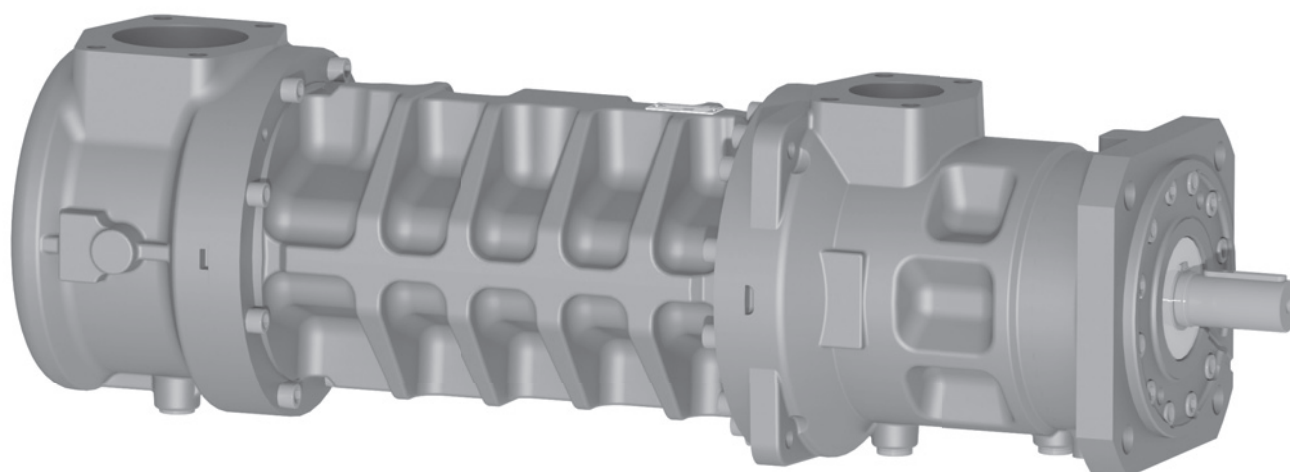


# Screw Pump

Original Operating Manual

**LB6D Series**



Version BA-2022.01 en-US  
181-044/0

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# 1 About this document

This manual:

- Is part of the pump
- Applies to the pump series mentioned above
- Describes safe and appropriate operation during all operating phases

## 1.1 Target groups

Target group	Duty
Operating company	<ul style="list-style-type: none"> <li>▶ Keep this manual accessible at the equipment operating site; it may be needed for later use.</li> <li>▶ Make sure that personnel read and follow the instructions in this manual and all other applicable documents, especially the safety instructions and warnings.</li> <li>▶ Observe any additional system-related rules and regulations.</li> </ul>
Qualified personnel	<ul style="list-style-type: none"> <li>▶ Read, observe and follow this manual and all other applicable documents, especially the safety instructions and warnings.</li> </ul>





Tab. 1 Target groups and their duties

## 1.2 Other applicable documents



Document	Purpose
ATEX additional instructions	Operation in explosion-hazard areas
Order data sheet	Technical specifications, conditions of operation
Setup drawing	Setup dimensions, connection dimensions etc.
Technical description	Technical specifications, operating limits
Sectional drawing	Sectional drawing, part numbers, component designations
Supplier documentation	Technical documentation for parts supplied by subcontractors

Tab. 2 Other applicable documents and their purpose

## 1.3 Warnings and symbols


Warning	Risk level	Consequences of disregarding the warning
	Immediate acute risk	Death, serious bodily harm
	Potential acute risk	Death, serious bodily harm
	Potentially hazardous situation	Minor injury
	Potentially hazardous situation	Material damage

Tab. 3 Warnings and consequences of disregarding them

Symbol	Meaning
	Safety warning sign ▶ Take note of all information highlighted by the safety warning sign and follow the instructions to avoid injury or death.
▶	Instruction
1. , 2. , etc.	Multiple-step instructions
✓	Precondition
→	Cross reference
	Information, notes

Tab. 4 Symbols and their meaning

## 2 Safety

 The manufacturer accepts no liability for damages caused by disregarding any of the documentation.


### 2.1 Intended use

- Only use the pump to pump the stipulated pumped liquids (→ order data sheet).
- Adhere to the operating limits.
- Avoid dry running:
  - Make sure the pump is only operated with, and never without, pumped liquid.
- Avoid cavitation:
  - Fully open the suction-side armature and do not use it to adjust the flow rate.
  - Open the pressure-side fitting completely.
- Avoid damage to the motor:
  - Do not switch on the motor more than the maximum permissible number of times per hour (→ manufacturer's specifications).
- Consult the manufacturer about any other use of the pump.
- Pumps delivered without a motor must be assembled into a pump unit according to the provisions of EC Machine Directive 2006/42/EC.

#### Prevention of obvious misuse (examples)

- Note the operating limits of the pump with regard to temperature, pressure, viscosity, flow rate and motor speed (→ order data sheet).
- Do not operate the pump while the pressure-side fitting is closed.
- Pumps may not be used with foodstuffs if they have not been adapted accordingly. Use of the pump for foodstuffs must be specified in the order data sheet.
- Only select the setup type according to this operating manual. For example, the following are not allowed:
  - Hanging base plate pumps in the pipe
  - Overhead installation
  - Installation in the immediate vicinity of extreme heat or cold sources
  - Installation too close to the wall

### 2.2 General safety instructions

 Observe the following regulations before carrying out any work.

#### 2.2.1 Product safety

The pump has been constructed using state-of-the-art technology and the applicable technical safety rules. Nevertheless, operation of the pump can still present a risk for the life and health of the user or third parties, or the pump or other property can be damaged.

- Only operate the pump if it is in perfect technical condition and only use it as intended, remaining aware of safety and risks, and adhere to the instructions in this manual.
- Ensure this manual and all other applicable documents remain complete, legible and accessible to personnel at all times.
- Keep the information on the pump in a complete and legible condition.
- Refrain from any procedures and actions that would present a risk to personnel or third parties.
- In the event of any safety-relevant malfunctions, shut down the pump immediately and have the malfunction corrected by the personnel responsible.
- In addition to the entire documentation for the product, comply with statutory or other safety and accident-prevention regulations and the applicable standards and guidelines in the country where the system is operated.

#### 2.2.2 Obligations of the operating company

##### Safety-conscious operation

- Only operate the pump if it is in perfect technical condition and only use it as intended, remaining aware of safety and risks, and adhere to the instructions in this manual.
- Ensure that the following safety aspects are observed and monitored:
  - Intended use
  - Statutory or other safety and accident-prevention regulations
  - Safety regulations governing the handling of hazardous substances
  - Applicable standards and guidelines in the country where the pump is operated
- Make personal protective equipment available.

**Qualified personnel**

- Make sure all personnel assigned to work on the pump have read and understood this manual and all other applicable documents, especially the safety, maintenance and repair information, before they start any work.
- Organize responsibilities, areas of competence and the supervision of personnel.
- Make sure that trainee personnel only work on the pump under the supervision of specialist technicians.
- All activities may only be carried out by specialist personnel with the required qualifications:

Activities	Required personnel qualifications
Mechanical work (installation, repairs, maintenance)	Mechanic
Electro-technical work (electrical installation)	Qualified electrician
All other work	Instruction from operator

**Safety equipment**

- Provide the following safety equipment and verify its functionality:
  - For hot, cold and moving parts: on-site safety guards for the pump
  - For possible electrostatic charges: provide the necessary grounding
  - If there is no pressure relief valve in the pump: Provide a suitable safety device on the pressure side between the pump and the first shut-off device

**Warranty**

- Obtain the manufacturer's approval prior to carrying out any modifications, repairs or alterations during the warranty period.
- Only use genuine parts or parts that have been approved by the manufacturer.

**Drive system**

For pumps delivered without a drive system, comply with the following requirements for the drive system:

- When using three-phase asynchronous motors, observe IEC 60034-30-1.
- Power of the drive according to EN ISO 5199 is recommended (EN ISO 5199 also applicable for drives of screw pumps).
- When using combustion engines, consult Allweiler.
- For pumps with stub shaft, connect drive system and pump directly with stub shaft.
- Use elastic coupling according to DIN 740-2.
- Use coupling guard with the following requirements:
  - Fastening elements must be connected to the pump unit in undetachable design (cannot get lost).
  - Safety distances against the reaching of hazardous areas according to EN ISO 13857 must be complied with.

