

## Global Application of Thermal Control Technology for Electric Vehicles

### Thermal Control Technology is in the Spotlight Again

Thermal control is a mature technology, but in the field of new energy vehicles, the importance of this technology has been re-realized. traditional vehicles use engine waste heat to provide a heat source for the air conditioner. The mechanism by which residual heat is discharged through the exhaust pipe, etc., this basic idea of thermal management has not changed since the birth of gasoline cars in 1886. It can even be considered that thermal control has passed the mature stage as a technology that cannot generate innovation.

Prior to the development of electric vehicles (EVs), the focus has been on the motor that determines ride comfort, and the development of batteries that control the cruising distance. Thermal management has not been actively promoted. However, when the period of full popularization is approaching, pure electric vehicles still have the problems that the cruising range is not long enough and the battery is easy to deteriorate. "Thermal" control of the motor and battery has once again gained attention as a means of solving both problems.

With the high performance of EVs, technologies that can effectively thermally control motors and batteries have become the new core of competition. Companies such as DENSO are stepping up efforts to put new systems using refrigerants into practice. Tesla of the United States, which has swept the global pure electric vehicle market, is one of the companies that pays attention to thermal control technology. The company leads the field with its self-developed system equipment.

### DENSO Heat Pump Technology

Denso's thermal management system first uses heat pump air conditioning components to absorb heat from outdoor air and motors through refrigerants, and then uses this heat to heat the interior of the car. Compared with heating with heaters that consume on-board battery power, the cruising range of pure electric vehicles can be increased by 30%.

In addition, Denso also uses sensors to detect high-temperature parts of the vehicle battery, and preferentially flows the refrigerant into these parts to avoid temperature differences. By maintaining the same temperature, the deterioration of the battery is suppressed and the battery life is extended by 20%.

Not only that, it can also supply power while cooling with refrigerant during charging, and the charging time can also be shortened to 1/3 of the current time. Denso has also independently developed the "car brain", or ECU (Electronic Control Unit), that manages these precise controls in a unified manner.

### TESLA Octovalve

There is an oddly shaped 8-legged part where the engine of the Tesla "Model Y" is installed. This component is what Tesla CEO Elon Musk has called "one of the most important components", the

"Octovalve", the core component of the thermal management system. "

The biggest feature of this part is that the inlet and outlet of the 8 manifolds are equipped with on-off valves respectively. After the sensor finds the high temperature part of the manifold, it will only open the valve of that manifold to deliver refrigerant. This part is like a "human heart". It is precisely controlled by Tesla's self-developed software, and after the system is updated via the network, additional functions can be added.

### **SANDEN Thermal Management System**

SANDEN, a Japanese auto parts supplier, submitted an ADR application for business regeneration in 2020 and was subordinated to the Hisense Group, a large Chinese home appliance company. The company's resurrected ace is a thermal management system combined with an electric compressor. Its technical capabilities have attracted the attention of Apple in the United States, which is developing a pure electric vehicle.

Sanden's thermal management system combines heat pump air conditioners and electric compressors that do not require electricity to minimize battery degradation. It also makes full use of the heat of the outdoor air to heat the air conditioner. The company is also cooperating with Nidec, which aims to compete for the dominance of pure electric vehicles with the basic component "e-Axle", to jointly develop a system for the unified management of motor waste heat and air conditioning.

### **Can heat pumps allow electric vehicles to achieve heating freedom in winter travel?**

Unlike fuel vehicles, electric vehicles do not have an engine, so the vehicle thermal management system can only rely on the air conditioning system. The heat dissipation of the battery and the motor is controlled by the air conditioning compressor, and the heating is controlled by the air conditioning heat pump and PTC.

Under extremely low ambient temperature, how to maintain a suitable temperature in the car, while maintaining a suitable temperature in the car, how to quickly defrost, quickly heat the battery, maintain the linearity of the air conditioner temperature adjustment, and maintain a high level of comfort for the automatic air conditioner. The content of vehicle thermal management calibration, the further pursuit is to use the least amount of electricity to achieve the above content, and minimize the reduction of the vehicle's cruising range due to turning on the air conditioner.

In mass production vehicles, each brand will choose the most cost-effective solution according to the positioning and use characteristics of its own products, and then optimize it with software algorithms, which also makes the electric vehicles on the market perform well in thermal management solutions. Varies.

It can be said that thermal management has become the most important system for ensuring the battery life of electric vehicles in winter, and it is also the embodiment of the technical hard power of various manufacturers.