

# Data Center Cooling

**ebmpapst**

The engineer's choice



# About ebm-papst Inc.



## Headquarters - Farmington, CT

- » 250K sq. ft.
- » Acoustic testing chamber
- » Complete air testing lab on site
- » Mechanical/Design Engineering
- » Electrical Engineering
- » Sheet Metal & Contract Manufacturing
- » ISO 9001 and 14001 Certification
- » Distribution centers in Farmington (CT) and Toronto, Canada



## Expert design and manufacturing

Our staff of design, electrical, and application engineers possesses a wealth of knowledge and experience enabling unparalleled guidance and support to our customers and their projects. Cutting-edge equipment and innovative technologies are used to develop customer concepts into sub-assemblies or complete product ranges. Our engineers draw upon the vast resources available throughout the ebm-papst family to ensure that the most innovative and energy-efficient air movement components are correctly applied.



Beginning with the initial product concept, our application engineers work in tandem with customers to select the best air moving solution to suit specific goals and requirements. Once the prototype has been established, it can then be tested in our state-of-the-art airflow testing chambers, allowing for the optimization of all air moving solutions. Each chamber has been designed to meet AMCA 210-99 and ISO 5801 requirements. In addition to our airflow testing capabilities, ebm-papst can conduct sound (in a semi-anechoic chamber), temperature and velocity tests.



Design and electrical engineers advance the concept into a packaged air moving device incorporating sheet metal, fan controls, handlers, filters, gaskets and more. Our design engineers utilize the latest version of "Pro-Engineer" software to create a viable and cost-effective contract manufacturing solution. File sharing between customers and our team of engineers enables all stages of the prototype design to be verified before the initial build of the product. The electrical engineering team can design simple fan controllers for monitoring fan speed, or complex controllers and power supplies, filtering, and specific communication protocols. With these in-house tools, we can quickly take customer concepts to production.

# About ebm-papst Worldwide

## World Headquarters: Mulfingen, Germany

- » Worldwide Revenue / Sales: 1.8 Billion USD
- » 57 Sales and Distribution Groups Worldwide
- » 18 Production Sites Worldwide
- » 10,800 Employees Worldwide
- » Ship Over 50 Million Products Annually
- » All Locations are ISO 9001 Certified
- » RoHS and ErP Directive Compliant

## 50 years of ebm-papst in 2013

To facilitate the intelligent and highly efficient movement of air and combining the core areas of expertise of motor technology, electronics and aerodynamics. That was the goal of ebm-papst from its founding as it began operations with 35 employees in Mulfingen (Baden-Württemberg). Even in those early days, the family-owned business from south Germany achieved a leading position in technology. Today, 50 years later, ebm-papst is seen as by far the world market leader and trend setter in fans and motors.

## Passionate about air technology and drive engineering

The ebm-papst product portfolio now numbers over 14,500 products. Thus we offer the right solution for almost every air technology and drive engineering task. In addition, we work with you to develop very customized solutions that extend beyond our current product line. This is made possible by our extensive team of over 500 dedicated engineers and technicians out of our three central locations in Germany.

## Core competencies: motor technology, aerodynamics and electronics

Our innovative technologies keep turning into new industrial standards. Our advantage: We consider aerodynamic relationships as a whole. Thus we combine benchmark-setting motor technology with the intelligence of state-of-the-art electronics and aerodynamically optimized shapes. The system solution that results from these three core competencies have a synergy that is unique in all the world and make up the majority of our product line.

## GreenTech EC technology: Our motor for the future

Virtually our entire product range is now available with GreenTech, the leading edge EC technology. GreenTech EC motors deliver unparalleled energy efficiency when compared to conventional AC Technology. With wear-free and maintenance-free performance, longer service life, reduction in noise, intelligent electronic control, and higher aerodynamic efficiency, GreenTech EC motors from ebm-papst are the future of air moving technology.

## Passion, quality and responsibility: Three reasons for our success

Only real passion for fans and motors makes the highest level of achievement possible. With a clear organizational structure, flat hierarchies and a high degree of personal responsibility, we create the perfect foundation - not only technological innovation, but also for excellent service and active dedication to closely working with our customers. Our quality management is uncompromising, everywhere and in every process stage. This is also confirmed by our certification of compliance with the international standards DIN EN ISO 9001, ISO/TS 16949-2 and the standard DIN EN ISO 14001.



