

Submersible Motor Pump

Amarex KRT

Pump Sizes DN 40 to DN 300

Motor Sizes:

2-pole: 5 2 to 55 2

4 poles: 4 4 to 65 4

6-pole: 4 6 to 50 6

8-pole: 10 8 to 35 8

Installation/Operating Manual



Mat. No.: 01196129

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Installation/Operating Manual Amarex KRT

Original operating manual

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Glossary

Back pull-out unit

Pump without pump casing; partly completed machinery

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.

Close-coupled design

Motor directly fitted to the pump via a flange or a drive lantern

Flamepath

The surface of motor housing components which form flameproof joints when an explosion-proof motor is installed.

Hydraulic system

The part of the pump in which the kinetic energy is converted into pressure energy

1 General

1.1 Principles

This manual is supplied as an integral part of the type series and variants indicated on the front cover (for details, please refer to the tables below).

Table 1: Variants covered by this manual

Sizes	Impeller types	Material variant						
		Grey cast iron				Industrial materials		
		G	G1	G2	GH	H	C1	C2
40-250	F, K, S	F, K, S	F,K	F	F, K	F, K	F, K	F, K
80-250	E, F	E, F	F	F	F	F	F	F
80-251	F, K	F, K	K	-	K	K	K	K
80-315	D	D	D	-	-	-	-	-
80-316	F	F	F	F	F	F	-	-
100-240	F	F	F	F	F	F	F	F
100-250	E, F, K	E, F, K	F, K	F	F, K	F, K	F, K	F, K
100-251	D	D	D	-	-	-	-	-
100-315	D, E, F, K	D, E, F, K	D, F, K	F	F, K	F, K	F, K	F, K
100-316	D, F, K	D, F, K	D, F, K	F	F, K	F, K	F, K	F, K
100-400	K	K	K	-	-	-	-	-
100-401	E, F, K	E, F, K	F, K	F	F, K	F, K	F, K	F, K
150-251	D	D	D	-	-	-	-	-
150-315	D, E, F, K	D, E, F, K	D, F, K	F	F, K	F, K	F, K	F, K
150-400	D, K	D, K	D, K	-	-	-	-	-
150-401	D, E, F, K	D, E, F, K	D, F, K	F	F,K	F, K	F, K	F, K
151-401	K	K	K	-	K	K	K	K
200-315	D, K	D,K	D, K	-	K	K	K	K
200-316	K	K	K	-	K	K	K	K
200-330	K	K	K	-	K	K	K	K
200-400	D, K	D, K	D, K	-	-	-	-	-
200-401	E, K	E, K	K	-	K	K	K	K
250-400	D, K	D,K	D, K	-	K	K	K	K
250-401	K	K	K	-	K	K	K	K
300-400	D, K	D, K	D, K	-	K	K	K	K
300-401	K	K	K	-	K	K	K	K

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 clearly identify the pump set and serve as identification for all further business processes.

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

1.2 Installation of partly completed machinery

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

1.3 Target group

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

1.4 Other applicable documents


Table 2: 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, flow rate, efficiency and power input
General assembly drawing ¹⁾	Sectional drawing of the pump set
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
Supplementary operating manuals ¹⁾	E.g. for special accessories

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

1.5 Symbols

Table 3: 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. 2.	Step-by-step instructions
	Note Recommendations and important information on how to handle the product

¹⁾ If agreed to be included in the scope of supply








2 Safety



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

2.1 Key to safety symbols/markings

Table 4: Definition of safety symbols/markings

Symbol	Description
 DANGER	DANGER This signal word indicates a high-risk hazard which, if not avoided, will result in death or serious injury.
 WARNING	WARNING This signal word indicates a medium-risk hazard which, if not avoided, could result in death or serious injury.
 CAUTION	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 pump sets which are in perfect technical condition.
- Do not operate partially assembled pump sets.
- Only use the pump set to handle the fluids described in the data sheet or product literature of the pump model.

- Never operate the pump set without the fluid to be handled.
- Observe the limits for continuous operation specified in the data sheet or product literature ($Q_{min}^{2)}$ and $Q_{max}^{3)}$ (to prevent damage such as shaft fracture, bearing failure, mechanical seal damage, etc).
- When untreated waste water is handled the duty points in continuous operation lie within 0.7 to $1.2 \times Q_{opt}^{4)}$ to minimise the risk of clogging/hardening.
- Avoid duty points for continuous operation at very low speeds and small flow rates ($<0.7 \times Q_{opt}^{4)}$).
- Observe the maximum flow rates indicated in the data sheet or product literature (to prevent overheating, mechanical seal damage, cavitation damage, bearing damage, etc).
- Do not throttle the flow rate on the suction side of the pump set (to prevent cavitation damage).
- Consult the manufacturer about any use or mode of operation not described in the data sheet or product literature.
- Only use the respective impeller types in combination with the fluids described below.

	<p>Impeller with cutter (impeller type S)</p>	<p>Suitable for the following fluids: Fluids containing coarse substances and/or long fibres</p>
	<p>Free-flow impeller (impeller type F)</p>	<p>Suitable for the following fluids: fluids containing solids and stringy material as well as fluids with entrapped air or gas</p>
	<p>Closed single-channel impeller (impeller type E)</p>	<p>Suitable for the following fluids: fluids containing solids and stringy material</p>
	<p>Closed multi-channel impeller (impeller type K)</p>	<p>Suitable for the following fluids: Contaminated, solids-laden, non-gaseous fluids without stringy material</p>

2) Minimum permissible flow rate
 3) Maximum permissible flow rate
 4) Best efficiency point

	<p>Open, diagonal single-vane impeller (impeller type D)</p>	<p>Suitable for the following fluids: fluids containing solid substances and long fibres</p>
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Prevention of foreseeable misuse

- Observe the minimum flow velocities required to fully open the swing check valves to prevent the reduction of pressure and risk of clogging. (Contact the manufacturer for the required minimum flow velocities/loss coefficients.)
- Never exceed the permissible operating limits specified in the data sheet and in the 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 39)
- 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 35)

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.

2.10 Explosion protection



Always observe the information on explosion protection given in this section when operating an explosion-proof pump set.

Sections of the manual marked by the Ex symbol apply to explosion-proof pump sets also when temporarily operated outside potentially explosive atmospheres. Only pumps/pump sets marked as explosion-proof **and** identified as such in the data sheet must be used in potentially explosive atmospheres.

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

Especially adhere to the sections in this manual marked with the Ex symbol. 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 Repair

Special regulations apply to repair work on explosion-proof pumps. Modifications or alteration of the pump set could affect explosion protection and are only permitted after consultation with the manufacturer.


Repair work at the flameproof joints must only be performed in accordance with the manufacturer's instructions. Repair to the values in tables 1 and 2 of EN 60079-1 is not permitted.

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

	<p>⚠ DANGER</p>
	<p>Improper transport Danger to life from falling parts! Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Use the attachment point provided (pump handle) for attaching lifting accessories. ▷ Use the eyebolts for vertical loading only. For angular loading, replace the eyebolts with lifting tackle capable of accommodating other load directions (directions of pull). ▷ Never suspend the pump set by its power cable. ▷ Use the lifting chain/rope included in the scope of supply exclusively for lowering/lifting the pump set into/out of the pump sump. ▷ Securely attach the lifting chain/rope to the pump and crane. ▷ Use tested, marked and approved lifting accessories only. ▷ Observe any regional transport regulations. ▷ Observe the product literature supplied by the lifting accessory manufacturer. ▷ The load-carrying capacity of the lifting accessory must be higher than the weight indicated on the name plate of the pump set to be lifted. Take into account any additional system components to be lifted.

Transport the pump set as illustrated.

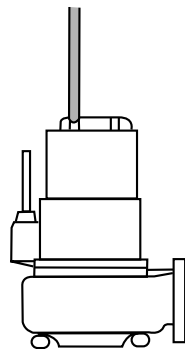





Fig. 1: Transporting the pump set

Setting down the pump set

	<p>⚠ WARNING</p> <p>Incorrect positioning Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▷ Set the pump set down in a vertical position with the motor on top. ▷ Use appropriate means to secure the pump set against overturning and tipping over. ▷ Refer to the weights given in the data sheet/on the name plate.
	<p>⚠ WARNING</p> <p>Improper placing of pump sets in vertical/horizontal position Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▷ Use appropriate means to secure the pump set against overturning or tipping over. ▷ Use two lifting devices when handling large pump sets, if possible (using the attachment point provided on the motor and the discharge nozzle). ▷ Secure power cables against falling. ▷ Use additional supports for the transport holder to secure the pump set against overturning. ▷ Maintain sufficient safety distance when lifting the pump set.
	<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.

3.3 Storage/Preservation

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





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

Table 5: Ambient conditions for storage

Ambient conditions	Value
Relative humidity	5 % to 85 % (non-condensing)
Ambient temperature	- 20 °C to + 70°C

- Store the pump set under dry and vibration-free conditions, if possible in its original packaging.
- 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).


	NOTE
	Observe the manufacturer's instructions for application/removal of the preservative.

3.4 Return to supplier

1. Drain the pump as per operating instructions. (⇒ Section 7.3 Page 47)
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 83)

	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
	<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. 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

Pump for handling untreated waste water containing long fibres and solid substances, fluids containing air/gas as well as raw, activated and digested sludge. (⇒ Section 2.3 Page 8)

4.2 Designation

Example: KRTK 150-315/164XKG-S

Table 6: Key to the designation

Code	Description
KRT	Type series
K	Impeller type, e.g. K = channel impeller
150	Nominal discharge nozzle diameter (DN) [mm]
315	Maximum nominal impeller diameter [mm]
16	Motor size
4	Number of poles
X	Motor version e.g. X = explosion-proof to ATEX II 2GT3
K	S1 operation with motors outside the fluid
G	Material variant, e.g. G = complete pump in grey cast iron
S	Installation type, e.g. S = stationary wet installation without cooling system

4.3 Name plate

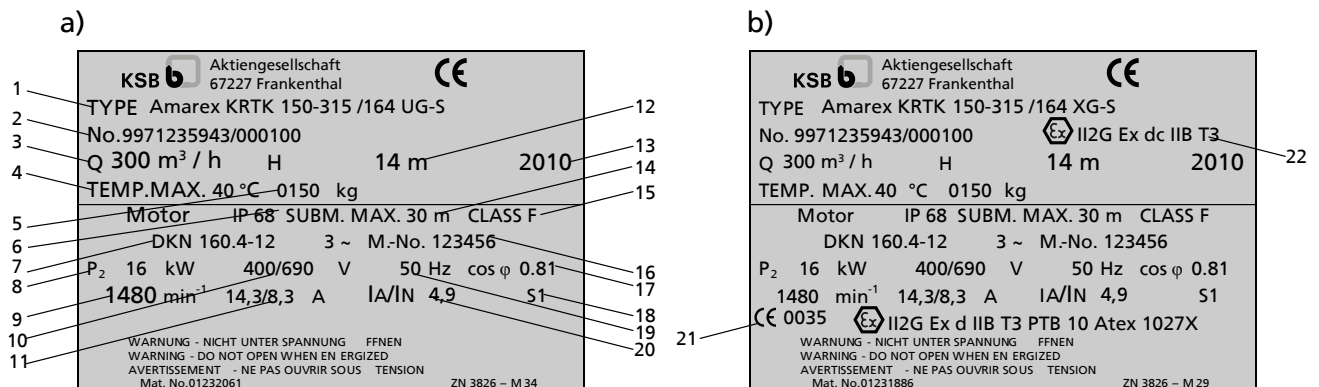


Fig. 2: Name plate (example) a) Standard pump set b) Explosion-proof pump set

1	Designation (⇒ Section 4.2 Page 16)	2	KSB order number
3	Flow rate	4	Maximum fluid and ambient temperature
5	Total weight	6	Enclosure
7	Motor type	8	Rated power
9	Rated speed	10	Rated voltage
11	Rated current	12	Head
13	Year of construction	14	Maximum submergence
15	Thermal class of winding insulation	16	Motor number
17	Power factor at design point	18	Mode of operation
19	Rated frequency	20	Starting current ratio
21	Atex marking for the submersible motor	22	Atex marking for the pump set

4.4 Design details

Design

- Fully floodable submersible motor pump
- Not self-priming

- Close-coupled design

Impeller type

- Various, application-based impeller types (⇒ Section 2.3 Page 8)

Shaft seal

- Two bi-directional mechanical seals in tandem arrangement, with liquid reservoir
- Pumps with reinforced bearings: with leakage chamber

Standard bearing assembly

- Grease-lubricated bearings sealed for life
- Maintenance-free

Reinforced bearing assembly

Motor-end bearing:

- Grease-lubricated bearings sealed for life
- Maintenance-free

Pump-end bearings:

- Grease-lubricated bearings
- Re-lubricable

The following hydraulic system/motor combinations have reinforced bearings:

Table 7: Reinforced bearing assembly

Size of hydraulic system	Motor size and number of poles				
	37 2	55 2	35 4	50 4	65 4
D 80-315	X	X	-	-	-
D 100-315	X	X	-	-	-
D 150-400	-	-	X	X	X
D 150-401	-	-	-	X	X
D 200-400	-	-	-	X	X
D 250-400	-	-	X	X	X

Drive

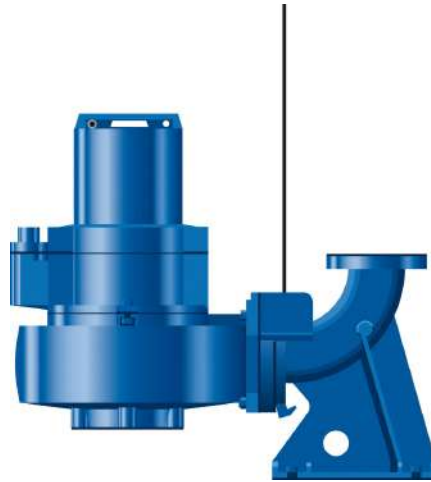
- Three-phase asynchronous squirrel-cage motor

Motors integrated in explosion-proof pump sets are supplied in Ex d IIB type of protection.

4.5 Types of installation

Installation types K and S

Table 8: Stationary wet installation



Guide wire arrangement



Guide rail arrangement

Installation type P

Table 9: Transportable wet-installed model



Pump sets of installation types P and S

are designed for continuously submerged operation. The motor is cooled by the fluid handled on the motor surface. Operation with the motor outside the fluid handled is possible for short periods.

Pump sets of installation type K

are suitable for continuous operation with the motor outside the fluid. Cooling is effected by means of air convection.

4.6 Configuration and function

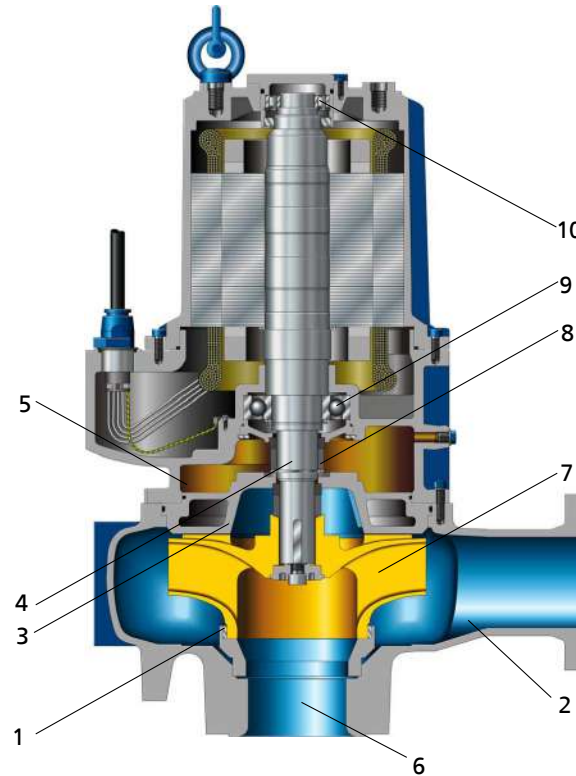


Fig. 3: Sectional drawing

1	Casing wear ring	2	Discharge nozzle
3	Discharge cover	4	Shaft
5	Bearing bracket	6	Suction nozzle
7	Impeller	8	Shaft seal
9	Bearing, pump end	10	Bearing, motor end

Design The pump is designed with an axial fluid inlet and a radial outlet. The hydraulic system sits on the extended motor shaft. The shaft runs in common bearings.

Function The fluid enters the pump axially via the suction nozzle (6) and is accelerated outward by the rotating impeller (7). In the flow passage of the pump casing the kinetic energy of the fluid is converted into pressure energy. The fluid is pumped to the discharge nozzle (2), where it leaves the pump. The casing wear ring (1) prevents any fluid from flowing back from the casing into the suction nozzle. At the rear side of the impeller, the shaft (4) enters the casing via the discharge cover (3). The shaft passage through the cover is sealed towards the atmosphere with a shaft seal (8). The shaft runs in rolling element bearings (9 and 10), which are supported by a bearing bracket (5) connected to the pump casing and/or discharge cover.

