HPC Compressed Air Systems

KAESER COMPRESSORS

Energy-Saving Refrigeration Dryers

SECOTEC TE and TF Series

Efficient, compact and maintenance-friendly

Flow rate 10.5 to 34.0 m³/min, Pressure 3 to 16 bar

www.kaeser.com

SECOTEC TE and TF series

Compact energy-saving refrigeration dryers with impressive latent heat storage

SECOTEC – that's the name of KAESER's renowned industrial quality refrigeration dryers that have long been valued for their stable pressure dew point performance, their exceptional dependability and their low total life-cycle costs. Together with the innovative SECOPACK LS latent heat storage heat exchanger system and the SIGMA CONTROL SMART controller, the next generation of these advanced dryers sets new standards when it comes to energy efficiency, compact design and user-friendliness.

Energy cost savings

The new SECOTEC refrigeration dryers require less than 97 W of electrical power per m³/min of compressed air (ISO 7183 A1). Thanks to energy-saving control, reserve cooling performance can be temporarily accumulated in the thermal storage medium during partial load operation and can subsequently be used for drying purposes without the need for additional energy consumption. The rapid reaction SECOPACK LS heat exchanger system ensures stable pressure dew points at all times.

Optimised and compact

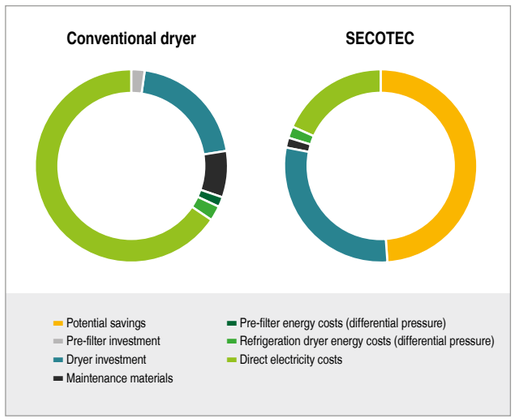
The thermal mass storage section of the innovative SECOPACK LS heat exchanger system is filled with a phase change material. Its significantly higher thermal storage density means that 98 % less storage material is required to achieve the same capacity as conventional storage media. This impressive storage capacity not only ensures excellent pressure dew point stability, but also drastically reduces space requirement. Optimised flow paths minimise pressure losses and consequently help enhance SECOTEC dryer efficiency.

Intuitive operation

The electronic SIGMA CONTROL SMART controller with colour display and language-neutral menu design is simple and intuitive to operate. Message memory, component-specific operating hours counters and maintenance timers enable efficient monitoring and analysis of operating data. Floating contacts and an optional Modbus TCP communications module provide easy networking with master controllers such as the SIGMA AIR MANAGER 4.0.

Long-term efficiency

The high-quality refrigeration circuit in SECOTEC refrigeration dryers assures dependable performance in ambient temperature up to 50 °C. The generously sized condensate separator and the electronic ECO-DRAIN condensate drain ensure reliable condensate removal in all load phases. Durability is increased because the condenser and SECOPACK LS are made from aluminium and corrosion-resistant compressed air piping, whilst the electrical equipment complies with standard EN 60204-1.



Reduce life-cycle costs

Three factors are responsible for achieving the exceptionally low life-cycle costs associated with the new SECOTEC refrigeration dryers, namely: low maintenance system design, selection of energy-efficient components and, last but by no means least, the demand-dependent SECOTEC energy-saving control.

This triple combination therefore enables a SECOTEC TF 340, for example, to achieve life-cycle cost savings of up to 50 % compared to other typically available refrigeration dryers.

Example: SECOTEC TF 340
Flow rate 34 m³/min, 40 % load, 6.55 kW/(m³/min), extra energy demand 6 % per bar, 0.20 €/kWh, 6,000 operating hours per year, annual debt service over 10 years.

Efficient, compact, maintenance-friendly

Image: SECOTEC TF 340

SECOTEC TE and TF series

Energy-efficient powerhouses

Consistent use of high quality components and KAESER's decades of expertise in system design and engineering enable SECOTEC refrigeration dryers to deliver exceptional efficiency throughout their entire load range.

Efficient refrigerant compressor

The scroll refrigerant compressors used in SECOTEC dryers are up to 26% more efficient than reciprocating compressors. They therefore play an important role in ensuring the outstanding efficiency of KAESER's new refrigeration dryers.

Minimal differential pressure

SECOTEC refrigeration dryers from KAESER truly shine when it comes to exceptionally low differential pressure. This is made possible thanks to the generously dimensioned flow cross-sections within the heat exchanger and compressed air connections.

Efficient thermal mass

It's the efficient phase change material that gives the exceptionally compact SECOPACK LS heat exchanger system its impressive thermal storage capacity. Special heat transfer elements ensure rapid charge and discharge, while premium-quality heat insulation boosts efficiency even further.

Significant energy savings

The SIGMA CONTROL SMART controller calculates load hours and the current actual electrical power consumption of the SECOTEC dryer. This advanced system displays the savings achieved with SECOTEC compared to conventional hot-gas bypass refrigeration dryers.

SECOTEC TE and TF series

Dependable drying

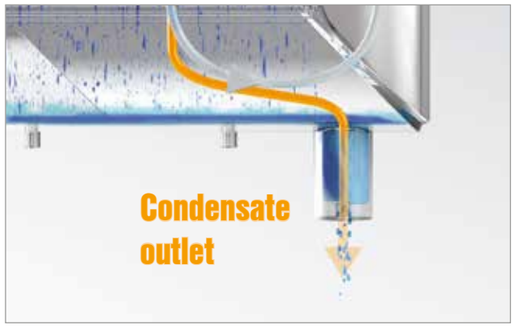
We don’t just talk about challenging operating conditions, but actually create them in our advanced climate testing facilities. This allows us to fine-tune SECOTEC refrigeration dryer design in order to ensure maximum reliability at all times.

