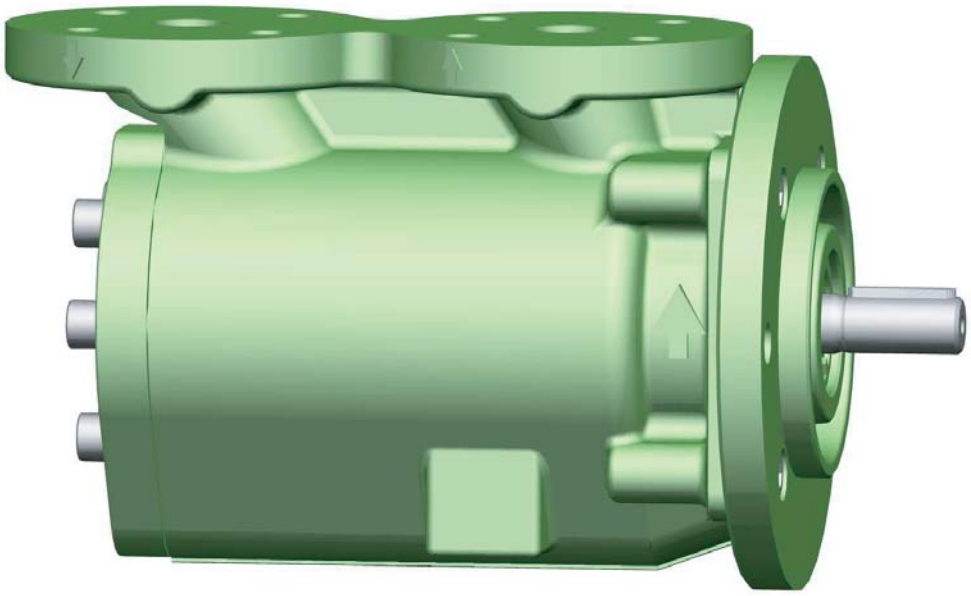
ALLWEILER

Screw Pump

Original Operating Manual SPF series



Version BA-2014.01
ID-No. 550 041
VM-No. 626.0005 GB

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Read carefully before use.
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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	► Keep this manual available at the site of operation of the equipment, including for 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
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
Declaration of conformity	Conformity with standards, contents of the declaration of conformity (→ 9.4 Declaration of conformity according to EC Machine Directives, Page 34).

Tab. 2 Other applicable documents and their purpose

1.3 Warnings and symbols

Warning	Risk level	Consequences of disregarding the warning
⚠ DANGER	Immediate acute risk	Death, serious bodily harm
⚠ WARNING	Potential 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
✓	Precondition
→	Cross reference
ℹ	Information, notes

Tab. 4 Symbols and their meaning

2 Safety

The manufacturer does not accept any liability for damages caused by disregarding the entire documentation.

2.1 Intended use

- Only use the pump to pump the agreed 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 fitting and do not use it to adjust the flow rate.
  – Open the pressure-side fitting completely.
- Avoid damage to the motor:
  – Note the maximum permissible number of times the motor can be switched on 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).
- When using auxiliary systems, ensure there is a continuous supply of the appropriate operating medium.
- 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. The 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 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 or damage the pump or other property.

- Only operate the pump if it is in perfect technical condition and only use it as intended, remaining 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 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 pump 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 in adherence 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 tasked 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.
- Ensure that all work is carried out by specialist technicians only:
  – Fitting, repair and maintenance work
  – Work on the electrical system
- Make sure that trainee personnel only work on the pump under the supervision of specialist technicians.

Safety equipment

- Provide the following safety equipment and verify its functionality:
  – For hot, cold and moving parts: Safety guarding provided by the customer for the pump
  – For possible build up of electrostatic charge: Ensure appropriate grounding
  – If there is no pressure relief valve in the pump: Provide an appropriate safety valve 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.

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 guarding for hot, cold or moving parts 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 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 Hazardous pumped liquids

- Follow the safety regulations for handling hazardous substances when handling hazardous (e.g. hot, flammable, poisonous or potentially harmful) pumped liquids.
- Use personal protective equipment when carrying out any work on the pump.

3 Layout and function

3.1 Label

3.1.1 Type plate

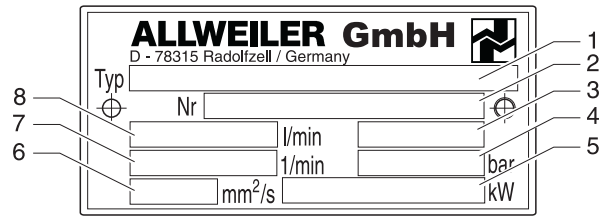

Fig. 1 Type plate (example)

1 Pump type
2 Pump number
3 Year of manufacture
4 Pumping pressure
5 Power consumption
6 Kinematic viscosity
7 Motor speed
8 Flow rate

3.1.2 ATEX plate

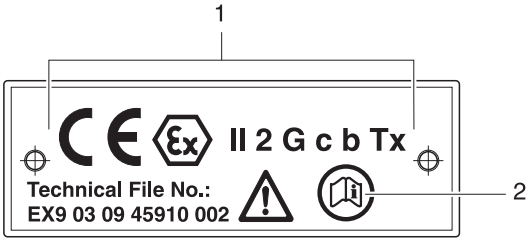

Fig. 2 ATEX plate (example)

