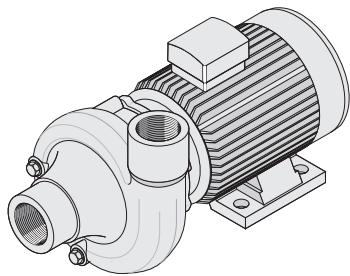
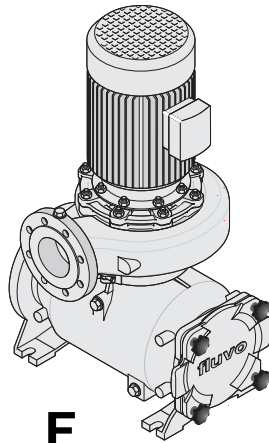


# Centrifugal Pump Type NB / FB / WP / SM / F

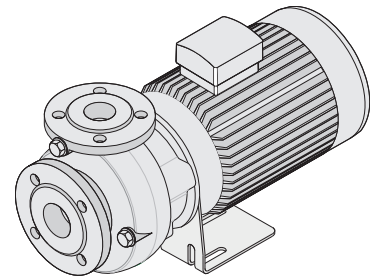
## **GB** Operator's Manual



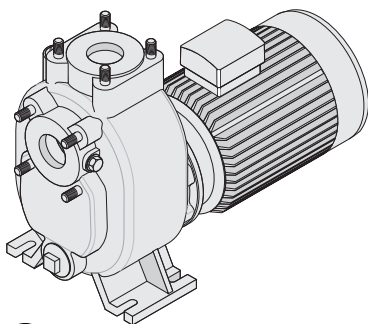
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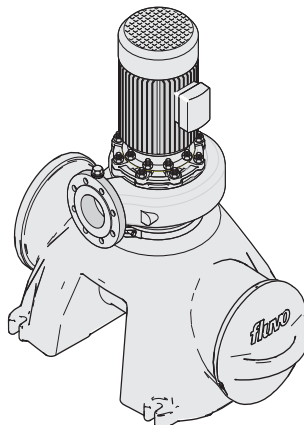
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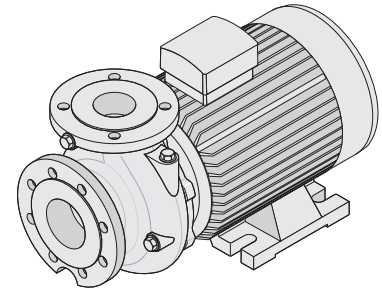
**FB**



**SM**



**Optimo F**



**NB**

**27216 - B.2**

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## **1 General Information**

### **1.1 User Information**

This Operator's Manual will make it easier for you to become familiar with the centrifugal pump and make full use of its range of options.

It contains important information for operating the centrifugal pump safely, properly and economically.

However, the Operator's Manual does not take into consideration requirements for a specific location. The operator is responsible for observing these requirements.

The pump rating plate indicates the series and frame size, the most important operating data and the factory number. Please specify this information if you have questions, subsequent orders, or especially when ordering spare parts.

### **1.2 Proper Use**

The centrifugal pump is intended exclusively for use in accordance with the original pump specification and the Operator's Manual. Any other or more extensive use is considered improper use. The manufacturer shall not be liable for any resulting damage.

### **1.3 Other Applicable Documents**

Each centrifugal pump has various documents which belong together with the Technical Documentation for the centrifugal pump. They are:

The Operator's Manual for the centrifugal pump

The Operator's Manual for the drive

The Operator's Manual for the accessories listed in the specification

Acceptance reports from TÜV, etc.

Test run report

Performance run report

Assembly drawing (dimension sheet)

Supplementary Operator's Manual for ATEX pumps

Declaration of Conformity / Manufacturer's Declaration

Specification with all information

Not all the documents named above exist or are included in every case. Observe the information in the specification in this regard.

### **1.4 Technical Data Specification**

The specification of the delivered centrifugal pump is the most important document for every Operator's Manual. It contains a summary of all factual and technical data for the centrifugal pump. It is the centrifugal pump's "birth certificate" and must be treated as such. The confirmation of order together with the delivery slip can be used as a replacement as proof of technical data.

## 1.5 Safety Instructions

Make certain the safety requirements and laws for the use of pumps which apply to the operating company and/or country in which the system is operated are observed.

We warn you of sources of danger in this Operator's Manual through corresponding notices. The use of symbols is designed to direct your attention at these notices.



### Caution - risk of injury!

This symbol warns you of dangers due to mechanical effects.



### Caution - danger of death!

This symbol warns you of dangers due to electrical current.



### Note!

This symbol warns you of actions that may damage or destroy the pump. It provides information about financially efficient use of the pump.

Notices placed directly on the centrifugal pump, such as the arrow for direction of rotation and identification of fluid connections, must always be observed. These notices must be maintained in legible condition and replaced if necessary.

- Use the centrifugal pump only when it is in flawless condition technically and according to its intended purpose. Be conscious of safety and dangers and observe all the instructions in this Operator's Manual!
- Eliminate all malfunctions that could have a detrimental effect on safety immediately.
- **Make certain before commissioning that the operating personnel have read and understood the Operator's Manual.** It is the owner rather than the operator who is responsible for safety!
- The centrifugal pump is designed for installation in a complete machine or system. The centrifugal pump is delivered without a contact safety device. If a contact safety device is required (for example when pumping hot liquids above 60°C) it must be provided by the system manufacturer when the centrifugal pump is installed in the system.
- If liquids are pumped that can cause effects detrimental to health in any way, suitable measures must be taken (rinsing, cleaning, washing) to bring the wetted surfaces of the pump to a condition to ensure that handling does not entail any dangers.
- Leaks of dangerous pumping media (for example explosive, toxic, hot) must be diverted so there is no endangerment to persons or the environment. Legal requirements must be observed.
- Hazards due to electrical energy must be excluded (for specific details, see country-specific regulations and/or your local energy supply company).
- Work on the pump's electric equipment must only be performed by a professional electrician or persons instructed by and under the direction and supervision of an electrician in accordance with the electrical regulations of VDE or IEC.
- Before turning on the pump or placing it in operation, make certain no one can be endangered by the pump starting up!



**Important:**

Stop the centrifugal pump immediately if any abnormal electrical voltages, vibrations, temperatures, noises, leaks, or other faults occur.

## 1.6 Temperature



**Caution! Danger of burns!**

The housing of the centrifugal pump heats up during operation! If the temperature increases above + 50°C, the centrifugal pump must be protected against direct contact by the operator.

## 1.7 Safety Instructions for Maintenance, Inspections, and Repair work

- Repairs of any nature must only be made by qualified professionals. The centrifugal pump must be drained for this purpose.
- The connected pipelines must be depressurised.
- Allow the pump to cool off.
- Before making repairs to the pump, disconnect it from its electrical power source and prevent it from being turned on again.

## 2 Transport, Storage and Assembly

### 2.1 Transport and Storage

#### 2.1.1 Transport

Centrifugal pumps must be transported lying down! The lifting lugs on the motor are only designed for the weight of the motor alone. A unit consisting of a motor and a pump unit must be attached on both the motor and pump sides. If necessary, the position of the centre of gravity is identified on the pump unit itself and on the packaging and the positions for inserting lifting equipment are marked.



**Risk of injury!**

Use only suitable lifting equipment and load holding devices which are in perfect working order and have adequate load-bearing capacity!  
Never work or stand under suspended loads!

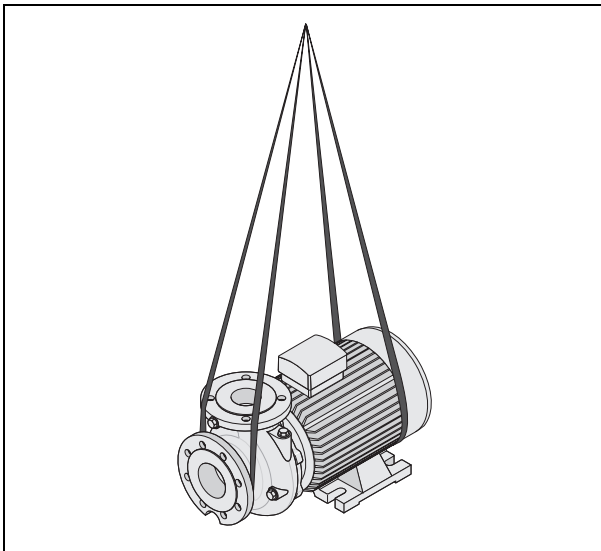
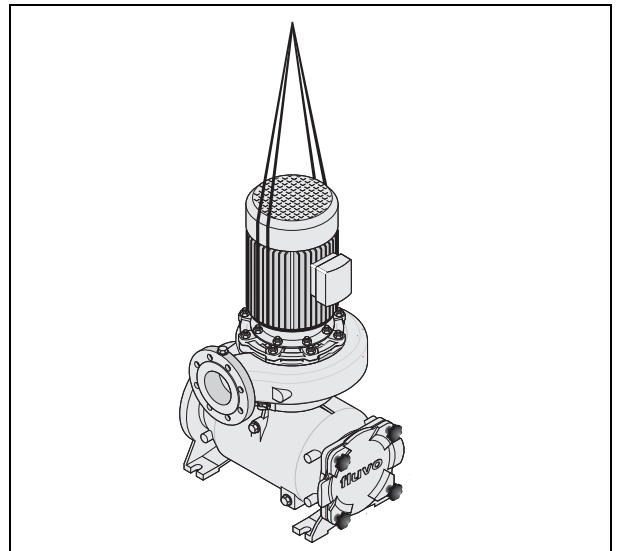


Fig. 1: Example of slinging for lifting



### 2.1.2 Storage

- Temporary storage  
Even for temporary storage of short duration, store in a dry, well ventilated location free of vibration on wooden supports at a temperature that is as constant as possible.
- Unsuitable storage  
If storage conditions are unsuitable (for example high relative humidity), or if the pump will be in storage for longer than 6 weeks, the pump housing must be filled with oil (see 2.1.3).
- Storage for extended duration  
If the storage time exceeds 2 years, the roller bearings in the motor must be regreased or completely replaced.

### 2.1.3 Preservation

The centrifugal pumps we deliver are provided with preservation according to the storage time specified in the order. This preservation must be removed before commissioning; see section 2.2.2 „Cleaning“.

If the pump will be taken out of operation for an extended time or if the storage time originally planned before commissioning will be considerably exceeded, preservation should be performed as corrosion protection.



The procedure to follow is described in detail in section 5.1 „Decommissioning / Placing in Storage / Preservation“.

## 2.2 Unpacking, Cleaning and Assembly

### 2.2.1 Unpacking

The pump is secured on a pallet with bands for transport. For transport over extended distances it is packed in cases or crates.

After the retaining bands are loosened, lift the pump out of the packaging with appropriate

auxiliary equipment (lifting tackle). Observe the instructions under 2.1.1 while doing so.

### 2.2.2 Cleaning

Various measures are provided for protection against transport damage or corrosion. Find out which ones have been selected for your pump.

1. Cover plates on the connections
2. Shaft protection, for delivery without motor
3. Protective paint on bare metal parts

Before set-up or installation of the pump, these protective devices must be removed. No contamination can be allowed to remain inside the pump.

**Note:**

Depending on the pumping medium, the inside of the pump must be cleaned of oil residue. Use a cleaning agent to do this that will not damage the mechanical seal or the pump material. Make certain the pump is carefully dried after cleaning.

Suitable cleaning agents include rectified spirits, Ritzol 155 or suds with a high alkaline content. If steam jet cleaners are used, allow the solvent to act first.

If possible do not use steam jet cleaners. If you do, make certain not to damage the electric motor and bearings during use.

### 2.2.3 Assembly

The pump generally comes premounted and is therefore ready for installation.

In special cases the pump is delivered without a drive motor. Connect the drive to the pump before the pump is mounted in the system.



Check to ensure the pump is running easily and freely before starting assembly. Other external accessories such as air chambers, etc., that are not premounted on the pump in the factory should not be connected until after the pump is installed in the system or on the pump foundation.

## 2.3 Setting Up and Connecting

**Explosion protection / safety instructions**

Electrical equipment that will be operated in areas subject to the risk of explosion must meet explosion protection requirements. These are identified by the factory plate on the motor. For installation in areas subject to the danger of explosion, applicable local regulations for explosion protection and requirements of the test certificate included with delivery, which was issued by the office responsible for testing, must be observed. The test certificate included with delivery must be kept in a safe place at the installation location (for example in the supervisor's office, etc.).



### 2.3.1 Before starting to set up, check the following

- Is the machine / system / container connection prepared according to the dimensions of the dimension sheet / installation diagram?
- Do the concrete foundations have sufficient concrete strength (min. B 15) per DIN 1045?
- Is the concrete foundation hardened?
- Is the surface horizontal and even?