Monitored availability

The innovative SIGMA CONTROL SMART controller controls thermal mass operation whilst constantly monitoring system temperature and pressure values. The automatic wire break and short circuit monitoring feature adds even greater operational reliability.

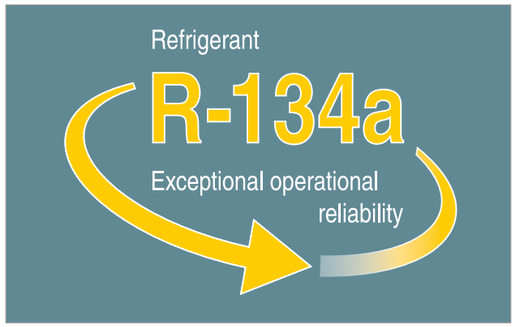
Compact condenser

Aluminium micro-channel condensers with large surfaces ensure effective contamination reserve and provide space-saving, compact design with low refrigerant volume requirement. This enables SECOTEC refrigeration dryers to deliver optimal drying performance even at high ambient temperatures.



Reliable separation

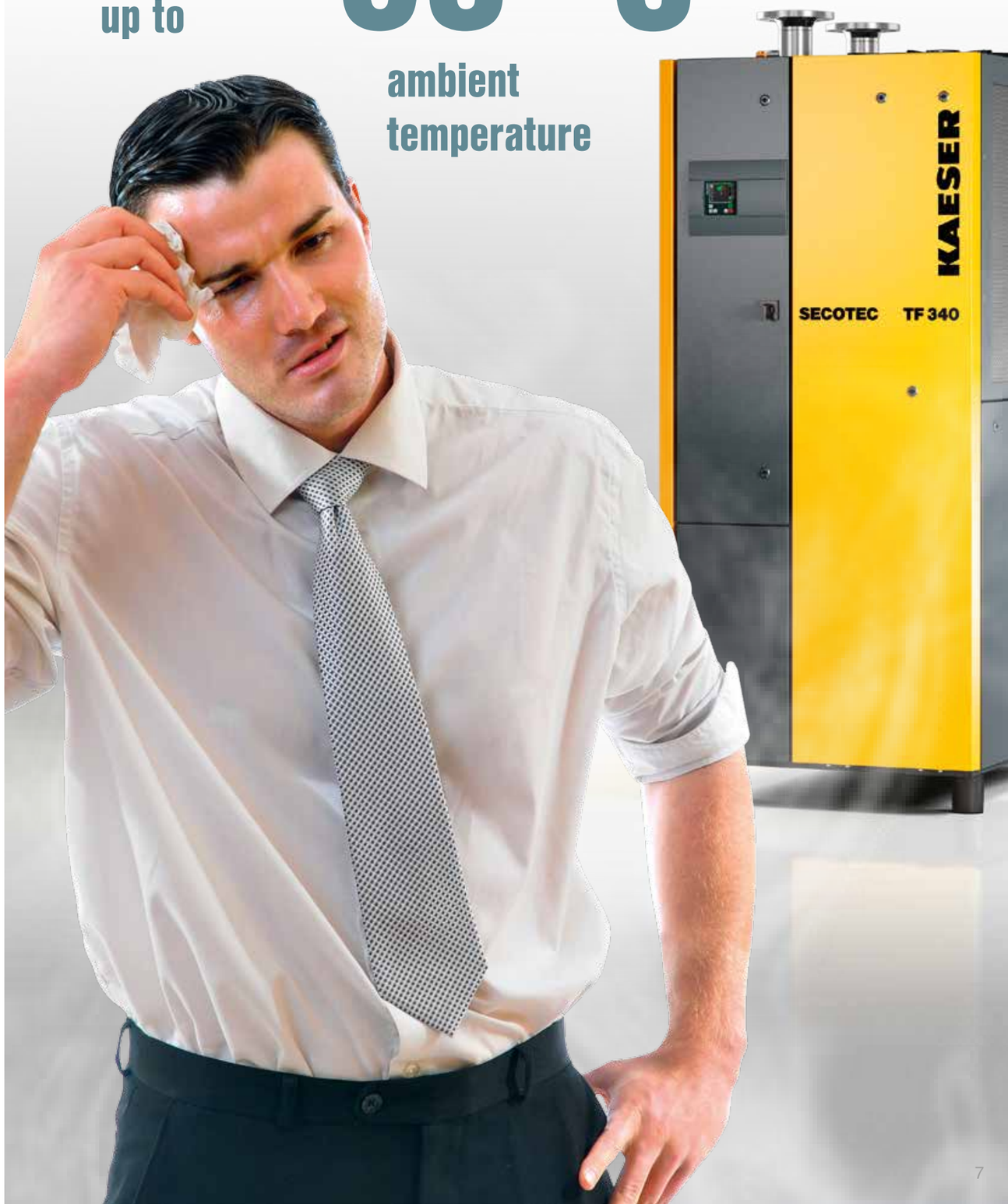
The SECOPACK LS heat exchanger system is made of corrosion-resistant aluminium and includes an integrated, large-diameter condensate separator for reliable separation of condensate during all load phases.



Reliable refrigeration circuit

The refrigerant circuit in SECOTEC refrigeration dryers is specially designed for efficient use of R-134a refrigerant. This ensures maximum efficiency and reliability, even at higher temperatures.

