

# Operating instructions

## POSITIVE DISPLACEMENT BLOWER

Series: F, ATEX



23A018427  
Type: F90R6  
23-15818-A/B

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Read the instructions prior to performing any task!

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# 1 General Information

## 1.1 Information about these instructions

These instructions allow for the safe and efficient handling of this machine. These instructions are an integral part of the machine and must be kept in the immediate vicinity of the machine so that they are accessible to personnel at all times. Keep these instructions in a safe place for future reference.

Personnel must read these instructions carefully and have understood them before beginning work. A fundamental requirement for working safely is compliance with all specified safety notes and guidelines in these instructions.

In addition, the local occupational health and general safety regulations apply to the machine's range of applications.

The diagrams in these instructions serve to provide the user with a basic understanding and may deviate somewhat from the actual design.

### Applicable documents

The following is a list of additional, supplementary documents to this instruction manual:

- Declaration of Conformity pursuant to the Machinery Directive
- Declaration of Conformity ATEX
- Machine performance data sheet
- Installation drawing (GAD)
- Piping and instrumentation diagram (PID)
- List of measurement points
- Circuit diagram
- Functional description
- Documentation for individual components
- Other order-related documents

## 1.2 Explanation of symbols

### Safety instructions

Safety instructions in this manual are illustrated using symbols. The safety instructions are organised into signalling words which designate the level of danger posed.



#### **DANGER!**

This combination of symbol and signalling word points to an imminently dangerous situation that could be fatal or lead to serious injury if it is not avoided.

## General Information

### Explanation of symbols



#### **WARNING!**

This combination of symbol and signalling word points to a potentially dangerous situation that could be fatal or lead to serious injury if it is not avoided.



#### **CAUTION!**

This combination of symbol and signalling word points to a potentially dangerous situation that could lead to minor injuries if it is not avoided.



#### **NOTICE!**

This combination of symbol and signalling word points to a potentially dangerous situation that could lead to material damage if it is not avoided.



#### **ENVIRONMENT!**

This combination of symbol and signalling word points to a potential risk for the environment.



#### **DANGER!**

This combination of symbol and signalling word indicates content and instructions for the intended use of the machine in potentially explosive areas.

Non-observance of this highlighted information poses a high risk of an explosion, which could lead to serious or fatal injury.

### Safety instructions as part of operating guidelines

Safety instructions may relate to certain individual operating guidelines. These safety instructions are integrated into the operating guidelines themselves so as to simplify the task of reading while carrying out work. The signalling words mentioned above are used.

Example:

1. ➤ Loosen screw.

2. ➤



#### **CAUTION!**

Pinch hazard on the cover!

Close cover carefully.

3. ➤ Tighten screw.








### Tips and recommendations



*This symbol draws attention to useful tips and recommendations as well as information about efficient and trouble-free operation.*

### Special safety instructions

To draw attention to exceptional hazards, the following symbols are used as part of the safety instructions:




Warning signs	Type of danger
	Warning – automatic start-up.
	Warning – hand injuries.
	Warning – high-voltage.
	Warning – explosive atmosphere.
	Warning – explosive substances.
	Warning – flammable substances.
	Warning – hot surface.
	Warning – suspended load.
	Warning – floor-borne vehicle.
	Warning – danger zone.

### Additional designations

To draw attention to operating guidelines, events, listings, references and other elements in this manual, the following designations are used:

## General Information

Addresses > Manufacturer

Designation	Explanation
 1., 2., 3. ...	Step-by-step operating guidelines
	References to sections of this manual and to relevant documentation
	Lists without a designated sequence
[push-button]	Control elements (e.g. push-buttons, switches), display elements (e.g. signal lamps)
'Display'	Screen elements (e.g. buttons, allocation of function keys)

### Marking of Ex-Zones



1

In order to draw attention to special information in this manual that is only applicable to certain Ex-Zones, the following marking is used.

Example marking: The information in this chapter applies to Ex-Zone 1.

## 1.3 Copyright protection

The contents of this manual is protected by copyright. The use of this manual is permitted within the framework of machine use. Any other use is excluded unless there is written approval by the manufacturer.

## 1.4 Addresses

### 1.4.1 Manufacturer

Tab. 1: Manufacturer contact information

Address	RKR Gebläse und Verdichter GmbH Braasstr. 1 31737 Rinteln, Germany
Telephone	+49 (0) 5751 4004 - 0
Fax	+49 (0) 5751 4004 - 30
E-mail	info@rkr.de
Internet	www.rkr.de

### 1.4.2 Customer service

Our customer service staff are on hand to provide you with technical information:

*Tab. 2: Customer service contact information*

Address	RKR Gebläse und Verdichter GmbH Braasstrasse 1 D-31737 Rinteln Germany
Service hotline	+49 (0) 5751 4004 - 73
Fax	+49 (0) 5751 4004 - 30
E-mail	aftersales@rkr.de
Internet	www.rkr.de



#### **Identification**

*When forwarding queries, please provide the following data:*

- *Machine type*
- *Serial number*
- *Order number*

*In the event of malfunctions, also add:*

- *a precise description of the occurring malfunction*
- *any troubleshooting measures taken so far*

In addition, we are always interested in receiving information and feedback pertaining to machine use that could be useful in helping us improve our products.

## General Information

Addresses > Customer service

## 2 Safety

This section gives an overview of all important safety aspects relevant to the protection of persons and to safe and fault-free operation. Further task-based safety instructions are contained in the section on the individual phases of the machine's service life.

Non-compliance with the handling and safety instructions provided in this instruction manual can lead to serious hazards.

The following section outlines the residual risks and hazards during the service life of the product that may arise as a result of non-compliance with safety instructions or disabling of safety equipment.

In order to reduce health and safety risks and to avoid dangerous situations, the safety instructions and warnings in this instruction manual must be observed.

### 2.1 Residual risks and fundamental risks

The following chapter states the general residual risks that have been established on the basis of a risk analysis.

- Compliance with these safety instructions and the safety instructions in the main chapters reduces the risk of personal injury, property damage and environmental harm and prevents dangerous situations.

### 2.1.1 Hazards due to potentially explosive atmospheres

#### Explosion protection



#### **DANGER!**

#### **Risk of explosion!**

The introduction of ignition sources such as sparks, open flames and hot surfaces can lead to explosions in Ex-Zones

- Obtain written approval before beginning work in Ex-Zones.
- Wherever possible, only carry out work if there is no atmospheric risk of explosion.
- Only use tools that are approved for use in Ex-Zones.
- If necessary, render the machine and pipelines inert before commissioning.
- Immediately remove dust residue in a proper manner. Do not stir up dust.
- Ensure that no altered, potentially explosive atmospheres arise as a result of enrichment of potentially explosive gases, leaks or similar.
- All protective equipment for the system and protective equipment provided by the operator must be installed and ready to operate.

Disregard for these instructions will render the explosion protection ineffective.

### 2.1.2 Electrical hazards

#### Electric current



#### **DANGER!**

#### **Risk of fatal injury from electric ignition sparks!**

There is a risk of explosion in potentially explosive atmospheres.

- Work on the electrical system should only be carried out by qualified electrical personnel.  
Work in potentially explosive atmospheres requires additional professional expertise in explosion protection.



### Static charge



#### **DANGER!**

##### **Risk of explosion from static charge!**

The release of static electrical energy can lead to an explosion.

- Bring the machine into an Ex-Zone without the packaging foil.
- Package the machine outside the Ex zone.
- Cleaning must only be carried out with a damp, antistatic cloth.
- Only use plastic insulation material that is approved for the Ex zone.
- Only use original belts.

### Electrical components



#### **DANGER!**

##### **Risk of injury from installation of electrical components!**

The improper installation of electrical components can lead to dangerous situations.

- Electrical components must be approved for use in the given Ex-Zone.
- Observe the electrical connection values for the relevant components.
- Do not alter the ignition protection of machines intended for use in potentially explosive atmospheres.

## Safety

Residual risks and fundamental risks > Electrical hazards

### Electric current



#### **DANGER!**

#### **Risk of fatal injury from electric current!**

Coming into contact with live parts poses an immediate and potentially fatal risk of an electric shock. Damage to insulation or individual components can prove fatal.

- Work on the electrical system should only be carried out by qualified electrical personnel.
- If the power supply's insulation is damaged, switch off the machine immediately and have the damage repaired.
- Before starting to work on active parts of the electrical systems and operating equipment, ensure that the machine is completely disconnected from any power source and remains so for the duration of the work.

When doing this observe the following 5 safety rules:

- Disconnect the machine completely.
- Secure the machine against restarting.
- Confirm that the machine is completely disconnected from any power source.
- Ground and short-circuit the unit.
- Cover or shut off adjacent live parts.
- Never bypass or deactivate fuses.
- When changing fuses, comply with the correct specified amperage.
- Keep moisture away from live parts. Moisture can cause the machine to short-circuit.

### Risk of fatal injury from an electric shock



#### **DANGER!**

#### **Risk of fatal injury from medium or high voltage components!**

Medium and high-voltage applications represent a particular risk. In some circumstances, excessive proximity to energised components can lead to a fatal electric shock.

- Work on the electrical system should only be carried out by qualified electrical personnel with special expertise in dealing with medium and high-voltages.
- Observe all safety warnings and safety measures that apply to low voltages including, for example, the “5 safety rules”.
- Before beginning any work, ensure that all wires that can absorb medium or high-voltage are grounded and that the main voltage supply line has been interrupted.
- Ensure that there is no live current during the entire work period.

### Operating faults caused by short-circuiting



#### **DANGER!**

#### **Risk of injury from operating faults!**

If the electrical system short circuits this can render the entire system inoperable. Operating faults can lead to explosions.

- Connect all housing parts to the local equipotential bonding rail.
- Install a fault-current circuit breaker in order to prevent ignition sparks and contact voltage in the event of a fault.

## Safety

Residual risks and fundamental risks > Hazards associated with the acoustic hood

### Operating faults caused by short-circuiting



#### **WARNING!**

##### **Risk of injury from operating faults!**

If the electrical system short circuits this can render the entire system inoperable. Operating faults can lead to serious injuries.

- Connect the machine's earthing connections and acoustic hood to the local equipotential bonding rail.
- Install a fault-current circuit breaker in order to prevent sparks and contact voltage in the event of a fault.
- After all work on the machine has been carried out, ensure that the earthing connection and equipotential bonding are connected correctly.

### 2.1.3 Hazards associated with the acoustic hood

#### Within the acoustic hood



#### **DANGER!**

##### **Risk of injury if the acoustic hood is open during operation!**

By opening the acoustic hood while the machine is in operation, there is a risk of direct contact with sources of danger, e.g. hot surfaces or rotating or moving components.

- Never open the acoustic hood while the machine is in operation or in stand-by mode.
- Never walk on or reach into the acoustic hood while the machine is in operation or in stand-by mode.
- Always lock the acoustic hood with the key provided and keep it locked.
- Only allow authorised personnel access to the key.

#### Falling parts



#### **CAUTION!**

##### **Risk of injury from unsecured parts of the acoustic hood!**

Unsecured parts of the acoustic hood can lead to injuries if they fall from the machine.

- Secure loose elements against falling.
- Always wear protective gear.
- Have a second person help you.

### Air flow at the air outlet



#### CAUTION!

##### **Risk of injury from the strong air flow at the air outlet of the acoustic hood!**

Strong air flows at the air outlet on the acoustic hood can suck in dirt particles from the environment and disperse them.

- Avoid standing in the direct vicinity of the air flow.
- Wear safety glasses and a safety mask.

### Noise



#### WARNING!

##### **Risk of injury from noise!**

The noise level present at the installation area can cause hearing damage. The magnitude of the noise level is dependent on operating data, among other factors.

- Never undertake measures to bypass or deactivate sound insulation.
- Wear hearing protection while working.
- Only stand in the high-noise-level area if it is absolutely necessary.

### Risk of falling



#### CAUTION!

##### **Risk of injury from standing on the roof elements!**

Standing on the roof elements of the acoustic hood carries with it a risk of injury from the potential collapse of the roof elements. Persons could fall into the internal area of the machine.

- Never stand on the roof elements of the acoustic hood.
- Never exert force on the roof elements of the acoustic hood.

## Safety

Residual risks and fundamental risks > Hazards associated with the acoustic hood

### Spark-generating work



#### **WARNING!**

#### **Risk of fire, injury and material damage from spark-generating work in the immediate vicinity of the machine!**

Welding or cutting work on the machine or in the immediate vicinity of the machine can cause fire to break out. This can result in material damage or personal injury.

Sparks and incandescent or flammable objects could be sucked in through the supply air openings on the acoustic hood or through the intake silencer. Sparks may be fanned by the fan of the acoustic hood. The insulation material could begin to smoulder.

- Avoid allowing sparks to fly in the direction of the machine.
- Never carry out work that generates sparks while the machine is in operation.

### Risk of fire and injury



#### **WARNING!**

#### **Risk of fire from easily-flammable materials that are sucked into the machine!**

Easily-flammable material, fluids or gases can be sucked into the machine and cause it to catch fire. This can lead to serious or fatal injuries.

- Never allow flammable materials to be sucked into the machine.
- In case of emergencies, have extinguishing agents (fire blanket, fire extinguisher, fire-extinguishing powder for fire classes A, B and C) at hand.
- Immediately report suspicious materials, liquids or gases to the responsible persons.
- In the event of fire, stop your work immediately and make an emergency call.

### Build-up of leaking gases



#### **DANGER!**

##### **Risk of poisoning and suffocation from the build-up of leaking gases!**

The build-up of leaking gases (e.g. inert gases) within the acoustic hood could lead to poisoning or suffocation.

- Never operate the acoustic hood without ventilation.
- After the machine has been brought to a standstill, the ventilation of the acoustic hood must continue to run for a certain period of time.
- Ventilate the installation site properly.
- Guide leaking gases into a collective line and out of the system.
- For decommissioning work or system downtime, seal off the gas intake pipe.

## 2.1.4 Risks of machines with belt guard

### Use of non-original belts



#### **WARNING!**

##### **Risk of fire and injury from using non-original belts!**

If, for a number of possible reasons, the machine is running sluggishly or is blocked, the belts may slip if non-original belts are being used. This results in strong heat generation which may lead to a fire.

- Only use original belts from the machine manufacturer.
- Adhere to the designated belt type, as only this type will have the required characteristics.
- Never select and use random belts.
- Activate motor overload protection and observe the setting values.

## Safety

Residual risks and fundamental risks > Hazards at the installation site and operating site

### Rotating components



#### **WARNING!**

##### **Risk of injury from rotating components!**

Rotating components may cause serious injury.

- During operation never reach into or perform work on rotating components.
- Never open covers during operation.
- Observe the run down time: before opening covers, make sure that no components are still moving.
- When in a hazard area, wear tight-fitting protective work clothing with low tensile strength.

### 2.1.5 Hazards at the installation site and operating site

#### Use in non-permissible areas



#### **DANGER!**

##### **Risk of explosion from using the machine in the non-permissible areas!**

Use of the machine in potentially explosive areas can lead to dangerous situations.

- Only use the machine in the defined Ex-Zones.
- Observe the ATEX information the rating plate.
- Observe the maximum permissible surface temperature.

#### Coating for IIC



#### **DANGER!**

##### **Risk of explosion due to incorrect application of coating!**

Due to the low ignition energy of gases in the IIC explosion group (acetylene, hydrogen, carbon disulphide), static charges and spark formation can lead to explosions.

- Never make unauthorised changes to the coatings. Contact the manufacturer before performing any work.



### Equalising currents



#### **DANGER!**

##### **Risk of explosion from equalising currents!**

Removing components that are installed between metallic, grounded parts can lead to spark formation, as a result of the interruption of the path of an equalising current.

- Before removing components that are installed between metallic, grounded parts, create an electrical bypass between the connection points that has very low resistance.
- Do not perform the work in a potentially explosive atmosphere.

### Securing the machine against restarting



#### **DANGER!**

##### **An unauthorised or unregulated restart can have fatal consequences.**

An unauthorised or unregulated restart of the machine can lead to serious or fatal injuries. There may be people located in the hazard area. Activating the energy supply and starting the machine could result in those people being fatally injured.

- Prevent the machine from restarting by:
  - disconnecting the electrical power supply
  - activating the EMERGENCY STOP function.
  - operating the main circuit breaker and disconnecting the machine from the power source.
  - attaching a padlock to the main circuit breaker.
  - ensuring that the machine is completely de-energised and disconnected from the power source.
  - displaying a sign on the machine that prohibits a machine start.
  - displaying a sign on the control centre that prohibits a machine start.
- Before restarting, ensure that safety devices are installed and functioning correctly and that there are no potential hazards to the safety of any persons.

## Safety

Residual risks and fundamental risks > Hazards at the installation site and operating site

### Run down time



#### **WARNING!**

##### **Risk of injury from not observing the run down time!**

After the machine has been switched off, it continues to run for several seconds.

- Before starting any work, wait until the machine has reached the 'zero' speed.

### High revolution speed of fan.



#### **WARNING!**

##### **Risk of injury from rotating components of the fan!**

Rotating components of the fan can cause serious injuries due to their high revolution speed.

- Prior to any work, switch off the machine and secure it against restarting.
- Observe the run down time.
- Before opening covers, check that no components are still moving.
- Never open covers or maintenance covers and work on the fan during operation.
- The blade wheel must not be accessible during operation.

### Water contact with live components



#### **DANGER!**

##### **Risk of fatal injury from water contact with live components!**

Risk of fatal injury from cleaning work using water in the vicinity of live components.

Water spray may enter electrical and electronic components.

- Do not use water.
- Proceed carefully when performing cleaning work. Water must not come into contact with live components.
- Water spray must not enter electrical and electronic components.
- Never clean voltage-carrying areas with a high-pressure jet.

### Unexpected start-up



#### **WARNING!**

##### **Risk of injury or personal shock if the machine starts suddenly!**

For example, a superordinate control system could send a start command to the machine so that it starts operating.

- Shut down the machine for all work and secure it against restarting.
- If running the machine from a control room, take precautions to prevent a restart there as well.
- You must be prepared for the machine to start at any time.

### Sharp edges and corners



#### **CAUTION!**

##### **Risk of injury from sharp edges and corners!**

Sharp edges and corners can cause excoriations and cuts to the skin.

- If working in the vicinity of sharp edges and corners, proceed with caution.
- Wear protective gloves.

### Intake components



#### **WARNING!**

##### **Risk of injury from intake components!**

Intake side silencers suck in ambient air with great force at their inlets.

- Always attach intake silencers to pipework provided by the operator.
- Never operate the machine without a pipe connection.

### Vibrations



#### **WARNING!**

##### **Risk of injury from vibrations!**

Vibrations may, in the long term, lead to injuries and chronic damage to personal health. The vibration source is decoupled from the surrounding environment by means of a vibration damper.

- Do not deactivate the vibration damper.
- Avoid coming into contact with vibrating areas.

## Safety

Residual risks and fundamental risks > Mechanical hazards

### Build-up of fluids



#### **CAUTION!**

##### **Risk of injury from slipping as a result of a build-up of fluids!**

Slipping on fluids that have built up on the floor area may lead to a fall. A fall may result in injury.

- Immediately remove built-up fluids with a suitable medium.
- Wear non-slip safety shoes.
- Place a warning notice and mandatory sign on or in the vicinity of any area where there could be a build-up of fluids on the floor area.

### 2.1.6 Hazards from landfill gas, biogas and natural gas

#### **Risk of explosion and injury**



#### **DANGER!**

##### **Risk of explosion and injury from leakage!**

Before and during operation, there is a risk of explosions and injuries from leakage!

- Rectify leakage immediately.
- Avoid a potentially explosive atmosphere.
- Avoid all sources of ignition.
- Ventilate the installation site properly.
- Comply with maintenance intervals.

### 2.1.7 Mechanical hazards

#### **Rotating components**



#### **WARNING!**

##### **Risk of injury from rotating components!**

Rotating components may cause serious injury.

- During operation never reach into or perform work on rotating components.
- Never open covers during operation.
- Observe the run down time: before opening covers, make sure that no components are still moving.
- When in a hazard area, wear tight-fitting protective work clothing with low tensile strength.

### Fan



#### **WARNING!**

##### **Risk of injury from rotating components of the fan!**

Rotating components of the fan can cause serious injuries due to their high revolution speed.

- Prior to any work, switch off the machine and secure it against restarting.
- Observe the run down time.
- Before opening covers, check that no components are still moving.
- Never open covers or maintenance covers and work on the fan during operation.
- The blade wheel must not be accessible during operation.

## 2.1.8 Thermal hazards

### Hot surfaces



#### **WARNING!**

##### **Risk of injury from hot surfaces!**

Component surfaces may become very hot during operation. Skin contact with hot surfaces causes serious burns.

- For all work performed in the vicinity of hot surfaces, wear protective work clothing and protective gloves.
- Make sure all surfaces have cooled down to ambient temperature before beginning any work.

### Hot media



#### **WARNING!**

##### **There is a risk of injury from the sudden emission of hot media from the shut-off valve, e.g. a safety valve.**

The emission of hot media may lead to scalding.

- Never stand in the immediate vicinity of the outlet vent.
- Never attempt to look inside the outlet vent.
- Never close or cover the outlet vent.

## Safety

Residual risks and fundamental risks > Risks from pressurised components

### Warm gas or heated condensate



#### **WARNING!**

#### **Risk of injury from warm media or heated condensate!**

Conveyed material may form condensate. If no discharge tank or residual gas pipework has been provided by the operator, the conveyed material can be bled off by briefly opening the lower bore holes. Warm media or heated condensate may escape.

The emission of hot media may lead to scalding.

- Never stand in the immediate vicinity of the outlet vent.
- Never attempt to look inside the outlet vent.

### 2.1.9 Risks from pressurised components

#### Pressurised components



#### **WARNING!**

#### **Risk of injury from compressed conveyed materials!**

When disassembling pressurised components, or in the case of a fault in a pressurised component such as pipes, containers, hoses or valves, hot conveying material can escape with a strong gas flow. This can result in serious injury.

- Before beginning work, fully relieve pressurised components of pressure.
- Check that components are not pressurised.
- Replace malfunctioning components immediately.
- Only disassemble pressurised components when they are not under pressure.

#### Noise during disassembly



#### **CAUTION!**

#### **Risk of injury from noise during the disassembly of pressurised gas pipes!**

When disassembling pressurised components such as pipes, containers, hoses or valves, hot conveying material is released, resulting in noise. This can cause hearing damage.

- Before beginning work, fully relieve pressurised components of pressure.
- Check that components are not pressurised.
- Only disassemble pressurised components when they are not under pressure.

## 2.1.10 Hazards due to hazardous substances

### Inert gases



#### **DANGER!**

##### **Risk of suffocation from inert gases!**

The inert gas used for flushing can lead to poisoning and respiratory distress.

- Ensure a closed system for flushing the pipeline and the machine.
- Do not release conveyed or inert gas into the atmosphere.
- Do not inhale gases.

### Hazardous substances



#### **WARNING!**

##### **Risk of poisoning from hazardous substances! Risk of skin irritation and allergic reactions!**

Substances such as lubricants and cleaning agents contain hazardous ingredients. These may lead to serious poisoning, irritation or allergic reactions.

- Observe the safety data sheets.
- Avoid shaking these substances and avoid mist formation.
- If inhalation occurs, bring the affected person out into fresh air immediately. Seek medical help.
- If a substance is swallowed, seek medical help immediately. The mouth must be rinsed out thoroughly with water.
- Avoid contact with the skin and eyes:  
Before working with these substances, apply suitable hand protection cream.  
Wear plastic or rubber protective gloves.
- Remove any dirt from the workspace properly and in an environmentally-friendly way.  
Lubricants and cleaning agents must not enter the sewerage system or soil.
- When working with these substances do not eat, drink or smoke.

## Safety

Residual risks and fundamental risks > Risks from flammable substances

### Hazardous dust



#### **WARNING!**

##### **Risk of injury from rising dust!**

Dust deposits may rise during machine operation.

Inhaling this dust may, in the long term, lead to lung damage or other health problems.

- Avoid the hazardous area.
- Wear light respiratory protection for any work in the hazard area.

## 2.1.11 Risks from flammable substances

### Fire hazard



#### **WARNING!**

##### **Fire hazard from spark-generating work and ignition sources in the immediate vicinity of the machine!**

Easily-flammable substances, fluids or gases may catch fire and cause serious or fatal injury.

- Take measures to protect against the build-up of steam in deep-lying or closed areas.
- Take measures to protect against electrostatic pressure charging.
- Do not smoke in the hazard area or in the direct vicinity of the machine.
- Do not use naked lights, fire or ignition sources of any kind.
- Immediately report suspicious materials, liquids or gases to the responsible persons.
- Have extinguishing agents (fire-extinguishing powder) for fire classes A, B and C at hand.
- In the event of fire, stop work immediately. Leave the hazard area until it is safe to return and notify the fire brigade.



### Improper fire protection



#### **WARNING!**

**There is a risk of injury and material damage from limited or improper fire protection!**

If, in the event of fire, the fire extinguisher is not operational or not suited to the specific class of fire, there is a risk of serious or fatal injury and considerable material damage.

- Ensure that only suitable fire extinguishers (fire-extinguishing powder for fire classes A, B and C) are at hand.
- Inspect fire extinguishers every 2 years to ensure they are functioning correctly.
- Refill fire extinguishers after each use.
- Only use extinguishing agents and replacement parts that correspond to the recognised model specified on the fire extinguisher.
- In case of use, observe the safety and operating instructions on the fire extinguisher.

### 2.1.12 Danger if maintenance specifications are disregarded



#### **WARNING!**

**Risk of injury due to failure to perform or deficient performance of maintenance and inspection!**

Careful and regular maintenance and inspection enable potential faults to be detected at an early stage. Non-compliance with specified maintenance intervals as well as improper performance of maintenance can cause critical and dangerous situations. There is therefore a risk of injury in the immediate vicinity of the machine.

Extensive consequential damage to the machine could also occur. This could lead to the total machine loss.

- Always comply with the maintenance intervals.
- Ensure proper performance of maintenance intervals.
- Observe the personnel qualifications.
- Never make any unauthorised extensions to maintenance intervals.

## Safety

Intended use

### 2.1.13 Environmental risk

#### Environmentally hazardous materials



#### ENVIRONMENT!

##### Environmental risk due to incorrect and negligent handling of environmentally hazardous materials!

Improper handling of environmentally hazardous operating materials and cleaning and sealing agents and, above all, their improper disposal, can cause considerable damage to the environment. These materials contain poisonous substances.

- Operating materials and cleaning and sealing agents must not be released into the environment.
- Disposal must be carried out by a certified waste management operator.
- If these materials are inadvertently released into the environment, take appropriate action immediately. If in doubt, contact the responsible local authority and inform them about the damage.

## 2.2 Intended use



Fig. 1: Correct use

The machine is intended for the oil-free conveyance and compression of gases in accordance with the project-specific performance data sheet.

The machine is only approved for use in the certified zone in accordance with the project-specific ATEX declaration of conformity.

The machine has been designed and constructed solely for its “intended use” in the industrial field, as described here.

Only machines with the relevant Ex zone approval may be installed in potentially explosive atmospheres.

The machine must be equipped with the requisite safety devices by the operator to ensure that safe operation is possible.

Observe and comply with the order-related operational data and operational limits.

This intended use also includes compliance with all information in this manual.

- Special reference is made to compliance with the specified maintenance intervals. Non-compliance with the specified maintenance intervals, as well as improper performance thereof, pose a danger to persons and to proper machine function.

Any use beyond the intended use or any other type of application is considered misuse.



*Operating data that deviates from the standard must be agreed with the manufacturer.*

### Operating site

The machine is designed for outdoor installation. Protected against unauthorised third-party access.

### Risk from misuse!



#### **DANGER!**

#### **Risk from misuse!**

Misuse of the machine can lead to dangerous situations.

- Never operate machines without an ATEX marking in a potentially explosive atmosphere.
- Never use machines with an ATEX marking in any zones other than the specified ex-zones.
- Never operate the machine outside the specified application limits (intake pressure, pressure difference, intake temperature, discharge temperature, speed etc.).
- Never operate the machine unless the oil level is correct.
- Never operate the machine without the designated, system-based safety equipment.
- When conveying flammable gases, never disassemble the machine without prior inertisation.

## Safety

Foreseeable misuse

### 2.3 Foreseeable misuse

#### Explosion protection



##### **DANGER!**

##### **Risk of explosion in the event of improper use of the machine in the Ex zone!**

There is a risk of explosion if a machine that is not approved for the Ex zone is operated in the Ex zone. Moreover, there is a risk of explosion if a machine that is approved for the Ex zone is not operated properly.

- Never operate machines without an ATEX marking in a potentially explosive atmosphere.
- Never use machines with an ATEX marking in any zones other than the specified Ex zones.
- Never operate the machine outside the specified application limits (intake pressure, pressure difference, intake temperature, discharge temperature, speed etc.).
- Only operate the machine if the oil level is correct.
- Never operate the machine without the designated, system-side safety devices.

#### Serious injury



##### **DANGER!**

##### **Danger in the case of misuse! Dangerous situations could occur that could lead to fatal or serious injuries.**

- Never disregard the “intended use”.
- Never disregard the specified maintenance intervals.
- Never operate the machine in an operating area other than the one intended.
- Never convey gases that are not listed in the order confirmation and the technical data.
- Never disregard the following information on misuse.

## Serious material damage



### NOTICE!

**Danger in case of misuse! Situations could occur that could lead to serious machine damage.**

- Never disregard the “intended use”.
- Never disregard the specified maintenance intervals.
- Never operate the machine in an operating area other than the one intended.
- Never convey gases that are not listed in the order confirmation and the technical data.
- Never disregard the following information on misuse.



### NOTICE!

**Machine damage from operation during a sandstorm!**

The operation of the machine during a sandstorm can lead to the following impairments and damage:

- Reduction of cooling air and intake air.
- Overheating of the machine.
- Large sand deposits in the entirety of the machine.
- Impaired operation of accessory parts.
- Never operate the machine during a sandstorm.
- Clean and inspect the machine when recommissioning (after a sandstorm).

