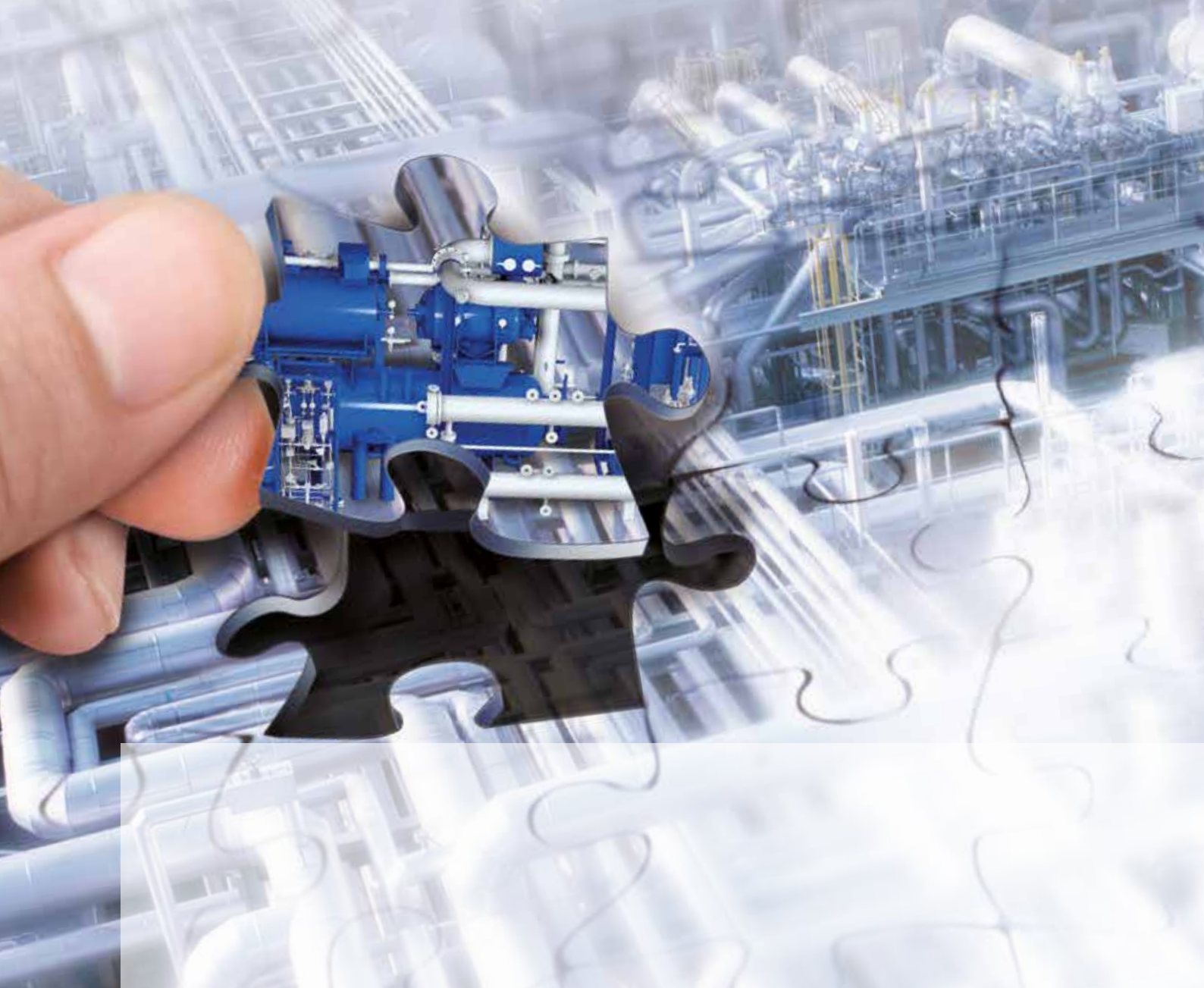


AERZEN PROCESS GAS SOLUTIONS

Screw compressors and positive displacement blowers for use
in the process gas industry



AERZEN

AERZEN. PREMIUM QUALITY FOR EVERY PROCESS.



Discover the difference.

Differences in compressor technologies reveal themselves precisely where the demand is greatest: the compression of critical process gases and coolants in the chemical, petrochemical, energy, food, and pharmaceutical industries, for example. Often, industry demands made on plant design, engineering, documentation, and global service are just as high as the safety and environmental guidelines to be followed.

In the course of its 150-year history, AERZEN has developed a unique expertise in these industries. Beginning with Europe's first rotary lobe compressor, in 1868, over the course of our history we have developed a unique set of technological advances and skills, and we have focused it primarily on our PGD centre – the AERZEN Process Gas Division.

Made in Germany by AERZEN.

Nothing creates more pressure than your own expectations. At AERZEN, we seek to provide our clients with the best possible solutions. Advanced blowers and compressors for the process gas and coolant industries that are unbeatable in their quality and inspiring in their longevity, reliability, and uptime. Adapted with precision to client process requirements, AERZEN assemblies are revolutionary in their efficiency.

That is why we are available in over 100 countries around the world – because proximity to our clients is important to us. That is why we make every effort to understand the unique features of your applications down to the final detail. It is also probably the reason why our blowers and oil-free and oil-injected compressors are market leaders, and why the name AERZEN has become synonymous for premium technology made in Germany.



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KEY APPLICATIONS. SOMETIMES CRITICAL. ALWAYS DEMANDING.

Chemical and Petrochemical Industries

- Compression of H₂ and CH mixtures
- Acetylene
- Ethylenes
- Lime kiln gas
- Rich gas
- Synthesis raw gas
- Butadiene
- Vinyl chloride
- Hydrogen sulphide
- Hydrogen

Refineries

- Hydrocracking
- Hydrosulphurisation
- Fractionating
- Reforming
- Catalytic cracking
- PSA
- Flare gas
- Compression of H₂ and CH mixtures

Energy production

- Gas turbine supply
- Steam

Oil & Gas Conveyance and Storage

- VOC recovery
- Natural gas compression
- Pipeline booster
- Underground gas storage

Industrial gases

- Hydrogen generation
- Air separation
- Argon
- Syngas

Coolant industry

- Coolants (R1270, R290, etc.)

