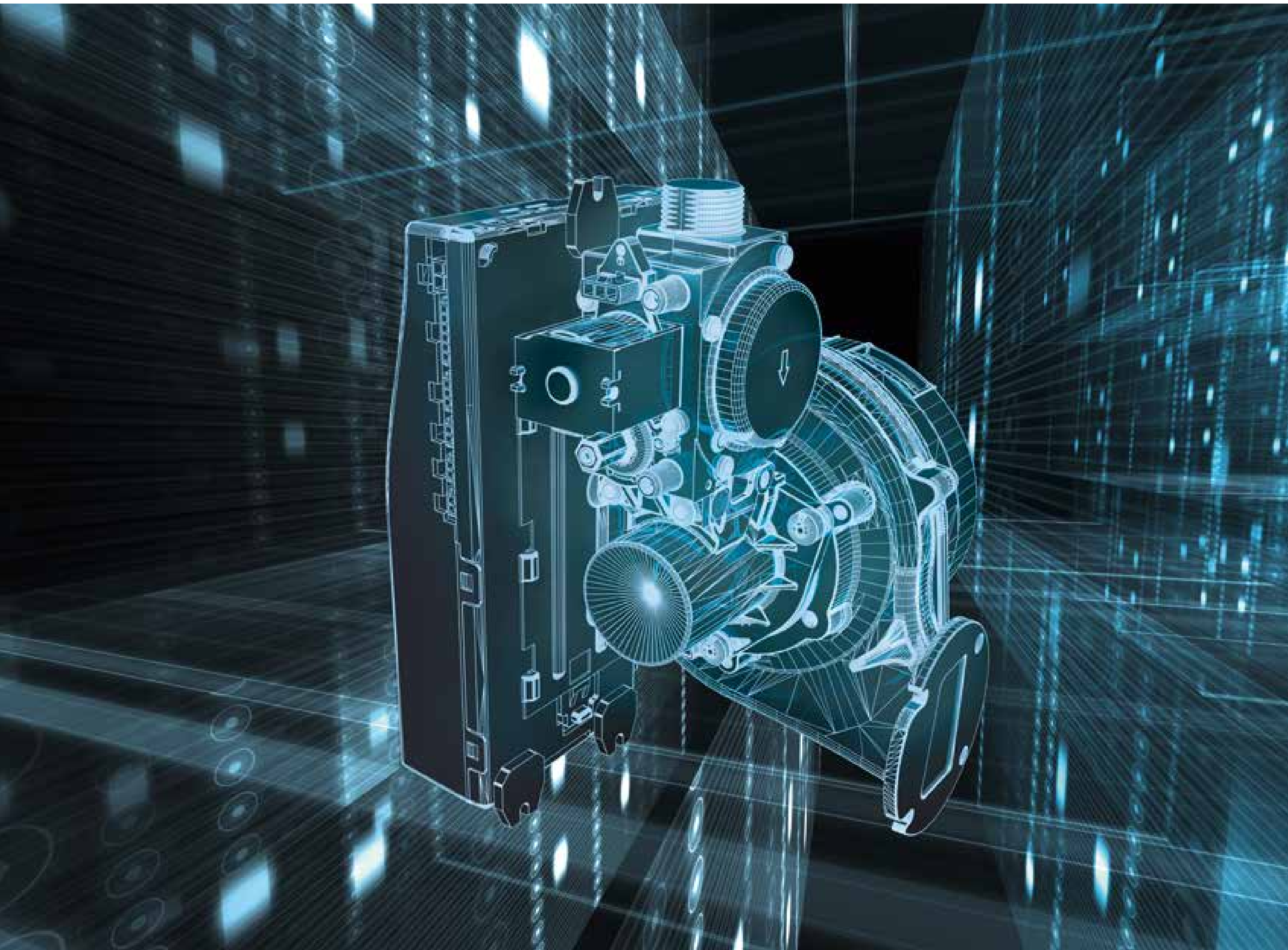
03°2015

techmag°

Technology by ebm-papst



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“We are moving forward with the integration of our systems”

Stefan Brandl, Managing Director at ebm-papst Landshut GmbH

The heating industry is facing a transformation similar to the one that the automotive industry just went through. Complete, ready-to-install systems are in demand instead of individual components. We have responded to this trend from the beginning and as a result have become system suppliers. This is also a logical step from a technical standpoint, as in condensing technology, a perfectly coordinated gas/air composite system is indispensable for efficient, and therefore environmentally friendly, combustion. For this reason, the gas valve, blower, and mixing device – referred to as the venturi – simply belong together when gases are burned.

In the NRV family, we have combined these components in a system that meets the requirements of small as well as large heating capacities. By now, the series includes four different system variants. In order to offer the greatest degree of flexibility possible, equipment manufacturers can also use the multiventuris developed by us to modify the output of individual systems. This is made possible by different inserts that change the diameter of the venturi, thus allowing customizations for smaller quantities.

In the company’s own gas laboratory at our site in Landshut, we can adjust the NRVs to the specific requirements of the customer, who then receive a preset, verified system developed in advance. As the components do not have to be matched, equipment manufacturers are able to reduce their production and development costs. As a result, we have intensified cooperation with our customers – creating real partnerships in development.

In the future we will continue to move forward with system integration. The best example for this is the iNR77, an electronic system in which the gas valve is integrated directly in the blower. In addition to integration, intelligence plays an increasingly important role: the networking and communication of components. The trend is clearly headed in the direction of Industry 4.0. And we at ebm-papst are ready for it.

I hope you will find this edition informative and will enjoy reading about the other subjects as well!

An efficient family

Optimum burning in gas appliance requires perfect harmony between the components. The NRV systems by ebm-papst provide the perfect gas/air mixture.

Whether a classic boiler in a single-family dwelling, a micro CHP for heat and energy generation, or the deep fryers in restaurants for crispy french fries – as different as the functions of these devices are, they all have one thing in common: They all use energy produced by burning gas. Compared to other fuels, this process is more efficient and produces lower emissions. Gas can only develop these environmentally friendly characteristics in an optimum combustion process. Achieving the highest energy output is always a challenge for equipment manufacturers. The mix ratio, among other things, is crucial. If the concentration of gas is too high, not enough oxygen will be available. This is referred to as a "rich mixture". The result: The gas that is not burned escapes with the fumes, the amount of soot increases, and carbon monoxide is released into the atmosphere. On the other hand, if the concentration of gas is too low, the flame will be extinguished in the burner. Furthermore, not all gases are alike. There are many different types of gas, with different compositions and energy contents, depending on where they are extracted. Therefore the gas flowing through the supply grid varies from region to region. For the best mixture, these factors have to be considered.

