

Centrifugal pump with volute casing

Original Operating Manual

L / LV series



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ALLWEILER GmbH
Postfach 1140
Allweilerstr. 1
78301 Radolfzell
Germany
Phone: +49 (0) 7732-86-0
Fax: +49 (0) 7732-86-436
Email: service@allweiler.de
Internet: <http://www.allweiler.com>

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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 at all operating phases

1.1 Target groups

Target group	Duty
Operating company	<ul style="list-style-type: none"> ▶ 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 information and warnings. ▶ Observe any additional rules and regulations referring to the installation.
Qualified personnel, fitter	<ul style="list-style-type: none"> ▶ Read, observe and follow this manual and the other applicable documents, especially all safety information and warnings.





Tab. 1 Target groups and their duties

1.2 Other applicable documents



Document	Purpose
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, parts numbers, component designations
Supplier documentation	Technical documentation for parts supplied by subcontractors
Replacement parts list	Ordering replacement parts
Declaration of conformity	Conformity with standards Contents of the declaration of conformity (→ 9.5 Declaration of conformity according to EC machine directives, Page 47).

Tab. 2 Other applicable documents and their purpose

1.3 Warnings and symbols


Warning	Risk level	Consequences of disregard
	Immediate acute risk	Death, serious bodily harm
	Potential acute risk	Death, serious bodily harm
	Potential hazardous situation	Minor bodily harm
	Potential 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
✓	Requirement
→	Cross reference
	Information, advice

Tab. 4 Symbols and their meaning

2 Safety

 The manufacturer does not accept any liability for damage resulting from disregard of the entire documentation.

2.1 Intended use


- Only use the pump for pumping the agreed pumped media (→ order data sheet).
- Adhere to the operating limits and size-dependent minimum flow rate.
- Avoid dry running:
Initial damage, such as destruction of the mechanical seal and plastic parts, will occur within only a few seconds.
 - Make certain that the pump is only operated with, and never without a pumped medium.
- Avoid cavitation:
 - Fully open the suction-side armature, do not use to adjust the flow rate.
 - Do not open the pressure-side armature beyond the agreed operating point.
- Avoid overheating:
 - Do not operate the pump while the pressure-side armature is closed.
 - Note the minimum flow (→ order data sheet).
- Avoid damage to the motor:
 - Do not open the pressure-side armature beyond the agreed operating point.
 - Note the maximum permissible number of times the motor can be switched on per hour (→ manufacturer's specifications).
- Consult with the manufacturer about any other use of the pump.
- When a pump is delivered without a motor, the pump unit must be completed in accordance with the stipulations of machine directive 2006/42/EC.

Prevention of obvious misuse (examples)

- Note the operating limits of the pump concerning temperature, pressure, flow rate and motor speed (→ order data sheet).
- The power consumed by the pump will increase with increasing density of the pumped medium. To avoid overloading the pump, coupling or motor, stay within the agreed density (→ order data sheet).
A lower density is allowed. Adapt auxiliary systems accordingly.
- When pumping liquids containing solids, ensure that the limits for the proportion of solids and the grain size are maintained (→ order data sheet, technical description).
- When using auxiliary systems, ensure that there is a continuous supply of the appropriate medium.

- Pumps used with water as the pumped liquid must not be used for foodstuffs or drinking water. Use of the pump for foodstuffs or drinking water 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

 Take note of the following instructions 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 involve risk to life and health of the user or of third parties and risk of damage to the pump and other property.

- Only operate the pump if it is in perfect technical condition, only use it 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 expose personnel or third parties to any risk.
- Should there be any safety-relevant fault, shut down the pump immediately and have the fault corrected by appropriate personnel.
- In addition to the entire documentation for the product, always comply with statutory or other safety and accident-prevention rules and with the applicable standards and guidelines in the country where the pump is operated.

2.2.2 Operator's obligations

Safety-conscious operation

- Only operate the pump if it is in perfect technical condition, only use it 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 rules
 - safety regulations governing the handling of hazardous substances
 - applicable standards and guidelines in the country where the pump is operated
- Make protective equipment available.

Qualified personnel

- Make certain that 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 instructions, before they start work.
- Organize responsibilities, who is in charge of any specific duty and how personnel is supervised.
- Ensure that all work is carried out by specialist technicians only:
 - fitting, repair and maintenance work
 - work on the pump electrical system
- Make certain that trainee personnel is supervised by a specialist technician when working on the pump.

Safety equipment

- Provide the following safety equipment and verify their functionality:
 - for hot, cold and moving parts: protection from accidental contact with the pump parts provided by customer
 - for possible build up of electrostatic charge: ensure appropriate earthing

Warranty

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

2.2.3 Duties of the operating personnel

- All directions given on the pump must be followed (and kept legible), e.g. the arrow indicating the direction 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 guards to prevent contact with hot, cold or moving parts during operation.
- Use protective equipment whenever necessary.
- Only carry out work on the pump while it is not running.
- Isolate the motor from its supply voltage and keep it locked in that state when carrying out any fitting or maintenance work.
- Refit the safety installations on the pump properly, as required by regulations, after completion of work on the pump.

2.3 Special hazards

2.3.1 Hazardous pumped media

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

3 Layout and function

3.1 Labels

3.1.1 Type plate

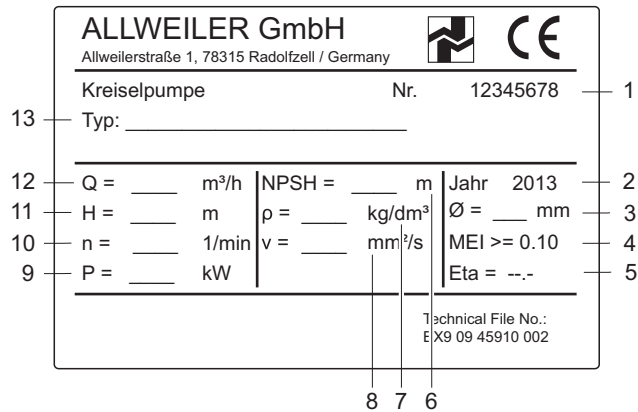


Fig. 1 Type plate (example)

- 1 Pump number
- 2 Year of manufacture
- 3 Nominal impeller diameter
- 4 Minimum efficiency index (MEI)
- 5 Eta efficiency (—.- = not specified)
- 6 Pump NPSH value
- 7 Density
- 8 Kinematic viscosity
- 9 Power consumption
- 10 Motor speed
- 11 Differential head
- 12 Flow rate
- 13 Pump type code

3.1.2 Pump type code

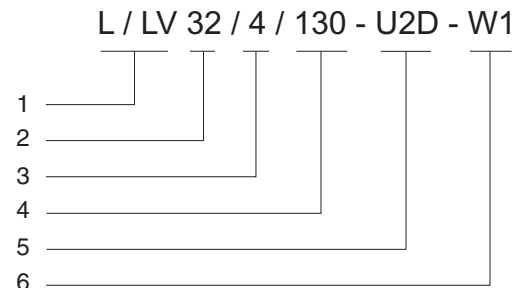


Fig. 2 Pump type code (example)

- 1 Series (L = horizontal, LV = vertical)
- 2 Outlet flange DN [mm]
- 3 Stage number
- 4 Actual impeller diameter [mm]
- 5 Shaft seal
- 6 Material key

3.2 Construction

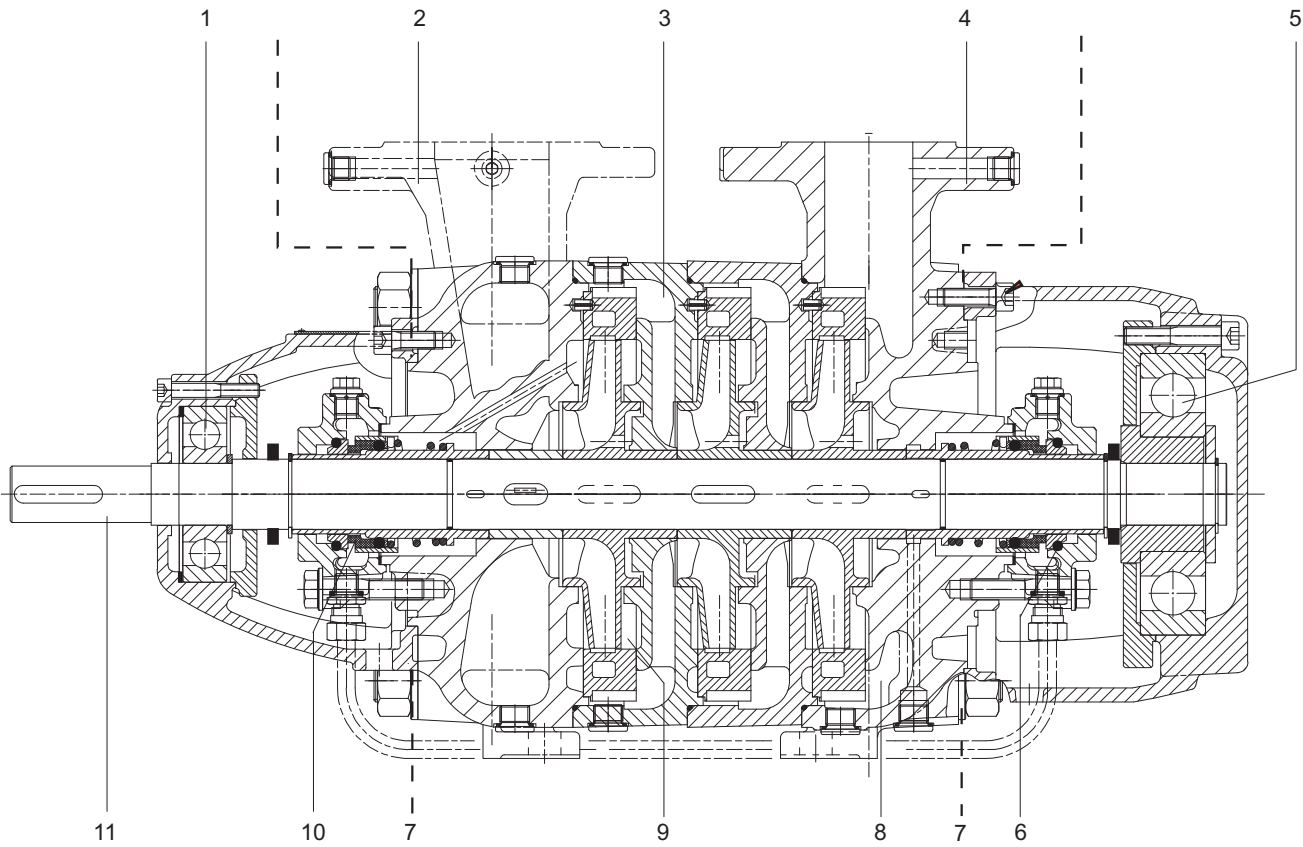


Fig. 3 L series layout

- | | | |
|------------------------|----------------------------|-----------------------------|
| 1 Suction-side bearing | 5 Pressure-side bearing | 9 Limit for heat insulation |
| 2 Suction casing | 6 Pressure-side shaft seal | 10 Suction-side shaft seal |
| 3 Stage casing | 7 Guide wheel | 11 Shaft |
| 4 Discharge casing | 8 Impeller | |

