

# Waste Water, Condensate and Heat Transfer Fluid Pump

## MK

## Installation/Operating Manual



CE

KSB 

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Installation/Operating Manual MK

Original operating manual

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## Glossary

### **Certificate of decontamination**

A certificate of decontamination is enclosed by the customer when returning the product to the manufacturer to certify that the product has been properly drained to eliminate any environmental and health hazards arising from components in contact with the fluid handled.

### **Discharge line**

The pipeline which is connected to the discharge nozzle

### **Pool of pumps**

Customers/operators' pumps which are purchased and stored regardless of their later use.

### **Pump**

Machine without drive, additional components or accessories

### **Pump set**

Complete pump set consisting of pump, drive, additional components and accessories

## 1 General

### 1.1 Principles

This operating manual is valid for the type series and variants indicated on the front cover.

The operating manual describes the proper and safe use of this equipment in all phases of operation.

The name plate indicates the type series and size, the main operating data, the order number and the order item number. The order number and order item number clearly identify the pump set and serve as identification for all further business processes.

In the event of damage, immediately contact your nearest KSB service facility to maintain the right to claim under warranty.

### 1.2 Installation of partly completed machinery

To install partly completed machinery supplied by KSB refer to the sub-sections under Servicing/Maintenance.

### 1.3 Target group

This operating manual is aimed at the target group of trained and qualified specialist technical personnel. (⇒ Section 2.3, Page 9)

### 1.4 Other applicable documents

**Table 1:** Overview of other applicable documents

Document	Contents
Data sheet	Description of the technical data of the pump (set)
General arrangement drawing/ outline drawing	Description of mating and installation dimensions for the pump (set), weights
Hydraulic characteristic curve	Characteristic curves showing head, NPSH <sub>required</sub> , efficiency and power input
General assembly drawing <sup>1)</sup>	Sectional drawing of the pump
Sub-supplier product literature <sup>1)</sup>	Operating manuals and other product literature describing accessories and integrated machinery components
Spare parts lists <sup>1)</sup>	Description of spare parts
Piping layout <sup>1)</sup>	Description of auxiliary piping
List of components <sup>1)</sup>	Description of all pump components

For accessories and/or integrated machinery components, observe the relevant manufacturer's product literature.

### 1.5 Symbols

**Table 2:** Symbols used in this manual

Symbol	Description
✓	Conditions which need to be fulfilled before proceeding with the step-by-step instructions
▷	Safety instructions
⇒	Result of an action
⇔	Cross-references

<sup>1</sup> If agreed to be included in the scope of supply

Symbol	Description
1. 2.	Step-by-step instructions
	Note Recommendations and important information on how to handle the product

### 1.6 Key to safety symbols/markings

Table 3: Definition of safety symbols/markings

Symbol	Description
 <b>DANGER</b>	<b>DANGER</b> This signal word indicates a high-risk hazard which, if not avoided, will result in death or serious injury.
 <b>WARNING</b>	<b>WARNING</b> This signal word indicates a medium-risk hazard which, if not avoided, could result in death or serious injury.
<b>CAUTION</b>	<b>CAUTION</b> This signal word indicates a hazard which, if not avoided, could result in damage to the machine and its functions.
	<b>Explosion protection</b> This symbol identifies information about avoiding explosions in potentially explosive atmospheres in accordance with EU Directive 2014/34/EU (ATEX).
	<b>General hazard</b> In conjunction with one of the signal words this symbol indicates a hazard which will or could result in death or serious injury.
	<b>Electrical hazard</b> In conjunction with one of the signal words this symbol indicates a hazard involving electrical voltage and identifies information about protection against electrical voltage.
	<b>Machine damage</b> In conjunction with the signal word CAUTION this symbol indicates a hazard for the machine and its functions.



## 2 Safety

All the information contained in this section refers to hazardous situations.

In addition to the present general safety information the action-related safety information given in the other sections must be observed.

### 2.1 General

- This operating manual contains general installation, operating and maintenance instructions that must be observed to ensure safe operation of the system and prevent personal injury and damage to property.
- Comply with all the safety instructions given in the individual sections of this operating manual.
- The operating manual must be read and understood by the responsible specialist personnel/operators prior to installation and commissioning.
- The contents of this operating manual must be available to the specialist personnel at the site at all times.
- Information and markings attached directly to the product must always be complied with and kept in a perfectly legible condition at all times. This applies to, for example:
  - Arrow indicating the direction of rotation
  - Markings for connections
  - Name plate
- The operator is responsible for ensuring compliance with all local regulations not taken into account.

### 2.2 Intended use

- The pump (set) must only be operated in the fields of application and within the use limits specified in the other applicable documents.
- Only operate pumps/pump sets which are in perfect technical condition.
- Do not operate the pump (set) in partially assembled condition.
- Only use the pump to handle the fluids described in the data sheet or product literature of the pump model or variant.
- Never operate the pump without the fluid to be handled.
- Observe the minimum flow rates indicated in the data sheet or product literature (to prevent overheating, bearing damage, etc).
- Observe the minimum flow rate and maximum flow rate indicated in the data sheet or product literature (to prevent overheating, mechanical seal damage, cavitation damage, bearing damage, etc).
- Do not throttle the flow rate on the suction side of the pump (to prevent cavitation damage).
- Consult the manufacturer about any use or mode of operation not described in the data sheet or product literature.

#### 2.2.1 Prevention of foreseeable misuse

- Never exceed the permissible application and operating limits specified in the data sheet or product literature regarding pressure, temperature, etc.
- Never open the discharge-side shut-off elements further than permitted.
  - The maximum flow rates specified in the product literature or data sheet would be exceeded.
  - Risk of cavitation damage
- Observe all safety information and instructions in this manual.

### 2.3 Personnel qualification and training

All personnel involved must be fully qualified to transport, install, operate, maintain and inspect the machinery this manual refers to.

The responsibilities, competence and supervision of all personnel involved in transport, installation, operation, maintenance and inspection must be clearly defined by the operator.

Deficits in knowledge must be rectified by means of training and instruction provided by sufficiently trained specialist personnel. If required, the operator can commission the manufacturer/supplier to train the personnel.

Training on the pump (set) must always be supervised by technical specialist personnel.

### 2.4 Consequences and risks caused by non-compliance with this manual

- Non-compliance with these operating instructions will lead to forfeiture of warranty cover and of any and all rights to claims for damages.
- Non-compliance can, for example, have the following consequences:
  - Hazards to persons due to electrical, thermal, mechanical and chemical effects and explosions
  - Failure of important product functions
  - Failure of prescribed maintenance and servicing practices
  - Hazard to the environment due to leakage of hazardous substances

### 2.5 Safety awareness

In addition to the safety information contained in this operating manual and the intended use, the following safety regulations shall be complied with:

- Accident prevention, health regulations and safety regulations
- Explosion protection regulations
- Safety regulations for handling hazardous substances
- Applicable standards, directives and laws

### 2.6 Safety information for the operator/user

- Fit protective equipment (e.g. contact guards) supplied by the operator for hot, cold or moving parts, and check that the equipment functions properly.
- Do not remove any protective equipment (e.g. contact guards) during operation.
- Provide the personnel with protective equipment and make sure it is used.
- Contain leakages (e.g. at the shaft seal) of hazardous fluids handled (e.g. explosive, toxic, hot) so as to avoid any danger to persons and the environment. Adhere to all relevant laws.
- Eliminate all electrical hazards. (In this respect refer to the applicable national safety regulations and/or regulations issued by the local energy supply companies.)
- If stopping the pump does not increase potential risk, fit an emergency-stop control device in the immediate vicinity of the pump (set) during pump set installation.

### 2.7 Safety information for maintenance, inspection and installation

- Modifications or alterations of the pump (set) are only permitted with the manufacturer's prior consent.
- Use only original spare parts or parts/components authorised by the manufacturer. The use of other parts/components can invalidate any liability of the manufacturer for resulting damage.
- The operator ensures that maintenance, inspection and installation are performed by authorised, qualified specialist personnel who are thoroughly familiar with the manual.
- Only carry out work on the pump (set) during standstill of the pump.
- Only perform work on the pump set when it has been disconnected from the power supply (de-energised).
- The pump (set) must have cooled down to ambient temperature.
- Pump pressure must have been released and the pump must have been drained.
- When taking the pump set out of service always adhere to the procedure described in the manual. (⇒ Section 6.3, Page 33)
- Decontaminate pumps which handle fluids posing a health hazard.
- As soon as the work has been completed, re-install and re-activate any safety-relevant devices and protective devices. Before returning the product to service, observe all instructions on commissioning. (⇒ Section 6.1, Page 29)

### 2.8 Unauthorised modes of operation

Never operate the pump (set) outside the limits stated in the data sheet and in this operating manual.

The warranty relating to the operating reliability and safety of the pump (set) supplied is only valid if the equipment is used in accordance with its intended use. (⇒ Section 2.2, Page 8)

### 2.9 Explosion protection

**Always observe the information on explosion protection given in this section when operating the product in potentially explosive atmospheres.**

Pumps/Pump sets must not be used in potentially explosive atmospheres unless marked as explosion-proof **and** identified as such in the data sheet.

Special conditions apply to the operation of explosion-proof pump sets in accordance with EU Directive 2014/34/EU (ATEX).

Especially adhere to the sections in this manual marked with the Ex symbol and the following sections, (⇒ Section 2.9.1, Page 10) to (⇒ Section 2.9.4, Page 12)

The explosion-proof status of the pump is only assured if the pump is used in accordance with its intended use.

Never operate the product outside the limits stated in the data sheet and on the name plate.

Prevent impermissible modes of operation at all times.

#### 2.9.1 Marking

**Pump** The marking on the pump refers to the pump part only.

Example of such marking:

II 2G Ex h IIC T5-T1 Gb

Refer to the Temperature limits table for the maximum temperatures permitted for the individual pump variants. (⇒ Section 2.9.2, Page 11)

The pump complies with the requirements of type of protection constructional safety "c" to ISO 80079-37.

**Motor** The motor has its own marking. The marking is maintained on the condition that the temperatures the pump causes to develop at the motor flange and motor shaft are permitted by the motor manufacturer.



The motors fitted by KSB on pumps with ATEX certification meet this condition.

**2.9.2 Temperature limits**

In normal pump operation, the highest temperatures are to be expected at the surface of the pump casing, at the shaft seal and in the bearing areas.

The surface temperature at the pump casing corresponds to the temperature of the fluid handled. If the pump is heated in addition, the operator of the system is responsible for observing the specified temperature class and fluid temperature (operating temperature).

The table below lists the temperature classes and the resulting theoretical temperature limits of the fluid handled.

The temperature class specifies the maximum permissible temperature at the surface of the pump set during operation.

For the permissible operating temperature of the pump in question refer to the data sheet.

**Table 4:** Temperature limits

Temperature class to ISO 80079-36	Maximum permissible fluid temperature
T1	90 °C
T2	90 °C
T3	90 °C
T4	90 °C
T5	80 °C

**Temperature class T5** Temperature class T5 can only be complied with if the bearing temperature is limited to 80°C.

Misuse, malfunctions or non-compliance with the instructions may result in substantially higher temperatures.

If the pump is to be operated at a higher temperature, the data sheet is missing or if the pump is part of a pool of pumps, contact KSB for the maximum permissible operating temperature.

**Motor supplied by the operator** If a pump is supplied without motor (e.g., as part of a pool of pumps), the motor specified in the pump data sheet must meet the following conditions:

- The permissible temperature limits at the motor flange and motor shaft must be higher than the temperatures generated by the pump.
- Contact KSB for the temperatures generated by the pump.

**2.9.3 Monitoring equipment**

The pump (set) must only be operated within the limits specified in the data sheet and on the name plate.

If the system operator cannot warrant compliance with these operating limits, appropriate monitoring devices must be used.

Check whether monitoring equipment is required to ensure that the pump set functions properly.

Contact KSB for further information on monitoring equipment.

**Bearing temperature monitoring**

If temperature class T5 is to be complied with, the bearing temperature must be monitored. For this purpose, the pump must be equipped with a temperature sensor at the drive-end fixed bearing (G 1/8 connection, DIN 3852).

The temperature sensor must be operated with an ATEX-approved transducer providing explosion protection for the sensor. The bearing temperature must be monitored so as to ensure it does not exceed 80 °C.

#### 2.9.4 Operating limits

The minimum flow rates indicated in (⇒ Section 6.2.3.1, Page 32) refer to water and water-like fluids handled. Longer operating periods with these fluids and at the flow rates indicated will not cause an additional increase in the temperatures at the pump surface. However, if the physical properties of the fluids handled are different from water, it is essential to check whether an additional heat build-up may occur and if the minimum flow rate must therefore be increased. The calculation formula in (⇒ Section 6.2.3.1, Page 32) can be used to check whether an additional heat build-up may lead to a dangerous temperature increase at the pump surface.

### 3 Transport/Storage/Disposal

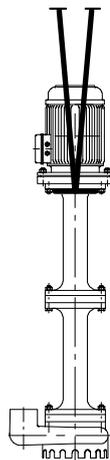
#### 3.1 Checking the condition upon delivery

1. On transfer of goods, check each packaging unit for damage.
2. In the event of in-transit damage, assess the exact damage, document it and notify KSB or the supplying dealer and the insurer about the damage in writing immediately.

#### 3.2 Transport

	<p><b>! DANGER</b></p>
	<p><b>The pump (set) could slip out of the suspension arrangement</b>            Danger to life from falling parts!</p> <ul style="list-style-type: none"> <li>▷ Always transport the pump (set) in the specified position.</li> <li>▷ Never attach the suspension arrangement to the free shaft end or the motor eyebolt.</li> <li>▷ Observe the information about weights, centre of gravity and fastening points.</li> <li>▷ Observe the applicable local accident prevention regulations.</li> <li>▷ Use suitable, permitted lifting accessories, e.g. self-tightening lifting tongs.</li> </ul>
	<p><b>CAUTION</b></p>
	<p><b>Incorrect transport of the pump</b>            Damage to the shaft seal!</p> <ul style="list-style-type: none"> <li>▷ For transport, lock the pump shaft with a suitable transport lock to prevent any movement of the shaft.</li> </ul>

To transport the pump/pump set suspend it from the lifting tackle as shown.



**Fig. 1:** Transporting the complete pump set

#### 3.3 Storage/preservation

If commissioning is to take place some time after delivery, we recommend that the following measures be taken for pump (set) storage.

