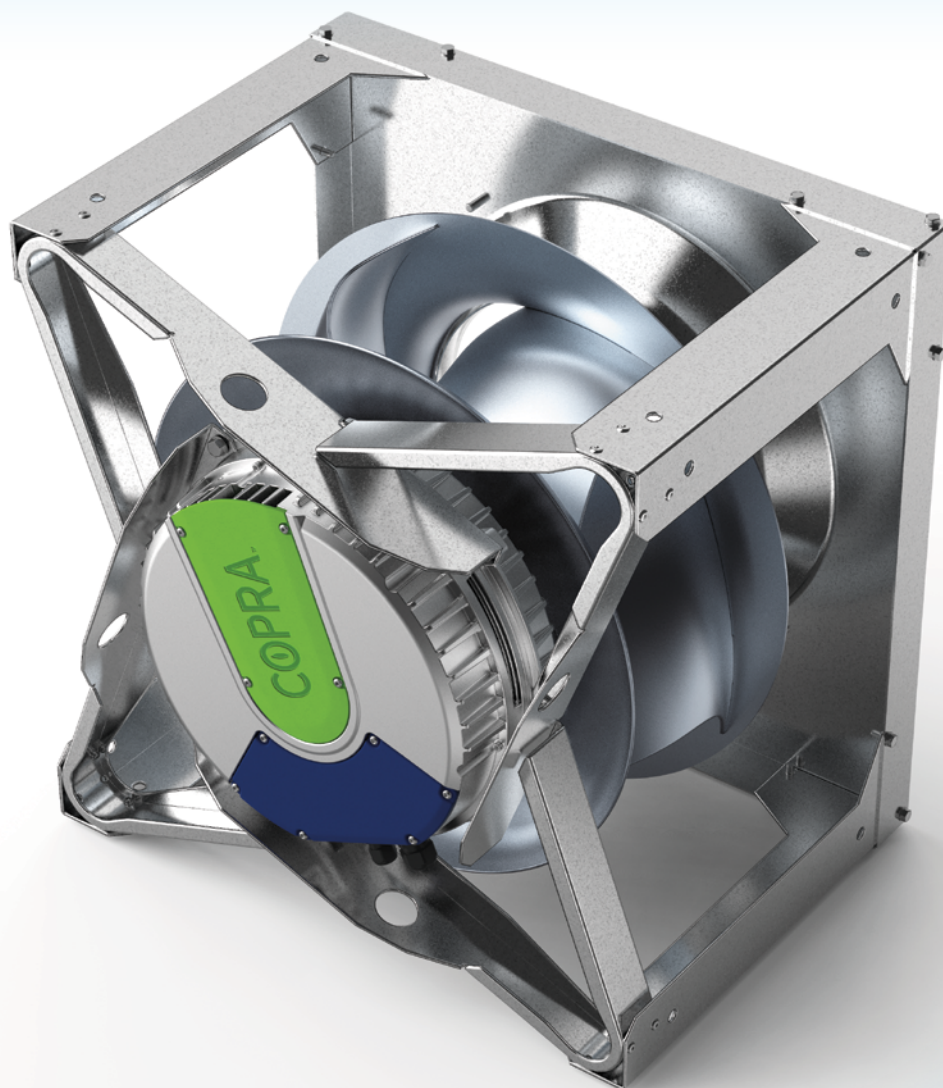


NICOTRA | Gebhardt®

COPRA Fans Compact and efficient. The perfect match.

the space-saving centrifugal fan system



PUTTING AN END TO COMPROMISE

COPRA™ fans combine high system efficiency, decisive compactness and high power density for the best overall performance.

The new space-saving COPRA™ system is comprised of a motor, impeller and integrated controller. It combines three properties in a way that previously seemed almost impossible: exceptional compactness, outstanding system efficiency and high power density. Its short motor does not restrict airflow while minimizing the space needed for the system. This, with the newly developed aerodynamic impeller design, delivers maximum efficiency – especially at reduced operating speeds.

Compared to conventional plug fans, COPRA™ fans offer maximum airflow with the greatest possible efficiency and significantly reduce footprint for all sizes. With its low installation losses, the new aluminum impeller demonstrates its advantages to the fullest, even in confined installation conditions. This makes COPRA™ fans the ideal solution in HVAC systems, data centers, and many other areas.

Why only improve, when you can reinvent?

For good reasons, free-running or hybrid radial fans have largely replaced fans with scroll housings in air-conditioning applications. Even though the latter have some positive physical characteristics, free-running fans take up less space, and drive losses due to belts, bearings or couplings are not an issue. Planners are particularly focused on lower pressures. In addition, the European Ecodesign Directive prescribes variable-speed drives. This favors direct-drive solutions.

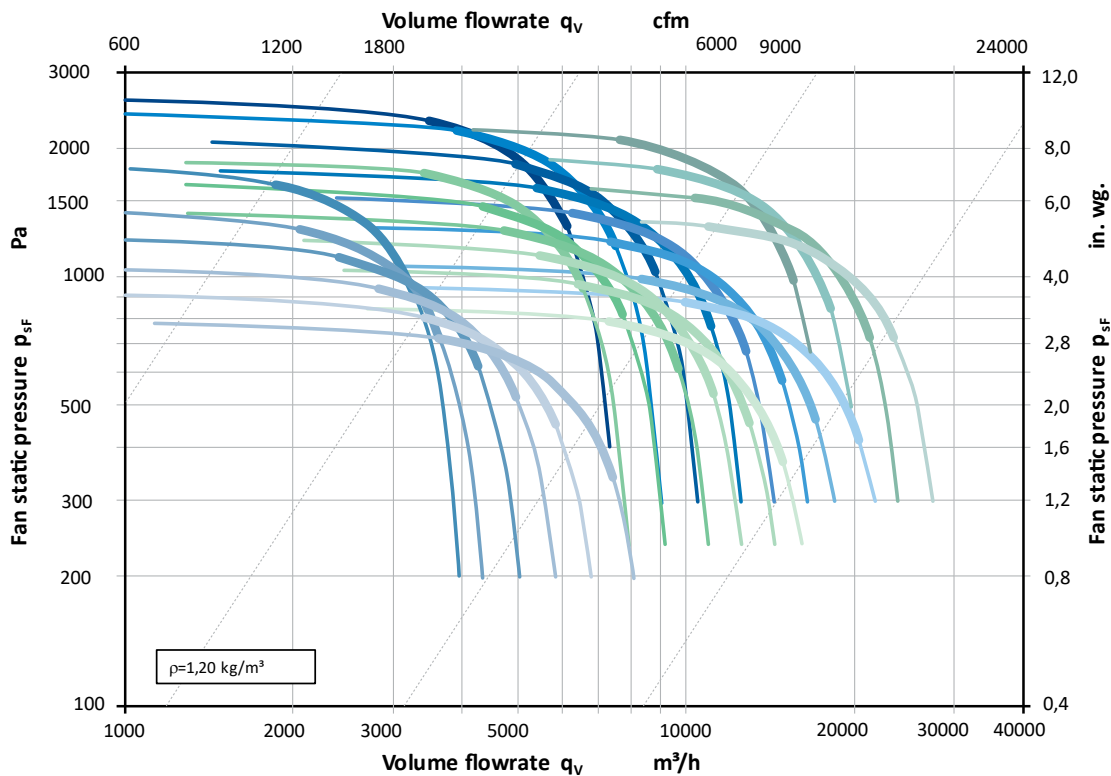
In terms of physics, free-running impellers can only achieve a pressure increase or energy conversion via two factors: a swirl added to the flow and a maximum delay in the relative flow in the impeller's blade channel.

