



FTE automotive – Innovation drives

CLUTCH ACTUATION SYSTEMS

SYSTEM EXPERTISE FOR PASSENGER CARS
AND COMMERCIAL VEHICLES

LONG-LASTING, ECOLOGICAL, EFFICIENT INNOVATIONS FOR THE FUTURE OF MOBILITY

With over 70 years of experience, FTE automotive is one of the world's main driving forces behind added safety, comfort and more driving pleasure on the roads. What's more, our hydraulic clutch actuation systems always help to solve important issues related to the future. To us, responsibility means offering our customers an innovative lead in the sector of manual gear shifting. Increasing economic and ecological demands, improved performance and an ever-growing level of efficiency in production – constantly improving our products allows us to meet these challenges head on.

Products

Committed to innovation. We develop and manufacture technical solutions, from the initial idea through to series production. Our products are also subject to an ongoing optimization process which applies to their performance as well as our materials and development technologies, such as CAD, FEM, and FMEA. Functional and endurance tests during the prototype, pre-series and series production phases make sure our products are of a high quality.

TRIED AND TESTED MILLIONS OF TIMES MANUAL GEAR SHIFTING

Clutch System

Engine and transmission are linked by a clutch system made up of numerous components. Its task is to temporarily interrupt the link to the powertrain to allow the gear to be changed.

Hydraulic Clutch Actuation System

In a hydraulic clutch actuation system, the transmission of power is regulated by a foot pedal. The power is passed through several components and transferred to the clutch module. Peak torque limiters (PTL) avoid excessive levels of torque and prevent the clutch from closing too quickly. A frequency modulator makes sure that the vibrations from the crankshaft do not have a negative impact on the pedal.

The Challenge

Having a hydraulic clutch actuation system that works seamlessly is one of the basic requirements for vehicles equipped with a manual gearbox. The absolute reliability of the system and a long service life must be guaranteed. From the driver's point of view, the pressure point for the clutch has to feel reliable. Vehicle manufacturers and OE partners require a compact system, light-weight design, simple and speedy assembly, and the increasing use of sustainable and recyclable materials.

The Solution

Throughout the automotive industry's long history, hydraulic clutch actuation systems have proven to be successful in millions of vehicles. They feature a sophisticated technical design yet require very little work to be adapted to a new vehicle model. Their resistance to corrosion, long service life and positive effects on fuel consumption are further reasons why manual gearboxes will continue to be the standard for small and medium passenger cars and commercial vehicles.

Processes

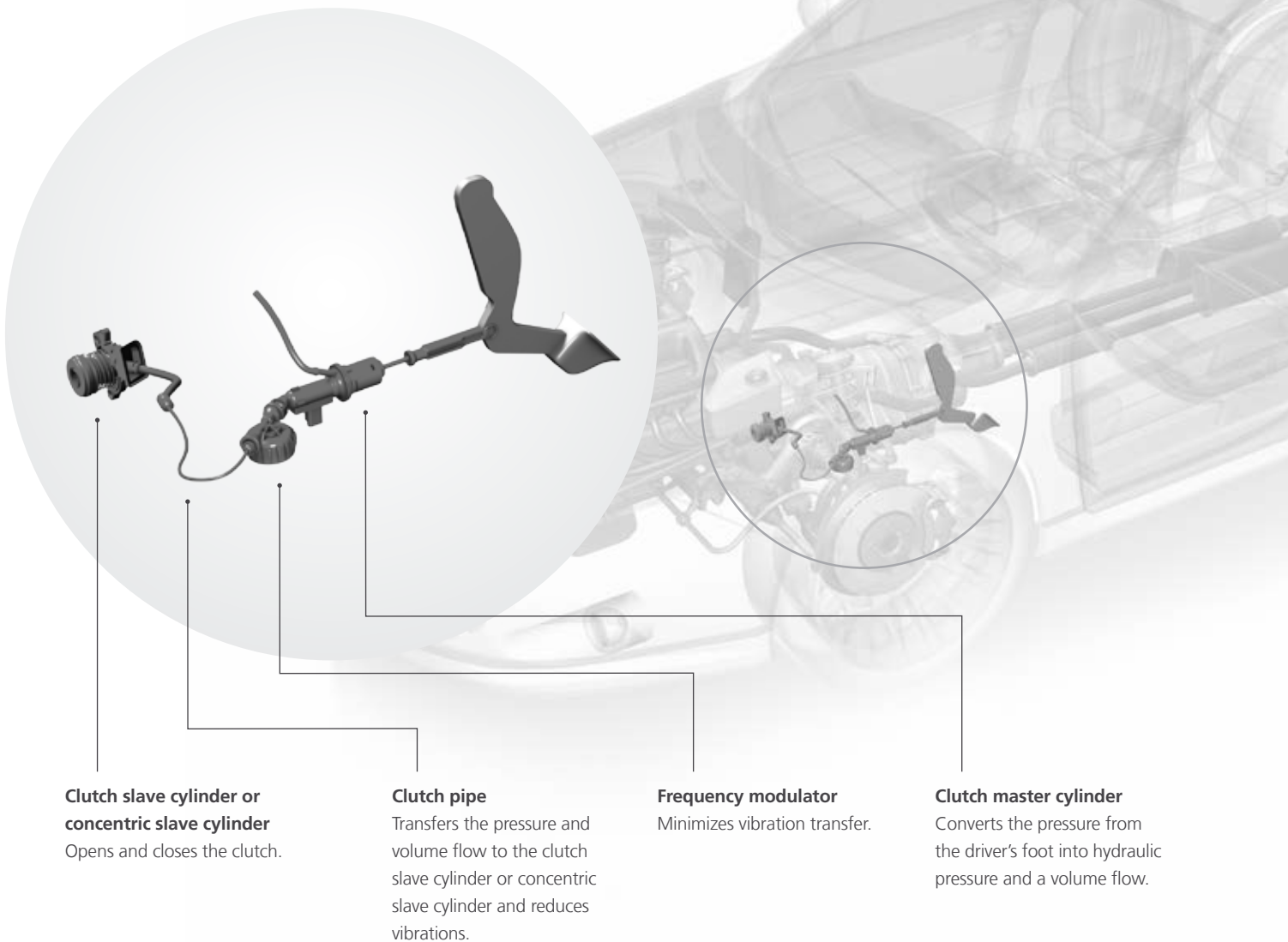
System logistics as the motor of efficiency. With eleven production sites across four continents, FTE automotive is present in the main hubs of the automotive industry. Thanks to this close proximity, our specialists can always respond proactively to new developments on the market.

