## When to Use Motorized Impellers

Motorized impellers, also known as backward curved impellers, are designed for applications that require high airflows in a small package. Motorized impellers maximize heat dissipation to extend the operating life of electronic components and systems. Motorized impellers work in a broad operating temperature range, and they are available for both AC and DC motor applications. These impellers are ideal for air filtration and ventilation systems, networking systems, and for cooling electronic and telecommunications cabinets.

### Energy Efficiency

Energy efficiency is of ever increasing importance in today's world. According to a U.S. Department of Energy report in 2011, approximately 6.5 percent of the primary electricity consumption is used by commercial and industrial fans, blowers and fume hoods. Replacing such equipment with more advanced energy-efficient options would result in a substantial reduction in energy usage and cost. Technological advances in design and manufacturing is resulting in motorized impellers and blowers with improved energy efficiency.

### Blowers versus Motorized Impellers

Blowers and motorized impellers have one major design difference – the direction in which the blades curve – and this leads to a difference in the way that air exits from the motor. For blowers, or forward curved fans, the blades curve in the same direction as the motor's rotation. The pressure side of the blade is concave, and the suction side is convex. As the motor rotates, the air exits in the radial direction in a manner that is tangential to the curve of the blades.

For motorized impellers, or backward curved impellers, the curvature of the blades is reversed – they curve away from the direction in which they rotate. Here the pressure side is the convex side and the suction side is the concave side. As the motor rotates, the air exits radially from the motor away from the direction of rotation.

Both motorized impellers and blowers are used to direct air flow. The high volume of air that they produce makes them ideal choices for commercial and industrial applications. For a given size, however, motorized impellers and blowers have some significant operating differences. Motorized impellers typically run at higher speeds (RPM) than blowers. Motorized impellers have a higher airflow (CFM) than blowers as well. Motorized impellers typically have a higher total efficiency than blowers. Due to their design, motorized impellers are somewhat less susceptible to particle build-up on the blades than blowers, so they can be used in environments that have some level of particulate materials.

**Why Use Motorized Impellers**

Motorized impellers offer a great many benefits that promote their use in commercial and industrial applications. They produce a high volume of air that can be concentrated or directed very effectively to deliver good ducted air movement.

The unique coupling of mounting the impeller blades directly onto the motor rotor provides a system that minimizes space and vibration. Since both the motor and impeller are located in the air stream, there is highly efficient motor cooling with excellent heat dissipation. The airflow over the motor rotor ensures low internal operating temperatures and substantial energy savings.

The small size, compact dimensions and low profile of motorized impellers provide a distinct installation advantage over fans with forward-curved impellers. Additionally, motorized impellers can operate with or without a casing or scroll housing, further reducing their footprint size. Motorized impellers combine their high airflow with high aerodynamic efficiency and high reliability, providing maintenance-free operation.

Motorized impellers offer exceptional pressure performance, generating significant static pressure relative to other fan options.

Noise levels can be a consideration for motorized impellers, especially those installed in indoor locations. Noise levels can be controlled by making adjustments to the fan size and speed – reducing the system to the smallest size and the lowest speed that accomplish the task will minimize the amount of noise. Clearing the airflow path of physical interference will also minimize noise levels. Finally, proper installation of the motorized impeller will minimize vibrations and noise.

Using motorized impellers with smart controls further improves their energy efficiency. Smart controls allow the motorized impeller to be run at the lowest fan speed needed to get the job done, reducing noise and minimizing energy usage while optimizing performance. These smart controls also allow the user to monitor operation and operating conditions, such as temperature and airflow.

Airflow monitors can be installed with motorized impellers, providing a method to track when airflow becomes compromised. An audible alarm and/or an optical LED indicates when the airflow falls below a preset limit, either due to interference with the impeller or to clogging of optionally installed fan filters throughout the installation. With an operating life of more than 100,000 cycles, these airflow monitors can be retrofit onto the intake side of existing motorized impellers.

**Applications**

Motorized impellers are the system of choice for applications where the primary considerations are high airflow, high reliability, high static pressures, limited space and low power consumption.

Motorized impellers are typically used in environments with higher static pressure, higher impedance or back pressure, such as in-line boosters in duct work, and air circulation/recirculation systems including HVAC (heating, ventilation and air-conditioning). Motorized impellers are also an excellent choice for exhaust applications such as commercial extractor hoods and kitchen range hoods. They can also be used to produce negative pressures for industrial vacuum systems.

