Dry Compression
Rotary Screw Compressors

CSG-2 Series
Flow rate up to 13.75 m³/min, Pressure 4, 6, 8 and 10 bar

www.kaeser.com
Durable and clean-running for sensitive processes

Two-stage dry compression rotary screw compressors from KAESER not only impress with their intelligent component layout, but also with their many innovative details – all of course with the renowned KAESER quality and distinctive, contemporary design. Whether they are being used in the semiconductor, foodstuff or automotive industries, our two-stage dry-running compressors tirelessly prove that process-appropriate purity and cost-effectiveness really can go hand in hand – even in adverse conditions.

Long-term efficiency

Compressed air simply has to be available whenever it is needed. KAESER dry compression rotary screw compressors are therefore built to last, ensuring many years of dependable performance. Comprising tried and tested components developed as a result of KAESER KOMPRESSOREN's near century of experience in mechanical engineering, they deliver durability and compressed air availability to meet even the toughest of demands.

Efficiency as standard

KAESER quality and expertise really count when it comes to those all-important overall system costs for asset investments, such as compressors or complete compressed air supply systems. Lowest possible compressed air costs and maximum availability can be guaranteed only through a combination of perfect interplay between energy efficiency and service/maintenance, and by viewing the compressed air supply system as a whole.

Innovation you can trust

Using all of the advantages that KAESER's advanced Research and Development Centre in Coburg has to offer, KAESER engineers designed every detail of the two-stage dry compression rotary screw airend with maximum efficiency and performance in mind. Further innovative details include the use of fibre-free pulse dampers and, on water-cooled compressor systems, an integrated heat recovery module.

Service-friendly

Right from the outset, these versatile systems were designed for maximum ease of servicing. Fewer wearing parts and the use of premium-quality materials ensure reduced maintenance requirement, longer service intervals and extended service life. Excellent component accessibility, thanks to generously-sized maintenance doors and a swing-out cooler, are just some of the features that make servicing so effortless.

Energy efficiency: the essential requirement

Investment and service costs account for only a small part of a compressor’s total life-cycle costs. Since energy accounts for the lion’s share of those costs, it’s wise to save with KAESER Life-Cycle Management. KAESER has been committed to minimising your energy costs for compressed air production for over 40 years. We also have the bigger picture in clear focus when it comes to service and maintenance, as well as maximum compressed air supply availability.
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CSG-2

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Super Premium Efficiency IE4

When it comes to base load compressors, SUPER PREMIUM EFFICIENCY IE4 asynchronous motors guarantee the highest possible efficiency levels, thanks to their well-established, durable technology and renowned service-friendliness.

Perfect teamwork – IES2

In the case of compressors with variable speed control, motor and frequency converter must work together in harmony in order to operate efficiently. For this reason, KAESER selects SIEMENS reluctance motors with specifically-matched frequency converters so as to guarantee perfect interplay at the highest levels of efficiency – IES 2.
Efficient and economical
Synchronous reluctance motors score high marks for efficiency across the whole speed range. This helps to save both energy and costs, even during partial load operation.

Resource-conserving and service-friendly
The synchronous reluctance motors fitted by KAESER are designed to conserve resources. Specially-formed magnetic steel sheets replace aluminium, copper and expensive rare earth materials. This makes the drive not only highly durable, but also service-friendly.

Efficient and economical
Synchronous reluctance motors score high marks for efficiency across the whole speed range. This helps to save both energy and costs, even during partial load operation.
Integrated web server

The SIGMA CONTROL 2 is equipped with its own web server, making it possible to visualise compressor status via intranet or Internet. Operational data and maintenance/alarm messages can therefore be viewed, with password protection, from any PC running a standard Internet browser. This feature benefits users considerably by simplifying operation and maintenance.

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.
KAESER CONNECT
The SIGMA AIR MANAGER 4.0’s integrated web server provides visual display of all compressed air system data in the form of HTML pages. The information is available any time, anywhere, and can be visualised in real-time on all network-capable devices.

SIGMA AIR MANAGER 4.0
This powerful master controller provides efficient control and coordinated management of up to 16 pieces of compressed air supply equipment, whilst also monitoring the associated air treatment components. The SIGMA AIR MANAGER 4.0 also ensures full compatibility of all KAESER compressed air supply systems within an Industrie 4.0 environment.
Service...

...virtually maintenance-free

(1) Hydraulic inlet valve
The hydraulically-operated inlet valves in KAESER dry compressing rotary screw compressors are unaffected by contaminants and condensate. This enhances their reliability and ease of maintenance when compared to pneumatic valves.

