KAESER KOMPRESSOREN®

Marine Compressed Air Systems

Reliable marine compressors from KAESER
with **SIGMA PROFILE**

www.kaeser.com

SIGMA

Marine air systems

Quality, made in Germany

For more than 100 years, the name of KAESER KOMPRESSOREN has been synonymous with innovative products and efficient complete solutions. Established in 1919 by Carl Kaeser Senior as a machine workshop in the German town of Coburg, the company has grown to become one of the world's leading compressor manufacturers and compressed air systems providers.

KAESER today relies on the production processes of tomorrow – the smart factory. In accordance with highly efficient Industrie 4.0 structures, compressor and treatment component manufacture is both intelligent and fully networked, resulting in a production process that benefits from exceptional precision, optimised productivity and shortest possible delivery times.

All areas of the business, from Product Development to Sales and Service, work together hand-in-hand. Our Service department begins planning the spare parts supply process in parallel with the product development procedure, whilst expert Sales Engineers advise our customers regarding optimal system sizing and specification. We can provide you with the perfect compressed air solution, even when it comes to operating on the high seas.

KAESER is represented in more than 140 countries by a comprehensive network of subsidiaries and exclusive distribution partners. Moreover, specialised Marine Service Hubs offer worldwide, round-the-clock technical support for our customers. If needed, highly trained technicians and experienced service specialists are available to provide immediate assistance from the nearest port of call.

Close customer contact is very important to KAESER, since only constant and ongoing dialogue provides the basis for continuous improvement of products and services. The result? Maximum reliability and efficiency with minimal maintenance requirement.

KAESER KOMPRESSOREN's commitment, expertise and dedication to customer satisfaction are second to none. Although at home throughout the world, this family-owned company with headquarters in Coburg has never lost sight of its German roots, and has remained synonymous with the 'Made in Germany' mark of quality for over 100 years.

KAESER – Your one-stop shop

Production

The dependability, durability and energy efficiency of KAESER products are no accident, but the result of rigorous development and precision manufacturing. Highly qualified specialists at the company's Coburg and Gera production facilities, located in central Germany, meticulously assemble every compressor and blower block or airend to the very highest quality standards for which KAESER is renowned throughout the world.

Certification

KAESER compressors, blowers and compressed air treatment components are certified by all marine classification societies. No effort is required on the part of the customer; the acceptance and certification procedures are fully taken care of in Coburg. This saves time, which means that products can be delivered even more quickly to where they are needed.

Contents

Delivery

No matter whether on land or at sea, nowhere is too far away or too difficult to reach for KAESER – we specialise in making the seemingly impossible possible. Before beginning their journey to the customer, products are carefully packed and prepared for despatch in our state-of-the-art distribution centre. A comprehensive logistics network keeps delivery times to an absolute minimum.

Installation

Customer needs are paramount at KAESER. Special focus is therefore placed on user-friendliness during product development. All compressors, blowers and compressed air treatment components are designed to be as compact and easy to install as possible. Systems are delivered ready for immediate operation, ensuring straightforward and trouble-free installation – even during short layovers.

Quality inspection and certification

KAESER compressors can be accepted and approved by all notable vessel classification societies, including Lloyd's Register, CCS, ABS, DNV, Rina, Korean Register, Bureau Veritas and ClassNK. Classification societies monitor and document compliance with the relevant guidelines and confer the corresponding class accordingly. The assigned class represents an assessment of a vessel's seaworthiness and therefore a basis for insurance of the vessel and its cargo, as well as trade of the vessel itself. Classification societies can thus be thought of as an equivalent of the TÜV for the marine industry.

Lloyd's Register
CCS China Classification Society 中國船級社
ABS
DNV
RINA
KR Korean Register
Bureau Veritas
ClassNK

The advantages are clear: Factory approval, better delivery control and manufacturing flexibility. KAESER is available for type testing in conjunction with all notable classification societies. Separate approvals can be granted on a case-by-case basis for classification societies not covered by type approvals. Type testing makes certification quick and simple.

Long-distance inspection with Remote Control

In order to minimise delivery times for our marine customers, and also to reduce the carbon footprint of our activities, KAESER prefers to carry out the required approvals remotely if the applicable classification society offers such a service. Our brand new, state-of-the-art test facilities for marine compressors offer live-streaming connectivity, in addition to all the necessary equipment to undertake remote inspections. This means the customer can participate in the approval process from anywhere in the world, without needing to worry about travel time, costs or waiting times and benefitting from direct communication with our marine compressor experts. The result: Faster completion with documented proof of compressor approval.

Full power ahead for your air supply

KAESER offers a comprehensive range of rotary screw compressors, reciprocating compressors, blowers and compressed air treatment devices specially developed for marine compressed air use, including application-specific operating air, starting air, air for Selective Catalytic Reduction (SCR), air lubrication and nitrogen generation, as well as blower air for wastewater treatment systems aboard cruise ships. KAESER marine products are certified by all marine classification societies and are valued as much for their reliability as for their energy efficiency and long service life.

Reliable and durable

As a ship owner or manager, you need to be able to have complete trust in your ship's compressed air supply. The exceptional quality of KAESER compressors and rotary blowers provides you with this peace of mind. This quality stems from strong vertical integration, in conjunction with an optimised mix combining years of experience and a flair for creative technical innovation.

Tailored solutions

Our extensive range of proven, reliable products, consisting of compressors, compressed air treatment devices and rotary blowers, is available for every conceivable compressed air application on board a ship. Our trained experts can therefore offer a system solution that is specially tailored to meet the needs of any requirement and operating environment. Compact and durable, KAESER systems provide performance you can trust, even under the toughest of conditions.

Efficient and environmentally friendly

At the heart of every KAESER rotary screw compressor lies a premium-quality airend, developed in Coburg, that is equipped with energy-saving SIGMA PROFILE rotors. Flow-optimised, these high-efficiency rotors provide long service life whilst setting new standards in specific package input power. The advantages speak for themselves: energy costs are minimised, whilst sustainability and environmental friendliness are maximised.

Energy saving is key

KAESER compressors, treatment devices and blowers ensure outstanding efficiency. This makes it possible for many ship devices – such as generators – to be smaller and therefore more energy efficient. With a clear focus on the environment, KAESER is committed to conserving valuable resources.

