

Centrifugal Pump with Volute Casing

Operating manual

NAM-F series



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We reserve the right to make technical changes.

Table of contents

1 About this document	4	5.4.4 Inspection for stress-free pipe connections	14
1.1 Target groups	4	5.5 Electrical connection	14
1.2 Other applicable documents	4	5.5.1 Connecting the motor	14
1.3 Warnings and symbols	5	5.5.2 Checking the direction of rotation	14
1.4 Technical terms	5	5.6 Checking the alignment of the coupling	15
2 Safety	6	6 Operation	16
2.1 Intended use	6	6.1 Preparations for the initial start-up	16
2.2 General safety instructions	6	6.1.1 Identifying the pump type	16
2.2.1 Product safety	6	6.1.2 Removing the preservative	16
2.2.2 Obligations of the operating company	7	6.1.3 Lubricating the bearings	16
2.2.3 Duties of the personnel	7	6.1.4 Preparing auxiliary systems (if available)	16
3 Layout and function	8	6.1.5 Filling and bleeding	16
3.1 Labels	8	6.2 Start-up	16
3.1.1 Type plate	8	6.2.1 Switching on	16
3.1.2 Pump type code	8	6.2.2 Switching off	17
3.2 Layout	9	6.3 Shutting down	17
3.3 Shaft seal	9	6.4 Start-up following a shutdown period	18
3.3.1 Single mechanical seal	9	6.5 Operating the stand-by pump	18
3.4 Auxiliary systems	9	7 Maintenance	19
3.4.1 Automatic aspirator (if available)	9	7.1 Inspections	19
4 Transport, storage and disposal	10	7.2 Maintenance	19
4.1 Transport	10	7.2.1 Antifriction bearings lubricated with grease	19
4.1.1 Unpacking and inspection on delivery	10	7.2.2 Mechanical seals	19
4.1.2 Lifting	10	7.3 Dismounting	20
4.2 Preservation	10	7.3.1 Returning the pump to the manufacturer	20
4.3 Storage	10	7.3.2 Preparations for dismounting	20
4.4 Removing the preservative	11	7.4 Installing	21
5 Setup and connection	12	7.5 Ordering spare parts	21
5.1 Preparing the setup	12	8 Troubleshooting	22
5.1.1 Checking the ambient conditions	12	9 Appendix	25
5.1.2 Preparing the installation site	12	9.1 Sectional drawings	25
5.1.3 Removing the preservative	12	9.1.1 Auxiliary connections	25
5.1.4 Fastening the pump	12	9.1.2 Part numbers and designations	25
5.2 Installing the motor	12	9.1.3 NAM-F series sectional drawings	27
5.3 Planning the piping	12	9.2 Technical specifications	29
5.3.1 Keeping the piping clean	12	9.2.1 Ambient conditions	29
5.3.2 Specifying supports and flange connections	12	9.2.2 Preservatives	29
5.3.3 Specifying nominal diameters	13	9.2.3 Sound pressure levels	29
5.3.4 Specifying pipe lengths	13	9.2.4 Tightening torques	30
5.3.6 Optimizing cross-section and direction changes	13	9.2.5 Cleaning agents	30
5.3.7 Provide safety and control devices (recommended)	13	9.2.6 Lubricants	30
5.4 Connecting the pipes	14	9.3 Recommended spare parts	31
5.4.1 Installing auxiliary pipes (if available)	14		
5.4.2 Installing the suction pipe	14		
5.4.3 Installing the pressure pipe	14		

List of figures

Fig. 1	Type plate (example)	8
Fig. 2	Pump type code (example)	8
Fig. 3	NAM-F layout	9
Fig. 4	Automatic aspirator – extension example	9
Fig. 5	Fastening the lifting gear to the pump aggregate	10
Fig. 6	Straight pipe lengths upstream and downstream of the pump (recommended)	13
Fig. 7	Checking the lateral displacement	15
Fig. 8	Checking the angular displacement	15
Fig. 9	U3...D Unbalanced mechanical seal Base installation	27
Fig. 10	Wall attachment version	28
Fig. 11	Attachment of the pump feet to the bell housing	28
Fig. 12	Bearing and impeller retention version for bearing bracket size 530	28

List of tables

Tab. 1	Target groups and their duties	4
Tab. 2	Other applicable documents and their purpose	4
Tab. 3	Warnings and consequences of disregarding them	5
Tab. 4	Symbols and their meaning	5
Tab. 5	Technical terms and their meaning	5
Tab. 6	Measures to be taken if the pump is shut down	17
Tab. 7	Measures depending on the behavior of the pumped medium	17
Tab. 8	Measures to be taken after prolonged shutdown periods	18
Tab. 9	Measures for return	20
Tab. 10	Fault number assignment	22
Tab. 11	Troubleshooting list	24
Tab. 12	Abbreviations of the connection designations	25
Tab. 13	Designations of components according to part numbers	26
Tab. 14	Ambient conditions	29
Tab. 15	Valvoline preservatives	29
Tab. 16	Sound pressure levels	29
Tab. 17	Tightening torques	30
Tab. 18	Cleaning agents	30
Tab. 19	Grease types	30
Tab. 20	Minimum amounts for grease lubrication	30
Tab. 21	Recommended spare parts	31

1 About this document

This manual

- Is part of the pump
- Applies to the afore-mentioned pump series
- Describes safe and appropriate operation during 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 system, 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	<ul style="list-style-type: none"> ► 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
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
Automatic aspirator operating manual	Technical documentation
Supplier documentation	Technical documentation for parts supplied by subcontractors
Spare parts list	Ordering spare parts
Safety certificate	Returning the pump to the manufacturer
Declaration of conformity	Conformity of the pump with standards

Tab. 2 Other applicable documents and their purpose

1.3 Warnings and symbols

Warning	Risk level	Consequences of disregard
	Immediate acute risk	Death, grievous bodily harm
	Potentially acute risk	Death, grievous bodily harm
	Potentially hazardous situation	Minor bodily harm
	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
	Information, advice


Tab. 4 Symbols and their meaning

1.4 Technical terms

Term	Meaning
Auxiliary systems	Systems for operating the pump

Tab. 5 Technical terms 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 sure the pump is only operated with, and never without, a pumped medium.
- Avoid cavitation:
 - Fully open the suction-side armature and do not use it 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.
 - Observe the minimum flow rate (→ 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 the manufacturer about any other use of the pump.

