



HYDRAULIC ACCUMULATORS FOR E-MOBILITY SOLUTIONS

FREUDENBERG
SEALING TECHNOLOGIES

 **FREUDENBERG**
INNOVATING TOGETHER

OUTSTANDING TECHNOLOGICAL EXPERTISE

With its unique portfolio of products and services, Freudenberg Sealing Technologies is one of the world's leading specialists in the sealing and accumulator field. Its expertise in materials and technology was built up over decades, and it is a proven supplier and an innovative development and service partner to a wide range of industries.

It has always assigned special importance to the auto industry. Aside from conventional combustion engines, its focus is increasingly on advanced powertrain concepts relating to electric mobility and fuel cells. Freudenberg Sealing Technologies has always combined market-specific know-how with unique expertise in materials, technologies and development, in order to create innovative products and services.

In the automotive industry, Freudenberg Sealing Technologies is the leading producer of accumulators as well as seals, combining high performance with efficiency and lightweight construction. Developed specifically for the customer and the application, hydraulic accumulators provide energy for state of the art automated manual transmissions, dual clutch transmissions and start-stop systems.

BENEFITS

Freudenberg Sealing Technologies stands for:

- more than six decades of experience with accumulator technology.
- a complete range of hydraulic accumulators from a single source: piston, diaphragm and bladder accumulators, in all the right materials and configurations for stationary, mobile and automotive applications.
- in-house material and seal development, which means that unmatched expertise in sealing and hydraulic accumulators is concentrated under one roof.
- for seals and diaphragms that are optimized for the particular application
- for accumulators with high operating reliability and long service lives
- for energy efficiency, harmonious gear changes, good driving dynamics and comfort within the automobile

THE ENTIRE RANGE OF ACCUMULATORS
WORLDWIDE FROM A SINGLE SOURCE:
FREUDENBERG SEALING TECHNOLOGIES
STANDS FOR CUTTING-EDGE ENERGY STORAGE
TECHNOLOGY ACROSS ALL INDUSTRIES.



MORE DRIVING COMFORT IN BATTERY-ELECTRIC VEHICLES

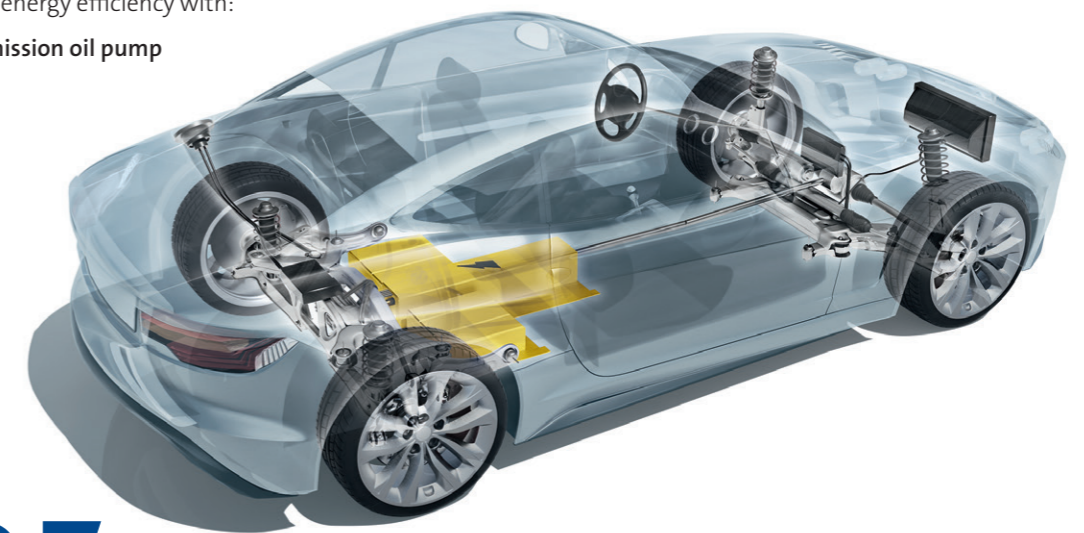
Do electric vehicles need transmissions? Yes, if they are not merely intended for driving in city traffic but over long distances on highways as well. Hydraulic accumulators from Freudenberg Sealing Technologies get them moving. The combination of electric motor and transmission optimizes costs and improves efficiency.