Sealing The pump is sealed by two bi-rotational mechanical seals in tandem arrangement. A lubricant reservoir in-between the seals ensures cooling and lubrication of the mechanical seals.

4.7 Scope of supply

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

Stationary wet installation (installation types S and K)

- Pump set complete with power cables
- Claw with sealing element (O-ring) and mounting elements
- Lifting rope, lifting chain or lifting bail (optional)
- Mounting bracket with mounting elements
- Duckfoot bend with mounting elements

- Guide wire
(guide rails are not included in KSB's scope of supply)

Transportable wet-installed model (installation type P)

- Pump set complete with power cables
- Foot plate or pump stool with mounting elements
- Lifting rope, lifting chain or lifting bail (optional)




A separate name plate is included in KSB's scope of supply. This name plate must be attached in a clearly visible position outside the place of installation (e.g. at the control panel, pipeline or mounting bracket).

4.8 Dimensions and weights

For dimensions and weights please refer to the general arrangement drawing/outline drawing or data sheet of the pump set.

5 Installation at Site

5.1 Safety regulations

	<p>⚠ DANGER</p> <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 given in the data sheet and on the name plate of the pump set.
	<p>⚠ DANGER</p> <p>Persons in the tank during pump operation Electric shock!</p> <ul style="list-style-type: none"> ▸ Never start up the pump set when there are persons in the tank.
	<p>⚠ WARNING</p> <p>Impermissible solid objects (tools, screws/bolts or similar) in the pump sump/inlet tank during pump start-up Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▸ Check the pump sump/inlet tank for impermissible solid objects before flooding, and remove, if necessary.


5.2 Checks to be carried out prior to installation

5.2.1 Checking the operating data

Before installing the pump set, verify that the name plate data matches the data given in the purchase order and the site system data.

5.2.2 Preparing the place of installation

Place of installation for stationary models

	<p>⚠ WARNING</p> <p>Installation on mounting surfaces which are unsecured and cannot support the load Personal injury or damage to property!</p> <ul style="list-style-type: none"> ▸ Use a concrete of compressive strength class C12/15 which meets the requirements of exposure class XC1 to EN 206-1. ▸ The mounting surface must have set and must be completely horizontal and even. ▸ Refer to the weights indicated.
---	---

Resonances

Any resonances at the usual excitation frequencies (1x and 2x rotational frequency, rotational noise) must be prevented both in the foundation and in the connected piping, as such frequencies may cause extreme vibrations.

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

Place of installation for transportable models

	<p>⚠ WARNING</p>
	<p>Incorrect positioning Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▶ Set the pump set down in a vertical position with the motor on top. ▶ Use appropriate means to secure the pump set against overturning and tipping over. ▶ Refer to the weights given in the data sheet/on the name plate.

Resonances Any resonances at the usual excitation frequencies (1x and 2x rotational frequency, rotational noise) must be prevented both in the foundation and in the connected piping, as such frequencies may cause extreme vibrations.

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

5.2.3 Checking the lubricant level

The lubricant reservoirs have been filled with an environmentally-friendly, non-toxic lubricant at the factory.

1. Position the pump set as illustrated.

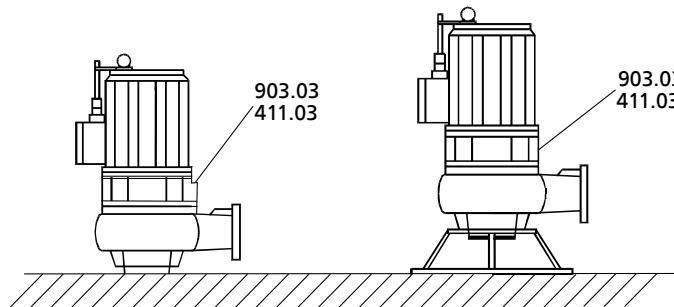




Fig. 4: Checking the lubricant level

2. Unscrew screw plug 903.03 with joint ring 411.03.
⇒ The lubricant must be level with the filler opening.
3. If the lubricant level is lower, fill the lubricant reservoir via the filler opening until the reservoir overflows. (⇒ Section 7.2.2.1.4 Page 45)
4. Close screw plug 903.03 with joint ring 411.03 again.

5.2.4 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 or objects inside the pump casing Risk of injuries, damage to the pump!</p> <ul style="list-style-type: none"> ▶ Never insert your hands or any other objects into the pump. ▶ Check that the inside of the pump is free from any foreign objects. ▶ Take suitable precautions (e.g. wear safety goggles, etc).

	<p>⚠ WARNING</p> <p>Improper positioning of pump set when checking the direction of rotation Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▸ Use appropriate means to secure the pump set against overturning or tipping over.
	<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.

✓ The pump set is connected to the power supply. (⇒ Section 5.4.2 Page 33)

1. Start the pump set and stop it again immediately to determine the motor's direction of rotation.
2. Check the direction of rotation.
Impeller rotation must be anti-clockwise (seen from the pump mouth end). On some pump casings, the direction of rotation is marked by an arrow.

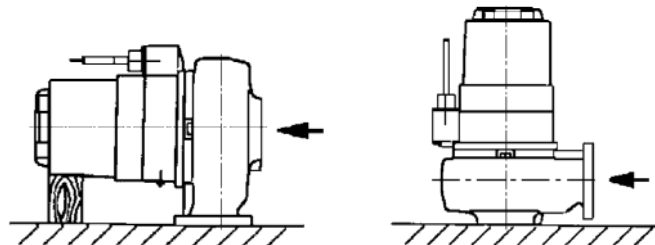


Fig. 5: Checking the direction of rotation

3. If the impeller is running in the wrong direction of rotation, check the electrical connection of the pump and the control system, if necessary.
4. Disconnect the pump set from the power supply and make sure it cannot be switched on accidentally.

5.3 Installing the pump set

Always observe the general arrangement drawing/outline drawing when installing the pump set.

5.3.1 Stationary wet installation

5.3.1.1 Fastening the duckfoot bend

Depending on the pump size, the duckfoot bend is fastened with chemical anchors and/or foundation rails.

Fastening the duckfoot bend with chemical anchors

1. Position duckfoot bend 72-1 at the bottom of the tank/sump.
2. Insert chemical anchors 90-3.38.
3. Bolt duckfoot bend 72-1 to the floor using chemical anchors 90-3.38.

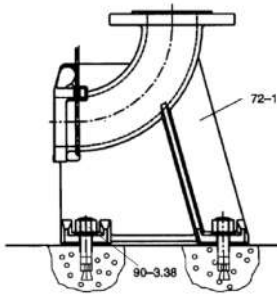


Fig. 6: Fastening the duckfoot bend

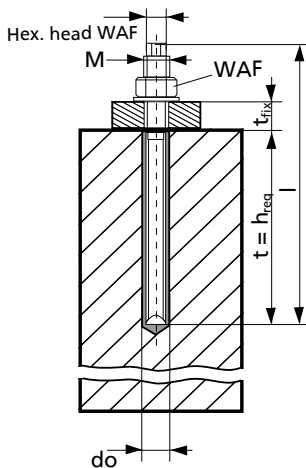


Fig. 7: Dimensions

Table 10: Chemical anchor bolt dimensions

Bolt size	d _o [mm]	t=h _{req} [mm]	t _{fix} [mm]	WAF [mm]	M [mm]	Hex. head WAF [mm]	Torque [Nm]
M 10x130	12	90	20	17	10	7	20
M 12x160	14	110	25	19	12	8	40
M 16x190	18	125	35	24	16	12	60
M 20x260	25	170	65	30	20	12	120
M 24x300 ⁵⁾	28	210	65	36	24	-	150
M 30x380 ⁵⁾	35	280	65	46	30	-	300

Table 11: Curing times of mortar cartridge

Floor temperature	Curing time [min]
-5 °C to 0 °C	240
0 °C to +10 °C	45
+10 °C to +20 °C	20
> +20 °C	10

5.3.1.2 Connecting the piping

	<p>⚠ DANGER</p> <p>Impermissible loads acting on the flange of the duckfoot bend Danger to life from leakage of hot, toxic, corrosive or flammable fluids!</p> <ul style="list-style-type: none"> ▸ 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. ▸ Observe the permissible flange loads. ▸ Take appropriate measures to compensate thermal expansion of the piping.
	<p>NOTE</p> <p>When the pump set is used for draining low-level building areas, install a swing check valve in the discharge line to avoid backflow from the sewer system.</p>

⁵⁾ Mounting accessories of respective manufacturer required.

	CAUTION
	<p>Critical speed Increased vibrations! Damage to mechanical seals and bearings!</p> <ul style="list-style-type: none"> ▶ Install a swing check valve in longer riser pipes to prevent the pump from excessive running in reverse. When fitting a swing check valve, make sure that the unit can still be vented properly.

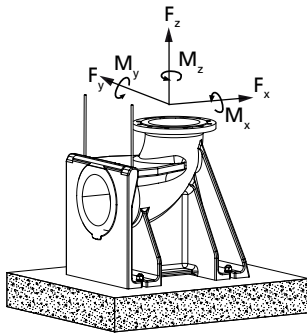


Fig. 8: Permissible flange loads

Table 12: Permissible flange loads

Nominal diameter of the flange	Forces [N]				Moments [Nm]			
	F _y	F _z	F _x	ΣF	M _y	M _z	M _x	ΣM
50	1350	1650	1500	2600	1000	1150	1400	2050
80	2050	2500	2250	3950	1150	1300	1600	2350
100	2700	3350	3000	5250	1250	1450	1750	2600
150	4050	5000	4500	7850	1750	2050	2500	3650
200	5400	6700	6000	10450	2300	2650	3250	4800
250	6750	8350	7450	13050	3150	3650	4450	6550
300	8050	10000	8950	15650	4300	4950	6050	8900

5.3.1.3 Fitting the guide wire arrangement

The pump set is guided into the sump or tank along two parallel, tightly stretched guide wires made of stainless steel. It attaches itself automatically to the duckfoot bend which has been fitted to the floor.

	NOTE
	<p>Should site conditions/piping layout, etc. require the wire to run off the vertical, do not exceed a maximum angle of 5° to ensure reliable fitting and guiding of the pump set.</p>

Fitting the mounting bracket

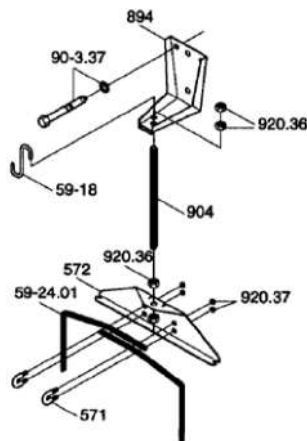


Fig. 9: Fitting the mounting bracket

1. Fasten mounting bracket 894 to the edge of the tank/sump opening with steel anchor bolts 90-3.37 and tighten the anchor bolts to a tightening torque of 10 Nm.
2. Push clamping pieces 571 through the holes of suspension bracket 572 and fasten with nuts 920.37.
3. Fasten threaded bolt 904 with the pre-assembled clamping arrangement to the mounting bracket with nut 920.36.
Do not tighten nut 920.36 too much in order to allow sufficient play for subsequently tensioning the guide wire.

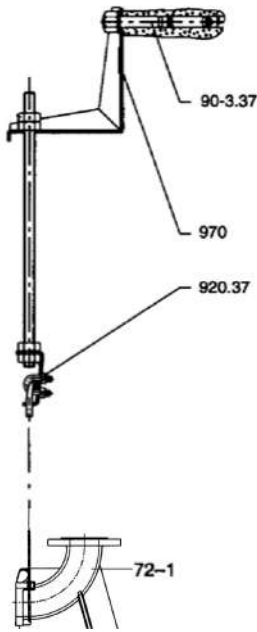


Fig. 10: Inserting the guide wire

Inserting the guide wire

1. Lift clamping piece 571 and insert one end of the guide wire.
2. Run wire 59-24.01 around duckfoot bend 72-1 and back again to suspension bracket 572 and insert it into clamping piece 571.
3. Manually tension wire 59-24.01 and secure it by means of hexagon nuts 920.37.
4. Pull the wire taut by tightening hexagon nut(s) 920.36 on the upper side of the mounting bracket. Observe the table "Guide wire tension".
5. Secure the nut(s) with a second hexagon nut.
6. The loose wire ends at guide wire suspension bracket 572 can either be twisted into a ring or the end can be cut off. After length adjustment, tape the ends to avoid fraying.
7. Attach hook 59-18 to mounting bracket 894 for attaching the lifting chain/rope at a later stage.

Table 13: Guide wire tension

DN	Tightening torque M_A [Nm]	Wire tensioning force P [N]
50	14	6000
80		
100		
150		
200	30	10000
250		
300		

5.3.1.4 Fitting the guide rail arrangement

The pump set is guided into the sump or tank along two vertical guide rails. It attaches itself automatically to the duckfoot bend which has been fitted to the floor.

	NOTE
	<p>The guide rails are not included in KSB's scope of supply. Select guide rail materials which are suitable for the fluid handled or as specified by the operator.</p>

Observe the following dimensions for the guide rails:

Table 14: Guide rail dimensions

Size of hydraulic system	Outside diameter [mm]	Wall thickness [mm] ⁶⁾	
		Minimum	Maximum
DN 40 ... DN 150	60	2	5
DN 200 ... DN 700	89	3	6

Fitting the mounting bracket

1. Fasten mounting bracket 894 to the edge of the sump opening with steel anchor bolts 90-3.37 and tighten the anchor bolts to a tightening torque of 10 Nm. Observe the hole pattern for the anchor bolts. (See outline drawing.)

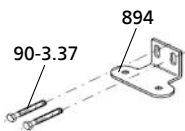
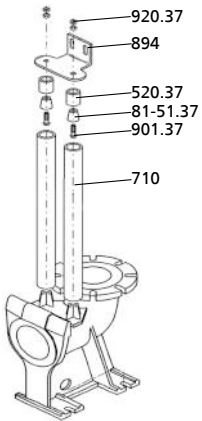


Fig. 11: Fitting the mounting bracket

⁶⁾ To DIN 2440/2442/2462 or equivalent standards

Fitting the guide rails

	<p>CAUTION</p>
<p>Improper installation of the guide rails Damage to the guide rail arrangement!</p> <p>▷ Always adjust the guide rails so that they are in a perfectly vertical position.</p>	



1. Place rails 710 onto the conical bosses provided on duckfoot bend 72-1 and position vertically.
2. Mark the length of rails 710 (up to the lower edge of the mounting bracket), taking into account the adjusting range of the slotted holes in mounting bracket 894.
3. Shorten rails 710 with a 90° cut to the pipe axis. Debur the rails inside and outside.
4. Insert mounting bracket 894 with elastic sleeves 520.37 into guide rails 710 until the mounting bracket rests on the rail ends.
5. Tighten nuts 920.37.
This pulls clamping sleeves 81-51.37 upwards and expands sleeves 520.37 against the inside pipe diameter.
6. Lock nuts 920.37 with a second nut and secure with Loctite 243.

Fig. 12: Fitting the guide rails

	<p>NOTE</p>
<p>For installation depths > 6 m, the scope of supply may include brackets as a middle support for the guide rails. The mounting brackets also serve as spacers between the two guide rails.</p>	

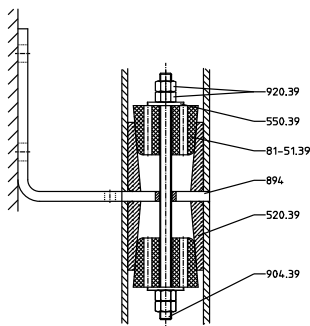


Fig. 13: Fitting the middle support

Fitting the middle support

1. Measure the inside diameter of the guide rails.
2. Expand elastic sleeves 520.39 with clamping sleeves 81-51.39 to the inside diameter of the guide rails by tightening nuts 920.39.
3. Slip the guide rails onto the sleeves and check whether there is a tight fit between the guide rails and the sleeves.
4. Secure the fasteners with locknuts.
5. Proceed to fit the guide rails.

5.3.1.5 Preparing the pump set

Fitting the claw

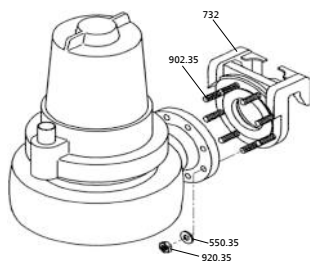
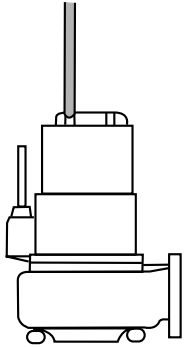


Fig. 14: Fitting the claw

1. Fasten claw 732 to the discharge flange with studs 902.35, discs 550.35 and nuts 920.35.
Observe the tightening torques. (⇒ Section 7.6 Page 57)
2. Fit profile joint 410 or round cord seal 99-6 into the groove of the claw.
This will seal the duckfoot bend/pump connection.

Attaching the lifting chain/rope

1. Attach the lifting chain or rope to the lug/eyebolt/bail at the pump set on the opposite side of the discharge nozzle. This attachment point achieves a forward inclination of the pump set towards the discharge nozzle, which allows the pump claw to hook onto the duckfoot bend.