	<p><b>CAUTION</b></p>
	<p><b>Damage during storage due to humidity, dirt or vermin</b> Corrosion/contamination of pump (set)!</p> <ul style="list-style-type: none"> <li>▷ For outdoor storage cover the pump (set) and accessories with waterproof material and protect against condensation.</li> </ul>
	<p><b>CAUTION</b></p>
	<p><b>Wet, contaminated or damaged openings and connections</b> Leakage or damage to the pump!</p> <ul style="list-style-type: none"> <li>▷ Clean and cover pump openings and connections as required prior to putting the pump into storage.</li> </ul>

Store the pump (set) in a dry, protected room where the atmospheric humidity is as constant as possible.

Rotate the shaft by hand once a month, e.g. via the pump impeller.

If properly stored indoors, the equipment is protected for a maximum of 12 months. New pumps/pump sets are supplied by our factory duly prepared for storage.

For storing a pump (set) which has already been operated, observe the instructions in (⇒ Section 6.3.1, Page 33) .

### 3.4 Return to supplier

1. Drain the pump as per operating instructions. (⇒ Section 7.3, Page 41)
2. Flush and clean the pump, particularly if it has been used for handling noxious, explosive, hot or other hazardous fluids.
3. If the pump has handled fluids whose residues could lead to corrosion damage in the presence of atmospheric humidity or could ignite upon contact with oxygen, the pump must also be neutralised, and anhydrous inert gas must be blown through the pump to ensure drying.
4. Always complete and enclose a certificate of decontamination when returning the pump.  
Indicate any safety measures and decontamination measures taken.  
(⇒ Section 11, Page 62)

	<p><b>NOTE</b></p>
	<p>If required, a blank certificate of decontamination can be downloaded from the following web site: <a href="http://www.ksb.com/certificate_of_decontamination">www.ksb.com/certificate_of_decontamination</a></p>

## 3.5 Disposal

	 <b>WARNING</b>
	<p><b>Fluids handled, consumables and supplies which are hot and/or pose a health hazard</b></p> <p>Hazard to persons and the environment!</p> <ul style="list-style-type: none"><li>▷ Collect and properly dispose of flushing fluid and any fluid residues.</li><li>▷ Wear safety clothing and a protective mask if required.</li><li>▷ Observe all legal regulations on the disposal of fluids posing a health hazard.</li></ul>

1. Dismantle the pump (set).  
Collect greases and other lubricants during dismantling.
2. Separate and sort the pump materials, e.g. by:
  - Metals
  - Plastics
  - Electronic waste
  - Greases and other lubricants
3. Dispose of materials in accordance with local regulations or in another controlled manner.

## 4 Description of the Pump (Set)

### 4.1 General description

- Waste water, condensate and heat transfer fluid pump

Pump for handling waste water, oils, emulsions, condensate, heat transfer fluids and aggressive fluids.

### 4.2 Product information as per Regulation No. 1907/2006 (REACH)

For information as per chemicals Regulation (EC) No. 1907/2006 (REACH), see <https://www.ksb.com/ksb-en/About-KSB/Corporate-responsibility/reach/>.

### 4.3 Designation

**MK A - B 20 - 1/ 100**

**Table 5:** Designation key

Code	Description	
MK	Type series	
A	Variant	
	- <sup>2)</sup>	Pump without discharge pipe, without cover plate, with motor
	A	Pump with square mounting/cover plate and discharge pipe, with flange-mounted motor
	Y	Pump with round mounting/cover plate and flanged discharge pipe, lantern, gland packing and motor
B	Casing material	
		Grey cast iron
	B	Tin bronze
	C	Chrome nickel molybdenum cast steel
2	Pipe connection	
	2	Rp 2
0	Design status	
1	Power code (defines the impeller diameter)	
	1 - 6	
100	Installation depth [cm]	
	100, 190, 280	

<sup>2)</sup> Blank

4.4 Name plate

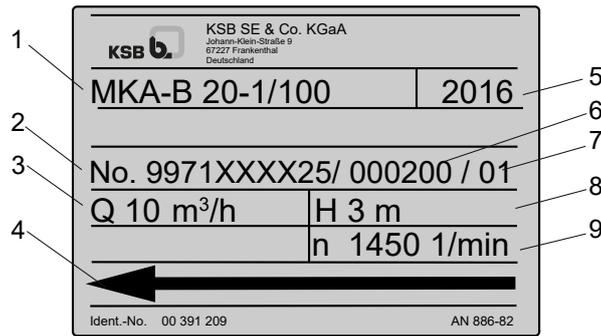


Fig. 2: MK name plate (example)

1	Type series, size and version	2	KSB order number (ten digits)
3	Flow rate	4	Direction of rotation
5	Year of construction	6	Order item number (six digits)
7	Consecutive number (two digits)	8	Head
9	Speed		

4.5 Design details

Design

- Volute casing
- Vertical installation
- Rigid connection between pump and motor
- Single-stage

Drive

- KSB surface-cooled IEC three-phase current squirrel-cage motor
- 230/400 V
- Type of construction IM V1
- Enclosure IP55
- Motors integrated in explosion-proof pump sets are supplied in Ex eb IIB / Ex db eb IIC type of protection.

Shaft seal

MK, MKA:

- Vapour barrier

MKY:

- Gland packing

Impeller type

- Three-channel impeller

Bearings

Drive end:

- Radial ball bearing
- Greased for life

Impeller end:

- Bearing bush
- Product-lubricated
- Optional:
  - Internal lubrication by fluid handled
  - Grease lubrication
  - Lubrication by external fluid

### Explosion protection

MK, MKA:

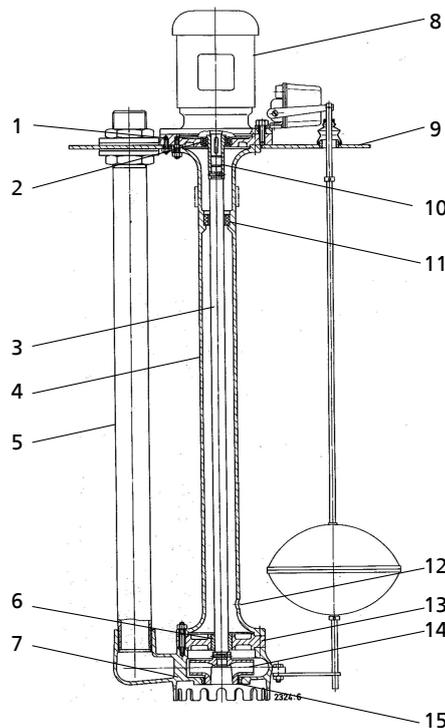
- Available
- For explosion-proof variants one of the optional lubrication types must be used for the bearing bush.

MKY:

- Not available

### 4.6 Configuration and function

MKA



**Fig. 3: MK, MKA**

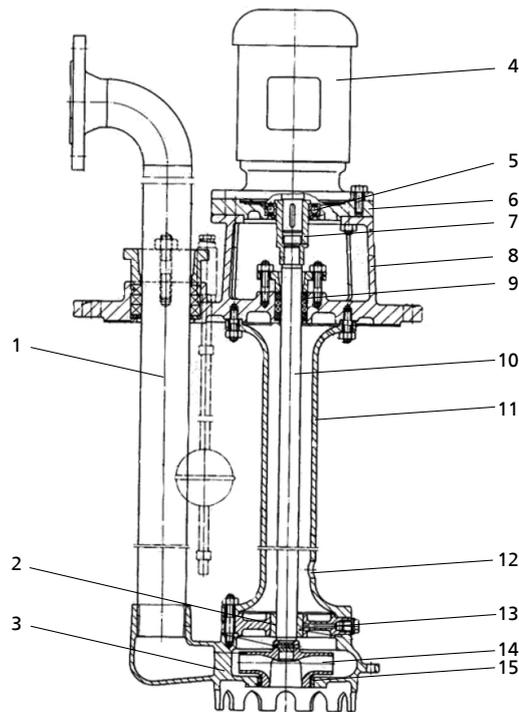
1	Thrust and radial bearing	2	Radial ball bearing
3	Shaft	4	Support column
5	Discharge pipe	6	Bearing bush
7	Volute casing	8	Motor
9	Cover plate	10	Shaft coupling
11	Vapour barrier	12	Overflow opening
13	Radial bearing	14	Impeller
15	Clearance gap		

**Design** The vertical non-self-priming submerged pump in single-stage, single-entry design features an axial fluid inlet and a radial fluid outlet.

At the drive end the rotor is axially and radially supported by a radial ball bearing which is greased for life; at the impeller end it is radially supported by a product-lubricated bearing bush. It is connected to the motor by a rigid coupling sleeve. Various installation depths can be accommodated by up to three support column sets and matching incremental lengths of the shaft assembly. The required radial bearings are lubricated by the fluid handled. As an alternative, external lubrication can be used. To protect the drive-end radial ball bearing the shaft is enclosed by a vapour barrier below the thrust and radial bearing. For pump sets installed with a cover plate (MKA) the discharge nozzle of the volute casing is connected to the plate via a discharge pipe.

- Function** The uniformly rotating impeller of the submerged pump transfers mechanical energy to the fluid passing through. The fluid enters the pump set vertically via the suction nozzle and is accelerated outward by the rotating impeller. In the flow passage of the volute casing the kinetic energy of the fluid handled is converted into pressure energy. The fluid leaves the pump set via the discharge nozzle. The clearance gap minimises the fluid flowing back from the volute casing into the suction nozzle. On the rear side of the impeller, the hydraulic system extends up to the radial bearing with bearing bush. The shaft passes through the radial bearing.
- Sealing** Apart from a vapour barrier protecting the fixed bearing the pump set is seal-less. A small amount of leakage flows into the support column at the shaft passage and then through the overflow opening back into the tank.

**MKY**



**Fig. 4: MKY**

1	Discharge pipe	2	Bearing bush
3	Volute casing	4	Motor
5	Radial ball bearing	6	Thrust and radial bearing
7	Shaft coupling	8	Drive lantern
9	Shaft seal	10	Shaft
11	Support column	12	Overflow opening
13	Radial bearing	14	Impeller
15	Clearance gap		

**Design** The vertical non-self-priming submerged pump in single-stage, single-entry design features an axial fluid inlet and a radial fluid outlet.

Above the drive lantern the rotor is axially and radially supported by a radial ball bearing which is greased for life; at the impeller end, it is radially supported by a product-lubricated bearing bush. It is connected to the motor by a rigid coupling sleeve. Various installation depths can be accommodated by up to three support column sets and matching incremental lengths of the shaft assembly. The pump set is installed in a drive lantern. The discharge nozzle of the volute casing is connected to the lantern via a discharge pipe. The discharge pipe ends in a flanged bend.

**Function** The uniformly rotating impeller of the submerged pump transfers mechanical energy to the fluid passing through. The fluid enters the pump vertically via the suction nozzle and is accelerated outward by the rotating impeller. In the flow passage of the volute casing the kinetic energy of the fluid handled is converted into pressure energy. The fluid leaves the pump via the discharge nozzle. The clearance gap minimises the fluid flowing back from the volute casing into the suction nozzle. On the rear side of the impeller, the hydraulic system extends up to the radial bearing with bearing bush. The shaft passes through the radial bearing.

**Sealing** The pump set is sealed towards the fixed bearing with a shaft seal (gland packing).

### 4.7 Noise characteristics

**Table 6:** Surface sound pressure level  $L_{pA}$ <sup>3)</sup>

Rated power input $P_N$ [kW]	Pump set	
	1450 rpm [dB]	2900 rpm [dB]
0,55	52	-
0,75	57	64
1,1	-	64
1,5	-	65
2,2	-	66

### 4.8 Scope of supply

Depending on the model, the following items are included in the scope of supply:

- Pump

#### Drive

- Surface-cooled IEC frame three-phase squirrel-cage motor

#### Special accessories

- As required

#### Soleplate

MK:

- Without baseplate

MKA:

- Baseplate accommodating pump and motor

MKY:

- Baseplate integrally cast with the lantern

#### Monitoring equipment (optional)

- Temperature sensor at the drive-end fixed bearing with G 1/8 threaded connection

<sup>3)</sup> Surface sound pressure level to ISO 3744, valid for a pump operating range of  $Q/Q_{BEP} = 0.8 - 1.1$  and non-cavitating operation. If noise levels are to be guaranteed: Add +3 dB for measuring and constructional tolerance. The above values apply to the pump set without cover plate. If a cover plate is fitted, this value may increase by up to 2 pA (dB).

### Level control system (optional)

- Level control system with rod-actuated float switch
- Level control system with magnetic float switch
- Level control system with EURO float switch

## 5 Installation at Site

### 5.1 Safety regulations

	<p><b>⚠ DANGER</b></p> <p><b>Improper installation in potentially explosive atmospheres</b> Explosion hazard! Damage to the pump set!</p> <ul style="list-style-type: none"> <li>▸ Comply with the applicable local explosion protection regulations.</li> <li>▸ Observe the information in the data sheet and on the name plates of pump and motor.</li> </ul>
	<p><b>⚠ DANGER</b></p> <p><b>Improper cleaning of coated pump surfaces</b> Explosion hazard by electrostatic discharge!</p> <ul style="list-style-type: none"> <li>▸ When cleaning coated pump surfaces in atmospheres of Explosion group IIC, use suitable anti-static equipment.</li> </ul>

### 5.2 Checks to be carried out prior to installation

Check the structural requirements.  
The structural work required must have been prepared in accordance with the dimensions stated in the outline drawing and/or general arrangement drawing.

### 5.3 Fitting and setting the float switch control (optional)

#### 5.3.1 Control elements for MK/MKA

##### 5.3.1.1 Rod-actuated float switch control

The pump set is controlled by a switch fitted on the motor flange. The switch is actuated by a float via a switch rod with stop clamps.

