



# Rotary Screw Compressors

## ESD Series

With the world-renowned SIGMA PROFILE

Flow rate 6.2 to 47.2 m<sup>3</sup>/min, Pressure 5.5 to 15 bar

ESD series

# Setting the standard

KAESER KOMPRESSOREN pushes the boundaries of compressed air efficiency and availability once again with its latest generation of **ESD** series rotary screw compressors. Intelligent design solutions have not only lead to enhanced ease of operation and serviceability, but also give this series of class-defining compressors their distinctive modern appearance.

## ESD – The multi-saver

Delivering improved specific power, the flow-optimised and further refined SIGMA PROFILE rotors provide the foundation for exceptional energy efficiency. The use of high performance IE4 drive motors maximises energy efficiency, whilst KAESER's 1:1 drive design eliminates the transmission losses associated with gear or V-belt driven systems, as the motor directly drives the airend. Furthermore, the radial fan fulfils the efficiency requirements for fans as per EU directive 327/2011. Last, but not least, the advanced SIGMA CONTROL 2 compressor controller achieves additional energy savings and minimises cost-intensive idling periods through the use of a variety of specially developed control options, e.g. Dynamic Control.

## Service-friendly = Efficient

The distinctive and eye-catching design of these systems from the outside is complemented by intelligent component layout on the inside for even greater energy efficiency: for example, all service and maintenance points are within easy reach and are directly accessible from the front of the unit. This not only saves time and money when performing service work, but also maximises compressed air system availability.

## Perfect partners

ESD series rotary screw compressors are the perfect partners for high-efficiency industrial compressed air stations. The internal SIGMA CONTROL 2 compressor controller offers numerous communications interfaces (e.g. Ethernet), which, when connected within the KAESER SIGMA NETWORK, allows seamless communication with advanced master controllers, such as KAESER's SIGMA AIR MANAGER 4.0, and in-house centralised control systems. This enables simple set-up and achieves unprecedented levels of efficiency.

## Electronic Thermo Management

Powered via an electric motor, the sensor-controlled temperature control valve integrated into the cooling circuit is the heart of the innovative Electronic Thermo Management (ETM) system. The SIGMA CONTROL 2 compressor controller monitors intake and compressor temperature in order to prevent condensate formation, even under conditions with higher air humidity. ETM dynamically controls the fluid temperature and low fluid temperature enhances energy efficiency. ESD packages are equipped with additional ETM systems if heat recovery is used. This enables heat recovery to be better adapted to the customer's exact requirements.

## Why choose heat recovery?

The question should in fact be: Why not? Amazingly, up to 100 % of the (electrical) energy input to a compressor is converted into heat. Up to 96 % of this energy can be recovered and reused for heating purposes. This not only reduces primary energy consumption, but also significantly improves the applicable company's total energy balance.



Up to  
**96%**  
usable for heating

The infographic features a dark teal background. On the left, the text 'Up to 96% usable for heating' is written in white. To the right of the text is a yellow bar chart with three bars of varying heights, representing the percentage of energy recovered for heating.

# Service-friendly



Image: Air-cooled ESD 445



09:26 75°C  
ON LOAD  
Key - on 30A - Load  
Run 13005h Load 17105h  
Maintenance Int. 1995h

KAESER



GAMMA CONTROL 2

KAESER  
KOMPRESSOREN  
02/20XX

ESD series

# Energy savings in every detail



## Save energy with the SIGMA PROFILE

At the heart of every ESD system lies a premium quality airend featuring KAESER's SIGMA PROFILE rotors. Operating at low speed, KAESER's airends are equipped with flow-optimised rotors for superior efficiency.



## SIGMA CONTROL 2: Optimum efficiency

The internal SIGMA CONTROL 2 controller ensures efficient compressor control and monitoring at all times. The large display and RFID reader provide easy communication and maximum security. Variable interfaces enable seamless networking capability, whilst the SD card slot makes updates quick and easy.



## Tomorrow's technology, today: IE4 motors

KAESER is currently the only compressed air systems provider to equip its compressors with super premium efficiency IE4 motors as standard, thereby delivering maximum performance and energy efficiency.



## Correct temperature assured

According to operating conditions, the innovative Electronic Thermo Management (ETM) system dynamically controls fluid temperature to ensure safe prevention of condensate accumulation and also boosts energy efficiency.

ESD series

# Efficient in every way



## 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 pressure loss. Dependable and efficient condensate separation is therefore assured at all times, even under conditions with high ambient temperatures and humidity.



## Environmentally-friendly fluid filter

The ECO-filter elements housed in the aluminium fluid filter enclosure are 'metal-free'. They can therefore simply be disposed of thermally at the end of their service life.



## Optimised intake valve

The new flow-optimised design of the inlet valve helps minimise intake pressure losses and simplifies servicing.



## Energy-saving 1:1 direct drive

With 1:1 direct drive, the drive motor and air end – together with the coupling and coupling flange – form a compact durable unit that operates with zero drive losses.





# Clever cooling, significant savings



## Low operating temperature

Thermostat-controlled fans with variable speed motors produce the exact amount of cooling air required by the fluid cooler to ensure low operating temperatures. This significantly reduces the overall energy demand of ESD rotary screw compressor systems.



## Low compressed air temperature

Effective aftercooling helps maintain low compressed air discharge temperature. This, in combination with the centrifugal separator, removes large volumes of condensate, which is then drawn off without energy loss via the electronically controlled ECO-DRAIN condensate drain. In turn, the burden on downstream treatment equipment is also reduced.