**2.2.3 Obligations of personnel**

- All directions given on the pump must be followed (and kept legible), e.g. the arrow indicating the sense of rotation and the markings for fluid connections.
- Pump, coupling guard and components:
  - Do not step on them or use as a climbing aid
  - Do not use them to support boards, ramps or beams
  - Do not use them as a fixing point for winches or supports
  - Do not use them for storing paper or similar materials
  - Do not use hot pump or motor components as a heating point
  - Do not de-ice using gas burners or similar tools
- Do not remove the safety guards for hot, cold or moving parts during operation.
- If necessary, protective equipment that is appropriate for the respective assignment must be used:
  - Helmet
  - Safety shoes
  - Safety goggles
  - Gloves (min. protection class 3/C)
  - Other protective equipment depending on the (pumped) liquid
- Only carry out work on the pump while it is not running.
- Isolate the motor from its supply voltage and secure it against being switched back on again before all assembly and maintenance work.
- Reinstall the safety equipment on the pump as required by regulations after any work on the pump.



## 2.3 Specific hazards

### 2.3.1 Explosion-hazard area

- (→ ATEX additional instructions).

### 2.3.2 Electric shock

In case of contact with live parts (for example, cables in the terminal box of the electric motor) there is a risk of electric shock resulting in serious injuries or death.

- Have all electrical work carried out by qualified electricians only.

### 2.3.3 Hazardous and spraying (pumped) liquids

(Pumped) liquids can be toxic and hot and can spray out. There is a risk of burns and skin rashes on contact.

- Follow the safety regulations for handling hazardous substances when handling hazardous (e.g. hot, flammable, poisonous or potentially harmful) pumped liquids.
- Before carrying out any work, allow the pump to cool down properly and then depressurize it.
- Safely collect any leaking (pumped) liquid and dispose of it in accordance with the environmental rules and requirements.
- Drain the pump when carrying out maintenance and repair work.
- Use protective equipment when carrying out any work on the pump.

### 2.3.4 Moving parts

With moving parts (e.g. shaft, coupling) there is a risk of fatal injuries from being pulled in, crushed or caught.

- Do not touch the pump during operation.
- Do not carry out any work on the pump during operation.
- Keep a sufficient distance away from moving parts.
- Isolate the motor from its supply voltage and secure it against being switched back on again when carrying out any installation or maintenance work.

### 2.3.5 Hot surfaces

During operation and after switching off, high temperatures occur on the housing surfaces. There is a risk of burns when touching hot surfaces.

- Do not touch the pump during operation.
- Allow the pump to cool down completely before carrying out any work.
- Wear protective gloves.

### 3 Layout and function

#### 3.1 Label

##### 3.1.1 Type plate

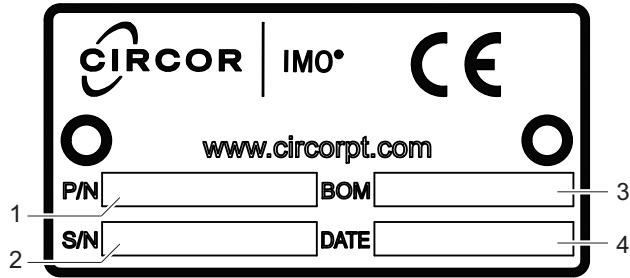


Fig. 1 Type plate (example)

- 1 Pump type
- 2 Pump number
- 3 IMO part number
- 4 Year of manufacture

##### 3.1.2 ATEX plate

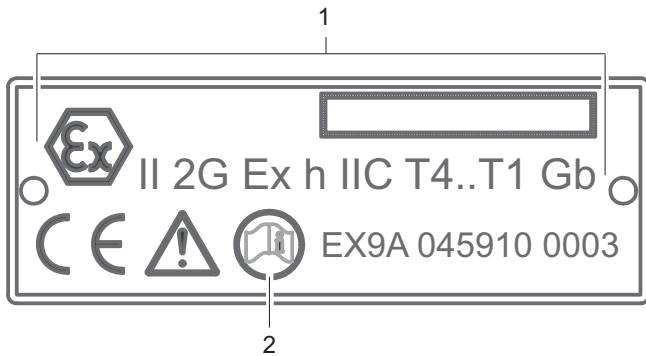


Fig. 2 ATEX plate (EN 80079-36)

- 1 Explosion protection mark
- 2 Reference to ATEX additional instructions

##### 3.1.3 Pump type code

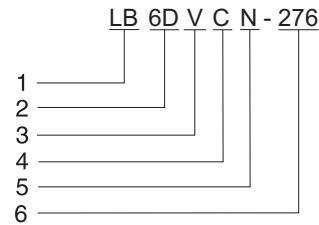


Fig. 3 Pump type code (example)

- 1 Series
- 2 Rotor length
- 3 Elastomer material
- 4 Type of setup
- 5 Casing material
- 6 Size

## 3.2 Layout

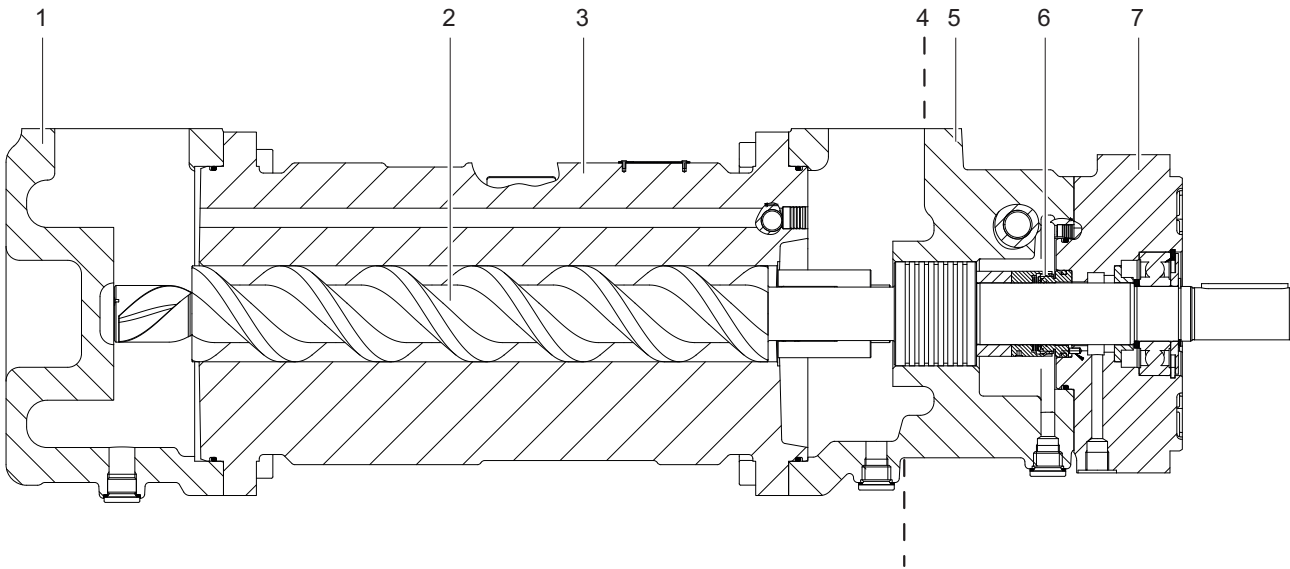



Fig. 4 Layout

- |                  |                             |              |
|------------------|-----------------------------|--------------|
| 1 Suction casing | 4 Limit for heat insulation | 7 Pump cover |
| 2 Spindle set    | 5 Discharge casing          |              |
| 3 Rotor housing  | 6 Shaft seal                |              |


## 3.3 Shaft seals

### 3.3.1 Mechanical seals

 Mechanical seals have functional leaks.

- Mechanical seal, 8.9 version
  - Standard for dry setup
  - Uncooled, maintenance-free unbalanced mechanical seal construction

### 3.3.2 Shaft seal ring


 Shaft seal rings have functional leaks.