Fitting the rod-actuated float switch

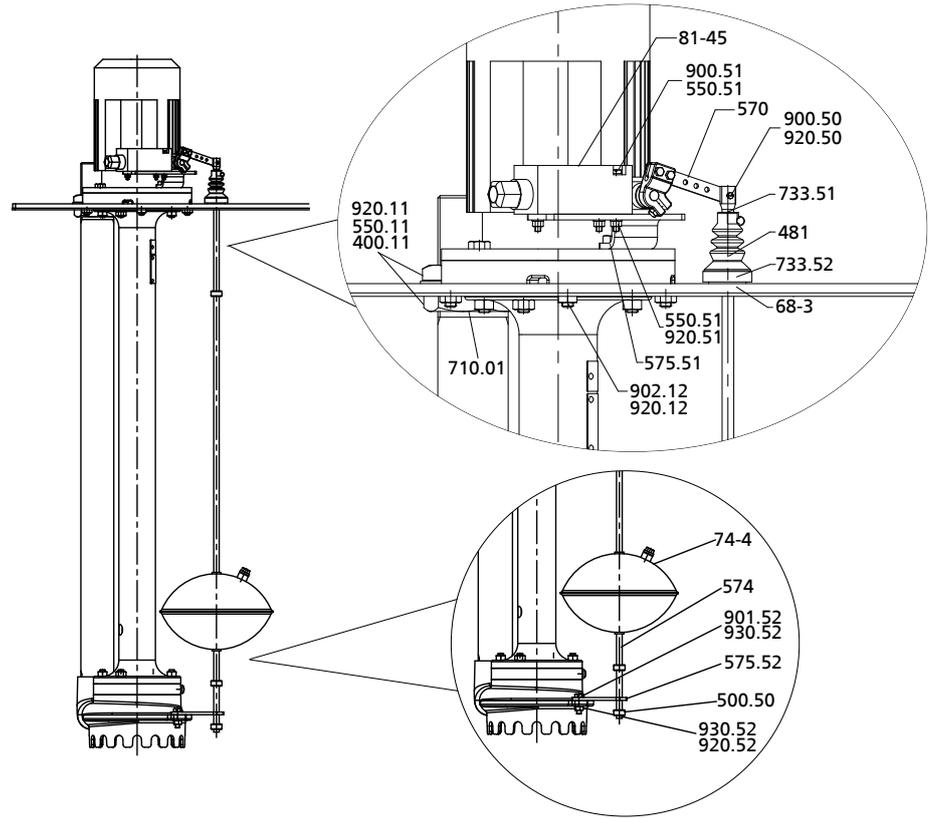


Fig. 5: Fitting the rod-actuated float switch

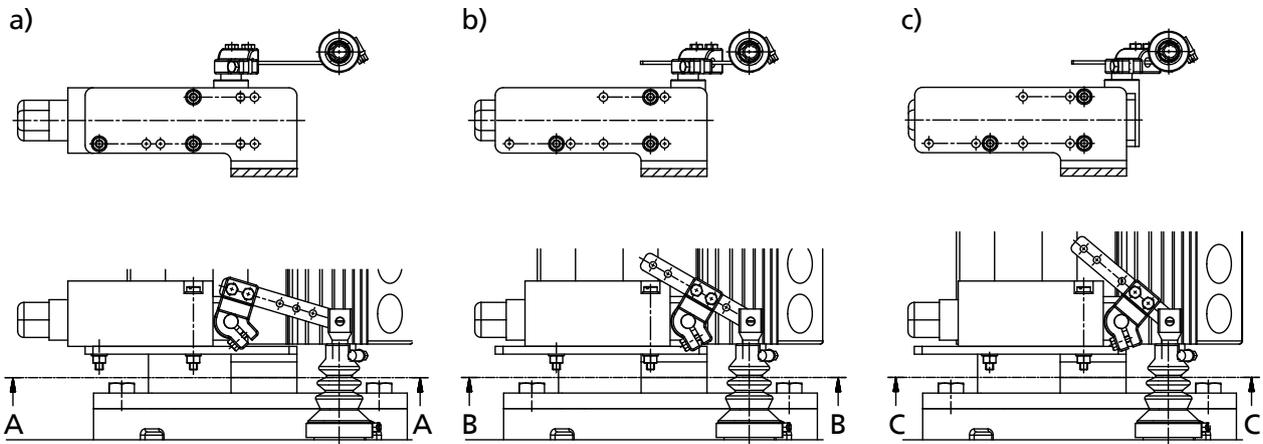
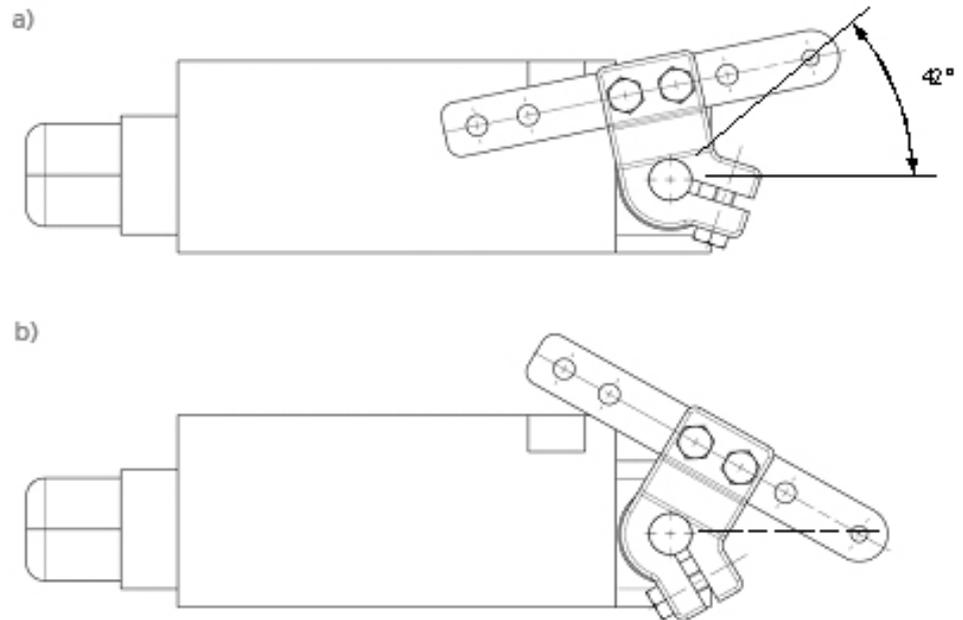


Fig. 6: Positioning the rod-actuated float switch for installation depth: a) 1000 mm; b) 1900 mm; c) 2800 mm

A	1000 mm	B	1900 mm
C	2800 mm		



**Fig. 7:** Float switch a) installation position; b) switching position

1. Fasten strip 575.51 to the motor flange and strip 575.52 to the pump casing with hexagon head bolt 901.52, hexagon nut 920.52 and spring washers 930.52.
2. Mount float switch 81-45 on strip 575.51 using hexagon socket head cap screws 900.51, discs 550.51 and nuts 920.51.
3. Fit the lever on float switch 81-45.
4. Assemble guide rod 574 with float 74-4 and the two upper adjusting rings 500.50.
5. Run the guide rod through strip 575.52 and fit adjusting ring 500.50 beneath the strip.
6. Connect the lever and the guide rod using hexagon socket head cap screw 900.50 and hexagon nut 920.50.
7. If applicable, fit bellows 481 and hose clamp 733.51 on the guide rod.
8. Fasten the bellows on cover plate 68-3 with hose clamp 733.52.
9. Position adjusting rings 500.50 in the desired switching levels above and below the float, respectively, to start and stop the pump as required.
10. Adjust the switching mechanism of float switch 81-45 such that the lever is angled 42° off the horizontal in non-actuated position, see illustration of float switch a) installation position. In installed condition, the lever position must be as shown in the illustration of the float switch b) switching position.
  - ⇒ As the float rises, the lever is lifted into the position shown and contact 15-16 closes.
11. Check that the rod-actuated float switch functions properly.

### 5.3.1.2 Magnetic float switch control (non-ATEX applications only)

Pump sets for installation depths of 1000 and 1900 mm are controlled by a magnetic float switch arrangement. It is equipped with a sensor tube with integrated dry-reed contacts. The float with integrated permanent magnets can move freely along the sensor tube and activates the dry-reed contacts when it reaches the minimum and maximum fluid levels. The fluid levels are permanently pre-set by means of adjusting rings.

**Fitting the magnetic float switch control**

1. Remove the plug from the G<sup>3</sup>/<sub>4</sub> through-hole in the cover plate.
2. Tightly screw the magnetic float switch arrangement into the G<sup>3</sup>/<sub>4</sub> hole provided.

	<b>NOTE</b>
<p>The switching points - measured from the cover plate - are located at 300 mm for "ON" and 800 mm (for installation depth 1000 mm) or 1700 mm (for installation depth 1900 mm) for "OFF" and cannot be altered. The max. contact rating is 1 A; for MK pumps separately at the tank.</p>	

**5.3.1.3 EURO float switch control (non-ATEX applications only)**

The pump set is started/stopped by the float switch in response to the fluid level.

The free length of the float's connection cable (= length from the attachment point to the float switch) defines the fluid levels for starting/stopping the pump.

Float switches with 5, 10 or 20 m connection cable must only be used for fluids with a maximum temperature of 70 °C.

**5.3.2 Control element for MKY**

Pump sets installed in heat transfer fluid and recirculating systems usually do not need any control elements.

If the pump set is used for handling condensate at temperatures of up to 110 °C and is installed at installation depths of 1000 mm or 1900 mm, it can be equipped with magnetic float switch control. (⇒ Section 5.3.1.2, Page 24)

**5.4 Installing the pump set**

- ✓ The installed motor is protected against flooding.
  - ✓ Motor and (optional) float switch are located outside the pit or tank.
  - ✓ Motor and (optional) float switch are ventilated and protected against moisture.
1. Remove the transport plugs from the volute casing and the discharge pipe.
  2. For pump sets with installation depths of 1900 mm and 2800 mm without cover plate (MK) fit the pipe union 731, which is supplied separately strapped to the pump. (⇒ Section 9.1.2, Page 55) (⇒ Section 9.1.4, Page 57)
  3. Place the pump set on the floor of a pit (approximately 500 x 500 mm) or, if the pump set is installed in a tank, fit it to the tank edge with a cover plate.
  4. If the pump set is installed in a pit without a cover plate and angular frame, secure it to the pit wall using mounting clamps.

**5.5 Connecting the piping**

	<b>DANGER</b>
<p><b>Impermissible loads acting on the pump nozzles</b>            Danger to life from leakage of hot, toxic, corrosive or flammable fluids!</p> <ul style="list-style-type: none"> <li>▷ Do not use the pump as an anchorage point for the piping.</li> <li>▷ Anchor the pipes in close proximity to the pump and connect them properly without transmitting any stresses or strains.</li> <li>▷ Take appropriate measures to compensate for thermal expansion of the piping.</li> </ul>	

2324.81/20-EN

	<b>CAUTION</b>
	<p><b>Incorrect earthing during welding work on the piping</b> Destruction of rolling element bearings (pitting effect)!</p> <ul style="list-style-type: none"> <li>▷ Never earth the electric welding equipment on the pump or soleplate.</li> <li>▷ Prevent current flowing through the rolling element bearings.</li> </ul>

	<b>NOTE</b>
	<p>Installing check and shut-off elements in the system is recommended, depending on the type of plant and pump. However, such elements must not obstruct proper drainage or hinder disassembly of the pump.</p>

	<b>NOTE</b>
	<p>If the pump is used for automatic drainage, fit a non-return or check valve.</p>

- ✓ The nominal diameters of the pipelines are equal to or greater than the nominal diameters of the pump nozzles.
- ✓ Adapters to larger nominal diameters are designed with a diffuser angle of approx. 8° to avoid excessive pressure losses.
- ✓ A flow velocity of 2-3 m/s is recommended.
- ✓ The pipelines have been anchored in close proximity to the pump and connected without transmitting any stresses or strains.
  1. Thoroughly clean, flush and blow through all vessels, pipelines and connections (especially of new installations).
  2. Before installing the pump in the piping, remove the flange covers on the suction and discharge nozzles of the pump.

	<b>CAUTION</b>
	<p><b>Welding beads, scale and other impurities in the piping</b> Damage to the pump!</p> <ul style="list-style-type: none"> <li>▷ Free the piping from any impurities.</li> </ul>

3. If required, fit a suction strainer upstream of the pump nozzle.
4. Connect the discharge-side pump nozzle with the piping.

	<b>CAUTION</b>
	<p><b>Aggressive flushing liquid and pickling agent</b> Damage to the pump!</p> <ul style="list-style-type: none"> <li>▷ Match the cleaning operation mode and duration of flushing and pickling to the casing materials and seal materials used.</li> </ul>

**5.6 Permissible forces and moments at the pump nozzles**

No piping-induced forces and moments (from warped pipelines or thermal expansion, for example) must act on the pump.

5.7 Electrical connection

	<p><b>⚠ DANGER</b></p> <p><b>Incorrect electrical installation</b> Explosion hazard!</p> <ul style="list-style-type: none"> <li>▷ For electrical installation, also observe the requirements of IEC 60079-14 .</li> <li>▷ Observe the manufacturer's product literature supplied with the motor.</li> <li>▷ Observe the manufacturer's product literature supplied with the float switch if float switch control is used.</li> <li>▷ Always connect explosion-proof motors via a motor protection switch.</li> </ul>
 	<p><b>⚠ DANGER</b></p> <p><b>Electrostatic charging</b> Explosion hazard! Damage to the pump set!</p> <ul style="list-style-type: none"> <li>▷ Connect the potential equalisation conductor to the earthing terminal provided.</li> <li>▷ Make sure that the connection between pump and baseplate is electrically conductive.</li> <li>▷ Screws, bolts, nuts and shims must not be coated or the coating must be removed.</li> <li>▷ Provide potential equalisation between the pump set and the foundation.</li> </ul>
	<p><b>⚠ DANGER</b></p> <p><b>Electrical connection work by unqualified personnel</b> Danger of death from electric shock!</p> <ul style="list-style-type: none"> <li>▷ Always have the electrical connections installed by a trained electrician.</li> <li>▷ Observe regulations IEC 60364 and, for explosion-proof versions, EN 60079 .</li> </ul>
	<p><b>⚠ WARNING</b></p> <p><b>Incorrect connection to the mains</b> Damage to the power supply network, short circuit!</p> <ul style="list-style-type: none"> <li>▷ Observe the technical specifications of the local energy supply companies.</li> </ul>
	<p><b>NOTE</b></p> <p>Installing a motor protection device is recommended.</p>

1. Check the available mains voltage against the data on the motor name plate.
2. Select an appropriate starting method.

5.8 Checking the direction of rotation

	<p><b>⚠ DANGER</b></p> <p><b>Pump set running dry</b> Explosion hazard!</p> <ul style="list-style-type: none"> <li>▷ Check the direction of rotation of explosion-proof pump sets outside potentially explosive atmospheres.</li> </ul>
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	<p style="background-color: #f4a460; padding: 5px;"><b>⚠ WARNING</b></p> <p><b>Hands inside the pump casing</b> Risk of injuries, damage to the pump!</p> <ul style="list-style-type: none"> <li>▸ Always disconnect the pump set from the power supply and secure it against unintentional start-up before inserting your hands or other objects into the pump.</li> </ul>
	<p style="background-color: #f4c400; padding: 5px;"><b>CAUTION</b></p> <p><b>Pump set running dry</b> Increased vibrations! Damage to mechanical seals and bearings!</p> <ul style="list-style-type: none"> <li>▸ Never operate the pump set for more than 60 seconds without the fluid handled.</li> </ul>
	<p style="background-color: #f4c400; padding: 5px;"><b>CAUTION</b></p> <p><b>Drive and pump running in the wrong direction of rotation</b> Damage to the pump!</p> <ul style="list-style-type: none"> <li>▸ Refer to the arrow indicating the direction of rotation on the pump.</li> <li>▸ Check the direction of rotation. If required, check the electrical connection and correct the direction of rotation.</li> </ul>

The correct direction of rotation of the motor and pump is clockwise (seen from the drive end).