Perfectly harmonized The mixture preparation plays an important role in devices that use gas as an energy carrier. The unit consists essentially of three components: a blower, a venturi mixing

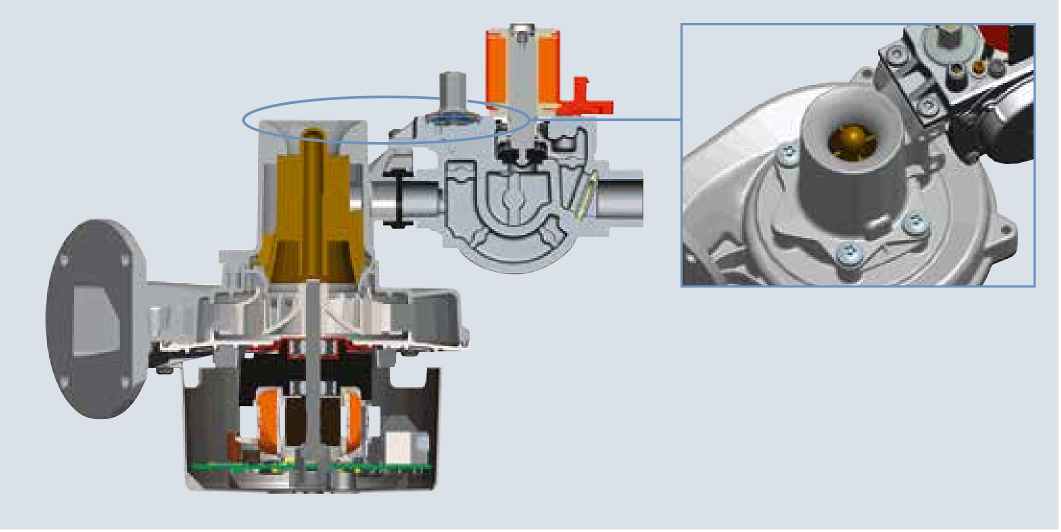


Figure 1: NRV 77 – The heat output range can be adjusted by the displacer in the venturi.

Figure 2: Water heater kit consisting of NRV 118 and burner controller.

device, and a valve. In order to achieve perfect harmony, ebm-papst in Landshut has combined these three components into a so-called "NRV system".

All versions of the system are built according to the same principle. In the venturi, fresh air flows through a tapered nozzle. This produces a vacuum at the narrowest point that causes the gas to be pulled through the valve. It is attached to the side of the venturi, and – in the so-called pneumatic combustion system – regulates the amount of gas that may actually flow out. The blower is responsible for a homogeneous gas/air mixture and conveys it to the burner. As an option, ebm-papst also offers the appropriate burner control unit that monitors gas safety and controls the heat output for this system. Thus, customers receive a complete system perfectly matched to their requirements.

Individual solution Currently the NRV family includes four different systems with different blower sizes: NRV 77, 118, 137 and 148. They cover different power ranges, and all have a turn down ratio of at least 1:5. Depending on the model, even a ratio of 1:10 is possible. The specific parameter indicates the ratio between the possible minimum and maximum power output of the heating unit. The greater the modulation range, the better the power can be adapted to the actual need. This enables efficient combustion even in low power ranges. The power ranges in the NRV systems can be modified to allow for the best possible adaptation. This is made possible by the multiventuris developed especially by ebm-papst. Here, a displacer located in the plastic tool is used to vary the cross section of the venturi (figure 1). For example, for the NRV 77 three different venturi elements can realize 2 to 15, 5.5 to 28, and 7 to 35 kilowatts, thus enabling individual adjustments for small quantities without additional costs.

Compact construction One thing that all NRV systems have in common is their compact design. Due to the modular structure, they can be adapted easily to the space requirement of the respective customer appliance. This allows different installation positions. Further flexibility is given by the possibility to adjust the mounting positions of the multiventuri and the valve.

Adjustable mounting clips make it possible to mount the burner control unit directly on the assembly (figure 2) without any further adjustments. But it can also be installed separately from the system.

The electronically controlled combustion system: iNR77 With the iNR77, component integration has been taken to the next level. In this electronic system, a mass flow sensor measures the air flow supplied to the burner. Based on this information, the blower motor is controlled spe-

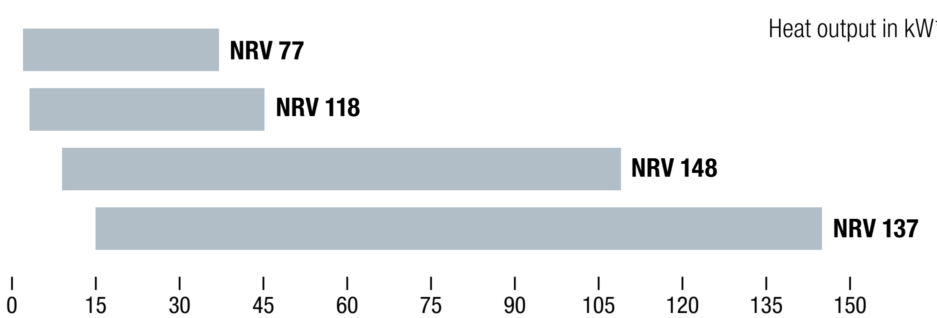
Figure 3 (left): iNR77: The electronic system with integrated gas valve covers a power range up to 35 kilowatts, but is available only project-specifically.

Figure 4 (right): Application of the NRV system using the example of the wall-mounted gas heater.

cifically to generate the optimum gas/air mixture. The iNR77 requires significantly less space because the electronic gas valve is integrated directly in the blower housing (figure 3).

Individually set In the company's own gas laboratory in Landshut, the engineers are able to adjust the systems to the specific needs of the customers. This means a very efficient procedure in the development process together with the customers, and the production of optimally adjusted, environmentally friendly, and energy-efficient devices (figure 4).

Overview of the heat output ranges of the NRV family



* Realized by different venturi elements

Diverse applications

The NRV systems can be used in the following applications:

- Gas-condensing boilers for households or commercial applications
- Air and water heaters
- Humidifiers
- Restaurant equipment such as gas-operated deep fryers or stoves
- Fuel cells

The author of this article is Stefan Kellerer, Key Account Manager for ebm-papst Landshut.

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Plug & play centrifugal fans for ventilation systems

The trend continues – the next step toward greater efficiency

The technology for centrifugal fans used in ventilation systems has advanced continually in recent years. The reason is growing demands from users, particularly with respect to control and efficient use of energy. Regulations such as Germany's EnEV (energy conservation regulation) and the ErP (energy-related products) directive have raised awareness of this issue considerably. Enhanced plug & play EC centrifugal fans make allowance for these and future market requirements, and go even further.

Experience has repeatedly shown that the EC drives used in modern fan technology are clearly superior in terms of energy efficiency to the conventional AC drives that are still frequently used in ventilation and air conditioning equipment. However, one should not forget that a fan must be viewed as a complete system consisting of the impeller, motor, housing and control electronics. All components – from the electrical connection to the impeller outlet and even the way it is installed in the ventilation and air

Figure 1: The familiar RadiPac with a new look. The main focus of this re-engineering centered around the area where air enters the impeller, the position of the external rotor motor in the impeller and the impeller's blade profile.

The motor design with an external rotor is advantageous in many regards.

conditioning equipment – must be considered during the optimization process if all potential savings are to be realized.

Continuous improvement process The motor and fan specialists at ebm-papst Mulfingen have been involved for quite some time in this continuous improvement process, which ultimately benefits both the environment and the customer's wallet in equal measure. And so the RadiPac product range (Figure 1), which was specifically designed for use in air handling units (AHU), has been steadily improved in recent years, with particular emphasis being given to energy efficiency, but also to noise reduction and handling.