Attaching the lifting chain/rope - stationary wet installation

Table 15: Types of attachment

Drawing	Type of attachment	
	Chain attached directly to the motor housing	
	914.26	Hexagon socket head cap screw
	920.26	Nut
	Looped lifting rope	
	59-24.02	Rope
	Shackle with lifting rope or chain at the bail	
	59-17	Shackle
	59-24.02	Rope
	885	Chain
	914.26	Hexagon socket head cap screw
	920.26	Nut
	Chain attached to the eyebolt with a shackle	
	59-17	Shackle
	885	Chain
	Lifting rope attached to the bail	
	59-24.02	Rope
	571	Yoke

5.3.1.6 Installing the pump set

	NOTE
	Make sure the pump set with the pre-assembled claw can easily be slipped over the mounting bracket, threaded onto the guide rails and lowered down. If required, alter the position of the crane during installation.

1. Guide the pump set over the suspension bracket/mounting bracket, thread it onto the guide wires/rails and slowly lower it down. The pump set attaches itself to duckfoot bend 72-1.
2. Attach lifting chain/rope to hook 59-18 at the mounting bracket.

5.3.2 Transportable wet installation

Fitting the foot plate or pump stool

Fit the foot plate or pump stool before installing the pump. (⇒ Section 9.5 Page 81)
Tighten the screws as specified, see table "Tightening torques". (⇒ Section 7.6 Page 57)

Attaching the lifting chain/rope

1. Attach the lifting chain or rope to the lug/eyebolt on the discharge nozzle side (see illustration on the left and table "Types of attachment").

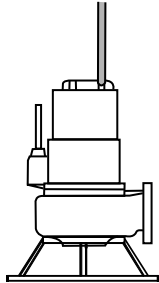


Fig. 15: Attaching the lifting chain/rope

Connecting the piping

The discharge nozzles can be connected to rigid or flexible pipes.

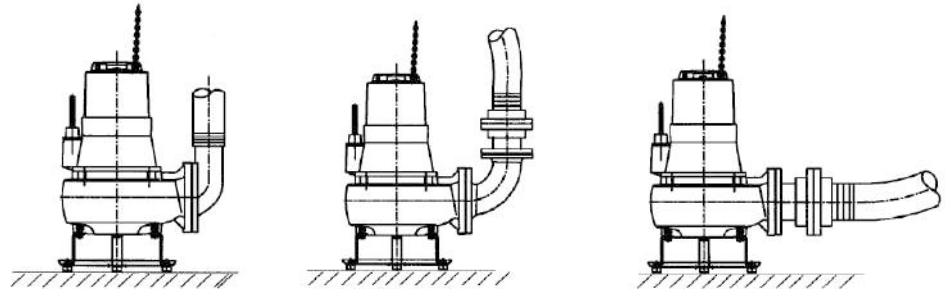


Fig. 16: Connection options

5.4 Electrical system

5.4.1 Information for planning the control system

For the electrical connection of the pump set observe the wiring diagrams contained in the Annex.
The pump set is supplied with power cables; it is wired for DOL starting. Star-delta starting is also possible.

	NOTE
	When laying a cable between the control system and the pump set's connection point, make sure that the number of cores is sufficient for the sensors. A minimum cross-section of 1.5 mm ² is required.


The motors can be connected to electrical low voltage networks with nominal voltages and voltage tolerances as per IEC 38 or other networks or supply systems with rated voltage tolerances of max. ±10 %.

5.4.1.1 Overload protection

1. Protect the pump set against overloading by using a thermal time-lag overload protection device in accordance with IEC 947 and local regulations.
2. Set the overload protection device to the rated current specified on the name plate. (⇒ Section 4.3 Page 16)

5.4.1.2 Level control

	⚠ DANGER
	Pump set running dry Explosion hazard! ▷ Never allow an explosion-proof pump set to run dry!


	CAUTION
	<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.

Automatic operation of the pump set in a tank requires the use of level control equipment.
Observe the minimum fluid level. (⇒ Section 6.2.4.2 Page 37)

5.4.1.3 Frequency inverter operation

The pump set is suitable for frequency inverter operation as per IEC 60034-17.

	⚠ DANGER
	<p>Operation outside the permitted frequency range Explosion hazard!</p> <ul style="list-style-type: none"> ▷ Never operate an explosion-proof pump set outside the specified range.

	⚠ DANGER
	<p>Incorrect setting of frequency inverter current limit Explosion hazard!</p> <ul style="list-style-type: none"> ▷ Set the current limit to max. 1.2 times the rated current indicated on the name plate.

Selection When selecting a frequency inverter, check the following details:

- Data provided by the manufacturer
- Electrical data of the pump set, particularly the rated current

Start-up

- Ensure short start ramps (max. 5 s)
- Only start speed-controlled operation after 2 minutes at the earliest.
Pump start-up with long start ramps and low frequency may cause clogging.

Operation

Observe the following limits when operating the pump set via frequency inverter:

- Only utilise up to 95 % of the motor rating P_2 indicated on the name plate. (⇒ Section 4.3 Page 16)
- Frequency range 25-50 Hz (⇒ Section 2.3 Page 8)



Electromagnetic compatibility


Frequency inverter operation produces RFI emissions whose level varies, depending on the inverter used (type, interference suppression, make). To prevent the drive system, consisting of a submersible motor and a frequency inverter, from exceeding the limits stipulated in EN 50081 always observe the EMC information provided by the inverter manufacturer. If the inverter manufacturer recommends a shielded power cable, make sure to use a pump set with a shielded power cable.

Interference immunity

The pump set generally meets the interference immunity requirements to EN 50082. For monitoring the sensors installed the operator must ensure sufficient interference immunity by appropriately selecting and laying the cables in the plant. No modifications are required on the power/control cable of the pump set. Suitable analysing devices must be selected. To monitor the leakage sensor inside the motor, it is recommended to use a special relay available from KSB.


5.4.1.4 Sensors

 	<p>⚠ DANGER</p>
	<p>Operating an incompletely connected pump set Explosion hazard! Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Never start up a pump set with incompletely connected power cables or non-operational monitoring devices.

	<p>CAUTION</p>
	<p>Incorrect connection Damage to the sensors!</p> <ul style="list-style-type: none"> ▷ Observe the limits stated in the following sections of this manual when connecting the sensors.



The pump set is equipped with sensors designed to prevent hazards and damage to the pump set.

Measuring transducers are required for analysing the sensor signals supplied. Suitable devices for 230V~ can be supplied by KSB.

	<p>NOTE</p>
	<p>Reliable and safe operation of the pump within the scope of our warranty is only possible if the sensor signals are properly analysed as stipulated in these operating instructions.</p>

All sensors are located inside the pump set and are connected to the power cable. For information on wiring and core marking please refer to the wiring diagrams. The individual sensors and the limit values to be set are described in the following sections.


5.4.1.4.1 Motor temperature
 Installation types P and S

 	<p>⚠ DANGER</p>
	<p>Insufficient cooling Explosion hazard! Winding damage!</p> <ul style="list-style-type: none"> ▷ Never operate a pump set without operational temperature monitoring. ▷ For explosion-proof pump sets use a thermistor tripping unit with manual reset which is ATEX-approved for monitoring the temperature of explosion-proof motors with "flameproof enclosure" Ex d type of protection.

The pump set features double monitoring of the winding temperature. Two bimetal switches (terminals 21 and 22, max. 250 V~/2 A) serve as temperature control devices which open when the winding temperature is too high. Tripping must result in the pump set cutting out. Automatic re-start is permissible.

For explosion-proof pump sets, the three additional, series-connected (PTC) thermistors with terminals 10 and 11 must be used. They must be connected to a thermistor tripping unit with manual reset and ATEX approval for monitoring the temperature of explosion-proof motors with "flameproof enclosure" Ex d type of protection.

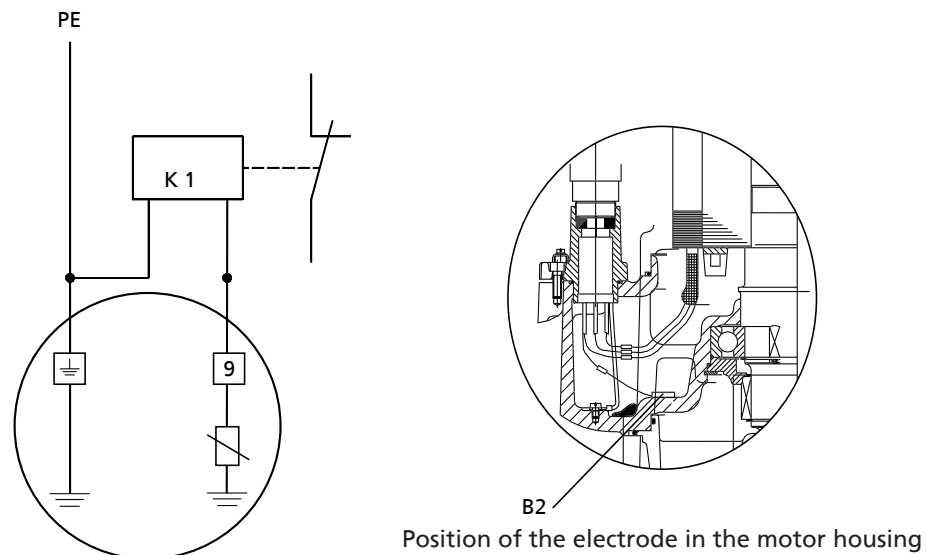
Installation type K

	<p>⚠ DANGER</p>
<p>Insufficient cooling Explosion hazard! Winding damage!</p> <ul style="list-style-type: none"> ▷ Never operate a pump set without operational temperature monitoring. ▷ For explosion-proof pump sets use a thermistor tripping unit with manual reset which is ATEX-approved for monitoring the temperature of explosion-proof motors with "flameproof enclosure" Ex d type of protection. 	

The motor is monitored by three series-connected PTC thermistors with terminals 10 and 11. Tripping must result in the pump set cutting out. Automatic re-start is not permitted.

On explosion-proof pump sets, they must be connected to a thermistor tripping unit with manual reset and ATEX approval for monitoring the temperature of explosion-proof motors in "flameproof enclosure" Ex d type of protection.

5.4.1.4.2 Leakage inside the motor



Connecting the electrode relay

An electrode fitted inside the motor monitors the winding and connection space for leakage. This electrode must be connected to an electrode relay (core identification 9). Tripping of the electrode relay must result in the pump set cutting out.

The electrode relay (K1) must meet the following requirements:

- Sensor circuit 10 to 30 V ~
- Tripping current 0.5 to 3 mA (equivalent to a tripping resistance of 3 to 60 kΩ)

5.4.1.4.3 Leakage at the mechanical seal (only for pump sets with reinforced bearings)

The chamber for mechanical seal leakage is equipped with a float switch (core identification 3 and 4). The contact (maximum 250 V~/2 A) opens when leakage is detected in the leakage chamber. Opening of the contact shall trigger an alarm signal. (⇒ Section 9.2 Page 74) (⇒ Section 4.4 Page 16)

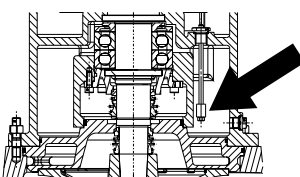


Fig. 17: Float switch

5.4.1.4.4 Bearing temperature






As an option, the pump set can be supplied with temperature monitoring in the area of the pump-end bearings.
Check in the data sheet whether the pump set is equipped with bearing temperature monitoring.




The bearing temperature sensor is a PT100 resistance thermometer. It must be connected to a temperature control device with a PT100 input and 2 separate outputs for two different switching points (sensor circuit maximum 6 V/2 mA).

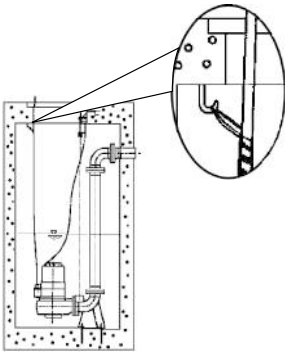
Set the following limits:

- Alert at 110 °C
- Cut-out of the pump set at 130 °C

5.4.2 Connection to power supply

	<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>CAUTION</p> <p>Improper routing of power cable Damage to the power cables!</p> <ul style="list-style-type: none"> ▸ Never move the power cables at temperatures below - 25 °C. ▸ Never kink or crush the power cables. ▸ Never lift the pump set by the power cables. ▸ Adjust the length of the power cables to the site requirements.
	<p>CAUTION</p> <p>Motor overload Damage to the motor!</p> <ul style="list-style-type: none"> ▸ Protect the motor by a thermal time-lag overload protection device in accordance with IEC 947 and local regulations.
<p>For connection to power supply observe the wiring diagrams in the Annex and the information on planning the control system (⇒ Section 5.4.1 Page 29) .</p>	
<p>The pump set is supplied complete with power cable. Always connect all marked cores.</p>	
	<p>⚠ DANGER</p> <p>Incorrect connection Explosion hazard!</p> <ul style="list-style-type: none"> ▸ The connection point of the cable ends must be located outside the potentially explosive atmosphere or inside electrical equipment approved to equipment category II2G.



	<p>⚠ DANGER</p> <p>Operating an incompletely connected pump set Explosion hazard! Damage to the pump set!</p> <ul style="list-style-type: none"> ▶ Never start up a pump set with incompletely connected power cables or non-operational monitoring devices.
	<p>⚠ DANGER</p> <p>Connection of damaged power cables Danger of death from electric shock!</p> <ul style="list-style-type: none"> ▶ Check the power cables for damage before connecting them to the power supply. ▶ Never connect damaged power cables.
	<p>CAUTION</p> <p>Flow-induced motion Damage to the power cable!</p> <ul style="list-style-type: none"> ▶ Run the power cable upwards without slack.



1. Run the power cables upwards without slack and fasten them.
2. Only remove the protective caps from the power cables immediately before connecting the cables.
3. If necessary, adjust the length of the power cables to the site requirements.
4. After shortening the cables, correctly re-affix the markings on the individual cores at the cable ends.

Fig. 18: Fastening the power cables

Potential equalisation The pump set does not have an external PE connection (risk of corrosion).

	<p>⚠ DANGER</p> <p>Incorrect wiring Explosion hazard!</p> <ul style="list-style-type: none"> ▶ Explosion-proof pump sets installed in a tank must never be retrofitted with an external potential equalisation connection!
	<p>⚠ DANGER</p> <p>Touching the pump set during operation Electric shock!</p> <ul style="list-style-type: none"> ▶ Make sure that the pump set cannot be touched during operation.


6 Commissioning/Start-up/Shutdown

6.1 Commissioning/start-up


6.1.1 Prerequisites for commissioning/start-up


Before commissioning/starting up the pump set, make sure that the following conditions are met:

- The pump set has been properly connected to the power supply and is equipped with all protection devices.
- The pump has been primed with the fluid to be handled.
- The direction of rotation has been checked. (⇒ Section 5.2.3 Page 22)
- The lubricant has been checked.
- After prolonged shutdown of the pump (set), the required activities have been carried out. (⇒ Section 6.4 Page 39)


	⚠ DANGER
	<p>Persons in the tank during pump operation Electric shock!</p> <ul style="list-style-type: none"> ▸ Never start up the pump set when there are persons in the tank.

6.1.2 Start-up

	⚠ DANGER
	<p>Persons in the tank during pump operation Electric shock!</p> <ul style="list-style-type: none"> ▸ Never start up the pump set when there are persons in the tank.


	CAUTION
	<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 it has come to a standstill. ▸ Never start up the pump set while the pump is running in reverse.

✓ The fluid level is sufficiently high.


	CAUTION
	<p>Pump start-up against a closed shut-off element Increased vibrations! Damage to mechanical seals and bearings!</p> <ul style="list-style-type: none"> ▸ Never operate the pump set against a closed shut-off element.

1. Fully open the discharge line shut-off element, if any.
2. Start up the pump set.

6.2 Operating limits

	⚠ DANGER
	<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 Frequency of starts


	CAUTION
	<p>Excessive frequency of starts Risk of damage to the motor!</p> <ul style="list-style-type: none"> ▷ Never exceed the specified frequency of starts.

To prevent high temperature increases in the motor and excessive loads on the motor, seal elements and bearings, the switching frequency shall not exceed the following number of start-ups per hour.


Table 16: Frequency of starts

Motor rating [kW]	Maximum No. of starts [Starts/hour]
≤ 7.5	30
> 7.5	10

These values apply to mains start-up (DOL or with star-delta contactor, autotransformer, soft starter). The limit does not apply to frequency inverter operation.

	CAUTION
	<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 it has come to a standstill. ▷ Never start up the pump set while the pump is running in reverse.

6.2.2 Supply voltage

	⚠ DANGER
	<p>Non-compliance with permissible supply voltage tolerances Explosion hazard!</p> <ul style="list-style-type: none"> ▷ Never operate an explosion-proof pump (set) outside the specified range.

The maximum permissible supply voltage deviation is ±10%, for explosion-proof pump sets ±5% of the rated voltage. The voltage difference between the individual phases must not exceed 1%.