## Misuses



Fig. 2: Prohibited use

The machine is not intended for:

- Conveying gas mixtures containing oxygen, which could create an Ex zone inside the machine.
- Conveying media in solid, liquid or powder form.
- Conveying corrosive media.
- Conveying corrosive media.
- Altering, retrofitting or modifying the overall design or of individual equipment parts, with the aim of altering the field of application or scope of use.

## Further examples of misuse

The following application ranges or operations and uses are considered improper and must be avoided.

## Safety

### ATEX marking

- **Operation:**
  - Outside the scope of intended use
  - Outside the scope of the intended operating data
  - Using gases other than those specified in the performance data sheet
  - With the machine operating in the incorrect direction of rotation
  - With closed flange connections
  - With missing or damaged components
  - Without a correctly connected control system, fault transmitter, EMERGENCY STOP function
  - Without any or with damaged protective equipment
  - With contaminated intake filter or starting strainer
  - Without sufficient ventilation of the room
  - Activation while coming to a stop or when rotating backwards
  - Pole changing to a lower rotational speed before the drive motor has come to a standstill
  - Non-compliance with the maintenance intervals
  - Exceeding the maximum oil level
  - Securing the customer's system pressure with RKR safety valves
  - Using RKR safety valves as a safety-oriented component in the system line
- **Application:**
  - Using the machine to "purge" blockages in the conveying pipes
  - Using the machine for exceeding the maximum permissible discharge pressure
  - Using the safety valve to adjust the operating data
- **Installation:**
  - Installation on inclined, sloped or lamellar surfaces
  - Attachment of transport aids to the acoustic hood
  - Open flames or spark formation in the immediate vicinity of the machine

## 2.4 ATEX marking


### ATEX marking



The machine is only approved for use in the certified zone in accordance with the

- ATEX declaration of conformity and
- marking on the machine

Tab. 3: General explanation of the ATEX marking

Marking	Designation	Explanation
CE	CE marking	Conformity marking pursuant to Appendix X of the directive 2014/34/EU. The manufacturer affixes the marking before the machine is brought into general use.
0044	Notified body	Body approved by the EU for the inspection and issuance of certification relating to conformity-assessment procedures. 0044 = TÜV NORD CERT GmbH
	Ex marking	Indicates equipment to be used in potentially explosive atmospheres.
II	Equipment group	The equipment may be used in potentially explosive areas, with the exception of mining applications.
1	Equipment category	In the case of Category 1 equipment, potentially explosive atmospheres occur constantly, frequently or over a prolonged period of time. The equipment ensures a high degree of safety, even when 2 faults occur simultaneously, and can be used in zones 0 and 20.
2	Equipment category	In the case of Category 2 equipment, potentially explosive atmospheres may occur occasionally. The equipment ensures a high degree of safety and can be used in zones 1 and 21.
3	Equipment category	In the case of Category 3 equipment, potentially explosive atmospheres may occur rarely and briefly. The equipment ensures the necessary degree of safety during normal operation and can be used in zones 2 and 22.
/	Equipment category (internal/external)	If there are different equipment categories inside and outside the conveyor section, these are separated by a forward slash.
G	Substance group	A potentially explosive atmosphere occurs due to the presence of: G – gases D – dust
Ex h	Identification code	Non-electrical equipment for explosive atmospheres - Non-electrical type of protection constructional safety “c”, control of ignition sources “b”, liquid immersion “k” as per DIN EN ISO 80079-37
d	Ignition protection type	Flameproof enclosure as per DIN EN 13463 - 3

## Safety

ATEX marking

Marking	Designation	Explanation
T6	Temperature class	T1– maximum surface temperature: 450 °C T2– maximum surface temperature: 300 °C T3– maximum surface temperature: 200 °C T4– maximum surface temperature: 135 °C T5– maximum surface temperature: 100 °C T6– maximum surface temperature: 85 °C
Gb	Equipment protection level – EPL	Ga – For use in zone 0, 1, 2 Gb – For use in zone 1, 2 Gc – For use in zone 2 Da – For use in zone 20, 21, 22 Db – For use in zone 21, 22 Dc – For use in zone 22
X	Further information	The instruction manual also contains further conditions for safe use.  e.g. notes on use of potentially explosive gases in sub-group C



## Ex zones

Equipment group I Underground parts of mines – danger posed by firedamp and dust		Equipment group II Equipment for use in other potentially explosive areas Danger posed by potentially explosive atmospheres containing gas-air or dust-air mixtures, mists or vapours					
Category M		Category 1		Category 2		Category 3	
1	2	G (Gas)	D (Dust)	G (Gas)	D (Dust)	G (Gas)	D (Dust)
		Zone 0	Zone 20	Zone 1	Zone 21	Zone 2	Zone 22
For equipment in both underground parts of mines and their respective above-ground facilities that ensures a very high degree of safety. Operation must also be ensured with regard to occasional disruptions.	For equipment in both underground parts of mines and their respective above-ground facilities that ensures a high degree of safety. It is possible to shut down the equipment in cases where a potentially explosive atmosphere occurs.	For equipment that ensures a very high degree of safety. Intended for continuous, long-term or frequent operation in potentially explosive areas (> 1,000 hours per annum). The equipment is not an effective ignition source, even in the rare event of malfunctions.		For equipment that ensures a high degree of safety. Intended for cases in which potentially explosive atmospheres are likely to occur (10–1,000 hours per annum). The equipment is not an effective ignition source, even in the event of the expected malfunctions.		For equipment that ensures a normal degree of safety. Intended for cases in which potentially explosive atmospheres are likely to occur only on an infrequent basis and for short periods (0–10 hours per annum). The equipment is not an effective ignition source during normal operation.	

## Safety

Responsibility of the operator

### Additional notes on “potentially explosive gases”

Group II represents potentially explosive gases. Depending on the type of protection, this group is divided into 3 subgroups (A, B, C).

Subgroup C comprises hydrogen, acetylene, and carbon disulphide.

Gases in subgroup C are ignited by very low-energy ignition sources. RKR and the operator must observe special protective measures.

Measures taken by RKR

- Gas-tight machine stage.
- Explosion pressure shock-resistant machine stage.
- Explosion pressure shock-resistant accessories.
- Strength and leakage test.
- Conductive paint.

Measures taken by the operator

- Avoid electrostatic discharge
  - Do not remove stickers on site.
  - Remove packaging foil when outside the Ex zone.
  - Only allow conductive paint to be touched up by RKR.
  - Wear approved protective clothing for subgroup C.
  - Comply with the specified humidity values or even more stringent values.
- Use approved tools for subgroup C.
- Comply with primary ventilation measures or establish these measures.
- Only use original spare parts from RKR.
- Functional accessories must be suitable for subgroup IIC.
- Prevent mechanically and electrically generated sparks.
- Earth the machine.

## 2.5 Responsibility of the operator

### Owner

The owner is the person who either operates the machine themselves, for commercial or business purposes, or who assigns the use of the machine to a third party. During operation, the owner holds legal responsibility pertaining to the product, for the protection of the user, personnel and third parties.

### Operator's obligations

The machine is used for commercial purposes. The operator of the machine is thus subject to the applicable legal obligations for occupational safety.

Alongside the safety instructions in this manual, the safety, occupational and environmental regulations relevant to the field of application for the machine must also be complied with.

The operator is obligated to:

- Inform themselves about the applicable occupational protection regulations. As part of a hazard assessment, the operator must also establish the hazards that could result from special working conditions at the machine location. They must implement these for the operation of the machine in the form of operating instructions. The necessary safety data sheets can be obtained from the relevant manufacturer.
- During the entire service life of the machine, check that the operating instructions created by the manufacturer correspond to the current status of the applicable regulations. If necessary, adjust the operating instructions accordingly.
- Clearly structure and specify the responsibilities for installation, operation, fault rectification, maintenance and cleaning.
- Ensure that all persons who come into contact with the machine have read and understood these instructions. In addition, the operator must regularly provide personnel training and inform personnel of the related hazards.
- Provide personnel with the necessary protective equipment and communicate to them that wearing this protective equipment is compulsory.

In addition, the operator is responsible for ensuring that the machine is in perfect technical condition.

For this reason, the following applies:

- The maintenance intervals described in this instruction manual must be complied with.
- All safety devices must be regularly inspected to ensure they are in good working order.

### **Additional obligations of the owner**

The owner must ensure that the following requirements are complied with and put into practice:

- The machine is only operated in its original delivered condition. In cases where the operator adds his own fittings or makes modifications, the manufacturer's declaration of conformity is rendered void.
- Any working behaviour that jeopardises the safety of the machine is prohibited.
- The machine must always be kept in a technically-perfect and operationally-safe condition. Replace damaged or non-operational components immediately. If in doubt, be sure to contact the manufacturer or the responsible contact person.
- Do not operate the machine if the protective equipment has been disassembled or disabled.
- Observe all warnings and notices displayed on the machine and make sure they are readable. You must replace loose or illegible signs. Ask the manufacturer for replacements.
- Install the separately provided components listed in the scope of delivery onto the machine and incorporate these into the overall safety concept.
- Do not disassemble or incorrectly fit any electrical, mechanical or hydraulic connections.

## Safety

Responsibility of the operator

- For protection against potential damage caused by lightning, make sure a suitable earthing system is in place.
- If the conveyed medium tends to form condensate, the condensate must be bled off (e.g. using discharge tanks, residual gas pipes or by briefly opening the lower condensation holes).
- Separate dusty material before it enters the machine. Material that collects in the conveying chamber or on the rotors presents a particular danger for the working safety of the machine.

### Operator's obligations for ATEX application

Alongside the safety instructions in this manual, the safety, occupational and environmental protection regulations relevant to the ATEX application must also be complied with.

For this reason, the following applies:

- Maintain an explosion protection document.
- All work in Ex zones must be given separate clearance.
- All components provided must have ignition protection appropriate to the given Ex zone rating.
- Only personnel with additional qualifications in explosion protection may be tasked with work in potentially explosive atmospheres.
- Avoid any accumulation of dust.
- All safety equipment must be operational.
- Avoid ignition sources in potentially explosive atmospheres.
- Separate any solid ingredients or dusty material before they enter the machine stage.

Where necessary, suitable strainers/filters are to be used on the intake side. Intake-side installation reduces the intake capacity of the machine stage. Note the maximum permissible particle sizes.

- Safety valves must be connected on site in such a way that released gas is not a hazard.
- Only use a drive motor with the correct design for the relevant Ex zone.
- Only use a gas detection system with the correct design for the relevant Ex zone.
- Integration of monitoring of the operating parameters in the control system. Comply with the operating data.
- Observe the limits specified by the manufacturer for monitoring vibrations.
- Protect against lightning.
- Check safety equipment at regular intervals to ensure that it is in good working order and complete.
- Avoid static electricity resulting from plastics. It is only permitted to use insulation that is suitable for the ATEX zone or is conductive in terms of its design.

■

### Operator's obligations at the installation site

The operator must ensure that the following requirements are always complied with and put into practice:

- The machine is solely for use in stable three-phase networks. Voltage fluctuations/drops beyond the tolerance range may cause serious damage to the drive system.
- Motor overload protection must be active.
- For system variants without a main circuit breaker with an EMERGENCY STOP function, incorporate the safety circuit of the machine into the EMERGENCY STOP concept of the overall system. Ensure the accessibility of additional EMERGENCY STOP switches in the vicinity of the machine.  
The machine must be equipped with one or more EMERGENCY STOP command devices for operation.  
The EMERGENCY STOP function must be available and operational at all times, regardless of the mode of operation.
- It must be ensured that a shut-down machine cannot start automatically.
- For the purposes of operation, the machine must be equipped with a command unit that shuts down the machine accordingly in dangerous situations.  
In dangerous situations, the power supply to the motor must be cut off.  
If this is not possible, the “standstill” operating condition must be monitored and maintained.
- Avoid electrostatic charges. Connect an equipotential bonding.
- Regardless of the operating state, the connected system pipes must not exert forces or moments that affect the machine. Fasten all system pipe connections at the delivery limit.
- For accidents and emergencies, integrate emergency measures for the machine into the emergency operational measures. Incorporate these measures in the evacuation and rescue plan and the fire warning plan in particular.
- The operator must ensure compliance with the maximum permissible system pressure by means of safety valves provided by the customer. Independently of the safety valves used in the machine!
- In emergency situations, the operator must ensure sufficient relief for the system.

### Operator's obligations for the use of potentially-explosive gases



#### **For conveying natural gas!**

*For conveying natural gas the Technical Rules of the DVGW worksheet G 492/II (building and equipment of systems for gas volume measurement) are to be observed.*

In order to avoid explosions, observe the following points:

- Retrofit the machine with a gas detection system if there is no guarantee of an alarm being triggered and all electrical ignition sources being switched off in the case of the lower explosive limit being exceeded.
- The value of the lower explosive limit is defined by the owner, as this depends on the medium being used.

## Safety

Responsibility of the operator

- Install the separately supplied non-return flap in the owner's system pipeline.
- If none is installed already, install a safety valve between the machine and the non-return flap.
- Do not use open flames or create sparks in the vicinity of the machine.
- Ensure there is sufficient ventilation.
- Check the leak-tightness of the machine.
- Relieve the pressure on the delivery lines before disassembling and clean with neutral gas.

In order to avoid damage to the machine, observe the following points:

- Lay down the intake-side pipelines in ascending order and with condensate drains.
- Drain off the conveyed medium before entry into the machine stage.
- Avoid sudden pressure impacts and pressure increases in the system line.

### Operator's obligations for medium/high-voltage applications

Alongside the information in these operating instructions, the following notes must also be given particular attention for medium/high-voltage applications.

- Only plan switchgear sourced from providers that are qualified in the field of medium/high-voltage applications.
- Only entrust work to be performed on energised components to personnel who, on the basis of their field-specific training, expertise, experience and knowledge of the relevant standards and requirements, are able to carry out their work on electrical systems safely, while independently recognising and avoiding hazards.
- Personnel must be authorised to perform work involving medium/high voltage applications.
- Observe the relevant documentation of the electrical components!
- Observe the operating manual/assembly manual of the drive motor!
- Observe the cable manufacturer's information on selecting, handling and routing the motor cable.
- Observe the specified distances to adjacent components.
- Observe the relevant fire safety requirements, especially for wall bushings.
- Ensure that there is no risk of flashovers.
- Before entering the high-voltage area, first ensure that the primary line has been interrupted and the machine is grounded.
- If using movable drive motors (with hinged motor support), ensure that the drive motor can move freely without restrictions. The connecting cable must not impair the movement of the motor for the purposes of tensioning the belts.

- Fit a flexible connecting cable with strain relief. In cases where the hinged motor support sinks fully and suddenly, this must not cause the connecting to cable to be torn or pulled out of the terminal box.
- For operation with an acoustic hood, it is particularly important to ensure a correctly installed wall bushing.
- Observe the permissible bending radii for the cables that are used.

## 2.6 Spare parts

### Explosion protection



#### **WARNING!**

#### **Risk of explosion from the use of incorrect replacement parts!**

The use of incorrect or faulty replacement parts can lead to explosions in the Ex zone. This can result in serious or fatal injury and considerable material damage.

- Only use the manufacturer's original replacement parts or parts expressly approved by the manufacturer.
- If in doubt, always contact the manufacturer.

Failure to comply with these instructions will result in the loss of the explosion protection.

### Use of incorrect replacement parts



#### **CAUTION!**

#### **Safety risk from using incorrect replacement parts!**

Incorrect, defective or unsuitable replacement parts or copies of original components may endanger personal safety and lead to damage, faults or total failure.

- Only use the manufacturer's original replacement parts or parts approved by the manufacturer.
- If in doubt, always contact the manufacturer.

Purchase replacement parts from an authorised dealer or from the manufacturer directly. For contact information, see Customer service. ↗ 1.4.2 'Customer service' on page 13

## Safety

Requirements for personnel > Qualifications

### Replacement parts

Replacement parts that have not been provided by RK R Gebläse und Verdichter GmbH have not been tested or approved. They do not correspond to the original components. The use of such products can potentially have an effect on the default design characteristics of the systems. The manufacturer assumes no liability for damage resulting from the use of non-original components.

## 2.7 Requirements for personnel

### 2.7.1 Qualifications

The various tasks described in this manual are associated with a variety of requirements in terms of the qualifications of the persons responsible for carrying out these tasks.

#### Insufficient qualifications



#### **WARNING!**

##### **Risk if persons are not sufficiently qualified!**

Insufficiently qualified persons are unable to gauge the risks presented by the use of the machine and put themselves, and others, at risk of serious or fatal injury.

- Only allow work to be carried out by suitably qualified persons.
- Observe the information on qualifications in this manual.
- Keep insufficiently qualified persons away from the operating range of the machine.

For the purposes of all work with this machine, only allow persons who are expected to carry out their work reliably to do so. Persons whose reaction times have been impaired, e.g. through drug or alcohol consumption or medication, are not be permitted to work.

The follow section of this manual states the qualification requirements for persons carrying out the various tasks:

#### **Additional qualification for explosion protection**

In addition to their general professional competence, personnel with an additional qualification in explosion protection are capable of performing work on systems or components in potentially explosive areas on the basis of their field-specific training, expertise, experience and knowledge of the relevant standards and requirements.

Personnel with an additional qualification in explosion protection can independently recognise hazards and avoid dangers and can perform work without a loss of the machine's explosion protection.



This additional qualification in explosion protection, as supplementary to a standard professional qualification, is essential for the approval for the performance of work in potentially explosive atmospheres.

### **Authorised electricians**

Authorised electricians, on the basis of their field-specific training, expertise, experience and knowledge of the relevant standards and requirements, are able to carry out their work on electrical systems safely while independently recognising and avoiding hazards.

Authorised electricians are specially trained for the environment in which they work and are familiar with the relevant standards and requirements.

### **Authorised electricians for medium or high voltage applications**

Authorised electricians for medium and high-voltage applications are specialists in this particular field and have expert knowledge when it comes to handling medium and high voltage-carrying components. On the basis of their field-specific training, expertise, experience and knowledge of the relevant standards and requirements, they are able to carry out their work on electrical systems safely while independently recognising and avoiding hazards.

Authorised electricians are specially trained for the environment in which they work and are familiar with the relevant safety requirements.

### **Gas specialists**

Gas specialists are specially trained for the environment in which they work and are familiar with the relevant standards and requirements. Due to their technical training, knowledge and experience, gas specialists are able to carry out work on the system, independently recognise possible hazards and thus avoid the associated dangers.

Gas specialists in particular possess practical experience and extensive field-specific expertise for the variety of tasks.

- Acceptance of the technical gas system
- Maintenance
- Fault rectification

Depending on the designated job, additional qualifications are required:

- **Safety valve competence:** specialist technical training and practical experience in the handling of safety valves.
- **Gas warning device competence:** specialist technical training and practical experience in the handling of gas warning devices.

### **Manufacturer's customer service division**

Certain work may only be performed by the customer service division of the manufacturer. On the basis of its special, field-specific training, expertise and experience, the customer service division is up to the task of performing highly-skilled work.

The customer service division is a competent point of contact. It is able to perform all work with the highest efficiency.

### **Service personnel**

Service personnel are able to carry out their work on the basis of their field-specific training, expertise, experience and knowledge of the relevant standards and requirements. They recognise hazards independently and avoid risks.

Service personnel in particular possess practical experience and extensive field-specific expertise for the following activities:

- Transport
- Assembly/installation
- Commissioning
- Maintenance
- Fault rectification
- Disassembly

Depending on the designated job, additional qualifications are required:

- Operation and handling of compressors
- Parameterisation of compressors
- Optimisation work within the permissible operating data range

### **Skilled staff for industrial waste**

Skilled staff for industrial waste possesses comprehensive, field-specific expertise relating to the disposal and recycling of industrial waste. Skilled staff transports the industrial waste to the waste disposal company and holds responsibility for proper sorting of waste. The staff incorporates this sorting into the recycling and disposal processes.

### **Supervisor**

The supervisor is a person who is reliable, familiar with the work and has power of authority. This person supervises and monitors the correct and safe performance of works. They must be sufficiently qualified.

### **User**

The machine user is trained by the system operator in terms of operation, maintenance work and basic fault rectification. They are informed of possible operational hazards and improper behaviour. Tasks that go beyond those for which the machine user is trained or instructed may only be carried out if these tasks are listed in this instruction manual and the operator has expressly designated these tasks to the user.

### 2.7.2 Unauthorised personnel

#### Unauthorised personnel in the installation area



##### **WARNING!**

##### **Risk of fatal injury for unauthorised persons in the installation area!**

Unauthorised persons who do not fulfil the requirements described here, are not familiar with the hazards in the installation area. Therefore, unauthorised persons are at risk of serious or fatal injury.

- Keep unauthorised persons away from the installation area.
- If in doubt, instruct such persons to leave the installation area.
- Stop all work as long as unauthorised persons are in the installation area.

### 2.7.3 Training

The operator must regularly provide safety training for personnel. For tracking purposes, a training report must be drafted with the following mandatory content:

- Date of training
- Name of the training participant
- Content of the training
- Name of the training instructor
- Signatures of the participant and instructor

## 2.8 Personal protective equipment

Personal protective equipment is used to protect people from adverse effects on safety and health when at work.

Personnel, when working near or with the machine, must wear the personal protective equipment described separately in the individual sections of this manual.

### Description of personal protective equipment

The following is a description of the personal protective equipment:



#### **Antistatic protective work clothing for ATEX applications**

Antistatic protective work clothing prevents the build-up of a static charge which could produce sparks and lead to a fire or an explosion. This protective work clothing must be made so that it cannot produce any electric, electrostatic or charged arc or spark which could lead to the ignition of a combustible atmosphere. Protective work clothing is tight-fitting work clothing with minimal tensile strength, tight sleeves and without protruding parts.



#### **Conductive footwear and antistatic clothing (7010-M032)**

Conductive footwear and antistatic clothing are used to protect against static charge, e.g. when handling sensitive electronic components or in potentially explosive areas.



#### **Gas detector (7010-M048)**

The gas detector for mobile use is used to warn of hazardous gas accumulations at the installation site and thus to protect persons.



#### **Hearing protection (7010-M003)**

Hearing protection serves to protect against hearing damage from noise generation.



#### **Industrial hard hat (7010-M014)**

Industrial hard hats protect the head against falling or stray objects and loads and from collisions against stationary objects.



#### **Light respiratory protection (7010-M016)**

Light respiratory protection protects against harmful dusts.

## Safety

Safety devices > Overview of safety devices



### Protective gloves (7010-M009)

Protective gloves protect hands from friction, abrasion, puncture hazards or more serious injuries and from contact with hot surfaces.

They are oil-resistant and protect hands from coming into contact with lubricants.



### Protective work clothing (7010-M010)

Protective work clothing is tight-fitting work clothing with minimal tensile strength, tight sleeves and without protruding parts.



### Safety goggles (7010-M004)

Safety goggles serve to protect the eyes against flying particles and splashing liquids.



### Safety shoes (7010-M008)

Safety shoes protect feet from being crushed, from falling objects and from slipping on slippery surfaces.

## 2.9 Safety devices

### Function of the safety devices



#### WARNING!

#### Risk of fatal injury from non-functioning safety devices!

Non-functioning or deactivated safety devices may cause serious or fatal injury.

- Before beginning work, check that all safety devices are functioning correctly and are correctly installed.
- Never deactivate or bypass safety devices.
- Ensure that all safety devices are accessible at all times.

### 2.9.1 Overview of safety devices

#### General

Overview of safety-relevant machine components.



*Safety devices that are not included in the scope of delivery for the machine must be provided and attached by the system manufacturer.*

Depending on the application and version of the machine, the following safety equipment is used:

- EMERGENCY STOP function
- Overcurrent protection
- Intake-side filter (on system side)
- Starting strainer (intake from pipe)
- Safety valve
- Belt guard
- Acoustic hood
- Earthing connection
- Instrumentation for monitoring the operating parameters as per measurement points and instruments list

### 2.9.2 EMERGENCY STOP function



*The EMERGENCY STOP function serves, in cases where there is a hazard or when one is averting a hazard, to bring the machine quickly to a safe stop (standstill).*

Depending on the customer's specifications, machine variants are available with or without a power circuit breaker system.

Depending on the model, the machine:

- may not feature a control system
- may not feature an EMERGENCY STOP function

#### **Before operating the machine:**

Check whether the EMERGENCY STOP function is in place and installed.

It must function perfectly.

## Safety

Safety devices > EMERGENCY STOP function

### EMERGENCY STOP command device



Fig. 3: Example of an EMERGENCY STOP command device

An EMERGENCY STOP command device includes a special command unit which is connected to the control system.

The EMERGENCY STOP function allows for the machine to be shut down safely and immediately in case of a potential or existing hazard.

The power supply to all turning components is interrupted immediately when the EMERGENCY STOP function is activated.

It is also possible to install additional EMERGENCY STOP command devices.

#### Without a power circuit breaker system

- For this variant, an EMERGENCY STOP command device is not installed on the machine at the factory.
- The machine is delivered without an EMERGENCY STOP apparatus.
- The owner must provide a power circuit breaker system with electrical overload protection, an On/Off command unit and an EMERGENCY STOP function.
- Activate Stop Category 0.
- Detail the performance data of the electrical installation in accordance with the operating data of the motor. Take into consideration the necessary data, for example: Voltage, current, frequency.
- The connection to the power supply is made using the installed and delivered power cabinet.
- The lines running to the power supply are fed directly to the electric motor and are connected inside a terminal box.
- Feed the connection lead through the cable conduit to the terminal box.
- Protect the motor against overheating.
- A main circuit breaker must be installed.

#### With a power circuit breaker system

- Depending on the model, an EMERGENCY STOP command device is installed at the factory in the power circuit breaker system.
  - If the factory-installed power circuit breaker system does not feature an EMERGENCY STOP command device, this must be provided by the operator.  
Activate Stop Category 0.
  - If the factory-installed power circuit breaker system does feature an EMERGENCY STOP command device, Stop Category 0 is performed.
- A main circuit breaker must be installed if it is not part of the power circuit breaker system.
- The power supply is connected at the power cabinet.
- Observe the wiring diagram!



**Notes on installation by the operator**

The EMERGENCY STOP device must:

- be installed and integrated into the safety line of the system controller.
- be clearly recognisable, highly visible and quickly accessible.
- shut down dangerous operation quickly without causing any additional risks.
- if necessary, trigger specific safety measures or authorise the triggering of safety measures.
- be installed in such a way that the machine user can activate it immediately in an emergency.
- be designed in such a way that, in cases where there is an interruption in the power supply or the power supply is activated after an interruption, no situations can occur in which there is a threat of personal injury or material damage.
- supplement other protective measures without acting as a substitute for them.

**Requirements for installation by the operator**

The EMERGENCY STOP function must be available and operational at all times, independent of the operating mode.

The EMERGENCY STOP facility must not require the entire machine to be voltage-free. In situations where a risk is detected, it must be possible for the user to stop the machine in order to protect against a hazard. For the purposes of a controlled shut-down, electrical voltage may be necessary. The electrical system is still under voltage.

If several EMERGENCY STOP devices are in place, all of these devices must be able to shut down the machine.

The EMERGENCY STOP function must, after being triggered, remain effective until authorisation is given for a restart.

It must not be possible to attempt to block the EMERGENCY STOP device without a “stop” command being issued.

Ensure that it is only be possible to release the EMERGENCY STOP device by means of authorised activation.

This authorisation must not cause the machine to start operating again automatically but rather it should make a machine restart possible.

**2.10 Safety classification**

The following symbols and notices are displayed on the machine. They relate to the immediate vicinity in which they are located.

## Safety

Safety classification

### Unreadable signage



#### **WARNING!**

#### **There is a risk from unreadable signage!**

There is a risk of injury resulting from dirty or illegible signs. It may be impossible to recognise hazards and to follow the necessary operating information.

- Keep all safety, warning and operating information in a thoroughly readable condition.
- Replace damaged signs or stickers immediately.

### Do not walk or stand here



Walking or standing on these surfaces is prohibited because of:

- low load-bearing capacity
- substantial danger

### No lifting point



It is forbidden to lift the machine at the marked points due to

- low load-bearing capacity
- substantial danger

### Hot surface



Hot surfaces, such as hot machine parts or system parts, containers or materials - but also hot liquids - are not always noticeable. Do not touch them without protective gloves.

### Gas emission



Risk from sudden gas emission.

The opening of the safety valve results in the emission of gas and accompanying noise emissions. There is a risk of hearing damage, injuries to eyes or injuries to skin.

### Substances hazardous to health or irritant substances



These substances can irreparably damage health, trigger allergies, and irritate mucous membranes.

## Potentially explosive atmosphere



Warning against a potentially explosive atmosphere in the working area and in gas cylinder storage rooms.

A potentially explosive atmosphere can be caused by the volatilization of flammable fluids (e.g. petrol) or, similarly, by fine, rising dust.

Keep any ignition sources (e.g. open flames, heat sources, electronic devices that are not protected against explosion) away from the explosion hazard area. Welding, separating and grinding work is not permitted.

Only equipment that corresponds to the relevant scope of protection may be used in a potentially explosive atmosphere.

## 2.11 Instruction signs

### Wear hearing protection



In areas where this symbol is displayed there is a risk of hearing damage. Therefore, wear hearing protection when in these areas.

#### Information on wearing hearing protection

< 80 dB(A)	Hearing protection is not prescribed as mandatory but should be worn as a matter of personal responsibility.
80 to 85 dB(A)	Hearing protection is recommended
> 85 dB(A)	<b>Hearing protection must be worn</b>

### Observe the instruction manual



Only use the labelled machine once you have read the instruction manual.

### Lashing point



Lash down the component at the marked points.

## Safety

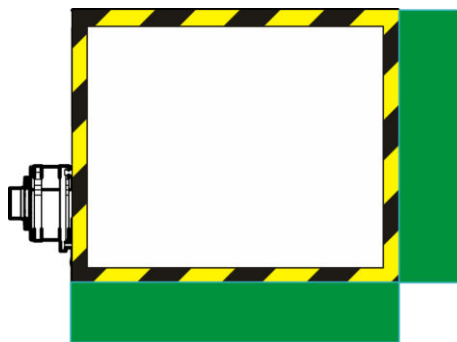
Hazard area and controls area and/or display area

### Earth before use


Earth the component at the point indicated.