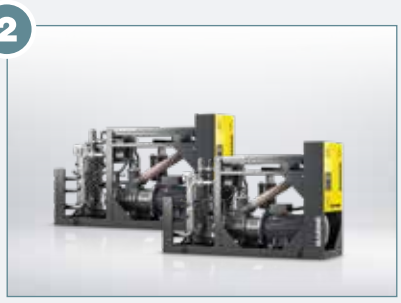
Gas tanker operations

1

Air lubrication

► See page 34 for further details

2



N_2 production

► See pages 26-29 for further details

3

Working air

► See pages 18-21 for further details

4

Control air

► See pages 22-25 for further details

5

Air for SCR systems

► See page 34 for further details

6

Starting air

► See pages 30-33 for further details

Container ship operations

1

Air lubrication

► See page 34 for further details

2

Working air

► See pages 18-21 for further details

3

Control air

► See pages 22-25 for further details

4

Air for SCR systems

► See page 34 for further details

5

Starting air

► See pages 30-33 for further details

Oil tanker operations

1

Air lubrication

► See page 34 for further details

2

Working air

► See pages 18-21 for further details

3

Control air

► See pages 22-25 for further details

4

Air for SCR systems

► See page 34 for further details

5

Starting air

► See pages 30-33 for further details

Bulk Carrier operations

1

Air lubrication

► See page 34 for further details

2

Bulk cargo handling

► See page 35 for further details

3

Working air

► See pages 18-21 for further details

4

Control air

► See pages 22-25 for further details

5

Air for SCR systems

► See page 34 for further details

6

Starting air

► See pages 30-33 for further details

Cruise ship operations

1

Air lubrication

► See page 34 for further details

2

Wastewater treatment

► See page 35 for further details

3

Working air

► See pages 18-21 for further details

4

Control air

► See pages 22-25 for further details

5

Air for SCR systems

► See page 34 for further details

6

Starting air

► See pages 30-33 for further details

Yacht operations

1

Working air (Yacht)

► See pages 18-21 for further details

2

Working air (Work boat)

► See pages 18-21 for further details

Work boat operations

3

Control air

► See pages 22-25 for further details

4

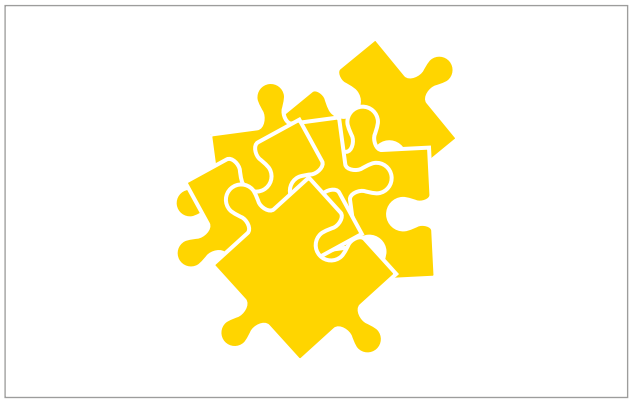
Starting air

► See pages 30-33 for further details

Working air

Your dependable assistant for every voyage

Working air is essential on board any vessel, even under the toughest of conditions. With a **standard working air range of 15-750 m³/h**, KAESER can offer the right solution to meet every need. **Compact and durable**, KAESER systems impress with their **outstanding reliability,** taking ambient temperatures from as low as **-10 °C** right up to **+55 °C** in their stride. Offering a product power range **from 2.2 – 75 kW**, KAESER has the perfect product for any class of vessel, no matter whether a small yacht or a huge container ship. Compressors can be optionally specified with **integrated refrigeration dryer** and **frequency control**. Marine certification is available for all classification societies.



Optional equipment

Our compressors can be adapted to match any requirement: they can be specified with water or air-cooling, adjustable machine feet or condensate heating. A **variety of electrical connections** and **network configurations** are available for your power requirements, whilst add-on dryers and filters guarantee **high-quality compressed air**. Numerous connectivity options ensure **system flexibility** and permit communication with the vessel's on-board systems.

Service and maintenance

Openly accessible systems mean all maintenance components are easy to reach, making **servicing a breeze** – even within the tight confines of a machine room. The use of **exceptionally robust and durable components** helps to minimise operating costs and maximise compressor availability. **Short time requirements for maintenance work** make servicing possible even during brief layovers. Moreover, KAESER's service kits allow many **maintenance tasks** to be performed whilst **at sea**.

From small to large – the perfect solution for every vessel

Compact, energy-saving refrigeration dryers

From port to the high seas, SECOTEC energy-saving refrigeration dryers ensure a dependable supply of the right quality compressed air, wherever it may be needed. KAESER refrigeration dryers are renowned for their **stable pressure dew point performance**, **exceptional reliability** and impressively **low life-cycle costs**. Adjustable according to requirement and superbly economical, SECOTEC refrigeration dryers from the TA to TG series feature high-efficiency thermal mass control for providing reliable compressed air drying down to a **pressure dew point of +3 °C**. The generously dimensioned thermal mass ensures **resource-friendly operation** and stable pressure dew point performance. Moreover, the use of the **climate-friendly** R-513A refrigerant guarantees future **security of supply**.

Image: SECOTEC TA 11, TB 26, TC 44, TD 76

Energy cost savings

SECOTEC series refrigeration dryers are **highly energy efficient**. With its energy-saving control, the **thermal mass** can store excess cooling capacity until it is needed, enabling subsequent drying **without any power consumption** – which is especially beneficial during partial load operation. SECOTEC dryers from the TE series and upwards feature the innovative **SECOPACK LS** heat exchanger system. The latent thermal storage system is filled with a dynamic phase change material, which has enabled a highly compact dryer design for maximum space savings .

Long-term reliability

Thanks to the effective thermal mass, the high-quality refrigerant circuit in SECOTEC dryers delivers reliable performance, even at **high ambient temperatures**, with minimal material stress. The generously dimensioned **stainless steel condensate separator** and **electronic ECO-DRAIN condensate drain** (from type TA 8 and up) provide reliable condensate removal in all load phases in the most efficient way – no compressed air loss.