#### **Stability - risk of injury!**

Pump with large drives that are installed vertically are top-heavy. These pumps must be secured against tipping during assembly or disassembly, for example by using retaining ropes.

### 2.3.2 Installation and Set-up of the Pump

Except for the special design, pumps are always placed on a base plate with the pump, bracket or motor mount and fastened with bolts.

For assembly on a foundation, the centrifugal pump must be aligned with a spirit level.

#### **Pump with angle base**

For installation on a foundation, the unit must be aligned using a spirit level on the pressure connection.

#### **Installation on motor mounts**

Alignment as for angle base. For certain motor sizes, the motor mounts must be supported underneath (see installation diagram).

### 2.3.3 Connecting the Pipelines



The pump must never under any circumstances be used as a point for securing the pipeline. No forces or moments (for example caused by warping or heat expansion) from the pipelines may be allowed to affect the pump. Pipes must be intercepted directly before the pump and connected with no tension.



#### **Danger of death! When working with hot, corrosive and toxic pumping media!**

If pipeline forces are exceeded, points with faulty seals may develop on the pump itself or on the flange connections, which may result in powerful ejection of pumping medium.

For short pipelines, the nominal widths should at least match those of the pump connections. For longer pipelines, determine the most cost-effective nominal width from case to case.

Transition pieces to larger nominal widths should be designed with an expansion angle of about 8° to prevent increased pressure loss.

The suction line rises continuously to the pump. Lay pipelines continuously falling for the supply to prevent air lock from forming.

Depending on the type of system and pump, installation of backflow prevention valves and shut-off elements is recommended.

Expansion of pipelines due to temperature must be countered by suitable measures. We recommend installing compensators in the pipeline.

Always avoid fittings in pipelines that close suddenly (rapidly). Pressure peaks which occur as a result of these fittings may exceed the maximum permissible housing pressure of the pump several times over! To avoid strong pressure peaks, install pressure absorbers or air chambers.



After assembly is complete or before starting up the system, the containers, pipelines and connections must be thoroughly cleaned, rinsed and blown out with air.

Often welding beads, pipe scale and other impurities do not come loose until some time has passed. They must be kept out of the pipe by installing a sieve in the suction line. The open cross-section of the sieve must be at least three times the cross-section of the pipeline to prevent too much resistance from building up due to trapped foreign objects. Experience shows that hat-shaped sieves containing a mesh wire net with a mesh size of 2.0 mm and a wire diameter of 0.5 mm and made of corrosion resistant material are effective.

### **2.3.4 Electrical Connection**

The electrical connection for the pump should only be made by a company specialising in electrical systems that is approved by the power provider, taking into consideration the technical connection requirements.

Connection tasks must only be performed by a certified installation electrician.

Applicable DIN VDE regulations 0100 and for explosion protection 0165/ IEC 60079-14 must be observed.

Compare the existing mains power supply with the information on the factory plate of the motor and select a suitable circuit.

### **Direction of Rotation Check**

The direction of rotation of the motor must match the direction indicated by the direction of rotation arrow on the spiral housing of the pump. Check by switching on and off briefly.

If the direction of rotation is incorrect, reverse any two phases L1, L2 or L3 of the mains power supply line in the motor terminal box.

### **Auxiliary Equipment for Motor**

If special control devices are provided, for example in conjunction with use of the pump in a technical system, the manufacturer's instructions for these control devices must always be observed.

We recommend using a motor protection device. Motors with explosion protection must always be connected using a motor protection switch.

Connect the motor according to the circuit diagram in the terminal box or as shown in 2 or 3.

**Circuit Δ (low voltage**

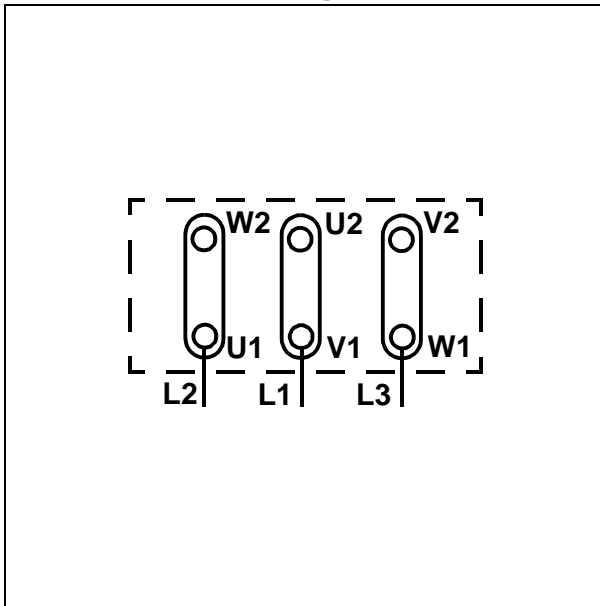


Fig. 2: Connection diagram for three-phase motors, circuit Δ

**Circuit Y (high voltage**

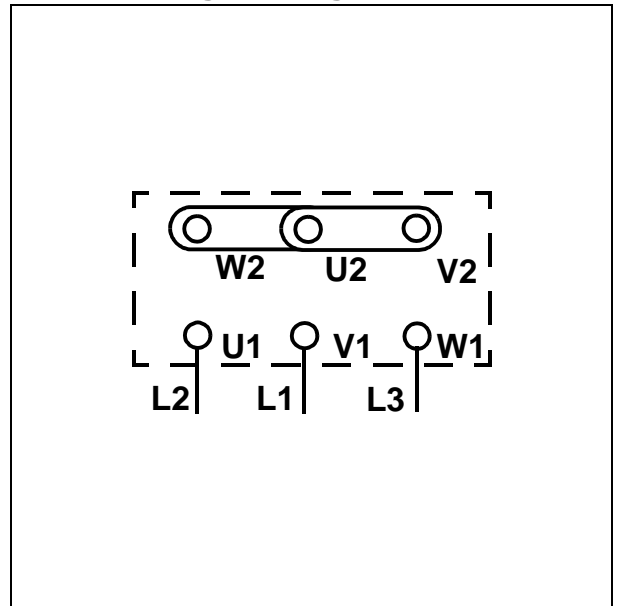


Fig. 3: Connection diagram for three-phase motors, circuit Y

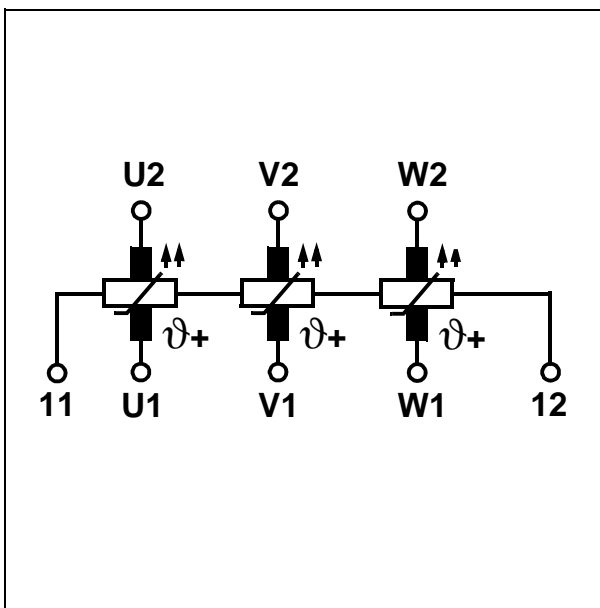


Fig. 4: Temperature sensor built into the bracket head and insulated. (Max. permissible voltage 2.5 V per sensor)

**Time Relay Setting**

For three-phase motors with star-delta connection, you must ensure that the switching points between star and delta follow one after the other in as little time as possible. Longer switching times will result in damage to the motor. Time delay setting for star-delta connection: < 3 sec.

### 3 Pump Operation

#### 3.1 Initial Commissioning

Make certain the following preconditions are met before initial commissioning of the pump:

- The pump is connected electrically with all protective devices in accordance with requirements.
- The pump is filled with pumping medium and is receiving supply.
- All shut-off elements are open on the suction end and the suction line is vented.
- **Make certain:** Dry running results in increased wear and must always be avoided!
- Rotating parts of the pump must be provided with a contact safety device (in accordance with German accident prevention requirements (UVV) the pump may only be operated with a contact safety device).
- The pump shaft has been tested to ensure it moves easily
- The direction of motion has been checked.

##### 3.1.1 Starting the Pump

The pump must only be turned on with the pressure-end shut-off element half open! Do not open it until full speed is reached. Then slowly open it and adjust control to the operating point.

#### 3.2 Operation

##### 3.2.1 Operation Monitoring

In most cases the pump is controlled from the central control unit of the entire system. Data associated with the design of the pump and related to the intended purpose (see specification) must be observed as a precondition for problem-free functionality.



It is especially important to observe the points listed below during manual operation of the pump:

1. **Temperature of the pumping liquid.** -Do not operate the pump at temperatures higher than those listed in the original specification.
2. **Switching frequency.** - To avoid large temperature increases in the motor and excessive load on the pump, motor and bearings, the permissible rate of one switching-on process per minute must not be exceeded.

With motor output	Max. number of switchings/h
Up to 3 kW	20
From 4 to 11 kW	15
From 11 to 45 kW	10

3. **Minimum quantity.** -If the nature of the system includes the possibility of running against the shut-off element closed on the pressure end, a minimum flow of (for t -30 to +70 °C) - 15% of Qopt.  
(over +70 to +110 °C) - 25% of Qopt must be provided.
4. **Density of the pumping liquid.** - The power consumption of the pump varies proportionally to the density of the pumping medium. To avoid overload on the motor, the density must match the specification data.

### 3.2.2 Other Requirements

Installed reserve pumps must be placed in operation briefly once a week to ensure they are ready for operation. The duration of operation should be about 15 minutes each time.

## 3.3 Notices of Incorrect Operation

### 3.3.1 General Information

Operation by means of a central control system ensures that incorrect operation is largely excluded.

For manual operation, but also with system control, observe the following instructions.

Avoid damage to the pump and make certain that:

- The pump always runs quietly and without vibration.
- The pump does not run dry.
- Extended operation against a closed shut-off element is avoided to prevent the pumping medium from heating up. The required minimum pumping quantity is present (see section 3.2.1).
- The maximum permissible room temperature of + 40° C is not exceeded.
- The ball bearing temperature does not exceed + 50° C above room temperature, or in any case + 90° C (measured on the outside of the motor housing).
- When the pump is in operation the shut-off element is not closed in the supply line.

### 3.3.2 Faults

When faults occur while the pump is in operation that are not caused by the control system or other external errors, follow these steps:

1. Pinpoint the fault or malfunction.
2. Determine the cause.
3. Eliminate the fault.

Chapter 8 **3.5 „Troubleshooting“** contains a table with the most frequent flow faults, their causes and recommendations for eliminating them.

### 3.4 Shutdown

1. Close the shut-off elements in the pressure and suction lines. If a backflow prevention valve is installed in the pressure line, the shut-off element can remain open provided counter pressure is present.
2. Turn off the motor. Make certain run-out is quiet. Depending on the system, when the heat source (if present) is turned off, the pump should have sufficient coast-down until the pumping medium temperature is reduced enough so that heat backup in the pump is avoided.
3. Close the shut-off element in the pressure line.



If there is danger of freezing and/or for extended periods of standstill, the pump must be emptied and/or protected against freezing (auxiliary heating).

