TRANSMISSION ACTUATION

HYDRAULIC AND ELECTROMECHANICAL COMPONENTS FOR AUTOMATIC TRANSMISSIONS

Valeo

SMART TECHNOLOGY FOR SMARTER CARS

INNOVATIVE ELEMENTS FOR THE CURRENT DEVELOPMENT TREND

TRANSMISSION ACTUATORS FROM VALEO

INNOVATIVE COMPONENTS FOR CURRENT TRANSMISSION SYSTEMS

Valeo develops advanced hydraulic and electromechanical transmission components for different variants of modern automatic transmissions. These include the automated manual transmission (AMT), the dual clutch transmission (DCT), the torque converter automatic transmission (TC), and the continuously variable transmission (CVT). Currently, it is becoming more and more apparent that, in the future, these systems will be increasingly accepted all around the world because, compared to manual transmissions, they offer improved comfort. Furthermore, they reduce fuel consumption due to their more intelligent switching logic, which in turn results in lower CO2 emissions.

MOUNTING POSITIONS AND TASKS

Valeo's gear shift cylinders and gear shift modules are applied in automated manual transmissions and dual clutch transmissions. They are mounted on the ends of the shift rails via which they engage the gears. The cooling oil valve sits in dual clutch transmissions and ensures that oil is appropriately diverted from the main oil flow in order to cool the dual clutch. The park lock actuator is installed inside of dual clutch transmissions, torque converter automatic transmissions and continuously variable transmissions where it activates the mechanism that prevents stationary vehicles from rolling away.

ADVANTAGE THROUGH NEW MATERIALS

The transmission components from Valeo are largely made from plastics – in the cooling oil valve, for example, the share of this material amounts to approximately 90 percent. The plastics used are high-quality thermoplastics which are characterized by great strengths, excellent media resistance and high longevity. Their lower weight compared to conventional materials has a very favorable effect on fuel consumption – and therefore directly on CO2 emissions as well.

TAILOR-MADE SOLUTIONS

The transmission actuators shown here are exemplary implementations, as in each case their design is individually adjusted to the respective customer requirements and specifications.

GEAR SHIFT CYLINDER

ELECTROHYDRAULIC PARK LOCK ACTUATOR

ELECTROMECHANICAL PARK LOCK ACTUATOR

HYDRAULIC COOLING OIL VALVE

GEAR SHIFT MODULE

HYDRAULICALLY SHIFTING GEARS

GEAR SHIFT CYLINDERS AND GEAR SHIFT MODULES

MOUNTING POSITION AND TASK

The gear actuators work inside the transmission on the wheel set side. Towards the clutch bell, they are installed on the ends of the shift rails. Individually or combined into a module, the gear shift cylinders operate the shift rails with the shift forks and thus realize the engagement of the gears.

OPERATING PRINCIPLE

The gear shift cylinders are designed as double-acting hydraulic cylinders of type differential cylinder. They are pressurized by the transmission hydraulics.

DESIGN

A gear shift cylinder consists of the housing with integrated piston rod bearing (in the form of a bushing), the piston rod, the piston rod sealing, and the actual piston which is equipped with two groove rings and an overmolded sensor magnet.

At every cylinder, the piston rod is screwed to the shift rail. Both the gear shift cylinders as well as the modules consist of high-quality plastics or plastics and aluminum respectively.

Upon request of the customer, the gear actuators can be equipped with sensors (Hall sensors for detecting the axial position of the pistons/shift rails, and additionally, in the case of the module, speed sensors for determining the rotational speed of the transmission shafts). Concerning the module, the sensors are linked to the transmission control electronics via a central connector.

PARTICULAR ADVANTAGES

The gear actuators from Valeo support fast and precise shifting. They produce less shifting noise than electromechanical designs. Since the actuators are made from plastics, sensors can be integrated in them more easily than in electromechanical solutions. Due to the fact that the shift rail bearings are already integrated, the customers do not have to provide for such bearings themselves. Thanks to a patented groove ring system, the gear actuators are self-venting, and thus ensure trouble-free operation even after longer standing periods. In the case of the module, the oil ducts are integrated in the transmission (i. e. in the flange area of the component), and therefore the oil conduit proves to be simpler than in previous solutions. When using modules, the mounting is very easy (one part, one connector), while gear shift cylinders can be installed very flexibly.

