

Machines with Flash Battery systems can operate in harsh climates

Thermal management for lithium batteries

Flash Battery's CEO spoke with DPI about the thermal management requirements of lithium batteries used in off-highway and industrial machinery.

By **Roberta Prandi**



Marco Righi, Flash Battery

Lithium batteries are now used in many different applications, ranging from off-highway machinery through to agricultural vehicles, aerial platforms, airport ground support and marine.

Each of these has its own requirements based on operating conditions. Thermal management of the battery pack is a critical function, influencing performance and total operating lifetime. If the temperature is too low it reduces the battery capacity; too high and it can cause degradation and reduce the number of potential recharging cycles.

Marco Righi, CEO and founder of Flash Battery, explained that the ideal temperature range for a lithium battery is between 20 and 35°C. "This does not mean that batteries cannot work at lower or higher temperatures, but that the expected battery lifetime will be impacted," he said.

COOLING SYSTEMS

According to Flash Battery, most off-highway applications don't need a battery cooling system due to longer charge/discharge times. It is rapid cycling which can affect pack temperature and reduce maximum lifespan. "Ultra-fast charging or hybrid systems where the battery is discharged quite rapidly need a cooling system," reported Righi.

Cooling systems can be implemented in three different ways: with a forced ventilation system; with an air cooling system inside the pack; or with a liquid cooling system inside the pack. The best solution will depend on the application, battery pack stress and forecast production numbers. Righi: "For indoor applications, such as automated systems used in logistics, forced ventilation is usually enough; for outdoor applications, a liquid cooling solution is usually required."

HEATING SYSTEMS

A limitation of lithium batteries is that they are unable to charge at below 0°C. In addition, if left at temperatures below 10°C, the internal resistance can suffer, resulting in a drop in voltage and efficiency loss. A heating system allows a vehicle to operate outside, regardless of the weather conditions.

Heating systems for batteries can be implemented in two different ways, using electric heating elements or with a fluid circuit. A heating system is highly recommended for lithium batteries in a hybrid or electric vehicle. Heating is controlled by the battery management system (BMS) according to need.

BMS FOR SAFETY

Flash Battery's BMS monitors pack function across a series of parameters. If a single cell is affected, the BMS immediately interrupts the charge/discharge phase to prevent damage to the entire pack. More general overheating can be caused by an intensive use of the battery. In this case, the BMS interacts with the vehicle to reduce performance.

"A smart BMS works preventively to avoid overheating before it begins," said Righi. "Our proprietary Flash Balancing System acts both actively and passively with a much higher balancing power than traditional BMS (20A). It guarantees an ultra-rapid balancing and always ensures the maximum autonomy of the battery."

Besides balancing, the BMS manages all parameters of the battery in real time: information sent to the vehicle's EMS or display; the recharging system; plus cooling and heating functions. All support predictive analysis of the health of the equipment powered by the battery.

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