# GreenTech

## The symbol of our commitment

GreenTech is a name put to the philosophy ebm-papst has used for decades: "Each new product that we develop has to be better than its predecessor in terms of economy and ecology." Our company philosophy is not just for designing new and more efficient fans and blowers; it's in practice in the offices and factories, locally and internationally. At the U.S. headquarters, two separate arrays of solar panels have been installed to provide the engineering building with electricity, along with additional renovations that make the facilities even more environmentally friendly.

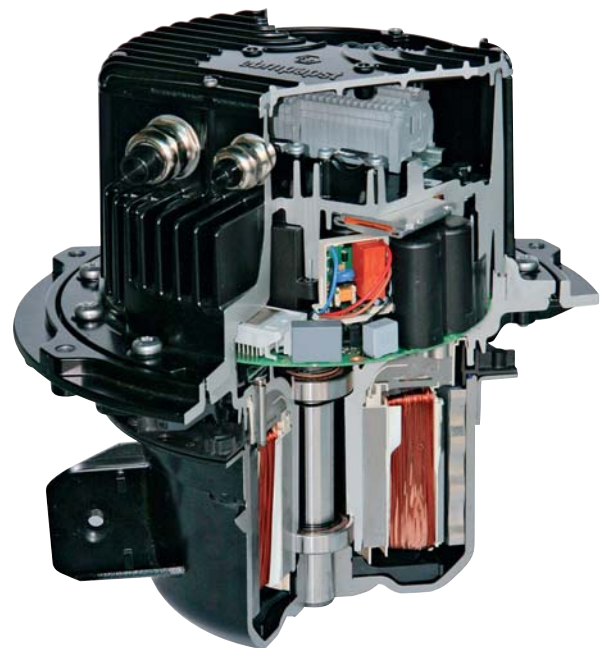
GreenTech symbolizes our continuous commitment, achievements, and passion to provide customers with high quality products through the use of modern development and production methods, responsible business practices and initiatives that benefit not only the user, but the environment as well.

## What is EC Technology?

EC technology is an important factor in our GreenTech philosophy. At the heart of this philosophy is the ebm-papst EC motor - a custom, high-voltage DC motor that permits higher efficiency and performance than traditional AC products. ebm-papst EC fans use permanent magnet external rotor DC motors with fully integrated electronic commutation (EC) and AC to DC power conversion. EC motors give the flexibility of connecting to AC mains with the efficiency and speed control capabilities of a DC motor. With EC fans, the user benefits from the innovative commutation without wear-and-tear on the motor.

With this technology, EC motors and fans can be easily controlled, are maintenance-free, offer outstanding efficiency and have a considerably long service life. The variable speed range possible in EC technology makes using a multitude of individual models a thing of the past by offering control down to lower speeds compared to the full nominal speed. With EC technology, the same performance can be achieved from various voltage and frequency ranges.

Our R&D efforts are not only focused on saving energy. In terms of air performance and low noise, our products exceed the toughest specifications. EC technology pays off for every owner or operator, while conserving precious energy resources. When you use intelligent ebm-papst EC technology in your applications, everyone wins - companies, customers, and the environment.



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# Fans and Their Function

Available in AC, DC or GreenTech EC design

Fans from ebm-papst, which have long been the standard in electronics cooling, are available in these 3 designs: **axial**, **centrifugal** or **diagonal**. For each type, ebm-papst offers a large selection of fans, available in AC, DC or GreenTech EC design, for all voltages and in all standard sizes. With electronics built-in at the factory, they also offer numerous additional options and can be networked intelligently with MODBUS or other device logic.



## Radial impellers

*Medium flow rate at medium pressure*

If the required cooling air has to be turned 90° or if the system resistance is too high for an axial fan, radial fans are the most effective. ebm-papst offers not only motor/blower assemblies but also radial fan packages that include the inlet ring, power connector and housing for simpler installation.

