Advancements in Blower Technology

Blowers & Active Air-Cooled Systems

Overview

Although fans are the most common air-cooling technology, in the last few decades, blowers have seen a surge in use and in innovation more innovative as they are being optimized for newer applications. This article will provide an overview of when to effectively utilize blowers and new advancements for next generation applications. These advancements range from ultra-thin lightweight blower design to large blower trays with low acoustics for system level cooling. Choosing the correct technologies and integrations is essential to optimizing your applications' performance.

FORCED CONVECTION: FANS VS. BLOWERS

One of the most common ways to classify thermal management methods and technologies is whether they are Passive or Active.

Passive cooling utilizes natural convection to optimize heat dissipation and does not have moving parts or external components to enhance heat transfer. Passive technologies are often used in lower power applications or applications that require extremely long lifetimes, have limited volume for ducting or fluid flow or have strict requirements for acoustics, vibration and reliability.

When passive cooling is insufficient, active cooling becomes necessary. Active cooling utilizes forced convection to enhance heat transfer for cooling higher power applications and to enable smaller solutions with similar or better performance. Forced Convection involves the addition of another device with moving parts to increase the fluid flow rate resulting in faster dissipation and improved cooling.

Forced convection can include liquid cooling, however forced air cooling is the most common. This involves the addition of a fan or blower to move ambient air across the heat sink or thermal solution.

Mechanism of Forced Convection Air Cooling

Convection can be expressed as:

$$q_{*conv} = h(T_s - T_\infty)$$

q∗conv - Heat Transfer (W/m2)
Ts - the initial material temp.
T∞ - the final material temp.

With natural convection, ***h*** is fixed.

With forced convection, ***h*** changes proportionally based on the air being pushed through the fins of the heat sink or thermal solution. This leads for faster cooling and higher performance

Fans

Fans are one of the most commonly used thermal technologies and are used in conjunction with heat sinks. Typically, in thermal management, a “fan” is an axial fan where fan blades rotate around an axis to draw air in parallel to the axis and force the air out in the same direction. These air movers can create a large volume of airflow and high flow rate at a low pressure; and they require a low power input to operate.

Axial fans are generally the go-to solution for standard, less complex cooling because of their high flow, low pressure and low power input as well as their design flexibility. Fans are customizable with varying speeds, voltages, and function types and can be used to force air throughout the full system or a single heat sink. Fans can also be grouped in trays for higher power applications such as rack cooling in Enterprise Computing.

Blowers

Although sometimes referred to as “Centrifugal Fans”, in thermal management a “blower” refers to air movers that utilize impellers to draw air in parallel to the rotating circular hub that and is accelerated and expelled perpendicularly at a higher pressure. Despite having a lower flow rate, blowers offer a steadier air flow than fans. This steady, high pressure air flow enables more optimized cooling for many applications. Blower fabrication requires more enclosed housing than fans, protecting the moving parts from a large percentage of general wear and tear.

More benefits of blowers include:

High Efficiency – The constant, steady airflow allows blowers to generate energy with up to 84% static efficiency. This makes them ideal for enabling and sustaining larger air systems.

Ease of Maintenance – Blower are easier to clean and the housing protects moving parts from particle and dust build up.

Versatility – Enable multiple airflow/pressure combinations and have more options for orientation and how they can be designed into systems

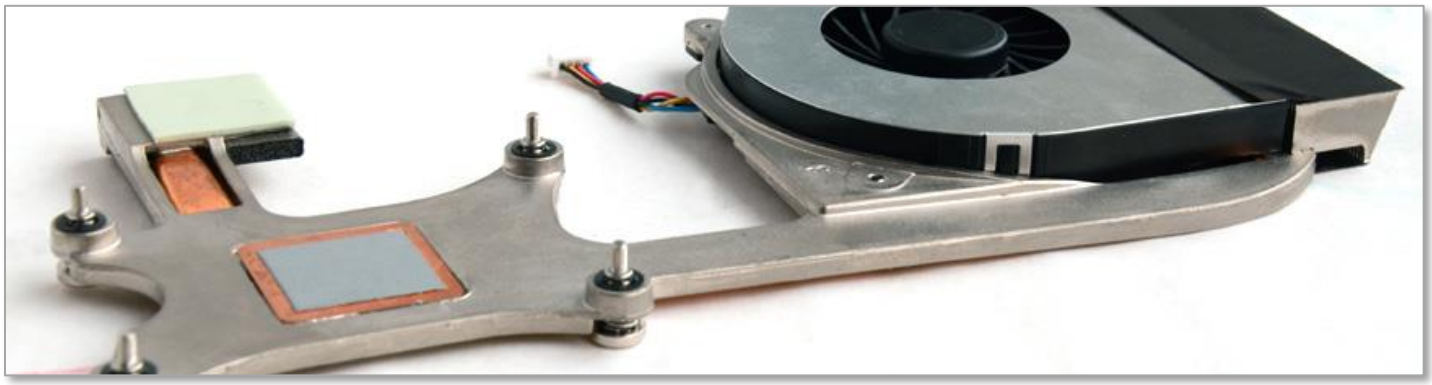
ADVANCEMENTS IN BLOWERS

As applications and systems become more powerful the need for higher power cooling within the same or smaller footprints is increasing. Blower design is evolving to meet these needs as an ideal method for improving performance at relatively low cost. Noticeable trends in blower design for new and next generation applications include thinner blowers for low profile cooling in smaller electronics and designs for larger systems where engineers require increased efficiency but are not prepared to switch to liquid cooling.

