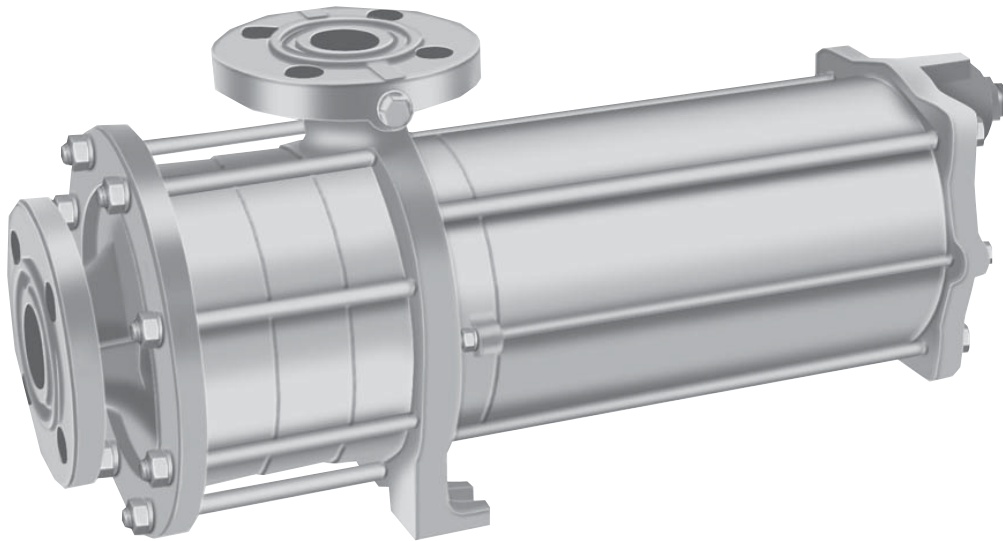


Refrigerant Pump

Original operating manual

Series CAM



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We reserve the right to make technical changes.



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1 About this operating manual

This manual:

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

1.1 Target groups

Target group	Duty
Operating company	► Keep this manual available at all times at the site where the equipment is operated, even during later use. ► Ensure that personnel read and follow the instructions in this manual and the other applicable documents, especially all safety instructions and warnings. ► Observe any additional rules and regulations referring to the system.
Qualified personnel, fitter	► Read, observe and follow this manual and the other applicable documents, especially all safety instructions and warnings.

Tab. 1 Target groups and their duties

1.2 Other applicable documents

Document	Purpose
Tightening torques	Installation of the pump
Performance curve	Operating limits
Declaration of conformity	Legally binding confirmation that the pump fulfills all requirements of the applicable EC guideline(s) (→ 9.4 Declarations in accordance with the EC Machinery Directive , Page 42).
Dimensional drawing	Setup dimensions, connection dimensions, etc.
Brochure	Technical specifications, operating limits
Parts list, sectional drawing	Ordering spare parts
Maximum support load table	Maximum permissible forces and torques at the supports
Technical specification	Technical specifications, conditions of operation
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 disregard
 DANGER	Immediate acute risk	Death, serious bodily harm
 WARNING	Potentially acute risk	Death, serious bodily harm
 CAUTION	Potentially hazardous situation	Minor bodily harm
NOTE	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. , ...	Multiple-step instructions
ü	Precondition
→	Cross-reference
	Information, recommendation

Tab. 4 Symbols and their meaning

2 Safety



The manufacturer does not accept any liability for damage resulting from disregard of any parts of this documentation.

2.1 Intended use

- Only use the pump within the limits set by the technical specifications (→ technical specification).
- Liquid pumped
 - Only use the pump for pumping the agreed liquids (→ technical specification).
 - Observe the specified physical properties of the pumped liquids, such as temperature, density, viscosity, specific heat and vapor pressure.
- Electric motor
 - Only operate the electric motor with the designated voltage and frequency (→ technical specification).
- Conditions of use
 - Suction head, system pressure and flow rate must remain within the specified limits (→ technical specification).

2.1.1 Prevention of obvious misuse (examples)

- Pumping liquids containing solids is not permitted.
- Pumping liquids containing impurities is not permitted. It can cause cavitation and damage to the pump.
- Do not use in areas where there is a risk of explosion.
- Avoid dry running
 - Dry running causes severe damage, such as destruction of the sleeve bearings and pump components, within a few seconds.
 - Ensure that the pump is always filled with pumping liquid.
 - Bleed the pump completely before the initial start-up.
- Avoiding cavitation
 - Observe the minimum suction head (→ 5.2.3 Specifying pipe lengths, Page 20).
 - Fully open the suction-side valve and do not use it to adjust the flow.
 - Monitor the suction-side filter.
 - Ensure that the flow rate remains within the specified limits (→ technical specification).
- Avoid overheating
 - Do not operate the pump while the pressure-side fitting is closed.
 - Observe the minimum flow rate (→ technical specification).
- Avoid overloading
 - Observe the maximum flow rate (→ technical specification).
- Remove covers, transport and sealing covers before installation.

2.1.2 Residual risks and measures

Residual risk	Measures by the operating company
Cuts while working without personal protective equipment.	Observe warnings in the operating manual. Training for personnel. Provide and use personal protective equipment.
Electric shock: - Motor not properly electrically connected - Pump is not, or incorrectly, grounded - Access by unauthorized persons	Observe warnings in the operating manual. Training for personnel. Prevent access by unauthorized persons.
Burns, frostbite, crushing - Pump is insufficiently protected from accidental contact - Access by unauthorized persons	Observe warnings in the operating manual. Training for personnel. Prevent access by unauthorized persons. Install protection against accidental contact.
Injuries due to escaping pumped liquids when not used in accordance with specifications.	Observe warnings in the operating manual. Training for personnel. Prevent access by unauthorized persons. Provide and use personal protective equipment.

2.2 General safety instructions



Note the following regulations before carrying out any work.

2.2.1 Product safety

The pump has been constructed according to the latest technology and recognized technical safety rules. Nevertheless, operation of the pump can still put the life and health of the user or third parties at risk, damage the pump or other property.

- Only operate the pump when in perfect technical condition and only use as intended, staying aware of safety and risks, and in adherence to the instructions in this manual.
- Keep this manual and all other applicable documents complete, legible and accessible to personnel at all times.
- Refrain from any procedures and actions that would pose 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 appropriate personnel.
- 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 pump is operated.

2.2.2 Obligations of the operating company

Safety-conscious operation

- Only operate the pump when in perfect technical condition and only use as intended, staying aware of safety and risks, and in adherence to the instructions in this manual.
- Ensure that the following safety aspects are observed and monitored:
 - Adherence to 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
- Provide personal protective equipment.