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).
Lower densities are allowed. Adapt the 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.

2.2 General safety instructions

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

- Only operate the pump if it is in perfect technical condition and 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 regulations and with 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, staying aware of safety and risks, and in adherence to the instructions in this manual.
- Ensure that the following safety aspects are observed and monitored:
 - Adherence to intended use
 - Statutory or other safety and accident-prevention regulations
 - Safety regulations governing the handling of hazardous substances
 - Applicable standards and guidelines in the country where the pump is operated
- Make 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 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 electrical system
- Make sure 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: guard provided by the customer to prevent contact with the pump
 - For possible build up of electrostatic charge: ensure appropriate grounding

Warranty

- Obtain the manufacturer's approval prior to carrying out any modifications, repairs 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 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.
- Do not remove the guards to prevent contact with hot, cold or moving parts during operation.
- Use protective equipment if 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.
- Reinstall the safety equipment on the pump as required by regulations after any work on the pump.

3 Layout and function

3.1 Labels

3.1.1 Type plate

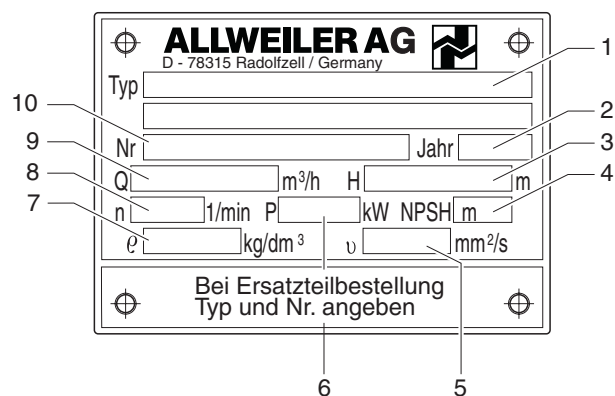


Fig. 1 Type plate (example)

- 1 Pump type
- 2 Year of manufacture
- 3 Differential head
- 4 Pump NPSH value
- 5 Kinematic viscosity
- 6 Power consumption
- 7 Density
- 8 Motor speed
- 9 Flow rate
- 10 Serial number

3.1.2 Pump type code

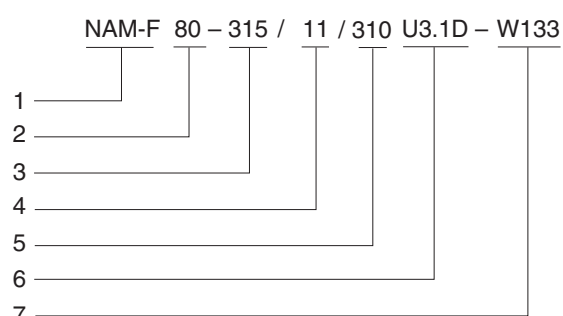


Fig. 2 Pump type code (example)

- 1 Series
- 2 Pressure flange DN [mm]
- 3 Nominal impeller diameter [mm]
- 4 Hydraulic no.
- 5 Actual impeller diameter [mm]
- 6 Shaft seal
- 7 Material key

3.2 Layout

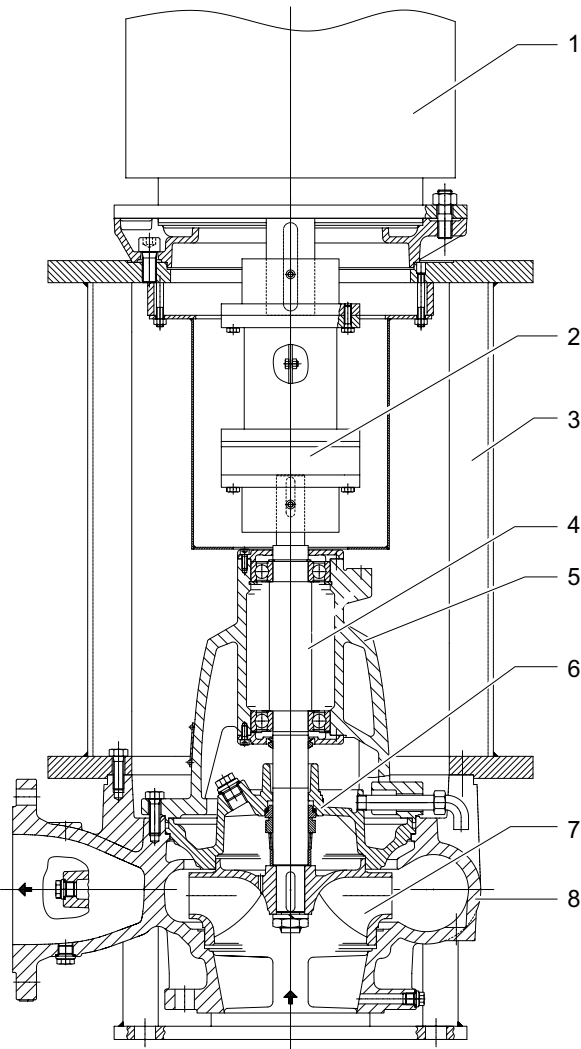



Fig. 3 NAM-F layout

- 1 Motor
- 2 Coupling with extension piece
- 3 Bell housing
- 4 Shaft
- 5 Bearing bracket
- 6 Shaft seal
- 7 Impeller
- 8 Volute casing


3.3 Shaft seal

3.3.1 Single mechanical seal

 Mechanical seals have functional leaks.

