

Operating and Maintenance Instructions

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Volute Casing Centrifugal Pumps

Series NIM of the Inline–Type
Series NAM with Axial Inlet

**Retain
 for future
 use!**

Order no.:

Pump ident. no.:

Machine no.:

Pump type:

Operating data of pump as per order data sheet
 Dimensions as per technical specification VM 634/...

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These Operating and Maintenance Instructions contain information from the pump manufacturer. They may need to be supplemented by instructions of the operator company for its personnel. These instructions do not take account of specific information relating to operation and maintenance of the process plant into which the pump is integrated. Such information can only be given by the persons responsible for construction and planning of the plant (plant manufacturer).

Such specific instructions relating to operation and maintenance of the process plant into which the pump is integrated have priority over the instructions of the pump manufacturer.

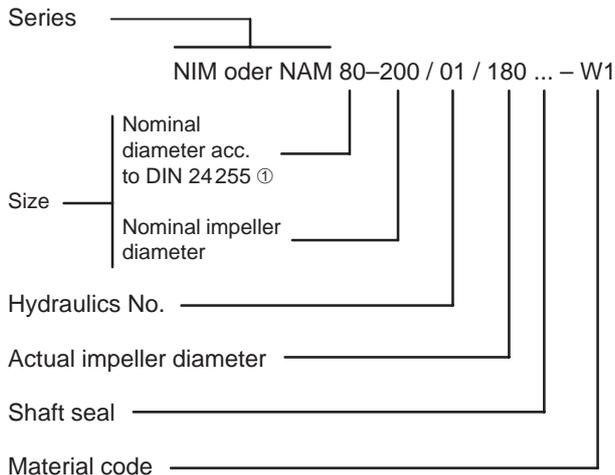
Refer to the operating instructions of the plant manufacturer!

1 General

1.1 Abbreviation

The abbreviation of the centrifugal pump is set up according to the following schema, and is engraved on the type plate.

Example:



① in case of series NIM this value does not correspond to the actual nominal diameter (refer to technical documentation VM 634/...)

1.2 Application and range of utilization

The volute-casing centrifugal pumps of series NIM and NAM are single-stage pumps for vertical pedestal or wall-type mounting with inline casing (NIM) or axial inlet (NAM). They are used for handling pure water, industrial water, seawater, condensate, oils, brines, lyes etc.

The fluids must contain no abrasive components and must not chemically attack the pump materials. The application of uniform components in several pump series and sizes allows for economical stocking of spares and procurement of replacement parts.

1.3 Types of construction

The pumps are supplied in various designs, differing mainly in the shaft seals and the materials.

1.4 Performance data

The exact performance data applicable to the pump can be taken from the order data sheet and/or acceptance test report, and are engraved on the name plate.

1.5 Warranty

Our warranty for shortcomings in the supply is laid down in our delivery conditions. No liability will be undertaken for damages caused by non-compliance with the operating instructions and service conditions.

If at any later date the operating conditions change (e.g. different fluid conveyed, speed, viscosity, temperature or supply conditions), it must be checked by us from case to case and confirmed, if necessary, that the pump is suited for those purposes. Where no special agreements were made, pumps supplied by us may, during the warranty period, only be opened or varied by us or our authorized contract service workshops; otherwise our liability for any defects will cease.

1.6 Testing

Prior to leaving our factory, all pumps are subjected to a leak and pressure test. A performance test is carried out if agreed. Only properly operating pumps, achieving the performance assured by us, leave the factory. Thus, compliance with the following operating instructions ensures fault-free operation and full delivery.

1.7 Availability

As a matter of principle, we recommend stocking replacement pumps and withdrawable units (hydraulic action system) where the supplied pumps are a decisive factor in maintaining a production or delivery process. In this way downtimes can be avoided, or reduced to a minimum.

1.8 Pressure limit



The sum of inlet pressure and maximum delivery pressure must not be greater than the permissible internal pump pressure **$p_{d \max} = 10 \text{ bar}$** .

2 Safety

These operating instructions contain basic safety instructions for installation, operation and maintenance. It is therefore essential that they are read by fitters and all specialist staff and customer personnel prior to installation and start-up. They must always be kept at hand at the place of installation.

The special safety instructions contained in the other chapters must be observed in addition to the general safety instructions in this chapter.

2.1 Marking of instructions in the operating instructions

The safety instructions contained in these operating instructions which represent a danger to personnel if not complied with are specially marked by the general danger symbol:



Warning symbol
as per DIN 4844–W9

Warning of danger from electric voltage is given as follows:



Warning symbol
as per DIN 4844–W8.

Instructions which are essential to avoid endangering the machine and its functioning are marked by the word

ATTENTION

Instructions affixed directly to the machine such as

- Directional markers
- Signs for fluid connections

must always be observed and maintained in fully legible condition at all times.

2.2 Personnel qualification and training

The operating, maintenance, inspection and mounting personnel must be appropriately qualified for the duties assigned to them. The scope of their responsibilities, competency and supervisory duties must be closely controlled by the customer. If the personnel do not have the required knowledge, they must be trained and instructed. If required, this may be provided by the manufacturer/supplier on behalf of the customer. The customer must additionally ensure that personnel fully understand the content of the operating instructions.

2.3 Dangers in the event of non-compliance with safety instructions

Failure to comply with the safety instructions may result in danger to persons, and place the environment and the machine at risk. Non-compliance with the safety instructions may lead to the loss of any claims for damages.

Non-compliance may relate to the following dangers:

- Failure of important functions of the plant
- Failure of specified methods for maintenance and servicing
- Danger to persons resulting from electrical, mechanical and chemical effects
- Danger to the environment resulting from leakage of hazardous substances

2.4 Responsible working practices

The safety instructions contained in these operating instructions, current national accident prevention regulations, as well as internal working, operating and safety rules of the customer, must be observed.

2.5 Safety instructions for the user/operator

- Hot or cold parts representing a danger must be protected against accidental contact on site.
- Protection against accidental contact for moving parts (such as the coupling) must not be removed while the machine is in operation.
- When operating pump aggregates in a dust-laden environment (e.g. milling, chipboard manufacture, bakeries), the surfaces of the pumps and motors must be cleaned at regular intervals, depending on local conditions, in order to maintain the cooling effect and eliminate the possibility of spontaneous combustion. Refer also to explosion protection regulations (ZH 1/10).
- Leakage (e.g. from the shaft seal) of hazardous substances being handled, such as explosive, toxic or hot materials, must be discharged such that no danger to persons or the environment is created. Legal regulations must be observed.
- Dangers from electrical energy must be eliminated. For details in this regard, refer to VDE and local power company regulations.

2.6 Safety instructions for maintenance, inspection and mounting work

The operator company shall ensure that all maintenance, inspection and mounting work is performed by authorized and qualified specialist personnel who have thoroughly studied the operating instructions.

Work on the machine is only to be carried out when the machine is at a standstill. The means of shutdown of the machine described in the operating instructions must always be followed.

Pumps or aggregates handling fluids which are detrimental to health must be decontaminated. All safety and protective devices must immediately be refitted and made operational on completion of the work.

The instructions under Section 6.1, "Preparation for start-up", must be observed before restarting.

2.7 Unauthorized conversion and production of replacement parts

Conversion or modification of the machines is only permissible after consultation with the manufacturer. Original replacement parts and accessories approved by the manufacturer serve safety purposes. If other parts are used the manufacturer cannot be held liable for the consequences.

2.8 Impermissible modes of operation

The operating safety of the machine supplied is only ensured when it is used in accordance with *Section 1* of the operating instructions. The limit values given on the data sheet must under no circumstances be exceeded.

3 Transportation and Intermediate Storage

3.1 Packaging

Attention must be paid to the markings on the packaging.

The suction and pressure sides and all auxiliary connections must always be closed during transportation and storage. The closing plugs must be removed when the pump aggregate is installed.

3.2 Transportation

The pump or pump aggregate is to be safely transported to the place of installation, if required by means of lifting gear.



The generally applicable safety regulations for lifting loads must be observed. The crane device and cables must be adequately dimensioned. The cables must not be attached to the attachment eyes of the motor.

For pump aggregates of vertical installation it is suitable to fix the sling ropes to the pump bracket.

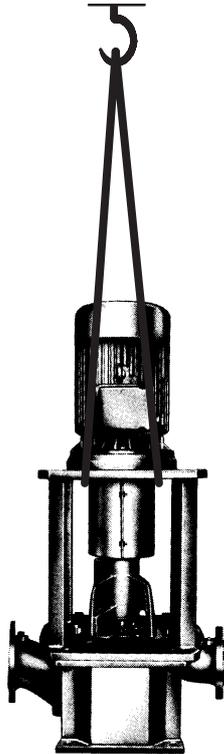


Fig. 1: Transportation of a vertically mounted pump aggregate

ATTENTION During transportation ensure that the aggregate is secured against toppling over.