Qualified personnel

- Make sure all personnel entrusted with 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.
- Have all work in all operating phases carried out by specialist technicians only.
- Make sure that trainee personnel only work on the pump under supervision of specialist technicians.

Safety equipment

- Provide the following safety equipment and verify its functionality:
 - for hot, cold surfaces: protection against accidental contact for the pump, provided by the operating company
 - ensure appropriate grounding

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.

2.2.3 Obligations of personnel

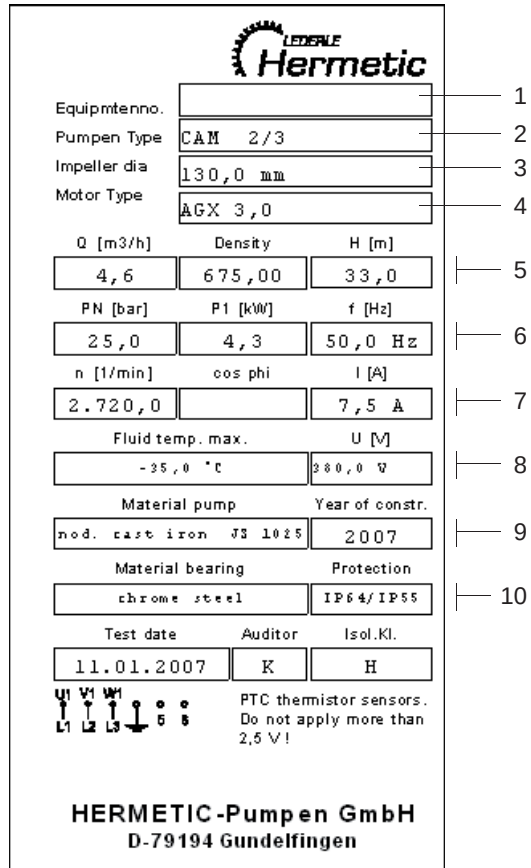
- Observe all warnings on the pump and ensure they are legible.
- Do not remove protection against accidental contact for hot and cold surfaces during operation.
- Use personal protective equipment whenever necessary.
- Only carry out work on the pump while it is not running.
- Isolate the motor from its supply voltage and secure it against being switched back on again when carrying out any fitting or maintenance work.
- Reinstall the safety equipment on the pump according to regulations after any work on the pump.

3 Layout and Function

3.1 Description

Multi-level centrifugal pump with canned motor for boiling liquids or coolants.

3.2 Label



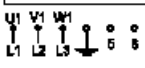
		
Equipmtenno.		
Pumpen Type	CAM 2/3	
Impeller dia	130,0 mm	
Motor Type	AGX 3,0	
Q [m ³ /h]	Density	H [m]
4,6	675,00	33,0
PN [bar]	P1 [kW]	f [Hz]
25,0	4,3	50,0 Hz
n [1/min]	cos phi	I [A]
2.720,0		7,5 A
Fluid temp. max.		U [V]
-25,0 °C		380,0 V
Material pump		Year of constr.
nod. cast iron JS 1025		2007
Material bearing		Protection
chrome steel		IP64/ IP55
Test date	Auditor	Isol.Kl.
11.01.2007	K	H
		
PTC thermistor sensors. Do not apply more than 2,5 V!		
HERMETIC-Pumpen GmbH D-79194 Gundelfingen		

Fig. 1 Name plate (example)

- 1 Equipment number
- 2 Pump type
- 3 Actual impeller diameter [mm]
- 4 Motor type
- 5 Flow rate [m³/h], specific density [kg/m³], differential head [m]
- 6 Nominal pressure [bar], nominal motor output [kW], frequency [Hz]
- 7 Nominal speed [rpm], phase shift [°], rated current [A]
- 8 Fluid temperature [°C], nominal voltage [V]
- 9 Material of pump, year of construction
- 10 Materials of bearing, protection class

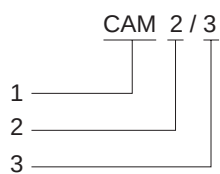


Fig. 2 Pump type label (on the name plate)

- 1 Series
- 2 Size
- 3 Number of stages

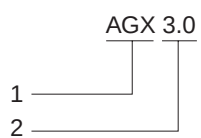


Fig. 3 Motor type label (on the name plate)

- 1 Construction type
- 2 Size

3.3 Layout

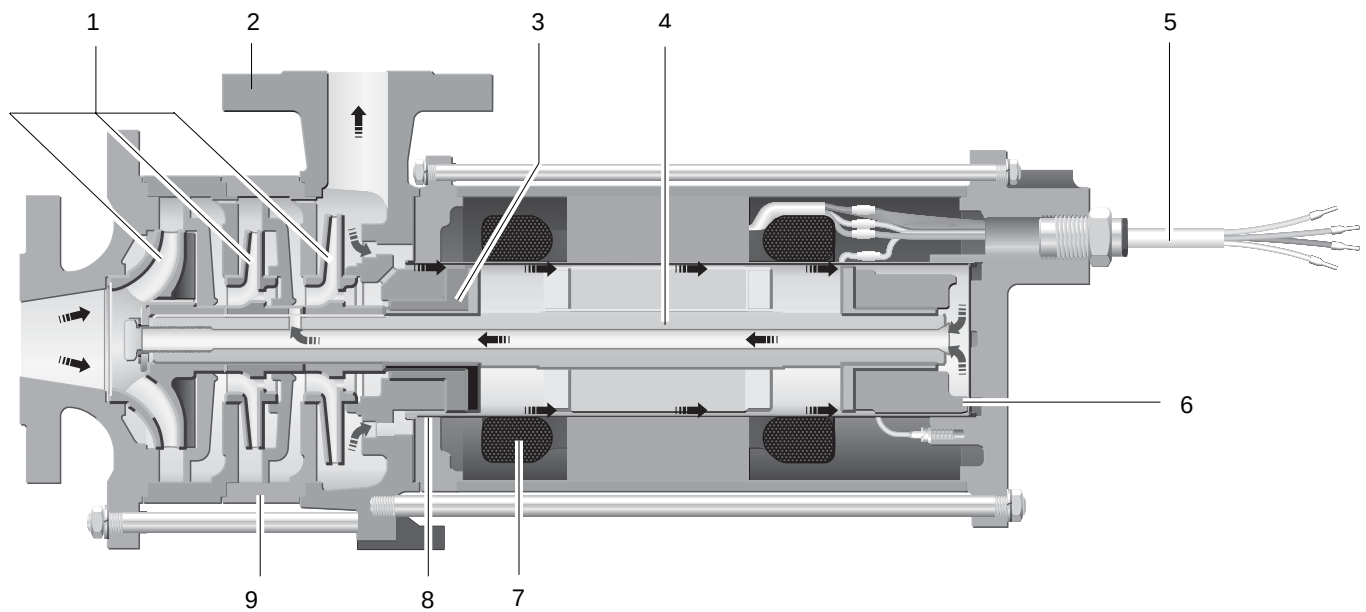


Fig. 4 CAM layout (example CAM 2/3)

- 1 Impellers
- 2 Pressure stage
- 3 Front sleeve bearing
- 4 Top shaft
- 5 Connection cable
- 6 Rear sleeve bearing
- 7 Electrical winding
- 8 Stator tube
- 9 Stage casing

4 Transport, Storage and Disposal

4.1 Transport

Weight specifications (→ dimensional drawing, delivery note).