Helium Refrigerator and Liquefier

- Helium

Offshore

- Natural gas compression

Breweries

- Waste steam

Pharmaceuticals

Coking plants



Gas supply



Chemical industry



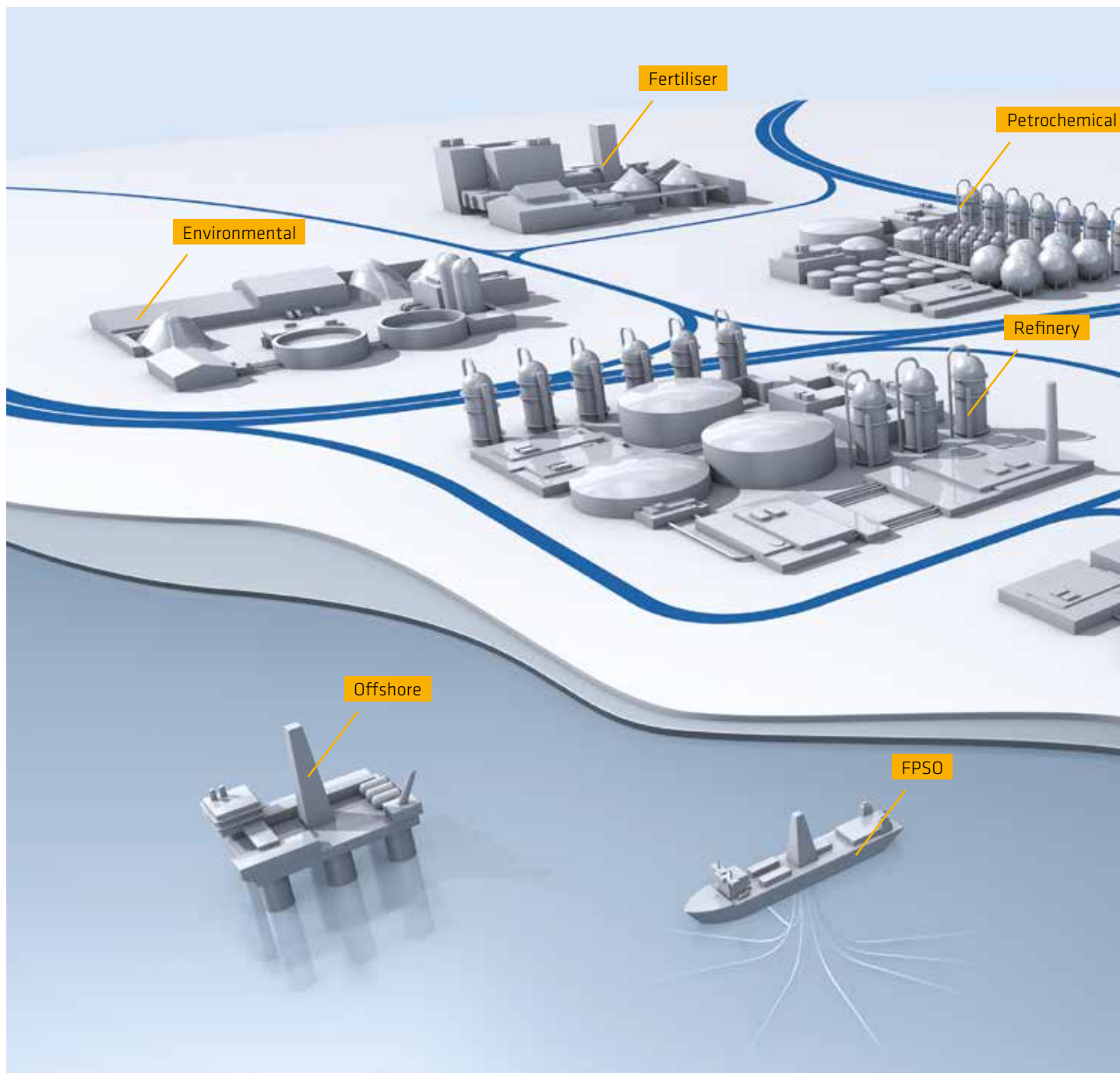
Power station technology

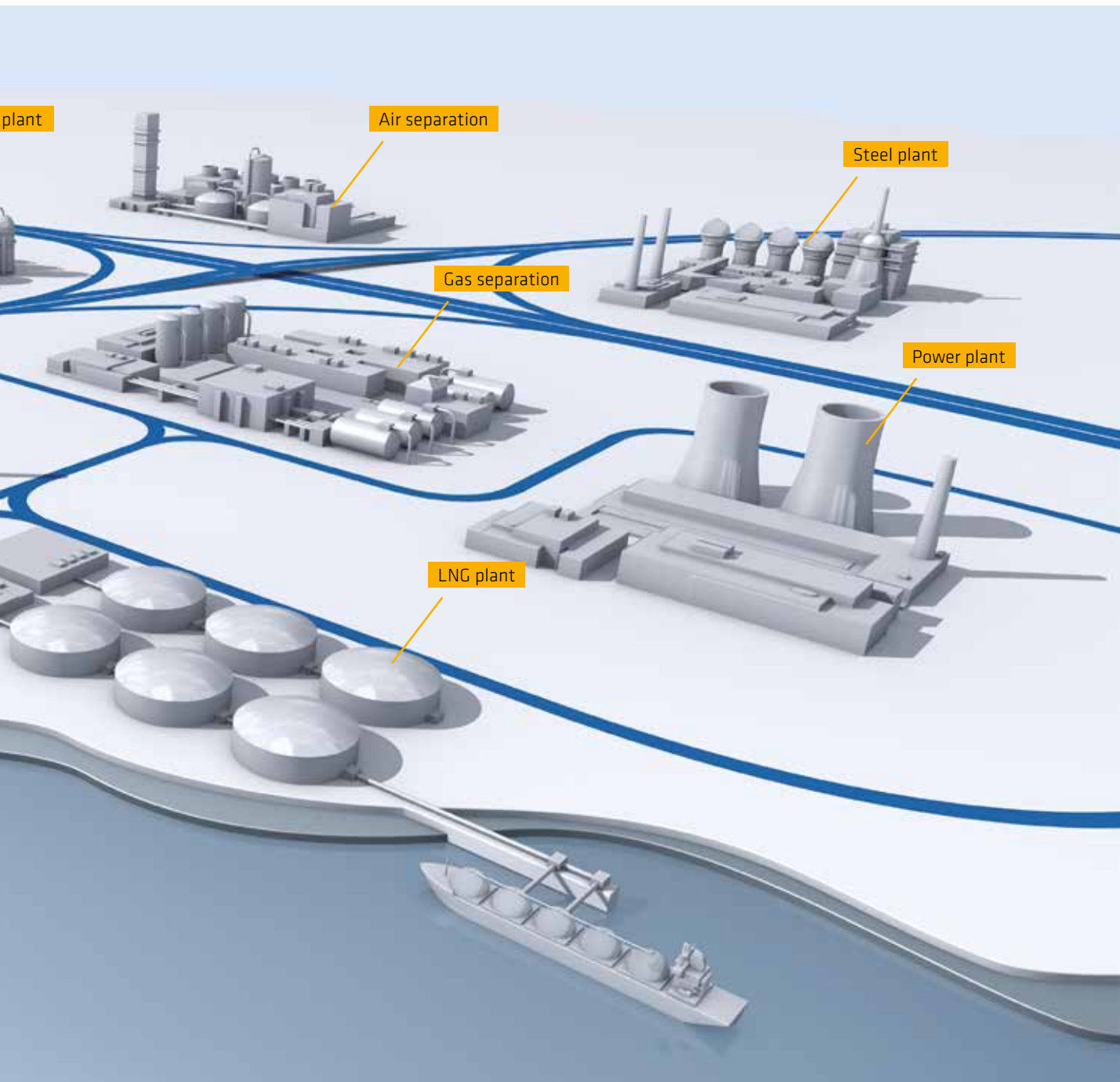


'PROCESS GAS COMPRESSORS AND BLOWERS FROM AERZEN FUNCTION RELIABLY FOR EVERY INDUSTRY AND EVERY MARKET, IN EVERY COUNTRY ON EARTH.'

INDUSTRIES AND SECTORS. COMPRESSION UNDER ANY CONDITION.