Low Profile Blowers

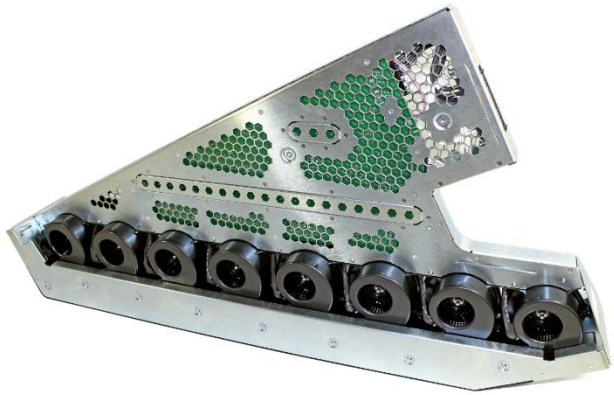
By utilizing thinner, lightweight materials, blowers can be designed in thin and ultra-thin profiles ideal for the smaller, more powerful devices that customers require. Capable of high pressure drops in limited volumes and ideal for hot spot cooling, these blowers are gaining popularity in consumer electronics design as well as mobile and portable applications across all industries. Ultra-thin blowers can be as thin as 3mm while still providing direction, high pressure, fully optimized cooling while maintaining durability and quiet acoustics.

Low profile blowers operate in the same way that regular blowers do, however engineers use miniaturization design and manufacturing techniques to take up less volume. This includes the use of thinner longer impellers and alterations to the housing such as longer, thinner outlets. Utilize these blowers as part of an assembly with heat pipes or vapor chambers and low profile heat sinks such as extruded, skived, or zipper fins to develop lightweight, more powerful cooling in smaller packages.

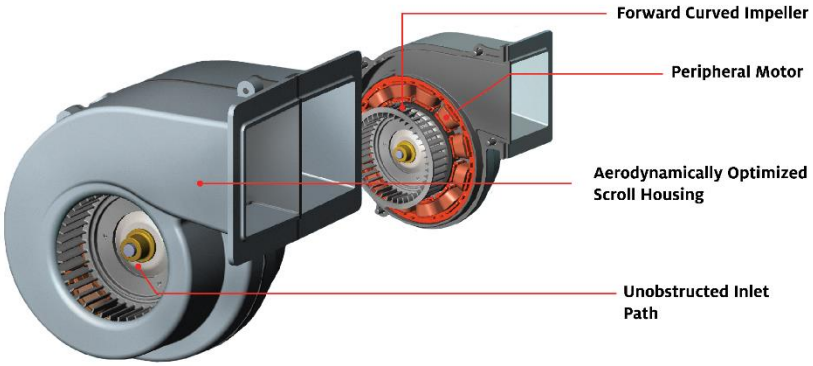


New Blower Designs for Large Systems: Double Width, Double Inlet (DWDI)

Trends and advancements in blowers are changing the fastest in applications where fans are not a sufficient or optimal air moving solutions. This includes thinner applications and larger applications where more pressure and improved cooling are required. The latter is especially common in Enterprise and 5G where new blower designs such as Double Width Double Inlet (DWDI) are becoming more popular.



Noise, Reliability, and pressure drop are typically key concerns when dealing with air cooled systems. DWDI blowers are developed to improve cooling and acoustics within a durable high-pressure air-cooled system. They can also be arranged within smaller trays to allow more space and pressure. For applications such as rack and server cooling or large equipment, these factors are critical to maintain reliability, keep the workers safe, and save facility space.



DWDI Standard Specifications

General Size Range

40mm: 40x40x56mm
80mm: 80x80x80mm
120mm: 118x117x112mm

Typical Flow Rate, Pressure Drop

10 cfm – 220 cfm
1.5” – 8” H20

Acoustic Range

Approx. 4-8 dBA less than axial fans

Benefits

- Patented peripheral motor greatly minimizes sound levels
- Unique impeller and housing design for high performance
- Eliminates axial fan blade pass frequency
- In-house designed three phase brushless motor
- Unrestricted air inlets
- Patented balancing methodology lowers vibration Blower form factor allows unique product design

WHAT IS NEXT?

Thermal technologies will continue to advance as customers and OEMs demand higher power, smaller sizes, and all-around better performing applications. As these requirements grow, so does the need for better air cooling and more specific functionality than fans can offer. Blowers development is rising to meet that challenge and offer the best possible cooling that can be retrofit or designed into better air cooled systems.

Boyd not only offers customized blower design, it leads the industry in integrated air cooled systems that combines optimized blower design, with creative ducting and air flow management, heat pipes and vapor chambers, and all major heat sink fabrications to create the ideal system for your application.

Boyd Corporation's decades of innovation expertise, experience, resources and unique approach to integrating multiple functionalities into streamlined products will continue to keep the company on the forefront of thermal innovation and continually improved manufacturing methodologies. If you are ready to improve or retrofit your air-cooled system or are looking to tackle new challenges for the next generation, start by contacting Boyd Corporation to learn more about your options for better optimized cooling.

To receive more information regarding Air Movers of any type, please visit www.boydcorp.com.