

MARITIME APPLICATIONS

AIR AND PROCESS GASES ON BOARD

Comprehensive solutions from AERZEN blowers and compressors



AERZEN

AHOY, AND WELCOME ABOARD CUSTOMISED CONCEPTS FOR THE SHIPPING INDUSTRY.

Screw compressors, positive displacement blowers and rotary lobe compressors are essential for a variety of applications and processes in ships of all sizes. As a specialist in the compression of process air and process gases, we fully understand your requirements. With 150 years of experience in the development and manufacture of blowers and compressors, AERZEN specialises in providing customers with product solutions

Variety to meet your goals.

Our Delta Blower, Delta Screw, Delta Hybrid and oil-injected screw compressors VMX and VMY product series form the basis for individualised and energy-efficient process air and process gas applications for handling small to substantial volume flows in the shipping industry. Assemblies from AERZEN have been certified by DNV GL and Lloyd's Register and can therefore be

Maneuvering systems

- Anti-heeling systems for ship stabilisation
- Keeping areas free from ice for icebreakers (Duck Walk)
- Transverse thrusters aboard yachts
- Air lubrication of the ship's hull

Water treatment

- Wastewater treatment plants on ships, available in all sizes

Process gases

- CH-mixed gases
- VOC (Volatile Organic Compounds)
- Boil-off gas
- Inert and purge gases

Noise protection and cavitation interruption

- Air injection for ship propellers
- Air curtain systems for offshore sites

Refrigeration plants

Compressor supercharging

- Pre-compression for compressed air generation

Pneumatic industry

- Suction and pressure conveying for loading and unloading
- Semi-submersible ships