6.2.3 Frequency inverter operation

	⚠ DANGER
	<p>Operation outside the permitted frequency range Explosion hazard!</p> <ul style="list-style-type: none"> ▷ Never operate explosion-proof pump sets outside the specified range.
	CAUTION
	<p>Pumping solids-laden fluids at reduced speed Increased wear and clogging!</p> <ul style="list-style-type: none"> ▷ Never operate the pump set with flow velocities below 0.7 m/s in horizontal pipes and 1.2 m/s in vertical pipes.

Frequency inverter operation of the pump set is permitted in the frequency range from 25 to 50 Hz.

6.2.4 Fluid handled

6.2.4.1 Temperature of the fluid handled

The pump set is designed for transporting liquids. The pump set is not operational under freezing conditions.

	CAUTION
	<p>Danger of frost/freezing Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Drain the pump set or protect it against freezing.

Refer to the maximum permissible fluid and ambient temperature on the name plate and in the data sheet.

6.2.4.2 Minimum fluid level

	⚠ DANGER
	<p>Pump set running dry Explosion hazard!</p> <ul style="list-style-type: none"> ▷ Never allow an explosion-proof pump set to run dry!
	CAUTION
	<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.

Pump sets (installation types P and S)

The pump set is designed for continuously **submerged** operation. This condition has to be fulfilled for the motor to be cooled sufficiently.

Ready for operation

The pump set is ready for operation as soon as the motor is fully submerged (dimension A). Exact dimensions see general arrangement drawing/outline drawing.

The pump can be operated at a lower fluid level for short periods. If the motor is not sufficiently cooled, an internal temperature monitoring device will trip the pump set and automatically re-start it after the motor has cooled down. The fluid level must not drop below the specified minimum (dimension B). Exact dimensions see general arrangement drawing/outline drawing.

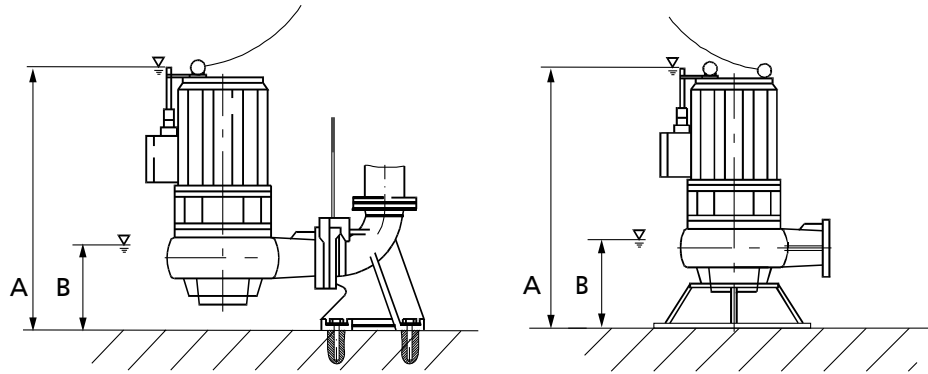


Fig. 19: Minimum level of fluid handled

	NOTE
	<p>Compliance with dimension B does not guarantee trouble-free operation of the pump set. Depending on the pump's duty point, higher fluid levels may be required. Observe the NPSH values indicated in the characteristic curve (see hydraulic characteristic curves).</p>

Pump sets (installation type K)

The pump set is suitable for continuous operation with the motor **outside the fluid**.

Ready for operation

The pump set is ready for operation when the minimum fluid level has been reached (dimension B). Exact dimensions see general arrangement drawing/outline drawing.

	NOTE
	<p>Compliance with dimension B does not guarantee trouble-free operation of the pump set. Depending on the pump's duty point, higher fluid levels may be required. Observe the NPSH values indicated in the characteristic curve (see hydraulic characteristic curves).</p>

6.2.4.3 Density of the fluid handled




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

	CAUTION
	<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.

6.3 Shutdown/storage/preservation

6.3.1 Measures to be taken for shutdown

The pump set remains installed

	<p>⚠ WARNING</p> <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.
	<p>⚠ WARNING</p> <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.
	<p>CAUTION</p> <p>Danger of frost/freezing Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ If there is any danger of frost/freezing, remove the pump set from the fluid handled and clean, preserve and store it.

✓ Make sure sufficient fluid is available for the operation check run of the pump set.

1. For prolonged shutdown periods, start up the pump set regularly once every three months for approximately one minute.
This will prevent the formation of deposits within the pump and the pump intake area.

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


✓ All safety regulations are observed. (⇒ Section 7.1 Page 41)

1. Clean the pump set.
2. Preserve the pump set.
3. Observe the instructions given in (⇒ Section 3.3 Page 14) .

6.4 Returning to service

For returning the pump set to service observe the sections on commissioning/start-up (⇒ Section 6 Page 35) and operating limits. (⇒ Section 6.2 Page 36)

For returning the pump set to service after storage also follow the instructions for servicing/inspection. (⇒ Section 7.2 Page 42)

	<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.
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**NOTE**

On pumps/pump sets older than 5 years we recommend replacing all elastomer seals.

7 Servicing/Maintenance

7.1 Safety regulations

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

	<p>⚠ DANGER</p> <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! ▷ Never open an energised pump set. ▷ Always perform maintenance work on explosion-proof pump sets outside potentially explosive atmospheres only.
	<p>⚠ WARNING</p> <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.
	<p>⚠ WARNING</p> <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.
	<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.
	<p>⚠ WARNING</p> <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.
	<p>NOTE</p> <p>Special regulations apply to repair work on explosion-proof pump sets. Modification or alteration of the pump set may affect explosion protection and are only permitted after consultation with the manufacturer.</p>

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.

	NOTE
	<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 Servicing/inspection

KSB recommends the following schedule for pump set maintenance:

Table 17: Overview of maintenance work

Maintenance interval	Maintenance work	For details see ...
Every 4000 operating hours ⁷⁾	Measure the insulation resistance	(⇒ Section 7.2.1.3 Page 42)
	Check the power cables	(⇒ Section 7.2.1.2 Page 42)
	Visually inspect the lifting chain/rope	(⇒ Section 7.2.1.1 Page 42)
Every 10,000 operating hours ⁸⁾	Check the sensors	(⇒ Section 7.2.1.4 Page 43)
	Check the mechanical seal leakage	(⇒ Section 7.2.1.5 Page 44)
	Change the lubricant	(⇒ Section 7.2.2.1.4 Page 45)
	Lubricate the bearings	(⇒ Section 7.2.2.2.3 Page 46)
Every 5 years	General overhaul	

7.2.1 Inspection work

7.2.1.1 Checking the lifting chain/rope

- ✓ The pump set has been lifted out of the pump sump and cleaned.
- 1. Inspect the lifting chain/rope as well as the attachment for any visible damage.
- 2. Replace any damaged components by original spare parts.

7.2.1.2 Checking the power cables

- Visual inspection**
- ✓ The pump set has been pulled out of the pump sump and cleaned.
 - 1. Inspect the power cable for any visual damage.
 - 2. Replace any damaged components by original spare parts.

- Checking the earth conductor**
- ✓ The pump set has been pulled out of the pump sump and cleaned.
 - 1. Measure the resistance between earth conductor and earth. The resistance measured must be less than 1 Ω.
 - 2. Replace any damaged components by original spare parts.

	⚠ DANGER
	<p>Defective earth conductor Electric shock!</p> <ul style="list-style-type: none"> ▷ Never switch on a pump set with a defective earth conductor.

7.2.1.3 Measuring the insulation resistance

Measure the insulation resistance of the motor winding during annual maintenance work.

⁷⁾ At least once a year

⁸⁾ At least every three years

- ✓ The pump set has been disconnected in the control cabinet.
 - ✓ Use an insulation resistance measuring device.
 - ✓ The recommended measuring voltage equals 500 V (maximum permissible 1000 V).
1. Measure the winding against earth.
To do so, connect all winding ends together.
 2. Measure the winding temperature sensors against earth.
To do so, connect all core ends of the winding temperature sensors together and connect all winding ends to earth.
- ⇒ The insulation resistance of the core ends against earth must not be lower than 1 MΩ.
If the resistance measured is lower, power cable and motor resistance must be measured separately. Disconnect the power cable from the motor for this purpose.

	NOTE
	If the insulation resistance for one of the power cables is below 1 MΩ, the cable is defective and must be replaced.

	NOTE
	If the insulation resistance values measured on the motor are too low, the winding insulation is defective. The pump set must not be returned to service in this case.

7.2.1.4 Checking the sensors

	CAUTION
	<p>Excessive test voltage Damage to the sensors!</p> <p>▶ Never test the sensors with voltages exceeding 30 V.</p>

The tests described below measure the resistance at the core ends of the control cable. The actual sensor function is not tested.

Temperature sensors in the motor winding

Table 18: Resistance measurement

Measurement between terminals ...	Resistance
21 and 22	< 1 Ω
10 and 11	200 Ω - 750 Ω

If the specified tolerances are exceeded, disconnect the power cable at the pump set and repeat the check inside the motor.
If the tolerances are exceeded here, too, the motor section has to be opened and overhauled. The temperature sensors are fitted in the stator winding and cannot be replaced.

Leakage sensor in the motor

Table 19: Resistance of leakage sensor in the motor

Measurement between terminals ...	Resistance
9 and earth conductor (PE)	> 60 kΩ

Lower resistance values suggest water ingress into the motor. In this case the motor must be opened and overhauled.

Float switch (mechanical seal leakage) (only pump sets with reinforced bearings) (⇒ Section 4.4 Page 16)

Table 20: Resistance measurement of the float switch

Measurement between terminals ...	Resistance
3 and 4	< 1 Ω

If the readings suggest an open switch, check for mechanical seal leakage.

Bearing temperature sensor

Table 21: Resistance measurement of the bearing temperature sensor

Measurement between terminals ...	Resistance
15 and 16	100 Ω - 120 Ω

7.2.1.5 Checking the mechanical seal leakage (only pump sets with reinforced bearings)

	<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.

	<p>NOTE</p>
	<p>Slight wear of the mechanical seal is unavoidable. This will be aggravated by abrasive substances contained in the fluid handled.</p>

- ✓ The pump set has been placed in vertical position.
- 1. Place a suitable container under screw plug 903.34.
- 2. Remove screw plug 903.34 and joint ring 411.34.
- 3. Drain the leakage.

	<p>NOTE</p>
	<p>If more than 0.25 litres of leakage should escape we recommend to replace the mechanical seals.</p>

- 4. Close screw plug 903.34 with joint ring 411.34 again.

7.2.2 Lubrication and lubricant change

7.2.2.1 Lubricating the mechanical seal

The mechanical seal is supplied with lubricant from the lubricant reservoir.

7.2.2.1.1 Intervals

Replace the lubricant after every 10,000 operating hours but at least every 3 years. (⇒ Section 7.2 Page 42)

7.2.2.1.2 Lubricant quality

The lubricant reservoir is filled at the factory with environmentally friendly, non-toxic lubricant of medicinal quality (if not requested otherwise by the customer). The following lubricants can be used to lubricate the mechanical seals:

Table 22: Oil quality

Description	Properties	
Paraffin oil or white oil Alternative: Motor oils of classes SAE 10 W to SAE 20 W	Kinematic viscosity at 40 °C	<20 mm ² /s
	Flash point (in accordance with Cleveland)	+160 °C
	Pour point	-15 °C

Recommended oil types:

- Merkur WOP 40 PB, SASOL
- Merkur white oil Pharma 40, DEA

- Liquid paraffin oil No. 7174, Merck
- Equivalent brands of medicinal quality, non-toxic
- Water-glycol mix

	⚠ WARNING
	Lubricant contaminating fluid handled Hazard to persons and the environment! ▶ Using machine oil is only permitted if the oil is disposed of properly.

7.2.2.1.3 Lubricant quantity

Table 23: Lubricant quantity

Motor sizes Size	5 2, 6 2, 8 2, 12 2, 17 2, 22 2, 25 2, 4 4, 5 4, 7 4, 11 4, 16 4, 19 4, 21 4, 4 6, 6 6, 9 6, 12 6, 15 6, 19 6	23 2, 23 4, 29 4, 20 6, 26 6, 10 8, 17 8, 21 8	37 2, 55 2, 35 4, 50 4, 65 4, 32 6, 40 6, 50 6, 26 8, 35 8
40-250	2.1 l	-	-
80-250			
80-251			
100-240			
100-250/251			
150-251			
80-315/316	4.6 l	7 l	2.1 l
100-315			-
100-316			
150-315			
200-315/316			
100-400/401	-	4.5 l	6.5 l (reinforced bearings: 2.1 l)
150-400/401			
151-401			
200-330			
200-400/401			
250-400/401			
300-400/401			

7.2.2.1.4 Changing the lubricant

	⚠ WARNING
	Lubricants posing a health hazard and/or hot lubricants Hazard to persons and the environment! ▶ When draining the lubricant take appropriate measures to protect persons and the environment. ▶ Wear safety clothing and a protective mask, if required. ▶ Collect and dispose of any lubricants. ▶ Observe all legal regulations on the disposal of fluids posing a health hazard.

	⚠ WARNING
	Excess pressure in the lubricant reservoir Liquid spurting out when the lubricant reservoir is opened at operating temperature! ▶ Open the screw plug of the lubricant reservoir very carefully.

Draining the lubricant

1. Position the pump set as illustrated.

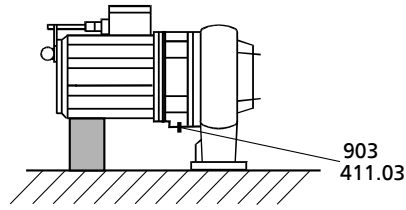


Fig. 20: Draining the lubricant

2. Place a suitable container under the screw plug.
3. Unscrew screw plug 903 or 903.03 with joint ring 411.03 and, if applicable, screw plug 903.04 with joint ring 411.05. Drain the lubricant.

Filling in the lubricant

1. Position the pump set as illustrated.

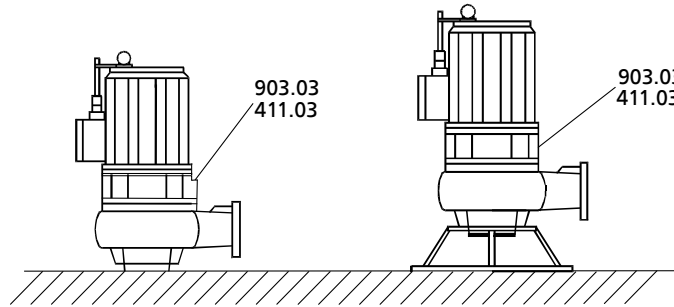


Fig. 21: Filling in the lubricant

2. Pour lubricant into the lubricant filler opening until the lubricant reservoir overflows.
3. Close screw plug 903.03 again with a new joint ring 411.03.

7.2.2.2 Lubricating the rolling element bearings

The rolling element bearings of the pump set are packed with maintenance-free grease, with the exceptions noted below.

On pump sets with reinforced bearings (⇒ Section 4.4 Page 16) the pump-end rolling element bearings can be re-lubricated; they need to be relubricated as part of the maintenance work.

7.2.2.2.1 Grease quality

The following greases can be used to lubricate the rolling element bearings:

**Grease quality
Recommended
commercially available
brands**

- Lithium soap grease suitable for high temperatures
- ESSO UNIREX N3
- FAG ARCANOL L40
- TEXACO HYTEX EP3/DEA Pragon


7.2.2.2.2 Grease quantity


Use 60g grease to lubricate the rolling element bearings.


7.2.2.2.3 Re-lubrication

An encapsulated water-tight lubricating nipple allows re-lubrication of the angular contact ball bearings without opening the pump.


Pump sets with reinforced bearings (⇒ Section 4.4 Page 16)

	⚠ DANGER
	<p>Dry running Explosion hazard!</p> <ul style="list-style-type: none"> ▸ Re-lubricate explosion-proof pump sets outside potentially explosive atmospheres.

	⚠ WARNING
	<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.


	CAUTION
	<p>Incomplete re-lubrication Bearing damage!</p> <ul style="list-style-type: none"> ▸ Always re-lubricate the bearings with the pump set in operation.

- ✓ The pump set has been positioned on a level surface.
- ✓ The pump set is secured against tipping over.
- 1. Remove screw plug 903.46 and joint ring 411.46.
- 2. Connect the pump set to the power supply. (⇒ Section 5.4.2 Page 33)

	CAUTION
	<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.

- 3. Start up the pump set.
- 4. Fill in grease via lubricating nipple 636.02.
- 5. Disconnect the pump set from the power supply again and make sure it cannot be switched on unintentionally.
- 6. Close screw plug 903.46 with joint ring 411.46.


7.3 Drainage/cleaning

	⚠ WARNING
	<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 83)

7.4 Dismantling the pump set

7.4.1 General information/Safety regulations

	⚠ WARNING
	<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.


	⚠ WARNING
	<p>Hot surface Risk of injury!</p> <ul style="list-style-type: none"> ▶ Allow the pump set to cool down to ambient temperature.


