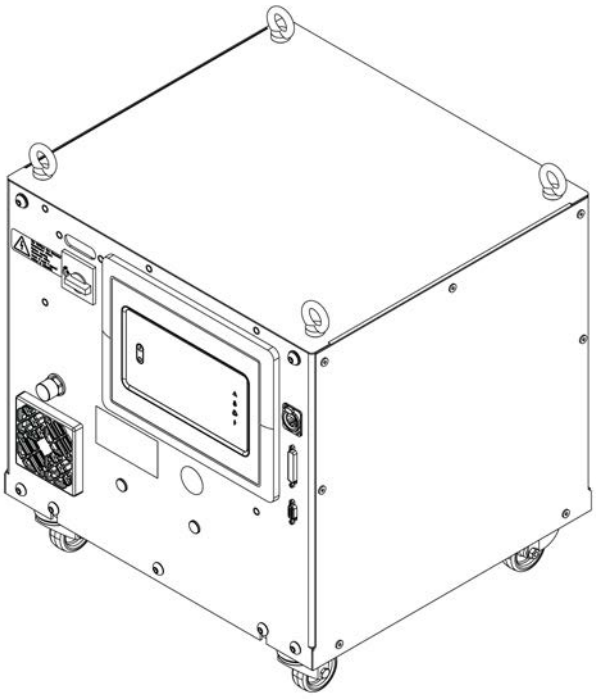
Leybold

Helium Compressor

Compressor Unit For Cryogenic Refrigerators

Operating instructions 301309692_002_C1



Part Numbers

840000E12XXMI

X = 0-9

Original instructions

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We accept no liability for loss of profit, loss of market or any other indirect or consequential loss whatsoever.

Product warranty and limit of liability are dealt with in our standard terms and conditions of sale or negotiated contract under which this document is supplied.

You must use this product as described in this manual. Read the manual before you install, operate, or maintain the product.

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1 Safety and compliance

For safe operation from the start, read these instructions carefully before you install or commission the equipment and keep them safe for future use. Read all the safety instructions in this section and the rest of this manual carefully and make sure that you obey these instructions.

The instruction manual is an important safety document that we often deliver digitally. It is your responsibility to keep the instruction manual available and visible while working with the equipment. Please download the digital version of the instruction manual for use on your device or print it if a device will not be available.

1.1 Definition of Warnings and Cautions

Important safety information is highlighted as warning and caution instructions which are defined as follows. Different symbols are used according to the type of hazard.

WARNING:

If you do not obey a warning, there is a risk of injury or death.

CAUTION:

If you do not obey a caution, there is a risk of minor injury, damage to equipment, related equipment or process.

NOTICE:

Information about properties or instructions for an action which, if ignored, will cause damage to the equipment.

We reserve the right to change the design and the stated data. The illustrations are not binding.

1.2 Trained personnel

For the operation of this equipment “trained personnel” are:

- skilled workers with knowledge in the fields of mechanics, electrical engineering, pollution abatement and vacuum technology and
- personnel specially trained for the operation of vacuum pumps

1.3 Safety symbols

The safety symbols on the products show the areas where care and attention is necessary.

The safety symbols that we use on the product or in the product documentation have the following meanings:

	**Warning/Caution** Risk of injury and/or damage to equipment. An appropriate safety instruction must be followed or a potential hazard exists.
	**Warning - Dangerous voltage** Risk of injury. Identifies possible sources of hazardous electrical shock.
	**Warning - Flammable material** Risk of fire. Identifies possible sources of flammable gases, liquids or materials.
	**Warning - Hot surfaces** Risk of injury. Identifies a surface capable of inflicting burns through contact.
	**Warning - Pressurised** Risk of injury or damage to equipment. Identifies equipment containing pressurised gases or liquids.
	**Warning - Risk of explosion** Risk of injury or damage to equipment. Identifies a situation that could result in an explosion.
	**Warning - Overpressure** Risk of increased pressure beyond permissible limit.
	**Warning - Use protective equipment** Risk of injury. Use appropriate Personal Protective Equipment (PPE) when performing the task.
	**Mandatory action symbol** Failure to comply with this action may result in injury or damage to equipment.
	**Mandatory - Read the manual** Failure to comply with this action may result in injury or damage to equipment.

2 Important safety information

2.1 Mechanical hazards

CAUTION: OVERPRESSURE IN THE SYSTEM

Risk of damage to equipment. The pressure may exceed the maximum permissible operating pressure of 26 bar(g) when you top up the helium. Use a pressure reducer with an additional safety valve at the outlet and maintain the opening pressure between 16-20 bar(g).

1. The compressor and the pressure lines are pressurised to a helium filling pressure of up to 16 bar(g) during standstill and up to 26 bar(g) during operation. Even after switching off, compressor and pressure lines remain pressurised up to the filling pressure.
2. Fit or disassemble the pressure lines only after the compressor is switched off.
3. Do not disconnect the pressure lines while the cold head is cold, as when warmed, it may cause a pressure rise which may exceed the permissible operating pressure of 26 bar(g).
4. The equipment must only be operated in the assembled condition and with all covers in place.
5. Make sure that the electric and pressure lines are not damaged. Take precaution to not damage the pressure lines (for example, with pointed or sharp items).
6. Pressurised components of the compressor like helium compressor, separator, adsorber and the pressure lines must be not processed mechanically or thermally.
7. All valves or switches of the compressor must not be blocked or modified.
8. Do not install the flexible pressure lines along passageways as there is a risk of damage or corrosion and stumbling.
9. Always maintain a bending radius of at least 20 cm. There is a risk of pinching if the radius is less than it.
10. Do not repair pressure lines.
11. Do not install any damaged pressure lines.
12. Install protection caps to the self-sealing fittings of the flexible pressure lines and at the compressor to protect them from dirt after disconnecting the pressure lines.
13. When topping up helium use only certified pressure lines that can withstand a pressure greater than 20 bar(g).

2.2 Electrical hazards

1. The electrical connections must be provided by a trained electrician in accordance with VDE 0105 according to the guidelines of VDE 0100 (or corresponding to the harmonized national standards and guidelines which apply in the country where the equipment is being operated).
2. Unplug the mains only after switching off the device at the main switch.
3. Connect the compressor to the protective earth conductor to prevent touching of dangerously high voltages in the case of a malfunction.

4. The electrical connecting line between the compressor and the cold head must be connected or disconnected only when the compressor is switched off by means of the main switch. Compressor and cold head can get damaged.
5. Hazardous voltages are present in the compressor. Before you do repair work, always switch off the compressor first and disconnect it from the mains power (Lockout/Tagout).
6. Unauthorized conversions and modifications to the equipment are prohibited for safety reasons. Hazardous voltages are present inside the compressor. In case of contact, it can cause death or severe injury. Before you open the compressor, always disconnect it from the mains power and prevent it from being switched on inadvertently (lockout/Tagout).
7. After all service work, the internal ground connections must be correctly re-established and it is mandatory to do an electrical safety test according to the local standards.
8. Avoid exposure of the compressor to splash or drip water.
9. Place the connecting lines so that they cannot be damaged. Protect the lines against humidity and contact with water.
10. If the compressor and the connecting cables are stored in a humid atmosphere then these components may corrode. Corrosion forms conductive deposits which can result in short-circuits or reduced insulation of voltage carrying parts.

2.3 Thermal hazards

WARNING: HOT SURFACE

Risk of burn. Compressor capsule, heat exchanger and pipes can get hot (over 80 °C) during operation and there is the risk of suffering burns. Before you start the work on the compressor always switch it off and leave it to cool down.

2.4 Hazards caused by materials and substances

1. Do not direct the flow of helium gas towards persons or components when you drain the helium out. Compressed gas at high concentrations can have a suffocating effect. Do not breathe in helium at high concentrations.
2. The compressor can get contaminated due to environmental influences or the process. Contaminated parts can cause damage to your health and environment.
3. Before you start the work get the information about any possible contamination. When you work with contaminated components, obey the applicable regulations and comply with the protective measures.

2.5 Ignition hazard

WARNING: EXPLOSION HAZARD AREA

Risk of injury or damage to the equipment. The standard version of the compressor is not suitable for operating in explosion hazard areas. Contact us if you want to use the compressor in explosive areas.

2.6 Hazards in connection with safety-related measures and precautions

1. The compressor is not equipped with the emergency shutdown switch. If required, install the emergency shutdown switch separately.
2. After a brief mains power failure for ≤ 1 second, the compressor will restart automatically and resume its previous operating status.
3. After a brief mains power failure for > 1 seconds, the compressor will go in standby mode.

2.7 Risk of damage to the compressor

1. Use only very high purity helium (with a purity of 99.995% or higher).
2. Install all self-sealing fittings with protection caps when not used during normal operation.
3. When you transport or store the compressor, do not tilt it more than 30° as there is a risk of toppling and during operation not more than 10° (secured properly).
   Greater tilt angles can cause damage to the compressor capsule or oil contamination in the helium circuit. If you intend to operate the compressor at greater tilt angles than 10°, contact us.
4. All conductors L, N, PE (protective earth) must be inserted to the correct terminals when connecting the compressor to the mains plug. Inserting the conductors into the wrong terminals can damage the compressor or cold head.
5. Only connect cold heads which are suitable for the compressor units used. For the approved cold heads.

3 General description

Cryo systems consists of:

- A compressor unit,
- Flexible pressure lines,
- A refrigerator (cold head) or a cryopump.

These instructions for use describe the design and the operation of the compressor units and the corresponding flexible pressure lines.

3.1 Design and function

Compressor units compress the helium gas which is expanded in the cold head to create low temperatures.

Each compressor unit comprises the following function modules:

- Helium compressor,
- Heat exchanger,
- Gas purifiers,
- Electrical components (for example, power supplies, controller).

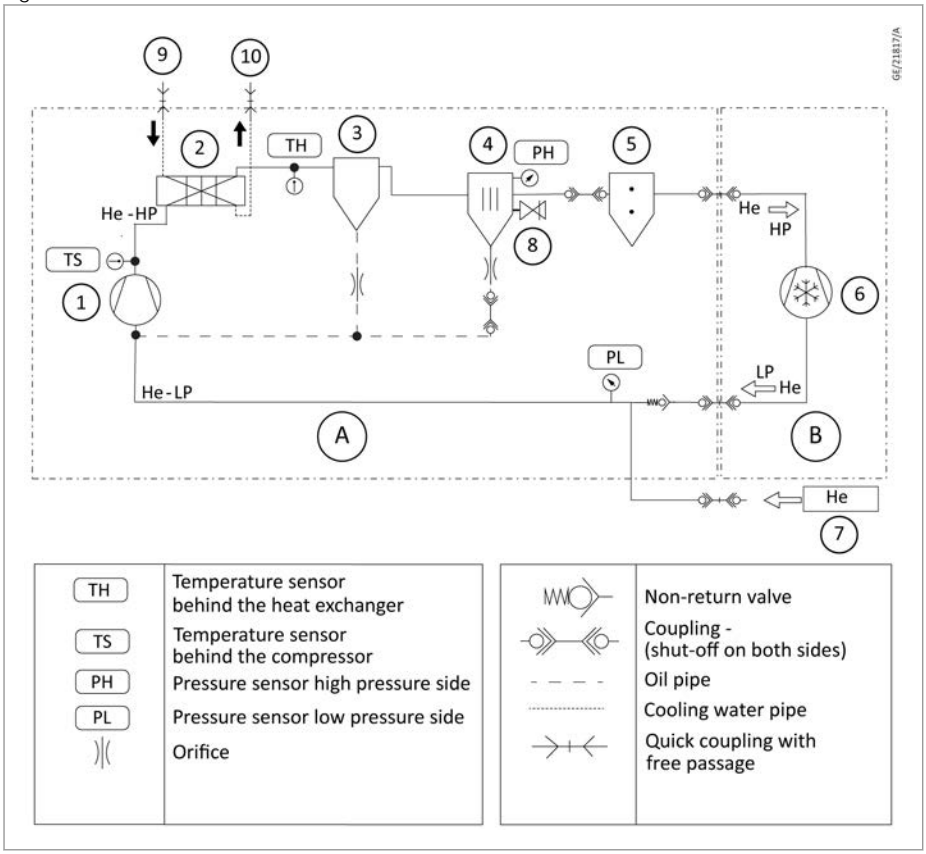
The compressor unit and the cold head are connected through flexible pressure lines. The compressor unit, cold head and pressure lines are provided with self-sealing screw fittings and are filled with high-purity helium gas.

The helium compressor is lubricated and cooled with oil. The oil is cooled by water in a heat exchanger.

