TOTAL QUARTZ EV FLUID

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TECHNICAL GUIDE

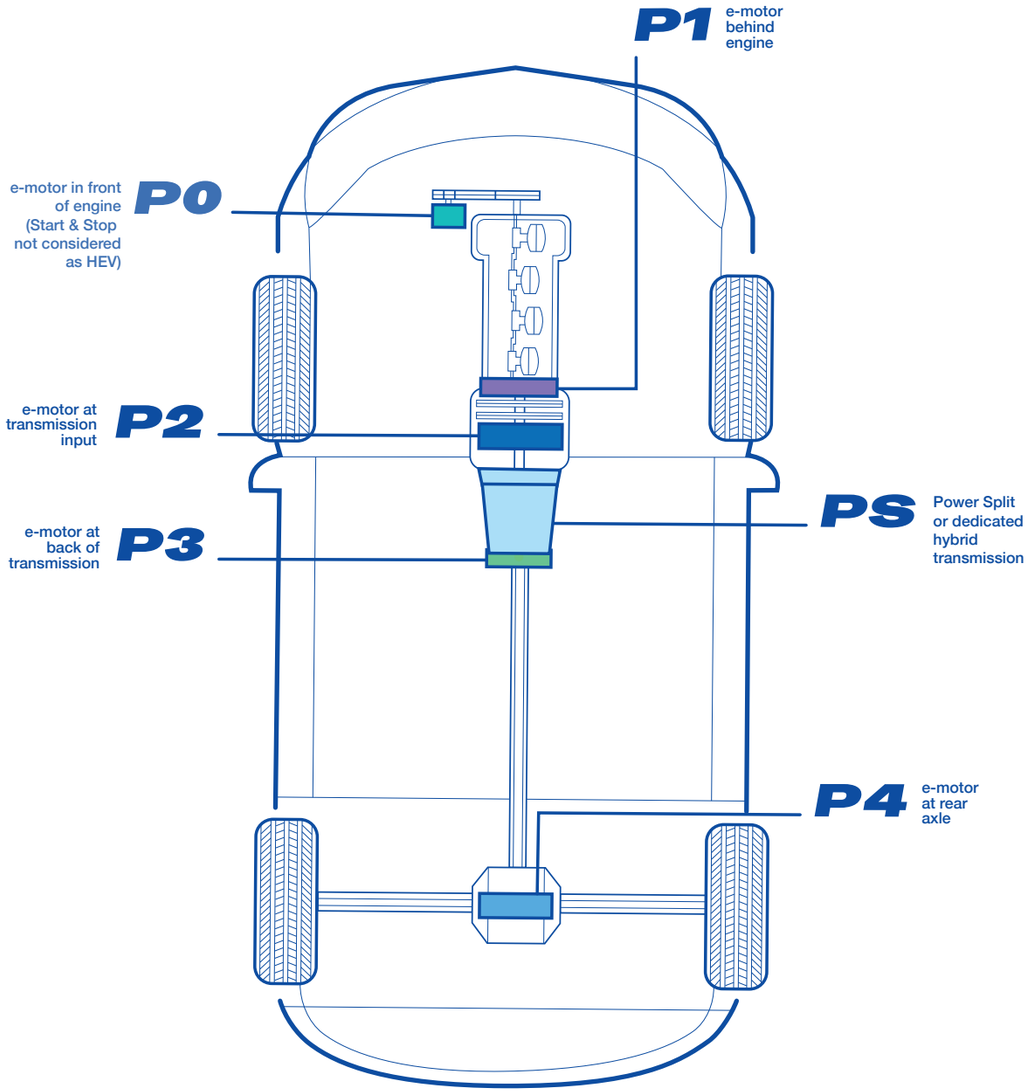
TOTAL
Committed to Better Energy

WHAT IS A HYBRID ELECTRIC VEHICLE?

Hybrid Electric Vehicle

A Hybrid Electric Vehicle (HEV) is one of the solutions to reduce fuel consumption and respond to climate issues. The Hybrid Electric Vehicle is equipped with an Internal Combustion Engine (ICE) and an electric motor. Two different sources of energy can be used : fuel and/or electricity.