3.4 Auxiliary systems

3.4.1 Automatic aspirator (if available)

 Information on the material, functional description and electrical connection (→ A25 automatic aspirator operating manual).

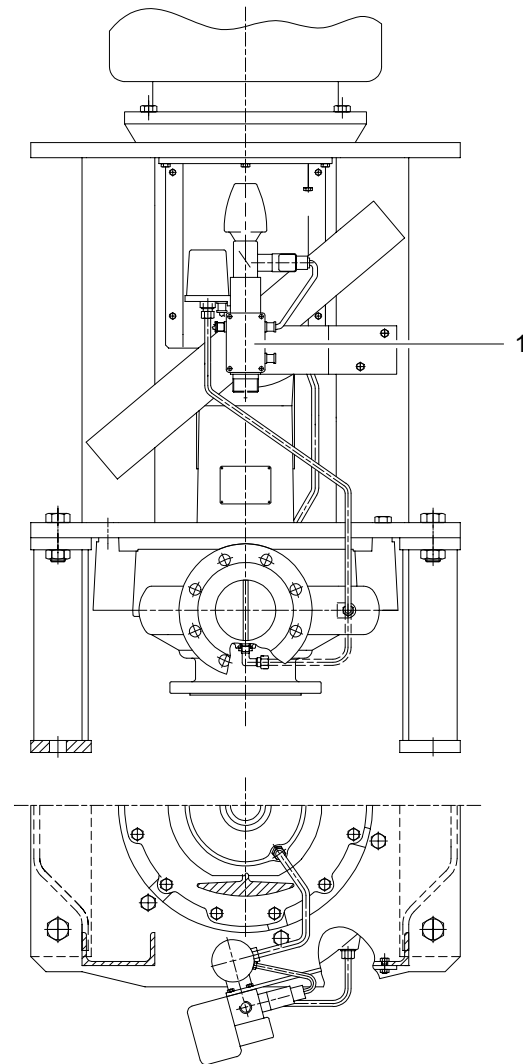


Fig. 4 Automatic aspirator – extension example


1 Automatic aspirator

The maintenance-free A25 automatic aspirator:

- Used for automatic bleeding of pumps and suction pipes
- Operates according to the ejector principle with pressure-dependent control
- Suitable for clean, chemically neutral water

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 it 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 or overturning loads!

- Use lifting gear appropriate for the total weight to be transported.
- Fasten the lifting gear as illustrated below.
- Do not stand under suspended loads.
- Set the load down on a level surface.

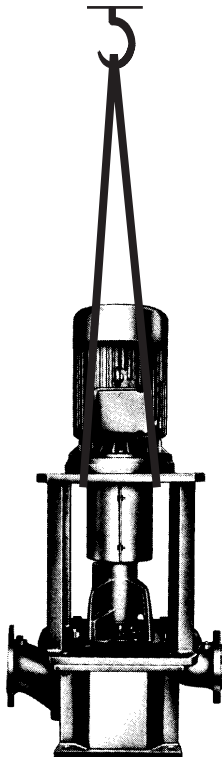



Fig. 5 Fastening the lifting gear to the pump aggregate

- Lift the pump/aggregate properly.

4.2 Preservation

 Not necessary for non-rusting materials

CAUTION

Material damage due to inappropriate treatment for storage!

- Treat the pump properly, inside and outside, for storage.
1. Choose a preservative appropriate for the type and duration of storage (→ 9.2.2 Preservatives, Page 29).
 2. Use the preservative specified by the manufacturer.
 3. All bare metal parts should be treated, inside and outside.


4.3 Storage

CAUTION

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 sure the storage room meets the following conditions:
 - Dry
 - Frost-free
 - Vibration-free
 3. Turn the shaft once a month.
 4. Make sure the shaft and bearing change their rotational position in the process.

4.4 Removing the preservative

 Only necessary for pumps treated with preservative

WARNING

Risk of poisoning from preservatives and cleaning agents in the foodstuffs and drinking water sector!

- ▶ Only use cleaning agents which are compatible with the pumped medium (→ 9.2.5 Cleaning agents, Page 30).
- ▶ Completely remove all preservative.

CAUTION

High water pressure or spray water can damage bearings!


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

CAUTION

Damage to seals due to incorrect cleaning agent!

- ▶ Ensure the cleaning agent does not corrode the seals.

1. Choose a suitable cleaning agent for the application.
(→ 9.2.5 Cleaning agents, Page 30).

 With Tectyl 506 EH: allow benzine to soak in for 10 minutes (recommended).

2. Dispose of preservatives according to local regulations.
3. 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.

5 Setup and connection

CAUTION

Material damage caused by dirt!

- ▶ Do not remove the transport seals until immediately before setting up the pump.
- ▶ Do not remove any 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

1. Make sure the required ambient conditions are fulfilled (→ 9.2.1 Ambient conditions, Page 29).
2. For setup heights > 1000 m above sea level, consult the manufacturer.

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 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 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 11).

5.1.4 Fastening the pump

- ▶ Install and fasten the pump (→ installation drawing):
 - Base installation: screw the feet to the floor.
 - Wall attachment: screw the console onto the wall.

5.2 Installing the motor

-  Only necessary if the pump aggregate is assembled on site.

CAUTION

Material damage caused by knocks and bumps!

- ▶ Keep the coupling halves properly aligned when pushing on the motor.
- ▶ 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. Without a mounting rig: remove the 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 are flush with the center of the coupling. When doing this, ensure 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. Screw in the motor bolts and tighten them.

5.3 Planning the piping

5.3.1 Keeping the piping clean

CAUTION

Material damage due to impurities in the pump!

- ▶ Make sure no impurities can get into the pump.
1. Clean all piping parts and armatures prior to assembly.
 2. Ensure no flange seals protrude inwards.
 3. Remove any blind flanges, plugs, protective foils and/or protective paint from flanges.