1 Explosion protection mark
2 Reference to ATEX additional instructions

3.1.3 Pump type code

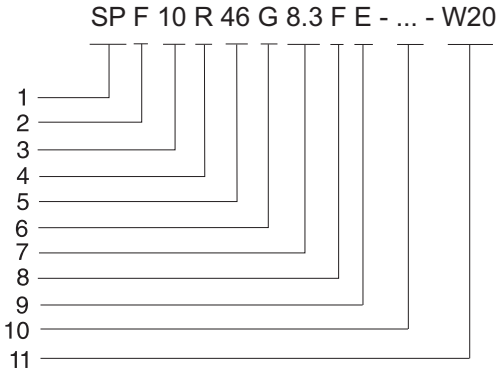

Fig. 3 Pump type code (example)

Position	Meaning	
1	Series (SP)	
2	Design	
	F	Flange pump
3	Size (theoretical flow rate in l/min at normal inclination and 1450 rpm)	
4	Spindle pitch direction	
	R	Right (standard)
	L	Left
5	Spindle pitch angle in degrees	
6	Design characteristic	
	G	Internal sleeve bearing
	U	Internal antifriction bearing, uncooled, unheated
7	Shaft seal	
	8.3	Mechanical seal
8	Filter version	
9	E	Version with electric filter heating
10	Pressure relief valve adjustment range	
11	Material key	

Tab. 5 Pump type code

3.2 Layout

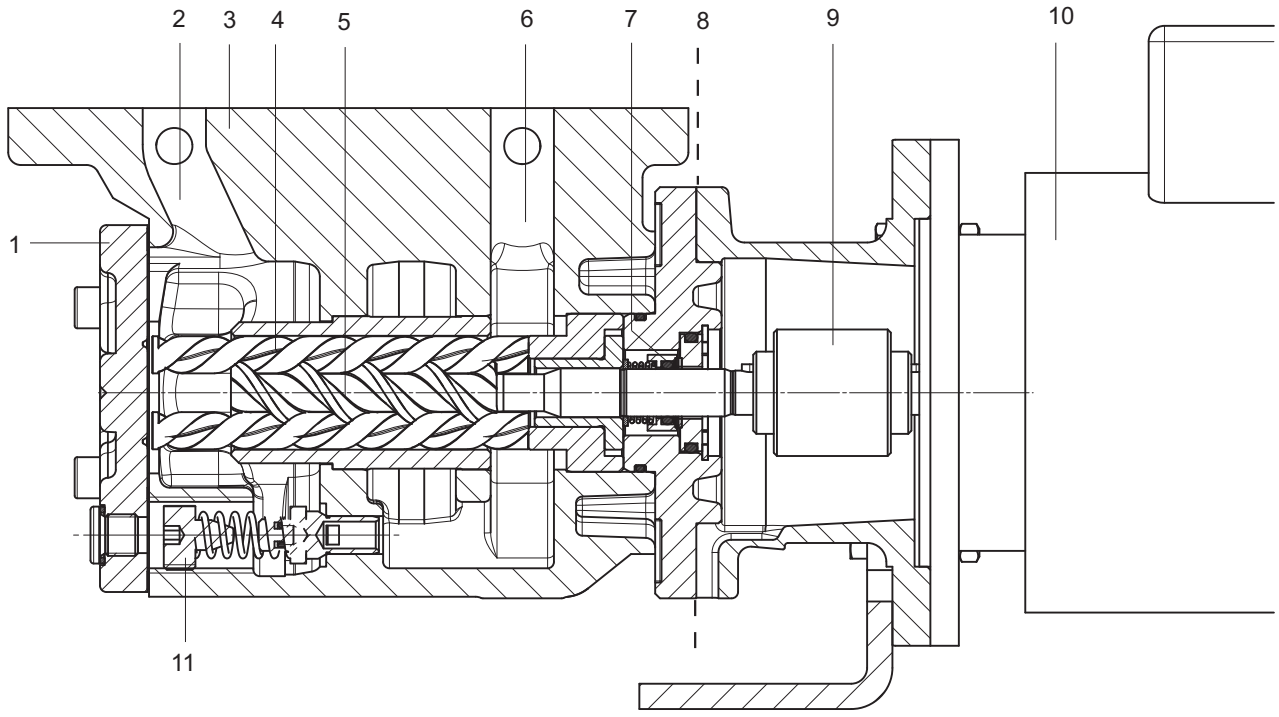

Fig. 4 Layout

1 Pump cover, end side
2 Suction flange
3 Pump casing
4 Idler spindle (2 x)
5 Work spindle (1 x)
6 Pressure flange
7 Shaft seal
8 Edge of heat insulation
9 Coupling
10 Motor
11 Pressure relief valve

3.3 Shaft seals

3.3.1 Mechanical seals

Mechanical seals have functional leaks.

- Mechanical seal, standard version
  – Uncooled, maintenance-free unbalanced mechanical seal construction

3.3.2 Shaft seal rings

Shaft seal rings have functional leaks.

- Two or three shaft seal rings, standard version

3.4 Bearings and lubrication

- Sizes 10, 20
  – Sleeve bearing lubricated by pumped liquid
- Size 40
  – Groove ball bearing lubricated with pumped liquid according to DIN 625

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/unit on 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.
- ► Select the attachment points according to their center of gravity and weight distribution.
- ► Use at least two hoisting cables.
- ► 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 against tipping over for units with a high center of gravity).
- ► Do not stand under suspended loads.