After compression, the helium gas and the oil are cooled in a heat exchanger and subsequently, oil is separated in oil separators and the adsorber.

General description

Figure 1. Flow chart



1. *Helium compressor (horizontal design)*
2. *Heat exchanger*
3. *Pre-separator*
4. *Oil fine-filter*
5. *Adsorber*
6. *Cryopump / Coldhead*
7. *Helium refill*
8. *Safety valve*
9. *Cooling water inlet*
10. *Cooling water outlet*

3.2 Conforming utilization

1. The compressors must only be used in conjunction with cold heads and other devices with integrated cold heads, for example, refrigerator cryopumps or refrigerator cryostats. Any other use is not permissible.
2. The compressor has been designed to compress very high purity helium.
3. Compressors and connected cryopumps or cold heads are designed to be operated indoors.
4. The compressor must be installed on a leveled floor so that it cannot move.
5. Use the components supplied by us for connection to the compressors. To use any other component, contact us for approval.
6. The compressor unit must only be used to operate the cold heads or cryopumps specified in *Technical data* on page 16. Operation of other cold heads and cryopumps requires prior approval by us.

3.3 Non-conforming utilization

WARNING: NON-CONFORMING UTILISATION

Risk of injury or damage to equipment. Any non-conforming utilisation of the cold head, cryopumps and accessories can result in severe injury and may cause damage to components.

Non-conforming utilisations for the compressor are as follows:

1. Disable safety devices or process control devices.
2. Use of helium which is not pure (purity of 99.995 % or higher is required) or other gases.
3. Operation at helium pressures lower or higher than those specified in *Technical data* on page 16.
4. Use of the compressor in environments which demand a type of protection in excess of IP40 and altitude above 2000 m.
5. For operation without cold head or cryopump, contact application management.
6. Remove cover or obstruct warning information.
7. Store the compressor without having sealed it off suitably and dried it.
8. Storage or operation of the compressor in an atmosphere where air humidity can condense and avoid condensate during change of location of storage (from cold to warm).Refer to *Figure: Dew-point diagram* on page 24.
9. Pulling on cables and flexlines, stepping on compressor.
10. Operation of the system or system components on mobile platform.
11. The use of cables, helium pressure lines and other accessories not approved as original accessories from us.
12. Conversions, modifications and maintenance work by personnel not authorised by us.
13. Use of the compressor in an environment or atmosphere subject to explosion hazard.

3.4 Supplied equipment

The compressors are delivered with helium and oil filling. They are provided with removable eyebolts. The helium filling adapter is supplied as an accessory.

The self-sealing screw fittings are closed by protective caps.

4 Technical data

Table 1. Environment conditions

Parameter	Value
Ambient temperature	4 °C up to 45 °C (shipping/storage -20 °C up to 65 °C)
Relative humidity*	10% up to 95%, non condensing
Overvoltage category	IEC 60664-1 category II
Air pressure (height)	Minimum 780 mbar (maximum 2000 m)
Installation location	Indoor use
Pollution degree	2

** Refer to Figure: Dew-point diagram on page 24 for detailed information.*

4.1 Ordering information

Table 2. Ordering information

Description	Part number
Helium refill adapter	E6545923
Adsorber, (1/2“,1/2“)	E6568302

Note:

Use only the adsorbers supplied by us. The adsorbers are specially tested pressure vessels. The use of other adsorbers will void the warranty and will also void the CE Declaration of Conformity.

Technical data

Table 3 Technical data

Helium compressor	
Part number	840000E1201MI
Helium system filling pressure to be set at room temperature	15.0 bar(g)
Helium filling pressure at the time of delivery	15.0 bar(g)
Helium filling mass at time of delivery	24 g
Mains connection 50/60 Hz 1-ph, ±10% each 50/60 Hz 1-ph, ±10% each	 230 V 208 V
Electrical power consumption 50 Hz operation 60 Hz operation	 2.2 - 2.5 kW 2.3 - 3.0 kW
Operating current 230 V, scroll at 50 Hz operation 208 V, scroll at 60 Hz operation	 12.0 A 15.0 A
Supply voltage for the cold head	200 V a.c. 3-phase
Nominal value for the automatic circuit breaker in the mains power line (Slow triggering characteristics)	16 A
Type of residual current device (RCD)*	Type B SK short term delayed
Short-circuit breaking capacity 230 V	 50 kA
Maximum mains impedance at the supply connection point	0.1+0.06 Ohm
Helium connections: Self-sealing screw fittings	1/2" (Aeroquip series 5400-8b)
Weight	80 kg
Safety standard	IP 40
Enclosure type	Type 1 (UL 50E)
Average sound pressure level (A) 1 m distance	60 dB(A)
Tilt angle**	Maximum 10° in operation Maximum 30° during transport

** Refer to local regulations for the use of RCDs*

***If the intended tilt angle during operation is more than 10°, contact us.*

5 Transportation and storage

WARNING: PRESSURISED PARTS

Risk of injury. The compressor, the cold head and the pressure lines are subjected to a filling pressure of up to 16 bar(g) even after turning off. Obey the relevant safety regulations.

WARNING: LIFTING HAZARD

Risk of injury. Always use 4 eyelets to lift the compressor. Not following this rule can result in damage to the compressor and can cause a risk to the operating personnel. The installed handles are not to be used to lift the compressor but just push or pull it while installation/maintenance.

WARNING: TRANSPORTATION SAFETY

Risk of injury. The weight of the compressor exceeds the maximum lifting capacity of the handles. Do not use installed handles to lift the compressor but just push or pull it during installation/maintenance.

CAUTION: FROST HAZARD

Risk of damage to the equipment. Drain the cooling water before you store or transport the compressor and blow the compressor out with compressed air.

Always store the compressor in a dry place.
Relative humidity 10% maximum up to 95%, non condensing.

The permissible ambient temperature range during transportation/storage is from -20 °C up to 65 °C.

The atmospheric pressure must not be below 780 mbar.

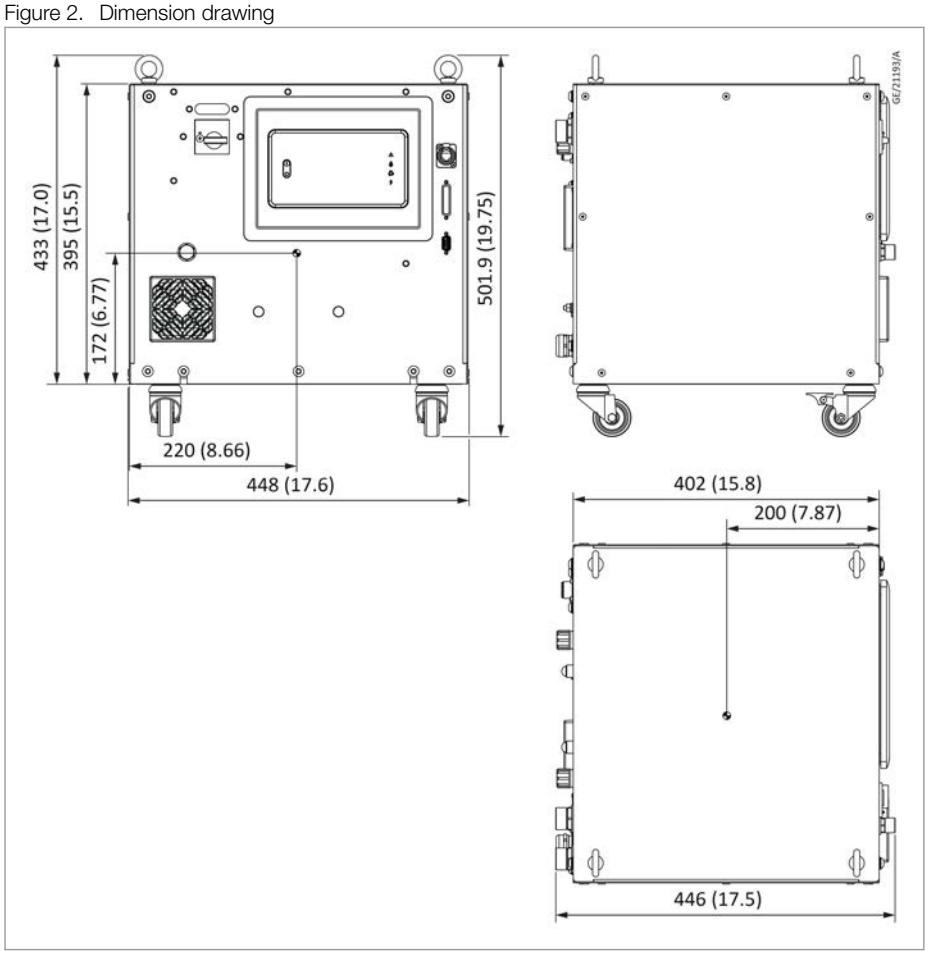
Note:

Do not tilt the compressor by more than 30° during transport and storage. Make sure that it does not tip over.

The equipment has only been approved for all types of transport worldwide when properly packaged in its original packaging (ASTM D4169-16 DC 4).

6 Installation

Figure 2. Dimension drawing



Note:

All dimensions are given in mm (inch).

6.1 Unpack and Inspect

WARNING: SUSPENDED LOAD

Risk of injury and damage to equipment. Fixing points (eye bolts) are provided on the compressor as standard. Always use all 4 eyebolts to lift the compressor.

When you lift and set down the compressor, do not reach under the frame edges with your hands. There is a risk of bruising of hands and feet.

To avoid damage, only use the intended eyebolts for moving the compressor. Do not hold or move the compressor by way of the pipelines or other parts or components.

1. Examine the transport package for external damage.
2. Unpack the devices immediately after receipt, even if you do not intend to commission them until later.

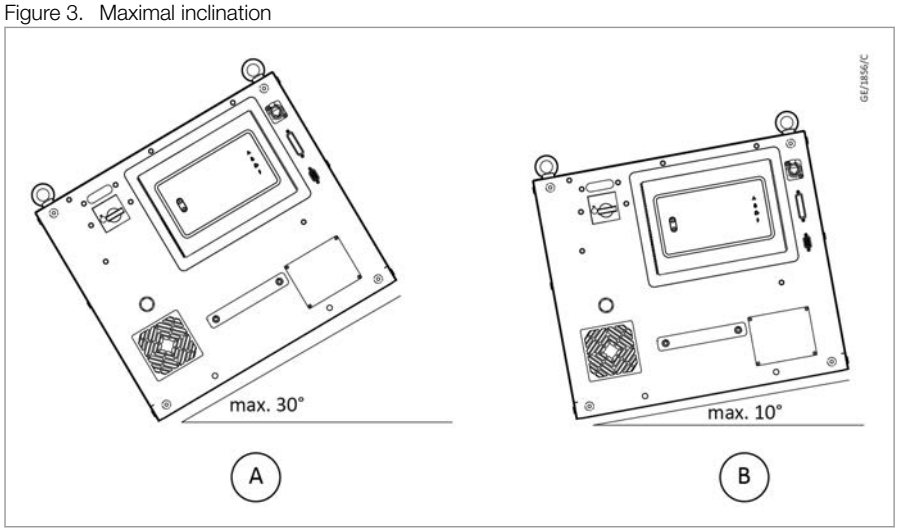
3. Release the strapping, open the cardboard box and lift out the compressor using all 4 eyebolts. The eyebolts can be screwed out.

Note:

The system can be stored for up to 1 year after delivery.
When you transport or store the compressor, do not tilt more than 30° (tilt hazard). The Greater inclination may cause damage to the scroll compressor or oil contamination in the helium circuit.
After excessive inclination, or if the compressor tips over, call our service department. Topple indicators (TIP'N'TELL) is attached to the packaging so that it is possible to inform afterwards when the package has been tilted during transit.

4. Check the pressure indication on the compressor, refer to *Technical data* on page 16. If the pressure is too low, top up helium or inform our service department.
5. Keep the transport package in case it becomes necessary to return the compressor.
6. Check that the equipment is complete (refer to *Supplied equipment* on page 15) and do the complete visual inspection of all the parts.
7. If you detect any damage, send a damage report to the forwarder and the insurance company immediately. If the damaged part needs to be replaced, contact us.

Figure 3. Maximal inclination



A. Transport *B. Operation*

6.2 Installation

For operation, the compressor can be erected with an inclination of 10° in any direction.

In case of high angles of inclination, secure the compressor against slipping. In areas subject to the hazard of earthquakes, the compressor must be connected to the building. The connection must be designed such that it withstands an acceleration of 0.5 g in the horizontal direction and 0.33 g in the vertical direction. A fixation kit (optional) is available as an accessory. Refer to *Ordering information* on page 16.