Transport damage

ATTENTION Check the pump for damage on receipt. Any damage detected must be notified immediately.

3.3 Preservation and storage of the centrifugal pumps

3.3.1 Preservation

In the case of storage or prolonged standstill, the pumps must be protected against corrosion. In those cases, an outside and inside preservation is to be provided. The durability of the protection against corrosion, which is limited in time, depends on the composition of the preservative to be applied and the storage conditions.

ATTENTION Under normal circumstances the pumps have no special preservative.

At an additional charge we can, however, supply pumps and replacement parts ex factory with a preservative adequate to the planned storage period.

We will be pleased to specify suitable preservatives for you on request.

3.3.1.1 Outside preservation

The outside preservative should be applied by painting or spraying with a spray gun.

Points of preservation:

All bright and unvarnished parts (e.g. shaft ends, couplings, flange facings, valve and manometer connections).

3.3.1.2 Inside preservation

The preservative is to be applied by filling the pump. For these purposes, the suction side of the pump must first be closed with a dummy flange. During filling, the pressure flange must be on a higher level than the suction flange. During the filling process, the shaft must be slowly cranked against the direction of rotation. Filling must be continued until the preservative reaches the sealing strip of the delivery flange, bubble-free. Then the outlet side is to be closed with a dummy flange.

Note: Not required for pumps made of stainless materials.

Points of preservation:

All bright parts inside the pump (e.g. pump casing inside, shafts, impellers and diffusers).

3.3.1.3 Monitoring of preservation

In the event of prolonged storage, the preservation of the pump must be checked by the customer at regular intervals.

Every six months the pump level must be checked; if necessary, preservative must be topped up to the sealing strip on the pressure flange.

At the same time, the packing must be checked for destruction, and repaired if necessary.

Note: Liability for damages caused by improper preservation cannot be assumed by us.

3.3.1.4 Depreservation



Prior to setting the pump in motion, the preservative applied must be removed.

Environmentally compatible disposal must be ensured.

The pump must be dismantled and thoroughly cleaned. This particularly applies to pumps used in the food industry or in drinking water supply. A suitable foodstuff-compatible solvent, compatible with the delivery medium, may be applied. Appropriate solvents are for example: spirit, Ritzol 155, or heavily alkaline soap suds. Steam jet cleaning devices with appropriate admixtures can also be used (allow solvent to act beforehand).

ATTENTION Prior to start-up after prolonged storage, all elastomers (O-rings, shaft seals) must be checked for their elasticity of shape. Embrittled elastomers must be exchanged. Elastomers of ethylene-propylene rubber (EPDM) must always be replaced. The pump must be filled with fluid to prevent seizing of the components.

Note: If pipelines, tanks or other parts in the plant are wetted with paraffin-containing preservative, the entire plant must be depreserved. All preservative residues must be eliminated; malfunctions of the pump may occur if they are not.

3.3.2 Storage

During storage of the pump, the suction and outlet branches and all other supply and discharge branches must always be closed with dummy flanges or dummy plugs.

Storage should be in a dry, dust-free room. During storage, the pump should be cranked at least once a month. During this process, parts such as the shaft and bearings should change their position.

4 Description

4.1 Structural design

Single-stage, single-entry volute-casing centrifugal pump for vertical pedestal or wall-type mounting.

4.1.1 Volute casing

NIM: Volute casing of the inline design.

NAM: Volute casing with axial inlet.

4.1.2 Branch positions/flanges

NIM: Suction and delivery branches arranged opposite in one line.

NAM: Suction branch axial, delivery branch radial.

Flanges: up to DN 150 according to DIN 2533
from DN 200 according to DIN 2532.

4.1.3 Auxiliary connections

For required auxiliary connections refer to the binding installation diagram of the pump aggregate.

4.1.4 Impeller

Enclosed radial wheel without back vanes. Axial thrust compensation by relief bore holes.

Residual thrust absorbed by groove ball bearing in the bearing bracket.

4.1.5 Shaft

The pump is equipped with a particularly rigid shaft, providing trouble-free operation in all load phases. As a result of the bending rigidity and the short distance between bearing and shaft seal, true running is achieved creating optimum conditions for the shaft seal.

4.1.6 Bearing and lubrication

By means of two grease-lubricated groove ball bearings JC3 DIN 625 in an unsplit bearing bracket.

4.1.7 Shaft seal

- **Stuffing box packing, asbestos-free**

Uncooled, stuffing box packing on graphite PTFE basis:

U1B: with internal sealing

U1C: with external sealing

- **Mechanical seal, balanced ①**

Uncooled, maintenance-free mechanical seal:

U2..D: with internal flushing

U2..K: with internal flushing bore

U2..F: with external flushing

U2..E: with external flushing

- **Mechanical seal, unbalanced ①**

Uncooled, maintenance-free mechanical seal:

U3..D: with internal flushing

U3..K: with internal flushing bore

U3..F: with external flushing

U3..E: with external flushing

① Special mechanical seals with other abbreviations may be installed.

The exact data are to be found on the order data sheet or the order-specific documentation.

4.2 Construction of the pump aggregate

4.2.1 Drive

Surface-cooled three-phase squirrel cage induction motors, type IM V1, class of protection IP 54 to IEC standard, class B insulation, outputs and speeds to DIN 42 677.

The exact motor data are to be found on the order data sheet.

4.2.2 Shaft coupling and contact protection

Flexible shaft coupling with spacer.

Protection against accidental protection to **DIN 24 295** is provided where a pump, pump lantern and shaft coupling are supplied as the product package.



According to accident prevention regulations, the pump must only be operated with a protection against accidental contact as per DIN 24 295.

If no contact protection is provided, it must be attached by the operator.

4.2.3 Pump lantern

The pump lantern allies the volute casing with the flanged motor and serves for fixing the pump feet or the wall bracket.

4.2.4 Air ejector A25A

The pump can be fitted with an air ejector for automatic bleeding of the suction pipeline and of the pump.

See separate Operating Instructions VM 490.0011/...

5 Installation/Mounting

5.1 Installation

The pumps are designed for vertical installation (motor on top).

5.1.1 Place of installation

The aggregate should as far as possible be installed at the lowest point of the plant; that is, where the geodetic supply head is highest.

ATTENTION Only the spiral casing may be insulated with heat-insulating material. All other pump components must not be insulated, in order to ensure optimum heat discharge.



To prevent injury from burns, appropriate protective devices must be installed (protection against accidental contact).

5.1.2 Ambient temperature at the place of installation

Pump aggregates in enclosed rooms must be installed such that no heat build-up occurs. If ambient temperatures above +40°C are to be expected, suitable ventilation must be provided to discharge the radiated heat and supply adequate fresh air to the room. Consult the factory if necessary.

5.2 Mode of fastening

The mode of fastening is dependent on the design type and size of the pump and the coupled motor, as well as local installation conditions.

Precise details on form and dimensions are given in the installation diagram.

5.3 Checking the coupling alignment

In the case of pumps with flanged drive motor, the pump and motor are precisely centered in the lantern. Alignment or re-alignment of the coupling is not required.

Note: Improper handling, e.g. during transportation, may impair the alignment between the pump and the motor. In this case the motor must be removed from the lantern. The true running accuracy and axial run-out of the shaft ends to the center diameters and end faces of the lantern must be determined by means of a dial gauge with retaining bracket and clamp. If a value of more than 0.05 mm is recorded, the pump and/or the motor must be returned to the factory for checking.

5.4 Assembly of pump and drive motor

If the aggregate is only assembled at the place of use, the coupling is assembled as follows:

1. Coat the pump and motor shaft ends with a fine film of molybdenum disulfide (e.g. Molykote) and insert keys.
2. Push on the coupling halves on the pump and motor side with the aid of a pusher device until the shaft end is flush to the coupling hub.
If no puller is available, heating the coupling halves to approx. 100°C (without rubber buffer) facilitates pushing.

ATTENTION

The possibility of axial shock stress on the pump and drive motor components during assembly of the coupling must be eliminated. When fitting the coupling halves, brace the pump shaft on the impeller side and the motor shaft on the fan side. Dismount the fan hood if necessary.

3. Tighten the grub screw on both coupling hubs.
4. Mount the coupling spacer and tighten the screws.
5. The coupling does not need to be re-aligned.
6. Mount the contact protection.
According to accident prevention regulations, the pump must only be operated with a protection against accidental contact.



5.5 Space required for maintenance and repair

ATTENTION

The pump must be accessible from all sides in order to be able to carry out necessary visual inspections. Adequate space must be provided for maintenance and repair work, in particular for removal of the drive motor or of the complete pump aggregate. It must also be ensured that all pipelines can be attached and removed without hindrance.