Dependable performance up to 50 °C ambient temperature



SECOTEC TE and TF series

Easy installation and excellent accessibility

KAESER understands customers' needs, as the company itself operates various compressed air stations. From first hand experience, we are well-versed in all aspects of compressed air station planning, implementation, operation and maintenance. We draw on this expertise to provide user-friendly and low-maintenance products.

Two wall sides

SECOTEC refrigeration dryers are accessed for operation and maintenance via the front and right sides. Access is not required to the other sides, meaning the dryer can be installed directly next to other structures/machines on two sides, resulting in further space savings.

Simple installation and maintenance

The control cabinet and maintenance components are easily accessible within the SECOTEC via two removable panels. Two access openings at the front enable rapid electrical connection (1) and easy cleaning of the condenser (2).

Left-hand side compressed air connections (optional)

If required, SECOTEC refrigeration dryers are available with compressed air connections located at the top on the side. This customised solution enables rapid installation at low cost.

Externally accessible: ECO-DRAIN

The ECO-DRAIN electronic condensate drain, fitted as standard, is easily accessible on the unit exterior for functional testing. The service unit can be replaced without de-pressurising the refrigeration dryer by simply closing the condensate inlet tap beforehand.

SIGMA CONTROL SMART

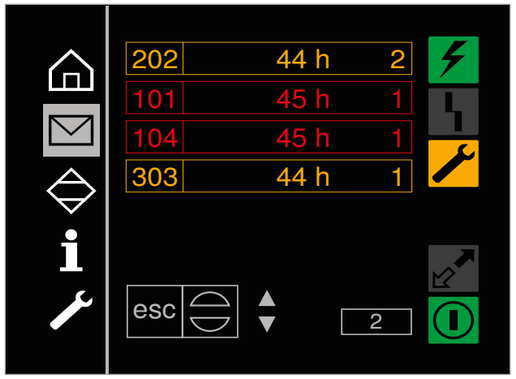
Comprehensive information and intuitive operation

The new generation of SECOTEC refrigeration dryers is equipped with the SIGMA CONTROL SMART electronic controller. With its colour display and language-neutral menu navigation, this advanced controller is exceptionally user-friendly.

Operational status can be viewed at a glance via the dew point trend indicator, prominent display of active messages and current operating data, as well as a clearly arranged P&I diagram. Furthermore, a message memory and floating message contacts provide highly effective analysis and monitoring capability.

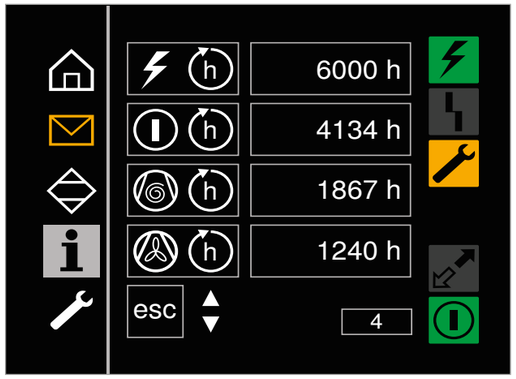
Main menu

- Pressure dew point trend display
- Eco-symbol displayed when thermal mass activated
- List of additional menus; symbols: controls for voltage, fault, maintenance / warning, remote on/off, controller on
- Status indicator for component-specific messages
- Flagging of unacknowledged maintenance / warning and affected component
- Unacknowledged faults indicated in red



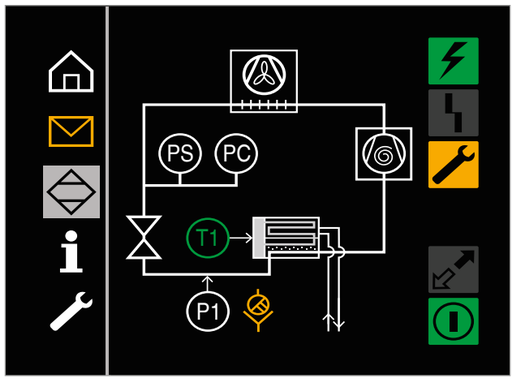
Messages

- Maintenance / warning: indicated in orange
- Faults: indicated in red
- Unacknowledged message: displayed with a border
- Messages identifiable by numerical codes
- Messages time-stamped with operating hours time
- Counter shows number of past messages



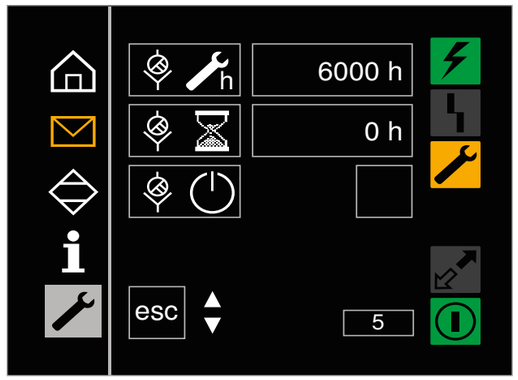
Information

- Multiple operating hours counters
- Temperature thresholds for messages
- Activation of remote on / off
- Display of actual electrical power consumption
- Estimated energy savings compared to refrigeration dryers with hot gas bypass control
- Change measurement units