5.3.2 Specifying supports and flange connections

CAUTION

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

- ▶ Do not exceed permissible limits.
1. Calculate the pipe forces taking every possible operating condition into account:
 - Cold/warm
 - Empty/full
 - Unpressurized/pressurized
 - Shift in position of flanges
 2. Ensure the pipe supports have permanent low-friction properties and do not seize up due to corrosion.

5.3.3 Specifying nominal diameters

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

1. Specify the nominal suction pipe diameter \geq nominal suction flange diameter.
2. Specify the nominal pressure pipe diameter \geq nominal pressure flange diameter.

5.3.4 Specifying pipe lengths

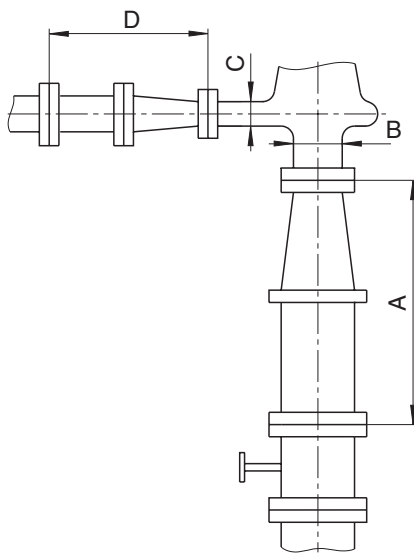



Fig. 6 Straight pipe lengths upstream and downstream of the pump (recommended)

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

- Maintain the recommended minimum values when installing 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.

5.3.6 Optimizing cross-section and direction changes

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

5.3.7 Provide safety and control devices (recommended)


Avoid impurities

1. Integrate a filter into the suction pipe.
2. To monitor impurities, install 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 the medium does 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 for motor-side torque measurements.
3. Provide for pump-side temperature measurements.

5.4 Connecting the pipes

5.4.1 Installing auxiliary pipes (if available)

 Follow the manufacturers' specifications for any existing auxiliary systems.

1. Connect the auxiliary pipes to the auxiliary connections so that they are stress-free and do not leak (→ setup drawing).
2. To avoid air pockets, run the pipes with a continuous slope up to the pump.

5.4.2 Installing the suction pipe

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

5.4.3 Installing the pressure pipe

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

5.4.4 Inspection for stress-free pipe connections

- ✓ Piping installed and cooled down

 1. Separate 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 small lever
 3. Make sure the flange surfaces are parallel.
 4. Reconnect the pipe connecting flanges to the pump.

5.5 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.

5.5.1 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.

5.5.2 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 an adequate distance to rotating parts.

CAUTION

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

- Uncouple the motor from the pump.
1. Switch the motor on and immediately off again.
 2. Check whether 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 again.

5.6 Checking the alignment of the coupling

 The motor and pump can be aligned precisely only at the factory.

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.

CAUTION

Material damage due to incorrect alignment of the coupling!

- If there is any lateral or angular displacement, 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:
 - Dial gage (can be used for couplings with a spacer piece)
 - Other suitable tools, e.g. laser alignment instrument

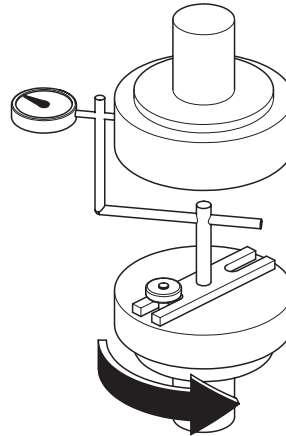


Fig. 7 Checking the lateral displacement

1. Check the lateral displacement with a dial gage:
 - Carry out the measurement as illustrated.
 - Permissible radial deviation, measured at the coupling circumference: $< 0.2 \text{ mm}$

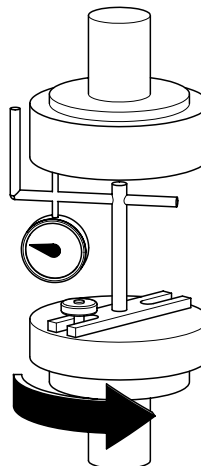


Fig. 8 Checking the angular displacement

2. Check the angular displacement with a dial gage:
 - Carry out the measurement as illustrated.
3. Send the pump to the factory for inspection and alignment in the event of impermissible lateral or angular displacement.

6 Operation

6.1 Preparations for the initial start-up

6.1.1 Identifying the pump type

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



Pump types vary e.g. with regard to bearing lubrication, bearing bracket size, type of shaft seal and auxiliary systems.

6.1.2 Removing the preservative



Only necessary for pumps treated with preservative

- (→ 4.4 Removing the preservative , Page 11).

6.1.3 Lubricating the bearings



Pumps with grease-lubricated roller bearings are ready for operation upon delivery.

6.1.4 Preparing auxiliary systems (if available)



The manufacturer does not accept any liability for damage arising from the installation or use of a third-party or unapproved auxiliary system.

6.1.5 Filling and bleeding

CAUTION

Material damage caused by dry running!

- Make sure the pump is filled properly.

Without automatic aspirator (supply operation)

1. Fill the pump and the suction pipe with pumped medium.
2. Open the suction-side armature.
3. Open the pressure-side armature.
4. If available: open the auxiliary systems and check the flow rate.
5. Verify that no pipe connections are leaking.

With automatic aspirator (suction operation)

1. Fill the pump and the suction pipe with pumped medium.
2. Open the suction-side armature.
3. Close the pressure-side armature.
4. If available: open the auxiliary systems and check the flow rate.
5. Verify that no pipe connections are leaking.
6. Start suction operation (→ A25 operating manual manufacturer instructions).

6.2 Start-up

6.2.1 Switching on

- ✓ Pump set up and connected properly
- ✓ Motor set up and connected properly
- ✓ Motor exactly aligned with the pump
- ✓ All connections stress-free and sealed
- ✓ Any existing auxiliary systems are ready for operation
- ✓ All safety equipment installed and tested for functionality
- ✓ Pump prepared, filled and bled properly

DANGER

Risk of injury due to running pump!