### 3.5 Troubleshooting

Pump stopped	Flow rate of the pump is too low	Motor overload	Pump end pressure too high	Increased bearing temperature	Pump leaking	Pump not running quietly	Temperature of pump is too high / too low	Oil level indicator too high / too low	Cause of the malfunction	To eliminate the malfunction
	X								Pressure against which the pump is pumping is too high	Readjust the operating point
	X								Counter pressure too high	System contaminated Reduce the gap between the wear plate and the open impeller. Install a new impeller (*)
	X					X	X		Pump / pipelines not fully vented	Vent and fill with liquid
	X								Supply or impeller blocked	Eliminate the cause in the pipeline or pump
	X								Air lock formation in the pipeline	Change pipeline or install new venting valve
	X					X	X		Suction lift too great / NPSH system too low (supply)	Correct fluid level/level control. Install pump lower, fully open fittings in the suction line, reduce the resistance of the supply line, clean the sieves and suction connection.
		X							Non-return flap does not open	Check the non-return flap, venting line immediately before non-return flap
	X				X	X			Wrong direction of rotation	Reverse 2 phases in the terminal box
	X								Speed too low	Increase speed (*) (new motor may be required)
	X					X			Worn internal parts (for example impeller), foreign objects in the pump	Replace worn parts, remove foreign objects from the pump housing
		X				X			Counter pressure is lower than what is indicated in the design (specification).	Reset the operating point precisely, throttle to increase counter pressure, screw out impeller if necessary (*), larger motor (*)
		X							Density or viscosity of the pumping medium is higher than specified	(*) (Pump must be retuned)
					X				Shaft seal worn or Sealing ring faulty, sealing ring old, dry running	Check the sealing liquid level. Replace the shaft seal. Replace the seal
		X	X						Motor connected incorrectly	Circuit diagram, see section 2.3.4, observe instructions
				X	X	X			Pump poorly aligned	Align accurately
				X	X	X			Pump braced or resonance vibrations in pipelines	Check pipeline connections or pump fastenings, connect pipelines with compensators.
				X					Increased axle thrust	Clean the relief holes in the impeller
				X		X			Bearing faulty; not enough, too much or the wrong lubricant	Replace bearing, add or reduce lubricant or replace completely
				X					Connection distance not observed	Adjust distance correctly
	X	X							Motor running on 2 phases	Check/repair fuse and line connections
				X	X				Impeller is unbalanced	Clean impeller, balance impeller (*)

Pump stopped	Flow rate of the pump is too low	Motor overload	Pump end pressure too high	Increased bearing temperature	Pump leaking	Pump not running quietly	Temperature of pump is too high	Oil level indicator too high / too low	Cause of the malfunction	To eliminate the malfunction
								X	GLRD (mechanical seal) faulty	Too low = GLRD faulty on motor side Too high = GLRD faulty on pump side Usually both must be replaced! (in pairs)
								X	Foam forms	Use the correct sealing medium, see section 4.2.5 (sealing medium in the catchment chamber system)
X									Foreign objects in the pump Motor bearing faulty	Remove foreign bodies Clean or replace pump housing Replace motor bearing
X									Circuit breaker was tripped by motor overload, circuit breaker rating too low, coiling faulty	Throttle pump, smaller impeller diameter, check electrical connection (compare with motor plate), larger motor or replace stator (*)
	X					X			High amount of air in the pumping medium	Degas the pumping medium
						X			Cavitation	Throttle pump on pressure side
			X		X				With plug-in shaft, clamping ring not correctly assembled	Align the shaft or assemble the clamping ring correctly. Assemble the slots of the shaft and clamping ring on opposite sides

(\*) Consult the manufacturer



## 4 Maintenance / Repair

### General Information

The operator must ensure that all inspection, maintenance and repair work on the pump is performed only by authorised and specially trained personnel. The operator must ensure that personnel is sufficiently informed through thorough study of the Operator's Manual.

We recommend creating and following a maintenance plan. This will help you to avoid costly repairs and achieve problem-free and reliable operation of the pump.

Only original spare parts may be used for repairs. This applies especially to the mechanical seal (GLRD).

When working on the **motor**, the manual of the relevant motor manufacturer and instructions in it must be followed.



#### **Danger of death!**

Normally work on terminal boxes and on machine control must only be performed with the electrical connections unclamped or the power turned off to avoid electrical shocks.



#### **Danger of injury and death!**

During checks and maintenance work, secure the pump against being turned on unintentionally (turn off the power).

### 4.1 Maintenance / Inspection

The following information should be used to create a maintenance plan. It consists of minimum recommendations that must be adjusted and if necessary supplemented as required by local specific details of the actual installation site.

#### 4.1.1 Checks

##### Continuous checks:

- Pumping data for the pump (pressure, quantity)
- Current consumption

##### Daily checks:

- Pump running = quiet with no vibration
- Storage temperature
- Mechanical seal leakage
- SKS (catchment chamber system) has no sealing pressure = Check fluid level

##### Check / replace every 6 months:

- Check if screws are tight
- If system has SKS, change sealing medium

The mechanical seal (GLRD) must be inspected as part of a system overhaul after 8000 operating hours. If the mechanical seal is removed during the system overhaul, it must be replaced by a new one.

#### 4.1.2 Lubrication and changing lubricant

Centrifugal pumps of type NB / FB / WP / SM / F in the standard design have a bearing in the drive motor only. The bearings in smaller motors are designed to last for life and have permanent grease lubrication that cannot be relubricated. Faulty bearings must be replaced.

Bearings in larger motors must be relubricated on a regular basis. See also the "Operator's Manual for Pump Drives" in **section 6.2 "Motor Bearings"**.

#### 4.2 Repair

##### General Information

Repair work must be performed on the centrifugal pump only after removal and in a suitable workshop.

Observe all general instructions at the beginning of the chapter!

The following instructions will allow you to disassemble the pump and reassemble it properly with the necessary new parts.



Note the exploded drawing under the Spare Parts section / drawings at the end of this Operator's Manual!

Special instructions must be followed when installing a new mechanical seal.

Other than this exception, jobs can be performed with standard workshop tools. Special tools are not required. After disassembly, clean all the individual parts of the pump. Check the individual parts for wear and damage. Parts that are not in flawless condition must be reworked or replaced.

#### 4.2.1 Preparations for Disassembly

Before starting disassembly, the pump must be secured so that it cannot be turned on (turn the power off). Place a warning notice on the switch cabinet!

If the system is in operation, inform the shift manager.

**When performing the jobs described below, take local regulations and specific features into consideration.**

#### 4.2.2 Disassembly / Removal of the Pump

The pump must have reached ambient temperature.

- Disconnect the power supply.
- Close the fittings (suction and pressure-end).
- Empty the pump through the drain screws 912, 913.
- If the system has a catchment chamber / pressure chamber, empty it through the drain screws 912. Dispose of the sealing medium properly.
- Unclamp the motor.
- Disassemble any additional connections that are present.
- Loosen the pressure and suction connections.
- Loosen the pump from the base plate.
- Lift the pump out completely.



When **emptying** the pump observe the following instructions!

1. If the pump has been used with liquids that endanger health, make certain when emptying the pump that there is no danger for persons or the environment.
2. Wear protective clothing and a safety mask to the extent necessary!
3. The rinsing and residual liquid in the pump must be disposed of properly without endangering persons or the environment.
4. Pumps which pump liquids that endanger health must be decontaminated. When draining the pumping medium, make certain that there is no danger for persons or the environment.
5. Legal requirements must be strictly observed.

### 4.2.3 Disassembly / Dismantling the Pump

#### Before beginning

Do not begin working until you have checked to ensure:

- that all necessary spare parts are present and they match the pump or the version of the pump you have, or that damaged parts which may still be discovered can be obtained in short order.
- that you have all tools and auxiliary equipment required for work.



Use only original spare parts for repairs!

Observing these instructions is a precondition for problem-free operation of the pump and for honouring any warranty claims that may be submitted.

**Customer Service:** Schmalenberger offers a 24-hour service for spare parts delivery!

### 4.2.4 Dismantling the Pump

#### Step 1:

Loosen the spiral housing fastening screws item 902.01 and corresponding nuts item 920.01. Remove the spiral housing. To loosen the seating, strike the spiral housing several times with a soft-face hammer directly next to the seating on the pressure cover.

Remove the gasket item 400 from the pump housing and pressure cover.

#### Step 2:

Loosen the impeller nut item 922 and unscrew it from the motor shaft item 819.

Pull the impeller item 233 off the motor shaft item 819. You will need an extractor to do this.

Take the keys item 940 out of their seating.

#### Step 3:

Remove the distance washer item 554. Remove the mechanical seal item 433.

#### Step 3:

##### Version 1 = Pressure cover clamped in:

Loosen the pressure cover item 163 from the motor bearing flange and pull it off of the shaft. If it will not come loose, a few light taps with a soft-face hammer should help. Make certain when doing so not to damage the counter ring.

##### Version 2 = Pressure cover screwed on:

Loosen the nuts item 920.01 and unscrew them. Carefully pull off the pressure cover item 163.01. If they will not come loose, a few light taps with a soft-face hammer should help. Make certain when doing so not to damage the counter ring.

**Step 5, catchment chamber systems (SKS)**, (see Fig. "Type SKS /GLRD Tandem (TLS)" and Fig. "Type SKS / GLRD Back to Back (catchment chamber)" in chapter "Spare Parts".):

Unscrew the nuts item 920.01 on the pressure cover item 163. Loosen the pressure cover item 163 and carefully remove it. As you do so, make certain not to damage the counter ring.

Identify where the double mechanical seal (GLRD) is seated on the shaft for reference during reassembly. Loosen the threaded pin in the set collar item 506 to loosen the GLRD from the shaft and then remove it.

Unscrew the nuts item 920 on the motor flange. Remove the catchment chamber from the motor flange. If it will not come loose, a few light taps with a soft-face hammer should help. Make certain when doing so not to damage the counter ring.

### **Arrangement: Tandem**

Removal of the front GLRD is as described in steps 1-3. Removal of the rear GLRD is as described for Back to Back.

## **4.2.5 Mechanical Seal (GLRD)**

The mechanical seals used in the centrifugal pumps are not wear-free. Before removing the pump, check the mechanical seals for damage. Always completely replace damaged mechanical seals.

Note also the instructions below.

Three different versions of mechanical seals are installed in the pumps. Please observe the pump specification.

1. Standard design without SKS (catchment chamber system)
2. SKS without sealing pressure (GLRD Tandem), (see Chap. 7)
3. SKS with sealing pressure (GLRD Back to Back), (see Chap. 7)

### **Standard without SKS**

In the standard design, the mechanical seal is inserted between the motor and pump. This design is available in two forms.

- Without pressure relief, max. perm. pressure 13 bar
- With pressure relief, max. perm. pressure 25 bar

#### 4.2.6 Reassembling the Pump

Assembly is essentially disassembly in the reverse order.

To prepare for assembly, please note:

- Thoroughly clean contamination from all individual parts.
- Check all parts for wear. Damaged parts must always be replaced by new ones.
- Always replace the clamp gaskets and O-rings with new ones. Grease O-rings before installation. Exception: Do not grease the O-ring on the mechanical seal (on the counter ring). For more information, see the special instructions for assembly of the mechanical seal (GLRD).
- When assembling the screw connections, tighten crosswise. Use a torque wrench to do this.

Recommended **tightening torques** for thread types DIN 13 are shown in the following table

<b>Screw class:</b>	<b>5.6</b>	<b>6.9</b>	<b>8.8</b>
Screw Ø <b>M8</b>	10.8	21.6	25.5 NM
Screw Ø <b>M10</b>	21.6	42.0	50.0 NM
Screw Ø <b>M12</b>	38.2	73.5	87.2 NM
Screw Ø <b>M16</b>	93.2	178	211 NM

These figures apply to new screws, unlubricated. Capacity utilization of screw yield strength is 90%.

#### Installation of GLRD

Preparation:

Increased cleanliness must be ensured in the immediate vicinity of where the GLRD (mechanical seal) is installed.

#### Auxiliary material:

- Propyl alcohol + paper tissue (no cleaning cloths!)
- O-ring lifter
- Water and rinsing agent

**Follow these steps:**

- Unpack the mechanical seal and check for damage.



Never place slide rings and counter rings on the contact surface without a protective cover.

- Thoroughly clean all contact surfaces with propyl alcohol and paper tissues.
- For mechanical seals with elastomer bellows, to avoid friction when mounting the seal, wet the bellows and shaft with wetted water (add rinsing agent) or with rinsing agent only.



**Do not under any circumstances use oil or grease** as a mounting aid!

- Cover the contact surface with a cardboard disk.
- Slowly and continuously press the counter ring into the receptacle seating. Use wetted water or rinsing agent as a gliding agent.
- Check the counter ring to ensure it is seated perpendicular to the shaft axle.
- Clean all contact surfaces with propyl alcohol and paper tissues so they are free of streaks.



Do not touch the contact surfaces after that with your bare fingers.

- Push the rotating unit (bellows unit and slide ring) on the shaft with slight clockwise rotation until the slide ring is resting on the counter ring. Then push the set collar further on up to the mark and fasten it in place to maintain the required pretension. As you are doing this, apply assembly forces only through the rear winding of the compression spring.

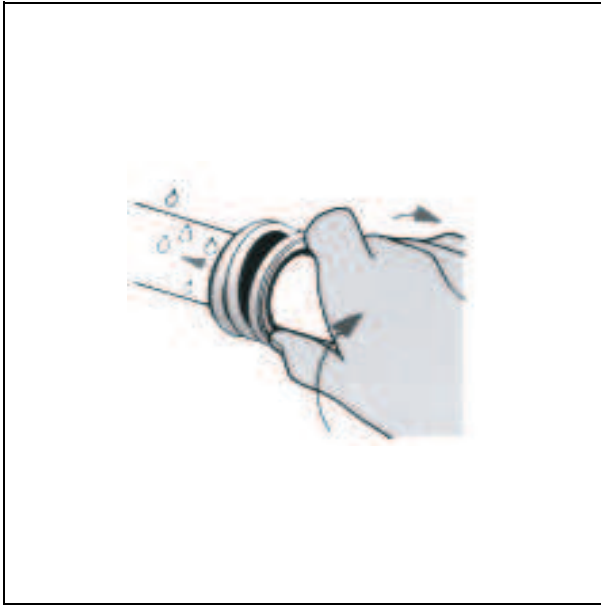


Fig. 5: GLRD assembly

For "Back to Back" arrangement and for mechanical seals (GLRD) without catchment chamber system (SKS), the required pretension is generated by assembling the pressure cover or impeller.