## Coolers cleaned from the outside

Unlike internally installed heat exchangers, the externally installed coolers in ESD systems are easy to access and simple to clean. Operational reliability and availability are therefore enhanced, as contaminant build-up is easily spotted.

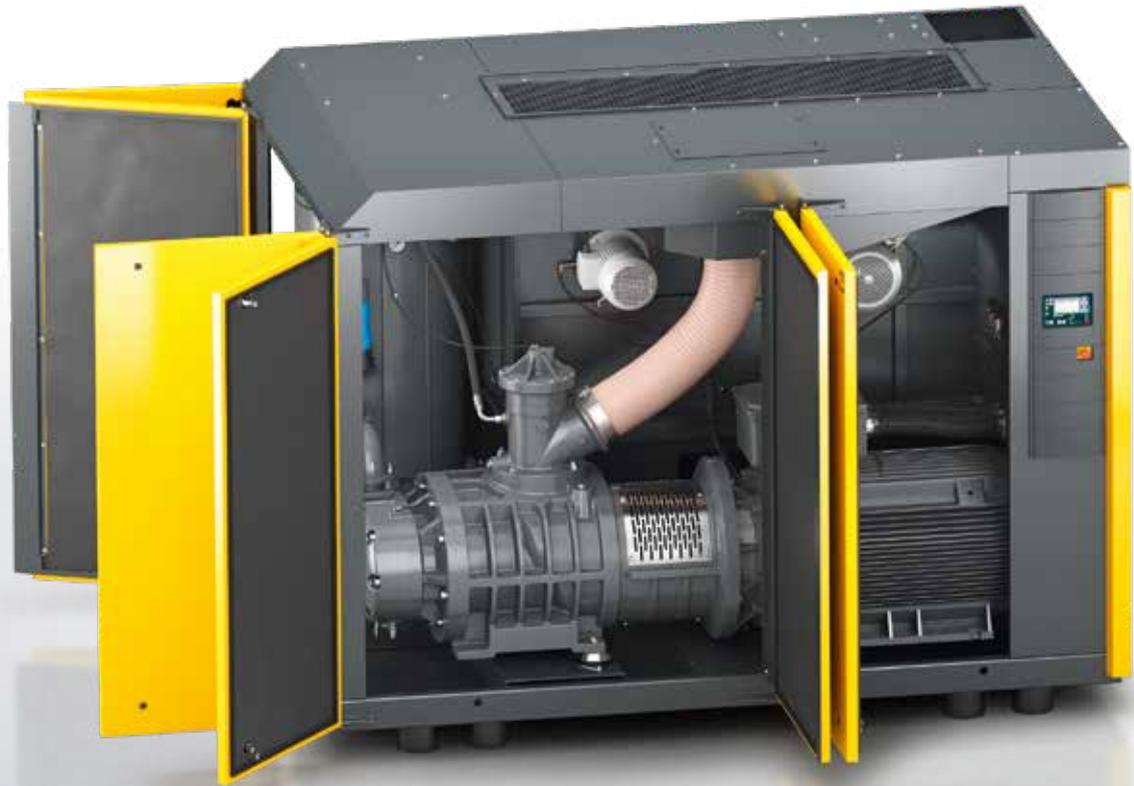


## High residual thrust exhaust air

The integrated radial fans are considerably more efficient than axial fans and provide high residual thrust. This generally enables the warm exhaust air to be directly ducted away without the need for an auxiliary fan.

Service-friendly

# Excellent accessibility



## Oil separator cartridge replacement

The cartridge can be replaced easily from the top; removal of just one enclosure section on the top is required. The oil separator tank cover can be swung out inside the system.

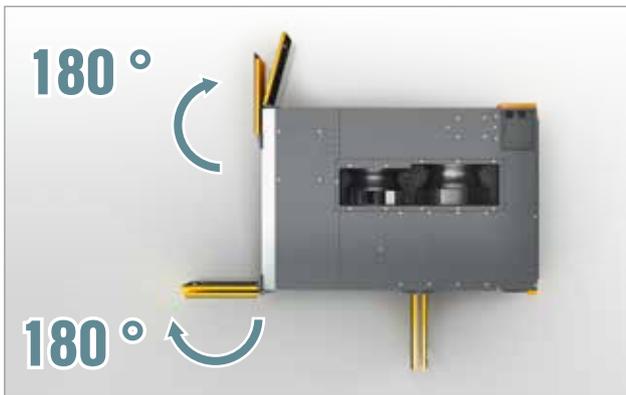


## External lubrication

Electric motors must be lubricated while running. In ESD systems, service staff can easily perform this task for the drive and fan motors from the outside of the machine, thereby ensuring maximum safety.