4.1.1 Unpacking and inspection on delivery

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

4.1.2 Lifting



DANGER

Death or crushing of limbs may be caused by falling loads!

- ▶ Use lifting gear appropriate for the total weight to be transported.
- ▶ Fasten the lifting gear as illustrated below.
- ▶ Do not stand under suspended loads.

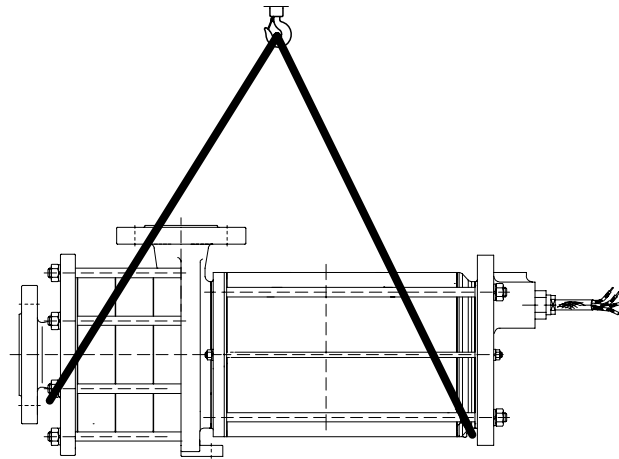


Fig. 5 Fastening lifting gear to pump unit

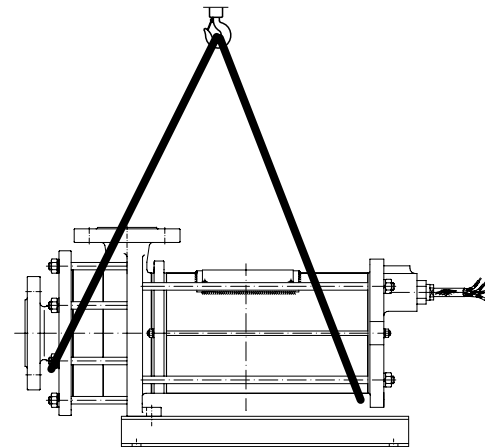


Fig. 6 Fastening the lifting gear to the pump unit with base plate

- ▶ Lift the unit in an orderly fashion.

4.2 Treatment for storage



Not necessary for stainless materials.

The preservation applied at the plant lasts for 12 months.

CAUTION

Material damage may occur due to inappropriate treatment for storage!

- Ensure the pump is treated for storage properly, both inside and outside.

1. Selecting preservatives:
 - Compatible with the pump materials
 - Compatible with the pumped liquid
2. Use the preservative specified by the manufacturer.
3. All bare metal parts should be treated with preservative, inside and outside.

4.3 Storage

CAUTION

Material damage may occur due to inappropriate storage!

- Store the pump properly.

1. Close all openings with blank flanges, plugs or plastic covers.
2. Ensure the storage room is:
 - dry
 - frost-free
 - vibration-free
3. Rotate the motor shaft before installing the pump and check that it can move freely.

4.4 Disposal



Risk of poisoning and environmental damage by 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 any leaking pumped liquid in accordance with local regulations.

1. Empty the pump completely and clean it.
2. Dispose of the pump in accordance with local regulations.

5 Installation and connection

CAUTION

Material damage can be caused by dirt!

- ▶ Do not remove any covers, transport and sealing covers until immediately before connecting the pipes to the pump.

5.1 Preparing the setup

5.1.1 Checking the ambient conditions

1. Make sure the required ambient conditions are fulfilled (→ 9.2.1 Ambient conditions, Page 40).
2. Adhere to system conditions (→ brochure, technical specification).

5.1.2 Preparing the installation site

- ▶ Ensure the installation site meets the following conditions:
 - Pump is freely accessible from all sides
 - There is 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 is not exposed to external vibrations (damage to bearings)

5.1.3 Preparing the foundation

- ▶ Make sure the foundation and surface are:
 - level
 - clean (no oil, dust or other impurities)
 - capable of bearing the weight of the pump unit and all operating forces
 - ensure the pump is stable and cannot tip over

5.1.4 Preparing the pump

- ▶ After longer storage/shutdown periods, perform the following measures:

Storage/shutdown period	Measure
2 years	▶ If necessary, replace the seals.

Tab. 5 Measures after longer storage/shutdown periods

5.2 Planning the piping

5.2.1 Specifying supports and flange connections

CAUTION

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

- Do not exceed the permissible values (→ maximum support load, torque table).
-

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

5.2.2 Specifying nominal diameters



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

1. Make sure the nominal suction pipe diameter is $\geq$ the nominal suction branch diameter.
2. Make sure the nominal vessel outlet diameter is $\geq$ the nominal outlet flange diameter.

5.2.3 Specifying pipe lengths

Calculate the minimum suction head (→ technical specification)

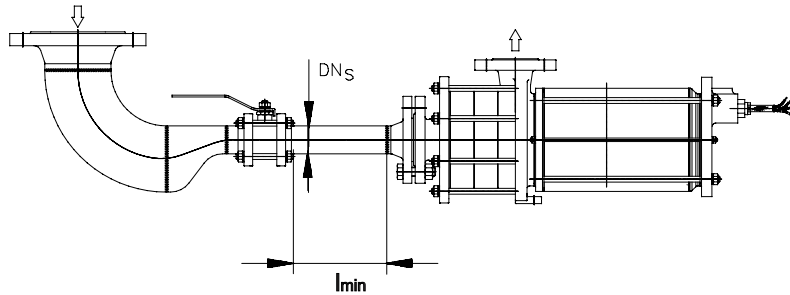


Fig. 7 Supply pipe

1. $e_{\min} = \text{NPSH}_{\text{req.}} + R_z + S$

$e_{\min}$ – minimum suction head [m]

R_z – resistance of the supply pipe [m]

S – additional safety factor [m]

2. Maintain the minimum suction head when installing the pump.

3. $l_{\min} = 5 \cdot \text{DN}_s$

$l_{\min}$ – minimum length of the settling section [mm]

DN_s – supply pipe diameter [mm]

4. Maintain the minimum length of the horizontal settling section.



Upstream: Shorter pipes are possible, but may restrict the hydraulic performance and/or lead to cavitation.