Use a suitable guide sleeve to push the mechanical seal through the keyways etc. without damage. You can order suitable guide sleeves from Schmalenberger GmbH + Co.

In exceptional cases you can also use the following method. Wrap a thick, clean plastic sheet around the shaft, for example a polyethylene transparent cover, and push the slide ring over it and onto the shaft.

- Check the angular rings (spring plate), spring and slide ring to ensure they are tight.

Then continue with the assembly of the pump by attaching the impeller.



## 5 Appendix

### 5.1 Decommissioning / Placing in Storage / Preservation

Every pump leaves the factory in carefully mounted condition. If commissioning will not take place for an extended time after delivery, we recommend the following measures for storage of the pump.

#### 5.1.1 Placing New Pumps in Storage

If requested, new pumps have preservation protection according to the storage time specified by the customer when the pumps are ordered. If this time is significantly exceeded, the condition of the pump must be checked and the pump must be represerved if necessary.

#### 5.1.2 Extended Decommissioning > 3 Months

##### 1. Pump remains installed

To ensure the pump is always ready for operation and to prevent accumulation of residue from forming inside the pump and in the immediate area of the pump supply, the pump unit should undergo a functional run briefly (about 5 minutes) at regular monthly to quarterly intervals when it is shut down for extended times. As a precondition, the pump must be filled with sufficient liquid.

##### 2. Pump has been removed and placed in storage

To remove the pump, take the measures listed in chapter 4 „Maintenance / Repair“. Before the pump is placed in storage, it must be thoroughly cleaned and preserved. The pump must be preserved inside and out.

#### 5.1.3 Recommissioning after Being Placed in Storage

##### Removal of preservation

Before the pump that was in storage is installed, the preservation material with which it was coated and/or filled must be removed. To do this, follow the instructions in section 2.2.2 „Cleaning“.



After an extended storage time under preservation conditions, check elastomer parts (O-rings, mechanical seals) to ensure they have retained proper shape and elasticity. Brittle elastomer parts must be replaced. Elastomer parts made of EPDM must always be replaced.

##### Recommissioning

Reinstall pumps that had been removed as described in section 2.3 „Setting Up and Connecting“.

Immediately after work is complete, all safety and protective equipment must be put back in place and/or placed in operation again.

Before recommissioning of the installed pump, the checks and maintenance measures described in section 4.1 must be performed. Before using the pump again, all the items listed in section 3.1 „Initial Commissioning“ must be observed.

**Special features of mechanical seals:**

Before initial commissioning and after an extended down time, or after installation of a new mechanical seal, always check for smooth operation.

Due to adhesive forces, the slide ring and counter ring may cling together strongly. When this happens, the driving spring does not have sufficient traction to break the slide ring free. Then the shaft runs into the fixed seals and driving spring, which results in damage. Remove the fan hood and rotate the fan wheel in the direction of the arrow indicating direction of rotation. If you encounter resistance and the fan wheel springs back, the mechanical seal must be removed and the slide and counter rings must be carefully separated. Try not to rotate the shaft forcefully.

## 5.2 Disposal

If you want to shut down the pump permanently and take it out of operation, observe local regulations for disposal of industrial waste.

**Danger of death / danger of poisoning!**

Pumps that have pumped toxic, corrosive or other chemical substances which represent a hazard to people and animals must be thoroughly cleaned and/or decontaminated before disposal.

The cleaning agents and remaining pumping medium must also be handled according to legal requirements.

If legal requirements in the pump operator's area so stipulate, the pump must be broken down and separated into different materials which must then be disposed of separately.

## 5.3 Documents for the pump drive

The following documents created by the motor manufacturer are enclosed:

- Operator's Manual
- Dimensional diagram

For complaints related to the pump motor, please contact us or the motor manufacturer.

## 5.4 Dimension sheet

The enclosed dimension sheet corresponds to the pump delivered to you.

You are not authorised to make dimensional changes to the pump. Please remember, **tampering with the pump delivered to you will void warranty claims.**



Always follow the instructions of the other applicable documents listed in the Operator's Manual, see section 1.3!

## 5.5 Important Information

### 5.5.1 Factory Repair

Please note the following instructions when returning the pump for repair.

1. If you send the pump in to the manufacturer's plant for repairs or modifications, include exact information about the medium pumped by the pump



2. If the media that were pumped are toxic or corrosive, etc. always enclose a copy of the safety sheet for the media!

3. Only completely emptied and cleaned pumps are accepted for repair.

## 5.6 Spare Parts List / Drawing

The "**Spare Parts**" section contains lists of spare parts and an exploded drawing of your pump. Please note your pump type and the corresponding design.

The **Complete List of Spare Parts** shows the parts of all pump types. Not all parts are installed in every pump.

### 5.6.1 Ordering Spare Parts

When ordering spare parts, always specify the following important information:

- Pump number and type designation, alternatively the motor number
- Pumping medium
- Item number from the spare parts list
- Name of the part
- Material information from the specification or confirmation of order

You will find the pump number on the nameplate, which is fastened onto the fan hood of the motor.

The confirmation of order or motor number may also be helpful.

This will help us deliver the right spare part for your pump!

### Customer Service:

Schmalenberger offers a 24-hour service for spare parts delivery!

Please visit our homepage at:

[www.schmalenberger.de](http://www.schmalenberger.de)

Address of main office:

Schmalenberger GmbH+Co. KG  
 Postfach 2380  
 D-72072 Tübingen, Germany  
 Phone: + 49 (0) 7071 - 7008-0  
 Fax: + 49 (0) 7071 - 7008-59

## 6 Pumps with Norm Motors

If your pump is equipped with an IEC norm motor as a drive, there is a connection for the shaft bearing between the pump and the motor.

- Version 1: Bearing retainer with 1 ball bearing
- Version 2: Intermediate lantern with plug-in shaft and without ball bearing
- Version 3: Bearing pedestal with 2 ball bearings and coupling

The bearings are closed and have permanent grease lubrication. The coupling is designed to last for the service life in normal operation.

Three different versions of connection are installed in the pumps.

See illustration "Shaft assembly of bearing pedestal" in section "Spare Parts".

Please note your pump type and the corresponding design.

See illustration "Shaft assembly of bearing pedestal" in section "Spare Parts".

### 6.1 Disassembly (See illustration "Shaft assembly of bearing pedestal" in section "Spare Parts")

**Caution!**

Disconnect the power supply!

#### Version 1

- To replace the ball bearing of the pump, disassemble the pump as described in sections 4.2.1 to 4.2.5.
- Remove 1 protective panel from the bearing retainer. If present, loosen the threaded pin on the shaft.
- Loosen the bearing retainer item 330. Use the extraction thread and screws item 901 for this. Pull the shaft item 215 and ball bearing item 320 off the motor (801).
- Remove the shaft ring item 932.02. Pull the shaft with ball bearing off the bearing retainer.
- Remove the retaining ring item 932.01 from the shaft and pull the ball bearing off.

#### Version 2 (only if shaft is damaged)

- Disassemble the pump as described in sections 4.2.1 to 4.2.5.

**Note:**

The shaft item 215 is rigidly connected with the norm motor.

- Loosen the intermediate lantern item 146 and pull it off the motor item 801.
- Loosen the screw on the set collar item 506 and pull it off the shaft item 215.  
(During reassembly push the shaft item 215 as far as it will go onto the motor shaft)

**Version 3**

- Remove 1 protective panel from the bearing pedestal. If present, loosen the threaded pin on the coupling.
- Loosen the drive from the bearing pedestal item 332. Remove the motor item 801 with the upper half of the coupling. You can now replace the inner part of the coupling item 840.
- To replace the ball bearings (items 320.01 and 320.02) the pump must be removed and disassembled as described in sections 4.2.1 to 4.2.5.
- Remove the retaining rings (items 932.01 and 932.02) from the shaft item 211 and from the bearing pedestal item 332. Remove the ball bearing (items 320.01 and 320.02).

**6.2 Reassembly**

Assembly is essentially disassembly in the reverse order.  
See section 4.2.2.

- Clean all parts thoroughly and check them for damage or wear.
- Replace faulty parts!



Note:

Use only original spare parts for repairs!  
During reassembly **all** seals must be replaced!

Detailed manuals are available upon request.

## 7 Pumps with catchment chamber systems

Applies to pump types NB, FB, WP, SM, ZHB

Applies to the arrangement of mechanical seals (GLRD) "Back to Back" and "Tandem".

Supplement to the Operating Manual for NB, SM, FB, WP, ZHB.

Please read the relevant manual carefully and follow the instructions in it.

If any of the information is unclear, make certain to contact SCHMALENBERGER!

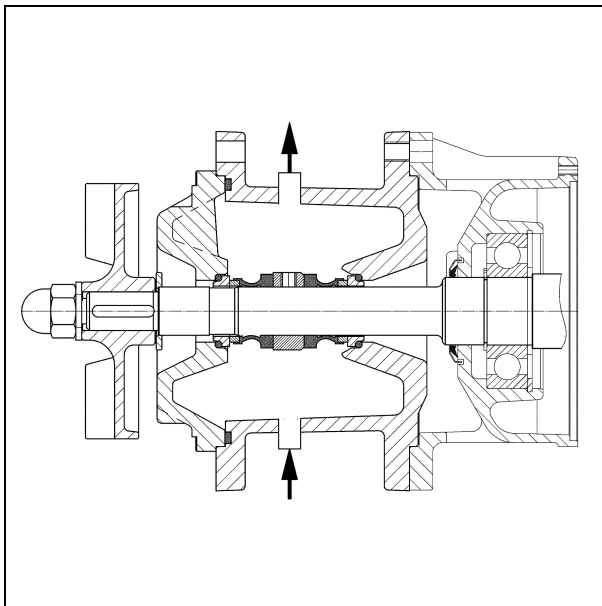


Fig. 6: System with sealing pressure (SK)  
GLRD "Back to Back"

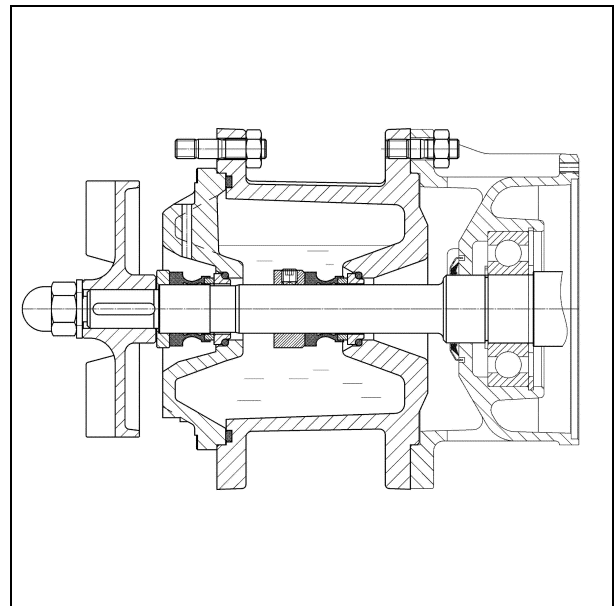


Fig. 7: System without sealing pressure  
(TLS) GLRD "Tandem"

Every person who is involved with the installation, removal, operation, commissioning and maintenance of the catchment chamber system (SKS) in the operator's facility must have read and understood the Operator's Manual and especially the safety instructions. We recommend to the operator having this confirmed in writing.

The catchment chamber system (SKS) meets very high quality standards (DIN EN ISO 9001) and provides reliable operation. However, the SKS may pose danger if it is not used properly or is used unprofessionally by untrained personnel.

The operator must determine what effects may be associated with the failure of the SKS and whether safety measures should be taken to protect persons or the environment.

The pump with integrated SKS (pump unit) must be set up so that failure of the integrated GLRDs cannot result in any personal injury caused by media spraying out and so that leakage can be disposed of properly.

Any type of operation that has a detrimental effect on the operating safety of the pump unit must be avoided.

Only trained, authorised and suitably instructed personnel are permitted to install pumps with integrated SKS, place them in operation, remove or repair them.

Work on the pump unit is only permitted when it is stopped and depressurized. Responsibilities for tasks must be clearly defined and observed so that there are no unclear areas of responsibility in terms of safety. In addition to the instructions given in this manual, generally applicable regulations for labour safety and accident prevention must be observed. Unauthorised conversions and changes that have a negative effect on the safety of the pump unit are not permitted.

## 7.1 Other Applicable Documents

This document is part of the pump documentation. This Operator's Manual also applies to SKS with slight modifications and/or in combination with pump types not mentioned here.

## 7.2 Usage Limits

Limits are determined mainly by the GLRDs that are used.