In a Hybrid Electric Vehicle, the electric motor can be placed in several different positions :



P1 •

The electric motor is connected to the thermal engine and is able to recover energy whenthe car brakes and uses it to start the car and accelerate.

P2 •

The electric motor is positioned before the gearbox or included in the transmission and is able to recover energy when the car brakes and uses it to start the car.
The electric motor is able to uncouple from the thermal engine for an all-electric drive.

PS power split •

The gearbox uses a set of planetary gears with one or two electric motors and is designed specifically for an electric use.
The electric motor is able to recover energy when the car brakes and uncouple from the thermal engine for an all-electric drive.

P3 •

The electric motor is positioned after the gear-box and is able to recover energy when the car brakes and uses it to start the car. The electric motor is able to uncouple from the thermal engine for an all-electric drive.

P4 •

The electric motor is integrated into the rear axle (e-axle), and is able to recover energy when the car brakes and uses it to start the car. The electric motor is able to uncouple from the thermal engine for an all-electric drive.

		P1	P2	PS	P3	P4
Position of the electric motor in the car	Before the transmission	●	●			
	In the transmission		●	●	●	
	After the transmission				●	●
Motor operation	Energy recovery when braking (electric generator)	●	●	●	●	●
	Start & Stop system	●	●	●	●	●
	Thermal engine torque booster	●	●	●	●	●
	All-electric drive		●	●	●	●

DIFFERENT TYPES OF HYBRID ELECTRIC VEHICLES

Hybrid Electric Vehicles can be classified according to the level of hybridization, that is to say, the importance of the electrical part compared to the thermal engine.

• ***Micro hybridation*** *S&S*

The vehicle is equipped with Start & Stop and a battery charging system that uses the energy recovered during braking. Batteries are designed with a voltage of 12V.

• ***MHEV*** *Mild Hybrid Electrical Vehicle*

The electric motor recovers the kinetic energy that is generated when braking and uses it to recharge the battery. This energy is used during Start & Stop and for extra power when needed. Batteries are designed with a voltage between 48 and 160V.

• ***FHEV*** *Full Hybrid Electrical Vehicle*

The vehicle can run solely on its electric motor, without running the conventional ICE, typically during very light cruising and light acceleration. When additional power is needed, ICE provides full power. Batteries, recharged during braking, have a voltage between 200 and 300V.

• ***PHEV*** *Plug-in Hybrid Electrical Vehicle*

Vehicle with the same characteristics of a FHEV, but batteries can be recharged on the electrical grid. Batteries have a voltage between 300 and 400V, increasing the driving capacity in full electric mode.

		Micro (S&S)	***MHEV***	***FHEV***	***PHEV***
Motor operation	Energy recovery when braking (electric generator)	●	●	●	●
	Start & Stop system		●	●	●
	Thermal engine torque booster		●	●	●
	All-electric drive			●	●
	Power of the electric motor (kW)	<5	10-20	20-40	60-120
Battery	Voltage (V)	12	48-160	200-300	300-400
	Rechargeable (Plug-in)				●
Range	All-electric mode (km)	0	0	5-10	<50

WHAT IS A BATTERY ELECTRIC VEHICLE?

