

Waste Water, Condensate and Heat Transfer Liquid Pump

MK

Installation/Operating Manual



Mat. No.: 01317346

Legal information/Copyright

Installation/Operating Manual MK

Original operating manual

All rights reserved. The contents provided herein must neither be distributed, copied, reproduced, edited or processed for any other purpose, nor otherwise transmitted, published or made available to a third party without the manufacturer's express written consent.

Subject to technical modification without prior notice.

© KSB Aktiengesellschaft, Frankenthal 08.07.2013

Contents

	Glossary	5
1	General	6
1.1	Principles	6
1.2	Installation of partly completed machinery	6
1.3	Target group	6
1.4	Other applicable documents	6
1.5	Symbols	6
2	Safety	8
2.1	Key to safety symbols/markings	8
2.2	General	8
2.3	Intended use	8
2.4	Personnel qualification and training	9
2.5	Consequences and risks caused by non-compliance with these operating instructions	9
2.6	Safety awareness	9
2.7	Safety information for the operator/user	10
2.8	Safety information for maintenance, inspection and installation work	10
2.9	Unauthorised modes of operation	10
2.10	Explosion protection	10
3	Transport/Temporary Storage/Disposal	13
3.1	Checking the condition upon delivery	13
3.2	Transport	13
3.3	Storage/preservation	13
3.4	Return to supplier	14
3.5	Disposal	14
4	Description of the Pump (Set)	16
4.1	General description	16
4.2	Designation	16
4.3	Name plate	16
4.4	Design details	17
4.5	Configuration and function	18
4.6	Noise characteristics	20
4.7	Scope of supply	20
5	Installation at Site	21
5.1	Safety regulations	21
5.2	Checks to be carried out prior to installation	21
5.3	Fitting and setting the float switch control (optional)	21
5.4	Installing the pump set	24
5.5	Connecting the piping	24

5.6	Permissible forces and moments at the pump nozzles	25
5.7	Electrical connection	25
5.8	Checking the direction of rotation	26
6	Commissioning/Start-up/Shutdown	28
6.1	Commissioning/start-up	28
6.2	Operating limits	29
6.3	Shutdown/storage/preservation	32
6.4	Returning to service	32
7	Servicing/Maintenance	34
7.1	Safety regulations	34
7.2	Maintenance/inspection	35
7.3	Drainage/cleaning	39
7.4	Dismantling the pump set	40
7.5	Reassembling the pump set	43
7.6	Tightening torques	48
7.7	Spare parts stock	48
8	Trouble-shooting	50
9	Related Documents	52
9.1	General assembly drawings/exploded views with list of components	52
10	EC Declaration of Conformity	58
11	Certificate of Decontamination	59
	Index	60

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 line which is connected to the discharge nozzle

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 supplied as an integral part of the type series and variants indicated on the front cover. The 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 uniquely identify the pump (set) and serve as identification for all further business processes.

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

Noise characteristics (⇒ Section 4.6 Page 20)

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 manual is aimed at the target group of trained and qualified specialist technical personnel.

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 required, efficiency and power input
General assembly drawing ¹⁾	Sectional drawing of the pump
Sub-supplier product literature ¹⁾	Operating manuals and other product literature describing accessories and integrated machinery components
Spare parts lists ¹⁾	Description of spare parts
Piping layout ¹⁾	Description of auxiliary piping
List of components ¹⁾	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

¹⁾ 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








2 Safety

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



2.1 Key to safety symbols/markings

Table 3: Definition of safety symbols/markings

Symbol	Description
	DANGER This signal word indicates a high-risk hazard which, if not avoided, will result in death or serious injury.
	WARNING This signal word indicates a medium-risk hazard which, if not avoided, could result in death or serious injury.
	CAUTION This signal word indicates a hazard which, if not avoided, could result in damage to the machine and its functions.
	Explosion protection This symbol identifies information about avoiding explosions in potentially explosive atmospheres in accordance with EC Directive 94/9/EC (ATEX).
	General hazard In conjunction with one of the signal words this symbol indicates a hazard which will or could result in death or serious injury.
	Electrical hazard In conjunction with one of the signal words this symbol indicates a hazard involving electrical voltage and identifies information about protection against electrical voltage.
	Machine damage In conjunction with the signal word CAUTION this symbol indicates a hazard for the machine and its functions.

2.2 General

This manual contains general installation, operating and maintenance instructions that must be observed to ensure safe pump operation and prevent personal injury and damage to property.

The safety information in all sections of this manual must be complied with.

This manual must be read and completely understood by the specialist personnel/operators responsible prior to installation and commissioning.

The contents of this manual must be available to the specialist personnel at the site at all times.

Information attached directly to the pump must always be complied with and be 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 in this manual.

2.3 Intended use

The pump (set) must only be operated within the operating limits described 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.

- Never operate the pump without the fluid handled.
- Observe the minimum flow rates indicated in the data sheet or product literature (to prevent overheating, bearing damage, etc).
- Observe the maximum flow rates indicated in the data sheet or product literature (to prevent overheating, 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.

Prevention of foreseeable misuse

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

2.4 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.

2.5 Consequences and risks caused by non-compliance with these operating instructions

- 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

2.6 Safety awareness

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

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

2.7 Safety information for the operator/user

- The operator shall fit contact guards for hot, cold and moving parts and check that the guards function properly.
- Do not remove any 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 shutting down 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.

2.8 Safety information for maintenance, inspection and installation work

- Modifications or alterations of the pump are only permitted with the manufacturer's prior consent.
- Use only original spare parts or parts authorised by the manufacturer. The use of other parts can invalidate any liability of the manufacturer for resulting damage.
- The operator ensures that all maintenance, inspection and installation work is 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.
- The pump casing 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 32)
- Decontaminate pumps which handle fluids posing a health hazard.
- As soon as the work is completed, re-install and/or re-activate any safety-relevant and protective devices. Before returning the product to service, observe all instructions on commissioning. (⇒ Section 6.1 Page 28)

2.9 Unauthorised modes of operation

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

The warranty relating to the operating reliability and safety of the supplied pump (set) is only valid if the equipment is used in accordance with its intended use. (⇒ Section 2.3 Page 8)

2.10 Explosion protection

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

Only pumps/pump sets marked as explosion-proof **and** identified as such in the data sheet may be used in potentially explosive atmospheres.

Special conditions apply to the operation of explosion-proof pump sets to EC Directive 94/9/EC (ATEX).

Especially adhere to the sections in this manual marked with the Ex symbol and the following sections (⇒ Section 2.10.1 Page 11) to (⇒ Section 2.10.4 Page 12) .

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



Never operate the pump set outside the limits stated in the data sheet and on the name plate.
Prevent impermissible modes of operation at all times.

2.10.1 Marking

- Pump** The marking on the pump refers to the pump part only.
Example of such marking: II 2 G c TX
Refer to the data sheet for the selected temperature class.
- 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 used by KSB on pumps with ATEX certification meet this condition.

2.10.2 Temperature limits

In normal pump operation, the highest temperatures are to be expected at the surface of the pump casing, the pipe assembly, the plain bearings 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 EN 13463-1	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, if there is no data sheet or if the pump is part of a pool of pumps, contact KSB for the maximum permissible operating temperature.

2.10.3 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.

2.10.4 Operating limits



The minimum flows indicated in (⇒ Section 6.2.3.1 Page 30) 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 differ from those of water, it is essential to check whether 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 30) can be used to check whether additional heat build-up may lead to a dangerous temperature increase at the pump surface.

3 Transport/Temporary 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 (as applicable) and the insurer about the damage in writing immediately.

3.2 Transport

	<div style="background-color: #f4a460; padding: 5px;">⚠ DANGER</div> <p>The pump (set) could slip out of the suspension arrangement Danger to life from falling parts!</p> <ul style="list-style-type: none"> ▷ Always transport the pump (set) in the specified position. ▷ Never attach the suspension arrangement to the free shaft end or the motor eyebolt. ▷ Give due attention to the weight data and the centre of gravity. ▷ Observe the applicable local health and safety regulations. ▷ Use suitable, permitted lifting accessories, e.g. self-tightening lifting tongs.
	<div style="background-color: #f4e040; padding: 5px;">CAUTION</div> <p>Incorrect transport of the pump Damage to the shaft seal!</p> <ul style="list-style-type: none"> ▷ For transport, lock the pump shaft with a suitable transport lock to prevent any movement of the shaft.