The base plate possesses drill holes for fixing the compressor. For vibration isolation, we recommend fixing using vibration dampers.

The compressor is prepared for installation in 19 inch racks.

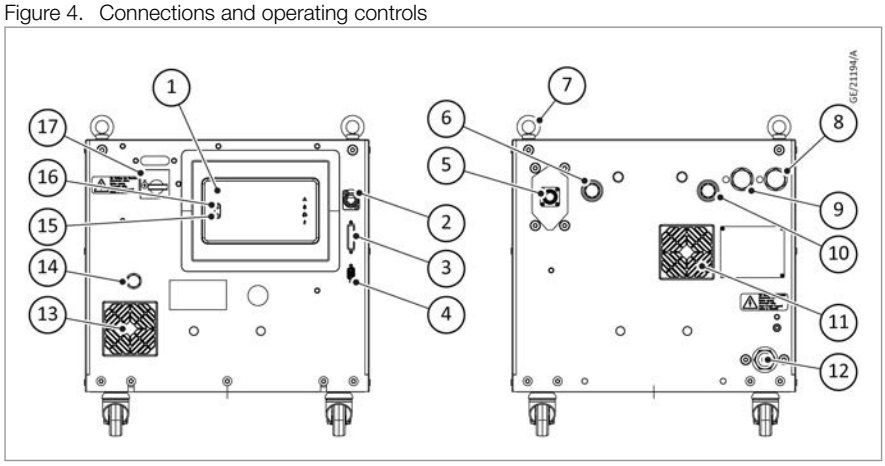
Make sure that the site of installation is dust-free. Do not expose the compressor to intensive solar irradiation.

Note:

Do not subject the compressor to splash or splashing water.
The saftey of the system into which the compressor is integrated is the responsibility of the installer of the system.

The eyebolts can be screwed out. We recommend you to keep the removed eyebolts in a safe place for future use.

Figure 4. Connections and operating controls



1. *Controller touch panel*
2. *Service/ethernet interface*
3. *Remote interface*
4. *Gateway connector*
5. *Cold head connector*
6. *Cooling water outlet*
7. *Lifting eyelets*
8. *Helium low pressure connection (green)*
9. *Helium high pressure connection (red)*
10. *Cooling water inlet*
11. *Cooling air outlet*
12. *Mains cable gland*
13. *Cooling air inlet (filter)*
14. *Helium refill connector*
15. *OFF touch-button*
16. *ON touch-button*
17. *Main switch*

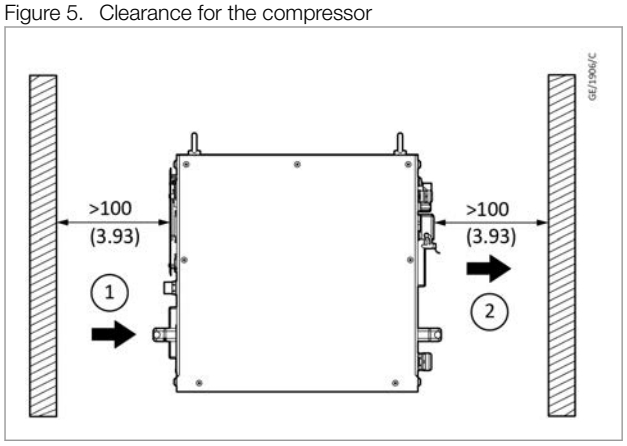
6.3 Ambient conditions

6.3.1 Ambient conditions

Parameter	Value
Ambient temperature at operation	4 °C up to 45 °C
Ambient air pressure (altitude)	Minimum 780 mbar (maximum 2000 m)

Keep sufficient clearance at the front and backside of the compressor to make sure cooling airflow, refer to *Figure: Clearance for the compressor* on page 22.

Figure 5. Clearance for the compressor



1. *Cooling air in - Frontside*
2. *Cooling air out - Backside*

6.3.2 Cooling water data

Refer *Cooling water connection* on page 23.

Table 4. Cooling water data

Parameter	Value
Cooling-water inlet temperature	5 - 32 °C
Permissible cooling-water connection pressure	Maximum 8 bar(g)
Pressure drop Δp between cooling-water inlet and outlet, depending on the cooling-water flow rate	0.2 - 0.6 bar(g)
Cooling-water connection: External-thread screw fittings	G 1/2 inch
Cooling-water requirements at an inlet temperature of 25 °C	≥ 5 l/min
Maximum cooling-water flow rate	10 l/min

6.3.3 Cooling water specification

Cooling water specification based on specifications of the brazed heat exchanger is as follows:

Table 5. Cooling water specification

Properties	Range
Appearance	-
Suspended matter	clear, without turbidity
Particle size	< 150 µm
Electrical conductivity	10…500 µS/cm
pH value	7.0…9.0
Saturation index SI (delta pH-value)	-0.2 < 0 < +0.2
Total hardness (total alkaline earths)	6…15 °dH
Aggressive carbon dioxide	< 20 mg/l
Chloride	< 100 mg/l
Sulphate	< 100 mg/l

Properties	Range
Hydrogen carbonate	< 300 mg/l
Hydrogen carbonate / sulphate ratio	> 1.0
Sulphide	< 1.0 mg/l
Hydrogen sulphide H_2S	< 0.05 mg/l
Nitrate	< 100 mg/l
Nitrite	< 0.1 mg/l
Iron	< 0.2 mg/l
Manganese	< 0.1 mg/l
Ammonia / Ammonium NH_3 / NH_4^+	< 2.0 mg/l
Free chlorine	< 0.5 mg/l

6.3.4 Water quality

Make sure that the cooling water does not contain any oils, greases and suspended solids.

Note:
Failure to observe the cooling-water specifications may result in internal corrosion. This could damage the compressor.
In case of deviating cooling water data, consult us.

6.3.5 Relative humidity

Do not install the compressors in condensing atmospheres, refer *Figure: Dew-point diagram* on page 24.

The diagram shows the minimum cooling-water inlet temperature at which condensation does not occur, depending on the maximum room temperature and the maximum relative humidity.

Example: Maximum room temperature 25 °C

Minimum cooling-water temperature 17 °C

= Maximum humidity 60%

6.3.6 Cooling water connection

Remove the sealing caps from the cooling water connections and connect the cooling water hoses. The maximum torque for G 1/2 inch screw connectors is 170 Nm.

Do not mix up inlet and outlet.

It is recommended to restrict the cooling water flow at the outlet.

Note:
Do not connect the cooling water connections of the compressor with the drinking water supply/public water supply.

Note:
Restriction of the cooling-water flowrate at the input or an insufficient pressure difference between the input and the output may result in insufficient cooling of the oil circuit. Possible consequences are failure of or damage to the compressor.

Only use cooling-water hoses of sufficient pressure strength (minimum 10 bar(g) at 70 °C).

Installation

Observe the *Cooling water specification* on page 22.

When you use water with different specifications, deposits in the heat exchangers may obstruct the water flow and heat dissipation. If necessary, install a 100 µm fine filter in the cooling water supply. The fine filter must be replaced at regular intervals. To make sure that the heat exchangers are not attacked by chemicals, distilled or soft water must only be used in conjunction with suitable inhibitors and only for the compressors with stainless steel water connections.

Continuous operation at ambient and water temperatures below 5 °C is only possible with additional safety measures. Even if antifreeze is used, the cooling-water inlet temperature must be in the permissible range, except during a warm-up time of approximately 15 minutes. If you use antifreeze, contact us for advice. The specific heat capacity, the viscosity and the corrosive properties of cooling water with additives differ significantly from the values applicable for standard cooling water.

Check the cooling water flow and the cooling-water temperature at regular intervals.

Figure 6. Dew-point diagram

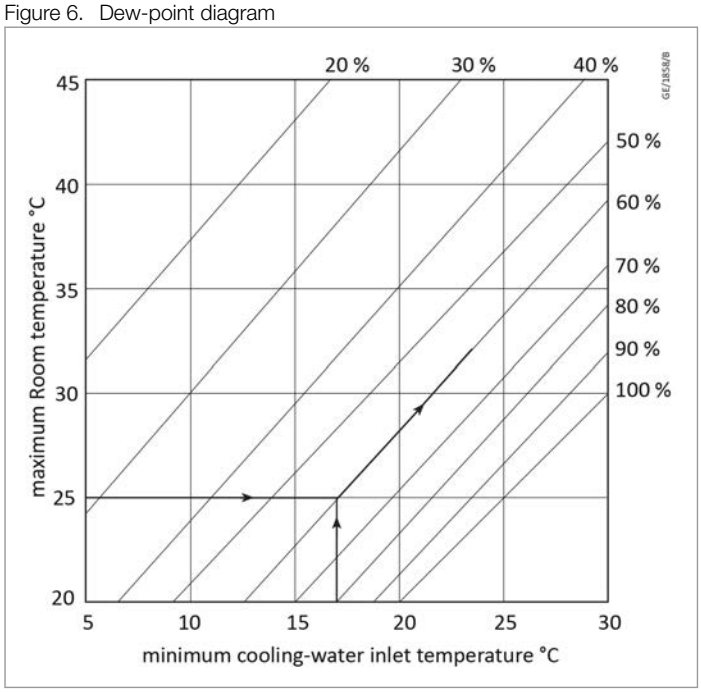
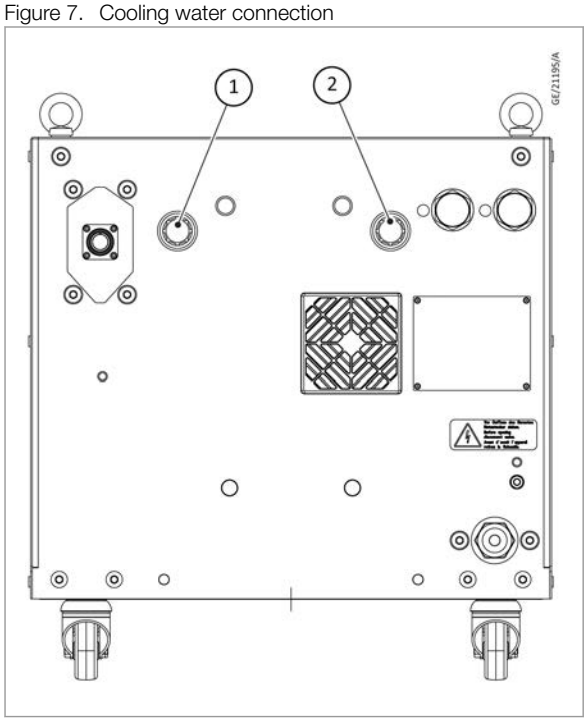


Figure 7. Cooling water connection



1. *Cooling water outlet*
2. *Cooling water inlet*

6.4 Electrical connection

When you lay cables, make sure that there is no risk of stumbling or falling.

Note the safety information given in Electrical hazards.

6.4.1 Connecting the power supply

The compressor is shipped with following mains power cord configuration:

- 840000E12XXMI: screened power cord 3x 2.5 mm² / 12 AWG, wire ferrules.

Connect the power supply as follows:

1. Make sure that the correct fuse or RCD is installed on the customer side, refer to *Technical data* on page 16.
2. When you lay the cables, make sure that there is no danger of stumbling or falling.
3. Install a plug on the mains cord. Make sure the plug utilizes a Protective Earth (PE) - connector and offers a sufficient ampacity according to local regulations and the technical data of the compressor.
4. The plug must have te following characteristics:
   - minimum ampacity: 16 A
   - minimum Voltage rating: 230 V a.c.
   - Protective earth connection with cross-section not smaller than 2.5 mm²

Note:

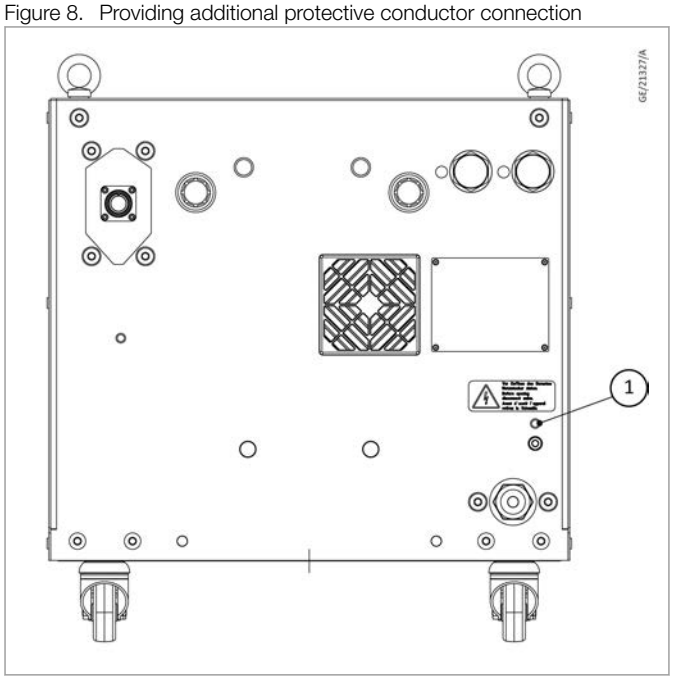
After all service work, the internal ground connections must be correctly re-established and it is mandatory to do an electrical safety test according to the local standards before you connect the compressor to the mains.