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

WARNING

Risk of injury due to hot pump parts!

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

CAUTION

Material damage caused by dry running!

- Make sure the pump is filled properly.

CAUTION

Risk of cavitation when throttling down the suction flow rate!

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

CAUTION

Material damage caused by overheating!

- Do not operate the pump while the pressure-side armature is 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 it for smooth running.
4. Once the motor has reached its nominal speed, slowly open the pressure-side armature until the operating point is reached.

5. After the initial stress caused by pressure and operating temperature, check that the pump is not leaking.

6.2.2 Switching off

- ✓ Pressure-side armature closed (recommended)

WARNING

Risk of injury due to 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 them if necessary.

6.3 Shutting down

WARNING

Risk of injury due to hot pump parts!

- Use protective equipment when carrying out any work on the pump.
- Take the following measures whenever the pump is shut down:

Pump is	Measure
...shut down for a prolonged period	► Take any measures depending on the pumped medium (→ Table 7 Measures depending on the behavior of the pumped medium, Page 17).
...emptied	► Close the suction-side and pressure-side armatures.
...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 10).

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

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. 7 Measures depending on the behavior of the pumped medium

6.4 Start-up following a shutdown period

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

Shutdown period	Measure
> 1 year	<ul style="list-style-type: none"> ► For versions with roller bearings without lifetime lubrication: relubricate
> 2 years	<ul style="list-style-type: none"> ► Replace elastomer seals (O-rings, shaft sealing rings). ► Replace antifriction bearings.

Tab. 8 Measures to be taken after prolonged shutdown periods

2. Carry out all steps as for the initial start-up (→ 6.2 Start-up, Page 16).

6.5 Operating the stand-by pump


- ✓ Stand-by pump filled and bled



Operate 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 16).

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

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 due to hot pump parts!


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

1. Check at appropriate intervals:
 - Maintenance of minimum flow rate
 - 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
 - No leaks
 - No cavitation
 - Suction-side gate valves open
 - Unobstructed and clean filters
 - Sufficient supply pressure
 - No unusual running noises or vibrations
 - No excessive leakage at the shaft seal
 - Proper functioning of auxiliary systems
 - Put the installed stand-by pump into operation at least once a week

7.2 Maintenance

 Service life of the antifriction bearings for operation within the permissible operating range: > 1000 h

Intermittent operation, high temperatures, low viscosities 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 actual 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 due to hot pump parts!

- ▶ Use protective equipment when carrying out any work on the pump.
- ▶ Allow the pump to cool down completely before commencing any work.
- ▶ Make sure the pump is unpressurized.
- ▶ Empty the pump.

7.2.1 Antifriction bearings lubricated with grease

1. Replace the antifriction bearings with lifetime lubrication (recommended):
 - After 1000 operating hours
 - At the latest after two years
2. Fill any open antifriction bearings without guard disks with grease (→ 9.2.6 Lubricants, Page 30).

7.2.2 Mechanical seals

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

- ▶ In the event of a larger leak: replace the mechanical seal and its auxiliary seals.

7.3 Dismounting

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 due to hot pump parts!

- ▶ Use protective equipment when carrying out any work on the pump.
- ▶ Allow the pump to cool down completely before commencing any work.
- ▶ Make sure the pump is unpressurized.
- ▶ Empty the pump.

7.3.1 Returning the pump to the manufacturer


- ✓ Pump unpressurized
 - ✓ Pump completely empty
 - ✓ Electrical connections isolated and motor secured against switch-on
 - ✓ Pump cooled down
 - ✓ Coupling guard dismantled
 - ✓ With couplings with a spacer piece: spacer piece removed
 - ✓ Manometer connections, manometer and fixtures dismantled
1. Always enclose a truthfully (fully) completed safety certificate when returning pumps or individual parts to the manufacturer. Order a safety certificate from the manufacturer if necessary.
 2. Take necessary measures, depending on the required repair work, as listed in the table below when returning the pump to the manufacturer.

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

Tab. 9 Measures for return


7.3.2 Preparations for dismantling

- ✓ Pump unpressurized
- ✓ Pump completely empty, flushed and decontaminated
- ✓ Electrical connections isolated and motor secured against switch-on
- ✓ Pump cooled down
- ✓ Coupling guard dismantled
- ✓ With couplings with a spacer piece: spacer piece removed
- ✓ Manometer connections, manometer and fixtures dismantled

 In production, the pumps are constructed to a standard process. The slide-in unit can be removed without removing the volute casing and piping.


- ▶ When dismantling, observe the following:
 - Precisely mark the assembly orientation and position of all components before dismantling.
 - Dismantle components concentrically without canting.
 - Dismount the pump (→ sectional drawing).

7.4 Installing

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

1. When installing, observe the following:
 - Replace worn parts with genuine spare parts.
 - Replace seals, inserting them so that they cannot rotate.
 - Maintain the specified tightening torques (→ 9.2.4 Tightening torques, Page 30).
2. Clean all parts (→ 9.2.5 Cleaning agents, Page 30). Do not remove the prepared markings.
3. Install the pump (→ sectional drawing).
4. Replace the antifriction bearings. Fill any open antifriction bearings without guard disks with grease:
 - Make sure you use the correct type and minimum amount of grease when filling the bearing (→ 9.2.6 Lubricants, Page 30).
 - 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 12).

7.5 Ordering spare parts

 For trouble-free replacement in the event of any faults, we recommend keeping complete slide-in units or spare pumps available on site (→ 9.3 Recommended spare parts, Page 31).

