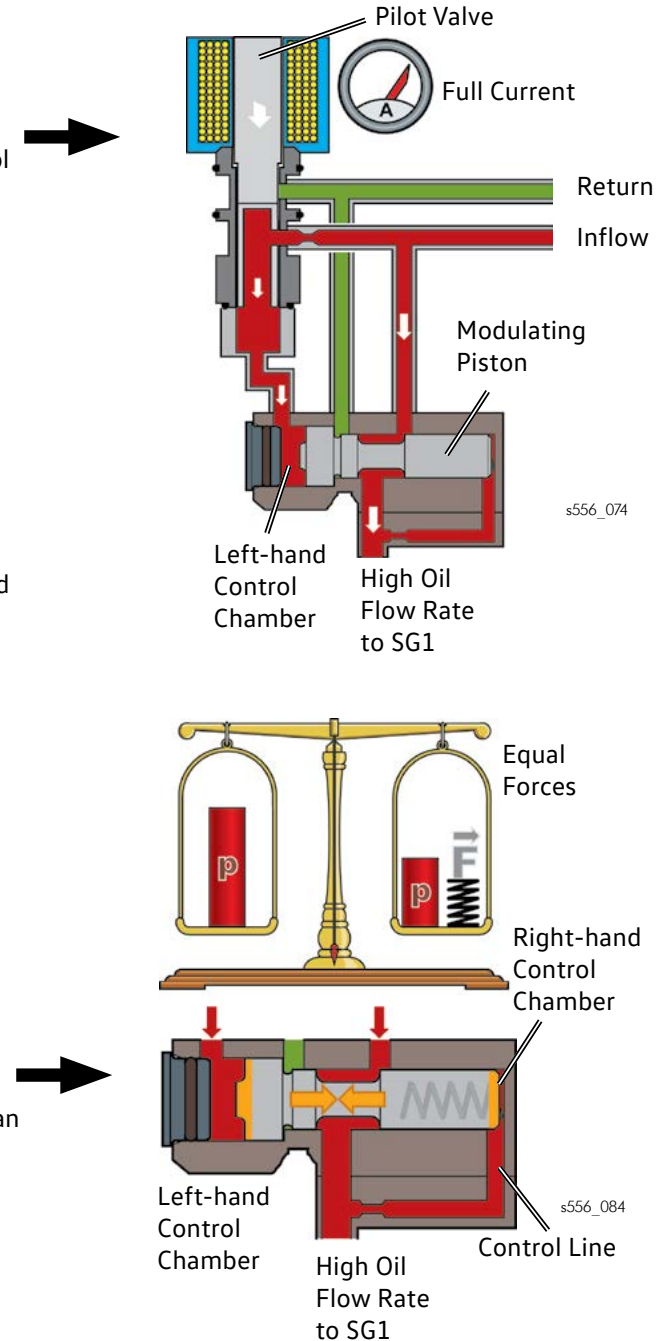
Function

When a stronger current is supplied to the solenoid, the armature moves downward with the piston. The supply is opened by the restrictor and the control pressure passes from the pilot valve to the left-hand control chamber of the modulating piston.

The modulating piston is pushed against the spring because a lack of equilibrium between the left-hand control chamber and the right-hand control chamber.



The regulated oil flow reaches sub-Transmission 1 (SG1) through the open modulating piston. At the same time, part of the oil flows through the control line to the right-hand control chamber. Together with the spring, the oil pushes the modulating piston against the control pressure from the pilot valve. It establishes an equilibrium of forces.