Smart with add-on dryer: How it works

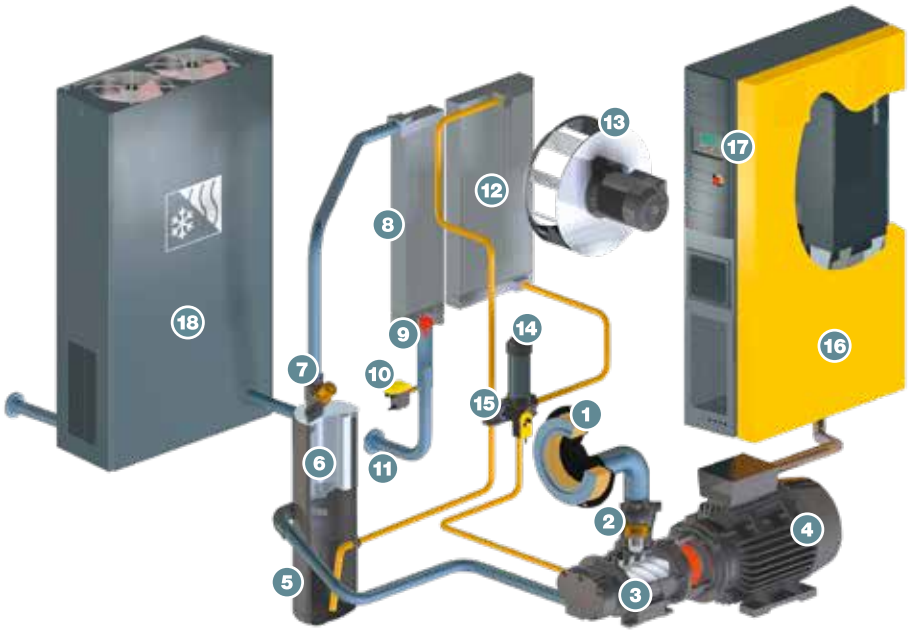


Image: Layout CSD 125

The air for compression passes through the intake filter (1) and the inlet valve (2) into the SIGMA PROFILE airend (3). The airend (3) is driven by a high-efficiency electric motor (4). The cooling oil injected for cooling purposes during the compression process is re-separated from the air in the fluid separator tank (5). The compressed air flows through the 2-stage oil separator cartridge (6) and the minimum pressure check valve (7) into the compressed air aftercooler (8). Following cooling, any accumulated condensate is removed from the compressed air by the integrated centrifugal separator (9) and is then drained away via the add-on ECO-DRAIN condensate drain (10). The condensate-free compressed air then exits the system via the compressed air connection (11). The heat generated during the compression process is removed from the cooling oil via the fluid cooler (12) and is dissipated into the surrounding environment by a separate fan with fan motor (13). The cooling oil is then cleaned by the ECO fluid filter (14). The Electronic Thermo Management system (15) ensures lowest possible operating temperatures. The control cabinet (16) houses the internal SIGMA CONTROL 2 compressor controller (17) and, depending on the compressor version, the star-delta starter or the frequency converter (SFC). Versions are available featuring an add-on refrigeration dryer (18) that cools the compressed air down to +3 °C, thereby ensuring effective moisture removal.

(1) Intake filter
(2) Inlet valve
(3) SIGMA PROFILE airend
(4) IE4 drive motor
(5) Fluid separator tank
(6) Oil separator cartridge
(7) Minimum pressure check valve
(8) Compressed air aftercooler
(9) KAESER centrifugal separator
(10) Condensate drain (ECO-DRAIN)
(11) Compressed air connection
(12) Fluid cooler
(13) Fan motor
(14) ECO fluid filter
(15) Electronic Thermo Management
(16) Control cabinet with integrated SFC frequency converter
(17) SIGMA CONTROL 2 compressor controller
(18) Add-on refrigeration dryer

System layout

Rotary screw compressor | Dryer | Compressed air receiver | Filter

Rotary screw compressor with integrated dryer | Compressed air receiver | Filter

Your benefits at a glance

Reliable and safe

Compact and durable, KAESER systems are renowned for their exceptional reliability. KAESER compressors take ambient temperatures from as low as -10 °C right up to +55 °C in their stride.

Comprehensive range of options

Thanks to a comprehensive range of available options, KAESER compressors can be individually tailored to meet the specific needs of any application. For example, they can be configured with water or air-cooling, adjustable machine feet or condensate heating. A variety of electrical connections and network configurations are available for your power requirements. Numerous connectivity options ensure system flexibility and permit communication with the vessel's on-board systems.

Service-friendly design

Openly accessible systems mean all maintenance components are easy to reach, making servicing a breeze – even within the tight confines of a machine room. A comprehensive network of subsidiaries, distribution partners and specialised Marine Service Hubs assures maximum availability for all KAESER products and services, wherever you may be in the world.

Compact, energy-saving refrigeration dryers

KAESER's refrigeration dryers are renowned for their stable pressure dew point performance, exceptional dependability and impressively low life-cycle costs. SECOTEC refrigeration dryers provide reliable compressed air drying down to a pressure dew point of +3 °C.

Control air

Everything under control

Dependable control air is needed around the clock, 365 days a year. **Energy efficiency** is therefore of key importance when it comes to technical marine operations. Every kilowatt hour (kWh) consumed has to be “bought at high cost” in the form of fuel prices, fuel processing and energy conversion. However, KAESER rotary screw compressors **save energy in a variety of ways**:

Equipped with **flow-optimised SIGMA PROFILE** rotors, the airend is actively managed by the **SIGMA CONTROL 2** compressor controller. This advanced controller matches compressed air delivery to actual air demand, thereby **keeping costly idling time to an absolute minimum**, thanks to its Dynamic control mode.

Image: Siemens reluctance motor

Variable speed control with reluctance motor

The new synchronous reluctance motor combines the advantages of both asynchronous and synchronous motors within a single drive system. The motor contains no aluminium, copper or expensive rare earth materials, making the drive system durable and easy to service. In addition, the functional principle minimises motor heat losses, resulting in considerably lower bearing temperatures. This ensures significantly extended bearing and motor service life. Together with a perfectly matched frequency converter, the synchronous reluctance motor delivers superior performance compared to an asynchronous motor when it comes to losses, particularly in the partial load range.

Electronic Thermo Management (ETM)

Powered by an electric motor and integrated into the cooling circuit, **the sensor-controlled temperature control valve** is the heart of the innovative Electronic Thermo Management system.

The SIGMA CONTROL 2 compressor controller monitors the inlet air and compressor temperature in order to **prevent condensate formation**, even under differing air humidity conditions. The ETM system dynamically controls fluid temperatures for greater **energy efficiency**, whilst at the same time protecting the downstream systems.

High-performance desiccant dryer

DC series desiccant dryers provide dependable compressed air drying down to a **pressure dew point of -70 °C**. They combine proven system design and **high energy efficiency** with exceptionally **low maintenance costs**. The provision of pressure dew points below 0 °C can be complex. It was therefore particularly important for KAESER to draw on its many years of compressed air engineering experience when designing the DC series of desiccant dryers and to use consistently high-quality components throughout. This meticulous attention to detail resulted in impressive energy efficiency across the entire load range. All models are installed on a rugged, space-saving frame and are **accepted by all notable classification societies**.

Image: DC

Desiccant: Activated alumina

The DC series operates exclusively with **activated alumina**. This is a highly pressure-resistant material with excellent mechanical stability, that requires **minimal energy for regeneration**. This means that DC series dryers typically require **up to 20% less regeneration air** for a pressure dew point of -40 °C than dryers using a molecular sieve.

Efficient regeneration

Rapid and complete expansion of the compressed air ensures full utilisation of its regeneration capacity. For this purpose, **rapid-switching valves** featuring large opening cross-sections and two generously dimensioned ¼" **high-performance silencers** are used. This guarantees dependable drying with minimal regeneration air demand.

Filters

For compressed air quality you can count on

KAESER FILTER products are key components in providing a dependable supply of quality compressed air. Regardless of the application or requirement aboard a ship, KAESER has the right filter for the job. Their service-friendly design not only allows simple, error-free opening and closing of the filter housing, but also enables quick and clean element changes. Moreover, this efficient design ensures consistently low pressure losses.

KAESER FILTER products use modern, deep-pleated filter media to remove particles and aerosols, whilst highly effective carbon matting traps oil vapours. Virtually any water / oil / particulate quality can be achieved by using various filter combinations.

The impressive performance data of KAESER FILTER products have been determined in accordance with ISO 12500 and confirmed by the independent “Lloyd’s Register” testing agency.

Image: KAESER Filter

Air receivers

Vertical or horizontal air storage

Air receivers are an important link in the compressed air chain: as storage media or buffers for peak load demand. Only the very best quality materials are used for KAESER air receivers.

