

EC vs AC

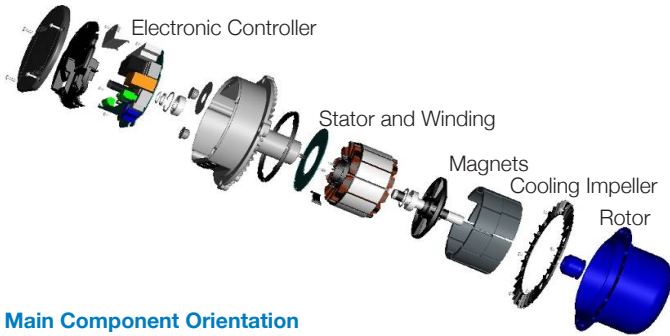
Information Centre

The Facts



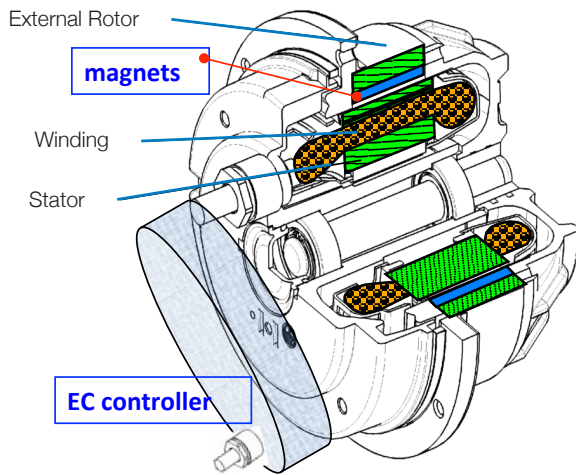
External Rotor EC Motor

EC Motor Mechanical Configuration



Main Component Orientation

Motor rotor positioned outside the stator.



EC Motors (electronically commutated)

- Commutation is required in both brushed and brushless DC motors
- Mechanical commutation is performed by the brushes and commutator of brush motors
- In the case of brushless DC motors, the communication is achieved electronically
- In permanent magnet external rotor EC motors, the stator which has the power applied to it sits within the rotor
- A rotating magnetic field is created in the stator winding by means of Electronic Communication
- The permanent magnets inside the rotor are drawn around by the rotating stator magnetic field, causing the rotor to rotate

EC Motor Losses

Stator copper losses – Current flowing through stator windings creates heat

Rotor copper losses – None

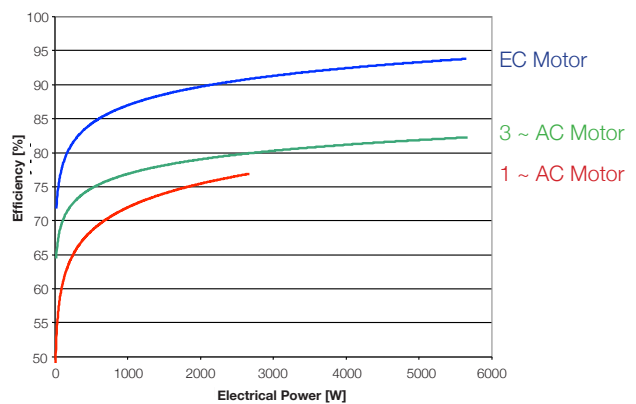
Rotor slip losses – None

Iron core losses – Hysteresis and eddy currents in the stator and rotor laminations, creating heat

Electronic losses – Low level losses from using electricity to drive electronics

Other losses – Bearing friction, windage

EC vs AC Fans



EC Driven Fans

- Relatively high capital expenditure on motors, but is becoming more competitive
- Using permanent magnets means none of the electricity applied to the stator is required to induce magnetic fields in the rotor (higher efficiency)
- Speed control built into the electronic commutation electronics
- Relatively low losses compared with equivalent AC motors, especially at reduced speed
- Higher efficiency than equivalent AC motor, especially at reduced speed, so lower running costs and 'life-time costs'

Summary

- Relatively high capital expenditure on motors, but is becoming more competitive
- Speed control built into the electronic commutation electronics
- Higher efficiency than equivalent AC fan, especially at reduced speeds, so lower running costs and 'life-time costs'

Benefits

- Precise speed control with direct motor speed measurements
- Very high efficiency
- High power density
- Start with full torque independent of rotor position
- Low electromagnetic noise from the motor
- Maximum speed is independent from mains frequency
- No long cable length between motor and controller
- Integrated controller
- Very simple connection
- Additional system is easy to make
- Less power consumption
- **Lowest installed cost option**

The Facts



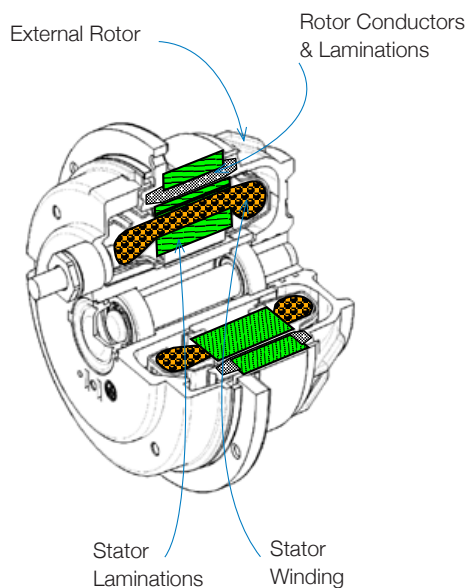
External Rotor AC Motor

AC Motor Mechanical Configuration



Main Component Orientation

Motor rotor positioned outside the stator.