- Shaft seal ring
  - Standard for wet pit installation

## 3.4 Bearings and lubrication

- External groove ball bearing lubricated with grease according to DIN 625
  - Not capable of relubrication, lifetime grease fill
  - Sealing washers on both sides

### 3.5 Types of setup

-  The following types of setup are possible:
- Container installation
  - Container top mounting
  - Mounting feet

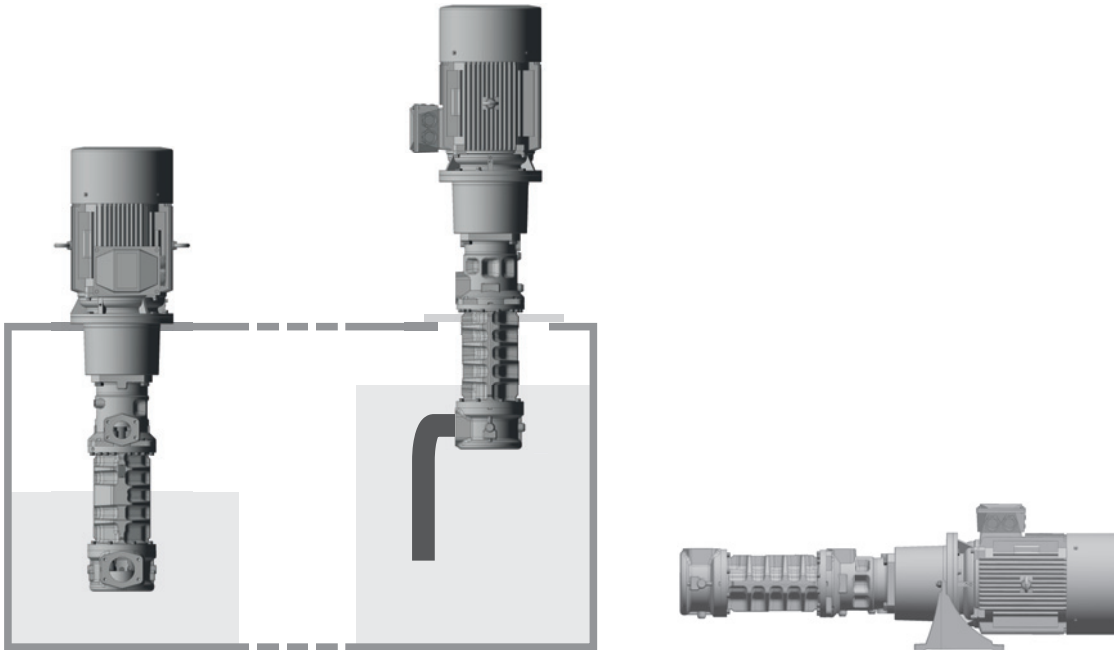



Fig. 5 Types of setup

## 4 Transport, storage and disposal

### 4.1 Transport

 Weight specifications (→ order data sheet).

#### 4.1.1 Unpacking and inspection on delivery

1. Unpack the pump/pump unit upon delivery and inspect it for transport damage.
2. Report any transport damage to the manufacturer immediately.
3. Dispose of packaging material according to local regulations.

#### 4.1.2 Lifting

 **DANGER**

**Death or crushing of limbs caused by falling or overturning loads!**

- ▶ Use lifting gear appropriate for the total weight to be transported.
  - ▶ Fasten the lifting gear as shown in the following illustrations.
  - ▶ For vertical transport: Provide a securing rope between the hook and load eyebolt of the motor.
  - ▶ Never fasten the lifting gear onto the motor eyebolt (unless used as a safety device to prevent units with a high center of gravity from tipping over).
  - ▶ Do not stand under suspended loads.
- 
- ▶ Fasten the lifting gear to the pump unit.

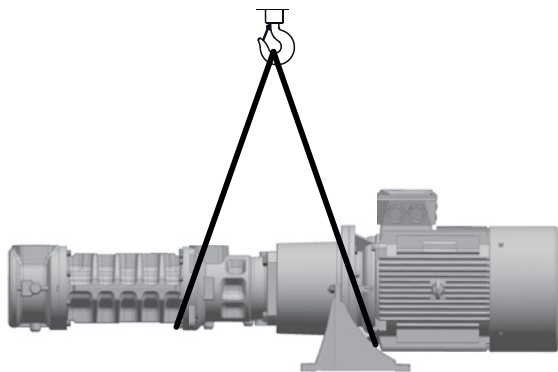


Fig. 6 Fastening the lifting gear to the pump unit (horizontal)

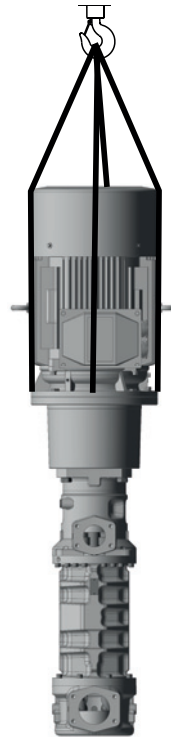



Fig. 7 Fastening the lifting gear to the pump unit (vertical)

### 4.2 Treatment for storage

 The pump has not been treated for storage at the factory. Contact the manufacturer for recommendations regarding preservatives.

#### NOTE

**Material damage due to inappropriate treatment for storage!**

- ▶ Treat the pump properly, inside and outside, for storage.

#### 4.2.1 Applying preservative to the inside

1. Close the suction-side flange with a blank flange.
2. Fill the pump with preservative.
3. Turn the shaft slowly against the pump's sense of rotation.
4. Continue filling and turning until the preservative escapes from the pressure flange without bubbles.
5. Close the pressure-side flange with a blank flange.

#### 4.2.2 Applying preservative to the outside

- ▶ Apply preservative to all bare metal parts.

### 4.3 Storage

---


#### NOTE

---

##### Material damage due to inappropriate storage!

- ▶ Treat and store the pump properly.
- 
1. Seal all openings with blank flanges, blind plugs or plastic covers.
  2. Make sure the storage room meets the following conditions:
    - Dry
    - Frost-free
    - Vibration-free
    - Dust-free
  3. Turn the shaft once a month.
  4. Make sure the shaft and bearing change their rotational position in the process.

### 4.4 Removing the preservative

-  Only necessary for pumps treated for storage.

---

#### NOTE

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##### High water pressure or spray water can damage bearings!

- ▶ Do not clean bearing areas with a water or steam jet.
- 

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#### NOTE

---

##### Damage to seals due to wrong cleaning agents!

- ▶ Ensure the cleaning agent does not corrode the seals.
- 
1. Choose the cleaning agent according to the application. (→ 9.2.4 Cleaning agents, Page 27).
  2. Remove the preservative from all bare internal parts of the pump.
  3. Dispose of cleaning agents in accordance with local regulations.
  4. For storage times in excess of 6 months check all elastomer parts (O-rings, shaft seals) for proper elasticity and replace them if necessary.

### 4.5 Disposal

-  Plastic parts can be contaminated by poisonous or radioactive pumped liquids to such an extent that cleaning will be insufficient.

---


#### WARNING

---

##### Risk of poisoning and environmental damage from the pumped liquid or oil!

- ▶ Use personal protective equipment when carrying out any work on the pump.
  - ▶ Prior to the disposal of the pump:
    - Collect and dispose of any pumped liquid or oil which is escaping in accordance with local regulations.
    - Neutralize residues of pumped liquid in the pump.
    - Removing the preservative (→ 4.4 Removing the preservative, Page 14).
  - ▶ Remove the plastic parts and dispose of them in accordance with local regulations.
- 
- ▶ Dispose of the pump in accordance with local regulations.

## 5 Setup and connection

 For pumps in explosion-hazard areas (→ supplementary ATEX instructions).

---

### NOTE

#### Material damage due to distortion, or electrical current flowing through the bearing!

- ▶ Do not make any structural modifications to the pump unit or pump casing.
- ▶ Do not carry out any welding work on the pump unit or pump casing.

---

### NOTE

#### Material damage caused by dirt!

- ▶ Do not remove any covers or transport and screw plugs until immediately before connecting the pipes to the pump.