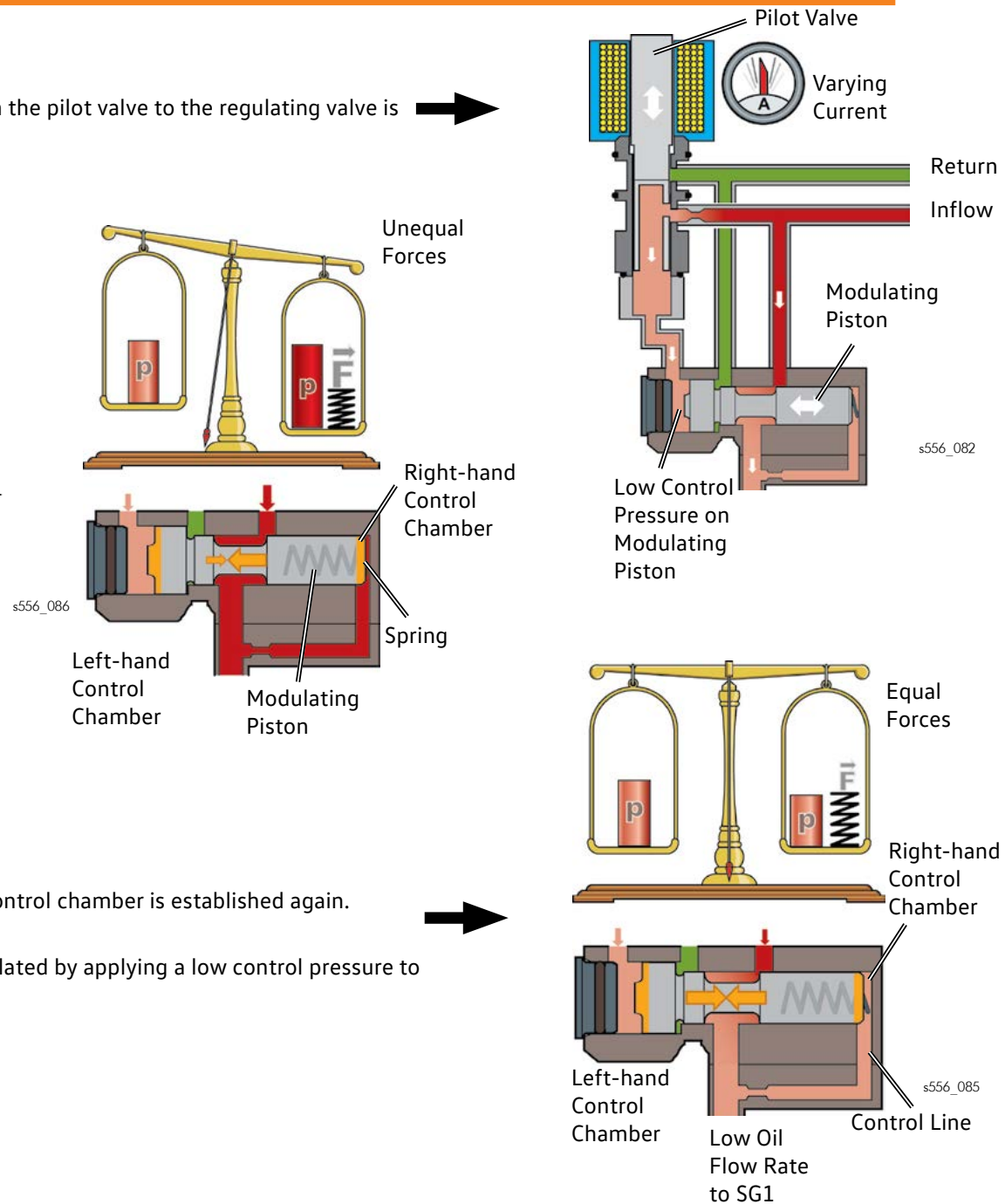
Mechatronic Unit

If the current to the solenoid is reduced, the control pressure from the pilot valve to the regulating valve is also reduced.

The modulating piston will be moved to the left by the spring, reducing the oil flow to sub-transmission 1. At the same time, less oil flows to the right-hand control chamber.