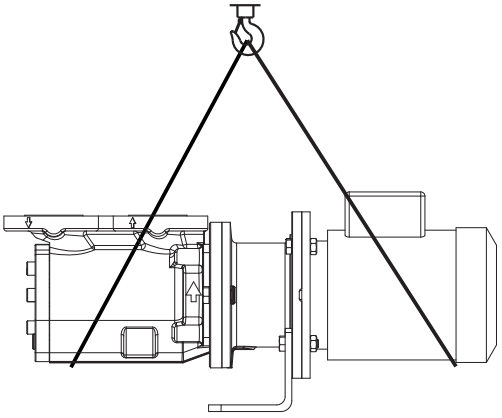

Fig. 5 Fastening the lifting gear to the pump unit horizontally (as illustrated)

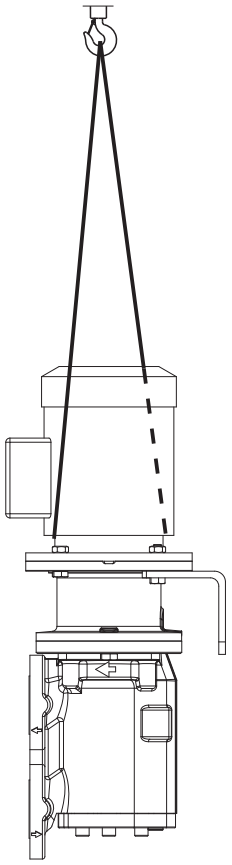

Fig. 6 Fastening the lifting gear to the pump unit vertically (as illustrated)

- ► Fasten the lifting gear to the pump unit.

4.2 Treatment for storage

The pump has not been treated for storage at the factory.
Treatment is not necessary for non-rusting materials.

NOTE

Material damage due to missing or inappropriate treatment for storage!

► Treat the pump properly, inside and outside, for storage.

4.2.1 Applying preservative to the inside

Spray the insert units with preservative (e.g. RUST-BAN 335) and shrink-wrap them in plastic film.

1. Close the suction-side flange with a blank flange.
2. With opposite flanges, turn the pump on the suction flange.
3. Fill the pump with preservative (e.g. RUST-BAN 335).
4. Turn the shaft slowly against the pump's sense of rotation.
5. Continue filling and turning until preservative escapes from the pressure flange without bubbles.
6. 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.
5. Every 6 months:
   – Renew the preservative if necessary (→ 4.2 Treatment for storage, Page 13).

4.4 Removing the preservative

Only necessary for pumps treated for storage.

NOTE

High water pressure or spray water can damage bearings!

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

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. (→ 9.2.6 Cleaning agents, Page 32).
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:
   – Replace the elastomer parts made of EP rubber (EPDM).
   – 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 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 of any escaping pumped liquid or oil in accordance with local regulations.
   – Neutralize residues of pumped liquid in the pump.
   – Remove the preservative (→ 4.4 Removing the preservative, Page 13).

► 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 (→ ATEX additional instructions).

NOTE

Material damage due to distortion or passage of electrical current in 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 31).

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 setup and connection: Remove the preservative prior to setup (→ 4.4 Removing the preservative, Page 13).

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 (→ Figure Layout, Page 10).

- ► Install the heat insulation properly.

5.2 Setup

If installing horizontally with lateral connections, the filling and bleeding holes and the manometer connections must face upward.

Setup options

- With wall-mounted/foot-mounted motor bracket
  - horizontal, connections on top or sides
  - vertical, motor at top

5.2.1 Setup with wall-mounted/foot-mounted motor bracket

Pump units with wall-mounted/foot-mounted motor bracket can be installed vertically (motor at the top) or horizontally.

1. Lift the pump unit and set it down at the installation location (→ 4.1 Transport, Page 12).
2. Install the pump unit (→ setup drawing).

5.3 Installing the motor

Only necessary if the pump unit is assembled on site.

5.3.1 Installing the motor on pumps in flange versions

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 in line.
   – 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. Check the distance between the coupling halves with a feeler gauge:
   – Permissible gap (→ 9.2.4 Coupling assembly, Page 32).
   – Use the feeler gauge to measure the gap (A) between the coupling halves.
   – Align the coupling halves if the gap is too wide.
7. Tighten the motor bolts.

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 permanent 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 ≥ the nominal suction branch diameter.
   – Make sure the flow rate is below 1 m/s
2. Make sure the nominal pressure pipe diameter is ≥ the nominal outlet flange diameter.
   – Make sure the flow rate is below 3 m/s

5.4.3 Specifying pipe lengths

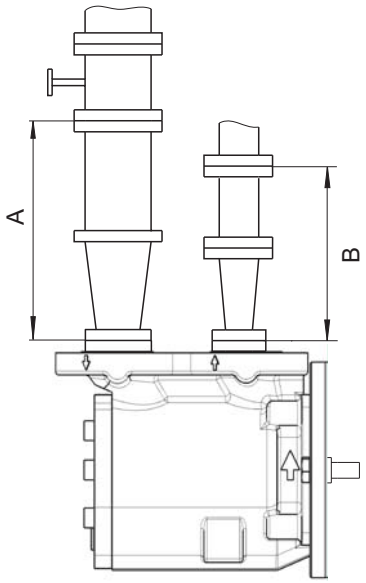

Fig. 7 Straight pipe lengths upstream and downstream of the pump (recommended)

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 restrict 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!