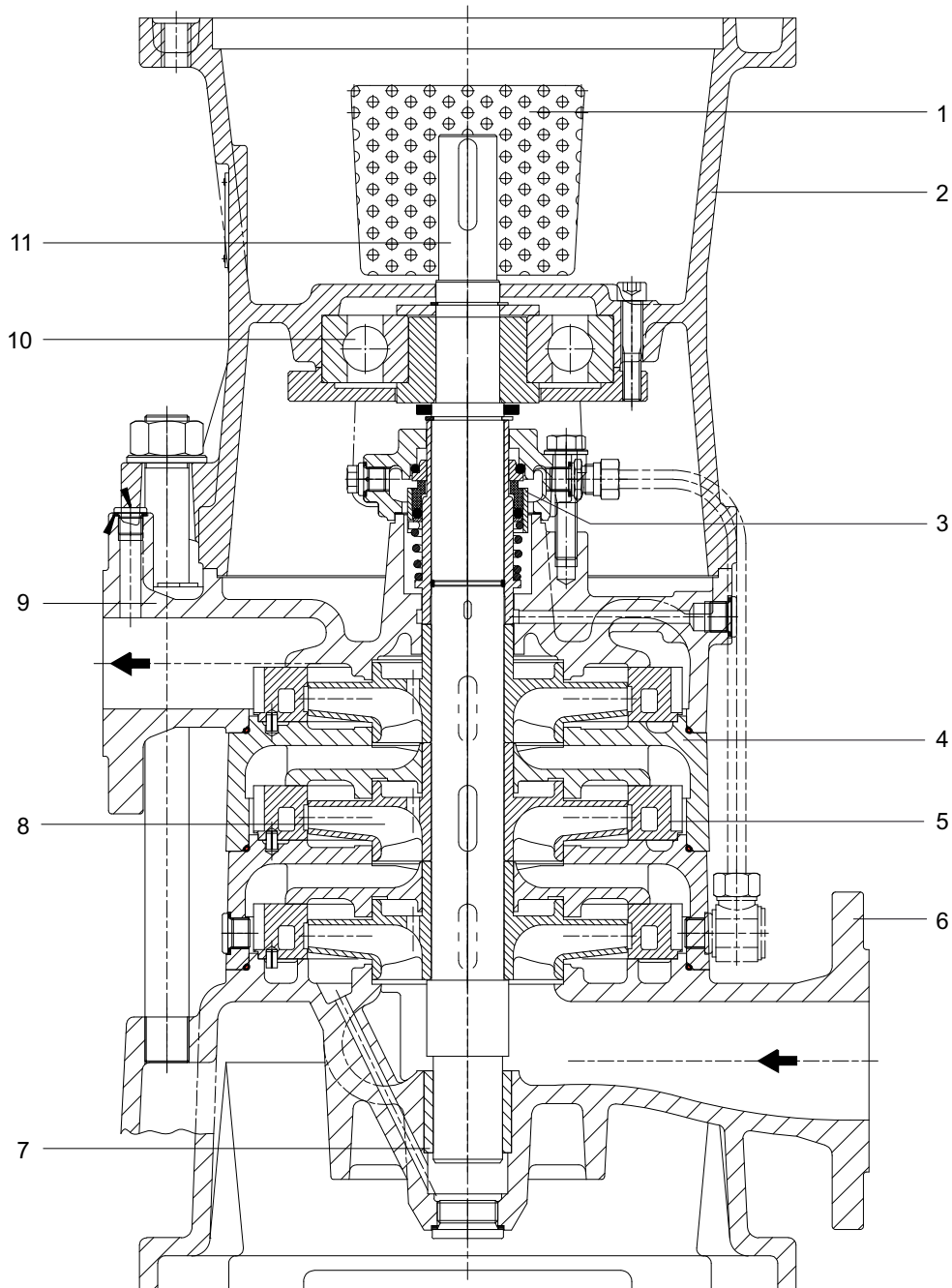




Fig. 4 LV series layout

- | | | |
|--------------------------------|------------------|-------------------------|
| 1 Safety guarding | 5 Guide wheel | 9 Discharge casing |
| 2 Support bearing bell housing | 6 Suction casing | 10 Antifriction bearing |
| 3 Shaft seal | 7 Plain bearing | 11 Shaft |
| 4 Stage casing | 8 Impeller | |

3.3 Shaft seals


 Only one of the following shaft seals can be used.

3.3.1 Mechanical seals

 Mechanical seals will always leak a bit, due to the way they work.


- Individual mechanical seals (dependent on sense of rotation)

3.3.2 Packing gland

 The packing gland must always leak slightly to carry the frictional heat away.

4 Transport, storage and disposal

4.1 Transport

 For details of weight (→ documents for the particular order).

4.1.1 Unpacking and inspection on delivery

1. Unpack the pump/aggregate on delivery and inspect for damage.
2. Report any 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 loads!

- ▶ Use lifting gear appropriate for the total weight to be transported.
- ▶ Fasten the lifting gear as shown in the illustrations below.
- ▶ 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.

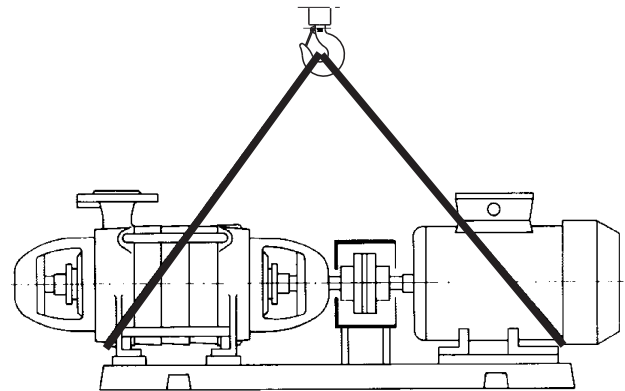


Fig. 5 Fastening lifting gear to horizontal pump unit

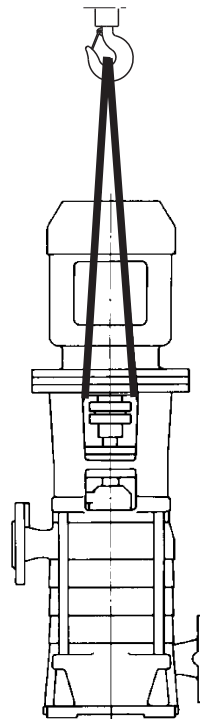



Fig. 6 Fastening lifting gear to vertical pump unit

- ▶ Lift the pump/aggregate properly.

4.2 Preservation

 This is not necessary for non-rusting materials.

NOTE

Material damage due to inappropriate treatment for storage!

- ▶ Treat the pump properly, inside and out, for storage.
-
1. Choose a preservative treatment appropriate for the type and duration of the storage (→ 9.2.4 Preserving agent, Page 42).
 2. Use preservative agent as specified by the manufacturer.
 3. All bare metal parts should be treated, inside and outside.
 4. Every 6 months:
 - Renew the preservative if necessary.


4.3 Storage

NOTE

Material damage due to inappropriate storage.

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

4.4 Remove the preservative treatment

 Only necessary for pumps treated with preservative.

WARNING

Risk of poisoning from preservative and cleaning agents in the area of foods and drinking water.

- ▶ Only use cleaning agents which are compatible with the pumped liquid (→ 9.2.6 Cleaning agents, Page 43).
 - ▶ Completely remove all preservative agents.
-


NOTE

High water pressure or spray water can damage bearings!


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

NOTE

Damage to seals through incorrect cleaning agent!

- ▶ Ensure that the cleaning agent will not attack the seals.
-
1. Choose a suitable cleaning agent for the application. (→ 9.2.6 Cleaning agents, Page 43).
-  For Tectyl 506 EH: Allow benzine to soak in for 10 minutes (recommended).
2. Dispose of preservative agent according to local regulations.
 3. For storage times in excess of 6 months:
 - Replace the elastomers made from EP rubber (EPDM).
 - Check all elastomer parts (O-rings, shaft seals) for proper elasticity and replace if needed.

4.5 Disposal

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

WARNING

Risk of poisoning and environmental damage caused by pumped medium or oil!

- ▶ Use protective equipment when carrying out any work on the pump.
 - ▶ Prior to disposal of the pump:
 - Catch and dispose of any medium or oil which runs out in accordance with local regulations.
 - Neutralize residues of pumped medium in the pump.
 - Remove any preservative treatment (→ 4.4 Remove the preservative treatment, Page 15).
 - ▶ Remove and dispose of any plastic parts in accordance with local regulations.
-
- ▶ Dispose of pump according in accordance with local regulations.

5 Setup and connection

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 transport seals until immediately before setting up the pump.
 - ▶ Do not remove covers and transport and sealing covers until immediately before connecting the piping 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 42).

5.1.2 Preparing the site for the installation

- ▶ Ensure that the site meets the following conditions:
 - pump is freely accessible from all sides
 - sufficient space for 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 foundations and installation surface

- i Installation options:
 - with concrete foundations
 - with steel foundation frame
 - without foundations
- ▶ Make certain that the foundations and installation surface meet the following conditions:
 - level surface
 - clean (no oil, dust or other impurities)
 - foundations and surface can support the weight of the pump aggregate and all operating forces
 - ensure that the pump is stable and cannot tip over
 - for concrete foundations: standard concrete of strength class B 25

5.1.4 Remove the preservative treatment

- ▶ If the pump is to be put into operation immediately after installation and connection: Remove the preservative treatment before installing (→ 4.4 Remove the preservative treatment, Page 15).

5.1.5 Installing the heat insulation (optional)

- i Only necessary to maintain the temperature of the pumped medium.

NOTE

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

- ▶ Only install the heat insulation on the volute casing (→ Figure L series layout, Page 11).
 - ▶ Install the heat insulation properly.
-

5.2 Setup

5.2.1 Installing with foundations

NOTE


Material damage due to distortion of base plate

- ▶ Place and fasten the base plate on the foundations as described in the following.

Setting the pump aggregate on the foundation

- ✓ Implements, tools and materials:
 - foundation bolts (→ installation drawing)
 - steel washers
 - non-shrinking mortar/concrete
 - spirit level

1. Lift the pump aggregate (→ 4.1 Transport, Page 14).
2. Working from below, locate the foundation bolts in the base plate fixing holes.

 Follow the manufacturer's instruction when using adhesive anchors.

3. Set the pump aggregate down onto the foundation. When doing this, sink the foundation bolts into the prepared anchoring holes.