1. Start the motor and stop it again immediately to determine the motor's direction of rotation.
2. Check the direction of rotation.  
The motor's direction of rotation must match the arrow indicating the direction of rotation on the pump.
3. If the motor is running in the wrong direction of rotation, check the electrical connection of the motor and the control system, if applicable.

## 6 Commissioning/Start-up/Shutdown

### 6.1 Commissioning/Start-up

#### 6.1.1 Prerequisites for commissioning/start-up

- The pump set has been properly connected to the power supply and is equipped with all protection devices.
- The direction of rotation has been checked.
- All auxiliary connections required are connected and operational.
- After prolonged shutdown of the pump (set), the activities required for returning the equipment to service have been carried out.
- Float switch control has been installed and set (if applicable).

#### 6.1.2 Filling in lubricants

**Thrust and radial bearings** The sealed-for-life radial ball bearings are already packed with grease.

**Radial bearings** The bearing bushes are lubricated by the fluid handled. The start-up point must be situated above the top bearing. Observe the minimum fluid level (⇒ Section 6.2.3.2, Page 32) . For grease lubrication (optional) fill the lubricators with grease. For lubrication by external fluid open the flushing liquid connection. (⇒ Section 7.2.2.2, Page 38)

#### 6.1.3 Start-up

 	 <b>DANGER</b>
	<p><b>Non-compliance with the permissible pressure and temperature limits due to a clogged intake or if the pump is operated with the discharge line closed.</b>  Explosion hazard!  Leakage of hot fluids!</p> <ul style="list-style-type: none"> <li>▷ Never operate the pump with the shut-off elements in the discharge line closed.</li> <li>▷ Only start up the pump set against a slightly or completely open discharge-side shut-off element.</li> <li>▷ Make sure that the intake area is clean and free from foreign objects.</li> </ul>
 	 <b>DANGER</b>
	<p><b>Excessive temperatures due to dry running or excessive gas content in the fluid handled</b>  Explosion hazard!  Damage to the pump set!</p> <ul style="list-style-type: none"> <li>▷ Never operate the pump set without liquid fill.</li> <li>▷ Prime the pump as per operating instructions.</li> <li>▷ Always operate the pump within the permissible operating range.</li> <li>▷ If the pump is in slurp mode, stop the pump immediately.</li> <li>▷ Provide for fill level monitoring to prevent dry running of the pump.</li> </ul>

	<b>CAUTION</b>
	<p><b>Abnormal noises, vibrations, temperatures or leakage</b>  <b>Damage to the pump!</b></p> <ul style="list-style-type: none"> <li>▷ Switch off the pump (set) immediately.</li> <li>▷ Eliminate the causes before returning the pump set to service.</li> </ul>

- ✓ The system piping has been cleaned.
- ✓ The pump and the inlet tank, if any, have been vented and primed with the fluid to be handled.
- ✓ The lines for priming and venting have been closed.

	<b>CAUTION</b>
	<p><b>Start-up against open discharge line</b>  <b>Motor overload!</b></p> <ul style="list-style-type: none"> <li>▷ Make sure the motor has sufficient power reserves.</li> <li>▷ Use a soft starter.</li> <li>▷ Use speed control.</li> </ul>

1. Close or slightly open the shut-off element in the discharge line.
2. Start up the motor.
3. Immediately after the pump has reached full rotational speed, slowly open the shut-off element in the discharge line and adjust it to comply with the duty point.

**6.1.4 Shutdown**

1. Close the shut-off element in the discharge line.
2. Switch off the motor and make sure the pump set runs down smoothly to a standstill.

	<b>NOTE</b>
	<p>If the discharge line is equipped with a non-return or check valve, the shut-off element may remain open provided that the system conditions and system regulations are considered and observed.</p>

	<b>NOTE</b>
	<p>If shut-off is not possible, the pump will run in reverse direction. The reverse runaway speed must be lower than the rated speed.</p>

For prolonged shutdown periods:

1. Close the auxiliary connections.

	<b>CAUTION</b>
	<p><b>Risk of freezing during prolonged pump shutdown periods</b>  <b>Damage to the pump!</b></p> <ul style="list-style-type: none"> <li>▷ Drain the pump and the cooling/heating chambers (if any) or otherwise protect them against freezing.</li> </ul>

### 6.2 Operating limits

	<p><b>⚠ DANGER</b></p>
	<p><b>Non-compliance with operating limits</b>            Damage to the pump set!</p> <ul style="list-style-type: none"> <li>▸ Comply with the operating data specified in the data sheet.</li> <li>▸ Never operate an explosion-proof pump set at ambient temperatures or fluid temperatures exceeding those specified in the data sheet and/or on the name plate.</li> <li>▸ Never operate the pump set outside the limits specified below.</li> </ul>

#### 6.2.1 Ambient temperature

	<p><b>CAUTION</b></p>
	<p><b>Operation outside the permissible ambient temperature</b>            Damage to the pump (set)!</p> <ul style="list-style-type: none"> <li>▸ Observe the specified limits for permissible ambient temperatures.</li> </ul>

Observe the following parameters and values during operation:

**Table 7:** Permissible ambient temperatures

Permissible ambient temperature	Value
Maximum	40 °C
Minimum	- 20 °C

#### 6.2.2 Frequency of starts

	<p><b>⚠ DANGER</b></p>
	<p><b>Excessive surface temperature of the motor</b>            Explosion hazard!            Damage to the motor!</p> <ul style="list-style-type: none"> <li>▸ In case of explosion-proof motors, observe the frequency of starts specified in the manufacturer's product literature.</li> </ul>

To prevent high temperature increases in the motor and excessive loads on the pump, coupling, motor, seals and bearings, the frequency of starts shall not exceed 20 start-ups per hour (h).

	<p><b>CAUTION</b></p>
	<p><b>Re-starting while motor is still running down</b>            Damage to the pump (set)!</p> <ul style="list-style-type: none"> <li>▸ Do not re-start the pump set before the pump rotor has come to a standstill.</li> </ul>

### 6.2.3 Fluid handled

#### 6.2.3.1 Flow rate

Unless specified otherwise in the characteristic curves or in the data sheets, the following applies:

- Short-time operation:  $Q_{\min}^{4)} = 0.1 \times Q_{\text{BEP}}^{5)}$
- Continuous operation:  $Q_{\min}^{4)} = 0.3 \times Q_{\text{BEP}}^{5)}$
- 2-pole operation:  $Q_{\max}^{6)} = 1.1 \times Q_{\text{BEP}}^{5)}$
- 4-pole operation:  $Q_{\max}^{6)} = 1.25 \times Q_{\text{BEP}}^{5)}$

The data refer to water and water-like fluids. Longer operating periods with these fluids and at the flow rates indicated will not cause an additional increase in the temperatures on the pump surface. However, if the physical properties of the fluids handled differ from those of water, the calculation formula below must be used to check if an additional heat build-up may lead to a dangerous temperature increase at the pump surface. If necessary, the minimum flow must be increased.

$$T_o = T_f + \Delta \vartheta$$

$$\Delta \vartheta = \frac{g \times H}{c \times \eta} \times (1 - \eta)$$

Table 8: Key

Symbol	Description	Unit
c	Specific heat capacity	J/kg K
g	Acceleration due to gravity	m/s <sup>2</sup>
H	Pump discharge head	m
T <sub>f</sub>	Fluid temperature	°C
T <sub>o</sub>	Temperature at the casing surface	°C
η	Pump efficiency at duty point	-
Δϑ	Temperature difference	K

#### 6.2.3.2 Minimum level of fluid handled

	<p><b>⚠ DANGER</b></p> <p><b>Pump set running dry</b> Explosion hazard!</p> <p>▷ Never allow an explosion-proof pump set to run dry!</p>
	<p><b>CAUTION</b></p> <p><b>Fluid level below the specified minimum</b> Damage to the pump set by cavitation!</p> <p>▷ Never allow the fluid level to drop below the specified minimum.</p>

**Minimum** 120 mm above the bottom edge of the casing; if handling condensate ~400 mm

**Maximum** 150 mm below the plate

Before start-up, the pump set must always be immersed in the fluid to be handled so it is above the minimum switch-off level (⇒ Section 6.1.2, Page 29) .

<sup>4</sup> Minimum flow rate

<sup>5</sup> Flow rate at best efficiency point

<sup>6</sup> Maximum flow rate

6.2.3.3 Temperature of the fluid handled

	<b>CAUTION</b>
	<p><b>Incorrect fluid temperature</b>                  Damage to the pump (set)!</p> <ul style="list-style-type: none"> <li>▷ Only operate the pump (set) within the temperature limits indicated.</li> </ul>

Table 9: Fluid temperature

Design	Temperature [°C]	
	Minimum	Maximum
MK, MKA	-10 °C	90 °C <sup>7)</sup>
MKY	-10 °C	200 °C <sup>8)</sup>

6.2.3.4 Density of the fluid handled

The power input of the pump set will change in proportion to the density of the fluid handled.

	<b>CAUTION</b>
	<p><b>Impermissibly high density of the fluid handled</b>                  Motor overload!</p> <ul style="list-style-type: none"> <li>▷ Observe the information about fluid density in the data sheet.</li> <li>▷ Make sure the motor has sufficient power reserves.</li> </ul>

6.2.3.5 Gas content of fluid handled

	<b>⚠ DANGER</b>
	<p><b>Excessive temperatures as a result of bearing bushes running hot</b>                  Explosion hazard!                  Fire hazard!                  Damage to the pump set!</p> <ul style="list-style-type: none"> <li>▷ Never pump fluids with excessive gas content.</li> <li>▷ Allow sufficient time for gases to leave the fluid handled.</li> </ul>

6.2.3.6 Abrasive fluids

Do not exceed the maximum permissible solids content specified in the data sheet. When the pump handles fluids containing abrasive substances, increased wear of the hydraulic system and shaft seal are to be expected. In this case, reduce the commonly recommended inspection intervals.

6.3 Shutdown/storage/preservation

6.3.1 Measures to be taken for shutdown

The pump (set) remains installed

- ✓ Sufficient fluid is supplied for the functional check run of the pump.
  1. For prolonged shutdown periods, start up the pump (set) regularly between once a month and once every three months for approximately five minutes.

<sup>7</sup> 80 °C for bearing material 1.4571-NBR

<sup>8</sup> 200 °C for bearing material EK 3205; 110 °C when handling water; 80 °C for bearing material 1.4571-NBR

⇒ This will prevent the formation of deposits within the pump and the pump intake area.

**The pump (set) is removed from the pipe and stored**

- ✓ The pump has been properly drained.
  - ✓ The safety instructions for dismantling the pump have been observed.
  - ✓ The permissible ambient temperature for storing the pump is observed.
1. Spray-coat the inside wall of the pump casing and, in particular, the impeller clearance areas with a preservative.
  2. Spray the preservative through the suction nozzle and discharge nozzle. It is advisable to then close the pump nozzles (e.g. with plastic caps)
  3. Oil or grease all exposed machined parts and surfaces of the pump (with silicone-free oil or grease, food-approved, if required) to protect them against corrosion.  
Observe the additional instructions on preservation.

If the pump set is to be stored temporarily, only preserve the wetted components made of low-alloy materials. Commercially available preservatives can be used for this purpose. Observe the manufacturer's instructions for application/removal.

**6.4 Returning to service**

	 <b>WARNING</b>
	<p><b>Failure to re-install or re-activate protective devices</b> Risk of injury from moving parts or escaping fluid!</p> <p>▷ As soon as the work is completed, properly re-install and re-activate any safety-relevant devices and protective devices.</p>

For returning the equipment to service, observe the sections on commissioning/start-up (⇒ Section 6.1, Page 29) and the operating limits .

In addition, carry out all servicing/maintenance operations before returning the pump (set) to service. (⇒ Section 7, Page 35)

## 7 Servicing/Maintenance

### 7.1 Safety regulations

	<p><b>⚠ DANGER</b></p> <p><b>Improper cleaning of coated pump surfaces</b> Explosion hazard by electrostatic discharge!</p> <ul style="list-style-type: none"> <li>▷ When cleaning coated pump surfaces in atmospheres of Explosion group IIC, use suitable anti-static equipment.</li> </ul>
	<p><b>⚠ DANGER</b></p> <p><b>Sparks produced during servicing work</b> Explosion hazard!</p> <ul style="list-style-type: none"> <li>▷ Observe the safety regulations in force at the place of installation!</li> <li>▷ Always perform maintenance work at an explosion-proof pump (set) outside of potentially explosive atmospheres.</li> </ul>
	<p><b>⚠ DANGER</b></p> <p><b>Improperly serviced pump set</b> Explosion hazard! Damage to the pump set!</p> <ul style="list-style-type: none"> <li>▷ Service the pump set regularly.</li> <li>▷ Prepare a maintenance schedule with special emphasis on lubricants, shaft seal and coupling.</li> </ul>
<p>The operator ensures that maintenance, inspection and installation are performed by authorised, qualified specialist personnel who are thoroughly familiar with the manual.</p>	
	<p><b>⚠ WARNING</b></p> <p><b>Unintentional starting of the pump set</b> Risk of injury by moving components and shock currents!</p> <ul style="list-style-type: none"> <li>▷ Ensure that the pump set cannot be started unintentionally.</li> <li>▷ Always make sure the electrical connections are disconnected before carrying out work on the pump set.</li> </ul>
	<p><b>⚠ WARNING</b></p> <p><b>Fluids handled, consumables and supplies which are hot and/or pose a health hazard</b> Risk of injury!</p> <ul style="list-style-type: none"> <li>▷ Observe all relevant laws.</li> <li>▷ When draining the fluid take appropriate measures to protect persons and the environment.</li> <li>▷ Decontaminate pumps which handle fluids posing a health hazard.</li> </ul>

	<p><b>⚠ WARNING</b></p>
	<p><b>Insufficient stability</b>            Risk of crushing hands and feet!</p> <ul style="list-style-type: none"> <li>▷ During assembly/dismantling, secure the pump (set)/pump parts to prevent tilting or tipping over.</li> </ul>

A regular maintenance schedule will help avoid expensive repairs and contribute to trouble-free, reliable operation of the pump, pump set and pump parts with a minimum of servicing/maintenance expenditure and work.

