

Process-reliable and efficient solutions for the cement and lime industry



AERZEN
EXPECT PERFORMANCE

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More efficiency, performance, sustainability and reliability

Solutions for the cement and lime industry.

Blowers and compressors play a crucial role in the cement and lime industry: if they fail, the entire process comes to a standstill. This causes enormous costs. At the same time, the production of cement and lime is highly energy-intensive and therefore particularly harmful to the climate. Those who want to remain competitive in this segment and enter the future well-positioned are dependent on safe, reliable and economical processes which use resources sparingly.

Robust, reliable blowers and compressors

Machines and packages which take over conveying processes of raw materials or process media must be optimally designed for the demanding environmental conditions of the industry, so that they can cope with the extreme loads in continuous operation. Users expect maximum process reliability, reliable, first-class quality of the end product at all times - and, bottom line, economical use in the energy-intensive industry.

Knowledge and experience translated into innovative technology

With AERZEN specialists you are on the safe side: we know the industry's requirements for reliability, quality and efficiency down to the last detail and know from many years of experience what is important in the cement and lime industry. Our engineers turned this know-how into innovative blower and compressor technology developed to the highest possible standards.

Individually tailored to your process

The investment in Delta Blower, Delta Hybrid, Aerzen Turbo and Delta Screw pays off. You see, AERZEN offers a machine concept which is optimally tailored to your requirements and provides up-to-date answers to your question about the perfect solution: our packages are robust and prove maximum performance even in demanding production environments. They are particularly easy to maintain and feature an innovative energy concept which effectively supports you in making savings and ensures more resource protection. In short: highly available solutions for your process air.

- How can safety and reliability be increased in process air production?
- How can efficient blowers and compressors support the cement and lime industry with its sustainability goals?
- Which solution is best suited for your application?

On the following pages we are presenting our answers to you.

LET'S TALK

"... about the **Process safety, reliability** and **efficiency** of your process air supply."



High-end solutions for demanding processes

We know what is important

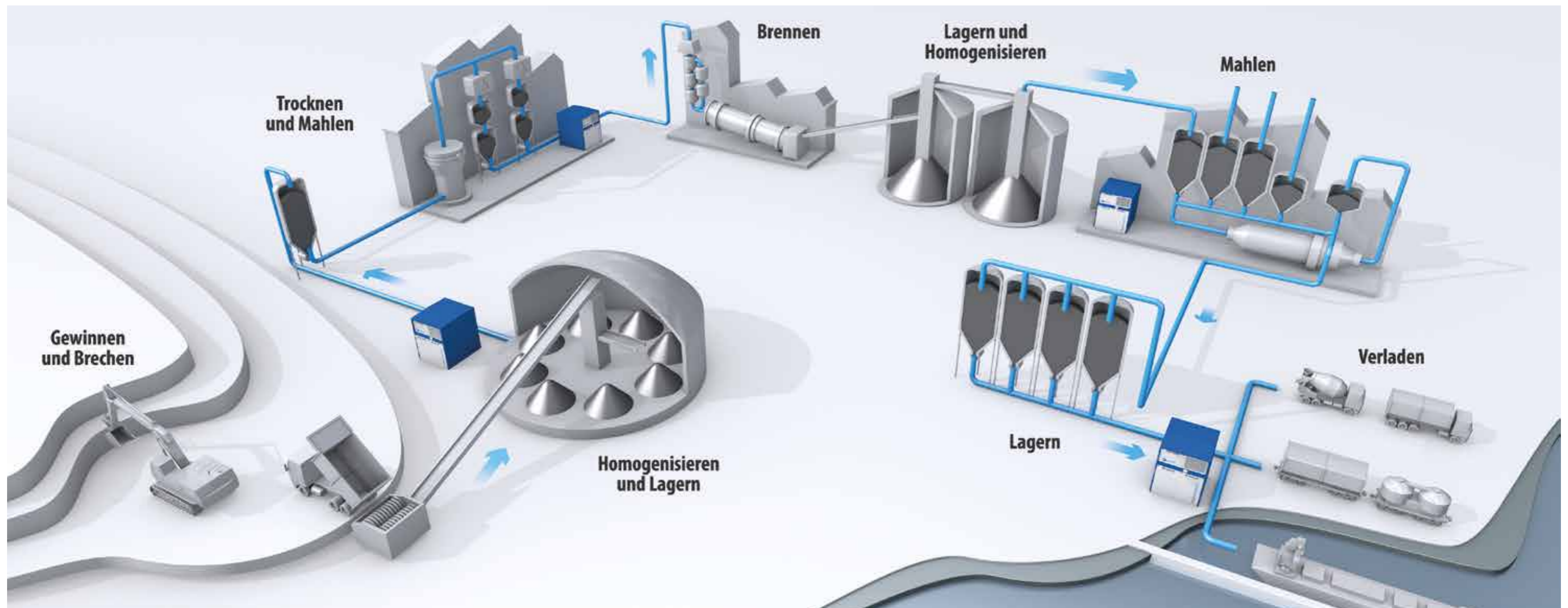
For the production of cement and lime, blower and compressor technology is irreplaceable in numerous process steps. Thanks to their outstanding properties, our packages have become firmly established in many areas.