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

8 Troubleshooting

For faults which are not specified in the following table or cannot be traced back to the specified causes, please consult 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. 10 Fault number assignment

Fault number									Cause	Remedy
1	2	3	4	5	6	7	8	9		
X	–	–	–	–	–	–	–	–	Supply/suction pipe and/or pressure pipe closed by armature	► Open the armature.
x	–	–	–	–	–	–	–	–	Automatic aspirator defective	► (→ A25 automatic aspirator operating manual).
–	X	–	X	–	–	–	–	–	Supply/suction pipe not fully opened	► Open the armature.
X	X	–	X	–	X	–	–	–	Supply/suction pipe, pump or suction screen blocked or encrusted	► Clean the supply/suction pipe, pump or suction screen.
–	X	–	X	–	X	–	–	–	Supply/suction pipe cross-section too narrow	► Increase the cross-section. ► Remove any encrustations from the suction pipe. ► Open the armature completely.
X	–	–	–	–	–	–	–	–	Transport and sealing cover still in place	► Remove the transport and sealing cover. ► Dismount the pump and inspect it for dry-running damage.
–	X	–	X	–	X	–	–	–	Differential head excessive: $NPSH_{\text{pump}}$ larger than $NPSH_{\text{system}}$	► Increase the supply pressure. ► Consult the manufacturer.
X	–	–	–	–	X	–	–	–	Supply/suction pipe not bled properly or not filled up completely	► Fill up the pump and/or piping completely and bleed them.
X	–	–	–	–	X	–	–	–	Supply/suction pipe contains air pockets	► Install the armature for bleeding. ► Correct the piping layout.
X	X	–	X	–	X	–	–	–	Air is sucked in	► Seal the source of malfunction.
X	X	–	X	–	X	–	–	–	Excessive amount of gas: pump is cavitating	► Consult the manufacturer.

Fault number									Cause	Remedy
1	2	3	4	5	6	7	8	9		
–	X	–	X	–	X	–	–	–	Pumped medium temperature too high: pump is cavitating	<ul style="list-style-type: none"> ► Increase the supply pressure. ► Lower the temperature. ► Consult the 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 the manufacturer.
–	X	–	X	–	–	–	–	–	Geodetic differential head and/or pipe flow resistances too high	<ul style="list-style-type: none"> ► Remove sediments from the pump and/or pressure pipe. ► Install a larger impeller and consult the 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	–	–	–	Pressure pipe blocked	<ul style="list-style-type: none"> ► Clean the pressure pipe.
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 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	–	X	X	–	–	Pump parts worn	<ul style="list-style-type: none"> ► Replace the worn pump parts.
–	–	X	X	–	X	–	–	X	Pressure-side armature opened too wide	<ul style="list-style-type: none"> ► Throttle down at the pressure-side armature. ► Machine the impeller down. Consult the manufacturer and adjust the impeller diameter.
–	–	X	–	–	X	–	–	X	Geodetic differential head, pipe flow resistances and/or other resistances lower than specified	<ul style="list-style-type: none"> ► Throttle down the flow rate at the pressure-side armature. Observe the minimum flow rate. ► Machine the impeller down. Consult the manufacturer and adjust the impeller diameter.
–	–	X	–	X	–	–	–	–	Viscosity lower than expected	<ul style="list-style-type: none"> ► Machine the impeller down. Consult the manufacturer and adjust the impeller diameter.
–	–	X	–	X	X	X	–	X	Motor speed too high	<ul style="list-style-type: none"> ► 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	–	–	X	Impeller diameter too large	<ul style="list-style-type: none"> ► Throttle down the flow rate at the pressure-side armature. Observe the minimum flow rate. ► Machine the impeller down. Consult the manufacturer and adjust the impeller diameter.
X	X	–	X	–	X	–	–	–	Impeller out of balance or blocked	<ul style="list-style-type: none"> ► Dismount the pump and inspect it for dry-running damage. ► Clean the impeller.

Fault number									Cause	Remedy
1	2	3	4	5	6	7	8	9		
–	X	–	X	–	X	–	–	–	Hydraulic parts of the pump dirty, clotted or encrusted	<ul style="list-style-type: none"> ► Dismount the pump. ► Clean the parts.
–	–	–	–	–	X	X	–	X	Defective antifriction bearing in bearing bracket	<ul style="list-style-type: none"> ► Replace the antifriction bearing.
–	–	–	–	–	–	X	–	X	Defective antifriction bearing in motor	<ul style="list-style-type: none"> ► Replace the antifriction bearing.
–	–	–	–	–	–	X	–	–	Lubricant: too much, not enough or unsuitable	<ul style="list-style-type: none"> ► Reduce, top up or replace the lubricant.
–	–	–	–	–	–	–	X	–	Connecting bolts not tightened correctly	<ul style="list-style-type: none"> ► Tighten the connecting bolts.
–	–	–	–	–	–	–	X	–	Mechanical seal worn	<ul style="list-style-type: none"> ► Replace the mechanical seal.
–	–	–	–	–	–	–	X	–	Housing seal defective	<ul style="list-style-type: none"> ► Replace the housing seal.
–	–	–	–	–	–	–	X	–	Shaft sleeve is penetrated	<ul style="list-style-type: none"> ► Replace the shaft sleeve and/or O-ring.
–	–	–	–	–	X	X	X	X	Pump distorted	<ul style="list-style-type: none"> ► Check the pipe connections and pump fixings. ► Check the coupling alignment. ► Check the fixing of the support foot.
–	–	–	–	–	X	X	–	–	Coupling not properly aligned	<ul style="list-style-type: none"> ► Align the coupling.
–	–	–	–	–	X	–	–	–	Coupling units worn	<ul style="list-style-type: none"> ► Replace the coupling units and realign them.
–	X	–	X	–	X	–	–	X	Motor running on 2 phases	<ul style="list-style-type: none"> ► Check the fuse and replace it if necessary. ► Check the cable connections and insulation.