AERZEN offers the process gas and coolant industries an incredibly broad spectrum of blower and compressor technologies – perhaps the broadest of any manufacturer. Our product line includes machines that operate as stand-alones, in machine or container combinations, onshore and offshore, for nearly any key industrial application imaginable.





ENGINEERING. FROM APPLICATION TO HIGH-END SOLUTIONS.

It is not the machine that defines the process – it's the process that defines the machine. This is our philosophy. Anyone as application-oriented as AERZEN invests heavily in groundwork: The kind that results in a solid understanding of the client's business, and forms the basis for the high-performance solutions that come from our engineering centre. State-of-the-art technologies for the most demanding process gas and coolant applications.

Understanding the process.

The intellectual background and technical design underlying process gas and coolant facilities demand a high level of intelligence. After all, they are expected to function in the world's most demanding industries, often for highly critical applications. That is why AERZEN has assembled its best minds for our Process Gas Division. A team of highly-trained specialists from our construction, instrumentation, control, and project management divisions, they all possess international experience in every area of process gas compression and transport. They operate in Germany, Hungary, and the US. For markets and industries the world over.

AERZEN as a design hub.

Our process gas and coolant compressors are designed, constructed, and tested according to certified design processes and DIN ISO 9001. In Germany – in the town of Aerzen, to be precise. AERZEN's technical expertise finds its central focus within our engineering and production centre. This is where all of our R&D work and engineering happens. From construction to measurement, control and electronic technologies. That's where we test to ensure that our high quality solutions can go into serial production – even if they're already above average.



AERZEN's engineering process is supported by modern software tools



Our engineering teams in Germany, Hungary and the US work in close collaboration





'AERZEN HAS ASSEMBLED SOME OF ITS BEST MINDS IN THE PROCESS GAS DIVISION, WORKING IN ALL AREAS OF PROCESS GAS COMPRESSION AND CONVEYANCE.'

Premium quality every step of the way.

Our PGD is responsible for developing and building compressor and blower stages for process gas applications, as well as right-sized assemblies. Our strength lies in developing ambitious technologies that satisfy clients' individual requirements. Underlying that strength is AERZEN's technical competence as a manufacturer of blowers and oil-free and oil-injected compressors, along with its extraordinary know-how and accomplishments. Our engineering teams guide the project through all phases of facility development – from the first on-site inspection to well after final commissioning. They assume responsibility for the project in all areas of system design – from project management and coordination to quality control and system integration, documentation and certification, packaging and shipping, and maintenance and service. This process further ensures that our turnkey solutions match the rigorous demand for quality that AERZEN makes of itself.

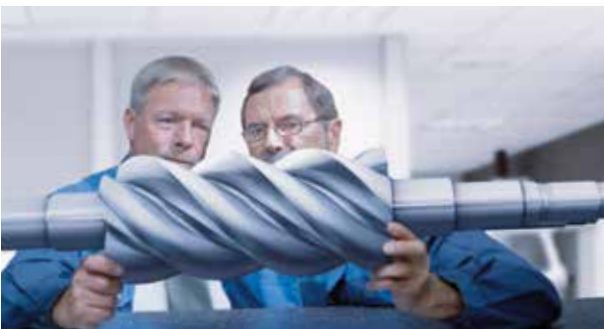
Quick minds. Smart technologies.

The engineering that we practice in Aerzen is based on decades of experience. It also rests on the use of modern software tools, such as state-of-the-art development and design technologies like AutoCAD Mechanical or Inventor, which ensure accuracy when planning out facility designs. Flow charts, lists and tables are created in Engineering Base,

process calculations with UNISYM. Special programmes are used to generate raw performance data and FEM calculations. All these tools yield clear 3D visualisations, precise materials lists, and transparent coordination with the client. To top it off, all AERZEN machines are also tested in Aerzen – at our own facilities.

Engineering services from AERZEN.

- Process data calculations (drive performance, coolant requirements)
- Preparation of drive dimensioning start-up curves
- Acoustic calculations
- Torsion and critical bending calculations
- Pipeline calculations (including earthquake calculations)
- Consultation for all client safety concerns (e.g. HAZOP studies)
- Re-engineering (constructive, electrotechnical)



At AERZEN, experience and innovation go hand in hand



Our design engineers work with the latest in technology





'EVERY SOLUTION FROM AERZEN IS INDIVIDUALISED
AND BUILT TO OUR CLIENTS' SPECIFIC REQUIREMENTS.
THAT'S OUR STRENGTH.'

VR PROCESS GAS COMPRESSORS. ANY PROCESS. NO LIMITATIONS.

Developed for the dry compression of nearly every gas, The VR series has an enormous range of applications. From ammonia and argon to styrene, vinyl chloride to hydrogen. The only limitations? Pressure, temperature ranges, and the range of rotational speeds. For final pressures up to 53 bar.

The hallmarks of efficiency.

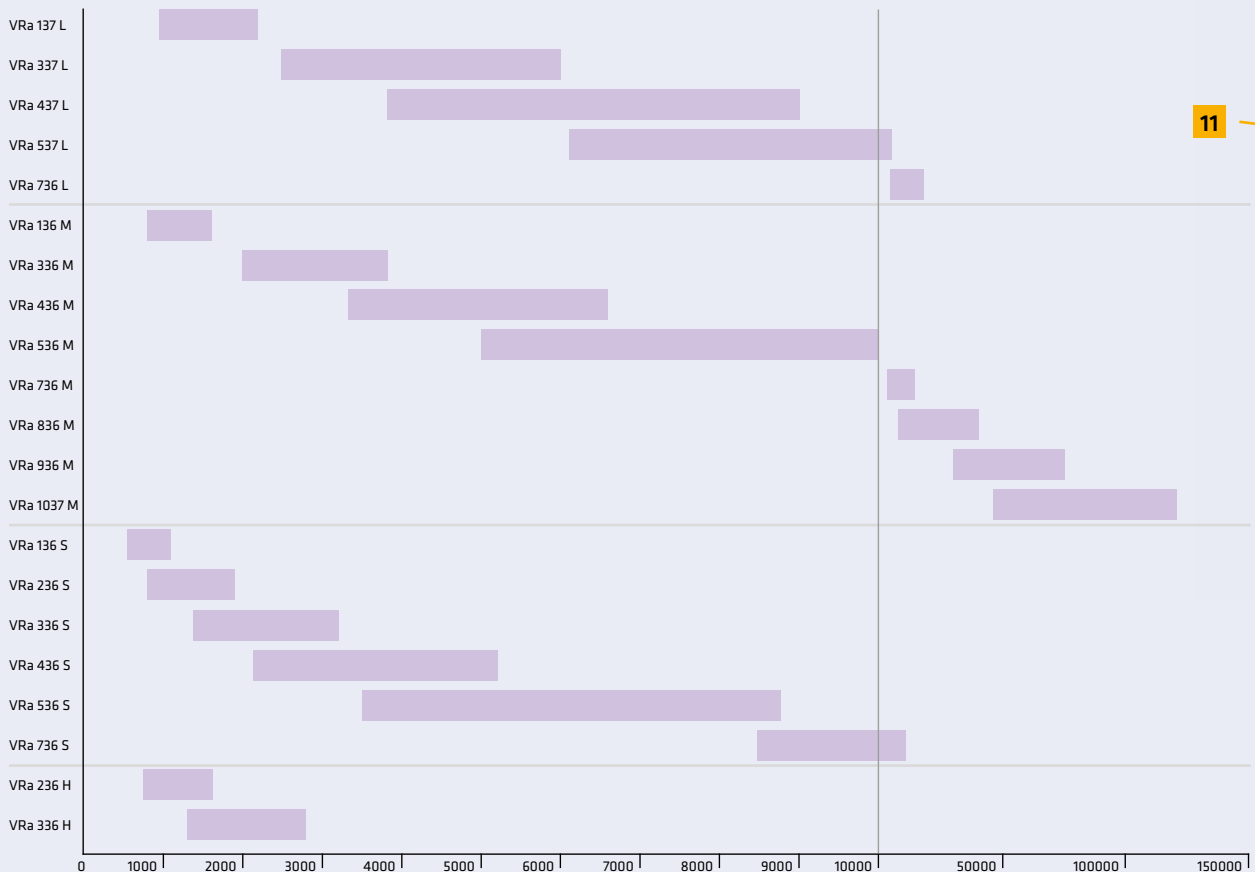
Large pressure differentials combined with volumetric efficiency rates: that is what differentiates AERZEN VR compressors from other rotary lobe machines that similarly operate according to the displacement principle with internal compression. A special 4+6 rotor profile brings this added efficiency to process gas applications. The highly capable VR compressors can be designed as either single stage or multi-stage, and can handle different drive types such as direct drive or helical gearing. Flanged or mounted separately. Assemblies are designed in principle with the conveying direction running from top to bottom – an important prerequisite for fluid injection, which is often