With two-speed electric drive units based on a wet dual clutch transmission equipped with Freudenberg accumulators, electric cars travel robustly, quickly and comfortably from point A to point B – and to even more distant destinations:

- > with harmonious gear changes.
- > with high initial torque, remarkable acceleration, enormous rotational speeds and impressive top speeds.
- > with lower energy requirements for the transmission oil pump than those for traditional solutions.

Leading the way on costs and energy efficiency with:

- > a smaller and lighter transmission oil pump
- > reduced CO2 emissions
- > a smaller vehicle battery
- > greater range



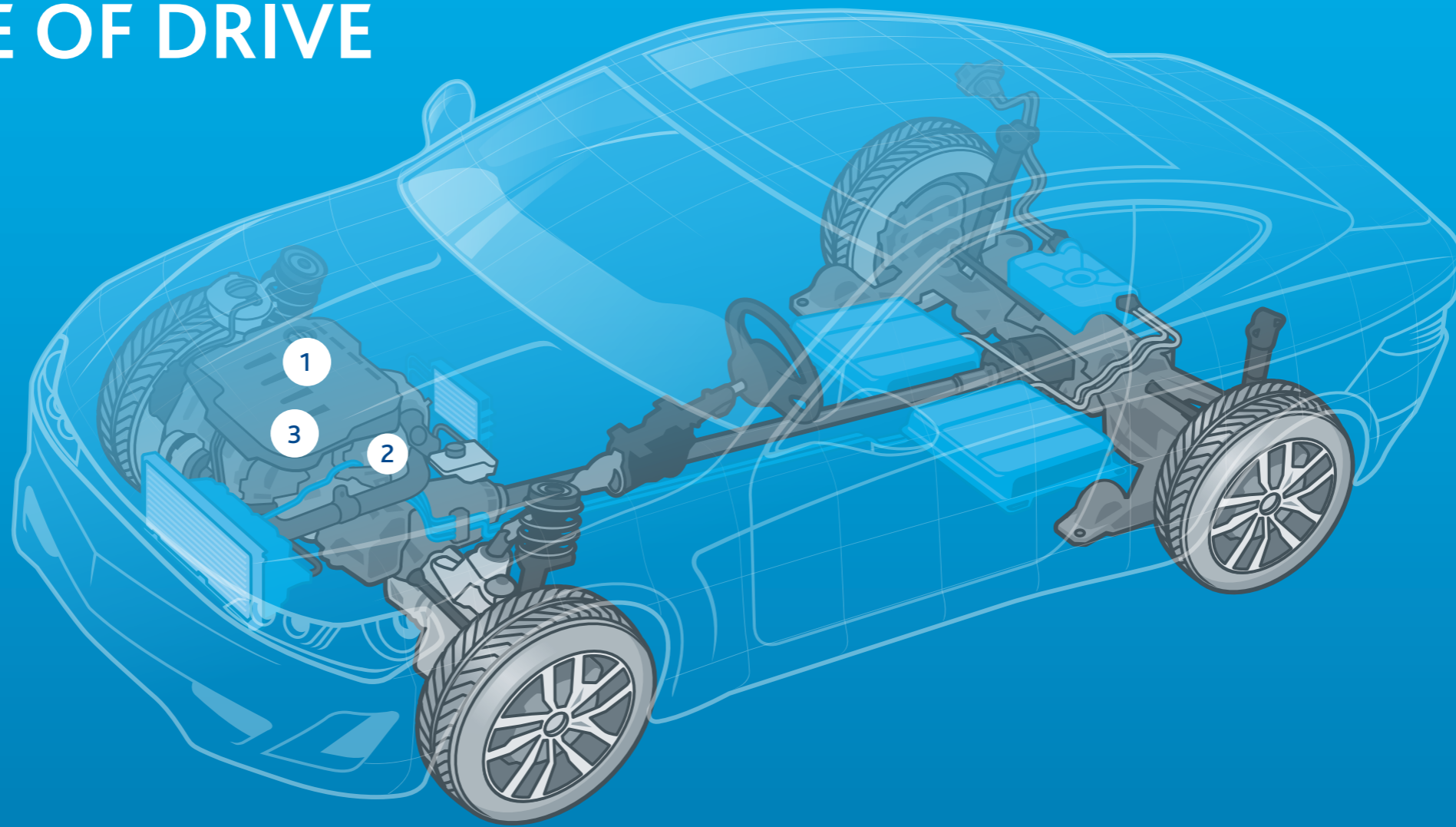
MORE EFFICIENCY IN HYBRID VEHICLES

Hybridized dual clutch transmissions (DCTs) using a high-pressure accumulator system from Freudenberg Sealing Technologies – in short, this is an ideal, energy-efficient solution for hybrid vehicles.

The reasons:

- > Accumulators store energy to cover peaks in demand, keeping it immediately available and delivering it exactly when requested.
- > This means the mechanical transmission oil pump does not have to run continuously
- > Thanks to the hydraulic accumulator, the transmission oil pump can have smaller dimensions. This reduces energy consumption and CO2 emissions long-term.
- > The system has a space-saving design and has an extremely long operating life with low maintenance expenses.

LEIGHTWHEIGHT SOLUTIONS FOR ANY TYPE OF DRIVE SYSTEM



1
Combustion engine



2
Hybrid drive



3
Electric drive



Piston accumulator
(Steel piston)



Piston accumulator
(Plastic piston)



Diaphragm accumulator
(Aluminum shell)



Diaphragm accumulator
(Steel shell)

Piston accumulator

PLASTIC INSTEAD OF METAL

Proven a million times over and pointing the way to the future: The Freudenberg Sealing Technologies piston accumulators used in automated manual transmissions, dual clutch transmissions and start-stop systems have been improving driving comfort for more than twenty years – with maximum energy efficiency.