SK with sealing pressure (Back to Back):

Max. pressure in catchment chamber	12 bar
Max. pressure of the pump	11 bar
Sealing medium temperature (Back to Back) max.:	60°C

Without sealing pressure TLS (Tandem):

Max. pressure in catchment chamber:	0.5 bar
Max. pressure of pump:	12 bar
Sealing medium temperature (Tandem)	t max.:70 °C (oil!)

Higher loads (pressure, temperature) can result in more wear on the GLRDs and damage to contact surfaces or the elastomers. That in turn causes shorter operating times but also the risk of sudden failure of the seal with dangers for persons and the environment.

The mechanical seal should be chosen by a SCHMALENBERGER employee (type, suitability, materials) or other authorised services. SCHMALENBERGER assumes no liability for an incorrect selection made by third parties.

The pump unit must be set up so that the plug screws of the SKS remain easily accessible and it is easy to empty and fill the pump and check the fill level.

### 7.3 Improper Use

Operation outside of the conditions listed in section 7.2 „Usage Limits“ is not permitted. Before operating the SKS under other conditions or at a different location, please consult with SCHMALENBERGER to determine whether there are any concerns.

### 7.4 Description of the Product

SKS (catchment chamber system) requires a sealing medium to retain proper function. The purpose of the sealing medium is to divert heat that is generated and to prevent the medium being sealed off (on the pump side) to a great extent from entering into the sealing gap. The sealing medium completely fills up the space between the product and atmosphere-side GLRD.

### 7.5 System with sealing pressure (SK)

#### Commissioning and safe operation

In this SKS (catchment chamber system) the arrangement of the GLRD (mechanical seal) is "Back to Back". The function of this double-action GLRD is only ensured if the catchment chamber is completely filled with clean sealing medium.

**Caution!**

Before commissioning the pump unit, make certain the catchment chamber is filled with clean sealing medium.

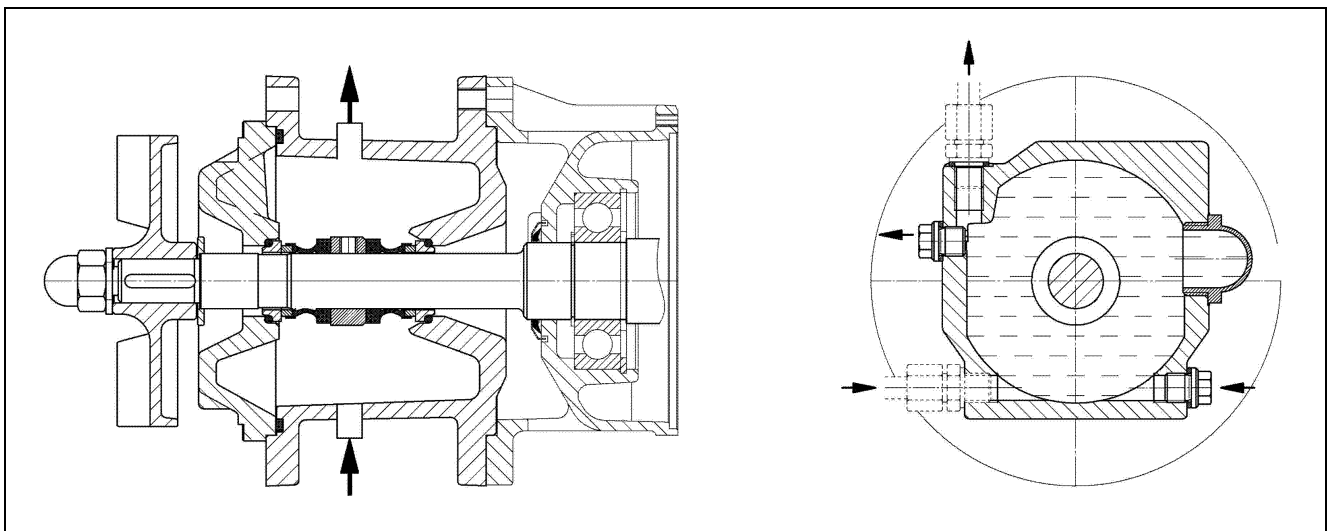


Fig. 8

**Caution!**

The pump unit was delivered with the catchment chamber empty. Due to the factory approval, however, the inside surfaces of the catchment chamber are wetted with oil. If the sealing medium is not compatible with mineral oil, the catchment chamber should be rinsed with a solvent before filling.



For systems with sealing pressure, constant circulation of sealing fluid must be ensured to provide safe and reliable operation. The sealing fluid must flow through the sealing space from bottom to top. We recommend placing the outlet of the sealing medium at the highest point on the SKS (catchment chamber system).

### **Laying lines for the SKS with sealing pressure**

When laying pipelines and hoses make certain no high points are created. The connection lines to the pump must always be laid rising to ensure self venting of the line. Our connections for sealing fluid have IG R1/4"

The pressure in the catchment chamber must always be 1-2 bar higher than the pressure in the pump so that the two seals only have to seal off the neutral sealing fluid. We recommend installing a pressure gauge to monitor pressure. The flow rate must be regulated so that the temperature of the sealing medium at the outlet is less than 60°C. The temperature difference between the intake and outlet must not exceed 15°C. The temperature of the sealing medium must never exceed the boiling temperature of the sealing fluid. We recommend monitoring the temperature of the sealing fluid.

The resulting flow rate can be determined by volumetric measurement. Under normal conditions a continuous rate of at least 3 l/min should be set.

If the stated operating limit data are observed and the instructions given in the manual are followed, the SKS (catchment chamber system) should operate with no problems.

## 7.6 System without sealing pressure

### Commissioning and operation

In this SKS (catchment chamber system) the arrangement of the GLRD (mechanical seal) is "Tandem".



**Caution!**

Before commissioning the pump unit, make certain the catchment chamber is filled with clean sealing medium.

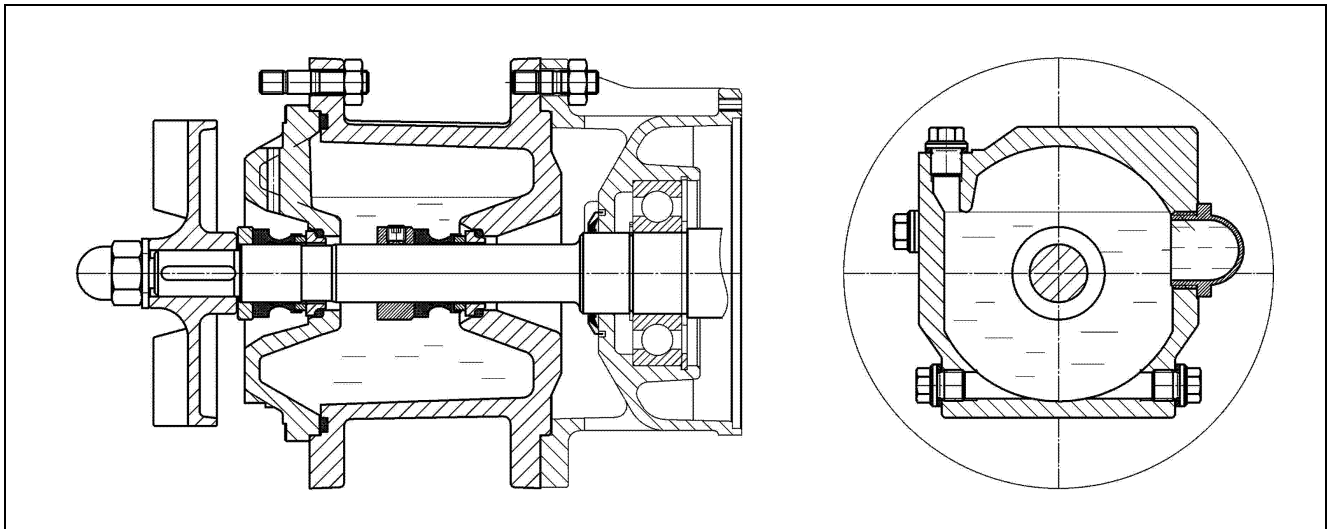


Fig. 9



**Caution!**

The pump unit was delivered with the catchment chamber full. A low alloyed mineral oil, 46 according to the ISO VG viscosity class, was used as the sealing medium. No synthetic oils may be used. (follow the instructions on the pump rating plate and in the Operator's Manual)

Before commissioning the pump unit, make certain the catchment chamber is filled with sealing medium. Filling must be exclusively through a filling hole located on the top of the SK housing.

### Use of the viewing glass. (manf. year 2009 and later): Version 2

If this hole is used, overfilling is not possible. The level of the liquid must be between the lower and upper edge of the viewing glass (quantity between 350 and 600 ml).

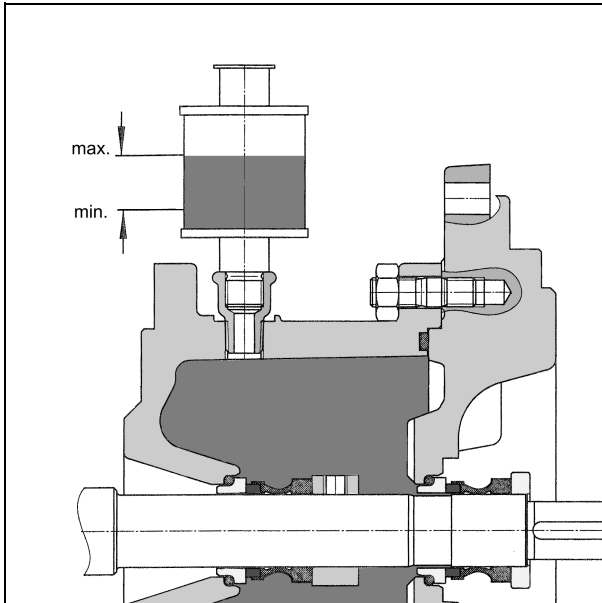
**When using glass container. (up to manf. year 2008): Version 1**


Fig. 10: Glass container

The minimum and maximum filling levels are marked on the viewing glass. The level of the sealing medium may increase while the pump is in operation due to heat. If the level is too high, the sealing fluid may flow out. However, that will not affect the functionality of the SKS.

To simplify filling the catchment chamber, an oil gun can be ordered from SCHMALENBERGER under item number 54199.

**TLS. safe operation**

To ensure safe operation, the catchment chamber must always be filled with a sufficient quantity of clean sealing fluid. The sealing fluid must exhibit good compatibility with the pumping medium. The slight overpressure in the catchment chamber of up to 0.5 bar is normal and serves as additional protection against the GLRD (mechanical seal) running dry.

The external temperature of the catchment chamber must not exceed 70°C in normal operation and must never exceed the boiling temperature of the sealing fluid. We recommend monitoring the temperature and level of the sealing fluid. The medium being sealed off must be in a liquid state against the GLRD (mechanical seal) of the SKS (catchment chamber system) in every operating state.

If the stated operating limit data are observed and the instructions given in the manual are followed, the SKS (catchment chamber system) should operate with no problems.

## 7.7 Sealing medium

The GLRDs require a sealing fluid to retain proper function. The purpose of the fluid is to divert heat from friction and to prevent the product from entering into the sealing gap. The sealing fluid fills up the space between the product side and atmosphere side GLRD.

### Requirements for sealing fluid:

- Compatibility with the medium being sealed off
- Suitability in terms of corrosion resistance of all parts in contact
- Free of solids
- Must not tend to form accumulations
- Good lubrication properties
- High specific heat capacity
- High evaporation temperature
- Environmentally friendly

### For SKS with sealing pressure we recommend:

Clean water with a low hardness rating in a closed circuit

### For SKS without sealing pressure we recommend:

Low alloy mineral oils; i.e. without EP (high-pressure) additives that tend to form accumulations, thin (max. rating 46 according to ISO VG viscosity class). For example Total CIRKAN RO 32 or

- Cool emulsion (coolant with at least 8% oil)
- Water/glycol mixture

The sealing medium must not damage the sealing materials either chemically (for example corrosion, embrittlement) or physically (accumulations, etc.).

## 7.8 GLRD Materials

The materials pairing of GLRD as a standard design (SiC/SiC + Viton ) may deviate from what is delivered! Note your pump specification. Usually the pump-side GLRD is designed medium-dependently.

## 7.9 Emissions, Personal Protection

A GLRD is a dynamic seal which cannot be leak-free for physical and technical reasons. The seal design, manufacturing tolerances, operating states and how smoothly the machine runs, etc. largely determine the leakage quantity. A GLRD has little leakage compared to other dynamic sealing systems.

The leakage may be in the form of a liquid or gas. How aggressive the leak is depends on the medium being sealed off.

If the seal fails, the medium being sealed off may spray out. The operator must arrange for and monitor preventive measures to protect against personal injury and damage to the environment such as putting spray protection in place, wearing safety goggles, etc., and must properly dispose of leaked materials.

### GLRD leak rates:

GLRD leakage must be selectively diverted and safely disposed of.