► Safely collect any leaking pumped liquid, 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 no pressure relief valve is present: Provide an appropriate safety valve in the pressure line.

NOTE

Material damage due to overheating of the pump!

► If the return flow of the pressure relief valve flows directly into the pump suction side or suction line: Monitor the temperature.

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 valve directly back into the suction pipe.

5.4.7 Providing safety and control devices (recommended)

Avoid impurities

ⓘ Only necessary if no filter is installed.

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 manometer.
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 gate valve to ensure the liquid does not flow back when the pump is switched off.

Enabling venting

► Provide a vent valve on the highest pressure line position.

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.

Heating up the pumped liquid

ⓘ Only necessary for pumped liquids that solidify when cold (e.g. heavy heating oil).

1. Provide heating for the pumped liquid or the suction pipe.
2. Dimension the heating to ensure that the pumped liquid is guaranteed to be in a liquid state, even when the pump starts up.

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 relieved 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 death due to electric shock!

► 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.

5.6.2 Connecting the filter heating (optional)

► Connect electric filter heating properly (→ Supplier documentation for filter heating).

5.6.3 Checking the sense of rotation

ⓘ Only possible when putting the pump into service (→ 6.1 Putting the pump into service for the first time, Page 18).

6 Operation

For pumps in explosion-hazard areas (→ ATEX additional 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 13).

6.1.2 Preparing auxiliary systems (if available)

The manufacturer does not accept any liability for damage caused by installing or using a third-party or unapproved auxiliary system.

Pressure relief valve

Pressure relief valves supplied by the manufacturer are pre-set.

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

Heating

1. Make sure that the pumped liquid is at the right temperature (that it is liquid).
2. Switch on the filter heating at least 2 hours before putting the pump into service.

6.1.3 Filling and bleeding

⚠ WARNING

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.

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 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.
► Allow the pump to cool down completely before starting any work.

1. Open the pressure-side fitting.
2. Open the suction-side fitting.
3. Switch the motor on and immediately off again.
4. Check whether the motor's sense of rotation is the same as that of the arrow on the pump.
5. If the sense of rotation is different:
   – Swap two phases (→ 5.6.1 Connecting the motor, Page 17).

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

⚠ DANGER

Risk of injury due to running pump or hot pump parts!

► Do not touch the running pump.
► Ensure that the coupling guard is attached.
► Do not carry out any work on the running pump.
► Allow the pump to cool down completely before starting any work.

⚠ DANGER

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

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

NOTE

Risk of cavitation when throttling down the suction flow rate!

► Fully open the suction-side fitting 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. After the first load under pressure and at operating temperature, check that the pump is not leaking.

6.1.6 Switching off

⚠ WARNING

Risk of injury due to hot pump parts!

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

1. Switch off the motor.
2. If there is no non-return valve in the pressure line: Close the pressure-side fitting.
3. If necessary: Flush and empty the pump.
4. 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
✓ Filter heating switched on at least 2 hours before the pump is switched on

⚠ DANGER

Risk of injury due to running pump or hot pump parts!

► Do not touch the running pump.
► Ensure that the coupling guard is attached.
► Do not carry out any work on the running pump.
► Allow the pump to cool down completely before starting any work.

⚠ DANGER

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

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

NOTE

Risk of cavitation when throttling down the suction flow rate!

► Fully open the suction-side fitting 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

⚠ WARNING

Risk of injury due to hot pump parts!

► Use protective equipment when carrying out any work on the pump.

NOTE

Material damage due to deposits!

► If the pumped liquid has crystallized, polymerized or solidified
  – Flush the pump
  – Ensure that the flushing medium is compatible with the pumped liquid

1. Switch off the motor.
2. If there is no non-return valve in the pressure line: Close the pressure-side fitting.
3. If necessary: Flush and empty the pump.

6.3 Shutting down the pump

⚠ WARNING

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 according to the pumped liquid (→ Table 7 Measures depending on the behavior of the pumped liquid, Page 20).
...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	► Follow the storage instructions (→ 4.3 Storage, Page 13).

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
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. 7 Measures depending on the behavior of the pumped liquid

6.4 Start-up following a shutdown period

1. If the pump is shut down for over 6 months, take 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 all 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 (→ ATEX additional instructions).

Trained service technicians are available for fitting and repair work. Present a pumped liquid 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 or hot pump parts!

- ► Do not touch the running pump.
- ► Do not carry out any work on the running pump.
- ► Allow the pump to cool down completely before starting any work.

⚠ 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:
   - 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 suction pressure
   - No unusual running noises or vibrations
   - No excessive leakage at the shaft seal
   - Proper functioning of auxiliary systems

7.2 Maintenance

Sleeve bearings are maintenance free.

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.

Shaft seals are subject to natural wear, which strongly depends on the respective operating conditions. Therefore, general statements regarding their service life cannot be made.

⚠ DANGER

Risk of injury due to running pump or hot pump parts!

