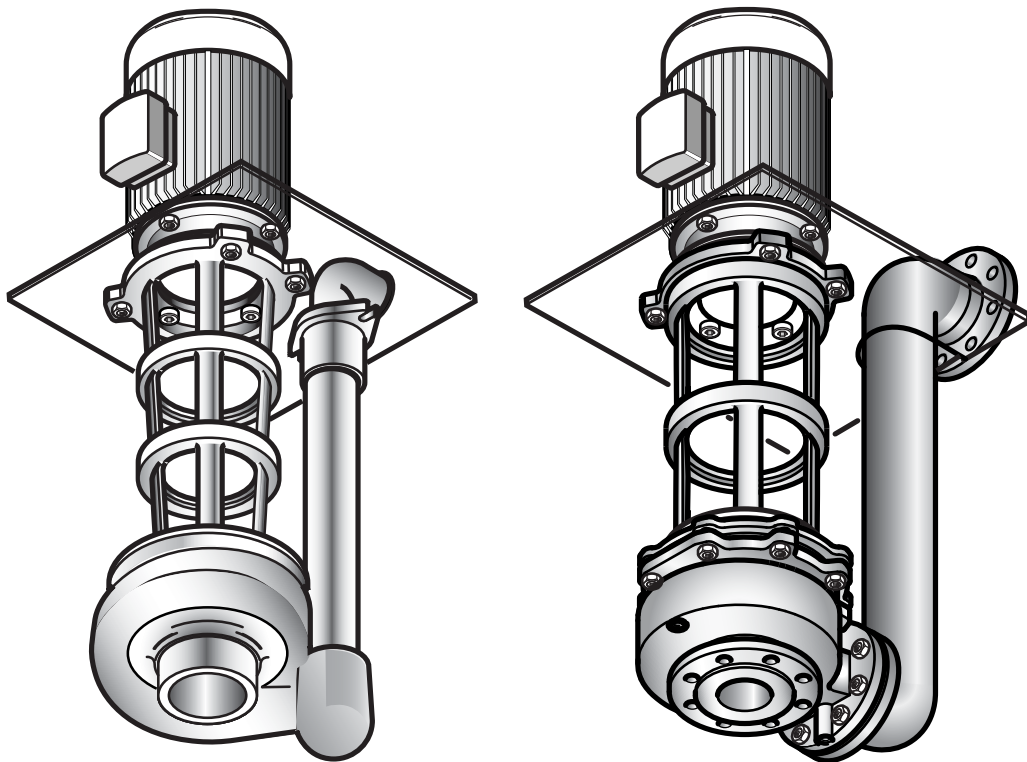


# Circulating pump

## Type Z, FZ, SZ, NZ, ZL, FZL, SZL, NZL, ZB, FZB, SZB, NZB

**GB** Operator's manual / installation instructions  
Translation of the original



27215 - H.2

## EU Declaration of Conformity

**Manufacturer:**

Schmalenberger GmbH + Co. KG  
Strömungstechnologie  
Im Schelmen 9-11  
D-72072 Tübingen / Germany

The manufacturer hereby declares that the product:

Centrifugal pump type:

Z, FZ, NZ, SZ, ZL, ZB, FZL, FZB, NZL, NZB, SZL, SZB (identification numbers: all)

Serial number range: 2023000001 - 2028999999

has been manufactured in accordance with the following directives:

Directive 2006/42/EC "Machinery"

The machine continues to comply with the provisions of the directives:

2014/34/EU - applies only to products with ATEX marking: 2G, 3G, 2D or 3D on the pump rating plate.

Standards that were used: EN ISO 80079-36, EN ISO 80079-37

Harmonised standards that were used:

EN 809+A1+AC, EN ISO 12100, EN 60034-1, EN IEC 60034-5, EN 60034-30-1

Authorised representative for the compilation of the technical documentation:

Robin Krauß

Quality assurance

Schmalenberger GmbH + Co. KG

D-72072 Tübingen / Germany

Phone +49 (0)7071 7008-18

The EU Declaration of Conformity has been issued:

Tübingen, 3 February 2025



---

Timon Rogg  
Head of Development & Design  
Schmalenberger GmbH + Co. KG

## EU Declaration of Incorporation

Manufacturer:  
Schmalenberger GmbH + Co. KG  
Strömungstechnologie  
Im Schelmen 9-11  
D-72072 Tübingen / Germany

The manufacturer hereby declares that the product:  
Centrifugal pump if delivered without drive, type:  
ZB, ZL, FZB, FZL, NZB, NZL, SZB, SZL (identification numbers: all)

Serial number range: 2023000001 - 2028999999

an incomplete machine in accordance with Regulation 2006/42/EC Article 2g and provided exclusively for assembly with another machine  
which meets the following basic requirements of Regulation 2006/42/EC:  
Appendix I, Article 1.1.1, 1.1.2, 1.1.3, 1.1.5.

Harmonised standards that were used: EN 809+A1+AC, EN ISO 12100

The machine continues to comply with the provisions of the directives:  
2014/34/EU - applies only to products with ATEX mark 3G or 3D on the pump rating plate.  
Standards that were used: EN ISO 80079-36, EN ISO 80079-37

The incomplete machine must not be placed in operation until it has been determined that the machine to be installed in the incomplete machine is in compliance with the requirements of the Machinery Directive (2006/42/EC).

Authorised representative for the compilation of the technical documentation:

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Quality assurance  
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D-72072 Tübingen / Germany  
Phone +49 (0)7071 7008-18

The EU Declaration of Incorporation has been issued:  
Tübingen, 3 February 2025



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Timon Rogg  
Head of Development & Design  
Schmalenberger GmbH + Co. KG



## UK Declaration of Conformity

**Manufacturer:**

Schmalenberger GmbH + Co. KG  
Im Schelmen 9-11  
D-72072 Tübingen / Germany

**Importer:**

IPP - Industrial Process Pumps Ltd.  
22-30 Dunton Close, West Meadows Industrial Estate  
Derby DE21 6XB  
United Kingdom  
www.ipp-group.com

**Object of declaration:**

Z, FZ, NZ, SZ, ZL, ZB, FZL, FZB, NZL, NZB, SZL, SZB  
Serial number range: 2023000001 - 2028999999

**The manufacturer hereby declares:**

The objects of the declaration described above are in conformity with the relevant Statutory Instruments:

SI 2019 No. 492: The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2019  
SI 2008/1597: Supply of Machinery (Safety) Regulations 2018

References to the relevant Designated Standards used or references to the other technical specifications in relation to which conformity is declared:

EN 809+A1+AC, EN ISO 12100, EN 60034-1, EN IEC 60034-5, EN60034-30-1.

**Electromagnetic compatibility**

BS EN 61000-6-1,2,3,4  
BS EN (IEC) 60801, Part 2

**Electrical safety**

BS EN 50110, Parts 1 and 2  
BS EN 982, BS EN ISO 12100  
PD 5304, BS EN 60204

**The UK declaration was issued:**

Tübingen, 3 February 2025

A handwritten signature in black ink, appearing to read 'J. Rogg'.

-----  
Timon Rogg  
Technical Manager  
Schmalenberger GmbH + Co.KG



## UK Declaration of Incorporation

Manufacturer:  
Schmalenberger GmbH + Co. KG  
Im Schelmen 9-11  
D-72072 Tübingen / Germany

Importer:  
IPP - Industrial Process Pumps Ltd.  
22-30 Dunton Close, West Meadows Industrial Estate  
Derby DE21 6XB  
United Kingdom  
[www.ipp-group.com](http://www.ipp-group.com)

Object of declaration:  
ZB, ZL, FZB, FZL, NZB, NZL, SZB, SZL  
Serial number range: 2023000001 - 2028999999

The manufacturer hereby declares:  
The objects of the declaration are incomplete machines in conformity with the relevant Statutory Instruments  
SI 2008/1597: Supply of Machinery (Safety) Regulations 2018  
and provided exclusively for assembly with another machine which meets the following basic requirements:

SI 2008/1597: Supply of Machinery (Safety) Regulations 2018 Appendix I, Article 1.1.1, 1.1.2, 1.1.3, 1.1.5.

References to the relevant Designated Standards used or references to the other technical specifications in relation to which conformity is declared:

EN 809+A1+AC, EN ISO 12100.

The incomplete machine must not be placed in operation until it has been determined that the machine to be installed in the incomplete machine is in compliance with the requirements:  
SI 2008/1597: Supply of Machinery (Safety) Regulations 2018

The UK declaration was issued:  
Tübingen, 3 February 2025

A handwritten signature in black ink, appearing to read 'T. Rogg', is positioned above a horizontal dashed line.

Timon Rogg  
Technical Manager  
Schmalenberger GmbH + Co.KG

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## **1 General Details**

### **1.1 User Information**

This operator's manual makes it easier to get to know the centrifugal pump and to make full use of its facilities.