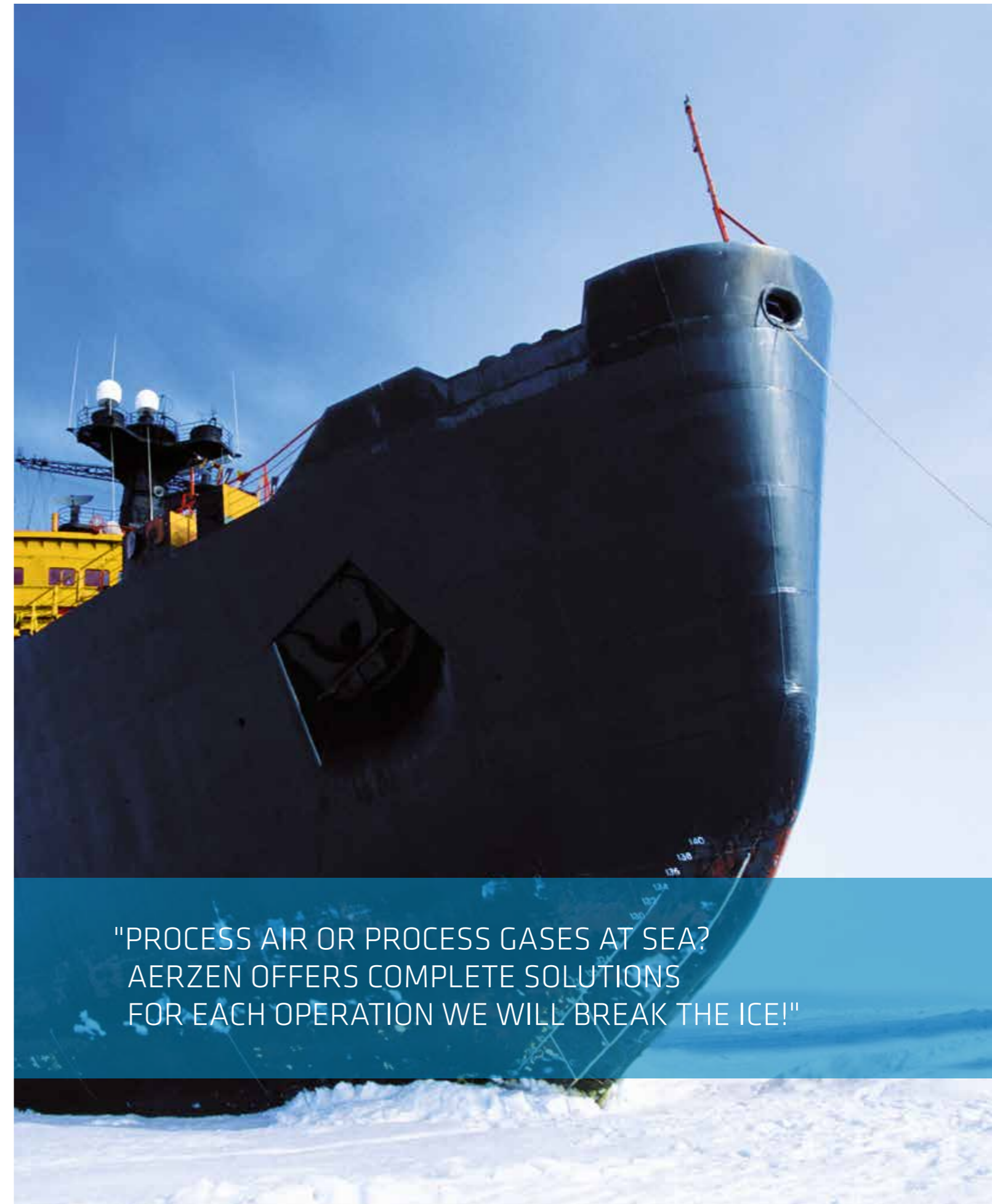
Seismology

- Seabed investigation

used for safety-relevant applications on board. We are happy to provide you with additional certifications upon request.

The general conception and technical layout of process air and process gas plants demands a high level of intelligence – after all, they must be able to handle challenging environmental conditions around the world. To this end, AERZEN has assembled an outstanding team consisting of specialists with international work experience onshore and aboard from our design, control systems, quality and project management departments.

Thanks to AERZEN's variety of products, our specialists are able to select the appropriate machine for your process or modify it if necessary, ensuring that you will always receive the optimal solution. Whether it is a classical air compressor or a crucial component for special applications – such as seismic analyses of the seabed or the exhaust of VOC gases on oil tankers or boil-off gas in LNG applications – there are plenty of individual maritime applications. AERZEN blowers and compressors will make all the difference on board for a wide variety of maritime applications.



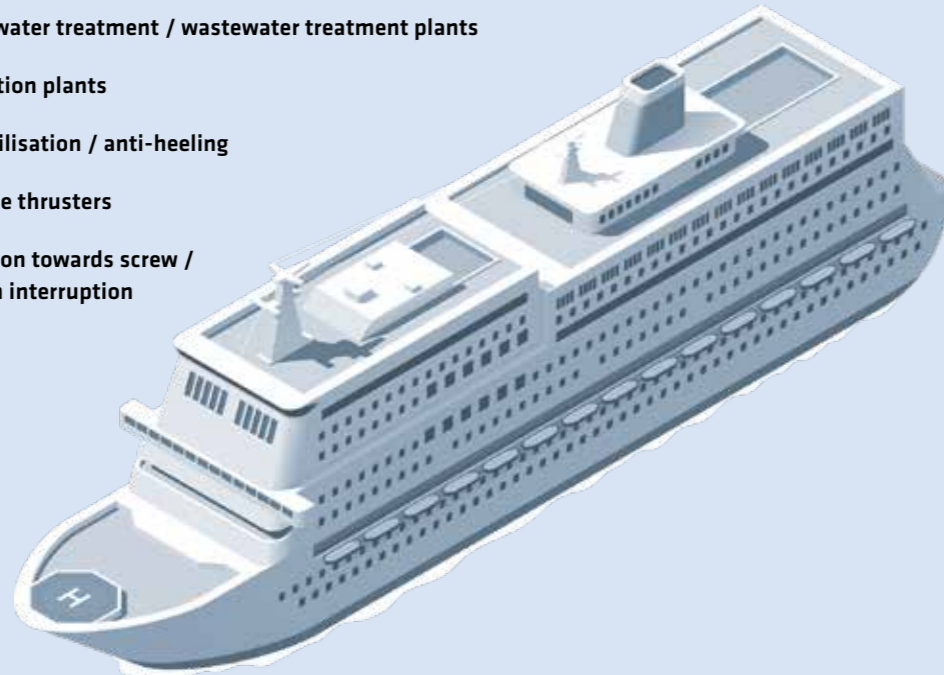
"PROCESS AIR OR PROCESS GASES AT SEA?
AERZEN OFFERS COMPLETE SOLUTIONS
FOR EACH OPERATION WE WILL BREAK THE ICE!"