### 5.1 Preparing the setup

#### 5.1.1 Checking the ambient conditions

- ▶ Make sure the required ambient conditions are fulfilled (→ 9.2.1 Ambient conditions, Page 27).

#### 5.1.2 Preparing the installation site

- ▶ Ensure the installation site meets the following conditions:
  - Pump is freely accessible from all sides
  - Sufficient space for the installation/removal of the pipes and for maintenance and repair work, especially for the removal and installation of the pump and the motor
  - Pump not exposed to external vibrations (damage to bearings)
  - Frost protection


#### 5.1.3 Preparing the surface

- ▶ Make sure the surface meets the following conditions:
  - Level
  - Clean (no oil, dust or other impurities)
  - Capable of bearing the weight of the pump unit and all operating forces
  - The pump is stable and cannot tip over

#### 5.1.4 Removing the preservative

- ▶ If the pump is to be put into operation immediately after installation and connection: Remove the preservative prior to installation (→ 4.4 Removing the preservative, Page 14).

#### 5.1.5 Installing the heat insulation (optional)

 Only necessary to maintain the temperature of the pumped liquid.

---

### NOTE


#### Material damage on the bearing or shaft seal due to overheating!

- ▶ Only install the heat insulation on the pump casing. (→ Fig. 4 Layout, Page 11).
- ▶ Install the heat insulation properly.

### 5.2 Setup

1. If the pump is set up in a vertical position (container layout/installation):
  - Install the pump unit with pump bracket or discharge casing on the cover of the container.
2. If the pump is set up in a horizontal position:
  - Install the pump unit with mounting feet on a level surface.
  - Ensure that the leakage bore hole / pipe points downwards.
  - Turn the pump cover on the drive side if necessary.
3. If present: Install the pressure sensor (→ 9.1.2 Drawings, Page 25).

### 5.3 Installing the motor

 This is only necessary if the pump unit is assembled on site.

---

### NOTE

#### Material damage caused by knocks and bumps!

- ▶ Keep the coupling halves properly aligned when slipping them on.
- ▶ Do not knock or hit any components of the pump.

1. Smear a very thin coat of molybdenum disulfide (e.g. Molykote) on the shaft ends of the pump and motor.
2. Insert the shaft keys.
3. Slip on the pump-side and motor-side coupling halves. Adhere to the prescribed axis projection:
  - Without a mounting fixture: Remove the rubber buffers and heat the coupling halves up to approximately 100 °C.
4. Tighten the grub screws on both coupling halves.
5. Lift the motor and position it on the pump bracket.
6. Screw in the motor screws.

## 5.4 Planning the pipes

### 5.4.1 Specifying supports and flange connections

#### NOTE

#### Material damage due to excessive forces and torques exerted by the piping on the pump!

- ▶ Do not exceed the permissible values (→ flange loads according to EN ISO 14847)

1. Calculate the pipe forces, taking every possible operating condition into account:
  - Cold/warm
  - Empty/full
  - Depressurized/pressurized
  - Positional changes of the flanges
2. Ensure the pipe supports have consistently low-friction properties and do not seize up due to corrosion.

### 5.4.2 Specifying nominal diameters

- ◡ Keep the flow resistance in the pipes as low as possible.

1. Make sure the nominal suction pipe diameter is  $\geq$  as possible to the nominal suction flange diameter.
  - Recommended flow rate speed  $< 1$  m/s
2. Make sure the nominal pressure pipe diameter is  $\geq$  as possible to the nominal outlet flange diameter.
  - Recommended flow rate speed  $< 3$  m/s

### 5.4.3 Specifying pipe lengths

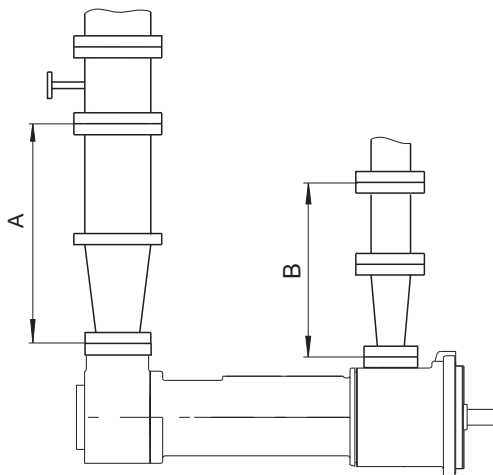


Fig. 8 Straight pipe lengths upstream and downstream of the pump (recommended)

- A  $> 5$  x nominal suction pipe diameter
- B  $> 5$  x nominal pressure pipe diameter

- ▶ Recommendation: Provide long, straight pipes upstream and downstream of the pump.
  - This will improve the suction performance of the pump.

- ◡ Suction side: Shorter pipes are possible, but may impair the hydraulic performance.

Pressure side: Shorter pipes are possible, but can result in increased operating noise.

### 5.4.4 Optimizing changes in cross-section and direction

1. Avoid bending radii of less than 1.5 times the nominal pipe diameter.
2. Avoid abrupt changes of cross-section and direction along the piping.

### 5.4.5 Discharging leaks

#### ⚠ WARNING

#### Risk of injury and poisoning due to hazardous pumped liquids!

- ▶ Collect any leaking pumped liquid safely, then discharge and dispose of it in accordance with environmental regulations.

1. Provide equipment for collecting and discharging leaking liquids.
2. Ensure the free discharge of leaking liquids.

### 5.4.6 Avoiding excessive pressure

#### ⚠ WARNING

#### Risk of injury due to excessive pressure!

- ▶ If there is no pressure relief valve in the pump: Provide a suitable safety device in the pressure line.

1. Observe the operating instructions of the manufacturer.
2. Make sure the factory setting of the pressure relief valve meets the requirements of the system.
3. Do **not** feed the return flow of the safety device directly back into the suction pipe.

### 5.4.7 Providing safety and control devices (recommended)

#### Avoid impurities


1. Install a dirt trap in the suction pipe (mesh size of 0.6 mm).
2. To monitor impurities, install a differential pressure gauge with contact pressure gauge.
3. Provide a fine filter if necessary:
  - Select the filter mesh, depending on the type, level of contamination and pumping pressure

#### Avoiding reverse running

- ▶ Install a non-return valve between the outlet flange and the stop valve to ensure the liquid does not flow back when the pump is switched off.



## Making provisions for isolating and shutting off pipes


 For maintenance and repair work.

- ▶ Provide shut-off devices in the suction and pressure pipes.

## Allowing measurement of the operating conditions

1. Provide manometers for pressure measurements in the suction and pressure pipes.
2. Provide for suction-side temperature measurements.

## Monitoring leaks

 Only necessary for hot or hazardous pumped liquids.

1. Provide leak monitoring equipment.
2. Safely collect any leaking pumped liquid (e.g. following a seal malfunction) and dispose of it.

## 5.5 Connecting the pipes

### 5.5.1 Keeping the pipes clean

---

#### NOTE

---

#### Material damage due to impurities in the pump!

- ▶ Make sure no impurities can enter the pump.
1. Flush all pipe parts and fittings prior to assembly.
  2. Ensure no flange seals protrude inwards.
  3. Remove any blank flanges, plugs, protective foils and/or protective paint from the flanges.
  4. On welded pipes: Remove the welding beads.

### 5.5.2 Installing the suction pipe

1. Remove the transport and screw plugs from the pump.
2. To avoid air pockets:
  - For supply operation: Run the pipes with a continuous downward slope to the pump.
3. Ensure no seals protrude inwards.
4. On wet pit installations: Observe the minimum immersion depth (→ technical description).

### 5.5.3 Installing the pressure pipe

1. Remove the transport and screw plugs from the pump.
2. Install the pressure pipe.
3. Ensure no seals protrude inwards.

## 5.5.4 Checking the stress-free pipe connections

- ✓ Piping installed and cooled down

---

#### NOTE

---

#### Material damage due to distorted pump casing

- ▶ Ensure that all pipes are stress-free when connected to the pump.
1. Disconnect the pipe connecting flanges from the pump.
  2. Check whether the pipes can be moved freely in all directions within the expected range of expansion:
    - Nominal diameter < 150 mm: by hand
    - Nominal diameter > 150 mm: with a small lever
  3. Make sure the flange surfaces are parallel.
  4. Reconnect the pipe connecting flanges to the pump.


