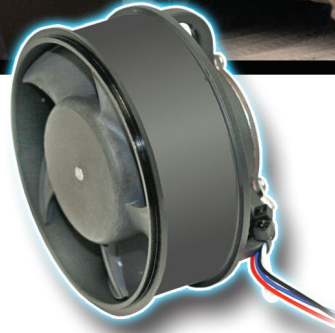
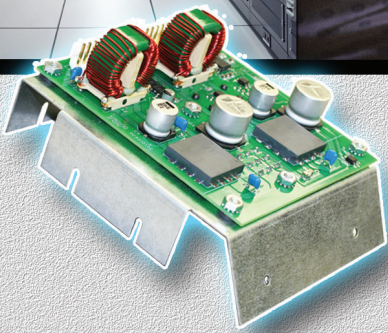


Air Moving Solutions

Product Guide



A complete line of air moving solutions for the most demanding applications.

- Medical Equipment
 - Ventilators
 - Particle Counters
 - Pressure Management Mattresses
- Telecommunications
 - Data Storage / Servers
 - Electronic Rack Cooling
 - Power Backup Systems
- Military Aircraft and Ground Vehicles
 - Scavenge Fans
 - NBC Filtration Fans
 - Air-to-Air Heat Exchangers

MOOG

About Moog

Air Moving Solutions

Moog offers off-the-shelf products through our Moog AirMax™ series of fans and blowers and utilizes our proven high efficiency Silencer® series brushless DC motors to create tailored solutions for more unique applications. Combining our expertise in thermal management with our innovative motor technology, we have expanded the customer's options for solving difficult thermal, airflow, acoustic and efficiency problems. As an optimum choice for each application, we are offering tailored airflow products that are designed using off-the-shelf components to provide a cost effective solution without compromising performance.

Products

With our combination of in-house design, development and production, we are able to offer custom products that are cost effective without the compromises associated with the use of off-the-shelf devices. We are dedicated to providing our customers with efficient, high quality and on-target solutions.

Blowers

With our sheet metal capabilities, blowers can be tailored to the application. From 1U slot blowers, high pressure multistage blowers, dual centrifugal blowers to radial wheel blowers, we have the experience to help with your application. Our blowers are configurable with virtually any voltage, flow sensors and finger guards. Custom mounting flanges can be fabricated to fit your exact application.

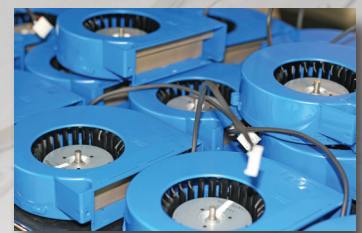
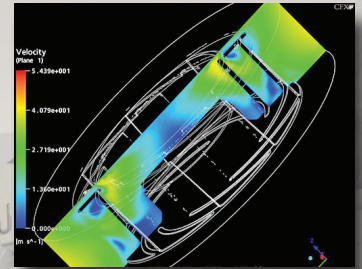
Impellers

Our motorized impellers offer quiet, high pressure airflow in a compact versatile design. Designed for virtually any form factor, any bus voltage, our in-house electronic and sheet metal capabilities allow custom products to be used in cost sensitive, extreme environments and confined space applications.

Controllers

The ability to build electronic controls customized to the application means that the designer can select the exact combination of functions necessary to optimize the system.

- AC or DC powered units
- Redundant systems sensing speed to maintain overall airflow in case of fan failure
- Speed synchronization for reduced noise
- Watchdog circuitry
- Digital communication, I²C, RS-232 / 485, CAN Bus
- Soft start and / or sequential start
- Filter blockage sensing
- Wide input voltage compensation
- Local and remote alarms
- Thermal speed control
- Conducted noise filtering



Fan Trays

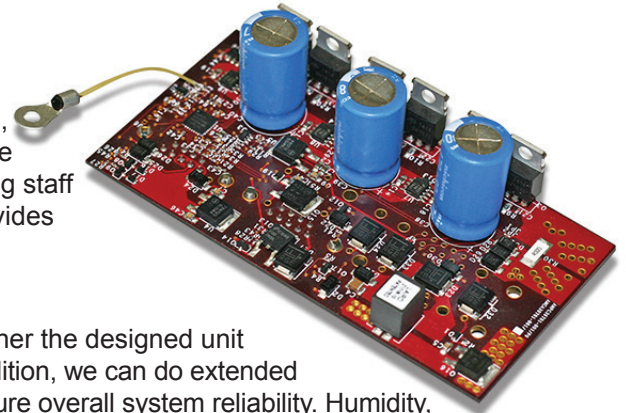
Our fan assemblies creatively package axial fans for maximum airflow in a compact footprint. Available with cooling on demand, fan trays can be programmed to sense and evaluate temperature and vary fan speed to maintain an ideal operating environment. Not locked into using any particular off-the-shelf fan allows us to select the best fan for the application or use multiple fan manufacturers when dual sourcing is advantageous. If a standard fan is not available for your application, we can design one for you.

