

Motor Design, Quality and Performance are Critical to Reliable Operation of Fans & Blowers

Most electronic systems create heat which needs to be removed. Blowers and fans are the most reliable, efficient way to control heat rise in electronic equipment. Although blower selection relies on a variety of design parameters, including air flow, system impedance, package size, electrical characteristics and acoustics, the motor which powers the impeller or fan is critical to safe and reliable operation and protection of valuable system components.

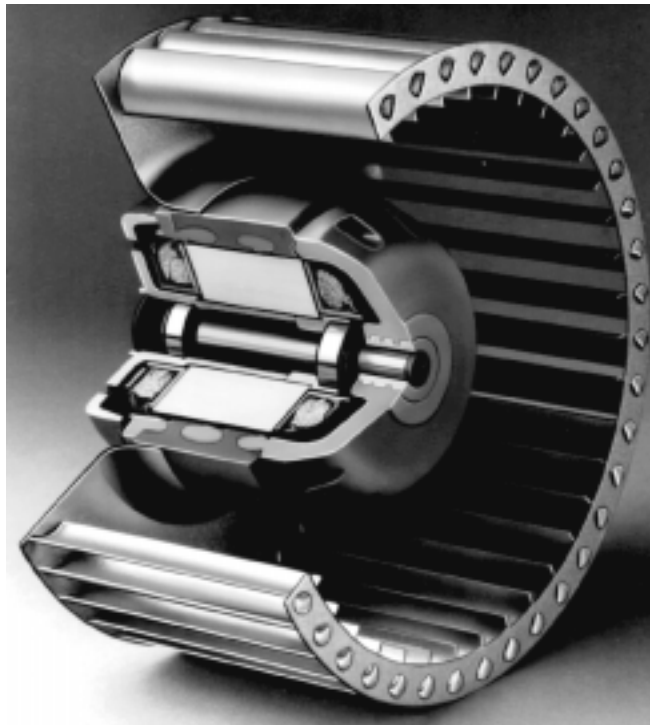
In most applications, the fan/blower motor operates continuously when the system is on and in operation. Although speed control is possible with most motors, it is rarely a major factor when selecting major features of the motor. Similarly, many of the common motor evaluation criteria are not major factors when choosing a fan or blower. Typical speed/torque curves are not important. Acceleration, deceleration are not critical. What is important? Long-life operation, maintenance-free performance, size, weight, efficiency and power compatibility with other components which are being assembled into one integrated system. The external rotor motor which is available in both AC and brushless DC versions provides the best performance and most reliable operation for most applications.

THE ADVANTAGES OF EXTERNAL ROTOR CONSTRUCTION

Since most motor heat is produced in the rotor, making it the rotating element and keeping the stator stationary (see Photo) have several very important effects on performance:

- More effective cooling improves reliability and extends the life of the motor
- Motor efficiency and size/output relationships are better than with induction-type motors.

Even if the external rotor motors operate at low speeds which in turn increases heat, current (amps) increases only slightly (in many internal rotor motors current often rises 30% to 40%). Superior cooling and heat dissipation from the motor still occurs because the air flow passes over the rotor. Speed control is very easy with external rotor motors by voltage reduction using fixed or variable resistors, auto-transformers, or electronic speed controllers. Speed control has better linearity, too.



Because motors are totally enclosed they run clean and stay clean for long life operation. Shorter lamination stacks reduce copper losses. Less induction is required to reach equivalent torque. The operating temperature range for most blowers or fans is commonly -22°F to $+300^{\circ}\text{F}$ (-30°C to $+150^{\circ}\text{C}$) but varies with motor type and power selection. Most AC motors include built-in overload protection by impedance or thermal cutout.

Many options can be added depending on user needs. They include: Hall

Effect sensors, a choice of different alarms, different windings, dual voltage, constant speed back up if a speed controller fails, adaptation to substantial load changes, impeller attachment and a choice of bearing systems. External rotor motors are also better when multiple motors operate simultaneously in a system at a common frequency or speed, for example, using several fans in a fan tray or fan rack, or using one blower at an intake inlet and another at an exhaust outlet.