Safety has the highest priority in the demanding processes of the cement and lime industry. You can trust premium technology from AERZEN: our positive displacement blowers, screw blowers, screw compressors and turbo blowers have been developed and produced to the highest standards, so that you can fully rely on their safe and reliable operation.

The packages are highly efficient, with low maintenance and generate their process air 100% oil-free according to ISO 8573

Class 0. They are used around the globe in numerous sections of cement and lime production, whether in pneumatic conveying, aeration, silo loosening, packaging, cooling or for the generation of combustion air.

We support you in finding the best solution for your application.



Your technology partner in the cement and lime industry - competent, experienced, application-oriented

AERZEN is a global player in process air manufacturing, an innovation pioneer, a technology leader and driving force. Years of experience, an application-oriented approach and customer proximity are what set us apart. We know where the shoe pinches and support the cement and lime industry with reliable, energy-efficient and high-performance blower and compressor solutions.

Optimally combining features such as quality, reliability, economy and innovation - this is the vision behind our unique portfolio of blower and compressor solutions. As a long-standing partner of the cement and lime industry, we are acquainted with diverse challenges of the industry and take these into account in our product development.

Trend-setting solutions

We have the perfect technology concept for every process (Delta Blower, Delta Hybrid, Delta Screw, Aerzen Turbo) and enable you to produce in an equally economical, resource-saving and environmentally friendly way. Our products and solutions set standards in terms of pow-

er density, reliability and efficiency and come with all the necessary certificates and regional approvals. Even in highly dusty environments or at extreme altitudes with correspondingly low absolute ambient pressure, the oil-free and low-maintenance packages ensure a reliable process air supply and guarantee maximum performance and process reliability. It is therefore no coincidence that users around the globe have chosen AERZEN in numerous sections of cement and lime production.



You profit from this with us:

- Robust and reliable packages
- Unique know-how in engineering
- Process control and automation concepts according to Industry 4.0
- Wide product and accessories portfolio: Technology mix from one single source
- Customised solutions for your process air applications
- More than 150 years of experience, international references
- Worldwide service presence, fast supply of spare parts
- Certificates and regional approvals (ASME, UL, CRN, SELO etc.)

Unique expertise and experience

Every process, every requirement, every location has its specifics. Our application specialists know the industry-specific processes down to the last detail and provide you with comprehensive advice on the selection of perfect blower and compressor technologies. AERZEN machines perform their tasks in demanding continuous operation precisely, efficiently and reliably for years and decades. They ensure the highest process reliability as well as maximum

plant availability and support you in reducing your operating costs, permanently increasing the efficiency of your processes and sustainably protecting the environment. By the way: with probably the largest variety of options and accessories, we offer you a unique level of individualisation. Benefit from our broad portfolio, our many years of experience and our comprehensive expertise. LET'S TALK!