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

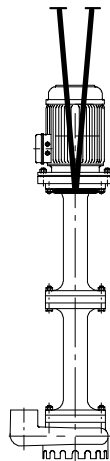




Fig. 1: Transporting the complete pump set

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.

	CAUTION Damage during storage by humidity, dirt, or vermin Corrosion/contamination of the pump (set)! <ul style="list-style-type: none"> ▸ For outdoor storage cover the packed or unpacked pump (set) and accessories with waterproof material.
	CAUTION Wet, contaminated or damaged openings and connections Leakage or damage to the pump set! <ul style="list-style-type: none"> ▸ Only remove caps/covers from the openings of the pump set at the time of installation.

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 32) .

3.4 Return to supplier

1. Drain the pump as per operating instructions. (⇒ Section 7.3 Page 39)
2. Always flush and clean the pump, particularly if it has been used for handling noxious, explosive, hot or other hazardous fluids.
3. If the fluids handled by the pump set leave residues which might lead to corrosion damage when coming into contact with atmospheric humidity, or which might ignite when coming into contact with oxygen, the pump set must also be neutralised, and anhydrous inert gas must be blown through the pump for drying purposes.
4. Always complete and enclose a certificate of decontamination when returning the pump (set).
Always indicate any safety and decontamination measures taken. (⇒ Section 11 Page 59)

	NOTE If required, a blank certificate of decontamination can be downloaded from the KSB web site at: www.ksb.com/certificate_of_decontamination
---	---

3.5 Disposal

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

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 liquid pump

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

4.2 Designation

MK A - B 20 - 6/ 190

Table 5: Key to the designation

Code	Description
MK	Type series
A	Version
2)	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 installation flange, lantern, gland packing and flanged discharge pipe, with motor
B	Casing material
2)	Grey cast iron
B	Tin bronze
C	Cast chrome nickel molybdenum steel
2	Pipe connection
2	Rp 2
0	Design status
1	Power code (defines the impeller diameter)
1 - 6	
190	Installation depth [cm]

4.3 Name plate



Fig. 2: MK name plate (example)

1	Type series, size and version	2	KSB order number (ten digits)
3	Flow rate	4	Speed
5	Year of construction	6	Order item number (six digits)

2) Blank

7	Consecutive number (two digits)	8	Head
9	Speed		

4.4 Design details

Design

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

Drive

- KSB surface-cooled IEC frame three-phase current squirrel-cage motor
- 230 / 400 V
- Type of construction: V1
- IP 55 enclosure

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:** grease lubrication, lubrication by external liquid

4.5 Configuration and function

MKA

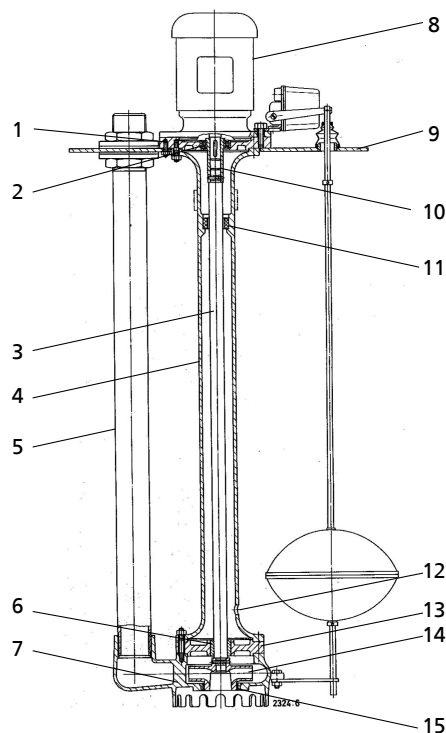


Fig. 3: MK, MKA

1	Thrust and radial bearing	2	Radial ball bearing
3	Shaft	4	Intermediate pipe
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 intermediate pipe 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 intermediate pipe at the shaft passage and then through the overflow opening back into the tank.

MKY

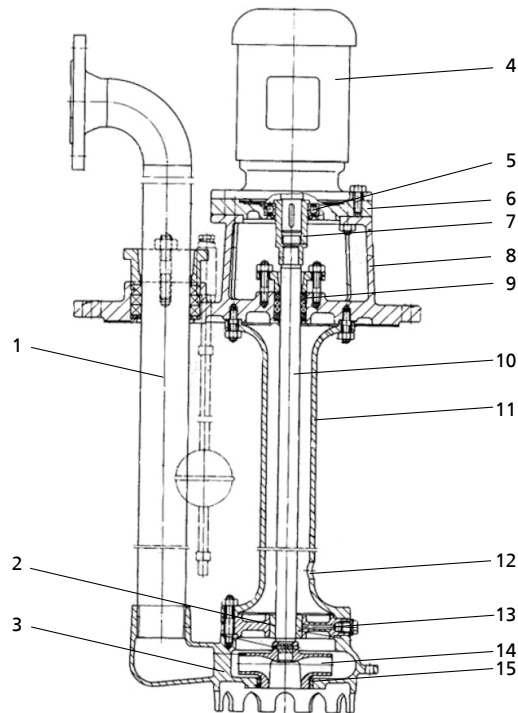


Fig. 4: MKY

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	Intermediate pipe	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 intermediate pipe 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).

4.6 Noise characteristics

Table 6: Surface sound pressure level L_{pA} ³⁾

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

4.7 Scope of supply




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

Drive	<ul style="list-style-type: none"> ▪ Pump
Special accessories	<ul style="list-style-type: none"> ▪ Surface-cooled IEC frame three-phase squirrel-cage motor
Soleplate	<ul style="list-style-type: none"> ▪ As required ▪ MK: none ▪ MKA: accommodates pump and motor ▪ MKY: plate integrally cast with the lantern
Monitoring (optional)	<ul style="list-style-type: none"> ▪ Temperature sensor at the drive-end fixed bearing with G 1/8 threaded connection
Level control (optional)	<ul style="list-style-type: none"> ▪ Level control <ul style="list-style-type: none"> – With rod-actuated float switch – With magnetic float switch – With EURO float switch

³⁾ Spatial average; as per ISO 3744; valid for pump operation in the $Q/Q_{opt} = 0.80 - 1.1$ range and for 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).

5 Installation at Site

5.1 Safety regulations

 	<div data-bbox="491 315 1449 369"> DANGER</div> <div data-bbox="491 376 1449 571"><p>Improper installation in potentially explosive atmospheres Explosion hazard! Damage to the pump set!</p><ul style="list-style-type: none">▸ Comply with the applicable local explosion protection regulations.▸ Observe the information in the data sheet and on the name plates of pump and motor.</div>
--	--

5.2 Checks to be carried out prior to installation

Check the structural work.

All structural work required must have been prepared in accordance with the dimensions stated in the outline drawing/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 control