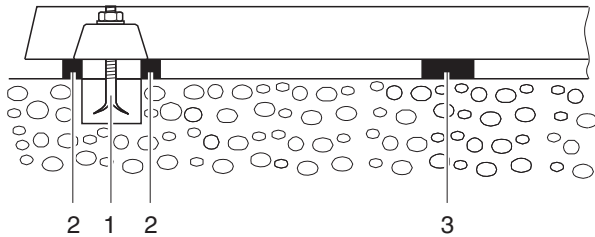



Fig. 7 Installation with foundation

4. Use steel washers to align the pump to the height and system dimensions as described in the following:
 - Next to each foundation bolt (1) place a steel washer (2) to the left and to the right.
 - If the spacing between the fixing holes > 750 mm, place additional steel washers (3) in the middle, on each side of the base plate.
5. Make certain that the steel washers lie flat against the base plate, in full contact.
6. Use the integrated spirit levels to check that the pump is level end to end and side to side with max. 1mm/m allowable tilt.
7. Repeat procedure until the base plate is correctly aligned.

Fixing the pump aggregate

 Filling out the base plate with mortar grout will improve the damping behavior.

1. Fill the anchoring holes with mortar grout.
2. When the mortar grout has set, screw down the base plate at three points with the specified torque.
3. Before tightening the remaining bolts, compensate for any unevenness in the surface, using metal spacing shims next to each bolt.
4. Check the pump aggregate for any distortion, using a straightedge:

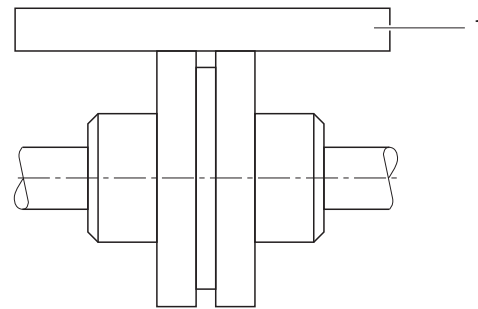




Fig. 8 Checking for distortion

- Check in two planes at an angle of 90° to one other on the circumference of the coupling.
- Check at the outer diameter using a straightedge (1): Position the straightedge across both halves of the coupling. If there is a significant deviation, loosen the fixings to the base plate and correct the distortion by inserting more shims.
- Fill the inside of the base plate with concrete, if applicable. Knock on the base plate to ensure that no cavities are created in the process.

 Couplings with a spacer piece (dismountable coupling) can also be checked with a dial gauge.


5.2.2 Vertical setup (LV series)

 Pump units with base are installed vertically (motor at the top).

1. Lift the pump unit and set it down at the installation location (→ 4.1 Transport, Page 14).
2. Install the pump unit (→ setup drawing).

5.3 Mounting the motor

5.3.1 Installing the motor on the base plate

 Only necessary if the pump unit is assembled on site.


NOTE

Material damage caused by knocks and bumps!

- ▶ Keep the coupling halves properly aligned when pushing on the motor.
- ▶ Do not knock or hit any component of the pump.

1. Smear a very thin coat of molybdenum disulfite (e.g. Molykote) on the shaft ends of the pump and motor.
2. Insert shaft keys.
3. Without a mounting rig: Remove rubber buffers and warm up both halves of the coupling to approx. 100 °C.
4. Slide on the pump-side and motor-side coupling halves until the shaft ends and the center of the coupling are flush with one other. When doing this, ensure that the prescribed spacing between the two halves of the coupling is maintained (→ assembly instructions for the coupling).
5. Tighten the grub screws on both halves of the coupling.
6. When using horizontal versions, use suitable metal shims at the motor to align the end of the motor shaft to the end of the pump shaft.
7. Fit the motor bolts, but do not tighten them yet (→ 5.8 Aligning the motor, Page 23).

5.3.2 Installing the motor at pumps in flange version

 Only necessary if the pump unit is assembled on site.

NOTE

Material damage caused by knocks and bumps!

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

1. Smear a very thin coat of molybdenum disulfide (e.g. Molykote) on the shaft ends of the pump and motor.
2. Insert shaft keys.
3. Slip on the pump-side and motor-side coupling halves in line.
 - Without a mounting rig: remove the rubber buffers and heat the coupling halves up to approximately 100 °C.
4. Tighten the grub screws on both coupling halves.
5. Raise the motor and position it on the bell housing.
6. Check the distance between the coupling halves with a feeler gauge:
 - Permissible gap (→ setup drawing)
 - 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 piping

5.4.1 Specifying supports and flange connections


NOTE

Material damage due to excessive forces and torque, exerted by the piping, on the pump.

- ▶ Do not exceed permissible limits.

1. Calculate pipe forces taking every possible operating condition into account:
 - cold/warm
 - empty/full
 - unpressurized/pressurized
 - shift in position of flanges
2. Ensure that pipe supports have permanent low-friction properties and will not seize up through corrosion.

5.4.2 Specifying nominal diameters

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

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

5.4.3 Specifying pipe lengths

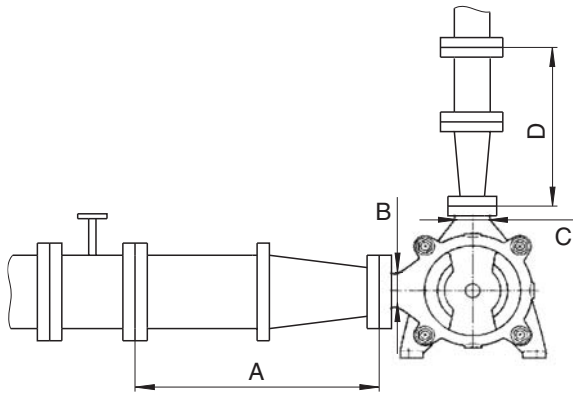



Fig. 9 Straight pipe lengths upstream and downstream of the pump (recommended)

- A > 5x suction pipe nominal diameter
- B suction pipe nominal diameter
- C pressure pipe nominal diameter
- D > 5x pressure pipe nominal diameter

- ▶ Maintain recommended minimum values when installing the pump.

 Suction side: shorter pipes are possible but can restrict hydraulic performance.
 Pressure side: shorter pipes are possible but can lead to increased operating noise.

5.4.4 Optimizing cross-section and direction changes

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

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 Providing safety and control devices (recommended)


Avoid contamination

1. Integrate filter into the suction pipe.
2. To monitor contamination, fit a differential pressure gauge with a contact manometer.

Avoid reverse running

- ▶ Install a non return valve between the pressure flange and the gate valve to ensure that the medium will not flow back when the pump is switched off.

Make provisions for isolating and shutting off the pipes

 For maintenance and repair work.

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

Allow the measurement of the operating conditions

1. Provide manometers for pressure measurements in suction and pressure pipes.
2. Provide load monitors (overload and underload) on the motor side.
3. Provide for pump-side temperature measurement.

5.5 Connecting the pipes

5.5.1 Keep the piping clean


NOTE

Material damage due to impurities in the pump!

- ▶ Make certain that no impurities can get into the pump.

1. Clean all piping components and armatures prior to assembly.
2. Ensure that no flange gaskets protrude inwards.
3. Remove blind flanges, plugs, protective foils and/or protective paint on flanges.

5.5.2 Installing auxiliary piping

-  Follow manufacturers' specifications for any existing auxiliary systems.

1. Install the auxiliary pipes so that they are stress-free and don't leak, to the auxiliary connections (→ installation drawing).
2. To avoid air pockets: run pipes with a continuous slope up to the pump.

5.5.3 Installing the suction pipe

1. Remove transport and sealing covers from the pump.
2. To avoid air pockets: run pipes with a continuous slope up to the pump.
3. Ensure that no gaskets protrude inwards.
4. For suction operation: Install a foot valve in the suction line to prevent the pump and suction pipe from running empty during downtime.

5.5.4 Installing the pressure pipe

1. Remove transport and sealing covers from the pump.
2. Install the pressure pipe.
3. Ensure that no gaskets protrude inwards.

5.5.5 Inspection for stress-free pipe connections

- ✓ Piping complete and cooled down

NOTE

Material damage due to distorted pump casing

- ▶ Ensure that all pipes are stress relieved when connected to the pump.

1. Separate the pipe connecting flanges from the pump.
2. Check that pipes can move freely in all directions within the expected range of expansion:
 - Nominal diameter < 150 mm : by hand
 - Nominal diameter > 150 mm : with short lever
3. Make certain that the flange surfaces are parallel.
4. Reconnect the pipe 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.

DANGER

Risk of death due to rotating parts!

- ▶ Isolate the motor from its supply voltage and keep it locked in that state when carrying out any fitting or maintenance work.

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 that no danger arises due to electrical energy.
3. Install an EMERGENCY STOP switch.

5.6.2 Checking the direction of rotation

DANGER

Risk of death due to rotating parts!

- ▶ Use protective equipment when carrying out any work on the pump.
- ▶ Secure the shaft key from being thrown out when checking the direction of rotation.
- ▶ Keep adequate distance to rotating parts.

NOTE

Material damage caused by running dry or wrong direction of rotation!

- ▶ Uncouple the motor from the pump.

1. Switch motor on and immediately off again.
2. Check that the direction of rotation of the motor corresponds to the rotational direction arrow on the pump.
3. If the direction of rotation is different: swap two phases.
4. Couple the motor to the pump.

5.7 Precisely align the coupling

 Only for horizontal versions (L series).

DANGER

Risk of death due to rotating parts!

- ▶ Isolate the motor from its supply voltage and keep it locked in that state when carrying out any fitting or maintenance work.

NOTE

Material damage due to incorrect alignment of the coupling!

- ▶ If there is any height, lateral or angular misalignment, align the motor exactly with the pump.
- ▶ For detailed information and special couplings: (→ manufacturer's specifications).

Checking the alignment of the coupling

- ✓ Implements, tools and materials:
 - feeler gauge
 - straightedge
 - dial gauge (for couplings with spacer piece)
 - other suitable tools, e.g. laser alignment instrument

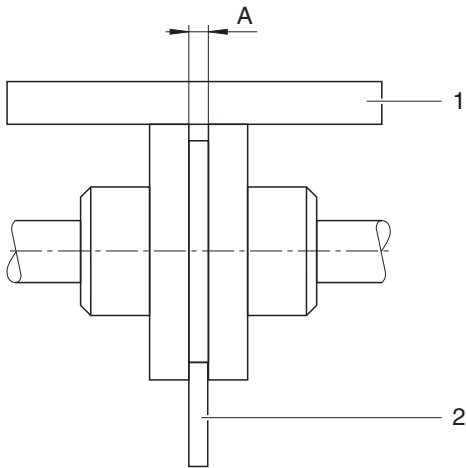


Fig. 10 Checking the alignment of the coupling

1. Measure in two planes at an angle of 90° on the circumference of the coupling.
2. Check on the outer diameter with a straightedge (1):
 - Position the straightedge across both halves of the coupling.
 - If there is a visible gap under the straightedge on the outer diameter, align the motor (→ 5.8 Aligning the motor, Page 23).

3. Measure the gap with a feeler gauge (2):
 - Permissible gap (→ installation drawing).
 - Use the feeler gauge to measure the gap (A) between the coupling halves.
 - If the gap exceeds the permissible range, align the motor (→ 5.8 Aligning the motor, Page 23).