- ► Do not touch the running pump.
- ► Do not carry out any work on the running pump.
- ► Allow the pump to cool down completely before starting any work.
- ► 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 or hot pumped liquids!

- ► Use personal protective equipment when carrying out any work on the pump.
- ► Allow the pump to cool down before commencing any work.
- ► Make sure the pump is depressurized.
- ► Empty the pump and safely collect the pumped liquid. Dispose of it in accordance with environmental rules and requirements.

7.2.1 Antifriction bearing

- ► As a precautionary measure, replace the antifriction bearing 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

⚠ DANGER

Risk of injury due to running pump or hot pump parts!

► Do not touch the running pump.

► Do not carry out any work on the running pump.

► Allow the pump to cool down completely before starting any work.

► 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 or hot pumped liquids!

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

► Allow the pump to cool down before commencing any work.

► Make sure the pump is depressurized.

► Empty the pump, safely collect the pumped liquid and dispose of it in accordance with environmental regulations.

⚠ 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 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

✓ Auxiliary systems shut down, depressurized and emptied

✓ Manometer lines, manometer and holdings dismounted

1. Enclose a truthfully and fully completed safety certificate when returning pumps or components to the manufacturer (→ 9.3 Safety certificate, Page 33).
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 (not disassembled) to the manufacturer.
...at the manufacturer's premises for warranty repairs	

Tab. 8 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
✓ Auxiliary systems shut down, depressurized and emptied
✓ Manometer lines, manometer 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 carefully (e.g. mechanical seal, tensioned bearing, valves etc.), 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, drives, belt drive etc.).

1. Observe the following during removal:
   – Mark the precise orientation and position of all components before dismounting 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 lost or damaged screws with screws of the same strength (→ 9.2.3 Tightening torques, Page 31).
► 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.
   – Maintain the prescribed tightening torques (→ 9.2.3 Tightening torques, Page 31).
2. Clean all parts (→ 9.2.6 Cleaning agents, Page 32). Do not remove any markings which have been applied.
3. Replace the antifriction bearings.
4. Install the pump (→ 9.1 Sectional drawings, Page 28).
5. Install the pump in the system (→ 5 Setup and connection, Page 14).

7.4 Ordering spare parts

ⓘ For trouble-free replacement in the event of faults, we recommend keeping entire spare pumps or insert units available on site.

Parts which can be replaced can be found in the parts list (→ 9.1.1 Part numbers and designations, Page 28).

► Have 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

8.1 Pump malfunctions

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. 9 Malfunction/number assignment

Malfunction number								Cause	Remedy
1	2	3	4	5	6	7	8		
X	–	–	–	–	–	–	–	Transport screw plugs still in place	► Remove the transport screw plugs. ► Dismount the pump and inspect it for dry-running damage.
X	–	–	–	–	–	–	–	Supply/suction pipe closed by fitting	► Open the fitting.
X	–	–	–	X	–	–	–	Supply/suction pipe not bled properly or not filled up completely	► Fill up the pump and/or pipe completely and bleed them.
X	–	–	–	X	–	–	–	Formation of air pockets in the supply or suction pipe	► Install the fitting for bleeding. ► Correct the piping layout.
X	–	–	–	X	–	–	–	Pressure pipe blocked	► Clean the pressure pipe.
X	–	–	X	X	–	–	–	Pump running in the wrong sense of rotation	► Swap any two phases on the motor (→ 5.6.3 Checking the sense of rotation, Page 17).
X	–	–	X	–	X	–	–	Pump very dirty	► Dismount and clean the pump.
X	X	–	X	X	–	–	–	Supply/suction pipe, pump or suction strainer blocked or encrusted	► Clean the supply/suction pipe, pump or suction strainer. ► Clean the suction strainer.
X	X	–	X	X	–	–	–	Air is sucked in	► Seal the source of malfunction.
X	X	–	X	X	–	–	–	Excessive amount of gas: Pump is cavitating	► Check the cable gland. ► Clean/enlarge the filter. ► Enlarge the supply/suction pipe cross-section.

Malfunction number								Cause	Remedy
1	2	3	4	5	6	7	8		
X	X	–	X	X	–	–	–	Excess play between: • Spindles • Spindles and housing	► Repair or replace any worn parts.
X	X	–	X	–	–	X	–	Shaft seal leaking	► Replace the shaft seal.
–	X	–	X	–	–	–	–	Motor speed too low	► Compare the required motor speed with the specifications on the pump type plate. Replace the motor if necessary. ► Increase the motor speed if speed control is available.
–	X	–	X	–	–	–	–	Supply/suction pipe not fully opened	► Open the fitting.
–	X	–	X	X	–	–	–	Supply/suction pipe cross-section too narrow	► Enlarge the supply/suction pipe cross-section. ► Remove any encrustations from the suction pipe. ► Open the fitting completely.
–	X	–	X	X	–	–	–	Suction height excessive: $NPSH_{pump}$ larger than $NPSH_{system}$	► 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	–	–	–	Hydraulic parts of the pump dirty, clotted or encrusted	► Dismount the pump. ► Clean the parts.
–	X	–	X	–	–	–	X	Viscosity or specific weight of the pumped liquid outside the range specified for the pump	► Consult the manufacturer.
–	–	–	–	X	–	–	–	Pressure-side fitting not opened wide enough	► Open the pressure-side fitting.
–	X	–	X	X	X	–	–	Pump parts worn	► Replace the worn pump parts.
–	–	X	–	X	–	–	X	Motor speed too high	► Compare the required motor speed with the specifications on the pump type plate. Replace the motor if necessary. ► Reduce the motor speed if speed control is available.
–	–	–	–	X	X	–	X	Antifriction bearing defective	► Replace the antifriction bearing.
–	–	–	–	–	X	–	X	Defective antifriction bearing in motor	► Replace the antifriction bearing.
–	–	–	–	–	–	X	–	Tie bolts not tightened properly	► Tighten the tie bolts (→ 9.2.3 Tightening torques, Page 31).
–	–	–	–	–	–	X	–	Seal shaft seal	► Replace the mechanical seal.
–	–	–	–	–	–	X	–	Housing seal defective	► Replace the housing seal.