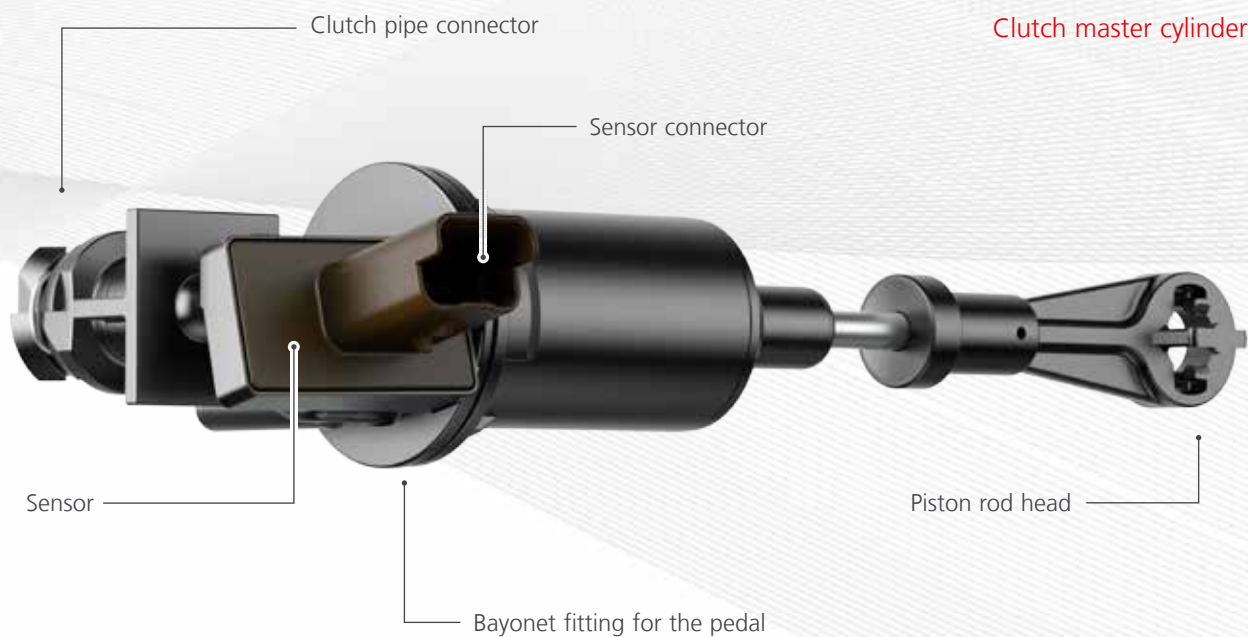
Partnership

Moving ahead together. FTE automotive works closely with vehicle manufacturers to enhance its products and processes. By cooperating to define goals, we make sure that our innovations always help to strengthen our partners' competitive position.