A swirl in the flow at the exit from the impeller is unavoidable and necessary for energy conversion. However, this swirl also represents a loss in air-conditioning applications. As a result, fan concepts of this kind can achieve maximum aerodynamic system efficiencies of around 70%. We have achieved these maximum plug static efficiencies with COPRA™ fans.

The only way to gain more static efficiency from the energy of the flow swirl at the impeller exit is to use guide vanes, specifically a direct-driven hybrid fan with multiple discharge scrolls. However, this is typically less compact in design. Taking the above aspects into account, we have achieved greater aerodynamic efficiency levels with a reduced footprint in the development of the COPRA™ system.



Consolidated characteristics: overview of sizes.



The chart shows an overview of sizes 250 mm to 710 mm with up to 8 kW motor power at the maximum speed of the respective size. The ranges with the best overall static fan efficiencies (operating range with best efficiency) are highlighted.

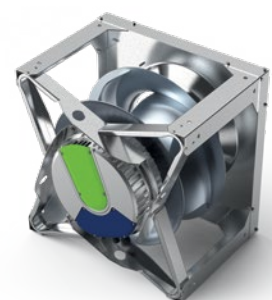
COPRA™

COPRA™ CORE 1.3 – 8 kW COPRA™ PLUG 1.3 – 8 kW

- Internal-rotor motor PM/EC technology with efficiency up to IE6
- Integrated electronics
- Air volume up to 28,000 m^3/h / 16,480 CFM
- Static pressures up to 2,000 Pa / ~6.8" wg
- Installation made simple with COPRA™'S CUBE frame system



COPRA™ CORE



COPRA™ PLUG

Impeller

- Aluminum, welded; 3-dimensional backward curved blade design
- Impeller diameters: 250, 280, 315, 355, 400, 450, 500, 560, 630, 710 mm
- Maximum static pressure 2,000 Pa / ~6.8" wg
- Maximum circumferential speed at impeller outer diameter: ~70 m/s
- Conical backplate

Motor

- 1.3 kW, 3.0 kW, 4.5 kW, 8.0 kW
- 200-240 V 50/60 Hz 3~
- 380-480 V 50/60 Hz 3~
- No use of rare earth magnets
- Operating temperature range: -20 to +40 °C

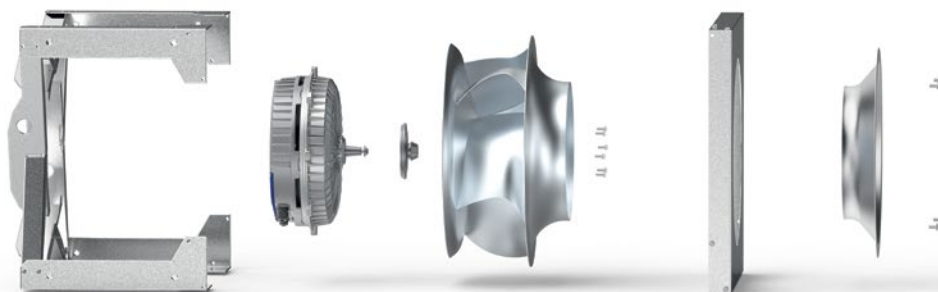
A PERFECT COMBINATION

Maximum airflow, maximum efficiency together on one unit;
with COPRA™ fans, the motor and impeller are optimally matched.

In the new COPRA™ fans, a perfect combination of impeller and motor across all sizes ensures maximum airflow with the highest possible efficiency and no mutual aerodynamic interference. Every application benefits from the perfect fit of COPRA™ fans' motor and impeller. Aerodynamically, the new impeller is one of the best currently available. It also enables a perfect symbiosis with the new motor form factor. Since the new internal-rotor motor is very short and its motor hub does not recede into the impeller it does not obstruct the impeller airflow. And at the same time, the overall system is highly compact and has a small footprint.

Standout features: maximum aerodynamic efficiency levels with ultra small footprint.

Conventional plug fans with external-rotor motors are hard to improve in terms of system efficiency and compactness. The greatest optimization potential for fan systems lies in adapting the characteristics of the drive required for the application in terms of the geometry and specifications – without aerodynamic disturbance or the need for additional cooling. It is precisely this goal – the perfect motor/impeller combination – that we have pursued and achieved in the development of COPRA™ fans. We have perfectly matched the motor and impeller geometrically and with regard to the necessary power, speed and speed range, aerodynamics, pressure increase, and corresponding torque. We have eliminated any mutual aerodynamic interference.



The Impeller

The new aluminum impeller with its advanced geometry can compete aerodynamically with the best impellers. Its three-dimensional backward curved blade design provides the necessary width to achieve a physical balance of forces between the flow lines and flow surfaces. It avoids an unfavorable cross-flow within the impeller. The profiled design (hollow profile) achieves the best aerodynamic properties at the respective flow surfaces for the pressure increase in the blade region. The profile cross-sections are designed as airfoils, in order to optimize the flow on the suction and pressure sides of the blades at every position within the impeller.