Image: Air-cooled ESD 375



### Service doors open 180°

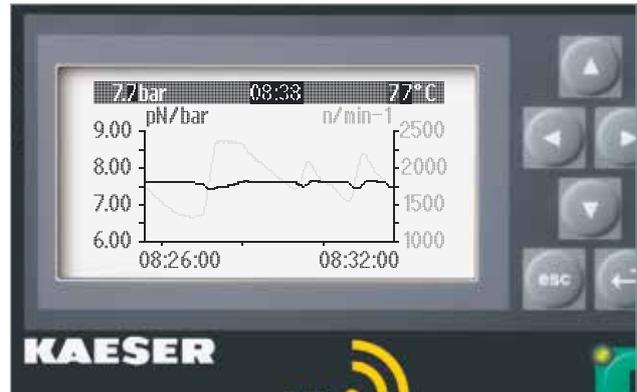
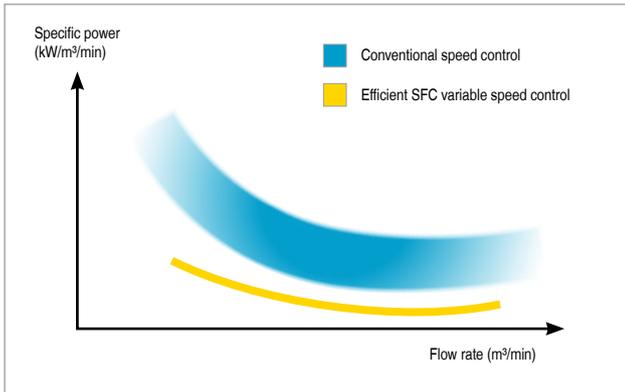
The wide-opening service doors allow excellent accessibility to all components for maximum ease of service. This speeds up service work, which reduces operating costs and increases availability.



### Easy replacement of maintenance parts

Just like the air filter which is changed from the front of the unit, all other maintenance parts are easily accessible. Thanks to the intake filter's additional pre-separation filter matting, larger particles are captured and the service life of the filter element is significantly extended.

# Compressor with variable speed drive



## Optimised specific power

The variable speed rotary screw compressor is the most heavily loaded piece of equipment in every compressor station. ESD-SFC models are therefore designed to provide maximum efficiency without running at extreme speeds. This saves energy, maximises service life and enhances reliability.

## Precision pressure control

The flow rate can be adjusted within the control range according to pressure to suit actual compressed air demand. As a result, operating pressure is precisely maintained to within  $\pm 0.1$  bar. This allows maximum pressure to be reduced which saves both energy and money.



## Separate SFC control cabinet

The SFC (SIGMA FREQUENCY CONTROL) variable speed drive is housed in its own control cabinet to shield it from heat from the compressor. A separate fan keeps operating temperatures in the optimum range to ensure maximum performance and service life from the SFC unit.

## EMC-certified

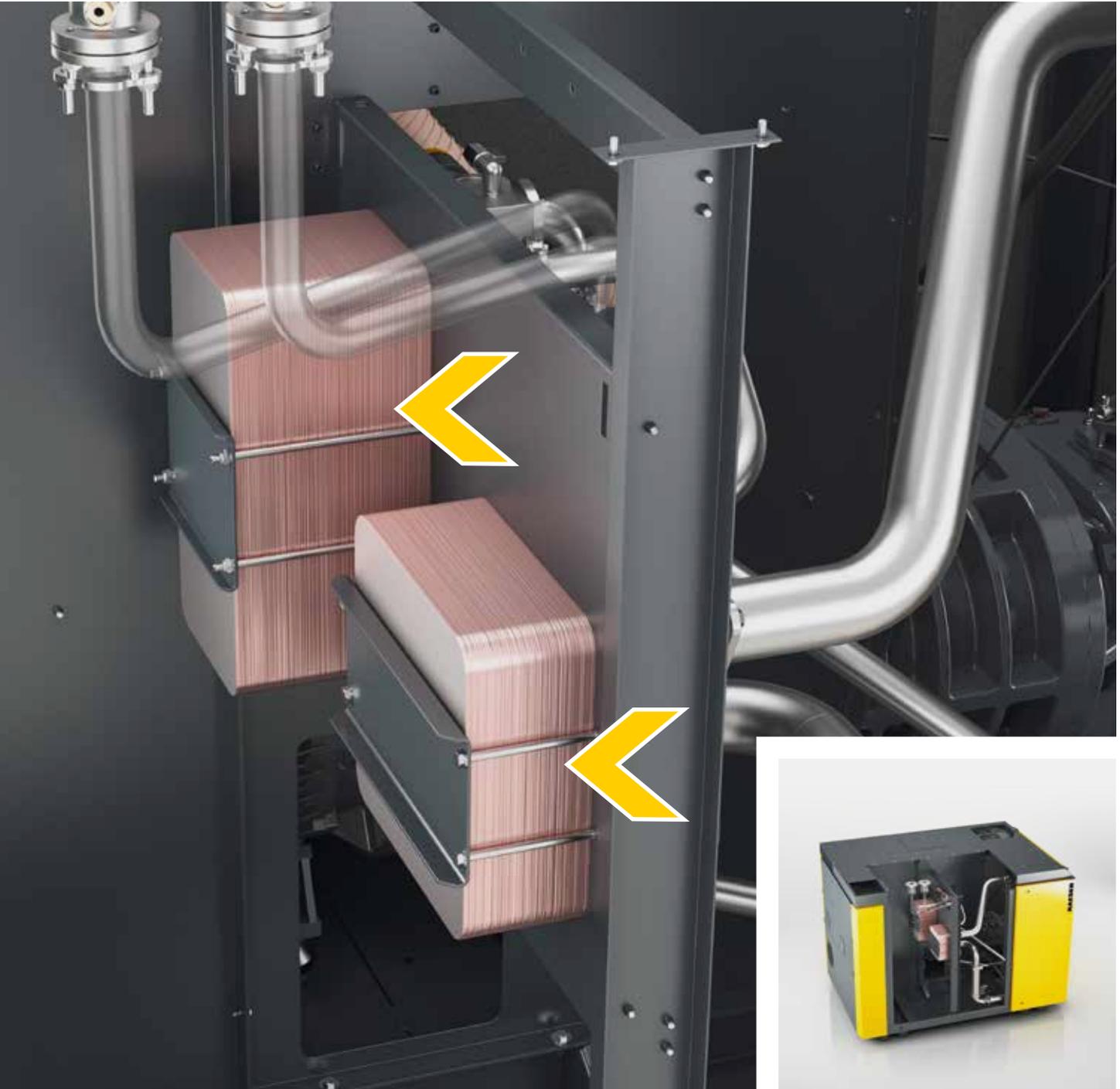
It goes without saying that the SFC control cabinet and SIGMA CONTROL 2 are tested and certified both as individual components and as a complete system to EMC directive EN 55011 for Class A1 industrial power supplies.