5.2.4 Supply flow speed

1. Calculate the supply flow speed.
 - Optimum speed: 0.3 m/s – 0.5 m/s
2. If necessary, adjust the diameter of the supply pipe.

5.2.5 Optimizing cross-section and direction changes

1. Avoid bending radii of less than 1.5 times the nominal pipe diameter.
2. Avoid abrupt changes of cross-section along the piping.
3. Lay the supply pipe so that it runs constantly downwards and not horizontally to the separator.

5.2.6 Providing safety and control devices (recommended)

1. Provide a separator in the supply pipe.
2. Provide a vortex breaker in the vessel outlet.
3. Arrange the vessel inlet and outlet at angles to each other.
4. If parallel operation is in use: provide each pump with its own vessel outlet.
5. Ensure that the pressure/temperature in the supply container drops slowly.

5.2.7 Making provisions for isolating and shutting off pipes



For maintenance and repair work.

- Provide shut-off devices in the supply pipes and vessel outlets.

5.2.8 Allow measurements of the operating conditions

1. Provide manometers for pressure measurements in the supply pipes and vessel outlets.
2. Provide for pipe-side temperature measurements.

5.2.9 Installation Recommendations

Avoiding cavitation

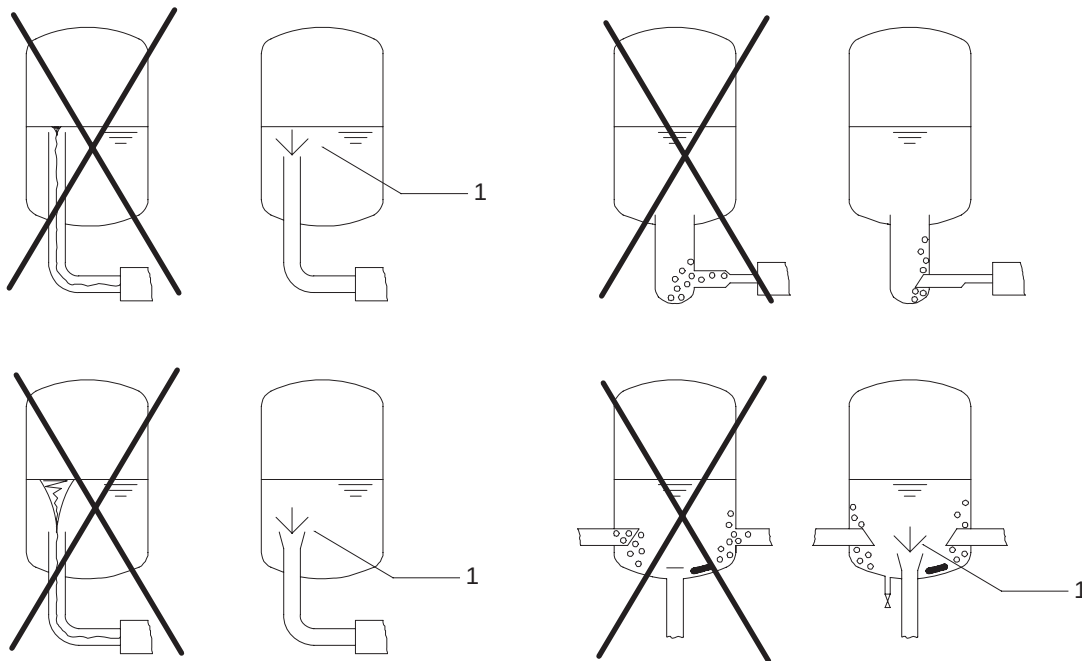


Fig. 8 Arrangement of vortex breakers at the vessel outlet

1 Vortex breaker

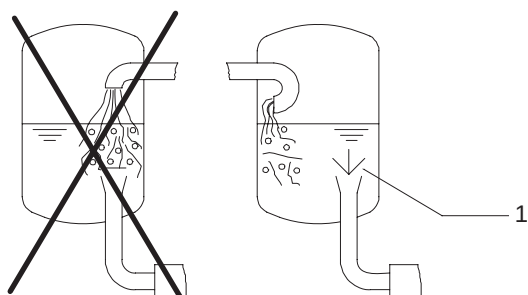


Fig. 9 Vessel inlet/vessel outlet arrangement

1 Vortex breaker

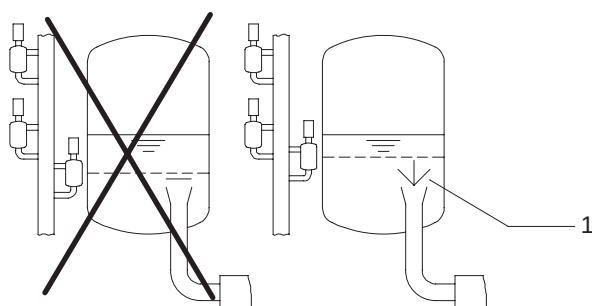


Fig. 10 Level monitor arrangement

1 Vortex breaker

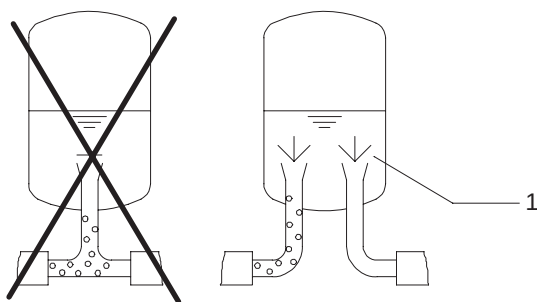


Fig. 11 Parallel operation arrangement

1 Vortex breaker

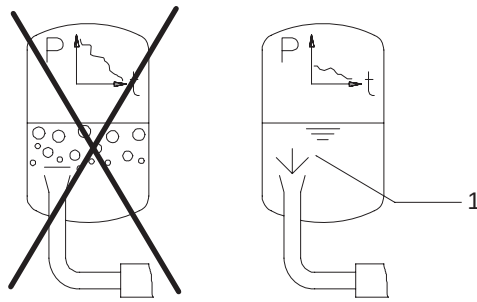


Fig. 12 Slow pressure/temperature drop

1 Vortex breaker

Automatic venting

1. Install a non-return valve between the outlet flange and the gate valve to ensure the medium does not flow back when the pump is switched off.
2. Provide a bypass pipe to enable venting:
 - Install it in front of the non return valve.
 - Make sure that there is no non return valve in the bypass pipe.
3. For parallel operation:
 - Separate supplies for the pumps
 - Separate bypass pipes