Conveying, aerating, loosening up

Select the perfect AERZEN solution

Blowers play a crucial role during the manufacturing process of cement and lime. Whether conveying, loosening, mixing, heating or cooling: AERZEN packages are the first choice for every application. They offer maximum reliability in high-performance operation and ensure absolute process safety.

There are two processes for the production of cement. The drying process is the most common and popular method. Raw materials such as chalk, limestone, silica sand, clay and slate are crushed in several steps until they have a diameter of three inches or less. Other raw materials such as iron ore are then mixed with the crushed rock and conveyed into the kiln, which heats the mixture to an extremely high temperature. The result of the burning process is the so-called cement clinker. To

produce the reactive product cement, it must be ground extremely finely after cooling before it is packed, loaded and transported to the concrete suppliers. The wet process works in a similar way. The only difference is that limestone and other raw materials are mixed with water before they enter the kiln. This process is even more energy-intensive than the drying process.

You benefit from AERZEN technology in the following process steps:



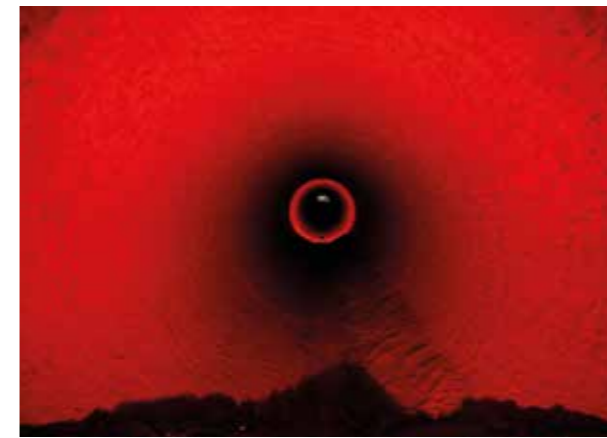
1. Transport from the raw mill to the silos: Delta Blowers provide consistent and reliable conveying and ensure a constant flow of material.

2. Homogenisation in the raw meal silos: Delta Blower loosens the raw meal with compressed air and enables uniform mixing.



3. Pneumatic transport from the silo to the preheating tower or kiln: Delta Hybrid prove an excellent energy/performance ratio when transporting the material, even in case of critical applications in highly dust-laden environments.

4. Pneumatic transport of coal or alternative fuels: Depending on the application and the fuel used, Delta Blower or Delta Hybrid take over this critical application. To meet the highest safety standards when dealing with explosive fuels or dusty ambient air, AERZEN products are supplied with ATEX certification on request.



5. In the section of combustion air, Delta, Blower, Delta Hybrid or Aerzen Turbo machines are used: all packages are equipped with a frequency inverter. This enables permanent flow control and ensures an ideal flame size in the kiln - for high-quality results when producing clinker.

6. Pneumatic conveying from the cement mill to the silos: depending on the throughput and the distance, all products of the Delta series are suitable for this process.



7. For homogenisation and fluidisation processes, as with pneumatic conveying, you can choose from the entire range of Delta series products which perform optimally in this application. We precisely tailor our solution to energy efficiency, plant capacity and operational processes/requirements.

8. Packing: Delta blowers deliver large volume flows and a constant pressure. This ensures continuous operation of the loading systems, e.g. of trucks.



Lime production

The same raw material is used for lime production as for the cement process. However, a temperature of "only" around 900 °C is required, so the energy demand is somewhat lower than for cement production. Production can take place according to two different processes:

1. In Europe and South America, vertical kilns are primarily used. Here, the Delta Hybrid offers excellent possibilities in the cooling process.