	<p><b>NOTE</b></p>
	<p>All maintenance work, service work and installation work can be carried out by KSB Service or authorised workshops. For contact details refer to the enclosed "Addresses" booklet or visit "<a href="http://www.ksb.com/contact">www.ksb.com/contact</a>" on the Internet.</p>

Never use force when dismantling and reassembling the pump set.

## 7.2 Servicing/Inspection

### 7.2.1 Supervision of operation

	<p><b>⚠ DANGER</b></p>
	<p><b>Impermissibly high temperatures</b>            Explosion hazard!            Damage to the pump!</p> <ul style="list-style-type: none"> <li>▷ Prolonged operation against a closed shut-off element is not permitted (heating up of the fluid).</li> <li>▷ Observe the temperature limits in the data sheet and in the section on operating limits. (⇒ Section 6.2, Page 31)</li> </ul>

	<p><b>⚠ DANGER</b></p>
	<p><b>Excessive temperatures as a result of bearings running hot or defective bearing seals</b>            Explosion hazard!            Fire hazard!            Damage to the pump set!            Risk of burns!</p> <ul style="list-style-type: none"> <li>▷ Regularly check the lubricant level.</li> <li>▷ Regularly check the rolling element bearings for running noises.</li> </ul>

	<p><b>CAUTION</b></p>
	<p><b>Fluid level below the specified minimum</b>            Damage to the pump set by cavitation! Dry running of the plain bearings!</p> <ul style="list-style-type: none"> <li>▷ Never allow the fluid level to drop below the specified minimum.</li> </ul>

While the pump is in operation, observe and check the following:

- The pump must run quietly and free from vibrations at all times.
- Check the shaft seal.
- Check the static sealing elements for leakage.

- Check the rolling element bearings for running noises. Vibrations, noise and an increase in current input occurring during unchanged operating conditions indicate wear.
- Monitor the correct functioning of any auxiliary connections.
- Monitor the stand-by pump. To make sure that stand-by pumps are ready for operation, start them up once a week.
- Make sure that the floats of rod-actuated and magnetic float switch arrangements can always slide along the guide rods without obstruction.
- The minimum fluid level must be observed. (⇒ Section 6.2.3.2, Page 32)
- Monitor the bearing temperature. The bearing temperature must not exceed 90 °C (measured on the outside of the bearing bracket). For monitoring the bearing temperature, a G 1/8 connection hole (Ø 7 mm) is provided in thrust and radial bearing 303.1 (max. width across corners of fastener used: 18 mm).

	<b>CAUTION</b>
	<p><b>Operation outside the permissible bearing temperature</b></p> <p>Damage to the pump!</p> <ul style="list-style-type: none"> <li>▸ The bearing temperature of the pump (set) must never exceed 90 °C (measured on the outside of the bearing bracket).</li> </ul>
	<b>NOTE</b>
	<p>After commissioning, increased temperatures may occur at grease-lubricated rolling element bearings due to the running-in process. The final bearing temperature is only reached after a certain period of operation (up to 48 hours depending on the conditions).</p>

**7.2.2 Lubrication and lubricant change**

	<b>⚠ DANGER</b>
	<p><b>Excessive temperatures as a result of bearings running hot or defective bearing seals</b></p> <p>Explosion hazard! Fire hazard! Damage to the pump set!</p> <ul style="list-style-type: none"> <li>▸ Regularly check the condition of the lubricant.</li> </ul>

**7.2.2.1 Lubrication of radial ball bearings**

The shaft runs in a radial ball bearing in the thrust and radial bearing. The radial ball bearing is fitted with sealing washers on both sides and greased for life.

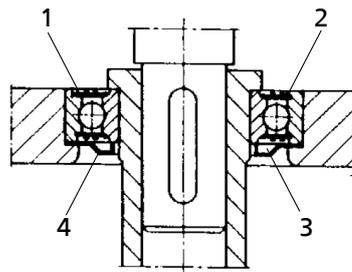


Fig. 8: Radial ball bearing (thrust and radial bearing)

1	Radial ball bearing	2	Washer
3	Grease fill	4	Nilos ring

Table 10: Bearings used

Sizes	Motor	Radial ball bearing	Nilos ring
MK, MKA 20-1 to 5	80 M	6006 2 RS	ZJV 6006
MK, MKA 20-6	90 S, L	6008 2 RS	ZJV 6008
MKY 20-1 to 4	80 M	6006 2 RS	ZJV 6006
MKY 20-5 and 6	90 S, L	6008 2 RS	ZJV 6008

**Grease quality**

- High-performance lithium soap grease to DIN 51825
- Free of resin and acid
- Not liable to crumble
- With good rust-preventive characteristics

**Bearing life**

With this grease, a theoretical bearing life Lh10 of 25,000 h at an operating temperature of 75 °C can be achieved. If temperatures are higher, grease life will be reduced. A temperature increase of 15 K will reduce grease life by half. However, bearing life may be reduced by vibrations, aggressive gases, humidity, etc.

7.2.2.2 Lubrication of bearing bushes

	<p><b>⚠ DANGER</b></p>
	<p><b>Excessive temperatures as a result of bearing bushes running hot</b>                  Explosion hazard!                  Fire hazard!                  Damage to the pump set!</p> <ul style="list-style-type: none"> <li>▸ Make sure the bearing bushes are properly lubricated.</li> <li>▸ Regularly check the bearing bushes for correct lubrication.</li> </ul>

The bearing bushes (radial bearings) in the support column and volute casing are lubricated by the fluid handled. Bearings must be checked for wear in the following cases:

- When the pump has been operated under dry-running or cavitation conditions
- When vibrations, noise and an increase in current input occur during unchanged operating conditions

**Internal lubrication by fluid handled**

Lubrication by the fluid handled is used for bearing bushes with a risk of dry running. Connect pipe union 731.21 between the discharge pipe and the support column.

Grease lubrication

	<b>CAUTION</b>
	<p><b>Insufficiently filled grease cups</b>                  Damage to the pump set by cavitation and ungreased bearings!</p> <ul style="list-style-type: none"> <li>▷ The grease cup must be filled with lubricant.</li> <li>▷ The grease cup must be screwed down regularly.</li> </ul>

Provide each bearing bush in the support column with a separate lubricating device including a lubricator.

**Grease quality**

Optimum grease properties:

Table 11: Grease quality to DIN 51825

Soap basis	NLGI grade	Worked penetration at 25° C in mm/10	Drop point
Lithium	2 to 3	220-295	≥ 175 °C

- Free of resin and acid
- Not liable to crumble
- Rust-preventive characteristics

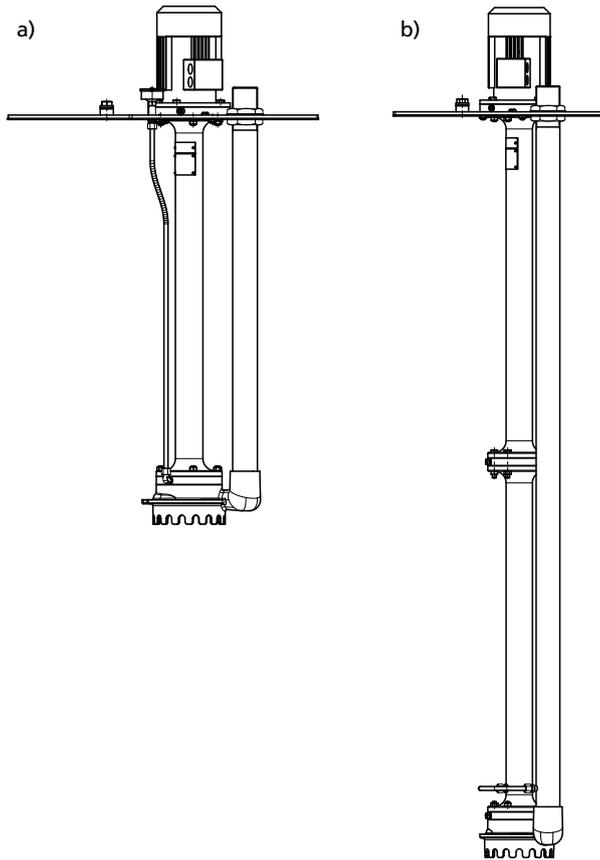


Fig. 9: a) Grease lubrication; b) Lubrication by fluid handled

Lubrication by external fluid

	<p style="background-color: #e67e22; color: white; padding: 5px;"><b>⚠ DANGER</b></p> <p><b>Failure of lubrication by external fluid</b> Explosion hazard!</p> <p>▸ Monitor lubrication by external fluid.</p>
  	<p style="background-color: #e67e22; color: white; padding: 5px;"><b>⚠ DANGER</b></p> <p><b>Risk of potentially explosive atmosphere by incompatible fluids mixing in the auxiliary piping</b> Risk of burns! Explosion hazard!</p> <p>▸ Make sure that the barrier fluid or quench liquid are compatible with the fluid handled.</p>

For lubrication by external fluid provide a flushing water connection which meets the following conditions:

- Maximum flushing water temperature: 40 °C
- Minimum pressure required: 2.5 bar
- Fit connection line with shut-off valve and non-return valve.
- Control by a solenoid valve connected in parallel with the motor is recommended.

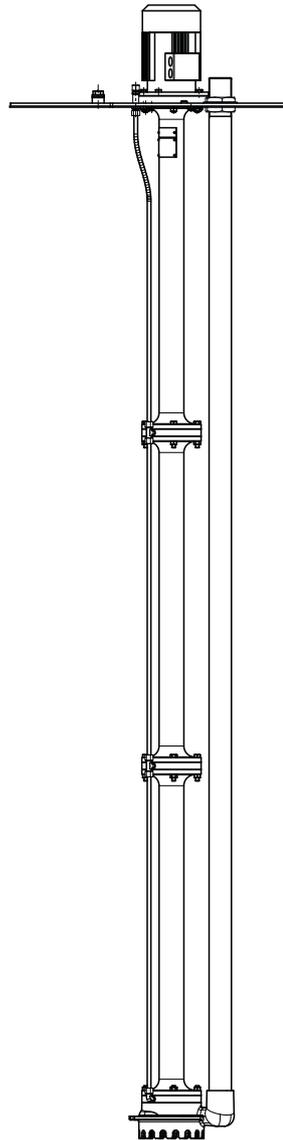


Fig. 10: Lubrication by external fluid

### 7.3 Drainage/cleaning

	<p><b>! WARNING</b></p>
	<p><b>Fluids handled, consumables and supplies which are hot and/or pose a health hazard</b></p> <p>Hazard to persons and the environment!</p> <ul style="list-style-type: none"> <li>▷ Collect and properly dispose of flushing fluid and any fluid residues.</li> <li>▷ Wear safety clothing and a protective mask if required.</li> <li>▷ Observe all legal regulations on the disposal of fluids posing a health hazard.</li> </ul>

1. Always flush the pump if it has been used for handling noxious, explosive, hot or other hazardous fluids.
2. Always flush and clean the pump before transporting it to the workshop. Provide a certificate of decontamination for the pump set. (⇒ Section 11, Page 62)

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### 7.4 Dismantling the pump set

#### 7.4.1 General information/Safety regulations

	<p><b>⚠ WARNING</b></p>
	<p><b>Unqualified personnel performing work on the pump (set)</b>                  Risk of injury!</p> <ul style="list-style-type: none"> <li>▷ Always have repair work and maintenance work performed by specially trained, qualified personnel.</li> </ul>
	<p><b>⚠ WARNING</b></p>
	<p><b>Hot surface</b>                  Risk of injury!</p> <ul style="list-style-type: none"> <li>▷ Allow the pump set to cool down to ambient temperature.</li> </ul>
	<p><b>⚠ WARNING</b></p>
	<p><b>Improper lifting/moving of heavy assemblies or components</b>                  Personal injury and damage to property!</p> <ul style="list-style-type: none"> <li>▷ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.</li> </ul>

Observe the general safety instructions and information. (⇒ Section 7.1, Page 35)

For any work on the motor, observe the instructions of the relevant motor manufacturer.

For dismantling and reassembly observe the exploded views and the general assembly drawing.

	<p><b>NOTE</b></p>
	<p>All maintenance work, service work and installation work can be carried out by KSB Service or authorised workshops. For contact details refer to the enclosed "Addresses" booklet or visit "<a href="http://www.ksb.com/contact">www.ksb.com/contact</a>" on the Internet.</p>
	<p><b>⚠ DANGER</b></p>
	<p><b>Insufficient preparation of work on the pump (set)</b>                  Risk of personal injury!</p> <ul style="list-style-type: none"> <li>▷ Properly shut down the pump set.</li> <li>▷ Close the shut-off elements in the discharge line.</li> <li>▷ Drain the pump and release the pump pressure.</li> <li>▷ Close any auxiliary connections.</li> <li>▷ Allow the pump set to cool down to ambient temperature.</li> </ul>
	<p><b>NOTE</b></p>
	<p>After a prolonged period of operation the individual components may be hard to pull off the shaft. If this is the case, use a brand name penetrating agent and/or - if possible - an appropriate puller.</p>

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### 7.4.2 Removing the pump set from the piping

1. De-energise the pump set and secure it against unintentional start-up.
2. Disconnect the motor from the power supply.
3. Disconnect and remove all auxiliary pipework.
4. Unbolt the discharge nozzle from the pipeline.
5. Lift the pump set with support column 712 and/or pipe 710.01 and the cover plate out of the tank or pit.

### 7.4.3 Dismantling the pump section

#### 7.4.3.1 Dismantling the pump set (MK)

- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 42) to (⇒ Section 7.4.2, Page 43) have been observed/carried out.
- ✓ The pump set is kept in a clean and level assembly area.

	<b>CAUTION</b>
	<p><b>Damage to the shaft assembly</b> Warping of the shaft!</p> <ul style="list-style-type: none"> <li>▷ Support the shaft assembly if the shaft is long.</li> </ul>

1. Undo nuts 920.02.
2. Remove volute casing 102 with casing wear ring 502.
3. Remove grooved pin 561.02 and take impeller 230 off the shaft.
4. Remove radial bearing 303.02 and 303.03 (if any) with bearing bush 545.
5. Undo nuts 920.12.
6. Remove support column 712.01.