AT HOME ON ANY SHIP. SOLUTIONS FROM AERZEN.

Professionally implemented blower and compressor concepts aboard pay off in any number of ways. They help to meet increasing environmental and climate protection requirements. They reduce energy consumption, which means lower energy costs, and improve maritime safety. All in all, maritime applications supplied by AERZEN can and will increase your company's productivity and economic efficiency.

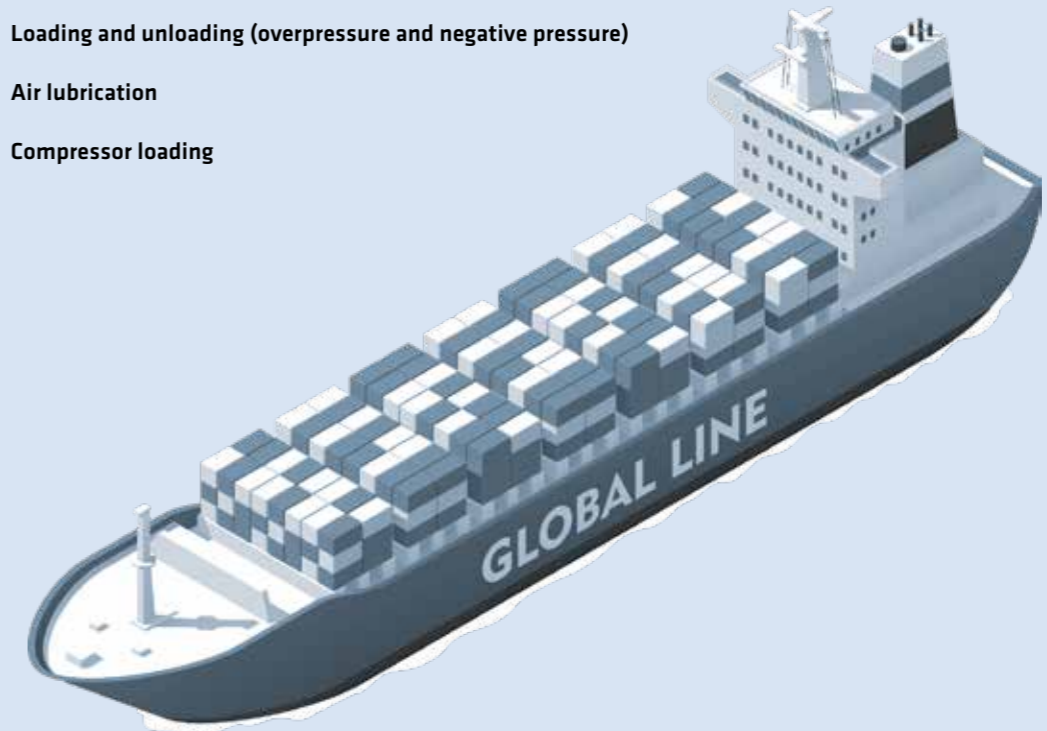
Passenger ships and yachts

- 5 Drinking water treatment / wastewater treatment plants
- 6 Refrigeration plants
- 7 Ship stabilisation / anti-heeling
- 8 Transverse thrusters
- 9 Air injection towards screw / cavitation interruption



Cargo ships

- 10 Loading and unloading (overpressure and negative pressure)
- 11 Air lubrication
- 12 Compressor loading



5 7 8 9 10 11 12 14 15

Delta Hybrid – rotary lobe compressor

Motor rating: 7.5 to 400 kW
Volume flow: 110 to 9,000 m³/h
Max. differential pressure:
-700 up to +1,500 mbar



5 7 8 9 10 11 12 14 15

Delta Blower – positive displacement blower

Motor rating: 1.1 to 1,100 kW
Volume flow: 39 to 66,000 m³/h
Max. differential pressure:
-500 up to +1,000 mbar