The Motor

The COPRA™ fans' motor sets the benchmark with its maximum efficiency and high effectiveness. At the same time, it has to be as compact as possible in combination with the impeller – and without negatively affecting the aerodynamics. For centrifugal fans with an impeller within a plug arrangement, this means the motor must be as short as possible. We have achieved all this with the PM/EC motor in COPRA™ fans. It achieves an efficiency class of up to IE6. Moreover, the COPRA™ fans' motor does not require direct cooling by air circulation or a separate cooling system. The integrated cooling of the motor electronics is sufficient. In any case, the motor's high efficiency means it requires less cooling. This makes the motor and system extremely reliable in operation.

Compact and efficient without impeller obstruction: COPRA™ fans make the impossible possible.

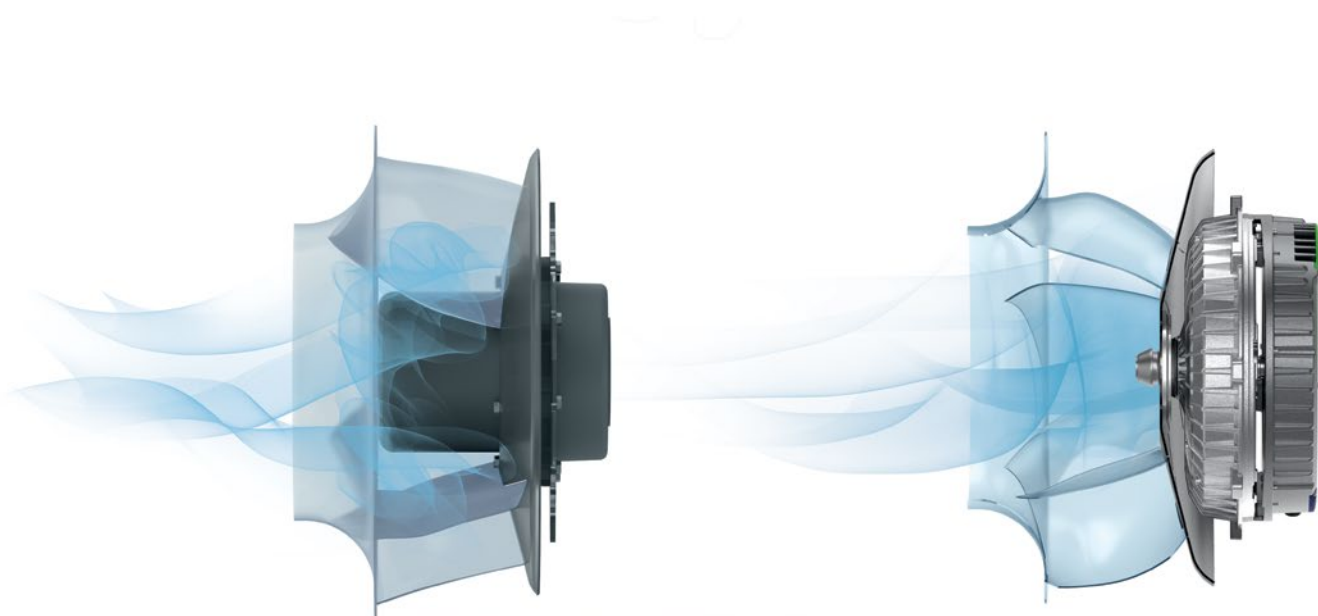
The size and shape of an external-rotor motor have an immense impact on the aerodynamic efficiency of a fan. The problem here is obstruction of the impeller airflow. With COPRA™ fans, it has been possible to avoid impeller obstruction and still achieve an extremely compact, highly efficient centrifugal fan system with an internal rotor. Solutions that are compact but compromise on efficiency are now a thing of the past. COPRA™ fans therefore unlock completely new potential for saving energy and costs.

Partly because of how they were historically developed, the design of external-rotor motors is better suited to axial flow fans than centrifugal fans. Nevertheless, despite the aerodynamic disadvantage of obstructing the airflow in the impeller, they have also become widely used for centrifugal fans. However, especially with compact EC motors, the motor protruding into the impeller significantly reduces system efficiency.

Pulling the motor out of the impeller – withdrawing it into a cone-shaped impeller or backplate – does reduce impeller obstruction, because the fan hub no longer protrudes into the

impeller. However, this sacrifices the system's footprint. Yet compactness is a crucial requirement in many applications. This is because, particularly where space is limited, fan solutions with pulled-out motors cannot be implemented in some applications due to their length.

Using an EC external-rotor motor in a plug fan is always a compromise between efficiency and overall length. This is why COPRA™ fans, with a very short internal-rotor motor, consistently prove to be the ideal, compromise-free, and therefore highly economical, system solution.



Fan solution with external-rotor motor and obstruction of the airflow in the impeller.

Fan solution with COPRA™ technology, without obstructing the airflow in the impeller.

CREATING SPACE WHERE THERE IS NONE

In short, COPRA™ fans are the ideal system for tight installation spaces.

In the new COPRA™ fans, it has been possible to make the internal rotor motor so short that it does not obstruct the impeller's airflow as is the case in conventional fan solutions. This creates ideal conditions for particularly economical operation even in tight installation spaces; the shortest axial length with maximum efficiency.

At the same time, the new motor/impeller concept ensures very low installation losses. There are hardly any unexpected, disadvantageous interactions between fan and application. A major reason for this is the modified overall geometry of the impeller.

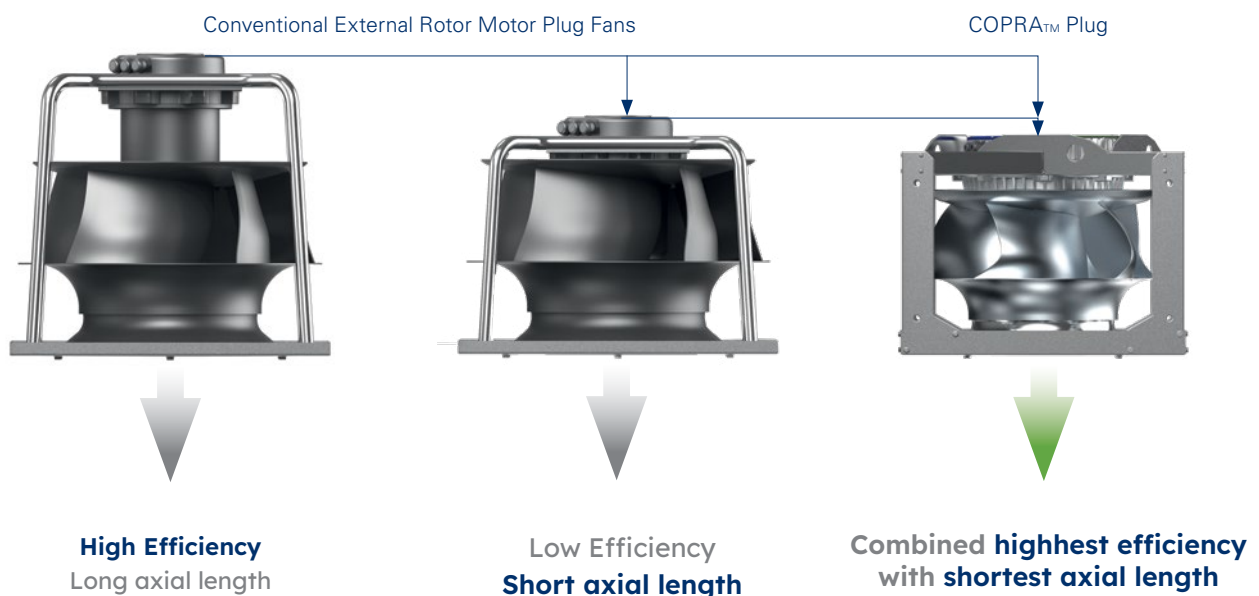
No more compromise: short axial length plus high efficiency.