	⚠ WARNING
	<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 Page 41)

For dismantling and reassembly observe the general assembly drawing.

In the event of damage you can always contact our service staff.

	⚠ DANGER
	<p>Insufficient preparation of work on the pump (set) Risk of injury!</p> <ul style="list-style-type: none"> ▶ Properly shut down the pump set. ▶ Close the shut-off elements in suction and discharge line. ▶ Drain the pump and release the pump pressure. ▶ Close any auxiliary connections. ▶ Allow the pump set to cool down to ambient temperature.

	⚠ WARNING
	<p>Components with sharp edges Risk of cutting or shearing injuries!</p> <ul style="list-style-type: none"> ▶ Always use appropriate caution for installation and dismantling work. ▶ Wear work gloves.

7.4.2 Preparing the pump set

✓ The notes and steps stated in (⇒ Section 7.4.1 Page 48) have been observed/ carried out.

1. De-energise the pump set and secure it against unintentional start-up.
2. Drain the lubricant. (⇒ Section 7.2.2.1.4 Page 45)
3. Drain the leakage chamber and leave it open for the duration of the disassembly.

7.4.3 Dismantling the pump section

Dismantle the pump section in accordance with the relevant general assembly drawing. (⇒ Section 9.1 Page 61)

7.4.3.1 Removing the back pull-out unit

1. Unscrew screwed connection 902.01 and 920.01 and pull the complete back pull-out unit out of pump casing 101.
2. Place the back pull-out unit in a safe and dry assembly area and secure it against tipping over or rolling off.

7.4.3.2 Removing the impeller

7.4.3.2.1 Removing the impeller with tapered fit

1. Unscrew socket head cap screw 914.10 with disc 550.23.
2. Completely screw the grub screw into the shaft thread.
3. Use a forcing screw to pull off impeller 230.

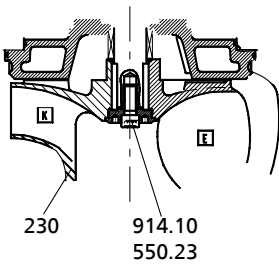


Fig. 22: Removing the impeller

	NOTE
	The forcing screw is not included in the scope of supply. It can be ordered separately from KSB.

Table 24: Forcing screws for pulling off the impeller

Size	Impeller type	Forcing screw	
		Thread	Code
40-250	F, K, S	M16	ADS 1
80-250	E, F	M16	ADS 1
100-240	F	M16	ADS 1
100-250	E, F, K	M16	ADS 1
80-251	F, K	M20	ADS 2
80-316	F	M20	ADS 2
100-315	E, F, K	M20	ADS 2
150-315	E, F, K	M20	ADS 2
200-315	K	M20	ADS 2
200-316	K	M20	ADS 2
100-251	D	M16	ADS 3
150-251	D	M16	ADS 3
80-315	D	M20	ADS 4
100-315	D	M20	ADS 4
100-316	D	M20	ADS 4
150-315	D	M20	ADS 4
200-315	D	M20	ADS 4
80-315	D - reinforced bearing assembly	M24	ADS 5
100-315	D - reinforced bearing assembly	M24	ADS 5
150-400	D	M24	ADS 5
150-401	D	M24	ADS 5
200-400	D	M24	ADS 5

Size	Impeller type	Forcing screw	
		Thread	Code
250-400	D	M24	ADS 5
300-400	D	M24	ADS 5

7.4.3.2.2 Removing the impeller with cylindrical interference fit with key

1. Unscrew socket head cap screw 914.10 and impeller hub cap 260.
2. Remove the impeller using a special impeller fitting and removal tool. (⇒ Section 7.4.3.2.2.1 Page 50)
3. Remove key 940.01.

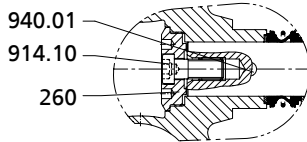


Fig. 23: Cylindrical interference fit

7.4.3.2.2.1 Using the special fitting and removal tool

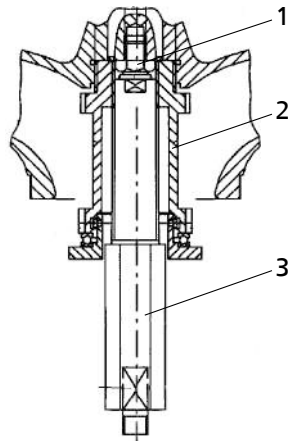


Fig. 24: Special fitting and removal tool

1. Screw hexagon head bolt 1 into the shaft end to prevent any damage to the shaft thread.
2. Screw part 2 into the impeller.
3. Screw threaded bolt 3 into part 2 and pull off the impeller.

Table 25: Special impeller fitting and removal tool

Size	Impeller type	Special fitting and removal tool
100-400	E, F, K	AV1
100-401		
150-400		
150-401		
151-400		
200-330		
200-400		
250-400		
250-401		
300-400		
300-401	K	AV2
200-401		
200-401	E	

7.4.3.3 Dismantling the mechanical seal

Dismantle the mechanical seal in accordance with the general arrangement drawings.

7.4.3.3.1 Dismantling the pump-end mechanical seal

- ✓ The back pull-out unit and the impeller have been removed as described above.
- 1. Pull the rotating assembly of mechanical seal 433.02 off shaft 210.
- 2. Remove discharge cover 163 from bearing bracket 330.
- 3. Push the stationary seat of mechanical seal 433.02 out of discharge cover 163.

7.4.3.3.2 Dismantling the motor-end mechanical seal

- ✓ The back pull-out unit and the impeller have been removed as described above.
- 1. Remove taper lock ring 515 or circlip 932.03.
- 2. Pull the rotating assembly of mechanical seal 433.01 off shaft 210.

7.4.3.4 Removing the wear plate

- ✓ The back pull-out unit has been separated from the pump casing.
- ✓ The inside of the casing has been cleaned.
- ✓ Result of visual inspection: The wear plate needs to be replaced.
- 1. On transportable models, separate the pump casing from the piping.
- 2. Undo hexagon socket head cap screws 914.12.
- 3. Remove wear plate 135.01 and O-rings 412.34.

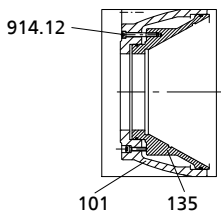


Fig. 25: Removing the wear plate

7.4.4 Dismantling the motor section




	NOTE
	Special regulations apply to repair work on explosion-proof pump sets. Modifications or alteration of the pump set may affect explosion protection and are only permitted after consultation with the manufacturer.
	NOTE
	The motors of explosion-proof pump sets are supplied in "flameproof enclosure" type of protection. Any work on the motor section which may affect explosion protection, such as re-winding and machining repairs, must be inspected and approved by an approved expert or performed by the motor manufacturers. No modifications must be made to the internal configuration of the motor space. Repair work at the flameproof joints must only be performed in accordance with the manufacturer's instructions. Repair to the values in tables 1 and 2 of EN 60079-1 is not permitted.

When dismantling the motor section and the power cables make sure that the cores/ terminals are clearly marked for future reassembly.

7.5 Reassembling the pump set

7.5.1 General information/Safety regulations

	⚠ WARNING
	<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>⚠ WARNING</p>
	<p>Components with sharp edges Risk of cutting or shearing injuries!</p> <ul style="list-style-type: none"> ▷ Always use appropriate caution for installation and dismantling work. ▷ Wear work gloves.
	<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.
	<p>NOTE</p>
	<p>Before reassembling the motor section, check that all joints relevant to explosion protection (flamepaths) are undamaged. Any components with damaged flamepaths must be replaced. Refer to the "Flamepaths" annex for the position of the flamepaths.</p>

- Sequence** Always reassemble the pump set in accordance with the corresponding general assembly drawing.
- Sealing elements**
 - O-rings
 - Check O-rings for any damage and replace by new O-rings, if required.
 - Never use O-rings that have been glued together from material sold by the metre.
 - Assembly adhesives
 - Avoid the use of assembly adhesives, if possible.
- Tightening torques** When reassembling the pump set, tighten all screws/bolts as indicated. (⇒ Section 7.6 Page 57)
In addition, secure all screwed connections closing off the flameproof enclosure with a thread-locking agent (Loctite Type 243).

7.5.2 Reassembling the pump section

7.5.2.1 Installing the mechanical seal

Observe the following points to ensure trouble-free operation of the mechanical seal:

- Only remove the protective wrapping of the contact faces immediately before assembly takes place.
 - Make sure the surface of the shaft is absolutely clean and undamaged.
 - Before the actual installation of the mechanical seal, wet the contact faces with a drop of oil.
 - For easier installation of bellows-type mechanical seals, wet the inside diameter of the bellows with soapy water (no oil).
 - To prevent any damage to the rubber bellows, place a thin foil (thickness approximately 0.1 to 0.3 mm) around the free shaft stub.
Slip the rotating assembly over the foil into its installation position.
Then remove the foil.
 - ✓ The shaft and rolling element bearings have been properly installed in the motor.
1. Push drive-end mechanical seal 433.01 onto shaft 210 and secure it with taper lock ring 515 or circlip 932.03.

2. Insert O-rings 412.04/412.35 and 412.15/412.11 into discharge cover 163, and press them into bearing bracket 330 as far as they will go.
3. Push pump-end mechanical seal 433.02 onto shaft 210.

For special mechanical seals with covered springs, tighten the socket head cap screw at the rotating assembly before fitting the impeller. Observe installation dimension "A".

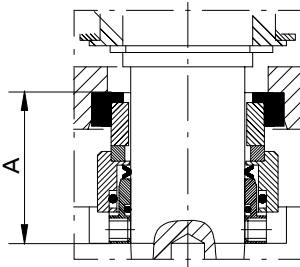


Fig. 26: Installation dimension "A"

Table 26: Installation dimension "A"

Size	Installation dimension "A" [mm]
40-250, 80-250, 100-240, 100-250	29
80-251, 100-251, 150-251, 80-315/-316, 150-315, 200-315/-316, 100-315/316	38.5
100-400, 100-401, 150-400, 150-401, 151-401, 200-330, 200-400, 200-401, 250-400/-401, 300-400/-401	48.3

7.5.2.2 Fitting the impeller



NOTE

For bearing brackets with tapered fit make sure that the tapered fit of impeller and shaft is undamaged and installed free from grease.

- ✓ The shaft and rolling element bearings have been properly installed.
 - ✓ The mechanical seals have been properly installed.
1. Slip impeller 230 onto the shaft end.
 2. Screw in impeller screw 914.10 and disc 550.23.

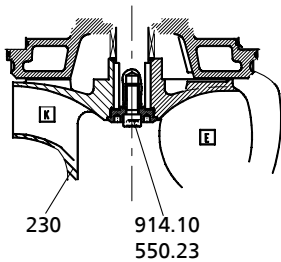


Fig. 27: Fitting the impeller

Table 27: Tightening torque for the impeller screw

Size	Thread	Tightening torque [Nm]
40-250, 80-250, 100-240, 100-250, 150-251, D 100-251	M 10	35
80-251, F, E, K 100-251, 80-315/-316, 150-315, 200-315/-316, 100-315/316	M 16	150
100-400/401, 150-400, 151-401, 200-330, 200-400/401, 250-400/-401, 300-400/-401	M 20	290

7.5.2.2.1 Fitting the impeller using the special fitting and removal tool

1. Mount the impeller using the special impeller fitting and removal tool. (⇒ Section 7.5.2.2.1.1 Page 54)
2. Fit the impeller fastening elements.

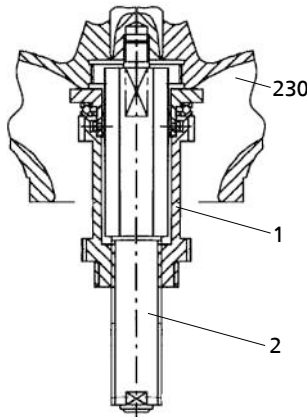


Fig. 28: Special fitting and removal tool

7.5.2.2.1.1 Using the special fitting and removal tool

1. Screw part 2 of the special fitting and removal tool into the shaft end of the pump set.
2. Screw part 1 to the threaded bolt, part 2.

7.5.2.2.2 Fitting the cutter

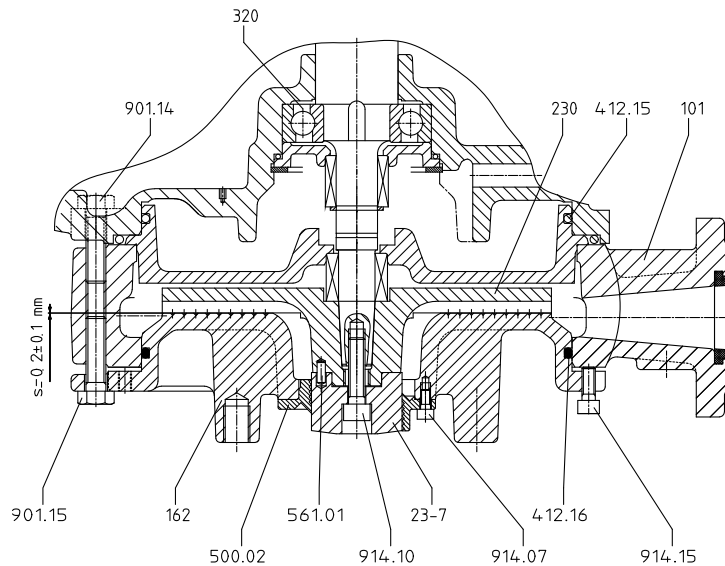


Fig. 29: Fitting the cutter


✓ Pump-end mechanical seal 433.02 has been installed.

1. Slide impeller 230 onto the conical shaft end.
2. Insert grooved pin 561.01 into the impeller and fit impeller body 23-7 on the centring hub.
3. Screw in impeller screw 914.10 and use a torque wrench to tighten the screw to a torque of 50 Nm.
4. Fit the pump casing including O-ring 4.12.15 using hexagon head bolts 901.14. Use a torque wrench to tighten the bolts to a tightening torque of 60 Nm.
5. Insert O-ring 4.12.16 in suction cover 162.
6. Fasten ring 500.02 with socket head cap screw 914.07 in the suction cover.
7. Insert the suction cover into the pump casing, making sure the suction cover touches the impeller vanes.
(Make sure that socket head cap screws 914.15 do not protrude from the threaded holes in the suction cover.)
8. Screw in hexagon head bolt 901.15 to hold the suction cover in place. Do not tighten the bolt yet.
9. Measure the distance between the impeller and the suction cover. Distance S should measure approximately 0.2 ± 0.1 mm.


10. If required, adjust the position of the suction cover in relation to the pump casing using socket head cap screw 914.15.
11. Tighten hexagon head bolt 901.15 to a torque of 30 Nm.
12. Rotate the impeller body to check that the impeller turns smoothly. Make sure that the suction cover and impeller do not touch each other.

7.5.2.3 Installing the back pull-out unit

7.5.2.3.1 Design with axial clearance

	NOTE
<p>After casing wear rings with a radial clearance have been fitted in pump casing 101, they have the required inner diameter and do not need to be readjusted.</p>	

1. Use a rubber mallet to push casing wear ring 502 into pump casing 101 as far as it will go.
2. Insert the complete back pull-out unit in the pump casing.
3. Evenly tighten screwed connection 920.01 between pump casing and bearing bracket.

	CAUTION
<p>Axial displacement of the rotor Damage to shaft seal and bearings!</p> <ul style="list-style-type: none"> ▸ Always adjust and check the axial clearance with the pump set in vertical position. 	

4. Use a rubber mallet to push casing wear ring 502 in until it is close to impeller 230.
5. Suspend the pump set vertically, as illustrated.

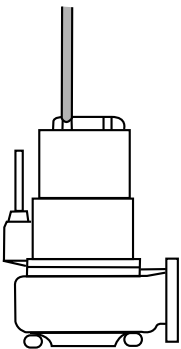


Fig. 30: Suspending the pump set

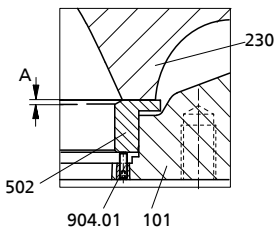


Fig. 31: Fitting the casing wear ring

6. Lift off the pump set and adjust the axial clearance to 0.3 ± 0.1 mm.

7.5.2.3.2 Design with wear plate

- ✓ The shaft, rolling element bearings, mechanical seal and impeller have been assembled properly.