The operator's manual contains important instructions how to use the centrifugal pump safely, properly and economically. Your careful attention to these instructions will help to avoid danger, to reduce repair costs and breakdowns and to increase the reliability and useful life of the centrifugal pump.

The operator's manual does not take account of local regulations. The user is responsible for ensuring that they are complied with.

The label specifies the machine series, the frame size, the most important operating data and the serial number. We request that you always quote it in case of queries, when placing subsequent orders and especially when ordering spare parts.

### **1.2 Usage Instructions**

The centrifugal pump must only be used in accordance with the original pump specifications and the operator's manual. Any other usage or operation where these figures are exceeded is not permitted. The manufacturer is not liable for damage resulting from such improper use.

The pump must only be operated in applications that are described in the relevant documents.

- The pump must only be operated if it is in flawless technical condition.
- The pump must not be operated if it is only partially mounted.
- The pump may only be used to convey the media described in the data sheet or in the documentation for the relevant design.

- Never operate the pump without a pumping medium.
- Pay careful attention to the information in the data sheet or documentation regarding minimum delivery volume (to prevent damage from overheating, damage to the bearings, etc.).
- Pay careful attention to the information in the data sheet or documentation regarding maximum delivery volume (to prevent overheating, damage to the mechanical seal, cavitation damage, damage to the bearings, etc.).
- Do not throttle the pump on the suction end (to prevent cavitation damage).
- Coordinate other types of operation with the manufacturer if they are not cited in the documentation or data sheet.

#### **Preventing foreseeable misuse**

- Never open the pressure-end shut-off elements beyond the permissible range
  - Exceeding the maximum delivery volume cited in the data sheet or documentation is not permitted (possible cavitation damage)
- Never exceed the permissible operating limits cited in the data sheet or documentation in terms of pressure and temperature, etc.
- Comply with all safety instructions and directions in this operator's manual.

### **1.3 Relevant Documentation**

Various documents are associated with every centrifugal pump that comprise the technical documentation of the pump. These are as follows:

- Specification with all data
- Operator's manual
- Declaration of conformity / Declaration of Incorporation
- Drive operator's manual
- Declaration of conformity with supplement BA for ATEX-pumps



- Manual for accessories listed in the specifications manual
- Pilot run report
- Performance run report
- Dimensions sheet
- Acceptance report from the TÜV (Technical Certification Authority) etc.

Not all the above documentation has been produced and supplied in every case. For this please check the details in the specification.

## 1.4 Technical Data / Specifications

The specifications of the centrifugal pump is the most important document in every operator's manual. Contained therein are all the relevant and technical data relating to the centrifugal pump. It is the birth certificate of the centrifugal pump and should be treated accordingly.

As a substitute the order confirmation together with the delivery schedule may also be a source of technical data.

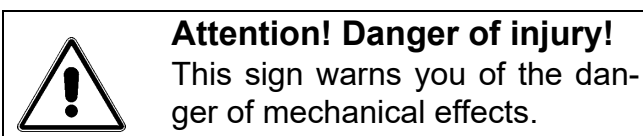
## 2 Safety Instructions

### 2.1 General

It is essential that the relevant safety regulations and laws that apply in the operating company and / or country where the pumps are to be used are observed .

In this operating manual the following symbols are used to draw your attention to sources of danger. The symbols are intended to attract your attention to these instructions!

Symbol      Meaning:



### Warning! Mortal danger!

This sign warns you of the danger from electric shocks.



### Information:

It also instructs you in the economic use of the pump.

Notices attached directly to the pump, e.g. arrows indicating direction of rotation and the marking for fluid connections, must always be observed and maintained in a clearly legible condition.

- Use the pump only if it is in perfect technical condition, in accordance with the regulations, observing safety requirements and danger conditions and strictly adhering to all the instructions in the operator's manual!
- Promptly remedy any faults that could influence safety.
- **Prior to starting up, make sure that the operators have read and understood the operator's manual.** Not the operator but the owner is responsible for safety!
- The centrifugal pump is designed to be built into a total machine or plant.



### Attention!

The centrifugal pump is delivered without a contact safety device.

When the pump is installed in the system, the system manufacturer must attached the contact safety device for hot, cold and moving parts on-site and check its function.

Do not remove the contact safety device during operation!

- Leaks of hazardous delivery media, (e.g. explosive, poisonous, hot) must be controlled so that no danger occurs to persons or the environment. Comply with legal requirements.

- Danger from electric shocks must be completely excluded (for details see the country specific regulations and / or those of the local power supply company).
- Electrical equipment must be installed and maintained exclusively by qualified electricians in accordance with regulations VDE or IEC.
- Before switching on or starting up the centrifugal pump, make sure that no-one will be endangered by the start-up of the pump!



**Important:**

The centrifugal pump must be immediately stopped if abnormal electrical voltages, temperatures, noises, vibrations, leakages or other faults should arise.

## 2.2 Temperature



**Warning! / Danger of burns!**

The centrifugal pump housing gets hot during operation. If the temperature rises to over +50°C, the centrifugal pump must be protected from direct contact by the operator.

## 2.3 Safety Instructions for Maintenance and Repairs

- Regardless of what nature they may be, repairs must only be carried out by qualified persons and the centrifugal pump must be emptied first.
- The attached pipework must be depressurized.
- Allow the pump to cool off.
- Prior to carrying out repairs to the pump it must be isolated from the electrical supply and protected from unintentional switching on.

## 3 Transport, Storage, Installation

### 3.1 Transport and Storage

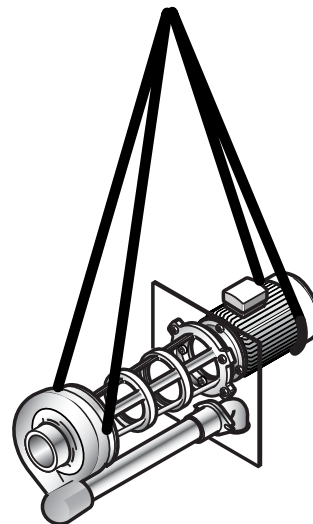
#### 3.1.1 Transport

Pumps that are designed to be built into containers must be transported lying down! The eyebolts on the motor are designed to carry only the weight of the motor. To lift the combined motor and pump aggregate suitable attachments must be made so that both units are catered for! If necessary the centre of mass is indicated on the pump unit and on the packing material, and places for applying lifting hooks are marked.



**Attention! Danger of injury!**

Use only suitable and technically perfect lifting and load-bearing equipment with sufficient carrying power! Never stand or work underneath swinging loads!



Hoisting example for pumps designed to be built into containers

#### 3.1.2 Storage

- Interim storage

Even for short periods of interim storage, store on a wooden base in a dry, well ventilated and vibration free environment at constant temperature.

- Unsuitable storage

If unsuitable storage conditions prevail (e.g. high humidity) or if the pump is to be stored for longer than 6 weeks, then the pump housing should be filled with oil (see chapter 3.1.3.).

- Long periods of storage

After a storage period of more than 2 years the motor roller bearings and bearing supports need to be re-greased or replaced entirely.

### 3.1.3 Conservation

The centrifugal pumps that we deliver are treated with a conservation material corresponding to the storage time quoted us by the purchaser. This conservation must be removed before start-up. See chapter 3.2.2 "Cleaning".

If the pump is to be taken out of service for a longer period of time or if the originally envisaged storage time is going to be considerably exceeded, then conservation must be undertaken as protection against corrosion.

How to do this is described in detail in chapter 6.1 "Shutdown and Storage".

## 3.2 Unpacking, Cleaning and Assembly

### 3.2.1 Unpacking

For transportation purposes the pump is fastened to a palette by bands. For transportation over long distances it is packed in crates or boxes.

After removing the retaining bands extract the pump out of its packing with the help of suitable lifting equipment. Observe the instructions in section 3.1.1.

### 3.2.2 Cleaning

A number of measures are taken for protection against transportation damage and corrosion. Check your pump for which measures have been taken.

1. Covering lid on the nozzles
2. Shaft protection for deliveries without the motor
3. Protective paint on exposed parts.

These protective measures must be removed before the pump is set up or installed. Under no circumstances must impurities be left inside the pump.



**Important:**

Depending on the delivery medium to be used, the interior of the pump should be cleaned of residual traces of oil. Use a cleaning agent that will not be harmful to the throttling section and pump materials. Make sure that the pump is carefully dried after cleaning.

The cleaning agents that can be used include spirit, Ritzol 155 or a strongly alkaline soap solution, for example. If a steam jet cleaner is to be used, then let the solvent work itself in for a time first. Then also please take care not to damage the electric motor and bearings.

### 3.2.3 Assembly

In general the pump is delivered fully assembled and can be installed directly.

In special cases the pump is delivered without the drive motor. Prior to installing the pump in the plant, install the drive motor into the pump.



**Important:**

Before installation check that the pump runs freely and easily.