Typical competitive fans use external rotor motors while COPRA™ fans use a compact internal rotor motor. For fans with external rotor motors (left), pulling the motor out of the impeller provides high efficiency, but makes the system longer. In addition, cooling is required for the external rotor motor due to the lack of air stream around the rotor in the impeller.

For systems with an external rotor located inside the impeller (center), the opposite is true. The system is compact and the motor is cooled in the airstream, but unavoidable turbulence in the impeller considerably reduces the aerodynamic efficiency.

COPRA™ fans (right) utilize the best features from both configurations without the compromises. The exclusively-designed short motor does not protrude into the impeller, making the system extremely compact and does not generate any turbulence. It also has integrated cooling for the electronics. The result is the best efficiency with maximum compactness of the system.

With its outstanding compactness, COPRA™ fans are ideal for use in specific applications in data centers, or in ventilation and air-conditioning system fan arrays, where installations can often be made a crucial few centimeters shorter. This results in valuable material cost savings.

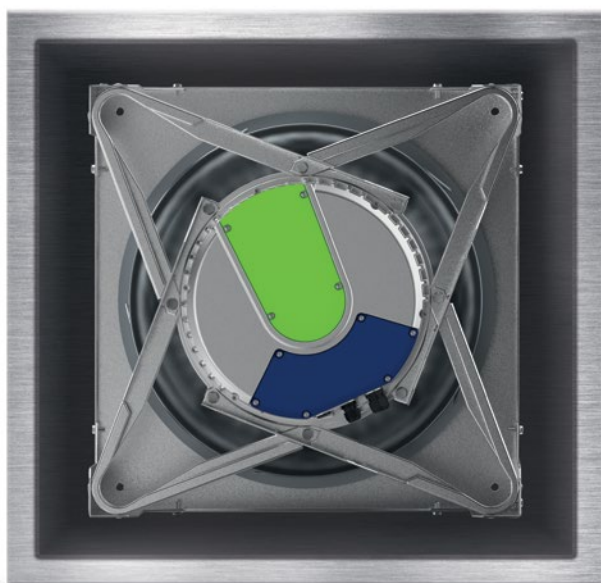
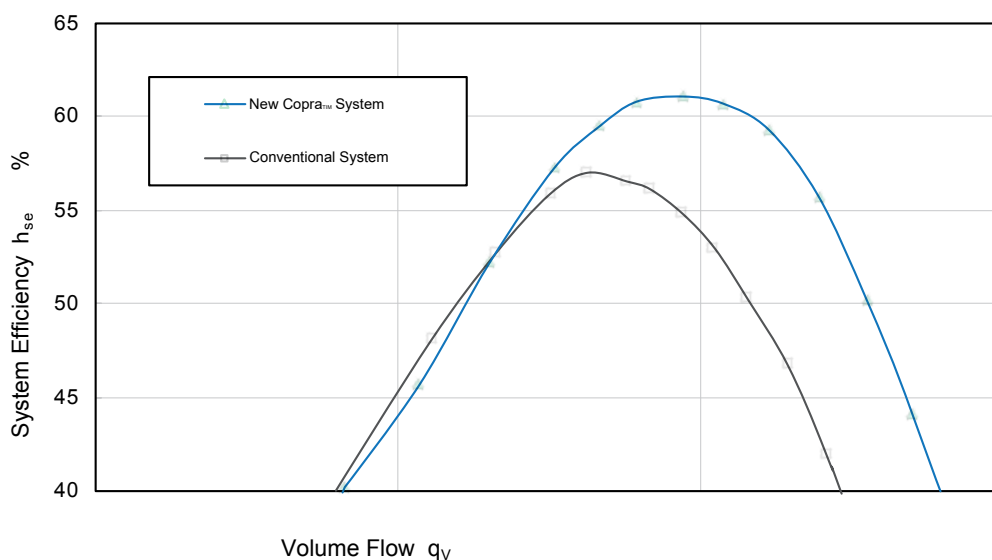


COPRA™ fans: the perfect system for tight installation spaces.

Tight installation spaces cause many challenges for centrifugal fan systems. The usual problem here is that the fan is not running under ideal conditions, and efficiency drops due to the limited gap between the fan and the chamber walls. In this case, the actual values can differ significantly from the catalog data measured in the laboratory.

COPRA™ fans, by contrast, show their strengths particularly under such difficult installation conditions. The technical reasons for this are found in the modified overall geometry of the impeller. They include its three-dimensional properties with large flow surfaces resulting in relatively low flow velocities, as well as the conical backplate and different diameters on the backplate and cover plate.

Compared to conventional EC fans, for example, COPRA™ fans attain the maximum achievable aerodynamic static pressure increase and static efficiency. The specific performance, i.e. the relationship between the power consumption for given diameters and speeds, and the volume of air moved, has been optimized.



In this example, we compare V Green Evo (TM) motor series fan with the COPRA™ system under otherwise identical conditions. With an installation ratio of factor 1.5 to the outer wall, in relation to the impeller diameter, COPRA™ fans achieve significantly better values, especially to the right of the optimum.

THE BEST PERFORMANCE FOR EVERYONE

COPRA™ fans deliver excellent system efficiency and maximum power density.

