DENSO Develops High Output Power Control Unit and Battery Cooling System for Hybrid Vehicles

New Products are Installed on Lexus LS 600h, LS 600hL

DENSO Corporation has developed a high output power control unit (PCU) and a battery cooling system for hybrid vehicles. The products are installed on the Lexus LS 600h and the Lexus LS600hL, which were launched in May by Toyota Motor Corporation.

High output PCU
The PCU consists of a boost converter that raises the main battery voltage (288V) up to the maximum system voltage (650V), and two inverters that convert direct current (DC) into alternate current (AC) to drive the main traction motors. DENSO developed a new PCU that can produce higher output power by approximately 60 percent per unit volume, compared to the company’s conventional technology, thus improving the hybrid system performance. When the PCU is designed to produce the same output as the conventional technology, it can be reduced approximately 30 percent in size and approximately 20 percent in volume.

For this PCU, DENSO developed a unique cooling structure that significantly improves cooling performance for power semiconductor devices (*1) that constitute the PCU. To achieve a higher PCU output, the power devices are required to handle more power, resulting in more heat generated by the power devices. However, it was difficult to adequately cool higher power devices using a conventional cooling structure where power devices are mounted horizontally on a cooling unit through a heat sink so that only the side facing the cooling unit is cooled (Fig.1).

In DENSO’s new cooling structure, the power devices are sandwiched between two heat sinks and inserted in layers between stacked cooling tubes (Fig. 2). This structure
allows both sides of the power devices to be cooled, which substantially enhances the cooling performance. The new cooling structure also is more compact than the conventional structure.

Since both sides of the power devices are soldered to the heat sinks, DENSO reduced the thickness of each power device to ease stress on joint portions, ensuring high reliability.

The new PCU design can easily be used in hybrid systems with different output levels by changing the number of stacked power devices and cooling tubes.

**Battery cooling system**

In conventional battery cooling systems, the battery blower draws only cabin air to cool the hybrid vehicle’s main battery. DENSO’s newly developed battery cooling system can use cooled air from the cooling unit of the rear air conditioning system as well as cabin air to cool the main battery.

Accordingly, the new battery cooling system provides comparable cooling performance with approximately half the amount of air required by previous models. This reduces noise from blowing air by approximately 30 percent, contributing to the quieter vehicle cabins required for the Lexus LS600h and the Lexus LS600hL.

In addition to the high output PCU and battery cooling system, other DENSO hybrid vehicle products including the DC-DC converter, the battery-monitoring unit, the system main relays, and the current sensor are installed on the Lexus LS600h and the Lexus LS600hL.

“DENSO has been providing a variety of products for hybrid vehicles since 1997,” said Mineo Hanai, senior managing director responsible for DENSO’s Electric Systems Business Group. “Using our experience and expertise, DENSO will continue to create new technologies and products for vehicles that are less harmful to the environment.”

DENSO Corporation, headquartered in Kariya, Aichi prefecture, Japan, is a leading global supplier of advanced technology, systems and components. Worldwide, the company employs approximately 112,000 people in 32 countries and regions, including Japan. Consolidated global sales for the fiscal year ended March 31, 2007 totaled US$30.6 billion. DENSO common stock is traded on the Tokyo, Osaka and Nagoya stock exchanges in Japan. For more information, go to www.globaldenso.com or visit our media website at www.densomediacenter.com.
*1) A power semiconductor device is a switching device that consists of an insulated gate bipolar transistor and a diode and turns on and off electric current.

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Fig 1. Conventional PCU cooling structure

Fig 2. New PCU cooling structure

Notes

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