The initial focus was on the motors used in the fans. The control electronics in the GreenTech EC motors with external rotor design were recently improved and the electromagnetic circuit was optimized to improve the efficiency. Though the energy-saving motors, which are grid-powered, permanently energized synchronous motors (also known as BLDC or PM motors), have an efficiency well above the level we know from the IE4 efficiency class, they make do with "basic" and inexpensive and – above all – readily available ferrite magnets. So they are not dependent on the limited supply of rare-earth magnets and still reach efficiencies of well over 90 percent (see box).

The motor design with an external rotor is advantageous for fans in another regard as well: it allows axial blades or centrifugal impellers to be mounted on the rotating rotor, i.e. directly on the "housing" of the motor. The result is a compact device, especially in the axial direction. Cooling is simplified as the air transported by the fan cools the motor. In addition, the complete rotating assembly of rotor and impeller is dynamically balanced in two planes for extremely smooth running.

Optimizing the flow machine The GreenTech EC motors can only be marginally improved as they already work at over 90 percent efficiency, but there are other adjustments that can be made to achieve high overall efficiency for a fan. Measurements have shown that there is still some room for improvement in the proven RadiPac impellers, the medium-pressure centrifugal fans with GreenTech EC technology, so in a further step, the fan specialists from ebm-papst had another look at the flow machine. The main focus of this re-engineering centered around the area

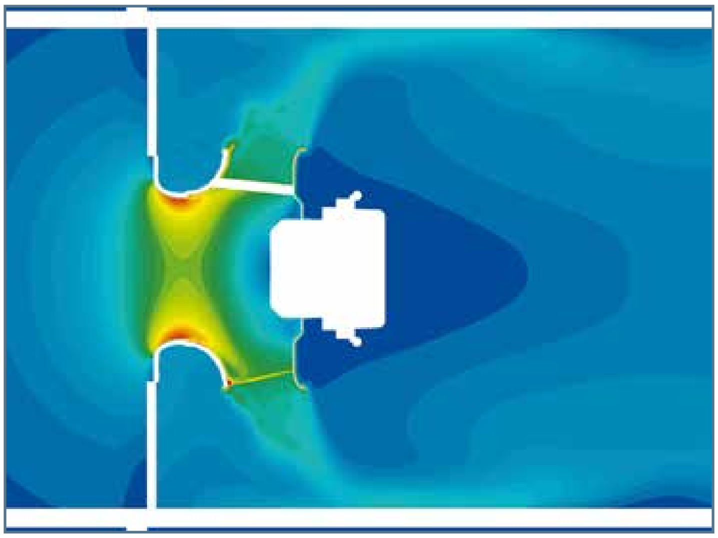

Figure 2: A flow simulation is used to determine the influence the modifications have on efficiency. This made it possible to optimize the outflow behavior.

where air enters the impeller, the position of the external rotor motor in the impeller, and the impeller's blade profile.

For example, the inlet nozzle was designed for a perfect match to the impeller with its aerodynamically optimized blade channel. The motor's position in the impeller was also reworked to achieve a good compromise between the compactness of the overall fan unit and an aerodynamically optimal placement of the motor in the impeller. In the impellers themselves, new airfoil aluminum blades result in higher efficiency; their special shape reduces the weight of the impeller while simultaneously increasing its stability. Pressure losses at the inlet were reduced further and the outflow behavior was also improved. The air is already channeled in the main flow direction of the AHU, significantly reducing deflection losses (Figure 2). The results of the optimization are impressive, as the comparison in Figure 3 shows. All told, the redesign of the flow machine resulted in an efficiency increase of more than 8 percent for the RadiPac fans while also reducing their noise level. The new centrifugal fans run very quietly.

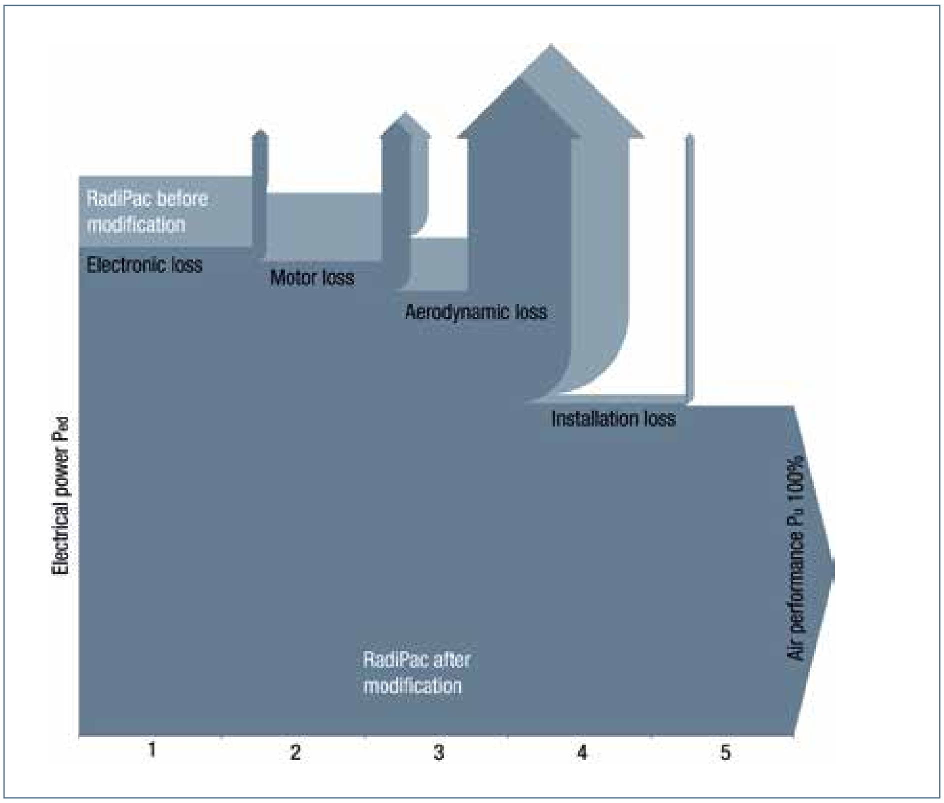

Figure 3: The results of the optimization are impressive. All told, the redesign of the motor and the flow machine resulted in an efficiency increase of more than 8 percent for the size 400 RadiPac fan.

Systematic rather than component-based approach The centrifugal fans are also convincing in other respects as the RadiPac product range for ventilation equipment includes other mechanical components in addition to its preci-

Expensive adjustments during commissioning are no longer needed

sion impeller with inlet nozzle, its GreenTech EC motor and its control electronics. The result is a complete fan unit that is ready for installation as delivered. In contrast to other solutions such as those with asynchronous or PM motors, the user does not have to deal with individual components such as motors, frequency converters and impellers, all of which must be procured, installed, connected and adjusted.

Since the motor and the electronics integrated in the motor system are also already perfectly adjusted to one another in RadiPac fans, additional electronic filters and shielded cables are unnecessary. There is no longer any need for expensive adjustments during commissioning. Moreover, with the continuous closed-loop speed control typical of EC motors, the output of the fans can be exactly adapted to specific requirements. Control is possible via the 0-10 V input or MODBUS-RTU.