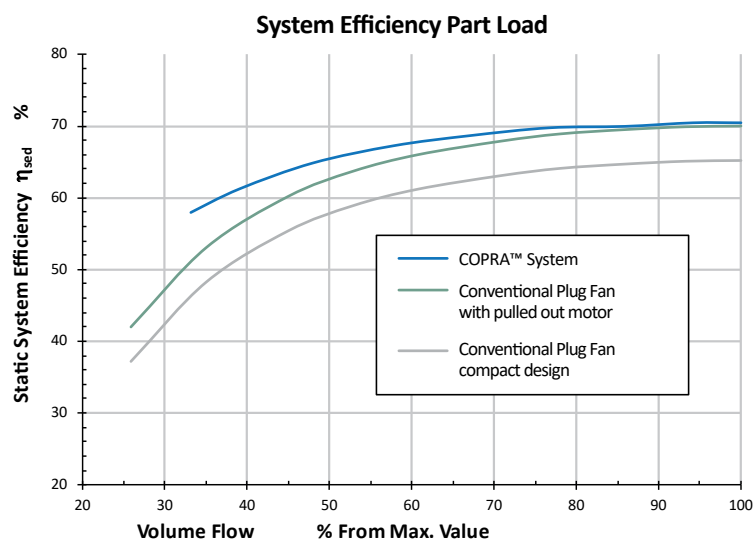
With COPRA™ fans, small dimensions equal big power. The new COPRA™ fans achieve static system efficiencies of around 70 percent and more with the greatest compactness. At the same time, they offer significantly higher power density than conventional plug fans. This ensures maximum airflow with the greatest possible efficiency for every size.

In many cases, COPRA™ fans reach the operating point with the next smaller size or achieve higher efficiency with the same size. When operating under reduced speed, they offer the highest system efficiency compared to conventional EC fan technology. In summary, they provide outstanding system efficiency.

Highest aerodynamic efficiency levels with greatest compactness.

COPRA™ fans provide the best reduced speed performance.

In most applications, fans do not run under full speed. They run under reduced speed as required. COPRA™ fans shine whether used for specific applications in ventilation and air-conditioning — for example, use in redundant operation in fan arrays — or in data centers. The units provide outstanding efficiencies, not only at maximum speed, but also in the reduced speed range. This is true in comparison with both compact and efficiency-optimized fans. The difference becomes particularly evident where fans with a pulled-out motor cannot be used due to a lack of space in the axial direction.



A comparison of the new COPRA™ fans with the best conventional fans with external-rotor motor shows that COPRA™ fans achieve the highest system efficiency under reduced speed compared to conventional EC fan technology.

COPRA™ fans score twice with outstanding system efficiency and highest power density.

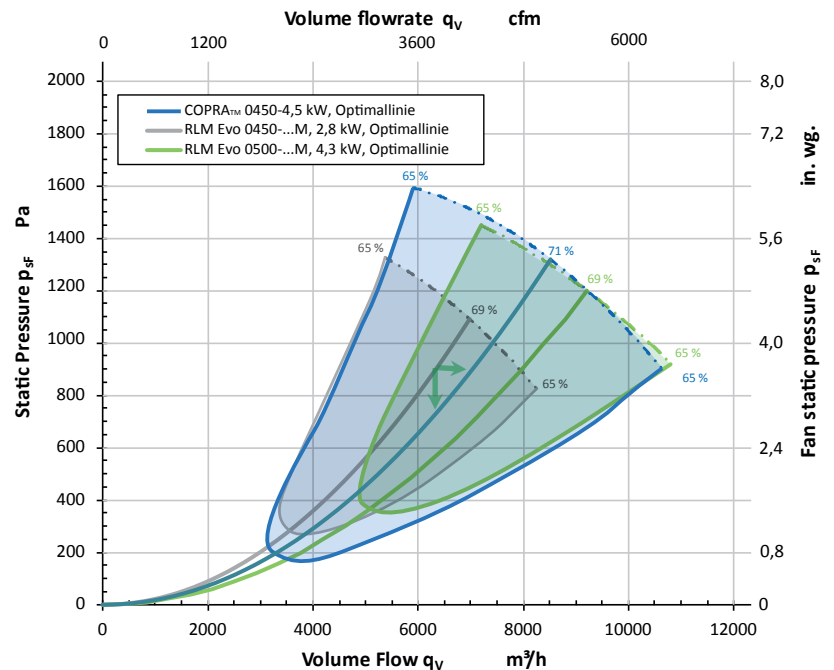
In a system efficiency comparison, COPRA™ fans' benefits are compelling. When comparing our impeller from the well-known V Green Evo (TM) motor series in size 500 with COPRA™ fans in size 450, COPRA™ fans are the clear front-runner.

Compared to the RLM EVO with IE5 PM motor technology, a smaller sized COPRA™ fan can be selected – and with at least the same efficiency.

In a comparison of plug fans, COPRA™ fans have to achieve the decisive advantage of high compactness with the highest efficiencies. Therefore, the development goal was to maximize their specific performance with the highest possible static efficiencies. In other words, the aim was to achieve the highest possible airflow for the fan's size and speed at the highest efficiencies, i.e. maximum airflows at the respective pressure level.

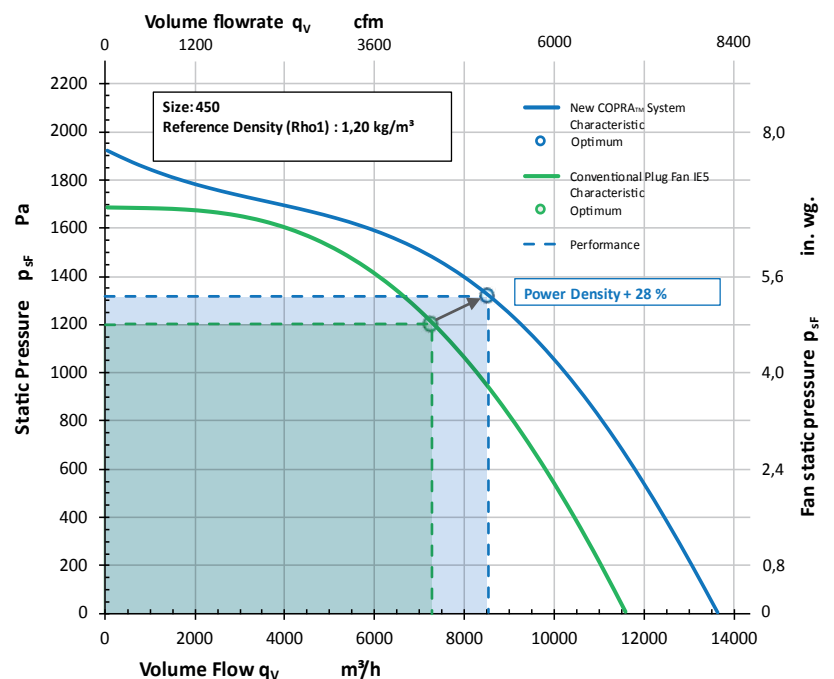
As a fan solution for specific tasks, COPRA™ fans can therefore be sized smaller than other solutions available on the market. Furthermore, the system runs at lower speeds than other solutions of the same size. And this is achieved with maximum efficiencies, lower power consumption, reduced space requirements, less noise, and also lower speeds.