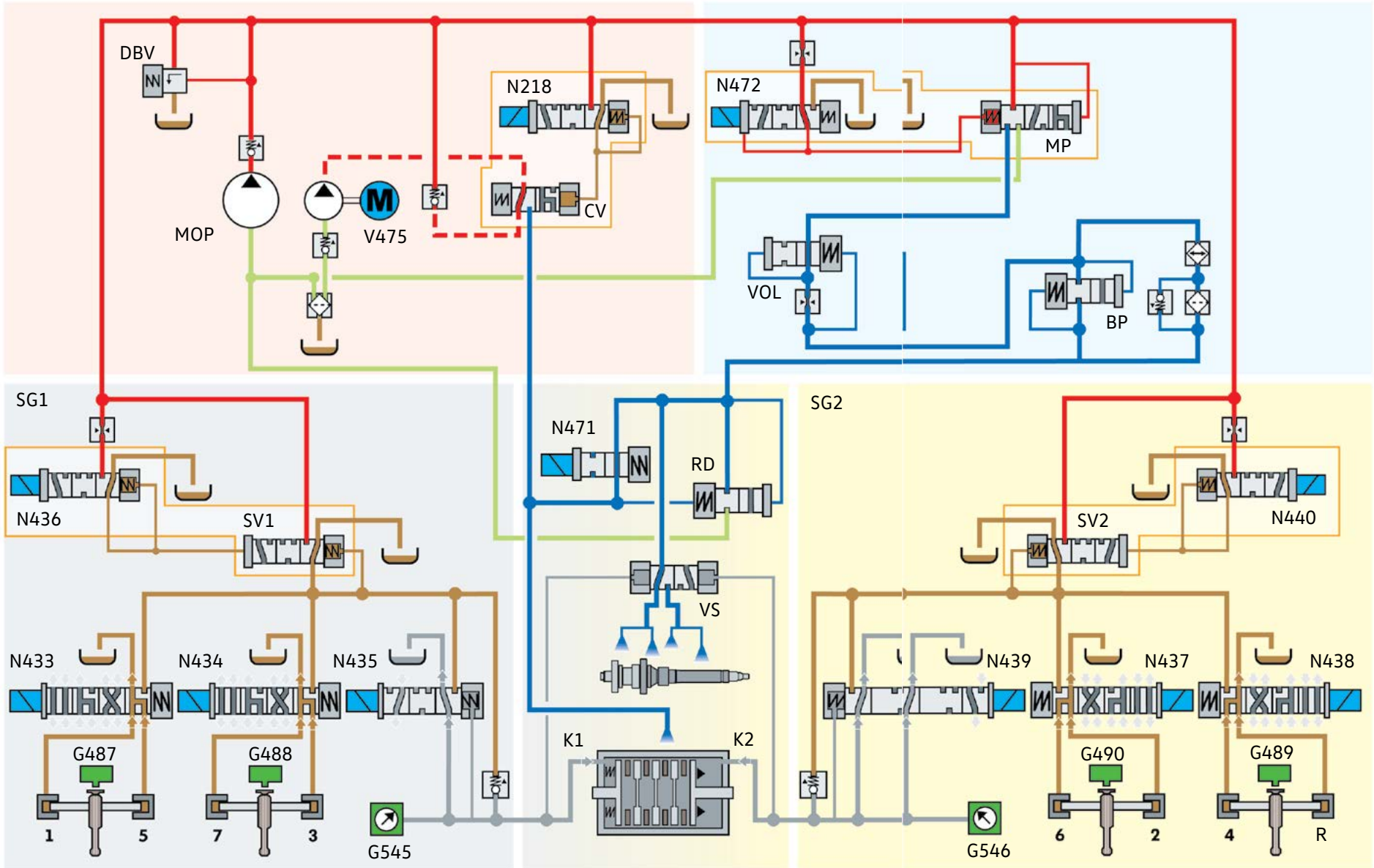
An equilibrium of forces between the left-hand and right-hand control chamber is established again.

The oil flow rate to sub-transmission 1 (working pressure) is regulated by applying a low control pressure to the modulating piston (low pressure) because of this.



Mechatronic Unit





Hydraulics Diagram



Mechatronic Unit

Hydraulics Diagram Legend

- G487 Gear Position Distance Sensor 1
- G488 Gear Position Distance Sensor 2
- G489 Gear Position Distance Sensor 3
- G490 Gear Position Distance Sensor 4
- G545 Hydraulic Pressure Sensor 1
(measures the actuation pressure on clutch K1)
- G546 Hydraulic Pressure Sensor 2
(measures the actuation pressure on clutch K2)
- N218 Automatic Transmission Pressure Regulating Valve 4 (actuates the changeover valve)
- N433 Sub-transmission 1 Valve 1
(operates the gear actuator for gears 1 and 5)
- N434 Sub-transmission 1 Valve 2
(operates the gear actuator for gears 3 and 7)
- N435 Sub-transmission 1 Valve 3 (actuates clutch K1)
- N436 Sub-transmission 1 Valve 4 (safety valve 1)
- N437 Sub-transmission 2 Valve 1
(operates the gear actuator for gears 2 and 6)
- N438 Sub-transmission 2 Valve 2
(operates the gear actuator for gears 4 and R)
- N439 Sub-transmission 2 Valve 3 (actuates clutch K2)
- N440 Sub-transmission 2 Valve 4 (safety valve 2)
- N471 Cooling Oil Valve (regulates the flow rate for cooling oil requirements)
- N472 Main Pressure Valve (regulates the working pressure)
- V475 Transmission Fluid Auxiliary Hydraulic Pump 1
- BP Bypass Valve
- CV Changeover Valve
- DBV Pressure Relief Valve
- K1 Clutch 1
- K2 Clutch 2
- MOP Main Oil Pump
- MP Main Pressure Valve
- RD Residual Pressure Valve (regulates the cooling oil pressure to 3 bar)
- SG1 Sub-transmission 1
- SG2 Sub-transmission 2
- SV1 Safety Valve 1
- SV2 Safety Valve 2
- VOL Volume Regulating Valve
- VS Valve, Spray Pipe