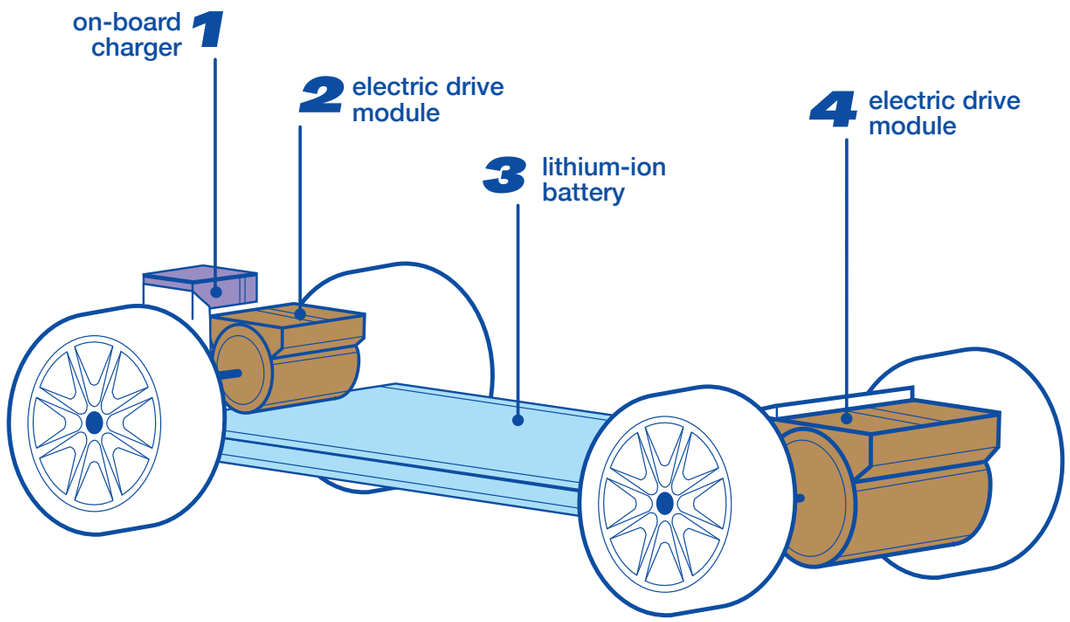
Battery Electric Vehicle

A Battery Electric Vehicle (BEV) uses one or two electric motors powered by electrical energy, stored in batteries.

The electric motor converts electrical energy into mechanical energy with an efficiency of around 80%, while Internal Combustion Engine only achieves 35% of efficiency. Batteries are energy accumulators and are the electric car's main technological challenge. Major objectives of a battery are : high energy density, reduced charging time and lower cost. The lithium-ion battery is the most commonly used technology.

The electric engine does not require the use of standard complex gearboxes, which are otherwise necessary in today's vehicles. A reducer equipped with one or two speeds is used to transfer the electric motor's mechanical power to the wheels.

Major objectives of a battery are : high energy density, reduced charging time and lower cost.



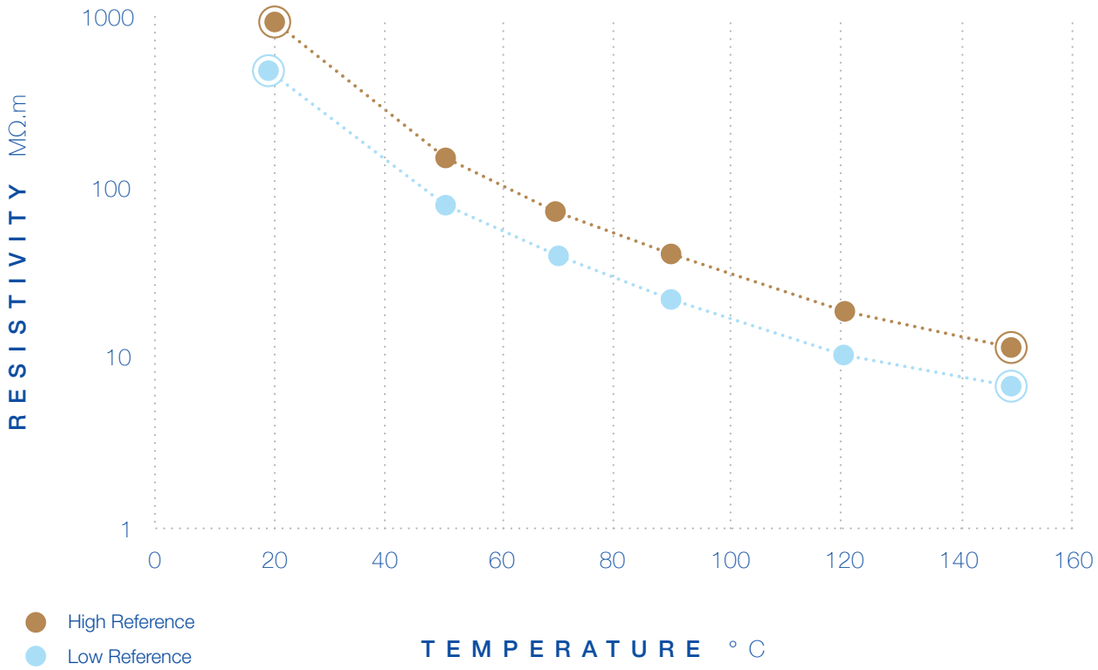
NEW TECHNICAL REQUIREMENTS

New technical constraints for the electrification of vehicles require the development of new fluids that must meet the following properties :

Dielectric properties

Fluids used in electric vehicles require electrical insulation properties. The fluid must be insulating to prevent any arcing since it is going to be in close contact with the electrical and/or electronic components of the vehicle.