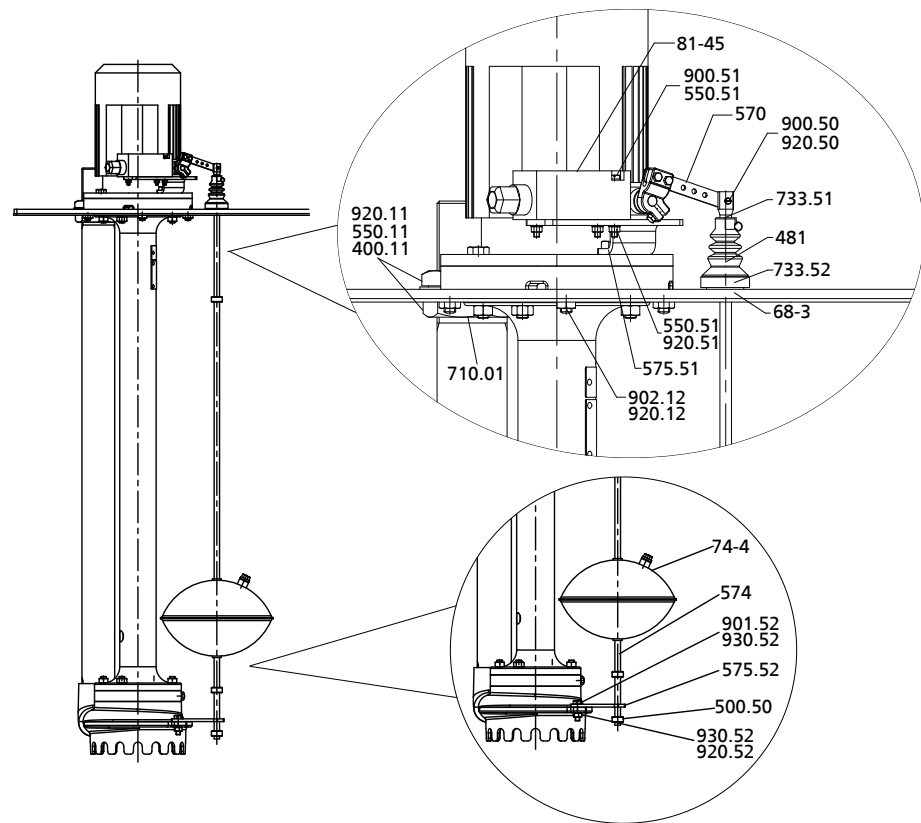


Fig. 5: Fitting the rod-actuated float switch control

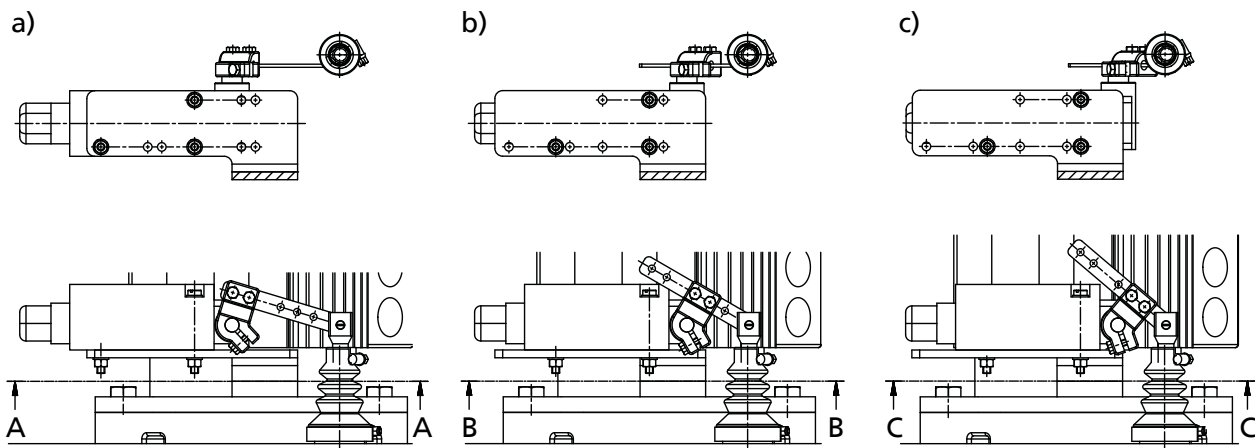


Fig. 6: Positioning the rod-actuated flow switch a) installation height 100; b) installation height 190; c) installation height 280

A	Installation height 1000 mm	B	Installation height 1900 mm
C	Installation height 2800 mm		

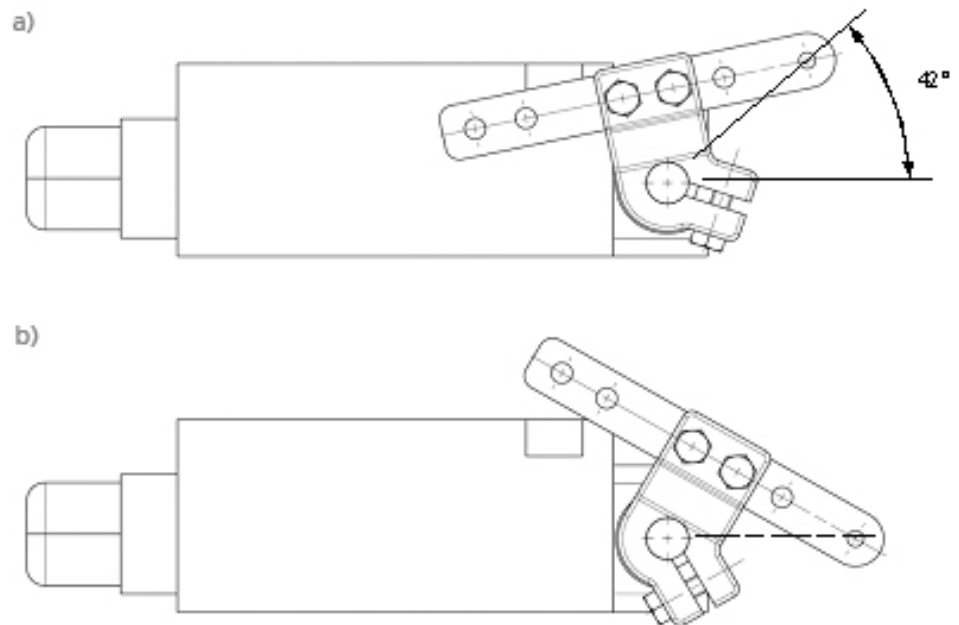


Fig. 7: Float switch a) installation position; b) switching position

1. Bolt 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 cheese head 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 cheese head 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 the correct function of the rod-actuated float switch control.

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 G³/₄ through-hole in the cover plate.

2. Tightly screw the magnetic float switch arrangement into the G^{3/4} hole provided.



NOTE

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.

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 23)

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 53) (⇒ Section 9.1.4 Page 55)
 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



DANGER

Excessive loads acting on the pump nozzles

Danger to life from leakage of hot, toxic, corrosive or flammable fluids!

- ▷ Do not use the pump as an anchorage point for the piping.
- ▷ Anchor the pipelines in close proximity to the pump and connect them without transmitting any stresses or strains.
- ▷ Take appropriate measures to compensate thermal expansion of the piping.





CAUTION

Incorrect earthing during welding work on the piping


Destruction of rolling element bearings (pitting effect)!

- ▷ Never earth the electric welding equipment on the pump or sole plate.
- ▷ Prevent current flowing through the rolling element bearings.


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

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

- ✓ The nominal diameters of the pipelines are at least equal to the nominal diameters of the pump nozzles.
 - ✓ To prevent excessive pressure losses, adapters to larger diameters have a diffuser angle of approx. 8°.
 - ✓ 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.

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


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




	<p>CAUTION</p> <p>Aggressive flushing and pickling agents Damage to the pump!</p> <ul style="list-style-type: none"> ▸ Match the cleaning operation mode and duration for flushing and pickling service to the casing and seal materials used.
---	---

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>⚠ DANGER</p> <p>Incorrect electrical installation Explosion hazard!</p> <ul style="list-style-type: none"> ▸ For electrical installation, also observe the requirements of IEC 60079-14. ▸ Observe the manufacturer's product literature supplied with the motor. ▸ Observe the manufacturer's product literature supplied with the float switch if float switch control is used.
---	---

	<p>⚠ DANGER</p> <p>Work on the pump set by unqualified personnel Danger of death from electric shock!</p> <ul style="list-style-type: none"> ▶ Always have the electrical connections installed by a trained and qualified electrician. ▶ Observe regulations IEC 60364 and, for explosion-proof models, EN 60079.
	<p>⚠ WARNING</p> <p>Incorrect connection to the mains Damage to the mains network, short circuit!</p> <ul style="list-style-type: none"> ▶ Observe the technical specifications of the local energy supply companies.
	<p>NOTE</p> <p>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 start-up method.

5.8 Checking the direction of rotation

	<p>⚠ DANGER</p> <p>Pump set running dry Explosion hazard!</p> <ul style="list-style-type: none"> ▶ Check the direction of rotation of explosion-proof pump sets outside the potentially explosive atmosphere.
	<p>⚠ WARNING</p> <p>Hands inside the pump casing Risk of injuries, damage to the pump!</p> <ul style="list-style-type: none"> ▶ 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.
	<p>CAUTION</p> <p>Pump set running dry Increased vibrations! Damage to mechanical seals and bearings!</p> <ul style="list-style-type: none"> ▶ Never operate the pump set for more than 60 seconds outside the fluid to be handled.
	<p>CAUTION</p> <p>Drive and pump running in the wrong direction of rotation Damage to the pump!</p> <ul style="list-style-type: none"> ▶ Refer to the arrow indicating the direction of rotation on the pump. ▶ Check the direction of rotation. If required, check the electrical connection and correct the direction of rotation.