necessary in cases of highly contaminated or polymerising gases.

Performance and characteristics.

- Technology: oil-free positive-pressure and negative-pressure compressor packages and stages
- Volume flow: 650 to 120,000 m³/h
- Negative pressure: -900 mbar; positive pressure 52 bar (g)
- Rotors: 4+6 profile
- Media: air as well as neutral, toxic, flammable, or corrosive gases or gas mixtures

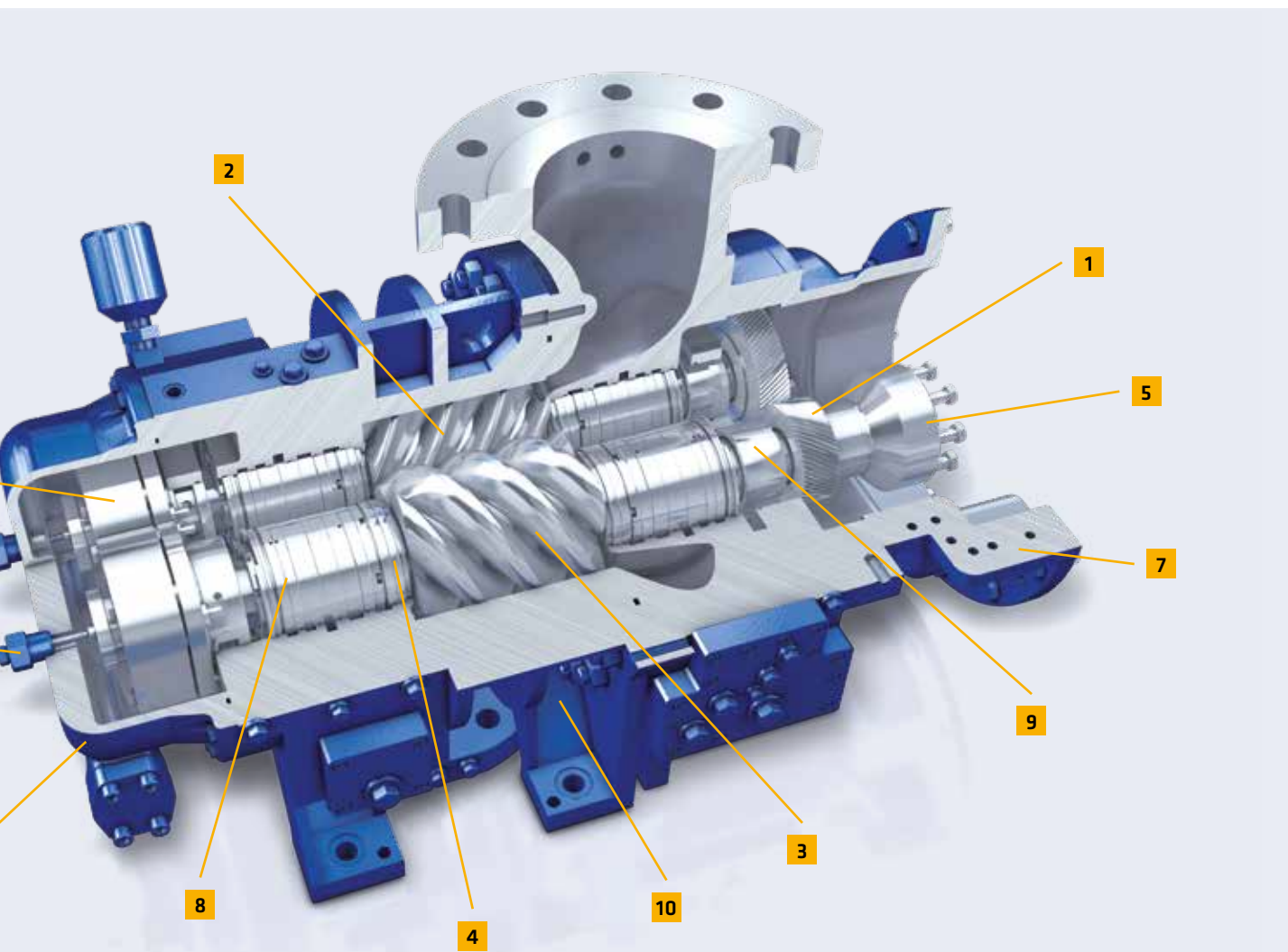
Intake volume flow Q_1 (m³/h)



6

11

12



VR process gas compressor.

- | | | | |
|-----------------------|-------------------------|-----------------------------------|--------------------------------|
| 1 Gear pair | 4 Labyrinth seal | 7 Intermediate plate drive | 10 Housing |
| 2 Female rotor | 5 Coupling hub | 8 Mechanical seal | 11 Axial thrust sensors |
| 3 Male rotor | 6 Axial bearings | 9 Radial bearing | 12 Housing lid |

THE VMY PROCESS GAS COMPRESSOR. THE BEST SOLUTION FOR VARIABLE VOLUME STREAMS.

Compressors in the VMY series have built their reputation on closed cooling circuits, demonstrating equal effectiveness in open process systems required in chemistry, petrochemistry, and energy production. They are the ideal machines for gases with low molecular weights, high compression ratios, and variable configurations.