2. In North America and Asia, horizontal kilns are most common. The process is similar to conventional cement production, so that the AERZEN packages are also used in comparable processes. Some work steps are omitted here.

Process reliability

Designed for maximum plant availability

Plants and components in the cement and lime industry must withstand the highest loads. The blowers and compressors play a special role here: if they fail, the entire production comes to a standstill. AERZEN ensures that risks around availability and safety are minimised.

Cement plants are subject to challenging environmental conditions. The production of cement, which is one of the most important and popular building materials, takes place under extreme temperatures during continuous operation. In addition, the machines used are exposed to loads weighing several tonnes and large quantities of dust.

Highest machine availability

AERZEN blower and compressor technology is designed to meet these challenges, ensuring you safe and reliable operation in even the most demanding production environments. Thanks to robust construction and service-friendly design, we ensure high machine availability. Our packages also cut a fine figure when installed outdoors. Whether high wind loads of over 200 km/h, temperatures of -40 to +50 °C or operation in earthquake-prone areas: AERZEN machines can really be used everywhere. No ifs, no buts!

State of the art in every application

Numerous innovations from our research and development contribute to regularly raising technological standards. One example is our absorbent-free silencer technology: as there is no removal of absorption material possible, the silencer is

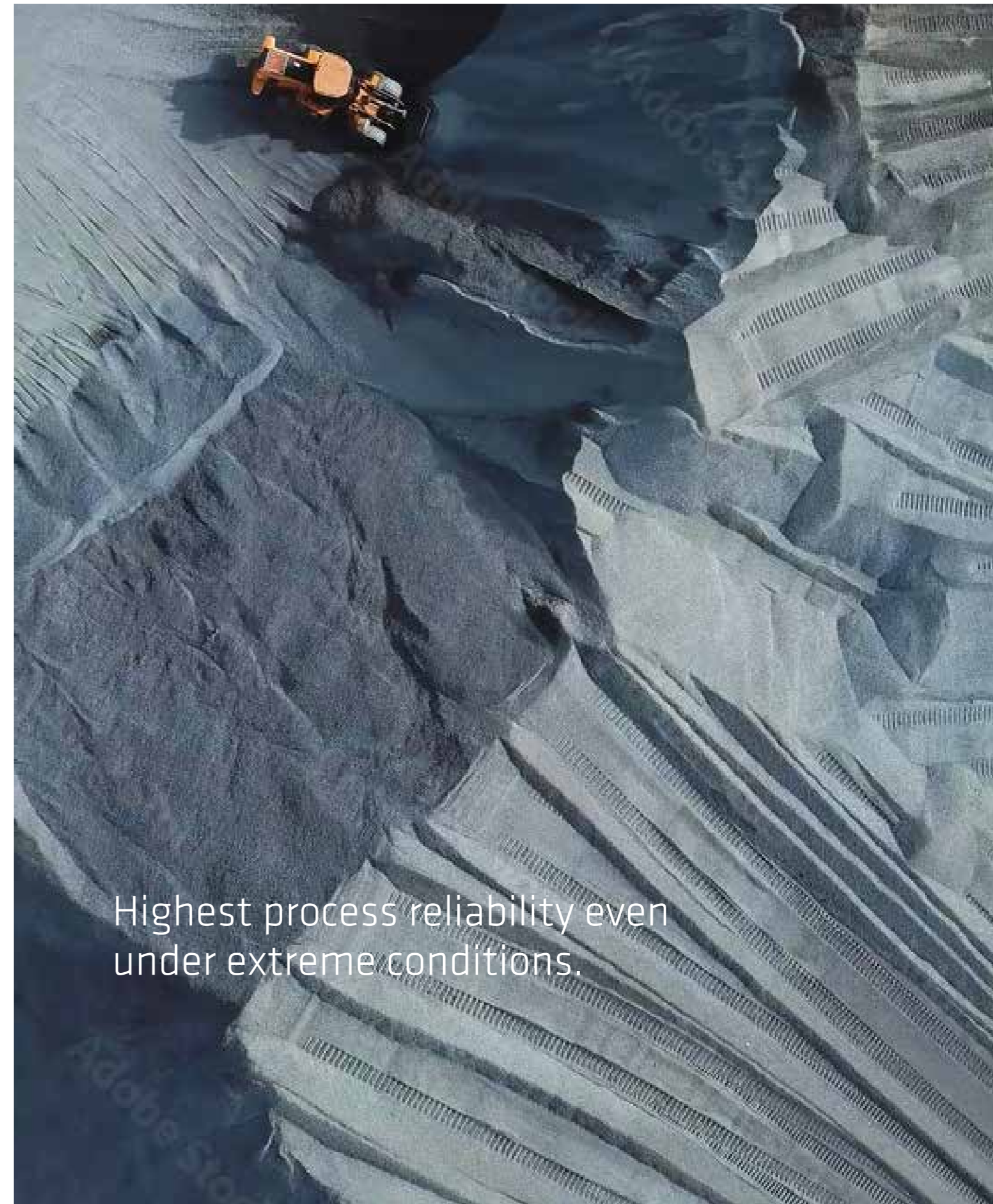
guaranteed to function consistently for many years. A spark arrester integrated into the silencer further increases safety: it prevents sparks, which can be generated by blowers and compressors in the event of a malfunction, from entering the conveying pipe or the silo.