## Plenum fans/RadiPac

*Medium flow rate at medium pressure*

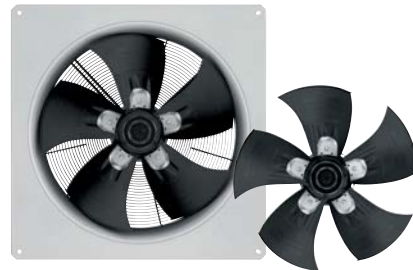
The plenum fan is the easiest to integrate a radial impeller into a system. Plenum fans are driven by energy-saving EC external rotor motors with drive capacities between 400 W and 12 kW. The position of the impellers on the EC external-rotor motors have optimized aerodynamics and installation requirements.

For a full range of products and specifications, visit [www.ebmpapst.us](http://www.ebmpapst.us)

### **Axial fans**

*High flow rate at lower pressure*

Axial fans supply air flow at relatively low system pressures, without changing the air direction. Mounting the impeller to the rotor eliminates the need for an external driveshaft, forming a very compact assembly. The motor and impeller assembly can be mounted to a wall plate with integrated venturi and a grill guard. This complete package provides easy mounting, low noise levels and high efficiency.



### **Compact tubeaxial fans**

*High flow at medium to high pressure*

Tubeaxial fans for cooling electronics are equipped with external housing and an electric motor integrated into the fan hub. The construction saves space and is easy to install; the flange comes equipped with mounting holes.

*ebm-papst compact fans are available in various IP (Ingress Protection) ratings, select models up to IP68.*



### **Diagonal fans**

*High flow rate at relatively high pressure*

At first glance diagonal fans only differ slightly from axial fans. Intake is axial whereas exhaust is diagonal. Due to the conical shape of the wheel and housing the air is pressurized higher, in direct comparison with axial fans of the same size and comparable performance. These fans are also distinguished by the lower operating noise and higher efficiency.



# IT Market Overview



## **IT product cooling for data centers**

As the use of tablets, e-readers and other devices becomes more mainstream, users are given the ability to do more and more online. From streaming video to shopping, this constant connectivity puts a strain on IT equipment everywhere. As more products and technologies emerge, the demands for more efficient data center systems increase.

With each generation, IT equipment becomes smaller and more powerful, increasing the consumption of energy and consequently emitting more heat. Component overheating and heat build-up within enclosures are the primary causes for failure. If heat is not continuously removed it can result in reduced service life, severely impacting ROI and operating performance.

ebm-papst understands the complexity of your company needs for reliable performance of electronic components in the data center environment. To meet the needs of company demands, ebm-papst offers thousands of off-the-shelf and custom solutions all incorporating innovative technology that enables the optimal performance needed to match the ever increasing demands of modern IT components.

## **EC, the first choice for data centers**

Although fans and blowers can be used interchangeably with various applications, some are used more frequently than others. For data centers, radial impellers tend to be the first choice because of their natural high aerodynamic efficiency. Our radial impellers with EC technology are appropriate for evaporator fans for direct cooling, in-room-cooling systems, power exhaust, economizers, evaporative cooling, air to air heat exchangers, fan coil units, fan arrays, supplementary cooling systems, CRAC (Computer room air conditioning), CRAH (Computer Room Air Handling), unit cooling and air handling units.

Axial fans can be chosen when applications limit the use of radial impellers. EC axial fans from ebm-papst are appropriate for condensers, chillers, fan arrays, evaporators, power exhaust systems and rooftop units. For the highest efficiency at variable load performance, multiple fans can be modulated together. The choice is simple - ebm-papst fans and blowers are the best solutions to deliver the results you need for your data center applications.



# Rack and Cabinet Level Cooling

## Rack cooling for Data Centers

Data center heat loads have increased dramatically as more components are squeezed into densely packed rack space. Excess heat in a server room adversely effects equipment performance, shortens equipment life-spans, and is the primary reason for downtime. Rack cooling ventilation designs should reduce hot spots and provide adequate cooling to every part at the rack level. Hot spots caused by improper airflow and poor circulation that are not properly cooled result in temperatures that exceed the recommended conditions for equipment reliability and performance. Effective cooling techniques must be employed so heat can be dissipated as efficiently and as close to the source as possible. This calls for the most innovative and efficient solutions to meet the challenging needs of data center applications.

## Maximum performance, custom solutions

Our fans and blowers for rack cooling in data centers can direct cooled air to where it can be used most productively and efficiently and are available in a wide range of AC, traditional 12, 24, 48 VDC and full EC systems. Our compact fans are high performing, able to handle high backpressures, and can be intelligently controlled and adapted to specific requirements, all while delivering long service life and maintenance-free operation. Our wealth of contract manufacturing capabilities and expertise allows us to customize solutions to meet your unique data center needs.