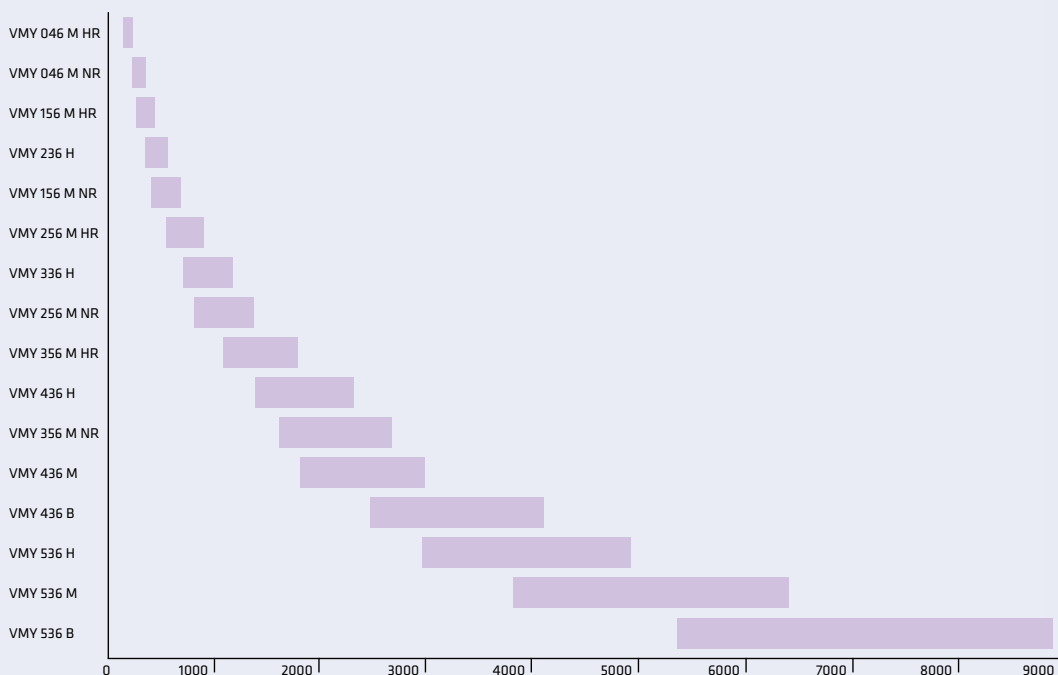
Reliability even with continuous uptime.

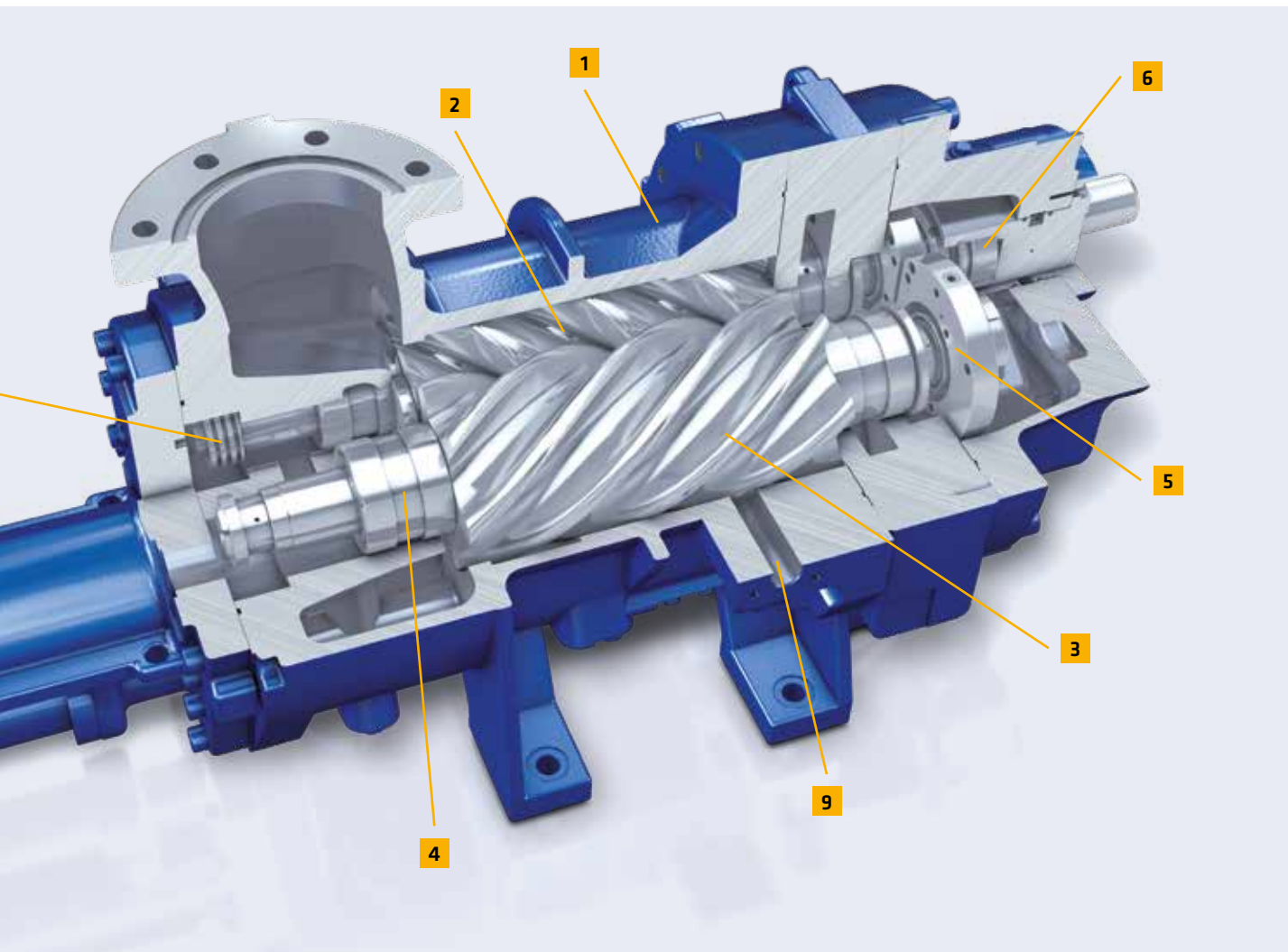
AERZEN's oil-injected VMY screw compressors are unaffected by variations in volume, temperature, or pressure, making them ideal for use in discontinuous operation. All assemblies and stages in the series are outfitted with a control carriage for volume flow regulation (gate control). Continuous stageless change in volume streams between 100% and 20% means optimal customisation for the operation at hand. Reliability over a vast range of requirements and operating conditions, low operating costs, and reliability are their hallmarks. There are a total of 16 different models available.

Performance and characteristics.

- Technology: assemblies and stages with oil injection
- Volume flow: 233 to 8,910 m³/h
- Negative pressure: -900 mbar; positive pressure: 25 bar (g)
Higher pressures available on request
- Rotors: energy-saving 4+6 profile
- Vi modification based on operating data
- Media: neutral and flammable gases, oil-consistent gas mixtures and process gases, as well as all standard coolants

Intake volume flow Q_1 (m³/h)





VMY process gas compressors.

- | | | | |
|-----------------------|--------------------------|------------------------------|--------------------------|
| 1 Housing | 4 Radial bearing | 7 Displacement sensor | 10 Balance piston |
| 2 Male rotor | 5 Axial bearing | 8 Vi setting | |
| 3 Female rotor | 6 Mechanical seal | 9 ECO connection | |

GR/GQ PROCESS GAS BLOWERS.

BLOWER POWER FOR SPECIAL REQUIREMENTS.

All AERZEN oil-free process gas blowers have one thing in common: they are durable, high-performance machines that are unaffected by gas contaminants or moisture and suitable for continuous fluid injection for gas cooling or cleansing. What's more, they can be designed to include a wide range of special materials and seals.