## 7.10 Maintenance / Inspection

### For SKS with sealing pressure:

- Check the pressure. The rinsing fluid must always be under pressure if the pump is in operation, including starting and switching off.
- Check the temperature of the rinsing fluid continuously
- With closed sealing systems: Check the condition of the rinsing fluid. If it has become dirty with leakage fluid, replace it.

### Perform the following checks for SKS (catchment chamber system) without sealing pressure:

- Check the level in the reserve container
- Check the temperature of the sealing fluid
- Inspect the sealing liquid to determine its condition

If you notice that the fluid level has risen above the "Max." mark or if the sealing fluid is significantly contaminated by leakage fluid, the liquid must be replaced. In this case check the GLRD (mechanical seal) as well and replace it if necessary.

In normal operation the oil should be replaced at least every 6 months, for emulsion at least every 3 months. In difficult conditions shorten these times as needed.

### In the Ex area:



#### Caution!

For explosion protection areas in accordance with Directive 94/9EC (Atex95), an additional Operator's Manual must be observed.

- Check the level, temperature and condition of the liquid in the catchment chamber continuously!
- Check the mechanical seal for proper function at regular intervals. A GLRD must never run dry!

The mechanical seal must be inspected as part of a system overhaul after 8000 operating hours.

If the mechanical seal is removed during the system overhaul, it must be replaced by a new one.

### 7.11 Repairs

When an SKS (catchment chamber system) is repaired, the GLRD are usually removed. If you have questions about disposing of the removed GLRDs, please contact SCHMALENBERGER.

If a repair needs to be performed at the usage location, they should be performed in a clean room and preferably by SCHMALENBERGER technicians or trained operating personnel. In any case the slide rings, counter rings, all elastomers and springs should always be replaced.

### 7.12 Spare Parts

Use only Schmalenberger original spare parts.

### 7.13 Removal and Reinstallation of GLRD (Mechanical Seal)



**Caution!**

Please use the NB, SM, FB, WP, F Operator's Manual for the pump. Section 4.2.4 „Dismantling the Pump“ Step 5.

### 7.14 Copyright

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Subject to technical changes for the improvement of the product even if such changes are not taken into consideration in this manual.