	<b>CAUTION</b>
	<p><b>Damage to the shaft assembly</b> Warping of the shaft!</p> <ul style="list-style-type: none"> <li>▷ Support the shaft assembly if the shaft is long.</li> </ul>

7. **For installation depths 1900 mm/2800 mm:** Undo hexagon head bolts 901.03 and nuts 920.03 and carefully take support column 712.02/03 and radial bearings 303.02 and 303.03 (if any) with the respective bearing bush 545 off the shaft.
8. Undo hexagon head bolt 901.01.
9. Remove the motor.
10. Remove the key.
11. Remove grooved pin 561.01 from sleeve 520.
12. Pull shaft 210 out of sleeve 520.
13. Press sleeve 520 out of radial ball bearing 321.
14. Remove radial ball bearing 321 from thrust and radial bearing 303.01.
15. Remove grease-packed ring 500.01.

#### 7.4.3.2 Dismantling the pump set (MKA)

- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 42) to (⇒ Section 7.4.2, Page 43) have been observed/carried out.
- ✓ The pump set is kept in a clean and level assembly area.

	<b>CAUTION</b>
	<p><b>Damage to the shaft assembly</b> Warping of the shaft!</p> <p>▷ Support the shaft assembly if the shaft is long.</p>

1. Remove any lubricating lines.
2. Remove level control equipment, if any.
3. Remove screw plug 903.01 with joint ring 411.01 from radial bearing 303.02 and 303.03 (if any).
4. Undo nuts 920.11.
5. Unscrew the discharge pipe from the volute casing 102. Note discs 550.11 and gaskets 400.11.
6. Undo nuts 920.02.
7. Remove volute casing 102 and casing wear ring 502.
8. Undo nuts 920.12.
9. Remove cover plate 68-3.

**7.4.3.3 Dismantling the pump set (MKY)**

- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 42) to (⇒ Section 7.4.2, Page 43) have been observed/carried out.
  - ✓ The pump set is kept in a clean and level assembly area.
1. Remove float switch control equipment, if any.
  2. Undo screws 900.61 and remove cover plates 81-92.
  3. Undo nut 920.62 at gland follower 452.62 and unscrew pipe 710.01 from volute casing 102.
  4. Remove gland follower 452.62, gland packing 461.62 and neck ring 457.
  5. Undo nuts 920.02.
  6. Remove volute casing 102 with casing wear ring 502.
  7. Remove grooved pin 561.02 and take impeller 230 off the shaft.
  8. Remove radial bearing 303.03 with bush 545.
  9. Undo nuts 920.01.
  10. Remove support column 712.01.

	<b>CAUTION</b>
	<p><b>Damage to the shaft assembly</b> Warping of the shaft!</p> <p>▷ Support the shaft assembly if the shaft is long.</p>

11. For installation depths 1900 mm/2800 mm: Undo the corresponding hexagon head bolt 901.03 and nut 920.03 and carefully take further support column(s) 712.02/.03 and radial bearings 303.02 and 303.03 (if any) with the respective bearing bush 545 off the shaft.
12. Loosen nuts 920.60 at the gland follower.
13. Undo nuts 920.61.
14. Remove drive lantern 341 with gasket 400.60 at the lower end of the shaft.
15. Remove gland follower 452.60 and take out discs 550.60 and gland packing 461.60/.61.
16. Undo hexagon head bolts 901.01 and remove the motor.
17. Remove the key.
18. Drive grooved pin 561.01 out of sleeve 520.

19. Pull shaft 210 out of sleeve 520.
20. Press sleeve 520 out of radial ball bearing 321.
21. Remove radial ball bearing 321 from thrust and radial bearing 303.01.
22. Remove grease-packed ring 500.01.

## 7.5 Reassembling the pump set

### 7.5.1 General information/Safety regulations

	<p><b>! WARNING</b></p>
	<p><b>Improper lifting/moving of heavy assemblies or components</b>          Personal injury and damage to property!</p> <ul style="list-style-type: none"> <li>▸ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.</li> </ul>
	<p><b>CAUTION</b></p>
	<p><b>Improper reassembly</b>          Damage to the pump!</p> <ul style="list-style-type: none"> <li>▸ Reassemble the pump (set) in accordance with the general rules of sound engineering practice.</li> <li>▸ Use original spare parts only.</li> </ul>

**Sequence** Always reassemble the pump in accordance with the corresponding general assembly drawing.

**Sealing elements**

- **Gaskets**
  - Always use new gaskets, making sure that they have the same thickness as the old ones.
  - Always fit gaskets of asbestos-free materials or graphite without using lubricants (e.g. copper grease, graphite paste).
- **O-rings**
  - Never use O-rings that have been glued together from material sold by the metre.
- **Packing rings**
  - Always use pre-compressed packing rings.

	<p><b>CAUTION</b></p>
	<p><b>Contact of O-ring with graphite or similar material</b>          Fluid could escape!</p> <ul style="list-style-type: none"> <li>▸ Do not coat O-ring with graphite or similar material.</li> <li>▸ Use animal fats or lubricants based on silicone or PTFE.</li> </ul>

- **Assembly aids**
  - For gaskets, avoid the use of assembly adhesives, if possible.
  - If assembly adhesives are required, use a commercially available contact adhesive (e.g. Pattex).
  - Only apply adhesive at selected points and in thin layers.
  - Never use quick-setting adhesives (cyanoacrylate adhesives).
  - Coat the locating surfaces of the individual components and screwed connections with graphite or similar before reassembly.
  - Prior to reassembly, screw back any forcing screws or alignment screws.

**Tightening torques** For reassembly, tighten all screws and bolts as indicated. (⇒ Section 7.6, Page 50)

**7.5.2 Reassembling the pump section**

**7.5.2.1 Re-assembling the pump set (MK)**

	<b>DANGER</b>
	<p><b>Incorrect shaft connection</b> Explosion hazard!</p> <p>▷ Connect the shafts between pump and motor as described in this manual.</p>

	<b>NOTE</b>
	<p>If the shaft is worn at the bearing positions, it may be turned upside down and installed again for continued use. At first re-installation in reversed position, the running faces on the shaft are as new. The bearing bushes have to be replaced at the same time.</p>

1. Press sleeve 520 into radial ball bearing 321 in cold condition.
2. Pull shaft 210 into sleeve 520 and secure it with grooved pin 561.01. Make sure it is firmly seated.

	<b>CAUTION</b>
	<p><b>Insufficient lubrication</b> Damage to the bearing! Prior to fitting the Nilos ring, pack its cranked sealing groove with grease.</p>

3. Fit studs 902.01 in thrust and radial bearing 303.01.
4. Pack the cranked sealing groove of ring 500.01 with grease. Then fit the ring in thrust and radial bearing 303.01.
5. Fit radial ball bearing 321 with fitted sleeve 520 and shaft 210 in prepared thrust and radial bearing 303.01.
6. Insert the key into the motor shaft.
7. Slide the motor shaft into sleeve 520.
8. Bolt the motor to thrust and radial bearing 303.01 with hexagon head bolts 901.01.
9. Apply a thin coat of grease to the bearing positions on shaft 210.
10. Press ring 550.01 into the first intermediate pipe 712.01 following thrust and radial bearing 303.01.
11. Swiftly press bearing bushes 545 into the corresponding radial bearings 303.02 / 303.03.

	<b>CAUTION</b>
	<p><b>Damage to the shaft assembly</b> Warping of the shaft! ▷ Support the shaft assembly if the shaft is long.</p>

12. Carefully slide first intermediate pipe 712.01 with fitted ring 550.01 on the shaft. Secure it to radial bearing 303.01 with nut 920.01.
13. Depending on the installation depth, carefully fit further radial bearings 303.02 /303.03 with pressed-in bearing bush 545 and intermediate pipes 712.02/.03 and secure them with hexagon head bolts 901.03 and nuts 920.03.
14. Slide impeller 230 onto the shaft stub and secure it with grooved pin 561.02. Make sure it is firmly seated.

15. Apply a thin layer of grease to the face of impeller 230 at the sealing clearance.
16. Press casing wear ring 502 into volute casing 102. Screw in studs 902.02.
17. Carefully pull prepared volute casing 102 over impeller 230. Screw it to the bottom radial bearing 303.02 and intermediate pipe 712.02/03 with hexagon nuts 920.02.
18. Fit screw plug 903.01 with joint ring 411.01 in radial bearing 303.02 / 303.03.
19. Install the lubricating lines, if any.
20. Fit float switch control equipment, if any.

	<b>NOTE</b>
For lubrication by the fluid handled, the Ermeto pipe fitting to be installed in the intermediate pipe and the weld-on threaded union with the pipe to be installed in the discharge pipe are supplied but not fitted.	

**7.5.2.1.1 Installing the shaft seal**

The bearing assembly is sealed by washers in the ball bearing of the thrust and radial bearing and a grease-backed ring. The MK/MKA models are additionally equipped with a vapour barrier (PTFE ring) in upper support column 712.01.

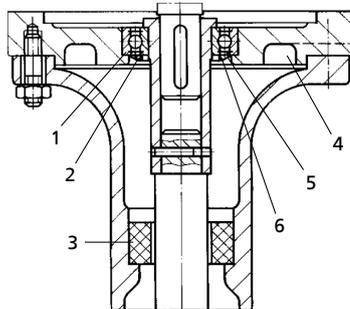


Fig. 11: Shaft seal MK/MKA

1	Radial ball bearing	2	Grease fill
3	Vapour barrier (PTFE ring)	4	Vent groove
5	Washers	6	Nilos ring

**7.5.2.2 Re-assembling the pump set (MKA)**

	 <b>DANGER</b>
<p><b>Incorrect shaft connection</b> Explosion hazard!</p> <p>▷ Connect the shafts between pump and motor as described in this manual.</p>	

	<b>NOTE</b>
If the shaft is worn at the bearing positions, it may be turned upside down and installed again for continued use. At first re-installation in reversed position, the running faces on the shaft are as new. The bearing bushes have to be replaced at the same time.	

1. Press sleeve 520 into radial ball bearing 321 in cold condition.
2. Pull shaft 210 into sleeve 520 and secure it with grooved pin 561.01. Make sure it is firmly seated.

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	<b>CAUTION</b>
	<p><b>Insufficient lubrication</b>          Damage to the bearing!          Prior to fitting the Nilos ring, pack its cranked sealing groove with grease.</p>

3. Fit studs 902.01 in thrust and radial bearing 303.01.
4. Insert studs 902.12 into thrust and radial bearing 303.01.
5. Pack the cranked sealing groove of ring 500.01 with grease. Then fit the ring in thrust and radial bearing 303.01.
6. Fit radial ball bearing 321 with fitted sleeve 520 and shaft 210 in prepared thrust and radial bearing 303.01.
7. Insert the key into the motor shaft.
8. Slide the motor shaft into sleeve 520.
9. Bolt the motor to thrust and radial bearing 303.01 with hexagon head bolts 901.01.
10. Apply a thin coat of grease to the bearing positions on shaft 210.
11. Press ring 550.01 into the first intermediate pipe 712.01 following thrust and radial bearing 303.01.
12. Swiftly press bearing bushes 545 into the corresponding radial bearings 303.02 / 303.03.

	<b>CAUTION</b>
	<p><b>Damage to the shaft assembly</b>          Warping of the shaft!          ▷ Support the shaft assembly if the shaft is long.</p>

13. Carefully slide first intermediate pipe 712.01 with fitted ring 550.01 on the shaft. Secure it to radial bearing 303.01 with nut 920.01.
14. Depending on the installation depth, carefully fit further radial bearings 303.02 / 303.03 with pressed-in bearing bush 545 and intermediate pipes 712.02/.03 and secure them with hexagon head bolts 901.03 and nuts 920.03.
15. Slide impeller 230 onto the shaft stub and secure it with grooved pin 561.02. Make sure it is firmly seated.
16. Apply a thin layer of grease to the face of impeller 230 at the sealing clearance.
17. Fit cover plate 68-3 and slightly tighten nuts 920.12.
18. Fit volute casing 102 with casing wear ring 502.
19. Tighten nuts 920.02.
20. Run pipe 710.01 through cover plate 68-3 with nut 920.11, disc 550.11 and gasket 400.11 and screw it into the nozzle of casing 102.
21. Secure cover plate 68-3 by tightening nuts 920.12.
22. Secure the pipe above the plate with another nut 920.11 with disc 550.11 and sealing element 400.11.  
 N.B.: Make sure the pump is free from stresses and strains when tightening the R2 hexagon nuts.
23. Fit screw plug 903.01 with joint ring 411.01 in radial bearing 303.02 / 303.03.
24. Install the lubricating lines, if any.
25. Fit float switch control equipment, if any.

	<b>NOTE</b>
	<p>For lubrication by the fluid handled, screw the pipe union tightly into the intermediate pipe and connect it via a pipe with the weld-on threaded union of the discharge pipe.</p>

### 7.5.2.3 Re-assembling the pump set (MKY)

	<b>NOTE</b>
	<p>If the shaft is worn at the bearing positions, it may be turned upside down and installed again for continued use. At first re-installation in reversed position, the running faces on the shaft are as new. The bearing bushes have to be replaced at the same time.</p>

1. Press coupling sleeve 520 into radial ball bearing 321 in cold condition.
2. Pull shaft 210 into sleeve 520 and secure it with grooved pin 561.01. Make sure it is firmly seated.

	<b>CAUTION</b>
	<p><b>Insufficient lubrication</b> Damage to the bearing! Prior to fitting the Nilos ring, pack its cranked sealing groove with grease.</p>

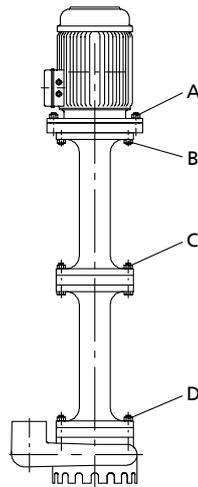
3. Pack the cranked sealing groove of ring 500.01 with grease. Then fit the ring in thrust and radial bearing 303.01.
4. Fit bearing 321 with fitted sleeve 520 and shaft 210 in prepared thrust and radial bearing 303.01 using studs 902.61.
5. Insert the key into the motor shaft.
6. Slide the motor shaft into sleeve 520.
7. Screw the motor to the thrust and radial bearing with hexagon head bolts 901.01.