5.6 Laying the pipelines

5.6.1 Nominal widths

The nominal diameters of the pipelines need not necessarily correspond to those of the inlet and outlet branch, however, they must not be smaller. Different nominal diameters of connections and pipelines are to be compensated by eccentric/centric transition pieces. Formation of air bags is to be avoided.

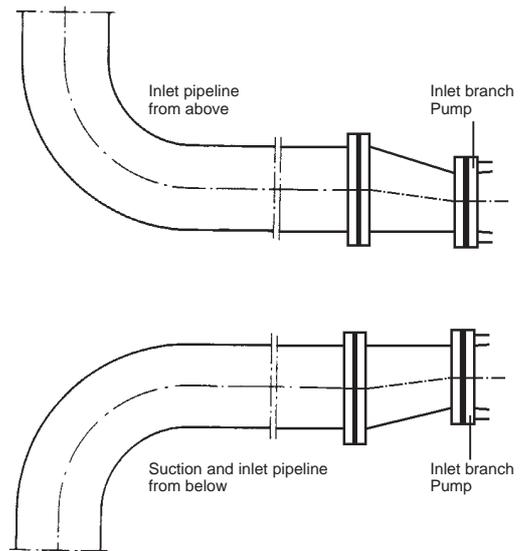


Fig. 2: Laying of pipelines

For short pipelines, the nominal width should be enough to keep the flow resistance as low as possible. For long pipelines the economical nominal width should be determined from case to case.

5.6.2 Change of cross-sections and directions

Sudden changes of cross-sections and directions, as well as hairpin bends, are to be avoided.

5.6.3 Supports and flange connections

The pipelines must be connected to the pump, stress-free. They must be supported close to the pump and must allow easy screwing-on to avoid twisting. When the connections are loosened the pipeline must neither be slanted nor springing, nor must it be under pressure. Any thermal stresses occurring on the pipelines must be kept away from the pump by suitable means, e.g. installing compensators.

5.6.4 Cleaning pipelines prior to attachment

Prior to assembly, all pipeline parts and valves must be thoroughly cleaned; especially in the case of welded pipelines, burrs and welding beads must be removed. Flange gaskets must not protrude inwards. Blanking flanges, plugs, protective film and/or protective paint on flanges and seals must be removed completely.

5.6.5 Suction and inlet pipeline

In order to avoid the formation of air bags, the suction pipeline must be laid uphill, the inlet pipeline with a slight inclination down to the pump.

In the event of the local conditions not allowing a steady rise of the suction pipeline, a breather must be provided at the highest point.

5.6.5.1 Foot valve and extractor basket (suction mode)

For suction operation, the suction pipeline must be equipped with a foot valve preventing the pump and suction pipeline from running empty while at rest.

The extractor basket must be attached so that neither dirt from the sump nor air from the fluid level can enter.

5.6.5.2 Stop valve (inlet mode)

A stop valve is to be installed in the inlet pipeline close to the pump. It must be fully open during operation, and must not be used for regulating.

5.6.5.3 Inlet/suction conditions (NPSH)

To ensure fault-free continuous operation, the inlet and suction conditions of the plant must be appropriately adjusted to the pump demand (NPSHreq.)

The service condition is fulfilled when the plant NPSH value (NPSHavail.) is above the pump NPSH (NPSHreq.). The NPSHreq. is given in the characteristic sheets of the respective pumps

ATTENTION

When media are delivered close to boiling point, particular attention must be paid to the plant-side NPSH conditions, to ensure the pump is not destroyed by cavitation.

5.6.6 Pressure pipeline

5.6.6.1 Stop valve in the pressure pipeline

A stop valve should be installed in the pressure pipeline close to the pump, to regulate the delivery.

5.6.6.2 Check valve in the pressure pipeline

It is recommended to install a check valve between the pressure connection and the stop valve in order to prevent damaging fluid splashes onto the pump when the plant comes to a sudden standstill.

5.6.6.3 Bleeding

A bleed facility should be provided at the highest point of the pressure pipeline.

5.6.7 Auxiliary connections

The positions of the auxiliary connections on the pump are shown in the sectional drawing and the installation diagram.

5.7 Safety and control devices

5.7.1 Manometers

Suitable pressure gauges are to be installed in the suction and pressure pipelines.

5.7.2 Safety devices in the inlet, delivery and auxiliary pipelines

Safety devices in the form of stop valves must be installed in the pipelines, if not already provided, to allow the pipelines to be shut off and disconnected during maintenance and repair work.

5.8 Electrical connections



The power supply cables of the coupled drive motor must be connected by a trained electrician, according to the motor manufacturer's circuit diagram. The applicable VDE regulations and local power company rules must be observed.

Danger from electrical energy must be eliminated.

6 Start-up/Shutdown

6.1 Preparations for (initial) start-up

6.1.1 Filling and bleeding the pump

Prior to starting up, the pump and the suction and inlet pipeline must be filled with delivery fluid.

During bleeding, the stop valves in the inlet and delivery pipelines must be open to allow air pockets to escape into the piping system, and out from there via the bleeder pipeline.

If the pump fails to build up pressure when started up (see manometer), bleeding must be repeated.

ATTENTION The pump must not run dry, not even for checking the direction of rotation.



During bleeding of the pump and the plant, hazardous or environmentally harmful fluid and gas emerging must be safely collected and discharged.

6.1.2 Control of drive motor direction of rotation

The direction of rotation of the motor must match the direction of rotation arrow on the pump. The motor can be briefly switched on to check the direction of rotation. A wrong direction of rotation impairs delivery and may damage the pump.

If it is wrong, the direction of rotation of the three-phase motor can be reversed by swapping any two phases.

6.2 Start-up

6.2.1 Starting

6.2.1.1 Starting without air ejector

To avoid overloading the drive motor, the pump should be run up only against a closed pressure stop valve during starting.

The stop valve in the inlet pipeline must be fully open.

6.2.1.2 Starting with air ejector A25A

Fully open the stop valve in the inlet pipeline and close the delivery-side valve.

Initiate suction. (For description of function of air ejector see separate Operating Instructions VM 490.0011/...). When suction is completed open the delivery-side valve and adjust the operating point.

6.2.2 Drive

Switch on the motor.

Pay attention to product-specific characteristics. Refer to the operating instructions of the drive motor manufacturer.

6.2.3 Setting the delivery values

When the motor has reached its operating speed, the delivery-side stop valve must be opened until the necessary delivery values are reached.

As a protection of the shaft seal function, a minimum inlet pressure (required safety against evaporation) is to be maintained when handling hot water.



Danger of burning!
Do not touch pumps for handling hot water.

6.2.4 Maintaining the minimum delivery rate

To prevent cavitation damage as a result of additional heating of the fluid, the pump should not be run against the closed stop valve in the pressure pipeline except in the starting phase.

ATTENTION The following equation is applied to determine the minimum delivery rate:

Output [KW] at rate $Q = \text{zero}$ (see characteristic) for the design impeller diameter [mm] x faktor 0.5 = minimum delivery rate [m³/h].

6.2.5 Temperature

Sudden temperature shocks are to be avoided.

6.2.6 Higher density or viscosity

If the density or viscosity of the delivery fluid is higher than foreseen by the design of the pump, the motor may be overloaded.

6.2.7 Higher delivery rate

If delivery is run at a higher rate than foreseen by the design of the pump, it is essential to ensure that the existing suction head is still adequate, because otherwise cavitation and resulting damage may occur.

Condition: $NPSH_{\text{avail.}} > NPSH_{\text{req.}}$

The delivery rate should, as far as possible, not exceed the value at η_{opt} .

6.2.8 Adjusting the stuffing box

Any increased leakages at the stuffing box in the initial operating hours are normally eliminated in the course of the run-in period. If necessary, tighten the hexagonal nuts on the gland slightly.

ATTENTION A slight leakage must be set at the stuffing box. This will discharge any frictional heat occurring at the sealing surface.

6.3 Shutdown and Restart

6.3.1 Stopping operation

- **Pump run-on**

Prior to the motor being switching off, the pump must have sufficient run-on when the heating source is switched off. The delivery fluid temperature must be reduced to the extent that heat build-up inside the pump is avoided.

- **Pressure pipeline**

If a check valve is installed in the pressure pipeline, the stop valve can remain open. If no check valve is fitted, the stop valve must be closed.

- **Drive**

Switch off the motor. Make sure the pump runs down smoothly and evenly.

- **Inlet line**

Close stop valve in inlet line.

6.3.2 Restart

Before restarting, check that the pump shaft is at a standstill. If the stop valve in the delivery pipeline is leaky, the pump shaft may rotate in reverse direction due to the backflow of the delivery fluid.