### 2.12 Hazard area and controls area and/or display area



 Hazard area

 Controls area and/or display area

The hazard area is located in the marked zone (in the acoustic hood interior zone). The opening of acoustic hood elements and protective covers during operation is not permissible. Opening is permissible only for maintenance work or for troubleshooting and provided all safety precautions are observed. The controls area and/or display area is the position marked in green (example).

*Fig. 4: Hazard area and controls area and/or display (view from above)*

## 2.13 Securing the machine against restarting

### Sudden restart



#### **DANGER!**

**An unauthorised or unregulated restart can have fatal consequences.**

An unauthorised or unregulated restart of the machine can lead to serious or fatal injuries. There may be people located in the hazard area. Activating the energy supply and starting the machine could result in those people being fatally injured.

- Prevent the machine from restarting by:
  - disconnecting the electrical power supply
  - activating the EMERGENCY STOP function.
  - operating the main circuit breaker and disconnecting the machine from the power source.
  - attaching a padlock to the main circuit breaker.
  - ensuring that the machine is completely de-energised and disconnected from the power source.
  - displaying a sign on the machine that prohibits a machine start.
  - displaying a sign on the control centre that prohibits a machine start.
- Before restarting, ensure that safety devices are installed and functioning correctly and that there are no potential hazards to the safety of any persons.

### EMERGENCY STOP button (option)

- 1.** ➤ Press the EMERGENCY STOP button.  
⇒ The power supply is shut off.
- 2.** ➤ Activate the main circuit breaker.  
⇒ The machine is free of current.
- 3.** ➤ Attach a padlock to the main circuit breaker.
- 4.** ➤ Ensure that the machine is completely de-energised and disconnected from the power source.
- 5.** ➤ Inform supervisory personnel of work in the hazard area.

## Safety

### Environmental protection

- 6.** ➤ Place a sign on the machine and (where applicable) control centre that notifies persons of the work being carried out in the hazard area and forbids activation of the machine. The sign must contain the following information:
- Shut-down on:
  - Shut-down at:
  - Shut-down by:
  - Important: Do not switch on!
  - Important: Only switch on the machine once it has been ensured that there is no risk to personal safety.

### EMERGENCY STOP feature (operator-installed)



*The particular approach to preventing a restart is dependent on the operator-installed EMERGENCY STOP feature.*

- 1.** ➤ Secure the machine against restarting in accordance with the operator's instructions.
- 2.** ➤ Follow the instructions of the responsible supervisory personnel.
- 3.** ➤ Once all work has been completed, check that there is no risk to personal safety.
- 4.** ➤ All safety devices and protective equipment must be installed and fully functional.

## 2.14 Environmental protection

### Environmentally hazardous materials



#### ENVIRONMENT!

**Improper handling of environmentally hazardous materials presents a threat to the environment!**

Incorrect handling of environmentally hazardous materials, particularly in the case of improper disposal, can cause considerable damage to the environment.

- Always observe the information below on the handling of environmentally hazardous materials and their disposal.
- If environmentally hazardous materials are inadvertently released into the environment, take appropriate action immediately. If in doubt, inform the responsible local authority about the damage and seek advice on taking appropriate measures.

**The following environmentally hazardous materials are used:**

### Lubricants

Lubricants such as greases and oils contain poisonous substances. They must not be released into the environment. Disposal must be carried out by a certified waste management company.

### Insulation material

Damage to insulation material can release fibres that may lead to accumulation of dust and dust residues. Skin contact with these fibres can lead to an itching sensation.

Disposal is performed in conjunction with the applicable provisions and procedures in the country in which the use or disposal takes place.

### Electronics

Electrical and electronic components may contain poisonous material. These components must be collected separately and deposited at local collection points or disposed of by specialist companies.

### Cleaning fluids

Solvent-based cleaning agents contain poisonous substances. They must not be released into the environment. Disposal must be carried out by a certified waste management company.

### Condensate

Depending on the composition of the conveyed medium, the condensate can cause irritation or contain environmentally hazardous substances. Its disposal may only take place in an environmentally friendly manner, in accordance with local regulations.

### Anti-corrosion agents

Anti-corrosion agents may contain poisonous substances. They must not be released into the environment. Disposal must be carried out by a certified waste management company.

## Safety

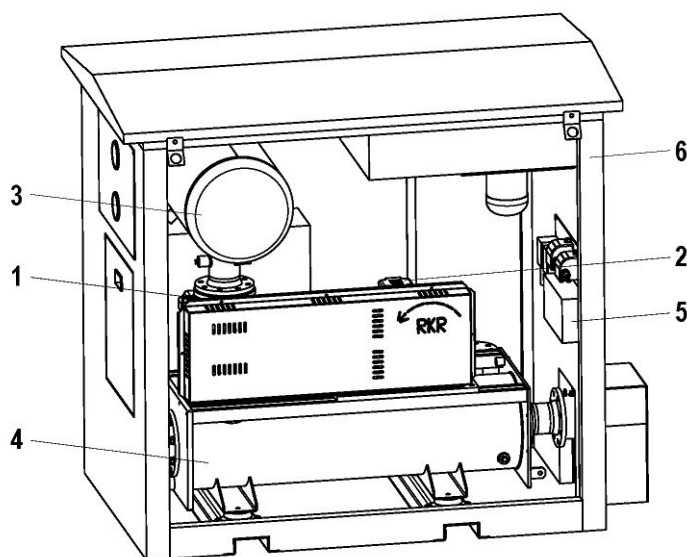
Environmental protection



### 3 Design and operation

#### 3.1 Overview of assemblies

##### Machine with belt drive



*Fig. 5: Main assemblies of the machine*

- 1 Machine stage
- 2 Drive system
- 3 Conveying system, intake side
- 4 Conveying system, discharge side
- 5 Instrumentation
- 6 Acoustic hood

#### 3.2 Operating principle

The conveyed medium enters through a flexible connection on the intake silencer. The starting strainer protects the machine against coarse particles from the pipe.

The machine stage conveys and compresses the conveyed medium. The conveyed medium then flows through the discharge silencer, via a non-return flap, to the flexible connection in the customer's system.

A safety valve on the base support protects the components of the machine. The conveyed medium is discharged in a targeted manner.

The positive displacement blower is driven by a drive motor with belt drive. The drive motor is powered by connecting its power lines in the terminal box.

Depending on the version of the machine, operating parameters are permanently monitored and/or displayed on the machine.

A fan is responsible for ventilation in the version with an acoustic hood.

## Design and operation

Application ranges > Operating information for pneumatic conveyance

### 3.3 Medium and high voltage applications

Medium and high voltage applications call for special requirements in terms of power system design, staff qualifications and safety measures. The power systems must be planned in such a way that they do not pose potential dangers, such as spark flashovers, accidental contact or fire hazards. Special measures must be taken in terms of insulation and contact protection. Personnel must be suitably qualified in order to perform work on energised components correctly and safely. The safety and warning notes in these operating instructions must be observed.

### 3.4 Operating modes

The machine can be used with the following operating mode:

#### On-site operation

Operation of the machine is carried out directly on site.

#### Remote operation

The machine is operated via the process control system.

#### Automatic operation

The machine is permanently monitored by monitoring devices and controlled via its connection to a control system.

#### Load operation

Load operation is the operating mode in which the machine operates according to the specified operating data.

### 3.5 Application ranges

#### 3.5.1 Operating information for pneumatic conveyance

##### Pneumatic conveyance

When the machine is being used for the purposes of pneumatic conveyance, pressure surges must not occur when switching between different delivery lines.

Pressure surges can be prevented by making the switching process for the intake-side and discharge-side valves take at least five seconds. This pre-accelerates the gas column in the pipework. The gas can no longer accelerate suddenly. This prevents damage to the machine.

The distance between the switchover valve and the intake-side flange must be at least 10 x DN. DN = nominal diameter of the pipe.

This note applies to both positive pressure operation and vacuum operation.

### 3.5.2 Operating information for air-separation systems

#### Air-separation systems

When the machine is being used in air-separation systems with alternating air-separation columns, pressure surges must not occur when switching between different delivery lines.

Pressure surges can be prevented by making the switching process for the intake-side and discharge-side valves take at least five seconds. This pre-accelerates the gas column in the pipework. The gas can no longer accelerate suddenly. This prevents damage to the machine.

The distance between the switchover valve and the intake-side flange must be at least  $10 \times DN$ . DN = nominal diameter of the pipe.

This note applies to both positive pressure operation and vacuum operation.

## 3.6 Description of assemblies

For the purposes of explaining its functionality, the machine is divided into several assemblies. Each assembly consists of a number of components which, combined, perform a specific machine function. A single assembly can consist of sub-assemblies and additional components.

### 3.6.1 Gas-tight machine stage

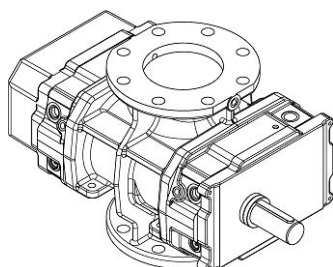


Fig. 6: Machine stage

The machine stage is the core of the machine and includes all components for gas compression. The gas compression process takes place in the machine stage.

#### Drive shaft seal

To seal the machine housing, either one or two radial seal rings with an intermediate grease trap are used on the drive shaft.

#### Grease nipple

The grease nipple is used to supply grease to the sealing rings.



*The grease in the gas-tight version must be replaced at regular intervals in accordance with the maintenance schedule.*

## Design and operation

Description of assemblies > Drive system

### Sealing gas system

The machine stage is gas-tight by design:

- Modification of the drive shaft seal
- Pressurisation of the neutral chambers with sealing gas

The sealing gas system supplies the seals between the conveying chamber and the oil chamber with a constant pressure and a constant flow rate. The conveyed medium cannot escape and enter the atmosphere. Contamination of the lube oil or corrosion of the seal of the conveying chamber and the oil chamber by the conveyed medium is prevented.

Inert gas (e.g. nitrogen) is used as a sealing medium.

The relief valve opens if there is an impermissible pressure rise.

### 3.6.2 Corrosion protection (optional)

#### Corrosion protection in the conveying chamber

If aggressive media are to be used, corrosion protection is applied to internal machine stage components. This coating is impervious to most chemicals.

- Temperature-resistant PTFE coating
- Chemical nickel

### 3.6.3 Drive system

The drive system comprises the drive motor and the drive elements. The drive system provides a high speed for the rotational motion of the machine stage.

#### 3.6.3.1 Belt drive

##### Belt drive

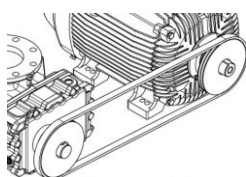


Fig. 7: Belt drive

The belt pulleys are fitted and aligned at the factory for the most part.

The belt pulley for the machine stage is fitted to the drive shaft. The position and orientation of this belt pulley therefore affects the alignment of the drive motor pulley.

Check the alignment:

- Before initial commissioning.
- According to the maintenance schedule.
- After replacing the belt pulley(s).

### Belt guard

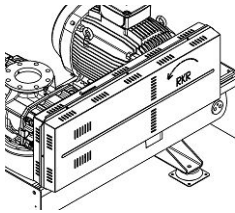


Fig. 8: Belt guard



*The belt guard serves to protect against rotating components.*

The belt guard prevents direct contact with moving components of the belt drive.

The belt guard cover can be removed for maintenance work.

### 3.6.3.2 Drive motor

#### Motor connection requirements



*Due to the effects of contaminants in the atmosphere, the cable and lead sheathing used must be resistant to the normal wear expected.*

#### General requirements

- Fine-core cable is recommended for the connecting lead.
- The connecting hardware must be suitable for the cross-section and type of the connecting leads.
- Cables, leads and connection points must not be subjected to excessive bending and tensile forces. Install the connecting cable via a cable bridge (not included in the delivery) to prevent the terminal box being subjected to forces or moments.
- Install cables and leads in such a way that they cannot sustain any external damage.
- Avoid contact with the machine, excessive friction and excessive radiant heat.
- The connecting cable must be resistant to light movements, e.g. the changes in the speed of the motor.

## Design and operation

Description of assemblies > Drive system

### Requirements for the mains supply



#### NOTICE!

**There is a risk of material damage due to voltage fluctuations/voltage drops.**

Voltage fluctuations/voltage drops beyond the tolerance interval may lead to serious damage to the drive system.

Requirements for operating rotary piston machines with electric induction motors in a three-phase AC supply system:

- Use suitable means of protection to shut down the motor and safeguard it against an automatic restart in the event of impermissible electrical operating data.
- Connect the motor voltage and control voltage to a stable common three-phase network to ensure that the power contactor is no longer latched in the event of a power failure.
- Observe the voltage and frequency limits.  
↳ *Chapter 11.10.1 'Voltage fluctuations' on page 199*

Refer to the circuit diagram for details of the input voltage and permissible tolerance range.

### Connection

- Only authorised electricians may perform the connection.
- Authorised electricians must observe all applicable regulations when connecting the drive motor.
- Observe the tightening torques of the terminal screws.
- Secure all connections against inadvertent release or loosening.
- Ensure that the nominal electrical data is complied with during operation.

### Circuit types

- Star-delta connection
- Direct start
- Soft starter

### Permissible starting frequency



#### NOTICE!

##### **Material damage!**

The permissible start-up frequency for the machine stage and the drive motor is limited.

The starts must be distributed evenly across one hour. Observe the duration of the restart lock.

Nominal power	Starts	Duration of restart lock $t_2$
up to 160 kW	6 starts per hour	10 minutes
from 200 kW	3 cold starts per hour	20 minutes
	or 2 warm starts per hour	30 minutes

Refer to the instruction manual provided by the drive motor manufacturer for further specifications and information.



### **Operation with a frequency converter:**

*As the maximum nominal motor current flows during start-up with a frequency converter (soft start), a restart lock is not required.*

### 3.6.3.3 Factory installation of the drive motor

#### Factory installation



*Observe the information on the rating plate and in the drive motor instruction manual.*

*Refer to the drive motor instruction manual for electrical operating data, maintenance intervals and suitable lubricants.*

### 3.6.3.4 Drive motor – on-site installation

#### On-site installation (optional)



*Depending on the machine order and model, a drive motor may not be part of the scope of delivery. The on-site installation of the motor is then the responsibility of the purchaser.*

*The purchaser is responsible for the availability of the required instruction manual for the drive motor.*

The dimensions, weight and mechanical and electrical operating data of the drive motor must be coordinated with, and approved by, RKR before installation.

- The drive motor may not be installed without approval.

The installation material is not included in the scope of delivery for the drive motor.

## Design and operation

Description of assemblies > Conveying system intake side

### 3.6.4 Conveying system intake side

The intake-side assembly includes all components fitted upstream of the machine stage gas inlet. The conveyed medium is drawn into the machine stage by these components.

The intake side assembly serves to reduce noise and to filter the conveyed medium before it enters the machine stage.

#### Intake-side filter (on site)



*The filter must be supplied by the operator.*

The intake-side filter removes dust particles from the conveyed medium before it enters the conveying system. For conveyed medium purity, see ⓘ 'Conveyed medium' on page 190.

#### Starting strainer

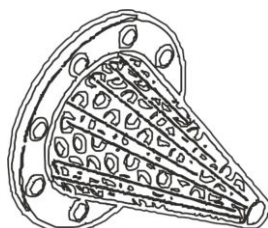


Fig. 9: Starting strainer

On the intake side, the starting strainer is used to draw in media from a closed pipe system.

During start-up, there is a particularly high risk of impurities from the intake pipe system entering the machine. The starting strainer protects the machine stage from coarse foreign particles.



#### **NOTICE!**

#### **Material damage due to missing starting strainer!**

Foreign bodies can damage the rotors of the machine stage. This will result in a blockage.

Installation involves clamping between a pair of flanges.

Monitor the resistance of the starting strainer. The starting strainer needs to be disassembled and cleaned if the maximum resistance of 40–50 mbar is exceeded.

If the operator inserts an appropriate strainer in the incoming line and ensures that no impurities can enter the machine via this strainer, the strainer can be removed and replaced by an intermediate ring.

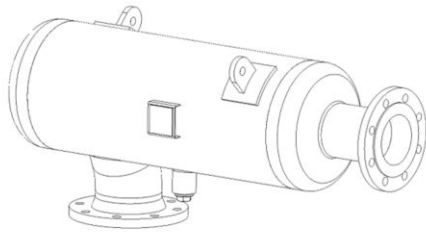
This must be ensured throughout the entire operating period, as well as during and after maintenance, inspection, and servicing.

Removal of the starting strainer included in the delivery is at the operator's own risk.

Depending on the version, the starting strainer is included in the scope of delivery.



### Intake silencer



The intake silencer reduces the noise emissions that may be produced during the intake process. The intake silencer is an absorbent-free component.

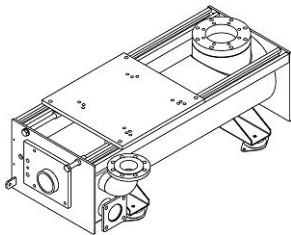
To allow potential condensate to be drained from the intake silencer, there is a condensate drain on the intake silencer. The condensate drain must be closed during operation.

Fig. 10: Intake silencer

### 3.6.5 Conveying system discharge side

The discharge-side assembly includes all components fitted downstream of the machine stage gas outlet. All components are pressurised during operation and have hot surfaces.

#### Base support with discharge silencer



The base support serves as the base for the machine stage and the drive system. The integrated discharge silencer is designed as an absorbent-free reactive silencer and reduces the noise level on the outlet side of the machine.

To allow potential condensate to be drained from the discharge silencer, there is a condensate drain on the silencer. The condensate drain must be closed during operation.

Fig. 11: Base support

#### Machine feet



To avoid structure-borne noise being transmitted to the foundations, the machine is supported by machine feet.

Fig. 12: Machine base

## Design and operation

Description of assemblies > Conveying system discharge side

### Safety valve

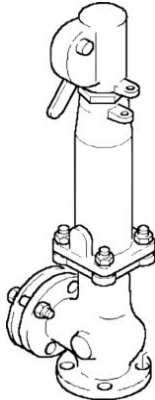


Fig. 13: Safety valve

The safety valve is a safety device which protects pressurised pipes and vessels from an impermissible pressure increase.

If the set maximum value is exceeded, the valve opens and releases excess conveyed medium into the atmosphere or into collection pipes.

Depending on the design, a safety valve is installed, or is to be installed, between the machine and the non-return flap.

The safety valve is set at the factory. The set values must not be changed.

The safety valve is NOT a control component and is not to be used as such.



#### NOTICE!

**Premature wear and failure of the safety valve from use as an operating data controller!**

Disabling the safety valve, e.g. by setting a higher opening pressure, can cause serious material damage. This may result in total failure of the machine.

Never obstruct or seal off the outlet vent of the safety valve. Ensure that the cross-section is unobstructed.

### Non-return flap

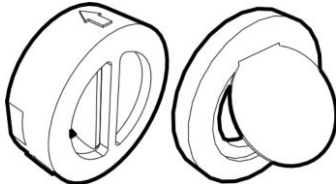


Fig. 14: Non-return flap variants

The non-return flap prevents the compressed, conveyed medium from entering the machine stage and causing depressurisation once the machine has been switched off. This prevents the machine stage from running "in reverse".

The non-return flap is supplied separately depending on the version of the machine.



#### NOTICE!

The operator is responsible for installing the non-return flap on site as per the installation diagram. It is imperative to ensure that no conveyed medium flows back into the machine.

### Expansion joint

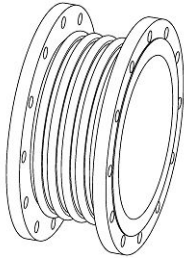


Fig. 15: Expansion joint

The compensator equalises changes to length caused by thermal expansion as well as minor axial and angular offsets at the pipe connection.

The elastic connection decouples the piping system from the machine. Structure-borne noise transfer to the connected piping systems is reduced.

### 3.6.6 Instrumentation

Depending on the version and scope of delivery of the machine, the operating parameters are permanently displayed and/or monitored.

- 1.) Pressure gauge as a display instrument without a switching function.
- 2.) Switches for pressure and temperature in conjunction with display instruments.
- 3.) Pressure and temperature transducers in conjunction with a control system.



*See order-specific measurement points and instruments list for detailed specifications for instrumentation and limits (settings).*

Exceeding or falling below the specified limits leads to a shutdown of the drive motor and, consequently, to the shutdown of the machine.

### Terminal box

The terminal box contains the electrical and electronic components that are not located directly on the machine (e.g. sensors).

It contains terminals for connecting electrical and electronic components to the external power supply.

When the terminal box is closed, accidental or unintended contact with live components is not possible.

As it contains internal components carrying dangerous voltages, the terminal box is locked. It can only be opened with special tools (terminal box key, triangular/square key).

## Design and operation

Description of assemblies > Acoustic hood

### 3.6.7 Acoustic hood

#### Acoustic hood

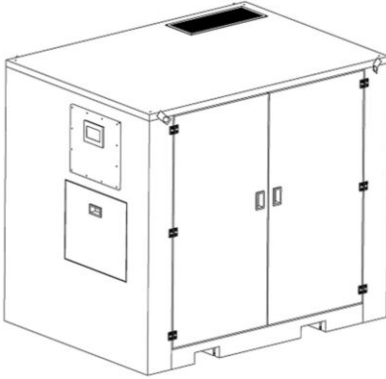


Fig. 16: Acoustic hood (example)



*The acoustic hood provides protection against mechanical and thermal hazards.*

The acoustic hood serves to reduce noise emissions and acts as a guard.

The acoustic hood protects the machine from external influences. Installation outdoors is possible with the weather protection.



#### **CAUTION!**

Operation with an open acoustic hood is not permissible.

Always keep the acoustic hood closed during operation.

The earthing connection is located near the floor.



*Refer to the installation diagram for details of the exact position of the earthing connection.*

#### Lockable acoustic hood (optional)

The acoustic hood can be locked depending on the scope of delivery.

Access to the key must only be possible for personnel who have been briefed in the safe operation of the machine and the contents of the instruction manual.



*Operation with an open acoustic hood is not permissible!*

- *Always lock the elements of the acoustic hood with the key provided.*
- *The key must only be accessible for authorised personnel.*

### Acoustic hood fan



Fig. 17: Fan



#### NOTICE!

##### Hazard due to overheating!

Pay attention to the acoustic hood's direction of flow. Ensure that the fan's direction of rotation is correct.

The drive motor must shut down if the fan malfunctions.

The ventilation of the acoustic hood is carried out by an electric fan.

The fan is connected at the factory. The fan must be activated in parallel with a machine start. After a machine stop, the fan continues to operate for a further 20 minutes.

Depending on the version of the machine, the fan motor starts and stops according to the monitored interior temperature of the acoustic hood.

### Fan cover

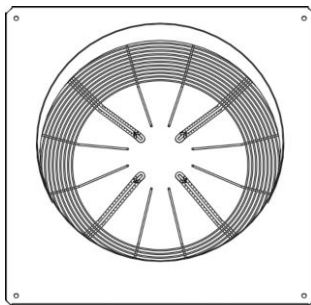


Fig. 18: Cover



*The fan cover serves to protect against rotating components.*

- The fan is covered by a protective grille.
- It prevents direct contact with components moving at high speeds.

## 3.7 Accessories

The accessories are part of the supplementary equipment for the machine.

### 3.7.1 Soft starter (optional)

#### Starter



*Observe the soft starter instruction manual provided by the manufacturer.*

## Design and operation

### Supplier components

- The soft starter must be designed with a constant load torque for operation of a machine.  
The use of a 2-phase, controlled soft starter is not recommended.
- It is necessary to start the machine with reduced torque.  
This depends on the machine type and version. It can be done by a relief valve on the discharge side or with a start unloading device, for example.
- The soft starter must be designed in accordance with the machine's start-up curve.

## 3.8 Control elements (optional)

### 3.8.1 Customer-installed control element

#### Customer-installed control element



*Depending on the order and version of the machine, the control elements may not be included in the scope of delivery. The installation and design of the control elements are then the responsibility of the customer.*


## 3.9 Supplier components



*The appendix contains further drawings, lists and supplier documentation for the valves and equipment of the machine.*

### 3.10 Required tools

The following tools are required:

 **ATEX – non-sparking tools and measuring equipment**  
**Non-sparking tools and non-sparking measuring equipment** are required for work in areas in which there are flammable or highly combustible gases, vapours, fluids or dusts. Such tools are also required in all situations in which sparks potentially produce a risk of fire and explosion. These tools and measuring equipment are extremely resistant to corrosion and salt water and made of materials that ensure they are non-magnetic.

#### **Auxiliary materials, tools**

e.g. receptacle for oil, drain hose, cleaning cloth.

#### **Conveyor rails**

The conveyor rails must be made of steel. They act as slide-in modules in the forklift tunnel of the acoustic hood. The cables are pulled by the conveyor rails and joined above the machine using the lifting beams.

#### **Electric drill**

Electric drill, e.g. for drilling fixing holes.

#### **Gas specialist tools**

Gas specialist basic equipment, e.g. gas measuring devices (anemometer), pressure measuring devices.

#### **General measurement tools and equipment**

For example a steel ruler, plumb line, folding yardstick, spirit level.

#### **General tools**

For example various screwdrivers, a combination key, socket driver set, Allen key set, hammer.

#### **Lifting beams**

Transverse truss required for crane transport for absorbing cable force.

#### **Lifting equipment**

For lifting loads, e.g. ropes, belt anchorages, shackles, eyebolts with nuts.

#### **Locking key**

The locking key is a component of the overall safety concept. This must be stored safely and should only be made accessible to trained personnel. It is intended for the proper opening and closing of the acoustic hood elements.

#### **Oil funnel**

The oil funnel is used for the precise filling of lubricant oil.

#### **Test pump**

The test pump is used to simulate system pressure in the measurement lines during commissioning. This allows for the operation of the pressure switch or the pressure sensors to be checked.

## Design and operation

### Required tools

#### **Tools for authorised electricians**

Basic electrical engineering equipment, e.g. multimeter, voltage detector, insulated tools.

#### **Transport equipment**

For transporting packaged units and the machine, e.g. with lift trucks, forklifts.



## 4 Transport, packaging and storage

### 4.1 Transport

#### 4.1.1 Safety instructions

##### Improper transport



##### **WARNING!**

##### **Risk of injury from improper transport!**

Improper transport may result in personal injury.

- Proceed with caution upon delivery, when unloading the machine and during in-house transport.
- Observe the symbols and information on the packaging.
- Only use the intended anchorage points.
- Observe the centre of gravity.
- Attach lifting equipment accordingly and hang the load so that it is balanced.
- Do not remove the packaging until just before installation of the machine.

##### Packaging foil



##### **DANGER!**

##### **Risk of explosion from static charges!**

The discharge of static electrical charges from packaging foil can lead to an explosion.

- Only unpack the machine when outside an Ex-Zone.
- Never bring packaging into the ex-zone.
- For the purposes of shipping the machine for repairs/maintenance etc., only package the machine when outside an Ex-Zone.

## Transport, packaging and storage

Transport > Safety instructions

### Industrial trucks



#### **WARNING!**

#### **There is a risk of fatal injury from industrial trucks!**

Transport with industrial trucks can result in objects and other loads falling accidentally and causing serious or fatal injury. There is also the risk of the driver failing to see persons and running them over.

- Industrial trucks should only be operated by trained drivers (e.g. forklift drivers).
- Only walk past an industrial truck if the driver has signalled that he has recognised the person in his path.
- Only use approved industrial trucks with sufficient load carrying capacity.
- Never transport materials over persons or the areas in which persons are located.

### Suspended loads



#### **WARNING!**

#### **Lethal danger from suspended loads!**

During lifting work, loads may swing out and fall. This can result in serious or fatal injury.

- Never walk under or into the range of a suspended load.
- Move loads under supervision only.
- Observe lifting points.
- Ensure that the lifting slings are fitted securely.
- Do not hang lifting equipment on protruding machine parts or on the lugs of attached components.
- Only use approved hoists, load handling equipment and lifting slings with sufficient load carrying capacity.
- Do not use damaged load handling equipment such as chains, ropes or pulleys.
- Do not lay load handling equipment across sharp edges or corners and do not tie or twist them.
- Set down the load when leaving the work area.

### Disregard for the machine's centre of gravity



#### **WARNING!**

**There is a risk of the unit toppling and falling over if there is disregard for the machine's centre of gravity!**

If the machine's centre of gravity is disregarded, the packaged unit may topple and cause life-threatening injury.

- Observe the centre of gravity.
- Observe the packaging information on the machine's centre of gravity.
- Attach lifting equipment in such a way that it is located above the centre of gravity.
- Raise the load carefully and ensure that it does not topple. If necessary, change the position of the lifting equipment.

### Risk of slipping



#### **CAUTION!**

**Risk of injury due to slipping on the packaging foil!**

The packaging foil features a slippery surface that can cause persons to slip on it. Moisture, creases, edges and tension straps on the packaging foil entail a risk of slipping or stumbling. The packaging foil is not suitable for supporting weight. A fall may result in injury.

- Never stand on the packaging foil.
- Never lean on the packaging foil or use it for support.

### Improper transport



#### **NOTICE!**

**Risk of damage from improper transport!**

Improper transport may result in considerable material damage.

- Proceed with caution upon delivery, when unloading the machine and during in-house transport.
- Only use the intended anchorage points.
- Observe the centre of gravity.
- Attach lifting equipment accordingly and hang the load so that it is balanced.
- Do not remove the packaging until just before installation of the machine.

## Transport, packaging and storage

Transport > Type of delivery

### Requirements for personnel

In order to transport packages and the machine, the following is required:

Personnel: ■ Service personnel

The following tasks require additional “explosion protection” qualifications:

- All work on equipment with ATEX marking.
- All work in zones with ATEX marking.

Personnel: ■ Additional qualification for explosion protection

### Protective equipment

Requirements for transport:

Protective equipment: ■ Protective work clothing (7010-M010)  
 ■ Safety shoes (7010-M008)  
 ■ Protective gloves (7010-M009)  
 ■ Industrial hard hat (7010-M014)

### Special tools

Requirements for transport:



#### NOTICE!

Risk of damage to the machine!

