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Tesla and BYD lead the market again and go beyond cool

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Cool ideas emerge as the EV market heats up

Regulating the temperature of an electric vehicle's (EV's) battery, electric motor and power electronics is a complex process. While most EV thermal management systems use a water tank, a chiller, and various electronics and actuators, the trend is toward an integrated thermal management system (ITMS) that can improve driving range and charging capability, as well as reduce module weight, size and cost. For example, by maintaining the battery pack within the ideal temperature range, the ITMS helps maximize the charging rate and overall performance. However, specific benefits of an ITMS would vary depending on the vehicle's design and system architecture.

The heat is on

Grouped around three categories — coolant-integrated module, refrigerant-integrated module and coolant-refrigerant module — ITMS are becoming increasingly popular. Coolant-refrigerant modules account for 46% of total ITMS modules used in EVs. By 2028, refrigerant-integrated modules will account for 38% of all ITMS modules, while coolant-integrated modules and coolant-refrigerant modules will account for 31% of total EV ITMS modules.

S&P Global Mobility forecasts that, by 2028, Tesla and BYD will lead the market in terms of ITMS development and deployment, followed by Stellantis, Geely, Volkswagen and BMW.

On a regional basis, Greater China is the biggest market and will continue to lead with demand for ITMS increasing from 2.6 million units in 2023 to 8.1 million units by 2028. The majority of mainland Chinese OEMs such as BYD, Geely, Nio and Xpeng EV have deployed ITMS in their current EV models. Although demand for ITMS units will continue to grow steadily in Europe from 2023 to 2028, significant demand from other regions is unlikely in the short term.

Tesla's head start

Tesla was first past the post, installing an ITMS for the Model Y in 2020. Its Model 3 already had a rudimental coolant module called Superbottle used primarily to regulate battery cooling and heating. The Model Y's coolant-refrigerant module moved the game on by merging two manifolds (Supermanifold) and several electronic parts to provide a compact, lighter unit compared to a non-integrated system. Attached is Tesla's Octovalve, which controls the flow of fluid throughout the vehicle. It is named as such because it combines eight coolant inlets/outlets actuated by a single stepper motor.

Given that thermal management is another area where Tesla appears to have set the standard, others have been inspired to follow, including Geely and Hyundai (both installing a coolant-integrated module) and VW and BYD (both opting for refrigerant-integrated modules). However, none match the functionality of the Octovalve. Whereas Tesla's Octovalve uses a liquid cooling system to regulate temperature, BMW uses a combination of liquid cooling and air cooling to do the same job. Liquid cooling is typically more effective at transferring heat, while air cooling provides additional cooling in certain areas.

What else is cool?

The VW refrigerant module serves as a means of outsourcing the assembly process for AC lines, accumulator and chiller. On the other hand, the BYD refrigerant module features a highly integrated

design. Although it bears a resemblance to Tesla's design, its primary function is to control heat pump operating modes.

Chinese suppliers are catching up quickly. Huawei took less than two years to launch a similar Supermanifold in production for Avatr vehicles. Other suppliers pushing back the technical boundaries in the ITMS arena include Hyundai Wia, Marelli and the Schaeffler Group.

Implications

Is this another illustration of how, in the EV world, Tesla's and BYD's vertical integration is paying off? Simply put, no. Tesla is without a vertically integrated thermal components manufacturing capability. The Supermanifold is simply marked with Made in Mexico, and its suppliers have almost adopted an oath of omerta. BYD, Nio and Geely operate in a similar way.

It seems the old departmental structure of historical OEMs is no longer in vogue, at least if you want to get ahead in the BEV game.

Meanwhile, legacy OEMs will be able to play catch up when their next-generation BEV architectures are in place in the next few years. By then, do not be surprised if the likes of Tesla and BYD have moved the game on again.

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