ATTENTION The pump must not be switched on when the pump shaft is rotating in reverse direction, as this may damage the pump shaft.

6.3.3 Measures in case of prolonged interruption

If a prolonged interruption is intended, and there is a risk of frost, the pump must be drained and preserved (see Section 3.3).

7 Maintenance/Repair

7.1 Maintenance

- The instructions in Section 2, *Safety*, must be observed in maintenance and repair work.
- Regular monitoring and maintenance of the pump and drive motor increases their service life.

The following instructions are generally applicable.

7.1.1 General monitoring

1. The pump must not run dry.
2. The minimum delivery rate must always be maintained (see Section 6.2.4).
3. In case of handling hot water, the required minimum inlet pressure must be maintained against evaporation.
4. The bearing temperature may be max. 50°C above room temperature, but must not exceed 80°C.
5. The drive motor must not be overloaded.
6. Built-in stuffing boxes must drip slightly in operation. Mechanical seals must have no inadmissible leakage.
7. Pressure and temperature monitors and flow meters must be observed.
8. Installed standby pumps must be started up once a week, being switched on and off in succession.

7.1.2 Maintenance of components

7.1.2.1 Bearing and lubrication

By means of two maintenance-free, grease-lubricated groove ball bearings to DIN 625. The nominal service life of the groove ball bearings at least reaches the operating hours specified in the DIN ISO 5199 technical specifications. The actual service life may be reduced due to intermittent operation, high temperature, low viscosity or the like. We therefore recommend checking the running noises and temperature in the bearing area at regular intervals. If scraping or rattling noises are heard compared to the normal humming, or if excessive temperature rises are detected, this indicates impending bearing damage, and the groove ball bearing should be replaced as soon as possible.

7.1.2.2 Shaft seal

The shaft is sealed either by a stuffing box or mechanical seal.

• Stuffing box

Any increased leakages at the stuffing box in the initial operating hours are normally eliminated in the course of the run-in period. If necessary, tighten the hexagonal nuts (920.03) on the gland slightly.

Ensure that there is slight leakage at the stuffing box. This will discharge any frictional heat occurring on the sealing surface.

If the leakage increases excessively, and if it also cannot be reduced by repeated slight tightening of the hexagonal nuts (920.03), the packing rings have lost their elasticity of shape and must be replaced.

• Mechanical seal

A single-action, maintenance-free mechanical seal is installed, the functioning of which complies with the required service characteristics. Minimal dripping of non-volatile media resulting from the functioning of the components is to be expected. In the event of heavy leakage due to wear, the mechanical seal should be replaced.

ATTENTION Because the mechanical seal must not run dry, the pump must only be started up when filled and bled.

7.1.2.3 Drive

Refer to the operating instructions of the motor manufacturer.

7.2 Repair (Dismounting and Mounting Instructions)

General

Trained Service fitters are available on request to carry out mounting and repair work.

Where repairs are carried out by the operator's own personnel or by specialist fitters, it must be ensured that the pump is fully drained and cleaned.

This particularly applies to pumps which are sent for repair to our factory or one of our service workshops. We must refuse acceptance of repair work on pumps filled with fluid, for the protection of our staff and for environmental reasons. Otherwise we must invoice the customer/operator for the costs of environmentally compatible disposal.

Where repairs are to be carried out on pumps which have been operated with hazardous substances ① and/or environmentally harmful media, the customer/operator must inform its own personnel on site, or our personnel where repairs are returned to our factory or a service workshop, without being specifically requested to do so.

In such cases a verification of delivery material, for example in the form of a DIN safety data sheet, must be submitted to us together with the request for a Service fitter.

Alternatively, you can request a certificate of safety (form no. 448/191) from our Service department, filling it out truthfully, correctly and in full. Send the completed form to the center commissioned with carrying out the repair, or hand it to our Service fitter.



① **Hazardous substances are:**

- Toxic substances
- Health-endangering substances
- Corrosive substances
- Irritants
- Explosive substances
- Fire-inducing substances
- Highly flammable, easily flammable and normally flammable substances
- Carcinogenic substances
- Substances impairing fertility
- Genetically distorting substances
- Substances in other ways hazardous to humans



For all work on site, the operator's own personnel and/or our fitters must be advised of the possible dangers involved in the repair work.

The most important dismantling and mounting operations are described in these instructions. The mounting steps described in the individual sections must be consistently observed.

7.2.1 Dismounting the centrifugal pump

Before dismantling, the following work must be carried out:



- The power supply cable must be disconnected from the motor by an authorized electrician. Electrical danger must be eliminated! The motor must be secured against being switched on.
- Close all stop devices in the supply and pressure pipeline.
- Allow the pump housing to cool to ambient temperature.
- Drain the fluid in flowable condition from the pump. For these purposes, screw out plugs for draining.
Note: Use a collecting tank.
- The pump must be depressurized and drained.



- Hazardous substances and/or environmentally harmful media must be drained off and collected such that no danger to life and limb is created. Environmentally compatible disposal must be ensured.
- Remove auxiliary pipelines, if fitted.
- Dismount manometer lines, manometers and holding devices.
- Dismount protection against accidental contact.

7.2.1.1 Dismounting the cartridge-unit pump

As a result of the general use of removable couplings the cartridge-unit pump (including impeller) can be dismantled without having to remove the volute casing, the pipelines or the drive motor.

Note: In pumps with air ejector connecting line Q2/E4 must be removed first.

- Loosen hexagon screws on removable coupling and remove spacer.
- On NAM, remove spacer ring (5.10.2).
- Loosen union nut from gland (738.2) and remove with leakage pipe (710.7).
- Loosen and unscrew hexagon screws (901...).
- Press cartridge-unit pump evenly out of the centering of the volute casing (102.01) using forcing screws (908...).
- Set cartridge-unit pump at an angle between supports of pump lantern and lift out with suitable lifting gear.
Note: In the case of pumps with bearing bracket size 530 the cartridge-unit pump can only be removed through the supports with the wider spacing.
- Remove gasket (400.01) or (400.02) from the sealing surface and clean sealing surfaces.
- Unscrew and remove screwed gland (738.2) with pipe double-nipple (736.5) from casing cover (161...).

7.2.1.2 Dismounting the impeller

- Remove impeller nut (922.01) with spring ring (936.01) or spring washer (934.01) from shaft (210.01).
- Detach impeller (230.01) from shaft (210...).
- Remove key (940...) from shaft (210...).
- By loosening the socket-head cap screws (914.01), remove intermediate ring (509.01), if fitted. Remove gasket (400.02), clean sealing surfaces.

7.2.1.3 Dismounting the stuffing box packing (without dismantling the cartridge-unit pump)

- Remove nuts (920.03) from the stud bolts (902.03).
- Push gland (452.01) on the shaft (210...) against the bearing cover (360...).
- Remove old stuffing box packing (461.01) from the shaft sealing chamber and clean the chamber carefully.

7.2.1.4 Dismounting the casing cover with installed stuffing box packing

Note: To allow the groove ball bearings to be removed, the casing cover (161...) must be dismantled as described in the following.

- Mark mounting position of the casing cover (161...) to the bearing bracket (330.01).
- Dismount casing cover (161...) together with the stuffing box packing (461.01) from the centering of the bearing bracket (330.01). To facilitate dismantling, slacken nuts (920.03) beforehand.

7.2.1.5 Dismounting the mechanical seal, all design versions

- After dismantling the impeller (230.01), the key (940.01) and the spacer sleeve (525.01), remove the rotating part of the mechanical seal from the shaft (210...).
- Mark mounting position of the casing cover (161...) to the bearing bracket (330.01).

Note: In the following operations take particular care that the components are dismantled concentrically and are not canted, in order to avoid damage to the stationary seal ring.

- Pull casing cover (161...) with stationary seal ring (433...) and O-ring out of the centering of the bearing bracket (330.01).
- Remove stationary seal ring (433...) with O-ring from the casing cover (161...).

7.2.1.6 Dismounting the groove ball bearings

Dismounting of the two groove ball bearings, as described, is only possible with the cartridge-unit pump, impeller and casing cover with shaft seal removed.