**8 Spare Parts**

**8.1 Type NB**

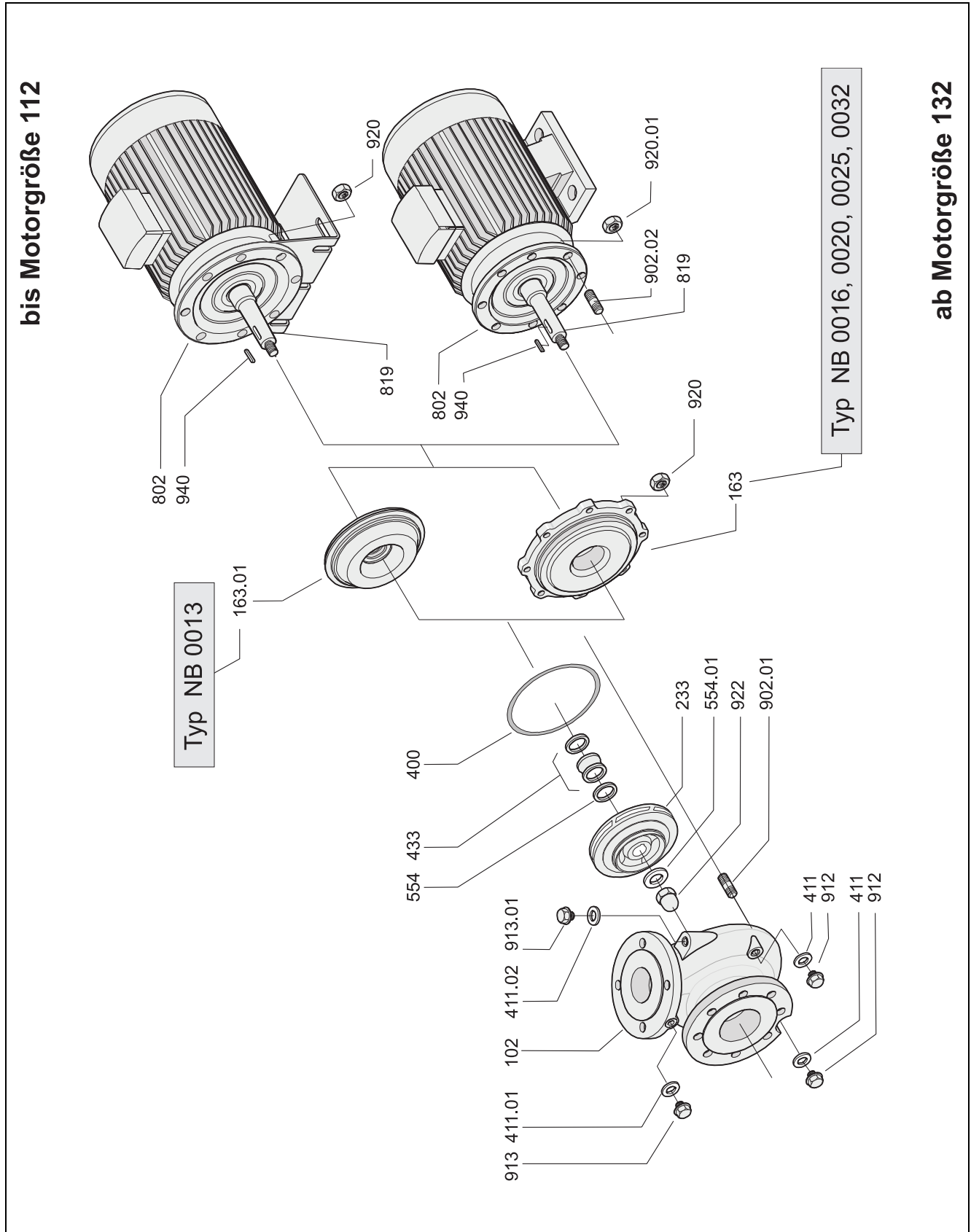


Fig. 11: Type NB

8.2 Type FB

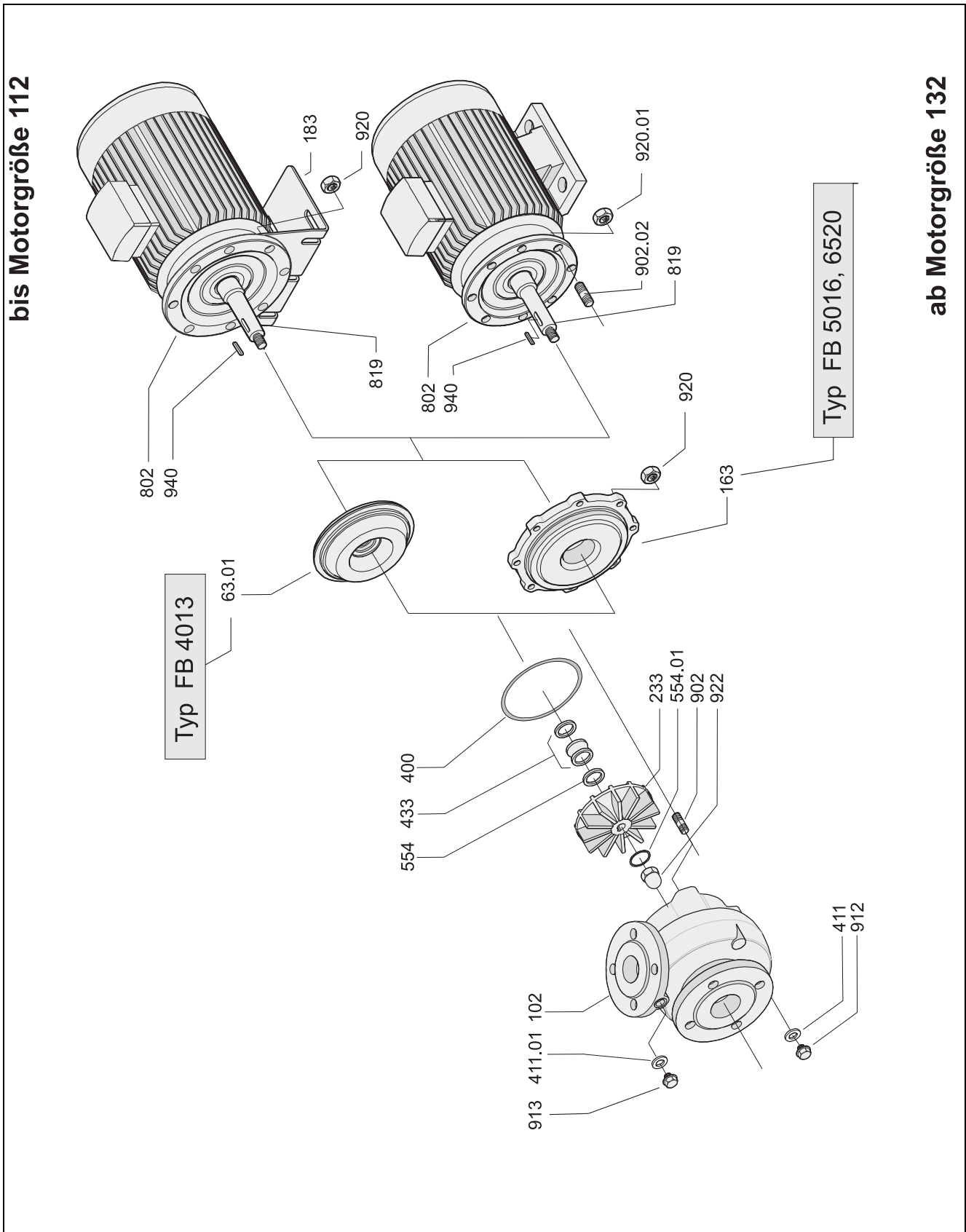


Fig. 12: Type FB



**8.3 Type WP**

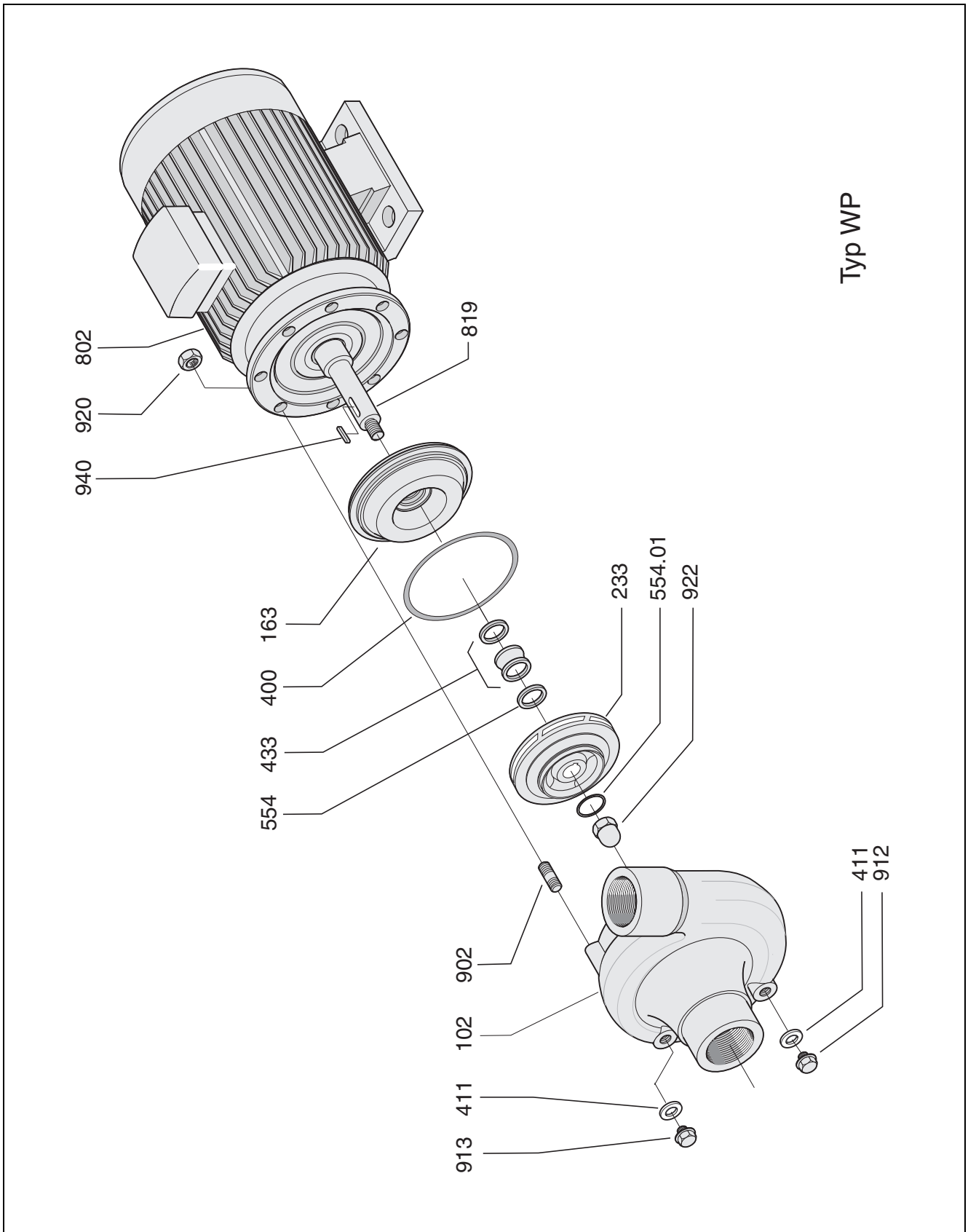


Fig. 13: Type WP

8.4 Type F

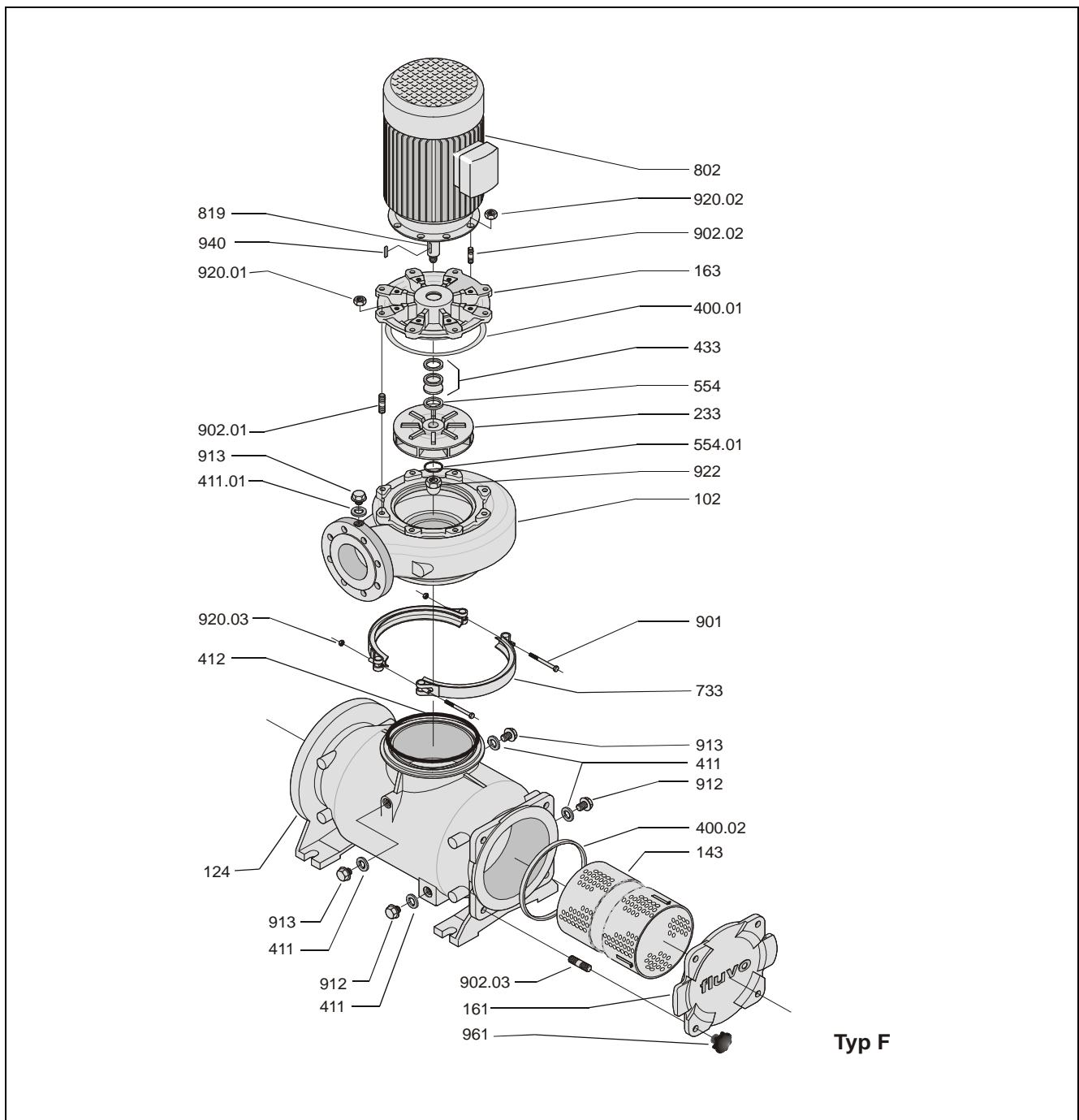


Fig. 14: Type F

**8.5 Type Optimo**

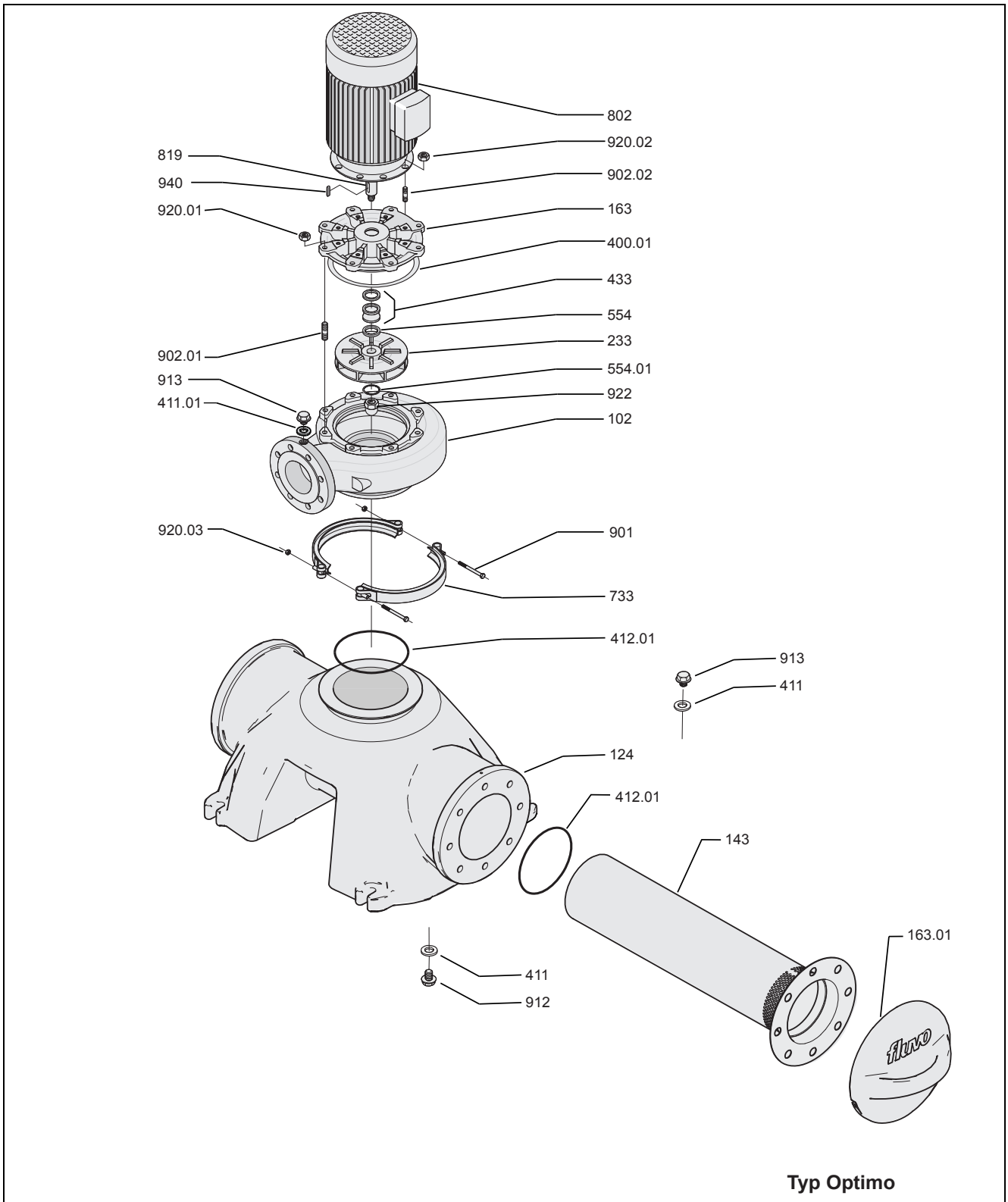


Fig. 15: Type Optimo



**Caution!**

Extended operation against closed shut-off elements must be avoided.  
We recommend installing a safety valve (max. 2.5 bar).