All air receivers are designed, manufactured and tested by us in accordance with the Pressure Equipment Directive 2014/68/EU (formerly 97/23/EC) and AD2000 regulations. Furthermore, acceptance and certification according to the rules of the established international vessel classification societies are an indispensable standard for us.

Rigorous construction makes inspection cycles of ten years possible. This saves money and increases operational efficiency.

KAESER air receivers are available with various connection and valve options. Depending on the application, different sizes and pressures can also be accommodated. Acceptance by all classification societies is also possible upon request.

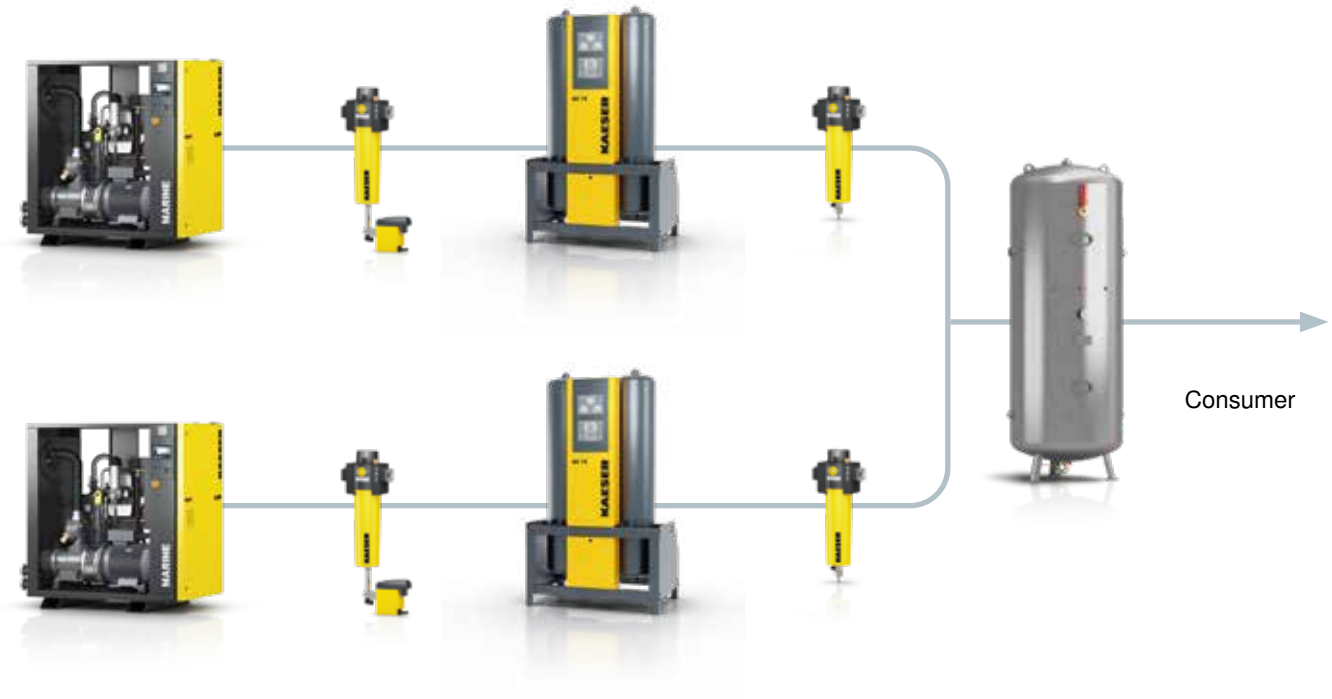
Image: Air receiver

Achievable compressed air quality classes

as per ISO 8573-1 (2010)

Particulates			Water	Oil
Max. particle count per m³ of particle size d in [µm]			Pressure dew point in °C	Total oil concentration (fluid, aerosol + gaseous) in mg/m³
0.1 < d ≤ 0.5	0.5 < d ≤ 1.0	1.0 < d ≤ 5.0		
≤ 20,000	≤ 400	≤ 10	≤ -70 °C	≤ 0.01

System layout



Rotary screw compressor | Prefilter | Dryer | KD afterfilter | Compressed air receiver

Your benefits at a glance

SIGMA PROFILE airend

KAESER developed its own rotor profile in-house in order to ensure maximum performance and efficiency for its rotary screw compressors. The SIGMA PROFILE provides significant energy savings compared with conventional rotor profile designs.

Dynamic fluid temperature control

Powered by an electric motor and integrated into the cooling circuit, the sensor-controlled temperature control valve is the heart of the innovative Electronic Thermo Management (ETM) system. The ETM system dynamically controls fluid temperatures for greater energy efficiency.

Durable and service-friendly drive

Synchronous reluctance motors do not use aluminium, copper or expensive rare earth magnets, which makes these drive systems highly durable and service-friendly. Furthermore, motor heat losses are minimised, resulting in considerably lower bearing temperatures. This ensures significantly extended bearing and motor service life.

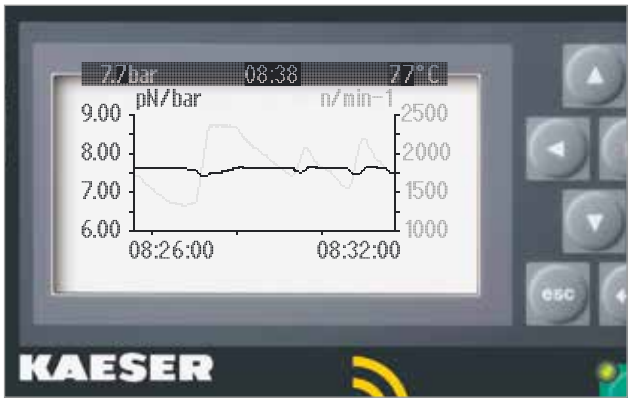
High-performance desiccant dryer

DC series desiccant dryers from KAESER provide dependable compressed air drying to a pressure dew point of -70 °C. They combine proven system design and high energy efficiency with exceptionally low maintenance costs.

N_2 production

Dependable nitrogen production

With a **rotary screw compressor range from 15 - 5100 m³/h** and a constant pressure of up to 14 bar, KAESER offers the best possible compressed air supply systems for on-board nitrogen generation, whilst setting the standard with world-renowned quality. Perfectly dimensioned coolers ensure an **exceptionally low airend discharge temperature**. Oil separation takes place via a three-stage separation process with large oil separator tanks which benefit from a long oil filter maintenance interval. Manufactured by KAESER and **maintenance-free**, the centrifugal separator is also highly effective in eliminating moisture from the compressed air. **Far less energy** is therefore required to produce premium-quality compressed air.



Ready-to-run powerhouses

KAESER rotary screw compressors are compact, **ready-to-run powerhouses**. An optional frequency converter with infinite speed control offers additional flexibility and **maintains constant pressure**. A high-quality refrigeration dryer delivers the dried compressed air required for nitrogen generation.

Stable pressure

The high pressures available for the air enable the use of **smaller membrane nitrogen generators** with the same production capacity. The air discharge pressure is **kept stable within ± 0.1 bar**, allowing these generators also to be operated without an air receiver.