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 electric 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, the activities required for returning the pump 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 Radial bearings


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

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 31) . 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 37)

6.1.3 Start-up

	<div data-bbox="491 1010 1453 1059" style="background-color: #f06292; padding: 5px;">⚠ DANGER</div> <p>Non-compliance with the permissible pressure and temperature limits if the pump is operated with the suction and/or discharge line closed. Explosion hazard! Leakage of hot or toxic fluids!</p> <ul style="list-style-type: none"> ▷ Never operate the pump with the shut-off elements in the suction line and/or discharge line closed. ▷ Only start up the pump set with the discharge-side shut-off element slightly or fully open.
	<div data-bbox="491 1332 1453 1382" style="background-color: #f06292; padding: 5px;">⚠ DANGER</div> <p>Excessive temperatures due to dry running or excessive gas content in the fluid handled Explosion hazard! Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Never operate the pump set without liquid fill. ▷ Prime the pump as specified. ▷ Always operate the pump within the permissible operating range.
	<div data-bbox="491 1655 1453 1704" style="background-color: #ffeb3b; padding: 5px;">CAUTION</div> <p>Abnormal noises, vibrations, temperatures or leakage Damage to the pump!</p> <ul style="list-style-type: none"> ▷ Switch off the pump (set) immediately. ▷ Eliminate the causes before returning the pump set to service.


- ✓ 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.


	<div style="background-color: yellow; padding: 5px;">CAUTION</div> <p>Start-up against open discharge line Motor overload!</p> <ul style="list-style-type: none"> ▷ Make sure the motor has sufficient power reserves. ▷ Use a soft starter. ▷ Use speed control.
---	--

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.

	<div style="background-color: #0070C0; color: white; padding: 5px;">NOTE</div> <p>If the discharge line is equipped with a non-return or check valve, the shut-off element in the discharge line may remain open, provided the site's requirements and regulations are taken into account and observed.</p>
---	--


	<div style="background-color: #0070C0; color: white; padding: 5px;">NOTE</div> <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.

	<div style="background-color: yellow; padding: 5px;">CAUTION</div> <p>Risk of freezing during prolonged pump shutdown periods Damage to the pump!</p> <ul style="list-style-type: none"> ▷ Drain the pump and the cooling/heating chambers (if any) or otherwise protect them against freezing.
---	--

6.2 Operating limits

	<div style="background-color: #D9534F; color: white; padding: 5px;">⚠ DANGER</div> <p>Non-compliance with operating limits Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Comply with the operating data indicated in the data sheet. ▷ Avoid operation against a closed shut-off element. ▷ Never operate an explosion-proof pump set at ambient and fluid temperatures exceeding those specified in the data sheet or on the name plate. ▷ Never operate the pump set outside the limits specified below.
---	---

6.2.1 Ambient temperature


	<div style="background-color: yellow; padding: 5px;">CAUTION</div> <p>Operation outside the permissible ambient temperature Damage to the pump (set)!</p> <ul style="list-style-type: none"> Observe the specified limits for permissible ambient temperatures.
---	--

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

	<div style="background-color: orange; padding: 5px;">⚠ DANGER</div> <p>Excessive surface temperature of the motor Explosion hazard! Damage to the motor!</p> <ul style="list-style-type: none"> In case of explosion-proof motors, observe the frequency of starts specified in the manufacturer's product literature.
---	---

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

	<div style="background-color: yellow; padding: 5px;">CAUTION</div> <p>Re-starting while motor is still running down Damage to the pump (set)!</p> <ul style="list-style-type: none"> Do not re-start the pump set before the pump rotor has come to a standstill.
---	--

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

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 are different from 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.

4) Minimum permissible flow rate
5) Flow rate at best efficiency point
6) Maximum permissible flow rate



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

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

Table 8: Key

Symbol	Description	Unit
c	Specific heat capacity	J/kg K
g	Gravitational constant	m/s ²
H	Pump head	m
T _f	Temperature of the fluid handled	°C
T _o	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

	<div style="background-color: #f44336; color: white; padding: 5px;">⚠ DANGER</div> <p>Pump set running dry Explosion hazard!</p> <ul style="list-style-type: none"> ▶ Never allow an explosion-proof pump set to run dry!
	<div style="background-color: #ffc107; padding: 5px;">CAUTION</div> <p>Fluid level below the specified minimum Damage to the pump set by cavitation!</p> <ul style="list-style-type: none"> ▶ Never allow the fluid level to drop below the specified minimum.

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 28) .

6.2.3.3 Temperature of the fluid handled


	<div style="background-color: #ffc107; padding: 5px;">CAUTION</div> <p>Incorrect temperature of the fluid handled Damage to the pump (set)!</p> <ul style="list-style-type: none"> ▶ Do not operate the pump (set) outside the specified temperature limits.
---	---

Table 9: Fluid temperature


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

6.2.3.4 Density of the fluid handled



The pump input power changes in proportion to the density of the fluid handled.

⁷⁾ 80 °C for bearing material 1.4571-NBR

⁸⁾ 200 °C for bearing material EK 3205; 110 °C when handling water; 80 °C for bearing material 1.4571-NBR

	<div style="background-color: #FFD700; padding: 5px;">CAUTION</div> <p>Impermissibly high density of the fluid handled Motor overload!</p> <ul style="list-style-type: none"> ▷ Observe the information on fluid density indicated in the data sheet. ▷ Make sure the motor has sufficient power reserves.
---	--

6.2.3.5 Gas content of fluid handled

	<div style="background-color: #FF4500; padding: 5px;"> DANGER</div> <p>Excessive temperatures as a result of bearing bushes running hot Explosion hazard! Fire hazard! Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Never pump fluids with excessive gas content. ▷ Allow sufficient time for gases to leave the fluid handled.
---	--

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 operation check run of the pump.

1. Start up the pump (set) regularly between once a month and once every three months for approximately five minutes during prolonged shutdown periods. This will prevent the formation of deposits within the pump and the pump intake area.

The pump (set) is removed and stored

✓ The pump has been properly drained and the safety instructions for dismantling the pump have been 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 and discharge nozzles. It is advisable to then close the pump nozzles (e.g. with plastic caps or similar).
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.



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.

Observe any additional instructions and information provided. (⇒ Section 3 Page 13)

6.4 Returning to service


For returning the pump to service observe the sections on commissioning/start-up (⇒ Section 6.1 Page 28) and the operating limits .



In addition, carry out all servicing/maintenance operations before returning the pump (set) to service. (⇒ Section 7 Page 34)

	<p> WARNING</p>
	<p>Failure to re-install or re-activate protective devices Risk of personal injury from moving parts or escaping fluid!</p> <ul style="list-style-type: none"> ▸ As soon as the work is complete, re-install and/or re-activate any safety-relevant and protective devices.


7 Servicing/Maintenance


7.1 Safety regulations


	<div style="background-color: #f4a460; padding: 5px;">⚠ DANGER</div> <p>Sparks produced during servicing work Explosion hazard!</p> <ul style="list-style-type: none"> ▷ Observe the safety regulations in force at the place of installation! ▷ Always perform maintenance work on explosion-proof pump sets outside potentially explosive atmospheres.
---	--

 	<div style="background-color: #f4a460; padding: 5px;">⚠ DANGER</div> <p>Improperly serviced pump set Explosion hazard! Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Service the pump set regularly. ▷ Prepare a maintenance schedule with special emphasis on lubricants, shaft seal and coupling.
--	--


The operator ensures that all maintenance, inspection and installation work is performed by authorised, qualified specialist personnel who are thoroughly familiar with the manual.

	<div style="background-color: #f4a460; padding: 5px;">⚠ WARNING</div> <p>Unintentional starting of pump set Risk of injury by moving parts!</p> <ul style="list-style-type: none"> ▷ Make sure that the pump set cannot be started up unintentionally. ▷ Always make sure the electrical connections are disconnected before carrying out work on the pump set.
---	---

	<div style="background-color: #f4a460; padding: 5px;">⚠ WARNING</div> <p>Fluids and supplies posing a health hazard and/or hot fluids or supplies Risk of injury!</p> <ul style="list-style-type: none"> ▷ Observe all relevant laws. ▷ When draining the fluid take appropriate measures to protect persons and the environment. ▷ Decontaminate pumps which handle fluids posing a health hazard.
---	--

	<div style="background-color: #f4a460; padding: 5px;">⚠ WARNING</div> <p>Insufficient stability Risk of crushing hands and feet!</p> <ul style="list-style-type: none"> ▷ During assembly/dismantling, secure the pump (set)/pump parts to prevent tipping or falling over.
---	--




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

	<div style="background-color: #0070c0; color: white; padding: 5px;">NOTE</div> <p>All maintenance, service and installation work can be carried out by KSB Service or authorised workshops. Find your contact in the attached "Addresses" booklet or on the Internet at "www.ksb.com/contact".</p>
---	--

Never use force when dismantling and reassembling the pump set.