GR process gas blowers.

Our 1 or 2 stage blowers can be used for almost all technical gases and gas mixtures in nearly every industry. They are also ideal for gases with negative intake temperatures down to $-30\text{ }^{\circ}\text{C}$.

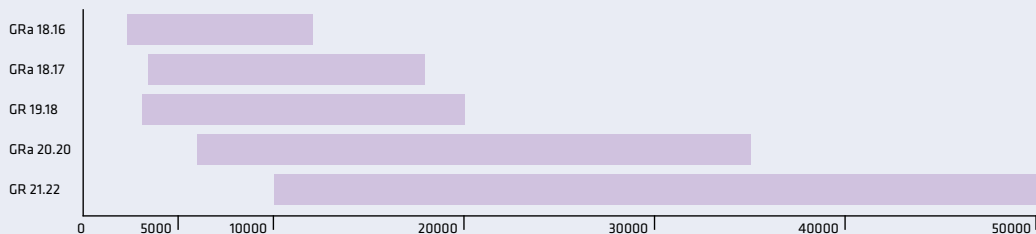
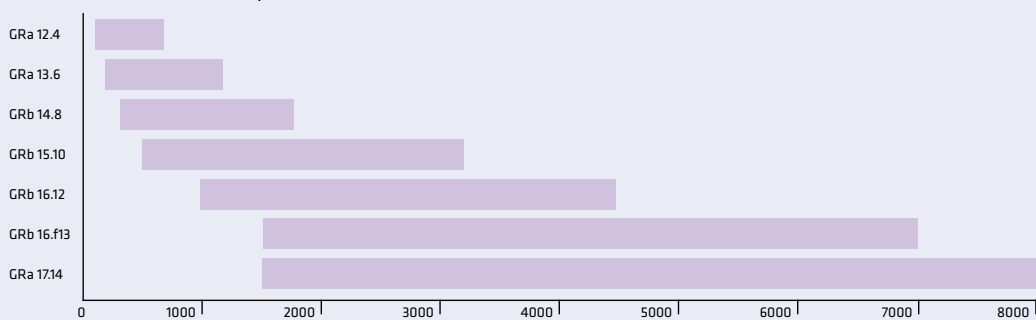
- Volume flow: 100 to 50,000 m^3/h
- Negative pressure: -500 mbar ; positive pressure: $5,000\text{ mbar (g)}$
Differential pressure up to $1,500\text{ mbar (max)}$
- Conveying direction: vertical
- Media: air, oxygen, as well as neutral, toxic, flammable, or corrosive gases or gas mixtures

GQ process gas blowers.

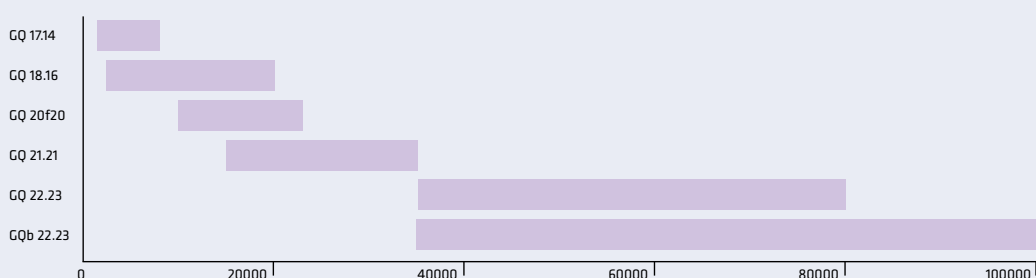
Ideal for use in steel plants for the compression of process, cooling, and seal gas. These blowers are often used as 2-stage assemblies and capable of handling extreme challenges.

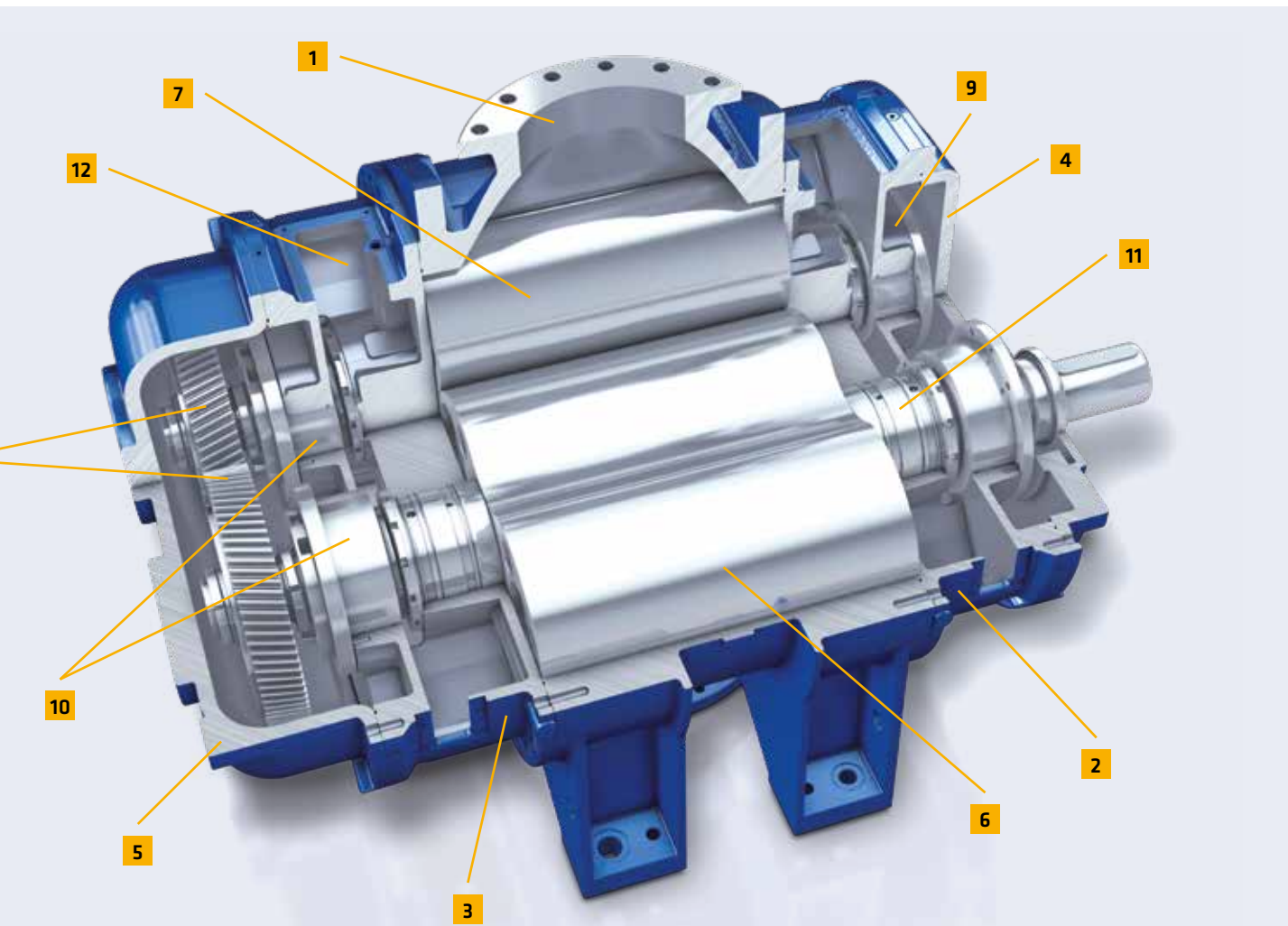
- Volume flow: 15,000 to 100,000 m^3/h
- Negative pressure: -500 mbar ; positive pressure: $5,000\text{ mbar (g)}$
Differential pressure up to $1,500\text{ mbar max}$
- Conveying direction: horizontal
- Media: air, as well as neutral, toxic, flammable, or corrosive gases or gas mixtures

GR intake volume flow Q_1 (m^3/h)



GQ intake volume flow Q_1 (m^3/h)





GR process gas blowers.