Custom Solutions

When off-the-shelf products are inadequate for the application, we can tailor existing products to meet the demands of the system at cost competitive prices. With our air moving expertise and experience, we can design low profile, higher efficiency products. That, with our in-house electronic design capabilities, allows us to provide effective solutions to demanding cooling problems.

Development to Manufacturing

With a development process including mechanical and electrical design, airflow analysis, environmental testing, as well as safety and compliance requirements, you can count on our trained CAD design and engineering staff to get you the product that is best suited for your application. Moog provides on-site electronics testing and troubleshooting.



Environmental Testing

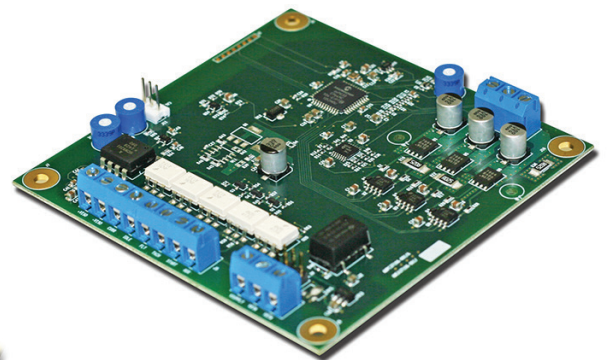
Moog has state-of-the-art environmental chambers that can verify whether the designed unit will work reliably at all temperature extremes from -73°C to 175°C. In addition, we can do extended temperature testing on most systems with the air movers installed to ensure overall system reliability. Humidity, salt fog, shock and vibration testing is also available.

Safety and Compliance

We have successfully designed and manufactured products certified by UL, NSF, ETL, TUV, CE and other emerging market requirements. In addition to safety, Moog designs / certifies products to meet NEBS, GR-1098-CORE, CISPR 22 and other Telcordia® specifications. EMC compliance testing and MIL-STD-810G and MIL-STD-461E certified products are available.

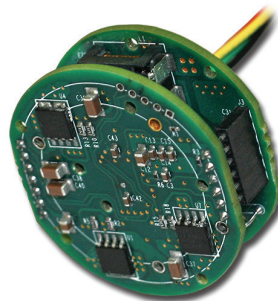
Manufacturing

- Automation
- Molded parts
- SMT / through-hole prototype to production
- Simple functional to fully automated testing



Call or email our knowledgeable application engineers for more information:

+1-540-443-4742 or mcg@moog.com



Capabilities

- Manufacturing and assembly
- Concept design and modeling
- Rapid prototyping and product development
- System airflow and thermal verification
- Airflow CFD modeling and testing
- Electronic controls experience
- Motor drive experience
- Distribution testing
- Environmental testing
- Electrical testing
- Acoustic and vibration testing
- Accelerated life testing
- Fabrication and assembly
- Precision balancing
- Rugged environment design and testing
- Automated production testing
- Aerodynamics design
- Simulation and analysis
- Thermal and airflow modeling
- Design modeling and verification

Design Guide

Determining Airflow Requirements

$$Q = m \cdot cp \cdot \Delta T$$

Q = heat to be dissipated (watts)

cp = specific heat of fluid

m = mass flow rate

ΔT = fluid temperature rise through system

kW = kilowatts

For standard air (sea level 25°C ambient)

$$CFM = \frac{(3170) \cdot kw}{\Delta T(^{\circ}F)} = \frac{(1760) \cdot kw}{\Delta T(^{\circ}C)}$$

To ensure adequate cooling at altitude and temperature, additional margin must be added to account for reduced density.

Acoustic

Thermal speed control is effective in most applications for reducing acoustics to acceptable levels:

$$db_2 = db_1 - 50 \log \left(\frac{rpm_2}{rpm_1} \right)$$

db_1 = acoustic level at max speed

db_2 = acoustic level under speed control conditions

rpm_1 = max speed (rev / min)

rpm_2 = controlled speed (rev / min)

Fan Laws

Along a system curve, airflow, speed, pressure and power requirements can be determined using fan laws:

$$CFM_2 = CFM_1 \left(\frac{rpm_2}{rpm_1} \right)$$

$$sp_2 = sp_1 \left(\frac{rpm_2}{rpm_1} \right)^2$$

$$pwr_2 = pwr_1 \left(\frac{rpm_2}{rpm_1} \right)^3$$



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