EC Vs AC Motors

The trend to EC motors has been steady since their introduction in 2003. Size, weight, longevity and efficiency have all contributed to their success. This article explores the benefits of these motors over the traditional PSC motor.

AC induction motors are designed to operate at a certain point on their performance curve which coincides with their peak efficiency which is good in constant speed applications. The efficiency can drop considerably on either side of the optimum operating point which happens often in todays' variable speed world. An AC motor generally consumes more energy by simply having to produce a magnetic field by inducing a current into the rotor where an EC motor, ECM, uses permanent magnets giving it an inherent efficiency advantage.

Figure 1: AC Direct Drive fan Motor (.5kW)

EC motors operate on DC voltage and are electronically commutated as opposed to using brushes as in a standard DC motor. Brushless DC motors have integrated electronics that convert AC power to DC, perform the commutation, and control the speed by regulating the power to the motor. EC motors are limited in capacity to about 7.5kW or 10HP.

Figure 2: EC Direct Drive Fan Motor (.5kW)

They also have a flat efficiency curve which varies relatively little across the speed range. The range is not limited to synchronous speeds or voltage fluctuations as with an AC motor which allows the ECM to match the performance requirements of an application while maintaining a high operating efficiency. These differences give the ECM a 20 to 25% efficiency advantage over a PSC motor. EC motors are typically lighter, smaller and quieter and require less maintenance than AC motor making them ideal for decentralized HVAC equipment. It must be stated however that the peak efficiency of a PSC motor is very close to an EC motor so if your application requires a specific constant speed, a correctly selected PSC motor may provide comparable efficiency at a lower cost. The second caution with EC motors is temperature. Magnets degrade with temperatures over 125F so a safe operating temperature range must be considered in your application.

The by-product of lower efficiency motors is heat which can drag down the "system" efficiency if the motor is located in the air stream. This additional thermal load must be offset by adding cooling capacity, again giving the ECM an advantage in HVAC applications.

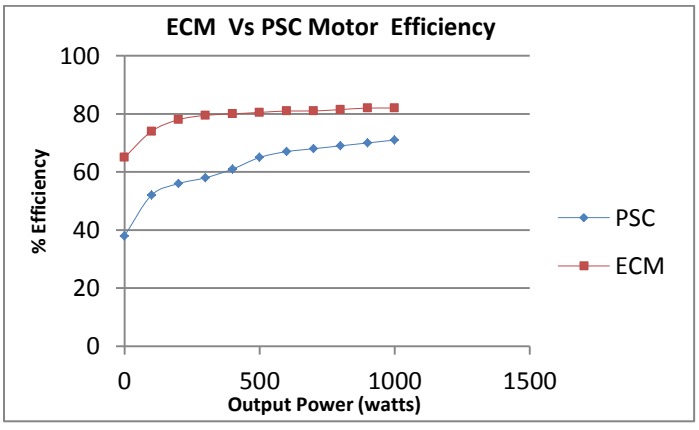

Table 1 Efficiency Comparison – PSC Motor & EC Motor

There are a number of variables in calculating over-all system efficiency such as load profile, heating or cooling application, and fan, type but Table 1 illustrates the efficiencies of 4 common motor types at varying loads. The ECM is approximately 20% more efficient than the single phase AC motor at 50% load and is considerably more efficient at lower loads. Table 2 compares variable and multi speed EC motors with PSC motors.

	Variable Speed EC Motor	Multi Speed EC Motor	Variable Speed PSC Motor	Multi Speed PSC Motor
Peak Efficiency	Best	Best	Best	Best
Part Load Efficiency	Best	Best	Good	Good
First Cost	Good	Better	Best	Best
Operating Cost	Best	Best	Better	Good
Maintenance Cost	Better	Best	Best	Best
Life Cycle Cost	Best	Best	Better	Good

Good Better Best

Table 2 ECM, Variable & Constant Speed PSC Comparison for fan coil application (less than 1500CFM)

In applications less than 1500CFM, we recommend the multi-speed ECM because the operating range of the speeds will match the load profile without the added cost of the variable speed controller. In a real life scenario, this example shows the annual savings of an EC multi-speed motor over a PSC multi-speed motor in a typical hi- rise fan coil application.

<u>ECM Vs AC Fan Operating Cost</u>

a/ Operating hours = 8760
b/ Annualized Average ECM W = 213
c/ Annualized Average PSC W = 281
d/ Average Electrical cost = $0.18/KWH
Savings = (c – b) x a x d
= ((281- 213) x 8760))/1000 x $0.18
= $107.72

In summary, EC motors are the future and the price gap will continue to close as the ECM market share grows. We at Temspec strongly recommend all systems be designed with the highest efficiency equipment and lowest life cycle cost to help ensure a healthy planet for our ancestors.
EC Motors are available on all Temspec unit ventilators and fan coils.

To Learn more, contact your local Temspec sales representative or contact us directly at:

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