



E-MOBILITY INSIGHTS

ASM or PSM—Which Motor Design Is Better?

Issue no. 04/2026

Anyone who regularly reads service or repair guides for electric vehicles has probably seen the abbreviations PSM (permanent magnet synchronous motor) and ASM (asynchronous motor) many times. They're currently the most commonly used types of motors in electric vehicles—but what's the difference between them?

Similarities and differences

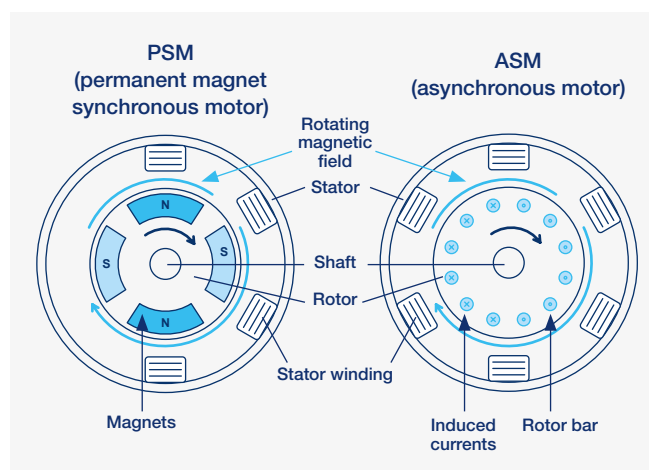
First, the similarities: Both PSM and ASM consist of a fixed stator and a moving rotor. In both cases, three-phase alternating current generates a rotating magnetic field in the stator, which sets the rotor in motion.

The key difference lies in the design of the rotors. In a PSM, permanent magnets are built into the rotor, whereas an ASM typically features what's known as a squirrel-cage rotor, in which the magnetic field is induced electrically. As a result, the rotor in a PSM moves in direct response (synchronously) to the stator's magnetic field, while the rotor in an ASM turns at a slightly different speed (asynchronously).

Pros and cons

The main reason why many European vehicle manufacturers prefer to use PSMs is their efficiency. Thanks to its permanent magnets, a PSM can convert electrical energy into drive power very efficiently, with a positive impact on energy consumption and cruising range. However, permanent magnets add to material costs and make the drive system dependent on raw materials like rare earth elements.

ASMs don't need permanent magnets. This makes them simpler to build and less dependent on critical raw materials. However, the disadvantage of ASMs is that they're generally slightly less efficient than PSMs.



New concepts

MAHLE's magnet-free MCT motor (Magnet-Free Contactless Transmitter) offers the advantages of a synchronous motor but requires no rare earth elements and transfers energy from the stator to the rotor without any physical contact. This design not only makes the motor extremely durable but also ensures highly efficient operation across a wide range of speeds and torques. So, it's entirely possible that future service manuals will feature a new abbreviation: MCT.

[> More information about the MAHLE MCT motor](#)