Full control over every process

Digitalisation ahead: with the AERtronic, designed for the highest IE4 requirements, you have full control over your process air applications, and you are protected from quality or output problems. The intelligent package control takes over the efficient control and monitoring of your machines or your machine combination, prepares operating states graphically and communicates with your control room via all common bus systems. This improves the efficiency of the individual machines, but also of your entire production plant, and ensures homogeneous utilisation. The connection is made via Modbus, Profibus or Profinet. Even components such as e.g. control cabinets from third-party suppliers can be integrated without any problems.



With AERtronic Master you can control your packages in combination



Highest process reliability even under extreme conditions.

Economy meets ecology

Turbo technology in the cement and lime industry

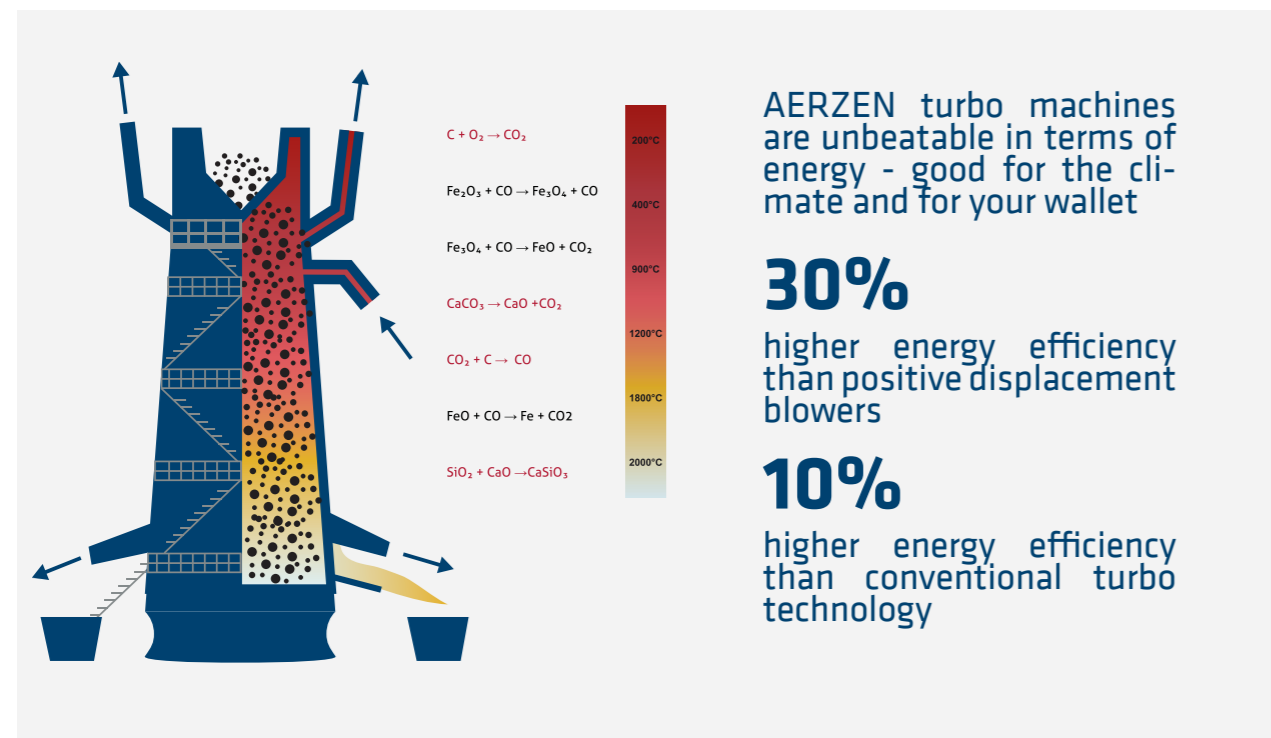
Greater climate friendliness is one of the most ambitious goals of the energy-intensive cement and lime industry. As long-standing partner, we know the enormous challenges currently facing the industry. We offer you active support through innovative technological developments, e.g. in turbo technology.