(2) Fibre-free pulse dampers
KAESER’s new fibre-free pulse dampers keep pressure losses to an absolute minimum, help maintain consistent air quality and minimise unwanted vibrations. In addition, their fibre-free design reliably eliminates the possibility of compressed air contamination.
...excellent accessibility

(3) Easy-access coupling
The electric motor directly drives the airend via a maintenance-free coupling, which virtually eliminates transmission losses. Since there is no need for complicated disassembly work, the easy-access coupling can be replaced quickly and easily.

(4) High-efficiency condensate separator
Thanks to its flow-optimised design, the newly developed condensate separator reliably separates the condensate downstream from the air coolers – with minimal pressure loss.

Image: CSG 120-2 RD SFC W
Cleaning made simple

Thoroughly cleaning the air coolers does not require the use of a crane – they can simply be swung out by a service technician. Cleaning can then be carried out quickly and easily beside the machine, without the risk of contaminating the interior of the compressor unit.

Capable of operation in ambient temperatures up to +45 °C as standard

Air-cooled CSG machines operate dependably in ambient temperatures up to +45 °C, thanks to their durable and energy-efficient radial fan.
Energy-saving standstill fan

When the large radial fan in air-cooled CSG units is switched off as part of the transition to standby mode, the energy-saving, temperature-controlled standstill fan reliably removes any residual heat from the compressor.

Outstanding durability through pre-cooling

Highly effective pre-cooling with a stainless steel tube cooler on the high pressure side ensures outstanding air cooler durability. Furthermore, this robust cooler combination also delivers comparably low compressed air discharge temperatures.

Air-cooling

Dependable performance – even under extreme conditions

The benefits:
- No cooling-water infrastructure is required.
- Meticulously designed machines with logical component layout make maintenance and service work quick and easy.
- The heated cooling air can be easily re-used for space-heating purposes.
Water-cooling

Compact energy-savers

The benefits:
- Exceptionally low compressed air discharge temperature thanks to high-quality separate air cooler.
- Load-dependent cooling-water control for optimum compressor cooling and simultaneous efficient use of cooling-water.
- Compact, low-standing design.

Parallel heat exchanger
Both the low and high pressure stages of water-cooled KAESER dry compression rotary screw compressors are equipped with their own dedicated parallel heat exchanger for enhanced heat transfer. This optimised cooling consequently improves specific power performance.

Optimised water cooler
Water-cooled CSG compressors feature highly efficient air/water heat exchangers. CuNi10Fe cooling pipes with internal star lamella fins provide optimum heat transfer and lowest possible compressed air discharge temperatures with minimal pressure loss.
Clever control

Water-cooled CSG-2 compressors feature sealed water control valves that are actuated via the advanced SIGMA CONTROL 2 compressor controller, which precisely adjusts the volume of water to meet the actual load requirement.

Permanent adjustment

The important but time-consuming task of performing hydraulic adjustment on both air coolers is carried out permanently and automatically during commissioning and whilst the machine is in operation. Cooling performance is therefore optimally matched to the operating conditions.
Why recover heat?

In fact, the question should be: Why not?
You will not only reduce your company's primary energy consumption, but also reduce its CO₂ balance.

Compressors with air-cooling

Compressed air users need to develop clever ideas regarding the use of warm exhaust air from their compressors. KAESER has the long-standing expertise to help you with all you need to know in this regard and will stand side-by-side with you every step of the way.

Compressors with water-cooling

Thanks to the compact heat recovery module integrated into the compressor, generating hot water for production or auxiliary heating purposes could not be simpler. Cost and space-intensive external infrastructure is not necessary with KAESER solutions and the amortisation period of the heat recovery module is usually less than a year (see example calculation below).

### Example amortisation calculation

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Inlet temperature</td>
<td>20 °C</td>
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<tr>
<td>Relative humidity</td>
<td>30 %</td>
</tr>
<tr>
<td>Cooling water inlet (primary)</td>
<td>20 °C</td>
</tr>
<tr>
<td>Cooling water outlet (primary)</td>
<td>80 °C</td>
</tr>
<tr>
<td>Compressor power consumption CSG-130-2 10 bar (g)</td>
<td>96.8 kW</td>
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<tr>
<td>Heat recovery potential based on total power consumption</td>
<td>87 %</td>
</tr>
<tr>
<td>Recoverable heat capacity</td>
<td>84.2 kW</td>
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<tr>
<td>Annual operating hours</td>
<td>6,000 hrs</td>
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<td>Kilowatt hours per year</td>
<td>505,296 kWh</td>
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<tr>
<td>Fuel costs</td>
<td>0.02 €/kWh</td>
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<tr>
<td>Annual fuel cost savings</td>
<td>€ 10,105</td>
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</table>

**Amortisation period**

< 1 year
Amortisation period
< 1 year

Up to +90 °C heat

Process, heating and service water
Compressor exhaust heat can be used to produce hot water with temperatures up to +90 °C, which can then be used for a wide range of applications.