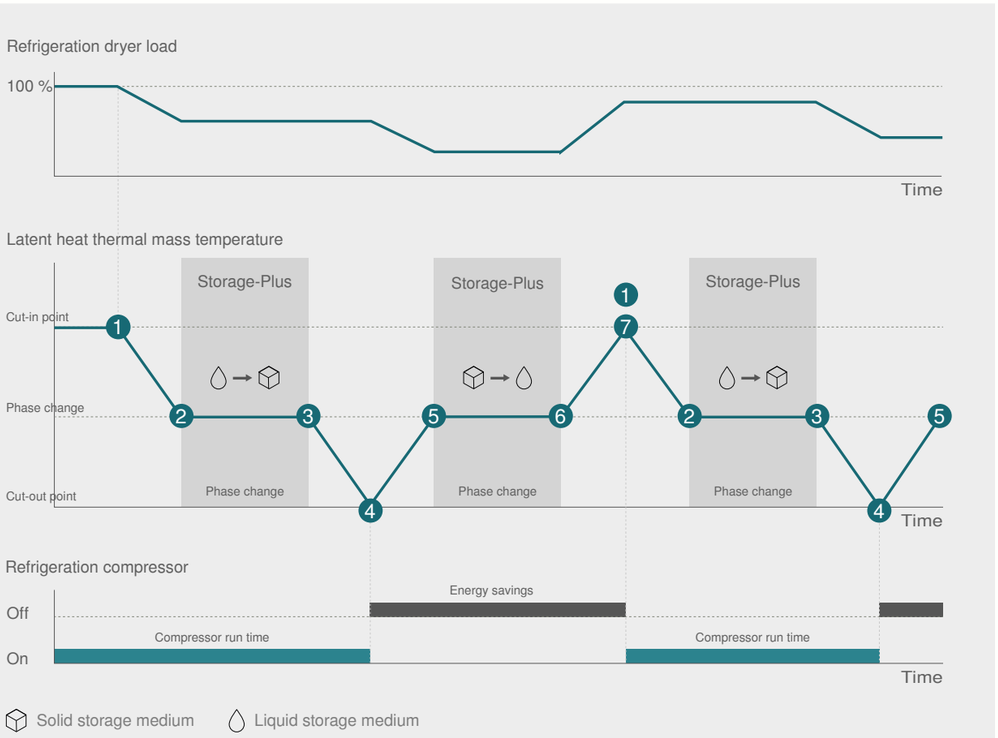
P&I diagram

- Displays functional principle
- Messages displayed with coloured switch symbols (e.g. condensate drain maintenance)



Service

- List of individual maintenance intervals for condensate drain and condenser cleaning
- Current interval status
- Reset maintenance timer



SECOTEC thermal mass control

Innovative energy-saving control with Storage-Plus

(1) Refrigeration compressor runs: cooling action supplied for compressed air drying and cooling the thermal mass

(2) Thermal mass solidifies at constant temperature and transfers a significant amount of heat to the refrigerant

(3) Refrigerant further cools the thermal mass down to the cut-out temperature

(4) Refrigerant compressor switches off

(5) Thermal mass transfers cooling action for compressed air drying and warms up

(6) Thermal mass melts at constant temperature, taking on a significant amount of heat from the moist compressed air

(7) Thermal mass warms up to the cut-in temperature and the refrigerant compressor switches on

SECOPACK LS heat exchanger system

The high efficiency module for maximum energy savings

SECOTEC refrigeration dryers are equipped with the innovative SECOPACK LS heat exchanger system. Its latent heat thermal mass is composed of a phase change material. Compressed air warms the material until its melting point (thermal mass discharge), absorbing melting heat in the process. This is significantly greater than the amount of heat that it can absorb based on its normal specific heat capacity (without phase change properties).

The latent heat thermal mass in new SECOTEC dryers therefore has a dramatically higher thermal density and is capable of delivering the same performance, yet requires 98% less thermal mass material than equivalent conventional systems.

The key advantages:
High thermal capacity for stable pressure dew points and material-friendly operation combined with dramatically reduced unit footprint.

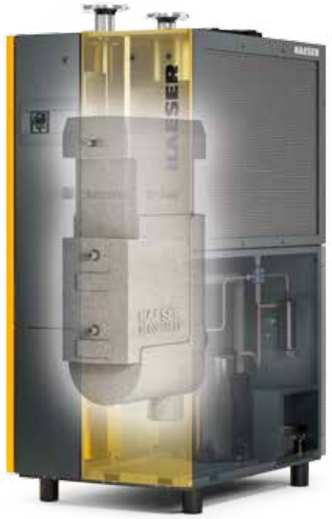
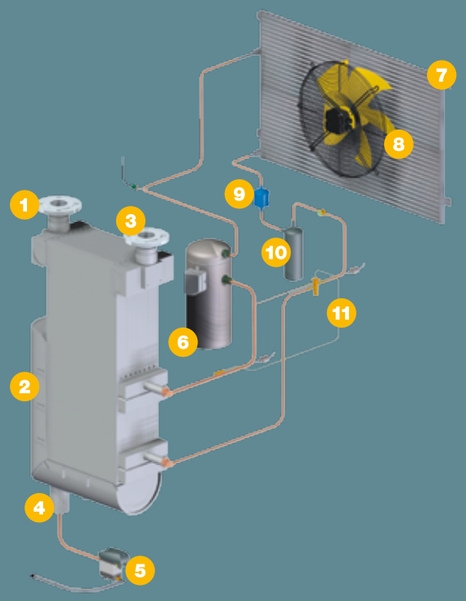


Image: SECOPACK LS in SECOTEC TF



Design

(1) Compressed air inlet
(2) SECOPACK LS heat exchanger system
(3) Compressed air outlet
(4) Condensate outlet
(5) ECO-DRAIN condensate drain
(6) Refrigerant compressor
(7) Micro-channel condenser
(8) Fan
(9) Filter dryer
(10) Refrigerant receiver
(11) Expansion valve