7.2 Maintenance/inspection

7.2.1 Supervision of operation

	<div style="background-color: #f4a460; padding: 5px;">⚠ DANGER</div> <p>Excessive temperatures as a result of bearings running hot or defective bearing seals Explosion hazard! Fire hazard! Damage to the pump set! Risk of burns!</p> <ul style="list-style-type: none"> ▷ Regularly check the lubricant level. ▷ Regularly check the rolling element bearings for running noises.
	<div style="background-color: #f4d03f; padding: 5px;">CAUTION</div> <p>Fluid level below the specified minimum Damage to the pump set by cavitation! Dry running of the plain bearings!</p> <ul style="list-style-type: none"> ▷ Never allow the fluid level to drop below the specified minimum.
	<div style="background-color: #f4d03f; padding: 5px;">CAUTION</div> <p>Impermissibly high temperature of fluid handled Damage to the pump!</p> <ul style="list-style-type: none"> ▷ Prolonged operation against a closed shut-off element is not permitted (heating up of the fluid). ▷ Observe the temperature limits in the data sheet and in the section on operating limits.

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 seals 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 the 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 31)
- 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 G¹/₈ connection hole (Ø 7 mm) is provided in thrust and radial bearing 303.01 (max. width across corners of fastener used: 18 mm).

	<div style="background-color: #f4d03f; padding: 5px;">CAUTION</div> <p>Operation outside the permissible bearing temperature Damage to the pump!</p> <ul style="list-style-type: none"> ▷ The bearing temperature of the pump (set) must never exceed 90 °C (measured on the outside of the bearing bracket).
---	---



NOTE

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).

7.2.2 Lubrication and lubricant change



⚠ DANGER

Excessive temperatures as a result of bearings running hot or defective bearing seals
Explosion hazard!
Fire hazard!
Damage to the pump set!

- ▷ Regularly check the condition of the lubricant.

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.

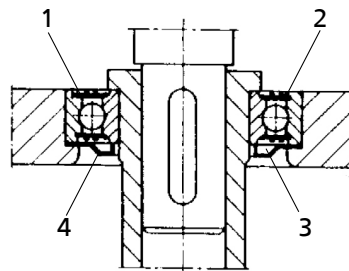


Fig. 8: Radial ball bearing (thrust and radial bearing)

1	Radial ball bearing	2	Washer
3	Grease fill	4	Nilosring

Table 10: Bearings used

Sizes	Motor	Radial ball bearing	Nilosring
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 L_{h10} 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

	<div style="background-color: #f44336; color: white; padding: 5px;">⚠ DANGER</div> <p>Excessive temperatures as a result of bearing bushes running hot Explosion hazard! Fire hazard! Damage to the pump set!</p> <ul style="list-style-type: none"> ▸ Make sure the bearing bushes are properly lubricated. ▸ Regularly check the bearing bushes for correct lubrication.
---	--


The bearing bushes (radial bearings) in the intermediate pipe and volute casing are lubricated by the fluid handled. Bearings shall 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

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 intermediate pipe.

Grease lubrication

	<div style="background-color: #ffc107; padding: 5px;">CAUTION</div> <p>Insufficiently filled grease cups Damage to the pump set by cavitation and ungreased bearings!</p> <ul style="list-style-type: none"> ▸ The grease cup must be filled with lubricant. ▸ The grease cup must be screwed down regularly.
---	---

Provide each bearing bush in the intermediate pipe with a separate lubricating device (2) including a grease cup.

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

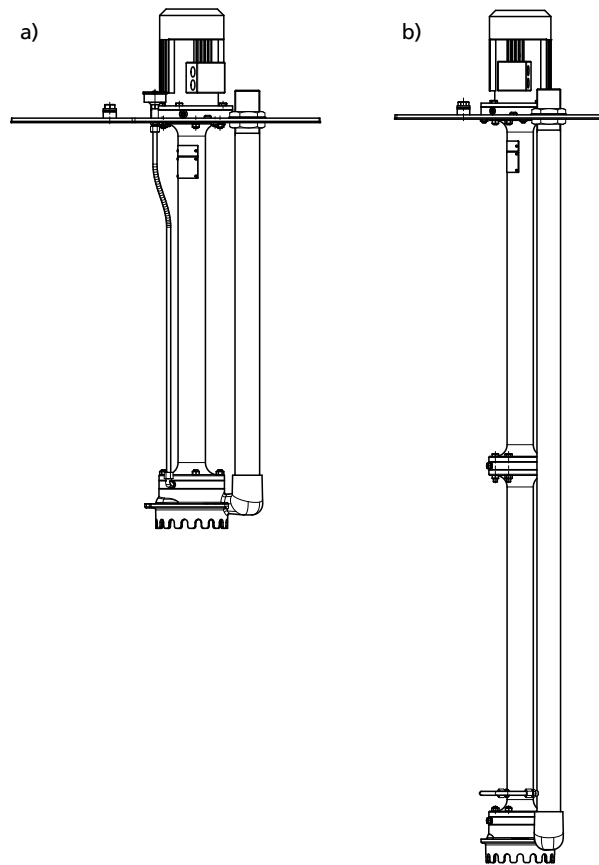




Fig. 9: a) Grease lubrication; b) Lubrication by fluid handled

Lubrication by external fluid

	<div style="background-color: #e67e22; color: white; padding: 5px;"> DANGER</div> <p>Failure of lubrication by external fluid Explosion hazard!</p> <p>▸ Monitor lubrication by external fluid.</p>
---	--

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

- 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.

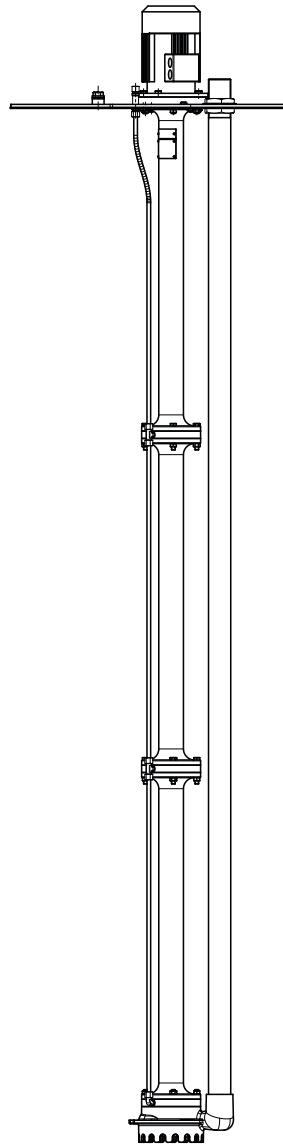



Fig. 10: Lubrication by external fluid




7.3 Drainage/cleaning

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

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 sending it to the workshop.
Make sure to add a certificate of decontamination. (⇒ Section 11 Page 59)

7.4 Dismantling the pump set




7.4.1 General information/Safety regulations

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

Observe the general safety instructions and information. (⇒ Section 7.1 Page 34)

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>NOTE</p> <p>All maintenance, service and installation work can be carried out by KSB Service or authorised workshops. Find your contact in the attached "Addresses" booklet or on the Internet at "www.ksb.com/contact".</p>
	<p>⚠ DANGER</p> <p>Insufficient preparation of work on the pump (set) Risk of personal injury!</p> <ul style="list-style-type: none"> ▷ Properly shut down the pump set. ▷ Close the shut-off elements in the discharge line. ▷ Drain the pump and release the pump pressure. ▷ Close any auxiliary connections. ▷ Allow the pump set to cool down to ambient temperature.
	<p>NOTE</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>

7.4.2 Preparing the pump set


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 intermediate pipe 712 and/or pipe 710.01 and the cover plate out of the tank or pit.

7.4.3 Removing the pump set from the piping

7.4.3.1 Dismantling the pump set (MK)


- ✓ The notes and steps stated in (⇒ Section 7.4.1 Page 40) to (⇒ Section 7.4.2 Page 40) have been observed/carried out.
- ✓ The pump set is kept in a clean and level assembly area.