Space heating with hot exhaust air
Heating made easy: Thanks to radial fans with high residual thrust, the reusable (hot) air from air-cooled CSG-2 systems can easily be ducted away to spaces that require heating – usually without the need for additional fans.
Technical implementation of integrated heat recovery

CSG - Water-cooled version with heat recovery

(1) Inlet filter
(2) Low pressure stage (Stage 1)
(3) High pressure stage (Stage 2)
(4) Drive motor
(5) Air cooler downstream from Stage 1 (air/water)
(6) Air cooler downstream from Stage 2 (air/water)
(7) Optional additional heat exchanger (air/water)
   → Version as plate-type heat exchanger
(8) Heat exchanger (water/water)
(9) Check valve
(10) Water control valve
      (actuated by SIGMA CONTROL)
(11) Pump
(12) Expansion tank
(13) Condensate separator
(14) Integrated i.HOC rotation dryer
In two-stage dry compression rotary screw compressors, some 90% of the usable heat is processed through the two air coolers (5) and (6).

KAESER therefore uses separate, high-quality heat exchangers developed specially to meet heat recovery requirements. The remaining 10% of usable heat is processed through the oil cooler and in the jacket cooling system of the compression stages.
Compressed air drying process - Overview

1. **Refrigeration dryer**
   - Temperature: -70°C
   - RMC: RMC 1

2. **i.HOC rotation dryer**
   - Temperature: -40°C
   - RMC: RMC 2

3. **Combination dryer**
   - Temperature: -30°C
   - RMC: RMC 3

4. **Desiccant dryer**
   - Temperature: +3°C
   - RMC: RMC 4

Residual moisture in the compressed air following drying.

\(^1\) RMC = Residual Moisture Class
Precision analysis essential

The required pressure dew point plays a significant role in determining the drying process, as well as the investment, service and energy costs associated with compressed air drying. It is therefore highly recommended to carry out a detailed system analysis. Unnecessarily high compressed air volumes create additional costs, which is something that we will gladly help you avoid!

Refrigeration dryer
For oil-free compression rotary screw compressors, refrigeration dryers are the go-to choice for delivering best possible energy efficiency and favourable investment costs when pressure dew points down to +3 °C are required. Pressure dew points below +3 °C are provided by desiccant dryers.

Combination dryer
HYBRITEC dryers combine the energy-saving operation of modern refrigeration dryers with the ultra-low pressure dew points of desiccant dryers. HYBRITEC dryers can deliver pressure dew points as low as -40 °C with exceptional efficiency.

i.HOC rotation dryer
Integrated into the rotary screw compressor, the optional i.HOC rotation dryer can reliably and efficiently deliver pressure dew points down to -30 °C. The hot compressed air from the second compression stage is used to regenerate the desiccant.

Heatless regenerating desiccant dryer
KAESER’S DC series heatless regenerating desiccant dryers deliver pressure dew points as low as -70 °C, even under extreme operating conditions.
Integrated refrigeration drying

KAESER refrigeration dryers ensure dry compressed air that is perfectly suited for the intended application and all flow rates. With these high-quality industrial machines, you will be providing reliable protection against condensate damage for your systems and processes, even under the harshest of conditions.

Energy-saving drying

An integrated design, together with the generously-dimensioned aluminium block heat exchanger, helps ensure a minimal pressure loss of less than 0.1 bar. The energy-saving scroll refrigerant compressor helps to achieve additional compressed air energy savings.

Excellent accessibility

All refrigeration dryer components are perfectly accessible via the service door on the front of the unit. This makes servicing and maintaining the dryer a breeze.
Full-flow regeneration in detail

The i.HOC (Integrated Heat of Compression Dryer) system uses 100% of the heat of compression from the second compression stage for drying purposes (full-flow regeneration). This heat, which is produced in any case, is therefore effectively available at zero cost.

Drying even near the limit

The advantages of full-flow regeneration become obvious, especially with increased coolant temperatures. KAESER rotation dryers achieve outstanding drying results, even without additional electrical heating of the regeneration air.
i.HOC

**Dependable pressure dew points thanks to innovative process engineering**

The patented i.HOC rotation dryer from KAESER reuses up to 100% of the compression heat! Thanks to this full-flow regeneration, it can deliver reliable pressure dew points up to an ambient temperature of +45 °C – without any electrical heating or additional cooling of the regeneration air. Both air and water-cooled versions are available.