Freilaufende Ventilatoren Vergleich von Optimalbereichen



In many cases, COPRA™ reaches the operating point with the next smaller size or achieves higher efficiency with the same size.

Plug Fans New COPRA™ System with higher power density



With COPRA™ fans, specific performance has been maximized with the highest possible static efficiencies.

LOW NOISE MEETS LIGHTWEIGHT, WORLDWIDE

The compelling advantages of geometry and material, realized.

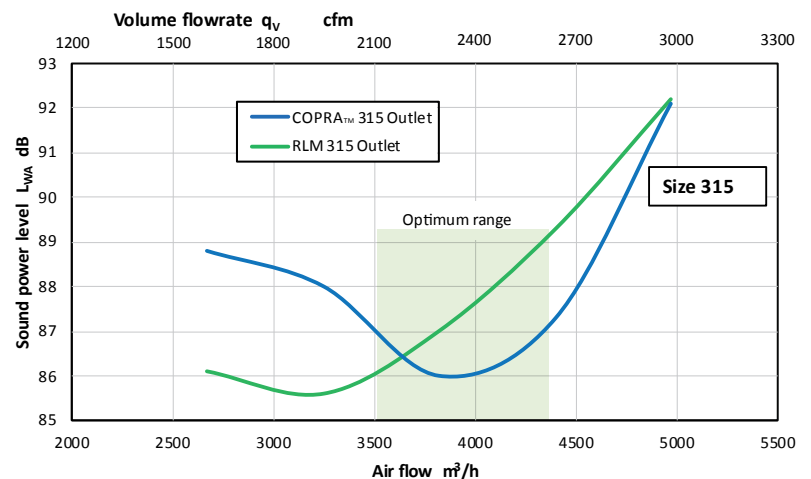
Whether data centers or HVAC systems, wind power or retrofit, COPRA™ fans offer decisive advantages in many applications. Planners, plant engineers and operators will appreciate their compactness, efficiency, power density and high cost-effectiveness. The system's low noise level, the material, and worldwide availability are further reasons to choose COPRA™ fans.

Low noise.

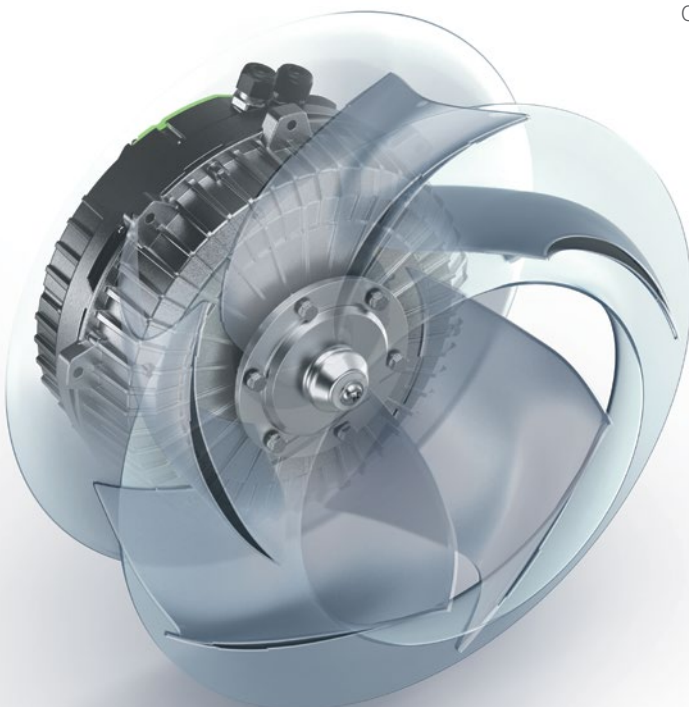
With its special blade and impeller geometry, COPRA™ fans generate less noise thanks to better flow conditions. Their psychoacoustically more comfortable frequency range is also an important advantage, especially for HVAC applications in residential and office buildings. COPRA™ fans' PM internal-rotor motors generate significantly less noise compared to external-rotor motor concepts. This, too, has a positive effect on the overall system's sound power level.

In particular, the profiled blade sections (hollow profiles) implemented with three-dimensional geometry make a significant contribution to these excellent characteristics.

Sound power level comparison outlet



For many years, our customers have appreciated the V Green Evo (TM) motor impeller's low noise emissions. But it gets even quieter: Typically, the higher noise values on the pressure side are often the most decisive factor. Compared to the Evo impeller, we have achieved further improvements with COPRA™ in applications with predominantly high airflows.



Enjoy all the advantages of aluminum.