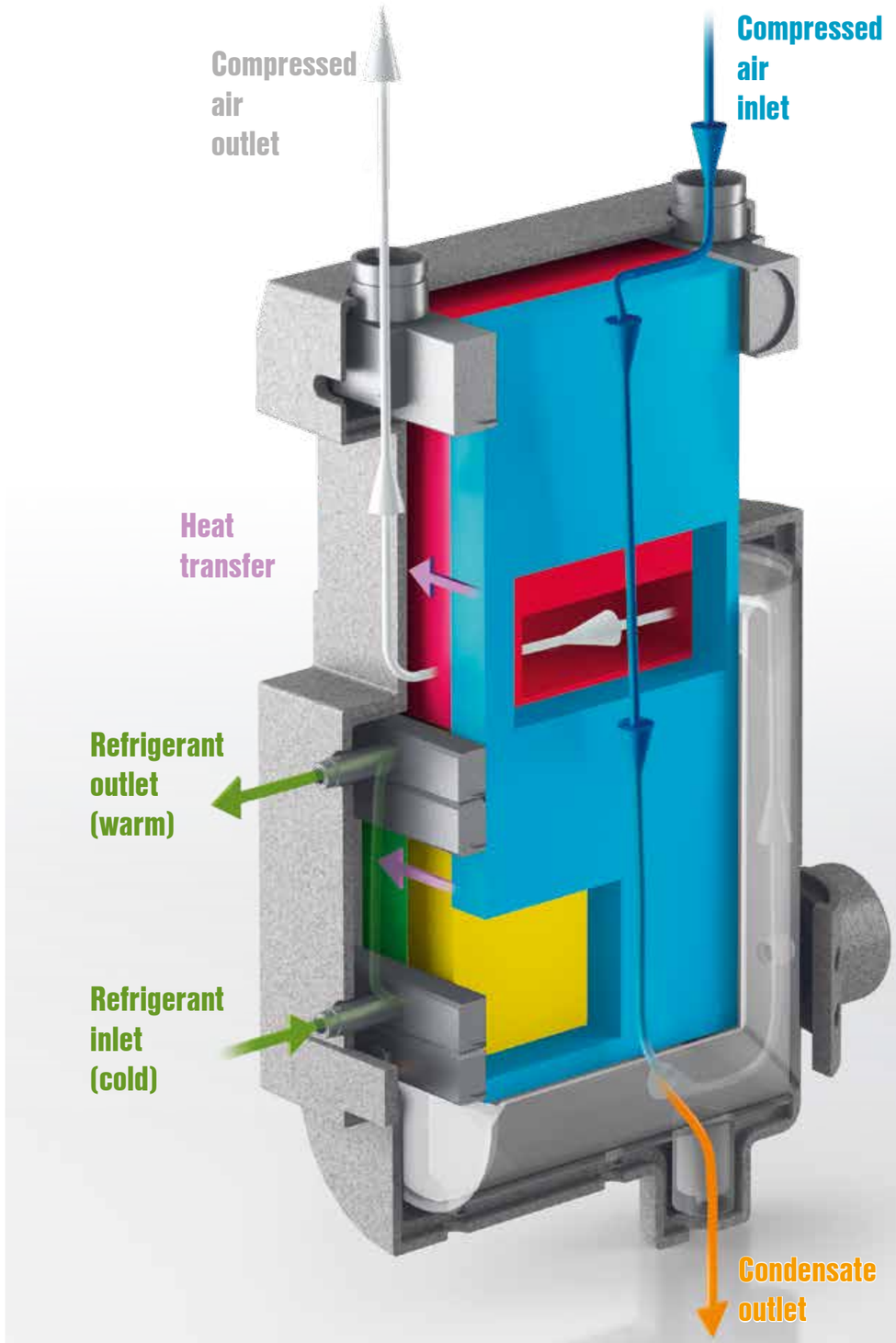
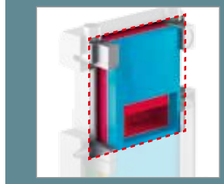
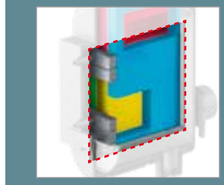