-  Working Pressure Circuit
-  Cooling Circuit
-  Return
-  Return

Service

Maintenance

The DSG oil must be changed at the maintenance intervals specified in ELSAPro. The drain plug is located at the rear of the gear case. There is no need to change the oil filter. The filter has been designed for lifetime use.

The following general steps should be performed when changing the oil:

- Oil temperature of 35°C–45°C
- Turn OFF the engine
- Set the selector lever to the "P" position
- Wait 4–5 minutes before draining



The reason for the waiting time is:
The oil in the baffle plate needs time to drain into the gear case.
You will find exact details on the oil change in the repair manual.

* Always verify the correct procedure in ElsaPro! ElsaPro has the latest information in case procedures change.

Information about Towing

If a vehicle with the OGC transmission has to be towed, the usual restrictions for automatic transmissions need to be observed:

- Turn ON ignition
- Activate the manual release mechanism for the parking lock
- Move the selector lever to the "N" position
- The maximum towing speed is 50km/h
- The maximum towing distance is 50km
- If you tow the vehicle with a raised axle, then only raise the front axle.

Reason

If the engine is not running, the oil pump will not be driven and certain parts in the transmission will not be lubricated. If you do not observe the towing requirements, serious transmission damage may result.



Please observe the further descriptions and information on the topic of towing in the owner's manual.

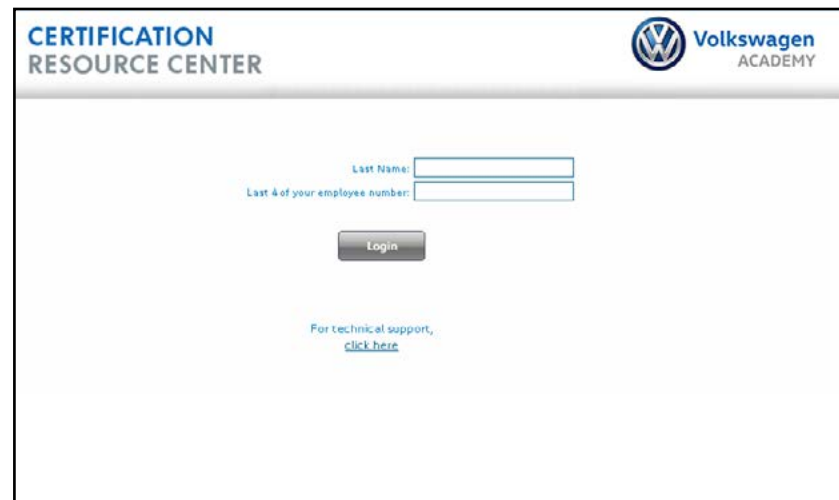
Knowledge Assessment

An on-line Knowledge Assessment (exam) is available for this Self-Study Program. The Knowledge Assessment may or may not be required for Certification.

You can find this Knowledge Assessment at: **www.vwwebservice.com**

For Assistance, please call: **Volkswagen Academy, Certification Program Headquarters 1-877-791-4838 (8:00 a.m. to 8:00 p.m. EST)**

Or, E-mail: **concierge@volkswagenacademy.com**



The screenshot shows the login interface for the Volkswagen Academy Certification Resource Center. At the top left, the text "CERTIFICATION RESOURCE CENTER" is displayed. At the top right, the Volkswagen logo and "Volkswagen ACADEMY" are shown. The main area contains two input fields: "Last Name:" and "Last 4 of your employee number:". Below these fields is a "Login" button. At the bottom, there is a link for technical support: "For technical support, [click here](#)".



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