A VARIETY OF MOTORS

The motors used in ebm blowers and motorized impellers are either shaded-pole, permanent split capacitor or brushless DC designs with Class "B" insulation. AC units operate at 115V or 230V, 50/60Hz. Dual voltage (115/230 volt) motors, three phase motors and other special AC models rated from 12 to 440V are available on a special order basis. AC motors are thermally protected in accordance with UL, CSA and VDE requirements.

Brushless DC models are available in 12, 24, 48 and special voltages. Motors are up to 5 times as efficient as AC motors. Voltage can deviate $\pm 30\%$ from the nominal voltage. DC motors feature electronic locked rotor protection. Electronic features such as Hall effect for failure monitoring or output for external control, temperature sensing and control can be integrated in the motor. Dimensions will vary with each motor. NEW brushless DC motors and blower products are constantly being introduced. Call us for complete and current information, 860-674-1515.

The motor ratings listed correspond to the maximum power demand of the impeller occurring at zero static pressure.

SPEED CONTROL

All ebm external rotor motors are 100% speed controllable by voltage reduction or other means and operate at very low voltages without overheating or reducing reliability. The outstanding advantage of ebm/Papst motors, when speed controlled, is their STABILITY which permits proper balance between air flow and noise.

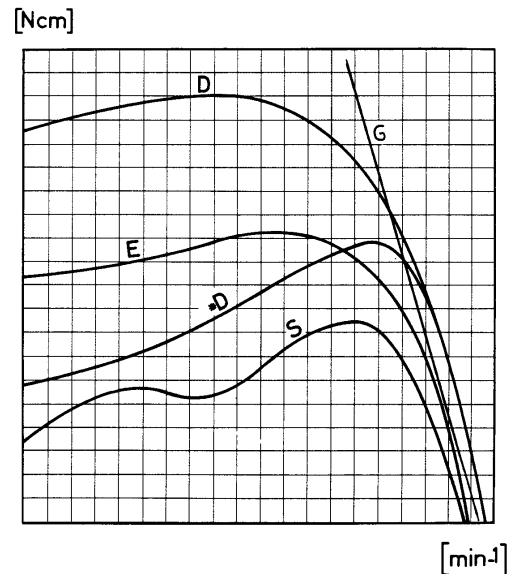
It is possible to make any ebm fan or blower with a PSC motor a multi-speed blower by adding a second or third capacitor on the load line (see wiring diagrams) at or near the value of the motor run capacitor. Actual capacitor value and RPM achieved are dependent on the uniqueness of the customer's application.

To maintain operating reliability of AC products, a reactive filter (sine filter) should be used when controlling speed with a variable frequency drive (VFD).

For brushless DC motors the speed/torque relationship is more linear than that of most AC induction motors. Speed control electronics can be built in to the DC motor assuring high quality performance of the motor and the air mover.

GROUNDING

Grounding can be achieved through mounting to the metal chassis. Additional ground connections on the blowers can include an unpainted M4 tapped hole or separate ground wire to meet VDE requirements.



- S = Shaded pole motor: low starting torque, low efficiency
- E = Single phase motor: high starting torque, good speed control, fair efficiency
- D* = 3 \emptyset motor with capacitor: high pull out torque, high efficiency, excellent speed stability
- D = 3 \emptyset motor: high starting torque, very high efficiency, good speed control characteristics
- G = DC, brushless motor: highest starting torque, exceptionally high efficiency, 100% speed controllable.

HIGH QUALITY, SPACE-SAVING DESIGN

Flexible air flow design, long life and structural stability are inherent properties of all ebm fans, blowers and motorized impellers. The external rotor motor, shaft and impeller blades are each manufactured by ebm/Papst and assembled into a single unit which is dynamically balanced in accordance with DIN 1940.

The external rotor motor is mounted in the center of the fan or impeller to save space, improve efficiency and minimize the vibration that commonly occurs when the impeller is mechanically affixed to the motor shaft with set screw and hub.

ACOUSTICS

Sound measurements are made in an anechoic chamber at nominal voltage with a microphone one meter from the air inlet. Sound values are determined using a Bruel and Kjaer sound level meter 2131. Low noise levels are achieved by computer-aided-design of impeller blades and by precision manufacturing and balancing.