Other external accessories, such as a blast tank or similar equipment, that have not been assembled with the pump at the factory, should be mounted on the pump after it has been installed in the system or on the pump base.

### 3.3 Installing and Connecting



**Safety Instructions**  
**Explosion proof**  
Pay particular attention to the  
Supplementary operator's  
manual "explosion protection"

#### 3.3.1 Check before you start installing

- Have the machine, the system and the container nozzles been properly prepared in accordance with the figures on the dimensions sheet or installation plan?
- Has the concrete base got adequate strength (minimum of B 15) in accordance with DIN 1045?
- Is the concrete base hydrated?
- Is the surface level and even?



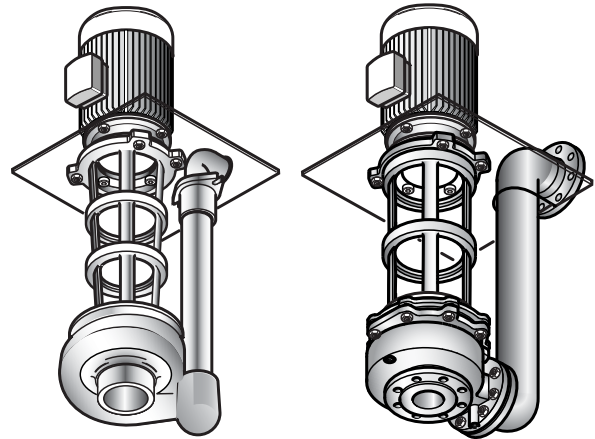
**Warning!**  
**Stability, Danger of injury!**  
Pumps with a motor at the top are very top heavy. These pumps must be safeguarded against tipping up during installation or removal e.g. with the help of ropes.



**Caution!**  
Never install the pump with the „motor below“.

#### 3.3.2 Installing the unit

These centrifugal pumps must only be installed in a vertical position.



Except for special models, the pumps are always placed on the cover plate (base plate) and fastened down by screws. When installed on a foundation the centrifugal pump must be set up with the aid of a spirit level.

#### 3.3.3 Connecting the Pipework



##### **Warning!**

Under no circumstances must the pump be used as anchor point for the pipework. No forces or moments (e.g. due to twisting or heat expansion) from the pipework must act on the pump. The pipes must be supported as close as possible to the centrifugal pump and connected to it free of all tension.

In the case of pipework the nominal bore should be at least the same as the pump connections.

Connection pieces to larger nominal bores should be carried out with approx. 8° expansion angle to avoid significant loss of pressure.

The suction pipe to the pump must be installed to rise continuously, on the pressure side it must fall continuously.

Depending on the type of system and pump being used, it is recommended that backflow prevention and shut-off devices are installed.

Expansion of the pipes due to temperature must be remedied by suitable measures. We recommend the installation of compensators in the pipeline.



#### **Important**

Pipe compensators must not be used to make up for inaccuracies in the pipelines, for example with a centre offset of the flange.

Valves that close very suddenly (abruptly) must be avoided in the pipework. The resulting pressure surges can greatly exceed the maximum permitted housing pressure of the pump! To prevent too strong pressure surges dampers or blast tanks should be installed.



#### **Information:**

At the end of installation, before starting up the system the containers, pipes and connections must be thoroughly cleaned, rinsed and blown through.

Often welding beads, scales and other impurities do not get dislodged for some period of time. They should be kept clear of the pump by inserting a sieve in the suction pipe. The free cross-section of the sieve must be 3 times the cross-section of the pipe so that there is not too large a resistance built up due to foreign bodies that flow in. Hat-shaped sieves containing a mesh wire net having a mesh size of 2.0 mm and 0.5 mm wire diameter made of corrosion resistant material have proved useful in practice.

### **3.3.4 Electrical Connections**

The electrical connections to the pump must be carried out by a specialised company in the electrical engineering branch approved by the local energy provider, taking into account the technical connection requirements.

The connections must be carried out by a qualified electrician.

**The relevant DIN VDE (Association of German Engineers) regulations must be observed.**

Compare the available power supply voltage with the details on the motor's factory plate and select the appropriate switching.

We recommend the use of a motor protection facility.



#### **Risk of explosion!**

Where there is a risk of explosion a motor protection device must be fitted!

In compliance with VDE 0530-8, three-phase motors are always wired for clockwise rotation (looking at the motor shaft stub).

The direction of rotation of the pump is anti-clockwise as standard (viewed from the suction flange).

**Always note the arrow on the pump indicating the direction of rotation.**

Connect the motor according to the circuit diagram in fig. 1 or fig. 2.

Delta connection  $\Delta$  (low voltage)

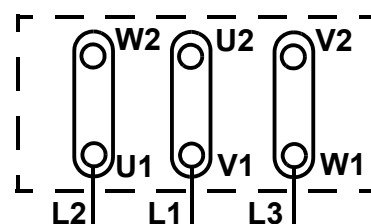


Fig. 1 Connection for 3-phase motors, connection  $\Delta$

Star connection Y (high voltage)

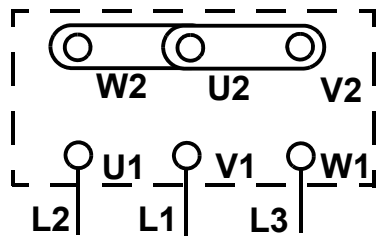


Fig. 2 Connection for 3-phase motors, connection Y

### Motor with PTC thermistors as thermal winding protection

Connect the PTC thermistor (PTC sensor) to the downstream trigger unit if required. The PTC thermistors are designed according to DIN 44081 and DIN 44082.

### Time relay setting

For three-phase motors with star-delta connection it must be ensured that the switching points between star and delta follow each other very rapidly. Long switching times can result in damage to the pump. Setting of the time relay for star-delta connection: < 3 sec.

### Direction of rotation check

The direction of rotation of the motor must agree with the direction of the rotation arrow on the motor housing of the pump (seen from the motor, in a clockwise direction). Check by rapidly switching on and off.

If the direction of rotation is wrong, change any two phases L1, L2 or L3 of the power supply in the motor terminal box over.

### Additional motor equipment

If particular control devices are to be used e.g. in connection with the installation of the pump in a process engineering facility, the instructions of the manufacturer of the control devices must be strictly observed.

## 4

## Operating the Pump

### 4.1

### Initial Start-up



#### Warning!

Prior to initially starting up the pump please make sure that the following prerequisites have been met:

1. The pump has been connected properly electrically and with all requisite safety features.
2. The pump is filled with delivery medium or there is a minimum level of fluid in the tank / pool (pump is covered).
3. **Please observe:** Running dry creates increased wear and must be avoided at all costs!
4. The rotating parts of the pump have been covered by a protective shield. (In accordance with UVV (Accident Prevention Regulations) the centrifugal pump may only be operated if a safety shield has been fitted).
5. The pump shaft turns easily.
6. The direction of rotation has been checked.
7. The minimum distance between the suction inlet and tank wall is 150 mm.

#### 4.1.1

#### Starting the pump

Make sure that the shut-off device on the pressure end is half open before starting the pump up! Once the maximum rotation speed has been reached, slowly open it up and adjust to full operational level.

## 4.2 Operating

### 4.2.1 Operation Monitoring

In most cases the pump is controlled from the central point of the overall facility. A prerequisite for a perfectly functioning pump is adherence to the data provided for its installation and use. See the chapter on specifications.



#### **Information:**

Pay particular attention to the following points for the manual operation of the pump:

#### 1. Temperature of the delivery fluid:

Never operate the pump at temperatures in excess of those stated in the original specification.

#### 2. Noise emission:

The acoustic power or sound pressure level is determined by the motor as well as the pump, and especially by the installation situation. Special protective measures must be taken to reduce transmission of structure-borne or air-borne sound.

#### 3. 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 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

#### 4. Minimum amount:

If the sort of facility includes the possibility of a run against closed shut-off device on the pressure-end, a minimum delivery rate at  $t -30$  to  $+70^{\circ}\text{C}$  15% of  $Q_{\text{opt}}$ . over  $+70$  to  $+110^{\circ}\text{C}$  25% of  $Q_{\text{opt}}$ . must be supplied during this time.

## 5. Density of the delivery fluid:

The power input of the pump changes in proportion to the density of the delivery fluid. In order to prevent the motor being overloaded, the density must correspond to the specifications.

### 4.2.2 Miscellaneous

Installed reserve pumps must be run briefly once a week to ensure that they are always ready for operation. They should be run for approx. 5 minutes.

## 4.3 Indications of Faulty Operation

### 4.3.1 General

When operated via a central control facility faulty operation can be largely ruled out.

In the case of manual operation, but also within a control complex, please observe the following instructions.