TECHNICAL DATA

Temperature range:	–40 °C to +140 °C (briefly up to +150 °C)
Shifting power:	up to 1,700 N
Shifting speed:	200 mm/s
Operating pressures:	up to 30 bar
Weight:	gear shift cylinder 61 g, gear shift module 460 g (including sensors)

PROTECTING DUAL CLUTCHES FROM OVERHEATING

HYDRAULIC COOLING OIL VALVE

MOUNTING POSITION AND TASK

The cooling oil valve works inside the transmission on the wheel set side and is pressurized by an auxiliary oil pump. It ensures that when the dual clutch is under load oil is appropriately diverted from the main oil flow to the dual clutch in order to cool it. The valve and the auxiliary oil pump are mainly used when the vehicle operates in start-stop mode or in sailing mode because then the main oil pump is not driven.

OPERATING PRINCIPLE

The cooling oil valve is designed as a seat valve. According to demand, the control piston is moved via the control channel, and the valve opens. Thanks to a spring, it automatically closes again as soon as the control pressure is removed.

DESIGN

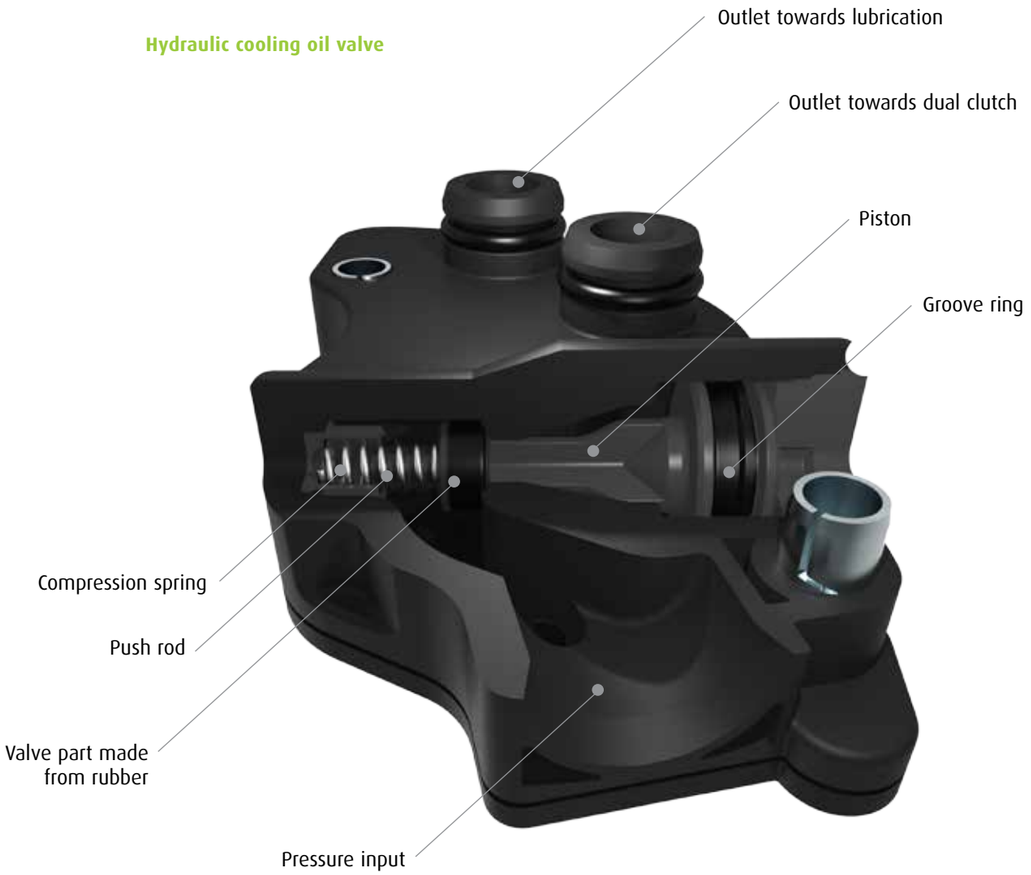
The cooling oil valve consists of a housing, a cover, a compression spring and a valve unit. This valve unit comprises a piston with a groove ring and a push rod with a valve part. The valve part is made from rubber and is responsible for the sealing. The push rod with the locking part is guided by the piston and the spring guide, and it is preloaded by the compression spring.