AN OVERVIEW

HYDRAULIC CLUTCH ACTUATION SYSTEM





INTERPRETING WHAT THE DRIVER WANTS

CLUTCH MASTER CYLINDER

The Challenge

As well as providing basic functions, modern clutch master cylinders have to meet a wide range of additional requirements. To improve safety and comfort, functions such as cruise control systems, start inhibitors, electric parking brakes, torque adjusters and automatic start-stop systems now have to be incorporated. Despite this, manufacturers are also required to reduce the size and weight of systems while also allowing for simple and speedy installation.

The Solution

Clutch master cylinders from FTE automotive are distinguished by their low friction and low volume intake and therefore offer high levels of effectiveness. Their long service life is down to their robust design and high bursting strength. All necessary displacement and switching point sensors can be integrated into the system. A bayonet fitting and a snap joint to the pedal make for particularly simple installation. Weight is kept to a minimum. Recyclable materials are employed to ensure the long-term fulfillment of all environmental standards.

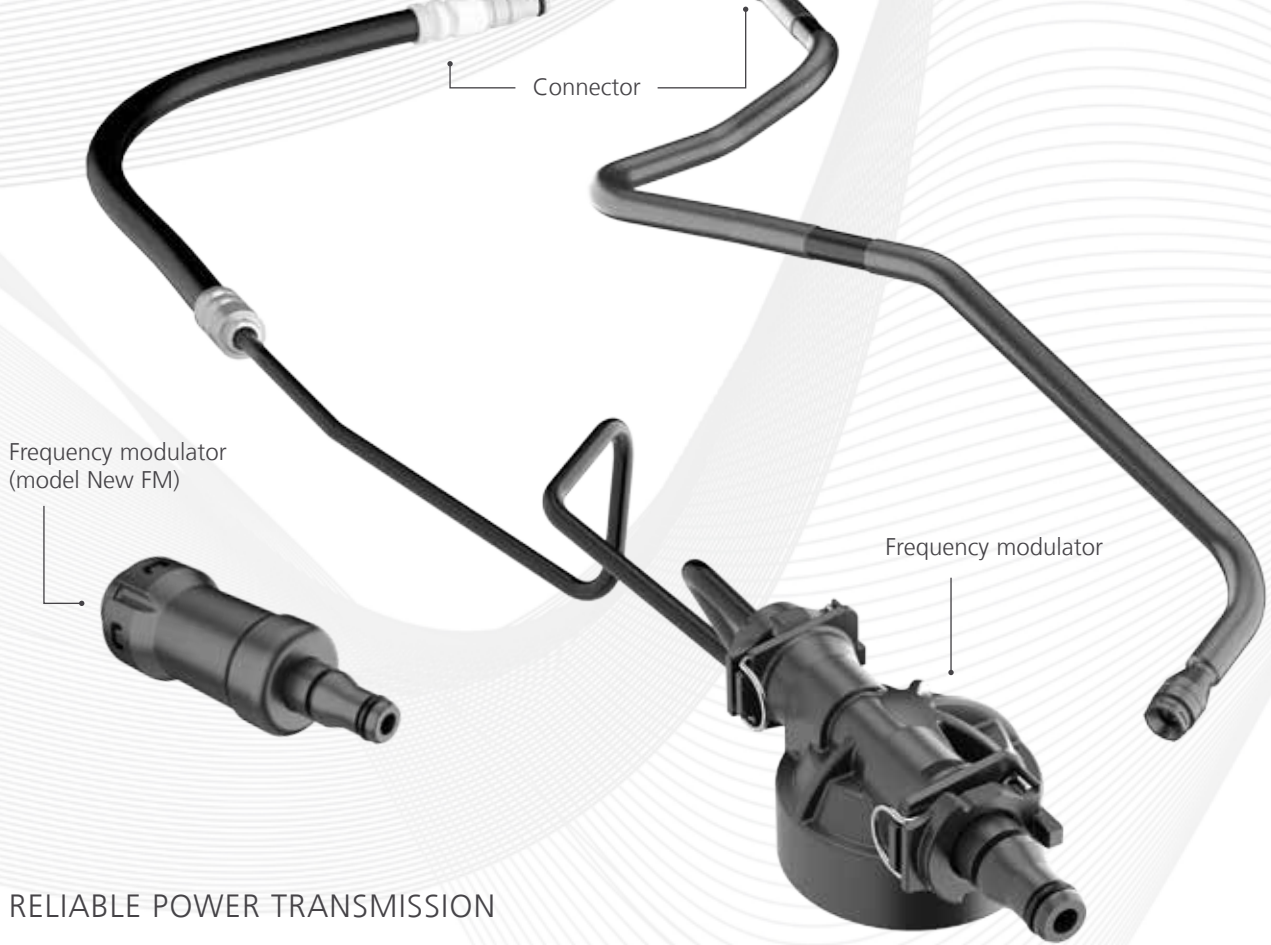
The clutch master cylinder is connected directly to the pedal. The pressure applied to the pedal pushes the piston along the path inside the cylinder. The piston translates this force into hydraulic pressure and a volume flow, transferring it to the clutch slave cylinder or concentric slave cylinder via the clutch pipe.