8.6 Type SM

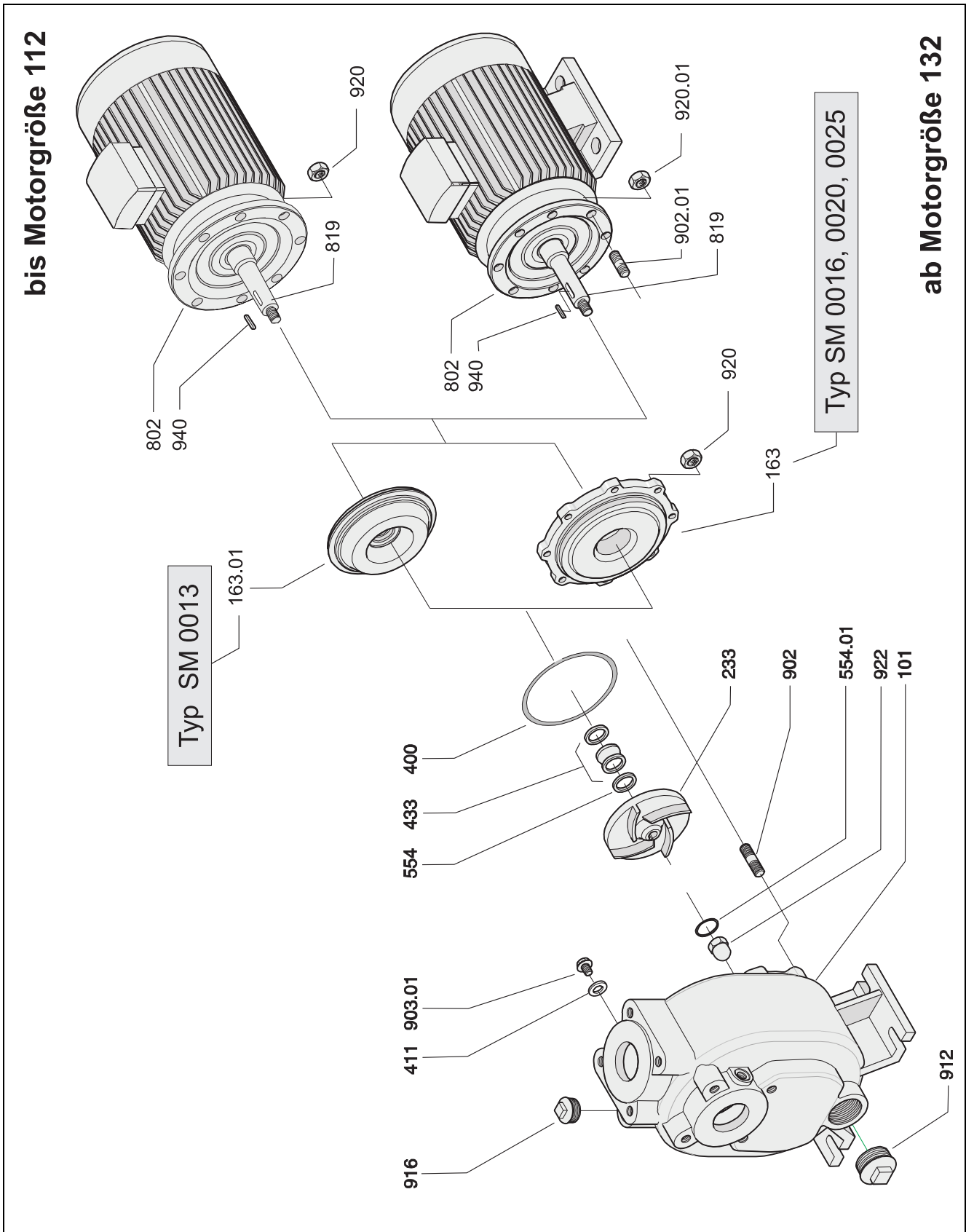


Fig. 16: Type SM

**8.7 Shaft assembly of bearing pedestal**

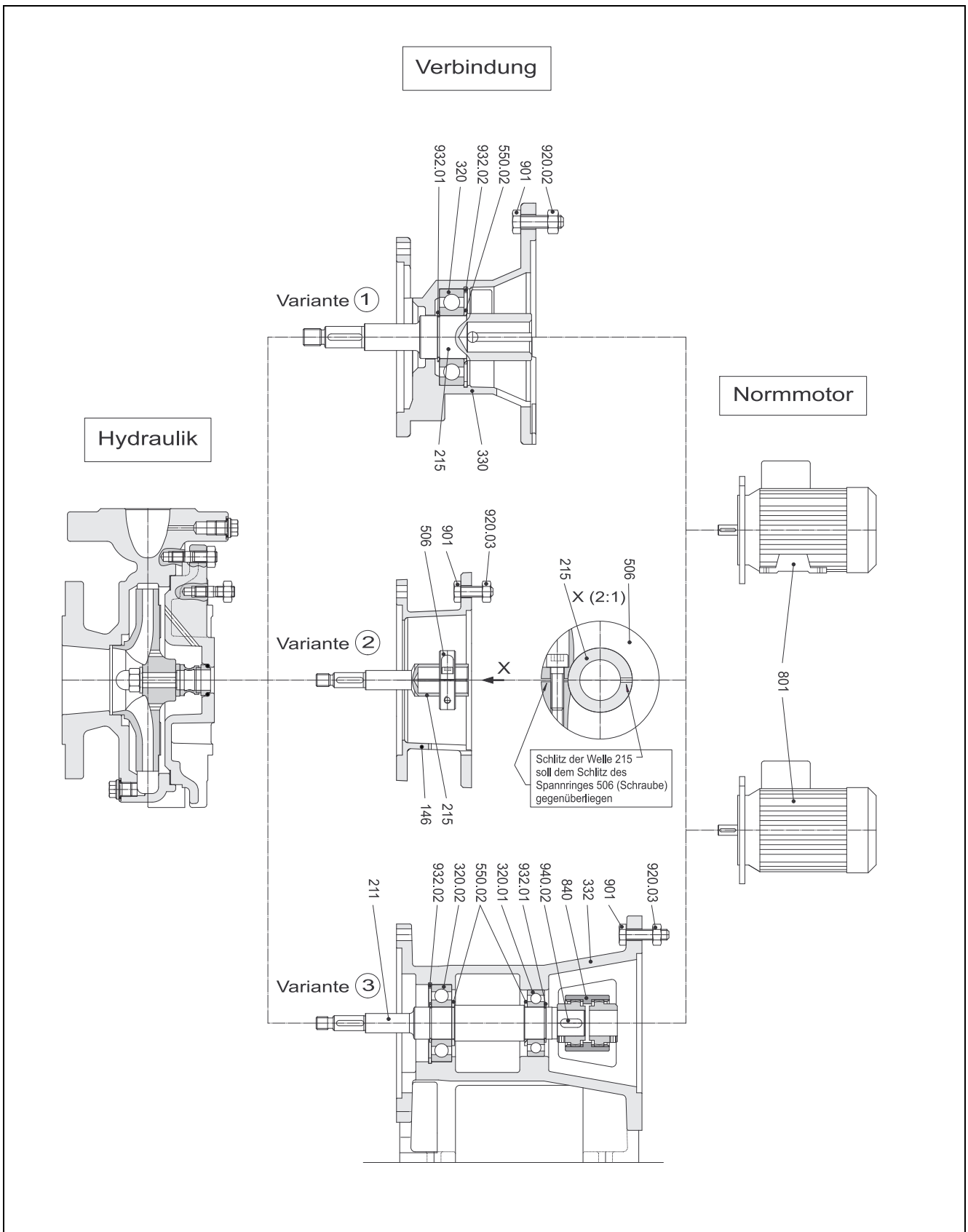
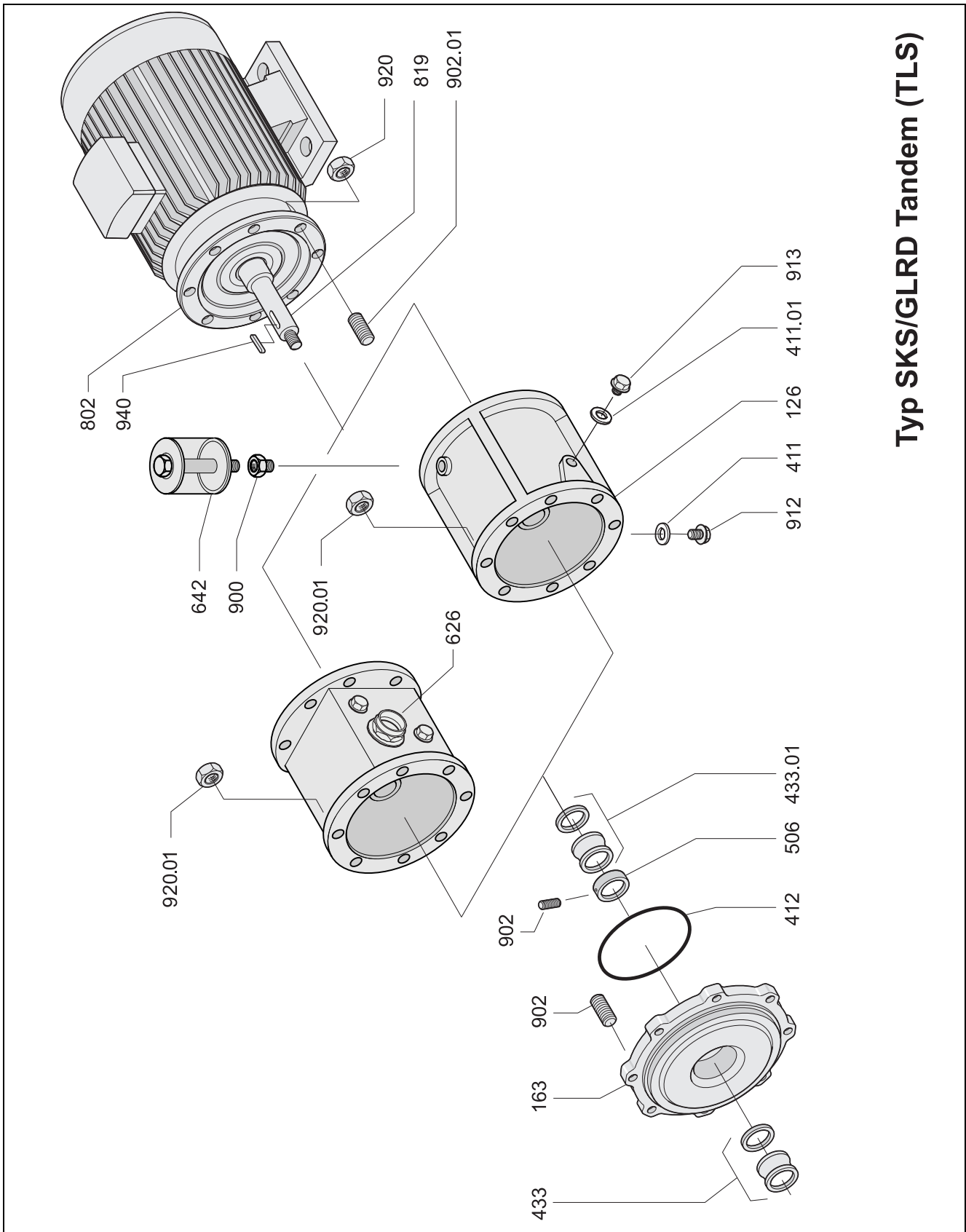


Fig. 17: Shaft assembly of bearing pedestal

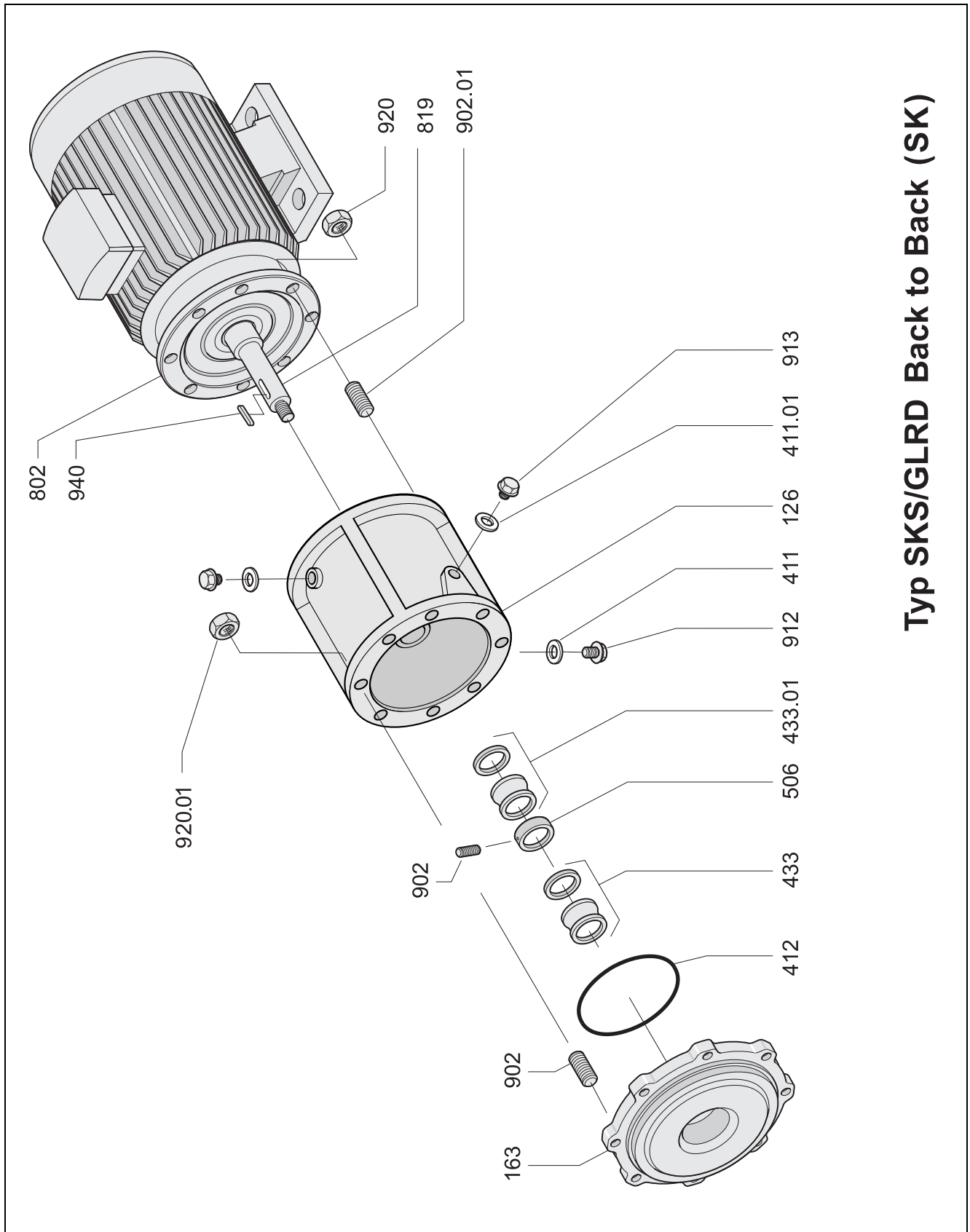
**8.8 Type SKS /GLRD Tandem (TLS)**



**Typ SKS/GLRD Tandem (TLS)**

Fig. 18: Type **SKS /GLRD Tandem (TLS)**

**8.9 Type SKS / GLRD Back to Back (catchment chamber)**



**Typ SKS/GLRD Back to Back (SK)**

Fig. 19: Type SKS / GLRD Back to Back (catchment chamber)

**8.10 Spare parts list**

Item	Order No.	Name	Comment
101		Pump housing	
102		Spiral housing	
124		Filter housing	
126		Catchment chamber	
143		Filter insert	
146		Intermediate lantern	
161		Cover	
163/.01		Pressure cover	
183		Support foot	
211		Pump shaft	
215		Pump hollow shaft	
233		Impeller	
320/.01/.02		Roller bearing	
330		Bearing retainer	
332		Bearing pedestal	
400/.01/.02		Clamp gasket	
411/.01/.02		Sealing ring	
412/.01		O-ring	
433/.01		Mechanical seal (cpl.)	
506		Set collar	
515		Clamping ring	
550/.01/.02		Washer	
554/.01		Distance washer	
626		Viewing glass	
642		Oil level indicator	
733		Clamping ring	
801		Norm motor	
802		Block motor	
819		Motor shaft	
840		Coupling	
900		Extension to 642	
901		Hex. socket head cap screw	
902/.01/.02/.03		Plug screw	
903/.01		Plug screw	
912		Outflow stopper	
913/.01		Bleed screw	
915		Screw plug	



Item	Order No.	Name	Comment
916		Stopper	
920/.01/.02/.03		Hexagonal nut	
922		Impeller nut	
932/.01/.02		Retaining ring	
940/.01/.02		Key	
961		Hand screw	

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Pump NB/FB/WP/SM/F  
Version: 27216 - B