The valve actuation is done hydraulically by the control pressure which is supplied via the control channel. As a variant, the cooling oil valve may also be designed with a shift valve and a solenoid; then, the actuation is done electromechanically.

PARTICULAR ADVANTAGES

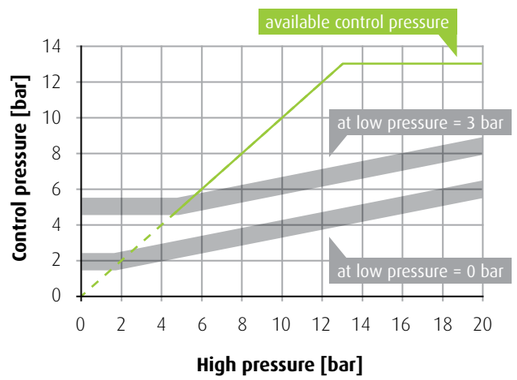
The cooling oil valve is very compact and requires only very little space in the transmission. In the course of the use of high-quality plastics, modern and eco-friendly welding methods such as hot gas welding or ultrasonic welding are applied in the production of the valve; they ensure absolutely liquid-tight and high-strength connections.

Hydraulic cooling oil valve



TECHNICAL DATA

Operating medium:	mineral oils/transmission oils
Temperature range:	–40 °C to +140 °C (briefly up to +150 °C
Pressure range main channel:	up to 20 bar
Pressure range control channel:	up to 13 bar
Weight:	126 g



Characteristic curve of the cooling oil valve: control pressure required for opening the valve in dependency of the pump pressure.

ELECTROHYDRAULICALLY PREVENTING VEHICLES FROM ROLLING AWAY

ELECTROHYDRAULIC PARK LOCK ACTUATOR

MOUNTING POSITION AND TASK

The electrohydraulic park lock actuator sits inside the transmission on the wheel set side. There, it is fastened to the inner surface of the transmission housing. Either directly or indirectly via a shift linkage, it operates the pawl that blocks or releases the park lock gear in the transmission. If this gear is blocked, it is ensured that, even at a full load and at maximum slope or maximum gradient, the vehicle cannot roll down forwards or backwards on an incline. Thus, the handbrake is no longer needed as parking brake.

OPERATING PRINCIPLE

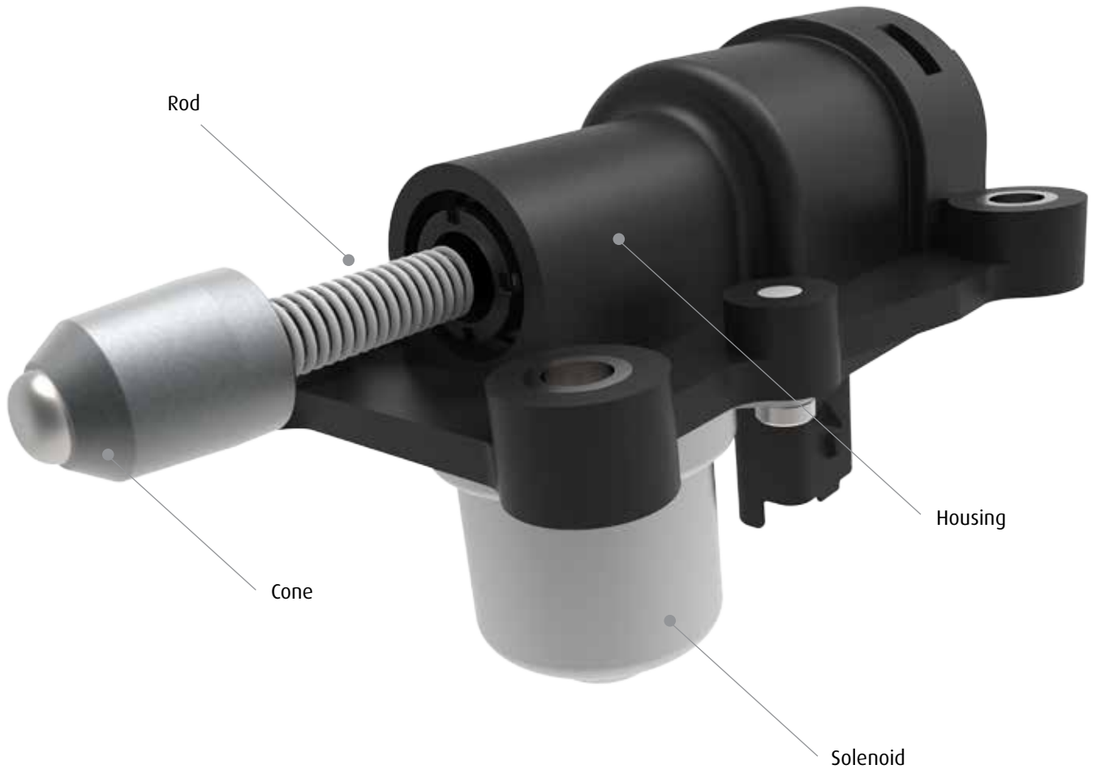
Park lock actuators are part of the shift-by-wire or park-by-wire architectures of modern dual clutch or automatic transmissions. The electrohydraulic park lock actuator is designed as a single or double acting cylinder and pressurized by a pump. In the case of a single acting cylinder, the engagement movement is carried out by a compression spring. The respective position is locked, and unlocking is then carried out either electrically via a solenoid or hydraulically; if redundancy is required, both release methods are possible. The solenoid is supplied with current by the vehicle's on-board power system.