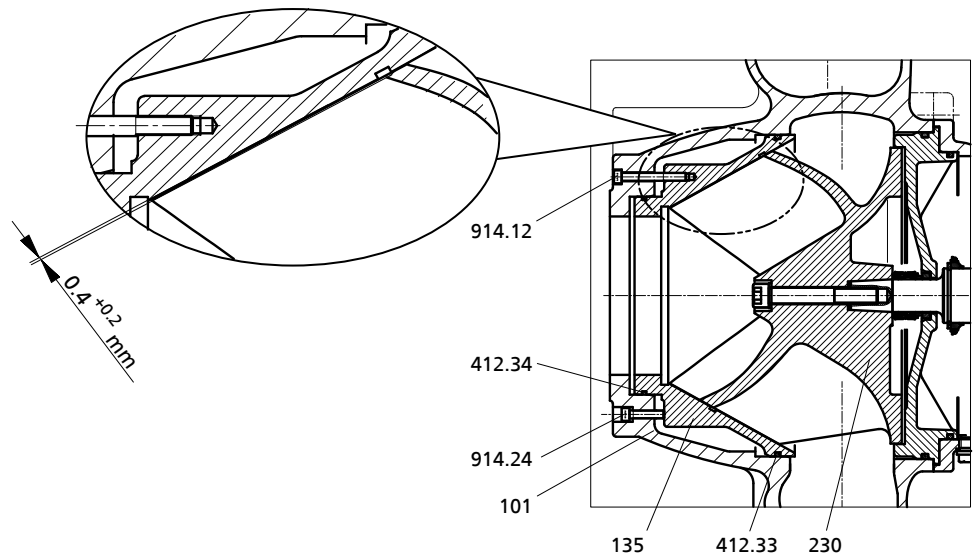


Fig. 32: Fitting the wear plate

1. Equip wear plate 135 with two new O-rings 412.33 and 412.34.
2. Insert wear plate 135 into pump casing 101.
3. Fasten wear plate 135 to pump casing 101 with socket head cap screws 914.12.
4. Adjust the clearance between impeller 230 and wear plate 135 by loosening and tightening screws 914.12 and 914.24.
 - ⇒ Screw 914.24 pushes the wear plate in the direction of the impeller.
 - ⇒ The clearance equals 0.4 ^{+0.2} mm (measured on the suction side from the outer surface of the impeller vane to the wear plate).
5. Insert the complete back pull-out unit into the pump casing.
6. Evenly tighten screwed connection 920.01 between pump casing and bearing bracket.

7.5.3 Reassembling the motor section

	<p>NOTE</p>
	<p>Before reassembling the motor section, check that all joints relevant to explosion protection (flamepaths) are undamaged. Any components with damaged flamepaths must be replaced. Only use original spare parts made by KSB for explosion-proof pumps. Observe the flamepath positions specified in the Annex. Secure all screwed connections closing off a flameproof enclosure with a thread-locking agent (Loctite type 243).</p>
	<p>⚠ DANGER</p>
	<p>Wrong screws/bolts Explosion hazard!</p> <ul style="list-style-type: none"> ▷ Always use the original screws/bolts for assembling an explosion-proof pump set. ▷ Never use screws/bolts of different dimensions or of a lower property class.

7.5.4 Leak testing

After reassembly the mechanical seal area/lubricant reservoir must be tested for leakage. The lubricant filler opening is used for leak testing.

Observe the following values for leak testing:

- **Test medium:** compressed air

- **Test pressure:** 0.8 bar (max.)
- **Test period:** 2 minutes

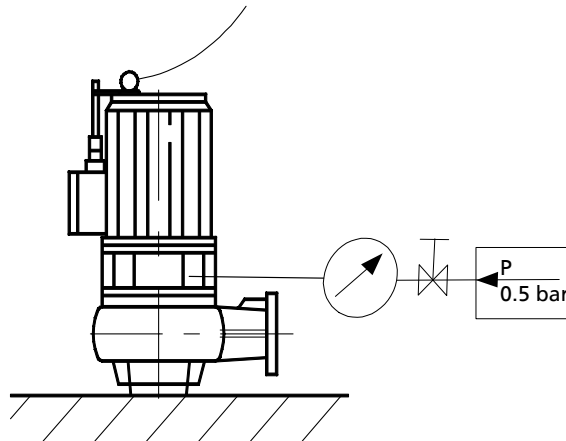


Fig. 33: Screwing in the testing device

1. Unscrew and remove the screw plug and joint ring of the lubricant reservoir.
2. Screw the testing device tightly into the lubricant filler opening.
3. Carry out the leak test with the values specified above.
The pressure must not drop during the test period.
If the pressure does drop, check the seals and screwed connections.
Repeat the leak test.
4. If the leak test has been successful, fill in the lubricant. (⇒ Section 7.2.2.1 Page 44)

7.5.5 Checking the connection of motor/power supply

Once reassembly has been completed, carry out the steps described in (⇒ Section 7.2.1 Page 42) .

7.6 Tightening torques

Table 28: Bolt tightening torques [Nm]
depending on thread, material and property class

Thread	Material				
	A4-50	A4-70		1.4462	8.8
	Property class Rp 0.2 N/mm ²				
	210	250	450	450	640
M 5	-	-	4	4	6
M 6	-	-	7	7	10
M8	-	-	17	17	25
M10	-	-	35	35	50
M12	-	-	60	60	85
M14	-	-	90	90	130
M16	-	-	150	150	210
M20	-	-	290	290	410
M24	230	278	-	500	700
M30	460	-	-	1000	1400
M42	1300	-	-	2750	3900
M48	1950	-	-	4200	6000

7.7 Spare parts stock

7.7.1 Ordering spare parts

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

- Pump type
- KSB order number
- Motor number

Refer to the name plate for all data. (⇒ Section 4.3 Page 16)

Also supply 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. (⇒ Section 9.1 Page 61)


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

Table 29: Quantity of spare parts for recommended spare parts stock⁹⁾

Part No.	Description	Number of pump sets (including stand-by pump sets)						
		2	3	4	5	6 and 7	8 and 9	10 and more
80-1	Motor unit	-	-	-	1	1	2	30 %
834	Cable gland	1	1	2	2	2	3	40 %
818	Rotor	-	-	-	1	1	2	30 %
230	Impeller	1	1	1	2	2	3	30 %
502	Casing wear ring	2	2	2	3	3	4	50 %
433.01	Mechanical seal, motor-end	2	3	4	5	6	7	90 %
433.02	Mechanical seal, pump-end	2	3	4	5	6	7	90 %
321.01 / 322	Rolling element bearing, motor end	1	1	2	2	3	4	50 %
320 / 321.02	Rolling element bearing, pump end	1	1	2	2	3	4	50 %
99-9	Set of sealing elements for the motor	4	6	8	8	9	10	100 %
99-9	Set of sealing elements for the hydraulic system	4	6	8	8	9	10	100 %

⁹⁾ For two years of continuous operation or 17,800 operating hours

8 Trouble-shooting

	⚠ WARNING
	<p>Improper remedial work on the pump (set) Risk of injury!</p> <p>▸ For any work performed in order to remedy faults on the pump (set) observe the relevant information given in this operating manual or the product literature provided by the accessories manufacturers.</p>

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

- A** Pump is running but does not deliver
- B** Pump delivers insufficient flow rate
- C** Excessive current/power consumption
- D** Insufficient discharge head
- E** Vibrations and noise during pump operation

Table 30: Trouble-shooting

A	B	C	D	E	Possible cause	Remedy
	X				Pump delivers against an excessively high pressure.	Re-adjust to duty point.
	X				Gate valve in the discharge line is not fully open.	Fully open the gate valve.
		X		X	Pump is running in the off-design range (low flow/overload).	Check the pump's operating data.
X					Pump or piping are not completely vented.	Vent by lifting the pump off the duckfoot bend and lowering it again.
X					Pump intake clogged by deposits.	Clean the intake, pump components and non-return valve.
X			X	X	Supply line or impeller clogged	Remove deposits in the pump and/or piping.
		X		X	Dirt/fibres in the clearance between the casing wall and impeller; sluggish rotor.	Check whether the impeller can be easily rotated. Clean the impeller, if required.
X	X	X	X	X	Wear of internal components	Replace worn components by new ones.
X	X		X		Defective riser (pipe and sealing element)	Replace defective riser pipes, replace sealing elements.
X			X	X	Impermissible air or gas content in the fluid handled	Contact KSB.
				X	System-induced vibrations	Contact KSB.
X	X	X	X	X	Wrong direction of rotation	Check the electrical connection of the motor and the control system, if any.
		X			Wrong supply voltage	Check the power cable. Check the cable connections.
X					Motor is not running because of lack of voltage.	Check the electrical installation. Contact the energy supplier.
X		X			Motor winding or power cable are defective.	Replace by new original KSB parts or contact KSB.
		X		X	Defective rolling element bearings	Please contact KSB.
X			X		In case of star-delta configuration: motor running in star configuration only	Check star-delta contactor.
	X				Water level lowered too much during operation.	Check level control equipment.
X					The temperature switch monitoring the winding has tripped the pump because of excessive temperature rise in the winding.	The motor will restart automatically once it has cooled down.
X					Thermistor tripping unit with manual reset for temperature limiter (explosion protection) has tripped the pump as a result of the permissible winding temperature being exceeded.	Have cause determined and eliminated by qualified and trained personnel.

A	B	C	D	E	Possible cause	Remedy
X					Motor has been tripped by leakage monitor.	Have cause determined and eliminated by qualified and trained personnel.
X					Mechanical seal monitor has tripped.	Have cause determined and eliminated by qualified and trained personnel.
X					Bearing temperature monitor has tripped.	Have cause determined and eliminated by qualified and trained personnel.

9 Related Documents

9.1 General assembly drawings

	NOTE
Refer to the following table for detailed views of the general assembly drawing (e.g. upper bearing).	

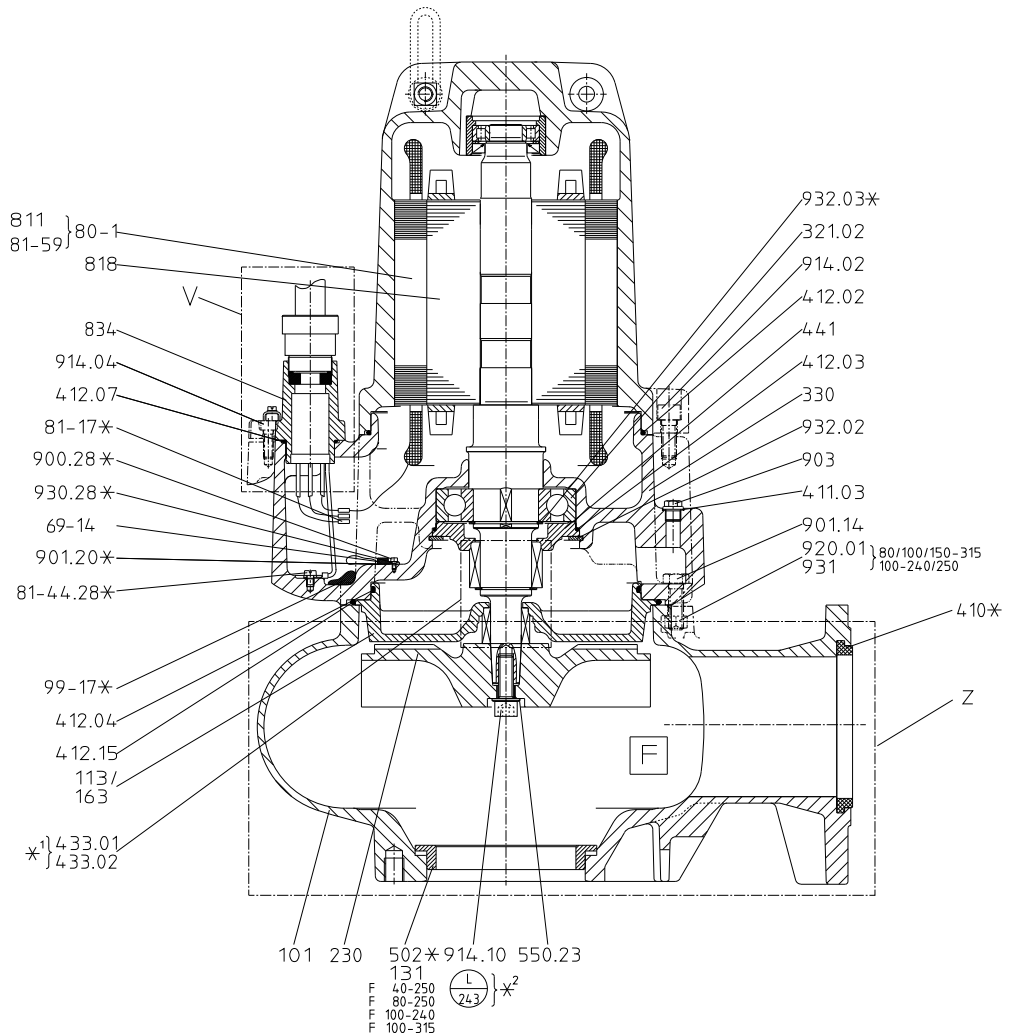
- * If applicable
- ¹⁾ Sectional drawings of mechanical seal
- ²⁾ For material variant C1/C2

Sizes of hydraulic system

- 40-250
- 80-250/251
- 80-315/316
- 100-240/250
- 100-251
- 100-315/316
- 150-251
- 150-315
- 200-315/316

Motor sizes

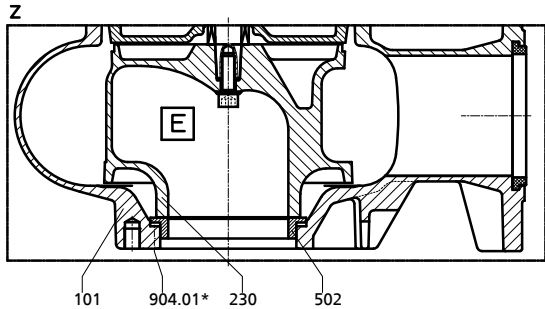
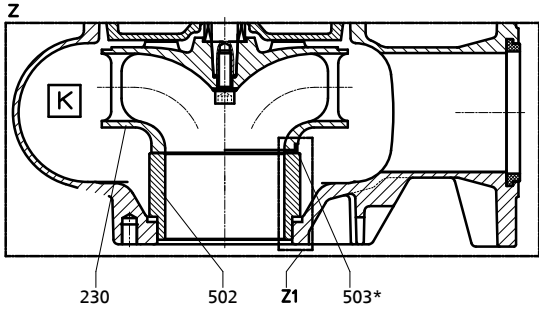
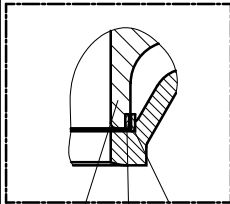
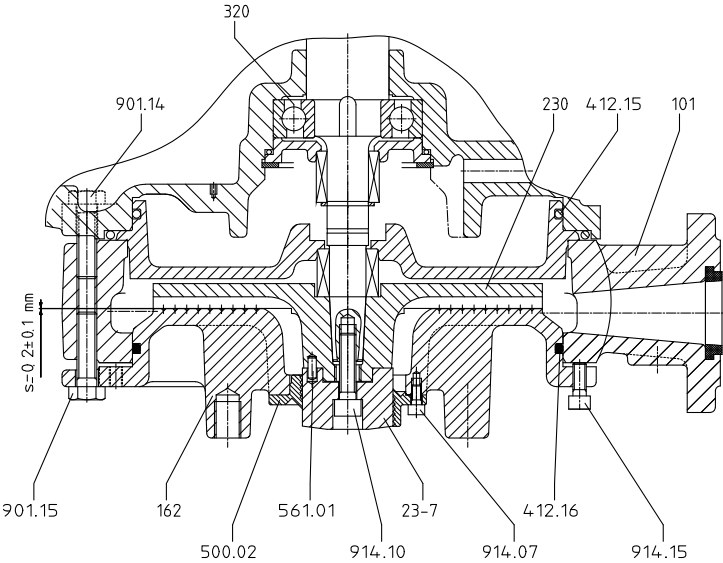
- 5 2, 6 2, 8 2, 12 2, 17 2,
- 22 2, 25 2, 23 2,
- 4 4, 5 4, 7 4, 11 4, 16 4,
- 19 4, 21 4, 23 4, 29 4,
- 4 6, 6 6, 9 6, 12 6, 15 6,
- 19 6



General assembly drawing of pump set with motor type DKN 132/160/161/181 and tapered fit (impeller type F)

Table 31: Detailed views of general assembly drawing of pump set with motor type DKN 132/160/161/181 and tapered fit

Description	Detailed view
Cable gland	
Upper bearing Motor sizes 5 2, 6 2, 8 2, 4 4, 5 4, 7 4, 4 6, 6 6	
Upper bearing Motor sizes 22 2, 25 2, 4 4, 5 4, 7 4 UK.../ XK... 4 6, 6 6 UK... / XK... 19 4, 21 4, 15 6, 19 6	
Upper bearing Motor sizes 12 2, 17 2, 23 2, 11 4, 16 4, 23 4, 29 4, 9 6, 12 6	
Impeller type D	

Description	Detailed view	
<p>Impeller type E</p>	 <p>* Only for E 150-315</p>	
<p>Impeller type K</p>	 <p>* If applicable</p>	<p>K200-315/316 only</p> <p>Z1</p>  <p>230 503* 502</p> <p>* If applicable</p>
<p>Impeller type S</p>		