Not just for ventilation The new RadiPac fans were first presented at the ISH trade fair in Frankfurt in March 2015. The new fans in sizes 250 to 560 are already available, making efficient, compact and quiet plug & play fans available for many applications, not just for ventilation and air conditioning units but also for cooling electronics such as the inverters in wind-power stations.

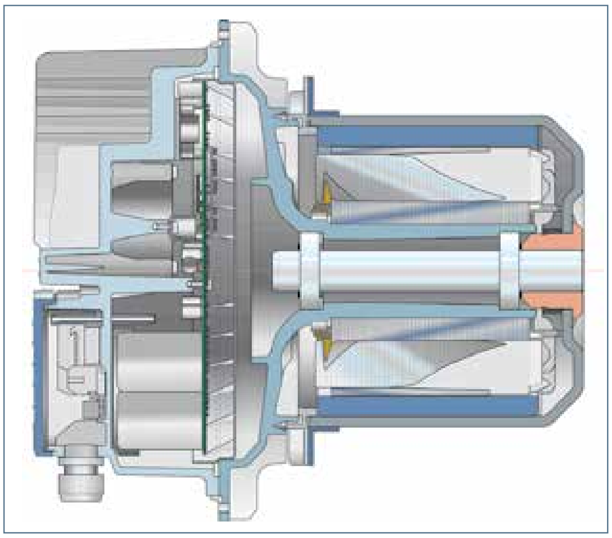

Figure 4: Cross section of external rotor motor with GreenTech EC technology: the rotor rotates not in, but around the stator, and works without rare-earth magnets.

Independence from rare-earth magnets

In external-rotor EC motors, the part of the motor at rest, the stator with the coils, is located on the inside and is surrounded by the moving part, the rotor with the permanent magnet (Figure 4). The externally positioned rotor rotates around the internally situated stator. This arrangement alone dictates that the external rotor motor can achieve a higher torque (magnet volume, air gap surface, radius) than an internal rotor motor with the same package length, the same magnet system and the same magnet thickness (reduced magnet volume, reduced air gap surface, smaller radius). By cleverly using the degrees of freedom in the fan and blower area, an external rotor motor using hard ferrite magnets can attain torques and efficiencies which an internal rotor motor with limited degrees of freedom (volume, mass) can achieve only with rare earth magnets. In contrast to servo drives, fans do not require high dynamics. On the contrary, a certain moment of inertia is entirely desirable for fans to have smooth starting and acceleration behavior. So for GreenTech EC motors, rare earth magnets can be readily dispensed with and ferrite magnets can be used instead. The latter are not only significantly less expensive, but also have stable market prices due to their availability.

The author of this article is Uwe Sigloch, head of Market Management, Ventilation and Air-Conditioning Technology division at ebm-papst Mulfingen

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Fresh air through closed windows

Small centrifugal fans from ebm-papst

Constantly improving insulation in buildings is accompanied by increasingly refined solutions for room ventilation. Today controlled ventilation systems with heat recovery are used with increasing frequency. The used but warm air from the interior is routed with a fan through a heat exchanger to the outside, while cool fresh air is brought in from the outside via this heat exchanger and warmed up. This minimizes heating losses and reduces the amount of required electrical energy.

Active or controlled ventilation systems can be designed as centralized or decentralized systems. In the former, a central system distributes the air via ducts throughout the house; in the latter, each room is supplied independently of the others. The devices used in decentralized systems are much smaller and can be integrated in a building's existing structure. A particularly elegant solution is to integrate the fan, the heat exchanger and the control electronics directly in the window frame (Figure 1, page 10). This was the approach taken by REHAU in the development of its GENEO INOVENT window fan in cooperation with the fan specialists at motor and fan manufacturer ebm-papst.

Figure 1: Window frame with controlled ventilation.

Fan, heat exchanger and control electronics are integrated in the window frame.

Requirements for fans and air duct design
Such a solution imposes special requirements on fans and air duct design. The conflicting aims of achieving the required air flow with compact dimensions and low noise emissions need to be reconciled. In the case described here, the fans from ebm-papst were specially designed to meet the conditions of REHAU's GENEO window system. The available space in the window frame made it necessary to design for two separate fan-heat exchanger systems for air intake and exhaust instead of a single system with a bulky counterflow heat exchanger. The fans were designed using modern 3D flow simulations, first for the fans alone, later together with the window frame components relevant to air flow.

Special use for cylindrical rotor fans For this task newly designed compact centrifugal fans from ebm-papst were chosen, so-called Sirocco fans, sometimes also called squirrel-cage fans. These DC fans have electronically commutated drives with electronic reverse polarity protection. The electronics are integrated in the fan's impeller hub to save space. The outstanding efficiency of the brushless drive results in lower heat stress for the bearings, which increases the service life of the fan. The air flows in through a round inlet orifice, is radially deflected inside the fan and leaves it through the tangentially positioned outlet. Sirocco fans are characterized by a high number of blades that are bent in the direction of rotation. The blades transfer the rotational energy to the air flow while the static pressure increase takes place in the spiral. Without the spiral the air would simply be mixed. Due to its design principle, this fan type has highly turbulent air flow with lower aerodynamic efficiency compared to other centrifugal fan designs. On the other hand, the high number of blades is beneficial as it results in lower noise emissions with fewer disturbing tonal components. Today, fluid mechanical calculations for centrifugal fans with forward-curved blades are possible with modern simulation methods.

Figure 2: Series fan with 65 mm impeller diameter.

Using numerical flow simulations, the complex air flow structure in the fans can be computed and the results are used to optimize the fan geometry with respect to the application.

Three-step fan design The fan design took place in three steps. In the first step, a low-vibration electronically commutated three-phase motor was integrated in a fan with similar dimensions (Figure 2). This drive ensures minimal generation of the structure-borne noise that is often considered disturbing at low speeds. In the second step, the aerodynamic components (scroll housing), number of blades and blade angles) were designed using 3D flow simulations and related experiments. Figure 3 shows the fan's overall sound power plotted against the back pressure of the flow channels through the window frame. With increasing air flow through the flow channels, the back pressure increases, thereby requiring a higher fan speed. Consequently, the values on the x-axis are also a measure of the fan