Avoid damage to the pump and make sure that:

- The pump always runs quietly and vibration free.
- The pump does not run dry.
- A longer period of operation with closed shut-off device is avoided to prevent heating up the delivery medium. For the required minimum delivery see section 4.2.1.
- The maximum permitted room temperature of  $+40^{\circ}$  is not exceeded.
- The maximum ball bearing temperature does not exceed room temperature by  $+50^{\circ}\text{C}$  and never exceeds  $+90^{\circ}\text{C}$  (measured on the outside of the motor housing).
- During pump operation the shut-off device in the supply line is not closed.

#### **4.3.2 Faults**

In case of faults in the operation of the pump, that were not caused by the control facility or other foreign devices, proceed as follows:

1. Locate the site of the fault or defect.
2. Determine the cause.
3. Remedy the fault.

In chapter **4.5 “Fault Elimination”** there is a table listing the most frequent faults, their cause and the recommended way to eliminate them.

#### **4.4 Shutdown**

1. Close the shut-off device in the pressure pipe. If backflow prevention is fitted to the pressure pipe the shut-off device can remain open, provided that there is back pressure.
2. Switch motor off. Allow it to come to rest. Depending on the sort of facility, the pump should be allowed sufficient idle run time – with the heat source, if any, switched off to allow the delivery fluid temperature to reduce – to prevent an accumulation of heat within the pump



#### **Warning!**

If there is a danger that the pump may freeze and / or for occasions where it is to be at a standstill for longer periods of time, the pump must be emptied or protected against freezing up (by auxiliary heating).



## 4.5 Fault Elimination

Table 1: The causes and elimination of faults

Pump stands still	too little delivery rate from pump	motor overload	too low pump pressure	too high pump pressure	high motor / bearing temperature	pump leaks	pump runs noisily, running noises	pump temperature too high	Cause of the fault	Elimination of the fault
	x		x						Back pressure too high, pump is delivering against too high a pressure, system resistance too great, pipe too small	Set new operating point, system dirty, increase rotation speed, install a new impeller, clean pipes, increase pipe size, install larger pump
	x		x				x		Pump / pipework not completely vented, air suction through too small a covering, gas build-up, air bubble in the pipework, high percentage of air in the medium, supply or impeller blocked.	Increase fluid level, correct level control, install pump lower down, vent the system, clean pipework, change pipework, de-gas the medium, decrease resistance in the supply pipe, fully open valves in the suction pipe, clean sieves and suction connections, install a relief valve directly in front of the non-return valve.
	x		x						Wrong phase sequence, wrong electrical connections, rotation speed too low, gap between wearing plate and open impeller too large, air entering via the throttling section	Change over two of the phases in the terminal box, increase rotation speed (*) (if necessary, get new motor), decrease the gap between wearing plate and open impeller, renew throttling section, install pump lower down or increase fluid level
	x						x		Worn internal parts (e.g. impeller)	Remove foreign body from pump housing, replace worn parts, renew throttling section
		x			x				Pump back pressure is lower than stated in the specifications, electrical connections wrong	Set operating point precisely, increase back pressure e.g.: by throttling the pump on the pressure side, perhaps turn off impeller (*), larger motor (*), compare electrical connections with those on the motor rating plate; observe circuit diagram in chapter 3.3.4
		x			x				Higher density or greater viscosity of the delivery medium than in the specifications	New pump correlation (*)
							x		Cavitation	Throttle pump on pressure side, larger pump (*)
			x						System resistances too low, manometer defective	Increase back pressure, e.g. by throttling the pump on the pressure side, larger pump (*), larger impeller (*)

Table 1: The causes and elimination of faults

Pump stands still	too little delivery rate from pump	motor overload	too low pump pressure	too high pump pressure	high motor / bearing temperature	pump leaks	pump runs noisily, running noises	pump temperature too high	Cause of the fault	Elimination of the fault
x									Foreign body in the pump, throttling section worn, motor bearings defective, safety switch was triggered due to motor overload, safety switch too small, winding defective	Remove foreign body from the pump housing, clean or change pump housing, renew throttling section, renew motor bearings, check electrical connections / compare to motor ratings plate, throttle pump, smaller impeller (*), larger motor (*)
					x		x		Impeller imbalanced, bearing defective, too little / too much or wrong lubricant	Clean impeller, balance the impeller (*), renew bearings, add / decrease or completely change the lubricant
					x		x		Coupling distance not maintained, pump wrongly adjusted, pump distorted or resonance vibrations in the pipework, several pumps on one console, increased axial thrust	Set correct distance, adjust pump correctly, check pipework connections / pump mountings, single pump setting, connect pipework via compensators, install vibration damper under the pump, stiffen the tank, clean relief bores in the impeller
				x					Rotation speed too high, pump too large (wrong design)	Decrease rotation speed, smaller pump (*), turn off impeller (*)
								x	Pump delivery too small, pipework blocked, closed valve on pressure side	Re-set pump, install a bypass for low volume requirements, clean pressure pipe, switch pump on only when required, pump must not run too long against closed valve; no reduction in temperature: use a smaller pump (*)
						x			Gaskets defective, pump badly adjusted, throttling section defective	Renew gaskets, adjust pump precisely, check pipework connections, renew throttling section.

(\*) Please contact the manufacturer

## 5 Maintenance / Repair

### General Instructions

The operator must ensure that all maintenance, service and repair work on the pump is carried out exclusively by authorised and specially trained persons. It must be established beyond doubt that the person has studied the operator's manual in detail.

We recommend the creation of and adherence to a maintenance schedule. That will enable you to avoid expensive repairs and have a reliable and trouble-free pump operation.

Only original spare parts must be used for repairs.

If work has to be carried out on the **motor** the instructions in the manual from the relevant motor manufacturer must be observed.



#### **Mortal danger!**

In order to prevent electric shocks, work on the terminal box and the machine controller must never be carried out before the electrical connections have been isolated or disconnected.



#### **Attention! Danger of injury! Mortal Danger!**

The pump must be safeguarded against unintentional switching on (be disconnected) if checking or maintenance work is to be undertaken.

## 5.1 Maintenance / Service

Use the following information to create a maintenance schedule. These are recommendations of minimum requirements that must be adjusted to local conditions of use of the pump and may need amending accordingly.

### 5.1.1 Checks

#### **Continuous checks:**

- Pump delivery data (pressure, amount)
- Power take-up

#### **Daily checks:**

- Pump running is quiet and vibration free
  - Bearing temperature (see section 4.3.1)
- More frequent monitoring must be planned for liquids with properties that differ greatly from those of water (which tend to stick or form accumulations, for example, or have a high gas content).

Smooth operation of the shaft may be impaired for example by accumulations or sticks. If this happens, smooth operation must be restored before starting up. See section 6.1.3 "Restarting after Periods of Storage".

#### **Monthly checks:**

- Wear on the coupling (elastic component)
- Screws are tight

### 5.1.2 Lubrication and change of lubricant

Pumps in their standard models only have bearings in the drive motor. In the models with IEC motor and intermediate stub the bearings in the intermediate stub are filled with a grease that cannot be replenished. This grease lasts for the working life of the unit and cannot be replenished. Defective 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"**.

## 5.2 Repair

### General

Always carry out repair work on the removed pump in an appropriate workshop.

Be sure to observe the general instructions at the beginning of the chapter!

The following instructions will enable you to dismantle the pump and to re-assemble it properly with the requisite spare parts in place.



**Information:**

Also take note of the exploded diagram in chapter 8 "Spare parts list / Drawing".

The work can be undertaken with the usual workshop tools. Special tools are not required, with the exception of for the installation of a new throttling bush.

After dismantling, thoroughly clean all the individual parts of the pump. Check the individual parts for wear and damage. Parts that are not perfect must be reworked or replaced.

### 5.2.1 Dismantling Preparations



**Important:**

Prior to starting to dismantle it the pump must be safeguarded against accidental switching on (it must be disconnected). Warning on the switching cabinet!

When used in a facility, inform the shift leader or manager.



**Important:**

For the following work, please be sure to observe local regulations and conditions.

### 5.2.2 Dismantling / Removal of the Pump

The pump must be allowed to reach room temperature.

- Disconnect the power supply.
- Close valves (on the suction and pressure sides).
- Remove existing additional connections.
- Release pressure and suction nozzles.
- Disconnect motor.
- Release pump base plate
- Completely lift out the pump (out of the tank, etc.)
- Empty the pump

When emptying the pump please observe the following instructions!



**Warning!**

1. If the pump was used to deliver liquids that are hazardous to health, then great care must be taken in emptying the pump that neither persons nor the environment are placed at risk through the process.
2. If necessary, wear protective clothing and protective mask!
3. The rinsing liquid used and any residual fluid out of the pump must be caught and disposed of properly and without placing persons or the environment in any danger.



4. Pumps that deliver liquids that are hazardous to health must be decontaminated. In draining the delivery medium off care must be taken that neither persons nor the environment are placed in any danger.
5. Legal requirements must be adhered to!

### 5.2.3 Dismantling / Dismantling the Pump

#### Before you begin

Begin the work only once you have checked that:

- The required spare parts are available and that they will fit this pump or your particular model thereof. Make sure that in your spare parts order the pump serial number was quoted.
- You have all the required tools and accessories for the work.