**The benefits:**
- Dependable sub-zero pressure dew points even at high ambient or coolant temperatures.
- Pressure dew point stability even at the lowest compressor loads – without any need for a partial load compensator.
- Available with pressure dew point control if required.
- Highly effective drying and heat recovery on water-cooled compressors.

**Perfect performance**

The i.HOC rotation dryer’s intelligent control ensures pressure dew point stability even with fluctuating flow rates and at partial compressor load. When commissioned, the target pressure dew point is reached after just one rotation of the drum.

**Pressure loss? On the contrary!**

The radial fan in the base of the rotation dryer equalises drying process pressure losses as needed, thereby guaranteeing maximum pressure dew point stability and quality - the pressure at the i.HOC dryer outlet is even higher than that at the inlet.
(1) Regeneration air inlet
(2) Drum
(3) Regeneration air outlet
(4) Heat exchanger stage 2
(5) Condensate separator
(6) Radial fan
(7) Demister
(8) i.HOC rotation dryer outlet
(9) Drum motor
(10) Pressure dew point sensor (optional)
**i.HOC**

**Precision operation for high efficiency and low pressure dew points**

*Precision drum*

The silica gel desiccant is bedded in a precision-manufactured drum with exceptionally high run-out qualities. Incorrect flow within the dryer and the resulting pressure dew point fluctuations are therefore reliably prevented.

*Variable-speed drum motor*

Drum speed is automatically adjusted according to actual compressor performance, so as to regenerate the desiccant as effectively as possible. This is the key to ensuring consistently low pressure dew points.

*External condensate separation*

The i.HOC system uses a highly efficient condensate separator downstream from the heat exchanger in the second compression stage, so as to separate the condensate formed during the regeneration process **outside the dryer**. This protects the drum from potentially damaging water droplets.

*Precise desiccant regeneration and low pressure dew points*
Technical expertise

Air-cooled CSG packages

Standard versions

How it works

Versions with rotation dryer

How it works

Versions with dryer

How it works

(1) Inlet filter
(2) Low pressure stage
(3) High pressure stage
(4) Air cooler downstream from Stage 1 (air/water)
(5) Air cooler downstream from Stage 2 (air/water)
(6) Oil cooler
(7) Standstill fan
(8) i.HOC rotation dryer, integrated
(9) Refrigeration dryer, integrated
<table>
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<th>Model</th>
<th>Standard</th>
<th>SFC with synchronous reluctance motor</th>
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<td>Flow rate complete system at max. gauge pressure</td>
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<tr>
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<td>m³/min</td>
<td>°C</td>
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<td>CSG 55-2</td>
<td>Upon request</td>
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<td>CSG 130-2</td>
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**Versions with rotation dryer**

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<tr>
<th>Model</th>
<th>Standard</th>
<th>SFC with synchronous reluctance motor</th>
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<td>CSG 130-2</td>
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**Specifications subject to change without notice.**

1) 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, 0 % rel. humidity.
2) Pressure dew point at inlet valve 1 bar (a); cooling and air inlet temperature +20 °C, relative humidity 60%, cooling water outlet temperature +30 °C.
3) CSG 70-2 SFC: Version with rated motor power 55kW.

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- **Rated motor power**: kW
- **Gauge pressure**: bar
- **Model**: CSG
- **Flow rate complete system at max. gauge pressure**: m³/min
- **Pressure dew point**: °C
- **Sound pressure level**: dB(A)
- **Mass**: kg
- **Flow rate complete system at max. gauge pressure**: m³/min
- **Pressure dew point**: °C
- **Sound pressure level**: dB(A)
- **Mass**: kg
Technical expertise

Water-cooled CSG packages

Standard versions

How it works

Versions with rotation dryer

How it works

Versions with dryer

How it works

1. Inlet filter
2. Low pressure stage
3. High pressure stage
4. Air cooler downstream from Stage 1 (air/water)
5. Air cooler downstream from Stage 2 (air/water)
6. Oil cooler
7. Auxiliary heat exchanger downstream from Stage 2
   air cooler (optional)
8. i.HOC rotation dryer, integrated
9. Refrigeration dryer
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<th>Rated motor power (kW)</th>
<th>Gauge pressure (bar)</th>
<th>Standard versions</th>
<th>Flow rate complete system at max. gauge pressure 1)</th>
<th>Pressure dew point 2)</th>
<th>Sound pressure level 2)</th>
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1) 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 0 % rel. humidity 2) Pressure dew point at inlet valve 1 bar(a); cooling and air inlet temperature +20 °C, relative humidity 60%, cooling water outlet temperature +30 °C 3) Sound pressure level as per ISO 2151 and basic standard ISO 9614-2, tolerance: ± 3 dB(A), measured at maximum pressure and maximum speed Specifications subject to change without notice.
Equipment

Complete system
Oil-free compression rotary screw compressor with two-stage compression; condensate separator, condensate drain and fibre-free pulse dampers for both compression stages; oil tank ventilation with microfilter, ready to operate, fully automatic, silenced.