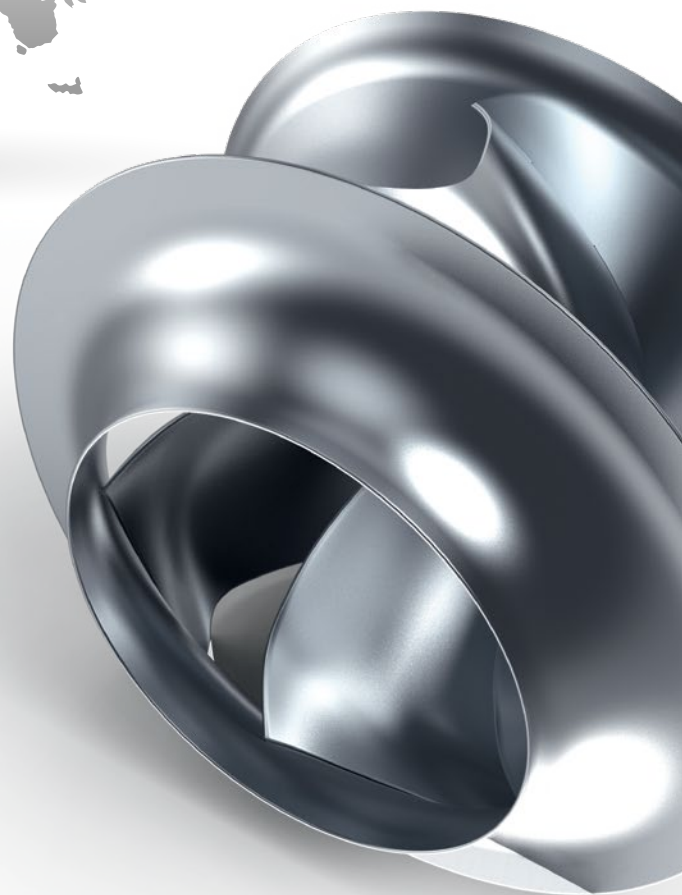
COPRA™'S impeller is made of high-quality aluminum. The material enables hollow-profile blades and hence optimal aerodynamic geometries, while also maximizing stability. The low system inertia of the impeller allows more dynamic adjustment of the speed. At the same time, the impeller is particularly lightweight, easy to handle and also corrosion-resistant. Plus, compared to the use of plastic throughout, the wall thicknesses are thinner. Imbalances also have less of an effect. As a result, both the center of gravity and the vibration characteristics are better in challenging installation situations. This has a positive impact on the service life of the motor and fan. Another factor that is becoming increasingly important is aluminum, unlike plastic, is virtually 100 percent recyclable – ensuring a good environmental footprint.



Well positioned worldwide: one series for all requirements.

As a company, we are established worldwide and manufacture wherever our customers are. COPRA™ meets all requisite conditions for global use. Where you would otherwise have to configure two different series, this one series can cover all requirements worldwide – and each features unique compactness and efficiency. As a plant engineer, you no longer need additional series that could have an impact on efficiency or axial length; your stock-keeping is much simpler.

Furthermore, COPRA™ is equally suitable for all regions of the world, and is available globally with a uniform quality standard. A local technical presence is assured worldwide. In addition, official certifications have been obtained worldwide.



CREATED FOR THE DATA AGE

Why COPRA™ fans perfectly meet data center application requirements.

Few applications generate as much heat as a data center. To dissipate the heat, speed-controlled centrifugal fan solutions with the best possible price/performance ratio are generally the desired solution. Maximum reliability and service life as well as excellent efficiency – especially at reduced operating speeds – are also among the most important requirements. Added to this are low vibration and minimized noise.



COPRA™ fans fulfill all of these data center requirements practically perfectly. Considering the usually tight available space, they deliver another decisive advantage: the ideal combination of high compactness, best efficiency and high power density. This synergy makes COPRA™ fans an unsurpassed, and at the same time highly economical, solution for data center cooling. Whether as cooling for the entire data center with a central fan system or as individual fans, it delivers economical yet powerful performance.

COPRA™ fans in data centers: A solution that fits where others won't

Advantages of COPRA™ fans in data centers:

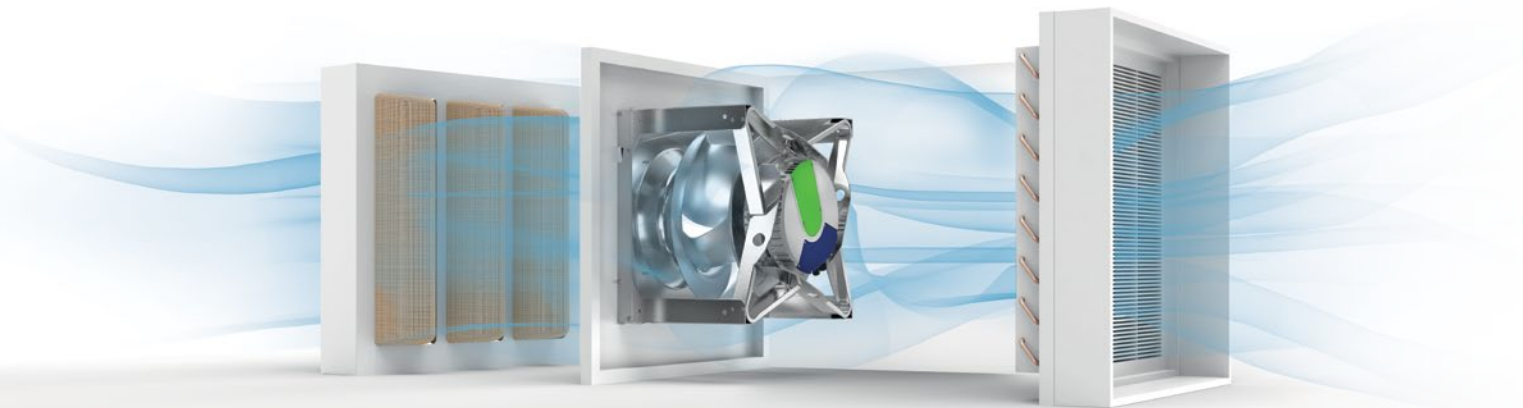
- High compactness and short axial length with outstanding efficiency – for maximum economy.
- Stepless speed controllability with maximum possible energy savings including under reduced speed.
- High reliability and long service life with maintenance-free operation.
- Ideal for new installations as well as retrofit projects.
- Save time and money with our worldwide availability.
- Low noise emissions ensure peace and quiet.



VERSATILITY IS ITS STRENGTH

COPRA™ fans are the ideal fan for any HVAC system.

The new COPRA™ fans maximize efficiency while minimizing required space in your system. Their short motor do not obstruct airflow, while the newly developed aerodynamic impeller design maximizes efficiency at both full and reduced speeds. Perfect for simple plug-&-play installation in new HVAC systems as well as for the modernization of existing systems, COPRA™ fans can deliver significant cost savings.



The ideal plug fan for fan arrays.

COPRA™ fans are ideally suited to multiple wall configurations in the form of several fans arranged next to and above each other. Although in principle plug fans also need sufficient installation space to achieve high system efficiencies, this is often neglected in the design of fan arrays. Unwanted air turbulence causes further installation losses. COPRA™ fans are the best fit for multiple wall configurations not only because of their compactness in axial length, but also because of their smallest possible diameters with high airflows.

Fan arrays are operated at reduced power to ensure a capacity reserve for redundancy operation. This is where COPRA™ fans' excellent reduced speed performance is a benefit. With a COPRA™ fan, its compactness in combination with high system efficiency and high power density ensures you get the maximum performance out of your system, whether as a single fan or as part of an array.