Chains, steel cables and similar equipment are not suitable lifting equipment.

Tool: ■ Lifting equipment  
 ■ Transport equipment  
 ■ Conveyor rails  
 ■ Lifting beams

### Lifting beams provided by the customer



#### NOTICE!

#### Material damage from lifting equipment!

During transport by crane, the lifting equipment can damage the acoustic hood.

- Always use suitable lifting beams for crane transport.

## 4.1.2 Type of delivery

### Packages

The machine is shipped using a freight forwarder. The packages have been prepared for transport according to the requirements.

The packages are to be protected against impact during transport.



*The individual assemblies (packages) are transported according to the information on the transport drawing.*

### 4.1.3 Securing loads

Machines without a floor frame are given a transport frame consisting of wooden planks. The machine and the acoustic hood (if included in the scope of delivery) are both fastened to this transport frame. Protruding packaging dimensions protect the machine from being struck during transport.

The machine is only suitable for transport in an enclosed truck.

#### Machine with an acoustic hood

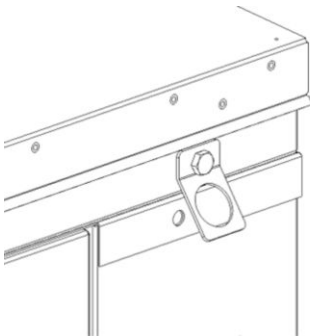


Fig. 19: Lashing lug

1. → Ensure that the arched part of the lashing lug is pointing downwards. To do so, loosen the screw slightly, align the lashing lug and tighten the screw properly.

2. →



#### NOTICE!

**Material damage due to incorrect lashing!**

Use edge protection to prevent damage to the machine.

3. →



#### WARNING!

**Risk of injury from the load slipping!**

Secure the machine properly on the truck for transport.

Fasten lashing straps to the intended lashing lugs and tension them on the truck such that they are as close to perpendicular as possible. Do not exceed a maximum tensioning force of 1,500 dN.

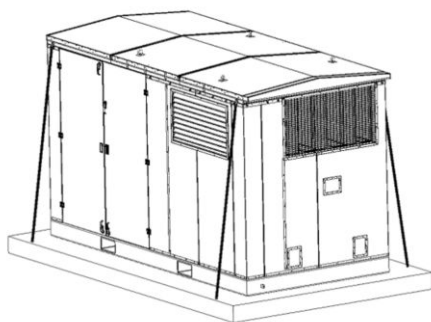


Fig. 20: Lashing points on the machine

#### Other packages

In accordance with the given requirements, packages are sealed in foil and then packed in wood.

## Transport, packaging and storage

Transport > Transport inspection



Fig. 21: Securing a package

1. ➤



### NOTICE!

**Material damage due to incorrect lashing!**

Use edge protection to avoid damage to the package.

2. ➤

Secure the package properly on the truck for transport.

### 4.1.4 Transport inspection

#### Completeness



#### Checking for completeness

*Check the goods for completeness immediately after delivery. Register missing parts and contact the manufacturer.*

Check the delivery for completeness on the basis of the packing slip.

- The packing slip is provided with the product.

#### Transport damage



#### Transport damage

*Inspect the package for potential damage immediately. Initiate a complaint immediately if there is any damage.*

Inspect the delivery immediately for transport damage.

In case of perceptible external damage, proceed as follows:

- Do not accept the delivery or only accept it under certain conditions.
- Note the scope of the damage in the transport documents or on the delivery docket provided by the carrier.
- Register the claim.

### 4.1.5 Transport to the installation site



#### NOTICE!

#### Material damage from incorrect attachment of hoisting gear!

The load eyelets on the acoustic hood cannot bear the machine's total weight.

- Do not lift the machine by the acoustic hood's load eyelets.
- When lifting the whole machine, do so using the forklift openings on the acoustic hood only.
- Only use the load eyelets if lifting the acoustic hood on its own.

#### 4.1.5.1 Transport using industrial vehicles

##### Machine with forklift openings

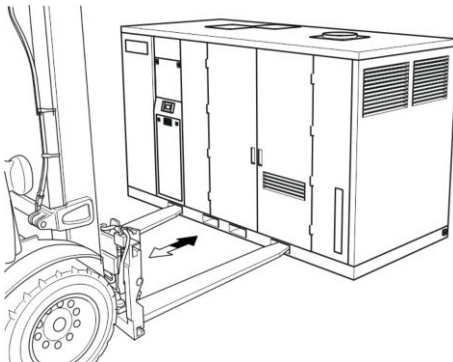


Fig. 22: Transport with an industrial truck

1. Drive the transport forks fully into the forklift openings.
2. Pay attention to the centre of gravity. Observe the marking.
- 3.



#### DANGER!

Risk of fatal injury from toppling components!

Determine the machine's centre of gravity by raising it carefully.

4. Transport the machine in a level position. The machine must not lean to one side.
5. Remove the lifting equipment at the installation site.

## Transport, packaging and storage

Transport > Transport to the installation site

### Machine on transport frame

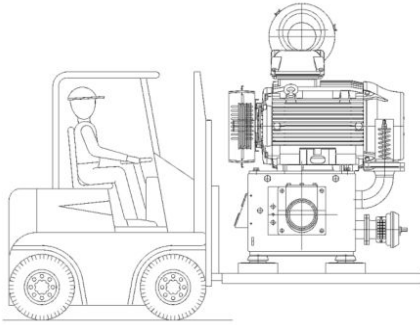


Fig. 23: Transport with an industrial truck

1. Drive the transport forks fully underneath the transport frame.
2. Pay attention to the centre of gravity. Observe the marking.
- 3.



#### **DANGER!**

Risk of fatal injury from toppling components!

Determine the machine's centre of gravity by raising it carefully.

4. Transport the machine so that it is balanced. The machine must not lean to one side.
5. Remove the lifting equipment at the installation site.

### Machine without transport frame/floor frame

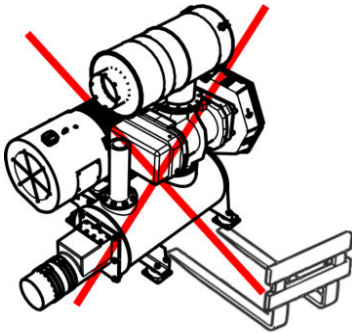


Fig. 24: Transport with an industrial truck



#### **DANGER!**

Risk of fatal injury from toppling components!

Transport of the machine using an industrial truck is not permissible!



### 4.1.5.2 Transport using a crane

#### Machine with forklift openings

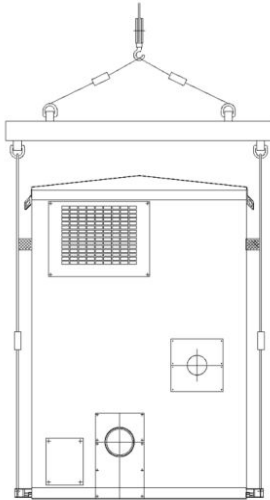


Fig. 25: Transport by crane

1. Guide the conveyor rails through the openings of the forklift tunnel.
2. Guide lifting equipment, such as cables or straps, through the conveyor rails and join them above the machine using the lifting beams.
3. Pay attention to the centre of gravity. Observe the marking.

4.



#### **DANGER!**

Risk of fatal injury from toppling components!

Determine the machine's centre of gravity by raising it carefully.

5. Transport the machine so that it is balanced. The machine must not lean to one side.
6. Remove the lifting equipment at the installation site.

#### Machine on transport frame

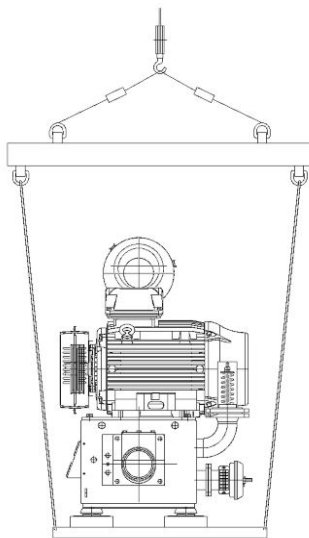


Fig. 26: Transport by crane

1. Insert the conveyor rails under the transport frame.
2. Guide lifting equipment, such as cables or straps, through the conveyor rails and join them above the machine using the lifting beams.
3. Pay attention to the centre of gravity. Observe the marking.

4.



#### **DANGER!**

Risk of fatal injury from toppling components!

Determine the machine's centre of gravity by raising it carefully.

5. Transport the machine so that it is balanced. The machine must not lean to one side.
6. Remove the lifting equipment at the installation site.

## 4.2 Packaging

### 4.2.1 Handling packaging

#### Handling packaging

The individual packaged items are packed in accordance with the anticipated transport conditions. In as far as it is possible, environmentally-friendly materials are used for the packaging.

## Transport, packaging and storage

### Storage

The packaging is intended to protect individual components from transport damage, corrosion and other forms of damage. For this reason, do not destroy the packaging and only remove it shortly before assembly.

Only remove packaging for transport to the installation site if it has been expressly permitted.

### Removing packaging



*Packaging material made of solid wood (e.g. wooden pallets, wooden crates) comply with the IPPC standard. It is re-usable. When disposing of the material, national and local requirements must be complied with.*

1. ➔



#### CAUTION!

Risk of injury from rough packaging material and protruding nails!

Separate the machine/system component from the transport pallet by removing the fastening screws.

2. ➔

Detach the packing foil and remove it.

3. ➔



#### ENVIRONMENT!

Packaging materials are valuable raw materials. They can be used several times or processed and then re-used. The improper disposal of packaging material can present a risk to the environment.

4. ➔

Sort packaging according to the material used and dispose of it properly.

## 4.3 Storage

### Requirements for personnel

The following is required when checking storage:

- Personnel:
- Service personnel
  - Manufacturer's customer service division

### Protective equipment

The following is required for measures during storage:

- Protective equipment:
- Protective work clothing (7010-M010)
  - Safety shoes (7010-M008)
  - Protective gloves (7010-M009)

### 4.3.1 Storage conditions

#### Storage instructions

Store packages under the following conditions:

- Keep flange connections closed.  
Avoid entry of foreign substances.
- Do not store outdoors.
- Protect from exposure to the sun.
- Avoid extreme temperature fluctuations.
- Avoid adverse water effects.
- Do not expose it to any aggressive media.
- Store in a dry and dust-free place.
- Load-bearing and level ground.
- Avoid mechanical vibrations.



#### NOTICE!

The storage conditions for individual packages may exceed the requirements specified here.

Note and comply with instructions.

Storage in an enclosed building is generally recommended.

Store packages in such a way that they are accessible for routine inspection. Recommendation: 1 metre clearance around the machine.

#### Environmental limits for storage

Data	Value	Unit
Temperature range	-20 to +50	°C
Relative humidity	0 to 80	%
chemical- and dust-free atmosphere		

The environmental limits may differ for machines designed for use in special climates.

#### Storage outdoors

Machines equipped with an acoustic hood and weather protection for outdoor installation may be stored outdoors for up to four weeks.



#### NOTICE!

#### Damage through environmental influences!

Incorrect outdoor storage can cause damage to the machine.

Never store the machine outdoors without weather protection.

Observe the following special conditions when storing outdoors:

- Check any packaging present and replace it if necessary.
- Close the pipe connections so that they are water-tight.

## Transport, packaging and storage

Storage > Storage period

- Close the pipe openings in the acoustic hood so that they are water-tight.
- Simple wooden boxes require tarpaulins for additional protection. It must be ensured that air can circulate between the tarpaulin and the box.



*Outdoor storage times can be extended by using a box for packaging that is adapted to the on-site climate conditions and expected storage period.*

### 4.3.2 Storage period



#### **NOTICE!**

The storage period for individual packages may exceed the requirements specified here.

Note and comply with instructions.

#### **Storage up to max. 12 months**

The machine, which has factory-applied preservative upon delivery, can be stored for a maximum period of 12 months if stored properly.

If the machine is installed in a plant when the 12 months have expired or before but not commissioned, the preservation must be renewed.

#### **Long-term storage for over 12 months**

Storage for more than 12 months requires approval from the manufacturer.

Preservation renewal must take place no later than every 12 months.

During the warranty period, preservation renewal may be performed only by the customer service of the manufacturer and will incur a charge.

#### **With box packaging**

The preserved machine is packaged in boxes in accordance with the planned storage period and with the latest packaging guidelines.

The belt drive is relieved of tension at the factory.

The maximum storage period for the machine is specified on the delivery note.

Preservation renewal must be carried out no later than when the maximum storage period is reached.

If the maximum storage period elapses during the warranty period, the machine must be unpacked and inspected by the manufacturer's customer service and the preservation must be renewed. This inspection will incur a charge.

If required, the machine is to be packaged correctly in boxes for a further storage period.



*Storage in air-conditioned rooms with low humidity has a positive influence on corrosion protection.*

### Storage for over 24 months



#### **NOTICE!**

Risk of corrosion! To avoid damage to the machine, an inspection of the overall extent of supply should be generally undertaken by the manufacturer for storage periods of over 2 years.

### 4.3.3 Measures during storage

#### General measures

- Inspect the general condition of the machine regularly. Rectify damage immediately.
- Check that the sealing caps are leak-tight and firmly in place.
- Ensure sufficient corrosion protection of the uncoated parts.
- Observe the preservation intervals.



#### **NOTICE!**

Additional measures could be required for individual components during storage depending on the specific order.

Observe and comply with the manufacturer's manuals.

#### Drive system

Relieve the belt drive of tension at the start of any storage period of more than 3 months.

Observe the measures for storing and preserving the drive motor as per the manufacturer's manual.

## Transport, packaging and storage

Storage > Measures during storage

### Machine stage



#### NOTICE!

##### **Danger of damage when at a standstill!**

Recommendation: If vibration-free storage is not possible, rotate the drive shaft of the machine stage by hand every 6 to 8 weeks. Carry out a minimum of 5 revolutions in this regard.

Observe the preservation measures as per the preservation regulation.

### Packaging during storage

- Inspect the general condition of the packaging regularly. Immediately rectify damage to the packaging.
- After opening the packaging:
  - Ensure sufficient corrosion protection of the uncoated parts.
  - Provide protection against humidity and damaging environmental influences.
  - Do not remove sealing flaps from the connection openings.
- Replace the drying agent at regular intervals according to the climate conditions.



#### NOTICE!

Risk of corrosion!  
Customised packaging is required in case of more stringent requirements according to the climate zones and in case of special customer requirements.

### Damaged packaging



#### NOTICE!

Risk of corrosion! As a result of damaged packaging, moisture and damaging environmental influences could directly affect the product.

Measures in the case of damaged packaging:

- Immediately rectify damage to the packaging. If necessary, refresh or replace the preservation material.
- Dry the machine, if necessary.
- Check the drying agent and replace it if necessary.
- Repair or replace the packaging.

If damage is detected on the packaging during the warranty period, the manufacturer is to be notified immediately.

### 4.4 Preservation

#### Personnel requirements

The following is necessary when checking and applying preservation:

Personnel: ■ Service personnel

The following tasks require additional “explosion protection” qualifications:

- All work on equipment with ATEX marking.
- All work in zones with ATEX marking.

Personnel: ■ Additional qualification for explosion protection

#### Protective equipment

Preservation requires:

- Protective equipment:
- Protective work clothing (7010-M010)
  - Safety shoes (7010-M008)
  - Protective gloves (7010-M009)
  - Safety goggles (7010-M004)
  - Light respiratory protection (7010-M016)

#### ATEX application

- Protective equipment:
- Antistatic protective work clothing for ATEX applications
  - Conductive footwear and antistatic clothing (7010-M032)

#### 4.4.1 Initial preservation

Factory preservation protects the machine for a certain time period in accordance with the relevant storage and packaging information.

A small number of components which, due to their function, do not have any coating as such, require preservation measures.

If expressly requested by the customer, the machine will be preserved for a longer storage period and packaged in boxes. Refer to the delivery note for details.



#### NOTICE!

The notes on preservation may differ for individual components. Observe the documentation issued by the manufacturer.

## Transport, packaging and storage

Preservation > Preservatives

### 4.4.2 Preservation intervals

#### Durability of initial preservation

If storage conditions are adhered to, the preservation applied to the machine at the factory will remain effective for up to 12 months after delivery.

If the machine is commissioned within these 12 months, the preservation requires renewal as part of routine maintenance work.

#### Decommissioning for longer than 2 months

If the machine is shut down for more than 2 months or put into long-term storage, the preservation must be renewed.

🔗 4.4.4 'Preservation work' on page 97

The machine must be preserved at the beginning and no later than 2 months after decommissioning.

To prevent downtime damage, turn the drive shaft of the machine stage and drive motor by hand every 6 to 8 weeks.



*Preservation renewal can be omitted if the machine is run for at least 10 minutes every 2 months. This requires electrical connections to be available and the monitoring facilities to be active.*

Preservation renewal must take place every 12 months.

#### In the event of long-term storage for longer than 12 months

Preservation must be renewed every 12 months. 🔗 4.4.4 'Preservation work' on page 97

To prevent downtime damage, turn the drive shaft of the machine stage and drive motor by hand every 6 to 8 weeks.

The preservation interval may deviate with regard to project-related long-term preservation and packaging.

### 4.4.3 Preservatives

Surfaces	Preservatives
Machine stage oil chambers	Operating lube oil
Exterior machined uncoated surfaces	Antirost C310 or equivalent
Sealing surfaces of flange connections	



### 4.4.4 Preservation work

#### Decommissioning



#### **WARNING!**

#### **Risk of injury through running machine!**

The components that require application of anti-corrosion agent pose numerous risks while the machine is running.

- Prior to beginning any work, switch off the machine and secure it against restart and uncontrolled pressure increases.
- Ensure that it is depressurised and de-energised.

#### Carrying out preservation treatment

Preservation measures:

- ➔ Open the packaging. Ensure that the machine is easily accessible.

#### Motor



*Observe the preservation specifications as per the manufacturer's instruction manual.*

Comply with the preservation specifications for the motor.

#### Machine stage conveying chamber



*The conveying chamber of the machine stage is coated.*

⇒ Preservation is **not** necessary.

#### Machine stage oil chambers



#### **WARNING!**

**Risk of poisoning from inhaling oil mist!**

Rotate the drive shaft by hand. Spray suitable preservative oil into the machine stage through the oil fill opening and oil drain opening.

⇒ Let excess preservative oil flow out of the oil drain opening.

## Transport, packaging and storage

Preservation > Preservation work

2. ➤ Seal the oil fill opening and oil drain.
  - ⇒ The oil chambers are preserved for 12 months of storage.

### Uncoated surfaces



#### **WARNING!**

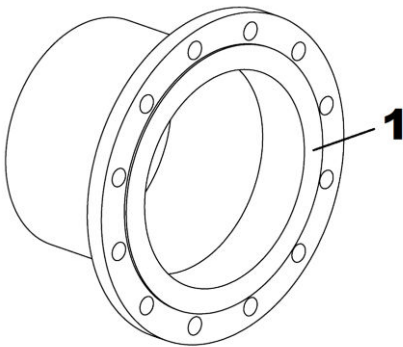
Risk of poisoning from inhaling oil mist!

Treat the outer, uncoated surfaces with preservative oil.

- Machine stage shaft journals
- Drive motor shaft journals
- Taper lock bushes
- Visibly uncoated surfaces

⇒ The uncoated surfaces are preserved for 12 months of storage.

### Connection flange sealing surfaces



#### **WARNING!**

Risk of poisoning from inhaling oil mist!

1. ➤
2. ➤ Protect the accessible sealing surface of the connection flange by applying corrosion protection.
  - ⇒ The sealing surface is preserved for 12 months of storage.
3. ➤ Seal the connection flange with a dust-tight cap.

Fig. 27: Sealing surface (1)

### Restoring the packaging

1. ➤ Check that the sealing caps are leak-tight and firmly in place.
2. ➤ Check and restore the packaging.

## 5 Set-up and installation

### 5.1 Safety instructions

#### Improper set-up and installation



#### **WARNING!**

#### **Risk of injury from improper set-up and installation!**

Improper set-up and installation can result in serious personal injury or material damage.

- Before beginning any work, ensure there is sufficient space for installation.
- Keep the workspace tidy and clean.
- Only use commercially-available tools or, if necessary, special tools.  
Unsuitable or damaged tools may cause injury!
- Secure components against falling during installation work.
- Install components correctly.
- Comply with the specified screw-tightening torques.

#### Improper set-up and installation



#### **WARNING!**

#### **There is a risk of explosion from improper set-up and installation!**

Improper set-up and installation can result in serious injury or damage. If ignition protection is rendered ineffective this can lead to an explosion.

- Insofar as it is possible, perform work outside the given Ex-Zone.  
For work performed inside an Ex-Zone, only entrust tasks to personnel with an additional qualification in explosion protection.
- Compare the existing Ex-Zone with the information on the type plate.
- For installation work inside an Ex-Zone, only use tools that are approved for use in Ex-Zones.
- Install all on-site safety equipment in accordance with the manufacturer's specifications and ensure that it is operational.
- Only use original belts that are approved for the relevant Ex-Zone.
- Ground the machine.

## Set-up and installation

Safety instructions

### Electrical system



#### **DANGER!**

##### **Risk of fatal injury from electric current!**

There is a risk of fatal injury from touching live components. Live electrical components may make uncontrolled movements and cause extremely serious, or even fatal injury.

- Before beginning work, switch off the electric power supply and secure it against restarting.

### Medium and high voltage applications



#### **DANGER!**

##### **Risk of fatal injury from improper handling for medium or high-voltage applications!**

Medium and high-voltage applications represent a particular risk. In some circumstances, excessive proximity to energised components can lead to a fatal electric shock.

- Work on the electrical system should only be carried out by qualified electrical personnel with special expertise in the handling of medium and high-voltage equipment.

### Electrostatic charges



#### **WARNING!**

##### **Risk of injury from electrostatic charges!**

The belt drive may generate electrostatic charges.

- Before first commissioning put in place equipotential bonding.
- Only use electrically-conductive belts.

### Health risk from cleaning agents



#### **WARNING!**

##### **Health risk from cleaning agents!**

There is a health risk from inhaling fumes and from skin contact with cleaning agents.

- Wear protective gloves and respiratory protection.
- Dispose of saturated cloths in an environmentally-friendly way, according to the manufacturer's instructions.

### On-site installation



#### **WARNING!**

##### **Risk of injury and material damage from incorrect assembly!**

The use of generic fastening materials that are not genuine RKR products may lead to the inadvertent loosening or displacement of the components and cause serious injuries.

Disregarding correct assembly procedures may lead to injury and material damage.

- Only task qualified service personnel with assembly.
- Observe the information in this instruction manual.
- Do not install damaged components.
- Only use original RKR fastening materials.

### Suspended loads



#### **WARNING!**

##### **Lethal danger from suspended loads!**

During lifting work, loads may swing out and fall. This can result in serious or fatal injury.

- Never walk under or into the range of a suspended load.
- Move loads under supervision only.
- Observe lifting points.
- Ensure that the lifting slings are fitted securely.
- Do not hang lifting equipment on protruding machine parts or on the lugs of attached components.
- Only use approved hoists, load handling equipment and lifting slings with sufficient load carrying capacity.
- Do not use damaged load handling equipment such as chains, ropes or pulleys.
- Do not lay load handling equipment across sharp edges or corners and do not tie or twist them.
- Set down the load when leaving the work area.

## Set-up and installation

Safety instructions

### Eccentric centre of gravity



#### **WARNING!**

##### **Risk of injury from falling or toppling components!**

Components may have an eccentric centre of gravity. An incorrect slinging point may cause the component to topple and fall. Falling or toppling components can cause severe injuries.

- Observe the markings and specifications concerning the centre of gravity on the components.
- When using the crane for transport, attach the load hook so that it is positioned above the component's centre of gravity or align the lifting slings on a lifting beam in accordance with the component's centre of gravity.
- Raise the component carefully and ensure that it does not topple. If necessary, change the slinging point.

### Sharp edges and corners



#### **CAUTION!**

##### **Risk of injury from sharp edges and corners!**

Sharp edges and corners can cause excoriations and cuts to the skin.

- If working in the vicinity of sharp edges and corners, proceed with caution.
- Wear protective gloves.

### Falling parts



#### **CAUTION!**

##### **Risk of injury from unsecured parts of the acoustic hood!**

Unsecured parts of the acoustic hood can lead to injuries if they fall from the machine.

- Secure loose elements against falling.
- Always wear protective gear.
- Have a second person help you.

### Risk of falling



#### CAUTION!

#### **Risk of injury from standing on the roof elements!**

Standing on the roof elements of the acoustic hood carries with it a risk of injury from the potential collapse of the roof elements. Persons could fall into the internal area of the machine.

- Never stand on the roof elements of the acoustic hood.
- Never exert force on the roof elements of the acoustic hood.

### Unauthorised persons



#### WARNING!

#### **Risk of fatal injury for unauthorised persons in the installation area!**

Unauthorised persons who do not fulfil the requirements described here, are not familiar with the hazards in the installation area. Therefore, unauthorised persons are at risk of serious or fatal injury.

- Keep unauthorised persons away from the installation area.
- If in doubt, instruct such persons to leave the installation area.
- Stop all work as long as unauthorised persons are in the installation area.

### Personnel requirements

Requirements for set-up and installation:

Set-up and installation of the mechanical components

Personnel: ■ Service personnel

Set-up and installation of electrical components

Personnel: ■ Authorised electricians

Assembly and installation of components for medium- or high-voltage applications:

Personnel: ■ Authorised electricians for medium or high voltage applications

The following tasks require additional “explosion protection” qualifications:

## Set-up and installation

Requirements for the installation site

- All work on equipment with ATEX marking.
- All work in zones with ATEX marking.

Personnel: ■ Additional qualification for explosion protection

### Protective equipment

Requirements for set-up and installation:

Protective equipment: ■ Protective work clothing (7010-M010)  
 ■ Safety shoes (7010-M008)  
 ■ Protective gloves (7010-M009)  
 ■ Safety goggles (7010-M004)  
 ■ Industrial hard hat (7010-M014)


### ATEX application

Protective equipment: ■ Antistatic protective work clothing for ATEX applications  
 ■ Conductive footwear and antistatic clothing (7010-M032)

### Special tools

The following is required for installation of the mechanical components:

Tool: ■ Transport equipment  
 ■ Lifting beams  
 ■ Lifting equipment  
 ■ General tools  
 ■ General measurement tools and equipment  
 ■ Electric drill

Tool: ■  ATEX – non-sparking tools and measuring equipment

The following is required for installation of the electrical components:

Tool: ■ Tools for authorised electricians

## 5.2 Requirements for the installation site

The installation site must meet the operating requirements for the permissible environmental limits.



- Take the following precautionary measures:
  - If possible, switch off the machine before entering the operating area. Otherwise, wear hearing protection.
  - Provide appropriate signage at the installation site.
  - The installation site must only be accessible for trained persons.
  - Choose an installation site where the duration of time persons spend in the immediate vicinity of the machine is extremely limited.

### Indoor installation

Without the acoustic hood, the machine is only suitable for installation in a machine room.



#### NOTICE!

Risk of corrosion! There must not be any excessive levels of dust, acids, steam or explosive or flammable gases at the installation site.

Machines without an acoustic hood require measures for sound insulation.

### Ventilation



#### NOTICE!

The thermal radiation of the drive motor, machine stage and conveyor system discharge side may heat up the service room.

- Ensure there is a suitable fresh air supply.
- Avoid heat accumulation.

#### Remedy

- Insulate the pressure line
- (Forced) room ventilation using a wall fan

### Outdoor installation

For outdoor installation, the machine must be equipped with an acoustic hood and with weather protection.

Depending on the environmental conditions, the machine must be equipped with additional options:

- Installation in an atmosphere with high load levels (e.g. industry/coastal): adapted corrosion protection
- Very dusty environment:  
“Sandstorm version” weather protection
- Operation with control cabinet at temperatures below 0 °C:  
Control cabinet with equipment for protecting the electrical components
- Operation at temperatures below -10 °C:  
“Winter protection” adapted to the climatic conditions, such as acoustic hood heating etc.

## Set-up and installation

Requirements for the installation site

### Space requirements with the acoustic hood

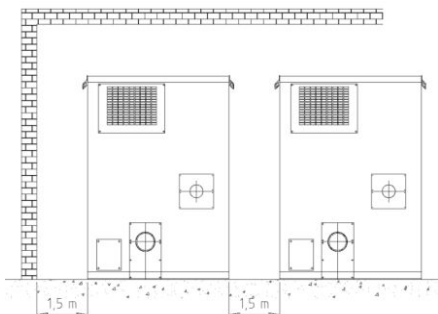


Fig. 28: Maintenance clearance

There must be sufficient access for transporting the machine as well as larger and heavier replacement parts to the installation site.

- Ensure that doors, hatches and access ways are large enough.
- Provide sufficient clearance for the piping system and power cabling.
- Provide an overhead gantry crane above the machine and/or sufficient space for transport equipment.

Ensure that a clearance of at least 1.5 metres remains all around the machine for maintenance purposes.



**The maintenance clearance may vary depending on the order.**

*Observe the specifications in the installation plan.*

### Ground properties

The installation surface must display the following properties:

- stable
- level
- free of vibrations
- without any incline
- without holes

The maximum permissible deviation from the horizontal plane is 1 mm per 1 m of length.



#### **NOTICE!**

Risk of deformation of the acoustic hood substructure! Do not install or mount the machine on "hollow" or lamellar foundations.



#### **NOTICE!**

##### **Static load capacity**

The ground must possess sufficient load-bearing capacity to support the static weight and to facilitate secure bolting down of the machine.

Check the static load capacity as per the installation plan specifications for foundations and weights.

No free inertial forces are produced.



#### **Foundation requirements for the cement floor.**

*The cement floor should have a recommended compressive strength of 30–40 N/mm<sup>2</sup>.*

### 5.3 Installing the machine

Before the machine is set up, make sure that the installation site meets all requirements regarding the environmental limits, necessary space and ground properties.