- Detach coupling half from shaft end. Use a puller device!
- Remove key (940.02) from shaft (210...).
- Remove shaft seal ring (420.01) from shaft (210...).
- Screw out socket-head cap screws (914.04) and (914.05) fastening the two bearing covers (360.01) and (360.02).
- Withdraw bearing covers (360.01) and (360.02) over the shaft (210...).
- Depending on the bearing size, remove compensating disk (557.01), Nilos rings (516.01) and (516.02) and distance washer (551.01).
- Press shaft (210...) with groove ball bearings (321.01) and (321.02) or (321.03) and (321.04) completely out of the two bearing seats of the bearing bracket (330.01) towards the driving side.
- Remove circlip (932.10) from the bearing bracket and suspend it from the shaft (210...) between the two groove ball bearings.
- Insert pump-side groove ball bearing (321.01) or (321.02) in the drive-side bearing seat and, together with the shaft (210...), completely press out of the bearing bracket (330.01).
- Remove circlip (932.01) from the shaft (210...).
- In case of bearing bracket size 530, 585 and 670, remove distance washer (551.01) and Nilos ring (516.02) from the shaft (210...).
- Withdraw groove ball bearings (321.01) and (321.02) or (321.03) and (321.04) from the shaft (210...).

- Remove circlip (932.10) from the shaft (210...).
- Clean shaft and/or shaft sleeve mainly in the area of the shaft seal, the bearing seats, the impeller and coupling seat.

7.2.2 Mounting the centrifugal pump

ATTENTION Before remounting check all parts for wear and, as necessary, replace with **original replacement parts**.

Clean all parts before mounting. Always fit new gaskets.

7.2.2.1 Mounting the groove ball bearings

The table below shows the allocation of the pump sizes to the bearing bracket size and the groove ball bearings to be installed.

Pump sizes		Bearing bracket size	Groove ball bearing Abbreviation
NIM	NAM		
65-250 65-315 65-400 80-200 80-250 80-315 100-200 100-250 100-315 125-250	65-250 65-315 65-400 - 80-250 80-315 - 100-250 100-315 125-250	470	6308-2Z J C3 DIN 625 Part Nos. 321.01 and 321.02 lifetime-lubricated
80-400 100-400 125-315 125-400 150-250 150-315 150-400 200-250 250-250	80-400 100-400 125-315 - - 150-315 - - -	530	6410-J C3 DIN 625 Part Nos. 321.03 and 321.04 lifetime-lubricated
200-315 250-315 250-400 300-315	- - - -	585	6413-J C3 DIN 625 Part Nos. 321.03 and 321.04 lifetime-lubricated
300-400	-	670	6416-J C3 DIN 625 Part Nos. 321.03 and 321.04 lifetime-lubricated

- Check shaft for wear, especially in the area of the shaft seal.
- Groove ball bearings (321.01) and (321.02) with guard disks are provided with a grease filling and are ready for installation.

- If required, carefully clean groove ball bearings (321.03) and (321.04) with Nilos rings (516.01) and (516.02) with Diesel fuel. If the running surfaces are bright and undamaged, the groove ball bearings can be re-used. If not, the bearings must be replaced.
- New groove ball bearings (321.03) and (321.04) must initially be provided with a permanent grease filling. In case of re-used, undamaged and cleaned groove ball bearings the permanent grease filling must be replaced.

The grease filling is replaced as described below:

1. Fill hollow spaces between the rolling bodies up to approx. 40% with grease. This corresponds to approx. 35g of grease for bearing size 6410 J C3, for bearing size 6413 J C3 approx. 65g.
2. Scrape off excess grease (most suitably with your fingers; do not use metal objects).

Rolling bearing greases

For the lubrication of the groove ball bearing, we recommend to use the below-listed rolling bearing greases or equivalent. The order of producers is no quality ranking.

Producer	Brand name	Designation to DIN 51825
Agip	Agip GR MU3	K3K-20
ARAL	Aralub HL3	K3K-20
BP	BP Energrelube LS3	K3K-20
ESSO	BEACON 3	K3N-30
Fuchs	RENOLIT FWA 220	K3N-20
Klüber	MICROLUBE GL 263	K3N-20
Mobil-Oil	Mobilux 3	K3K-20
Shell	Shell Alvania Fett R3	K3N-30
SKF	SKF-Fett LGMT3	K3K-30

If none of the listed rolling bearing greases is available, we recommend in any case a multi-purpose grease on lithium basis which corresponds to the above DIN designation.

Grease mixture with grease grades of different basic oils and thickeners leads to a reduction of the lubricating properties and must therefore be avoided.

- Mount pump-side groove ball bearing (321.01) or (321.03) over the shaft (210...) up to the shaft shoulder.
- Place circlip (932.10) over the shaft between the bearing seats.
- Mount drive-side groove ball bearing (321.02) or (321.04) over the shaft (210...) up to the shaft shoulder.
- In case of bearing bracket size 530, 585 and 670, install distance washer (551.01) over the shaft in front of the drive-side groove ball bearing (321.02) or (321.04).

- Install circlip (932.01) in the shaft groove provided in front of the groove ball bearing or, where appropriate, in front of the distance washer (551.01).
- Push shaft (210...) with the two groove ball bearings from the driving side, with the pump-side shaft end foremost, into the bearing bracket so that the pump-side groove ball bearing (321.01) or (321.03) is arranged between the bearing seats in the bearing bracket.
- Install circlip (932.10) in the groove provided on the drive-side bearing seat of the bearing bracket.
- Push shaft (210...) with the two groove ball bearings completely into the bearing seats of the bearing bracket until the drive-side groove ball bearing (321.02) or (321.04) rests against the circlip (932.10).
- Depending on the bearing bracket size, mount compensating disk (557.01), Nilos rings (516.01) and (516.02), distance washer (551.10) and cup springs (951.01) over the shaft in front of the groove ball bearings.
- Mount the two bearing covers (360.01) and (360.02) in the centering of the bearing bracket.
- Secure the two bearing covers (360.01) and (360.02) with socket-head cap screws (914.04) and (914.05).
- Push shaft seal ring (420.01) onto the shaft (210...).
- Fit key (940.02) in the shaft (210...).
- Push coupling half onto the pump shaft (210...).

7.2.2.2 Mounting the stuffing box packing (with installed cartridge-unit pump)

- After cleaning the shaft sealing chamber, carefully bend individual new stuffing box packing ring blanks in pre-bent shape (461.01) into final angular shape and, by means of the gland (452.01), push it in the correct sequence, together with the lantern ring (458.01), over the shaft (210...) into the shaft sealing chamber.

Note: The section joints of the individual stuffing box packing rings must be offset by approx. 90° to each other. A stuffing box packing ring must always be mounted in front of the lantern ring. When correctly installed, the lantern ring must be positioned under the internal bore hole or sealing liquid bore hole in the casing cover (161...).

Bearing bracket size	Stuffing box packing ring dimensions and blank length
360	30 x 46 x 8 / 130 mm long
470	40 x 60 x 10 / 171 mm long
530	50 x 70 x 10 / 205 mm long
585	65 x 85 x 10 / 257 mm long
670	—

7.2.2.3 Mounting the casing cover with installed stuffing box packing

- Mount casing cover (161...) together with the stuffing box packing concentrically into the centering of the bearing bracket over the shaft (210...). Keep to the markings made during dismounting!

Note: The installed packing rings must not be damaged. We recommend replacing old stuffing box packing rings with new ones (please refer to Section 7.2.2).

7.2.2.4 Mounting the mechanical seal, all design versions

Mechanical seals are high-grade precision parts. Careful handling and extreme cleanliness during installation are essential to ensure proper functioning. A suitable sliding lubricant can be used to aid mounting (e.g. glycerin or lubricating soap; not oil).

ATTENTION Lubricants in mineral oil form must not come into contact with elastomers of EPDM.

Note: Ensure that the parts sliding onto each other are only replaced in pairs.

Note: We recommend always mounting mechanical seals with elastomer bellows (versions U3.9D and U3.12D) in dry condition, to maintain the driving function of the bellows. The use of water with the addition of washing-up liquid as a lubricant is permissible.

- Push stationary seal ring (433...) with new O-ring into the cleaned casing cover (161...).
- Push casing cover (161...) with installed stationary seal ring (433...) over the shaft (210...) and insert in the centering of the bearing bracket. Keep to the markings made during dismounting.
Note: Take particular care that the casing cover with stationary seal ring and O-ring is pushed concentrically over the shaft into the centering of the bearing bracket and is not canted, in order to avoid damage to the stationary seal ring.
- Push rotating part of the mechanical seal (433...) onto the shaft (210...) against the stationary seal ring (433...).
- Where necessary, push spacer sleeve (525.01) over the shaft (210...) as far as the rotating part of the mechanical seal.

7.2.2.5 Mounting the intermediate ring in the case of appropriately equipped pumps

- Insert new gasket (400.02) in the intermediate ring (509.01).
Note: To facilitate mounting, we recommend coating the gasket with an appropriate adhesive.
- Mount intermediate ring (509.01) with gasket (400.02) over the shaft (210...) onto the casing cover (161...).
- Secure the intermediate ring (509.01) with socket-head cap screws (914.01) on the bearing bracket (330.01).

