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From Experience

The Power of Electrically Commutated Motors (ECMs)

Electrically Commutated Motors (ECMs) are becoming a more popular, sometimes necessary, option to meet new energy efficiency standards. This change in motor construction offers potential long-term energy savings and allows for simplified control strategies for motors.

Also known as brushless DC (BLDC) motors, an ECM is a type of electric motor which uses electronic control instead of mechanical brushes and a commutator to control the motor's rotation. Key components of ECMs are:

- **Rotor**: Contains permanent magnets.
- **Stator**: Contains electrical windings.
- **Electronic Controller**: This is the key difference from traditional motors. The controller sequences power to the stator windings, which creates a rotating magnetic field. This field interacts with the permanent magnets on the rotor, causing it to rotate. The controller uses sensors to determine the rotor's position, allowing it to precisely control the timing and direction of the current in the windings.

The electronic controllers found within ECMs are the essential component which provides several advantages over traditional AC motors, including:

- **Greater Efficiency:** ECMs are more efficient than traditional AC induction motors, especially when operating at a lower percentage of full load and in smaller horsepower motors. This is because they minimize energy losses associated with friction and electrical resistance.
- **Variable Speed Control:** ECMs can be controlled to operate at various speeds using a local 0-10V signal or 0-10V signal from a Building Management System (BMS), allowing for precise control and energy savings by matching motor speed to the required load. Having the controller integrated with the motor also reduces the need for individual motor starters or Variable Frequency Drives (VFDs) for each motor.

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ECMs can offer advantages in terms of energy efficiency, controllability, and reliability compared to traditional AC motors. However, ECMs are generally only available with horsepowers (HPs) up to 10 with most capping out at around 5 HP. This is mostly due to limitations of the physical properties of the permanent magnet rotor.

- **Compact Size and Lighter Weight:** For the same power output, ECMs are often smaller and lighter than traditional motors.

- **Quiet Operation:** ECMs operate more quietly due to the lack of mechanical commutation.

See the table (below) for a direct comparison between ECMs and AC motors.

Comparison with Traditional Motors

Feature	AC Induction Motors	Electronically Commuted Motors (ECMs)
Speed Control	Limited, often requires variable frequency drives	Precise and simple variable speed control
Size and Weight	Generally larger and heavier	Generally smaller and lighter
Noise	Can be noisier	Quieter operation
Cost	Lower initial cost	Higher initial cost

As technology advances, ECMs are becoming increasingly prevalent in a wide range of applications across industries. Today, we see them primarily in applications for power ventilators in HVAC systems. For example, on a recent project most of the power ventilators were specified with ECMs and allowed the design to eliminate Motor Control Centers (MCCs) that were intended to serve the fans. While the initial cost may be slightly higher, the operating efficiency of ECMs in HVAC applications can make them a cost-effective solution in the long run.

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