FSD SFC model shown

ESD series - water-cooled...

## ...with plate heat exchanger



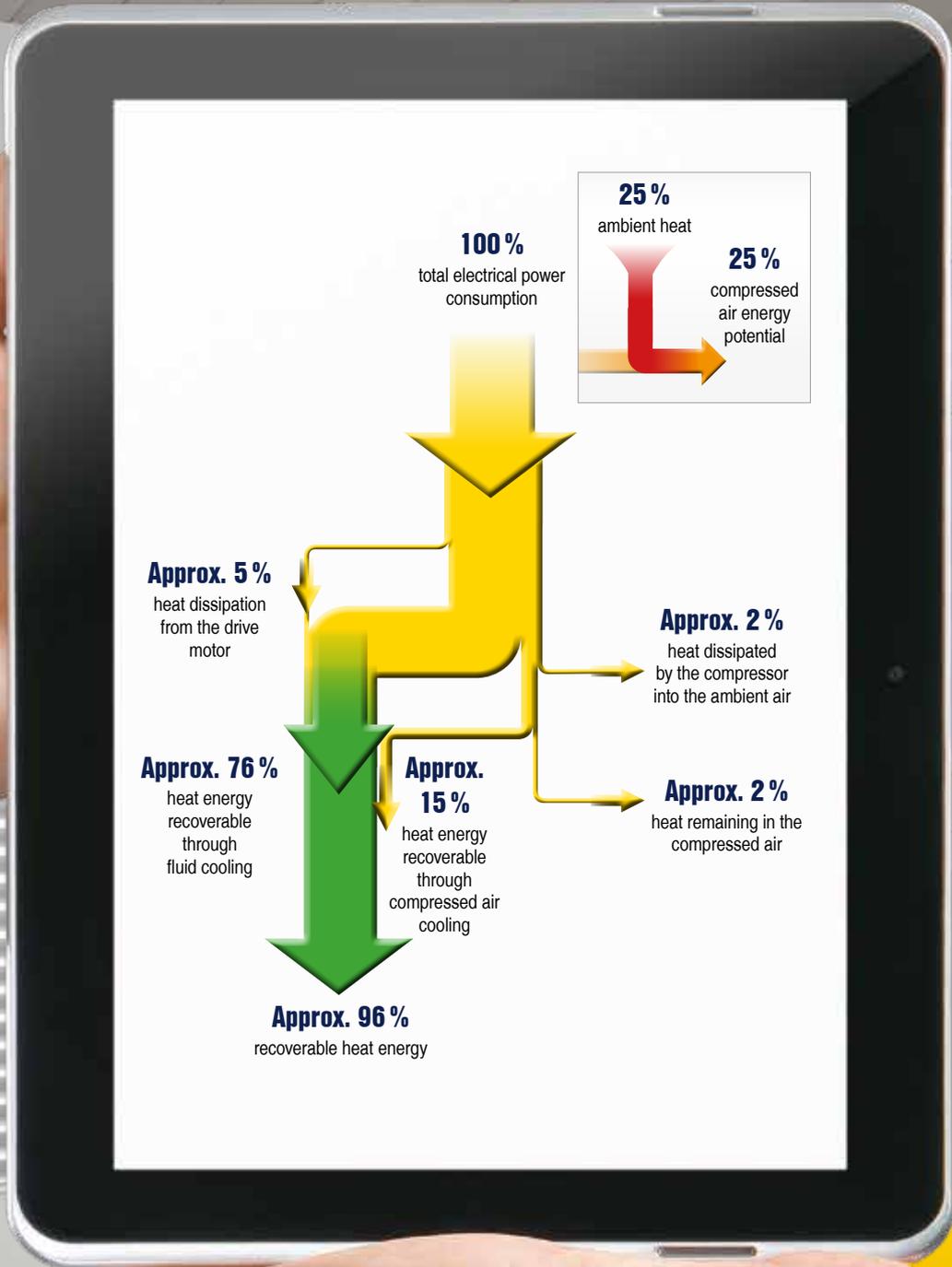
Two copper plate-soldered stainless-steel plate-type heat exchangers assure high cooling capacity thanks to the plate corrugation design with excellent heat transmission properties. This is the perfect choice for applications with clean compressor cooling water.

## ...with shell and tube heat exchanger



Providing sufficient cooling performance, shell and tube heat exchangers made of copper-nickel alloy (CuNi10Fe) in plate heat exchangers are less prone to contamination, are more robust and can be mechanically cleaned. Furthermore, the cooler inserts can be changed very easily.