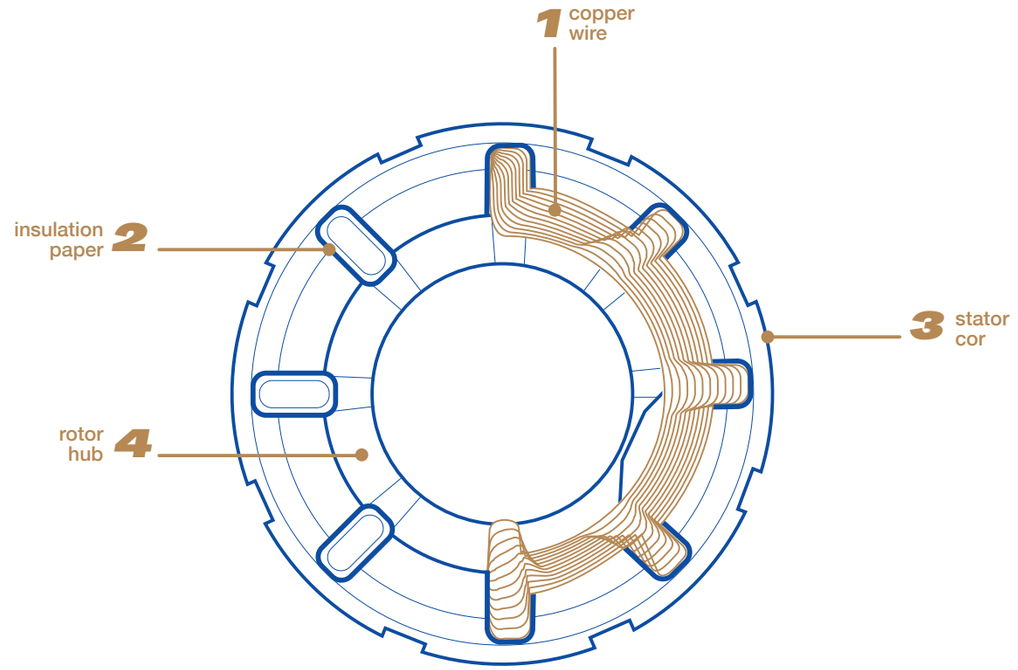
Dielectric properties must remain stable throughout the time in spite of harsh operating conditions : rising temperatures, oxidation, humidity, particle abrasion.



Compatibility with materials

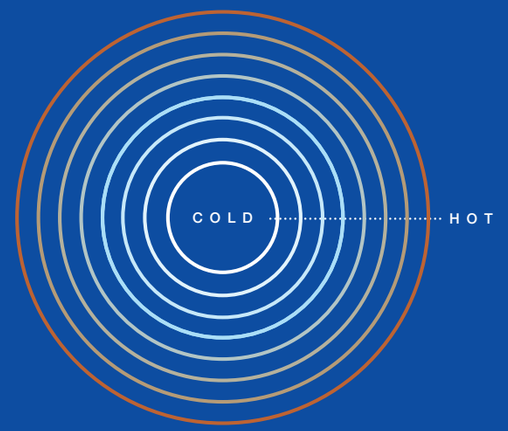
The fluid and new components of the electric vehicle are in direct contact. New challenges must be faced in terms of the fluid being compatible with different types of materials in order to avoid the following consequences : swelling, breakage, corrosion etc. Copper is a key material for these applications.

Its high electrical conductivity makes it the main critical component used for electrical wiring, windings and organs. It is therefore of the utmost importance to develop a fluid with excellent copper compatibility.



Thermal properties

Power electronics and the electric engine must operate within a defined temperature range. Operating at higher than the desired temperature range inevitably reduces the vehicles' service life, efficiency and power.
The components are subjectto the Joule effect, which is the heat dissipation of the electrical energy. A fluid must therefore ensure efficient heat evacuation at temperatures up to 180°C.



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