#### 7.5.2.3.1 Installing the shaft seals

- ✓ The relevant packing chamber has been cleaned meticulously.
1. Fit stud 902.60 in drive lantern and position the gland packing ring 461.60 in outer position and 461.61 in inner position.
  2. Insert the first packing ring and push it inwards with gland follower 452.60.
  3. Insert subsequent packing rings one at a time, with their joints staggered at approximately 90°. Use gland follower 452.60 to seat each individual packing ring in the packing chamber.
  4. Tighten gland follower 452.60 lightly and evenly. It must be easy to rotate the rotor after the final assembly.
  5. Fit studs 902.01 in drive lantern 341.
  6. Mount the prepared shaft assembly including motor on the drive lantern.
  7. Tighten nuts 920.61.
  8. Apply a thin coat of grease to the bearing positions on the shaft.
  9. Swiftly press bearing bushes 545 into the corresponding radial bearings 303.02 and 303.03 (if any).
  10. Carefully slide first support column 712.01 on the shaft. Secure it to drive lantern 341 with nut 920.01.
  11. Depending on the installation depth, carefully fit further radial bearings 303.02 and 303.03 (if any) with pressed-in bearing bush 545 and support columns 712.02/03 and secure them with hexagon head bolts 901.03 and nuts 920.03.

12. Slide impeller 230 onto the shaft stub and secure it with grooved pin 561.02. Make sure it is firmly seated.
13. Apply a thin layer of grease to the impeller face 230 at the sealing clearance.
14. Press casing wear ring 502 into volute casing 102. Screw in studs 902.02.
15. Carefully pull prepared casing 102 over impeller 230. Screw it to the bottom radial bearing 303.02 and support column 712 with nuts 920.02.
16. Fit studs 902.62 in drive lantern 341.
17. Carefully guide pipe 710.01 through gland follower 452.62 with neck ring 457 and gland packing 461.62 and bolt it to volute casing 102 using nuts 920.62.
18. Fit level control equipment, if any.

**7.6 Tightening torques**



**Fig. 12:** Tightening points

**Table 12:** Tightening torques [NM] depending on materials<sup>9)</sup>

Position	Thread	Material	[Nm]
	[mm]		
A, B, C, D	M10	5.8	22
A, B, C, D	M10	8.8	50
A, B, C, D	M10	A4-70	35

**7.7 Spare parts stock**

**7.7.1 Ordering spare parts**

Always quote the following data when ordering replacement or spare parts:

- Order number
- Order item number
- Type series
- Size
- Material variant
- Year of construction

Refer to the name plate for all data.

<sup>9)</sup> After repeated tightening of the threads and in case of good lubrication the values shall be reduced by 15 to 20 %.

Also specify the following data:

- Part number and description (⇒ Section 9.1, Page 54)
- Quantity of spare parts
- Shipping address
- Mode of dispatch (freight, mail, express freight, air freight)

**7.7.2 Recommended spare parts stock for 2 years' operation to DIN 24296**

**Table 13:** Quantity of spare parts for recommended spare parts stock

Part No.	Description	Number of pumps (including stand-by pumps)						
		2	3	4	5	6 and 7	8 and 9	10 and more
210	Shaft	1	1	2	2	2	3	30 %
230	Impeller	1	1	1	2	2	3	30 %
321	Radial ball bearing	1	1	2	2	3	4	50 %
400	Gasket	1	1	2	2	3	4	50 %
550.01	PTFE ring	1	1	2	2	3	4	50 %
457	Neck ring	1	1	2	2	3	4	50 %
461.60/.61	Gland packing, support column <sup>10)</sup>	4	6	8	8	9	12	150 %
461.62	Gland packing, discharge pipe <sup>10)</sup>	2	3	4	4	6	6	100 %
502	Casing wear ring	2	2	2	3	3	4	50 %
545	Bearing bush							
	for installation depth 1000 mm	1	1	1	2	2	3	30 %
	for installation depth 1900 mm	2	2	2	4	4	6	60 %
	for installation depth 2800 mm	3	3	3	6	6	9	90 %

<sup>10)</sup> For MKY only

## 8 Trouble-shooting

	 <b>WARNING</b>
	<p><b>Improper work to remedy faults</b> Risk of injury!</p> <p>▷ For any work performed to remedy faults, observe the relevant information given in this operating manual and/or in the product literature provided by the accessories manufacturer.</p>

If problems occur that are not described in the following table, consultation with the KSB service is required.

- A Pump does not start up
- B Motor is overloaded  
Motor protection switch trips the pump
- C Pump delivers insufficient flow rate
- D Excessive pump flow rate
- E Vibrations during pump operation
- F Excessive wear on bearings

**Table 14:** Trouble-shooting

A	B	C	D	E	F	Possible cause	Remedy <sup>11)</sup>
-	-	X	-	-	-	Wrong direction of rotation	<ul style="list-style-type: none"> <li>▪ Check the electrical connection of the pump set and the control system, if necessary.</li> </ul>
-	X	X	-	X	-	Wear of internal components	<ul style="list-style-type: none"> <li>▪ Replace worn components by new ones.</li> </ul>
-	X	-	X	-	-	System head is lower than specified in the purchase order.	<ul style="list-style-type: none"> <li>▪ Re-adjust to duty point by means of the shut-off valve in the discharge line.</li> <li>▪ Check whether the impeller could be turned down.</li> </ul>
-	X	X	-	-	-	Density or viscosity of fluid handled higher than stated in purchase order	<ul style="list-style-type: none"> <li>▪ Contact the manufacturer.</li> </ul>
-	X	-	-	-	-	Gland follower over-tightened or cocked	<ul style="list-style-type: none"> <li>▪ Tighten gland follower correctly.</li> </ul>
-	X	X	-	-	-	Motor is running on two phases only.	<ul style="list-style-type: none"> <li>▪ Check the electrical cable connections.</li> <li>▪ Replace the defective fuse.</li> </ul>
X	-	-	-	-	-	Motor is not running because of lack of voltage.	<ul style="list-style-type: none"> <li>▪ Check electrical connections.</li> <li>▪ Notify the energy supply company.</li> </ul>
-	X	-	-	-	-	Switchgear, control unit or overcurrent relay defective.	<p>Check and replace, if necessary.</p> <ul style="list-style-type: none"> <li>▪ Check and replace defective components.</li> </ul>
-	-	X	-	-	-	Pump delivers against an excessively high pressure.	<ul style="list-style-type: none"> <li>▪ Re-adjust to duty point.</li> <li>▪ Check system for impurities.</li> <li>▪ Fit larger impeller.<sup>12)</sup></li> <li>▪ Increase the speed (turbine, I.C. engine)</li> </ul>
-	X	X	-	X	-	Supply line or impeller clogged	<ul style="list-style-type: none"> <li>▪ Remove deposits in the pump and/or piping.</li> </ul>
-	X	X	-	X	-	Insufficient inflow	<ul style="list-style-type: none"> <li>▪ Check suction openings/screen of the volute casing for dirt accumulation.</li> </ul>

<sup>11</sup> Pump pressure must be released before attempting to remedy faults on parts which are subjected to pressure.

<sup>12</sup> Contact KSB.

A	B	C	D	E	F	Possible cause	Remedy <sup>11)</sup>
-	X	-	-	X	X	Pump is warped or sympathetic vibrations in the piping.	<ul style="list-style-type: none"> <li>Check pipeline connections and secure fixing of pump; if required, reduce the distances between the pipe clamps.</li> <li>Fix the pipelines using anti-vibration material.</li> </ul>
-	X	-	-	X	-	Defective bearing(s)	<ul style="list-style-type: none"> <li>Replace the bearing(s). If required, re-install the shaft upside down.</li> </ul>
-	X	-	-	-	X	Pump clogged by sand, dirt in the pump sump.	<ul style="list-style-type: none"> <li>Clean the intake, pump components and lift check valve.</li> <li>Drain and clean the pit.</li> </ul>
-	-	-	-	X	X	Rotor is out of balance, shaft is warped	<ul style="list-style-type: none"> <li>Clean the impeller.</li> <li>Re-balance the impeller.</li> <li>Fit a new shaft.</li> </ul>
-	X	-	-	-	-	Current exceeds the value set in the motor protection switch.	<ul style="list-style-type: none"> <li>Set the motor protection switch to the nominal value given on the name plate of the motor.</li> </ul>
-	-	X	-	-	-	Excessive temperature of the fluid handled	<ul style="list-style-type: none"> <li>Lower the fluid temperature.</li> </ul>
-	-	-	-	-	X	Aggressive fluid	<ul style="list-style-type: none"> <li>Use other bearing material.</li> </ul>
-	-	-	-	-	X	Abrasive fluid	<ul style="list-style-type: none"> <li>Use different bearing material, if necessary.</li> <li>Supply flushing water (lubrication by external fluid).</li> </ul>
-	-	-	-	X	-	Cavitation (rattling noise)	<ul style="list-style-type: none"> <li>Check steam trap.</li> <li>Increase suction head.</li> <li>Reduce condensate temperature.</li> <li>Increase back pressure by throttling.</li> </ul>

## 9 Related Documents

### 9.1 General assembly drawings/exploded views with list of components

#### 9.1.1 MK, MKA

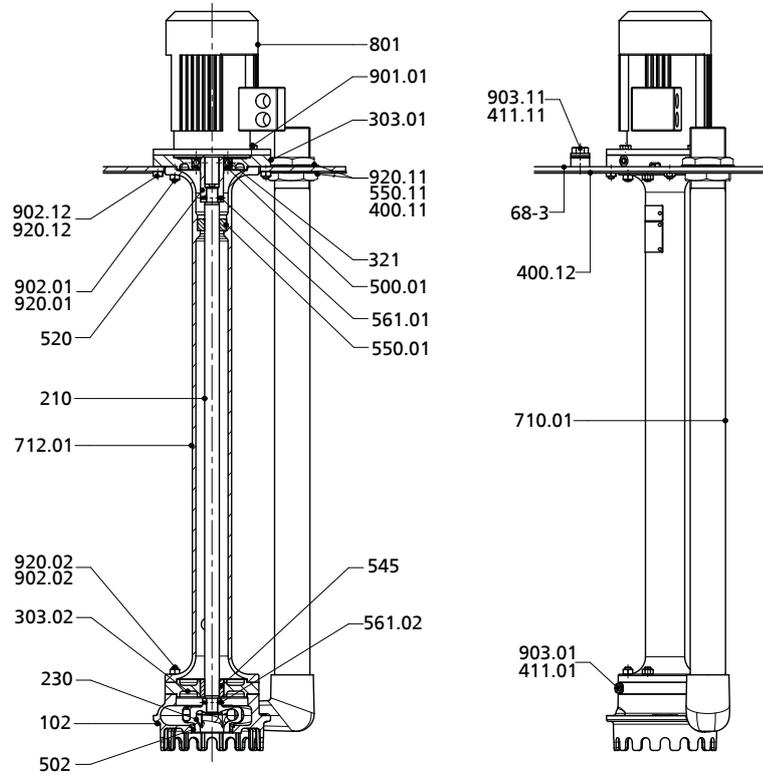


Fig. 13: Illustration of MK, MKA - installation depth 1000 mm

Table 15: List of components

Part No.	Description	Part No.	Description
102	Volute casing	545	Bearing bush
210	Shaft	550.01/.11	Disc
230	Impeller	561.01/.02	Grooved pin
303.01	Thrust and radial bearing	68-3	Cover plate
303.02	Thrust and radial bearing without vertical hole	710.01	Pipe
321	Radial ball bearing	712.01	Support column without hole
400.11/.12	Gasket	801	Flanged motor
411.01/.11	Joint ring	901.01	Hexagon head bolt
500.01	Ring	902.01/.02/.12	Stud
502	Casing wear ring	903.01/.11	Screw plug
520	Sleeve	920.01/.02/.11/.12	Nut

9.1.2 MK, MKA - grease-lubricated

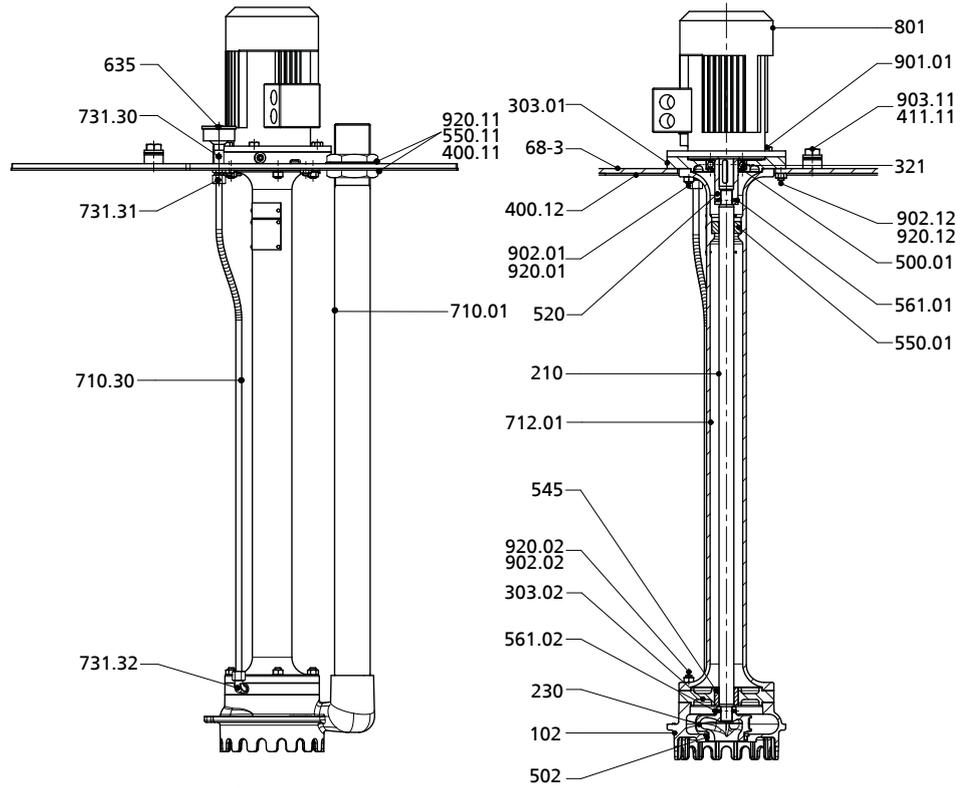


Fig. 14: Illustration of MK, MKA - installation depth 1000 mm, grease-lubricated

Table 16: List of components

Part No.	Description	Part No.	Description
102	Volute casing	635	Grease cup
210	Shaft	68-3	Cover plate
230	Impeller	710.01	Pipe
303.01	Thrust and radial bearing	710.30	Pipe
303.02	Thrust and radial bearing without vertical hole	712.01 <sup>13)</sup>	Support column without hole
321	Radial ball bearing	731.30/.31/.32	Pipe union
400.11/.12	Gasket	801	Flanged motor
411.11	Joint ring	81-39	Clamp
500.01	Ring	81-45	Float switch
502	Casing wear ring	901.01	Hexagon head bolt
520	Sleeve	902.01/.02/.12	Stud
545	Bearing bush	903.11	Screw plug
550.01/.11	Disc	920.01/.02/.11/.12	Nut
561.01/.02	Grooved pin		