- | | | | |
|--------------------------------|--|---|----------------------------------|
| 1 Housing | 4 Housing lid | 7 Rotary pistons with second shaft | 10 Fixed bearings |
| 2 Side plate drive-side | 5 Wheel case | 8 Timing gears | 11 Conveying chamber seal |
| 3 Side plate gear-side | 6 Rotary pistons with drive shaft | 9 Floating bearing | 12 Neutral chamber |

GM ... DZ HIGH-PRESSURE BLOWERS. FOR SAFETY IN DEMANDING SITUATIONS.

Special solutions for special applications. For cases where prepressurised media exit the pipes or pressure differentials of up to 2,000 mbar are required, turn to AERZEN's high-pressure blowers; it's what they were designed to handle. For oil-free conveyance in the chemical industry and many others.

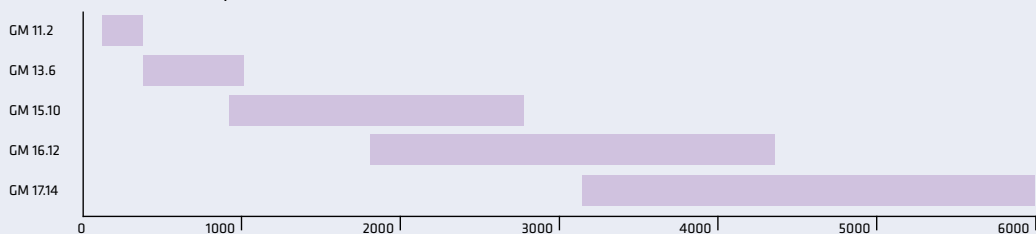
Pressure-stable up to PN 25.

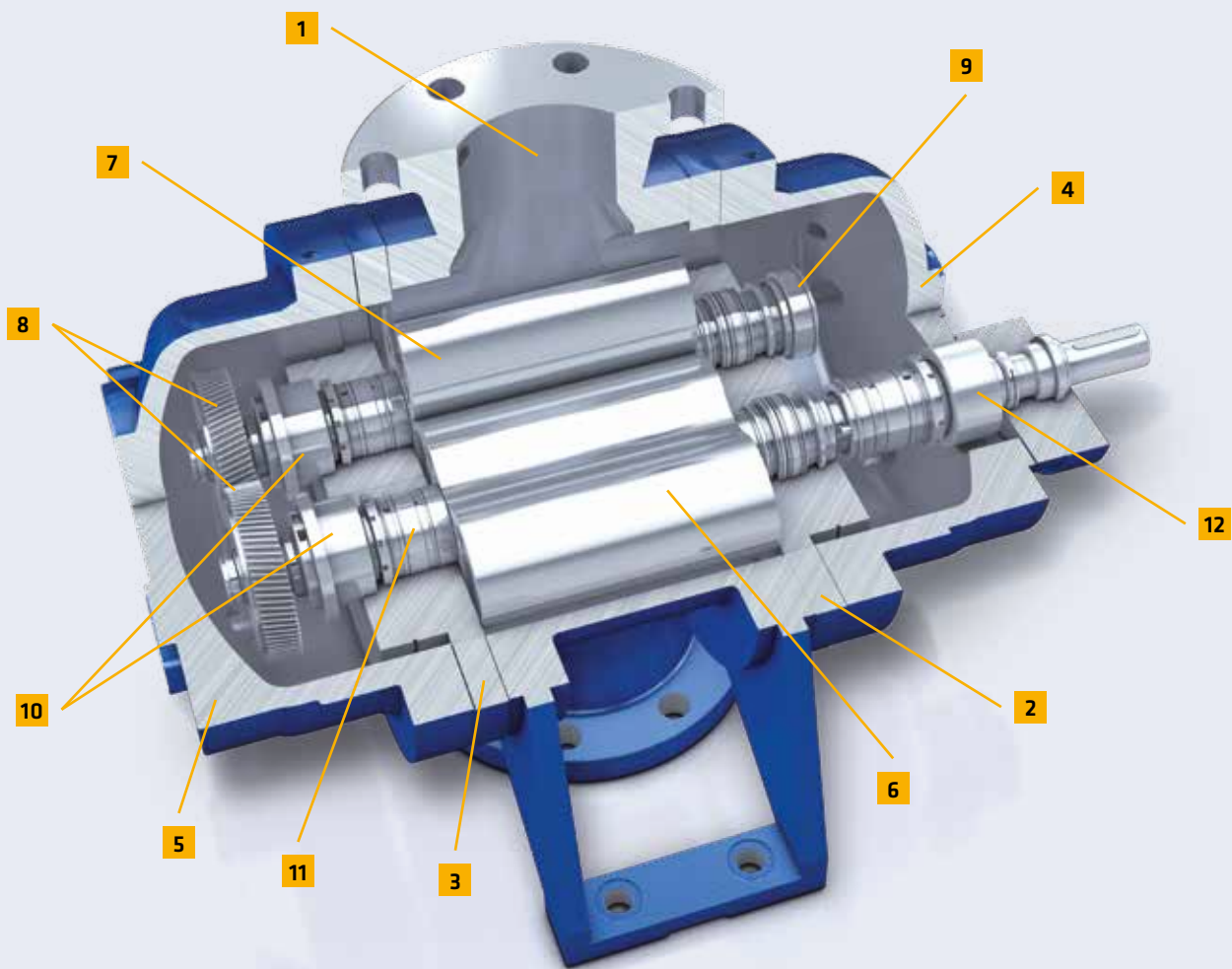
The direct-drive GM ... dz blowers from AERZEN are high-performance machines. 1 or 2 stage design, with separate pressurised oil lubrication for the oil-free transport and compression of air, neutral gases, and gas mixtures. Highly advanced and extremely durable Roots-type products. Available in a wide range of special materials and seals, such as stainless steel or as acetylene boosters according to TRAC norms.

Performance and characteristics.

- Volume flow: 60 to 6,000 m³/h
- Positive pressure: 25 mbar (g)
Differential pressure up to 2,000 mbar max
- Positive pressure: up to PN 25
- Conveying direction: vertical
- Media: air and neutral gases, gas mixtures

Intake volume flow Q_1 (m³/h)





GM ... dz process gas compressors.

- | | | | |
|--------------------------------|-----------------------|---|--------------------------------------|
| 1 Housing | 4 Housing lid | 7 Rotary piston with drive shaft | 10 Fixed bearings |
| 2 Side plate drive side | 5 Wheel case | 8 Rotary piston with secondary shaft | 11 Piston ring labyrinth seal |
| 3 Side plate gear side | 6 Timing gears | 9 Floating bearing | 12 Double mechanical seal |

PRODUCT OVERVIEW:

A WIDE VARIETY FOR INDIVIDUAL APPLICATIONS.