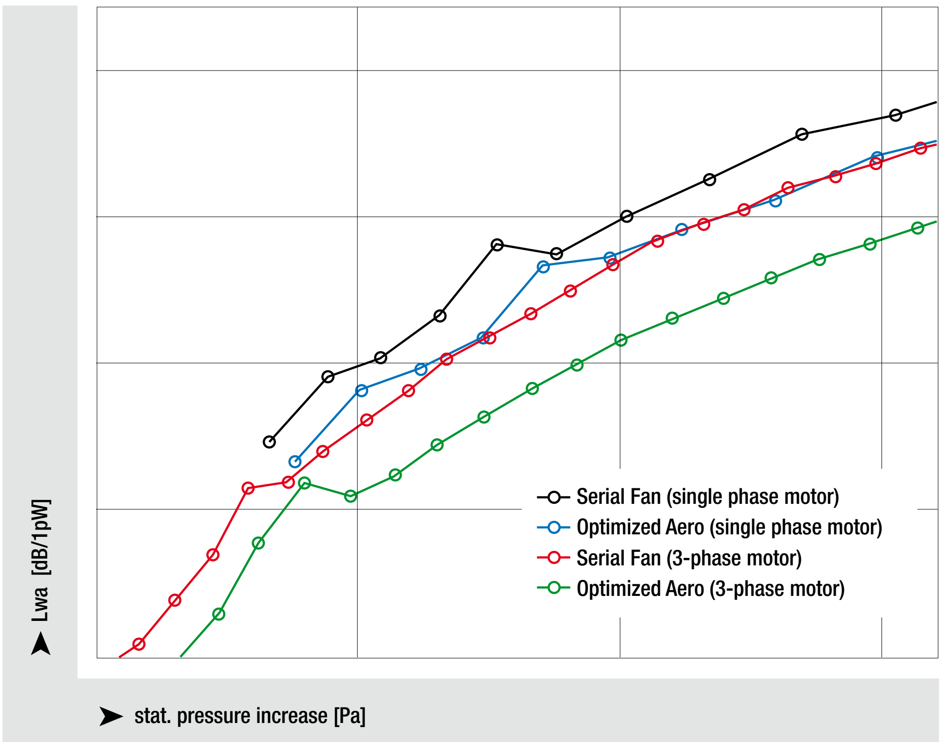

Figure 3: Effects of motor on sound power of fan.

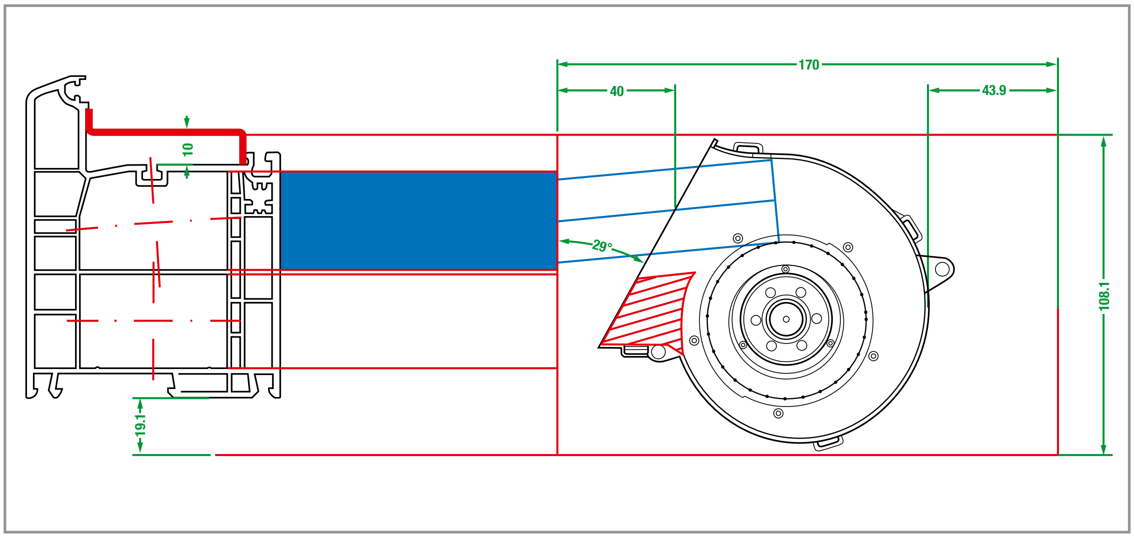

Figure 4: Geometrical adaptation of centrifugal fan to the available space.

speed: the higher the speed, the greater the air flow, the higher the back pressure and the higher the sound power level. The black curve shows the behavior of the series fan with a basic single-phase motor. The blue curve denotes a fan with the same dimensions and drive but with optimized aerodynamics and the red curve shows the acoustic behavior of the series fan when equipped with a three-phase motor.

Thanks to the easy window replacement the building suffers no negative visual impact.

Improvements to aerodynamics and motor It can be seen that improvements in aerodynamics are just as effective as choosing the right motor technology. For pressures above 90 Pa, both effects can be approximately added without negative interference, so both improvements were used in the new fan. The fan dimensions were further reduced and adapted to the geometrical requirements of the application (Figure 4).

Further optimization with CFD Since the fan cannot be operated under optimum intake and outlet conditions, the actual conditions of installation have to be included in further optimization efforts. For this purpose, computational fluid dynamics (CFD) is a very effective method. The relatively large effort involved in performing CFD calculations enables the simulation of complex flow processes in a unique way (Figure 5). Effective visualization of the results helps in assessing modifications and improvements so the amount of experimentation can be reduced considerably.

To integrate the system into the window frame, two fans with identical aerodynamics and motors but different directions of rotation are needed: a clockwise fan for the intake and a counterclockwise fan for the exhaust. With respect to air performance and noise emissions (shown as sound power), the fan operates close to its acoustic minimum. Regarding the scale of the red curve in Figure 6 the deviations are well within measurement tolerances and product variations.

Decentralized residential ventilation systems integrated in window frames provide the convenience of fresh, preheated air. Thanks to the easy window replacement without extra installation effort, the building suffers no negative visual impact. The window's functions of noise suppression and protection against break-ins remain in effect. To fully achieve these benefits, ebm-papst developed especially efficient and quiet fans with a design optimized for the limited available space in window frames. ○

In our customer magazine mag° we also cover the window fan: mag.ebmpapst.com/window_fan

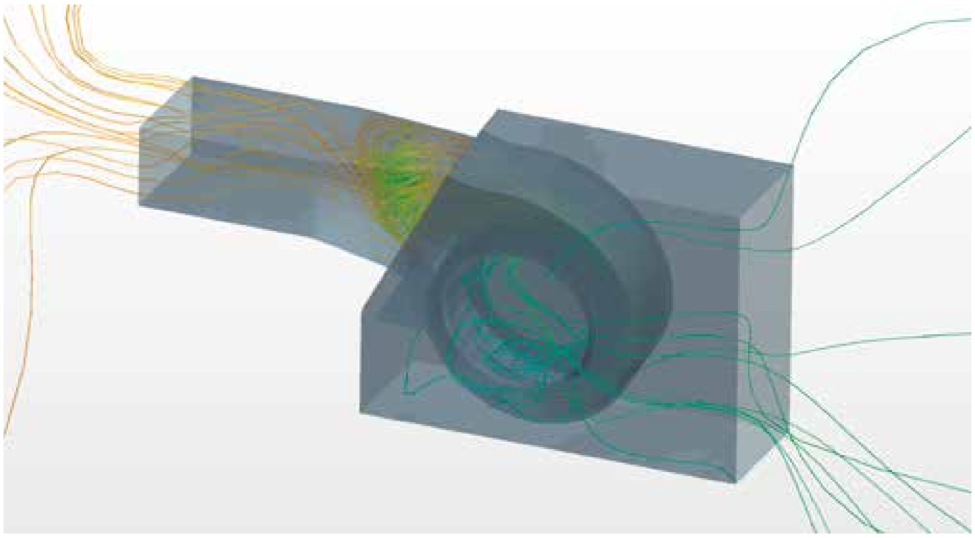

Figure 5: Flow simulation of complete fan in window frame.