#### Preparation

Installation of the machine depends on the scope of delivery and conditions on-site (maintenance clearance, transport equipment, lifting equipment). Make sure you know the sequence for assembling the various components.

Observe the specifications in the installation plan and the overview of weights and lifting points.



*Think ahead and make the necessary preparations before beginning work.*

*Observe the specifications in the installation plan.*

The machine is on a transport frame. For installation, the machine needs to be lifted off of the transport frame.

#### Temporary storage of components



#### CAUTION!

##### Risk of material damage!

Store components and fastening material on level, stable ground for the duration of installation. Ensure that they are dry and protected from dust.



#### Recommendation:

*Group disassembled components and fastening material according to their affiliation.*

#### 5.3.1 Lifting the machine off of the transport frame

##### Removing the lashing lugs

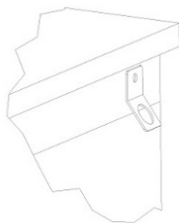


Fig. 29: Lashing lugs



#### DANGER!

##### Risk of fatal injury from heavy loads!

The lashing lugs on the acoustic hood cannot bear the machine's total weight.

- Do not lift the machine by the acoustic hood's lashing lugs.
- When lifting the whole machine, do so using the forklift tunnel on the acoustic hood only.

## Set-up and installation

Installing the machine > Lifting the machine off of the transport frame

Remove the lashing lugs.

### Lifting the machine off of the transport frame

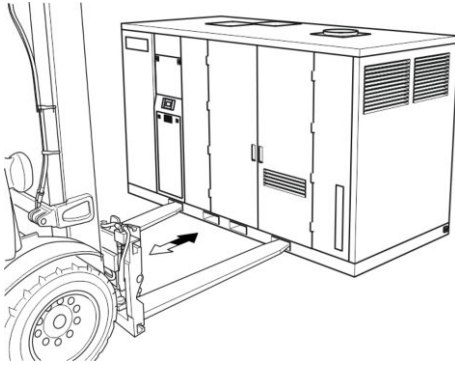


Fig. 30: Lifting the acoustic hood

1. ➤ Lock the doors.

2. ➤



#### NOTICE!

##### Material damage from lifting equipment!

Hoist gear can cause damage to the machine.

- The lifting equipment must not collide with machine components.
- Always use suitable lifting beams for crane transport.

#### Lifting using an industrial truck:

Drive the transport forks fully into the acoustic hood's forklift openings.

#### Lifting using a crane:

Guide the conveyor rails through the forklift openings. Guide lifting equipment, such as cables or straps, through the conveyor rails and join them above the machine using the lifting beams.

3. ➤ Separate the machine from the transport frame by removing the fastening screws.

4. ➤



#### CAUTION!

Risk of fatal injury from toppling loads!

Determine the machine's centre of gravity by raising it carefully.

Put the machine in a level position and lift it off of the transport frame.

5. ➤ Remove the transport frame.

### 5.3.2 Installing the machine

#### Positioning the machine on the foundations

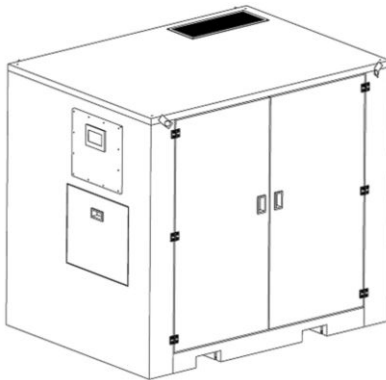


Fig. 31: Installation of the machine

The installation surface must be swept clean and be free of oil.



#### NOTICE!

Mounting on additional vibration dampers is prohibited.



Observe the foundations diagram.



The sealing strip is included in the scope of delivery.

1. ➤ Install the acoustic hood on the sealing strip.
2. ➤ Carefully align the machine.
3. ➤ Loosen the transport safety locks (if installed), such as lashing straps.
4. ➤ Level the machine lengthwise and crosswise.
  - Tolerance: 1 mm flatness at 1 m spacing.
5. ➤ Check the gap dimensions at doors and cassettes. Adjust if necessary.
6. ➤ Use suitable fasteners to correctly attach the machine to the foundations.

Observe the specifications in the installation diagram.

🔗 'Installing the anchor bolts' on page 109

#### Installing the anchor bolts

It must be ensured on site that the anchor bolts included in the scope of delivery are suitable for the foundations.

1. ➤



#### NOTICE!

Note the specifications for the bore hole as per the installation diagram.

Drill the hole into the foundations vertically.

2. ➤ Clean the hole, e.g. blow it out.
3. ➤ Drive in the anchor bolt fully using hammer blows.

## Set-up and installation

Connecting the system pipe > Connecting the pipe for conveyed medium

4. ➤ Ensure that the washer and nut lie flat.
5. ➤ Tighten the nut.
  - ⇒ The anchor bolt is extended.
6. ➤ Check the fastening.
  - ⇒ The anchor bolt lies flat if the foundations have not cracked.

### 5.4 Connecting the system pipe



#### NOTICE!

Risk of machine damage!

The connected pipe must not exert forces or moments that affect the machine.

- The connecting pipe must be aligned exactly.
- Secure and fasten the on-site pipe at the delivery limit.



*Observe the labelling and dimensions in the installation drawing.*

#### 5.4.1 Connecting the pipe for conveyed medium

Purge connection (on site)



*The purge connections must be supplied by the operator.*

*Observe the information on the P&ID.*

### Connecting to an expansion joint Corrugated-pipe expansion joint

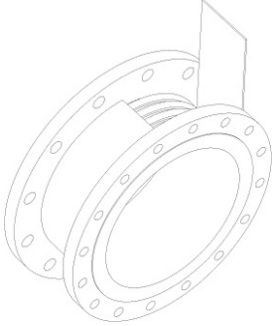


Fig. 32: Expansion joint

1. ➔



#### NOTICE!

##### Risk of material damage!

For connection to corrugated-pipe expansion joint:  
Observe the tolerance specifications for movement absorption as per the expansion joint data sheet.

The installation length is equal to the installed length of the expansion joint. The expansion joint is generally installed **without** pre-tensioning.



#### NOTICE!

##### Corrugated-pipe expansion joints with traction rod:

The maximum linear expansion of the expansion joint is set by the manufacturer.

The linear expansion must not be changed.

2. ➔ Remove the guard plate from the corrugated-pipe expansion joint.
3. ➔ Remove the sealing cover from the connection opening.
4. ➔ Check the expansion joint for mechanical damage and corrosion. The bellows must be free of foreign bodies.
5. ➔ Ensure that the expansion joint is installed in the direction of flow.
6. ➔ For connection to the **intake-side** pipe system:
  - Ensure that the pipe to be connected on site is free of deposits and foreign bodies on the inside. ➔ 'Conveyed medium' on page 190
7. ➔ Clean the flanges' sealing surfaces. Remove any anti-corrosion oil.
8. ➔ Insert a suitable seal.

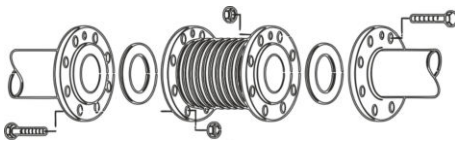


Fig. 33: Connecting an expansion joint

## Set-up and installation

Connecting the system pipe > Connecting the condensate drain line

9. ➔



### CAUTION!

The seal, screws and nuts must be suited to the conveyed medium and the occurring temperatures. Only use seals that are in perfect technical condition.

Make sure that the seal is centrally seated.

Bolt all flange connections, using a suitable tightening procedure in accordance with generally accepted techniques.

Connect the system pipe in such a way that it is free of tension.

### 5.4.2 Connecting the condensate drain line

#### Condensate drain (optional)

The condensate needs to be discharged in a targeted manner, depending on the version of the machine.



### ENVIRONMENT!

The condensate may contain substances that are harmful to the environment.



*Observe the specifications in the installation diagram.*

#### Condensate line connection

##### Connecting the pipe

1. ➔ Remove the sealing cover from the connection openings.
2. ➔ Clean the flanges' sealing surfaces. Remove any anti-corrosion oil.
3. ➔ Insert a suitable flange seal.
4. ➔



### CAUTION!

The seal, screws and nuts must be suited to the conveyed medium and the occurring temperatures. Only use seals that are in perfect technical condition.

Make sure that the seal is centrally seated.

Bolt all flange connections, using a suitable tightening procedure in accordance with generally accepted techniques.

Connect the pipe in such a way that it is free of tension.



### 5.4.3 Connecting the sealing gas system

1. ➔ To avoid soiling the sealing gas system, do not remove the sealing plug until shortly before installation.
2. ➔ Check the connections, including screw connections, for damage.



*Observe the information on the installation diagram and the P&ID.*

3. ➔ Connect the operator's sealing gas supply to the sealing gas system properly and free of tension.

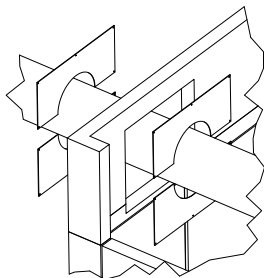
#### Relief valve

4. ➔ Connect the relief valve outlet.

The gas that escapes when the valve is opened must be discharged into a continuing pipe and/or be blown off into a safe environment.

## 5.5 Installing the cover plates

### Installing the cover plates



*In order to avoid sound output, the pipe ducts in the acoustic hood must be insulated and sealed, without applying stress.*

*Cover plates, insulation material, a sealing strip and fastening material are included in the scope of delivery.*

Fig. 34: Pipe duct

1. ➔ Use a sealing strip on the round cut-outs of the cover plates.
2. ➔ Use cover plates to seal the pipe duct inside the acoustic hood.
3. ➔ Fit the annular gap of the pipe duct with insulation material.
4. ➔ Use cover plates to seal the pipe duct from the outside.

## Set-up and installation

Establishing an electrical connection > Connecting the earthing

### Closing off the forklift tunnel

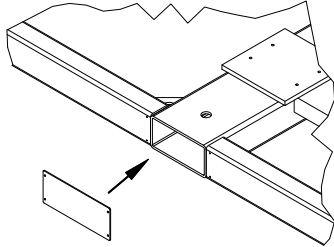


Fig. 35: Forklift tunnel cover plate

1. ➔



*Insulation material in the forklift tunnels reduces noise emissions.*

Fill the forklift tunnel with insulation material (if included in the scope of supply).

2. ➔

Mount the cover plates.

## 5.6 Integration in the on-site control system

### On-site control system

A machine without an integrated control system must be integrated in an operationally reliable control system as per the functional description.



*Observe information about integration of the machine, switch-on conditions, operation, and switch-off conditions as per functional description. See order-specific measurement points and instrument list for details of limits (settings).*

## 5.7 Establishing an electrical connection

### 5.7.1 Connecting the earthing

To prevent the build-up of electrostatic charges, the machine must be correctly earthed. Check all contact points for correct position and contact connection at regular intervals.

### Earthing the machine

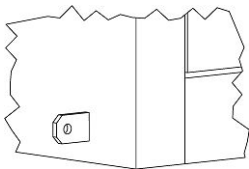


Fig. 36: Example – earthing connection

1. ➔



*The precise position of the earthing connections is specified in the installation diagram (GAD).*

Earth the machine at the designated connections.

### Earthing strap cross-sections

2. ➔

The cross-section of the earthing strap is to be designed in accordance with the locally applicable regulations.

However, the cross-section must be at least 16 mm<sup>2</sup>.

Observe the instructions in the instruction manuals for the components (e.g. motors).

3. ➤ Pay attention to bare metal contact surfaces.
4. ➤ Install the earthing connection properly.
5. ➤ Connect the earthing connection to the local equipotential bonding rail.

### 5.7.2 Connection of medium or high-voltage equipment

#### Preparing the connection

1. ➤ Maintain the specified distances from adjacent components.
2. ➤ Observe the relevant fire safety requirements, especially for wall bushings.
3. ➤ Ensure that there is no risk of flashovers.
4. ➤ The connection cable must not impair the movement of the motor for the purposes of tensioning the belts.
5. ➤ Fit a flexible connection cable with strain relief.
6. ➤ For operation with an acoustic hood, it is particularly important to ensure a correctly installed wall bushing.
7. ➤ Observe the permissible bending radii for the cables that are used.
8. ➤ Ensure that it is never possible for persons to enter the high-voltage area during machine operation.

### 5.7.3 Connecting electrical consumers

#### Checking the connection

In the case of a machine with an integrated power circuit breaker system, the drive motor and electrical consumers are connected at the factory depending on the order and version of the machine.

If installation of the power circuit breaker system occurs on site, the electrical lines for the drive motor and for the electrical consumers need to be laid and connected.

1. ➤ Check that an electrical connection is in place for electrical consumers.
2. ➤ An electrical connection is in place.
  - ⇒ Components are ready for operation.
3. ➤ An electrical connection is not in place.
  - ⇒ Establish an electrical connection on site.

## Set-up and installation

Establishing an electrical connection > Connecting electrical consumers

### 5.7.3.1 Preparing the connection

#### Preparation with acoustic hood

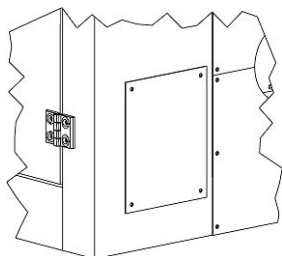


Fig. 37: Acoustic hood cable feedthrough

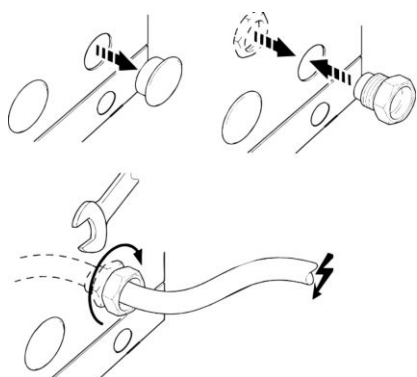


Fig. 38: Preparation

1. ➤



#### **DANGER!**

Risk of fatal injury in the case of incorrect electrical connection data!

Compare the connection data for the electrical consumers with those of the operator's grid.

2. ➤

Shut down the power from the operator's grid.

3. ➤

Observe the cable feedthrough on the installation drawing.

4. ➤

Prepare cable feedthroughs in the cover plate.

5. ➤



#### **DANGER!**

Risk of fatal injury from electric current!

Check that there is no live current in the connection cable.

6. ➤

Route the connection cable through the cable feedthroughs.

### 5.7.3.2 Routing cables

#### Routing the connection cable

1. ➤

Route the connection cable in accordance with the installation drawing.

2. ➤



#### **NOTICE!**

Risk of damage! The minimum bending radius must not be undershot.

Observe the permissible bending radii for the cables that are used.

### 5.7.3.3 Motor connection

#### Motor connection

1. ➤



*Note the specifications for the electrical connection as per the manufacturer's instruction manual.*

2. ➤

Open the motor terminal box.

3. ➔



### NOTICE!

Observe the direction of rotation of the motor.

Connect the cable connections with the motor terminals correctly, in accordance with the connection layout.

4. ➔

Connect auxiliary electrical devices of the drive motor (if available) as per the specification of the motor manufacturer.

5. ➔

Close the terminal box.

6. ➔



*Note the specifications for the electrical connection as per the circuit diagram.*

Establish the electrical connection to the power circuit breaker system.

### 5.7.3.4 Connecting further electrical consumers

#### Electrical connection

1. ➔



*Note the specifications for the electrical connection as per the manufacturer's instruction manual.*

*Note the specifications for the electrical connection as per the circuit diagram.*

Connect components (e.g. heater, lighting, customer provision) as per the specification of the manufacturer's instruction manual and the circuit diagram.

2. ➔

Establish the electrical connection to the power circuit breaker system.

### 5.7.3.5 Connecting the power supply

#### Connecting the power supply

1. ➔



### NOTICE!

Risk of machine damage from incorrect connection data!

Compare the machine's electrical connection data with those of the owner's grid.

## Set-up and installation

Establishing an electrical connection > Connecting electrical consumers

2. ➤



### **DANGER!**

Risk of fatal injury from electric current!

Shut down the power from the operator's grid. Check there is no live electricity.

3. ➤

Lay the connecting cable through the cable feedthrough.

4. ➤



*Note the connection layout as per the circuit diagram.*

Establish the electrical connections as per the circuit diagram.

5. ➤

Connect the operator's power supply to the main circuit breaker.

## 6 First commissioning

### 6.1 Safety instructions

#### Improper first commissioning



#### **WARNING!**

#### **Risk of injury from improper first commissioning!**

Improper first commissioning may lead to serious injury and considerable material damage.

- Before first commissioning, ensure that all installation work has been carried out and completed in accordance with the information and notes in this instruction manual.
- Before first commissioning, ensure that there are no persons in the hazard area.

#### Risks from medium and high voltage applications



#### **DANGER!**

#### **Risk of fatal injury from improper handling for medium or high-voltage applications!**

Medium and high-voltage applications represent a particular risk. In some circumstances, excessive proximity to energised components can lead to a fatal electric shock.

- Work on the electrical system should only be carried out by qualified electrical personnel with special expertise in the handling of medium and high-voltage equipment.

#### Customer service

Our customer service staff are on hand to provide you with technical information:

#### Personnel requirements

Requirements for commissioning:

Commissioning of mechanical components

Personnel: ■ Service personnel

Commissioning of electrical components

Personnel: ■ Authorised electricians

Commissioning of components for medium- or high-voltage applications:

## First commissioning

Inspecting explosion protection equipment

Personnel: ■ Authorised electricians for medium or high voltage applications

### Requirements for personnel

The following tasks require additional "explosion protection" qualifications:

- All work on equipment with ATEX marking.
- All work in zones with ATEX marking.

Personnel: ■ Additional qualification for explosion protection

### Protective equipment

Requirements for commissioning:

Protective equipment: ■ Protective work clothing (7010-M010)  
 ■ Safety shoes (7010-M008)  
 ■ Hearing protection (7010-M003)  
 ■ Protective gloves (7010-M009)  
 ■ Safety goggles (7010-M004)  
 ■ Industrial hard hat (7010-M014)

### ATEX application


Protective equipment: ■ Antistatic protective work clothing for ATEX applications  
 ■ Conductive footwear and antistatic clothing (7010-M032)

### Special tools

Requirements for initial commissioning:

Tool: ■ Oil funnel  
 ■ Test pump  
 ■ General tools  
 ■ General measurement tools and equipment  
 ■ Tools for authorised electricians

Tool: ■ Locking key

Tool: ■  ATEX – non-sparking tools and measuring equipment

## 6.2 Inspecting explosion protection equipment

Before initial commissioning can be performed, all explosion protection measures must be checked for correct operation:



- The pipes on the intake side and discharge side must not exert any force or moments on the nozzles of the machine.
- The components provided are in line with the required Ex zone and suitable ignition protection.
- All safety devices have been installed and connected.
- The instrumentation for monitoring the operating parameters is installed and connected. Exceeding or falling below the specified limits leads to a shutdown of the machine.

### 6.3 Establishing an electrical connection

#### Establishing an electrical connection

1. ➤ Check the earthing connections for correct operation.
2. ➤ Check that the electrical components have been installed properly.

3. ➤



#### **DANGER!**

Risk of fatal injury from electric current!

Supply the electrical components with voltage.

↪ 5.7.3.5 'Connecting the power supply' on page 117

4. ➤ Connect and activate the motor overload protection. Setting as per motor data sheet.
5. ➤ Observe the permissible starting frequency of the drive motor. ↪ 'Permissible starting frequency' on page 70
6. ➤ Ensure that the machine has been integrated in an operationally reliable control system as per the functional description.
7. ➤ Check the drive motor's direction of rotation.  
↪ 8.3.21 'Checking the drive motor's direction of rotation' on page 168

#### Checking the drive motor's direction of rotation

## First commissioning

Preparing the initial commissioning

### Checking the fan



Fig. 39: Fan

8. ➤



#### **WARNING!**

Risk of injury from rotating components!



#### **NOTICE!**

Risk of machine damage due to incorrect direction of rotation!

- Check that the fan impeller is running smoothly and does not come in contact with other components.
- Check the fan motor's direction of rotation.
- Observe the sign with direction of rotation on the fan motor.
- Direction of rotation is incorrect = correct the electrical connection.

### Checking the EMERGENCY STOP function

9. ➤

Ensure that the EMERGENCY STOP function is in place and installed.

- Check for correct operation.
- Document the test result.

### Disconnecting the power supply

10. ➤



#### **WARNING!**

Risk of injury from automatic start-up!

Secure the machine against unintentional start-up.

## 6.4 Preparing the initial commissioning

### Preparation

1. ➤ Check that the machine has been installed correctly.  
↳ 5 'Set-up and installation' on page 99
2. ➤ Check that the system pipes have been installed correctly.  
↳ 5.4 'Connecting the system pipe' on page 110
3. ➤ Ensure that the packaging has been fully removed.
4. ➤ Remove any dirt, dust or foreign matter from the intake area.
5. ➤ Ensure that the cross-sections of the inlet and exhaust air openings on the acoustic hood are unobstructed.

### Ventilation

6. ➤



*Note the permissible ambient temperatures.  
☞ 'Ventilation' on page 105  
Operating conditions: ☞ 11.4 'Technical performance data' on page 189*

Ensure there is adequate ventilation and air extraction at the installation site.

### Taking noise protection into consideration

7. ➤



*Natural vibrations and sound emissions may be induced in pipes and foundations.*

Reduce natural vibrations and sound emission using suitable measures, e.g. insulation.

### Taking heat protection into consideration

8. ➤



*Discharge-side system pipes can get very hot.*

Prevent contact with hot surfaces using suitable measures, e.g. insulation.

### Ventilating the pressure gauge

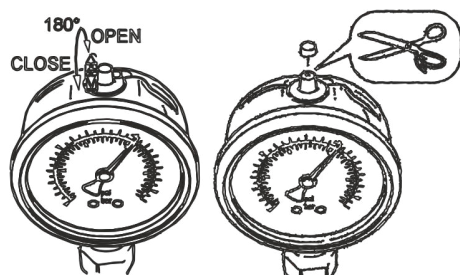


Fig. 40: Pressure gauge ventilation

9. ➤

Prepare the pressure gauge in line with the specific model.

- Cut off the rubber seals on the top.
- Turn the bleeder flap to "OPEN".

### Drive shaft seal

10. ➤

For version with gas-tight machine stage:

- Press grease, or depending on the version
- Activate relubrication device

### Aligning the belt pulleys

11. ➤

Check the alignment of the belt pulleys.

The maximum permissible belt pulley offset is 0.5 mm.

### Topping up the lube oil

12. ➤

Fill the machine stage with oil. ☞ 8.3.4.2 'Topping up lube oil' on page 153

Check the oil level. ☞ 8.3.3 'Checking the oil level' on page 150

### Sealing gas system

13. ➤

Ensure a sufficient supply of sealing gas.

14. ➤

Ensure that the flow rate and sealing gas pressure are set as per the specifications.

## First commissioning

Performing first commissioning > Carrying out a test run

### Shut-off valves

15. ▶ Ensure that any shut-off valves installed for the instrumentation are open.
16. ▶ Ensure that any condensate drains installed are closed.
17. ▶ Ensure that any vent valves installed are closed.
18. ▶ Ensure that all flange connections are subjected to a leakage test and that the machine is tight.

### Rendering the machine inert

19. ▶ Render the machine inert.  
⇒ The machine is prepared for initial commissioning.

## 6.5 Performing first commissioning

### 6.5.1 Carrying out a test run

#### Belt drive

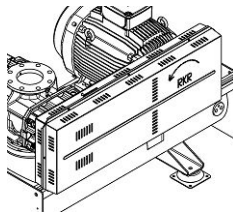


Fig. 41: Belt guard

1. ▶ Check the oil level. ↗ 8.3.3 'Checking the oil level' on page 150
2. ▶ Fit the belt. Check the belt tension. ↗ on page 159
3. ▶



#### WARNING!

Risk of injury from rotating components!

Make sure that the belt guard has been mounted correctly.

- Operation is only permissible with the covers installed.

#### Checking the protective equipment

4. ▶ Check all safety devices and sensors, which are intended to ensure safe operation of the machine, for correct operation.

#### Opening the system line

5. ▶ Open the slide plates on the system side.

#### Checking the safety valve

6. ▶ If included in the scope of delivery:  
Check the safety valve for correct operation.
7. ▶ Close the maintenance elements of the acoustic hood.

### Starting briefly

8. ➤



#### **WARNING!**

Risk of injury from rotating components!



#### **WARNING!**

Risk of injury due to pressurised components!

Do not loosen or remove any blanking plugs or pipe connections.

Switch on the drive motor.

Observe the machine:

- quiet, smooth operation
- even load
- no excessive vibrations
- no unusual noises
- no increased wear

9. ➤

Switch off the machine after approx. 20 seconds.

Make sure the machine coasts down smoothly.

If faults occur:

- Switch off the machine immediately.
- Determine the cause and rectify it.
- Contact the manufacturer's customer service division if necessary.

### Checking the oil level

### Checking the fan's functionality

10. ➤

Check the oil level. If necessary, correct it.

11. ➤



#### **WARNING!**

Risk of injury from rotating components!



#### **NOTICE!**

Danger due to temperatures being too high as a result of incorrect direction of rotation or blocked air exhaust ducts!

Check whether air escapes from the air outlet of the acoustic hood.

### Starting the machine

12. ➤



#### **WARNING!**

Risk of injury from rotating components!

As long as there are no malfunctions: Switch the machine on again.

## First commissioning

Performing first commissioning > Carrying out a test run

### Checks after initial commissioning

**13.** ► Perform the following checks:

Checks after initial commissioning. ↗ 6.5.2 'Checks after the initial commissioning' on page 127

### Acoustic hood protective equipment (optional)

**14.** ►



#### **WARNING!**

Risk of injury if protective equipment is missing.

Close the elements of the acoustic hood properly.

- Store the key for the acoustic hood safely.
- Only grant access to authorised personnel.

### Ready to operate

**15.** ►

If there are no malfunctions, the machine is ready for operation.



*After the first few operating hours, preservative oil could accumulate in the parting faces as a result of the machine warming up.*

### 6.5.2 Checks after the initial commissioning

During the 50 hour run-in period, the machine needs to be carefully monitored at short intervals.

Interval	Maintenance task
After the first 3 op. hrs	Check and document the operating parameters.
	Check the oil level. If necessary, correct it.
	Check the conveying system for tightness. Rectify any leaks.
	After the machine has cooled down, check the screw connections. Tighten if necessary.
	If included in the scope of delivery: Check the safety valve for correct operation.
After 25 op. hrs	Check and document the operating parameters.
	Check the oil level. If necessary, correct it.
	Check the control system, fault transmitter, pressure and temperature measuring devices for correct operation.
	If included in the scope of delivery: Check the intake filter. Replace it if it is dirty.
	If included in the scope of delivery: Check the starting strainer and clean it if necessary.
	If included in the scope of delivery: Check the ultra-fine filter.
	Check the alignment of the belt pulleys. If necessary, correct it.
	Check the belt tension. Tighten if necessary.
	Check the condition of the belt. Replace if necessary; establish cause.
	If included in the scope of delivery: Check the fastener elements of the acoustic hood heater for firm seating.
op. hrs = operating hours	

## First commissioning

Performing first commissioning > Checks after the initial commissioning



# 7 Operation

## 7.1 Safety instructions

### Improper operation



#### **WARNING!**

##### **Risk of injury from improper operation!**

Improper operation may lead to serious injury and considerable material damage.

- Carry out all activities in accordance with the information and notes in this instruction manual.
- Before beginning work, observe the following:
  - Ensure that all covers and safety devices are installed and operating correctly.
  - Ensure that there are no persons in the hazard area.
- Never deactivate or bypass safety devices during operation. Do not operate such devices in a manner that deviates from the operating data.

### An open acoustic hood



#### **WARNING!**

##### **Risk of injury from operation with an open acoustic hood!**

Open acoustic hoods may lead to dangerous situations and cause injury during machine operation.

- Always keep the acoustic hood closed during operation.

### Adjusting valves



#### **DANGER!**

##### **Risk of injury when adjusting valves!**

When the machine is running and an attempt is made to adjust a valve, body parts may be injured by rotating components. Take into account the stand-by mode and/or automatic start-up

Only make adjustments if:

- The machine is not running.
- The machine is secured against a restart.

## Operation

Safety instructions

### Risk of explosion and fire



#### **DANGER!**

#### **Risk of explosion and fire from ignition hazards!**

Prevent ignition hazards (open flames, flying sparks, welding beads, welding spatter) forming in the vicinity of the machine. Sparks and incandescent or flammable objects can be sucked in through the supply air openings of the acoustic hood or through the filter intake silencer. The fan may ignite the mixture, causing an explosion or fire.

- Avoid ignition hazards.
- Never carry out spark-generating work during machine operation.
- Ensure proper ventilation at the installation site.

### Requirements for personnel

Requirements for operation:

Using the machine

Personnel: ■ User

Adjusting valves

Personnel: ■ User  
■ Authorised electricians

### Protective equipment

Requirements for operation:

Protective equipment: ■ Protective work clothing (7010-M010)  
■ Safety shoes (7010-M008)  
■ Hearing protection (7010-M003)  
■ Protective gloves (7010-M009)

### ATEX application

Protective equipment: ■ Antistatic protective work clothing for ATEX applications  
■ Conductive footwear and antistatic clothing (7010-M032)

### Special tools

Adjusting the valves requires:

Tool: ■ General tools

Tool: ■ Locking key

## 7.2 Shut-down in case of emergency

In hazardous situations, the movements of components must be stopped as quickly as possible and the electric power supply must be shut off.

### Shut-down in case of emergency

In an emergency, proceed as follows:

1. ➤ Activate the EMERGENCY STOP immediately.
2. ➤ Inform the responsible staff.
3. ➤ Switch off the main circuit breaker and secure it against restarting.
4. ➤ Assign qualified personnel the task of rectifying the fault.
5. ➤



#### **WARNING!**

An unauthorised or unregulated restart can have fatal consequences.

Before commissioning, ensure that all safety devices are installed and operational.