5. Plug in the mains plug.
6. If no short circuit to a ground monitoring device or Residual Current Device (RCD) is present, then provide additional protective conductor connection.
7. Connect additional protective conductor connection at the backside of the compressor housing.

6.4.2 Providing additional protective conductor connection

- Stud bolt (M6) on the right, see arrow in *Figure: Providing additional protective conductor connection* on page 26.
- Use a wire gauge of at least 2.5 mm^2 or AWG 12 of copper if protection against mechanical damage is provided or 4 mm^2 or AWG 11 of copper if protection against mechanical damage is not provided.
- Note the correct sequence: tooth lock washer or washer, ring terminal of the PE wire, spring washer, washer, nut. Observe maximum line resistance to local standards.

Figure 8. Providing additional protective conductor connection

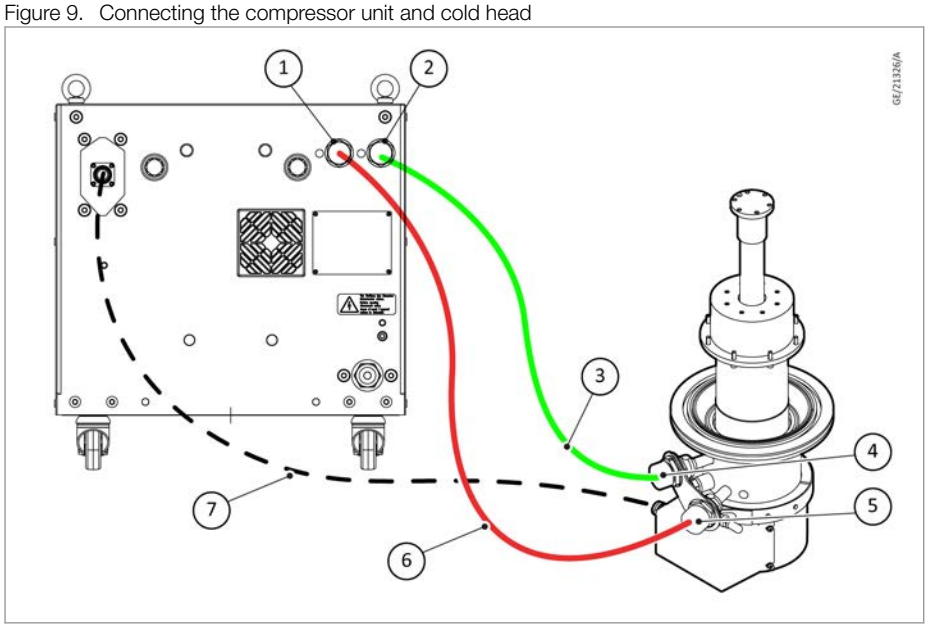


1. *Additional protective conductor connection*

6.5 Connect compressor and cold head

The helium compressor is capable to drive up to 1 cold head. Refer to *Technical data* on page 16 and the compressor type (catalogue number) of cold heads or cryopump that can be connected.

Figure 9. Connecting the compressor unit and cold head



1. *Compressor high pressure*
2. *Compressor low pressure*
3. *Low pressure flexline*
4. *Cold head low pressure*
5. *Cold head high pressure*
6. *High pressure flexline*
7. *Cold head supply cable*

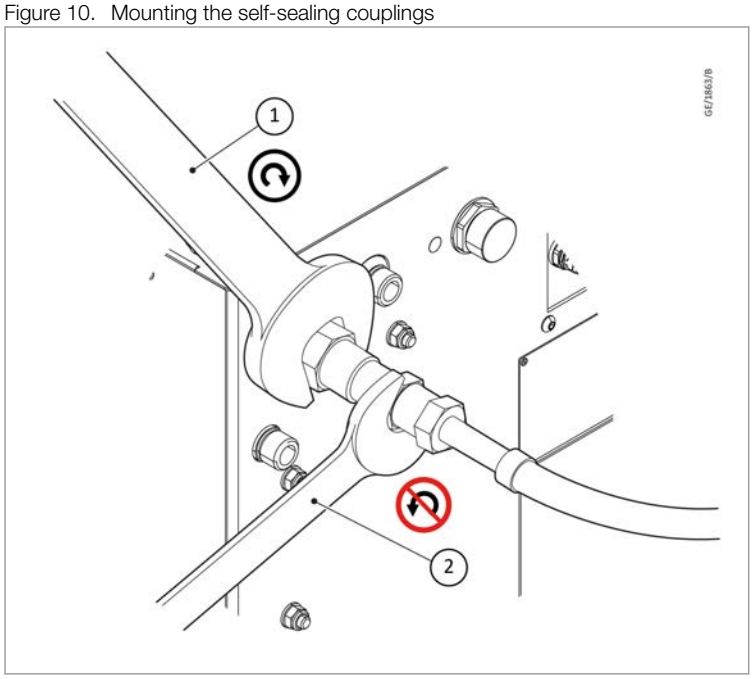
6.5.1 Connect the self-sealing screw fittings

Connect the self-sealing screw fittings as follows:

1. The interconnecting flexlines and elements possess self-sealing screw fittings. The connections can be opened and closed without helium escaping.
2. Remove the protective caps from the screw fittings.
3. Keep the protective caps in a safe place.
4. Check all connections for dust and dirt particles and clean them using a clean, lint-free cloth or a soft, clean brush.
5. Do not use solvents to clean the connections. The connections must not be greased or oiled.
6. Check the correct fit of the flat gaskets in the screwed fittings with external thread. Replace missing or damaged gaskets.
7. To mount the pressure lines, only use the specified wrenches.
8. Only connect or disconnect pressure lines if the compressor is turned off and the pressure is below 26 bar(g).

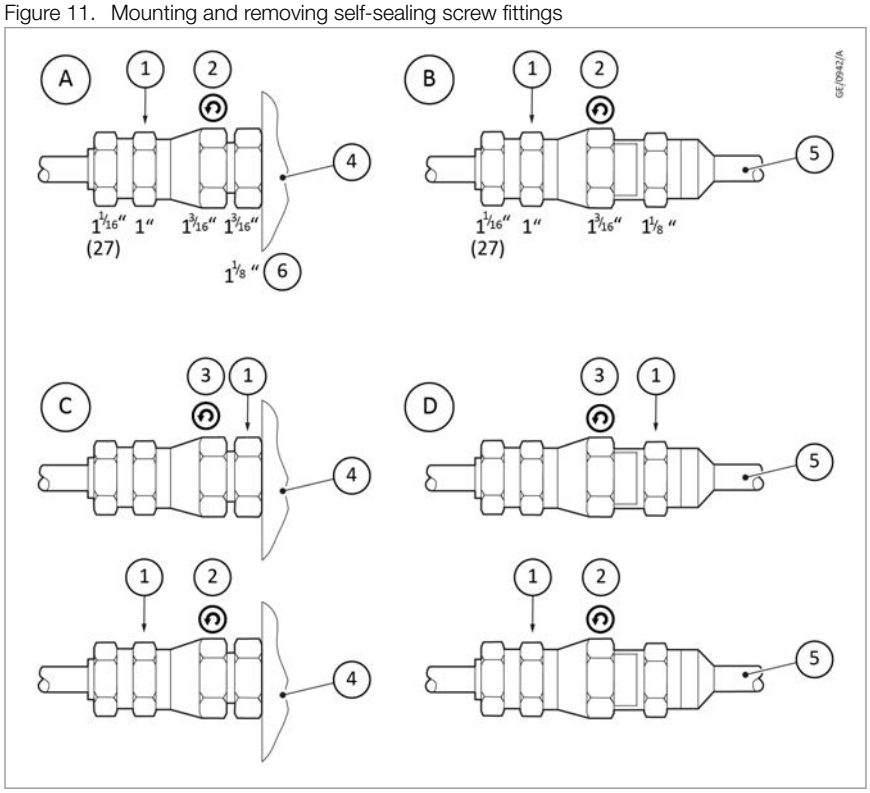
Installation

Figure 10. Mounting the self-sealing couplings



1. *Wrench for tightening*
2. *Stabilizing wrench*

Figure 11. Mounting and removing self-sealing screw fittings



A. *Fix the screw fitting on the compressor unit*
B. *Fix the screw fitting on the cold head*
C. *Remove the screw fitting from the compressor unit*
D. *Remove the screw fitting from the cold head*

1. *Hold up*
2. *Turn*
3. *Loosen*
4. *Compressor unit*
5. *Cold head*

Connect the self-sealing screw and coupling as follows:

- Do not twist the pressure lines.
- When you fix the screw fittings, use one wrench for tightening and a second wrench for countering, refer *Figure: Mounting the self-sealing coupling* on page 28 and *Figure: Mounting and removing self-sealing screw fittings* on page 28.
- 1/2” screw fitting:
  - For tightening, use a 1 3/16” wrench,
  - For holding up, use a 1 1/16” wrench.
- Tighten all screw fittings up to their stop and then turn them back by 1/4 turn for relief.
- If flexible pressure lines need to be routed with bending radii less than 20 cm, install 90° elbows, refer to *Ordering information* on page 16.
- To extend the helium pressure lines, use line couplings, refer to *Ordering information* on page 16.
- Bundle the flexlines and protect these against tripping and damage.

6.5.2 Install the flexible pressure lines

WARNING: PRESSURISED LINES

Risk of injury or damage to equipment. Use flexlines supplied by the manufacturer only.
Replace damaged flexlines.

Refer to *Connect the self-sealing screw fittings* on page 27 for the procedure to connect the self-sealing screw.

Refer to *Figure: Connecting the compressor unit and cold head* on page 27 and connect the flexlines in sequence, corresponding to the direction in which the helium flows:

1. High pressure connection at the compressor
2. High pressure connection at the cold head
3. Low pressure connection at the cold head
4. Low pressure connection at the compressor

Note:

Do not mix up the high and low-pressure connections. Interchanging these connections can cause damage inside the cold head.

Do not use a flexline on the high-pressure side which was ever used on the low-pressure side.

Do not connect the high-pressure connection directly to the low-pressure connection as it can cause short-circuit.

Operation with directly connected high and low-pressure can damage the compressor.

6.5.3 Check the helium filling pressure

Switch on the compressor by turning the main switch after the installation of the flexible pressure lines. You must not switch on the compressor with the ON touch button. Check the helium filling pressure at the main screen and correct it if required, refer to the cold head manual for the correct data and Topping up or draining helium gas for the filling or reducing procedure.

If the helium pressure level is below 10 bar(g), contact us.

6.5.4 Connect the cold head electrically

For the electrical connection between compressor and cold head use only the cables supplied by us. Refer to *Ordering information* on page 16.

CAUTION: COLD HEAD CONNECTION

Risk of damage to the equipment. When connecting or disconnecting the cold heads electrically using the cold head supply cables with the compressor, always make sure that the compressor is switched OFF (Mains switch is turned off). If you connect the cold head using the cold head supply cables while the compressor is switched ON, the cold head may be damaged and lose its function. Do not install damaged electrical lines or connectors.

Do not disconnect the line plug while the compressor unit is running. Do not remove the mains plug during compressor unit operation.

WARNING: COLD HEAD CONNECTION

Risk of electrical shock. The cold head supply cable between the compressor and the cold head must be connected or disconnected only when the compressor is switched off my means of the main switch. Compressor and cold head can get damaged.

Connect cold head

1. Make sure the compressor main switch if switched off. Plug the cold head supply cable into the socket at the cold head and tighten it. Then plug the the same cable into the socket "cold head" at the compressor and tighten it.
2. Switch on the main switch and wait until the compressor has booted.

There are two different ways to navigate into the cold head menu.

1. Navigate to Main screen 1 > Machine Settings > Equipment parameters > Cold Heads > Cold Head 1 connection status (Refer to *Figure: Main screen* on page 30).
2. Navigate to main screen 3 > touch the cold head symbol (Refer to *Figure: Main screen 3* on page 31).