#### Information:

Use only original spare parts for the repairs!

During re-assembly all the gaskets must be renewed.

Observing these instructions is a prerequisite for trouble-free operation of the pump and for the acceptance of potential claims under guarantee.

### 5.2.4 Dismantling the pump Type Z, FZ 4013, FZ 5016, SZ 2513, SZ 3216, SZ 4013, SZ 4016, SZ 5016, SZ 5020

#### Step 1:

Unscrew the spiral housing mounting screws pos. 901.1 and remove the spiral housing pos. 102. Remove the from the connecting piece pos. 145 and pull off the pressure pipe pos. 710. Now remove the two round gaskets pos. 412.

#### Step 2:

Unscrew and remove the impeller nut pos. 922 and the distance washer pos. 554.01. Now you can pull off the impeller pos. 233 and remove the key pos. 940.

#### Step 3:

Dismantle the connecting piece pos. 145 with the hexagon socket screws pos. 914. Now you can pull off the connecting piece pos. 145 together with the cover plate pos. 167.

Then take the protective shaft sleeve pos. 524 from the motor shaft pos. 818.

Make sure that for the dense shaft bushing (DWF) that the connecting piece pos. 145 is pulled off together with the shaft sealing ring pos. 420.

Now remove the counter ring pos. 475.

#### Step 4:

The throttling bush pos. 542 is glued into the connecting piece pos. 145. Dismantle the throttling bush only if it is to be replaced. The replacement is described in chapter 5.2.6.



#### Information:

For the SZ model you first have to unscrew the hexagon socket screws pos. 914 from the wearing plate in order to be able to remove the wearing plate pos. 164. When re-assembling install new gaskets and a new wearing plate.

## **5.2.5 Dismantling the pump Type NZ, FZ 6520, SZ 6520**

### **5.2.5.1 Type NZ, FZ 6520**

#### **Step 1:**

Unscrew the hexagon screws pos. 901.04 out of the pipework and remove them. Now remove the hexagon nut pos. 920.05 from the spiral housing. Lift the spiral housing pos. 102 off.

Now you can remove the two clamp gaskets pos. 400.01 and 400.02.

#### **Step 2:**

Unscrew and remove the impeller nut pos. 922 and the distance washer pos. 554.01. Now you can pull off the impeller pos. 233 and remove the key pos. 940.

#### **Step 3:**

Dismantle the pressure cover pos. 163 by unscrewing the hexagon nut pos. 920.06 and remove the protective shaft sleeve pos. 524.

Make sure that for the dense shaft bushing that you take off the shaft sealing ring pos. 420.

Remove the intermediate piece pos. 132. By unscrewing the hexagon screws pos. 901.01 on the motor flange and the transition piece pos. 721, you can remove the intermediate piece together with the cover plate pos. 167 and the pipework pos. 700.

#### **Step 4:**

The throttling bush pos. 542.01 is glued or pressed into the throttling bush holder pos. 542.02. The throttling bush holder is glued into the pressure cover pos. 163. Dismantle the throttling bush only if it is to be replaced. The replacement is described in chapter 5.2.6.



#### **Information:**

When re-assembling install new gaskets.

## **5.2.5.2 Type SZ 6520**

#### **Step 1:**

Unscrew the mounting screws pos. 914 and remove the suction cover pos. 162.

#### **Step 2:**

Unscrew and remove the suction impeller pos. 231 and the distance washer pos. 554.01. Now you can pull off the impeller pos. 233 and remove the key pos. 940.

#### **Step 3:**

Dismantle the spiral housing pos. 102 by unscrewing the mounting screws pos. 914.01 and remove the protective shaft sleeve pos. 524. Pull off the pressure pipe pos. 710. Now remove the two round gaskets pos. 412.

Make sure that for the dense shaft bushing that you take off the shaft sealing ring pos. 420.

Remove the intermediate piece pos. 132. By unscrewing the hexagon screws pos. 901 on the motor flange and the transition piece pos. 721, you can remove the intermediate piece (132) together with the cover plate pos. 167 and the pipe connection pos. 730.

Now remove the counter ring pos. 475.

#### **Step 4:**

The throttling bush pos. 542 is glued or pressed into the spiral housing pos. 102. Dismantle the throttling bush only if it is to be replaced.

The replacement is described in chapter 5.2.6.



#### **Information:**

When re-assembling install new gaskets.

## 5.2.6 Shaft sealing ring / throttling bush



### Information:

The throttling bushes built used in the centrifugal pumps are **not** wear-free.



### Warning!

When dismantling the pump inspect the throttling bush and protective shaft sleeve for damage. Be sure to replace a damaged throttling bush and / or protective shaft sleeve.



### Important:

Never use a throttling bush you have made yourself! We can accept no liability.

With the delivery of a new throttling bush you will receive fitting instructions (**AA-18003**) how to install it correctly in your centrifugal pump.

To fit the throttle bush you need a special centring tool that may be ordered from the manufacturer.

## 5.2.7 Pump re-assembly

Re-assembly is basically in the reverse order to dismantling.

Observe the following preparatory steps:

- Thoroughly clean all individual parts of dirt and residual glue (throttling bush seating).
- Inspect all parts for wear and be sure to replace any that are worn or damaged.
- Clamp gaskets and O-rings must always be replaced by new ones. Grease O-rings prior to installation.
- If a new throttling bush made of silicon carbide (SiC/SiC) was glued in place, then the glue must be allowed to harden for approx. 24 hours before assembly can proceed. See assembly instructions (**AA-18003**). Make sure that this period of time is observed!

- During assembly tighten screw connections crosswise. Use a torque wrench for this.

The following table shows the **torque** to be applied for standard DIN 13 thread.

Thread:	Torque [Nm] for screws:		
	to plastic parts	to cast parts	to bright steel parts
<b>M8</b>	7	10 - 15	20
<b>M10</b>	8	25 - 35	40
<b>M12</b>	10	30 - 40	70
<b>M16</b>	--	60 - 90	160
<b>M20</b>	--	80 - 110	--

The figures apply to new, ungreased screws. The table values do not apply if deviating values are specified on the general diagrams or due to other instructions.

## 5.2.8 Bearing support

If your pump is equipped with an IEC norm-motor (described as option "B") as the drive, then between the cover plate and the motor there is a bearing support for supporting the pump shaft and coupling.

There are two types of connecting integrated in the pumps.

Version 1: Bearing bracket with 1 ball bearing

Version 2: Bearing pedestal with 2 ball bearings and coupling

The bearings are sealed and filled with a grease that cannot be replenished. The coupling is designed to have a long service life under normal usage.

To change the coupling or a bearing, proceed as follows:

**Version 1:**

- Remove 1 protective plate pos. 598 from the bearing retainer pos.330. Loosen the threaded rod pos. 904 on the shaft if one is present.
- Dismantle the pump as described in sections 5.2.4 and 5.2.5 to replace the ball bearing.
- Loosen the bearing retainer pos. 330. Use the extraction thread and screws pos. 901 for this. Pull the shaft pos. 215 and ball bearing pos. 326 off the motor pos. 801.
- Remove the retaining ring pos. 932.02 and pull the shaft and ball bearing out of the bearing retainer.
- Remove the retaining ring pos. 932.01 from the shaft and pull off the ball bearing.

**Version 2:**

- Loosen the drive of the bearing support pos. 331. Remove the motor pos. 801 together with the upper half coupling. Now you can replace the inner coupling part pos. 840.
- To replace the ball bearings pos. 321 and pos. 321.01 the pump has to be removed and dismantled as described in sections 5.2.4 and 5.2.5.
- Next dismantle the bearing stub together with the shaft pos. 211 from the cover plate pos. 167.
- Remove the retaining rings pos. 932 from the shaft pos. 211 and from the bearing support. Dismantle the ball bearings pos. 321 and 321.01.
- Be sure to clean all parts in advance and check them for damage or wear. Replace defective parts! Assemble the parts in reverse order.



## 6 Appendix

### 6.1 Shutdown / Storage / Conservation

Every pump leaves the factory carefully assembled. If initial operation is predicted to be a long time after delivery we recommend the following measures for storage of the centrifugal pump.

#### 6.1.1 Storage of New Pumps

When requested, new pumps receive a conservation protection corresponding to the storage time stated by the purchaser. If this period of time is considerably exceeded the condition of the pump must be checked and, if required, re-conserved.

#### 6.1.2 Longer Periods of Shutdown >3 months

##### 1. Pump remains installed

To ensure that the pump is always ready for operation and to prevent the formation of deposits inside the pump and in its immediate vicinity, the pump aggregate should be run for a short time (approx. 15 minutes) monthly or quarterly during longer periods of inactivity. Prerequisite for this is that sufficient fluid is supplied to the pump.

