We're Fans of Blowers
How to choose the best motorized impeller or blower

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Energy-efficiency is one of the most important performance specifications for fan and blower manufacturers. In a 2011 report to the American Council for an Energy-Efficient Economy, ENERGY STAR estimated that there were more than one-million commercial kitchen ventilation systems installed in the U.S alone. In the same report, the Department of Energy (DOE) estimated that commercial and industrial fans, blowers, and fume hoods consume approximately 256 billion kWh per year - equivalent to about 6.5 percent of total U.S. electricity consumption. More recently, in 2013, the DOE proposed new energy-saving standards for commercial refrigeration and freezer equipment. In the written proposal, fans were one of several components specifically identified as needing improved efficiency. Manufacturers have continued to redesign fan and blower products to better meet energy-consumption requirements. The introduction of new technologies has led to more energy-efficient motorized impeller and blower options - many with increased functionality. With all of these advancements and new products to choose from, it is important to understand the applications that benefit most from blowers and motorized impellers, and how to select the best cooling solution for your application.

Benefits
Motorized impellers and blowers offer a space-saving design, simplified installation and mounting, and maintenance-free operation.

Blowers and motorized impellers produce a high volume of air that can be concentrated or directed more effectively to deliver better commercial and industrial ducted air movement. These blowers and motorized impellers combine high efficiency with small size to significantly lower the intrinsic heat in the system. The low-profile design of the blower provides excellent airflow over the motor itself, ensuring low internal operating temperatures and substantial energy savings.

Application Overview
Blowers and motorized impellers are typically used in applications with higher impedance or back pressure, including refrigeration and freezing equipment, ovens, cabinets and enclosures, HVAC (heating, ventilation and air-conditioning) and more. Motorized impellers and blowers can also be used to produce negative pressures for industrial vacuum systems.

Blower Types
There are three types of blowers: centrifugal, positive displacement and cross axial.

Centrifugal blowers feature a highly efficient, long-life external rotor motor that delivers high aerodynamic efficiency. Centrifugal blowers have a compact design, as the external rotor motor enables the impeller to be mounted directly to the motor without an external driveshaft. Air is drawn in parallel to the drive axis, deflected 90 degrees by the rotation of the centrifugal impeller, and is then discharged radially. Centrifugal blowers offer lower airflow at high system pressure compared to axial fans. They primarily operate at a pressure between 0.35 to 0.70 kg/cm2. A negative aspect to centrifugal blowers is that if the system pressure rises, the airflow drops.

All rotating parts are balanced in a centrifugal blower, creating a uniform load on both bearings and thus lower noise (sound and vibration). Centrifugal blowers with backward curved blades do not require a scroll housing and are typically used for intake suction. Centrifugal blowers with forward curved blades do need a scroll housing. They come in a wide range of blade options to meet application requirements.

Centrifugal blowers are used in a wide range of applications including climate-controlled cabinets and enclosures, conveying operations, medical devices, ovens, residential and commercial kitchen stoves and sterilization units.

Positive displacement blowers, or rotary air blowers, trap air in rotors and push it through the housing. The air is usually forced into some type of pipe or hose to propel materials or gas to a destination. Ideal for applications prone to clogging, positive displacement blowers provide consistent airflow regardless of changes to the system pressure. Positive displacement blowers are used in aeration, conveying and vacuuming applications across many industries.

Crossaxial, or crossflow, blowers provide an even, laminar airflow. This low velocity air delivery across a wide area is well suited for applications like printing presses and displays. Large crossaxial blowers are used as air curtains in facilities to prevent the influx of outside air through an opening in to a heated or cooled. Crossaxial blowers have a narrow footprint and are available in many standard and custom lengths. Grills and filters are also offered.

Motorized Impellers

Backward curved motorized impellers offer exceptional airflow and pressure performance in smaller footprint compared to centrifugal blowers. The backward curved blades provide efficient air movement without costly scroll housings. The dynamically balanced motor and impeller offer low noise characteristics and ensure a long, maintenance-free operational life. Motorized impellers require a capacitor for operation. Some models come with the external capacitor, however most manufacturers sell the capacitor separately. The space-saving motorized impellers that come with the required capacitor are easy to integrate into a system and some can be speed controllable, offering design flexibility and versatility.