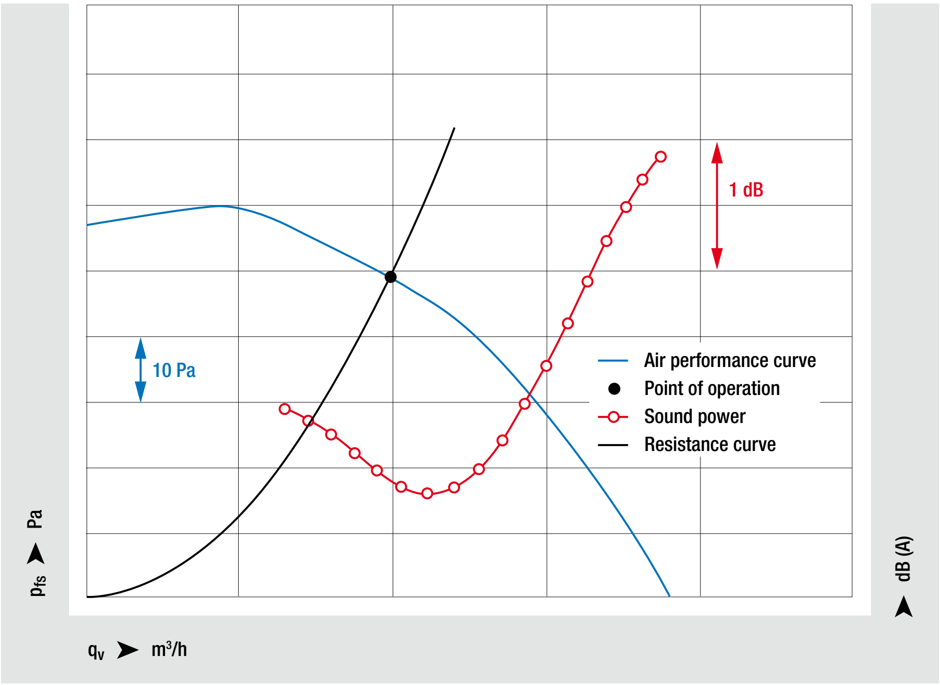

Figure 6: Air performance and sound power of centrifugal fan with point of operation and aerodynamic resistance curve for window frame.

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EC fans for fan coils

Active power factor correction (PFC) as a useful option

Selecting a suitable fan is no easy task for the producers of fan coils. Besides having the required power, running as quietly as possible and fitting into the housing, the fan drive that is used needs to operate in a way that matches the application's requirements, since the drive has a critical effect on energy consumption and thus on operating costs. Depending on the application, other fan characteristics can also be important. For example, when several EC fans are operated in parallel, active power factor correction (PFC) prevents objectionable harmonics and the relevant requirements of EN 61000-3-2 can then be met without additional engineering effort.

Fan coils used in offices, hotel rooms or municipal facilities are often operated in parallel connection. This method of connecting the EC fans that are usually used in these devices for reasons of energy efficiency and noise reduction does not fully exclude effects on the grid. The pulsed input current of EC fans gives rise to current harmonics, which strain the supply grid and can cause increased losses due to reactive power. In parallel operation of multiple EC fans, this can cause the permitted thresholds according to EN 61000-3-2 to be exceeded and can have a negative effect on other devices in the system network.

Expensive but avoidable interference suppression measures A remedy for this problem can be expensive. The operators need to ensure sufficient reactive power compensation and provide central interference filters, which of course take up space. And space is often in short supply. Since the harmonics also affect the internal supply network, consideration must also be given to adequate cable cross sections. When retrofitting fan coil units, new wiring may even be

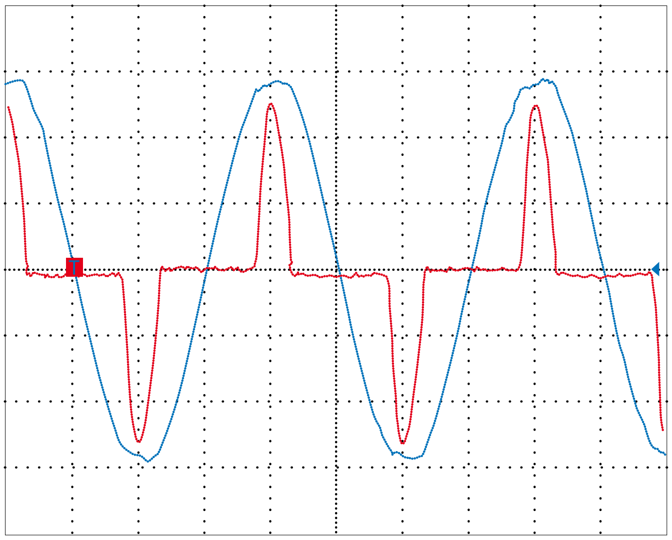

Figure 2: Without power factor correction (pulsed current curve shown in red): power factor λ = 0.53. The result: The peaks distort the network. The voltage curve is shown in blue.

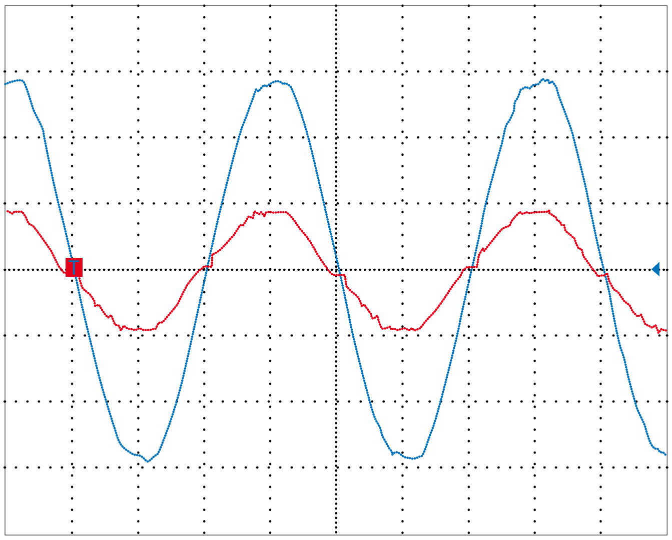

Figure 3: With power factor correction (sinusoidal current curve shown in red): power factor λ = 0.99. Ideally, the regulated current has the same phase as the line voltage. The voltage curve is shown in blue.

Figure 1: The EC centrifugal fans are available in single, twin and triple configurations for air performances of up to 2,500 m³/h in the power range up to 250 W.

necessary. However, installing it usually proves difficult or even impossible in practice for structural and economic reasons. Of course an external interference filter could be connected to each fan, but such devices are costly and may not exactly match their fans' motors and are thus only conditionally adequate.

Now planners and operators can save themselves all this trouble since the motor and fan specialist ebm-papst Mulfingen has addressed this issue. Now its EC centrifugal fans (Figure 1), which are specially designed for use in fan coil units, are now also available with active PFC. This integrated power factor correction converts the pulsed input current of the EC motors into a sinusoidal current. In the second step, the current is shifted so that it is in phase with the voltage. This significantly reduces the harmonic content of the input current. The effective value of the input current is also minimized and it is possible in many applications to select a smaller cross-section for the fan supply lines. Figs. 2 and 3 show the same combination of motor and fan impeller at the same operating point and with identically adjusted air performance with and without active PFC. Problems with harmonics and reactive power losses are no longer cause for worry thanks to the integrated power factor correction, which is perfectly matched to the motors. The requirements of EN 61000-3-2 are fulfilled with no additional measures.