Image: **HSD 782**
Motor power: 360 to 630 kW
FAD: 2,590 to 5,110 m³/h
Standard pressure: 8 to 14 bar (g)

Redundancy and energy savings

Water-cooled HSD series rotary screw compressors comprise two compressor units, each of which operates and is controlled independently of the other. **System availability is also optimised**, which means that **performance can be precisely adjusted to suit requirement** and costly **idling is kept to an absolute minimum**.

Compact and quiet

Thanks to **separate mounting and installation** of components, KAESER compressors are **exceptionally quiet and low in vibrations**. The use of flexible piping and damping pipe connections further reduces noise emissions, which **eliminates the need for cost-intensive soundproofing**.

More air, more nitrogen, more savings...

KAESER KOMPRESSOREN pushes the boundaries of compressed air efficiency and availability once again with its latest generation of DSD to FSD series rotary screw compressors. Air, water or seawater-cooled, these rotary screw compressors can be perfectly adapted to any application. The open version **features a particularly narrow design** and is therefore ideal for use on board ships. Thanks to the cooling system's **efficient and high-quality heat exchanger**, these versatile compressor packages keep a cool head at all times - even in tropical machine room temperatures. The rotary screw compressors are equipped with corrosion-free stainless steel piping, which, thanks to flexible piping connections, **ensures an exceptionally quiet and low-vibration** performance. Compressors are delivered **ready-to-run**, making on-board installation both straightforward and flexible.

Efficient and environmentally friendly

With **1:1 direct drive**, the drive motor and airend – together with the coupling and coupling flange – form a **compact, durable unit** that operates with zero drive losses. The ECO filter elements contained in the aluminium fluid filter housing are 'metal-free'. They can therefore simply be disposed of thermally at the end of their service life.

Reliable condensate pre-separation

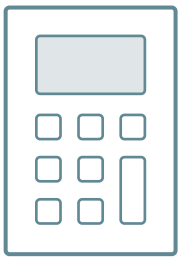
Integrated as standard, the KAESER centrifugal separator with electronic **ECO-DRAIN** condensate drain provides an exceptionally high degree of separation (>99 %) with **minimal pressure loss**. This ensures **dependable**, **energy-efficient** condensate separation performance, even at high ambient temperatures and in humid conditions, which is ideal for nitrogen generation.

System layout

Calculation example

Saving with KAESER products compared to conventional marine products

Compressor size: 310 kW **Average operating hours per year:** 1500 h



	Annual saving at 1500 operating hours	Lifetime saving 5 years	Lifetime saving 10 years	Lifetime saving 15 years	Lifetime saving 20 years	
kWh	425,700	2,128,500	4,257,000	6,385,500	8,514,000	Energy
t	5.5	27.5	55	82.5	110	MFO
t	5.9	29.3	58.5	87.8	112.5	HFO
t	5.6	28.1	56.2	84.4	112.5	LNG
t	19.3	96.5	193	289.6	386.1	CO_2 emissions

N_2 production

Your benefits at a glance

Quiet and low in vibrations

Thanks to separate mounting and installation of components, KAESER compressors are exceptionally quiet and low in vibrations. The use of flexible piping and damping pipe connections further reduces noise emissions.

Impressive performance, compact design

Made possible through water-cooling, the exceptionally compact design of KAESER rotary screw compressor stations means that they are able to deliver maximum compressed air performance with minimal space requirement. With carefully matched intake and cooling air flow, together with excellent soundproofing, sound levels are only 71-73 dB(A), which eliminates the need for cost-intensive soundproofing.

Zero drive losses

With 1:1 direct drive, the drive motor and airend – together with the coupling and coupling flange – form a compact, durable unit that operates with zero drive losses. The ECO filter elements contained in the aluminium fluid filter housing are 'metal-free'.

Dependable condensate pre-separation

Integrated as standard, the KAESER centrifugal separator with electronic ECO-DRAIN condensate drain provides an exceptionally high degree of separation (>99 %) with minimal compressed air loss.

Starting air

Full power ahead

The combination of **power**, **safety** and **reliability** makes KAESER starting air compressors the ideal choice for a wide range of applications. **Modular design** enables quick and straightforward installation, saves space and assures **maximum maintenance-friendliness**.

The compressors are available with different drive options and can be optimally adapted to specific applications using a variety of accessories. Air-cooled compressors require **minimal maintenance**, are **exceptionally compact** and achieve low airend discharge temperatures. Water-cooled reciprocating compressors can be optionally equipped to facilitate seawater cooling.

Maximum versatility

Equipped with **1 to 3 cylinders** depending on flow rate, starting air compressors compress atmospheric air in **2 or 3 stages to working pressures up to 40 bar.** Due to the wide range of options available, air or water-cooled compressors can be used on various types of vessel – from yachts to cruise ships, right up to container ships and tankers. With **low installation and maintenance costs**, starting air compressors are therefore the ideal solution for high performance requirements.

Modular design

Custom-made modules comprising air receivers and/or compressors are mainly used when **very short assembly times** are required.

Fully assembled, piped and wired, the units are completely ready-to-run following minimal installation effort.

Air-cooled

A breath of fresh air

Equipped with **1 to 3 cylinders** depending on flow rate, air-cooled reciprocating compressors compress atmospheric air in **2 or 3 stages up to 40 bar.** In addition to their durable and simple design, these space-saving compressors are **easy to install** and are highly practical thanks to their **modular construction principle**.

Image: Siemens reluctance motor

Water-cooled

Proven power

Water-cooled reciprocating compressors compress atmospheric air in **2 or 3 stages up to 40 bar.** They also impress with their quiet and low-vibration performance. These compressors require **minimal maintenance and inspection effort** to assure reliable and trouble-free operation. Cooling is possible via fresh water, as well as seawater, whilst simple handling and intelligent control ensure efficient operation at all times. The system is also ideal for high ambient temperatures, thanks to the effective water cooling.

Image: Siemens reluctance motor

Compressed air receiver

Steel and stainless steel receivers

Starting air receivers are used to store the compressed air required to start large diesel engines. The main areas of application are industrial power plants and ship propulsion systems.
In accordance with – or based on – DIN 6274 or DIN 6275, the receivers are supplied as standard in sizes from 30 to 2500 litres for a working pressure of 40 bar. Larger receivers and special versions with volumes up to approximately 25,000 litres, or with other operating specifications, are manufactured individually according to customer requirement. The receivers and valve heads are designed, manufactured, tested and certified according to the rules of the international classification and approval societies.

