



E-MOBILITY INSIGHTS

Just Chill! How to Keep Traction Batteries at the Ideal Temperature

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Thermal management systems keep the lithium-ion batteries in electric vehicles within the temperature range in which they operate most efficiently—regardless of outside temperatures and thermal loads, such as those experienced during fast charging. One particular system has established itself as the global industry standard.

The optimal temperature range

Lithium-ion batteries operate most efficiently between 15°C and 30°C. Below 15°C, electrochemical reactions in the cells slow down—performance and cruising range decrease, and fast charging takes longer or is disabled. At temperatures above 30°C, undesirable chemical processes in the cells speed up. This can accelerate aging, lead to irreversible capacity loss, and even pose safety risks. Manufacturers use various thermal management systems to get the most out of traction batteries.

Air cooling

Air cooling involves using the vehicle's air conditioning system to cool the traction battery as well, with conditioned air from the cabin directed to the battery pack. However, this simple form of thermal

MAHLE air filters for traction battery housings filter dust and particles out of the cooling air, increasing the efficiency and service life of air-cooled HV batteries.



management has a number of drawbacks. Air can absorb only a small amount of heat, so this method usually can't regulate the temperature of large battery packs evenly. Since the cooling air comes from the cabin, it also needs to be filtered effectively to keep dust particles and moisture away from the battery.

Liquid cooling with a chiller

Indirect liquid cooling has become the standard. In this method, a water-glycol mixture circulates through cooling plates inside the battery, enabling high levels of heat absorption and even temperature distribution.

If the battery temperature rises, the heat is released into the environment via a radiator. If sufficient cooling is not achieved, a chiller is put into operation. The chiller is connected to the battery's cooling circuit and the air conditioning system's refrigerant circuit, allowing it to dissipate heat very efficiently. When temperatures drop in winter, an electric heater or a heat pump can warm the coolant and quickly return the battery to the optimal temperature range.



MAHLE chillers are connected to the vehicle's cooling and refrigerant circuits and use the air conditioning system's refrigerant to lower the battery temperature.

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