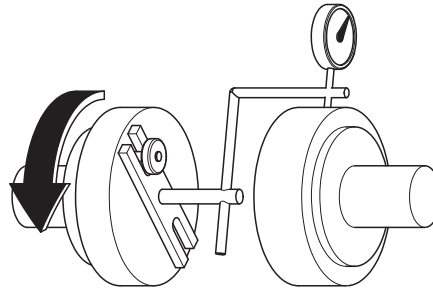


Fig. 11 Inspecting for lateral and vertical misalignment

4. Check for any lateral or vertical misalignment using the dial gauge:
 - Carry out the measurement as illustrated.
 - If there is any lateral or vertical misalignment, align the motor (→ 5.8 Aligning the motor, Page 23). Permissible axial or radial deviation, measured on the coupling front or coupling circumference, respectively: < 0.05 mm

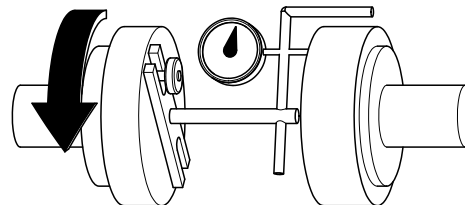




Fig. 12 Inspecting for angular misalignment

5. Check the angular displacement with a dial gauge:
 - Carry out the measurement as illustrated.
 - If there is any angular misalignment: align the motor.

5.8 Aligning the motor

 Only L series

 Alignment options:

- with sets of shims
- with adjusting screws

5.8.1 Aligning the motor using sets of shims

1. Align the motor so that the halves of the coupling are exactly flush with each other, fitting shims as necessary.
2. Check the alignment.
3. Repeat alignment procedure if there is still a vertical misalignment.
4. Tighten the motor bolts.

5.8.2 Aligning the motor with adjusting screws

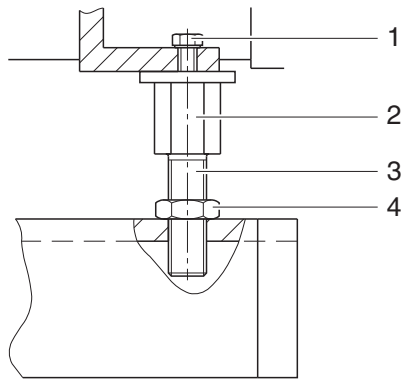




Fig. 13 Aligning the motor with adjusting screws

 When setting the adjusting screw note the angle of rotation of the shaft (→ 9.2.7 Height offset to align the motor using adjusting screw, Page 44).

1. Determine the necessary angle of rotation with the wrench for the height offset measured (→ 9.2.7 Height offset to align the motor using adjusting screw, Page 44).
2. Loosen the hexagon head bolts (1).
3. Carry out the following steps on all adjusting screws (3):
 - Hold the adjusting screw (3) firmly on the hexagon head (2) and loosen the lock nut (4).
 - Turn the adjusting screw (3) to the selected angle.
 - Hold the adjusting screw (3) firmly on the hexagon head (2) and tighten the lock nut (4).
4. Tighten the hexagon head bolts (1).
5. Check the alignment.
6. Repeat alignment procedure if there is still a vertical misalignment.
7. Tighten the motor bolts.

5.9 Installing the coupling guard

 Do not unscrew the non-looseable nuts (902.101) from the threaded rod.

Base plate version

1. Installing the coupling guard (→ Figure Coupling guard on base plate versions, Page 40).
 - Gap between coupling guard and pump < 8 mm
 - Gap between coupling guard and motor < 8 mm (set the equalizing pipe (681.102) accordingly)

Flanged drive


2. If available, install the coupling guard (two plates) on the bell housing.

6 Operation


6.1 Preparations for the initial start-up

6.1.1 Identifying the pump type

- ▶ Identify the pump type (→ order data sheet)


 The pump types vary e.g. with regard to the shaft seal.

6.1.2 Remove the preservative treatment

 Only necessary for pumps treated with preservative.

- ▶ (→ 4.4 Remove the preservative treatment, Page 15).

6.1.3 Lubricating the bearings

 Pumps with grease-lubricated roller bearings are ready for operation as delivered.

6.1.4 Filling and bleeding

WARNING

Risk of injury and poisoning due to hazardous pumped media!

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

NOTE

Material damage caused by dry running!

- ▶ Make certain that the pump is properly filled.
1. Fill the pump and the suction pipe with pumped medium.
 2. Open the suction-side armature.
 3. Open the pressure-side armature.
 4. Verify that no pipe connections are leaking.

6.2 Start-up

6.2.1 Switching on

- ✓ The pump is correctly set up and connected
- ✓ The motor is correctly set up and connected
- ✓ The motor is exactly aligned with the pump
- ✓ All connections are stress-free and sealed
- ✓ All safety devices have been installed and tested for functionality
- ✓ The pump has been correctly prepared, filled and bled

DANGER

Risk of injury due to running pump!

- ▶ 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 on it.

DANGER

Risk of injury and poisoning caused by pumped medium spraying out!

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

NOTE

Material damage caused by dry running!

- ▶ Make certain that the pump is properly filled.

NOTE

Risk of cavitation when throttling down the suction flow rate!

- ▶ Fully open the suction-side armature, do not use to adjust the flow rate.
- ▶ Do not open the pressure-side armature beyond the operating point.

NOTE

Material damage caused by overheating!

- ▶ Do not operate the pump for long periods with the pressure-side fitting closed.
- ▶ Observe the minimum flow rate (→ order data sheet).

1. Open the suction-side armature.
2. Close the pressure-side armature.
3. Switch on the motor and check for smooth running.
4. Once the motor has reached its nominal speed, slowly open the pressure-side fitting until the operating point is reached.
5. For pumps with hot pumped media, make certain that temperature changes do not exceed 5 K/min.
6. After the initial stress caused by pressure and operating temperature, check that the pump is not leaking.
7. For hot pumped media, briefly switch off the pump at the operating temperature, check the alignment of the coupling and realign the motor if necessary (→ 5.7 Precisely align the coupling, Page 22).
8. If present, set a slight leak at the packing gland.

6.2.2 Switching off

- ✓ The pressure-side armature is closed (recommended)

⚠ WARNING

Risk of injury caused by hot pump parts!

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

1. Switch off the motor.
2. Check all connecting bolts and tighten if necessary.

6.3 Shutting down

⚠ WARNING

Risk of injury and poisoning due to hazardous pumped media!

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

- ▶ Carry out the following measures when the pump is shut down:

Pump is	Action
shut down for a prolonged period	▶ Carry out measures depending on the pumped medium (→ Table 6 Measures depending on nature of pumped medium, Page 25).
emptied	▶ Close suction-side and pressure-side armatures.
disassembled	▶ Isolate the motor from its power supply and secure against unauthorized switch-on.
put into storage	▶ Follow storage instructions (→ 4.3 Storage, Page 15).

Tab. 5 Actions to be taken for pump shutdowns

Behavior of pumped medium	Duration of shutdown (depending on process)	
	short	long
Solids sediment	▶ Flush the pump.	▶ Flush the pump.
Solidifies/ freezes, non-corrosive	▶ Heat up or empty the pump and containers.	▶ Empty the pump and containers.
Solidifies/ freezes, corrosive	▶ Heat up or empty the pump and containers.	▶ Empty the pump and containers. ▶ Treat the pump and containers with preservative.
Remains liquid, non-corrosive	–	–
Remains liquid, corrosive	–	▶ Empty the pump and containers. ▶ Treat the pump and containers with preservative.

Tab. 6 Measures depending on nature of pumped medium

6.4 Start-up following a shutdown period

1. If shut down for > 1 year take the following measures before starting up again:


Shutdown period	Action
> 1 year	▶ For variants with roller bearings without lifetime lubrication: relubricate
> 2 years	▶ Replace elastomer seals (O-rings, shaft sealing rings). ▶ Replace antifriction bearings.

Tab. 7 Actions to be taken after prolonged shutdown periods

2. Carry out all steps as for the initial start-up (→ 6.2 Start-up, Page 24).


6.5 Running the stand-by pump

- ✓ The stand-by pump has been filled and bled


 Run the stand-by pump at least once a week.

1. Completely open the suction-side armature.
2. Open the pressure-side armature to an extent that the stand-by pump reaches its operating temperature and is heated through evenly (→ 6.2.1 Switching on, Page 24).

7 Maintenance

 Trained service technicians are available for fitting and repair jobs. 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 media!


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

1. At appropriate intervals check:
 - maintenance of minimum flow
 - temperature of roller bearings < 120 °C
 - normal operating conditions unchanged
 - coupling alignment and condition of elastic parts
2. For trouble-free operation, always ensure the following:
 - no dry running
 - minimum flow rate
 - no leaks
 - no cavitation
 - suction-side gate valves open
 - unobstructed and clean filters
 - sufficient suction pressure
 - no unusual running noises or vibrations
 - no visible leakage on the mechanical seal
 - slight leakage on the packing gland
 - proper functioning of auxiliary systems

7.2 Maintenance

 Service life of the antifriction bearings for operation within the allowable operating range: > 2 years

Intermittent operation, high temperatures, low viscosity and aggressive ambient and process conditions reduce the service life of antifriction bearings.

 Mechanical 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!

- ▶ Do not touch the running pump.
- ▶ Do not carry out any work on the running pump.
- ▶ Isolate the motor from its supply voltage and keep it locked in that state 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 protective equipment when carrying out any work on the pump.
- ▶ Allow the pump to cool down completely before commencing any work.
- ▶ Make certain that the pump is unpressurized.
- ▶ Empty the pump, safely collect the pumped medium and dispose of the medium in accordance with environmental rules and requirements.

7.2.1 Antifriction bearings lubricated with grease


1. As a precaution, replace antifriction bearing with lifetime lubrication every 2 years (recommended).
2. Fill any open antifriction bearings without guard discs with grease (→ 9.2.5 Lubricants, Page 43).

7.2.2 Mechanical seals

 Due to their function, mechanical seals will always leak a bit (→ manufacturer's specifications).

- ▶ In the event of major leaks: replace the mechanical seal and its auxiliary seals and check the integrity of the auxiliary systems.

7.2.3 Packing gland

 The packing gland must always leak slightly to carry the frictional heat away.

Larger leaks in the initial hours of operation lessen during the running-in period.

- ▶ If there is increased leakage: gently tighten the hexagon nuts on the gland.

7.2.4 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 Disassembling

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 keep it locked in that state 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 protective equipment when carrying out any work on the pump.
- ▶ Allow the pump to cool down completely before commencing any work.
- ▶ Make certain that the pump is unpressurized.
- ▶ Empty the pump, safely collect the pumped medium and dispose of the medium in accordance with environmental rules and requirements.

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.

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.).

7.3.1 Returning the pump to the manufacturer


- ✓ The pump is unpressurized
- ✓ The pump is completely empty
- ✓ Electrical connections are isolated and the motor is secured against switch-on
- ✓ The pump has cooled down
- ✓ Coupling shield has been removed
- ✓ For couplings with a spacer piece: Spacer piece removed
- ✓ Auxiliary systems shut down, depressurized and emptied
- ✓ Manometer connections, manometer and fixtures have been removed
- ▶ Enclose a truthfully (fully) completed document of compliance when returning pumps or single parts to the manufacturer. Order a document of compliance from the manufacturer if necessary (→ 9.4 Safety certificate, Page 46).

