Rotary Fin Air-cooling System and High-output Technology Achieving Powerful Driving
Lightweight, High-power In-wheel Motor for Motorcycles

- **Astemo's first in-wheel motor for motorcycles**
- **Lightweight and high output achieved by adopting rotary fin air-cooling system**
- **Halbach array magnets are used as Astemo's technology for motor development. Technology transferred from the development of in-wheel motors for automobiles**
- **Since the driving force comes from the wheels themselves, crisp and sharp output and linear handling are accomplished without the need for driving parts such as the transmission.**
- **The exhibit will feature the KAWASAKI Ninja e-1 equipped with a prototype in-wheel motor. With the addition of a rotating in-wheel motor demonstrating its quietness, a cut model, in which some parts have been cut so that the internal structure can be seen, will be exhibited.**





Astemo unveiled a prototype in-wheel motor for motorcycles for the first time at the Automotive Engineering Exposition held in May 2026. At EICMA 2026, we will exhibit the prototype mounted on the KAWASAKI Ninja e-1. Utilizing a rotary fin air-cooling system and technologies cultivated through long years of motor development, this product achieves high output along with crisp and sharp output characteristics despite being lightweight. Development is underway to launch the product in 2030.

In-wheel motors are drive systems that incorporate motors inside the wheels. The drive system can be designed in a compact size because no transmission, chain, or other drivetrain components are required. In addition, there is no need to mount driving parts such as a power

source or transmission on the vehicle body, thus contributing to a smaller and lighter body, and also less restraints as to the size and position of the battery. As a result, the center of gravity is reduced and the degree of freedom is increased in terms of both vehicle dimensions and design.

In addition, the motor built into the wheel drives the wheel directly, so there is less energy loss from drive system components and also less noise.

Astemo unveiled the prototype in-wheel motor for motorcycles at the Automotive Engineering Exposition held in May 2026, and will exhibit it mounted on the KAWASAKI Ninja e-1 at EICMA in 2026. The prototype uses our knowledge from long years of motor development to further refine the features of in-wheel motors. Derived from the development of in-wheel motors for automobiles and based on the technology accumulated from the start of the 2020s, it is now in the driving test stage. During these tests, the motor accomplished a higher linearity in the low-speed range than the development team expected.

There's a reason for the high linearity of Astemo’s in-wheel motors.

First, the rotary fin air-cooling system was adopted. The in-wheel motor achieves high cooling efficiency by rotating the housing itself. The cooling effect was enhanced by adding fins to the motor housing. The fin design was further improved to emphasize heat flow. It is designed so as not to create bottlenecks throughout the path in which heat is released from areas where heat is concentrated to the cooler areas with more exposed surface. Due to the characteristics of the circular structure of the wheel, the farther away from the center, the larger the surface area and the faster the flow velocity, so the centrifugal force of the wheel rotation is used to release heat to the outside, thereby increasing cooling capacity. The unit is lightweight and uses a simple structure for air cooling, and by thoroughly improving cooling efficiency, it achieves high output while being lightweight. The output produced in terms of weight of the unit is at the highest standard in its class.

Halbach array magnets and concentrated-winding coils with high space factor are another major factor in the units design. These are Astemo technologies that have also been used in the development of in-wheel motors for automobiles. The magnet arrangement makes it easy to concentrate the magnetic flux, which is the total amount of magnets, and the advantage is that the same output can be obtained even if the quantity of magnets used is reduced. When the power is turned off and the shaft is turned by hand, the magnetic force causes a catch or resistance called cogging torque. This cogging torque has been designed to be reduced, resulting in a quiet motor that rotates smoothly from low torque.

Astemo is developing motors by leveraging the expertise of the Hitachi Group in motor development. For example, home appliances used in indoor living environments are equipped with various motors that provide both quietness and durability while varying the speed and direction of rotation as required. The extensive knowledge gained through the development of motors for home appliances led to the creation of a motor with high speed accuracy used in this in-wheel motor. The motor with high speed accuracy is an advantage in terms of linearity to the throttle grip operation, as this emphasizes the response and rider's control of the motor in the very low speed range, making it similar to that created by the minute adjustment of the throttle opening in a conventional engine. Even if the inverter controls the speed and output of the motor, linearity cannot be achieved unless the motor itself responds precisely to instructions.

The characteristics of EVs are crisp and sharp output and seamless acceleration, but through the development of in-wheel motors, we learned that there is more to strive for depending on the characteristics of the motor. We are currently in the running test phase and are working on development with the goal of launching it in 2030.

At the same time, another characteristic of this motor is its design concept that focuses on resource recycling, such as easy-to-disassemble coils and efforts to eliminate rare earths. By mounting this motor onto the KAWASAKI Ninja e-1, we intended to demonstrate that it is possible to unify the motor unit for a wide variety of models and we plan to apply it to a wider range of categories in the future, including premium scooters and the 250cc class.

*Information contained in this Technical Information is current as of November 3, 2026, but may be subject to change without prior notice.