##### 2. Pump is removed and stored

To remove the pump proceed as outlined in chapter 5.

Prior to storing the pump it must be thoroughly cleaned and conserved. Conservation must be done both internally and externally.

#### 6.1.3 Restarting after Periods of Storage

##### De-conservation

Before the stored pump is re-installed the conservation agent (covering or filling) must be removed. Proceed as described in chapter 3.2.2.



#### Warning!

After long periods of storage under conservation conditions check the shape stability and elasticity of the Elastomers (O-rings and mechanical seals). Brittle rings must be replaced. Elastomers made of EPDM should be replaced in any event.

#### Restarting

Re-install the pump according to the procedure described in chapter 3.3.

Immediately after completing the above work, all safety and protective measures must be properly installed and checked that they function.

Before the pump is re-started the checks and maintenance measures stated in chapter 5.1 must be carried out. For the new re-start the points listed in section 4.1 "Initial Start-up" must also be observed.

### 6.2 Disposal

If you want to take the pump completely out of service and never re-use it then please observe the local regulations for the disposal of industrial waste.



#### Important: Mortal danger / Poison

Pumps that have delivered poisonous, caustic or other chemical substances which are hazardous to the health of people and animals must be thoroughly cleaned and / or decontaminated prior to being disposed of.

The cleaning agents and rests of the delivery medium must also be handled in accordance with legal requirements.

If corresponding laws apply in the area where the pump is operated, then the pump must be dismantled. The components must then be separated into the different materials and disposed of separately.

### 6.3 Documentation for pump operation

The following documents are enclosed:

- Operator's manual
- Dimensional sketch

In case of complaints regarding the pump motor, please contact us or the motor manufacturer.

### 6.4 Data sheet

Please see the enclosed data sheet for the actual dimensions of the pump delivered to you.



**Important:**

If changes are made to the pump delivered to you, your guarantee is invalidated!

## 7 Important Instructions

### 7.1 Factory repair

Please observe the following instructions if the pump is sent back to the factory for repair:

1. If you send the pump back to the manufacturer for repair or an upgrade then please be sure to enclose precise details of the media that were delivered by the pump.



**Important:**

2. If the delivered media were poisonous, caustic, etc. then please be sure to enclose a copy of the safety sheet for the media!
3. Only pumps that are completely empty and clean will be accepted for repair.

### 7.2 Ordering Spare Parts

When ordering spare parts please do not fail to give us the following important information:

- Pump serial number and type description
- Delivery medium
- Part number from the spare parts list
- Part description
- Material data from the specifications or the order confirmation

With this information you make it much easier for us to deliver the correct spare part for your pump!

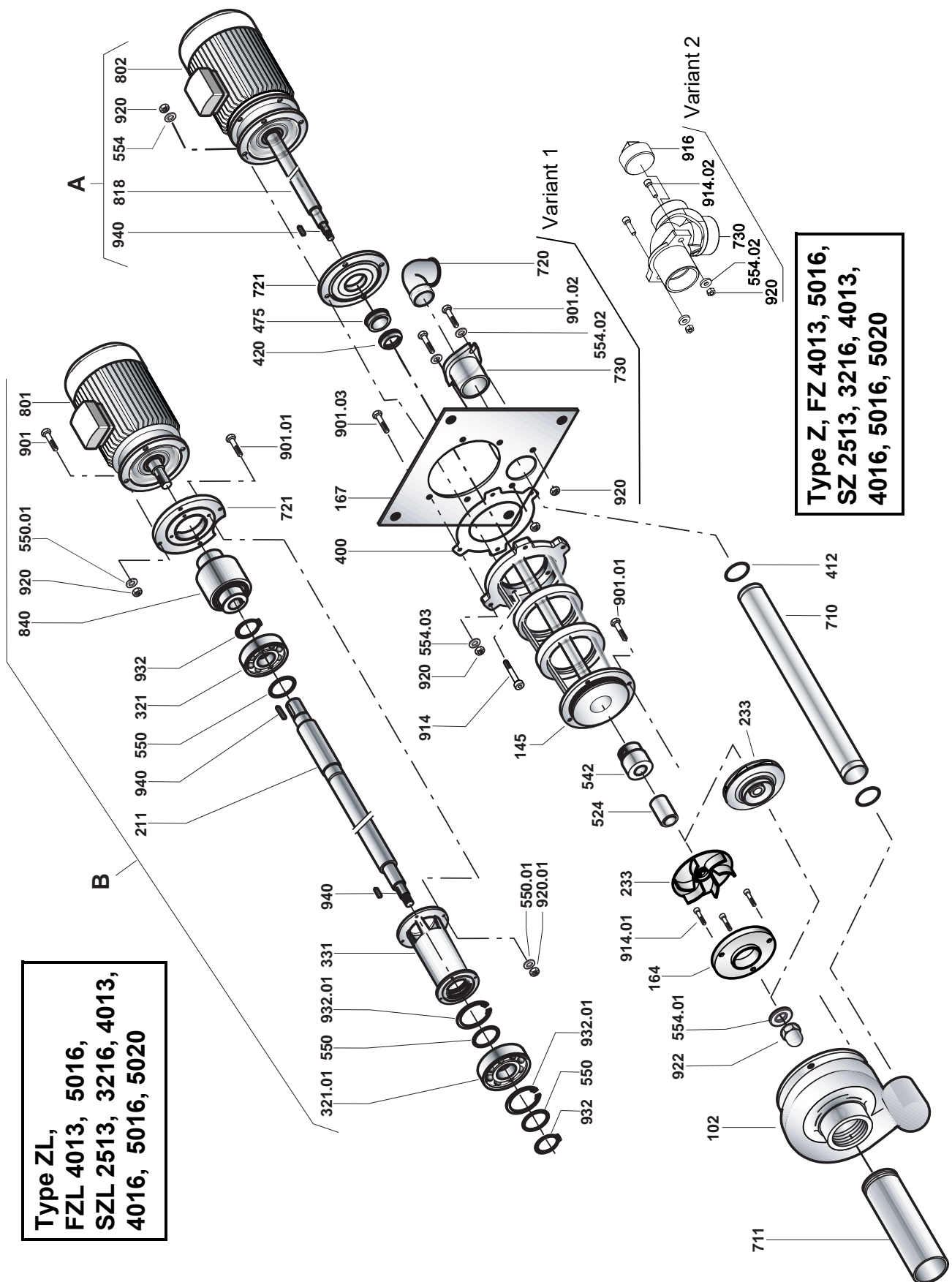
## 8 Spare parts list and drawing



**Information:**

Centrifugal pumps with block motor are described as drive variant "A".

Centrifugal pumps with norm-motor and coupling are described as drive variant "B".

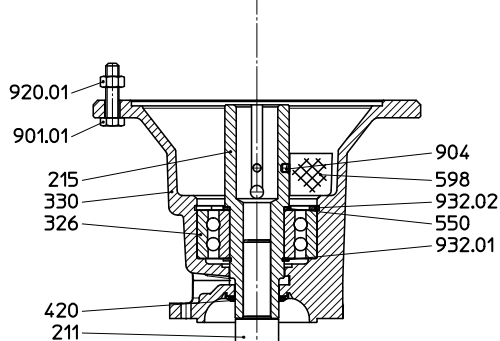
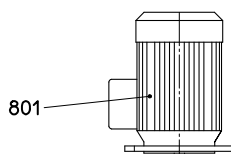