7 10 12

Delta Screw – oil-free screw compressors

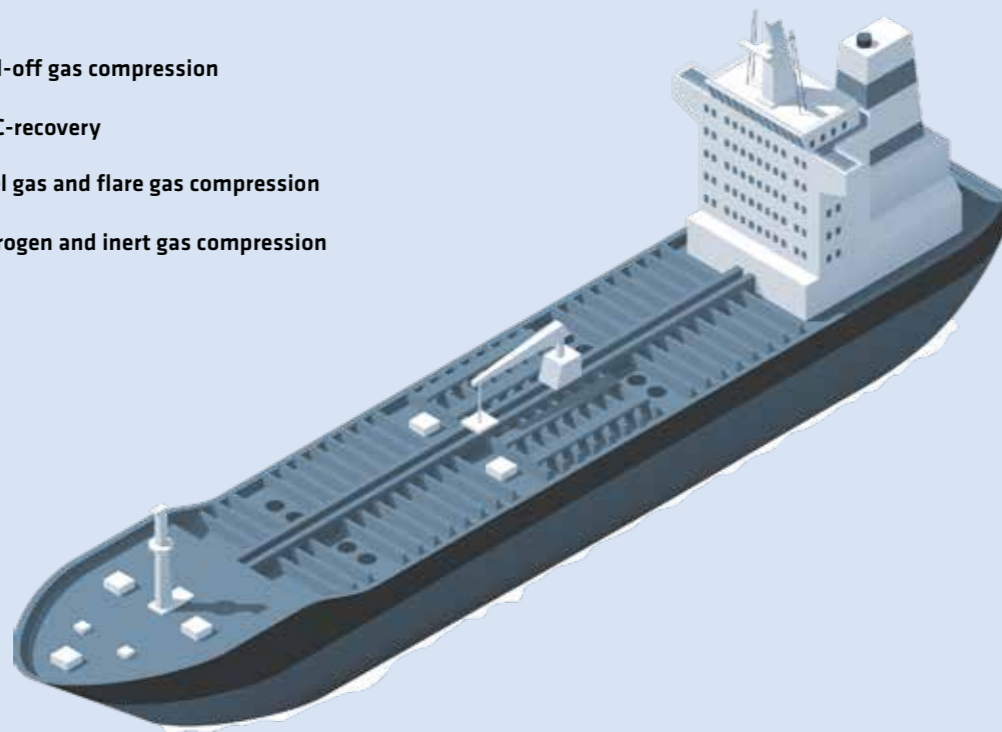
Motor rating: 11 to 800 kW
Volume flow: 120 to 15,000 m³/h
Max. differential pressure:
-850 up to 3,500 mbar



AERZEN blowers and compressors for process air and process gases have proven themselves globally in over 10,000 installed systems. Their traits? An extremely long service life. A consistent focus on efficiency. And last but not least: AERZEN's extensive solution portfolio. Modifications, accessories and special developments – all process requirements are fulfilled.

Tankers

- 1** Boil-off gas compression
- 2** VOC-recovery
- 3** Fuel gas and flare gas compression
- 4** Nitrogen and inert gas compression



Special applications

- 13** Air curtain systems for offshore sites
- 14** Semi-submersible ships
- 15** Seismic studies



- 1**
- 2**
- 3**
- 4**

Oil-injected screw compressors VMX

Motor rating: 355 kW
 Volume flow: 3,200 m³/h
 Max. differential pressure:
 13 bar



- 1**
- 2**
- 3**
- 6**

Oil-injected screw compressors VMY

Motor rating: 22 to 1,500 kW
 Volume flow: 100 to 9,000 m³/h
 Max. differential pressure:
 up to 25 bar



- 13**

Double-stage oil-free screw compressors VMT

Motor rating: 55 to 1,500 kW
 Volume flow: 1,000 to 8,100 m³/h
 Max. differential pressure: up to 10.5 bar



WITH AERZEN, YOU RUN THE SHIP.

AERZEN compressors and blowers can play a crucial role in modern auxiliary systems for manoeuvring and stabilising ships and keeping them free from ice. In addition to their use on yachts, our thrusters also work on larger ships, while air lubrication of the ship's hull promises future energy savings in the maritime shipping business. Anti-heeling systems tailored to the ship ensure a smooth, stable position in the water. Another important process air application is wastewater treatment plants for large passenger ships.

Anti-heeling and the Duck Walk.

Today, bespoke product solutions from AERZEN are used in anti-heeling systems for the stabilisation of ships in water. By means of a precisely dimensioned blower, water in the ballast water tank of the ship is forced from one side of the ship to the other via a piping system. Depending on the ship's position, the unit forces water to one side of the ship or the other via air valves. These can change the direction of air flow in less than one second.



Smooth sailing, guaranteed.