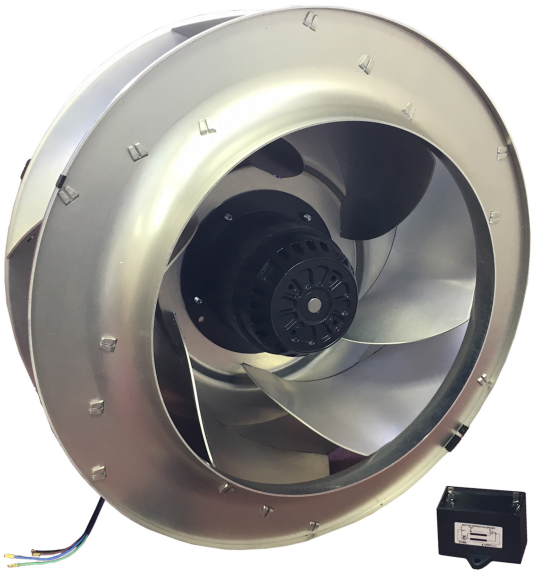

Image 1: This motorized, which includes the required capacitor, combines high airflow with high reliability in high static pressure environments

Application Considerations
Applications that utilize blowers and motorized impellers often require low profile, low noise and low power, with high reliability and ruggedness. From coolers and chillers to convection ovens and stove range venting ducts, blowers and motorized impellers need to operate quietly, withstand temperature extremes, resist moisture, and operate efficiently.

When specifying a blower or motorized impeller, an engineer must first understand the application's required airflow rate and any resistance to that flow rate in the form of ductwork, filters, obstructions and more. This system resistance is often referred to as backpressure or head loss. It is vital to know a blower's airflow rate capability in an open flow system with zero backpressure, a sealed system that is completely blocked, and everything in between. An application is best served by selecting the blower or motorized impeller that delivers the desired airflow rate performance with the least amount of input power.

There are several other things to consider when choosing a blower or motorized impeller for a design including size constraints, noise level, input voltage, fast dynamic response requirements, single speed versus speed modulation during operation, on-board controller versus external controller, and blower monitoring requirements, and future maintenance, just to name a few.

Noise
Maximum noise levels specified in acoustic noise standards for electronic and electrical devices depend greatly on the final location of the device. Noise levels are understandably most rigorous for units used inside. However, noise or loudness is a human perception. The volume of noise is a subjective term that tries to describe the strength of sound perception through our sense of hearing. Noise is measured in decibels (dB), and for all intensive purposes, dB levels of blowers and motorized impellers can be defined as:

- 3dB – barely noticeable
- 5dB - clearly noticeable
- 10dB - twice the volume (loud)

Noise is caused by a number of factors including blower speed, load, vortex shedding, turbulence, and vibration. Unwanted blower noise can be minimized by reducing the system impendence, minimizing airflow disturbances (clear pathways for air), optimum fan size and speed for the application (no overkill), consistent temperature, and optimum installation location to minimize vibration (isolation).

Ruggedness
Blowers and motorized impellers must not only be able to take the hot and the cold, but also the wet and greasy. For example, commercial fryers require blowers meet Class B or Class F to handle high temperatures, as well as IP55-rated to protect from moisture and liquids. IP55-rated blowers are also vital in any refrigeration and freezer application, as condensation can easily damage a cooling unit and other electronics not properly protected from moisture.

Control speed with additional functionality
Designs utilizing blowers with smart controls optimize performance, while also minimizing energy consumption. Smart thermal controls can reduce power consumption by as much 30%, while reducing noise levels, as the fans only operate at full speed when needed. Additional control options can include tachometer output, airflow monitors, locked rotor alarm, pulse width modulation (PWM) input, and constant speed controls. These intelligent control options allow the end users to better monitor their product operating temperatures and the airflow, while ensuring the fans are operating properly and at optimal conditions.

Airflow monitors provide a cost-effective method for monitoring and maintaining proper airflow in AC and DC blower applications, particularly those utilizing a filter. These modules indicate airflow, and more importantly, a lack thereof, with an optical LED and/or audible-alarm when airflow falls below 8.2 ft/s due to fan filter clogs or interference with the fan blade. With a long-operating life of more than 100,000 cycles, airflow monitors are rated to IP20, NEMA 1 certified, and have an operating temperature range of -20°C to 50°C. Able to mount via clip or clamp to any grill, airflow monitors are field retrofittable and can install perpendicular to the front or the intake side of the fan.

Image 2: This AC blower provides cooling solutions for a wide range of standard and specialty applications

Conclusion

When selecting the correct cooling solution, it is best to take a systems approach. Knowing the required airflow and system resistance, in addition to noise, power, environmental rating, speed, and size/footprint requirements ensures the right blower or motorized impeller is implemented. However, the most urgent design objective is to meet increasing demands for energy efficiency. It is important to avoid using oversized fans that use too much energy, create too much noise, cause stress on the system and risk unstable operation. And implementing smart thermal controls to the right sized blower drastically reduces power consumption. By better understanding the system, designers can appropriately select the best blower or motorized impeller for their application.

Reference

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http://www.appliance-standards.org/sites/default/files/Fans%2C%20Blowers%2C%20Fume%20Hoods%20Comments_Final.pdf