Repair carried out	Action for return
at customer's premises	▶ Return the defective component to the manufacturer.
at manufacturer's premises	▶ Flush the pump and decontaminate if hazardous media were pumped. ▶ Return the complete pump (not disassembled) to the manufacturer.
at manufacturer's premises for warranty repairs	▶ For hazardous pumped media only: flush and decontaminate the pump. ▶ Return the complete pump (not disassembled) to the manufacturer.

Tab. 8 Actions for return


7.3.2 Preparations for disassembling

- ✓ The pump is unpressurized
- ✓ The pump is completely empty, flushed and has been decontaminated
- ✓ Electrical connections are isolated and the motor is secured against switch-on
- ✓ The pump has cooled down
- ✓ Coupling shield has been removed
- ✓ For couplings with a spacer piece: Spacer piece removed
- ✓ Auxiliary systems shut down, depressurized and emptied
- ✓ Manometer connections, manometer and fixtures have been removed

 If a coupling with a spacer piece is used, the motor can stay mounted to the base plate.

- ▶ When disassembling take note of the following:
 - Precisely mark the assembly orientation and position of all components before disassembly.
 - Dismantle components concentrically without canting.
 - Disassemble pump (→ Sectional drawing).

7.4 Assembling the pump

 Refit components concentrically, without canting, following the markings made.

⚠ 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.

⚠ WARNING

Risk of injury during assembly!

- ▶ Install 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.).


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 42).
- ▶ Only replace seals with seals of the same material.

1. When assembling take note of the following:
 - Replace worn components with genuine replacement parts.
 - Replace gaskets, inserting them so that they cannot rotate.
 - Maintain specified tightening torque (→ 9.2.3 Tightening torques, Page 42).
2. Clean all components (→ 9.2.6 Cleaning agents, Page 43). Do not remove the prepared markings.
3. Install pump (→ Sectional drawing).
4. Replace the antifriction bearings. Fill any open antifriction bearings without guard discs with grease:
 - Make sure you use the correct type and minimum amount of grease when filling the bearing (→ 9.2.5 Lubricants, Page 43).
 - Fill the cavities between the rolling elements up to 40 % with grease.
 - Wipe off any excess grease with a soft object.
5. Install the pump in the system (→ 5 Setup and connection, Page 17).

7.5 Ordering replacement parts

 For trouble-free replacement in case of any fault we recommend keeping complete slide-in units or replacement pumps available on site.

The application guidelines conforming to DIN 24296 recommend provisioning for two years of continuous use (→ 9.3 Spare parts for 2 years of continuous operation according to DIN 24296, Page 45).

- ▶ Have the following information ready to hand for ordering replacement parts (→ Type plate):
 - Pump type
 - Pump number
 - Year of manufacture
 - Part number
 - Designation
 - Quantity

8 Troubleshooting

For faults which do not appear in the following table, or faults that cannot be traced back to the suggested causes, please consult with the manufacturer.

Possible faults are identified by a fault number in the table below. This number identifies the respective cause and remedy in the troubleshooting list.

Fault	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
Antifriction bearing temperatures too high	7
Pump leaking	8
Motor power uptake excessive	9

Tab. 9 Fault number assignment

Fault number									Cause	Remedy
1	2	3	4	5	6	7	8	9		
X	-	-	-	-	-	-	-	-	Transport and sealing cover still in place	<ul style="list-style-type: none"> ▶ Remove transport and sealing cover. ▶ Disassemble pump and inspect for dry-running damage.
X	-	-	-	-	-	-	-	-	Supply/suction line and/or pressure line closed by armature	<ul style="list-style-type: none"> ▶ Open the armature.
X	-	-	-	-	X	-	-	-	Supply/suction pipe not bled properly or not filled up completely	<ul style="list-style-type: none"> ▶ Fill up pump and/or piping completely and bleed them.
X	-	-	-	-	X	-	-	-	Supply/suction line contains air pockets	<ul style="list-style-type: none"> ▶ Install armature for bleeding. ▶ Correct the piping layout.
X	X	-	X	-	X	-	-	-	Supply/suction pipe, pump or suction screen blocked or encrusted	<ul style="list-style-type: none"> ▶ Clean supply/suction pipes, pump or suction screen.
X	X	-	X	-	X	-	-	-	Air is sucked in	<ul style="list-style-type: none"> ▶ Seal the source of malfunction.
X	X	-	X	-	X	-	-	-	Excessive amount of gas: pump is cavitating	<ul style="list-style-type: none"> ▶ Consult with manufacturer.
X	X	-	X	-	X	-	-	-	Pump running in the wrong direction	<ul style="list-style-type: none"> ▶ Swap any two phases on the motor.
X	X	-	X	-	-	-	-	-	Motor speed insufficient	<ul style="list-style-type: none"> ▶ Compare required motor speed with specification on pump type plate. Replace motor if necessary. ▶ Increase motor speed with speed control if available.
X	X	-	X	-	X	-	-	-	Impeller out of balance or blocked	<ul style="list-style-type: none"> ▶ Disassemble pump and inspect for dry-running damage. ▶ Clean the impeller.
X	X	-	-	X	X	-	-	-	Pressure pipe blocked	<ul style="list-style-type: none"> ▶ Clean the pressure pipe.
-	X	-	X	-	-	-	-	-	Supply/suction pipe not fully opened	<ul style="list-style-type: none"> ▶ Open the armature.

Fault number									Cause	Remedy
1	2	3	4	5	6	7	8	9		
-	X	-	X	-	X	-	-	-	Supply/suction pipe cross-section too narrow	<ul style="list-style-type: none"> ▶ Increase cross-section. ▶ Remove encrustations from suction pipe. ▶ Open the armature completely.
-	X	-	X	-	X	-	-	-	Differential head excessive: $NPSH_{pump}$ larger than $NPSH_{installation}$	<ul style="list-style-type: none"> ▶ Increase the suction pressure. ▶ Consult with manufacturer.
-	X	-	X	-	X	-	-	-	Pumped medium temperature too high: pump is cavitating	<ul style="list-style-type: none"> ▶ Increase the suction pressure. ▶ Lower the temperature. ▶ Inquire with manufacturer.
-	X	-	X	-	-	-	-	X	Viscosity or specific gravity of the pumped medium outside the range specified for the pump	<ul style="list-style-type: none"> ▶ Consult with manufacturer.
-	X	-	X	-	-	-	-	-	Geodetic differential head and/or pipe flow resistance too high	<ul style="list-style-type: none"> ▶ Remove sediments in pump and/or pressure pipe. ▶ Install larger impeller and consult with manufacturer.
-	X	-	-	X	X	-	-	-	Pressure-side armature not opened sufficiently	<ul style="list-style-type: none"> ▶ Open the pressure-side armature.
-	X	-	X	-	X	X	-	-	Pump components worn	<ul style="list-style-type: none"> ▶ Replace worn pump components.
-	X	-	X	-	X	-	-	-	Hydraulic components of the pump dirty, clotted or encrusted	<ul style="list-style-type: none"> ▶ Disassemble pump. ▶ Clean the components.
-	X	-	X	-	X	-	-	X	Motor running on 2 phases	<ul style="list-style-type: none"> ▶ Check fuse and replace it if necessary. ▶ Check cable connections and insulation.
-	X	-	-	-	-	-	X	-	Shaft sleeve has been penetrated	<ul style="list-style-type: none"> ▶ Replace shaft sleeve and/or seal.
-	-	X	-	-	X	-	-	X	Geodetic differential head, pipe flow resistance and/or other resistance lower than specified	<ul style="list-style-type: none"> ▶ Throttle down flow rate at pressure-side armature. Observe the minimum flow rate limit. ▶ Machine the impeller down. Consult with manufacturer and adjust the impeller diameter.
-	-	X	X	-	X	-	-	X	Pressure-side armature opened too wide	<ul style="list-style-type: none"> ▶ Throttle down at pressure-side armature. ▶ Machine the impeller down. Consult with manufacturer and adjust the impeller diameter.
-	-	X	-	X	-	-	-	-	Viscosity lower than expected	<ul style="list-style-type: none"> ▶ Machine the impeller down. Consult with manufacturer and adjust the impeller diameter.
-	-	X	-	X	X	X	-	X	Motor speed excessively high	<ul style="list-style-type: none"> ▶ Compare required motor speed with specification on pump type plate. Replace motor if necessary. ▶ Reduce motor speed with speed control if available.

Fault number									Cause	Remedy
1	2	3	4	5	6	7	8	9		
-	-	X	-	X	X	-	-	X	Impeller diameter too large	<ul style="list-style-type: none"> ▶ Throttle down flow rate at pressure-side armature. Observe the minimum flow rate limit. ▶ Machine the impeller down. Consult with manufacturer and adjust the impeller diameter.
-	-	-	-	-	X	-	-	-	Coupling unit worn	▶ Replace coupling unit and realign.
-	-	-	-	-	X	X	-	-	Coupling not properly aligned	▶ Align coupling.
-	-	-	-	-	X	X	-	X	Antifriction bearings in the pump defective	▶ Replace antifriction bearings.
-	-	-	-	-	X	X	X	X	Pump distorted	<ul style="list-style-type: none"> ▶ Check pipe connections and pump fixings. ▶ Check coupling alignment. ▶ Check fixing of support foot.
-	-	-	-	-	-	X	-	X	Faulty antifriction bearing in motor	▶ Replace the antifriction bearing (→ manufacturer's specifications).
-	-	-	-	-	-	X	-	-	Lubricant: too much, too little or unsuitable	▶ Reduce, top up or replace lubricant.
-	-	-	-	-	-	X	-	-	Excessive axial load	▶ Clean the relief bore in the impeller.
-	-	-	-	-	-	X	-	-	Distance between the coupling halves too large	▶ Adhere to the prescribed distance between the coupling halves (→ assembly instructions for the coupling).
-	-	-	-	-	-	-	X	-	Connecting bolts not tightened correctly	▶ Tighten connecting bolts.
-	-	-	-	-	-	-	X	-	Mechanical seal worn	▶ Replace the mechanical seal.
-	-	-	-	-	-	-	X	-	Faulty housing seal	▶ Replace housing seal.
-	-	-	-	-	-	-	X	-	Packing gland material unsuitable for pumped liquid	▶ Replace the packing gland.