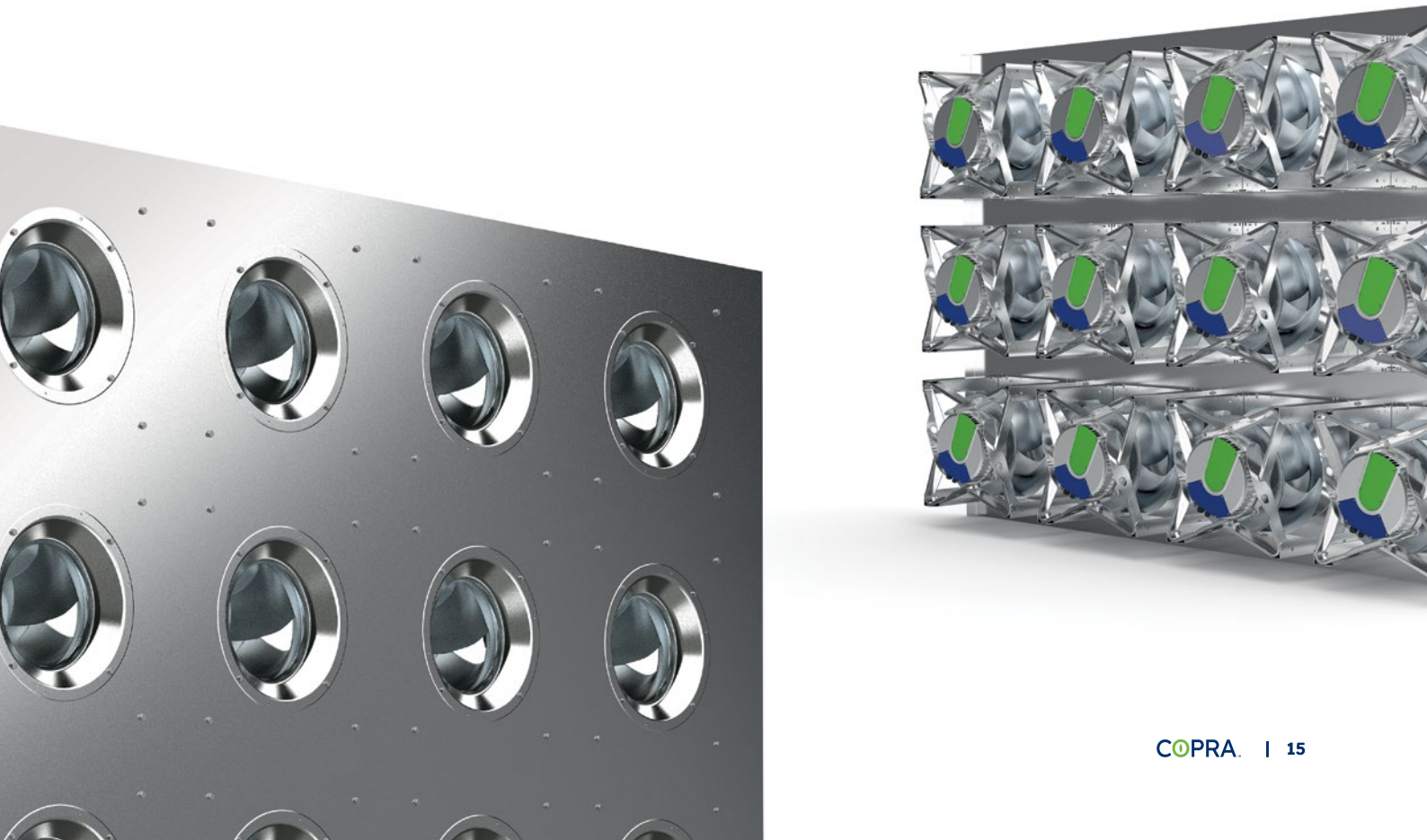
Retrofit: Replacing fans with COPRA™ fans pays off.

Replacing old, power-hungry and maintenance-intensive fans with economical devices featuring a flow-optimized design brings many advantages. From lower operating costs and CO2 emission savings to higher operational reliability and short payback times. Fans account for up to 70% of the operating costs in an overall ventilation and air-conditioning system. Take advantage of the resulting savings potential – with the new COPRA™ fans.

The question of the “best” and most economical solution when choosing fans depends on individual factors and can only be answered based on a professional system analysis. In retrofit projects, contractors will appreciate the minimal installation and maintenance work required, as well as the ease of fitting COPRA™ fans into often confined spaces. Often the preferred choice is COPRA™-style units; plug fans or hybrid fans with multi-spiral baffle plate technology.

The advantages of COPRA™ fans for ventilation and air-conditioning systems, at a glance:

- High system efficiency
- Small installation depth
- High power density
- Excellent reduced speed performance
- Almost no installation losses
- Low noise
- Less installation effort



About the Company

Regal Rexnord Corporation is a global leader in the engineering and manufacturing of factory automation sub-systems, industrial powertrain solutions, automation and mechanical power transmission components, electric motors and electronic controls, air moving products, and specialty electrical components and systems.

Through longstanding technology leadership and an intentional focus on producing more socially conscious and environmentally-friendly products and sub-systems, the Company is regularly addressing increasingly relevant secular demands of customers in the medical, alternative energy, aerospace, food & beverage, general industrial and warehouse/intralogs end markets, among others. In short, Regal Rexnord's 30,000 associates around the world are proud to be working each day towards fulfilling the Company's purpose: to create a better tomorrow with sustainable solutions that power, transmit, and control motion.

Regal Rexnord is comprised of three operating segments: Industrial Powertrain Solutions, Power Efficiency Solutions, and Automation and Motion Control. Regal Rexnord is headquartered in Milwaukee, Wisconsin and has manufacturing, sales and service facilities worldwide. For more information, visit www.regalrexnord.com.

NICOTRA||Gebhardt®

Nicotra Gebhardt Germany **Nicotra Gebhardt GmbH**

Gebhardtstraße 19-25
74638 Waldenburg (Germany)
Phone +49 7942 1010
Fax +49 7942 101 170
E-Mail info.ng.de@RegalRexnord.com
Web www.nicotra-gebhardt.com

Nicotra Gebhardt Italy **Regal Beloit Italy S.p.A.**

Via Modena, 18
24040 Zingonia (BG) (Italy)
Phone +39 035 873 111
Fax +39 035 884 319
E-Mail info.ng.it@RegalRexnord.com
Web www.nicotra-gebhardt.com

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