DESIGN

The electrohydraulic park lock actuator consists of a housing, the solenoid with corresponding detent elements, and the piston with sealing elements and overmolded sensor magnet. A rod with a cone is attached to the piston, and the cone actuates the pawl in the transmission, which in turn releases or blocks the park lock gear.

Upon request of the customer, the actuator can be equipped with a Hall sensor which determines the axial position of the piston. The sensor and the solenoid are linked to the transmission control electronics via a central connector.

Electrohydraulic park lock actuator



PARTICULAR ADVANTAGES

In the hydraulic area, the electrohydraulic park lock actuator consists of plastic components, and therefore it is significantly lighter than comparable products. At mechanically highly loaded points, metal inserts made from hardened steel are embedded in the plastic components. Thus, unlimited durability is achieved while saving weight at the same time. In addition, this results in an extremely compact design.

TECHNICAL DATA

Operating medium:	mineral oils
Temperature range:	-40 °C to +140 °C (briefly up to +150 °C)
Pressure range hydraulics:	up to 20 bar
Disengagement force:	up to 1,000 N
Force of the solenoid:	over 25 N at 1,600 mA
Weight:	628 g (including support plate, cone, solenoid and sensor)

ELECTROMECHANICALLY PREVENTING VEHICLES FROM ROLLING AWAY

ELECTROMECHANICAL PARK LOCK ACTUATOR

MOUNTING POSITION AND TASK

The electromechanical park lock actuator sits inside the transmission on the wheel set side. There, it is fastened to the inner surface of the transmission housing (in case of specially required accessibility also to the outer surface of the housing). Either directly or indirectly via a shift linkage, it operates the pawl that blocks or releases the park lock gear in the transmission. If this gear is blocked, it is ensured that, even at a full load and at maximum slope or maximum gradient, the vehicle cannot roll down forwards or backwards on an incline. Thus, the handbrake is no longer needed as parking brake.

OPERATING PRINCIPLE

Park lock actuators are part of the shift-by-wire or park-by-wire architectures of modern dual clutch or automatic transmissions and of transmissions for E-vehicles. The electromechanical park lock actuator is equipped with a compact electric motor that operates either the shift linkage via a simple transmission or the pawl directly. The actuator transmission can be designed either as self-locking or non-self-locking. In the case of the non-self-locking design, the end positions are locked. In the event of failure of the electric power supply, the integrated emergency strategy takes effect that has been agreed on with the customer.