Airend
Two-stage oil-free compression rotary screw airend with integrated gearing and collection tank for gear oil; rotors with durable coating; both high and low pressure compression stages feature jacket cooling; high pressure stage with chromium steel rotors.

Drive:
Precision gearing as per AGMA Q13/DIN Class 5 with helical spur gears.

SIGMA CONTROL 2
Full-text display, 30 selectable languages; soft-touch icon keys; "traffic light" style LEDs to indicate operating status; fully automatic monitoring and control; Dual, Quadro and Dynamic control modes selectable as standard; SD card slot for data logging and updates; RFID reader; web server; interfaces: Ethernet; optional communications modules for: Profinbus DP, Modbus, Profinet and Devicenet.

Dynamic Control
The Dynamic Control feature calculates run-on times based on the motor windings temperature, which is measured by a sensor in the windings. This reduces idling times and cuts energy consumption. Additional control options are stored in the SIGMA CONTROL 2 and can be called up as required.

Cooling
Air or water-cooling available; radial fan with separate drive motor; exhaust air discharged upwards.

Air-cooled version:
High-pressure side: aluminium cooler with stainless steel tube pre-cooler. Low pressure side: aluminium cooler; aluminium cooler for gear oil.

Water-cooled version:
Two shell and tube heat exchangers comprising coated steel jacket and pipes made from CuNi10Fe; one gear oil cooler.

Electrical components
Ventilated IP 54 control cabinet, automatic star-delta starter, overload relay, control transformer.

Dependable oil reservoir venting
The microfilter in the oil reservoir venting system prevents intake of oil-laden air. This is another key detail to ensure that compressed air quality is reliably and efficiently maintained at all times.

(1) Microfilter
(2) Oil mist removal
(3) Ejector
(4) Return to gear oil reservoir
<table>
<thead>
<tr>
<th>Options</th>
<th>Model</th>
<th>Air-cooled</th>
<th>Water-cooled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjustable machine feet</td>
<td>CSG-2</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Silencer, air inlet opening (Sound-insulated connecting links upstream from heat exchangers)</td>
<td>CSG-2</td>
<td>●</td>
<td>–</td>
</tr>
<tr>
<td>Cooling-air filter mats (Protects the heat exchanger against heavy contamination)</td>
<td>CSG-2</td>
<td>●</td>
<td>–</td>
</tr>
<tr>
<td>Integrated heat recovery with pump (Compressor is equipped with a complete second auxiliary water system, including water pump. This protects the compressor against excessive temperatures.)</td>
<td>CSG-2</td>
<td>–</td>
<td>●</td>
</tr>
<tr>
<td>Integrated heat recovery without pump (Compressor is equipped with a second auxiliary water system, without water pump. This protects the compressor against excessive temperatures.)</td>
<td>CSG-2</td>
<td>–</td>
<td>●</td>
</tr>
<tr>
<td>Auxiliary heat exchanger downstream from air cooler, 2nd stage (Reduces the compressed air discharge temperature in compressors with heat recovery. Improves the pressure dew point for compressors with i.HOC.)</td>
<td>CSG-2</td>
<td>–</td>
<td>●</td>
</tr>
<tr>
<td>Integrated heat exchanger downstream from i.HOC rotation dryer (Reduces the compressed air discharge temperature from the compressor in packages with integrated i.HOC.)</td>
<td>CSG-2</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Pressure dew point measurement (Pressure dew point sensor installed.)</td>
<td>CSG-2</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Pressure dew point adjustment (Controlled bypass around the stage 1 heat exchanger to improve pressure dew point as needed.)</td>
<td>CSG-2</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Pressure dew point control (Pressure dew point measurement and controlled bypass around the stage 1 heat exchanger to improve pressure dew point as needed.)</td>
<td>CSG-2</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>KAESER hot air control (Bypass around the stage 1 heat exchanger to increase compressed air temperature after leaving the 2nd stage, as needed. No heat exchanger installed downstream from the 2nd stage.)</td>
<td>CSG-2</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>

- Available
- Not available

Not available for packages with integrated rotation or refrigeration dryer.
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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