case.study

2006/05

In-line duct fans

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In-line duct fans

In-line duct fans are useful air-movement devices to supply or extract air from a room within a building. If general ventilation is required and an outside wall is not available to fit a wall or window fan, in-line duct fans can be used to overcome the pressure of the supply or exhaust duct to the outside world. The use of EC fans provides a significant power saving in this application. This case study considers a small unit with a free air delivery of 400 m³/h, and demonstrates a 60% saving at full speed, but 80% saving under speed control.

EC motors are DC motors with integrated AC to DC conversion. This gives the flexibility of connecting to AC mains with the efficiency and simple speed control of a DC motor. In this case study the EC motors are 80% efficient compared to 45% efficiency for the AC.

Measurements were taken at a 4 duty points, points 1 and 2 at full AC fan speed and points 3 and 4 at reduced speed.

Pts	Flow (m³/h)	Pressure (Pa)	Power input AC (W)	Power input EC (W)	Energy saving (W)
1	350	60	65	38	27
2	240	150	85	35	50
3	160	15	42	8	34
4	130	40	22	8	14

Table 1 comparison of power input AC versus EC

There is a bigger energy saving under speed control. AC motors can be speed controlled by voltage reduction. When the voltage to the motor is reduced its magnetic field strength weakens and the slip between the rotor and the stator increases. This slip gives speed control, but is achieve by making the motor more inefficient. EC motors by contrast do not use slip to reduce the speed and so the efficiency of the motor is maintained at reduced speed. This explains the increased energy saving of EC with reduced speeds.

Figure 1 demonstrates this further. It is an example of a 800 mm axial fan. At full speed (17,000 m³/h) the AC fan consumes 1.9 kW and the EC 1.6 kW, a difference of 300 W. However at a reduced speed and volume flow of 11,000 m³/h the AC fan consumes 1.15 kW and the EC 500 W, a difference of 650 W, more than twice the saving as at full speed.

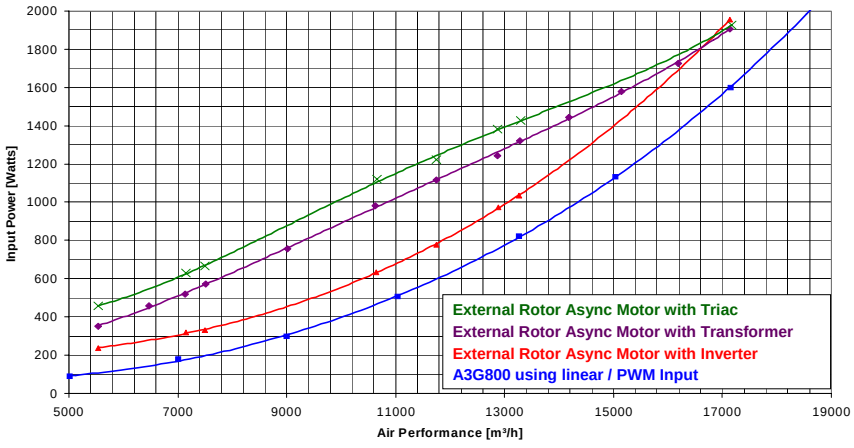

Figure 1 a comparison of an 800 mm axial fan with speed control.

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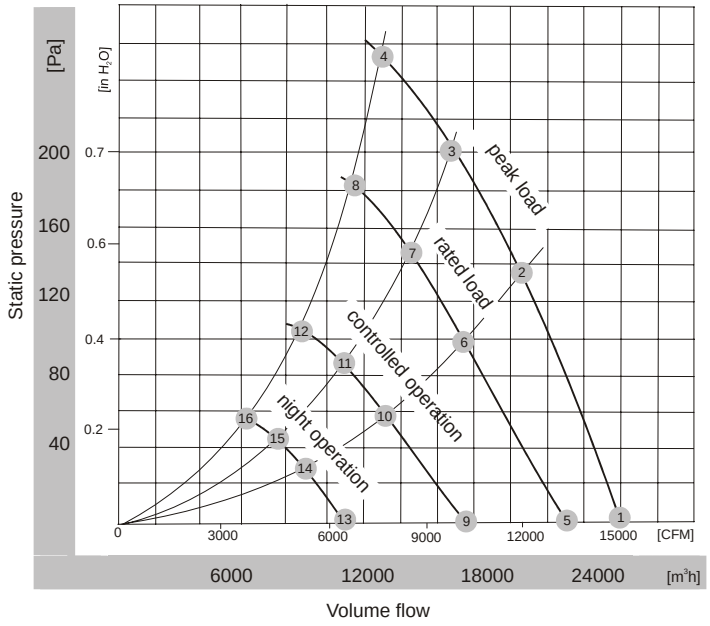
A further advantage of EC motors is there capability to rotate at faster speeds than and AC motors. AC motor speed is set by the number of poles and supply frequency. A 2 pole motor as used in this application will rotate at just below 3000 rpm on a 50Hz supply. EC motor speed is set by design at ebm-papst. In this case the equivalent EC motor can rotate at 4000 rpm, a 33% increase in speed. Figure 2 demonstrate the increased performance when fitted to a fan. The rated speed is equivalent to an AC fan and the peak load curve demonstrates the increased performance of the EC fan at full speed..

Reduced speed characteristics



EC fans can provide significant energy saving and also provide extra performance where necessary.

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