## 7.3 Requirements for operation

Prior to operating the machine, ensure that the following requirements are met:

- Commissioning has been carried out successfully and no decommissioning took place thereafter. If decommissioning was carried out, proper commissioning needs to be carried out.
- The safety devices are operational.
- Depending on the version of the machine: Drain any build-up of condensate before starting the machine.
- The supply line for the process gas is open and operational. The machine is filled with process gas.

## 7.4 Switching on

### Operating modes

Depending on the operating setup, the machine can be switched on in the following ways:



*If possible, start up the machine without a load.  
Observe the control circuit types.*

When starting and stopping the drive motor, observe all of the machine's protective equipment. Power take-offs must be actuated by a potential-free contact or be actuated directly. The start-up of the power take-offs runs in parallel to the drive motor.

## Operation

Switching on > Remote operation

### 7.4.1 Local control mode

Manually, on-site



#### **DANGER!**

Risk of injury if protective equipment is missing!

Manually activate the starter switch on the machine on site.

⇒ The machine starts and comes on stream.

### 7.4.2 Remote operation

Via remote station



#### **DANGER!**

Risk of fatal injury if protective equipment is missing!



#### **WARNING!**

Risk of injury if the machine starts suddenly!

Activate the starter switch in the remote station.

⇒ The machine is started remotely and goes into operation.

Remote station with control system



*Observe the operating manual for the control system.*

*Communication interface as per the circuit diagram.*

One of the following communication interfaces is possible depending on the order:

- Remotely via potential-free contact
- Remotely via MODBUS RTU
- Remotely via MODBUS TCP/IP
- Remotely via PROFIBUS DP
- Remotely via PROFINET

## 7.4.3 Automatic operation

### Switching on automatically



#### **DANGER!**

Risk of fatal injury if protective equipment is missing!



#### **WARNING!**

Risk of injury if the machine starts suddenly!

The start command is carried out by sensors or a system switch.

⇒ The machine starts automatically and goes into operation.

## 7.5 Displaying operating parameters

### Instruments (optional)

Depending on their design, analogue and/or digital instruments display the given operating data, e.g. discharge pressure, discharge temperature.

### Control system (optional)

Depending on the customer's control system, additional operating parameters can be recorded and displayed.

## 7.6 Checks during operation

The activity is limited to inspection tours during operation.

Pay attention to the following characteristics:

- Correct function
- Operating parameters
- Abnormal noises
- Leaks
- Odours
- Vibrations
- Exposed supply air openings
- Fill levels

## 7.7 Switching off

### Operating mode

Depending on the operating setup, the machine can be switched off in the following way:

## Operation

Switching off > Automatic operation

### 7.7.1 Local control mode

Manually, on-site

1. ➤



**WARNING!**

Risk of injury from unbraked shut-down!

Manually activate the cut-out switch on the machine.

⇒ The motor switches off and the machine powers down.  
The machine continues to run for a few seconds.

2. ➤

After machine downtime: close the discharge-side shut-off valve.

### 7.7.2 Remote operation

Via remote station

1. ➤



**WARNING!**

Risk of injury from unbraked shutdown!

Activate the cut-out switch in the remote station.

⇒ The motor switches off and the machine powers down.  
The machine continues to run for a few seconds.

2. ➤

After machine downtime: close the discharge-side shut-off valve.

### 7.7.3 Automatic operation

Switching off automatically

1. ➤



**WARNING!**

Risk of injury from unbraked shutdown!

The shutdown command is carried out by sensors or a system switch.

⇒ The motor switches off and the machine powers down.  
The machine continues to run for a few seconds.

2. ➤

After machine downtime: close the discharge-side shut-off valve.

## 7.8 Decommissioning



*Decommissioning means the shutdown of a machine for a longer period.*

### Measures

1. ➔ Switch off the machine properly and secure it against an unintentional start.
2. ➔ Disconnect fuses.
3. ➔ Close the shut-off valves of the delivery lines.
4. ➔ Close the initial shut-off valve for sealing gas system.
5. ➔ If installed: Close the system-side shut-off device of the sealing gas system.
6. ➔ Put the machine in a depressurised state.
7. ➔ Prevent condensate from entering the machine.
8. ➔ For a downtime of over six weeks: Apply preservative to the machine.
9. ➔ Initiate further measures for storage and preservation depending on the duration of decommissioning.

### Avoiding damage caused by downtime and corrosion

## 7.9 Measures for recommissioning

### Draining condensate



#### NOTICE!

#### **Risk of material damage due to condensate!**

Condensate can build up when the machine is at a standstill.

Drain any build-up of condensate prior to commissioning the machine.

1. ➔



*The precise position of the condensate drains is specified in the installation diagram.*

Drain the condensate. ➔ 8.3.15 'Draining the condensate' on page 163

2. ➔ Seal the condensate drains.

### 7.9.1 Commissioning after adjustment work

#### After adjustments

Steps as per ➔ 7.10.1 'Commissioning after adjustments' on page 136

## Operation

Adjusting valves > Commissioning after adjustments

### 7.9.2 Commissioning after maintenance work

**After maintenance**

Steps as per ↗ 8.5 'Commissioning after maintenance'  
on page 169

### 7.9.3 Commissioning after fault rectification

**After fault rectification**

Steps as per ↗ 9.6 'Commissioning after malfunction rectification'  
on page 178

## 7.10 Adjusting valves



### **DANGER!**

Risk of injury when adjusting valves or equipment!

**Preparation**

1. ➤ Agree the adjustments with the person responsible at the operating site.
2. ➤ Switch off the machine.
3. ➤ Trigger the EMERGENCY STOP function.
4. ➤ Switch off the main circuit breaker and secure it against restarting.
5. ➤ Ensure there is no live electricity.
6. ➤ Open the maintenance elements.

### 7.10.1 Commissioning after adjustments

**Commissioning**

1. ➤ Inform the responsible on-site person about the result of the work carried out and agree commissioning steps with that person.
2. ➤ Check all previously loosened screw connections for tightness.
3. ➤ Ensure that there are no persons in the hazard area.
4. ➤ Re-attach all safety hardware.
5. ➤ Remove all used tools, materials and other equipment from the workspace.
6. ➤ Release the main circuit breaker and switch it on.
7. ➤ Release the EMERGENCY STOP function.
  - ⇒ Start operation in accordance with the instructions in the "Operation" chapter.
8. ➤ Inform the person responsible at the operating site about the result of the work carried out.



## 8 Maintenance

### 8.1 Safety instructions

#### Run down time



#### **WARNING!**

#### **Risk of injury from a ventilator during lag time!**

A ventilator during lag time may cause injury to persons working in its direct vicinity.

- Wait until the ventilator has switched off completely.
- Never remove the protective guard.

#### Improperly performed maintenance work



#### **WARNING!**

#### **Risk of injury from improperly performed maintenance work!**

Improperly performed maintenance may lead to serious injury and material damage.

- Only perform maintenance work when the machine has been switched off.
- Secure the machine against a restart.
- Allow the machine to cool down to the ambient temperature.
- Before beginning work, ensure that there is sufficient space for installation work.
- Keep the workspace tidy and clean.
- Only perform maintenance work with suitable tools.
- Ensure removed components are re-installed correctly.
- Re-install all fastening elements and observe the screw tightening torques.

## Maintenance

Safety instructions

### Deficient maintenance and inspection



#### **WARNING!**

**Risk of injury due to failure to perform or deficient performance of maintenance and inspections!**

Careful and regular maintenance and inspections enable potential faults to be detected at an early stage. Non-compliance with specified maintenance intervals as well as improper performance of maintenance can cause critical and dangerous situations. There is therefore a risk of injury in the immediate vicinity of the machine.

- Always comply with the maintenance intervals.
- Ensure proper performance of maintenance intervals.
- Observe the personnel qualifications.
- Never make any unauthorised extensions to maintenance intervals.

### Maintenance work when the machine is in operation



#### **WARNING!**

**Risk of injury from maintenance work while the machine is currently in operation!**

Performing maintenance work during operation of the machine can lead to serious or fatal injuries.

- Always shut down the machine prior to maintenance work!  
Never start up the machine for maintenance work!
- Never operate or start up the machine with disassembled assemblies and accessories!

### Securing the machine against restarting



#### **WARNING!**

**An unauthorised or unregulated restart can have fatal consequences.**

An unauthorised or unregulated restart of the machine can lead to serious or fatal injuries. There may be people in the hazard area.

- Before beginning work, switch off the power supply, secure it against a restart, and ensure a de-energised state.

### Electrical system



#### **DANGER!**

##### **Risk of fatal injury from electric current!**

There is a risk of fatal injury from touching live components. Live electrical components may make uncontrolled movements and cause extremely serious injuries.

- Before beginning work, switch off the electrical supply, secure it against a restart, and ensure a de-energised state.

### Medium and high voltage applications



#### **DANGER!**

##### **Risk of fatal injury from improper handling for medium or high-voltage applications!**

Medium and high-voltage applications represent a particular risk. In some circumstances, excessive proximity to energised components can lead to a fatal electric shock.

- Work on the electrical system should only be carried out by qualified electrical personnel with special expertise in the handling of medium and high-voltage equipment.

### Rotating or moving components



#### **WARNING!**

##### **Risk of injury from rotating or moving components!**

Rotating or moving components can cause serious injuries.

- Never touch rotating or moving components.
- Never reach into the clamping area of the belts, for example.
- Keep a safe distance from rotating or moving components.
- Wear tight-fitting protective work clothing with low tensile strength within the hazard area.

## Maintenance

### Safety instructions

#### Hot operating materials



##### **WARNING!**

##### **Risk of injury from hot operating materials!**

Operating materials may reach high temperatures during operation. Skin contact with hot operating materials causes serious burns.

- For all work performed with hot operating materials, always wear protective work clothing and protective gloves.
- Before any work with operating materials, check whether they are hot. If necessary, allow them to cool down to ambient temperature.

#### Use of incorrect replacement parts



##### **CAUTION!**

##### **Safety risk from using incorrect replacement parts!**

Incorrect, defective or unsuitable replacement parts or copies of original components may endanger personal safety and lead to damage, faults or total failure.

- Only use the manufacturer's original replacement parts or parts approved by the manufacturer.
- If in doubt, always contact the manufacturer.

Purchase replacement parts from an authorised dealer or from the manufacturer directly. For contact information, see customer service.

#### ATEX notes



*Observe the information in the documents accompanying the supplied ATEX components!*



##### **NOTICE!**

##### **Risk of machine damage from cleaning!**

Cleaning using unsuitable materials can result in damage to the machine's seals.

- Do not use abrasive cleaning agents.
- Do not use pressure cleaning equipment.
- Never clean using compressed air.

## Deficient maintenance and inspection



### NOTICE!

#### **Risk of material damage due to failure to perform or deficient performance of maintenance and inspections!**

Careful and regular maintenance and inspections enable potential faults to be detected at an early stage. Non-compliance with specified maintenance intervals as well as improper performance of maintenance can cause extensive consequential damage and even result in total machine loss.

- Observe and comply with the maintenance intervals.
- Ensure proper performance of maintenance intervals.
- Never make any unauthorised extensions to maintenance intervals.
- Carry out maintenance intervals earlier depending on operating conditions and local conditions.

## Requirements for personnel

The maintenance work described here may only be performed by the designated personnel. The personnel entrusted with the respective maintenance tasks are listed in the maintenance plan.

For the preparation of the maintenance plan, the following is necessary:

- Personnel:
- Authorised electricians
  - Service personnel

For cleaning after maintenance, the following is necessary:

- Personnel:
- User

Commissioning after maintenance requires:

- Personnel:
- Authorised electricians
  - Service personnel

- Personnel:
- Gas specialists

## Requirements for personnel

The following tasks require additional "explosion protection" qualifications:

- All work on equipment with ATEX marking.
- All work in zones with ATEX marking.

- Personnel:
- Additional qualification for explosion protection

## Maintenance

### Safety instructions

#### Requirements for personnel

Maintenance of components for medium or high-voltage applications.

Personnel: ■ Authorised electricians for medium or high voltage applications

#### Protective equipment

Maintenance requires the following:

Protective equipment: ■ Protective work clothing (7010-M010)  
 ■ Safety shoes (7010-M008)  
 ■ Protective gloves (7010-M009)  
 ■ Safety goggles (7010-M004)  
 ■ Industrial hard hat (7010-M014)

#### ATEX application


Protective equipment: ■ Antistatic protective work clothing for ATEX applications  
 ■ Conductive footwear and antistatic clothing (7010-M032)

#### Special tools

Maintenance requires the following:

Tool: ■ Oil funnel  
 ■ General tools  
 ■ General measurement tools and equipment  
 ■ Auxiliary materials, tools

Tool: ■ Locking key

Tool: ■  ATEX – non-sparking tools and measuring equipment

## 8.2 Maintenance plan

The following section describes the maintenance work that is required for optimal and fault-free operation of the machine.

The intervals for different maintenance tasks could be regular (e.g. weekly) or could depend on the operating hours (op. hrs) of the machine.

If regular inspections reveal an increased level of wear, reduce the requisite maintenance intervals in accordance with the actual signs of wear.

Aggravating operating conditions could include:

- year-round ambient temperatures over 30 °C
- high dust levels

For questions pertaining to maintenance work and intervals, please contact customer service. ↪ *'Customer service' on page 119*

### Maintenance not performed



#### **WARNING!**

#### **Risk of injury due to non-performance of maintenance!**

If maintenance is not performed or it is performed too late, this could lead to faults and dangers. Such faults and dangers could result in serious bodily injuries.

- Service the machine regularly and carefully within the specified intervals.
- Inspect the machine on a regular basis.
- Rectify faults in good time.

### Maintenance not performed



#### **NOTICE!**

#### **Risk of machine damage due to non-performance of maintenance!**

If maintenance is not performed or it is performed too late, this could cause machine damage. Faults can occur and cause material damage.

- Service the machine regularly and carefully within the specified intervals.
- Inspect the machine on a regular basis.
- Rectify faults in good time.

## Maintenance

Maintenance plan > Maintenance schedule for normal operation

### 8.2.1 Maintenance schedule for normal operation

Interval	Maintenance work	Personnel
After the first 500 op. hrs	Change the machine stage's lube oil. ✎ 8.3.5 'Changing the oil' on page 155	Service personnel
	Press more grease on the drive shaft of the machine stage. ✎ 8.3.8 'Pressing more grease on a gas-tight drive shaft of the machine stage' on page 157	Service personnel
	Check the belt tension. Adjust if necessary. ✎ 8.3.11 'Determining the impression depth of the belts' on page 160	Service personnel
Weekly	Check the machine stage's oil level. ✎ 8.3.3 'Checking the oil level' on page 150 Correct the oil level as necessary. ✎ 8.3.4 'Adjusting the oil level' on page 151	User Service personnel
	Check the drive shaft seal for grease leakage. Replace the seal if necessary.	Service personnel Manufacturer's customer service division
	Check the belt guard. ✎ 8.3.13 'Checking the belt guard' on page 162	User
	Check the intake pressure display. Clean the starting strainer if dirty. ✎ 8.3.6 'Checking the starting strainer' on page 155	User Service personnel
	Keep the supply air openings on the acoustic hood free of foreign bodies and impurities.	User
	Check for condensate formation. ✎ 8.3.15 'Draining the condensate' on page 163	Service personnel
	Remove any deposits or accumulation of dust.	Service personnel
After every 1,500 op. hrs or every 2 months	Measure the machine stage vibrations. ✎ 8.3.7 'Measuring vibrations' on page 156	Service personnel
After every 2,000 op. hrs or every 3 months	Press more grease on the drive shaft of the machine stage. ✎ 8.3.8 'Pressing more grease on a gas-tight drive shaft of the machine stage' on page 157	Service personnel
	Check the belt tension. Adjust if necessary. ✎ 8.3.11 'Determining the impression depth of the belts' on page 160	Service personnel
	Check the condition of the belt. Replace if necessary. ✎ 8.3.10 'Replacing the belt' on page 158 Check the belt pulleys for unusual wear and obvious damage. Check for correct alignment and stability. ✎ 8.3.9 'Checking the belt drive' on page 158	Service personnel
Intervals for the drive motor	Clean the drive motor. Depends on level of soiling. Observe the instruction manual of the drive motor.	Service personnel



Interval	Maintenance work	Personnel
Intervals for the drive motor	Relubricate the drive motor. Observe the instruction manual and signage of the drive motor.	Service personnel
Intervals for the fan motor	Clean the fan motor. Depends on level of soiling. Observe the instruction manual for the motor.	Service personnel
	Relubricate the fan motor. Observe the instruction manual and signage on the motor.	Service personnel
After every 4,000 op. hrs or every 6 months	Change the machine stage's lube oil. 🔗 8.3.5 'Changing the oil' on page 155	Service personnel
	Check the safety valve for correct operation. 🔗 8.3.14 'Checking the safety valve' on page 163	Service personnel
	Check the electrical connection and lines for damage.	Service personnel
	Check the acoustic hood for damage. 🔗 8.3.18 'Checking the acoustic hood' on page 165	Service personnel
	Check and clean the inlet and exhaust air openings on the acoustic hood. Check the acoustic hood fan for correct operation and clean it. 🔗 8.3.19 'Checking the fan' on page 166	Service personnel
After every 8,000 op. hours or every 12 months	Replace the drive shaft seal on the machine stage.	Manufacturer's customer service division
	If a starting strainer is installed: Check and clean the starting strainer. 🔗 8.3.6 'Checking the starting strainer' on page 155	Service personnel
	Check the compensators for correct operation and tightness. 🔗 8.3.17 'Checking the expansion joint' on page 165	Service personnel
	Check the non-return flap for correct operation, wear, and tightness. 🔗 8.3.16 'Checking the non-return flap' on page 164	Service personnel
	Check the conveying system for mechanical damage and corrosion. Visually inspect the weld seams. Check the conveying system for tightness. Replace the seals if necessary and tighten the screw connections.	Service personnel
	Check the control system, monitoring devices, and safety devices for correct operation.	Manufacturer's customer service division
	Check that the screw connections are secure. Tighten if necessary.	Service personnel
	Check the flow meter.	Service personnel

## Maintenance

### Maintenance work

Interval	Maintenance work	Personnel
After every 8,000 op. hours or every 12 months	Observe the instruction manual for the flow meter.	
After every 16,000 op. hrs or every 2 years	Check the alignment of the belt pulleys. Correct if necessary. ↪ 8.3.9 'Checking the belt drive' on page 158 Replace the belt. ↪ 8.3.10 'Replacing the belt' on page 158	Service personnel
After every 20,000 op. hrs or every 3 years	Check the hose lines for tightness. Replace if necessary. Recommendation: Replace hose lines every 6 years.	Service personnel
	Recommended main inspection/servicing. Check and replace spare parts and wear parts. Inspect the entire machine.	Manufacturer's customer service division

op. hrs = operating hours

## 8.3 Maintenance work

### ATEX notes



*Observe the information in the documents accompanying the supplied ATEX components!*



#### NOTICE!

##### **Risk of machine damage from cleaning!**

Cleaning using unsuitable materials can result in damage to the machine's seals.

- Do not use abrasive cleaning agents.
- Do not use pressure cleaning equipment.
- Never clean using compressed air.

### ATEX preparation



#### **DANGER!**

##### **Risk of explosion!**

When removing or opening pipes and components, media that is hazardous to health could be discharged and a potentially explosive atmosphere could be form.

- To prevent explosions and health risks for personnel, the machine must be rendered inert.

1. ➤ Before performing work on systems that convey potentially explosive gases, render the machine inert using a neutral gas.
2. ➤ Before opening, observe a cool-down time of at least 30 minutes.
3. ➤ Do not leave the open machine unattended.

### Preparation for maintenance work

1. ➤ Agree maintenance work with the person responsible at the operating site.
2. ➤ Switch off the machine.
3. ➤ Switch off the main circuit breaker and secure it against a restart.
4. ➤ Close the shut-off valves in the conveying lines on the system side.
5. ➤ Observe the warnings on the machine.
6. ➤



#### **DANGER!**

Risk of injury from electric current!

Ensure there is no live current.

7. ➤ De-pressurise the machine.
8. ➤ Allow the machine to cool down to ambient temperature.

### 8.3.1 Rendering inert



#### **DANGER!**

##### **Danger from improper inertisation!**

If inertisation is carried out incorrectly, there is a danger of a potentially explosive atmosphere forming when opening the machine (external) or when filling with process gas (internal).

- Only deploy trained specialist personnel for inertisation.
- An important prerequisite for inertisation to be effective is safeguarding thereof by measuring the gas concentrations (e.g. oxygen) that could lead to the formation of a potentially explosive atmosphere.
- The operator must specify process-related limits that must be adhered to in order to prevent the formation of a potentially explosive atmosphere.

Protective equipment: ■ Gas detector (7010-M048)

Prior to commissioning, the oxygen needs to be removed from the machine and, prior to decommissioning and all maintenance work on the machine stage and on the conveying system, the process gas needs to be removed from the machine. A supply of dry, gaseous nitrogen ( $N_2$ ) is required to this end. This nitrogen is to be provided by the operator. Nitrogen is an inert gas.

During inertisation, oxygen or process gas is removed from the interior chambers of the machine. The gas mixture must be drained into a safe area that is free of ignition sources.



*Refer to the installation drawing for the arrangement of the flushing connectors.*

#### **Preparation**

1. ➤ Switch off the main circuit breaker and secure it against a restart.
2. ➤ Ensure there is no live current.
3. ➤ Close the shut-off valves in the conveying lines on the system side.
4. ➤ De-pressurise the machine.
5. ➤ Allow the machine to cool down to ambient temperature.

### Rendering inert



#### **DANGER!**

Risk of injury from residual pressure in the machine. Process gas could escape when opening the purge connections.

6. → Ensure that pressure relief has fully concluded and that the machine is no longer pressurised.

Connect the nitrogen supply to the *inlet* purge connections.

7. → Connect the nitrogen drain line to the *outlet* purge connections.

8. →



#### **DANGER!**

Perform inertisation correctly and ensure compliance with the limits specified by the operator by measuring the gas concentration.

Open the nitrogen supply slowly.

Open the nitrogen drain line slowly and safely bleed off the resulting gas mixture.

⇒ The pipes and components are flushed with nitrogen.

9. → Ensure that all system parts are fully flushed.
  10. → If necessary: Carry out a leakage test. ↪ 8.3.2 'Performing a leak test' on page 149
  11. → Slowly shut off the nitrogen supply at the purge connection and remove the nitrogen supply.
  12. → Shut off the nitrogen drain line at the purge connection and remove the nitrogen drain line.
- ⇒ The pipes and components are inert and are free of process gas or oxygen.

### 8.3.2 Performing a leak test



#### **WARNING!**

##### **Risk of injury from improper leakage test!**

Improperly performed leakage tests, e.g. incorrect connection configurations, wrong pressures or incorrect procedure, can cause serious injuries.

- Do not perform pressure testing with liquid in the machine.



*Leakage test should be performed in the smallest possible machine sections.*

## Maintenance

Maintenance work > Checking the oil level

Requirements:

- The machine has been fully and properly assembled.
- All safety devices have been installed and are operating correctly.
- All connections have been established.
- The installation site is sufficiently ventilated.

Carry out the leakage test with a neutral gas.

Material: ■ Leakage spray (Nekal test)

### Carrying out a leakage test

1. ➤



#### **WARNING!**

Risk of injury due to pressurised components!

Pressurise the machine section with a neutral gas at low pressure.

2. ➤

Spray the connection points with the liquid leakage spray.

- ⇒ ■ If no bubbles form, the machine section is leak-tight.
- If bubbles form, check the bolted connections of all fasteners and flanged connections by retightening them to the specified tightening torques. Observe the specified tightening sequences when doing so. Perform maintenance again if necessary.

3. ➤

Increase the pressure in the machine section in 100 mbar increments.

4. ➤

Repeat steps 2 to 3 until the operating pressure is reached.

5. ➤

Relieve the machine section of pressure in the proper manner.

6. ➤

Add a further machine section.

7. ➤

Keep repeating steps 2 to 6 until all of the machine sections have been integrated and operating pressure has been reached.

⇒ The leakage test is complete.

### 8.3.3 Checking the oil level

Checking the oil level



*The machine stage has two separate oil chambers:*

- Drive side
- Gear side

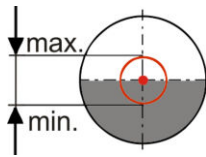


Fig. 42: Oil level display

1. ➔



## NOTICE!

Only check the oil level when the machine is at a standstill.



Use tools if necessary:

- Lamp
- Mirror

2. ➔

Check the lube oil level.

- The lube oil level is between the min./max. markings.  
→ Oil level is OK.
- The lube oil level is below the min. marking. Oil level too low.  
→ Top up oil.
- The lube oil level is above the max. marking. Oil level too high.  
→ Drain oil.

## Correcting the oil level

3. ➔



## NOTICE!

Risk of machine damage from incorrect lube oil quantity!

Correct the oil quantity. The level is correct when it is within the marking on the display. ➔ 8.3.4 'Adjusting the oil level' on page 151

## 8.3.4 Adjusting the oil level

### 8.3.4.1 Draining the lube oil

#### Draining the lube oil

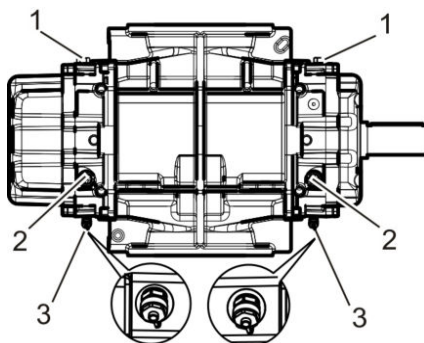


Fig. 43: Oil drain

3 Drain valves

1. ➔



## WARNING!

Risk of scalding from hot lube oil!

Allow the lube oil to cool down to the ambient temperature.

2. ➔



Observe the volume of the waste oil and the oil-resistant receptacle.

Have a receptacle ready.

3. ➔

Select an oil chamber with an excess filling capacity.

## Maintenance

Maintenance work > Adjusting the oil level

4. ➤ Open the oil fill opening.  
 ⇒ The lube oil runs out of the drain valve more evenly due to ventilation.

5. ➤ Remove the sealing cap from the drain valve.



*A blanking plug or a shut-off valve can be used as an alternative to the drain valve.*

*The oil chamber is opened by:*

- *Disassembly of the blanking plug.*  
Or by
- *Removal of the sealing plug from the shut-off valve. Opening the shut-off valve.*

If the sealing cap is seated very tightly, secure the drain valve using a wrench and loosen the sealing cap with an additional wrench.

6. ➤



### NOTICE!

Material damage to the drain hose from lube oil temperatures over 60 °C!

Guide the oil drain hose (included in the scope of delivery) into the receptacle.

7. ➤



### CAUTION!

Risk of skin irritation from waste lube oil!

Screw the drain hose onto the drain valve or open the drain valve and collect the draining lube oil in the proper manner.

⇒ Lube oil runs out of the oil chamber.



### CAUTION!

Risk of slipping from oil spillage!

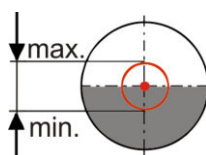


Fig. 44: Sight glass for oil level display

8. ➤ **With regard to correction of the oil level:**

If the permissible lube oil level is reached, remove the drain hose.

⇒ The drain valve closes automatically.



### 9. With regard to an oil change:

Drain all of the lube oil. Remove the drain hose.

⇒ The drain valve closes automatically.



*A blanking plug or a shut-off valve can be used as an alternative to the drain valve.*

*The oil chamber is closed by:*

- *Installation of the blanking plug with a new sealing ring.*
- Or by*
- *Closure of the shut-off valve. Seal the outlet of the shut-off valve with a sealing plug.*

10. Screw the sealing cap onto the drain valve.

11. Close the oil fill opening.

12.



#### ENVIRONMENT!

Risk of environmental damage from waste oil!

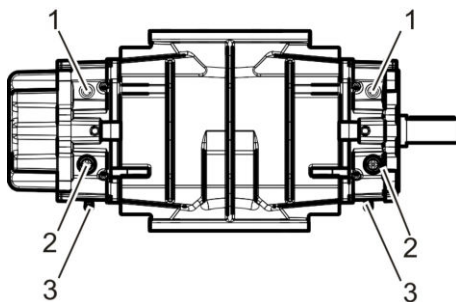
Collect any waste lube oil and residual oil correctly and dispose of it in an environmentally friendly manner.

Clean the workspace thoroughly.

Clean all auxiliary equipment.

### 8.3.4.2 Topping up lube oil

#### Topping up the lube oil



- 1 Oil fill openings, marked in RED
- 2 Oil level displays
- 3 Drain valves

Fig. 45: Machine stage BS3 to BS80

## Maintenance

Maintenance work > Adjusting the oil level

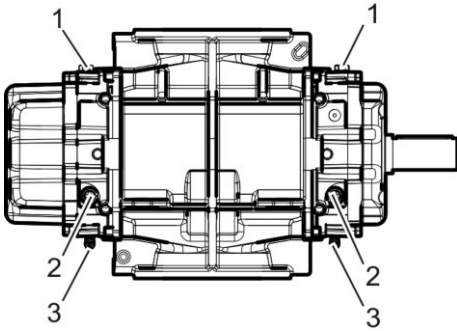


Fig. 46: Machine stage BS90 to BS400

1. ➤ Select the requisite oil chamber.
2. ➤ Check the drain valve for firm seating.
3. ➤ Check the sealing cap of the drain valve for firm seating.
4. ➤ Open the blanking plug (marked RED) for the oil fill opening.
5. ➤



### CAUTION!

Risk of skin irritation from lube oil!



### ENVIRONMENT!

Risks to the environment due to incorrect handling of lubricants!

Observe the total oil quantity and specification.

Observe the oil quantity distribution. Guide value:

- 1/3 of the entire lube oil quantity into the drive side.
- 2/3 of the entire lube oil quantity into the gear side.

The display in the oil level sight glass is authoritative.

Fill the lube oil in stages and in small quantities.

6. ➤ Observe the oil level.

Wait 5 to 10 minutes. The lube oil continues to flow.