Anti-heeling systems with blowers are considerably more economical and energy efficient than those with pumps. Floating hotels, cargo ships, tankers or cable ships lie more steadily in moving water, remaining stable even during loading and unloading. By using the anti-heeling unit in reverse, the resulting "Duck Walk" – a slight swaying from side to side – serves to keep icebreakers free from ice, as on the 'Polarstern', Germany's largest and most modern research vessel.



Navigating by energy savings.

Modern ship concepts consider energy aspects from the very beginning. Air lubrication poses a particularly interesting question for cargo ships. Oil-free compressed air, generated e.g. by an AERZEN Delta Blower or Delta Hybrid, flows out of numerous nozzles under the ship's hull to form an air curtain between the skin of the ship and the ambient seawater, thereby reducing friction and fuel consumption. Thrusters or rudders are also operated with oil-free compressed air. Finding their start in yachts, today they are also used on large ships.

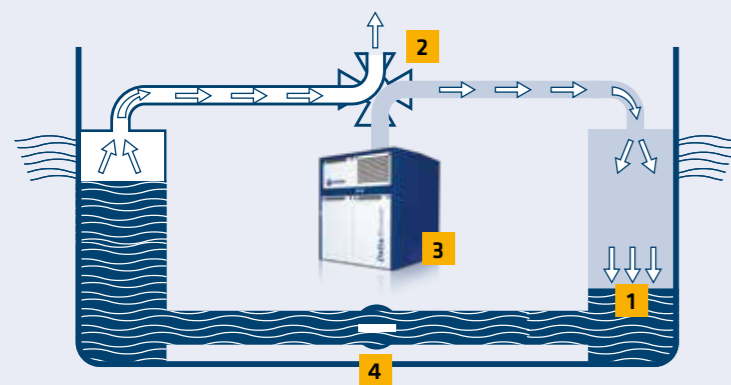


all sizes across the globe.

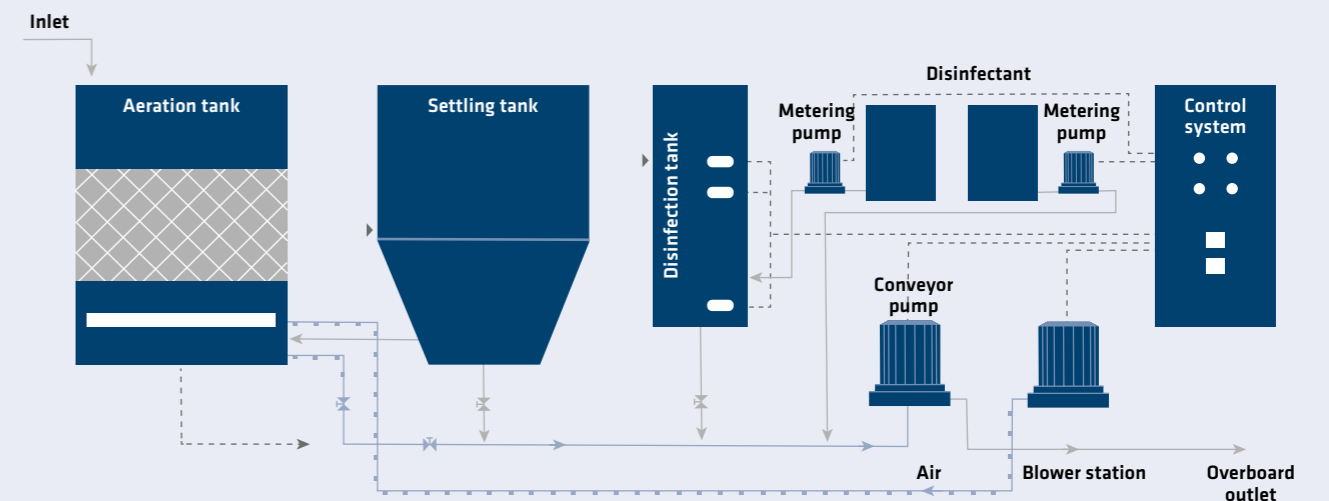
This also applies for mobile plants on ships. The heart of the plants is our Delta Blower and Delta Hybrid packages, which supply the aeration tank of the aerobic wastewater treatment system with air. Subsequently, wastewater flows into a settling tank where solids are separated. Finally, the purified water is sterilised before it is discharged into the water.