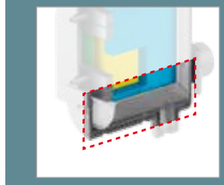
Image: SECOPACK LS



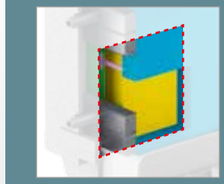
Air/air heat exchanger



Air/refrigerant heat exchanger



Condensate separator

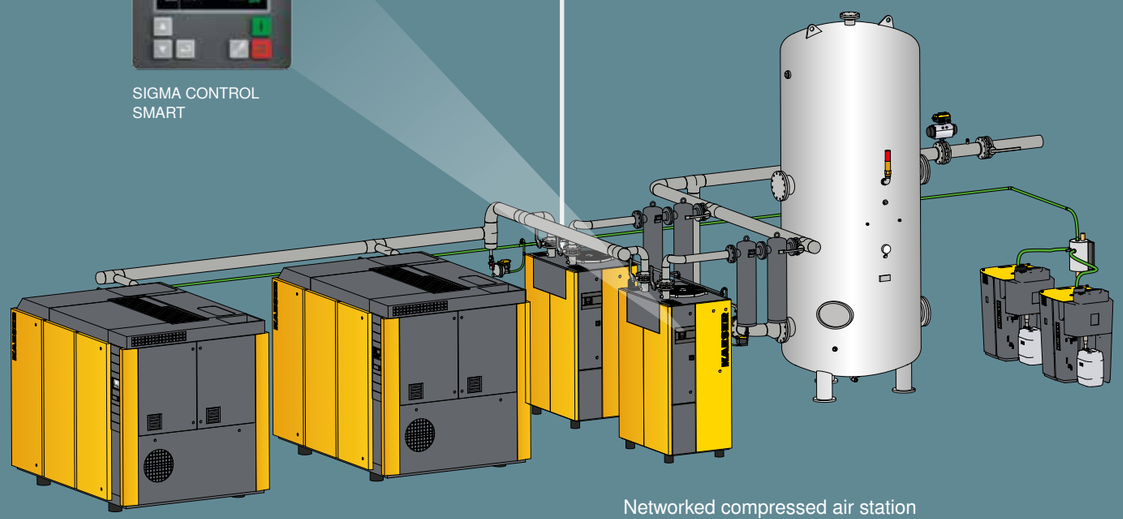


Thermal mass (yellow section)

SIGMA AIR MANAGER 4.0

KAESER SIGMA NETWORK

SIGMA CONTROL SMART



Networked compressed air station

SIGMA AIR MANAGER 4.0

Compressed air management technology 4.0 from KAESER

Industry 4.0 – that's the key phrase to describe the 4th industrial revolution. In addition to the focus on "individualised production processes" and "product-related information exchange", a further factor is becoming increasingly important: time – because time is money.

Based on advanced digital information technology, Industry 4.0 interconnects man and machine, equipment and components. This technological revolution is also about real-time information exchange – about data that can be transferred and analysed in real-time. It is this capability that provides the decisive competitive advantage. The technology also opens up new value added-potential by ensuring permanent utility and availability, for example, of important industrial equipment.

Identify, analyse, react – in real-time

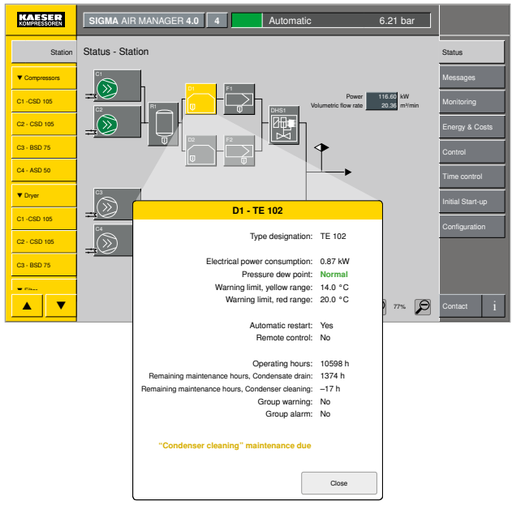
The SIGMA AIR MANAGER 4.0 is the heart of the SIGMA NETWORK and is key technology in the advanced world of Industry 4.0. As the central mastermind, it controls the entire compressed air supply system and – via KAESER IoT Clients (Internet of Things) – is responsible for data streaming to the centralised KAESER SIGMA SMART AIR application. Process data from the compressed air system in the SIGMA NETWORK is transmitted in real-time. Specialised software ensures continuous system evaluation and dependable data transmission to control centres or user end devices.

Centralised compressed air system monitoring is performed in the KAESER DATA CENTER and it is here where warning, maintenance, alarm and operational messages, as well as energy management, analyses and reports for optimised system performance are processed.

KAESER SIGMA SMART AIR: Predictive Maintenance – pre-planned servicing

The combination of remote diagnostics and needs-based, preventative maintenance helps ensure maximum compressed air supply dependability. Through permanent availability of compressed air system process data and the resulting continuous analysis, it is possible to identify the perfect point in the future when your compressed air supply system should be maintained and serviced. This prevents costly periods of downtime, increases energy efficiency (thanks to monitoring of key parameters) and allows compressed air system performance to be precisely matched according to demand throughout the entire life-cycle of the system.

This combination of remote diagnostics and demand-oriented preventative maintenance ensures maximum availability and potentially reduces service costs by up to 30%.



SECOTEC – Industry 4.0 ready

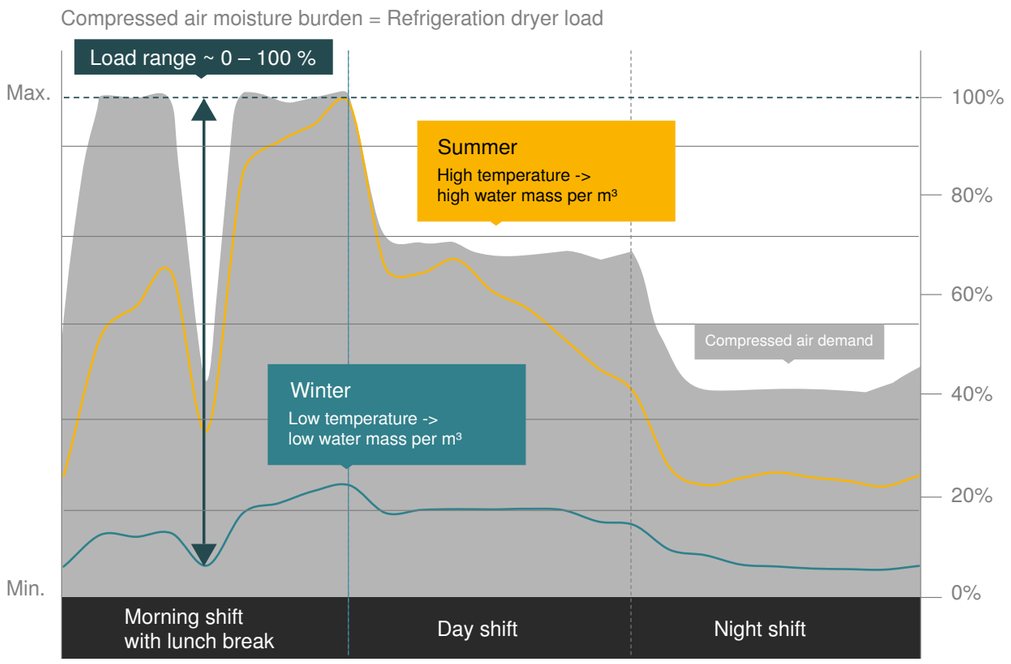
With installation of the optional Modbus TCP module, SECOTEC refrigeration dryers can be integrated in the SIGMA NETWORK. All essential operational parameters and messages are available in real-time.

