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Development of electric powertrain for new electric Kei Car

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Nissan has long-term vision to reduce product CO2 emissions from new vehicles by 90% from 2050 to 2000 for realize the sustainable society. Following the zero-emission strategy, Nissan released the B-seg-EV in December 2010 and October 2017 and the C-XO-EV in March 2022. In June 2022, Nissan released the new electric vehicle (EV) to Kei Car segment which accounts for 40% of registered car in Japanese market to drive electrification even more powerfully. This paper explains main technologies and features of the newly developed electric powertrain for Kei Car.

Fig.1 shows appearance of the conventional electric power train and the electric power train for the new Kei Car. The electric powertrain for the new Kei Car integrates motor, inverter, and reducer same as the conventional electric power train. Additionally, to accommodate in the small engine room, the inverter position was changed from upper of the motor to the side of the motor. Thus, the integrated motor, inverter and reducer produce the space in upper area of the engine room, which enables to place the power delivery module (PDM) – integration of the charger, the DCDC converter, and the junction box.

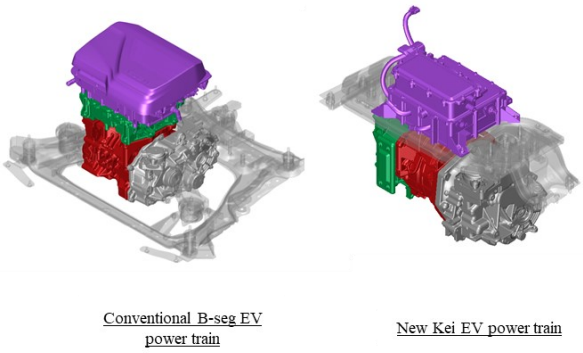

Fig.1 EV power train unit

Fig.2 shows the internal configuration of the motor and inverter of the electric power train for the new Kei Car. The Inverter components such as the circuit board are attached to the Motor Bracket and the MCU Cover contributes to minimize the total size of the motor and inverter, and the inverter is placed on the side of motor. Comparing to the motor of the same specification of separated structure, the volume can be reduced by 30% and the mass can be reduced by 15%. Also this structure can be reduced the pressure loss of the coolant by shortening the cooling channel.

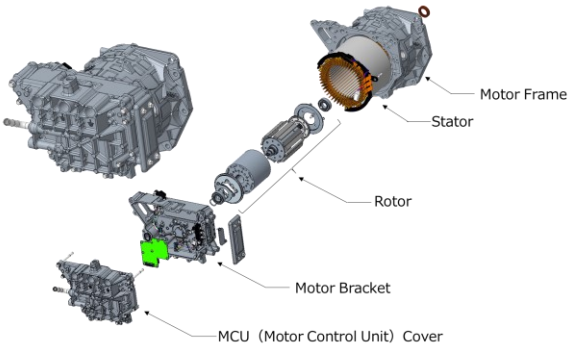

Fig.2 Motor/Inverter unit

Fig.3 shows the model of the motor, inverter, and reducer installed in the engine room. To satisfy collision and safety performance with the small engine room in the Kei Car, the electric powertrain is designed to avoid large force of vehicle collision. Fig.4 shows how to avoid collision force. The large force inputs on the mount boss which fixes the motor / inverter and the unitmember. The mount boss is designed to break with the large collision force and the unit behaves to avoid large force on the motor / inverter housing which in high-voltage parts are stored.

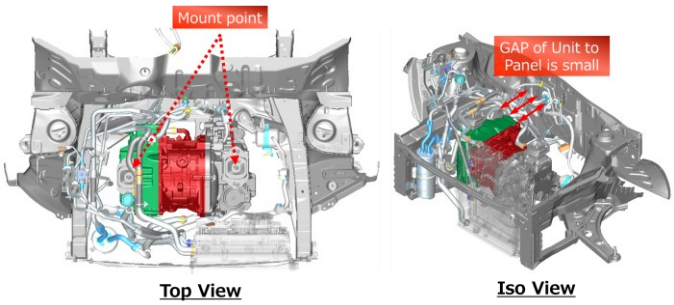

Fig.3 Electric powertrain in engine room

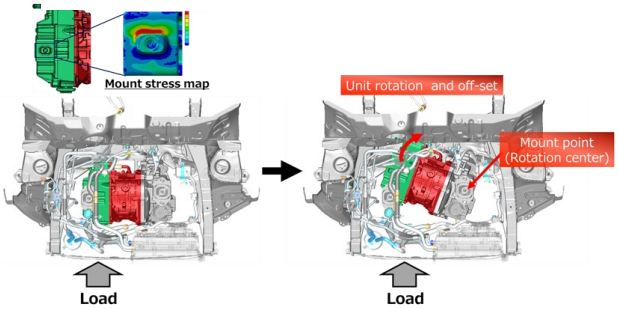

Fig.4 Collision countermeasure mechanism