Tab. 10 Troubleshooting list

9 Appendix

9.1 Sectional drawings

9.1.1 Auxiliary connections

Abbreviation	Connection
FF1	Filling
FD1	Emptying the suction casing
FD3	Emptying the discharge casing
LO	Leak / egress on packing gland
LO1	Leak / egress on suction side
LO3	Leak / egress on pressure side
PM1	Pressure measurement on suction casing
PM2	Pressure measurement on discharge casing
FV1	Bleeding the mechanical seal
FV3	Bleeding the pump
FV4	Bleeding the mechanical seal

Tab. 11 Abbreviations for the connection names

9.1.2 Part numbers and designations

Part no.	Designation
106.01	Suction casing
107.01	Discharge casing
108.01	Stage casing
108.02	Stage casing
171.01	Guide wheel
210.01	Shaft
230.01	Impeller
321.01	Radial ball bearing
321.02	Radial ball bearing
342.01	Support bearing bell housing
350.01	Bearing housing
350.02	Bearing housing
360.01	Bearing cover
360.02	Bearing cover
400.01	Seal
400.02	Seal
411.01	Seal ring
411.02	Seal ring
411.03	Seal ring

Part no.	Designation
411.04	Seal ring
411.05	Seal ring
411.06	Seal ring
411.07	Seal ring
411.08	Seal ring
411.09	Seal ring
411.10	Seal ring
411.11 ¹⁾	Seal ring
411.12 ¹⁾	Seal ring
411.13 ¹⁾	Seal ring
411.14 ¹⁾	Seal ring
411.15 ⁶⁾	Seal ring
412.01	O-ring
412.02	O-ring
412.03	O-ring
433.01	Mechanical seal (clockwise rotation)
433.02	Mechanical seal (anti-clockwise rotation)
452.01	Gland
452.02	Gland
458.01 ⁵⁾	Retaining ring
461.01	Gland packing
461.02	Gland packing
471.01	Seal cover
471.02	Seal cover
507.01	Oil thrower
507.02	Oil thrower
520.01	Sleeve
523.01	Shaft sleeve
523.02	Shaft sleeve
524.01	Shaft protection sleeve
524.02	Shaft protection sleeve
525.01	Spacer sleeve
525.02 ²⁾	Spacer sleeve
525.03 ²⁾	Spacer sleeve
531.01	Clamping sleeve
545.01	Bearing bush
550.106	Slotted disc

Part no.	Designation
550.107	Disc
551.01	Spacing washer
551.03	Spacing washer
554.01	Washer
554.02	Washer
554.03	Washer
554.04	Washer
554.05	Washer
557.01	Balance disc
562.01	Cylindrical pin
565.01	Rivet
599.101	Crimping sleeve
681.101	Coupling guard
681.102	Equalizing pipe
686.01	Guard sheet
710.01	Pipe
710.02 ¹⁾	Pipe
710.03 ¹⁾	Pipe
710.04	Pipe
730.01 ⁷⁾	Pipe connection
731.01 ³⁾	Pipe fitting
731.02 ³⁾	Pipe fitting
731.03 ¹⁾	Pipe fitting
731.04 ¹⁾	Pipe fitting
731.05 ¹⁾	Pipe fitting
901.01	Hexagon head bolt
901.02	Hexagon head bolt
901.03	Hexagon head bolt
902.01	Stud bolt
902.02	Stud bolt
902.101	Stud bolt
903.01	Screw plug
903.02	Screw plug
903.03 ⁴⁾	Screw plug
903.04	Screw plug
903.05	Screw plug
903.06	Screw plug
903.07 ⁴⁾	Screw plug
903.08	Screw plug

Part no.	Designation
903.09 ⁴⁾	Screw plug
903.10	Screw plug
903.11 ⁶⁾	Screw plug
904.01 ⁸⁾	Grub screw
905.01	Tie bolt
913.01	Air release plug
913.02	Air release plug
914.01	Socket head cap screw
914.02	Socket head cap screw
914.03	Socket head cap screw
914.04	Cheese head screw
914.05	Socket head cap screw
914.06 ²⁾	Socket head cap screw
914.07 ²⁾	Cheese head screw
920.01	Hexagon nut
920.02	Hexagon nut
920.03	Hexagon nut
920.04	Hexagon nut
920.106	Hexagon nut
920.107	Hexagon nut
932.01	Snap ring
932.02	Snap ring
932.03	Snap ring
940.01	Shaft key
940.02	Shaft key
940.03	Shaft key
940.04	Shaft key
971.01	Name plate

Tab. 12 Designations of components listed with part numbers

- 1) Only for mechanical seals U2D, U2.2D, U2.6D
- 2) Only for mechanical seals U2D, U2.2D
- 3) Only with pressure discharge for gland packing
- 4) Not applicable with pressure discharge for gland packing
- 5) Only for sizes L 50, L 65
- 6) Only for sizes LV 25, LV 32, LV 40
- 7) Only for size LV 65-W3
- 8) Only for versions without blocking

9.1.3 Overview sectional drawing

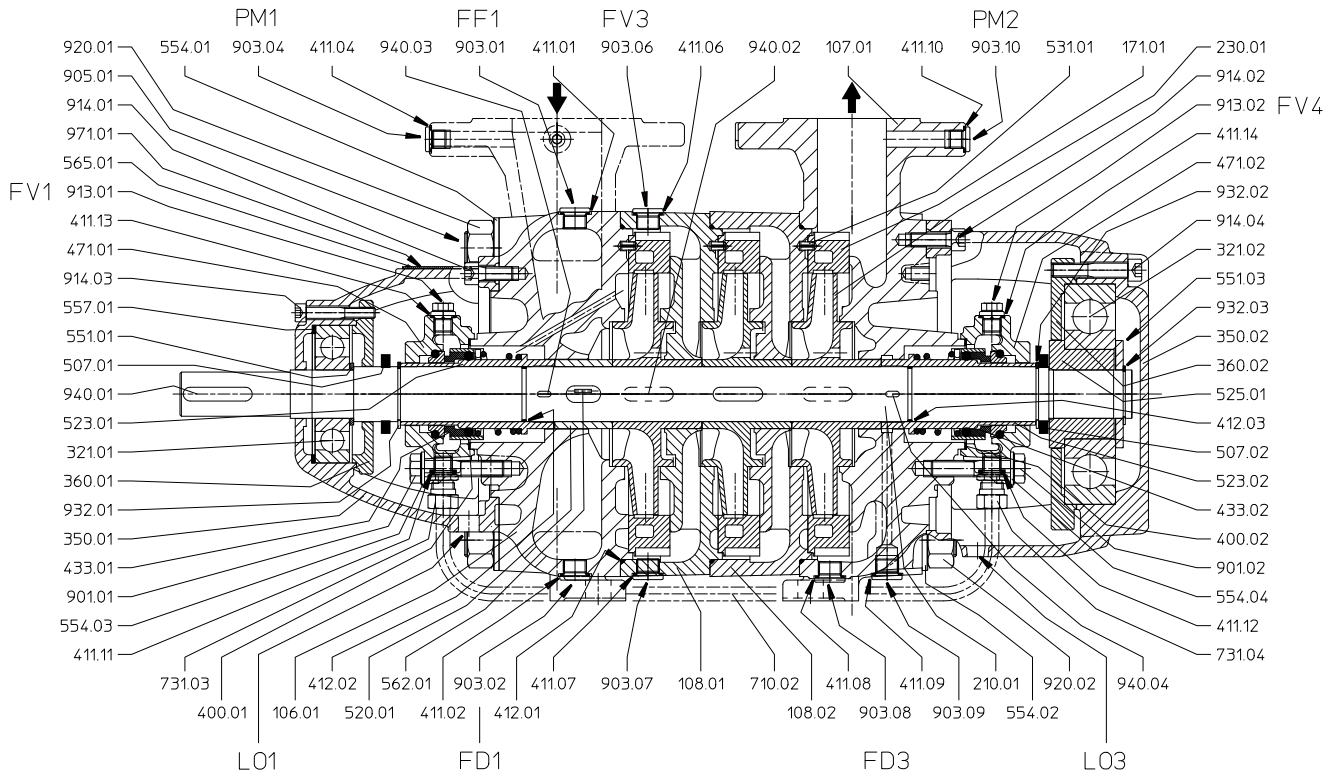


Fig. 14 Sizes L 50/65, with mechanical seal, balanced, uncooled, version U2.6D (suction side = clockwise rotation, pressure side = anti-clockwise rotation), with flushing

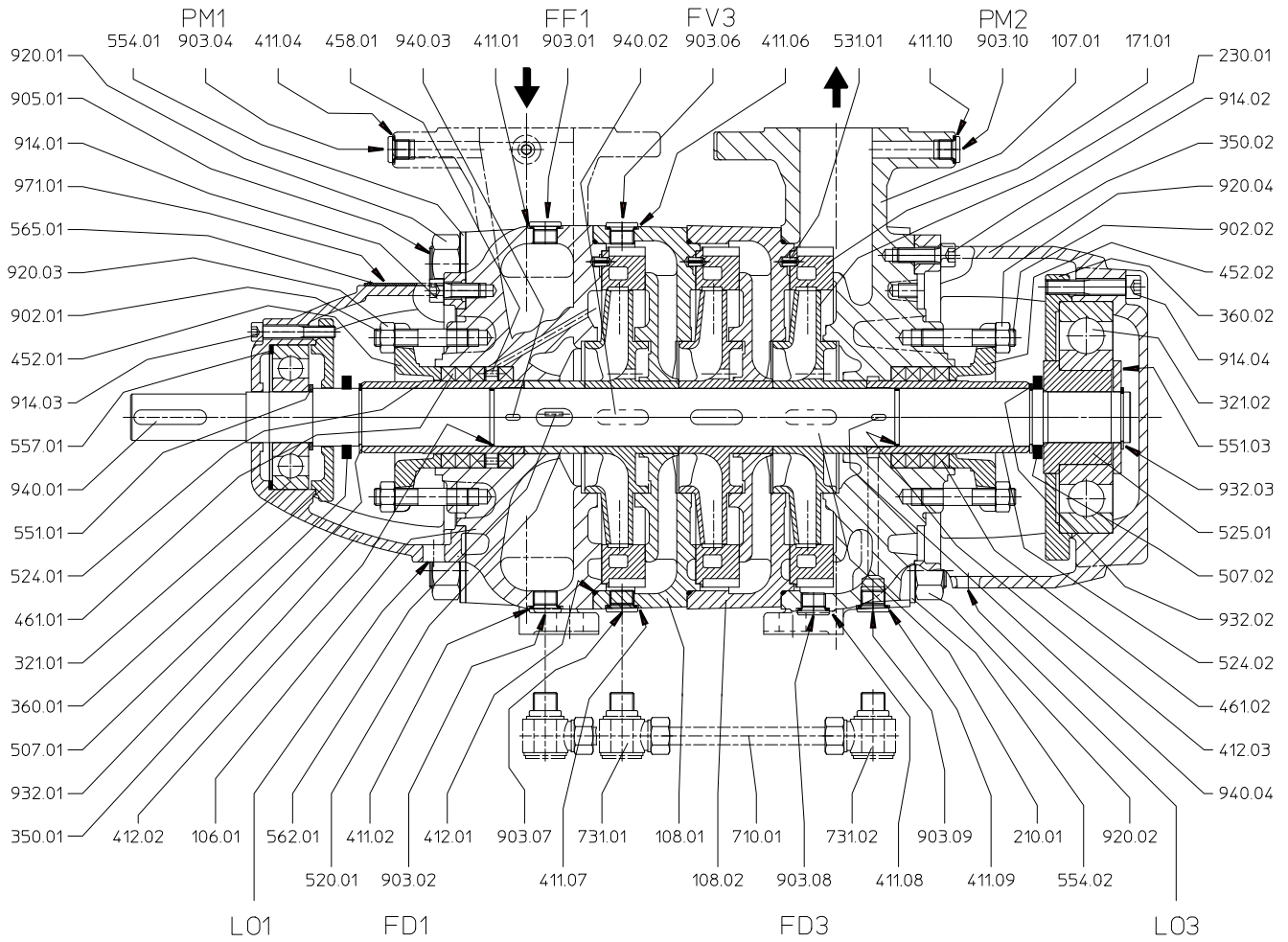


Fig. 15 Sizes L 25/32/40/50/65, with uncooled packing gland, version U1BA (suction side with blocking, pressure side without pressure discharge)