⇒ The oil level regulates itself in the oil system and in the oil chamber.

7. ➤ Check the oil level.

The lube oil level is between the min./max. markings.

⇒ The oil level is OK.

8. ➤ The lube oil level is beyond the min./max. markings.

⇒ Correct the oil level.

9. ➤ Close the oil fill opening tightly with a new seal.

10. ➤



### ENVIRONMENT!

Risk of environmental damage from incorrect storage of lube oils!

Clean the workspace thoroughly.

Dispose of residual lube oil in an environmentally friendly manner in accordance with the regulations applicable on site.

Clean all auxiliary equipment.

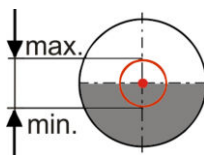


Fig. 47: Sight glass for oil level display

### 8.3.5 Changing the oil

1. ➔ Drain the lube oil fully and dispose of it in an environmentally friendly manner. ➔ 8.3.4.1 'Draining the lube oil' on page 151
2. ➔ Top up with lube oil of the same type. ➔ 8.3.4.2 'Topping up lube oil' on page 153

Further measures are necessary if the oil type is changed.  
➔ 11.8.1.1 'Change of oil type' on page 193

### 8.3.6 Checking the starting strainer

#### Removal and cleaning

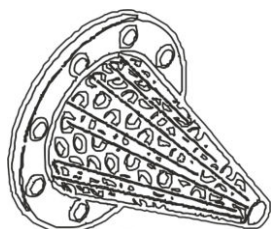


Fig. 48: Starting strainer

1. ➔ If resistance increases to the point where maximum resistance is exceeded, this means that the starting strainer is contaminated.

2. ➔



#### NOTICE!

##### Risk of machine damage!

The machine stage can be damaged by the smallest of foreign bodies and by dust. Ensure that no particles enter the machine stage.

Clean the workspace if necessary.

3. ➔ Remove the starting strainer.  
Protect nozzles from dust penetration.
4. ➔ Remove solids and dirt from the strainer. If necessary, purge with compressed air.

5. ➔



#### NOTICE!

Risk of machine damage from damage to the strainer! Check the starting strainer for damage.

If damaged, replace it.

6. ➔ Install a cleaned, intact starting strainer in the direction of flow.

#### Removal and replacement

If the operator inserts an appropriate strainer in the incoming line and ensures that no impurities can enter the machine during the entire operating period, including during and after maintenance, inspections and repairs, the strainer can be removed and replaced by an intermediate ring.

## Maintenance

Maintenance work > Measuring vibrations



### NOTICE!

Risk of machine damage due to the intake of solids! Ensure that the inside of the pipe is clean.

1. ➤ If the starting strainer pressure no longer increases and the starting strainer remains clean, it can be removed.
2. ➤ Remove the starting strainer and replace it with an intermediate ring.

### 8.3.7 Measuring vibrations



*Bearing damage can become noticeable at an early stage as a result of higher vibration velocities on the machine and accessories.*

1. ➤ Measure the vibration values of the machine stage in three directions (horizontal, vertical, axial).  
Employ a meter at the measuring point and take a reading of the values.
2. ➤ Compare the measurement values with the permissible vibration values of the VDI 3836 standard.  
⇒ If vibration values exceed the frequency ranges, shut down the machine. Inform customer service.
3. ➤ Document the test result.

Guideline values for permissible effective values of vibration velocities for positive displacement blower with low power:

Evaluation zone	Unit in mm/s	
I (normal)	< 12	
II (usable)	12 to 18	(alarm)
III (unusable)	> 18	(shutdown)

**Measuring point: connection flange, side plates**

**Radial: in horizontal and vertical direction**

**Axial: at the position of the fixed bearing (thrust bearing)**

## 8.3.8 Pressing more grease on a gas-tight drive shaft of the machine stage

### Choice of lubricant

The quality of the grease has a significant effect on the service life of the machine stage. Therefore, only use grease that has been specified and approved by RKR.

### Grease quantity

The required grease quantity varies depending on the size of the machine stage. For information about the grease quantities, see [11.8.2.2 'Grease filling quantities' on page 196](#).



*The following information applies only to gas-tight versions of the drive shaft with grease trap.*

*The old grease is replaced by pressing more grease.*

### Pressing more grease



*Press more grease a few operating hours before the lube oil change. The used, excess grease enters the oil chamber of the machine stage and is drained when the lube oil is changed.*

1. ➔ Switch off the machine and secure it against a restart.



#### NOTICE!

Depressurise the machine; it is not possible to press more grease otherwise.

2. ➔



#### WARNING!

Risk of burns due to hot housing surfaces!

Allow the housing surfaces to cool down to ambient temperature.

3. ➔ Press the grease quantity through the grease nipple. Observe the grease specifications.



#### CAUTION!

Risk of skin irritation from escaping grease!

Observe the grease quantity. [11.8.2.2 'Grease quantity for gas-tight machine stage with grease nipple' on page 196](#)

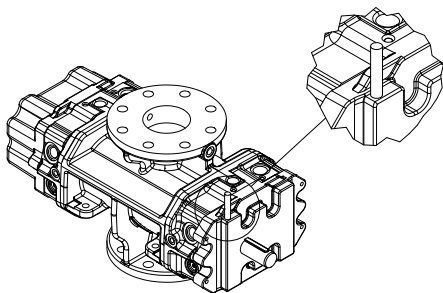


Fig. 49: Grease nipple

## Maintenance

Maintenance work > Replacing the belt

### 8.3.9 Checking the belt drive

For wear and damage

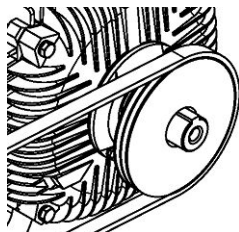


Fig. 50: Belt drive

1. ➤ Remove the belt.
2. ➤ Check V-belt and the belt pulleys for unusual wear and tear or obvious damage.
3. ➤ Check the belt pulleys for correct alignment and fastening.  
The maximum permissible belt pulley offset is 0.5 mm.
4. ➤ Replace the belt pulleys if necessary. ↗ 8.3.12 'Replacing the belt pulley' on page 161
5. ➤ Install the belt pulleys.
6. ➤ Fit the belt. ↗ 8.3.10 'Replacing the belt' on page 158

### 8.3.10 Replacing the belt

Original spare and replacement parts



#### NOTICE!

#### Machine damage from using incorrect spare parts!

Faulty or unsuitable replicas or copied parts can damage the machine.

Pulleys must only come from one manufacturer and from one production batch.

- Use only the manufacturer's genuine spare parts.
- Otherwise varying belt tensions can occur which can result in uneven running and premature wear.
- As a result of a risk of snapping, the belt pulleys must be suitable for the tip speed encountered.

### Removing the belt

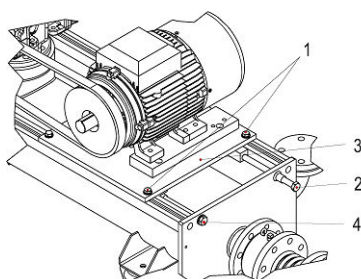


Fig. 51: Motor slide

1. ➤ Loosen the fastening screws (1) of the tensioning unit.
2. ➤



#### WARNING!

Risk of shearing and crushing from moving loads!

Adjust the motor slide (3) using the set screw (2).

⇒ Relaxing the belt

3. ➤ Remove the belt.

### Fitting the belt

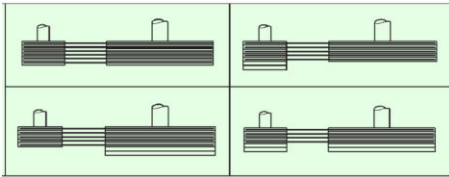


Fig. 52: Permissible belt layout

### Tensioning the belt

1. ➔



#### WARNING!

Risk of injury from tensioning, moving or rotating components!

Fit the belt. Adjust the motor slide if necessary.

Observe and comply with the permissible groove layout.

2. ➔

Determine the impression depth of the belts.

➔ 8.3.11 'Determining the impression depth of the belts' on page 160

3. ➔

Tension the motor slide (3) using the set screw (4).

⇒ Tensioning the belt

4. ➔

Check the belt tension and ensure that the impression depth determined earlier is adhered to.

5. ➔

Tighten the fastening screws (1) of the clamping unit with the appropriate torque.

Base support size	Screw size	Tightening torque [Nm]
1	M12	75
2		
3	M16	186
4		
5		

## Maintenance

Maintenance work > Determining the impression depth of the belts

### 8.3.11 Determining the impression depth of the belts

Determining the impression depth of the belts

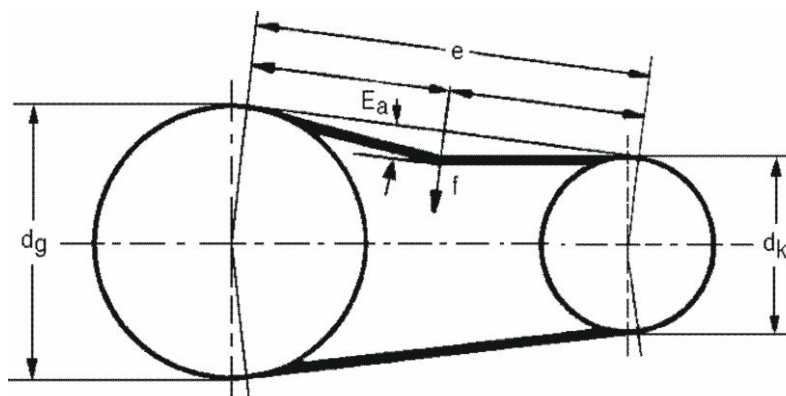


Fig. 53: Determining impression depth  $E_a$

The profile type determines the test force  $f$ .

Measure the diameter of the small belt pulley  $d_k$  and determine the impression depth  $E$  (according to application).

Calculate the impression depth  $E_a$  with the axis distance between belt pulleys  $e$ .

$$E_a = E \cdot e / 100$$

Profile type	Test force $f$ per belt [N]	Diameter $d_k$ of the small pulley [mm]	Impression depth $E$ [mm] per 100 mm run length
SPZ / XPZ	25	95 - 125	1.75
		132 or more	1.55
SPA / XPA	50	100 - 140	2.70
		150 - 200	2.50
		224 or more	2.30
SPB / XPB	75	160 - 224	2.20
		236 - 355	1.85
		375 or more	1.50
SPC / XPC	125	250 - 355	2.00
		375 - 560	1.80

Apply test force  $f$  to the belt in the middle of the axis distance between belt pulleys  $e$ . The test force must be applied vertically to the run.

Pretension the belt to the calculated impression depth  $E_a$ .



### 8.3.12 Replacing the belt pulley

#### Disassembling the belt pulley



*Depending on the size, the clamping bushes have one or two pusher holes (half thread).*

- 1.** ➤ Loosen all screws. Depending on the bushing size, unscrew one or two screws completely.
- 2.** ➤ Lightly oil the screw thread.
- 3.** ➤ Screw the screws into the pusher holes and tighten them evenly.
  - ⇒ The bushing is released from the hub and the belt pulley can be moved freely on the shaft.
- 4.** ➤ Remove the belt pulley and bushing from the shaft.

#### Installing the belt pulley

- 1.** ➤ Clean and degrease all uncoated surfaces:
  - Shaft
  - Bore and conical surface of the taper clamping bush
  - The taper bore of the belt pulley
- 2.** ➤ Insert the taper clamping bush into the hub and align all connection holes (half threaded holes of the hub must be opposite half blind holes of the bushing).
- 3.** ➤ Lightly oil the screws and screw them into the fastening holes. Do not yet tighten the screws.
- 4.** ➤ Place the feather key in the groove on the shaft. There must be clearance between the feather key and the groove.
- 5.** ➤ Push the belt pulley with taper clamping bush onto the shaft until it is in the desired position.

The maximum permissible belt pulley offset is 0.5 mm.

## Maintenance

Maintenance work > Checking the belt guard

6. ➤



### NOTICE!

Observe the tightening torques.

Tighten the screws evenly.

Bushing type	Screw tightening torque [Nm]	Screws Quantity
1,210	17	2
1,610	17	2
2012	26	2
2,517	41	2
3,020	77	2
3,535	95	3
4,040	145	3
4,545	163	3
5,050	230	3

7. ➤ After a brief period of operation ( $\frac{1}{2}$  to 1 hour), check and correct the tightening torque of the screws.

8. ➤ Fill the empty connection holes with grease.

⇒ This prevents any penetration by foreign bodies.

### 8.3.13 Checking the belt guard

#### Damage and fastening

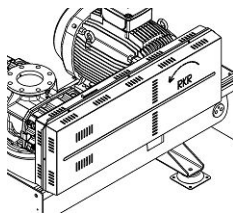


Fig. 54: Belt guard

1. ➤



### WARNING!

Risk of burns due to hot surfaces!

Check for damage and complete fastening.

2. ➤ Remove dirt from the belt guard.

3. ➤ If necessary, tighten the belt guard fastener.

⇒ If damaged, replace it. Contact customer service.

### 8.3.14 Checking the safety valve

#### Movement test

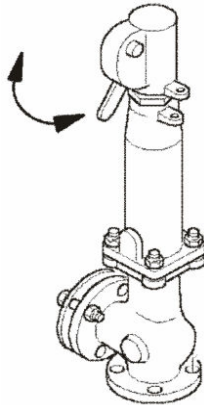


Fig. 55: safety valve

1. ➤



*The safety valves are set at the factory. Their settings must not be changed.*



#### **WARNING!**

In the operating position, an open valve can cause hot conveyed material to escape.

Turn the activation lever.

2. ➤

Move the activation lever back to its original position.

⇒ The valve is closed.

An intact valve can be opened and closed normally.

3. ➤

Check the seals and seal positions.

### 8.3.15 Draining the condensate



#### **Condensate drain (optional)**

*Depending on the scope of delivery, condensate is conveyed outwards via lines, collected, and drained via a condensate drain (optional).*



#### **DANGER!**

##### **Danger from escaping residual gases!**

Opening pipes and screw connections can allow gas to escape freely into the atmosphere, potentially leading to suffocation.

- Minimise residual gases as much as possible.
- Ventilate the work environment properly.

1. ➤

Switch off the machine and secure it against a restart.

2. ➤

Close the shut-off valves in the conveying lines on the system side.

3. ➤

De-pressurise the machine.

4. ➤

Ensure that there are no hazardous or potentially explosive gases in the machine. If necessary, render the machine inert.

## Maintenance

Maintenance work > Checking the non-return flap

5. ➤



*The precise position of the condensate drains is specified in the installation diagram.*



### **DANGER!**

Risk of injury from irritant condensate.

Drain any accumulation of condensate and collect it in a suitable container.

6. ➤

Seal the condensate drain.

Depending on the type and circumference of the condensate drain, ensure that suitable sealing materials are used.

7. ➤



### **ENVIRONMENT!**

The condensate may contain substances that are harmful to the environment.

Dispose of condensate in an environmentally sound manner.

### 8.3.16 Checking the non-return flap

#### Checking for correct operation and wear

1. ➤ Switch off the machine stage in the operating position.

2. ➤ Observe the machine's shut-down process until it is idle.

⇒ After a shutdown, the machine stage rotates backwards for a longer period = the non-return flap is faulty.

#### For tightness

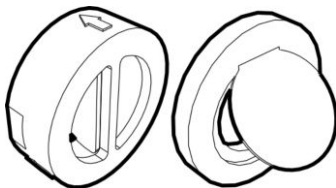


Fig. 56: Example of non-return flaps

1. ➤ Check for external tightness.

2. ➤ Carry out a visual inspection.

3. ➤ If there is no visible damage:

⇒ The non-return flap is OK.

4. ➤ If there is visible damage:

⇒ Replace the non-return flap

### 8.3.17 Checking the expansion joint

#### For damage

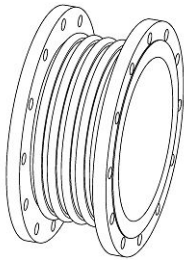


Fig. 57: Corrugated-pipe compensator

The compensator bellows must be free to ensure the compensator function.

1. ➤ Remove foreign bodies and coarse contamination from the compensator.
2. ➤ If heavily contaminated: Clean the metal bellows. Use only cleaning agents approved for stainless steel.
3. ➤ Carry out a thorough visual inspection.
4. ➤ If there are visible cracks, corrosion, discolouration or irregular deformations  
⇒ Replace the compensator.
5. ➤ If there is no discernible visible damage or contamination  
⇒ Compensator is OK.

### 8.3.18 Checking the acoustic hood

#### Damage

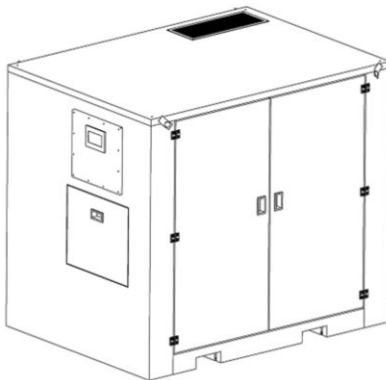


Fig. 58: Acoustic hood

1. ➤ Remove foreign bodies and impurities from the acoustic hood.
2. ➤ Check the acoustic hood for obvious damage or missing parts (visual inspection).
3. ➤ Replace damaged signs or stickers immediately.
4. ➤ Replace missing fastening material.
5. ➤ If the acoustic hood is leaking:  
⇒ Replace the seals.

#### 8.3.18.1 Checking the openings of the acoustic hood

##### Checking the supply and exhaust air openings

1. ➤ Perform a visual inspection of the supply air and exhaust air openings on the acoustic hood.
2. ➤ Clean the openings. Remove dirt.

## Maintenance

Maintenance work > Checking the fan

### 8.3.19 Checking the fan

#### Checking the fan for correct operation

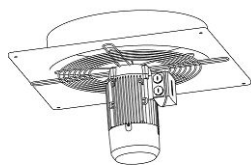




Fig. 59: Fan


1.  *Observe the ventilation openings of the acoustic hood as per the installation drawing.*
2. Check that the fan is running properly and is free of friction.
3. Check the direction of flow in the operating position with the acoustic hood closed.  
If exhaust air is discharged from the acoustic hood, the check is complete.  
⇒ The acoustic hood fan is operating correctly.
4. If no exhaust air emerges from the acoustic hood:
  - The fan's direction of rotation is incorrect. Correct the fan's direction of rotation. ↪ 8.3.19.1 'Correcting the fan's direction of rotation' on page 166
  - The fan is faulty. Replace the fan. ↪ 8.3.19.2 'Replacing the fan' on page 167

#### Cleaning the fan

1.  **DANGER!**  
Risk of injury from electric current!  
  
Ensure there is no live current.
2. Remove the deposits from the protective guard, housing, and motor.
3. If necessary, clean the impeller using suitable means. Dirt deposits on one side will cause unbalance.

#### 8.3.19.1 Correcting the fan's direction of rotation

##### Correcting the fan's direction of rotation

1.  **DANGER!**  
Risk of fatal injury from electric current!  
  
Open the terminal box of the fan motor.
2. Replace the connection cable in the terminal box.
3. Close the terminal box.

4. ➡ Check the direction of flow during machine operation.

### 8.3.19.2 Replacing the fan

#### Replacing the fan

1. ➡



**DANGER!**

Risk of fatal injury from electric current!

Disassemble the fan's electrical connection.

2. ➡



**WARNING!**

Risk of injury from rotating components!

Loosen the fastening screws on the fan.

3. ➡

Replace the fan.

4. ➡

Use fastening screws to install the fan.

5. ➡



**DANGER!**

Risk of fatal injury from electric current!

Establish an electrical connection.

6. ➡

Check the cooling air flow during machine operation.

### 8.3.20 Replacing the seal

#### Replacing the flange seal



*Ensure that the pipes are depressurised.*

1. ➡

Reinforce the pipes if necessary.

2. ➡

Undo any flange connections that are leaking.

3. ➡

Clean the flanges' sealing surfaces.

## Maintenance

Maintenance work > Checking the drive motor's direction of rotation

4. ➤



### CAUTION!

The seals must be suitable for the conveyed medium and the occurring temperatures. Only use seals that are in perfect technical condition.

Make sure that the seal is centrally seated.

Insert a new suitable flange seal.

5. ➤

Install the flange connection without tension.

Bolt all flange connections, using a suitable tightening procedure in accordance with good engineering practice.

6. ➤

Check that the flanges are parallel. Make corrections if necessary.

### 8.3.21 Checking the drive motor's direction of rotation

Checking the drive motor's direction of rotation

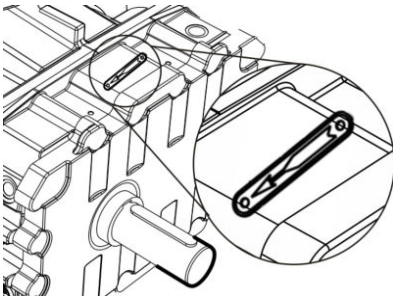


Fig. 60: Direction of rotation

1. ➤



### WARNING!

Risk of injury from rotating components!



### NOTICE!

Risk of machine damage due to incorrect direction of rotation!

Check the direction of rotation **without belts** in place.

Remove the cover from the belt guard.

2. ➤

Loosen the belt.

3. ➤

Observe the direction of rotation marking on the machine stage.

4. ➤

Ensure that the machine stage's shaft can be turned by hand without effort.

5. ➤

Start the drive motor briefly (approx. 1 to 2 seconds).

6. ➤

From the viewing position, the drive motor rotates to the left in front of the drive shaft.

⇒ Direction of rotation is correct ⇒ continue initial commissioning.

7. ➤

From the viewing position, the drive motor rotates to the right in front of the drive shaft.

⇒ Direction of rotation is incorrect ⇒ correct the electrical connection.



8. ➤ Fit the belt.
9. ➤ Attach the cover to the belt guard.

## 8.4 Cleaning after maintenance

### Cleaning after maintenance work

1. ➤



#### NOTICE!

Risk of damage! Do not use high-pressure cleaners, steam jet pumps, grease removal agents, thinners, compressed air etc. as cleaning methods.

2. ➤ Remove dust and dirt by cleaning thoroughly with a suitable cloth.
3. ➤ Clean components susceptible to scratches, display units such as the touch panel of the control system, gauges etc. with a soft, wet cloth.
4. ➤ Remove all cleaning agents from the immediate vicinity of the machine before commissioning.
5. ➤ Dispose of cloths in an environmentally-friendly way.

## 8.5 Commissioning after maintenance

### Commissioning after maintenance

1. ➤ Inform the person responsible at the operating site about the result of the work carried out and coordinate the commissioning steps with that person.
2. ➤ Check all previously loosened screw connections for tightness.
3. ➤ Properly install all previously loosened or disassembled assemblies and accessories.
4. ➤ Install all previously removed protective devices and protective covers.
5. ➤ Remove all used tools, materials, and other equipment from the workspace.
6. ➤ Clean the workspace. Remove equipment, operating materials, processing material or similar materials and dispose of them appropriately.
7. ➤ Ensure that there are no persons in the hazard area.
8. ➤ Render the machine inert.
9. ➤ Carry out a leakage test in accordance with statutory provisions.
10. ➤ Release the main circuit breaker and activate it.
11. ➤ Release the EMERGENCY STOP function.
12. ➤ Start the machine as per the instructions in the "Operation" chapter. ➤ 7.4 'Switching on' on page 131

## Maintenance

### Checks after maintenance

- 13.** ► Inform the person responsible at the operating site about the result of the work carried out.

## 8.6 Checks after maintenance

Interval	Check
during commissioning	Check that the machine is running smoothly. Check and document the operating parameters.
After the first 3 op. hrs	Check the oil level. If necessary, correct it. If included in the scope of delivery: Check the safety valve for correct operation.  Check the conveying system for tightness. Rectify any leaks.
After the first 25 op. hrs	Check the oil level. If necessary, correct it. Check the belt tension. Tighten if necessary. Check the alignment of the belt pulleys. If necessary, correct it.
<b>op. hrs = operating hours</b>	

## 9 Faults

The following chapters describe possible causes of faults and steps to be taken to rectify them.

If faults cannot be rectified using the following instructions, contact the manufacturer.

### 9.1 Safety instructions

#### Improper fault rectification

**WARNING!****Risk of injury from improper operation fault rectification!**

Improper fault rectification may lead to serious personal or material damage.

- Only perform fault rectification work when the machine has been switched off.
- Secure the machine against a restart.
- Allow the machine to cool down to the ambient temperature.
- Before beginning work, ensure that there is sufficient space for installation work.
- Keep the workspace tidy and clean.
- Only attempt to rectify faults with suitable tools.
- Ensure removed components are re-installed correctly.
- Re-install all fastening elements and observe the screw tightening torques.
- Check the following before a restart:
  - All safety and protective equipment is installed and functioning correctly.
  - No persons are located in the hazard area.

#### Fault rectification when the machine is in operation

**WARNING!****Risk of injury from fault rectification while the machine is currently in operation!**

Performing fault rectification during operation of the machine can lead to serious or fatal injuries.

- Always shut down the machine to search for a fault and never start up the machine to detect a fault!
- Never operate or start up the machine for fault rectification!
- Never operate or start up the machine with disassembled assemblies and accessories!

## Faults

Safety instructions

### Electrical system



#### **DANGER!**

##### **Risk of fatal injury from electric current!**

There is a risk of fatal injury from touching live components. Live electrical components may make uncontrolled movements and cause extremely serious injury.

- Before beginning work, switch off the electric power supply and secure it against restarting.

### Medium and high voltage applications



#### **DANGER!**

##### **Risk of fatal injury from improper handling for medium or high-voltage applications!**

Medium and high-voltage applications represent a particular risk. In some circumstances, excessive proximity to energised components can lead to a fatal electric shock.

- Work on the electrical system should only be carried out by qualified electrical personnel with special expertise in the handling of medium and high-voltage equipment.

### Securing the machine against restarting



#### **WARNING!**

##### **An unauthorised or unregulated restart can have fatal consequences.**

An unauthorised or unregulated restart of the machine can lead to serious or fatal injuries. There may be people in the hazard area.

- Before beginning work, switch off the power supply, secure it against a restart, and ensure a de-energised state.

## Explosion protection



### **WARNING!**

#### **Risk of explosion when rectifying faults!**

The entrance of ignition sources such as sparks, open flames and hot surfaces can lead to explosions in the Ex zone.

- Obtain written approval before beginning work.
- Only carry out work if there is no atmospheric risk of explosion.
- Only use tools that are approved for use in the hazard area.

Failure to comply with these instructions will result in the loss of the explosion protection.

## Explosion protection and fire protection



### **DANGER!**

#### **Risk from explosion and fire when rectifying faults!**

The entrance of ignition sources such as sparks, open flames and hot surfaces can lead to explosions in the machine area.

- Obtain written approval before beginning work.
- Only carry out work if there is no atmospheric risk of explosion.
- Completely relieve the pressure on pressurised components and clean with neutral gas.
- Ventilate the installation site properly.

## Protection against escaping gas



### **DANGER!**

#### **Risk of fatal injury during fault rectification!**

The entrance of ignition sources such as sparks, open flames and hot surfaces can lead to explosions in the machine area.

- Before entering the acoustic hood, open the elements and ventilate the interior.
- Obtain written approval and ventilate the installation room before beginning work.
- Only carry out work under a responsible supervisory person.
- Only carry out work to rectify faults if there is no atmospheric risk of explosion.
- Only use tools that are approved for use in the area.

## Faults

Safety instructions

### Requirements for personnel

The fault rectification work described here may only be performed by the designated personnel. The personnel entrusted with the respective troubleshooting tasks are listed in the table of fault descriptions in addition to their designated tasks.

Requirements in the event of faults and for preparations for fault rectification work:

- Personnel:
- Authorised electricians
  - Service personnel

For commissioning after rectification of a malfunction, the following is necessary:

- Personnel:
- Authorised electricians
  - Service personnel

- Personnel:
- Gas specialists

### Requirements for personnel

The following tasks require additional "explosion protection" qualifications:

- All work on equipment with ATEX marking.
- All work in zones with ATEX marking.

- Personnel:
- Additional qualification for explosion protection

### Requirements for personnel

Behaviour in the event of malfunctions and for preparations for fault rectification work: for components used in medium or high-voltage applications, the following is necessary:

- Personnel:
- Authorised electricians for medium or high voltage applications

### Requirements for personnel

Use of medium/high voltage-carrying components: for commissioning after rectification of a malfunction, the following is necessary:

- Personnel:
- Authorised electricians for medium or high voltage applications

### Protective equipment

Fault rectification work requires the following:

- Protective equipment:
- Protective work clothing (7010-M010)
  - Protective gloves (7010-M009)
  - Safety shoes (7010-M008)

## ATEX application

Protective equipment:

- Antistatic protective work clothing for ATEX applications
- Conductive footwear and antistatic clothing (7010-M032)

## Special tools

For fault rectification work the following is necessary:


Tool:

- General tools
- Tools for authorised electricians
- General measurement tools and equipment

Tool:

- Locking key

Tool:

-  ATEX – non-sparking tools and measuring equipment

## 9.2 Preparing for fault rectification

### Preparing for fault rectification

1. ➤ Agree fault rectification work with the person responsible at the operating site.
  2. ➤ Switch off the machine and secure it against a restart, if necessary.
  3. ➤ Close the shut-off valves in the conveying lines on the system side.
  4. ➤ If necessary, render the machine inert.
  5. ➤ Allow the machine to cool down to ambient temperature.
- ⇒ The fault can be rectified.

## 9.3 Fault displays

### Customer-installed control element

Depending on the customer's control system, additional fault messages can be recorded and displayed.

## 9.4 Fault diagnosis and rectification

If one of the specified causes occurs and it can only be rectified by the manufacturer, contact customer service immediately.

Please contact customer service should you have any questions about fault diagnosis and troubleshooting.

