The importance of *indoor air quality.*

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the engineer's choice

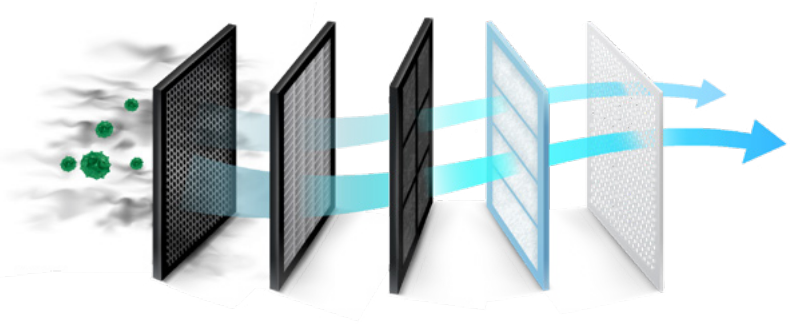
We are spending more time indoors, at home and at work. Studies show that the average American can spend up to 90% of his or her life indoors [1]. What many don't realize is that indoor air quality can be up to five times more polluted than typical outdoor spaces[2]. Unfortunately, our homes and offices trap harmful pollutants and allergens like CO2, tobacco smoke, pet dander, pollen, volatile organic compounds (VOCs), dust / dust mites, mold spores, viruses, bacteria, and other harmful contaminants. Exposure to these pollutants can cause a wide range of health conditions including respiratory issues and skin irritations, and can be a trigger for asthma and allergy sufferers.

It's clear that clean air is important for good health, so what can we do?

Can air purifiers help you breathe easier?

Air purifiers are devices that remove pollutants from the air. They can be used in both commercial and residential environments. There are several types of purifiers, each using different technologies to either trap or destroy contaminants. The most common way to rid air of pollutants is to physically capture them with a filter. HEPA filters are well known and widely used - they are regulated and proven to be at least 99.97% efficient at filtering particles down to 0.3 µm[3], using their net of synthetic fibers. They have also been shown to be effective against even smaller particles such as viruses. Carbon filters excel at capturing gaseous pollutants like smoke, cooking fumes, and VOCs as opposed to particulates. Most air purifiers use a combination of both HEPA and carbon filters for maximum effect.

While filters trap particles, other purification methods alter or destroy the particles altogether. The two most common use either UV light or catalytic oxidation to accomplish this. UV light deactivates microorganisms, molds, bacteria, and viruses in the air by altering the structure of their DNA, thereby stopping them from multiplying. Catalytic oxidation uses a combination of light and a catalyst to convert pollutants into harmless components. Both methods are very effective at destroying viruses, bacteria, and mold, but neither is very effective against particles or gaseous components;



therefore, these types of purifiers are commonly used in conjunction with physical filters.

One thing in common:

No matter which type of air purifier is used, they must all do one thing: Move air through the device in order for it to be cleaned. The right type of air mover is critical to the filtering efficiency of the device. By nature, filters are very restrictive and create an obstruction to airflow (this obstruction is referred to as pressure drop). To filter something as small as 0.3 µm (1 µm = 1/25,400th of an inch; for comparison a human blood cell is 6-8 µm), the area where air flows through the filter must be incredibly small. UV and catalytic types of purifiers do not create as much restriction, but do when used in conjunction with filters.

Choosing the right air mover for the application is critical.

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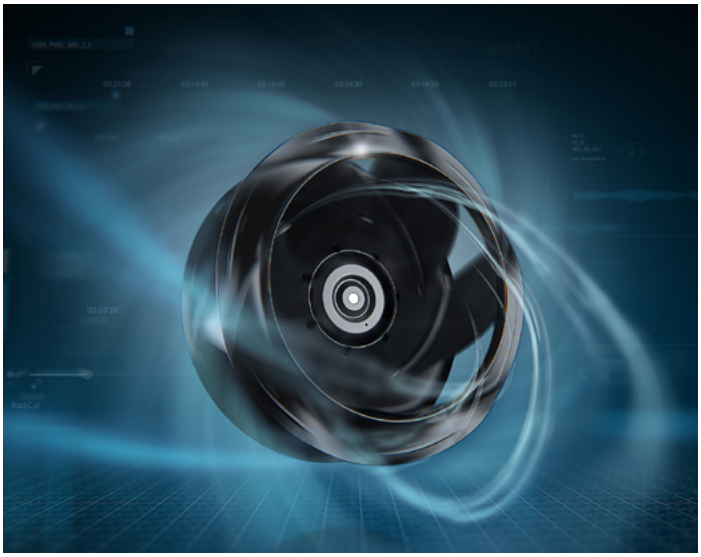

An ebm-papst RadiCal© impeller commonly used in air filtration units.