The result: Maximum availability with minimal costs. In addition, the SIGMA AIR MANAGER 4.0 provides a complete overview of all essential operating parameters of the refrigeration dryers. Colour-coded warnings and alarms are displayed in the compressed air station's P&I diagram. By selecting the dryer icon, all key operational parameters and message texts are displayed in plain text.

KAESER
SECOTEC TF 340

SECOTEC

The key to perfect refrigeration drying

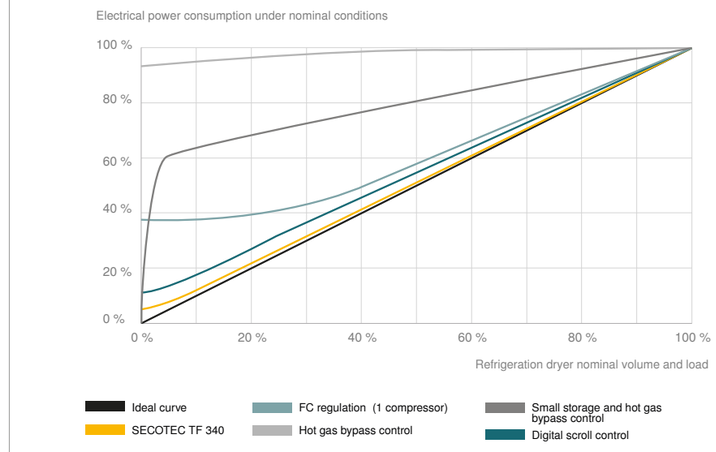


SECOTEC – Savings for all seasons

The load on a refrigeration dryer doesn't just depend on the volume of compressed air to be dried (grey area), but more importantly depends on how much water the incoming compressed air contains. The volume of water (moisture) increases as the temperature rises, so the load on refrigeration dryers increases dramatically when ambient temperatures are high, such as during summer (yellow curve).

The lower temperatures during winter (teal blue curve) therefore reduce the load on refrigeration dryers accordingly. To maintain a stable pressure dew point throughout all these fluctuations, refrigeration dryers should always be designed to provide sufficient performance during peak load times, and should also have additional capacity reserve.

Aside from these fluctuations in air flow and temperature, the output of refrigeration dryers constantly varies between 0 and 100 % of capacity. Because the SECOTEC storage control ensures energy is only used as needed across this entire load range, users benefit from exceptional savings.



Maximum energy savings thanks to storage control

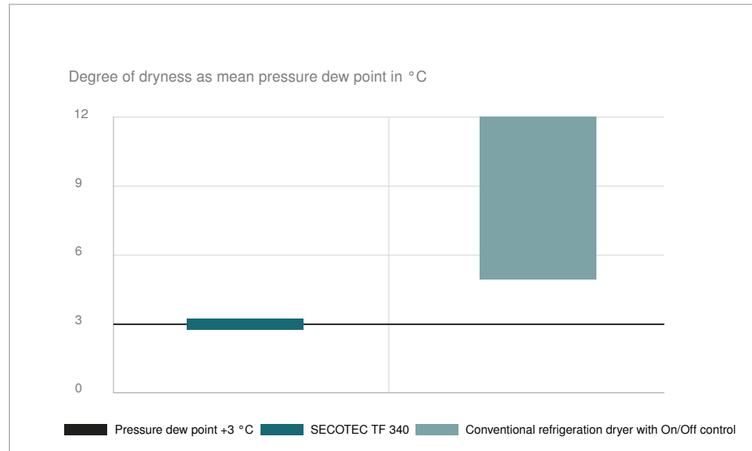
Refrigeration dryer load constantly fluctuates between 0 and 100%. Unlike conventional partial load control systems, SECOTEC storage control precisely adjusts electrical power consumption during all load phases.

This allows SECOTEC refrigeration dryers to save almost 60% of energy costs compared to refrigeration dryers with hot gas bypass control running at an average of 40% of capacity. **The TF 340 model typically saves 20,000 kWh/year based on 6,000 operating hours.** In contrast to conventional systems, the thermal mass in SECOTEC dryers always remains cool. This means compressed air can be dried effectively even during start-up phases. The high quality insulation around the thermal mass also helps keep energy usage to a minimum. Compressed air drying with SECOTEC refrigeration dryers not only ensures exceptional energy efficiency, but also, thanks to their impressive thermal capacity, provides material-friendly operation.

Optimal drying with low-wear operation

SECOTEC refrigeration dryers ensure stable pressure dew points in all load phases. Dried compressed air can cool to a temperature of + 3 °C (= achievable pressure dew point) without the moisture in the air condensing. Compressed air distribution systems and connected equipment enjoy optimal protection, even at lower ambient temperatures.

Conventional refrigeration dryers with switching operating modes, but without an additional thermal mass, use the heat exchanger material itself as a thermal mass. In these dryers it is therefore necessary to switch the refrigerant compressors and fan motors on and off much more frequently in order to maintain the required cooling performance.