Valves

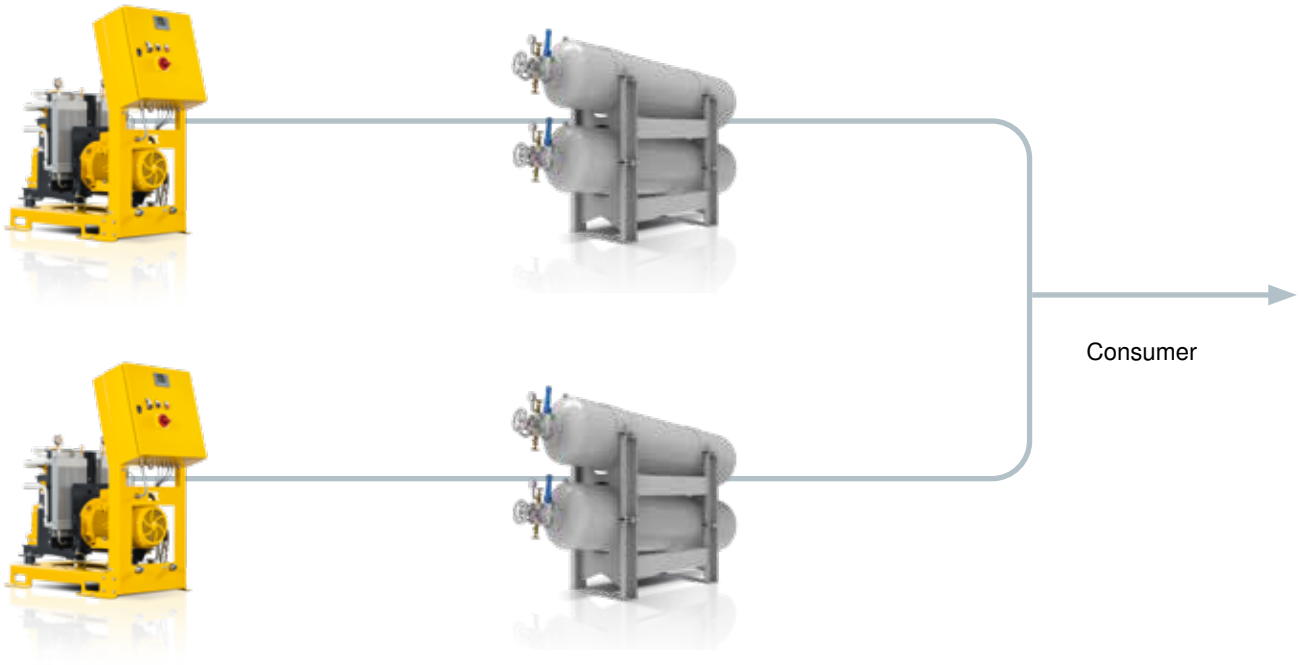
As per DIN 6276 and similar

Starting air receivers are equipped with matching valve heads in nominal sizes DN 38 (as per DIN 6276), as well as DN 50 and DN 80. The shut-off, safety and control fittings are arranged centrally on the valve head and are enclosed in a compact housing.

Typical options

- Diesel engine
- Electromagnetic centrifugal or manually operated coupling
- Oil level switch
- Thermostat for compressed air and cooling water circuit
- Ammeter
- Local remote switch
- Sequence selector switch for more than one compressor
- Accessories for seawater cooling
- Special colours

System layout



Your benefits at a glance

Modular design

Modular design enables quick and straightforward installation, saves space and assures maximum maintenance-friendliness. Custom-made modules ensure very short assembly times. Fully assembled, piped and wired, the units are completely ready-to-run following minimal installation effort.

Effective cooling

Air-cooled compressors require little maintenance, are exceptionally compact and achieve low airend discharge temperatures. Water-cooled reciprocating compressors can be optionally equipped to facilitate seawater cooling. They are also ideal for high ambient temperatures, thanks to the effective water cooling.

Wide range of options

The compressors are available with different drive options and can be optimally adapted to specific applications using a variety of accessories. Air or water-cooled compressors can therefore be used on board numerous types of vessel.

Receivers and valves

The receivers and valve heads are designed, manufactured, tested and certified according to the rules of the international classification and approval societies.

Air lubrication

Small air bubbles under the ship's hull serve to lubricate the water and therefore reduce friction in the water, known as 'ship resistance'. This reduces direct contact between the outer skin of the ship and the water, thereby lowering the ship's fuel requirement.

With this "micro-bubble" technology, small air bubbles are blown under the hull. To do this, the corresponding static pressure of 0.5 to 2 bar has to be overcome. In combination with the dynamic pressure, which depends on air speed and the pipe diameters and lengths, around 1 to 2.5 bar must be applied.

In conjunction with a correspondingly shaped hull, these air bubbles form a uniform layer beneath the ship from front to back and to the sides, which significantly reduces the ship resistance. As a result, the ship can achieve considerable fuel and emissions savings whilst operating at the same speed.

Selective Catalytic Reduction (SCR)

Selective Catalytic Reduction is one of the most effective methods for NOx reduction on motor vessels. With this technology, the NOx concentrations in the engine exhaust gas are converted into water (H2O) and nitrogen (N_2). Compressed air is required both for the injection of an aqueous urea or ammonia mixture into the exhaust gas before it enters the catalytic converter, as well as for regular particulate blow-off of the catalytic converter.

The International Maritime Organization (IMO) has set limit values for Stage I, II and III NOx emissions, which apply to every marine diesel engine with an output of more than 130 kW installed on a ship. Tier III standards only apply in NOx Emission Control Areas (ECA).

ECAs are being expanded rapidly at various locations around the world, which means that Tier III limit values are becoming increasingly commonplace when it comes to new construction projects at shipyards. The Tier III limit values require the use of special NOx emission reduction technologies, such as various forms of water introduction into the combustion process (with fuel, scavenging air or in the cylinder), exhaust gas recirculation or emission control through SCR.

Wastewater treatment

The volume of wastewater produced aboard large passenger and cruise ships can be immense. Since this wastewater cannot simply be dumped at sea or stored at the nearest port, such ships are equipped with wastewater treatment systems.

KAESER blowers supply the air required for aerobic wastewater treatment in the aeration tank. The wastewater is then directed into a settling tank, where the solids are separated. The water is subsequently sterilised and cleaned before being released into the sea.

KAESER blowers are renowned for their exceptional reliability and efficiency. As complete solutions with integrated electrics, they ensure easy on-board installation and maintenance.

Bulk handling systems

Compressed air is the first choice when it comes to transporting bulk materials. Whether for loading or flushing, KAESER rotary blowers are dependable and long-term partners for an energy-efficient compressed air supply. KAESER offers a wide range of rotary blower systems and packages with different capacities for the transportation of bulk materials. According to requirement, the blower packages contain fully integrated power electronics and are delivered ready-to-run.

On- and offshore

Containerised solutions – tailored to every need

KAESER containerised solutions are tailored to individual customer needs and can be operated in temperatures ranging from -50 °C to +45 °C. Ambient temperatures above +45 °C require alternative turnkey solutions, which can be offered according to requirement. KAESER guides its customers every step of the way from enquiry, design, order, factory approval, packaging, loading and transportation to unloading and initial on-site commissioning. The systems are manufactured to meet all application, marine and country-specific needs and can be offered with all common marine certifications. KAESER customers have the option of installing their turnkey compressor station(s) on-site, thereby reducing both costs and time. The systems can be designed, constructed, manufactured, tested and adjusted according to the agreed operating parameters at various KAESER locations. When installing several containers, care is taken to ensure that they can be operated both as single units and in combination with one another. System operation in association with the proven SIGMA AIR MANAGER 4.0 master controller guarantees best possible utilisation efficiency. This type of installation reduces on-site compressor installation time to a minimum.