	<p>CAUTION</p> <p>Damage to the shaft assembly Warping of the shaft!</p> <p>▷ Support the shaft assembly if the shaft is long.</p>
	<ol style="list-style-type: none"> 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 intermediate pipe 712.01.

	<p>CAUTION</p> <p>Damage to the shaft assembly Warping of the shaft!</p> <p>▷ Support the shaft assembly if the shaft is long.</p>
	<ol style="list-style-type: none"> 7. For installation depths 1900 mm/2800 mm: Undo hexagon head bolts 901.03 and nuts 920.03 and carefully take intermediate pipe 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 40) to (⇒ Section 7.4.2 Page 40) have been observed/carried out.
- ✓ The pump set is kept in a clean and level assembly area.

	<p>CAUTION</p> <p>Damage to the shaft assembly Warping of the shaft!</p> <p>▷ Support the shaft assembly if the shaft is long.</p>
	<ol style="list-style-type: none"> 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 40) to (⇒ Section 7.4.2 Page 40) 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 intermediate pipe 712.01.


	<div style="background-color: yellow; padding: 5px;">CAUTION</div> <div style="padding: 5px;"> Damage to the shaft assembly Warping of the shaft! <p>▷ Support the shaft assembly if the shaft is long.</p> </div>
---	--

11. For installation depths 1900 mm/2800 mm: Undo the corresponding hexagon head bolt 901.03 and nut 920.03 and carefully take further intermediate pipe(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>⚠ WARNING</p> <p>Improper lifting/moving of heavy assemblies or components Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▸ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.
---	--

	<p>CAUTION</p> <p>Improper reassembly Damage to the pump!</p> <ul style="list-style-type: none"> ▸ Reassemble the pump (set) in accordance with the general rules of sound engineering practice. ▸ Use original spare parts only.
---	---

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.

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

▪ Assembly adhesives




- 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.

Tightening torques

For reassembly, tighten all screws and bolts as specified in this manual. (⇒ Section 7.6 Page 48)

7.5.2 Reassembling the pump set

7.5.2.1 Reassembling the pump set (MK)

	<p>NOTE</p> <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> <ol style="list-style-type: none"> 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.
	<p>CAUTION</p> <p>Insufficient lubrication Damage to the bearing! Prior to fitting the Nilosring, pack its cranked sealing groove with grease.</p> <ol style="list-style-type: none"> 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 and 303.03 (if any).
	<p>CAUTION</p> <p>Damage to the shaft assembly Warping of the shaft!</p> <ul style="list-style-type: none"> ▸ Support the shaft assembly if the shaft is long. <ol style="list-style-type: none"> 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 and 303.03 (if any) 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 impeller face 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 and 303.03 (if any). 19. Install any lubricating lines. 20. Fit float switch control equipment, if any.



NOTE

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 loose.

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 intermediate pipe 712.01.

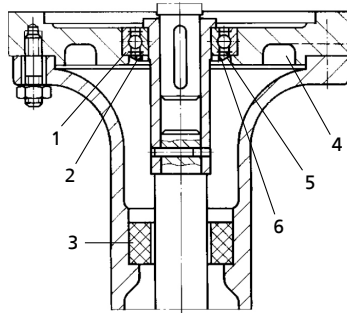


Fig. 11: Shaft seal MK/MKA

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

7.5.2.2 Reassembling the pump set (MKA)



NOTE

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.



CAUTION


Insufficient lubrication


Damage to the bearing!

Prior to fitting the Nilosring, pack its cranked sealing groove with grease.


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 and 303.03 (if any).


	CAUTION
	<p>Damage to the shaft assembly Warping of the shaft!</p> <p>▷ Support the shaft assembly if the shaft is long.</p>
<ol style="list-style-type: none"> 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 and 303.03 (if any) 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 impeller face 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 920.40, disc 550.30 and gasket 400.06 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 gasket 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 and 303.03 (if any). 24. Install any lubricating lines. 25. Fit float switch control equipment, if any. 	

	NOTE
	<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 Reassembling the pump set (MKY)

	NOTE
	<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.

	CAUTION
	<p>Insufficient lubrication Damage to the bearing! Prior to fitting the Nilosring, 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 intermediate pipe 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 intermediate pipes 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 intermediate pipe 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

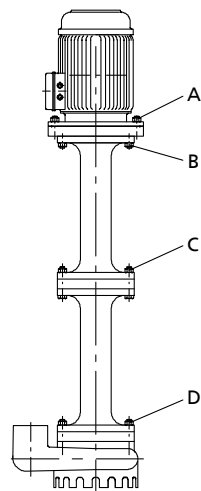


Fig. 12: Tightening points

Table 12: Tightening torques depending on materials⁹⁾

Position	Thread size [mm]	Material	Tightening torque M_A
A, B, C, D	M 10	5.8	22
A, B, C, D	M 10	8.8	50
A, B, C, D	M 10	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:

- Type series
- Size
- KSB order number
- Material variant
- Year of construction

Refer to the name plate for all data.

Also specify the following data:

- Description
- Part No.
- Quantity of spare parts
- Shipping address
- Mode of dispatch (freight, mail, express freight, air freight)

Refer to the general assembly drawing for part numbers and descriptions.

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

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, intermediate pipe ¹⁰⁾	4	6	8	8	9	12	150 %
461.62	Gland packing, discharge pipe ¹⁰⁾	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 %

¹⁰⁾ For MKY only

8 Trouble-shooting

- 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 ¹¹⁾
		X				Wrong direction of rotation	<ul style="list-style-type: none"> Check the electrical connection of the pump set and the control system, if necessary.
	X	X		X		Wear of internal parts	<ul style="list-style-type: none"> Replace worn parts by new ones.
	X		X			System head is lower than specified in the purchase order.	<ul style="list-style-type: none"> Adjust duty point accurately by means of the shut-off valve in the discharge line. Check whether the impeller could be turned down.
	X	X				Density or viscosity of the fluid handled is higher than stated in the purchase order.	<ul style="list-style-type: none"> Contact KSB.
	X					Gland follower over-tightened or cocked	<ul style="list-style-type: none"> Tighten gland follower correctly.
	X	X				Motor is running on two phases only.	<ul style="list-style-type: none"> Check the power cable connections. Replace the defective fuse.
X						Motor is not running because of lack of voltage.	<ul style="list-style-type: none"> Check the electrical installation. Contact the energy supplier.
	X					Switchgear, control unit or overcurrent relay defective	<ul style="list-style-type: none"> Check and replace, if necessary. Check and replace defective components.
		X				Pump delivers against an excessively high pressure.	<ul style="list-style-type: none"> Re-adjust to duty point. Check the system for impurities. Fit larger impeller.¹²⁾ Increase the speed (turbine, I.C. engine)
	X	X		X		Supply line or impeller clogged	<ul style="list-style-type: none"> Remove deposits in the pump and/or piping.
	X	X		X		Insufficient inflow	<ul style="list-style-type: none"> Check suction openings/screen of the volute casing for dirt accumulation.
	X			X	X	Pump warped or sympathetic vibrations in the piping	<ul style="list-style-type: none"> Check pipeline connections and secure fixing of pump; if required, reduce the distances between the pipe clamps. Fix the pipelines using anti-vibration material.
	X			X		Defective bearing(s)	<ul style="list-style-type: none"> Replace the bearing(s). If required, re-install the shaft upside down.
	X				X	Pump clogged by sand, dirt in the pump sump	<ul style="list-style-type: none"> Clean the intake, pump components and non-return valve. Drain and clean the pump sump.
				X	X	Rotor is out of balance, shaft is warped	<ul style="list-style-type: none"> Clean the impeller. Re-balance the impeller. Fit a new shaft.
	X					Current exceeds the value set in the motor protection switch.	<ul style="list-style-type: none"> Set the motor protection switch to the nominal value given on the name plate of the motor.

¹¹⁾ Pump pressure must be released before attempting to remedy faults on parts which are subjected to pressure.

¹²⁾ Contact KSB.

A	B	C	D	E	F	Possible cause	Remedy ¹¹⁾
		X				Excessive temperature of the fluid handled	<ul style="list-style-type: none"> Lower the fluid temperature.
					X	Aggressive fluid	<ul style="list-style-type: none"> Use different bearing material.
					X	Abrasive fluid	<ul style="list-style-type: none"> Use different bearing material, if necessary. Supply flushing liquid (lubrication by external fluid).
				X		Cavitation (rattling noise)	<ul style="list-style-type: none"> Check steam trap. Increase suction head. Reduce condensate temperature. Increase back pressure by throttling.