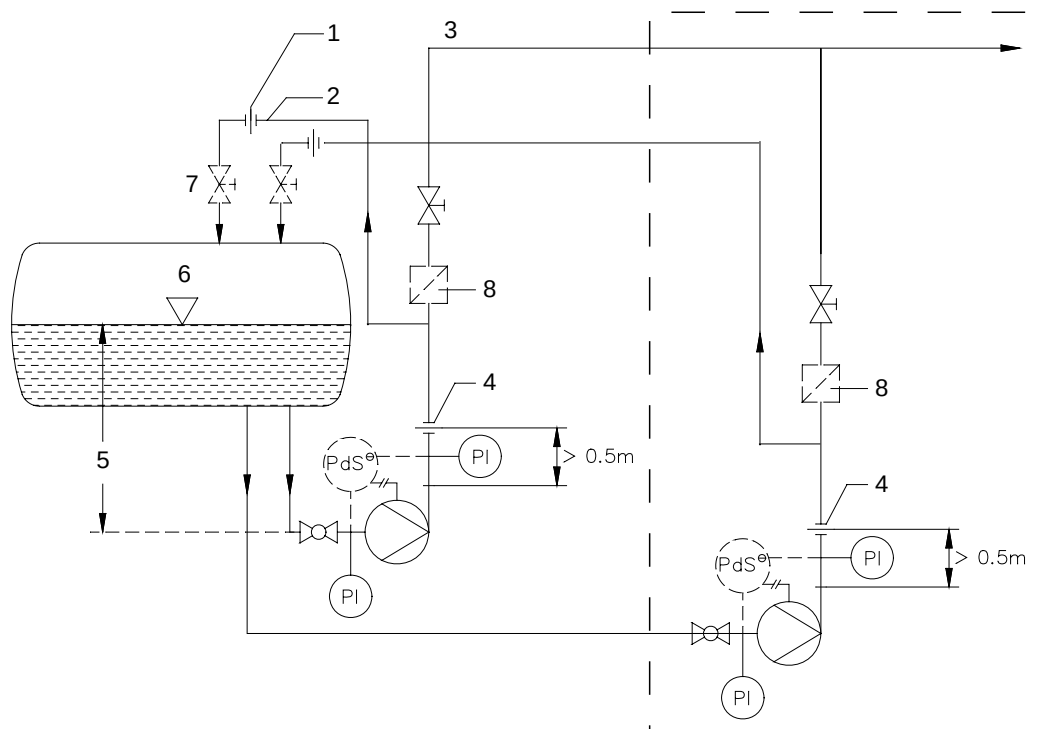


Fig. 13 Automatic venting (single pump - parallel pumps)

- | | | |
|---|--------------------|---|
| 1 Qmin – orifice (directly in front of gate valve/liquid separator) | 4 Qmax – orifice | 7 Gate valve (directly in front of the supply container/liquid separator) |
| 2 Bypass/venting | 5 Suction head | 8 Non-return valve |
| 3 Consumer | 6 Liquid separator | |

Making provisions for isolating and shutting off pipes



For maintenance and repair work.

- Provide shut-off devices in the supply pipes and vessel outlets.

Allow measurements of the operating conditions

1. Provide manometers for pressure measurements in the supply pipes and vessel outlets.
2. Provide for pump-side temperature measurements.

5.3 Connecting the pipes

5.3.1 Keeping the piping clean

CAUTION**Material damage may occur due to impurities in the pump!**

- Ensure no impurities can enter the pump:
 - Flush the pipes so that scales, welding beads and other foreign objects do not damage the pump.
 - If necessary, install a sieve in the supply pipe during the start-up phase.

1. Clean all piping 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.

5.3.2 Mounting the supply pipe

1. Remove the transport and sealing covers from the pump.
2. Run the pipes with a continuous downward slope to the separator.
3. Ensure no seals protrude inwards.

5.3.3 Installing the vessel outlet

CAUTION**Damages can result from incorrect connection!**

- Connect the pipes properly.

1. Remove the transport and sealing covers from the pump.
2. Installing the vessel outlet:
 - Qmax orifice at least 0.5 m above the outlet flange of the pump
3. Mounting the bypass pipe:
 - In front of the first gate valve of the vessel outlet
 - Qmin orifice as close as possible to the separator
4. Ensure no seals protrude inwards.

5.3.4 Ensuring stress-free pipe connections

1. Ensure that
 - the permissible flange forces are not exceeded
 - the pump is not used as an anchor point for pipes
2. When pumping hot liquids, ensure that
 - the pipes have been laid suitably for expansion
 - the pipes have been spring-suspended or expansion joints have been used

5.4 Electrical connection



DANGER

Risk of death due to electric shock!

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

5.4.1 Providing a motor protection switch

- ▶ Provide a motor protection switch in accordance with VDE 0660 with the following specifications:
 - Current rating on the name plate
 - Motor operation type = S1
 - Maximum permissible switch frequency in normal operation = 6 start-ups/hour
 - Minimum pause between 2 starts = 10 minutes

5.4.2 Connecting the motor



Connect the terminals as follows for the correct sense of rotation:

- U1 - L1
 - V1 - L2
 - W1 - L3
1. Connect the motor according to the connection diagram.
 2. Ground the pump using the grounding conductor of the cable connection.
 - If available, also ground the pump using the grounding terminal on the rear motor casing cover.
 3. Install an EMERGENCY STOP switch.

6 Operation

6.1 Putting the pump into service for the first time

6.1.1 Identifying the pump type

- ▶ Identify the pump type (→ technical specification).

6.1.2 Checking the shutdown period

- ▶ After a shutdown period of > 2 years: (→ Table 5 Measures after longer storage/shutdown periods, Page 18).

6.1.3 Filling and venting



Risk of injury and poisoning due to hazardous pumped liquids!

- ▶ Use personal protective equipment when carrying out any work on the pump.
- ▶ Safely collect any leaking pumped liquid and dispose of it in accordance with environmental rules and requirements.

CAUTION

Material damage caused by dry running!

- ▶ Make sure the pump is filled and bled properly.