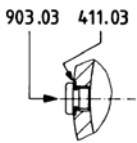


Fig. 16 Pressure discharge connection of packing gland in suction casing

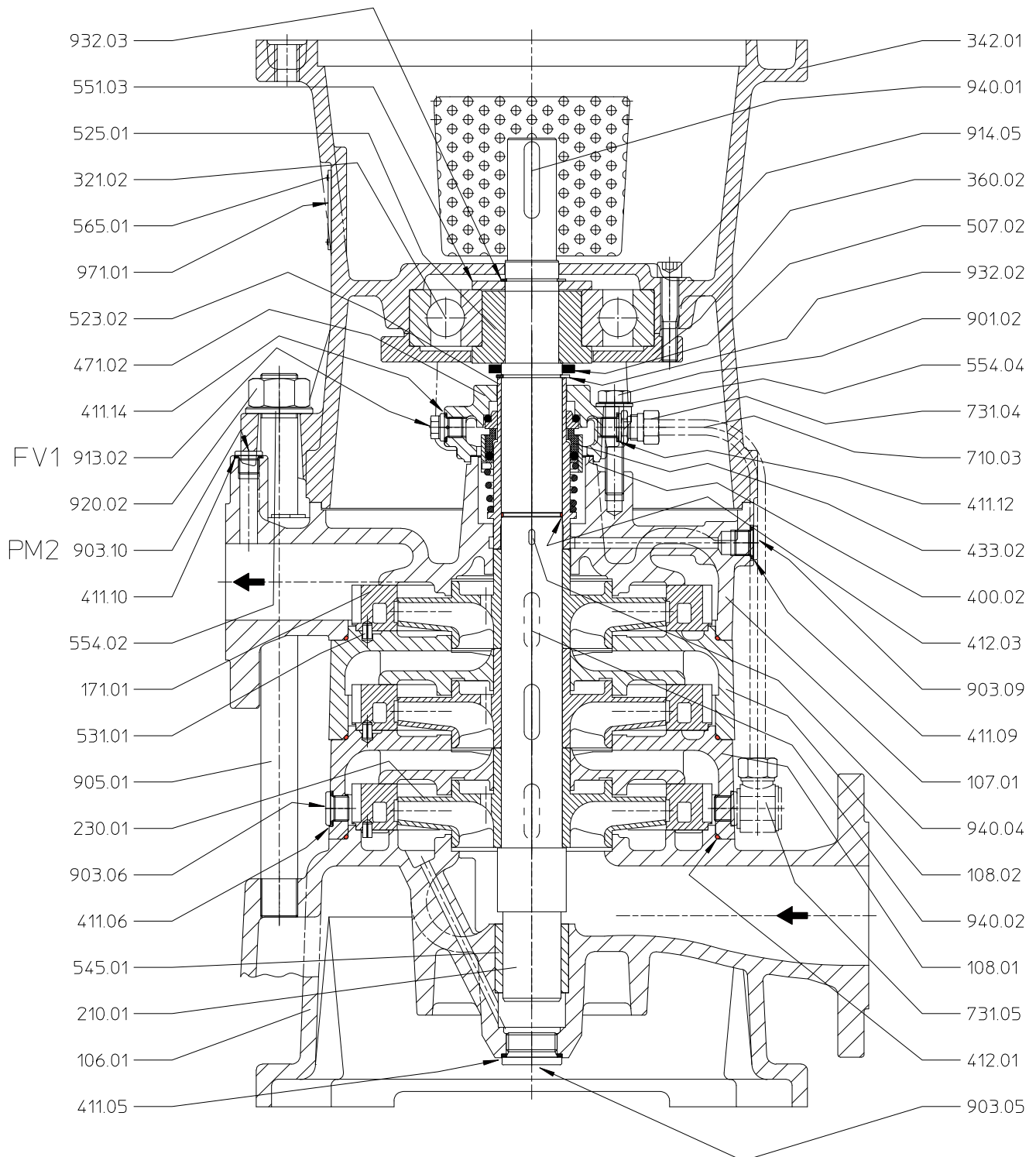


Fig. 17 Sizes LV 50/65, with mechanical seal, balanced, uncooled, version U2.6D (anti-clockwise rotation), with flushing

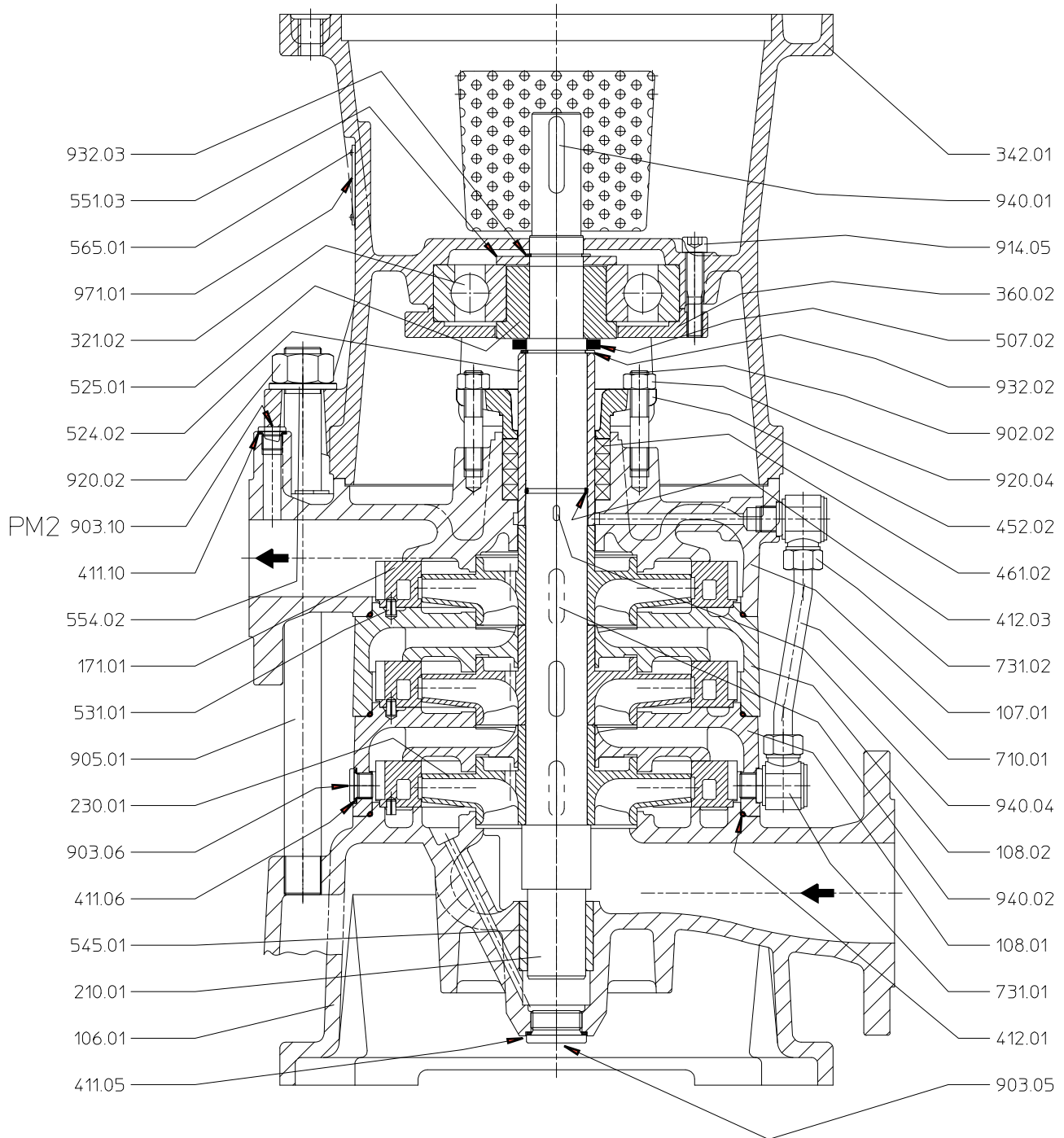


Fig. 18 Sizes LV 50/65, with uncooled packing gland, version U1A, pressure side without pressure discharge, version U1G, pressure side with pressure discharge

9.1.4 Coupling guard

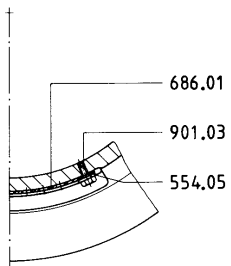


Fig. 19 Attachment of the safety guarding (LV series)

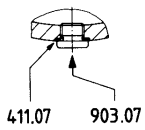


Fig. 20 Pressure discharge connection of packing gland on first stage (LV series)

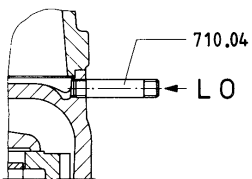


Fig. 21 Leakage in discharge casing (LV series)

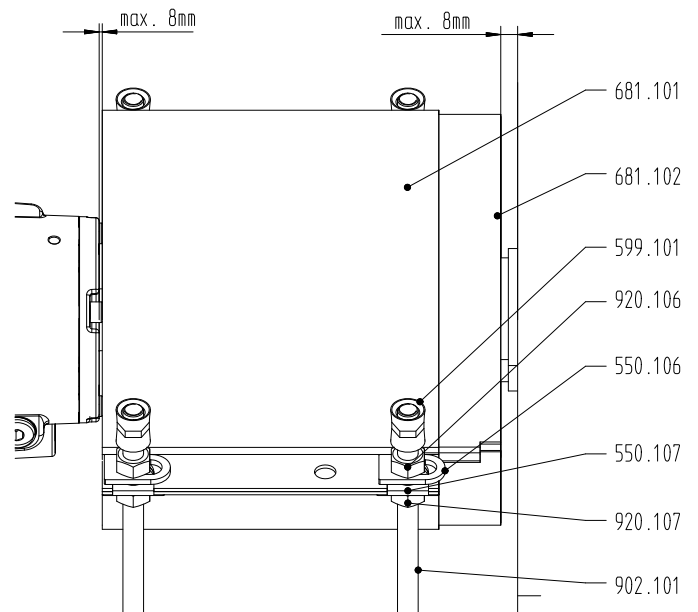


Fig. 22 Coupling guard on base plate versions

9.1.5 Variants

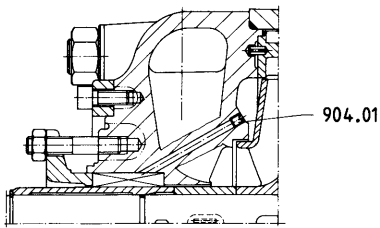


Fig. 23 Sizes L 25/32/40/50/65, uncooled packing gland, version U1AA (suction side without blocking, pressure side without pressure discharge)

