Stulz CyberAir Precision Air Conditioning Incorporating EC Inverter Fan Technology

Description

The CyberAir range incorporates the EC fans manufactured by EBM-Papst. The EC (electronically commutated) fans achieve high efficiency at full and partial speed. Fan speed is infinitely variable from a 0-10v signal from the Stulz microprocessor controller (C6000).

ASHRAE has recently honored EBM with an award for the most innovative energy saving product in the field of ventilation. This award was presented by the ASHRAE President, Richard Rooley, at the 2004 AHR Expo in Anaheim, California. In addition, EBM-Papst won the 2005 Cleanrooms Contamination Control Technology Award, the "Air Movement Product of the Year" at the 2004 H & V News Awards and "Environmental Product of the Year" at the Cooling Industry Awards in the same year.

Advantages of the EC Fan

Lower running cost – significantly more efficient motor itself

No drive belts – reduced maintenance (no changing nor adjusting)

No belt dust and therefore no contaminating of mission critical equipment, including servers, disk drives, telecom switch gear, etc.

Longer filter change intervals

No power transmission losses through belts and pulleys

Lower (audible) noise – no AC inverter whine – vibration free operation

Site adjustable air volume (fan speed) from CyberAir CompTrol controller and therefore easy adaptation to changing conditions

Increased net cooling – reduced cooling load on refrigeration plant

Integrated electronics – no need for secondary electronics e.g. inverters and filters

Power factor of R3G630-AB06-** is greater than 0.92 at full load due to integrated power factor controller – no need for correction

Soft start – without high inrush current – no belt slip or peak noise

Fan direction always correct – not phase directional

High efficiency is maintained at variable speeds / no efficiency penalty at reduced speeds

Integral overload protection

Backward curved aerodynamically optimized impeller

Due to individual direct drive nature of EC fan, redundancy is built into each unit containing multiple fans…particularly Chilled Water CRAH Units (greater allowable coil air volume range)

How It Works

The EC fan has a DC (direct current) motor operating off of an AC (alternating current source), 460v, 3 phase, 60 Hz main supply with an integral rectifier. The EC (electronically commutated) brushless motor has permanent magnets in the rotor, which revolves around the ***outside*** of the motor. The backward curved fan blades are attached to the rotor casing.

A more traditional DC motor uses brushes to switch the direction of the current in the stator (***this is known as commutation***) so that the ***N***orth magnetic pole of the stator windings repels the ***N***orth magnet in the rotor. Then, as the rotor revolves, the brushes switch current direction to ***S***outh to repel the ***S***outh magnet. Thus, with the rotor revolution a rotating magnetic field is generated.

The EC motor behaves like a brushed DC motor as the speed under load is proportional to the drive voltage and the developed torque is in linear proportion to the current. The EC motor utilizes a 'Hall Effect' I.C. switch to sense the position of the magnets in the rotor and then precisely times the switching of the output transistors to control the direction of the current in the stator windings (***electronic commutation***).

Adjustable fan speed is achieved by a 0-10v control signal from the CyberAir's system mounted CompTrol controller. The EC fan motor uses the 0-10v signal to proportionally adjust the effective voltage at the stator windings The EC motor has a sensing and feedback circuit to ensure that the correct speed is obtained.

Reliability

The DC motor is inherently more efficient than AC motors and, therefore, operates at a lower temperature putting less thermal stress on windings and bearings, while also reducing the amount of heat introduced into the air stream (lessening the impact on "total" vs. "net" capacity of the CRAC unit).

Mechanically, two internal bearings are used; significantly reducing the risk of failure.

Efficiency

The efficiency of the EC motor (typically > 90%) is higher than that of traditional asynchronous AC motors (typically < 80%) and generates less heat, as there are no slip losses, less copper and iron losses. The EC motor is also more efficient than alternative speed control methods including:

Inverter, AC frequency control
Triac voltage control
Multi-taped transformer voltage control (steps)
Star/Delta switch (two step)

Conclusion

CyberAir's EC fans offer on-demand, automatic and manually controllable variable speed capability and achieve the benefits of improved efficiency, reliability and low running costs.