Part No.	Description	Part No.	Description
23-7	Impeller body	421.01	Lip seal
69-14	Leakage monitor	433.01/02	Mechanical seal
80-1	Motor unit	441	Shaft seal housing
81-17	End connector	500.02	Ring
81-44.28	Terminal clamp	502	Casing wear ring
81-51	Clamping element	503	Impeller wear ring
81-59	Stator	529	Bearing sleeve
99-17	Desiccant	550.11/.23/.24	Disc
101	Pump casing	561.01	Grooved pin

Part No.	Description	Part No.	Description
113	Intermediate casing	811	Motor housing
131	Inlet ring	818	Rotor
135	Wear plate	834	Cable gland
162	Suction cover	900.28	Bolt/screw
163	Discharge cover	901.14/.15/.20	Hexagon head bolt
230	Impeller	903	Screw plug
320	Rolling element bearing	904.01	Grub screw
321.01/.02	Radial ball bearing	914.02/.04/.10/.15/.12/.24/.26	Hexagon socket head cap screw
322	Radial roller bearing	920.01/.26	Nut
330	Bearing bracket	930.28	Safety device
360	Bearing cover	931	Lock washer
411.03	Joint ring	932.01/.02/.03/.13	Circlip
412././02/.03/.04/.07/.15/.16/.33/.34	O-ring		

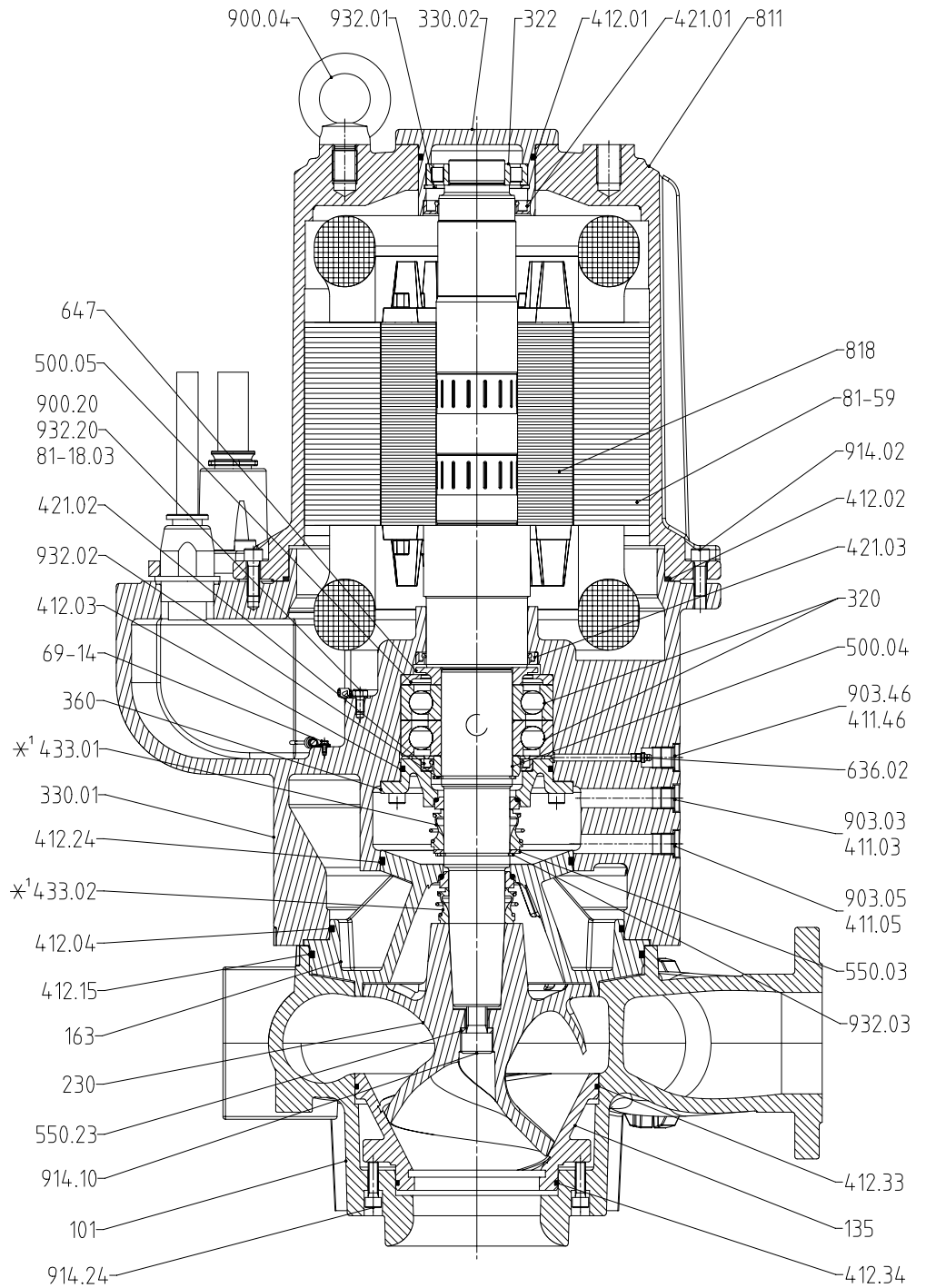
1) Sectional drawings of mechanical seal

Sizes of hydraulic system

D 80-315
D 100-315

Motor sizes

37 2
55 2



General assembly drawing of pump set with motor type DKN 226, 2-pole (impeller type D)

Table 32: Detailed views of general assembly drawing of pump set with motor type DKN 226, 2-pole

Description	Detailed view
Lubricant reservoir/ leakage chamber	
Cable glands	
Bearing temperature sensor	

Part No.	Description	Part No.	Description
69-6.01	Temperature sensor	421.02/03	Lip seal
69-14	Leakage monitor	433.01/02	Mechanical seal
81-18.03	Cable terminal	500.04/05	Ring
81-45	Float switch	520.01	Sleeve
81-51	Clamping element	550.03/.23	Disc
81-59	Stator	636.02	Lubricating nipple
101	Pump casing	647	Grease quantity control
135	Wear plate	818	Rotor
163	Discharge cover	834.01/.03	Cable gland
230	Impeller	900.20	Bolt/screw
320	Rolling element bearing	901	Hexagon head bolt
330.01	Bearing bracket	903.03/04/05/46	Screw plug
360	Bearing cover	914.01/02/03/04/05/10/12/.24	Hexagon socket head cap screw

Part No.	Description	Part No.	Description
411.03/05/26/46	Joint ring	932.03/20	Circlip
412.02/04/07/08/15/24/33/34	O-ring	970.02	Label/plate

* If applicable

1) Sectional drawings of mechanical seal

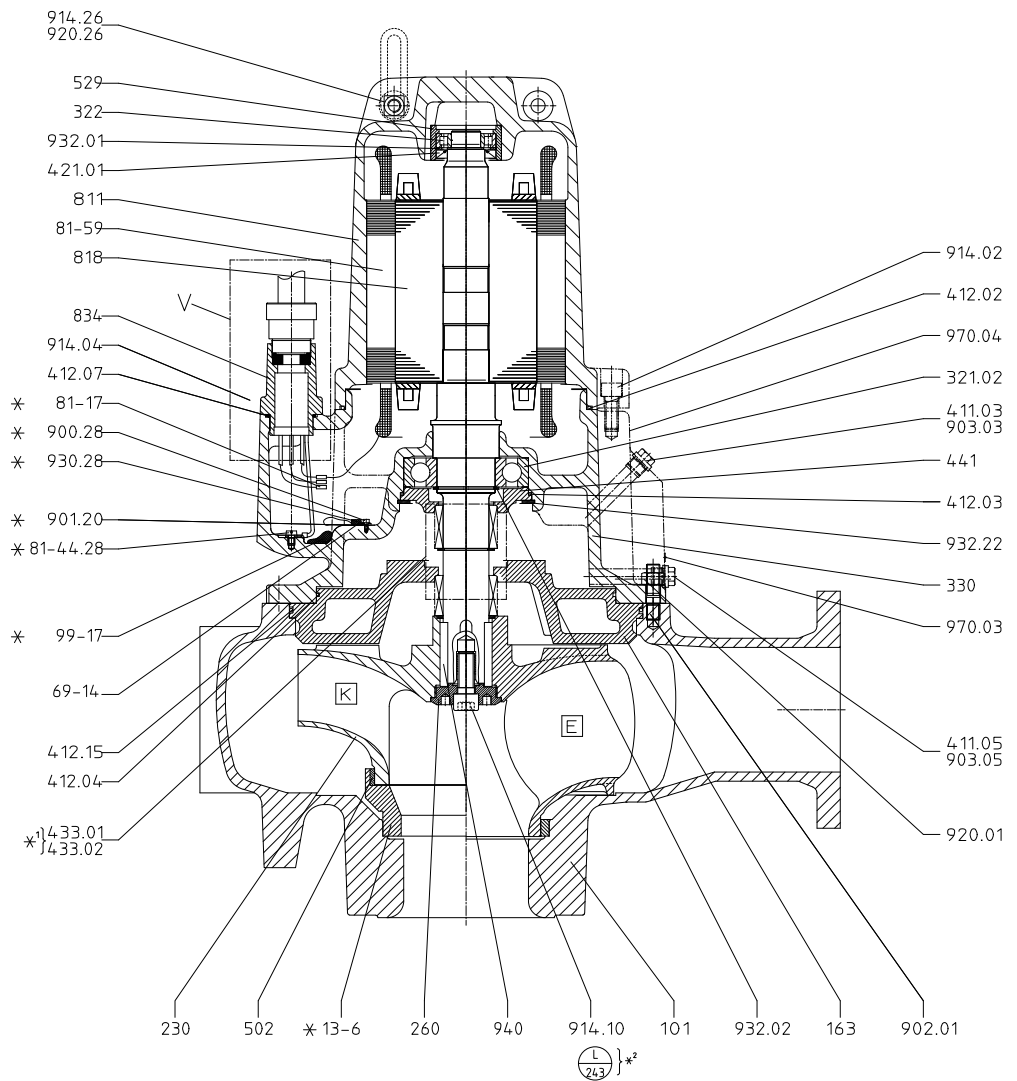
*2) For material variant C1/C2

Sizes of hydraulic system

- 100-400/401
- 150/151-400/401
- 200-330
- 200-400/401
- 250-400/401
- 300-400/401

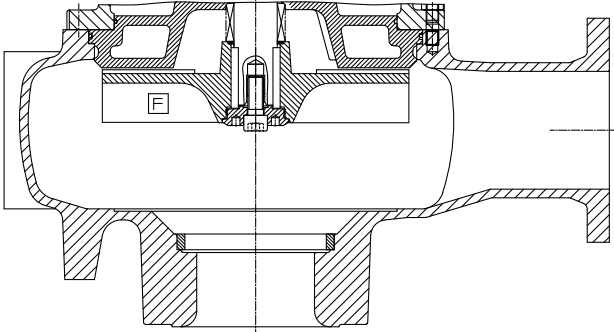
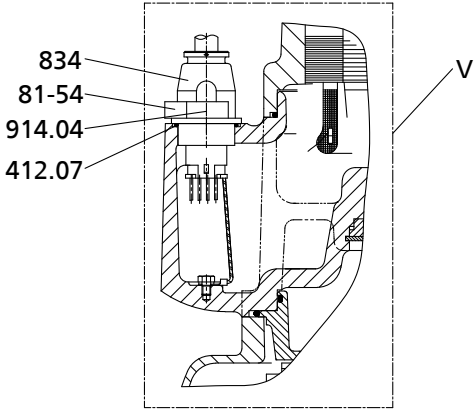
Motor sizes

- 23 4, 29 4
- 20 6, 26 6
- 10 8, 17 8, 21 8



General assembly drawing of pump set with motor type DKN 161/181 and cylindrical interference fit (impeller types K/E)

Table 33: Detailed views of general assembly drawing of pump set with motor type DKN 161/181 and cylindrical interference fit

Description	Detailed view
Impeller type F	
Cable gland	

Part No.	Description	Part No.	Description
13-6	Casing insert	433.01/02	Mechanical seal
69-14	Leakage monitor	441	Shaft seal housing
81-17	End connector	502	Casing wear ring
81-44.28	Terminal clamp	529	Bearing sleeve
81-51	Clamping element	811	Motor housing
81-59	Stator	818	Rotor
99-17	Desiccant	834	Cable gland
101	Pump casing	900.28	Bolt/screw
163	Discharge cover	901.20	Hexagon head bolt
260	Impeller hub cap	902.01	Stud
230	Impeller	903.03/05	Screw plug
321.02	Radial ball bearing	914.02/.10/.04/.26	Hexagon socket head cap screw
322	Radial roller bearing	920.01/.26	Nut
330	Bearing bracket	930.28	Safety device
411.03/05	Joint ring	932.01/02/.22	Circlip
412.02/03/04/07/.15	O-ring	940	Key
421.01	Lip seal	970.03/04	Label/plate

* If applicable

¹⁾ Sectional drawings of mechanical seal

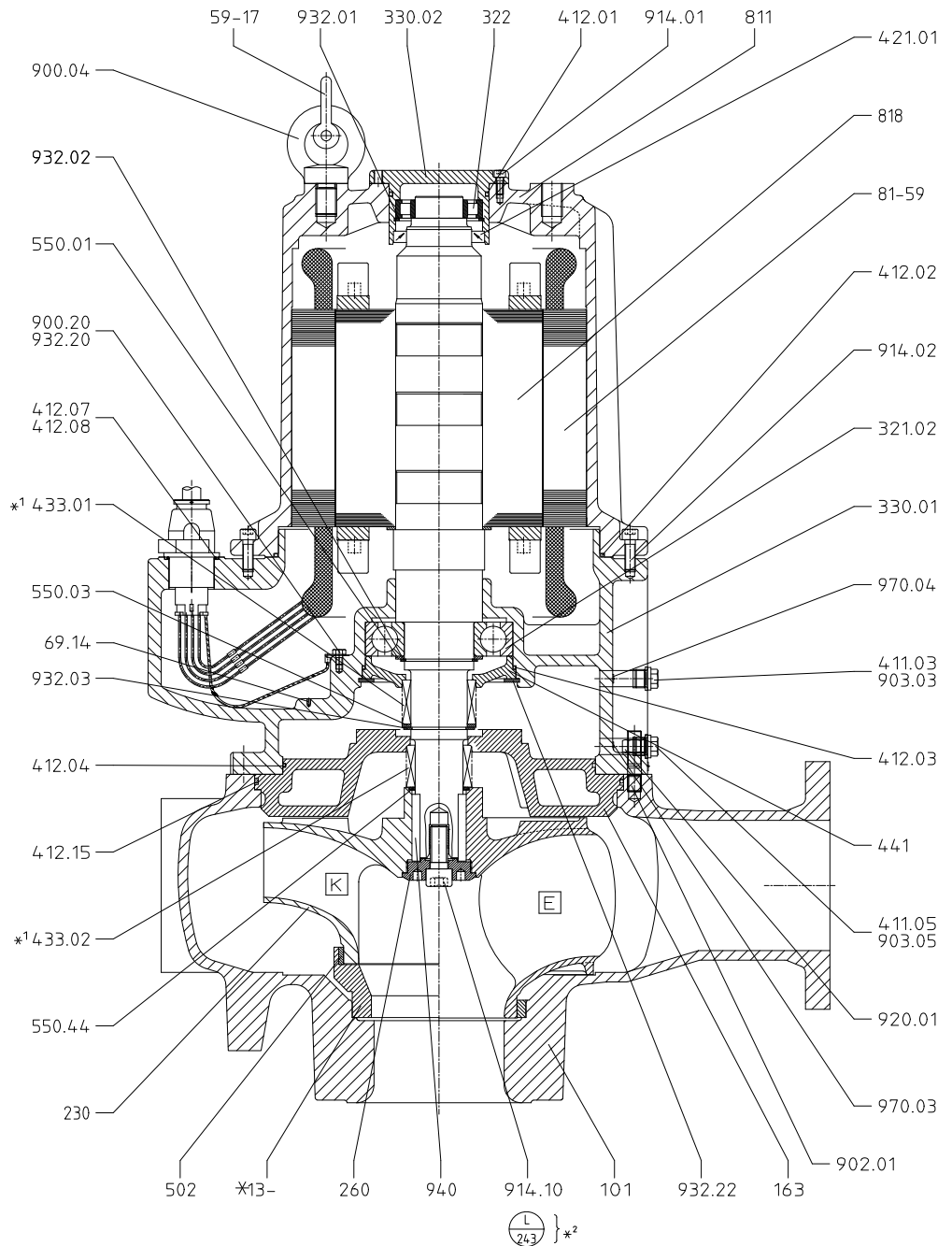
²⁾ For material variant C1/C2

Sizes of hydraulic system

- 100-400/401
- 150/151-400/401
- 200-330
- 200-400/401
- 250-400/401
- 300-400/401

Motor sizes

- 35 4, 50 4, 65 4
- 32 6, 40 6, 50 6
- 26 8, 35 8



General assembly drawing of pump set with motor type DKN 226 (impeller types K/E)

Table 34: Detailed views of general assembly drawing of pump set with motor type DKN 226