Tab. 11 Troubleshooting list

9 Appendix

9.1 Sectional drawings

9.1.1 Auxiliary connections

Abbreviation	Connection
FF	Filling
LO	Leak / egress
PM1/PM2	Pressure gauge
FV	Bleeding

Tab. 12 Abbreviations of the connection designations

9.1.2 Part numbers and designations

Part no.	Designation
102.01	Volute casing
161.05	Housing cover
182.01	Foot
210.01	Shaft
230.01	Impeller
321.01	Radial ball bearing
321.02	Radial ball bearing
321.03	Radial ball bearing
321.04	Radial ball bearing
330.01	Bearing bracket
346.01	Bell housing
360.01	Bearing cover
360.02	Bearing cover
400.01	Gasket
411.01	Seal ring
411.03	Seal ring
411.04	Seal ring
411.05	Seal ring
424.02	V-ring
433.01	Mechanical seal
504.01 ¹⁾	Spacer ring
509.02	Intermediate ring
516.01	Nilos ring
516.02	Nilos ring
525.01	Spacer sleeve

Part no.	Designation
551.01	Spacing washer
557.01	Balance disk
565.01	Rivet
672.01	Vent
681.01	Coupling guard
710.01	Pipe
710.02	Pipe
731.02	Pipe fitting
801.01	Flanged motor
855.01	Coupling with spacer piece
894.01	Console
901.01	Hexagon head bolt
901.03	Hexagon head bolt
901.04	Hexagon head bolt
901.09	Hexagon head bolt
901.16 ²⁾	Hexagon head bolt
902.08 ¹⁾	Stud bolt
902.10	Stud bolt
903.01	Screw plug
903.03	Screw plug
903.04	Screw plug
904.02	Grub screw
904.03	Grub screw
908.01	Jacking screw
914.01	Cheese head screw
914.04	Cheese head screw
914.05	Cheese head screw
914.10	Cheese head screw
920.04	Hexagon nut
920.08 ¹⁾	Hexagon nut
920.10	Hexagon nut
922.01	Impeller nut
932.01	Circlip
932.10	Circlip
934.01	Spring washer

1) Only available for bearing bracket 470

2) Only available for bearing bracket 530

Part no.	Designation
936.01	Spring ring
940.01	Shaft key
940.02	Shaft key
971.01	Name plate