Water treatment at sea.

The days when wastewater of a ship was simply dumped at sea are over. Yet large passenger ships and cruise ships do not have the capacity to store the volume of wastewater generated by thousands of passengers until they reach the next harbour. A wastewater treatment plant with AERZEN machines provides the answer. We draw on decades of research into the conception and equipment of wastewater treatment plants of



- 1 Water is moved by the blower air
- 2 Air valves change the direction of the water's flow in less than one second
- 3 Blower station runs continuously
- 4 Safety valve open in operation



AT AERZEN, YOUR PROCESS GASES ARE IN GOOD HANDS.

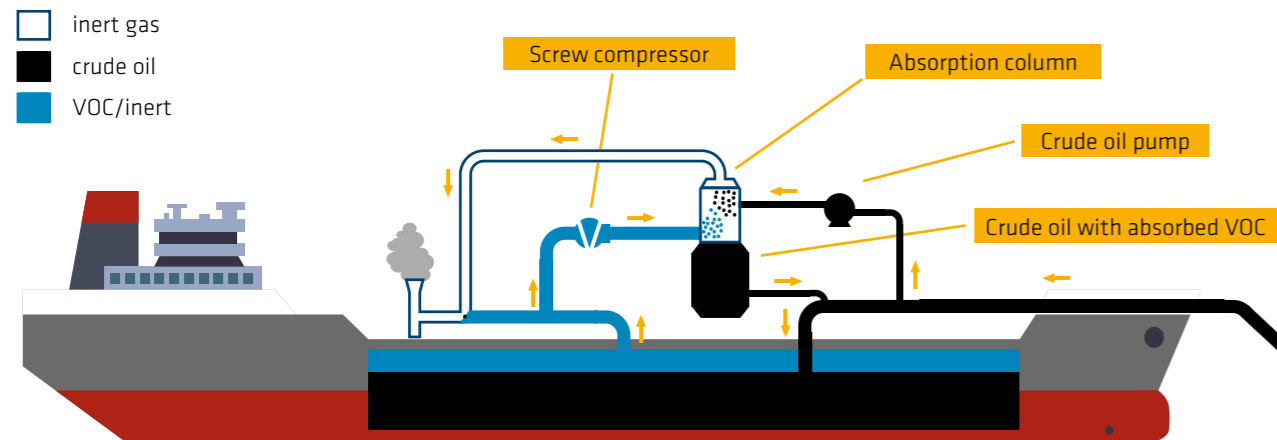
No matter whether they are combustible or not, AERZEN's experts know how to treat your process gases. Our screw compressors are used for the extraction of boil-off gas in LNG applications as well as for the recovery of Volatile Organic Compounds (VOC). Nitrogen compression used as an inert and flushing gas or for blanketing is a typical application for our Delta Blower positive displacement blowers. AERZEN compressors can also be found in many refrigeration plants aboard.

Good for the environment. Good for costs.

When loading and unloading tankers with crude oil, volatile organic hydrocarbons (VOCs) are released into the atmosphere. They not only represent an unused energy potential – they also worsen the greenhouse effect. Furthermore, they can generate ground-level ozone and other photochemical reaction products. By means of a VOC recovery unit aboard, these substances can be re-liquefied and fed back to the crude oil cargo. Developed especially for this process, screw compressor

packages from AERZEN help to reduce the greenhouse effect. VOC units with AERZEN technology find frequent use on many tank ships.

During the transport of liquefied natural gas (LNG) on tank ships, the gradual warming of the cold liquid gas results in the evaporation of so-called boil-off gas. While this gas was previously blown off into the atmosphere, now for reasons of environmental protection it is recompressed with the help of units made by AERZEN, then led back to the process.



Experts for special applications.

There are virtually no limits to the potential applications for AERZEN positive displacement blowers, rotary lobe compressors and screw compressors. Above all in the luxury sector of yacht building, the long forgotten art of injecting air into the ship's propeller is experiencing a renaissance. This eliminates screw noise to the greatest possible extent, while avoiding cavitation. The result: a smooth drive and longer service life. A similar application is found in air curtain systems for impact pile driving in wind power station foundations, in which a ring of air bubbles installed around the site protects the marine life from harmful sound influences. In another context, AERZEN also has experience installing positive displacement blowers on surveying ships and research ships for seismic survey of the sea floor.