The right solution:

There are two main types of air movers: Axial and Radial. Axial is the most common, and is likely what immediately comes to mind when thinking of a fan. Axial fans have flat or curved blades that blow air straight through (a residential box fan is a good example of this type). While great at moving large volumes of air in a wide open space, blocking the inlet or exhaust impedes proper function, so axials are not a good choice for moving air through something restrictive like a filter. Radial fans are designed so that the air exits the fan at a right angle to the inlet. This makes radial fans much more efficient and able to handle much higher restrictions or pressure drops, a perfect fit for use with a filter. The most popular type of radial fan used in air purifiers is called a Backward Curved Impeller. This style offers the ideal combination of low noise, compact size, high efficiency, and the ability to perform optimally even with restricted airflow.

More choices:

The heart of a fan is its motor. Two styles of fan motors are common in the market: ***AC and EC.*** AC motors have been around for well over one hundred years. They operate well, are inexpensive, and are available in different sizes. AC motors are common in air purifiers as they are a good entry level technology, but they do have drawbacks; they are typically a little noisier and offer limited speed control options. ebm-papst enhances this technology by merging it with an external rotor design, delivering a low profile AC solution for simpler applications.

EC motors are a technology pioneered by ebm-papst, and an excellent choice for air purifiers. EC motors are powered by the same AC voltage from a wall outlet via an inverter or switching power supply to drive each phase of the motor via a closed loop controller. This modern design results in higher speeds and more airflow. EC motors also offer a speed control range 2-3 times greater than a traditional AC motor, giving them best in class efficiency and lower noise.

An air purifier using EC technology offers the perfect range of high performance and whisper quiet operation while consuming less energy.

Portable air filtration unit.

[1] U.S. Environmental Protection Agency. 1989. Report to Congress on indoor air quality: Volume 2. EPA/400/1-89/001C. Washington, DC.
[2] U.S. Environmental Protection Agency. 1987. The total exposure assessment methodology (TEAM) study: Summary and analysis. EPA/600/6-87/002a. Washington, DC.
[3] https://www.ashrae.org/technical-resources/filtration-disinfection

RadiCal - Backward curved centrifugal fans.

RadiCal – Facts at a glance:

- Perfectly matched components (motor/impeller)
- High efficiency with improved ventilation technology and new EC motors
- Extremely quiet running with significantly reduced rotation noise
- Innovative impeller style designed to optimize airflow
- Mechanical compatibility of AC and EC fans
- EC fans feature 2 speed levels or continuously adjustable
- High power density
- Rugged design and maintenance-free operation

Backward curved fan blades with a rigid, hybrid design

RadiCal centrifugal fans with backward curved blades are the new standard in ventilation and air-conditioning. Advantages include both noise minimization and a decrease in energy consumption. The RadiCal impeller is made of fiberglass-reinforced composite, enabling an aerodynamically optimized shape that cuts the noise level in half and reduces power requirements significantly.

The designs for the both the impeller and backward curved blades were perfected with complex simulation models and adjusted using measurements on prototypes. The result eliminates drastic cross-sectional jumps and laminar separation, creates a uniform airflow profile, and allows fewer noise sources (therefore improving acoustics). The damping characteristics of the plastic also helps reduce noise emissions.

RadiCal© product family ranging from 133-630mm.

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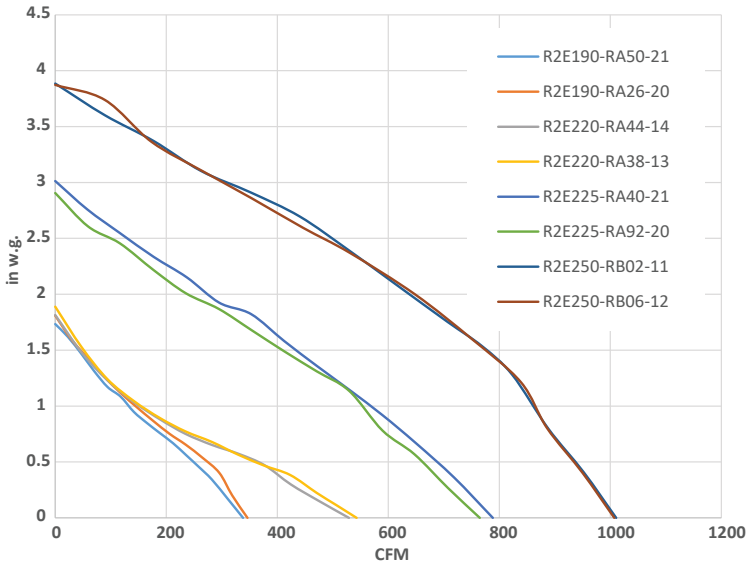
Technical performance data