To reduce switching frequency and wear, the refrigerant circuit therefore only switches on at much higher pressure dew points. The resulting fluctuations in the pressure dew point negatively affect drying performance. This can be risky, since corrosion can take hold even with relative compressed air humidity of 40% – corrosion can therefore occur even without condensate formation. SECOTEC refrigeration dryers, on the other hand, ensure material-friendly operation thanks to their high thermal storage capacity. Once the thermal mass has been charged, the refrigerant compressor and fan motor can remain switched off for much longer without impacting pressure dew point stability.

Standard equipment

Refrigeration circuit

Refrigeration circuit comprising a scroll compressor, aluminium micro-channel condenser with fan, pressure monitor, filter dryer, thermostatic expansion valve, SECOPACK LS aluminium heat exchanger system and pressure transducer.

SECOPACK LS

Air/air and air/refrigerant heat exchanger with aluminium block design, integrated thermal mass sector with phase change material, condensate separator, heat insulation and temperature transducer.

SIGMA CONTROL SMART

Electronic controller with colour display, language-neutral menu navigation, dew point trend indicator, P&I diagram with current operating data and messages, message memory, operating hours counter and maintenance timer.

Floating contacts

Operating messages: “Fault” and “Refrigerant compressor running”; warning messages: “Maintenance/warning” and “High pressure dew point”.

Condensate drainage

ECO-DRAIN 31 Vario electronic condensate drain with ball valve on the condensate inlet line, incl. insulation of cold surfaces.

Enclosure

Powder-coated enclosure. Removable panel for easy electrical connection and efficient condenser cleaning. Removable side panel serves as main access point to the interior. Machine mounts.

Connections

Compressed air pipework made from corrosion-resistant materials. Bulkhead for connection of the external condensate line and cable bushing for mains power connection on rear wall.

Electrics

Electrical equipment and testing to EN 60204-1 “Safety of machinery”. Control cabinet IP 54 protected.

Calculating flow rate

Correction factors for deviating operating conditions (flow rates in m³/min x k...)

Working pressure p at dryer inlet														
p bar$_{(g)}$	3	4	5	6	7	8	9	10	11	12	13	14	15	16
k_p	0.64	0.75	0.84	0.92	1.00	1.05	1.09	1.12	1.16	1.19	1.22	1.24	1.26	1.27

Compressed air inlet temperature T_i							
T_i (°C)	30	35	40	45	50	55	60
k_{Ti}	1.19	1.00	0.80	0.66	0.51	0.43	0.35

Ambient temperature T_a						
T_a (°C)	25	30	35	40	45	50
k_{Ta}	1.00	0.96	0.92	0.88	0.85	0.80

Example:			
Working pressure:	10 bar$_{(g)}$	(See table)	k_p = 1.12
Compressed air inlet temp.:	40 °C	(See table)	k_{Ti} = 0.80
Ambient temperature:	30 °C	(See table)	k_{Ta} = 0.96

TF 340 refrigeration dryer with 34.0 m³/min flow rate
Max. possible flow rate under operating conditions
V_{max} Operation = $V_{Reference}$ x k_p x k_{Ti} x k_{Ta}
V_{max} Operation = 34.0 m³/min x 1.12 x 0.8 x 0.96 = 29.25 m³/min

Technical Specifications

Model		**TE series**			**TF series**			
		TE 102	**TE 122**	**TE 142**	**TF 174**	**TF 230**	**TF 280**	**TF 340**
Flow rate	m³/min	10.5	12.2	14.5	17.0	23.0	28.0	34.0
Pressure loss, refrigeration dryer	bar	0.10	0.13	0.14	0.12	0.15	0.15	0.15
Elect. power consumption at 50 % Vol.	kW	0.49	0.59	0.71	0.73	1.04	1.22	1.33
Elect. power consumption at 100% Vol.	kW	0.93	1.10	1.40	1.39	1.94	2.43	2.72
Operating pressure	bar	3 to 16						
Ambient temperature	°C	+3 to +45						
Max. compressed air inlet temperature	°C	+60						
Mass	kg	220	225	240	340	360	385	415
Dimensions W x D x H	mm	712 x 982 x 1612			835 x 1230 x 2000			
Compressed air connection		G 2			DN 65	DN 80		
Condensate drain connection		G ¼						
Electrical supply		400 V / 3 Ph / 50 Hz						
Refrigerant mass R-134a	kg	1.45	1.6	1.9	2.2	2.0	2.6	
Refrigerant mass R-134a as CO_2 equivalent	t	2.1	2.3	2.7	3.15	2.9	3.7	
Options								
Water-cooled refrigerant dryer		Not available			Optional			
Adjustable machine mounts		Optional			Optional			
Integrated transformer to accommodate various mains voltages		Optional			Optional			
Ambient temperature to +50 °C		Optional			Optional			
Compressed air connections left		Not available			Optional			
Pipework kit for use with TF 173, 203, 251 (pre-installed at the factory)		Not available			Optional			
Modbus TCP communications module		Optional			Optional			
Special colour (RAL)		Optional			Optional			
Silicone-free version (VW factory standard 3.10.7)		Optional			Optional			

Performance data for reference conditions to ISO 7183, option A1: Point of reference: 1 bar(a), 20 °C, 0 % relative humidity; pressure dew point +3 °C, operating point: 7 bar working pressure, compressed air inlet temperature 35 °C, 100 % relative humidity, cooling air inlet temperature 25 °C. Contains fluorinated greenhouse gas R-134a (GWP = 1.430)

TE series

TF series

The world is our home

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

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.

HPC Compressed Air Systems

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