Energy-saving and quiet But the EC centrifugal fans have more to offer. For instance, fan coils are generally operated for extended periods, so high efficiency levels gain particular significance. The EC fans are also effective in this regard. They work with high efficiencies. Since their GreenTech EC motors consume up to 70% less energy than conventional AC motors, they have a noticable effect on operating costs (Figure 4). High efficiency also means that less heat is dissipated. When the fan coil is in cooling mode, dissipated heat would mean that additional cooling output is required. In addition, the low motor temperatures have a beneficial effect on the service life of the ball bearings. However, modern EC technology does not provide savings only during full-load operation. It is exactly when operating under partial load that EC motors lose much less of their efficiency. This means that the energy savings become noticeable even when the fans are operated in low speed ranges, and operators quickly notice the benefits on the bottom line.

The EC centrifugal fans are available in single, twin and triple configurations for air perfor-

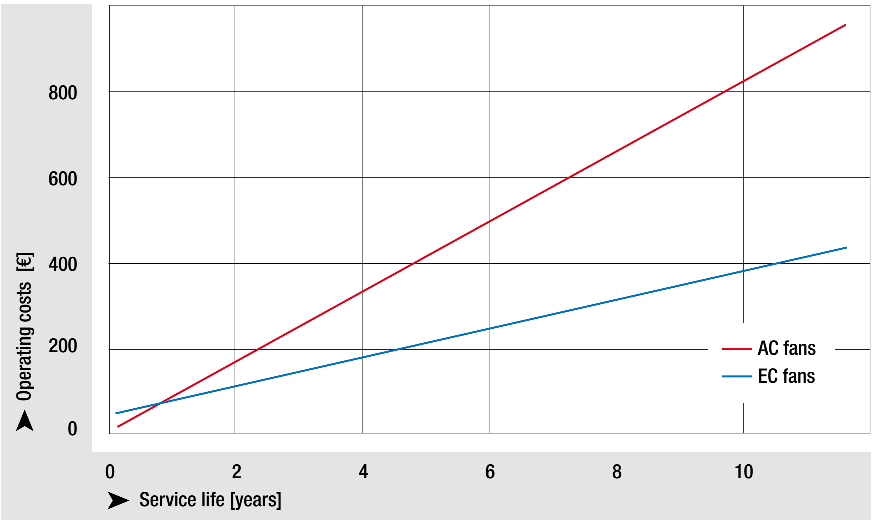

Figure 4: The investment in GreenTech EC technology is already amortized in less than two years thanks to its low energy consumption. Maintenance-free operation and long service life reduce life cycle costs even further.

mances of up to 2,500 m³/h in the power range up to 250 W. All versions are specially designed for low-noise operation; they are very compact and can be easily installed as a plug & play solution. The fan is mounted on its exhaust flange and connected using a plug system. The plastics used are light, yet durable and sound-absorbing; this combined with aerodynamic design allows the fans to operate at very low noise levels.

For different needs Since users should always pay only for the technology they need, in addition to the standard version that can optionally be equipped with power factor correction, there is also a basic version which also offers all the benefits of GreenTech EC technology and is suitable for applications in which a PWM signal is sufficient for infinitely variable speed control. There are now efficient EC centrifugal fans available for use in various fan coil applications; they can also be used for other applications with similar requirements (Figure 5). The air curtains in the entrance areas of department stores or factory halls are an example. ○

Figure 5: The EC centrifugal fans are ideal for use in fan coils.

Authors are Uwe Sigloch, head of Market Management, Ventilation and Air Conditioning division, and Philipp Uebel development engineer for electronics at ebm-papst Mulfingen

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New generation of fans, economical and quiet

Family of compact high-performance fans featuring high performance at top efficiency

For many applications, air is the ideal cooling medium to dissipate waste heat. For large amounts of heat in small spaces, a high-volume air flow is needed. Until now, high-performance fans that could deliver this air performance were loud, not especially economical to operate, and often could only be controlled in a limited fashion. A new generation of high-performance fans is now improving cooling efficiency and saving expensive energy. And for later disposal, the environment was already taken into consideration during the design phase, making it easier for users to fulfil both current and future standards.

As electronic components continue to get smaller and more powerful, they can be fitted into smaller devices with the same or even higher performance. This applies for many sectors such as IT, telecommunications and automation and also for frequency converters, welding machines and the continually improving solar inverters. The experts at ebm-papst have developed a new generation of high-performance fans, the S-Panther series (Figure 1), to give users of the latest technology a suitable fan solution. This generation was developed specifically with the aim of reducing noise emission, but without having to make compromises in air performance or efficiency.

New fan, proven technology To achieve that aim, it was necessary to completely rethink the aerodynamics and develop the fan from scratch. A comparison of the performance data for the current 172 mm S-Force fan at 6000 rpm with that of the new fan from the S-Panther series

Figure 1: fan of the S-Panther series, size 172 mm.

with the same dimensions at 4500 rpm shows that the maximum air performance has increased and the pressure saddle curve has been lowered (Figure 2). This design is suitable for moving maximum amounts of cooling air for almost all applications. Thanks to a further design refinement based on blades with winglets and trailing edges, it was possible to reduce the sound power level across the entire frequency range. An additional contribution comes from a new strut design specially configured to the blade geometry. The improved air conduction allows reduced speed for the same air performance, resulting in reduced noise emissions.

When the speed of the new fan from the S-Panther series is varied so that the same curve as that of the previous model is reached, a considerable reduction in the sound power level can be observed (Figure 3). Even at medium power levels, the operating noise at the same operating point has been reduced by up to 9 dB(A). The operating range to the left of the indicated line is characterised by strong aerodynamic detachment mechanisms. The sound power levels of both fans are the same there. Nevertheless, here too the new fans feature crucial improvements as regards noise perception (Figure 4). So-called tonal

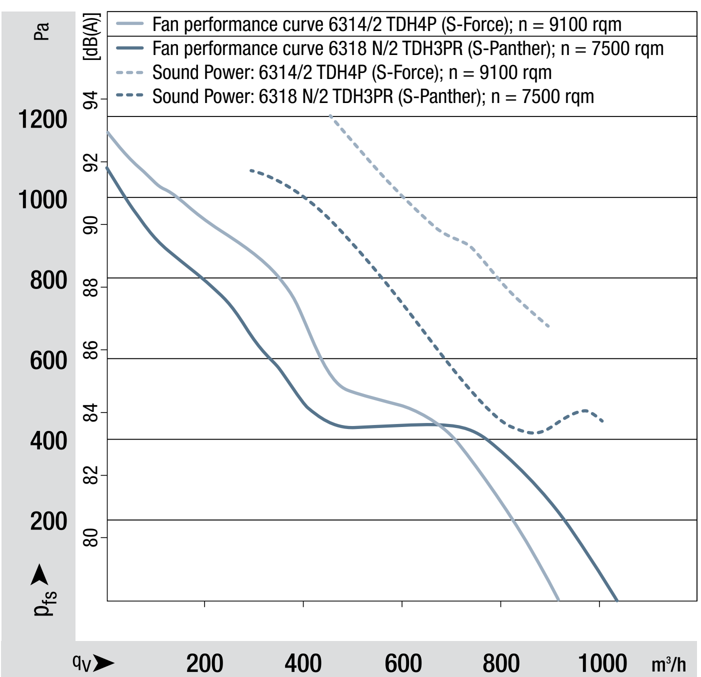

Figure 2: Comparison sound power and fan performance S-Force and S-Panther, size 172 mm.