## The preferred solutions for rack and cabinet level cooling:

- Radial impellers
- Diagonal fans
- Compact fans



# Modular Data Center Cooling



## **Modular / containerized data center cooling**

A new generation of data center is becoming an increasingly popular choice as the needs for more efficient systems grow. Some companies are migrating from large facility data centers to portable or modular data centers that are set up within sea containers or other pre-packaged systems. Portable or modular data centers are fitted to house many racks of IT equipment with ultra-efficient cooling systems inside. These data centers can be manufactured and deployed more rapidly than traditional data centers because this style offers the easiest 'scalable' solution while maintaining high operation efficiencies.

Because the majority of portable and modular data centers don't have the same heat/cooling duct losses experienced in traditional data centers, the new configurations can super-charge their energy efficiency by incorporating ebm-papst's range of EC blowers and fans, from our small 80 mm fans up to 1250 mm models.

## **The preferred solutions for modular / containerized cooling:**

- Plenum fans/RadiPac
- Radial impellers
- HyBlade® axial fans
- Compact fans

# Data Center Facility Cooling

## Facility cooling

Today's data center facilities require more power as demands for technology increase. Removing excess heat from a data center room or building requires a well-planned air moving design that directs cooling at various locations while maintaining overall area cooling. This dilemma can easily be solved by using sensors that constantly capture air and processor temperatures, used to automatically regulate fan speeds and cool system power, preventing systems from running continuously at full power. Our EC products can work as a fan with integrated controller (master) or with an existing facility controller (slave).

### The preferred solutions for facility cooling:

- Plenum fans/RadiPac
- Radial impellers
- HyBlade® axial fans

*\*For larger applications, axial and plenum fans are available in 1,250 mm.*



# EC Plenum Fans / RadiPac



## Features

Sizes (mm):  $\varnothing$ 250 to  $\varnothing$ 1,250

Air Flow (CFM): 1,758 to 27,158

Frequency (Hz): 50/60

Voltage (VAC): 230, 277, 380, 480

Integrated electronics, extremely low noise and minimal heat generation with an aerodynamically optimized mounting package.

### Plenum fans

	Size	Max. Air Flow	Max. Static Pressure	Power Input	Nom. Speed	Sound Pressure	Max. Ambient Temp.	Weight
Series	mm	CFM	in. wg	Watts	RPM	dB(A)	°C	lbs
EG1R-XXX-250	$\varnothing$ 250	1,758	5.15	820	3,580	72	60	14.7
EG1R-XXX-280	$\varnothing$ 280	2,322	4.52	1,000	3,100	72	60	15.6
EG1R-XXX-310	$\varnothing$ 310	3,410	8.87	3,240	4,100	84	40	33.0
EG1R-XXX-355	$\varnothing$ 355	3,702	4.92	1,700	2,600	73	50	28.6
EG1R-XXX-400	$\varnothing$ 400	5,239	5.89	3,000	2,550	78	60	48.4
EG1R-XXX-450	$\varnothing$ 450	7,216	8.33	5,370	2,750	82	40	68.2
EG1R-XXX-500	$\varnothing$ 500	8,980	7.08	5,500	2,200	82	45	72.6
EG1R-XXX-560	$\varnothing$ 560	10,130	5.65	4,700	1,750	78	40	88.0
EG1R-XXX-630	$\varnothing$ 630	11,163	4.35	4,000	1,370	75	50	85.8

### RadiPac

	Size	Max. Air Flow	Max. Static Pressure	Power Input	Nom. Speed	Sound Pressure	Max. Ambient Temp.	Weight
Series	mm	CFM	in. wg	Watts	RPM	dB(A)	°C	lbs
K3G630-AS	$\varnothing$ 630	15,139	7.90	11,000	1,850	83	40	352.0
K3G710-AS	$\varnothing$ 710	19,266	7.02	11,800	1,550	80	40	425.9
K3G800-AS	$\varnothing$ 800	20,871	7.02	11,600	1,370	82	40	431.2
K3G900-AS	$\varnothing$ 900	21,134	5.16	8,700	1,050	78	40	510.4
K3GZ50-XX	$\varnothing$ 1,250	27,158	1.12	2,750	350	62	40	792.0

# EC Radial Impellers



## Features

Sizes (mm):  $\varnothing$ 133 to  $\varnothing$ 630

Air Flow (CFM): 333 to 13,741

Frequency (Hz): 50/60

Voltage (VAC): 230, 277, 380, 480

Integrated electronics and extremely low noise.