## 5.6 Electrical connection

 **DANGER**

#### Risk of electrocution!

- ▶ Have all electrical work carried out by qualified electricians only.

### 5.6.1 Connecting the motor

 Follow the instructions of the motor manufacturer.


1. Connect the motor according to the connection diagram.
2. Make sure no danger arises due to electric power.
3. Install an EMERGENCY STOP switch.

## 5.7 Installing the coupling guard

#### Flanged drive


1. If present, install the coupling guard (two plates) on the bell housing.

## 6 Operation

 For pumps in explosion-hazard areas (→ supplementary ATEX instructions).


### 6.1 Putting the pump into service for the first time

#### 6.1.1 Removing the preservative

 Only necessary for pumps treated for storage.

▶ (→ 4.4 Removing the preservative, Page 14).

#### 6.1.2 Pressure relief valve

 The pressure relief valve supplied by the manufacturer is pre-set.

▶ Make sure the safety valve on the system side meets the requirements of the pump.

#### 6.1.3 Filling and bleeding

1. On wet pit installations: Adhere to the minimum immersion depth (→ technical documentation).
2. Open the suction-side fitting.
3. Fill the pump and suction pipe with pumped liquid until pumped liquid escapes without bubbles.
4. Open the pressure-side fitting.
5. Ensure that no pipe connections are leaking.

#### 6.1.4 Checking the sense of rotation

- ✓ Pump filled and bled

---

#### NOTE

##### **Material damage caused by dry running!**

▶ Make sure the pump is filled properly.

1. Switch the motor on and immediately off again.
2. Make sure the motor turns clockwise (when looking at the motor fan).
3. If the sense of rotation is different: Swap two phases.

#### 6.1.5 Switching on

- ✓ Pump set up and connected properly
- ✓ Motor set up and connected properly
- ✓ All connections stress-free and sealed
- ✓ All safety equipment installed and tested for functionality
- ✓ Pump prepared, filled and bled properly
- ✓ Sufficient filling level in the container (minimum immersion depth)

---

#### NOTE

##### **Risk of cavitation when throttling down the suction flow rate!**

▶ Fully open the suction-side armature and do not use it to adjust the flow rate.

---

#### NOTE

##### **Material damage due to excessive pressure!**

▶ Do not operate the pump while the pressure-side fitting is closed.

---

#### NOTE

##### **Material damage caused by dry running!**

▶ Make sure the pump is filled properly.

1. Open the pressure-side fitting.
2. Open the suction-side fitting.
3. Switch on the motor and make sure it is running smoothly.
4. Make sure the temperature rises at a rate of no more than 2 K/min.
5. Make sure the minimum pumping pressure is above 2 bar.
6. Make sure the correct pressure build-up:
  - 2 bar/min below 50 bar discharge pressure
  - 1 bar/min between 50 and 75 bar discharge pressure
  - 0.5 bar/min above 75 bar discharge pressure
7. After the first load under pressure and at operating temperature, check that the pump is not leaking.

#### 6.1.6 Switching off

1. Switch off the motor.
2. After initial start-up: Check all tie bolts and tighten them if necessary.

## 6.2 Operation

### 6.2.1 Switching on

- ✓ Pump initially put into service properly
- ✓ Pumps filled and bled

#### NOTE

#### Risk of cavitation when throttling down the suction flow rate!

- ▶ Fully open the suction-side armature and do not use it to adjust the flow rate.

#### NOTE

#### Material damage caused by dry running!

- ▶ Make sure the pump is filled properly.
1. Open the pressure-side fitting.
  2. Open the suction-side fitting.
  3. Switch on the motor and make sure it is running smoothly.
  4. Make sure the temperature rises at a rate of no more than 2 K/min.
  5. Make sure the minimum pumping pressure is above 2 bar.

### 6.2.3 Switching off

- ▶ Switch off the motor.

## 6.3 Shutting down the pump

- ▶ Take the following measures whenever the pump is shut down:

Pump is	Measure
...shut down for a prolonged period	▶ Perform measures according to the pumped liquid (→ Tab. 6 Measures will depend on the behavior of the pumped liquid, Page 19).
...emptied	▶ Close the suction-side and pressure-side fittings.
...dismounted	▶ Isolate the motor from its power supply and secure it against unauthorized switch-on.
...put into storage	▶ Observe the storage instructions (→ 4.3 Storage, Page 14).

Tab. 5 Measures to be taken if the pump is shut down

Behavior of the pumped liquid	Duration of shutdown (depending on process)	
	Short	Long
Solids sedimenting	▶ Flush the pump.	▶ Flush the pump.
Solidifying/ freezing, non-corrosive	▶ Heat up or empty the pump and containers.	▶ Empty the pump and containers.
Solidifying/ freezing, corrosive	▶ Heat up or empty the pump and containers.	▶ Empty the pump and containers. ▶ Treat the pump and containers with preservative.
Remains liquid, non-corrosive	–	–
Remains liquid, corrosive	–	▶ Empty the pump and containers. ▶ Treat the pump and containers with preservative.

Tab. 6 Measures will depend on the behavior of the pumped liquid


## 6.4 Start-up following a shutdown period


1. If the pump is shut down for more than 6 months, perform the following measures before starting it up again:
  - Replace the elastomer seals (O-rings, shaft seal rings).
  - Replace the antifriction bearings.
  - If necessary: Replace the motor bearing (→ operating manual of the motor manufacturer).
2. Carry out the same steps as for the initial start-up (→ 6.1 Putting the pump into service for the first time, Page 18).

## 6.5 Operating the stand-by pump


- ✓ Stand-by pump filled and bled
- ▶ Operate the stand-by pump at least once a week.

# 7 Maintenance

 For pumps in explosion-hazard areas (→ supplementary ATEX instructions).


 Trained customer service technicians are available for fitting and repair work. A pumped liquid certificate (DIN safety data sheet or safety certificate) must be presented when requesting service.


## 7.1 Inspections

 The inspection intervals depend on the operational strain on the pump.

1. Check at appropriate intervals:
  - Temperature of antifriction bearings > 0 °C < 70 °C (> 32 °F < 158 °F)
  - Normal operating conditions unchanged
  - Check whether the pressure relief valve is working
2. For trouble-free operation, always ensure the following:
  - No dry running
  - No leaks
  - No cavitation
  - Suction-side gate valves open
  - Unclogged and clean filters
  - Sufficient pump ingress pressure
  - No unusual running noises or vibrations
  - No excessive leakage at the shaft seal

## 7.2 Maintenance


 Service life of the antifriction bearings for operation within the permissible operating range: > 2 years  
Intermittent operation, high temperatures and aggressive ambient and process conditions reduce the service life of antifriction bearings.

 Mechanical seals are subject to natural wear, which is largely determined by the respective operating conditions. Therefore, general statements regarding their service life cannot be made.

### 7.2.1 Antifriction bearings lubricated with grease

- ▶ As a precaution, replace antifriction bearings with lifetime lubrication every 2 years (recommended):

### 7.2.2 Mechanical seals

 Mechanical seals have functional leaks (→ manufacturer's specifications).

- ▶ In the event of major leaks: Replace the mechanical seal and its auxiliary seals.

### 7.2.3 Cleaning the pump

#### NOTE

**High water pressure or spray water can damage bearings!**

- ▶ Do not clean bearing areas with a water or steam jet.
- ▶ Clean large-scale grime from the pump.

## 7.3 Repairs

### WARNING

**Risk of injury due to heavy components!**

- ▶ Pay attention to the component weight. Lift and transport heavy components using suitable lifting gear.
- ▶ Set down structural components safely and secure them against overturning or rolling away.

### 7.3.1 Returning the pump to the manufacturer

- ✓ Pump depressurized
  - ✓ Pump completely empty
  - ✓ Electrical connections disconnected and motor secured against being switched on again
  - ✓ Pump cooled down
  - ✓ Coupling guard removed
  - ✓ On couplings with spacer piece: spacer piece removed
  - ✓ Auxiliary systems shut down, depressurized and emptied
  - ✓ Pressure gauge lines, pressure gauge and holdings dismantled
  - ✓ If present: Dismount the pressure sensor
1. Enclose a truthful, and fully completed, safety certificate when returning pumps or components to the manufacturer. (→ 9.3 Declaration of harmlessness, Page 28).
  2. Depending on the required repair work, take the necessary measures as listed in the table below when returning the pump to the manufacturer.