In addition they are seawater-proof, which means that they are suitable for compressors used in shipping operations and also operate with minimal pressure loss.



**Savings example for warm air heat recovery in terms of fuel oil (ESD 445)**

Maximum available heat capacity:	195 kW
Fuel value per litre of fuel oil:	9.86 kWh/l
Fuel oil heating efficiency:	90 % (0.9)
Price per litre of fuel oil:	0.60 €/l

**Cost saving:**  $\frac{195 \text{ kW} \times 2000 \text{ h per year}}{0.9 \times 9.86 \text{ kWh/l}} \times 0.60 \text{ €/l} = \text{€ } 26,366 \text{ per year}$

Further information regarding heat recovery:  
<http://www.kaeser.com/int-en/products/rotary-screw-compressors/heat-recovery/>

Heat recovery system

## Cost-effective heating



### Heat recovery is a win

Amazingly, 100 % of the electrical drive energy input to a compressor is converted into heat energy. Of that, up to 96 % is available for heat recovery purposes. Use this potential to your advantage!



### Space heating with warm exhaust air

It's heating made easy: thanks to the high residual thrust radial fan, exhaust (warm) air can be easily ducted away to spaces that require heating. This simple process is thermostatically controlled.



### Process, heating and service water

Hot water, up to 70 °C, can be produced from reusable compressor heat via PWT<sup>†</sup> heat exchanger systems. Please contact KAESER regarding higher temperature requirements.

<sup>†</sup> optionally installed within the package



### Clean hot water

If no other water circuit is interconnected, special fail-safe heat exchangers meet the highest demands for the purity of the water being warmed, as is the case with cleaning-water in the food industry for example.

Heat recovery

# Energy-saving, versatile and flexible

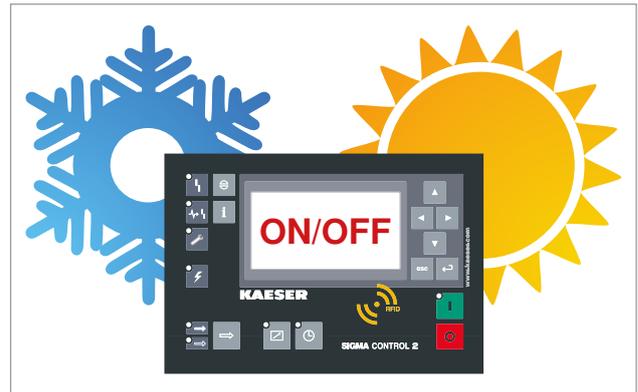


## Dual Thermo Management

ESD packages with integrated heat recovery are equipped with two electromotive temperature control valves (ETM), one for the heat recovery system and one for the package oil cooler.

## Flexible temperature

The SIGMA CONTROL 2 controller enables precision setting of the required airoend discharge temperature for the compressed air, in order to achieve the desired water discharge temperature from the heat recovery system.