1. Open the shut-off devices in the bypass pipe.
2. Fill the pump and the supply pipe with pumped liquid.
3. Wait until the pump casing has cooled to the temperature of the supply container.
4. Verify that no pipe connections are leaking.

6.1.4 Checking the sense of rotation

1. Switch on the motor.
2. Check the operating parameters or rotary field of the motor.



Risk of death due to electric shock!

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

3. In the event of deviating operational parameters or incorrect field of rotation: swap two phases.
4. Re-establish the electrical connections of the pump.

6.1.5 Switching on

- ✓ Pump 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



DANGER

Risk of injury due to running pump!

- ▶ Do not touch the running pump.
- ▶ Do not carry out any work on the running pump.



DANGER

Risk of injury and poisoning due to pumped liquid spraying out!

- ▶ Use personal protective equipment when carrying out any work on the pump.

CAUTION

Material damage caused by dry running!

- ▶ Make sure the pump is filled and bled properly.
- ▶ Observe the permissible flow rate (→ technical specification).

CAUTION

Risk of cavitation when throttling down the supply flow rate!

- ▶ Fully open the supply-side fitting and do not use it to adjust the delivery flow.
- ▶ Observe the permissible flow rate (→ technical specification).

CAUTION

Material damage caused by overheating!

- ▶ Do not operate the pump while the pressure-side fitting is closed.
- ▶ Observe the permissible flow rate (→ technical specification).

1. Open the supply-side fitting.
2. Close the pressure-side fitting.
3. Switch on the motor and make sure it is running smoothly.
4. Once the motor has reached its nominal speed, open the pressure-side fitting slowly until the operating point is reached.
5. 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. Check all tie bolts and tighten them if necessary.

6.2 Operating

6.2.1 Switching on

- ✓ Pump initially put into service properly
- ✓ Pump prepared, filled and bled properly



DANGER

Risk of injury due to running pump!

- ▶ Do not touch the running pump.
- ▶ Do not carry out any work on the running pump.



DANGER

Risk of injury and poisoning due to pumped liquid spraying out!

- ▶ Use personal protective equipment when carrying out any work on the pump.

CAUTION

Risk of cavitation when throttling down the supply flow rate!

- ▶ Fully open the supply-side fitting and do not use it to adjust the delivery flow.

CAUTION

Material damage caused by overheating!

- ▶ Do not operate the pump while the pressure-side fitting is closed.
- ▶ Observe the permissible flow rate (→ technical specification).

1. Open the supply-side fitting.
2. Close the pressure-side fitting.
3. Switch on the motor and make sure it is running smoothly.
4. Once the motor has reached its nominal speed, open the pressure-side fitting slowly until the operating point is reached.

6.2.2 Switching off

- ✓ Pressure-side fitting closed (recommended)



WARNING

Risk of injury due to cold surfaces!

- ▶ Use personal protective equipment when carrying out any work on the pump.

- ▶ Switch off the motor.

6.3 Shutting down the pump



Risk of injury and poisoning due to hazardous pumped liquids!

- ▶ Safely collect any leaking pumped liquid and dispose of it in accordance with environmental rules and requirements.

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

Pump is	Measure
...shut down for a prolonged period	▶ Take measures appropriate to the pumped liquid (→ Table 7 Measures depending on the behavior of the pumped liquid, Page 30).
...emptied	▶ Close the suction-side valve and pressure-side fittings.
...dismounted	▶ Isolate the motor from its power supply and secure it against unauthorized switch-on.
...put into storage	▶ Follow the storage instructions (→ 4.3 Storage, Page 17).

Tab. 6 Measures to be taken if the pump is shut down

Behavior of the pumped liquid	Duration of shutdown (depending on process)	
	Short	Long
Remains liquid, non-corrosive	–	–
Remains liquid, corrosive	–	▶ Empty the pump and containers. ▶ Treat the pump and containers with preservative.

Tab. 7 Measures depending on the behavior of the pumped liquid

6.4 Start-up following a shutdown period

1. In the event of shutdown periods of more than 2 years:
 - (→ Table 5 Measures after longer storage/shutdown periods, Page 18).
2. Carry out all steps as for the initial start-up (→ 6.1 Putting the pump into service for the first time, Page 27).

6.5 Operating the stand-by pump

1. Preparing the stand-by pump:
 - Putting the pump into service for the first time (→ 6.1 Putting the pump into service for the first time, Page 27).
 - Fill and bleed the stand-by pump.
2. Operating the stand-by pump (→ 6.2.1 Switching on, Page 29).

7 Maintenance

Trained service technicians are available for fitting and repair work. Present a pumped medium certificate (DIN safety data sheet or safety certificate) when requesting service.

7.1 Inspections



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



DANGER

Risk of injury due to running pump!

- ▶ Do not touch the running pump.
- ▶ Do not carry out any work on the running pump.



WARNING

Risk of injury and poisoning due to hazardous pumped liquids!

- ▶ Use personal protective equipment when carrying out any work on the pump.

1. Check at appropriate intervals:
 - Adhere to the minimum and maximum flow rates (→ technical specification)
 - Normal operating conditions unchanged
2. For trouble-free operation, always ensure the following:
 - Minimum suction head
 - No dry running
 - No leaks
 - No cavitation (max. pressure difference between suction and outlet flanges)
 - Open gate valves on supply side
 - No unusual running noises or vibrations

7.2 Repairs



DANGER

Risk of injury due to running pump!

- ▶ Do not touch the running pump.
- ▶ Do not carry out any work on the running pump.
- ▶ Isolate the motor from its supply voltage and secure it against being switched back on again when carrying out any fitting or maintenance work.



DANGER

Risk of death due to electric shock!

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



WARNING

Risk of injury and poisoning due to hazardous pumped liquids and hot or cold components!

- ▶ Use personal protective equipment when carrying out any work on the pump.
- ▶ Allow the pump to warm up and the motor to cool down before commencing any work.
- ▶ Make sure the pump is unpressurized.
- ▶ Empty the pump, safely collect the pumped liquid and dispose of it in accordance with environmental rules and requirements.



WARNING

Risk of injury during maintenance work!

- ▶ Secure the pressure-side valve against unintentional opening.
- ▶ Wear protective gloves, components could have very sharp edges.

7.2.1 Dismounting

CAUTION

Material damage due to inappropriate dismantling!

- ▶ Remove resinous residues between rotor and stator with solvents.
- ▶ Warm up immobile bearing sleeves.

Preparations for dismounting

- ✓ Pump unpressurized
- ✓ Pump completely empty, flushed and decontaminated
- ✓ Electrical connections disconnected and motor secured against being switched on again
- ✓ Pump de-iced
- ✓ Manometer lines, manometer and holdings dismantled



In production, the pumps are constructed using a multistage (modular) process.

