

Column Type Electric Power Steering Conforming to International Standard ISO26262 (Functional Safety)



We have developed column type electric power steering (C-EPS) in conformity with the international functional safety standard for automobiles (ISO26262), which achieves continuously-operating EPS, improved comfort and collision performance, and smaller size. This newly developed electric power steering is introduced below.

Development chronology

Creation of the development process was completed in 2011, after which we established traceability throughout the entire product life cycle according to this process.

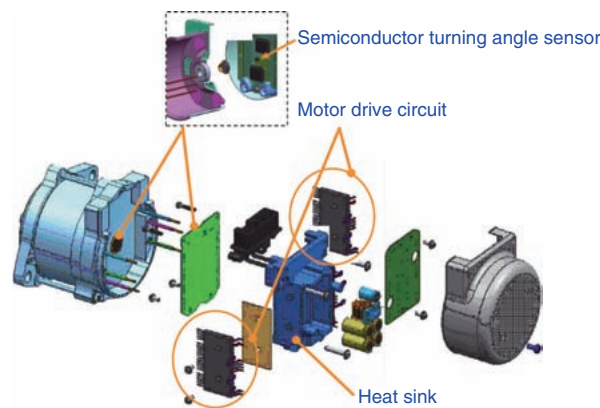
We also organized a system where functional safety auditing and assessment of the developed product can be conducted at an internal auditing department independent of the design and development departments.

The product described in this paper was developed through the abovementioned process and system, after which its mass production was begun.

Features

1. Continuously-operating EPS

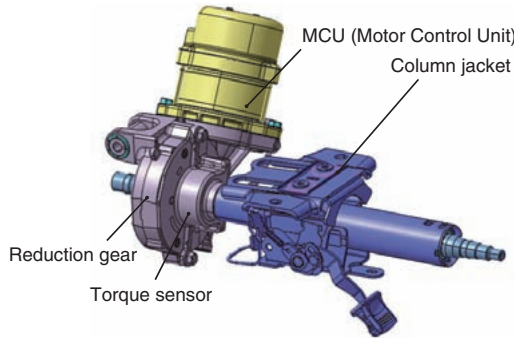
Redundancy has been implemented for the torque sensor which detects the operations made by the driver, and for the motor drive circuit of the MCU (Motor Control Unit), which generates assist torque. If failure occurs, this enables the continuation of EPS using the unaffected circuit.



Structural diagram of MCU

2. Collision performance

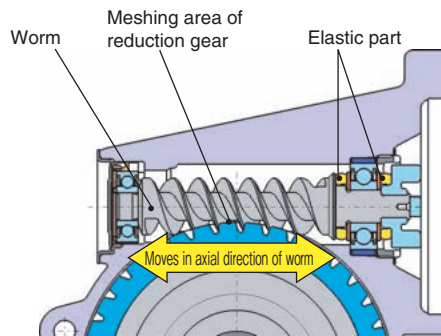
We have improved releasing load characteristics at the time of collision energy absorption by modifying the structure of the column jacket.



Column type electric power steering (C-EPS)

3. Comfort

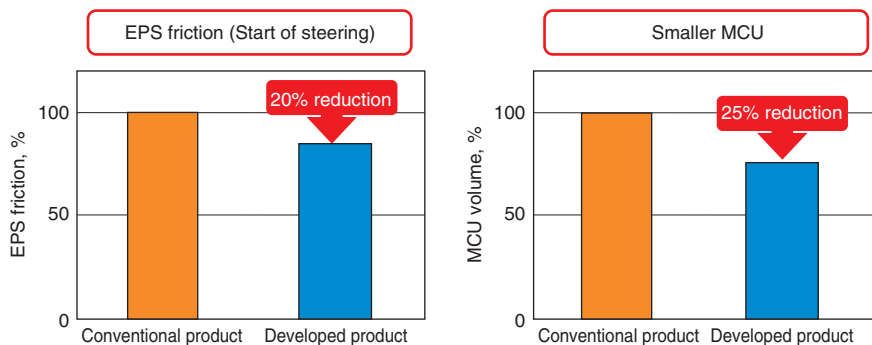
- By changing the motor of the MCU to a multiple-slot structure, we have suppressed the torque fluctuation and improved the quietness of the motor.
- By supporting the worm of the reduction gear portion with elastic parts and designing the worm to move in the axial direction, we have reduced friction at the start of steering by 20% compared with the conventional C-EPS, thereby improving steering feeling.



Elastic support and reduction gear

4. Size reduction (MCU)

- Implements compact connection of motor and ECU by three-dimensional arrangement of the integrated motor drive circuit.
- Allows heat to dissipate and has reduced the heat sink capacity.
- Replaced conventionally used resolver with semiconductor sensor for the turning angle sensor.
- Effects of size reduction have reduced volume by 25%.



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