And Freudenberg is continuing to develop these technologies. The requirements of automakers are the yardstick. One current example is an innovation that meets current preferences for lightweight design and easy handling. This novel piston accumulator relies on lightweight plastic instead of much heavier steel. To be precise, the piston is made of a highly stable, gas-impermeable composite material. The benefit: weight savings of about 70 percent. Another new feature: A single high-performance seal now handles the entire sealing function.

Diaphragm accumulator

ALUMINUM INSTEAD OF STEEL

In many automotive applications, diaphragm accumulators – in addition to piston accumulators – reserve the extra energy needed for dynamic and comfortable driving – for example, in dual clutch and automatic transmissions as well as hydropneumatic chassis systems.

In its diaphragm accumulators, Freudenberg also scores points for its lightweight designs and advanced process technology: with accumulator housings made of aluminum instead of steel, joined with an electromagnetic pulse technology. The accumulators can be used in many other automotive areas of application.

DIAPHRAGM ACCUMULATORS FOR AUTOMOTIVE APPLICATIONS

Nominal Volume (litres)	Perm. working pressure (bar)	Temp. (min. - max.)	Material		Pressure ratio	Lifetime
			Shell	Membrane		
0.07 – 3.5	350	-40°C.. + 80°C	Steel or Aluminum	ECO, NBR, FKM (others on request)	10 : 1	At least 10 Years

PISTON ACCUMULATORS FOR AUTOMOTIVE APPLICATION

Nominal Volume (litres)	Perm. working pressure (bar)	Temp. (min. - max.)	Material			Pressure ratio	Lifetime
			Shell	Sealing	Piston		
0.1 – 1.0	100	-40°C.. + 150°C	Coated/ painted steel	NBR, ECO, FKM, HNBR	Steel or Plastic	∞ : 1	At least 10 Years

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