Other applications that benefit from using motorized impellers include refrigeration and freezing equipment, ovens, and cabinets and enclosures. The mounting location within a cabinet can vary with the application, depending on where the air intake and exhaust vents are placed.

Depending on the application, motorized impellers need to run under a range of operating temperatures and humidity conditions. They need to withstand moisture penetration. Motorized impellers used in kitchen applications, for example, need IP55 ratings to ensure they are protected against liquids and condensation. Each application will determine the specific environmental rating needed for the motorized impeller.

Both AC and DC motorized impellers are available, and the choice depends on the specific application. They operate over a range of different voltages and are available with variable speed controls, adding to their flexibility of operation. They are available in a variety of sizes, ranging from about 120mm to 400mm diameter. Motorized impellers typically require a duct ring, or inlet ring, to prevent exhaust air from coming back into the system through the air intake. Some unified systems are available, where the duct ring comes attached to the motorized impeller, which in other cases, a separate duct ring must be installed before operation.

AC motorized impellers require a capacitor for operation. Some models call for the external capacitor to be obtained separately, but others come with it. Models have voltage ratings of 115VAC, 230VAC or 115/230VAC dual voltage. Most have a wide operating temperature range, as much as -20°C to +50°C. AC motorized impellers provide high airflow in a wide range of harsh and demanding applications.

In some applications, DC motorized impellers require pulse width modulation (PWM) input and a tachometer for output. Models have voltage ratings of 12VDC, 24VDC and 48VDC. Most have a wide operating temperature range, as much as -10°C to +70°C. DC motorized impellers provide a low-power solution with standard control and monitoring features as needed.

**Motorized Impellers from Orion Fans**

Orion Fans offers two series of motorized impellers. Their series of AC motorized impellers range in size from 133mm x 72mm up to 404mm x 162mm. Most are available in both 115VAC and 230VAC. The airflow ranges from 165-188 CFM for the smallest AC motorized impellers up to 1900 CFM for the largest ones. The rated speed drops as the size increases, ranging from 2780/3200 RPM for the smallest down to 1250 RPM for the largest. The noise level increases as the size increases, ranging from 56/60 dB

for the smallest up to 73 dB for the largest. Orion Fans' AC motorized impellers have an operating temperature range from -40°C to +60°C, with a life expectancy of 40,000 hours.

All AC motorized impellers are IP55-rated, providing protection against dirt, dust, oil and other non-corrosive materials, as well as protection against water sprayed against the motor by a nozzle from any direction. All models include the required capacitor as a standard feature. Also, all AC motorized impellers are designed to meet UL, cUL, TUV, VDE and CE standards.

Orion Fans' DC motorized impellers range in size from 133mm x 91mm up to 250mm x 110mm. One model is available to operate at 12VDC; all models are available in either 24VDC or 48VDC. The airflow ranges from 326 CFM for the smallest DC motorized impeller up to 825 CFM for the largest one. The rated speed drops as the size increases, ranging from 4600 RPM for the smallest down to 2600 RPM for the largest. The noise level is fairly constant as the size increases, at about 64-70 dB. Orion Fans' DC motorized impellers have an operating temperature range from -10°C to +65°C, with a life expectancy of 40,000 hours. All DC motorized impeller models include a tachometer and PWM function as standard features.

All of Orion Fans' AC and DC motorized impellers feature backward curved thermoplastic blades (metal blades are used on the largest AC models), a rugged diecast aluminum frame, and sealed dual ball bearings. Optional metal duct rings are available to fit all of the AC and DC motorized impellers. Custom packaging is available for most models upon request.

**Summary**

Motorized impellers move a significant amount of air for their small size, and they provide a long operating life with little-to-no maintenance. They offer superior maximum static pressure values for restrictive environments such as electronic cabinets, enclosures and ventilation systems. Using smart controllers to optimize operating conditions and monitor airflow can further improve energy savings.

By taking into account the demands on the application, in terms of airflow requirements, space restrictions, pressure, temperature and moisture levels, noise tolerance and energy efficiency, an appropriately sized motorized impeller can be selected. The usage of AC or DC motorized impellers depends on the specific application.

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