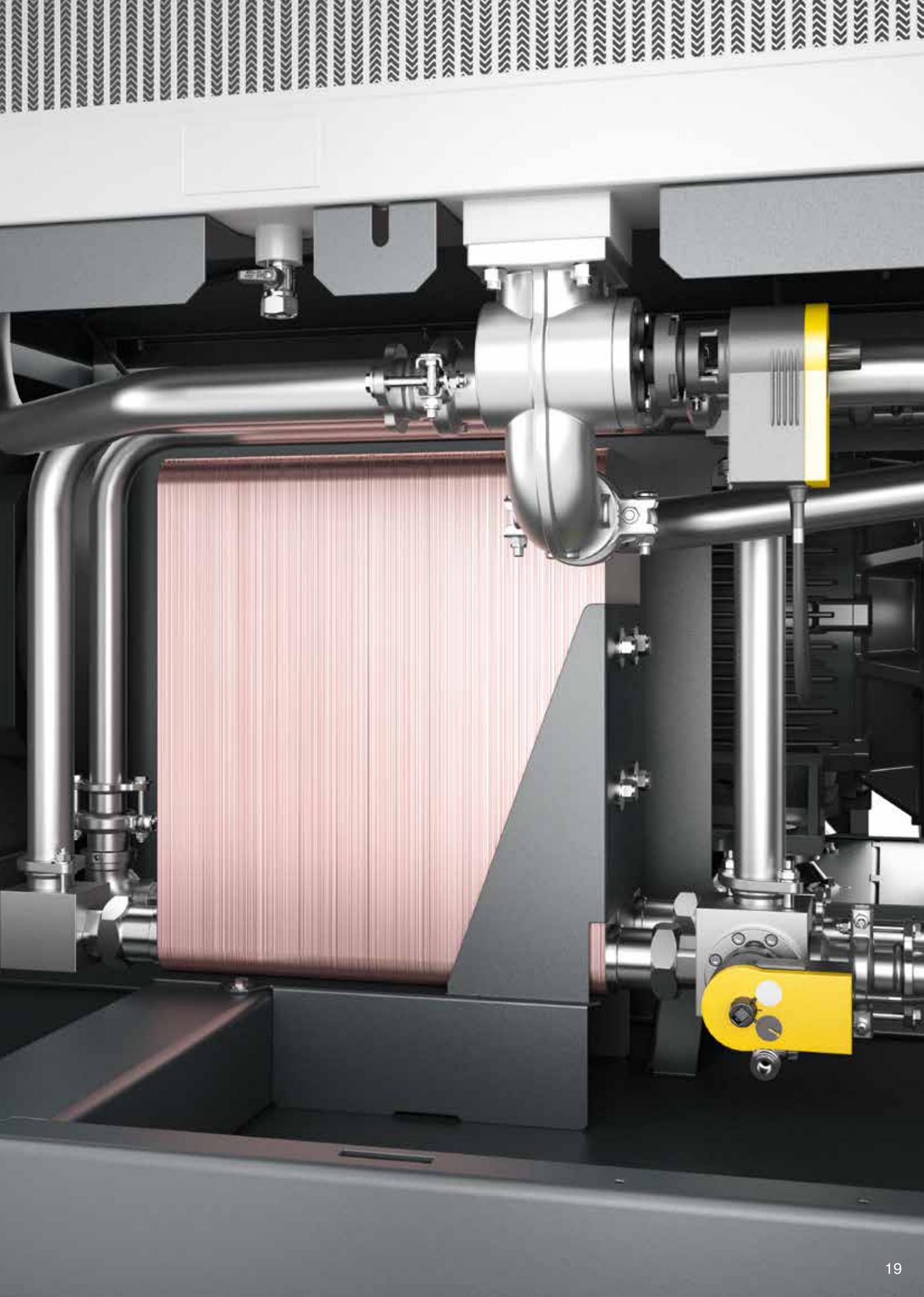


## Save energy with the SIGMA CONTROL 2

If all of the heat energy is drawn-off by the heat recovery system, then the SIGMA CONTROL 2 recognises that cooling is no longer required on the package cooler and, as a result, the fan on the fluid cooler is shut off. This achieves further energy savings.

## Winter ON – Summer OFF

If no heat recovery is required, such as in the summer months for example, this can be simply deactivated using the SIGMA CONTROL 2. Therefore, under ETM control, the package immediately starts to operate at maximum energy efficiency with lowest possible airoend temperature.



# Equipment

## Complete unit

Ready for operation, fully automatic, silenced, vibration damped, all panels powder coated. Can be used in ambient temperatures up to +45 °C. Service-friendly design: bearings for drive and fan motors can be lubricated externally.

## Airend

Genuine KAESER single-stage rotary screw airend with energy-saving SIGMA PROFILE rotors and cooling-fluid injection for optimised rotor cooling. 1:1 direct drive.

## Fluid and air flow

Dry air filter with pre-separation, inlet silencer, pneumatic intake and venting valve, cooling fluid reservoir separator tank with three-stage separation system; safety valve, minimum pressure check valve, Electronic Thermo Management (ETM) and eco fluid filter in cooling circuit, fluid and compressed air aftercooler (air-cooled as standard); two fan motors (one with variable speed control); KAESER centrifugal separator with electronically controlled ECO-DRAIN condensate drain (high efficiency and zero pressure loss); stainless steel pipework and centrifugal separator.

## Water-cooled version

Fluid and compressed air aftercoolers are designed as water-cooled plate or, alternatively, tubular heat exchangers (optionally also seawater-resistant); water circuit in stainless steel piping 1.4301.

## Optimised separator system

The combination of flow-optimised pre-separation and special separator cartridges results in minimal remaining fluid content of < 2 mg/m<sup>3</sup> in the compressed air. This separator system requires less maintenance.

## Internal heat recovery (optional)

Optionally equipped with integrated fluid-water plate heat exchangers and additional fluid thermostats; external connections.

## Electrical components

Super premium efficiency IE4 drive motor with three Pt100 winding temperature sensors for motor monitoring, IP 54 control cabinet, control cabinet ventilation, automatic

star-delta protection combination, overload relay, control transformer; for SFC version: frequency converter for drive motor.

## SIGMA CONTROL 2

"Traffic light" style LED indicators show operational status at a glance, plain text display, 30 selectable languages, soft-touch keys with icons, fully automated monitoring and control. Selection of Dual, Quadro, Vario, Dynamic and continuous control as standard. Interfaces: Ethernet; additional optional communication modules for: Profibus DP, Modbus, Profinet and Devicenet. SD-card slot for data-logging and updates; RFID reader, web server.

## Efficient dynamic control

The dynamic control feature calculates run-on times based on the measured motor winding temperature. This reduces idling times and energy consumption. Additional control options are stored in the SIGMA CONTROL 2 and can be called up as required.

## SIGMA AIR MANAGER 4.0

The further-refined adaptive 3-D<sup>advanced</sup> Control predictively calculates and compares various operating scenarios and selects the most efficient to suit the compressed air application's specific needs.

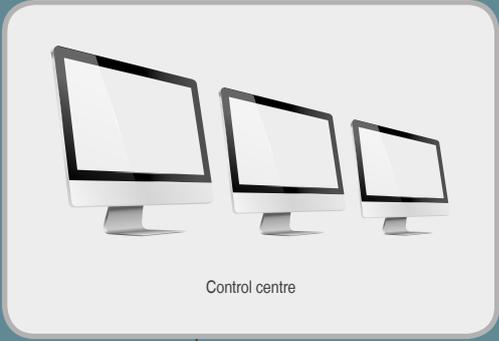
The SIGMA AIR MANAGER 4.0 therefore automatically optimally adjusts flow rates and compressor energy consumption in response to current compressed air demand. This powerful feature is made possible by the integrated industrial PC with multi-core processor in combination with the adaptive 3-D<sup>advanced</sup> Control. Furthermore, the SIGMA NETWORK bus converters (SBC) provide a host of possibilities to enable the system to be individually tailored to meet exact user requirements. The SBC can be equipped with digital and analogue input and output modules, as well as with SIGMA NETWORK ports, to enable seamless display of flow rate, pressure dew point, power or alarm message information.