KAESER has been successfully equipping a wide variety of industries for many years. Prestigious companies from all around the world can attest to KAESER's expertise. With its decades of experience in compressed air system design and engineering across a multitude of sectors, KAESER continues to strengthen its capabilities through direct cooperation with customers. This results in innovative solutions based on proven technology.

Image: Example installation

(1)	Galvanised sheet steel	(5)	DC desiccant dryer	(9)	Filter
(2)	Floodlights	(6)	Aquamat	(10)	Electric heater
(3)	700 mm escape route	(7)	Control cabinet	(11)	Attachment point
(4)	CSD package	(8)	Piping		

Image: Multi-container compressed air installation

Mitigation of underwater radiated Noise

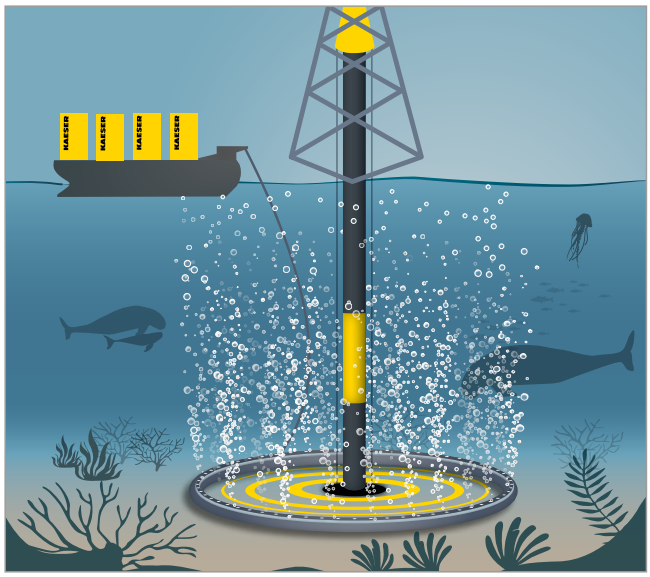
Wind farms, offshore platforms and port extensions

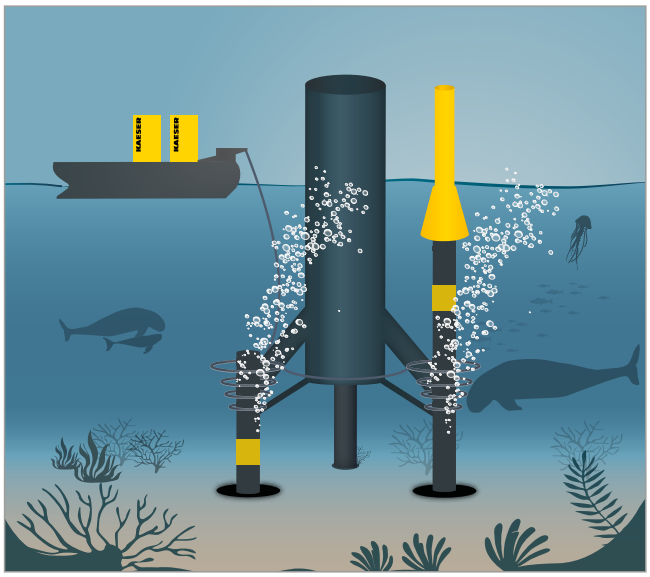
Big Air Bubble Curtain (BBC)

- Hose with drilled holes on the seabed to create a bubble screen with compressed air
- Project-specific volumes of compressed air, hose laying configuration & hose length
- Pile driving, drilling, dredging and detonation

Small Air Bubble Curtain (SBC)

- Adjusted and positioned much closer to the noise source than BBC
- Consists of a fixed frame arranged around the sound source, with several configuration options
- Pile driving and drilling





SIGMA CONTROL 2 controller

The SIGMA CONTROL 2 controller coordinates compressed air generation and consumption. With its intelligent control, this advanced system ensures efficient energy usage, especially during partial load operation. The industrial PC saves the last 200 operational events, helping you and KAESER Service to find and reproduce faults quickly. Furthermore, the integrated web server enables you to display operating data, maintenance and alarm messages on any PC. The SIGMA CONTROL 2 can be operated in any of 30 selectable languages, whilst a logical menu structure simplifies operation.

Software updates and operating parameters can be uploaded and transferred quickly via the available SD card slot. This minimises service costs and allows the SD card to be used for long-term storage of key operating data.

Clear authorisation

Your security is our priority

You decide which changes can be made and by whom.

Type testing

Simple and fast approval

Certified by all marine classification societies.

Long-lasting reliability

KAESER quality

We understand perfect system control.

Plug & Work

Ready-to-run in seconds

All-in-one, intelligent design.

Data storage

Secure your data

All relevant messages and operating data are recorded.

Web server

Always up-to-date

The user interface keeps you constantly updated in real-time.

Control types

Dual, Quadro, Vario, Dynamic

The different control types of the compressor control are integrated on all compressors by default. They enable the most efficient compressor operation for the various applications and modes of operation.

SIGMA AIR MANAGER 4.0

Master Controller

The SIGMA AIR MANAGER 4.0 compressed air management system monitors and controls all components within the compressed air supply system to achieve maximum energy and cost savings.

Exceptional versatility

Perfectly matched

All components operating in harmony via a single powerful unit.

Identify, analyse, react

Masterful communication

Simple and versatile data exchange.

The essence of efficiency

Connecting all strands

A firm grasp of all models and variants.

30 languages

International application

The SIGMA CONTROL 2 speaks 30 languages.

Reliable

Continuous monitoring

Target-oriented sensors provide comprehensive monitoring of all status data.

KAESER Marine Service: Anytime, anywhere

KAESER Service is only a moment away – no matter where you are. Globally networked and centrally coordinated by the Marine Head Office (MHO) in Coburg / Germany, qualified KAESER service specialists are waiting at the next port of call, or can be available following a telephone call as soon as the ship has docked.