Series	Size mm	Max. Air Flow CFM	Max Static Pressure in. wg	Power Input Watts	Norm. Speed RPM	Sound Pressure dB(A)	Max. Ambient Temp. °C	Weight lbs
R3G133	133	333	1.21	17	3,200	48	60	1.1
R3G190	190	575	4.80	169	4,120	63	60	3.0
R3G220	220	749	3.73	168	3,230	62	45	3.2
R3G225	225	767	3.05	170	2,860	60	60	3.9
R3G250	250	1,758	5.15	820	3,580	72	60	14.7
R3G280	280	2,322	4.52	1,000	3,100	72	60	15.6
R3G310	310	3,410	9.11	2,915	4,100	82	40	33.0
R3G355	355	3,702	4.92	1,700	2,600	73	50	28.6
R3G400	400	5,239	5.89	3,000	2,550	78	60	48.4
R3G450	450	7,216	8.33	5,370	2,750	82	40	68.2
R3G500	500	8,980	7.08	5,500	2,200	82	45	72.6
R3G560	560	10,130	5.65	4,700	1,750	78	40	88.0
R3G630	630	11,163	4.35	4,000	1,370	75	50	85.8

*Not all sizes available in all voltages.*

# EC HyBlade<sup>®</sup> Axial Fans



## Features

Sizes (mm): ø300 to ø1,250

Air Flow (CFM): 1,873 to 38,675

Frequency (Hz): 50/60

Voltage (VAC): 230, 277, 380, 480

Integrated electronics and extremely low noise.

Series	Size mm	Max. Air Flow CFM	Max. Static Pressure in. wg	Power Input Watts	Norm. Speed RPM	Sound Pressure dB(A)	Max. Ambient Temp. °C	Weight lbs
W3G300	300	1,873	0.56	170	2,020	62	60	8.8
W3G350	350	2,198	0.40	165	1,480	59	60	11.2
W3G400	400	3,316	0.65	400	1,630	67	60	19.1
W3G450	450	3,856	0.50	345	1,300	61	60	20.9
W3G500	500	6,130	0.81	980	1,600	68	60	36.3
W3G560	560	6,756	0.73	950	1,350	77	60	46.2
W3G630	630	12,502	1.17	3,200	1,510	78	65	88.0
W3G710	710	14,614	0.97	2,830	1,250	75	60	94.2
W3G800	800	16,479	1.05	2,980	1,090	76	65	114.4
W3G910	910	20,609	0.77	2,880	1,000	74	65	125.4
W3G990	990	20,559	0.73	2,580	960	77	70	135.1
W3GZ50*	1,250	38,675	0.79	4,700	690	76	60	318.3

\*1,250 mm size only available with aluminum blade design.

Contact Engineering for specific part numbers and values

# DC Impellers



## Features

Sizes (mm):  $\varnothing$ 101 to  $\varnothing$ 400

Air Flow (CFM): 112 to 1,947

Voltage (VDC): 12, 24, 48

DC fans with electronically commutated external rotor motor and fully integrated commutation electronics.

Series	Size mm	Max. Air Flow CFM	Max. Static Pressure in. wg	Power Input Watts	Nom. Speed RPM	Sound Pressure dB(A)	Max. Ambient Temp. °C	Weight lbs
RER101	101	112	1.76	19	5900	62.9	70	0.7
RER120TD	120	230	2.56	92	6300	72.6	60	0.9
RER133TD	133	333	3.06	87	6000	70.4	65	2.0
RER160NTD	160	298	4.72	142	6000	71.8	65	1.3
RER175TD	175	578	4.03	166	5400	75.4	65	1.7
RER190TD	190	572	3.81	148	4400	66.6	65	1.9
RER220TD	220	755	2.75	140	3500	68.7	55	2.1
RER225TD	225	944	3.10	165	3300	72.4	55	2.3
R3G250	250	932	2.42	135	2645	72	60	6.6
R3G280	280	1192	1.72	123	1965	70	60	7.3
R3G310	310	1546	2.30	208	1930	69	60	9.7
R3G400	400	1947	1.61	192	1160	63	60	11.7

Contact Engineering for specific part numbers and values

# DC Compact Fans



## Features

Sizes (mm):  $\varnothing 82$  to  $\varnothing 200$

Air Flow (CFM): 131 to 968

Voltage (VDC): 12, 24, 48

DC fans with electronically commutated external rotor motor and fully integrated commutation electronics.