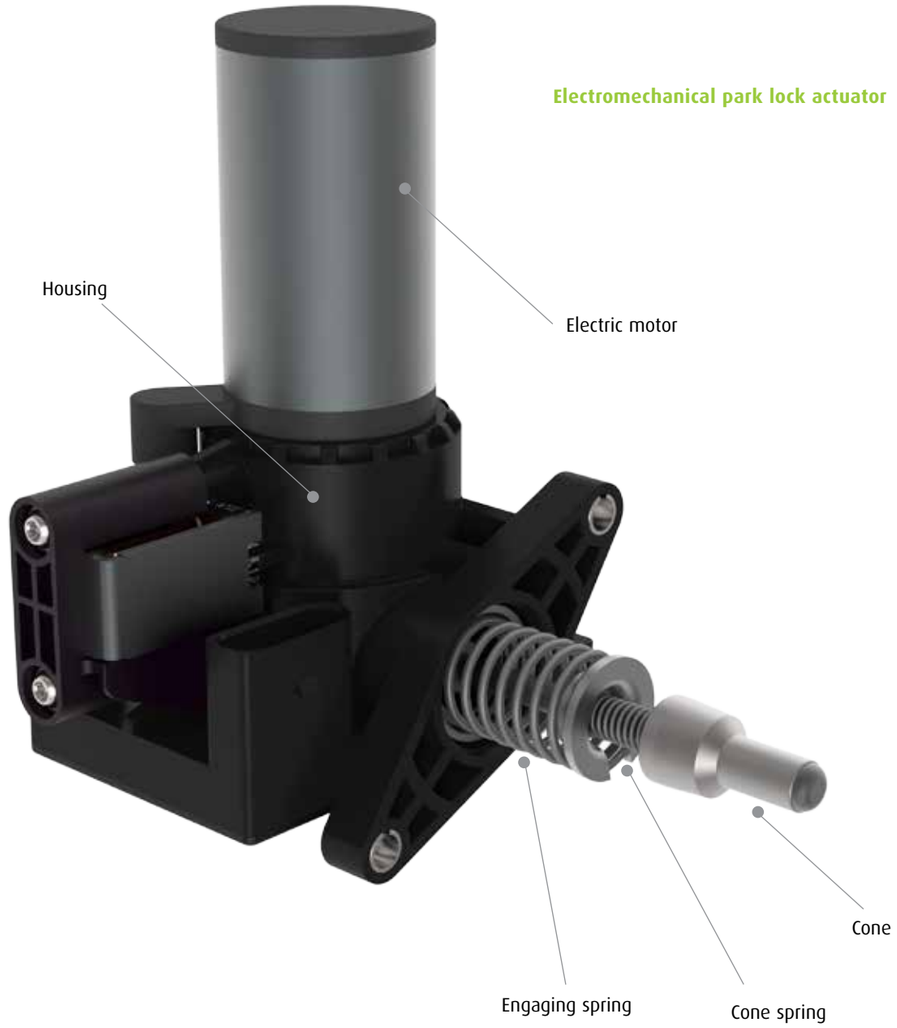
DESIGN

The electromechanical park lock actuator consists of an electric motor, a transmission and a cone rod. Via the transmission and the rod, the drive motor actuates the pawl that sits inside the vehicle transmission, and the pawl then releases or blocks the park lock gear. The motor and the actuator transmission are enclosed in a plastic housing, by which the component can also be fastened to the vehicle transmission. In one operating direction, the actuation is carried out by means of a compression spring. The park and non park positions are locked by detents; depending on whether active or passive holding of the positions is required, a solenoid or a spring is applied for this task.

The stroke is determined continuously by means of an integrated Hall sensor. The electromechanical park lock actuator can be equipped with integrated electronics which allows control via CAN of LIN interface, but solutions are also possible in which the control is done by the control unit on the gear side.

PARTICULAR ADVANTAGES

The design of the actuator transmission allows an energy-efficient layout of the drive motor. Customer requirements concerning redundancy are met by an intelligent combination of different functional components. The part can also be applied as theft protection. By using high-performance plastics which have been optimized for use in the transmission, a weight reduction is realized.



TECHNICAL DATA

Motor:	dc motor
Temperature range:	–40 °C to +140 °C (briefly up to +150 °C)
Nominal current:	3,6 A at 9 V
Disengagement force:	up to 1,000 N
Engaging:	via motor or, alternatively, via spring force
Redundancy:	according to agreement with the customer
Weight:	900 g (including electric motor, solenoid and sensor)

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