Amongst other key features, the SIGMA AIR MANAGER 4.0 provides long-term data storage capability for reporting, controlling and audits, as well as for energy management tasks as per ISO 50001.

*(See image to the right; excerpt from the SIGMA AIR MANAGER 4.0 brochure)*



Digital output device, e.g. laptop



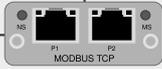
Control centre

KAESER CONNECT

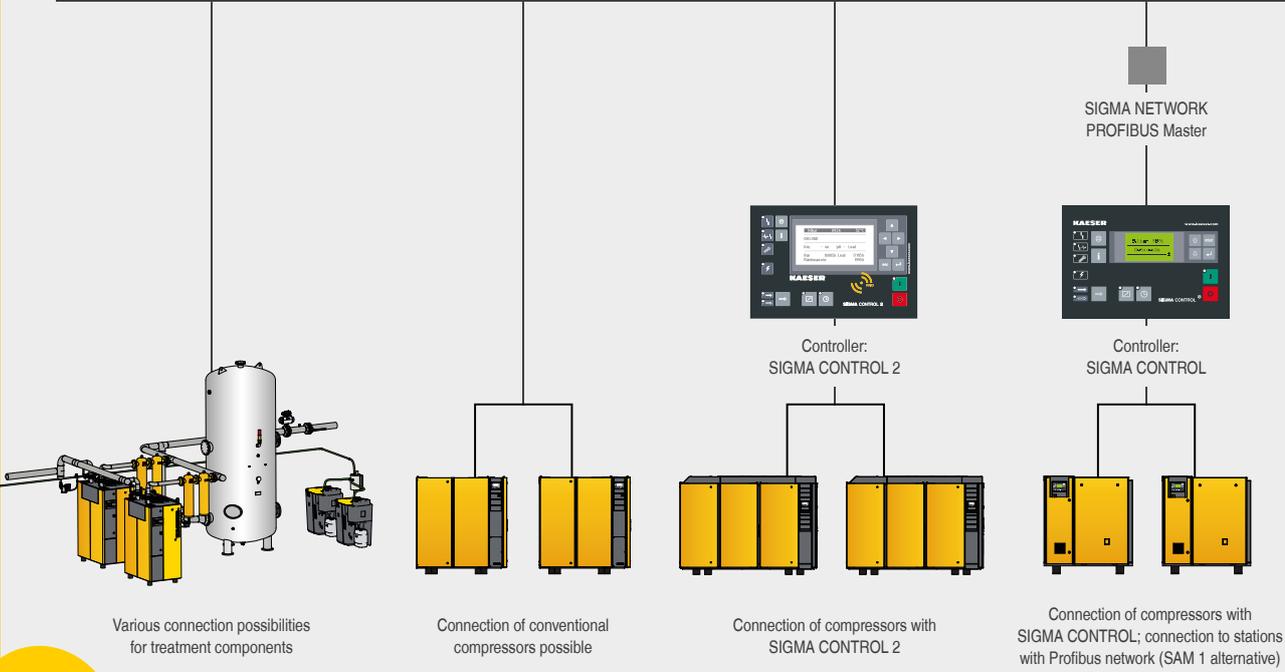


SIGMA AIR MANAGER 4.0

Communications module e.g. Modbus TCP



## KAESER SIGMA NETWORK



# Secure data – secure business!

# Technical specifications

## Standard version

Model	Operating pressure	Flow rate <sup>*)</sup> Overall system at operating pressure	Max. working pressure	Drive motor rated power	Dimensions W x D x H	Compressed air connection	Sound pressure level <sup>**)</sup>	Mass
	bar	m <sup>3</sup> /min	bar	kW	mm		dB(A)	kg
ESD 375	7.5	37.85	8.5	200	2960 x 2030 x 2140	DN 100	75	5000
	10	30.13	12					
	13	24.34	15					
ESD 445	7.5	42.20	8.5	250	2960 x 2030 x 2140	DN 100	76	5060
	10	37.23	12					
	13	29.67	15					



## SFC – Version with variable speed drive

Model	Operating pressure	Flow rate <sup>*)</sup> Overall system at operating pressure	Max. working pressure	Drive motor rated power	Dimensions W x D x H	Compressed air connection	Sound pressure level <sup>**)</sup>	Mass
	bar	m <sup>3</sup> /min	bar	kW	mm		dB(A)	kg
ESD 375 SFC	7.5	8.60 – 37.60	8.5	200	3200 x 2030 x 2140	DN 100	76	5480
	10	8.22 – 32.51	12					
	13	6.40 – 27.48	15					
ESD 445 SFC	7.5	10.60 – 43.2	8.5	250	3200 x 2030 x 2140	DN 100	77	5660
	10	8.33 – 37.89	12					
	13	7.77 – 31.94	15					



\*) Flow rate complete system as per ISO 1217: 2009 Annex C/E: Absolute inlet pressure 1 bar (a), cooling and air inlet temperature +20 °C

\*\*) Sound pressure level as per ISO 2151 and basic standard ISO 9614-2, tolerance: ± 3 dB (A)