### Compact Fans

	Size	Max. Air Flow	Max. Static Pressure	Power Input	Nom. Speed	Sound Pressure	Max. Ambient Temp.	Weight
Series	mm	CFM	in. wg	Watts	RPM	dB(A)	°C	lbs
8200J	80x38	131	2.62	36	14,000	71	70	0.4
3200J	92x38	165	2.82	50	13,000	73	70	0.5
4100N	119x38	336	5.04	120	11,000	78	75	0.9
5300	140x51	395	5.44	149	9,200	79	65	2.0
6300	172x51	561	4.64	150	9,200	75	65	2.0
2200F	200x51	720	4.03	1.03	6,500	72	65	2.2

### Diagonal Fans

	Size	Max. Air Flow	Max. Static Pressure	Power Input	Nom. Speed	Sound Pressure	Max. Ambient Temp.	Weight
Series	mm	CFM	in. wg	Watts	RPM	dB(A)	°C	lbs
DV6300	172x51	649	6.05	390	6,800	89	65	2.1
K3G200	225x89	968	3.23	418	5,480	87	60	4.8

Contact Engineering for specific part numbers and values



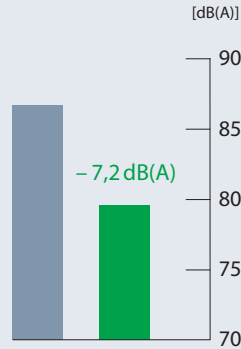
# Accessories

## AxiTop axial fan diffuser

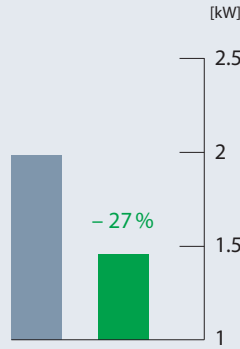


The AxiTop diffuser is designed to recover wasted energy by purposely and efficiently decelerating the flow and reducing swirl, boosting the pressure rise of the impeller. Aerodynamic efficiency is increased and acoustic noise is reduced.

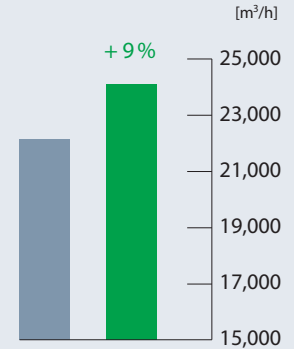
Reduced noise at same air volume



Less energy consumption at same air volume



Increased air volume at comparable energy consumption



Comparison figures measured in application, each with 800 mm EC fan.

*AxiTop is currently available for ebm-papst axial fan sizes 800mm and 910mm.*

## Temperature sensors



Part No.	Nom. Voltage VDC	Current Draw mA	Output Voltage VDC	Output Current mA	Output Impedance kΩ	Measuring Temp. °C
50005-1-0174	15-30	10	0-10	1.0	1.1	-20 to 80
50002-1-0174	18-60	10	2-10	0.1	6.8	-30 to 55
50003-1-0174	18-60	10	0-10	0.1	6.8	10 to 45

## USB-RS485 adapter



**Part Number:** 21490-1-0174

The ebm-papst USB RS485 adapter connects RS485 devices to a computer USB. This also requires the ebm-papst EC Control software version 2.0 or later. The USB drivers required for operating the adapter are also included.

## Knob potentiometer



**Part Number:** 420-05-0640

This unique design consists of a knob driving and incorporating a potentiometer. The mounting hardware and terminals are situated on the back side of the panel reducing to a minimum the required clearance.



# Notes



30% Total Recycled Fiber

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**ebmpapst**

The engineer's choice