“NO MATTER WHAT THE APPLICATION YOU NEED PROCESS AIR OR GASES ABOARD FOR, NO MATTER WHAT THE SHIP, NO MATTER WHAT THE BODY OF WATER - AERZEN WILL FIND A SOLUTION.”

AERZEN MOVES BULK LOADS WITH PRESSURISED AIR AND VACUUM.

Pneumatics plays an important role in loading and unloading bulk materials. AERZEN blowers and compressors generate overpressure and vacuum for this purpose. Even large individual loads can be lifted easily thanks to pressurised air, e. g. with semi-submersible heavy lift ships. If higher pressures are required, as for example for pressurised air, AERZEN blowers and compressors provide accurate elevated intake pressure.



Pneumatic conveying of bulk materials.

Deciding whether to use vacuum conveying or positive pressure conveying depends on the conveying material and the deployment scenario. With years of experience in both procedures, AERZEN has long supplied pneumatic systems for ships, port facilities and factories. The largest machines are installed in lifting systems and unload transport ships with an hourly capacity of up to 1,000 tons. Mobile unloading vehicles (e.g. silo trucks) driven to individual locations in the harbour can also benefit from AERZEN products. AERZEN oil-free compressing positive displacement blowers, rotary lobe compressors and screw compressors are the solution for each and every one of these transportation tasks, providing optimal efficiency and reliability.

Economical compressed-air generation.

Semi-submersible ships are used for lifting ships out of the water, working on the hull, or to salvage a non-seaworthy vessel. Hoisting the hull is accomplished by feeding compressed air into the ballast tanks. Water is pressed out of the tank, and due to the generated lift the hull is hoisted.

If compressed air or air at higher pressures is required, it is possible to omit a compressor stage in the downstream piston compressor thanks to compressor supercharging with the AERZEN Delta Blower or AERZEN Delta Screw. This results in significant savings in the investment costs for the entire plant.

All fields of application covered.

AERZEN is one of three leading application specialists worldwide in the economical and energy-efficient conveying and compression of gases. AERZEN positive displacement blowers, screw compressors and rotary lobe compressors are already used for diverse applications in the maritime industry. Our leadership rests on three key factors:

the extensive application and industry know-how of AERZEN experts; our hugely diversified portfolio, adjustable within reason to nearly any application; and finally our 150 years of experience in the construction of compressors and blowers. AERZEN supplies more than just high-quality assemblies. Our experts are at your disposal for any further information.

The most important product features for maritime applications.

- Certifications of ship classification companies for safety-related machinery
- Tear-resistant, flexible machinery mountings
- Welding frame for hulk mounting
- Electrical fans
- Anchor bolts for fixation
- Oil-free Delta packages certified as per ISO 8573-1, class 0
 - no oil filter in the compressed-air flow
 - no active carbon filter
 - no pressure loss
 - no residual oil content
 - lower operating costs
- Silencer free of absorption material
- Ex-protection design on request or ATEX compliance
- Space-saving design
- Special varnishes
- Dampened hinged motor mounting plate with locking
- Optimal service



STRIVING FOR PERFECTION FOR OVER 150 YEARS: A WORLD OF SERVICES FROM AERZEN.

The best kind of service is the kind you don't need. No technology, however, is completely free from wear and tear. Our machines are designed to do their job as long and as efficiently as possible – for decades, if need be. After-sales services from AERZEN will help extend their availability and lifetime – a real plus for your investment!

Benefit from AERZEN's OEM competence – any time, anywhere



Contact worldwide

AERZEN's team of 2,500 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

At your OEM's recommendation.

We have been manufacturing quality products for more than 150 years. Over this period, our company has created a service commitment that reflects this quality. We provide tailor-made solutions for each stage of your machine's life cycle. With OEM parts and logistics you can rely on, at AERZEN high-performance service remains our focus. In addition, we offer decentralised service locations, guaranteeing quick delivery of spare parts and competent service worldwide.

AERZEN on-site service.

Our service teams work wherever our machines are located: all across the world, onshore or offshore, often in extreme conditions. How do we do this? By taking the quickest routes. AERZEN has built a decentralised network of service locations and parts warehouses across the globe to provide our customers with rapid service. More than 200 expertly trained service technicians are on hand to help you at anytime, and wherever you may need them.



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 2,500 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