Malfunction number								Cause	Remedy
1	2	3	4	5	6	7	8		
–	–	–	–	X	X	X	X	Pump distorted	► Check the pipe connections and pump attachment.
–	–	–	–	X	–	–	–	Coupling elements worn	► Replace the coupling elements.
–	X	–	X	X	–	–	X	Motor running on 2 phases	► Check the fuse and replace it if necessary. ► Check the cable connections and insulation.

Tab. 10 Pump troubleshooting list

8.2 Pressure relief valve malfunctions

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
Pumping pressure drops	1
Pressure relief valve does not open	2
Pressure relief valve does not close	3
Pressure relief valve rattles	4

Tab. 11 Malfunction/number assignment

Malfunction number				Cause	Remedy
1	2	3	4		
X	–	–	–	Spring worn out	► Install a new spring.
X	–	–	–	Valve seat leaks	► Install a new valve cone.
–	X	–	–	Spring tension too high	► Relieve the pressure on the spring by turning the adjusting screw, then reset the pressure relief valve.
–	X	–	–	Foreign particles in the valve	► Remove the pressure relief valve. ► Clean the internal parts. ► Install the pressure relief valve.
–	X	–	–	Pump operating temperature too high	► Consult the manufacturer.
–	–	X	–	Spring has no or insufficient tension	► Reset the pressure relief valve.
–	–	X	–	Valve seat leaks	► Rework or replace the valve cone or valve casing.
–	–	–	X	Pressure relief valve rattles	► Measure the excess pressure with the fitting on the pressure side closed. ► Reset the pressure relief valve (opening pressure 10% higher than the operating pressure).

Tab. 12 Pressure relief valve troubleshooting list

9 Appendix

9.1 Sectional drawings

9.1.1 Part numbers and designations

Part no.	Designation
1	Pump casing
2 [1)]	Casing insert
3	Pump cover, drive end
4	Pump cover, end side
7	Housing cover
9	Filter housing
10 [1)]	Bush
12 [1)]	Drive spindle
13 [1)]	Idler spindle
20	Spacer sleeve
24	Socket head cap screw
29	Pipe
30	Pipe
100 [1)]	Seal
119 [1)]	O-ring
120 [1)]	O-ring
122 [1)]	O-ring
142 [1)]	Seal ring
143 [1)]	Seal ring
146 [1)]	Seal
151 [1)]	Seal ring
152 [1)]	Seal ring
156 [1)]	Seal ring
157 [1)]	Seal ring
159 [1)]	Seal ring
160	Sealing plug
186 [1)]	Mechanical seal
200	Socket head cap screw
201	Socket head cap screw
207	Hexagon head bolt
215 [3)]	Socket head cap screw
216 [3)]	Hexagon head bolt
217 [3)]	Hexagon head bolt
222	Screw plug
223	Bleeding plugs
227	Screw plug
231 [3)]	Hexagon nut
235	Screw plug
250	Snap ring
251	Snap ring
263	Supporting washer
280	Blind rivet
290	Key
292 [1)]	Ball bearing
330 [1)]	Valve cone
331	Spring retainer
333	Adjusting screw
340 [1)]	Spring
361	Pressure gauge
362	Ballcock
364	Connecting piece
460 [3)]	Bell housing
471 [3)]	Mounting foot
481	Screen filter
900 [3)]	Pump-side coupling half
901 [3)]	Motor-side coupling half
910 [3)]	Motor
962 [4)]	Heating shell with strap
970	Rating plate
978	DIN test plate

Tab. 13 Designation of components according to part numbers

1) Can be ordered as spare part/spare part kit

2) Possibly not shown

3) Parts are omitted if the delivery does not include bell housing, coupling and motor
4) Heating shell with strap (optional)