POSITIVE DISPLACEMENT BLOWERS



Model GR



Model GQ

Areas of particular expertise

Oil & gas upstream

Oil & gas midstream

Refineries

Petrochemical industry

Other industrial applications

Pharmaceutical industry

Applications

- Gas boost

- Gas boost
- Chemical processes
- Regeneration processes

- Gas boost for lime kilns, steel, coking plants
- Coke oven gas (COG)
- Blast furnace gas (BFG)
- Natural gas (NG)

- Product conveyance

- Gas boost for COG, BFG, CG
- Coke oven gas
- Blast furnace gas
- Cooling gas

Performance data

- Volume flow approx. 100 – 50,000 m³/h
- Negative pressure -500 mbar
Positive pressure 5,000 mbar (g)
- Delta P max 1,500 mbar

- Volume flow approx. 15,000 – 100,000 m³/h
- Negative pressure -500 mbar
Positive pressure 5,000 mbar (g)
- Delta P max 1,500 mbar

Models

- GR 12.4 – 21.22

- GQ 17.14 – 22.23



Model GM ... dz

- Nitrogen boost
- Acetylene boost (TRAC)

- Cooling loops
- Kiln pressure test bed
- Ammonia boosting

- Volume flow approx. 60 – 6,000 m³/h
- Positive pressure 25 bar (g) if the medium is prepressurised
- Delta P max 2,000 mbar

- GM ... d
- GM ... dz

OIL-FREE SCREW COMPRESSORS



Model VRa

- Associated gas
- Fuel gas boosting (gas turbine)

- H₂ and CH gas mixtures, flare/tail gas, butane and propane recovery

- CH gas mixture boosting

- Butadiene, lime kiln gas boosting, styrene, ammonia boosting
- Methyl chloride boosting

- Coke oven gas boost

- Volume flow approx. 650 – 120,000 m³/h
- Negative pressure -900 mbar
- Positive pressure 52 bar (g)

- VRa 137 – 736 L
- VRa 136 – 1037 M
- VRa 136 – 736 S
- VRa 236 – 336 H

OIL-INJECTED SCREW COMPRESSORS



Model VMY .36



Model VMY .56/046

- Gas gathering onshore, offshore

- Natural gas compression
- Fuel gas boosting (gas turbine)

- H₂ and CH gas mixtures, flare/tail gas, butane and propane recovery

- LNG, LPG, cryogenic, ammonia boosting

- Gas gathering onshore, offshore

- Natural gas compression
- Fuel gas boosting (gas turbine)

- H₂ and CH gas mixtures, flare/tail gas, butane and propane recovery

- BOG (Ethylene)
- Turbine fuel gas

- LNG, LPG, cryogenic, ammonia boosting

- Volume flow approx. 700 – 10,000 m³/h
- Negative pressure -999 mbar
- Positive pressure 25 bar (g)

- Volume flow approx. 444 – 2,700 m³/h
- Positive pressure 25 bar (g)

- VMY 236 – 536

- VMY 046/156/256/356

AERZEN process gas compressors and blowers have proven themselves in over 10,000 assemblies installed the world over. What are the deciding factors? An uncommonly long service life. Their clear focus on efficiency criteria. And last but not least: an unusually broad portfolio of solutions, including modifications, accessories and special developments to ensure they can handle every possible process requirement.



AERZEN engineering and production centre: where high-performance, high-end solutions for the process gas and coolant industries are born.

A focus on special requirements.

AERZEN is a pioneer in compressor technology. In many areas we are the market leader. We offer unique technological advantages, superior quality and high efficiency. Our product portfolio for the process gas and coolant industries encompasses a broad spectrum of specialised blowers and compressors, featuring high-end machines with a wide variety of designs, sizes, and special features. Our machines are configured to meet all relevant international regulations, building codes, and specifications in a wide variety of industrial branches and certification bodies, including ASME, API, TEMA, ANSI, Ex and DIN, the European Pressure Equipment Directive (PED), as well as safety regulations for electrical installations such as DIN, EN, NEMA, IEC and ATEX.

Right-sized for the process.

Energy efficiency is one of the main demands made of today's compressor technology. It's not surprising when you consider the fact that energy takes up as much as 80% of life cycle costs in compressor installations. As such, reducing energy consumption is one of the main goals at AERZEN's R&D department. All blowers and compressors are radically flow optimised. Carefully selected transmission variants are just as important to increasing efficiency as innovative component developments. But here's the real secret to reducing energy consumption: every compressor and blower package from AERZEN is right-sized to the individual requirements of our customers and their processes. The right size, and thus highly efficient.

SERVICE AROUND THE WORLD.

SERVICES FOR GLOBAL INDUSTRIES.

The best kinds of process gas and coolant installations are the kinds you do not notice, because they run straight for 20, 25, 30 years. That's where AERZEN comes in. With highly specialised service teams in Germany, throughout Europe, and in over 100 countries on our planet, we will secure your investment and productivity, and therefore your decisive advantage in global competition.

AERZEN OEM expertise is available to its customers anytime, anywhere in the world.



AERZEN on-site service.

Our Process Gas Division service teams work wherever AERZEN machines are found, the world over. How do we manage? By shortening the distance to our customers. The PGD has three regional service centres in Germany, Hungary, and the USA. Their experts work in all global AERZEN branch offices so they can be there, whenever and wherever you need them.

As multifaceted as our customers.

What is the philosophy behind PGD's customer-oriented service concept? It begins with our employees' friendliness and goes well past on-site training. Included in the service

portfolio are: exchange stages, right-sized service kits, machine diagnosis, process modifications, energy-savings studies, technological enhancements, acoustic optimisation, replacement parts, and a large selection of rental machines.

Packaging and shipment are also an important part of our services. The process gas and coolant compressors can be configured and packaged in Germany, Hungary, or the USA, and are right-sized precisely to customer need. Combining AERZEN's immense experience and engineering resources with our Process Gas Division's flexibility regarding project management and on-site packaging.



Contact worldwide

AERZEN's team of 2,000 employees is active on every continent. With six sales offices in Germany alone, we are always nearby. And with 50 subsidiary companies spread across 100 different countries, we are never far away should you need us. Call us at:

+49 5154 81-0

Service Hotline Germany

Our German service centre is available for customers, applications and the maritime industry in Germany. We look forward to your call:

0700 49318551

Customer Net

Looking to learn more about our company and about AERZEN's industry-leading compressor technology? It's easy: just visit our Customer Net or our home page. Everything you need to know in one location:

www.aerzen.com



AERZEN. Compression - the key to our success.

AERZEN was founded in 1864 as Aerzener Maschinenfabrik. 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. AERZEN is among the undisputed market leaders in many areas of application.

At our 50 subsidiaries around the world, over 2,000 experienced employees are working hard to shape the future of compression technology. Their technological expertise, our international network of experts, and the constant feedback we get from our customers provide the basis for our success. AERZEN products and services set the standard in terms of reliability, stability of value and efficiency. Go ahead - challenge us!

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AERZEN
EXPECT PERFORMANCE