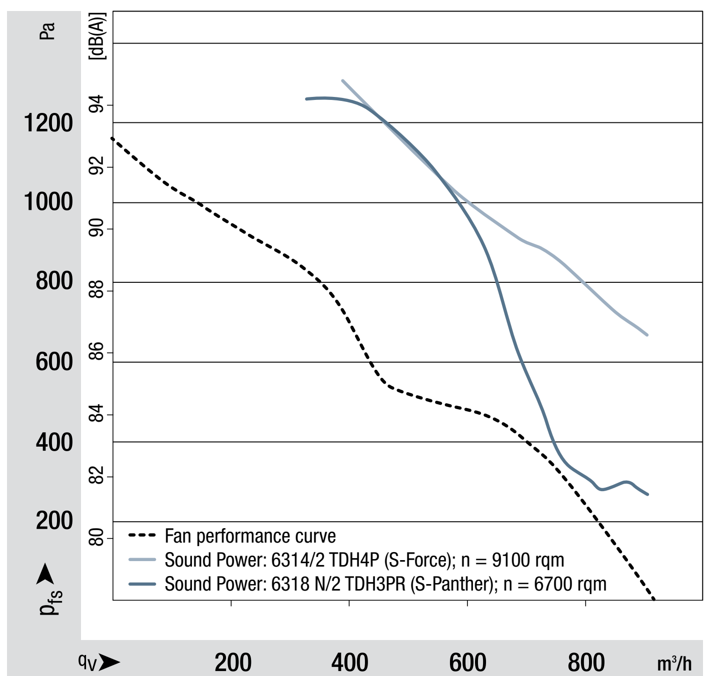

Bild 3: Comparison sound power S-Force and S-Panther, size 172 mm at same performance.

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noise in particular, which results from the number of blades and the speed and is always regarded as a nuisance, has been reduced considerably.

The mechanical stresses on all fan components have been reduced by the new design and its accompanying speed reduction, allowing the use of new technologies such as the mechanical design of the plastic impeller, the shaft-hub assembly or the rotor dynamics.

The bearing systems can be kept simpler, and together with reduced effort for balancing, they facilitate production at the same quality level. Drive is provided by proven 3-phase multipole motors with 6-, 8-, 10- or 12-pole magnetised rotor units which together with the 9-slot stator packs efficiently convert electrical to mechanical energy.

Performance in figures The sizes range from 80x80 mm up to 172 mm and cover all speed variants. Depending on the application, both low- and high-speed versions are available. Production of the new S-Panther fans will begin with the 63 and 32 series and will later be expanded to the 80 and 120 mm classes. All members of the new product family were designed from the beginning for environmentally friendly production and future disposal. ○

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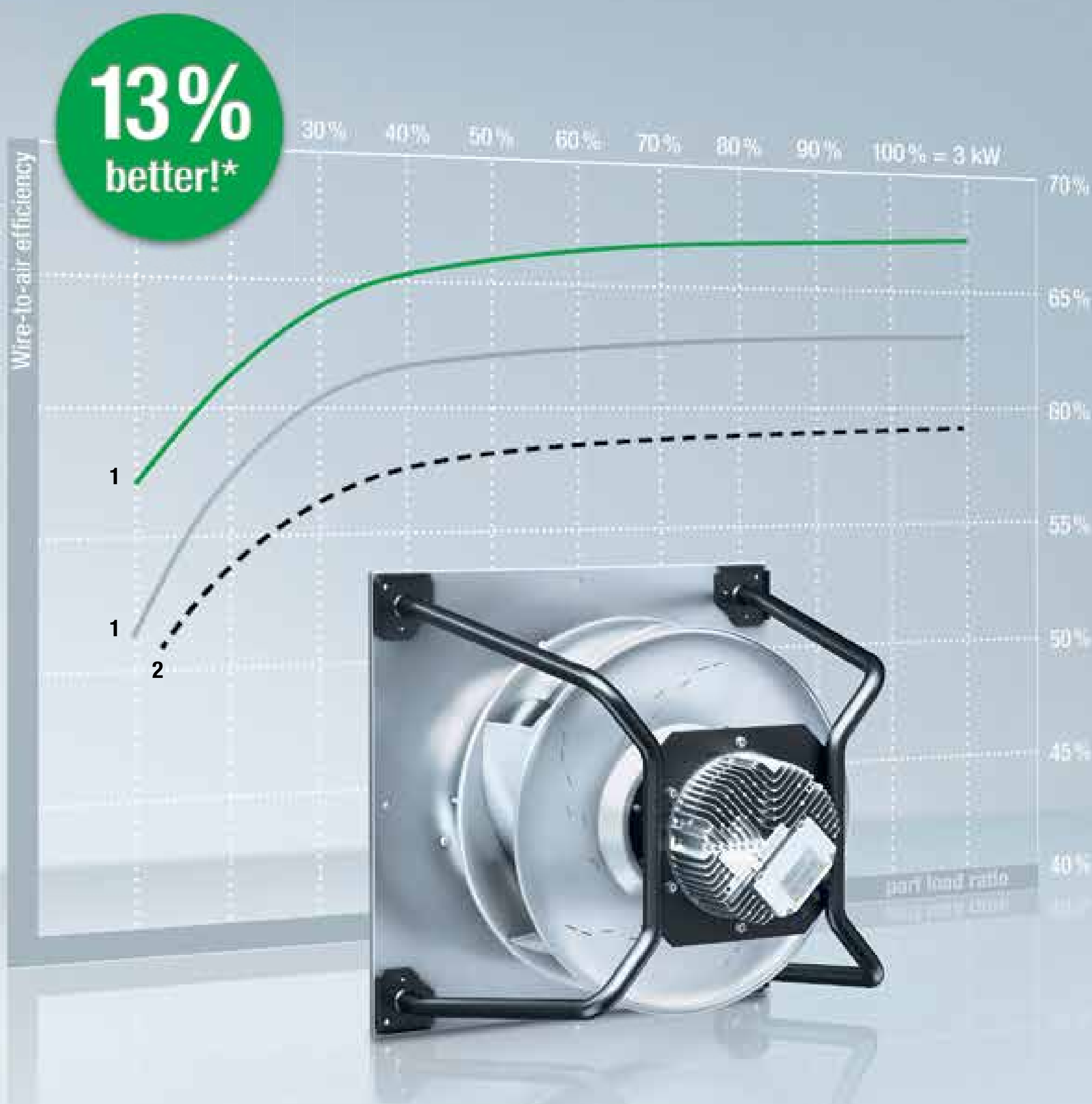

*Comparison of first- and second-generation size 400 RadiPac.
The results are [1] from the ILK-B-31-15-3981a technical report (dated 9 March 2015) by the Institute of Air Handling and Refrigeration (ILK) in Dresden and [2] our own laboratory measurements. For more information on the study, see www.ebmpapst.com/ilk

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