9.1.2 Sectional drawings

SPF with filter, size 10, 20

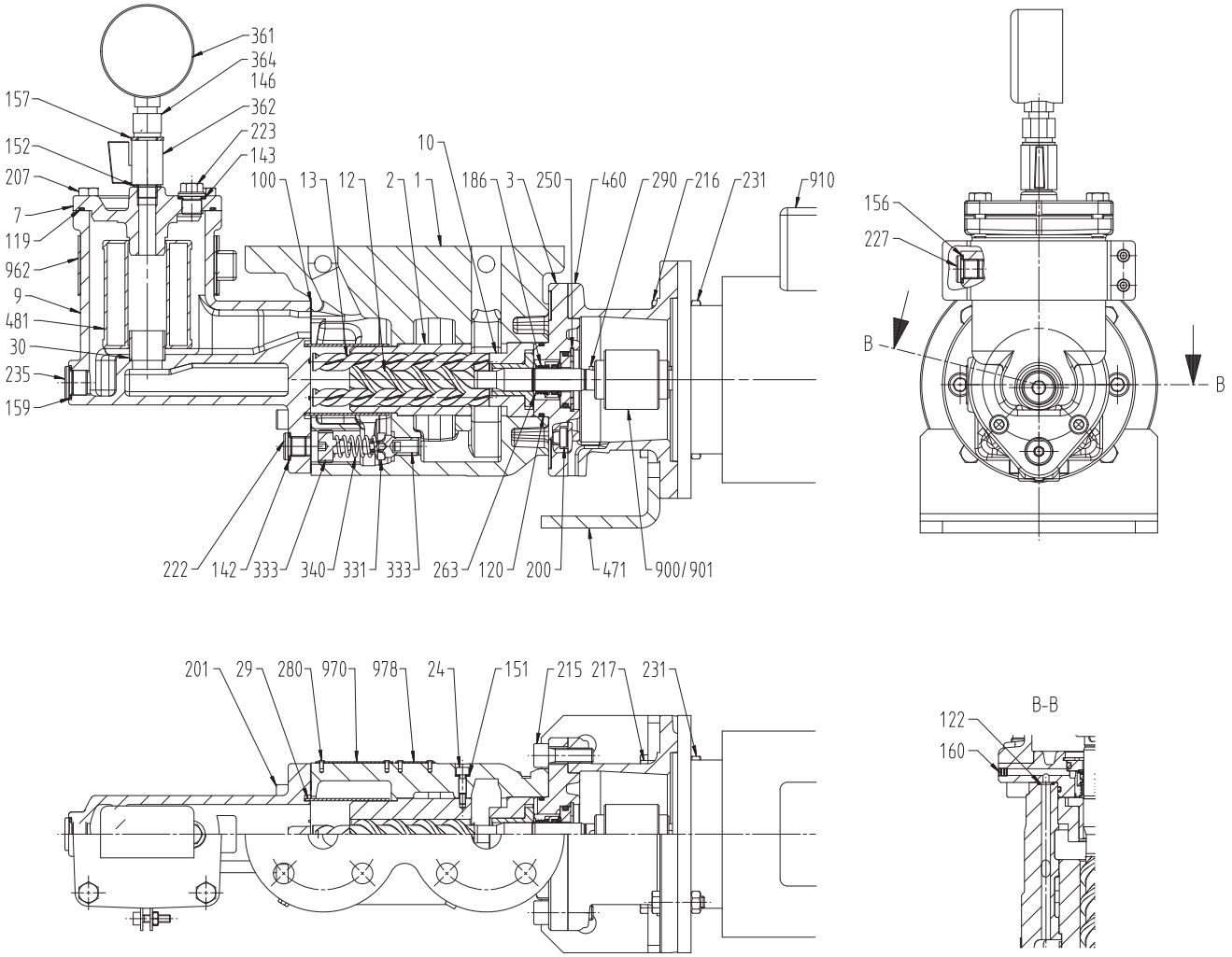

Fig. 8 SPF with filter, size 10, 20

SPF without filter

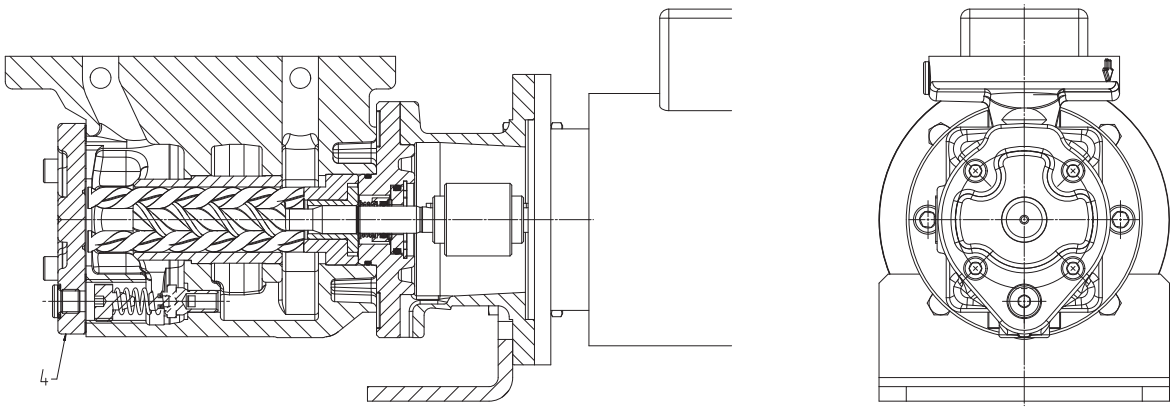

Fig. 9 SPF without filter

Mechanical seal

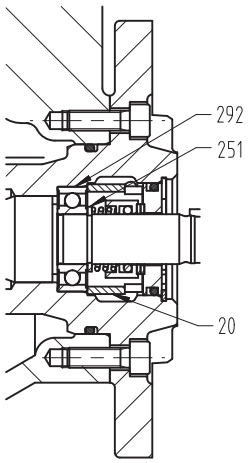

Fig. 10 **U8.3** mechanical seal, size 40

9.2 Technical specifications

More technical specifications (→ order data sheet).