## Shaft assembly of bearing support

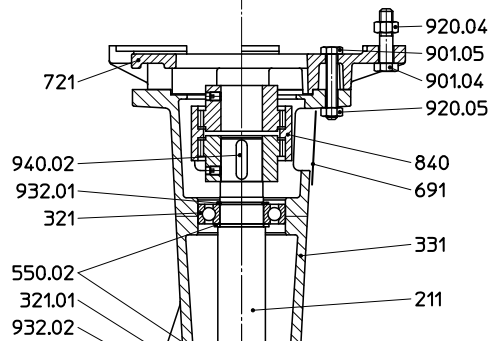
Norm motor

Connection

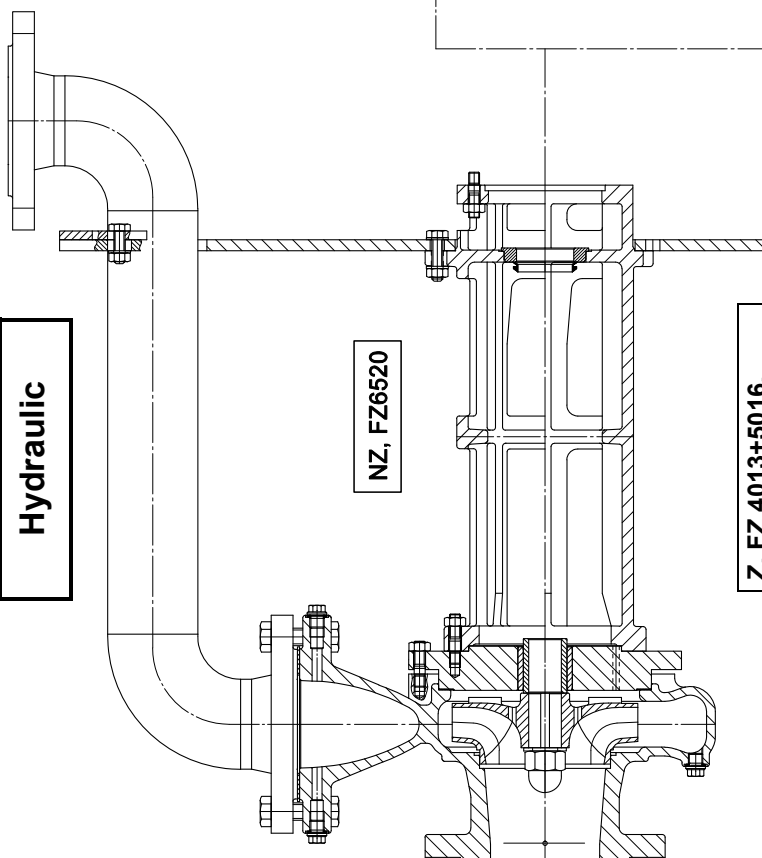
Hydraulic



Version 1:  
ZB, FZB,  
SZB, NZB

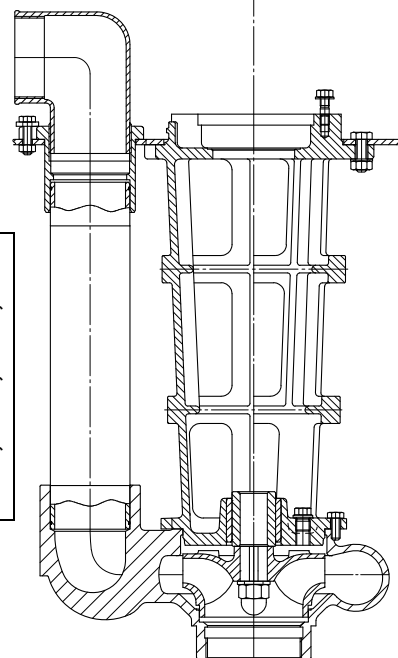


Version 2  
ZL, FZL,  
SZL, NZL



NZ, FZ6520

Z, FZ 4013+5016,  
SZ 2513, 3216, 4013,  
4016, 5016, 5020, 6520

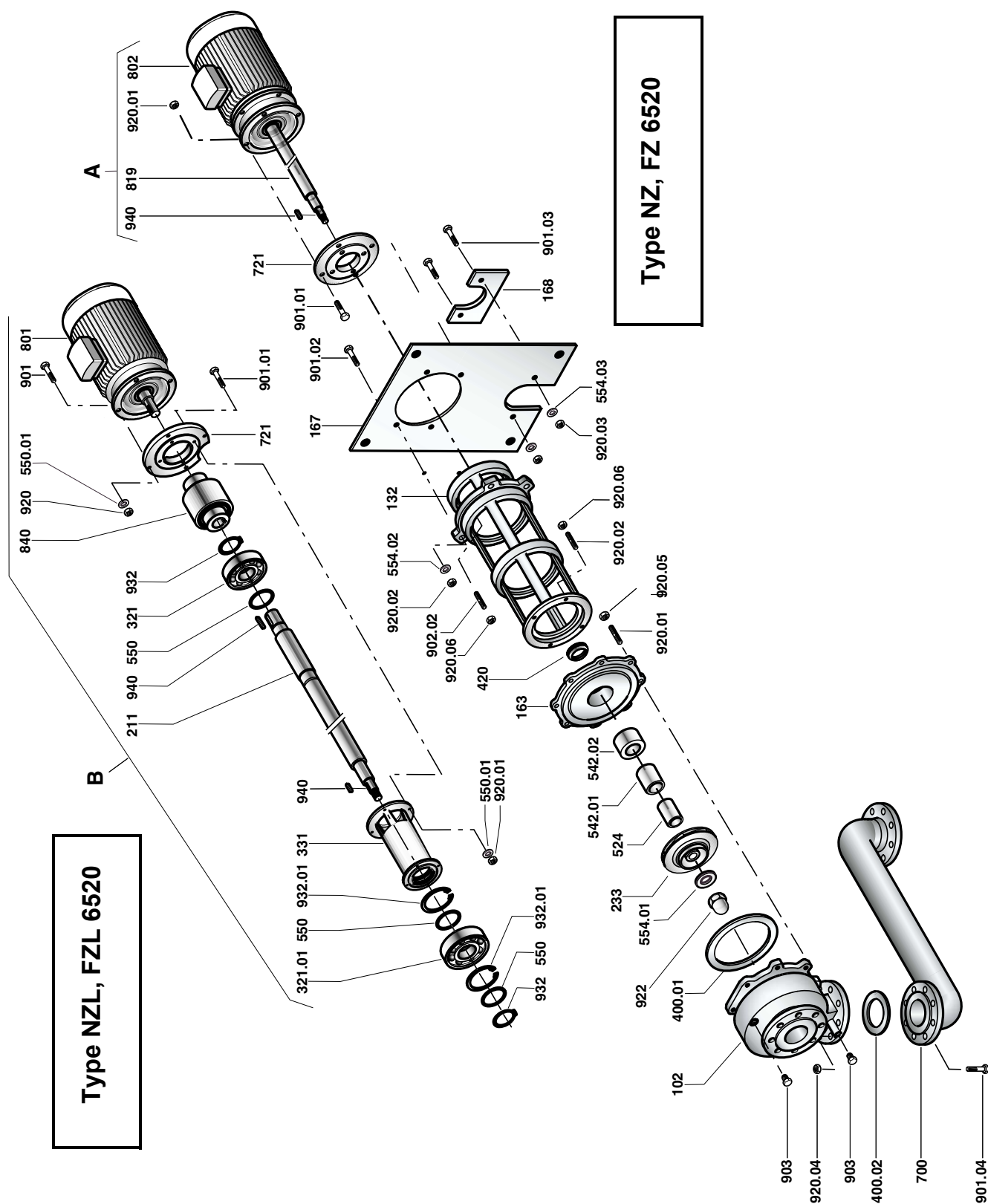


**8.1 Type: Z, FZ 4013, FZ 5016, SZ 2513, SZ 3216, SZ 4013, SZ 4016, SZ 5016, SZ 5020, ZL, FZL 4013, FZL 5016, SZL 2513, SZL 3216, SZL 4013, SZL 4016, SZL 5016, SZL 5020, ZB, FZB 4013, FZB 5016, SZB 2513, SZB 3216, SZB 4013, SZB 4016, SZB 5016, SZB 5020**

<b>Pos.:</b>	<b>Quantity:</b>	<b>Denomination:</b>	<b>Notice:</b>
102	1	Spiral housing	
145	1	Connecting piece	
164	1	Wearing plate	
167	1	Cover plate	
211	1	Pump shaft	
215	1	Pump hollow shaft	
233	1	Impeller	
321	1	Radial ball bearing	
321.01	1	Radial ball bearing	
326	1	Roller bearing	
330	1	Bearing retainer	
331	1	Bearing support	
400	1	Clamp gasket	
411		Sealing ring	
412	2	Round gasket (O ring)	
420	1	Shaft sealing ring	
475	1	Counter-ring	
512	1	Wearing ring	
524	1	Protective shaft sleeve	
542	1	Throttling bush	
550	3	Supporting ring	
550.01	1	Washer	
550.02	2	Washer	
554	4	Distance washer	
554.01	1	Distance washer	
554.02	2	Distance washer	
554.03	4	Distance washer	
598	1	Protective plate	
691	1	Protective plate for 331	
710	1	Pressure pipe	
711	1	Suction pipe extension	

Pos.:	Quantity:	Denomination:	Notice:
720	1	Angle (pipe bend 90°)	
721	1	Transition piece	
730	1	Pipe connection	
801	1	IEC Norm motor, for Type Z-L / Z-B	
802	1	Block motor, for type Z	
818	1	Motor shaft	
840	1	Coupling	
901	4	Hexagon screw	
901.01	4	Hexagon screw	
901.02	2	Hexagon screw	
901.03	4	Hexagon screw	
901.04	4	Hexagon screw	
901.05	4	Hexagon screw	
902	4	Threaded screw	
903		Plug screw	
904	1	Threaded rod	
914	4	Cylinder head screw with hexagon socket	
914.01	3	Cylinder head screw with hexagon socket	
914.02	2	Cylinder head screw with hexagon socket	
916	1	Stopper	
920	4	Hexagon nut for 901/914	
920.01	4	Hexagon nut for 901.01	
920.02	4	Hexagon nut for 901.02	
920.03	4	Hexagon nut for 901.03	
920.04	4	Hexagon nut for 901.04	
920.05	4	Hexagon nut for 901.04	
922	1	Impeller nut	
932	2	Retaining ring	
932.01	2	Retaining ring	
940	1	Fitting key	
940.02	1	Fitting key	

Not all parts are built into every pump, however.