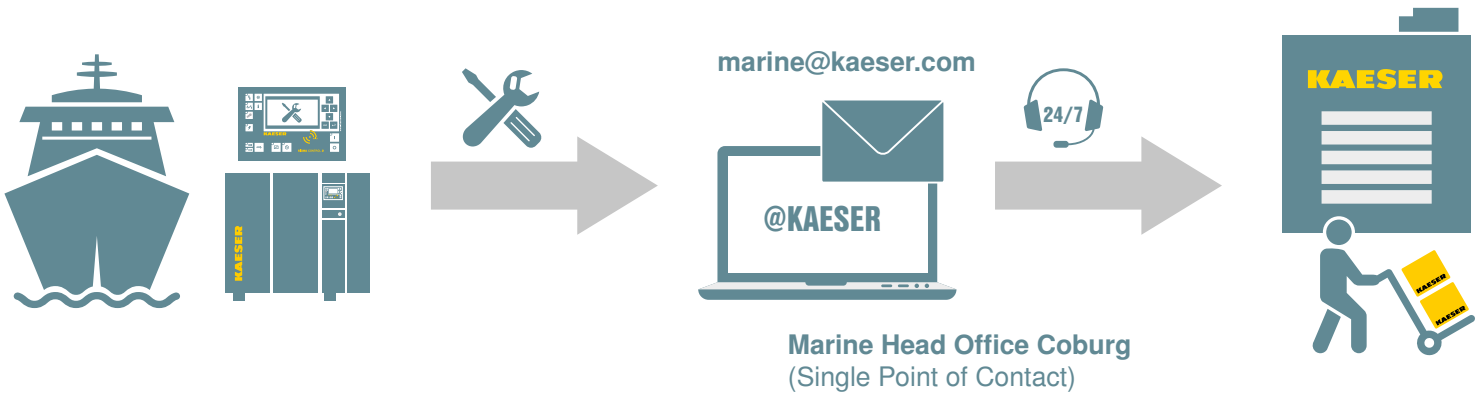
6 specialised Marine Service Hubs (MSH) located around the world are available to provide assistance whenever it is needed. KAESER service engineers, technicians and spare parts are there to ensure safe and reliable operation anytime and anywhere in the world.

Computer-aided parts logistics, constant availability of genuine KAESER spare parts and a global network of KAESER subsidiaries assure optimal parts supply.

Complete service kits are available for regular on-board maintenance.

- **Location**
- Branches
- Marine Stock/Service Hubs
- Service technicians
- Service package

Delivery process



Marine Head Office Coburg
(Single Point of Contact)


Norway (MSH)
Coburg (MHO / MSH)
Busan (MSH)
Shanghai (MSH)
Singapore (MSH)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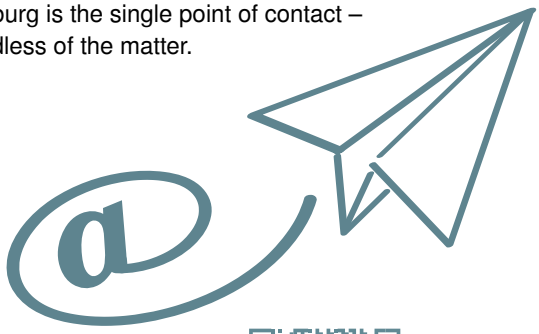
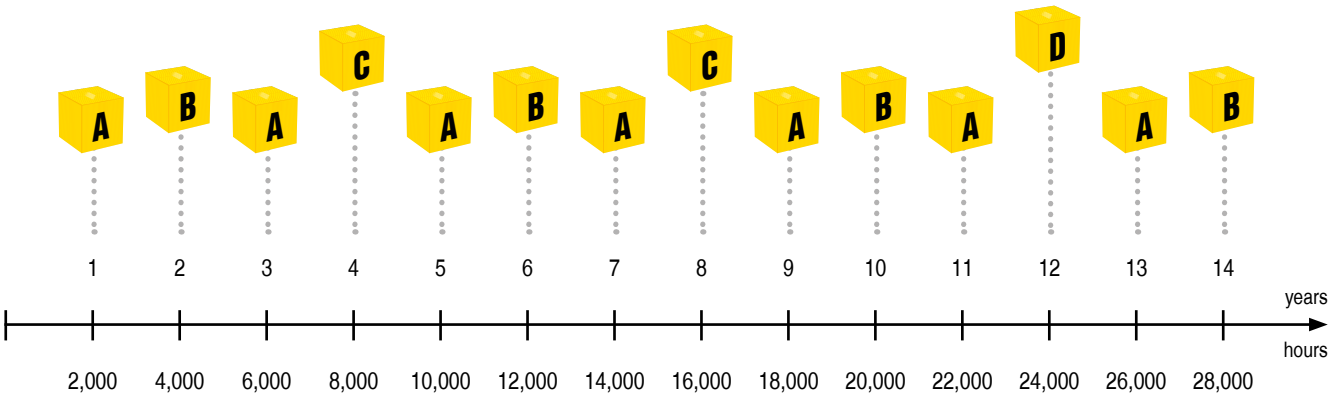
24h emergency service – Single Point of Contact

Compressed air needs to be available all day, every day, which is why technical support staff, replacement parts and service technicians are on standby to provide emergency support 24/7. The Marine Head Office (MHO) in Coburg is the single point of contact – regardless of the matter.



marine@kaeser.com

Marine service intervals



Service Kit A: Filtration
Service Kit B: Filtration, lubrication
Service Kit C: Filtration, lubrication, valve maintenance
Service Kit D: Filtration, lubrication, valve and motor maintenance, electrical components

Specially trained service technicians

KAESER has specially trained service technicians located around the world to provide assistance, whenever and wherever it is needed.

In order to ensure the highest-quality training, service technicians are trained at the company's own plant locations. This offers several advantages:

Cutting-edge service expertise – irrespective of whether from a mechanical, air treatment, or control technology perspective.

KAESER technicians are also experts in compressed air system optimisation and system efficiency – which means they always have an eye on the bigger picture.

Marine service technicians are highly trained, certified and arrive on board with all the necessary specialised equipment. They are therefore perfectly equipped for any task, whatever the vessel.

KAESER SPECIALIST CERTIFIED

Your benefits at a glance

One contact for all queries

Purchase, maintenance or emergency – you will always have the right contact at KAESER. No matter what the question may be, support is always available from the Marine Head Office (MHO) in Coburg / Germany – 24 hours a day, 7 days a week, 365 days a year.

Expert service hubs

Quality is not just a promise at KAESER – the same applies to the Marine Service Hubs (MSH) located throughout the world. They have highly trained service technicians at their disposal, who are fully certified and specially equipped for the task at hand.

Extensive global network

When time is of the essence, KAESER's extensive global network is also there to provide rapid assistance. In addition to the specialised Marine Service Hubs (MSH), KAESER branches and exclusive distribution partners in over 140 countries are on hand to meet customer needs.

KAESER – Your one-stop shop

From compressors and accessories to service kits, KAESER is your one-stop-shop for all of your compressed air needs. Whether on land or at sea, perfectly matched components ensure an ever-dependable supply of quality compressed air.

KAESER KOMPRESSOREN®

The world is our home

As one of the world's largest manufacturers of compressors, blowers and compressed air systems, KAESER KOMPRESSOREN is represented throughout the world by a comprehensive network of branches, subsidiaries and authorised distribution partners in over 140 countries.

By offering innovative, efficient and reliable products and services, KAESER KOMPRESSOREN's experienced consultants and engineers work in close partnership with customers to enhance their competitive edge and to develop progressive system concepts that continuously push the boundaries of performance and technology. Moreover, decades of knowledge and expertise from this industry-leading systems provider are made available to each and every customer via the KAESER group's advanced global IT network.

These advantages, coupled with KAESER's worldwide service organisation, ensure that every product operates at peak performance at all times, whilst providing maximum availability.

LGA InterCert
Certified
QM/EM System
DIN EN ISO 9001:2015/
14001:2015

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P-222ED Specifications subject to change without notice. 6/22