30 top tips to tackle HVAC challenges
No.02 - Electronically commutated motors
Not all motor technology is suitable for HVAC - electronically commutated motor (ECM)

Changes in building regulations are seeing the introduction of new technologies that may not be right for HVAC applications. Take electronically commutated motors. These are brushless DC motors that function using a built-in inverter and a magnetic rotor, and as a result are claimed to achieve greater efficiency in airflow systems than other kinds of AC motors. But beware…

Find out more by clicking on the tabs below.
Electronically commutated motors (ECMs)

**Advantages:**
- Medium to high efficiency
- Consistent airflow over a range of downstream static pressures
- Gradual ramp-up to set-point flow rate at start-up
- Longer motor life
- Less motor noise because smaller package of a “fan array” compared to one large motor
- Convenient package – simple installation

**Disadvantages:**
- Higher capital cost
- Above 7.5 kW do not have enough torque to overcome static pressure in the system
- Can generate incredible harmonic distortion – up to 120 percent total harmonic distortion (THD) is not uncommon
- Cannot ride through power dip situations
- Cannot catch a spinning load, something that is critical in the HVAC industry, especially data centres
- When one part of the system (fan, motor, controller) fails, the whole unit has to be replaced
- Cannot be connected directly to Fieldbus networks, like BACnet which is an industry standard, so not easy to gather data or control the application from a BMS
- Cannot program the controller to perform PID control or timed functions for the application, so no intelligence
Why can a variable speed drive catch a spinning load, yet an ECM cannot?
AC drives are in full control of field and torque inside the AC machine. The drive is able to send out a reduced excitation waveform which detects the present speed of the spinning motor. Once detected the motor is fully excited and then controlled from the present speed to the desired speed, even if the motor was spinning backwards. ECM motor controllers cannot perform this detection.

Why can a variable speed drive ride through a power dip, yet an ECM cannot?
VSD’s have large DC capacitor banks inside which can be used by the drive to store energy to allow power dip ride-through. Typically the drive detects the power going out then regenerates energy from the driven fan or pump to maintain the internal electronics by keeping the capacitors charged. When the power returns the motor is put back to normal operation. ECM controllers cannot perform this activity, so trip out when the power dips.

What is the significance of not being able to catch a spinning load?
If a controller cannot catch a spinning load (usually after a power outage), then it has to bring the motor to a very abrupt stop before accelerating the motor back to the desired speed. This abrupt stop is likely to severely damage the mechanics of the fan, the coupling or the belt systems and gearboxes.
Frequently Asked Questions

What is the significance of not being able to ride through a power dip?
If the system cannot ride through a power dip, then the controller will require to be reset to bring it back to operation. Resetting the system takes time, and during that time the HVAC system is not operating. If the controller is not on Fieldbus, then the reset has to be performed manually taking even more time.

How do you go about assessing the harmonics of a building and the affect of an ECM versus variable speed drive?
Perform an harmonics study, or ask ABB for a harmonic prediction.

Find out more by clicking here.
While the high efficiency offered by ECMs may be suitable for some applications, it is essential that the right motor technology is selected if unforeseen problems with harmonics, catching spinning loads and power loss ride-through are to be avoided.

For instance the cost-effective synchronous reluctance motor (SynRM) offers the same efficiencies as ECMs but without the aforementioned issues.

A SynRM motor controlled in a properly designed system can achieve the specific fan powers, whilst being controlled by a traditional VSD that then brings all of the advantages of a modern VSD:

- Improved harmonic mitigation
- Adequate power dip ride-through
- Fieldbus connectability
- Built-in control features to enhance the application
This is one of 30 top tips for users of variable speed drives in heating, ventilation and air conditioning applications. To ensure that you receive ALL the tips as they are published, please register your interest by clicking here