Fan Application

Fan impeller either integral with the rotor, or bolted to the rotor.

Very compact design, when compared with internal rotor motor.

AC Motor Losses

Stator copper losses – Current flowing through stator windings creates heat

Rotor copper losses – Current flowing through rotor conductors creates heat

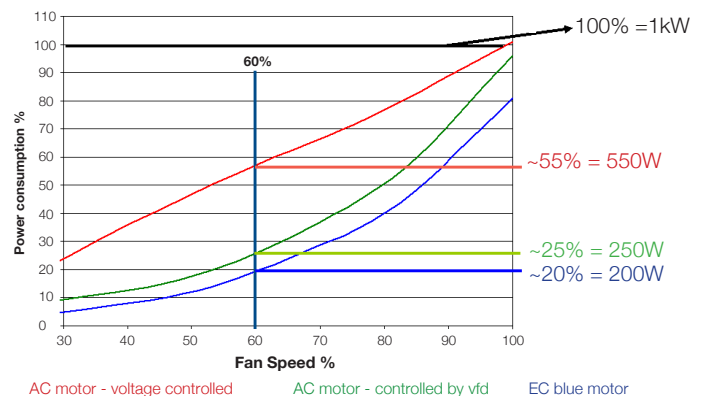
Rotor slip losses – Increasing slip increases the current flowing through rotor conductors, creating more heat, especially at reduced speed

Iron core losses – Hysteresis and eddy currents in the stator and rotor laminations, creating heat

Electronic losses – N/A

Other losses – Bearing friction, windage

Comparative Motor Efficiencies



AC Driven Fans

- Relatively low capital expenditure
- Some electrical power is required to 'induce' magnetic fields in rotor laminations and induce current flow in rotor conductors (lowered efficiency)
- Additional items required for speed control; additional cost for speed control
- Relatively high losses (slip, core), compared with EC motors, especially at reduced speed (lowered efficiency at reduced speed)
- Relatively high running costs and so relatively high 'life-time costs'

Summary

- Relatively low capital expenditure
- Lower efficiency than equivalent EC fan, especially at reduced speeds
- Additional items required for speed control
- Relatively high running costs compared with equivalent EC fan, and so higher 'life-time costs'

EC vs AC

EC	AC
Relatively high capital expenditure on motors, but is becoming more competitive.	Relatively low capital expenditure.
Using permanent magnets means none of the electricity applied to the stator is required to induce magnetic fields in the rotor (higher efficiency).	Some electrical power is required to 'induce' magnetic fields in rotor laminations and induce current flow in rotor conductors (lowered efficiency).
Speed control built into the electronic commutation electronics.	Additional items required for speed control which incurs additional costs.
Relatively low losses compared with equivalent AC motors, especially at reduced speed.	Relatively high losses (slip, core), compared with EC motors, especially at reduced speed (lowered efficiency at reduced speed).
Higher efficiency than equivalent AC motor, especially at reduced speed, so lower running costs and 'life-time costs'.	Relatively high running costs and so relatively high 'life-time costs'.
EC motors can be controlled from a simple low cost potentiometer.	AC motors require additional controllers to offer speed adjustment these tend to be big and expensive. They are also typically used with starters.
Precise speed control with direct motor speed measurements which allows precise flowrate adjustment optimising ventilation and energy usage.	AC controllers are typically stepped which doesn't allow specific speed control so tend to be over ventilating. This over ventilation could waste more energy than the fan is using especially when there are high levels of heating or cooling of the fresh air.
Wiring to EC controls is all by low voltage cabling.	Cabling between the controllers and fans needs to be mains cable sized for the current of the fan and needs to be wired up by a qualified electrician.
EC motors can be controlled by a 0-10V signal direct from the BMS and with additional controllers and have 2 way communication.	There is no standard option to offer BMS connectivity with AC Fans.
No matter the size of the fan, the control methodology stays the same so controller costs don't increase with size.	As the size of an AC motor increases so does the size of the controls and starters needed to deal with the extra power, creating a larger increase in price compared with EC fans.

In comparison, EC motor driven fans offer cost efficient technology that can have significant energy saving benefits.

Tel **+44 (0) 1489 566500**
 Fax **+44 (0) 1489 566555**
 Email **export@eltafans.co.uk**

17 Barnes Wallis Road, Segensworth East Industrial Estate,
 Fareham, Hampshire, PO15 5ST, United Kingdom

eltafans.com

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