Confirm the connection status of the cold head: The connection shows the status "Connected".

Figure 12. Main screen

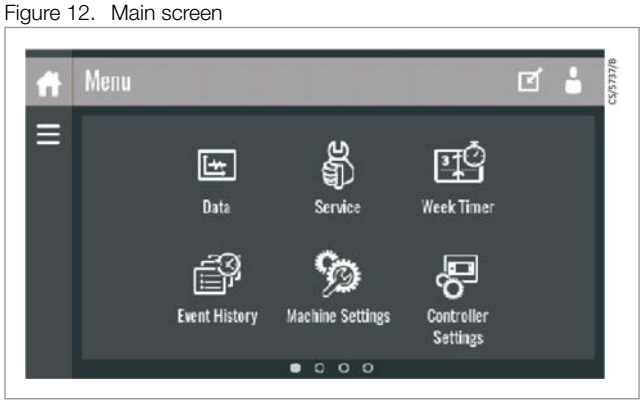
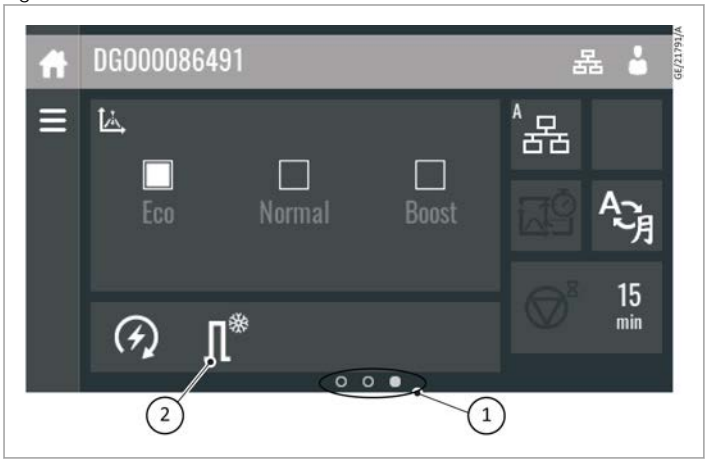
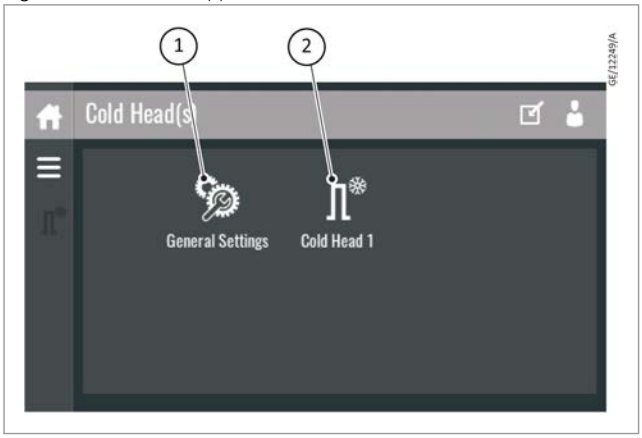


Figure 13. Main screen 3



1. *Main screen 3* 2. *Cold head symbol*

Figure 14. Cold head(s) menu



1. *General settings* 2. *Cold Head 1*

7 Operation

CAUTION: OPERATION SAFETY

Risk of damage to the equipment. Operate the compressor only in the proper condition with all covers in place.

Operation by expert personnel only.

The compressor offers 3 different operation points for the compressor - cold head system. Each operation point represents a set-point for the cold head speed. Following table illustrates the different operation points and the corresponding setpoints:

Refer to *Figure: Pin assignments on the Sub-D connector* on page 36.

	Operation point 1 (Normal)	Operation point 2 (Eco)	Operation point 3 (Boost)
Cold head	Cold head setpoint 1	Cold head setpoint 2	Cold head setpoint 3

The Operation point 1 (Normal) represents the maximum continuous operation of the system and is used as the default Operation point (if no other Operation point is activated, the compressor will use Operation point 1). The default cold head set point represent the maximum permissible speed for it's continuous operation.

The Operation point 2 (Eco) offers a variable operation to adapt to the needed cooling-power. The cold head setpoint is set to default values that represent the nominal operation and can be adjusted. Refer to the corresponding diagrams of the cold head performance within the cold head manual for these parameters.

The Operation point 3 (Boost) is a special operation point to gain short term maximum cooling power. It can be activated whenever necessary and for an unlimited period. As the cold head runs at elevated speed, wear of the displacer also increases.

During start-up, the compressor performs a system check before it will operate according to the chosen operation point.

7.1 Control mode

Press the icon when you navigate to the Main screen 3 to select the desired control mode.

The compressor offers 3 control modes.

- LOCAL

  Control the compressor through touch-display input
  - Switch compressor on and off with touch button
  - Change settings, operation points, connect or disconnect cold heads, see data, signal inputs and outputs
  - Switching cold head on or off, selecting operation points.
- REMOTE

  Control the compressor through remote-interface (25 pole D-sub connector at front plate).

- Switching on and off
- Switching cold head on or off, selecting operation points.

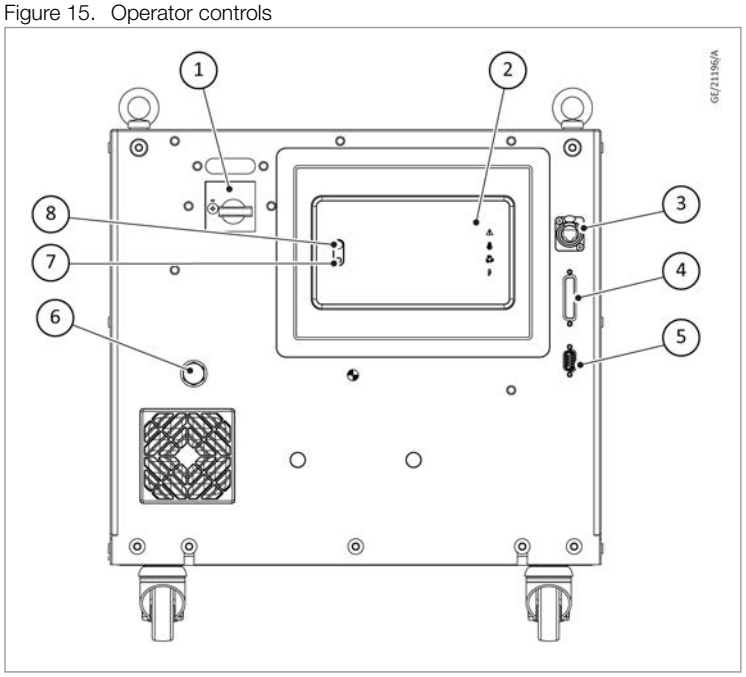
- LAN through a gateway (auxiliary)

  Control the compressor through a separate gateway module that can be connected via Modbus or Profibus

  - switching the compressor on or off, also cold heads and selecting operation points through a gateway
  - Read out data, values of temperature and pressure
  - Can be used for data logging.

Refer to the Gateway manual for detailed information on the operation of the compressor through the gateway.

Figure 15. Operator controls

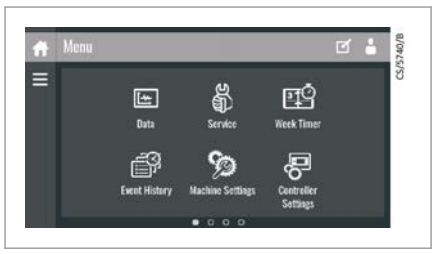


1. *Main switch*
2. *Controller touch panel*
3. *Service/ethernet interface*
4. *Remote interface*
5. *Gateway connector*
6. *Helium refill connector*
7. *Touch button off*
8. *Touch button on*

7.1.1 Local control mode

This control mode offers the possibility to change all settings of the compressor.

On Main screen 1 (Menu)



You have access to different menus

Operation

Data	Service	Week timer	Event history	Machine settings	Controller settings
Status Indicates the machine status	**Service plan** Information about planed services	Set up a calendar with automatic runtime	Failure log chart	**Alarms**	**Network settings** CAN and LAN
Inputs Information about all input signals	Service History	-	Event data Occurred failures	**Regulation** Customization Setpoint	**Localization** Data, Time, Language
Outputs Information about all output signals	Service Overview	-	-	**Control Parameters**	**User password**
Counters Running hour and system starts	-	-	-	**Auxiliary Equipment** Cold Head settings	**Help**
Auxiliary Equipment Information internal converter	-	-	-	**Auto restart**	**Information** General information

On Main screen 2

Note:
Above figure shows a switched off compressor.

- The Home-icon in the left upper corner is a shortcut to open Main screen 2.
- The menu-icon (3 horizontal lines) is a short cut to Main screen 1
- Main screen 2 indicates the actual high and low pressure side readings of the pressure sensors. A bar next to the pressure values shows by colour if the value is within the permissible range. Green indicates a permissible value, yellow indicates is a warning (value is permissible but close to failure) and red when a value is not permissible. When the value is not permissible a failure is triggered, the compressor shuts down, the failure LED at the side of the touch display and the failure sign (red triangle in the upper right corner of Main screen 2) will light up. By touching the failure sign, you will get access to the event data as a shortcut.

- The wrench icon lights up when a service is needed, by touching it you will get access to the service menu
- Depending on the machine status and control method the square icon changes.

On Main screen 3

The square symbol is used to change the control mode.

The stairs symbol is a shortcut to get to the systems settings menu (including cold head settings):

- Connect or disconnect the cold head(s)
- Select operation points (Normal, Eco, Boost)
- Adjust cold head speed

7.1.2 Remote control mode

To use the remote control mode, navigate to main screen 3 and select the square and select Remote Control.

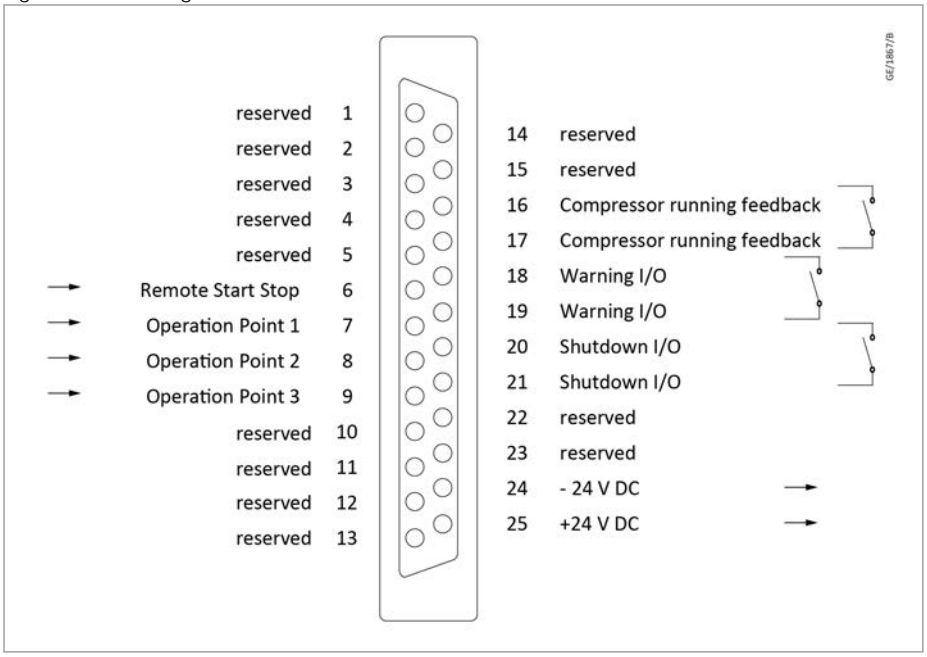
The 25 pole Sub-D at the front of the compressor is used to control it with digital input signals. To select the digital input signal use the +24 V d.c. from pin 25.

Refer to *Figure: Pin assignments on the Sub-D connector* on page 36 for pin assignments of all possible functionality.

The digital outputs (pins 16 to 21) are potential free contacts and rated with a maximum 24 V d.c. and 2.5 A.

The control lines for the REMOTE interface respond to the rising or falling flank of a +24 V d.c. signal.

Figure 16. Pin assignments on the Sub-D connector



The following schematic shows the behavior of the signal if selected or not.