Tab. 13 Designations of components according to part numbers

9.1.3 NAM-F series sectional drawings

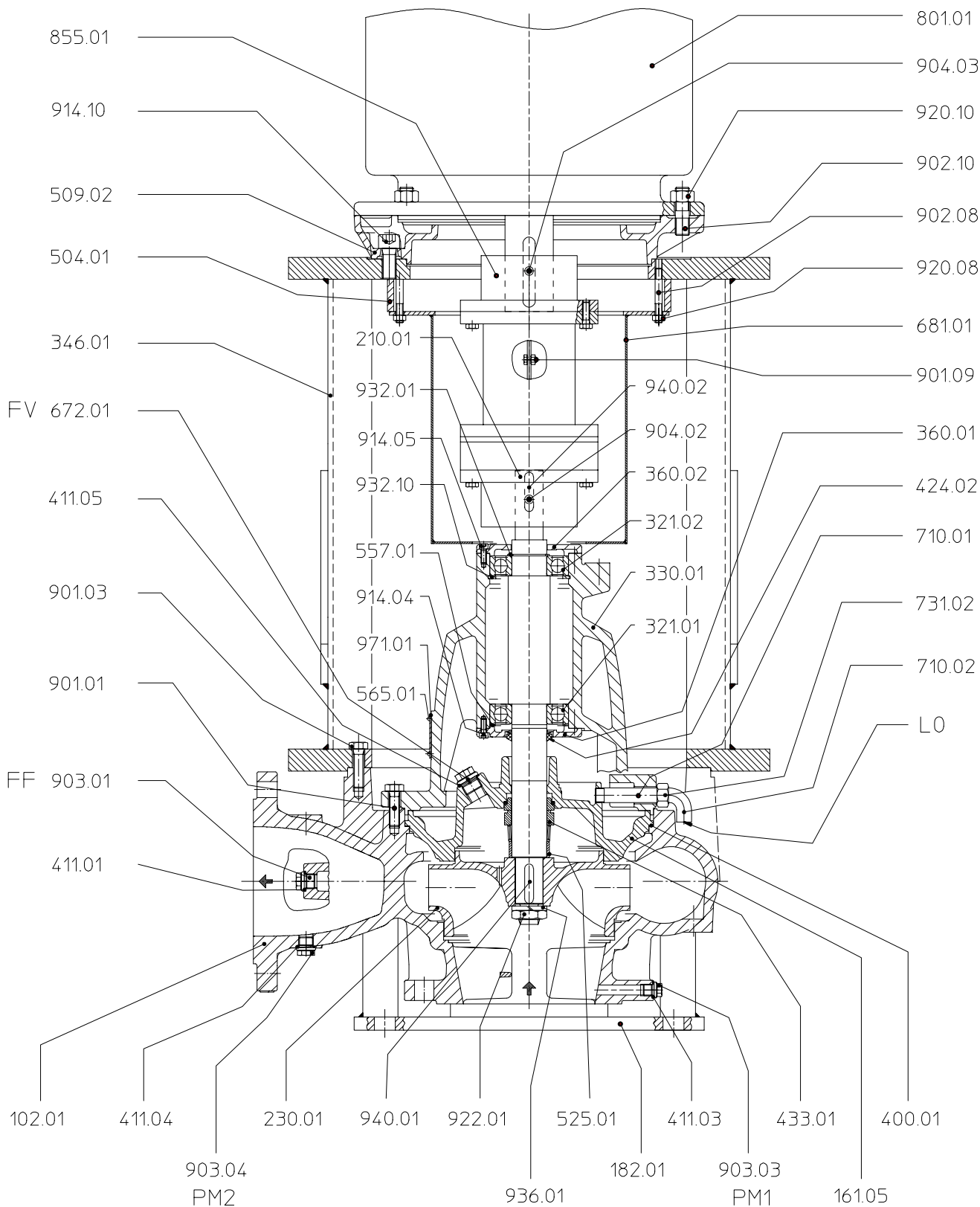


Fig. 9 **U3...D** Unbalanced mechanical seal
Base installation

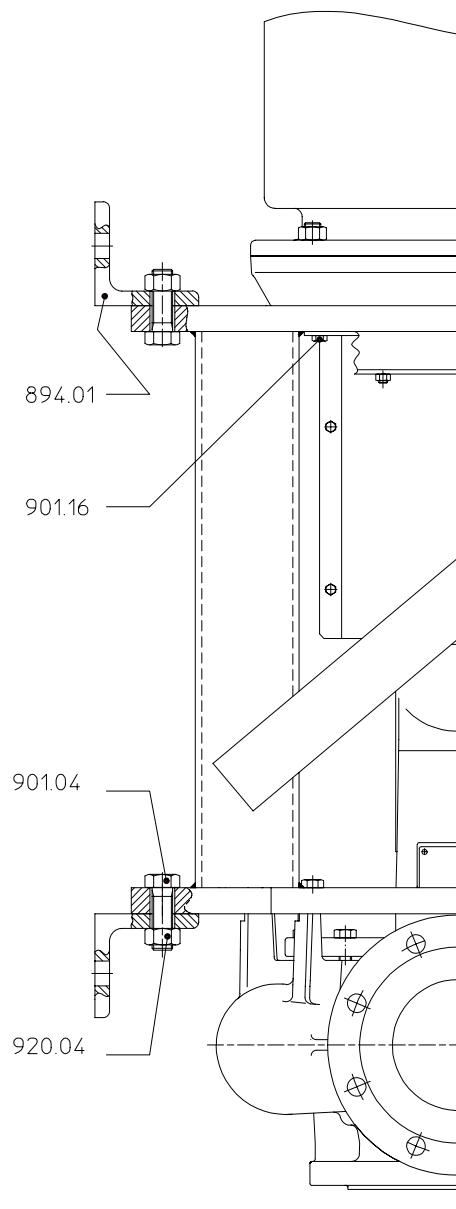


Fig. 10 Wall attachment version

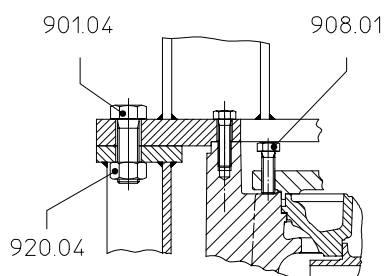


Fig. 11 Attachment of the pump feet to the bell housing

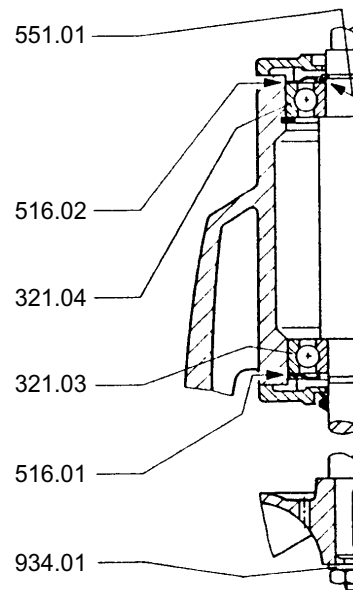




Fig. 12 Bearing and impeller retention version for bearing bracket size 530

9.2 Technical specifications

 More technical specifications (→ order data sheet).


9.2.1 Ambient conditions

 Operation under other ambient conditions to 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 Preservatives

 Use a Valvoline preservative or similar (recommended).

Type of storage	Storage duration [months]	Preservative 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 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. 15 Valvoline preservatives

9.2.3 Sound pressure levels

Measuring conditions:

- Distance to the 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 permissible limits.

Nominal motor power PM [kW]	Sound pressure level [dB] for pump with motor at speed [min ⁻¹]			
	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
160.0	79	79.5	84	85
200.0	80	80.5	85	86

Tab. 16 Sound pressure levels

9.2.4 Tightening torques

Part no.	Thread gage	Quality	Tightening torque [Nm]
901.01	M12	A4-70	45
901.03	M12 M16	8.8	70 170
901.04	M20 M24	8.8	330 560
901.09	M8	4.6	10
902.10	M16	A4-70	110
914.04 914.05	M6 M8 M10	8.8	10 20 40
914.10	M16	8.8	180
920.04	M20 M24	8.8	330 560
920.08	M8	5.8	12
920.10	M12 M16 M20	5.8	35 80 160
922.01	M24 x 1.5 M30 x 1.5	A4/1.44 A4/1.44	175 310

Tab. 17 Tightening torques

9.2.5 Cleaning agents

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

Tab. 18 Cleaning agents

9.2.6 Lubricants

Manufacturer	Brand name	Name according to DIN 51825
Klüber	ASONIC-GHY72	-

Tab. 19 Grease types

Size of the bearing bracket	Short designation of the antifriction bearing	Approx. amount of grease [g]
530	6410 J C3	35

Tab. 20 Minimum amounts for grease lubrication

9.3 Recommended spare parts

Part no.	Part designation	Number of identical pumps (including stand-by pumps)						
		2	3	4	5	6 or 7	8 or 9	> 9
		Set/quantity of spare parts						
230.01	Impeller	1	1	1	2	2	3	30 %
210.01 922.01 934.01 936.01	Shaft Impeller nut Spring washer or Spring ring	1	1	2	2	2	3	30 %
321.01 321.02 321.03 321.04	Groove ball bearing Groove ball bearing Groove ball bearing Groove ball bearing	1	1	2	2	3	4	50 %
– 1)	Bearing bracket, complete, consisting of: Shaft, bearing, bearing cover etc.	–	–	–	–	–	1	2
433.01	Mechanical seal	2	3	4	5	6	7	90 %
Various ¹⁾	Seals for pump housing (set) Other seals (set)	4	6	8	8	9	12	150 %

Tab. 21 Recommended spare parts

1) Delivered as a mechanical unit (BG) or sales unit (VG)

2) Depending on the size of the bearing bracket