Repairs	Measure for return
...at the customer's premises	▶ Return the defective component to the manufacturer.
...at the manufacturer's premises	▶ Flush the pump and decontaminate it if it was used for hazardous pumped liquids. ▶ Return the complete pump (not disassembled) to the manufacturer.
...at the manufacturer's premises for warranty repairs	

Tab. 7 Measures for returning the pump

### 7.3.2 Dismounting

- ✓ Pump depressurized
- ✓ Pump completely empty, flushed and decontaminated
- ✓ Electrical connections disconnected and motor secured against being switched on again
- ✓ Pump cooled down
- ✓ Coupling guard removed
- ✓ On couplings with spacer piece: spacer piece removed
- ✓ Auxiliary systems shut down, depressurized and emptied
- ✓ Pressure gauge lines, pressure gauge and holdings dismounted


### WARNING

#### Risk of injury during disassembly!

- ▶ Secure the pressure-side gate valve against accidental opening.
- ▶ Depressurize the blocking pressure system, if available.
- ▶ Wear protective gloves as components can become very sharp through wear or damage.
- ▶ Remove spring-loaded components (e.g. mechanical seal, tensioned bearing, valves etc.) carefully, as components can be ejected by the spring tension.
- ▶ Observe the manufacturer's specifications (e.g. for the motor, coupling, mechanical seal, blocking pressure system, cardan shaft, gear boxes, belt drive etc.).

1. Observe the following during removal:
  - Mark the correct installation location and position of all components before dismantling them.
  - Dismount components concentrically without canting.
2. Dismount the pump (→ sectional and exploded drawing).

### 7.3.3 Installing

-  Install the components concentrically, without canting, in accordance with the markings made.


### NOTE

#### Material damage due to unsuitable components!

- ▶ Always replace any lost or damaged screws with screws of the same strength. (→ 9.2.3 Tightening torques, Page 27).
- ▶ Only replace seals with seals of the same material.

1. Observe the following during installation:
  - Replace worn parts with genuine spare parts.
  - Replace seals, inserting them in such a way that they are unable to rotate.
  - Adhere to the prescribed tightening torques (→ 9.2.3 Tightening torques, Page 27).
2. Clean all parts (→ 9.2.4 Cleaning agents, Page 27). Do not remove any markings which have been applied.
3. Installing the pump (→ 9.1 Sectional drawings, Page 24).
4. Installing the pump in the system (→ 5 Setup and connection, Page 15).

### 7.4 Ordering spare parts

-  For trouble-free replacement in the event of faults, we recommend keeping a supply of complete spare pumps available on site.

Parts which can be replaced can be found in the parts list (→ 9.1.1 Part numbers and designations, Page 24).

- ▶ Keep the following information ready to hand when ordering spare parts (→ type plate):
  - Pump type
  - Pump number
  - Year of manufacture
  - Part number
  - Designation
  - Quantity

## 8 Troubleshooting

If malfunctions occur which are not specified in the following table or cannot be traced back to the specified causes, please consult the manufacturer.

Possible malfunctions are identified by a number in the following table. This number identifies the respective cause and remedy in the troubleshooting list.

Malfunction	Number
Pump not pumping	1
Pumping rate insufficient	2
Pumping rate excessive	3
No pump suction	4
Pump running roughly	5
Pump jammed	6
Pump leaking	7
Excessive motor power uptake	8

Tab. 8 Malfunction/number assignment

Malfunction number								Cause	Remedy
1	2	3	4	5	6	7	8		
X	-	-	-	-	-	-	-	Transport screw plugs still in place	<ul style="list-style-type: none"> <li>▶ Remove the transport screw plugs.</li> <li>▶ Dismount the pump and inspect it for dry-running damage.</li> </ul>
X	-	-	-	-	-	-	-	Supply/suction pipe closed by fitting	<ul style="list-style-type: none"> <li>▶ Open the fitting.</li> </ul>
X	-	-	-	X	-	-	-	Supply/suction pipe not bled properly or not filled up completely	<ul style="list-style-type: none"> <li>▶ Fill up the pump and/or pipe completely and bleed them.</li> </ul>
X	-	-	-	X	-	-	-	Formation of air pockets in the supply or suction pipe	<ul style="list-style-type: none"> <li>▶ Install the fitting for bleeding.</li> <li>▶ Correct the piping layout.</li> </ul>
X	-	-	-	X	-	-	-	Pressure pipe blocked	<ul style="list-style-type: none"> <li>▶ Clean the pressure pipe.</li> </ul>
X	-	-	X	X	-	-	-	Pump running in the wrong sense of rotation	<ul style="list-style-type: none"> <li>▶ Swap any two phases on the motor (→ 6.1.4 Checking the sense of rotation, Page 18).</li> </ul>
X	-	-	X	-	X	-	-	Pump very dirty	<ul style="list-style-type: none"> <li>▶ Dismount and clean the pump.</li> </ul>
X	X	-	X	X	-	-	-	Supply/suction pipe, pump or suction strainer blocked or encrusted	<ul style="list-style-type: none"> <li>▶ Clean the supply/suction pipe, pump or suction strainer.</li> <li>▶ Clean the suction strainer.</li> </ul>
X	X	-	X	X	-	-	-	Air is sucked in	<ul style="list-style-type: none"> <li>▶ Seal the source of malfunction.</li> </ul>
X	X	-	X	X	-	-	-	Excessive amount of gas: Pump is cavitating	<ul style="list-style-type: none"> <li>▶ Check the cable gland.</li> <li>▶ Clean/enlarge the filter.</li> <li>▶ Enlarge the supply/suction pipe cross-section.</li> </ul>
X	X	-	X	X	-	-	-	Excess play between: <ul style="list-style-type: none"> <li>• Spindles</li> <li>• Spindles and housing</li> </ul>	<ul style="list-style-type: none"> <li>▶ Repair or replace any worn parts.</li> </ul>
X	X	-	X	-	-	X	-	Shaft seal leaking	<ul style="list-style-type: none"> <li>▶ Replace the shaft seal.</li> </ul>