7.2.2.6 Mounting the impeller

- Fit key (940...) into shaft (210...).
- Push impeller (230.01) over the key (940...) onto the shaft (210...).
- Place spring ring (936.01) or spring washer (934.01) or new seal ring (411.10) over the shaft (210...) in front of the impeller (230.01).
- Turn impeller nut (922...) onto the shaft (210...) and tighten.
Note: To tighten the impeller nut, hold the shaft over the coupling half using a suitable tool.

7.2.2.7 Mounting the cartridge-unit pump

- Screw gland (738.02) with pipe double-nipple (736.05) through bearing bracket flange into casing cover (161...).
- Fit new gasket (400.01) or (400.02) for sizes with intermediate ring (509.01) into volute casing (102.01).
Note: To facilitate mounting we recommend coating the gasket with a suitable adhesive.
- Push cartridge-unit pump at an angle between supports of pump lantern using suitable lifting gear, and insert correctly positioned into volute casing.
Note: The gasket (400.01) or (400.02) must not be displaced in the process.
- Position the cartridge-unit pump so that the leakage outlet connection is located in the recess in the pump lantern.
- Attach cartridge-unit pump on volute casing (102.01) with hexagon screws (901.01) or (901.05).

Following the mounting the centrifugal pump, the following operations are to be performed.

- For series NAM: attach distance ring (510.02).
- Mount the spacer of the spacer type coupling.
- Attach protection against accidental contact.
- For pumps with air ejector: attach pipe connection Q2/E4.
- Attach manometer pipelines, manometer and holding devices to the pump.
- Fill pump with liquid to be pumped.
-  The power supply cable must be connected to the motor by an authorized electrician. Electrical danger must be eliminated! Pay attention to direction of rotation.

Start up pump as per instructions in Section 6.

7.3 Replacement parts

We recommend stocking parts for two years' continuous operating conditions as per the application guidelines in the VDMA data sheet 24 296 (see Section 7.3.2).

However, for operational safety reasons, we recommend you always stock a complete installation or standby pump.

The advantage is that in the event of a fault or damage the standby unit can replace the non-functioning unit quickly and without great effort.

7.3.1 Ordering spare/replacement parts

When ordering spare and replacement parts, besides the **part number, denomination** and **quantity**, the following should also be quoted:

**Pump abbreviation,
Pump number,
Year of construction.**

This information is engraved on the rating plate of the pump.

7.3.2 Replacement parts for two-year continuous operation as per VDMA 24 296

Part No.	Part denomination	Number of identical pumps (including standby pumps)						
		2	3	4	5	6 und 7	8 und 9	10 und mehr
		Set/Replacement parts quantity						
230.01	Impeller (all single-stage sizes)	1	1	1	2	2	3	30%
210.01 ①	Shaft with impeller nut spring washer spring ring key 922.01 and 934.01 or 936.01 and 940.01	1	1	2	2	2	3	30%
321.01 321.02	Groove ball bearing Groove ball bearing ②	1	1	2	2	3	4	50%
321.03 321.04	Groove ball bearing Groove ball bearing ③	1	1	2	2	3	4	50%
– ①	Bearing bracket complete, consisting of: Shaft, groove ball bearing, bearing cover etc.	–	–	–	–	–	1	2
400.01 400.02	Gasket (set) Gasket (for design with intermediate ring)	4	6	8	8	9	12	150%
433...	Mechanical seal	2	3	4	5	6	7	90%
461.01	Stuffing box packing (set)	4	4	6	6	6	8	40%

- ① Can be purchased as assembly group/sale group.
- ② Groove ball bearings for bearing bracket size 470.
- ③ Groove ball bearings for bearing bracket sizes 530, 585 and 670.

8 Operating Faults, Causes and Remedial Action

8.1 Faults with reference number for cause and remedial action

The table below is intended as a guide to identifying faults and their possible causes.

If faults occur which are not listed here, or which cannot be traced back to the listed causes, we recommend consulting the factory, or one of our branch offices or sales offices.



The pump must be depressurized and drained when faults are being rectified.

Centrifugal pump faults	Reference numbers for cause and remedial action
Delivery rate too low	1, 2, 3, 4, 5, 6, 7, 8, 9, 21, 22
Delivery head too low	2, 3, 4, 5, 6, 7, 8, 9, 21, 22
Power consumption of pump too high	9, 11, 12, 16, 17, 21, 22, 25
Delivery pressure too high	9, 12
Bearing temperature increased	16, 17, 18, 20, 25
Pump housing leaky	23
Heavy leakage of shaft seal	10, 13, 15, 16, 17
Pump not operating smoothly	2, 3, 4, 5, 6, 8, 11, 16, 17, 24, 25, 26
Pump gets hot	2, 5, 26
Rapid failure of mechanical seal	27