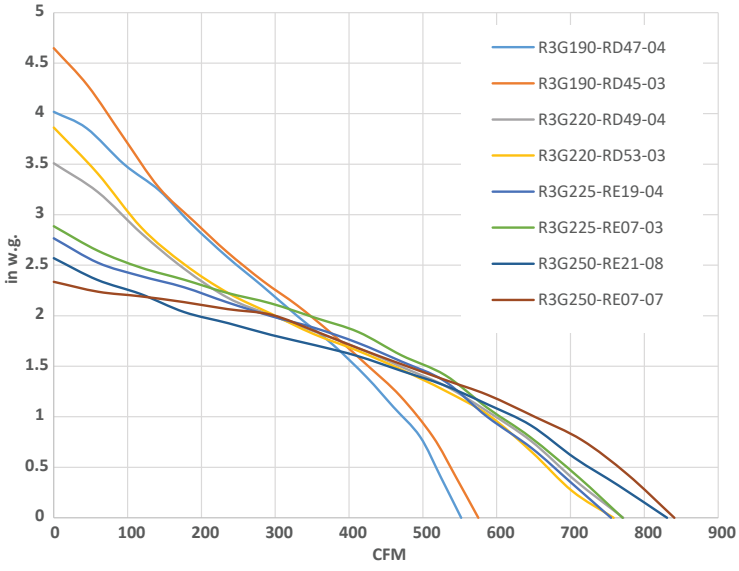
	Nominal data	Airflow	Nominal voltage range	Hertz	Ball bearings	Power input	Speed [1]	Temperature range [1]	Mass	Ingress Protection rating	Capacitor	UL
	Type	**CFM**	**VAC**			**Watts**	**RPM**	**°C**	**lb**		**µF**	
AC MOTORS	**R2E190-RA50-21**	338.3	115	50/60	Yes	70	2,450	-25...75	2.64	IP44	6	Yes
	R2E190-RA26-20	346.3	230	50/60	Yes	70	2,500	-25...75	2.64	IP44	1.5	Yes
	R2E220-RA44-14	529.0	115	50/60	Yes	108	2,100	-25...60	2.86	IP44	8	Yes
	R2E220-RA38-13	542.9	230	50/60	Yes	107	2,050	-25...60	2.86	IP44	2	Yes
	R2E225-RA40-21	788.3	115	50/60	Yes	225	2,700	-25...40	5.06	IP44	14	Yes
	R2E225-RA92-20	764.8	230	50/60	Yes	225	2,600	-25...45	5.06	IP44	3.5	Yes
	R2E250-RB02-11	1010.5	115	50/60	Yes	395	3,050	-25...60	8.36	IP44	20	Yes
	R2E250-RB06-12	1007.1	230	50/60	Yes	390	3,100	-25...55	8.36	IP44	5	Yes
EC MOTORS	**R3G190-RD47-04**	551.9	115	50/60	Yes	170	4,180	-25...50	3.08	IP54		Yes
	R3G190-RD45-03	575.1	230	50/60	Yes	169	4,120	-25...60	3.04	IP54		Yes
	R3G220-RD49-04	771.5	115	50/60	Yes	170	3,290	-25...50	3.30	IP54		Yes
	R3G220-RD53-03	758.4	230	50/60	Yes	168	3,230	-25...45	3.19	IP54		Yes
	R3G225-RE19-04	754.9	115	50/60	Yes	170	2,870	-25...45	3.85	IP54		Yes
	R3G225-RE07-03	770.6	230	50/60	Yes	170	2,860	-25...45	3.85	IP54		Yes
	R3G250-RE21-08	830.8	115	50/60	Yes	160	2,520	-25...60	5.28	IP54		Yes
	R3G250-RE07-07	840.7	230	50/60	Yes	170	2,510	-25...60	3.96	IP54		Yes

Data sheets available upon request. Data is subject to change without notice at ebm-papst discretion. An inlet ring can be ordered as an optional extra.
*Note: Occasional starting at temperatures between –40 °C and –25 °C is permitted. For continuous operation at temperatures below -25 °C (in refrigeration applications for example), we recommend our fan design with special low-temperature bearings.

AC performance range



EC performance range



For smaller or larger products not listed in the table and charts above, please contact us directly at sales@us.ebmpapst.com to be connected with our sales and engineering departments.

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