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<sup>13</sup> Number of support columns 712 without hole, for installation depth ET: 1000 mm = 0; 1900 mm = 1; 2800 mm = 2

9.1.3 MK, MKA - internally lubricated by fluid handled

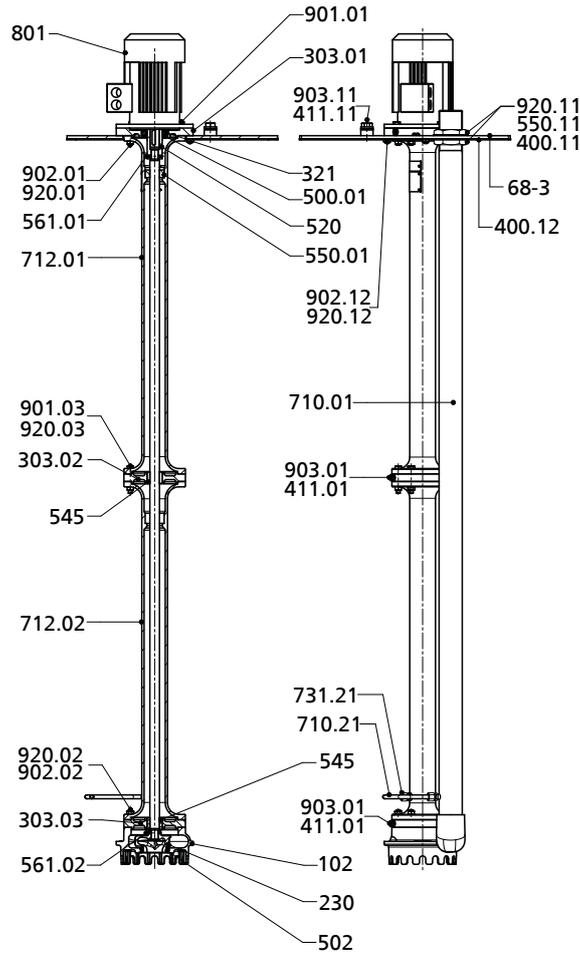


Fig. 15: Illustration of MK, MKA - installation depth 1900 mm, internally lubricated by fluid handled

Table 17: List of components

Part No.	Description	Part No.	Description
102	Volute casing	561.01/02	Grooved pin
230	Impeller	68-3	Cover plate
303.01	Thrust and radial bearing	710.01/21	Pipe
303.02	Thrust and radial bearing without vertical hole	712.01/02 <sup>14)</sup>	Support column without hole
303.03	Thrust and radial bearing with vertical hole	731.21	Pipe union
321	Radial ball bearing	801	Flanged motor
400.11/12	Gasket	900.46	Screw
411.01/11	Joint ring	901.01/03	Hexagon head bolt
500.01	Ring	902.01/02/.12	Stud
502	Casing wear ring	903.01/11	Screw plug
520	Sleeve	920.01/02/.03/.11/.12	Nut
545	Bearing bush	933.01	Split pin
550.11	Disc	99-3	Set of accessories

<sup>14</sup> Number of support columns 712 without hole, for installation depth ET: 1000 mm = 0; 1900 mm = 1; 2800 mm = 2

9.1.4 MK, MKA - lubricated by an external fluid

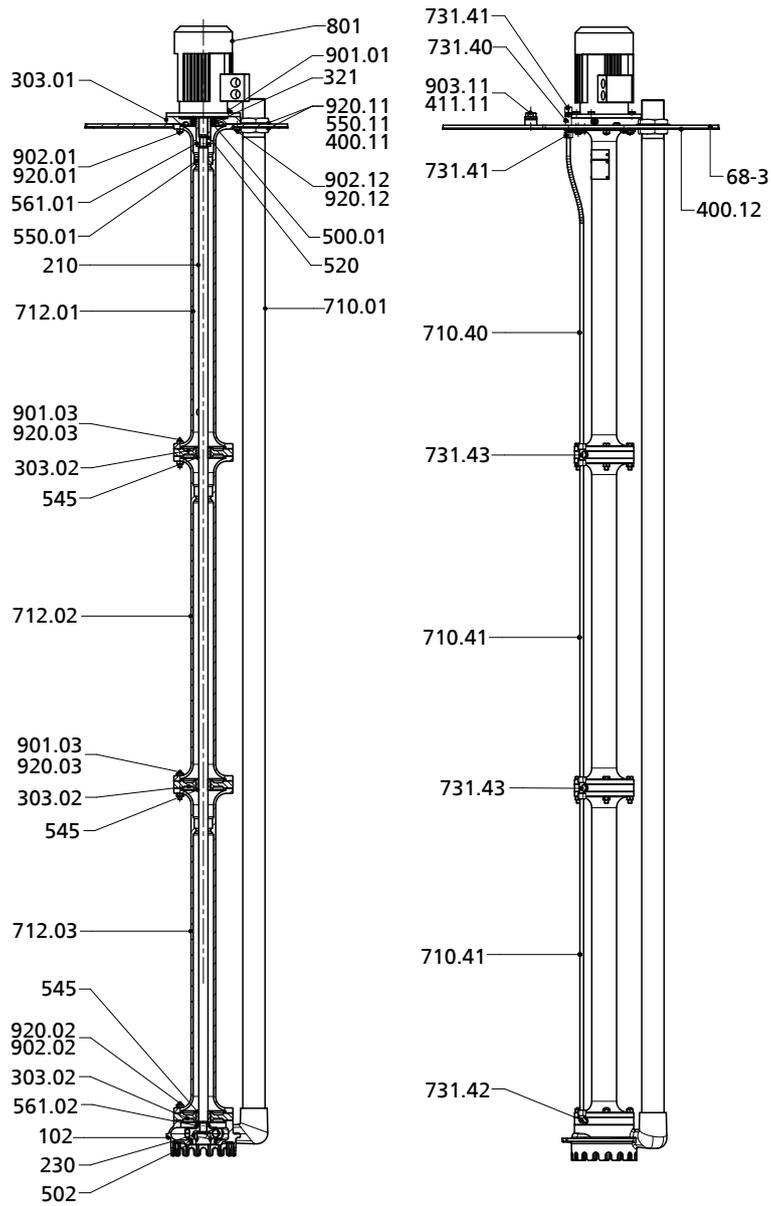


Fig. 16: Illustration of MK, MKA - installation depth 2800 mm, lubricated by an external fluid

Table 18: List of components

Part No.	Description	Part No.	Description
102	Volute casing	550.01/.11	Disc
210	Shaft	561.01/.02	Grooved pin
230	Impeller	68-3	Cover plate
303.01	Thrust and radial bearing	710.01/.40/.41	Pipe
303.02	Thrust and radial bearing without vertical hole	712.01/.02/.03 <sup>15)</sup>	Support column without hole
321	Radial ball bearing	731.40/.41/.42/.43	Pipe union
400.11/.12	Gasket	801	Flanged motor
411.11	Joint ring	901.01/.03	Hexagon head bolt
500.01	Ring	902.01/.02/.12	Stud

<sup>15)</sup> Number of support columns 712 without hole, for installation depth ET: 1000 mm = 0; 1900 mm = 1; 2800 mm = 2

2324.81/20-EN

Part No.	Description	Part No.	Description
502	Casing wear ring	903.11	Screw plug
520	Sleeve	920.01/.02/.03/.11/.12	Nut
545	Bearing bush		

9.1.5 MKY

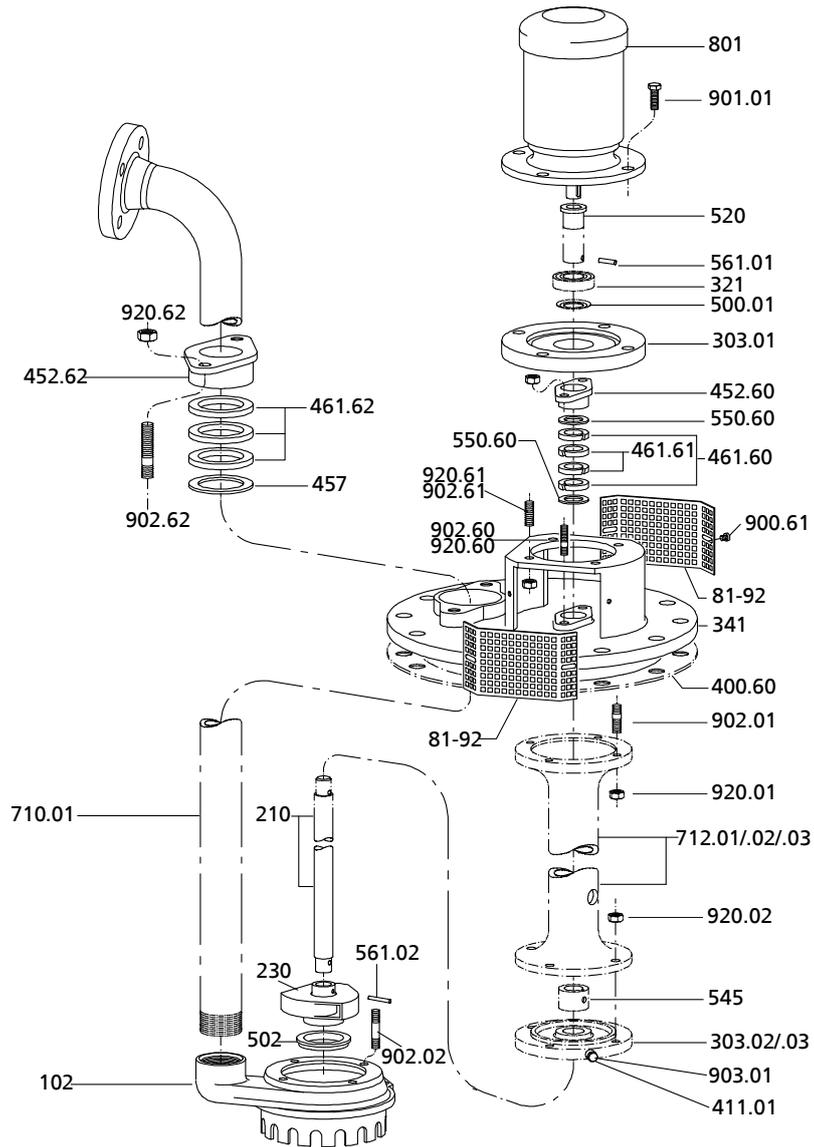


Fig. 17: MKY

Table 19: List of components

Part No.	Description	Part No.	Description
102	Volute casing	520	Sleeve
210	Shaft	545	Bearing bush
230	Impeller	550.60	Disc
303.01	Thrust and radial bearing	561.01/02	Grooved pin
303.02	Thrust and radial bearing without vertical hole	710.01	Pipe
303.03	Thrust and radial bearing with vertical hole	712.01	Support column with hole
321	Radial ball bearing	712.02/03	Support column without hole
341	Drive lantern	801	Flanged motor
400.60	Gasket	81-92	Cover plate
411.01	Joint ring	900.61	Screw
452.60/62	Gland follower	901.01	Hexagon head bolt
457	Neck ring	902.01/02/60/61/62	Stud
461.60/61/62	Gland packing	903.01	Screw plug

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Part No.	Description	Part No.	Description
500.01	Ring	920.01/02/60/61/62	Nut
502	Casing wear ring		

## 10 EU Declaration of Conformity

Manufacturer: **KSB SE & Co. KGaA**  
**Johann-Klein-Straße 9**  
**67227 Frankenthal (Germany)**

The manufacturer herewith declares that the product:

### **MK, MKA, MKY**

KSB order number: .....

- is in conformity with the provisions of the following directives / regulations as amended from time to time:
  - Pump (set): 2006/42/EC Machinery Directive

The manufacturer also declares that

- the following harmonised international standards<sup>16)</sup> have been applied:
  - ISO 12100
  - EN 809

Person authorised to compile the technical file:

Name  
Function  
Address (company)  
Address (street, No.)  
Address (post or ZIP code, city) (country)

The EU Declaration of Conformity was issued in/on:

Place, date

.....<sup>17)</sup>.....

Name  
Function  
Company  
Address

---

<sup>16)</sup> Apart from the standards listed here referring to the Machinery Directive, further standards are observed for explosion-proof versions (ATEX Directive) as applicable and are listed in the legally binding EU Declaration of Conformity.

<sup>17)</sup> A signed, legally binding EU Declaration of Conformity is supplied with the product.

### 11 Certificate of Decontamination

Type: .....

Order number /  
Order item number<sup>18)</sup>: .....

Delivery date: .....

Application: .....

Fluid handled<sup>18)</sup>: .....

Please tick where applicable<sup>18)</sup>:



Corrosive



Oxidising



Flammable



Explosive



Hazardous to health



Seriously hazardous to health



Toxic



Radioactive



Bio-hazardous



Safe

Reason for return:<sup>18)</sup> .....

Comments: .....

The product / accessories have been carefully drained, cleaned and decontaminated inside and outside prior to dispatch / placing at your disposal.

We herewith declare that this product is free from hazardous chemicals and biological and radioactive substances.

For mag-drive pumps, the inner rotor unit (impeller, casing cover, bearing ring carrier, plain bearing, inner rotor) has been removed from the pump and cleaned. In cases of containment shroud leakage, the outer rotor, bearing bracket lantern, leakage barrier and bearing bracket or intermediate piece have also been cleaned.

For canned motor pumps, the rotor and plain bearing have been removed from the pump for cleaning. In cases of leakage at the stator can, the stator space has been examined for fluid leakage; if fluid handled has penetrated the stator space, it has been removed.

- No special safety precautions are required for further handling.
- The following safety precautions are required for flushing fluids, fluid residues and disposal:

.....  
.....

We confirm that the above data and information are correct and complete and that dispatch is effected in accordance with the relevant legal provisions.

.....  
Place, date and signature

.....  
Address

.....  
Company stamp

<sup>18</sup> Required field

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2324.81/20-EN (01317346)