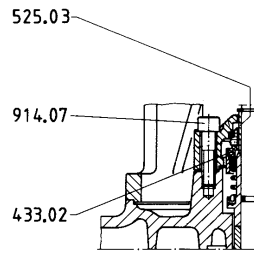


Fig. 26 Sizes LV 25/32/40, mechanical seal, balanced, uncooled, version U2D/U2.2D (anti-clockwise rotation), with flushing

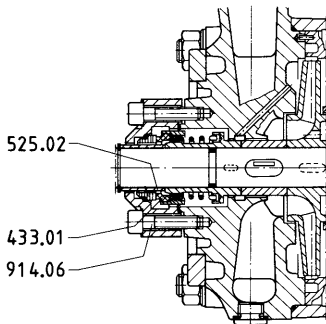


Fig. 24 Sizes L 25/32/40 (suction side), mechanical seal, balanced, uncooled, version U2D/U2.2D (suction side = clockwise rotation), with flushing

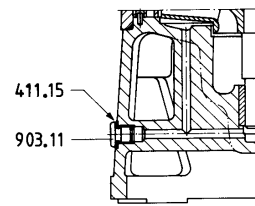


Fig. 27 Sizes LV 25/32/40, lubrication bore hole for sleeve bearings, suction side with screw plugs

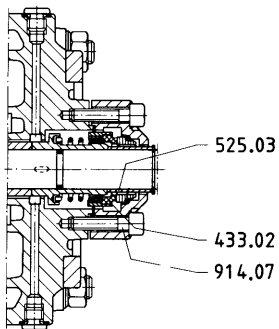




Fig. 25 Sizes L 25/32/40 (pressure side), mechanical seal, balanced, uncooled, version U2D/U2.2D (pressure side = anti-clockwise rotation), with flushing

9.2 Technical specifications

 More technical information (→ Order data sheet).

9.2.1 Ambient conditions

 Operation under other ambient conditions to be agreed with the manufacturer.

Temperature [°C]	Relative humidity [%]		Installation height above sea level [m]
	long-term	short-term	
-20 to +40	≤ 85	≤ 100	≤ 1000

Tab. 13 Ambient conditions

9.2.2 Sound pressure level

Measuring conditions:

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

Lower-noise versions of the motors are available if the expected noise levels exceed the allowed limits.

Nominal motor power PM [kW]	Sound pressure level [dB] for pump with motor at speed [rpm]			
	1450	1750	2900	3500
1.5	58	58.5	63	64
2.2	60	60.5	66	67
3.0	62	62.5	68	69
4.0	63	63.5	69	70
5.5	65	65.5	71	72
7.5	66	66.5	72	73
11.0	68	68.5	74	75
15.0	69	69.5	75	76
18.5	70	70.5	76	77
22.0	71	71.5	77	78
30.0	72	72.5	78	79
37.0	73	73.5	79	80
45.0	74	74.5	80	81
55.0	75	75.5	80	81
75.0	76	76.5	81	82
90.0	76	76.5	82	83
110.0	77	77.5	82	83
132.0	78	78.5	83	84


Tab. 14 Sound pressure level

9.2.3 Tightening torques

Part no.	Thread size	Quality	Tightening torque [Nm]
901.01 901.02	M12	8.8	65
903.01 – 903.11	G 1/4 G 3/8 G 1	St	10 15 85
913.01 913.02	EG 1/8 EG 1/4	5.8	5 10
914.01 – 914.07	M6 M8 M10	8.8	8 20 39
920.01 920.02	M14 M16 M24 x 1.5	5.6	45 69 253

Tab. 15 Tightening torques

9.2.4 Preserving agent

 Use a Valvoline preservative or similar (recommended).

Type of storage	Storage duration (months)	Preservation inside/ outside	Renew [months] inside/ outside
in closed, dry and dust-free room	6–12	Tectyl 511 M	–
	> 12	Tectyl 506 EH	48/48
in open air, central European climate	6–12	Tectyl 542	–
	> 12	Tectyl 506 EH	48/18
in the open air, tropical climate, aggressive industrial atmosphere or close to sea	6–12	Tectyl 542/ Tectyl 506 EH	–
	> 12	Tectyl 506 EH	48/12

Tab. 16 Valvoline preservatives

9.2.5 Lubricants

Manufacturer	Brand name	Grease temperature range [°C]	Name according to DIN 51825
Mobil ¹⁾	Mobilux EP 3	-20 ... 130	KP2K-20
FUCHS	Renolit GP3	-30 ... 120	K3K-30
SKF	LGMT3	-30 ... 120	K3K-30
Esso	BEACON 325	-60 ... 120	KE2G-60

Tab. 17 Grease types

1) Recommendation

Pump size	Short designation of the antifriction bearing 321.01 / 321.02	Approx. amount of grease [g] 321.01 / 321.02
L/LV 25	6,404 J C3	7
	6,407 J C3	16
L/LV 32	6,405 J C3	9
	6,410 J C3	25
L/LV 40	6,405 J C3	9
	6,410 J C3	25
L/LV 50	6,407 J C3	16
	6,413 J C3	40
L/LV 65	6,407 J C3	16
	6,413 J C3	40

Tab. 18 Minimum amounts for grease lubrication

9.2.6 Cleaning agents

Application area	Cleaning agents
Foodstuffs and drinking water sector	e.g. spirit, Ritzol 155, strong alkaline soapy solution, steam jet (for individual components only)
Other	Benzine, wax solvents, diesel, paraffin, alkaline cleaners

Tab. 19 Cleaning agents

9.2.7 Height offset to align the motor using adjusting screw

Height adjustment [mm]	Rotation angle of spindle [°]	Setting aid
0.02	5	–
0.04	10	–
0.06	15	–
0.08	20	–
0.10	25	–
0.13	30	Shaft key surface to point of hexagon
0.15	35	–
0.17	40	–
0.19	45	–
0.21	50	–
0.23	55	–
0.25	60	Shaft key surface to shaft key surface
0.27	65	–
0.29	70	–
0.31	75	–
0.33	80	–
0.35	85	–
0.38	90	1/4 turn
0.40	95	–
0.42	100	–
0.44	105	–
0.46	110	–
0.48	115	–
0.50	120	–
0.52	125	–
0.54	130	–
0.56	135	–
0.58	140	–
0.60	145	–
0.63	150	–
0.65	155	–
0.67	160	–
0.69	165	–
0.71	170	–
0.73	175	–

Height adjustment [mm]	Rotation angle of spindle [°]	Setting aid
0.75	180	1/2 turn
0.77	185	–
0.79	190	–
0.81	195	–
0.83	200	–
0.85	205	–
0.88	210	–
0.90	215	–
0.92	220	–
0.94	225	–
0.96	230	–
0.98	235	–
1.00	240	–
1.02	245	–
1.04	250	–
1.06	255	–
1.08	260	–
1.10	265	–
1.13	270	3/4 turn
1.15	275	–
1.17	280	–
1.19	285	–
1.21	290	–
1.23	295	–
1.25	300	–
1.27	305	–
1.29	310	–
1.31	315	–
1.33	320	–
1.35	325	–
1.38	330	–
1.40	335	–
1.42	340	–
1.44	345	–
1.46	350	–
1.48	355	–
1.50	360	1 revolution

Tab. 20 Height setting on the adjusting screw


9.3 Spare parts for 2 years of continuous operation according to DIN 24296


Part no.	Part designation	Number of identical pumps (including stand-by pumps)						
		2	3	4	5	6 and 7	8 and 9	> 9
		Set/quantity of spare parts						
171.01	Guide wheel ¹⁾	1	1	1	2	2	3	30 %
210.01	Shaft with shaft keys	1	1	2	2	2	3	30 %
230.01	Impeller ¹⁾	1	1	1	2	2	3	30 %
321.01 321.02	Groove ball bearing ²⁾	1	1	2	2	3	4	50 %
321.02 545.01	Groove ball bearing Bearing bush ³⁾	1	1	2	2	3	4	50 %
523.01 ²⁾ 523.02 ²⁾ 523.02 ³⁾	Shaft sleeve (for versions with mechanical ring)	2	2	2	3	3	4	50 %
524.01 ²⁾ 524.02 ²⁾ 524.02 ³⁾	Shaft sleeve (for versions with packing gland)	2	2	2	3	3	4	50 %
525.01	Spacer sleeve	1	1	2	2	3	4	50 %
461.01 ²⁾ 461.02 ²⁾ 461.02 ³⁾	Packing ring set ⁴⁾	4	4	6	6	6	8	40 %
433.01 433.02	Mechanical seal (clockwise rotation) Mechanical seal (anti-clockwise rotation L/LV 50/65) ⁴⁾	2	3	4	5	6	7	90 %
470.01 475.01 412.04	Mechanical seal, rotating part (clockwise rotation) ⁴⁾ Counter ring (L 25/32/40) O-ring (L 25/32/40)	2 2 2	3 3 3	4 4 6	5 5 8	6 6 8	7 7 10	90 % 90 % 150 %
470.02 475.02 412.05	Mechanical seal, rotating part (anti-clockwise rotation) ⁴⁾ Counter ring (L 25/32/40) O-ring (L 25/32/40)	2 2 2	3 3 3	4 4 6	5 5 8	6 6 8	7 7 10	90 % 90 % 150 %

Tab. 21 Replacement parts for 2 years of continuous operation

- 1) Set, corresponding with number of pump stages
- 2) Only L series
- 3) Only LV series
- 4) Delivered as a mechanical unit (BG) or sales unit (VG)


9.4 Safety certificate

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

The pump and accessories given for inspection / repair together with the safety certificate by us, the undersigned,	
Type: _____	Delivery date: _____
Serial no.: _____	Order no.: _____
Reason for inspection / repair: _____	
<p><input type="checkbox"/> was not used in areas dangerous to health or the environment.</p> <p><input type="checkbox"/> had the following field of application: _____</p> <p>and came into contact with substances that must be labeled or were contaminated.</p> <p><input type="checkbox"/> Last pumped liquid: _____</p> <p><input type="checkbox"/> The pump has been carefully emptied and cleaned on the outside and inside prior to delivery or provision.</p> <p><input type="checkbox"/> Special safety precautions are not necessary for subsequent use.</p> <p><input type="checkbox"/> The following safety precautions regarding rinsing liquids, liquid residue and disposal are necessary: _____</p>	
	If the pump was used with critical liquids, please make sure to also send a safety data sheet with the package.
We hereby declare that the information given is correct and complete, and that dispatch was made according to legal requirements.	
Company / address: _____	Phone: _____
	Fax: _____
Customer no.: _____	
Issuer name: (Capital letters) _____	Position: _____
Date: _____	Company stamp / signature: _____

Tab. 22 Safety certificate

9.5 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.

<p>EC declaration of conformity according to machine directive, appendix II A</p> <p>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:</p>	
Designation	L / LV
Equipment no.	
Order no.	
<p>complies with the following applicable EC directives :</p> <ul style="list-style-type: none"> • 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 	
<p>Applicable harmonized norms:</p> <ul style="list-style-type: none"> • 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. 23 Declaration of conformity according to EC machine directives