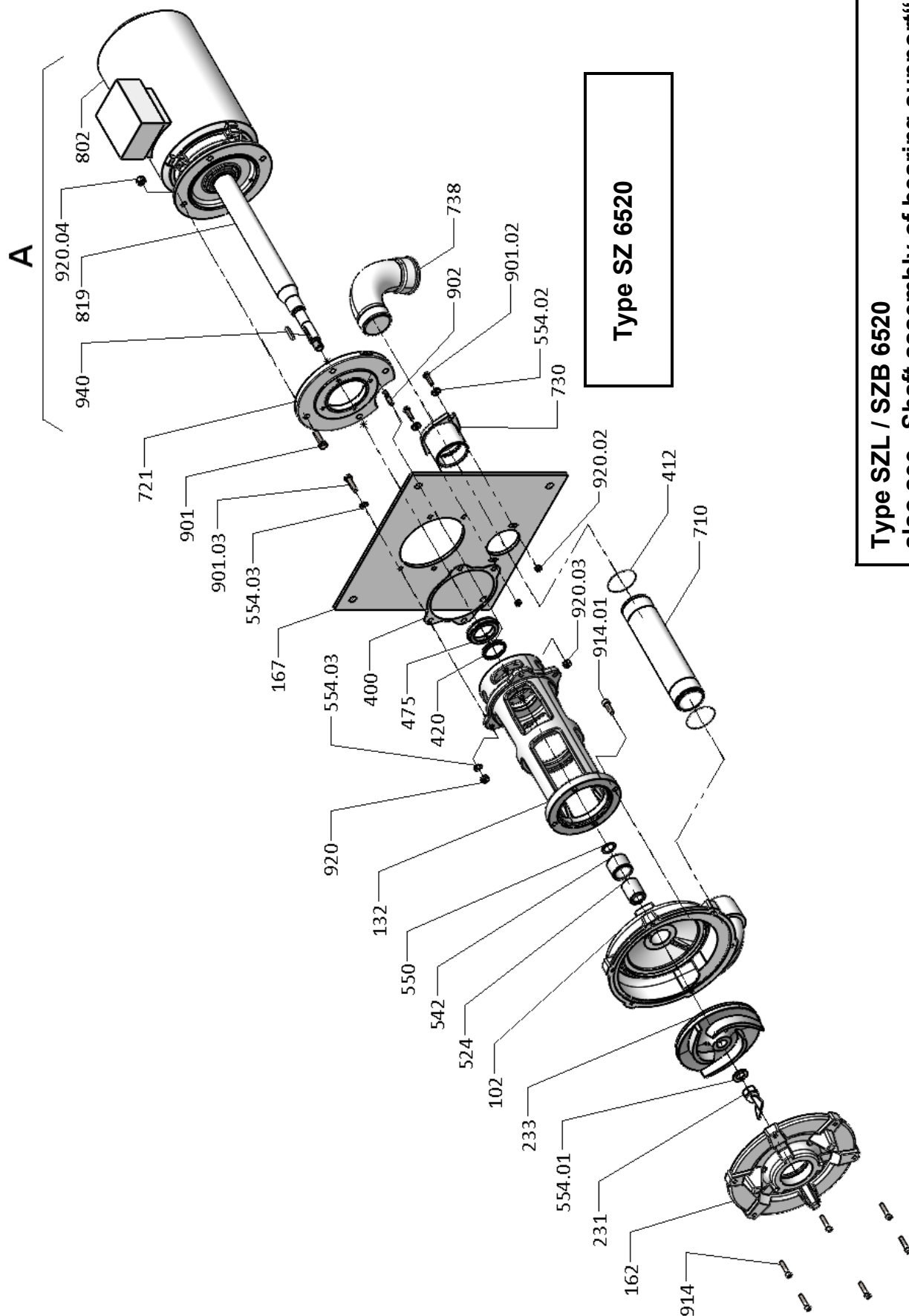
**8.2 Type: NZ, FZ 6520, NZL, FZL 6520, NZB, FZB 6520**

<b>Pos.:</b>	<b>Quantity:</b>	<b>Denomination:</b>	<b>Notice:</b>
102	1	Spiral housing	
132	1	Intermediate piece	
163	1	Pressure cover	
167	1	Cover plate	
168	1	Cover plate	
211	1	Pump shaft	
215	1	Pump hollow shaft	
233	1	Impeller	
321	1	Radial ball bearing	
321.01	1	Radial ball bearing	
326	1	Roller bearing	
330	1	Bearing retainer	
331	1	Bearing support	
400.01	1	Clamp gasket	
400.02	1	Clamp gasket	
411		Sealing ring	
420	1	Shaft sealing ring	
475	1	Counter-ring	
512	1	Wearing ring	
524	1	Protective shaft sleeve	
542.01	1	Throttling bush	
542.02	1	Throttling bush holder	
550	3	Supporting ring	
550.01	4	Washer	
550.02	2	Washer	
554	4	Distance washer	
554.01	1	Distance washer	
554.02	4	Distance washer	
554.03	2	Distance washer	
598	1	Protective plate	
691	1	Protective plate for 331	
700	1	Pipework	
721	1	Transition piece	



Pos.:	Quantity:	Denomination:	Notice:
801	1	IEC Norm motor, for Type Z-L / Z-B	
802	1	Block motor, for Type Z	
819	1	Motor shaft	
840	1	Coupling	
901	4	Hexagon screw	
901.01	4	Hexagon screw	
901.02	4	Hexagon screw	
901.03	2	Hexagon screw	
901.04	4	Hexagon screw	
901.05	4	Hexagon screw	
902	2	Threaded screw	
902.02	4+4	Threaded screw	
902.03	4	Threaded screw	
903		Plug screw	
904	1	Threaded rod	
913	1	Ventilation screw	
914	4	Cylinder head screw with hexagon socket	
920	4	Hexagon nut for 901	
920.01	4	Hexagon nut for 901.01	
920.02	4	Hexagon nut for 901.02	
920.03	2	Hexagon nut for 901.03	
920.04	4	Hexagon nut for 901.04	
920.05	4	Hexagon nut for 902.03	
920.06	4+4	Hexagon nut for 902.02	
922	1	Impeller nut	
932	2	Retaining ring	
932.01	2	Retaining ring	
940	1	Fitting key	
940.02	1	Fitting key	

Not all parts are built into every pump, however.



**Type SZL / SZB 6520**  
also see „Shaft assembly of bearing support“

### 8.3 Type: SZ 6520, SZL 6520, SZB 6520

Pos.:	Quantity:	Denomination:	Notice:
102	1	Spiral housing	
132	1	Intermediate piece	
162	1	Suction cover	
167	1	Cover plate	
211	1	Pump shaft	
215	1	Pump hollow shaft	
231	1	Suction impeller	
233	1	Impeller	
321	1	Radial ball bearing	
321.01	1	Radial ball bearing	
326	1	Roller bearing	
330	1	Bearing retainer	
331	1	Bearing support	
400	1	Clamp gasket	
412	2	Round gasket (O ring)	
420	1	Shaft sealing ring	
423	1	Gamma ring	
475	1	Counter-ring	
524	1	Protective shaft sleeve	
542	1	Throttling bush	
550	3/1	Washer	
550.02	1/3	Supporting ring	
554.01	1	Distance washer for 231	
554.02	2	Distance washer	
554.03	4/8	Distance washer	
598	1	Protective plate	
691	1	Protective plate for 331	
710	1	Pressure pipe	
721	1	Transition piece	
730	1	Pipe connection	
738	1	Angle (pipe bend 90°)	
801	1	IEC Norm motor, for Type Z-L / Z-B	
802	1	Block motor, for Type Z	

Pos.:	Quantity:	Denomination:	Notice:
819	1	Motor shaft	
840	1	Coupling	
901	4	Hexagon screw	
901.01	4	Hexagon screw	
901.02	2	Hexagon screw	
901.03	4	Hexagon screw	
901.04	4	Hexagon screw	
901.05	4	Hexagon screw	
902	4	Threaded screw	
904	1	Threaded rod	
914	6	Cylinder head screw with hexagon socket for 162	
914.01	4	Cylinder head screw with hexagon socket	
920	4	Hexagon nut for 901.03	
920.01	2	Hexagon nut for 901.01	
920.02	4	Hexagon nut for 901.02	
920.03	4	Hexagon nut for 902	
920.04	4	Hexagon nut for 901/601.04	
920.05	4	Hexagon nut for 901.05	
922	1	Impeller nut	
932.01	1/2	Retaining ring	
932.02	1/2	Retaining ring	
940	1	Fitting key	
940.02	1	Fitting key	

Not all parts are built into every pump, however.









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