## Faults

Fault diagnosis and rectification

Fault description	Cause	Remedy	Personnel
<i>Abnormal running sounds.</i>	Bearing damage.	Replace the bearings.	Manufacturer's customer service division
	Foreign bodies in gear wheels.	Check the gear wheels and repair the damaged area. Replace if necessary.	Manufacturer's customer service division
	Rotary pistons start up.	Check the machine stage. Replace the components.	Manufacturer's customer service division
	Belt pulleys are not aligned properly.	Checking the alignment Correct if necessary.	Service personnel
<i>Temperature too high.</i>	Starting strainer is dirty.	Clean the starting strainer.	Service personnel
	Ambient temperature too high.	Ensure that there is sufficient ventilation and air extraction.	User
	Openings of the acoustic hood for supply air or exhaust air are contaminated.	Clean the openings.	User
	Incorrect direction of rotation of the fan.	Correct the direction of rotation.	Service personnel
	The acoustic hood fan is faulty.	Replace the fan.	Service personnel
	The permissible operating data has been exceeded.	Check the operating data and comply with correct data.	User
	The temperature measurement device is faulty.	Replace the measurement device.	Service personnel
	Deterioration of volumetric efficiency due to increase in play.	Check the components.	Manufacturer's customer service division
<i>Lube oil in the conveyed medium.</i>	Wear and tear on seals.	Replace the seals of the machine stage.	Manufacturer's customer service division
	Oil level too high.	Correct the oil level.	Service personnel
<i>Intake volume is too low.</i>	Starting strainer is dirty.	Clean the starting strainer.	Service personnel
	Intake-side conveying system is leaking.	Locate and rectify the leaks.	Service personnel
<i>Delivery rate too low.</i>	Operating pressure too high.	Check the system.	Service personnel
	Conveying system is leaking.	Locate and rectify the leaks.	Service personnel



Fault description	Cause	Remedy	Personnel
<i>Delivery rate too low.</i>	Internal losses too high due to corrosion or erosion.	Check the components.	Manufacturer's customer service division
	Machine dimensioned incorrectly.	Compare with the performance data sheet.	Service personnel Manufacturer's customer service division
<i>The motor requires too much power.</i>	The operating data differs from the order data.	Check the operating data and comply with correct data.	User
	Mechanical damage.	Replace faulty components.	Service personnel
	Operating pressure too high.	Check the system.	Service personnel
	Drop in grid voltage.	Check the grid voltage.	Service personnel
<i>Belts are vibrating.</i>	Wear and tear on belts.	Replace the belt.	Service personnel
	Belt pulleys are not aligned properly.	Correct the alignment.	Service personnel
<i>Machine runs in reverse after being shut down.</i>	Non-return flap is leaking or faulty.	Replace the non-return flap.	Service personnel
	System-side shut-off device not active or not in place.	Install and activate the shut-off device.	Service personnel
<i>Intake pressure too high.</i>	Starting strainer is dirty.	Clean the starting strainer.	Service personnel
	System-side shut-off device in the intake line is partially or fully closed.	Check and open the shut-off device.	Service personnel
	Blank installed.	Remove the blank.	Service personnel
	Measurement device for intake pressure is faulty.	Replace the measurement device.	Service personnel
<i>Discharge pressure too high.</i>	Operating pressure too high.	Check operating data, comply with correct data.	Service personnel
	System-side shut-off device in the pressure line is partially or fully closed.	Check and open the shut-off device.	Service personnel
	Blank installed.	Remove the blank.	Service personnel
	Measurement device for discharge pressure is faulty.	Replace the measurement device.	Service personnel
<i>Oil temperature too high.</i>	Oil level too high.	Correct the oil level.	Service personnel
<i>The machine stage is leaking. Lube oil is seeping out.</i>	The screw connections of the oil system are loose.	Tighten or replace the screw connections.	Service personnel

## Faults

Commissioning after malfunction rectification

Fault description	Cause	Remedy	Personnel
<i>The machine stage is leaking. Lube oil is seeping out.</i>	The oil chamber seal is faulty.	Replace the seals of the machine stage.	Manufacturer's customer service division
<i>Heavy vibrations.</i>	Bearing damage.	Replace the bearings.	Manufacturer's customer service division
	Machine feet faulty.	Replace the components.	Service personnel

## 9.5 Supplier status and fault messages

### Suppliers



*A detailed explanation of status and fault messages can be found in the separate instruction manual*

### Control system fault message

Depending on the customer's control system, additional fault messages can be recorded and displayed.

## 9.6 Commissioning after malfunction rectification

### Commissioning after fault rectification

1. ► Inform the person responsible at the operating site about the result of the work carried out and coordinate the commissioning steps with that person.
2. ► Check all previously loosened screw connections for tightness.
3. ► Properly install all previously loosened or disassembled assemblies and accessories.
4. ► Install all previously removed protective devices and protective covers.
5. ► Remove all used tools, materials, and other equipment from the workspace.
6. ► Clean the workspace. Remove equipment, operating materials, processing material or similar materials and dispose of them appropriately.
7. ► Carry out a leakage test, if necessary.
8. ► If necessary, render the machine inert.
9. ► Ensure that there are no persons in the hazard area.
10. ► Release the main circuit breaker and activate it.
11. ► Release the EMERGENCY STOP function.
12. ► Acknowledge the fault in the control system.

- 13.** Depending on the scope of fault rectification, put the machine into operation as per the instructions in the “Commissioning” or “Operation” chapter.

## 9.7 Checks after fault rectification

Interval	Check
during commissioning	Check that the machine is running smoothly. Check and document the operating parameters.
After the first 3 op. hrs	Check the oil level. If necessary, correct it. If included in the scope of delivery: Check the safety valve for correct operation.  Check the conveying system for tightness. Rectify any leaks.
After the first 25 op. hrs	Check the oil level. If necessary, correct it. Check the belt tension. Tighten if necessary. Check the alignment of the belt pulleys. If necessary, correct it.
<b>op. hrs = operating hours</b>	

## Faults

Checks after fault rectification

## 10 Disassembly and disposal

Once the machine's service life is over, it must be disassembled and disposed of in an environmentally-friendly way. The following is a set of recommendations for environmentally-friendly disposal.

### 10.1 Safety instructions

#### Improper disassembly



##### **WARNING!**

##### **Risk of injury from improper disassembly!**

Stored residual energy, sharp components, edges and corners on or in the machine or on the necessary tools can cause injury.

- Before beginning work, ensure there is sufficient space.
- Allow the machine to cool down to the ambient temperature.
- Proceed with caution when working with open, sharp-edged components.
- Keep the workspace tidy and clean. Components and tools that are loosely stacked or lying around can cause accidents.
- Disassemble components correctly. Take into consideration the weight of each component. If necessary, use hoist gear.
- Secure components, so they do not topple or fall.
- If in doubt, contact the manufacturer.

#### Residual gas



##### **DANGER!**

##### **Risk of explosion from potentially explosive atmospheres!**

Residual media that escapes from the machine's interior can lead to an explosion.

- Render the machine inert before disassembly.
- Using a gas meter, ensure that the atmosphere is not potentially explosive.

## Disassembly and disposal

Safety instructions

### Electric current



#### **DANGER!**

##### **Risk of fatal injury from electric current!**

Disassembly of live components can cause serious or fatal injury.

- Switch off the power to the operating cable.
- Check there is no live current.

### Risks from medium and high voltage applications



#### **DANGER!**

##### **Risk of fatal injury from improper handling for medium or high-voltage applications!**

Medium and high-voltage applications represent a particular risk. In some circumstances, excessive proximity to energised components can lead to a fatal electric shock.

- Work on the electrical system should only be carried out by qualified electrical personnel with special expertise in the handling of medium and high-voltage equipment.

### Disassembling the delivery line



#### **WARNING!**

##### **Risk of injury from compressed conveyed materials!**

For the disassembly of pressurised components such as pipes, containers, hoses or valves, hot conveying material escapes with a strong gas flow. This can result in serious injury.

- Before beginning work, fully relieve pressurised components of pressure.
- Check that components are not pressurised.
- Only disassemble pressurised components when they are not under pressure.

### Potentially explosive gases



#### **DANGER!**

#### **Risk of explosion and injury during disassembly!**

During the disassembly of the machine and system piping, a potentially explosive atmosphere may arise due to escaping medium. Ignition sources lead to serious explosions. The conveyed medium is released under the emission of noise.

This results in serious injuries.

- Only carry out work under the guidance of a supervisory person.
- Relieve the pressure from the machine and system piping before the disassembly and flush with neutral gas.
- Discharge the escaping gas in a safe manner.  
Safe: no ignition sources in the areas of fire and explosion hazards; sufficiently ground the metallic outlet nozzles.
- Create a depressurised state and check it.
- Make a record of the disassembly work after approval measurement by the operator.
- Ventilate the disassembly site properly.

### Personnel requirements

Requirements for disassembly:

Disassembly of electrical components

Personnel: ■ Authorised electricians

Disassembly of frequency converter

Disassembly of components for medium- or high-voltage applications

Personnel: ■ Authorised electricians for medium or high voltage applications

Disassembly of mechanical components

Personnel: ■ Service personnel

Disassembly of gas technology components:

Personnel: ■ Supervisor  
■ Gas specialists  
■ Authorised electricians  
■ Service personnel

## Disassembly and disposal

Safety instructions

### Requirements for personnel

The following tasks require additional "explosion protection" qualifications:

- All work on equipment with ATEX marking.
- All work in zones with ATEX marking.

Personnel:                    ■ Additional qualification for explosion protection

### Requirements for personnel

Disassembly of components for medium or high-voltage applications.

Personnel:                    ■ Authorised electricians for medium or high voltage applications

### Protective equipment

Disassembly requirements:

Protective equipment:    ■ Protective work clothing (7010-M010)  
                                       ■ Safety shoes (7010-M008)  
                                       ■ Hearing protection (7010-M003)  
                                       ■ Protective gloves (7010-M009)  
                                       ■ Safety goggles (7010-M004)  
                                       ■ Industrial hard hat (7010-M014)

### ATEX application


Protective equipment:    ■ Antistatic protective work clothing for ATEX applications  
                                       ■ Conductive footwear and antistatic clothing (7010-M032)

### Special tools

Requirements for disassembly:

Tool:                            ■ General tools  
                                       ■ Tools for authorised electricians  
                                       ■ Auxiliary materials, tools  
                                       ■ Lifting equipment  
                                       ■ Transport equipment

Tool:                            ■ Locking key

Tool:                            ■  ATEX – non-sparking tools and measuring equipment

Tool:                            ■ Gas specialist tools



### 10.2 Disassembly

#### Preparing for disassembly:

1. ➤ Immediately inform the responsible staff on location about the disassembly.
2. ➤ Switch off the machine and secure it against a restart.
3. ➤ Seal off the pressure line and remove it.
4. ➤ Physically separate the entire electric power supply from the machine. Release stored residual energy.
5. ➤ If necessary, disconnect the machine control system from a connected process control system.
6. ➤ Remove the operating, auxiliary and residual processing materials, and dispose of them in an environmentally friendly way.
7. ➤ Clean the assemblies and components properly. Disassemble them in accordance with the local regulations for occupational safety and environmental protection.
8. ➤ Remove the machine's anchor bolts.
9. ➤ During disassembly, there should be a general sorting of parts according to disposal categories. ➤ 10.3 'Disposal' on page 185

### 10.3 Disposal

The machine is composed primarily of steel, casting material and various non-ferrous metals. In general, metallic materials are fully recyclable.

#### Proper disposal

In as far as no agreement has been made on the return or disposal of the machine, send dismantled components for recycling:

- Scrap metals.
- Send plastics for recycling.
- Sort and dispose of other components according to material composition.

#### Improper disposal



#### ENVIRONMENT!

##### Environmental risk from improper disposal!

Improper disposal can present a risk to the environment.

- Have insulating material, electronic waste, electronic components, auxiliary materials and chemicals disposed of by a professional waste disposal company.
- If in doubt, contact the local authorities or specialist companies for information on environmentally-friendly waste disposal.

## Disassembly and disposal

Disposal

### Oil and lubricants



#### ENVIRONMENT!

##### Environmental risk from oil!

The improper disposal of oil and lubricants can present a risk to the environment.

- Collect oil carefully, store it and dispose of it properly or recycle it.
- If in doubt, contact the local authorities or specialist waste disposal companies for information on environmentally-friendly waste disposal.

### Disposal of accessories

#### Motor

- For safety reasons, disposal may only be performed by specialists for industrial waste or, alternatively, it can be returned to the manufacturer.
- The encoder electronics are electronic waste.

#### Frequency converter



#### DANGER!

Hazard if the capacitor explodes and forms poisonous gases!

- For safety reasons, disposal may only be performed by specialists for industrial waste or, alternatively, it can be returned to the manufacturer.
- The encoder electronics are electronic waste.

### Requirements for staff

Disposal requirements:

Personnel: ■ Skilled staff for industrial waste

### Protective equipment

Disposal requirements:

Protective equipment: ■ Protective work clothing (7010-M010)  
 ■ Safety shoes (7010-M008)  
 ■ Hearing protection (7010-M003)  
 ■ Protective gloves (7010-M009)  
 ■ Safety goggles (7010-M004)  
 ■ Industrial hard hat (7010-M014)

### Special tools

Disposal requirements:

Tool: ■ Lifting equipment

### Categories for sorting

Scrap iron	Non-ferrous metal (except for scrap iron)	Insulation material	Electronic waste (encoder electronics)	Auxiliary materials and chemicals
<b>Scrap</b> <ul style="list-style-type: none"> <li>■ Scrap steel</li> <li>■ Foundry scrap</li> <li>■ Scrap from non-rusting steels</li> <li>■ Stainless steel scrap</li> </ul>	Aluminium	Various isolators (in terminal boxes)	Electrical tools	Lube and gear oils Grease
<b>Used metal/2A materials</b> <ul style="list-style-type: none"> <li>■ Steel beams</li> <li>■ Steel sheets</li> </ul>	Copper	Voltage and current transformers	Measurement, control and regulatory systems	Cleaning agents and solvents
<b>Machines made of metal</b> <ul style="list-style-type: none"> <li>■ Without electronics</li> </ul>	Brass	Power cables and leads		Paint residue
	Motor windings	Instrument wiring		Anti-corrosion agents
		Surge arresters		Cloths (soaked in agents or chemicals)
		Heat insulation materials		Batteries from the control system
<b>This does not include:</b> <ul style="list-style-type: none"> <li>■ Hazardous adhesions</li> <li>■ Sealed hollow parts (due to danger of deflagration or hazardous contents)</li> </ul>	<b>Valve disposal</b> <ul style="list-style-type: none"> <li>■ Remove the medium before disposal! Neutralise residual medium in the valves.</li> </ul>		<b>This does not include:</b> <ul style="list-style-type: none"> <li>■ PCB capacitors</li> </ul>	<ul style="list-style-type: none"> <li>■ Solvents, cleaning agents and paint residue must not be allowed to mix!</li> <li>■ Sort oils separately according to emulsions and solvents.</li> <li>■ Agents and chemicals must be collected in separate, labelled containers.</li> </ul>

## Disassembly and disposal

Disposal

## 11 Technical data

### 11.1 Dimensions and weights

#### General information

Exact details on dimensions and weights can be found in the following documents:

- Installation diagram
- Manufacturer's documentation for the individual components

Information on weight can be found on the packing note and the designation on the rating plate.

Dimensions including the packaging are included in the forwarding order.

### 11.2 Dimension specifications sheet

An accompanying dimension specifications sheet/installation drawing is provided with the product documentation.

These documents contain important dimensions for installation and set-up.

### 11.3 Operating data

See the machine's performance data sheet for the operating data.

The performance data sheet is provided with the product documentation.

### 11.4 Technical performance data

#### Operating and application limits

Exact details can be found on the performance data sheet.

#### Environmental limits

Data	Value	Unit
Temperature range Equipment without heater	0 to +40	°C
Temperature range Equipment with heater	-20 to +40	°C
Relative humidity	0 to 80	%
Chemical-free atmosphere		

Deviating environmental limits as per project-specific design.

## Technical data

Rating plate(s) and their locations

### Environmental limits for storage

Refer to the chapter on storage for details of the environmental limits in relation to storage.

### Maximum installation elevation

Data	Value	Unit
Maximum installation elevation above NN*	1,000	m

\*If installed at a different elevation, observe the order-specific performance data sheet.

### Operating period

Data	Value	Unit
Maximum operating period per day	24	h
Break until next operation	/	h

## 11.5 Conveyed medium requirements

### Conveyed medium

Before entering the machine stage, the conveyed medium must be pre-filtered at least to filter class ISO Coarse 60 to 85% as per DIN EN ISO 16890-1:2017-08.

The purity of the conveyed medium is ensured depending on the version and scope of delivery of the machine (e.g. via the proper use of a filter cartridge for atmospheric intake).

The purity of the conveyed medium must be ensured by on-site measures if no suitable filter is included in the scope of delivery.

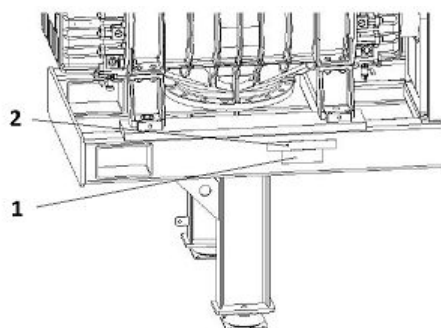
The starting strainer does not ensure the purity grade.

## 11.6 Rating plate(s) and their locations

### Placement on the machine

The machine's rating plate is on the operating side of the machine.

The ATEX marking is located near the rating plate on the machine.



- 1 Machine rating plate
- 2 ATEX marking



*The exact position is shown in the installation diagram.*

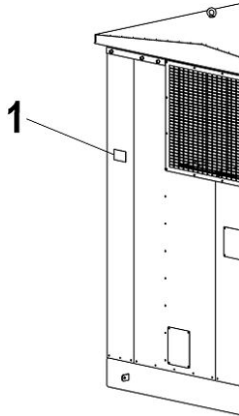
Fig. 61: Example: base frame signage

### Placement on the machine

The machine's rating plate is on the operating side of the machine.  
The ATEX marking is located near the rating plate on the machine and/or on the acoustic hood.



*The exact position is shown in the installation diagram.*



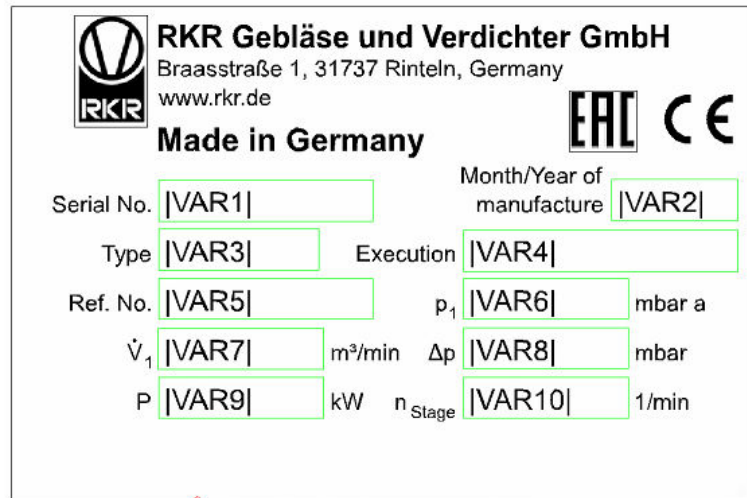
- 1 Machine rating plate
- 2 ATEX marking

*Fig. 62: Example: acoustic hood signage*

## Technical data

Rating plate(s) and their locations

### Machine rating plate



**RKR Gebläse und Verdichter GmbH**  
Braasstraße 1, 31737 Rinteln, Germany  
www.rkr.de

**Made in Germany**

Serial No. [VAR1] Month/Year of manufacture [VAR2]

Type [VAR3] Execution [VAR4]

Ref. No. [VAR5] p<sub>1</sub> [VAR6] mbar a

$\dot{V}_1$  [VAR7] m<sup>3</sup>/min  $\Delta p$  [VAR8] mbar

P [VAR9] kW n<sub>Stage</sub> [VAR10] 1/min

Fig. 63: Machine rating plate

- Manufacturer, address
- VAR1 Serial number
- VAR2 Month / year of manufacture
- VAR3 Machine type
- VAR4 Version
- VAR5 Order number
- VAR6 p<sub>1</sub> Inlet pressure (absolute)
- VAR7 V<sub>1</sub> Intake flow rate
- VAR8  $\Delta p$  Pressure increase
- VAR9 P Coupling performance  
(the power consumed by the machine stage)
- VAR10 n<sub>Stage</sub> Machine stage speed

### Type designation

The type designation is derived from the following table:

Tab. 4: Explanation using example: **F10D3**

Designation	Explanation	Details
F	Series	Rotary piston blower For gases of Fluid Group 1
10	Machine stage size	
D	Drive type	D = direct drive R = belt drive
3	Base support/base frame size	

### Component type plates

The position and information on the component type plates can be found in the respective manufacturer's documentation.



## 11.7 Noise emissions

### Noise emission data

See the machine's performance data sheet for specific details.

This information was determined in accordance with the performance data.

No-load operation or operation below the maximum performance values reduces noise emissions.

Machines without an acoustic hood have considerably higher noise emissions. Observe the measures for emission reduction.

🔗 5.2 'Requirements for the installation site' on page 104

### Measurement requirements

- applied basic standard DIN EN ISO 2151
- measured according to basic standard DIN EN ISO 3744
- with acoustic hood
- connected, insulated pipelines
- Tolerance:  $\pm 2$  dB(A)

## 11.8 Operating materials

### 11.8.1 Lube oil

#### Oil specification

- The oil used must be a synthetic polyalphaolefin-based (PAO) gear oil as per DIN 51517 -3:2018 (Lubricants - Lubricating oils - Part 3: Lubricating oils CLP, Minimum Requirements).
- ISO 220 = ISO-VG (International Organization for Standardization - Viscosity Grade) as per DIN ISO 3448:2010-02.

#### ISO VG 220

#### Fully synthetic polyalphaolefin (PAO), gear oil

Example: MOBIL SHC 630

#### 11.8.1.1 Change of oil type



#### NOTICE!

Alternative lube oils must be agreed with the manufacturer.

In general, different lube oils should not be mixed with each other. This applies even if the lube oils are compatible with each other as per the manufacturer's product data sheets. Mixing lube oils – even leaving small residual quantities – can adversely alter the properties of the lube oil.

## Technical data

Operating materials > Lube oil

### Measures

To preserve the working properties of the new lube oil, the lube oil that is replaced should be drained completely. After an operating time of 100 hours, the lube oil and the oil filter (if any) must be replaced once. Only lube oil of the same type should be used for topping up.

### Polyglycol-based lube oil



#### NOTICE!

Polyglycol-based lube oils cannot be mixed with any other lube oils. Even the smallest quantities of other lube oils will lead to a considerable adverse effect on the working properties in the short term.

Extended measures are recommended for the changeover after consultation with the manufacturer.

### 11.8.1.2 Lubricant filling quantities

#### Machine lube oil quantity



*The following specifications for lube oil quantities are guideline values. The main factor in determining the oil fill quantity are the displays of the relevant oil level indicator.*

#### Total oil quantity

Oil level when the machine is at a standstill: Middle of sight glass

Operating material	Machine type	Filling quantity, approx.	Unit
Lube oil	BS 3	0.55	Litre (l)
	BS 4	0.55	
	BS 7	0.55	
	BS 10	0.86	
	BS 15	0.86	
	BS 25	1.20	
	BS 30	1.20	
	BS 35	3.00	
	BS 50	3.50	
	BS 60	6.50	
	BS 80	6.50	
	BS 90	11.50	
	BS 100	11.50	
	BS 130	11.50	
	BS 150	11.00	
	BS 220	11.00	
	BS 240	18.00	
	BS 315	18.00	
	BS 400	22.00	

## Technical data

Operating materials > Grease for the drive shaft seal of machine stage

### 11.8.2 Grease for the drive shaft seal of machine stage

#### 11.8.2.1 Lubricant specification

Tab. 5: Greases for the drive shaft seal

##### Grease KHC-2P-30

If using the lube oils according to RKR lube oil specification, excluding polyglycol oils

Filling at the factory

**KLÜBER PETAMO GHY 133 N**

##### Grease MPG2K-40

If using a polyglycol oil according to RKR lube oil specification

Filling at the factory

**KLÜBER SYNTHESO PROBA 270**

#### Information on grease

- Avoid mixing different greases.
- Relubrication is only permitted with the same grease.
- If these greases are not available, completely remove the grease and replace it with another grease in accordance with KHC-2P-30 or MPG2K-40.
- Observe the seal compatibility with Viton!

#### 11.8.2.2 Grease filling quantities

Grease quantity for gas-tight machine stage with grease nipple

Machine stage Type	Filling quantity, approx. [cm <sup>3</sup> ]
BS3	5
BS4	5
BS7	5
BS10	5
BS15	5
BS25	5
BS30	5
BS35	10
BS50	10
BS60	10
BS80	10
BS90	10
BS130	10

Machine stage Type	Filling quantity, approx. [cm <sup>3</sup> ]
BS150	20
BS220	20
BS240	20
BS315	20

### 11.8.3 Sealing gas system

#### Operating materials



Observe the order-specific specifications on the P&ID.

Tab. 6: Technical data

Sealing gas	Value	Unit
Nitrogen, dry	-	-
Temperature	5 to 30	°C
min. sealing gas pressure, inlet	4	barg
max. sealing gas pressure, inlet	10	barg
Sealing gas pressure downstream of pressure regulator 1	2	barg
Sealing gas pressure downstream of pressure regulator 2	*1	mbarg
Setting for relief valve	1.1	barg
Flow rate	*1	Nm <sup>3</sup> /h

Relief valve	Value	Unit
Setting	1.1	barg

\*1 - As per project-specific information on the P&ID

## Technical data

Coating

### 11.8.4 Lubricant for motor

Lubricant for motor



#### NOTICE!

**Risk of motor damage due to incorrect lubricant!**

Observe the instruction manual provided by the motor manufacturer.

Adhere to lubricant specifications and filling quantities as specified by the manufacturer.

- Drive motor
- Fan motor
- Other motors, if included in the scope of delivery

## 11.9 Coating

Corrosion protection

Use of high-quality coating systems that match the agreed environmental conditions and installation conditions guarantees optimum corrosion protection of the surfaces.

For details of the machine coating, see delivery note/order confirmation and separate description *Coating systems*.

Drive and auxiliary motors

The coating systems for the drive and auxiliary motors have already been tailored to the environmental and installation conditions by the manufacturer and are therefore not given any additional coating.

Corrosion protection – IIc gases



*When conveying gases that correspond to explosion class IIC, a special coating suitable for explosion class IIC is used in the requisite coating thickness.*



#### WARNING!

**Danger of creating an ignition source!**

This danger exists if:

- Using a coating that does not comply with RKR specifications
- Changing the coating thickness

Observe the following points:

- Never use a different coating!
- Never change the thickness of the coating!



*Consult RKR for further information about the required painting and touch-up work.*

## 11.10 Electrical information

### 11.10.1 Voltage fluctuations

#### Permissible voltage fluctuations

Permissible voltage fluctuations are described in the international standard IEC 60038 subject to country-specific supply voltage tolerances.

Machine use only in a stable three-phase power supply. Voltage fluctuations or drops beyond the tolerance level may cause serious damage to the drive system.

### 11.10.2 Motor overload protection

#### Installation value

#### Nominal motor current

As per motor data sheet

## 11.11 Supplier components

For the individual components' technical data, refer to the respective manufacturer's documentation.

### 11.11.1 Balancing grade



*The vibration behaviour is determined not only by the balancing grade of the drive shafts but also by the balancing grade of the drive elements.*

The drive shafts of the pistons and rotors are balanced according to the half-key principle. Sheaves and couplings must therefore correspond to balancing type "H".

## Technical data

Supplier components > Balancing grade



## **12      Declarations of RKR Gebläse und Verdichter GmbH**



*This document is provided for informational purposes only and gives an account of the contents of the Declaration of Conformity. The original document is provided with the product or is sent in a separate document.*

# Declarations of RKR Gebläse und Verdichter GmbH

Declaration of Conformity

## 12.1 Declaration of Conformity

**pursuant to the EC Machinery Directive 2006/42/EC, Appendix II 1A**

German Original Declaration of Conformity /  
Translation of Original Declaration of Conformity

The manufacturer RKR Gebläse und Verdichter GmbH  
Braasstraße 1, 31737 Rinteln, Germany

hereby declares that the machine

Designation: Rotary piston blower / screw compressor

Machine type:

RKR reference no.:

Serial no.:

Customer order no.:

in the version delivered by us complies with the following relevant regulations:

- 2006/42/EC Machinery Directive
- 2014/35/EU Low Voltage Directive
- 2014/30/EU Electromagnetic Compatibility Directive
- 2014/68/EU Pressure Equipment Directive
- 2014/34/EU ATEX Directive\* \* see the enclosed declaration of conformity as per ATEX

Harmonised standards applied, specifically

- DIN EN 1012-1:2011-02 / DIN EN 1012-3:2014-04
- DIN EN 60204-1:2007-06
- DIN EN ISO 12100:2011-03

**Representative for technical documentation** RKR Gebläse und Verdichter GmbH  
Braasstraße 1, 31737 Rinteln, Germany

There are designated persons. Such persons are authorised to compile the documentation/technical documentation at the request of national authorities and to transmit said documentation in electronic form.

Rinteln, Germany		
Date	Signature of project manager	Management

## 12.2 Declaration of Conformity ATEX

### Pursuant to ATEX Directive 2014/34/EU

German Original Declaration of Conformity /  
Translation of Original Declaration of Conformity

The manufacturer	RKR Gebläse und Verdichter GmbH Braasstraße 1, 31737 Rinteln, Germany
hereby declares that the machine	
Designation:	Rotary piston blower
Scope of delivery as per drawing no.:	
Machine type:	
RKR reference no.:	
Serial no.:	
Customer order no.:	

the version delivered by us complies with the following relevant provision.

Standards applied, specifically

- DIN EN 1127-1:2019-10
- DIN EN IEC 60079-0:2019-09
- DIN EN ISO 80079-36:2016-12

Marking on the machine:	CE 
Internal/external	

Rinteln, Germany		
Date	Signature of project manager	Signature

## Declarations of RKR Gebläse und Verdichter GmbH

Declaration of Conformity ATEX

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