Malfunction number								Cause	Remedy
1	2	3	4	5	6	7	8		
-	X	-	X	-	-	-	-	Motor speed too low	<ul style="list-style-type: none"> <li>▶ Compare the required motor speed with the specifications on the pump type plate. Replace the motor if necessary.</li> <li>▶ Increase the motor speed if speed control is available.</li> </ul>
-	X	-	X	-	-	-	-	Supply/suction pipe not fully opened	<ul style="list-style-type: none"> <li>▶ Open the fitting.</li> </ul>
-	X	-	X	X	-	-	-	Supply/suction pipe cross-section too narrow	<ul style="list-style-type: none"> <li>▶ Enlarge the supply/suction pipe cross-section.</li> <li>▶ Remove any encrustations from the suction pipe.</li> <li>▶ Open the fitting completely.</li> </ul>
-	X	-	X	X	-	-	-	Suction height excessive: $NPSH_{\text{pump}}$ is larger than $NPSH_{\text{system}}$	<ul style="list-style-type: none"> <li>▶ Increase the pump ingress pressure.</li> <li>▶ Consult the manufacturer.</li> </ul>
-	X	-	X	X	-	-	-	Pumped liquid temperature too high: Pump is cavitating	<ul style="list-style-type: none"> <li>▶ Increase the pump ingress pressure.</li> <li>▶ Lower the temperature.</li> <li>▶ Consult the manufacturer.</li> </ul>
-	X	-	X	X	-	-	-	Hydraulic parts of the pump dirty, clotted or encrusted	<ul style="list-style-type: none"> <li>▶ Dismount the pump.</li> <li>▶ Clean the parts.</li> </ul>
-	X	-	X	-	-	-	X	Viscosity or specific gravity of the pumped liquid is outside the range specified for the pump	<ul style="list-style-type: none"> <li>▶ Consult the manufacturer.</li> </ul>
-	-	-	-	X	-	-	-	Pressure-side fitting not opened wide enough	<ul style="list-style-type: none"> <li>▶ Open the pressure-side fitting.</li> </ul>
-	X	-	X	X	X	-	-	Pump parts worn	<ul style="list-style-type: none"> <li>▶ Replace the worn pump parts.</li> </ul>
-	-	X	-	X	-	-	X	Motor speed too high	<ul style="list-style-type: none"> <li>▶ Compare the required motor speed with the specifications on the pump type plate. Replace the motor if necessary.</li> <li>▶ Reduce the motor speed if speed control is available.</li> </ul>
-	-	-	-	X	X	-	X	Antifriction bearing defective	<ul style="list-style-type: none"> <li>▶ Replace the antifriction bearing.</li> </ul>
-	-	-	-	-	X	-	X	Defective antifriction bearing in motor	<ul style="list-style-type: none"> <li>▶ Replace the antifriction bearing.</li> </ul>
-	-	-	-	-	-	X	-	Tie bolts not tightened properly	<ul style="list-style-type: none"> <li>▶ Tighten the tie bolts (→ 9.2.3 Tightening torques, Page 27).</li> </ul>
-	-	-	-	-	-	X	-	Mechanical seal worn	<ul style="list-style-type: none"> <li>▶ Replace the mechanical seal.</li> </ul>
-	-	-	-	-	-	X	-	Housing seal defective	<ul style="list-style-type: none"> <li>▶ Replace the housing seal.</li> </ul>
-	-	-	-	X	X	X	X	Pump distorted	<ul style="list-style-type: none"> <li>▶ Check the pipe connections and attachment of the pump.</li> </ul>
-	-	-	-	X	-	-	-	Coupling elements worn	<ul style="list-style-type: none"> <li>▶ Replace the coupling elements.</li> </ul>
-	X	-	X	X	-	-	X	Motor running on 2 phases	<ul style="list-style-type: none"> <li>▶ Check the fuse and replace it if necessary.</li> <li>▶ Check the cable connections and insulation.</li> </ul>

Tab. 9 Troubleshooting list

## 9 Appendix

### 9.1 Sectional drawings

#### 9.1.1 Part numbers and designations

Part no.	Designation
1	Discharge casing
2 <sup>2)</sup>	Rotor housing
3	Pump cover, drive end
4	Suction housing, axial/radial
12 <sup>2)</sup>	Drive spindle
13 <sup>2)</sup>	Idler spindle
21	Labyrinth ring
22	Labyrinth ring
23	Spacer ring
24	Spacer ring
26 <sup>1)</sup>	Balance bush
27 <sup>1)</sup>	Thrust ring
101 <sup>1)</sup>	O-ring
121 <sup>1)</sup>	O-ring
122 <sup>1)</sup>	O-ring
129 <sup>1)</sup>	O-ring
130	O-ring
140 <sup>1)</sup>	Seal ring
160	Sealing plug
161 <sup>4)</sup>	Sealing plug
162 <sup>4)</sup>	Bolts
183 <sup>2)</sup>	Shaft seal ring
186 <sup>2)</sup>	Mechanical seal
200	Socket head cap screw
201	Stud bolt
214	Screw plug
220	Hexagon nut
250	Snap ring
251	Snap ring
252	Snap ring

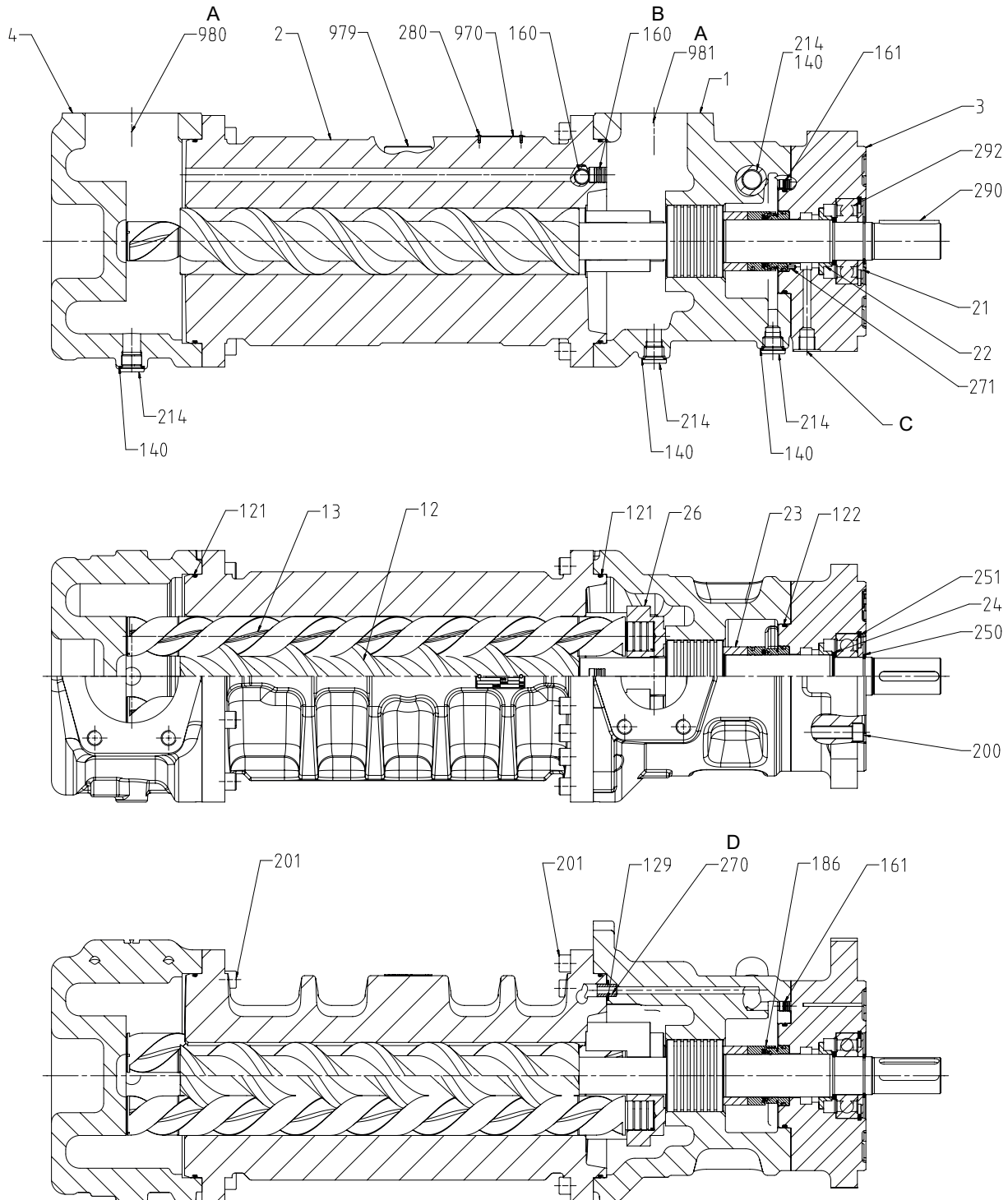
Part no.	Designation
270 <sup>4)</sup>	Support ring
271	Pin
280	Blind rivet
290	Shaft key
292 <sup>1)</sup>	Groove ball bearing
970	Rating plate
979	Additional plate (digital nameplate)
980 <sup>3)</sup>	Plug
981 <sup>3)</sup>	Plug

Tab. 10 Designation of components according to part numbers

- 1) Can be ordered as repair set
- 2) Can be ordered as spare part
- 3) Remove the plug before putting the pump into service
- 4) optional



**9.1.2 Drawings**  
**Sectional drawing**



**Fig. 9 Sectional drawing**

- |   |  |
|---|--|
| <b>A</b> Remove the plug before putting the pump into service | <b>C</b> Open the thread connection before putting the pump into service |
| <b>B</b> Is position 161 on sizes 217 and 236                 | <b>D</b> Not with sizes 217 and 236                                      |