The building materials industry is enormously energy-intensive. For example, the burning process for cement clinker requires temperatures of around 1,450 °C. The cement and lime industries are responsible for a significant proportion of global industrial CO₂ emissions. Both industries are facing up to their responsibility to protect the climate and are working hard to reduce their energy consumption. In order to become more climate-friendly, they want to reduce their CO₂ emissions by 25% by 2030 and achieve climate neutrality by 2050. Companies which stay ahead of the market with the help of environmentally friendly technology will strengthen their competitiveness for the future.

More efficient solution for cooling and combustion air
The cooling and combustion air supply offers great potential for optimisation. The choice of the solution applied is always a balancing act between energy efficiency and investment costs,

and in numerous cases it has been in favour of the positive displacement blowers. However, in view of the increasing relevance of energy efficiency due to rising energy prices as well as global and national climate targets, more efficient technologies are coming into focus - for example, turbo machines such as the Aerzen Turbo.

Climate protection and energy costs equally under control
We have been building turbo blowers since 1911 and have further perfected the technology of these packages over many decades. Our G5^{plus} series turbo blowers are among the most compact and efficient turbo machines in their class and are unbeatable in terms of energy: their energy efficiency is up to 10% higher compared to conventional turbo technology. Compared to displacement machines such as positive displacement blowers, even savings of up to 30% can be achieved.



Components optimised, power loss reduced

We have achieved this through highly efficient individual components in the turbo package. This includes the extremely powerful and energy-saving permanent magnet motor, which meets the future requirements of the IE5 classification (Ultra Premium Efficiency). The Aerzen Turbo is also characterised by a particularly aerodynamic design of the turbo impeller and spiral housing. Thanks to innovative multilevel frequency inverter technology, the power loss in the motor has been reduced by up to 90% - thus the package offers significant advantages compared to conventional converter technology. Speed control is required in the cooling and combustion air area, as the volume flow varies. Compared to turbo blowers with standard inverters, the turbo packages from AERZEN are less sensitive to pressure fluctuations and have a better control behaviour. Our turbo packages can thus be operated in a much more stable manner throughout the entire turbo characteristics.