9.2.1 Ambient conditions

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

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

Tab. 14 Ambient conditions

9.2.2 Sound pressure level

- Sound pressure level < 70 dB(A)

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	3,9
M 8		9,8
M 10		18,6
M 12		32,3
M 16		78.4
M 20		156,8
M 24		289,1
M 27		426,3
M 30		578,2
M 6	8.8	8,8
M 8		21,6
M 10		43,1
M 12		73,5
M 16		181,3
M 20		352,8
M 24		661,5
M 27		975,1
M 30		1323,0
M 6	10.9	13,2
M 8		31,8
M 10		63,0
M 12		108,0
M 16		264,0
M 20		517,0
M 24		890,0
M 27		1304,0
M 30		1775,0
M 6	12.9	16
M 8		40
M 10		79
M 12		135
M 16		340
M 20		660
M 24		1150
M 27		1700
M 30		2300

Tab. 15 Tightening torques

9.2.4 Coupling assembly

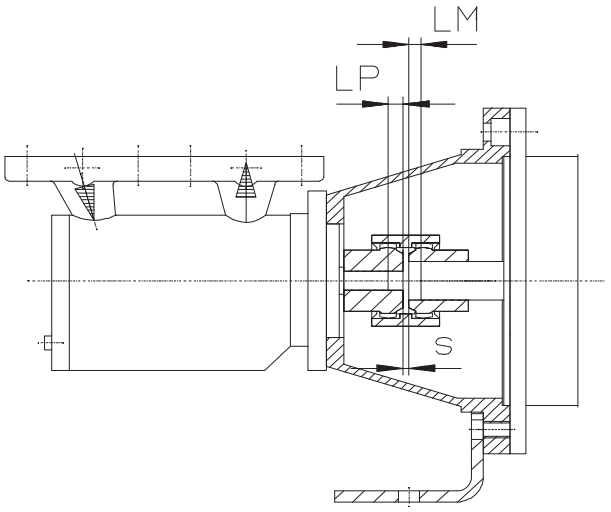

Fig. 11 Coupling assembly

1 Pump side

2 Motor side

Motor	Pump							
	SPF 10				SPF 20/40			
	LM [mm]	LP [mm]	S [mm]	Coupling	LM [mm]	LP [mm]	S [mm]	Coupling
63	1	22	2	AR24	-	-	-	-
71	0	0	2	Bowex Jun14	0	8	2	AR24
80	14	0	4	Bowex M19	0	0	3	Bowex Jun19
90S/L	4	0	4	Bowex M24	23	10	4	Bowex M24
100L/ 112M	8	10	4	Bowex M28	3	0	4	Bowex M28
132S/M	8	10	4	Bowex M38	7	0	4	Bowex M38
160M/L	-	-	-	-	19	0	4	Bowex M42

Tab. 16 Dimensions for installing coupling

9.2.5 Preservatives

Use RUST-BAN 335 as a preservative, for example.

9.2.6 Cleaning agents

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

Tab. 17 Cleaning agents

9.3 Safety certificate

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

The pump and accessories submitted for inspection / repairs together with the safety certificate by us, the signatory:

Type: _____ Delivery date: _____

Part no.: _____ Order no.: _____

Reason for inspection / repair: _____

☐ Was not used with liquids that are hazardous to health or the environment.

☐ Was used for the following application: _____

Came into contact with liquids that must be labeled for safety or are considered to be polluting.

☐ Last pumped liquid: _____

☐ The pump has been carefully emptied and cleaned on the outside and inside prior to delivery or provision.

☐ Special safety precautions are not necessary for subsequent handling.

☐ The following safety precautions regarding rinsing liquids, liquid residue and disposal are necessary:

_____

_____

If the pump was used with critical liquids, please make sure you enclose a **safety data sheet** in the package.

We hereby declare that the information given is correct and complete, and that the pump is being shipped in accordance with legal requirements.

Company / address: _____ Phone: _____

Fax: _____

Customer no.: ___ ___ ___ ___ ___ ___ ___

Issuer name: (capital letters) _____ Position: _____

Date: **Company stamp / signature:**

Tab. 18 Safety certificate

9.4 Declaration of conformity according to EC Machine Directives

The following declaration does not contain serial numbers or signatures. The original declaration is delivered with the respective pump.

Declaration of conformity

EC declaration of conformity according to machine directive, appendix II A

We,
ALLWEILER GmbH, Postfach 1140, 78301 Radolfzell, Germany; Tel. +49 (0)7732 86-0, Fax. +49 (0)7732 86-436,
hereby declare that, when the conditions in the operating manual are observed, the pump unit / pump:

Designation	SPF
Equipment no.	
Order no.	

complies with the following applicable EC directives :

- Machine directive (2006/42/EC)
- The protection targets of the low-voltage directive 2006/95/EC were adhered according to appendix I no. 1.5.1 of the directive 2006/42/EC

Applicable harmonized norms:

- EN 809:1998 + A1:2009 + AC:2010
- EN ISO 12100:2010

Person authorized to compile the technical file	ALLWEILER GmbH Allweilerstr. 1 78315 Radolfzell
Date: 06.02.2013	**Company stamp / signature:** Head of Development/Construction

Tab. 19 Declaration of conformity according to EC machine directives