Exploded drawing

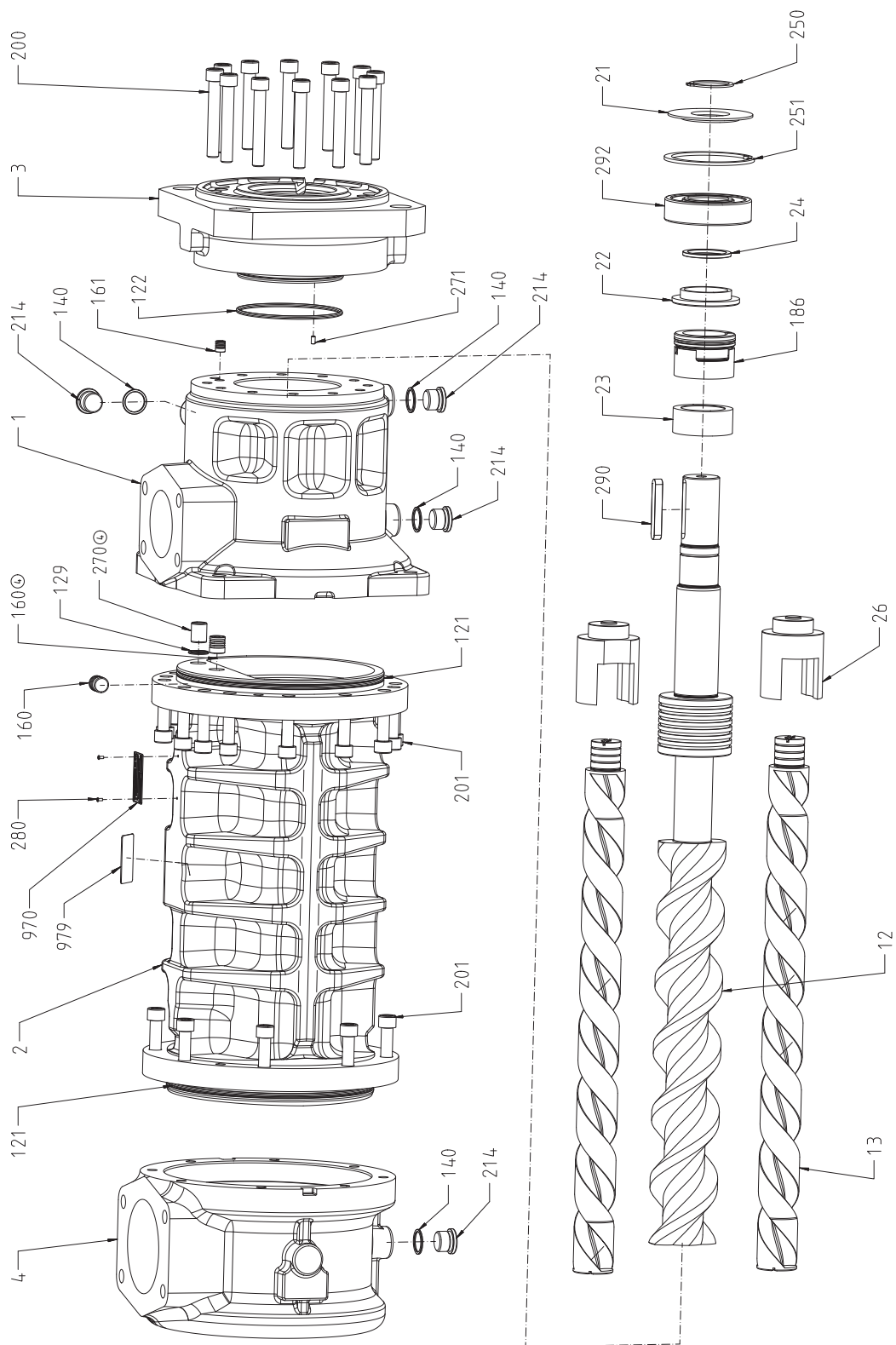




Fig. 10 Exploded drawing

## 9.2 Technical specifications

 More technical specifications (→ order data sheet).

### 9.2.1 Ambient conditions

 Operation under any other ambient conditions requires the agreement of the manufacturer.

Temperature [°C]	Relative humidity [%]		Setup height above sea level [m]
	Long-term	Short-term	
-20 to +40	≤ 85	≤ 100	≤ 1000

Tab. 11 Ambient conditions

### 9.2.2 Sound pressure level

Measuring conditions:


- Distance to the pump: 1 m
- Operation: cavitation-free
- Motor: IEC standard motor
- Tolerance ±3 dB

Versions of the motors which produce less noise are available if the expected noise levels exceed the permissible limits.

Size	Sound pressure level [dB] for pump at speed [rpm]			
	1450	1750	2900	3500
217	58	60	67	69
236	60	62	69	71
276	63	65	72	74

Tab. 12 Sound pressure level

### 9.2.3 Tightening torques

 The following values apply to oiled screws and torque tightening processes.

Thread size	Quality	Tightening torque [Nm]
M 6	5.6	4
M 8		10
M 10		19
M 12		32
M 16		78
M 20		157
M 24		289
M 27		426
M 30		578
M 6		8.8
M 8	22	
M 10	43	
M 12	76	
M 16	181	
M 20	353	
M 24	662	
M 27	975	
M 30	1323	
M 6	10.9	13
M 8		32
M 10		63
M 12		108
M 16		264
M 20		517
M 24		890
M 27		1304
M 30		1775

Tab. 13 Tightening torques

### 9.2.4 Cleaning agents

Application area	Cleaning agents
Other	Benzine, wax solvents, diesel, paraffin, alkaline cleaners

Tab. 14 Cleaning agents

### 9.3 Declaration of harmlessness

This declaration of harmlessness of the operator is used to ensure work safety and the protection of our employees, the transport company and the environment from harmful effects when handling dangerous materials as well as to protect you from claims for compensation.

Please copy this document and send it together with the pump.

Every commercial company is obligated to comply with the legal regulations on work safety, set forth for example in Germany in the Workplace Ordinance (ArbStättV), the Accident Prevention Regulations (UVV), the Hazardous Substances Ordinance (GefStoffV) and the applicable environmental regulations.

When returning pumps and their accessories, please send them back to us in a properly cleaned condition (safe and harmless for health and environment) and confirm the safety and harmlessness of the medium used.

If used with toxic, microbiological, explosive, radioactive or other hazardous substances, the safety data sheet must be provided to us and enclosed to the shipment.

Failure to follow the above instructions will lead to the implementation of measures that ensure the safe handling of the pump or the device, at your cost. We reserve the right to reject contaminated pumps and accessories and to return them for cleaning at your cost!

This declaration of harmlessness must be attached clearly visible outside of the packaging of the return shipment, and if possible sent in advance by e-mail including the safety data sheet, if applicable, to: service-emea-gr@circor.com. Please understand that return shipments without a declaration of harmlessness cannot be processed until such declaration is received.

Pump type \_\_\_\_\_

The pump has been thoroughly drained and cleaned outside and inside prior to dispatch or provision.

Serial number: \_\_\_\_\_

Special safety precautions are not necessary.

Was the pump operated with hazardous substances or other media that are hazardous to health or the environment?

No

Yes

Special safety precautions regarding residual liquid, rinsing media, personal protective equipment and disposal are necessary (safety data sheets are required and must be sent in advance/enclosed).

Medium used:

\_\_\_\_\_

Aside from the medium specified, are there any other safety aspects that need to be observed (for example, the cleaning medium used)?

UN / CAS number (see safety data sheet):

If yes, which:

\_\_\_\_\_

\_\_\_\_\_

Up-to-date safety data sheet enclosed.

**We do not accept return shipment of pumps or parts thereof that have been exposed to radioactive or microbiological contamination and that were not properly decontaminated.**

Contact:

\_\_\_\_\_

Tel. / fax / e-mail:

\_\_\_\_\_

**Legally binding declaration:**

We hereby certify that we have completed this declaration fully and truthfully to the best of our knowledge. The dispatch is performed in compliance with all legal requirements that apply to the packaging, shipping, and labeling of hazardous substances. The sender is liable for all damages caused by unmarked decontaminations of the returned object.

Place, date

Signature

Stamp

Tab. 15 Declaration of harmlessness