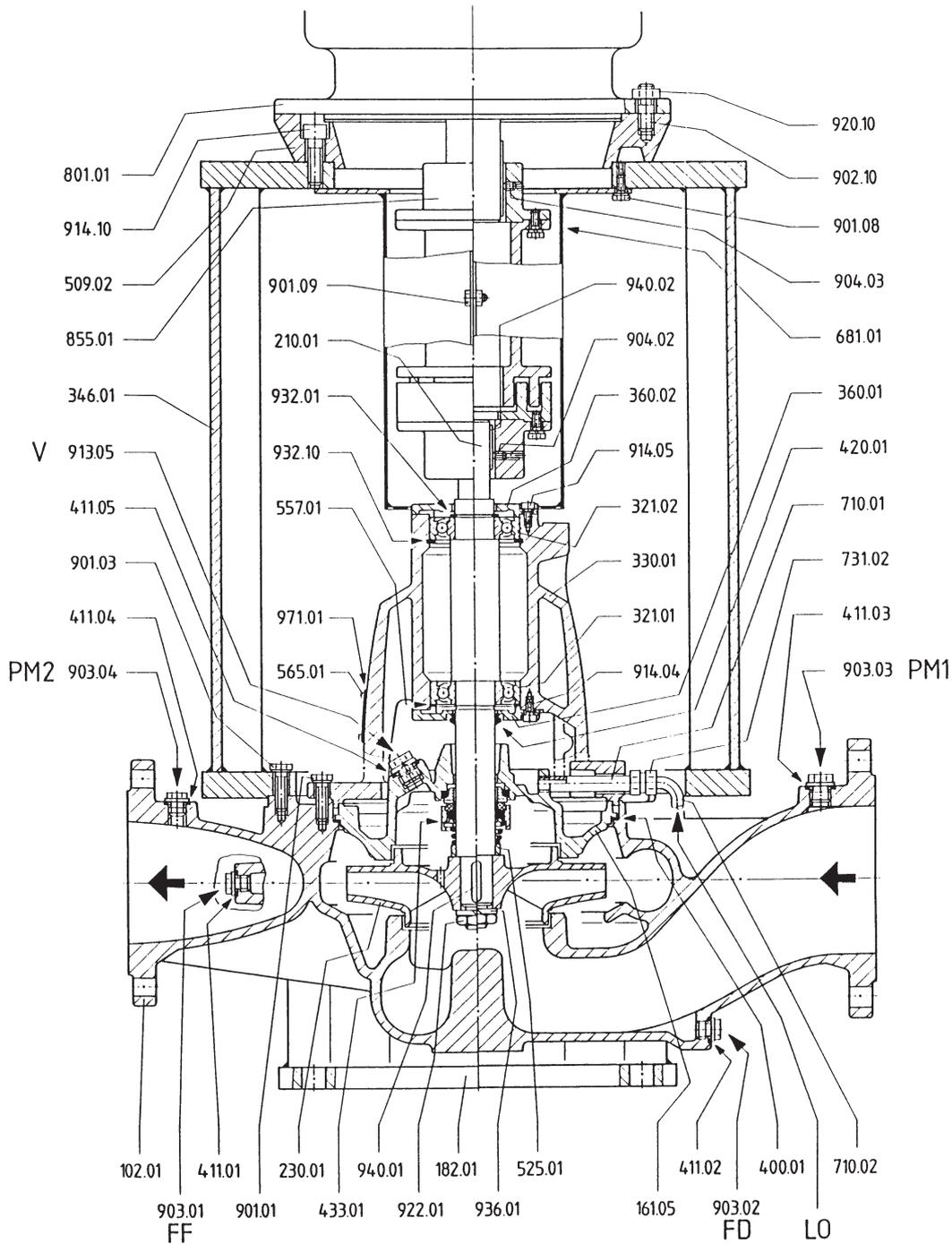
8.2 Causes and remedial action

Ref. no.:	Cause	Remedial action
1	Counterpressure higher than design pressure of pump.	1. Open stop valve in pressure pipeline until operating point is reached. 2. Install impeller with larger diameter. 3. Increase rotation speed (turbine, frequency control, ...) ①
2	Pump or pipelines not properly bled or filled.	Bleed and top up pump or pipelines.
3	Inlet pipeline or impeller blocked.	Clean pipelines and impeller.
4	Air pockets forming in pipeline.	Perhaps install a vent valve, or lay pipeline differently.
5	NPSH _{plant} (inlet) too low.	1. Check fluid level in inlet tank. 2. Open stop valve in inlet pipeline fully. 3. Lay inlet pipeline differently if friction losses are too high. 4. Check filter in inlet pipeline, if fitted.
6	Wrong direction of rotation of pump.	Reverse polarity of any two phases on motor.
7	Rotation speed too low.	Increase rotation speed (turbine, frequency control, ...). ①
8	Excessive wear on inner pump parts.	Replace worn parts.
9	Density or viscosity of delivery medium does not comply with pump design data.	Consult the factory in the event of faults due to non-compliance with design data. ①
10	Shaft sleeve damaged.	Mount new shaft sleeve.
11	Delivery head lower than nominal delivery head of pump.	1. Regulate operating point with stop valve in pressure pipeline. 2. Turn off impeller in event of continuous overload.
12	Rotation speed too high.	Reduce rotation speed (turbine, frequency control, ...). ①
13	Shaft seal damaged.	Check shaft seal parts for wear and replace if necessary.
14	–	–
15	Packing material unsuitable for the delivery medium. Gland is askew, or too loosely tightened.	1. Wrong packing material used. Repack pump with suitable material. 2. Tighten gland evenly.
16	Pump aggregate wrongly aligned.	Re-align pump as described.

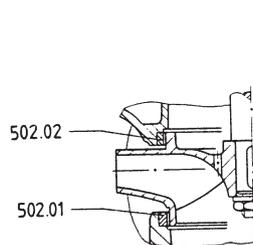
17	Pump twisted.	Check pipelines for twists in connections.
18	Excessive axial thrust.	Clean relief bore holes in impeller.
19	–	–
20	Specified coupling half gap not complied with.	Set coupling half gap as per installation diagram.
21	Motor voltage incorrect.	Use motor with correct voltage.
22	Motor runs only to two phases.	1. Check cable connection. 2. Replace fuses.
23	Screws not tight.	1. Tighten screws. 2. Replace gaskets.
24	Impeller out-of-true.	1. Clean impeller. 2. Re-balance impeller.
25	Groove ball bearing defective.	Replace groove ball bearing.
26	Delivery rate below minimum.	Increase delivery rate to minimum.
27	Water quality NOK.	Note dosing instructions of manufacturers of water treatment additives.

① Consult factory

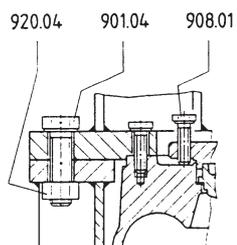
Sectional drawing – Series NIM
Pedestal mounting



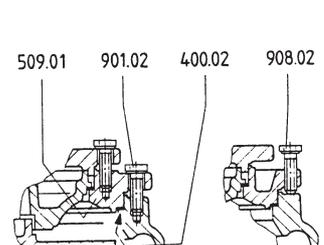
Shaft seal: uncooled, unbalanced mechanical seal
Abbreviation: **U3...D**



Design with split rings
(extra charge)

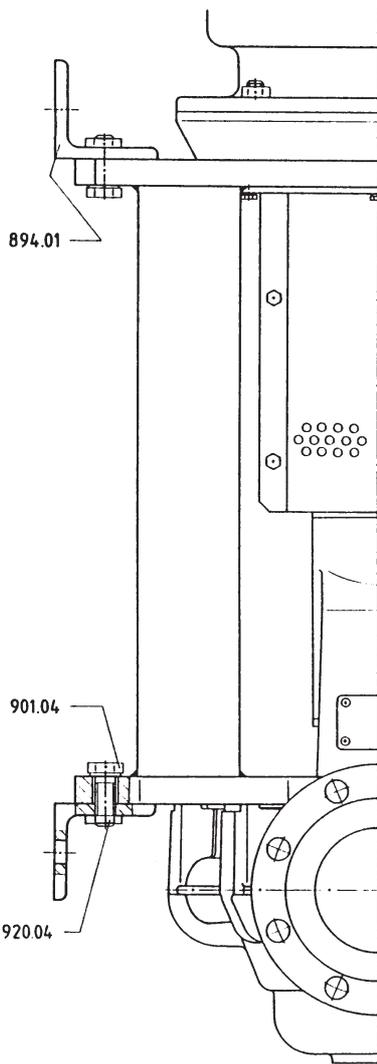


Fixing of pump feet
to the pump lantern



Design with intermediate ring

Sectional drawing – Series NIM
Wall mounting

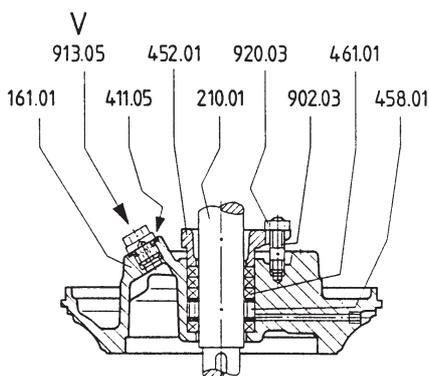


Parts list
for pedestal and wall mounting

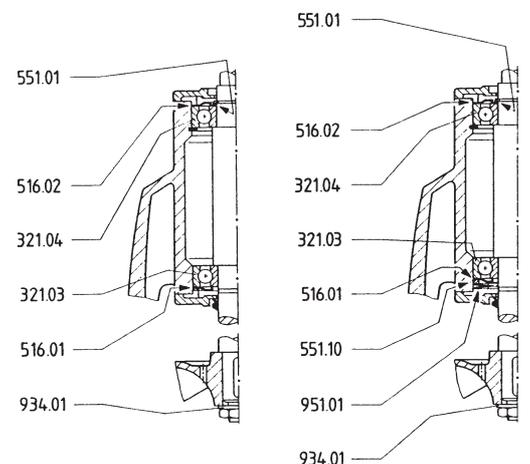
Denomination	Part No.	Denomination	Part No.
Volute casing	102.01	Coupling guard	681.01
Casing cover	161.01	Pipe	710.01
Casing cover	161.05	Pipe	710.02
Foot	182.01	Pipe union	731.02
Shaft	210.01	Flange motor	801.01
Impeller	230.01	Bracket	894.01
Groove ball bearing	321.01	Hexagon screw	901.01
Groove ball bearing	321.02	Hexagon screw	901.02
Groove ball bearing	321.03	Hexagon screw	901.03
Groove ball bearing	321.04	Hexagon screw	901.04
Bearing bracket	330.01	Hexagon screw	901.08
Pump lantern	346.01	Hexagon screw	901.09
Bearing cover	360.01	Stud bolt	902.03
Bearing cover	360.02	Stud bolt	902.10
Gasket	400.01	Screw plug	903.01
Gasket	400.02	Screw plug	903.02
Joint ring	411.01	Screw plug	903.03
Joint ring	411.02	Screw plug	903.04
Joint ring	411.03	Grub screw	904.02
Joint ring	411.04	Grub screw	904.03
Joint ring	411.05	Jack screw	908.01
Shaft seal ring	420.01	Jack screw	908.02
Mechanical seal	433.01	Air release plug	913.05
Gland	452.01	Socket-head cap screw	914.04
Seal ring	458.01	Socket-head cap screw	914.05
Stuffing box packing	461.01	Socket-head cap screw	914.10
Split ring	502.01	Hexagon nut	920.03
Split ring	502.02	Hexagon nut	920.04
Intermediate ring	509.01	Hexagon nut	920.10
Intermediate ring	509.02	Impeller nut	922.01
Nilos ring	516.01	Circlip	932.10
Nilos ring	516.02	Circlip	932.10
Spacer sleeve	525.01	Spring washer	934.01
Distance washer	551.01	Spring ring	936.01
Distance washer	551.10	Key	940.01
Ball bearing		Key	940.02
compensating disk	557.01	Cup spring	951.01
Rivet	565.01	Name plate	971.01

Connections

FD	Draining
FF	Filling
LO	Leakage outlet
V	Bleeding
PM1	Pressure measuring device
PM2	Pressure measuring device