¹¹⁾ Pump pressure must be released before attempting to remedy faults on parts which are subjected to pressure.

9 Related Documents

9.1 General assembly drawings/exploded views with list of components

9.1.1 MK, MKA - installation depth 1000 mm

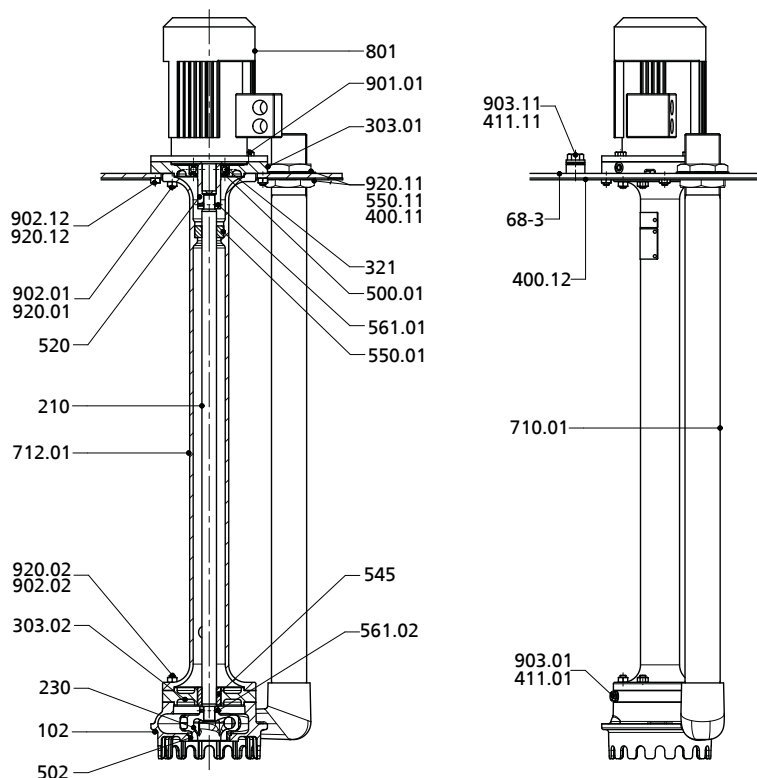


Fig. 13: General assembly drawing of MK, MKA - installation depth 1000 mm

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 10 x 1 x 300
321	Radial ball bearing	712.01	Intermediate pipe 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 - installation depth 1000 mm - grease-lubricated

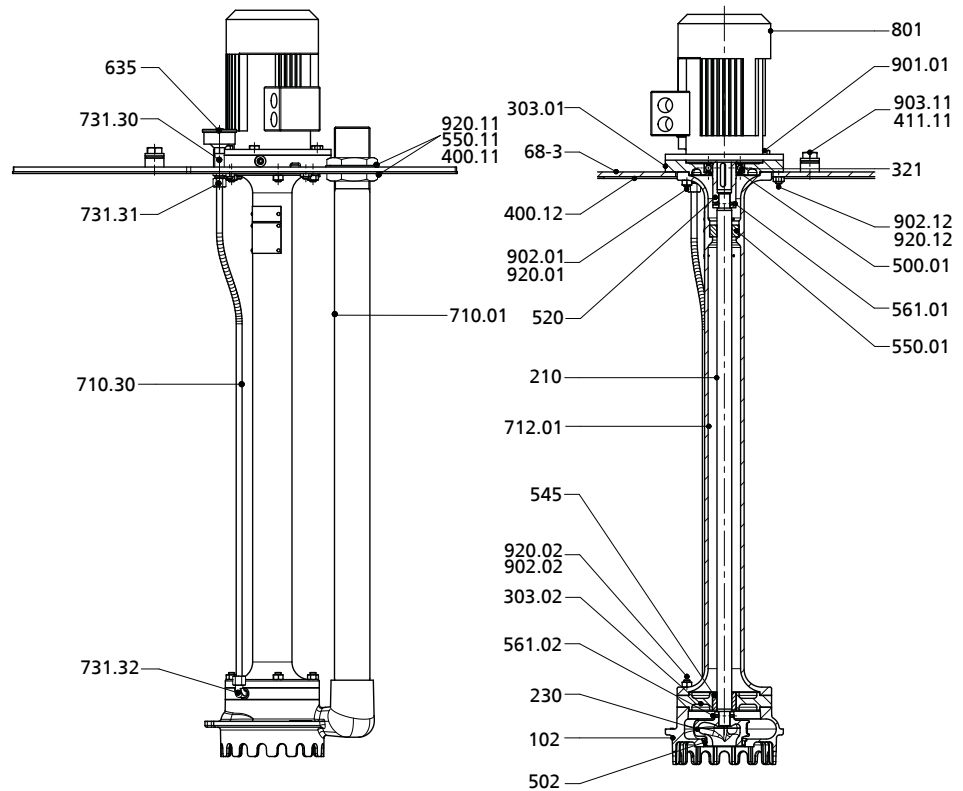


Fig. 14: General assembly drawing of MK, MKA - installation depth 1000 mm - grease-lubricated

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 10 × 1 × 300
303.01	Thrust and radial bearing	710.30	Pipe
303.02	Thrust and radial bearing without vertical hole	712.01 ¹³⁾	Intermediate pipe 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		

¹³⁾ Number of intermediate pipes 712 without hole for installation depth ET: 1000 mm = 0; 1900 mm = 1; 2800 mm = 2

9.1.3 MK, MKA - installation depth 1900 mm - lubricated by fluid handled

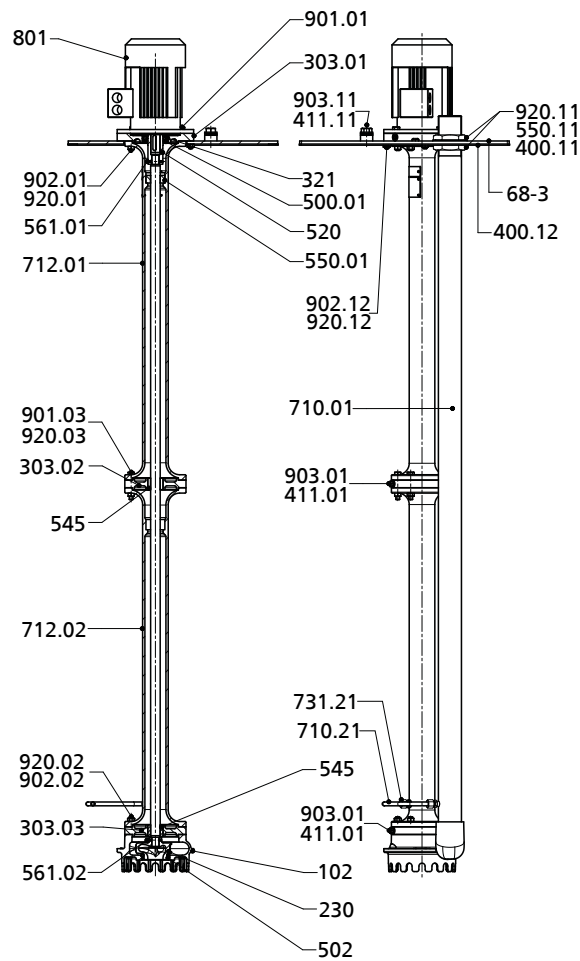


Fig. 15: General assembly drawing of MK, MKA - installation depth 1900 mm - lubricated by fluid handled

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 ¹⁴⁾	Intermediate pipe 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

¹⁴⁾ Number of intermediate pipes 712 without hole for installation depth ET: 1000 mm = 0; 1900 mm = 1; 2800 mm = 2