Ignite the turbo for more climate protection

Also in terms of installation space, robustness and durability, the 100% oil-free AERZEN turbo machines offer noteworthy advantages. For example, a turbo machine requires only a third or a quarter of the footprint of a positive displacement blower with comparable performance. As a result, the machine room can be a lot smaller. The innovative AERZEN air foil bearing with double coating ensures an increased service life of >80,000 operating hours and maximum reliability. The Aerzen Turbo is a future-proof technology which stands for efficiency, sustainability and reliability like no other package. Although the initial investment costs are higher than for a positive displacement blower, the turbo machines are way ahead in terms of energy efficiency and thus keep life cycle costs low. With improved performance and lower operating costs for more climate protection - a clear competitive advantage for the Aerzen Turbo on the way to more climate friendliness in the lime and cement industry.

Four for all cases

Technology mix from one single source

Delta Blower, Delta Hybrid, Aerzen Turbo or Delta Screw - which solution is best for you? Our application specialists know the answer and will offer you valuable support in deciding which technology is best for you.



Delta Blower: robust pneumatic all-rounder

Extremely resilient and durable positive displacement blower, suitable for a wide range of processes involving pneumatic conveying in both pressure and suction operation, as well as for cooling.

Product features

- Pressure range Underpressure -500 mbar, positive pressure 1,000 mbar (g)
- With Belt drive
- Numerous sizes for underpressure and positive pressure operation for small to large air volumes
- Extensive accessories and various modification options
- Low-maintenance, user-friendly design



Delta Hybrid: efficient conveying air generator

Screw blower with revolutionary compressed air generation concept which combines the advantages of blower and compressor technology in one system. The package is highly suitable for transporting and unloading dusty goods.

Product features

- Pressure range Positive pressure 1,500 mbar (g)
- Up to 30% energy savings compared to conventional blowers
- High reliability and durability even under extreme conditions
- With belt drive
- Reduced maintenance effort
- Low life cycle costs



Our extras for customised packages for your application:

- Suction filters of various fineness classes
- Spark arrester
- Zone separation filter
- Special acoustic hoods
- Special motors
- Valve technology
- Digital services
- Special oils
- Colour and coating systems

You can find more information about our accessories at www.aerzen.com in the product area Modifications and Accessories.



Aerzen Turbo Specialist for combustion air

The innovative Aerzen Turbo features multi-level frequency inverter technology and thus operates with up to 90% less power loss in the motor compared to conventional inverter technology. Thanks to state-of-the-art air filter solution systems, the package is also convincing in environments with high dust loads.

Product features

- Pressure range Positive pressure 1,000 mbar (g)
- Best energy efficiency with smallest footprint.
- Increased service life of > 80,000 operating hours thanks to innovative AERZEN air foil bearing with double coating
- Reliable and low-maintenance permanent magnet motor
- Lowest life cycle costs



Delta Screw: flexible power pack

The Delta Screw compressor is designed for difficult applications and challenging environmental conditions, covering a wide range of applications. The package is designed for an increased pressure range and can be optimally adapted to the desired application through a variety of accessories and modification options.

Product features

- Pressure range underpressure -850 mbar, positive pressure 3,500 mbar (g)
- Suitable for use under extreme temperatures
- Available with direct or belt drive
- Comprehensive performance spectrum thanks to different series
- Wide range of applications and flexibility
- Extremely resilient

Everything but ordinary

The service world of **AERZEN**

The long service life of AERZEN machines is legendary. So why is service a topic at all? Because it's about more than availability and OEM original parts. The services from AERZEN secure investments, productivity, and a decisive competitive edge. And this worldwide.



AERZEN on-site service.

Our service teams work where our machines are. All over the world. Onshore and offshore. Often under extreme conditions. How do we achieve this? With short distances. AERZEN has established for you a dense network of service centres and decentralised parts warehouses around the globe. More than 200 excellently trained service technicians are available to assist you from there. Anytime and wherever you need us.

