Electronically Commutated Motors (ECMs): A Quick Guide for Contractors

Electronically Commutated Motors (ECMs) are direct current (DC) motors that operate in HVAC systems using a built-in inverter and a magnet rotor to achieve greater efficiency than alternating current (AC) motors. They are often referred to as ultra-high efficiency brushless DC motors.

ECMs help improve air handler performance and have been shown to improve airflow and reduce fan power consumption in many systems; however, they are not appropriate for all situations. Field studies have shown that when installed in a system with drastically undersized ducts, ECM's advantage over regular permanent split capacitor (PSC) motors is reduced substantially.

HOW DOES ECM WORK?

An electronically commutated motor differs from a standard motor in that it has an on-board microprocessor. They were originally referred to as "integrated control motors." ECM uses a commutator and a microprocessor, instead of brushes, to switch the magnetic field to create a rotation. The microprocessor controls the motor's rotational speed in response to torque against the motor's drive shaft. This torque comes from changes in resistance to airflow such as a wet evaporator coil from condensation or a dirty filter. The motor senses this increased resistance and "ramps up" to maintain a constant airflow. They are more efficient than standard permanent split capacity (PSC) motors, and this ability to compensate for increased resistance also improves overall system performance.

VARIABLE SPEED MOTORS?

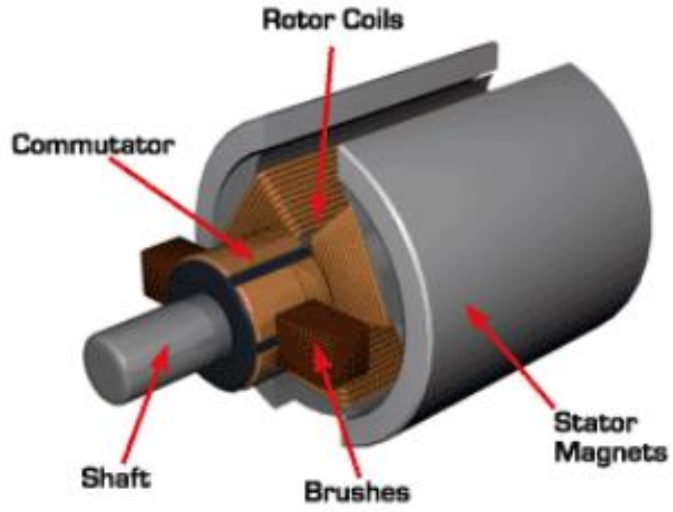
Although a commonly used term, "variable speed motors" is slightly misleading when referring to ECMs because it implies that the airflow of the system is modulated based on load or other conditions. Some applications utilize a true modulating motor, such as specialized pumps. In residential HVAC systems, ECMs are programmed to maintain a *constant airflow* as resistance changes. A more accurate term might be "constant airflow motors." Some ECMs can be programmed to run on a lower speed for a few minutes for added moisture removal, but, in our relatively dry climate, this is not an important feature.

ARE ECMS THE CURE FOR UNDERSIZED DUCTS?

No. ECMs can ramp up their speed in response to relatively small changes in resistance (static pressure), but they are most efficient when operating in the range of external static pressure of reasonably designed duct systems (0.5 to 0.7 inches water column (w.c.). When ECMs are installed in systems with very high static pressure, they may never achieve their target airflow but still use a lot of electricity. It is better to address improper duct sizing before considering a fan motor upgrade.

COSTS AND SAVINGS

All else being identical, ECMs are more efficient than PSC motors; however, to maximize savings, proper duct sizing and reduced external static pressure within 0.5 to 0.7 inches w.c. should be ensured when possible. Because of their more sophisticated controls, ECMs can be 100% to 300% more expensive than a comparable PSC, depending on size. Simple payback can range from two to four years in residential size furnace fans.



Electronically Commutated Motor
Source: http://theelectricenergy.com/what-is-a-brushless-dc-electric-motor/

Always refer to original equipment manufacturer installation instructions before replacing motors.

FOR MORE INFORMATION

"ECM Efficiency – Better (and Worse) Than You Think," Kohta Ueno, Home Energy Magazine. May/June 2010.

"The ECM Textbook," GE ECM by Regal-Beloit, 2007. www.thedealertoolbox.com

"Electronically Commutated Permanent Magnet Motors," Roth, et al, ASHRAE Journal. March 2004.