BEARING SYSTEMS

Product life will depend on ambient temperature, duty cycle, mounting position and environmental conditions. 100,000 operating hours is common. Bearings are totally maintenance free. MTBF and L-10 life information is available on request

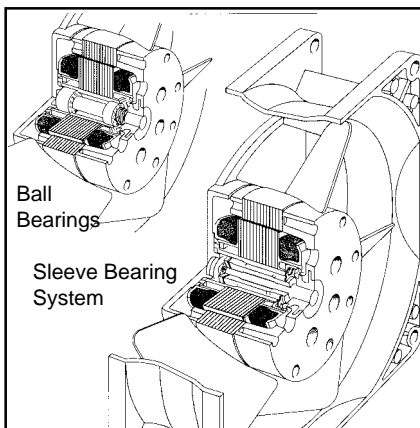
Two bearing systems are common in air moving products, sleeve bearings or ball bearings. ebm SINTEC SLEEVE BEARINGS utilize high technology to achieve outstanding performance in tubeaxial fans. The benefits of these porous double-sintered bearings are:

- Constant low-noise load during the lifetime of the fan, at normal speed ranges
- Long-life operation equal to the service life of ball bearings
- Lower shock sensitivity
- Extremely good temperature resistance

SINTEC BEARINGS are a single part bearing which has two precisely aligned bearing positions and an extremely large lubricant reservoir. Immediately after start up a dynamic lubrication film develops which prevents contact between the bearings and the shaft. The high temperature, non-aging, high viscosity lubricant penetrates the pores of the bearing to effectively reduce wear. SINTEC BEARINGS are available in both DC and AC tubeaxial fans.

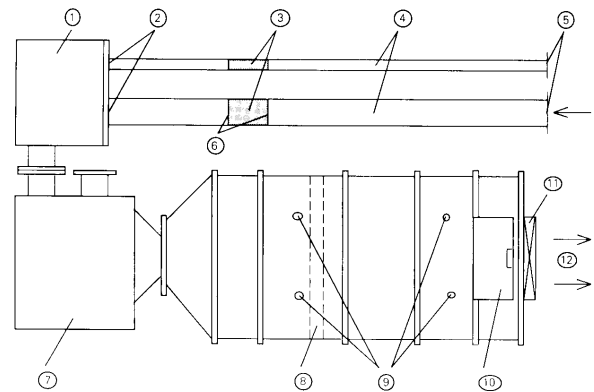
Several factors make it important to think about bearings in your selection of the proper motor you choose for a specific application:

- Two factors play a major role in bearing life:
 - Lubrication of the bearing
 - Operating temperature range
- Larger bearings extend operating life.
- Larger bearings reduce alignment sensitivity and permit more precise shaft positioning.



AIR PERFORMANCE

The air performance of ebm products is precisely determined in ebm's laboratory by using the test chamber shown. Blower performance curves are determined in accordance with DIN1952, DIN24163 and AMCA 210-85. A few blowers and motorized impellers must be operated against a minimum static pressure (as shown in the performance curves) to avoid overloading. The nominal CFM, watts and noise level figures listed correspond to the free air flow or minimum static pressure point on the performance curve.



- | | |
|----|--|
| 1 | Collector |
| 2 | Shutter |
| 3 | Venturi tube or nozzle |
| 4 | Ducts for different air volumes |
| 5 | Air intake |
| 6 | Measurement of differential pressure, air volume |
| 7 | Auxiliary fan with shutter |
| 8 | Air flow straightener |
| 9 | Measurement of static pressure by pipe ring |
| 10 | Door |
| 11 | Fan under test |
| 12 | Direction of air delivery, free air |

SAFETY

All fans and blowers are designed to meet existing UL, CSA, VDE AND CE standards. Approved products are listed in UL Files E54522, E76226, and E123518, CSA LR43145 and several VDE files. Products are also marked with the CE logo where applicable. It is the responsibility of the user to be sure blowers are installed and operated in accordance with all safety codes.

Call **ebm Industries** at 860-674-1515 • Fax 860-674-8536 • E-mail: sales@ebm.com for Technical Assistance

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