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Permanently Engaged Starter for Start and Stop Systems

— **Achieving quicker and quieter engine restart and less engine stop vibration** —

Start and stop systems automatically stop the engine while the vehicle is idling at a stop light or in other traffic situations to help reduce fuel consumption and CO2 emissions. Demand for this system is expected to grow as worldwide CO2 emission regulations become more stringent and as consumers want more environment-friendly vehicles.

DENSO has developed the permanently engaged starter, a key component for start and stop systems, which achieves a quicker, smoother and quieter engine-restart. Created jointly with Toyota Motor Corp., the starter is used in Toyota models, such as the Auris and Yaris models sold in Europe since January 2009.

Conventional start and stop system starters disengage gears, which can result in up to a 1.5 second engine-restart delay. More specifically, when starting a conventional starter, the pinion gear is thrust forward to engage the ring gear (the engine flywheel gear), and when the ignition key is returned to the “on” position, the two gears disengage to bring the pinion gear back to the original position. With this conventional structure the pinion gear does not mesh with the ring gear while the ring gear is coasting - even after the vehicle is stopped and the fuel supply ceases - which results in the delayed restart immediately after the vehicle has stopped. DENSO’s permanently engaged starter solves this issue because it constantly engages the pinion and ring gear, allowing the engine to restart more quickly and smoothly.

Compared to conventional starters, the new starter’s structure also prevents gear-tooth striking noise. For better driver comfort, DENSO also uses a rubber shock absorber and a clutch to isolate engine oscillations* that help reduce engine-restart noise and engine-stop vibrations.

DENSO, which has been making starters since its foundation 60 years ago, has been commercially producing start and stop system starters since 2003. Based on its technologies accumulated over many years, DENSO will continue to develop products to help vehicles increase fuel efficiency and reduce CO2 emissions.

*Engine oscillation refers to when the engine repeats forward rotation and reverse rotation before it is stopped completely, causing the vehicle’s seats to vibrate.