Individual services

The AERZEN service world is as individual as your applications. We offer customised service kits, replacement stages, machine diagnostics, sound optimisation and much more. What can we use to optimise your applications? Please contact us!

Rent instead of buy

Whether as a temporary solution in an emergency or for planned maintenance work: Our international rental service Aerzen Rental stands for an exceptionally broad portfolio of rental machines, tailor-made services and an all-round care-free offer which is second to none. On request, we can deliver the complete rental system worldwide on a turnkey basis. 24 hours a day, 7 days a week, 365 days a year.

www.aerzenrental.com



Contact worldwide

2,600 employees work for AERZEN. On every continent. With six sales offices in Germany alone, we're there for you. And with more than 50 subsidiaries in over 100 countries around the world. Hence we're never far away – should you ever need us.

Give us a call:

+49 5154 81 0

Service-Infoline

Our German Service Centre is available for customers and operators. We are happy to help you. We look forward to your call:

+49 700 49318551

Customer Net

Where you can learn more about the company and the leading compressor technologies from Aerzen? It's simple: In our Customer Net on our website, where we have stored everything that is worth knowing for you:

www.aerzen.com



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Find your local contact

www.aerzen.com/worldwide



360-degree solutions and everything from one single source with **AERZEN**.

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We will be happy to advise you.

Maximum process reliability ensures your economic efficiency. More climate friendliness secures our future. We reconcile both and support companies from the cement and lime industry with individually tailored solutions.

How safe is your process air really?

Your plant operates under maximum load in extreme environmental conditions in the cement or lime works. For the greatest possible reliability, have your machinery subjected to a comprehensive check by the specialists from AERZEN. Are some machines getting on in years? Do they release oil or absorption material into the process air? Is your system regularly maintained? Do the machines work economically? And with regard to your future viability: How can your energy-intensive processes be made more climate-friendly and efficient? If the answers to these questions reveal deficits, it is time to rethink the machinery and develop measures. A decisive step towards more economic efficiency and safety is the replacement of old compressed air generators with particularly resource-saving models which are characterised by maximum performance, availability, efficiency and robustness throughout their entire service life.

Competence on your side

Every industry is different. With AERZEN, you have a partner at your side who knows the special conditions of the cement and lime industry from the basis and has adapted to the high requirements in terms of resilience and safety. For more than 150 years, AERZEN has been an application specialist for the generation of process air. Our packages, certified many times, comprehensively fulfil the strict guidelines and specifications of the industry. With specialist know-how, we offer you

competent advice and develop individual and custom-fit concepts which are precisely tailored to your application.

Let's talk about efficiency and resource conservation

With a great deal of experience, modern technology and strict compliance with specifications and guidelines, AERZEN sustainably optimises the generation and control of your process air. We attach great importance to high process reliability and economical operation of compressed-air equipment. We prove that even in the energy-intensive cement and lime industry, more resource conservation and climate protection can be achieved with packages which are optimally adapted to your application.

With AERZEN you can always expect the best solution. We will find out together which concept fits your company best. Let's talk about it. LET'S TALK! We will be happy to advise you.



Find your local contact

www.aerzen.com/worldwide

AERZEN. Compression is the key to our success

The Aerzener Maschinenfabrik GmbH was founded in 1864. In 1868, we built Europe's first positive displacement blower. The first turbo blowers followed in 1911, the first screw compressors in 1943, and in 2010 the world's first rotary lobe compressor package. Innovations "made by AERZEN" keep driving forward the development of compressor technology. Today, AERZEN is among the world's longest established and most significant manufacturers of positive displacement blowers, rotary lobe compressors, screw compressors and turbo blowers. And among the undisputed market leaders in many areas of application.

In more than 50 subsidiaries around the world, more than 2,600 experienced employees are working hard on shaping the future of compression technology. Their technical competence, our international network of experts and the continual feedback from our customers are the basis of our success. AERZEN products and services set standards. In particular, with regard to reliability, stability of value and efficiency. Challenge us.



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