Pin	Description	Triggered	Not triggered
14+15	Reserve	Open	Closed
16+17	COOLPAK running feedback	Closed	Open
18+19	Warning I/O	Open	Closed
20+21	Shutdown I/O	Open	Closed
22+23	Reserve	Open	Closed

7.1.3 LAN control mode

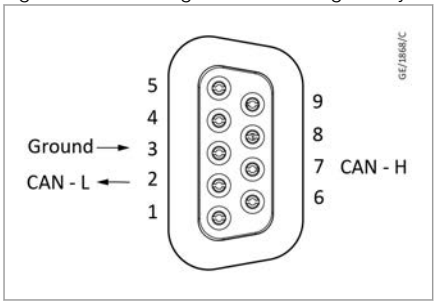
The LAN control mode offers the possibility to control the compressor with an auxiliary device, the Gateway. It communicates with the compressor(s) through an encoded CAN protocol and can address up to 30 compressors in a network. ProfiBus or ModBus can be used to communicate with the Gateway from the customer side.

To connect the gateway use a Sub-D 9 pole cable with the pin assignment from on page 37.

To install and configure the gateway, refer to the Modbus and Profibus manual.

For both Modbus and Profibus protocol an address mapping is available.

Figure 17. Pin assignments on the gateway connector



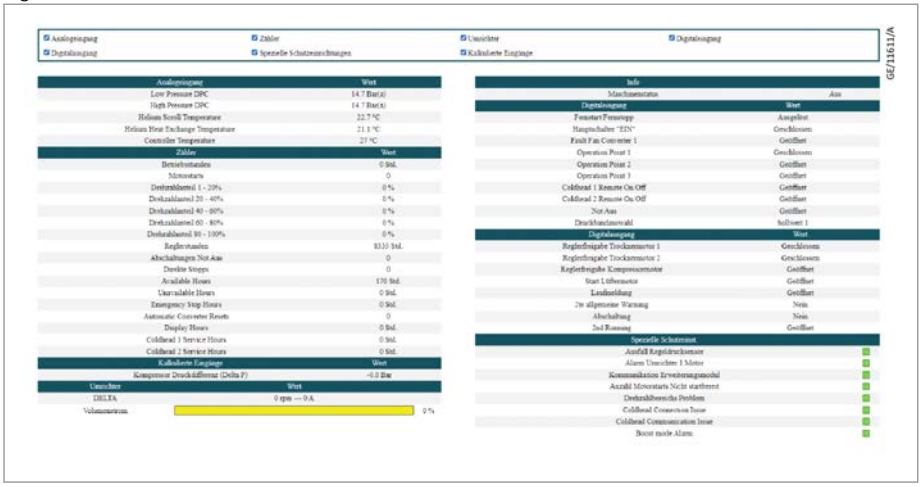
7.1.4 Web server

The web server monitors the current values of the inputs and outputs as well as the settings of the compressor, like pressure and temperature, current speed or selected operation point. It cannot be used to control the compressor.

To use the web server plug in an ethernet cable into the SERVICE socket (RJ-45) at the front side of the compressor and connect it to a computers network socket.

To get access to the web server type the default IP-address (192.168.100.100) in the command line of your web browser.

Figure 18. Webserver



7.2 Change settings of the operation points

The operation point defines an adjustable setpoint for the cold head speed.

The range for the speed of the cold head depends on the cold head type. For more information refer to the cold head technical data in the respective manual.

The cold head speed mainly influences the achievable cooling power of the cold head.

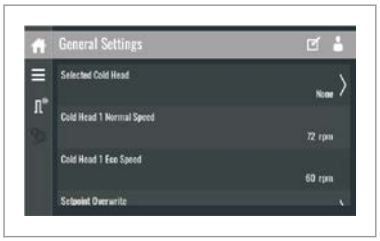
For a known cooling power demand, refer to the cold head manual for a useful speed of the cold head.

To change the operation point settings for cold head speed, navigate to Main Screen 3. Tap the cold head icon. Choose General Settings and select the cold head speed.

Operation

The operation points can be easily chosen by the touch buttons on the screen, via digital Input/Output or the Gateway interface. To change the parameter of cold head speed navigate to the cold head menu. Select the sub menu “general settings”. The displayed table contains the settings of the cold head speed.

After setting the values you can use the operation point in each control mode.



7.3 Error reset

CAUTION: ERROR RESET

Make sure that the reason which triggered the error is gone before switching on the system again. If the problem is not solved the compressor will switch off again.

In case an error occurs, there are three different possibilities to reset it. The first option is to tab on the main screen on the red triangle and reset the error by tapping on the circle symbol. Is the error reset done, the compressor can be switched on by the white touch button.

If the compressor is controlled by digital Input/Output signals the error can be reset by sending the compressor start command twice. The first high flank is to reset the error the second high flank is to switch the compressor on again.

If the compressor is controlled by gateway in LAN mode, then please use the command out of the address mapping of the gateway. There is one command to reset the error and another to start the compressor.

7.4 Switching on

CAUTION: FLEXLINES CONNECTION

Risk of damage to the equipment. Do not operate the compressor without connecting the flexlines and the cold head. Operation without flexlines and cold head may damage the compressor.

Open the cooling water supply.

Switch on the main switch.

After switching on the main switch, wait 30 seconds until the cold head(s) is (are) connected. Then proceed according to the selected control mode.

- Local: select the operation point in the menu and press the ON touch button
- Remote: select the operation point and start signal according to the pin assignment (refer to *Figure: Pin assignments on the Sub-D connector* on page 36)
- LAN: send the start-command via gateway controller

7.5 Switching off

According to the chosen control mode:

- Local: tap on the Off button at the display,
- Remote: unselect the remote Start/Stop input
- Gateway: send the Stop-command

Switch off the main switch. Allow the cooling water to circulate for 10 minutes after shutting down the compressor.

Close the cooling water supply.

7.6 Disconnect the cold head

If cold head change is necessary then follow the instructions below:

1. Make sure the compressors main switch is switched off and then unplug the cold head cable at the compressor, then at the cold head.Switch off the compressor by means of the main switch.
2. Let the cold head warm up to room temperature.
3. Unscrew the flexlines in a sequence reverse to that described in Install the flexible pressure lines.
4. Screw protective caps on to the self-sealing couplings.

7.7 Removing from service

CAUTION: OPERATION SAFETY

Risk of damage to the equipment. Do not detach the flexlines with the cold head at low temperature as it may, when they heat up, result in a rise in pressure beyond the permissible operating pressure of 26 bar(g) (377 psi(g) 2.6 MPa). Install the protective caps to all the self-sealing couplings which are not in use.

Note:

Switch off the compressor before you connect or disconnect the line between the compressor and the cold head. Not following this rule can cause damage to the compressor and the cold head. Do not disconnect the line when the compressor is operational.

Operation

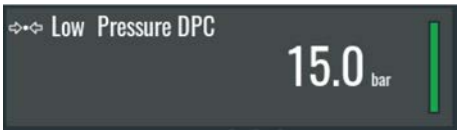
1. Switch the compressor off by means of the main switch and separate the compressor safely from the mains supply.
2. Disconnect the cold head(s) from the compressor by unplugging the cold head supply cable at the compressor. Then unplug it at the cold head.
3. Allow the cooling water to circulate for 10 minutes after shutting down the compressor.
4. Close the cooling water supply.
5. Allow the cold head to warm-up before detaching the flexlines.
6. Loosening the flexlines with the cold head at low temperatures can result in a loss of helium by triggering the safety valve.
7. Unscrew the flexlines in a sequence reverse to that described in Install the flexible pressure lines.
8. Screw protective caps on to the self-sealing couplings.
9. Never ship compressors, flexlines, cold heads or adsorbers without the appropriate protective caps.
10. Detach the cooling water supply lines. Drain out the cooling water. Apply pressurised air to the cooling water outlet connector and drain the cooling water by using the inlet line in reverse direction.
11. Drain out helium before you dispose of worn out compressor.

7.8 Operating structure

Table 6 Description of program items (connection with subsections)

Screen name	Menu	Sub menu	Function
Main Screen 1			Indicates the machine status
			Information about the input signals
			Output signals
			Counter for system starts and running hours
			Information about connected devices
		Service plan 	Information about planed services
		Service history 	Shows service in the past
		Service overview 	Overview about service at all
			Set up the calender with automatic runtime
		Saved data	Data of all failures
		Event data	Data of occurred failure
			Shows alarms of different modules

Operation

Screen name	Menu	Sub menu	Function
Main Screen 2			For customization of setpoints
			Unused
			Connect or disconnect Cold Heads. Information about Cold Heads, Change Cold Head speed
			Restart of device
			Settings for CAN communication and Network
			Settings for Data, Time, Language
			Possibility to create a password for customer
			Help
			General information about the compressor
			Indicates the pressure on the high pressure side of the system
			Indicates the pressure on the low pressure side of the system

Screen name	Menu	Sub menu	Function
Main Screen 3			Selection of setpoints
			Shortcut to change language
			Shortcut to change operation mode local, remote, LAN

8 Maintenance

WARNING: DANGEROUS VOLTAGE

Risk of electrical shock. Disconnect the compressor from the mains before you start the work. Check that no residual voltage is present and ensure that the compressor can not be reconnected to the mains during the maintenance work.

WARNING: SHARP EDGES

Risk of injury. Internal parts of the compressor can have sharp edges which possess the risk of scratching and cutting. Use gloves when carrying out any maintenance work at internal compressor parts.

WARNING: HOT SURFACES

Risk of burn. Scroll compressor, heat exchanger and pipelines are so hot during operation (> 80 °C) that a burning hazard results. Before starting any work, turn off the compressor and allow it to cool down.

Note:

All work not described in these operating instructions must only be done by our in-house service.

Do not repair pressure lines.

After repairs on the electrical equipment, the compressor must not be put into service again without an electrical safety test. For this reason, such work must only be done by expert personnel or by our service team.

Maintenance work which is not performed according to the relevant standards endangers the safety, service life and fitness for use and will render all warranty claims null and void.

8.1 Preventive maintenance schedule

Warranty - Product Liability

Use only authorised parts. Any damage or malfunction caused by the use of unauthorised parts is not covered by Warranty or Product Liability.

Service contracts

We offer several types of service contracts, relieving you of all preventive maintenance work. Consult your nearest Customer Centre.

Intervals

- Our local customer centre may overrule the maintenance schedule, specially the service intervals, it depends on the environmental and working conditions of the pump.
- Include the shorter interval checks with longer interval checks.
- Besides the daily and monthly checks, preventive service operations are specified in the schedule below.
- Each plan has a programmed time interval for the service actions.
- When you reach the interval, a message is shown on the screen that shows which service plans are to be followed.

- After servicing, reset the intervals, refer to Service menu.

Table 7. Preventive maintenance schedule programmed in the controller for normal operation

Action	Schedule
Check readings on display (temperatures and pressures).	Daily
Remove the air filter elements placed in front and backpanel, inspect and clean them. Replace damaged or heavily contaminated filter elements.	Monthly*
Check cooling water flow and temperatures.	
Replace the adsorber (Service A)	30000 hours
Compressor overhaul (Service B)	100000 hours

** Depending on type of application (normal, medium, harsh), it is necessary to do the maintenance more frequently. Contact our customer centre.*

The indicated service exchange intervals are valid for standard operating conditions and nominal operation. Exposure of the compressor to external pollutants or operation at higher temperatures may require a shorter service exchange interval. Contact us if in doubt.

The oil fine-filter and adsorber can only be replaced in a service center, so the compressor must be returned for that replacement.

8.2 Topping up or draining helium gas

WARNING: EXPLOSION HAZARD

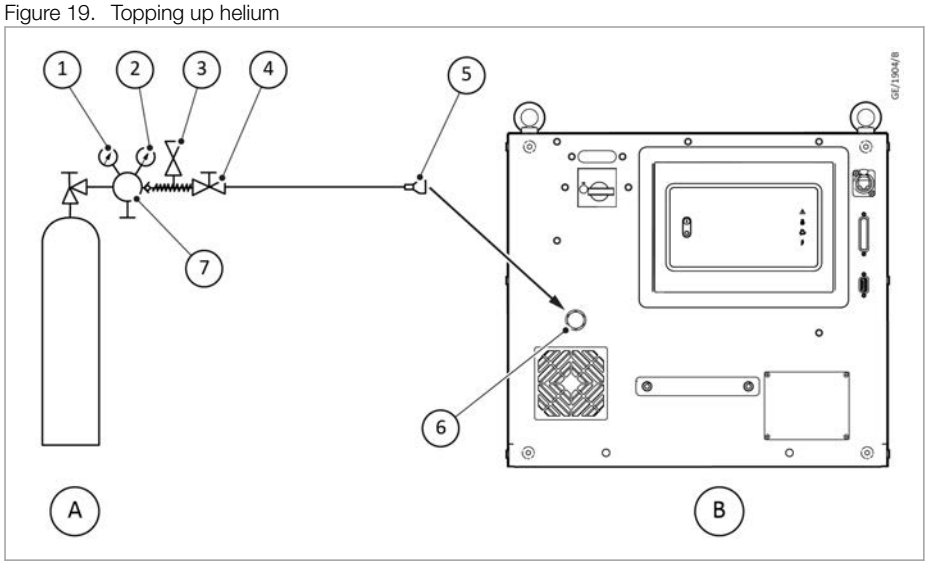
Risk of explosion. Use a safety valve with an opening pressure between 16 - 20 bar(g) at the outlet of the pressure reducer to make sure the maximum permissible pressure of the equipment (also of the connecting hose between Shut-off valve and Helium top-up adapter) is not exceeded.