- When dismantling, observe the following:
 - Mark the precise orientation and position of all components before dismantling them.
 - Dismount components concentrically without canting.

Dismount the pump and motor part:



For the designations and positions of the components (→ sectional drawing).

Mark the position of the suction cover **162.2**, stage casing **108** and pump housing **101**.

1. Loosen and remove the hex nuts **914.30** and split washers **930.1**.
2. Pull the suction cover **162.2** forward and off.
3. Bend up the locking plate **931.1** and remove the hex bolt **906** and tension disc **552.1**.
4. Pull off the impeller **230.1**, stage casing **108** and vane insert **174.2** without misaligning the motor shaft **819** and remove the key **940.1**.
5. Repeat step 4 until all the stages have been removed.
6. Loosen and remove the hex nuts **920.2** and split washers **930.9**.
7. Pull the stator completely out of the pump casing.
8. Pull the motor shaft **819** out of the pump casing.
9. Pull off the bearing bush **545.1** with the bearing sleeve **529.1** and engine shaft **819**.
10. Remove the snap ring **932.1** and pull the bearing sleeve **529.2** off the motor shaft **819**.
11. To dismount the motor-side carbon bearing **545.2** (only for motors AGX 3.0, 4.5 and 6.5):
 - Loosen the stator screw **900.3**.

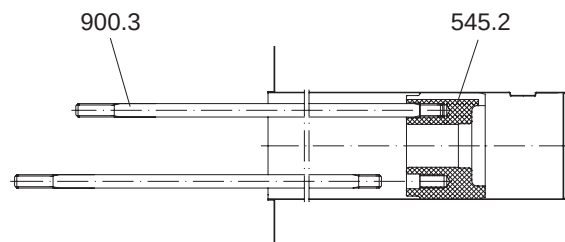


Fig. 14 Dismounting the carbon bearing

Dismounting the stator:

1. Open nut **920.12**, remove clamp screw **900.5**.
2. Remove cover for motor casing **160**.
 - When doing this, label the electric supply lines and disconnect at the connection point.
3. Press out the stator tube **816** out of the stator in the direction of the pump.
4. Remove the cover for motor casing **812.1** from the motor casing **811**.
5. Inspect the stator winding for possible damage:
 - If necessary, replace the stator or rewind it.

7.2.2 Returning the pump to the manufacturer

- ✓ Pump unpressurized
 - ✓ Pump completely empty
 - ✓ Secure motor against being switched on again
 - ✓ Pump de-iced
 - ✓ Manometer lines, manometer and holdings dismantled
1. Enclose a truthfully and fully completed document of compliance when returning pumps or components to the manufacturer (→ 9.3 Safety certificate , Page 41).
 2. Take necessary measures, depending on the required repair work, 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 unit (not disassembled) to the manufacturer.
...at the manufacturer's premises for warranty repairs	► Only in the event of hazardous pumped liquid: flush and decontaminate the pump. ► Return the complete pump unit (not disassembled) to the manufacturer.

Tab. 8 Measures for return

7.2.3 Installing

Preparations for mounting

1. Observe the following during the installation:
 - Replace worn parts with genuine spare parts.
 - Replace seals.
 - Maintain the prescribed tightening torques (→ 1.2 Other applicable documents, Page 6).
 - Reinstall the components concentrically, without canting, in accordance with the marks applied.
2. Clean all parts. Do not remove any markings that may have been attached.
3. Mount the pump (→ sectional drawing).
 Mounting is conducted in reverse order to dismantling. The following sections detail the particular features of mounting.

Installing

CAUTION

Material damage due to inappropriate mounting!

- ▶ Make sure there is a gas bleed hole (Ø 3 mm) on the top of the stage casing **108**.
- ▶ Make sure the lateral hole in the motor shaft **819** is lined up with the hole in the hub of the impeller **230** and does not cover it.
- ▶ Fit the suction cover **162.2**, stage casing **108** and pump housing **101** in the position and order they were marked in before disassembly.

1. With new bearing bushes **545.1/2** bearing sleeves **529.1/2** make sure:
 - That the cylindrical pin **562.1–3** is adjusted correctly
 - Groove in carbon bearing and notch flush in stator tube are aligned (the bearing can otherwise not be fully inserted).
2. Secure impeller nut **922** with locking plate **931.1**.

Completing assembly

- ▶ Pumpe prüfen (→ Technische Spezifikation):
 - Compressive strength
 - Leak proofness

7.3 Ordering spare parts



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

The application guidelines conforming to DIN 24296 recommend provisioning for two years of continuous use (→ parts list).

- ▶ Have the following information ready to hand when ordering spare parts (→ type plate):
 - Short designation of the pump
 - Equipment number
 - Year of manufacture
 - Part number
 - Designation
 - Quantity

8 Troubleshooting

8.1 Malfunctions

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
Pumping pressure insufficient	4
Pumping pressure excessive	5
Pump running roughly	6
Sleeve bearings temperature too high	7
Pump leaking	8
Excessive motor power uptake	9

Tab. 9 Malfunction/number assignment

8.2 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.

Malfunction number									Cause	Remedy
1	2	3	4	5	6	7	8	9		
X	X	–	X	–	X	–	–	–	Supply pipe or pump blocked or encrusted	► Clean the supply pipe or pump.
X	X	–	X	–	X	–	–	–	Air sucked into pump	► Seal the source of malfunction.
X	X	–	X	–	X	–	–	–	Excessive amount of gas: pump is cavitating	► Consult the manufacturer.
X	X	–	X	–	X	–	–	–	Pump running in the wrong sense of rotation	► Swap any two phases at the motor.
X	X	–	X	–	X	–	–	–	Impeller out of balance or blocked	► Dismount the pump and inspect it for dry-running damage. ► Clean the impeller.
X	X	–	–	X	X	–	–	–	Vessel outlet blocked	► Clean the vessel outlet.
X	X	–	X	–	–	–	–	–	Motor speed too low	► Compare the required motor speed with the specifications on the pump name plate. Replace the motor, if necessary. ► Increase the motor speed if speed control is available.