9.1.4 MK, MKA - installation depth 2800 mm - lubricated by external fluid

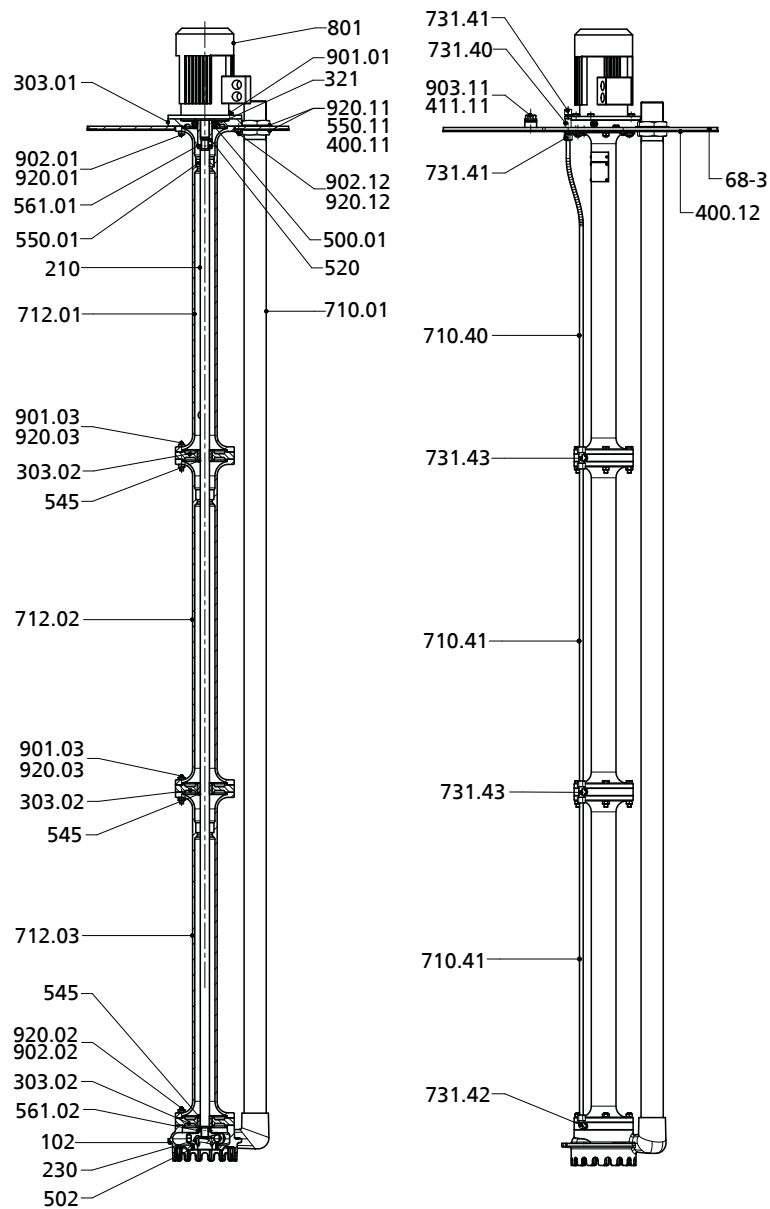


Fig. 16: General assembly drawing of MK, MKA - installation depth 2800 mm - lubricated by external fluid

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 ¹⁵⁾	Intermediate pipe 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

¹⁵⁾ Number of intermediate pipes 712 without hole for installation depth ET: 1000 mm = 0; 1900 mm = 1; 2800 mm = 2

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

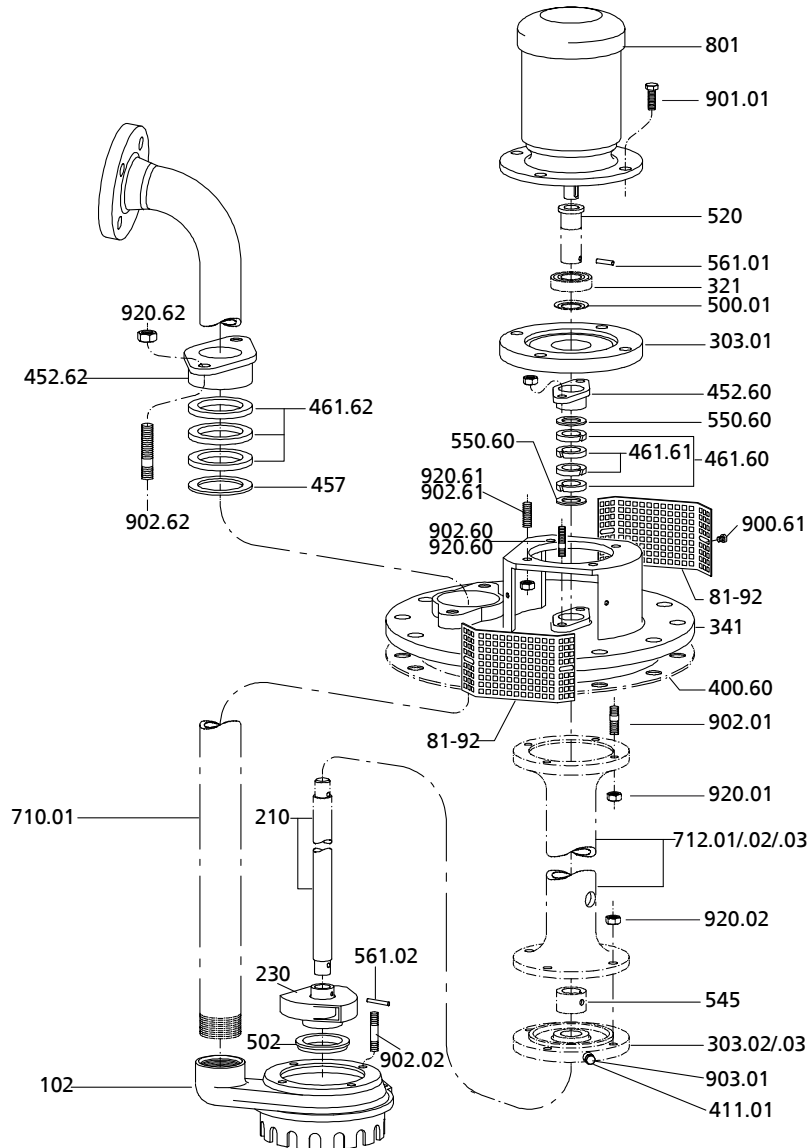


Fig. 17: MKY

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	Intermediate pipe with hole
321	Radial ball bearing	712.02/.03	Intermediate pipe 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
500.01	Ring	920.01/.02/.60/.61/.62	Nut
502	Casing wear ring		

10 EC Declaration of Conformity

Manufacturer: **KSB Aktiengesellschaft**
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 as amended from time to time:
 - Pump (set): Machinery Directive 2006/42/EC

The manufacturer also declares that

- the following harmonised international standards 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 EC Declaration of Conformity was issued in/on:

Place, date

.....¹⁶⁾.....
Name
Function
Company
Address
Address

¹⁶⁾ A signed, legally binding declaration of conformity is supplied with the product.

11 Certificate of Decontamination

Type
Order number/
Order item number¹⁷⁾

Delivery date

Field of application:

Fluid pumped¹⁷⁾:

Please tick where applicable¹⁷⁾:



☐ Radioactive



☐ Explosive



☐ Corrosive



☐ Toxic



☐ Harmful



☐ Bio-hazardous



☐ Highly flammable



☐ Safe

Reason for return¹⁷⁾:

Comments:

.....

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

We hereby declare that this product is free from hazardous chemicals, biological or radioactive substances.

On seal-less pumps, the rotor has been removed from the pump for cleaning.

- ☐ 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

¹⁷⁾ Required fields

Index

A

Abrasive fluids 32

B

Bearing temperature 35

Bearings 17

C

Certificate of decontamination 59

D

Design 17

Direction of rotation 26

Dismantling 40

Disposal 14

Drive 17

E

Explosion protection 10, 21, 25, 26, 28, 29, 30, 31, 32, 34, 35, 36, 37

F

Flow rate 30

Fluid handled

 Density 31

Frequency of starts 30

G

Grease lubrication

 Grease quality 37

I

Impeller type 17

Installation 21

Intended use 8

M

Misuse 9

Monitoring equipment 11

N

Noise characteristics 20

O

Operating limits 8

Order number 6

Ordering spare parts 48

Other applicable documents 6

P

Partly completed machinery 6

Permissible forces at the pump nozzles 25

Positioning the pump set 21

Preservation 14, 32

Product description 16

R

Reassembly 40

Return to supplier 14

Returning to service 33

Running noises 35

S

Safety 8

Safety awareness 9

Scope of supply 20

Servicing/maintenance 34

Shaft seal 17

Shutdown 29, 32

Start-up 28

Storage 14, 32

Suction strainer 25

T

Temperature limits 11

Transport 13

Trouble-shooting 50



KSB Aktiengesellschaft

67225 Frankenthal • Johann-Klein-Str. 9 • 67227 Frankenthal (Germany)

Tel. +49 6233 86-0 • Fax +49 6233 86-3401

www.ksb.com