CAUTION: PRESSURISED LINES

Risk of damage to the equipment. Do not disconnect the pressure lines while the cold head is still cold, as it may result in a pressure increase during warming up which exceeds the permissible operating pressure of 26 bar(g).

Make sure that all pressure lines and components installed in the helium circuit are coupled correctly, open couplings must be provided with protective caps.

Figure 19. Topping up helium



1. *Pressure gauge*
2. *Pressure gauge*
3. *Safety valve 16 - 20 bar(g)*
4. *Shutoff valve*
5. *Helium top-up adapter with tube connection and self-sealing screw fitting*
6. *Helium top-up connection with self-sealing screw fitting*
7. *Pressure reducer*

WARNING: EXPLOSION HAZARD

Risk of explosion. Observe the relevant safety regulations whenever you perform work with pressurized gas bottles.

If the helium pressure in the compressor has fallen below the minimum value, helium must be topped up.

If the helium filling pressure is too high, helium must be drained.

8.2.1 Helium filling pressure

To measure the system pressure correctly and to drain or top up helium, turn off the compressor. Allow it to cool down to room temperature, allow the connected cold heads to warm up. Refer to *Technical data* on page 16 for correct system filling pressure.

Disconnecting the pressure lines while the cold head is still cold may result in helium loss.

8.2.2 Draining helium

WARNING: INERT GAS

Risk of asphyxiation. When draining helium gas, do not direct the gas at persons or objects. Compressed gas in high concentrations may have suffocating effects. Do not inhale helium in high concentrations.

Remove the protective cap from the helium refill connector at the front side of the compressor (refer to *Figure: Connections and operating controls* on page 21).

Slowly and carefully screw the adapter with the self-sealing screw fitting onto the helium refill connector.

Note:

Do not screw on the adapter too quickly. There is a risk that too much helium could escape or else that oil could be drawn along from the compressor.

When the required helium filling pressure is reached, remove the adapter.

Close the helium refill connector with the protective cap.

8.2.3 Topping up helium

WARNING: EXPLOSION HAZARD

Risk of explosion. Use a safety valve with an opening pressure between 16 - 20 bar(g) at the outlet of the pressure reducer to make sure the maximum permissible pressure of the equipment (also of the connecting hose between Shut-off valve and Helium top-up adapter) is not exceeded.

WARNING: INERT GAS

Risk of asphyxiation. When topping up helium make sure that the work space is sufficiently ventilated with fresh air. In case of an overpressure helium is deliberated to the atmosphere and can displace the air for breathing.

CAUTION: PRESSURISED LINES

Risk of explosion. The top-up line on the helium bottle is still subject to high pressure up to 20 bar(g). Before you remove the top-up adapter, depressurize the line by loosening the tube connection screw fitting of the filling adapter slightly.

CAUTION: PRESSURISED LINES

Risk of damage to the equipment. Do not disconnect the pressure lines while the cold head is still cold, as it may result in a pressure increase during warming up which exceeds the permissible operating pressure of 26 bar(g).

Make sure that all pressure lines and components installed in the helium circuit are coupled correctly, open couplings must be provided with protective caps.

Note:

Only use super pure helium (purity 99.995% or better).

1. Connect the helium bottle to the supplied helium top-up adapter through a pressure reducer with an additional safety valve at the outlet with an opening pressure of 16 - 20 bar(g) and a suitable high-pressure hose, do not yet tighten the tube connection screw fitting.
2. Open the bottle valve.
3. Open the pressure reducer and the shutoff valve slightly so that the high-pressure hose and the top-up adapter are flushed with helium.
4. After several flushing cycles, tighten the tube connection screw fitting.
5. Set the pressure in the incoming supply line to the set-point of the compressor. If the pressure in the incoming supply line is too low, the oil may pass from the compressor into the incoming supply line.
6. Observe the notes provided in Install the flexible pressure lines.

7. Connect the screw fitting of the helium top-up adapter to the helium refill connector.
8. Fill the compressor up to its set-point.
9. Loosen the screw fitting on the helium refill connector.
10. Close the valve on the helium bottle.
11. Close the helium refill connector on the front side of the compressor tightly with a protective cap.

8.3 Replace the adsorber

WARNING: SHARP EDGES

Risk of injury. Internal parts of the compressor can have sharp edges which possess the risk of scratching and cutting. Use gloves when carrying out any maintenance work at internal compressor parts.

CAUTION: PRESSURISED LINES

Risk of damage to the equipment. Do not disconnect the pressure lines while the cold head is still cold, as it may result in a pressure increase during warming up which exceeds the permissible operating pressure of 26 barg.

Provide all self-sealing screw fittings currently not in use with protective caps.

The adsorber retains any oil vapour from the helium gas flow. The adsorber must be replaced after approximately 30,000 operating hours. Otherwise, the oil may accumulate in the cold head due to incomplete oil vapour adsorption. This results in a reduction of the cooling power or - in case of extreme contamination - even in a standstill of the cold head.

Note:

Use only original adsorbers from the manufacturer. The adsorbers are specially tested pressure vessels. If any adsorbers other than those from us are used, any warranty claim with regard to the compressors and the connected cryo-equipment will be rendered null and void, and the EC Declaration of Conformity no longer be valid. Refer to Ordering information on page 16 for spare part number.

To replace the adsorber, first turn off the compressor and disconnect it safely from the mains.

Before disconnecting the pressure lines, allow the connected cold head to warm up.

Observe the working instructions provided in *Connect the self-sealing screw fittings* on page 27.

Remove the flexible high-pressure line from the compressor.

Unscrew the side plate to access the Adsorber. When doing so, do not pull off the ground connection cable.

If the ground connection cable has been pulled off, an electrical safety test according to the local standards (protective earth continuity test) has to be performed after reconnecting the ground connection cable.

Loosen the fixing screw at the bottom side of the Adsorber.

Remove union nut, washer at the high pressure helium connector with a 1 3/16" wrench.

Loosen the self-sealing screw fitting of the adsorber inside of the compressor and stabilze the self-sealing screw fitting at the oil fine filter with a stabilizing wrench as mentioned in *Connect the self-sealing screw fittings* on page 27. After loosening the self-sealing screw fitting remove the Adsorber (the High-pressure connector remains at the Adsorber).

Remove the protective caps from the new adsorber and fit the new adsorber in the reverse order.

Place the new Adsorber in the compressor and fit the High pressure Helium connector with the lock washer through the back-plate.

Connect and tigthen the self-sealing screw fitting inside of the compressor to the self-sealing screw fitting at the Oil fine-filter. Stabilze the fitting at the oil fine-filter during the tightening process.

Ressemble the union nut and washer at the high pressure helium connector with a 1 3/26" wrench.

Fix the fixing screw at the bottom side of the Adsorber firmly.

Make sure the protective ground connection cable is still properly attached to the side-plate and remount the side plate with the fixing screws.

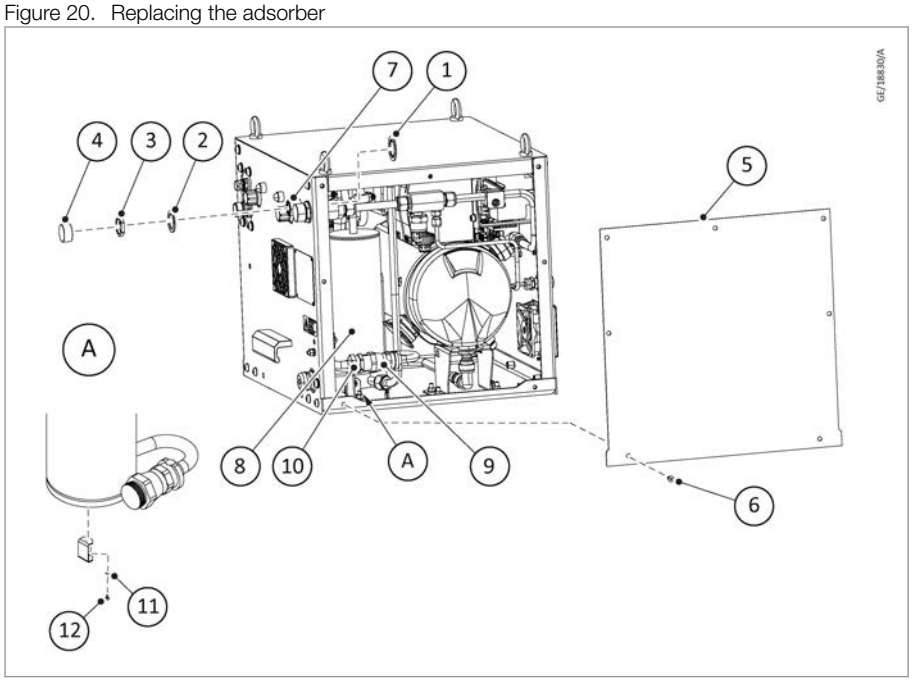
If the ground connection cable has been pulled off, an electrical safety test according to the local standards (protective earth continuity test) has to be performed after reconnecting the ground connection cable.

The new adsorber is filled with high purity helium at a pressure of 16 barg.

Blank off the adsorber which has been removed with protection caps and ship it to us.

Alternatively, the adsorber can be depressurized by expert personnel using suitable adapters and then it can be disposed off.

Figure 20. Replacing the adsorber

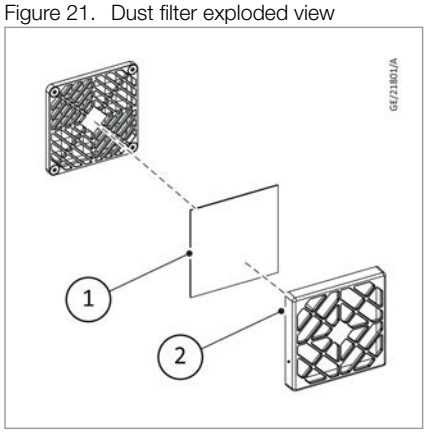


1. *Lock washer*
2. *Washer*
3. *Union nut*
4. *Dust cap*
5. *Side plate*
6. *Fixing screws of side plate*
7. *High pressure helium connector*
8. *Adsorber*
9. *Self-sealing screw connector at adsorber*
10. *Self-sealing screw connector at oil fine filter*
11. *Washer*
12. *Screw*

8.4 Cleaning cooling air filter at front and back panel

Make sure that the openings are not blocked with dust or other particles for the sufficient cooling of internal parts of the compressor. The air inlet and air outlet are equipped with a filter. Clean this filter by pulling off the filter-cap and clean the filter fleece. Reassemble it after cleaning.

Figure 21. Dust filter exploded view

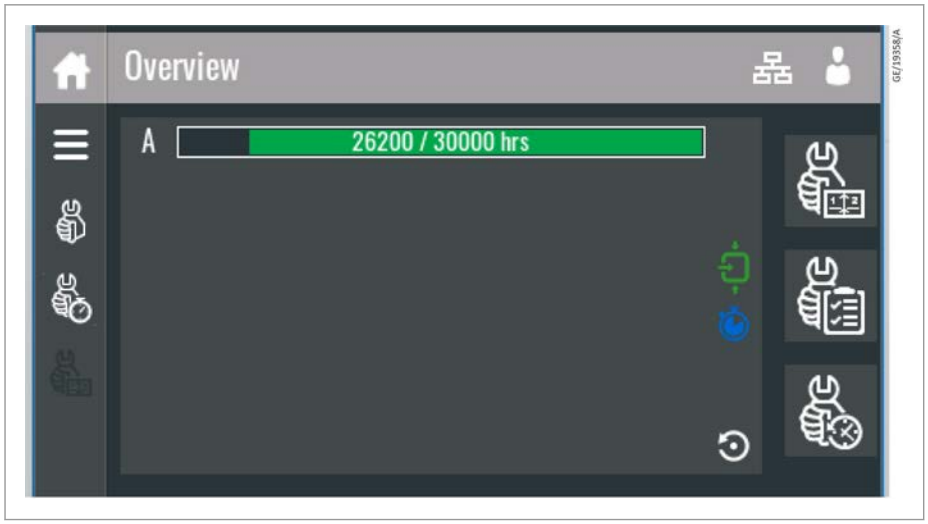


1. *Filter fleece*
2. *Filter cap*

9 Service

9.1 Service menu

On Service overview



The service overview menu shows the running hours available until service. For example the above picture shows 26200 hours left of the 30000 hrs Service Interval A.