Malfunction number										Cause	Remedy
1	2	3	4	5	6	7	8	9			
X	–	–	–	–	–	–	–	–	–	Transport and sealing cover still in place	► Remove the transport and sealing cover. ► Dismount the pump and inspect it for dry-running damage.
X	–	–	–	–	–	–	–	–	–	Supply pipe and/or vessel outlet closed by fitting	► Open the fitting.
X	–	–	–	–	X	–	–	–	–	Supply pipe and pump bled incorrectly or not filled completely	► Fill up the pump and/or piping completely and bleed them.
X	–	–	–	–	X	–	–	–	–	Supply pipe contains air pockets	► Install the fitting for venting. ► Correct the piping layout.
–	X	–	X	–	–	–	–	–	–	Geodetic differential head and/or pipe flow resistances too high	► Remove sediments from the pump and/or vessel outlet. ► Install a larger impeller and consult the manufacturer.
–	X	–	X	–	–	–	–	–	–	Supply pipe not completely open	► Open the fitting.
–	X	–	X	–	X	–	–	–	–	Hydraulic parts of the pump dirty, clotted or encrusted	► Dismount the pump. ► Clean the parts.
–	X	–	X	–	X	–	–	–	–	Cross section of supply pipe too narrow	► Increase the cross-section. ► Remove any encrustations from the supply pipe. ► Open the fitting completely.
–	X	–	X	–	X	–	–	–	–	$NPSH_{\text{pump}}$ larger than $NPSH_{\text{system}}$	► Increase the suction pressure. ► Consult the manufacturer.
–	X	–	X	–	X	–	–	–	–	Pumped liquid temperature too high: pump is cavitating	► Increase the suction pressure. ► Lower the temperature. ► Consult the manufacturer.
–	X	–	X	–	X	–	–	–	–	Pump parts worn	► Replace the worn pump parts.
–	X	–	X	–	X	–	–	X	–	Motor running on 2 phases	► Check the fuse and replace it if necessary. ► Check the cable connections and insulation.
–	X	–	X	–	–	–	–	X	–	Viscosity or specific gravity of the pumped liquid outside the range specified for the pump	► Consult the manufacturer.
–	X	–	–	X	X	–	–	–	–	Pressure-side fitting not opened wide enough	► Open the pressure-side fitting.
–	–	X	X	–	X	–	–	X	–	Pressure-side fitting opened too wide	► Throttle down at the pressure-side fitting. ► Machine the impeller down. Consult the manufacturer and adjust the impeller diameter.

Malfunction number									Cause	Remedy
1	2	3	4	5	6	7	8	9		
–	–	X	–	–	X	–	–	X	Geodetic differential head, pipe flow resistances and/or other resistances lower than specified	▶ Throttle down the flow rate at the pressure-side fitting. Observe the minimum flow rate. ▶ Machine the impeller down. Consult the manufacturer and adjust the impeller diameter.
–	–	X	–	X	–	–	–	–	Viscosity lower than expected	▶ Machine the impeller down. Consult the manufacturer and adjust the impeller diameter.
–	–	X	–	X	X	X	–	X	Motor speed too high	▶ Compare the required motor speed with the specifications on the pump name plate. Replace the motor, if necessary. ▶ Reduce the motor speed if speed control is available.
–	–	X	–	X	X	–	–	X	Impeller diameter too large	▶ Throttle down the flow rate at the pressure-side fitting. Observe the minimum flow rate. ▶ Machine the impeller down. Consult the manufacturer and adjust the impeller diameter.
–	–	–	–	–	X	–	X	X	Pump distorted	▶ Check the pipe connections and pump attachment.
–	–	–	–	–	–	X	–	–	Pumped liquid insufficient or unsuitable	▶ Add or replace pumped liquid.
–	–	–	–	–	–	–	X	–	Tie bolts not tightened properly	▶ Tighten the tie bolts.
–	–	–	–	–	–	–	X	–	Housing seal defective	▶ Replace the housing seal.
–	–	–	–	–	–	–	X	–	Separating can seal defective	▶ Replace separating can seal.

Tab. 10 Troubleshooting list

9 Appendix

9.1 Recommended spare parts



Detailed ordering information (→ parts list).

Item no.	Designation
400.XX	Gaskets
545.01/02	Bearing bushes
529.01/02	Bearing sleeves
758	Strainer insert

Tab. 11 Recommended spare parts

9.2 Technical specifications



See technical specification.

9.2.1 Ambient conditions

Ambient temperature: -50 °C to 50 °C



Operation under any other ambient conditions should be agreed with the manufacturer.

9.2.2 Sound pressure level



< 70 dB

9.3 Safety certificate



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

All industrial companies are obliged by statutory regulations to protect their employees, other people and the environment from detrimental effects when handling hazardous substances.

Products and their components are therefore only repaired or inspected if the following declaration is submitted after being filled out properly and completely and signed by an authorized and qualified specialist technician.

If safety precautions have to be taken by the operating company in spite of the product being completely emptied and cleaned, the required information must be submitted. This document of compliance is part of the repair or inspection order.

We hereby declare that the returned device

Pump type, motor type: _____

HERMETIC equipment no.: _____

Is free from substances that may be hazardous to health. Special safety precautions are not necessary for subsequent use.

Has been completely emptied and thoroughly cleaned on the outside and inside prior to delivery or provision.

Company/institute: _____

Street: _____

Postal code, place: _____

Phone: _____

Name: _____

Position: _____

Date: _____

Signature, company stamp: _____

9.4 Declarations in accordance with the EC Machinery Directive

9.4.1 Declaration of conformity in accordance with the EC Machinery Directive



The following declaration does not include a serial number or signatures. The original declaration is supplied with the respective pump.



EC Declaration of Conformity

according to Directive 2006/42/EC, Annex II Part 1 Section A

We hereby declare that the following machinery:

Denomination: Centrifugal pump with canned motor

Pump: _____

Motor: _____

Equipment No.: _____

Year: _____

complies with all relevant provisions of the following Directives regarding its conceptual design and its construction as well as its state in which it was placed on the market by us:

- Directive 2006/42/EC of 17 May 2006 on machinery

Harmonised standards used, as referred to in Article 7(2):

- EN ISO 12100-1/A1: 2009 Safety of machinery - Basic concepts, general principles for design - Part 1: Basic terminology, methodology
- EN ISO 12100-2/A2: 2009 Safety of machinery - Basic concepts, general principles for design - Part 2: Technical principle
- EN ISO 14121-1: 2007 Safety of machinery - Risk assessment - Part 1: Principles
- EN 809: 1998 Pumps and pump units for liquids - Common safety requirements
- EN 60034-1: 2007 Rotating electrical machines - Part 1: Rating and performance
- EN 60034-5: 2007 Rotating electrical machines - Part 5: Degrees of protection provided by integral design of rotating electrical machines (IP code) - Classification

Person authorised to compile the technical file:

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Gundelfingen, 12.02.2010

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Fig. 15 Declaration of conformity in accordance with the EC Machinery Directive