TECHNICAL DATA CLUTCH MASTER CYLINDER

Operating pressure:	Up to 50 bar
Vacuum resistance:	Up to 2 mbar
Temperature range:	-40°C to +130°C
Peak temperature:	+150°C
Diameter range:	15.87 to 38.1 mm
Stroke range:	Up to 45 mm
Operating medium:	Brake fluid or mineral oil

Pipe-hose assembly

Plastic pipe



RELIABLE POWER TRANSMISSION CLUTCH PIPE

The Challenge

Acting as a bridge between pedal and gearbox, the clutch pipe can also transfer vibrations. To make sure the driver can get a good feeling for the pressure point and to allow for comfortable operation, these vibrations need to be eliminated.

The Solution

Our clutch pipes can also be equipped with dampening components such as frequency modulators and vibration dampers. FTE automotive has developed modular solutions for unwanted frequency ranges; these solutions can be applied in specific customer systems and combined if necessary. They absorb disruptive vibrations, allow for an adapted volume increase, and therefore make it incredibly comfortable to use the pedal. Thanks to our decades of experience and cutting-edge calculation tools, we can adapt the compact design to new requirements as efficiently as possible and within a short space of time.

TECHNICAL DATA PIPE-HOSE ASSEMBLY

Operating pressure:	Up to 50 bar
Vacuum resistance:	2 mbar
Temperature range:	-40°C to +130°C
Peak temperature:	+160°C
Outer diameter of tube:	4.75 mm or 6 mm
Inner diameter of hose:	3.2 mm or 6 mm
Operating medium:	Brake fluid or mineral oil

TECHNICAL DATA PLASTIC PIPE

Operating pressure:	Up to 50 bar
Vacuum resistance:	2 mbar
Temperature range:	-40°C to +130°C
Peak temperature:	+160°C
Outer diameter:	8 mm
Wall thickness:	2.15 mm
Operating medium:	Brake fluid or mineral oil

ULTIMATE PRECISION FOR THE CLUTCH

CLUTCH SLAVE CYLINDER AND CONCENTRIC SLAVE CYLINDER

The clutch slave cylinder absorbs the pressure arriving from the clutch pipe and transfers it to the clutch release lever. The operating medium moves the piston forwards and disengages the clutch. On the return stroke, the clutch pushes the medium back

again. This engages the clutch. A concentric slave cylinder performs the same task by transferring the force directly onto the clutch's diaphragm spring tongues.

The Challenges

Unavoidable signs of wear-and-tear on the clutch must not impact on the functional safety of the clutch slave cylinder or concentric slave cylinder, meaning that they have to be balanced out reliably. Despite the compact design and light-weight construction, there must be no trade-offs in terms of performance and efficiency.

The Solution

Clutch slave cylinders and concentric slave cylinders from FTE automotive stand for excellent installation and functional safety. Their low hysteresis means low pedal forces, resulting in a high level of efficiency and good modulation. Both components are equipped with automatic adjustment to balance out the wear-and-tear of the clutch. The option to integrate a displacement sensor and a peak torque limiter (PTL) meets the requirements for ultimate driving comfort. Our concentric slave cylinders feature a light-weight clutch release bearing with a special lubricant, making them particularly resistant to heat. A radial shaft sealing ring can be incorporated, along with a cover for the opening to the gear unit.



Pneumatic concentric slave cylinder (trucks)

TECHNICAL DATA

PNEUMATIC CONCENTRIC SLAVE CYLINDER (TRUCKS)

Operating pressure:	Up to 12 bar
Vacuum resistance:	Not relevant
Temperature range:	-40°C to +120°C
Peak temperature:	+150°C
Max. release load:	12,400 N
Operating medium:	Air



Clutch slave cylinder

Sensor connector



Concentric slave cylinder

TECHNICAL DATA CLUTCH SLAVE CYLINDER

Operating pressure:	Up to 50 bar
Vacuum resistance:	Up to 2 mbar
Temperature range:	-40°C to +120°C
Peak temperature:	+150°C
Diameter range:	15.87 mm to 38.1 mm
Operating medium:	Brake fluid or mineral oil

TECHNICAL DATA CONCENTRIC SLAVE CYLINDER

Operating pressure:	Up to 50 bar
Vacuum resistance:	Up to 2 mbar
Temperature range:	-40°C to +180°C
Peak temperature:	+200°C
Max. release load:	Up to 7,000 N
Operating medium:	Brake fluid or mineral oil