9.2 Return the equipment or components for service

Before you send your equipment to us for service or for any other reason, you must complete a Declaration of Contamination Form. The form tells us if any substances found in the equipment are hazardous, which is important for the safety of our employees and all other people involved in the service of your equipment. The hazard information also lets us select the correct procedures to service your equipment.

If you are returning equipment note the following:

- If the equipment is configured to suit the application, make a record of the configuration before returning it. All replacement equipment will be supplied with default factory settings.
- Do not return equipment with accessories fitted. Remove all accessories and retain them for future use.
- The instruction in the returns procedure to drain all fluids does not apply to the lubricant in pump oil reservoirs.

Download the latest documents from *leybold.com/en/downloads/download-documents/declaration-of-contamination/*, follow the procedure in HS1, fill in the electronic HS2 form, print it, sign it, and return the signed copy to us.

NOTICE:

If we do not receive a completed form, your equipment cannot be serviced.

10 Fault finding

Information on display is divided into three categories.

1. Information of actual values
2. Warnings - Yellow triangle
3. Failures - Red triangle

The information about the actual values is dynamically changed according to the process.

- Warnings are shown with a yellow triangle on the second Main Screen in the right upper corner. These are only information and do not need action.
- Failures are shown with a red triangle on the secondary Main Screen in the right upper corner.

These force the compressor to stop. The compressor will shut down automatically and need to be reset. Failures can damage the system. So the system shut down to protect the compressor.

Table 8 Pressure and temperature values for failure

Parameter	Warning value	Failure value	Start check failure value
High pressure	Above 26 bar(g) Below 11 bar(g)	Above 27.5 bar(g) Below 9.3 bar(g)	Below 10 bar(g)
Low pressure	Below 1.5 bar(g) Above 8.5 bar(g)	Below 1.2 bar(g) (delay 300 sec) Below 0.5 bar(g) (delay 1 sec) Above 9 bar(g)	Above 17 bar(g)
Differential pressure	-	Below 5.5 bar(g) Above 22 bar(g)	-
Helium temperature	Above 40 °C	Above 45 °C	Above 65 °C (for 20 sec)
Scroll temperature	Above 85 °C	Above 95 °C	-

Fault	Cold head connection error
Cause	**Error while establishing CAN communication**
Remedy	Make sure that the correct procedure for connecting and disconnecting a cold head is used. Refer to *Connect compressor and cold head* on page 26. Check if the cold head controller is defective.

Fault	Cold head communication error
Cause	**Termination of communication during operation**
Remedy	Check cold head connection cable. Check connection status of the cold head. Re-establish cold head re-connecting it.Check the selection status of the cold head in the cold head menu.

Fault	High pressure error
Cause	**The high pressure exceed or fall below the values in** *Table: Pressure and temperature values for failure* **on page 52.**
Remedy	Check the filling pressure and operation points. Make sure that the compressor operate in the permitted operating limits.

Fault	Low pressure error
Cause	**The low pressure exceed below the values in** *Table: Pressure and temperature values for failure* **on page 52.**
Remedy	Check the filling pressure and operation points. Make sure that the compressor operate in the permitted operating limits.

Fault	Differential pressure error
Cause	**The differential pressure exceed or fall below the values in** *Table: Pressure and temperature values for failure* **on page 52.**
Remedy	Check the filling pressure and operation points.

Fault	Scroll temperature error
Cause	**The scroll limit temperature exceed the values in** *Table: Pressure and temperature values for failure* **on page 52.** **The cooling water is too warm.** **The water flow is too less**
Remedy	Check the cooling water flow and temperature. Contact us.

Fault	Helium temperature error
Cause	**The helium limit temperature exceed the values in** *Table: Pressure and temperature values for failure* **on page 52.** **The cooling water is too warm.** **The water flow is too less**
Remedy	Check the cooling water flow and temperature. Contact us.

11 Disposal

WARNING: CONTAMINATION HAZARD

Risk of toxic exposure. Contaminated parts can be detrimental to health and the environment. Before beginning with any work, first find out whether any parts are contaminated. Adhere to the relevant regulations and take the necessary precautions when handling contaminated parts.

The compressor is pressurised and must be de-pressurised before disposing of. Observe the relevant national safety regulations for disposal.

The compressor may have been contaminated by the process or by environmental influences. In this case the equipment must be decontaminated in accordance with the relevant regulations. We offer this service at fixed prices. Further details are available on request.

Separate clean components according to their materials, and dispose of these accordingly. We offer this service. Further details are available on request.

When sending any equipment to us, observe the regulations given in Leybold Service.

Dispose of the compressor and any components removed from it safely in accordance with all local and national safety and environmental requirements. We recommend that you entrust the transport and disposal of the waste to an authorised waste disposal company.

For decontamination according to the relevant standards, we recommend our service.

The disposal of electrical and electronic components is subject to the relevant national environmental and safety regulations. No old equipment is withdrawn under the Waste Electrical and Electronic Equipment (WEEE) Regulations.

The responsibility for the disposal of old equipment rests with the plant operator.

11.1 Disposal of waste oil

Owners of waste oil are entirely self-responsible for proper disposal of this waste.

EU Declaration of Conformity

This declaration of conformity is issued under the sole responsibility of the manufacturer:

Leybold GmbH
Bonner Strasse 498
D-50968 Köln
Germany

Documentation Officer
T: +49(0) 221 347 0
documentation@leybold.com

The product specified and listed below:

- *Product designation:* *Helium compressor unit*
- *Type designation:* *helium compressor; helium compressor aircooled*
- *Part numbers:* *840000E1xyzABC* *(xyz = 0…9/ ABC= MI; MIA)*

Is in conformity with the relevant Union harmonisation legislation:

2006/42/EC	Machinery directive *Note: The safety objectives of the Low Voltage Directive 2014/35/EU were complied with in accordance with Annex 1 No. 1.5.1 of this directive.*
2014/30/EU	Electromagnetic compatibility (EMC) directive Class A Emission, Industrial Immunity
2011/65/EU	Restriction of certain hazardous substances (RoHS) directive as amended by Delegated Directive (EU) 2015/863

Based on the relevant requirements of harmonised standards:

EN 1012-1:2011-02	Compressors and vacuum pumps. Safety requirements. Air compressors
EN 60204-1:2018	Safety of machinery. Electrical equipment of machines. General requirements
	Safety of machinery. Electrical equipment of machines. General requirements
EN 61326-1:2021	Electrical equipment for measurement, control and laboratory use. EMC requirements. General requirements
EN 61000-6-2:2019	Electromagnetic Compatibility (EMC) - Part 6-2: Generic Industrial Immunity Standard
EN 61000-6-4:2019	Electromagnetic Compatibility (EMC) - Part 6-4: Generic Industrial Emission Standard
EN 61000-3-3:2013	Electromagnetic compatibility (EMC). Limits. Limitation of voltage changes, voltage fluctuations and flicker in public low voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection.
EN 55011	Industrial, scientific and medical equipment. Radio-frequency disturbance characteristics. Limits and methods of measurement

This declaration, based on the requirements of the listed Directives and EN ISO/IEC 17050-1, covers all product serial numbers from this date on: *2025-08-22*

You must retain the signed legal declaration for future reference
This declaration becomes invalid if modifications are made to the product without prior agreement.

Ian Keech – VP Engineering
Scientific Vacuum Division
Burgess Hill, UK

Bram Houpeline – General Manager
Dresden Product Company

ADDITIONAL LEGISLATION AND COMPLIANCE INFORMATION (EU/UK)

EMC (EU, UK): Class A, Industrial equipment

Caution: This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.

RoHS (EU, UK): Material Exemption Information

This product is compliant with the following Exemptions
Annex III:

- 6(a) **Lead** as an alloying element in steel for machining purposes and in galvanised steel containing up to 0.35 % lead by weight
- 6(b) **Lead** as an alloying element in aluminium containing up to 0.4% by weight
- 6(c) Copper alloy containing up to 4% **lead** by weight
- 7(a) **Lead** in in high melting temperature type solder (i.e. lead based alloys containing 85% by weight or more lead)

REACH (EU, UK)

This product is a complex article which is not designed for intentional substance release. To the best of our knowledge the materials used comply with the requirements of REACH. The product manual provides information and instruction to ensure the safe storage, use, maintenance and disposal of the product including any substance based requirements.

Article 33.1 Declaration (EU, UK)

This product contains Candidate List Substances of Very High Concern above 0.1%ww by article as clarified under the 2015 European Court of Justice ruling in case C-106/14.

- Lead (Pb)
  This substance is present in certain steel / aluminium / brass / electrical or electronic components.

WASTE FRAMEWORK DIRECTIVE (EU)

SCIP Number: pending

WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT (EU,UK)

This product must be disposed of in accordance with the requirements of the WEEE Directive.

ADDITIONAL APPLICABLE REQUIREMENTS

The product is in scope for and complies with the requirements of the following:

cTUVus Certificate No.	pending
	UL61010-1: 2012 R.7.19: Safety requirements for electrical equipment for measurement, control and laboratory use – Part 1: General requirements
	UL61010-2-011:2017: Particular Requirements for Refrigerating Equipment
	CSA-C22.2 No.61010-1-12: Safety requirements for electrical equipment for measurement, control and laboratory use – Part 1: General requirements
	CSA-C22.2 No.61010-2-011:19: Particular Requirements for Refrigerating Equipment
CB test certificate	pending
	IEC 61010-1:2010+A1: Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements
	IEC 61010-2-011:2019: Particular requirements for refrigerating equipment

The product is certified by TÜV Rheinland of North America which is a “Nationally Recognized Testing Laboratory” (NRTL) for USA and Canada.

Dangerous Goods Declaration

This product includes components classified as dangerous goods under applicable transport regulations. The following declarations apply:

- **Hazardous Articles/Substances**: Lithium metal cell, Helium gas pressurized
- **Purpose**: Memory retention, cooling
- **Quantity**: 3g Lithium-metal cell with Lithium content 0,07 g; 25 g Helium
- **Pressure**: Helium at 16 bar
- **Component Pressure Rating**: 26 bar

⚠️ *Disclaimer: You must base your classification and handling requirements on current international regulations (IATA, IMDG, ADR, RID, CFR49). We accept no liability for changes in classification or misuse during transport.*

材料成分声明
China Material Content Declaration

部件名称 Part name	有害物质 Hazardous Substances									
	铅 Lead (Pb)	汞 Mercury (Hg)	镉 Cadmium (Cd)	六价铬 Hexavalent Chromium (Cr VI)	多溴联苯 Polybrominated biphenyls (PBB)	多溴二苯醚 Polybrominated diphenyl ethers (PBDE)	邻苯二甲酸二丁酯 Dibutyl phthalate (DBP)	邻苯二甲酸丁基苄酯 Benzyl butyl phthalate (BBP)	邻苯二甲酸双（2- 乙基己基）酯 Bis(2-ethylhexyl) phthalate (DEHP)	邻苯二甲酸二异丁酯 Diisobutyl phthalate (DIBP)
铸铝及铝合金制品 Aluminium alloys	X	O	O	O	O	O	O	O	O	O
钢合金制品 Steel alloys	X	O	O	O	O	O	O	O	O	O
铜管管件 Brass pipe fitting	X	O	O	O	O	O	O	O	O	O
铜接头 Brass connectors	X	O	O	O	O	O	O	O	O	O
电缆/电线/连接器 Cable/wire/connector	X	O	O	O	O	O	O	O	O	O
印刷电路组件 (PCA) Printed Circuit Assembly (PCA)	X	O	O	O	O	O	O	O	O	O
电子元件和控件 Electronics and Controls	X	O	O	O	O	O	O	O	O	O

O: 表示该有害物质在该部件的所有均质材料中的含量低于 GB/T 26572 标准规定的限量要求。
O: Indicates that the hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in GB/T 26572.

X: 表示该有害物质在该部件的至少一种均质材料中的含量超出 GB/T26572 标准规定的限量要求。

X: Indicates that the hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement of GB/T26572.

This product has been manufactured under a quality management system certified to ISO 9001:2015

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Leybold

Pioneering products. Passionately applied.

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