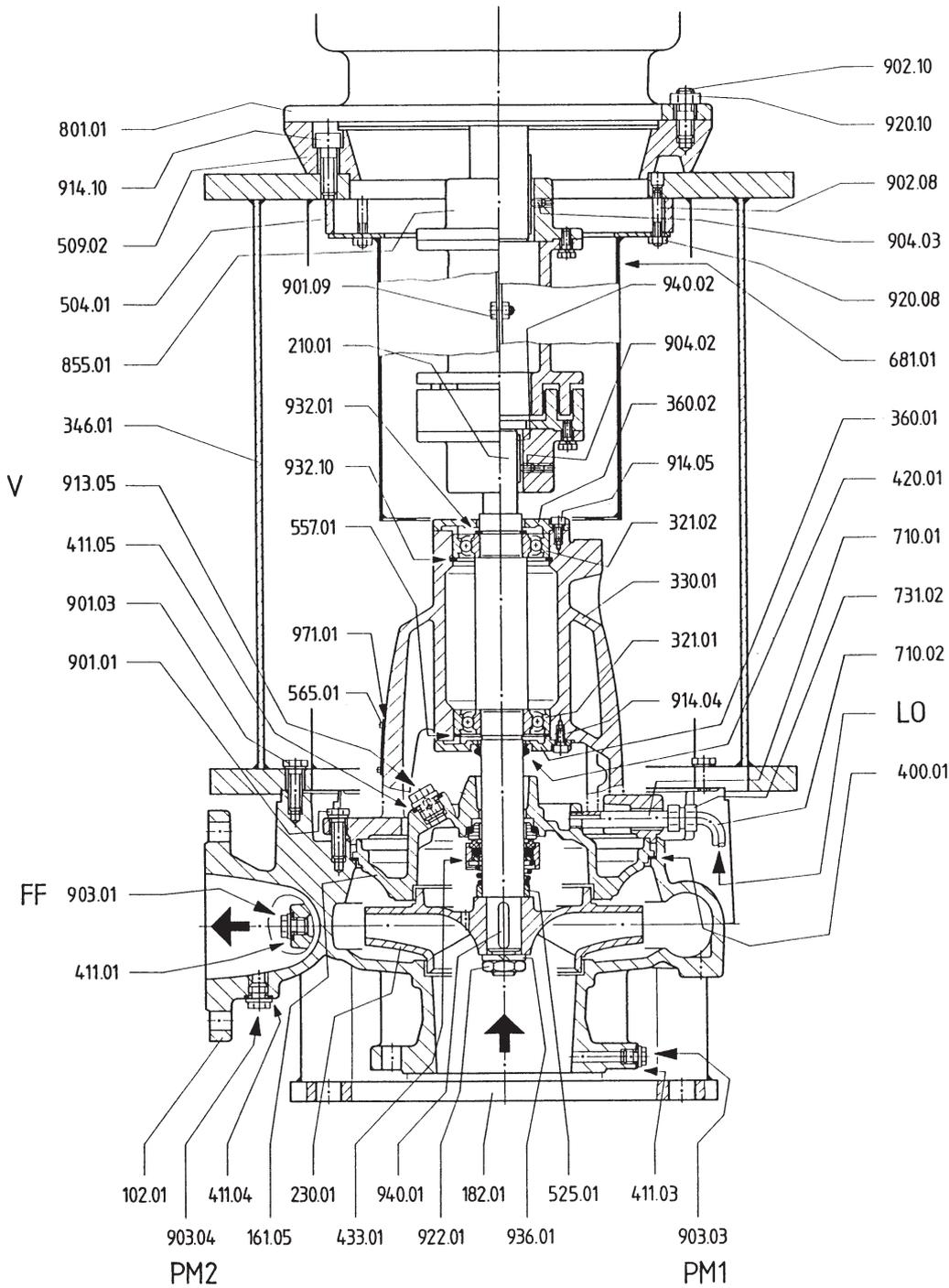


Stuffing box with
internal sealing **U1B**

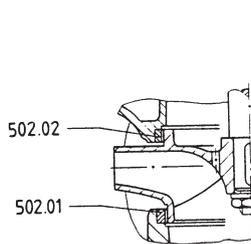


Design of bearing and impeller protection for
530 bearing bracket size **585**

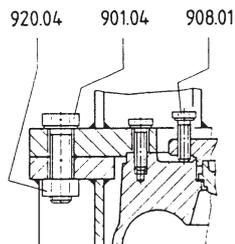
Sectional drawing – Series NAM
Pedestal mounting



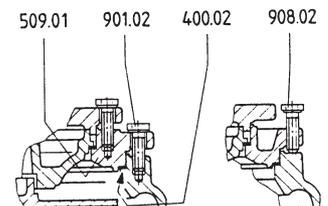
Shaft seal: uncooled, unbalanced mechanical seal
Abbreviation: **U3...D**



Design with split rings
(extra charge)

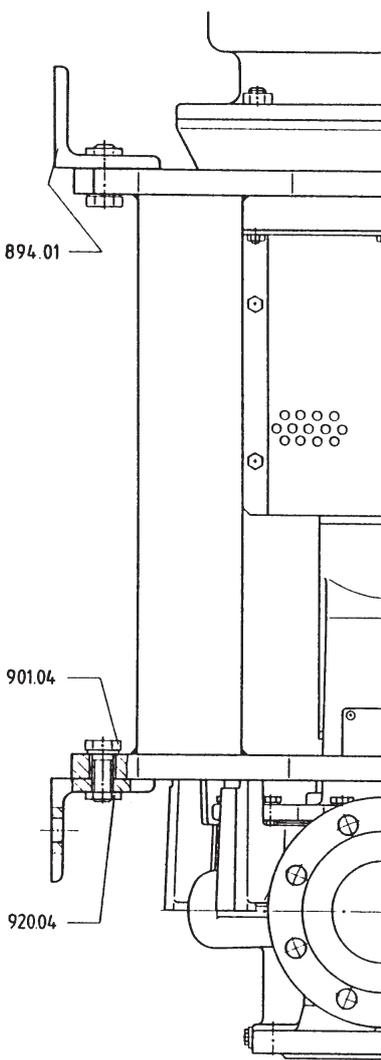


Fixing of pump feet
to the pump lantern



Design with intermediate ring

Sectional drawing – Series NAM
Wall mounting

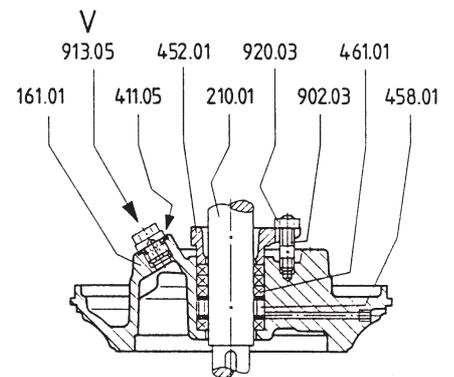


Parts list
for pedestal and wall mounting

Denomination	Part No.	Denomination	Part No.
Volute casing	102.01	Pipe union	731.02
Casing cover	161.01	Flange motor	801.01
Casing cover	161.05	Coupling with distance piece	855.01
Foot	182.01	Bracket	894.01
Shaft	210.01	Hexagon screw	901.01
Impeller	230.01	Hexagon screw	901.02
Groove ball bearing	321.01	Hexagon screw	901.03
Groove ball bearing	321.02	Hexagon screw	901.04
Bearing bracket	330.01	Hexagon screw	901.09
Pump lantern	346.01	Stud bolt	902.03
Bearing cover	360.01	Stud bolt	902.08
Bearing cover	360.02	Stud bolt	902.10
Gasket	400.01	Screw plug	903.01
Gasket	400.02	Screw plug	903.03
Joint ring	411.01	Screw plug	903.04
Joint ring	411.02	Grub screw	904.02
Joint ring	411.03	Grub screw	904.03
Joint ring	411.04	Jack screw	908.01
Shaft seal ring	420.01	Jack screw	908.02
Mechanical seal	433.01	Air release plug	913.05
Gland	452.01	Socket-head cap screw	914.04
Seal ring	458.01	Socket-head cap screw	914.05
Stuffing box packing	461.01	Socket-head cap screw	914.10
Split ring	502.01	Hexagon nut	920.03
Split ring	502.02	Hexagon nut	920.04
Spacer ring	504.01	Hexagon nut	920.08
Intermediate ring	509.01	Hexagon nut	920.10
Intermediate ring	509.02	Impeller nut	922.01
Spacer sleeve	525.01	Circlip	932.10
compensating disk	557.01	Circlip	932.10
Rivet	565.01	Spring ring	936.01
Coupling guard	681.01	Key	940.01
Pipe	710.01	Key	940.02
Pipe	710.02	Name plate	971.01

Connections

FF	Filling
LO	Leakage outlet
V	Bleeding
PM1	Pressure measuring device
PM2	Pressure measuring device



Stuffing box with internal sealing
U1B

Subject to technical changes.

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