Mazda’s Innovative i-ACTIV All-Wheel Drive

- Jinba Ittai, Maximizing All-Weather Performance and Minimizing Excess -

Mazda is, at its heart, an engineering-focused automotive company, staffed by men and women around the world who all have a common bond: They love cars, and they love driving them. More than a decade ago, Mazda planned to reinvent its technology suite. “The sky is the limit,” engineers were told, with a directive to keep Mazda’s fundamental promise of lightweight, fun-to-drive vehicles but to add efficiency and heightened performance as well.

And, thus, SKYACTIV Technology was born.

Since 2012, Mazda has discussed SKYACTIV Body, Chassis, Suspension, Engines and Transmissions, in addition to KODO—Soul of Motion design that was introduced on SKYACTIV “sixth-generation” vehicles. i-ACTIVSENSE, an encompassing term for Mazda’s active and passive safety technologies, joined Mazda’s portfolio around the same time.

All of which complements Mazda’s predictive i-ACTIV all-wheel drive technology.

i-ACTIV all-wheel drive was introduced in the 2013 Mazda CX-5, the first sixth-generation vehicle with a full integration of SKYACTIV Technologies. Subsequent models for the North American and Australian markets with i-ACTIV AWD include CX-3, which went on sale in 2015, and the all-new CX-9, which will go on sale in eight global markets in 2016. Several other global Mazda products also feature i-ACTIV AWD.

Mazda’s innovative i-ACTIV AWD works similarly in all models in which it is implemented, complementing Mazda’s Jinba Ittai—“horse and rider as one”—and Hoshiru Yorikobi—“joy derived from driving”—philosophies. That is to say, Mazdas are meant to be sporty and engage their drivers, allowing for precise control and spirited dynamics. i-ACTIV AWD was designed to complement those tenets—not hinder them.
In normal operation, vehicles route approximately 98 percent of their power to the front wheels, but torque transfer can reach as much as 50:50 front-to-rear if the vehicle determines more power is needed at the rear wheels. Where many systems are touted as sending power from “the wheels that slip to the wheels that grip”—a reactionary system—Mazda’s i-ACTIV AWD is predictive, reading road, engine, transmission, weather, windshield wiper use, internal and external temperature, yaw sensors, steering and other conditions more than 200 times per second to determine torque transfer. In all, i-ACTIV AWD uses 27 different sensors that feed to a central control module to determine how wheels need to be driven before the ever reach a patch of ice or deep puddle.

By contrast, many all-wheel-drive systems provide a jerky, disconcerting sensation when torque is transferred from axle to axle; i-ACTIV AWD is designed to be seamless in its operation and allows for smooth, controlled steering and throttle inputs.

At the heart of i-ACTIV AWD is Mazda’s SKYACTIV-Drive six-speed automatic transmission. The transmission is linked to a lightweight, high-strength propeller shaft that has a dynamic damper built into it to reduce NVH (noise, vibration and harshness). The rear differential is smaller than those in Mazda’s crossovers and SUVs made before i-ACTIV AWD as a result of an aluminum case with optimized thicknesses of as little as 2.5mm and a smaller ring gear—lacking much traditional ribbing that adds unnecessary weight. Fins were added to its underside for optimized cooling, and the Power Takeoff (PTO) unit in the rear differential uses ultra-low-viscosity oil due to its small size. The result: An immediate, smooth and quiet power transfer, with a level of internal friction so slight that it allows for fuel-efficiency similar to that of a front-wheel-drive-only vehicle.

The net benefit to the consumer is a system that is as predictable and controllable in wintery or rainy conditions as it is on dry roads providing the surefooted handling. Because, whether two- or four-wheel drive or at a racetrack or an ice track, a Mazda is a Mazda and needs to provide drivers with nothing less than the fun and driving pleasure they’ve come to expect from the brand.

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