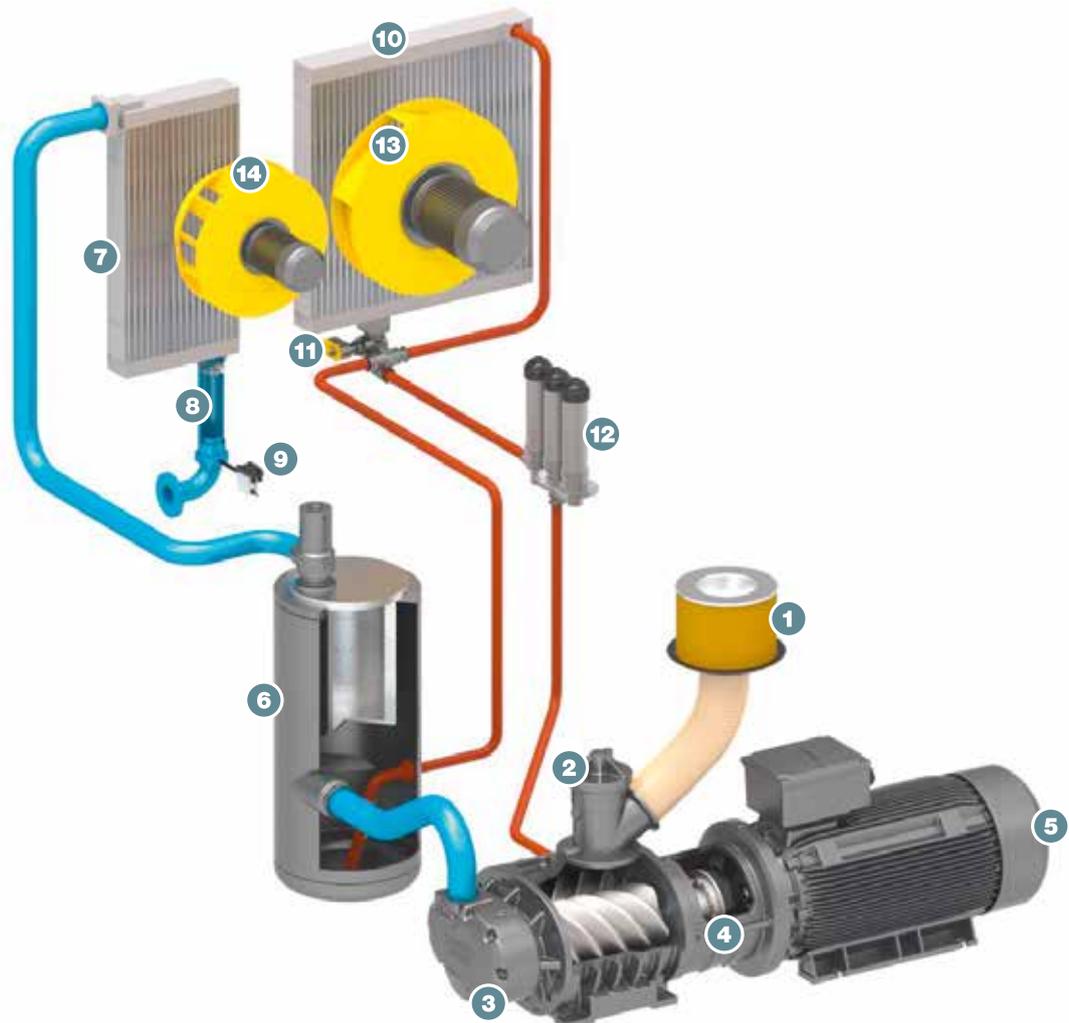
**Note for water-cooled version:** The technical specifications for 'Dimensions', 'Sound pressure level', and 'Mass' differ from the air-cooled version.

# How it works

The rotary screw airend (3) is driven by an electric motor (4). The fluid injected primarily for cooling purposes during the compression process is separated once again from the air in the fluid separator (5). The integrated fan ensures cooling of the compressor package and also provides sufficient flow of cooling air through the oil cooler and compressed air aftercooler (6 and 9).

The controller ensures that the compressor produces compressed air within the set pressure limits. Safety functions protect the compressor against failure of key systems via automatic shutdown capability.

- (1) Intake filter
- (2) Inlet valve
- (3) SIGMA PROFILE airend
- (4) 1:1 direct drive
- (5) IE4 drive motor
- (6) Fluid separator tank
- (7) Compressed air aftercooler
- (8) KAESER centrifugal separator
- (9) ECO-DRAIN condensate drain
- (10) Fluid cooler
- (11) Electronic Thermo Management
- (12) ECO fluid filter
- (13) Fluid cooler radial fan with variable speed control
- (14) Compressed air aftercooler radial fan



# The world is our home

As one of the world's largest compressed air system providers and compressor manufacturers, KAESER KOMPRESSOREN is represented throughout the world by a comprehensive network of branches, subsidiary companies and authorised partners in over 100 countries.

With innovative products and services, KAESER KOMPRESSOREN's experienced consultants and engineers help customers to enhance their competitive edge by working in close partnership to develop progressive system concepts that continuously push the boundaries of performance and compressed air efficiency.

Moreover, the decades of knowledge and expertise from this industry-leading system provider are made available to each and every customer via the KAESER group's global computer network.

These advantages, coupled with KAESER's worldwide service organisation, ensure that every product operates at the peak of its performance at all times and provides maximum availability.



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Air Systems

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