Description	Detailed view
Cable glands	
Impeller type F	

Part No.	Description	Part No.	Description
13-6	Casing insert	433.01/02	Mechanical seal
59-17	Shackle	441	Shaft seal housing
69-14	Leakage monitor	502	Casing wear ring
81-29	Terminal	550.01/03/44	Disc
81-51	Clamping element	811	Motor housing
81-59	Stator	818	Rotor
101	Pump casing	834/03	Cable gland
163	Discharge cover	900.04/20	Bolt/screw
230	Impeller	902.01	Stud
260	Impeller hub cap	903.03/05	Screw plug
322	Radial roller bearing	914.01/02/04/05/10	Hexagon socket head cap screw
330.01/02	Bearing bracket	920.01	Nut
321.02	Radial ball bearing	932.01/02/03/20/22	Circlip
411.03/05	Joint ring	940	Key
412.01/02/03/04/07/08/15	O-ring	970.03/04	Label/plate
421.01	Lip seal		

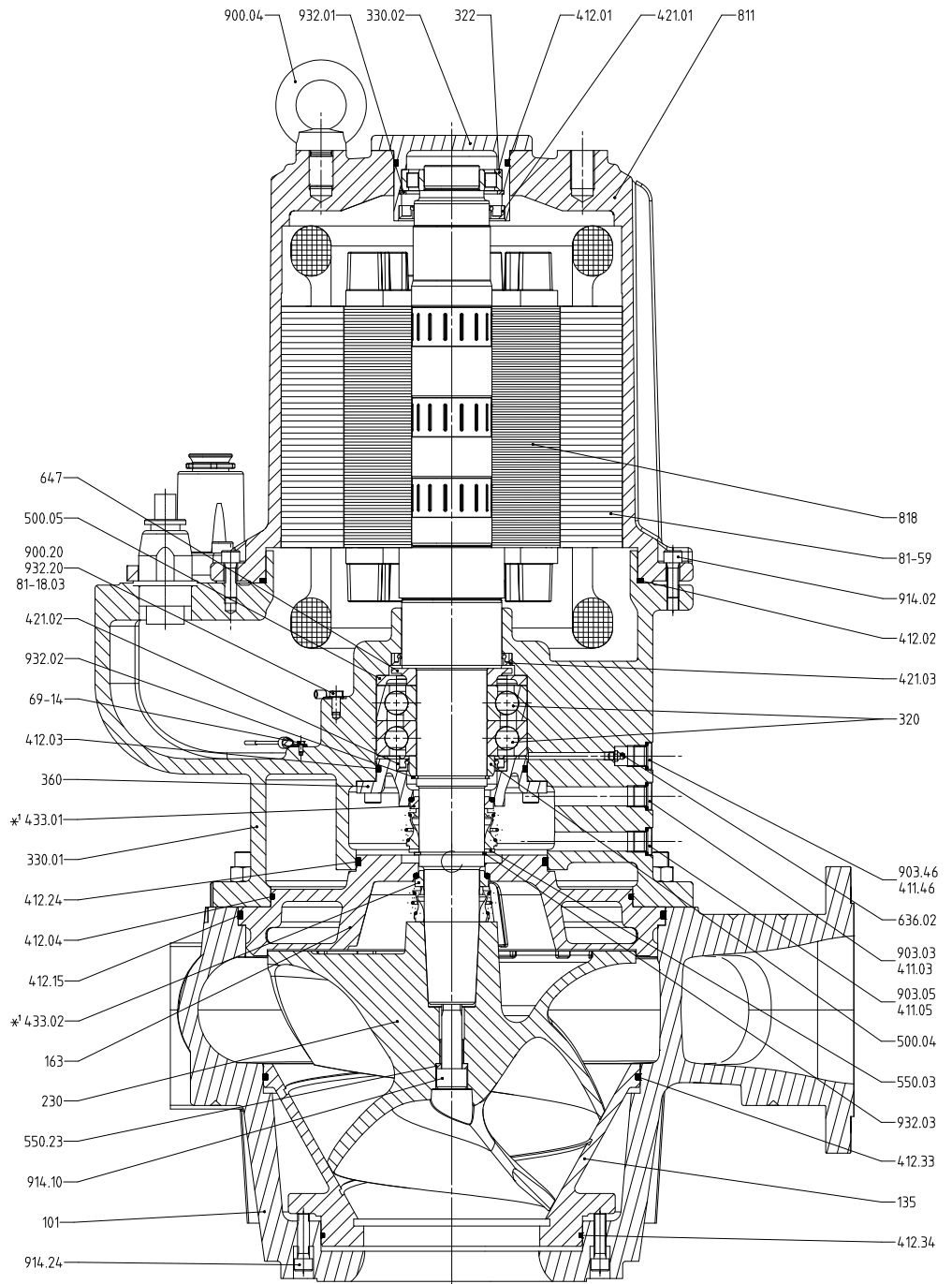
1) Sectional drawings of mechanical seal

Sizes of hydraulic system

- D 80-315
- D 100-315
- D 150-400
- D 150-401
- D 200-400
- D 250-400
- D 300-400

Motor sizes

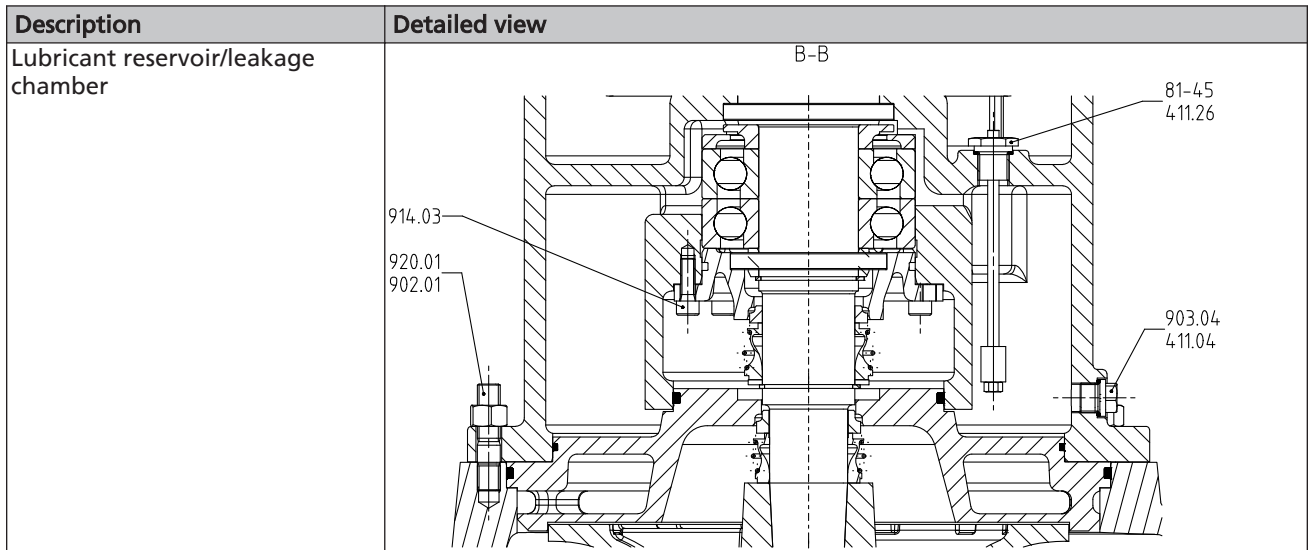
- 35 4, 50 4, 65 4
- 32 6, 40 6, 50 6
- 26 8, 35 8



General assembly drawing of pump set with motor type DKN 226, 4/6/8-pole (impeller type D)

Table 35: Detailed views of general assembly drawing of pump set with motor type DKN 226, 4/6/8-pole

Description	Detailed view
Cable gland	<p>This technical drawing shows a detailed view of the cable gland assembly. It features a circular main body with a central hub and a flange on the right side. Several components are labeled with part numbers: 81-51, 914.05, 834.03, 412.08, 834.01, 412.07, 914.04, 914.01, and 970.02. Section lines A-A, B-B, and C-C are indicated with arrows pointing to the respective views.</p>
Bearing temperature sensor	<p>This technical drawing shows a detailed cross-sectional view of the bearing temperature sensor assembly. The sensor is mounted on a shaft within a bearing housing. Callouts include 520.01*, 69-6.01*, and 914.12. A vertical section line C-C is shown at the top of the assembly.</p>

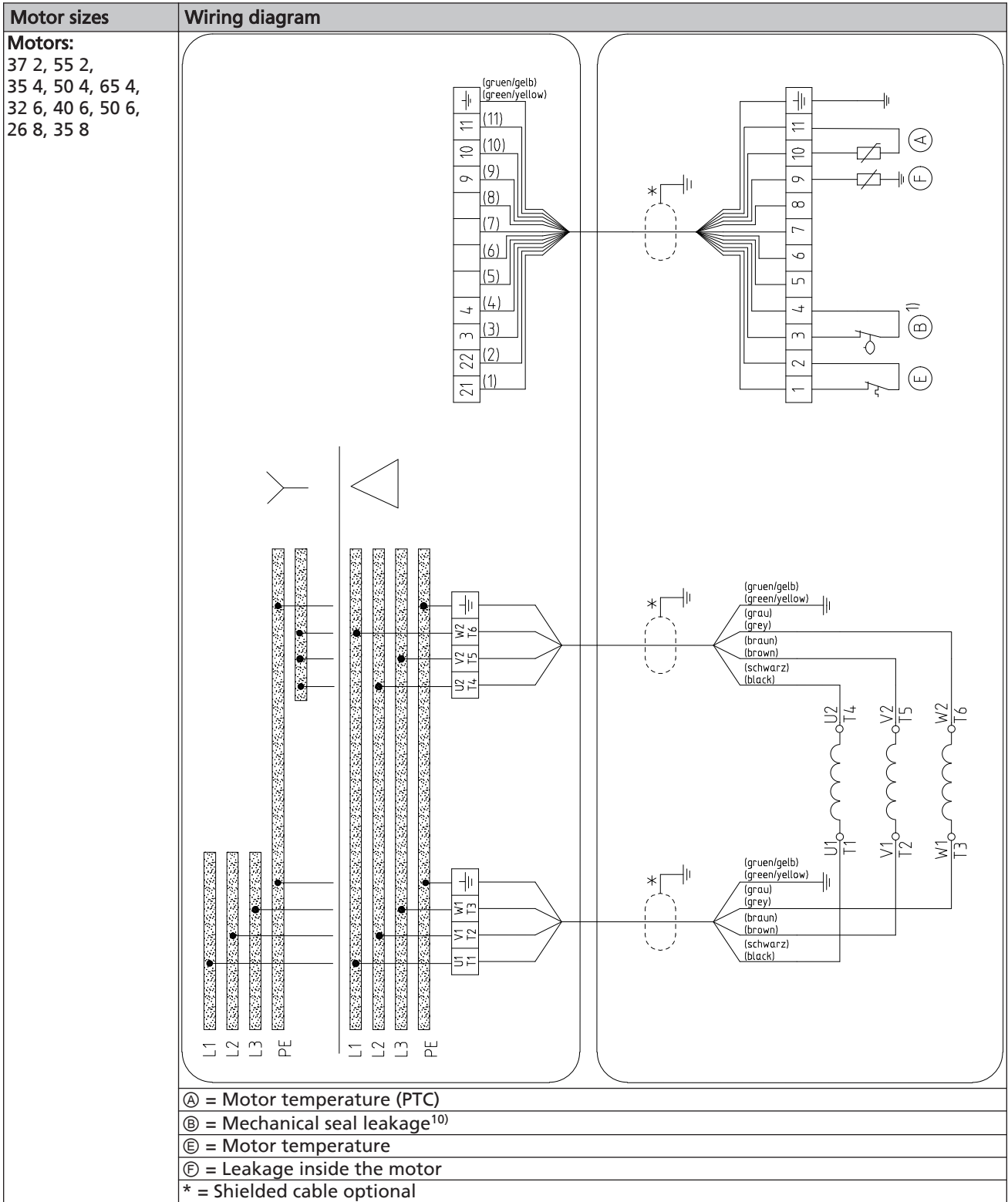


Part No.	Description	Part No.	Description
69-6.01	Temperature sensor	433.01/02	Mechanical seal
69-14	Leakage monitor	500.04/05	Ring
81-18.03	Cable terminal	520.01	Sleeve
81-45	Float switch	550.01/03/.23/44	Disc
81-51	Clamping element	636.02	Lubricating nipple
81-59	Stator	647	Grease quantity control
101	Pump casing	811	Motor housing
135	Wear plate	818	Rotor
163	Discharge cover	834.01/03	Cable gland
230	Impeller	900.04/20	Bolt/screw
320	Rolling element bearing	902.01	Stud
322	Radial roller bearing	903.03/04/05/46	Screw plug
330.01/02	Bearing bracket	914.01/02/03/04/05/10/12/24	Hexagon socket head cap screw
360	Bearing cover	920.01	Nut
411.03/04/05/26/46	Joint ring	932.01/02/03/20	Circlip
412.01/02/03/04/07/08/15/24/33/34	O-ring	970.02	Label/plate
421.01/02/03	Lip seal		

9.2 Wiring diagram Installation types S and P

Table 36: Wiring diagram for installation types S and P

Motor sizes	Wiring diagram
<p>Motors: 5 2, 6 2, 8 2, 12 2, 17 2, 22 2, 23 2, 25 2 4 4, 5 4, 7 4, 11 4, 16 4, 19 4, 21 4, 23 4, 29 4, 4 6, 6 6, 9 6, 15 6, 19 6, 26 6, 10 8, 17 8, 21 8</p>	<p> (A) = Motor temperature (PTC) (E) = Motor temperature (F) = Leakage inside the motor * = Shielded cable optional </p>



¹⁰⁾ Only for reinforced bearings

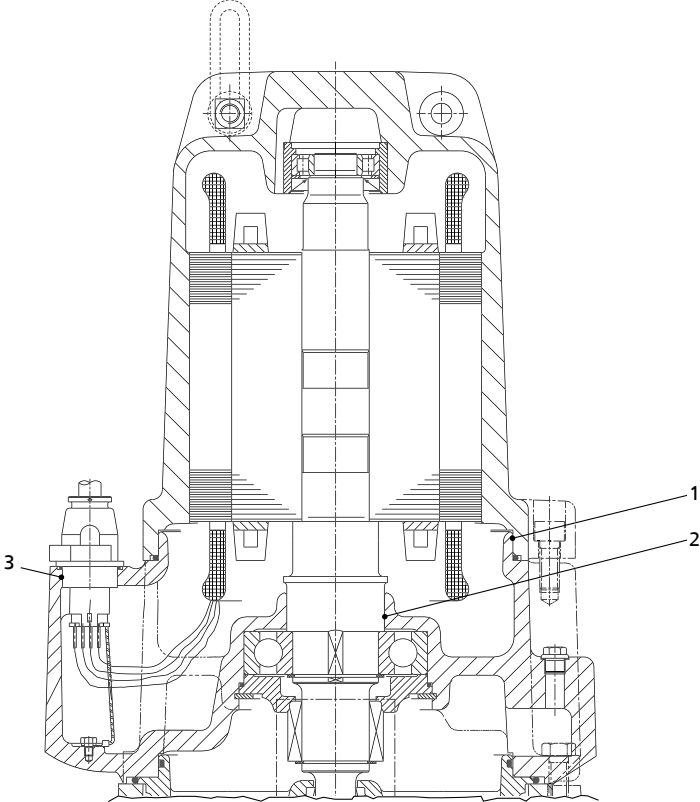
Installation type K

Table 37: Wiring diagram of installation type K

Motor sizes	Wiring diagram
<p>Motors: 4 4, 5 4, 7 4, UK.../XK..., 4 6, 6 6, UK.../XK...</p>	<p>The diagram illustrates the electrical connections for a motor. It includes three motor connection options: Y-Δ, Y, and Δ. The Y-Δ option shows six terminals (U1, V1, W1, U2, V2, W2). The Y option shows three phase terminals (L1, L2, L3) and two additional terminals (U2, V2, W2). The Δ option shows three phase terminals (L1, L2, L3) and two additional terminals (U2, V2, W2). A terminal block is shown with terminals 21, 22, 10, 11, 9, and PE. A detailed motor winding diagram shows six terminals (U1/T1, V1/T2, W1/T3, U2/T4, V2/T5, W2/T6) and three temperature sensors (R1, R2, R3) connected to terminals 10, 11, and 9. A leakage monitor (B2) is connected to terminal 9 and ground. The motor is labeled '3~' for three-phase.</p> <p>7x...+5x1.5mm² 12x....mm²</p> <p>(1) (1) U1/T1 (2) (2) V1/T2 (3) (3) W1/T3 (6) (6) W2/T6 (4) (4) U2/T4 (5) (5) V2/T5 (7) (1) 10 (8) (2) 11 (9) (3) 9 (10) (4) PE (11) (5)</p> <p>12</p> <p>R1, R2, R3, B2, PE, 3~</p>
<p>R1-R3 B2</p>	<p>Temperature sensor Leakage monitor</p>

9.3 Flamepaths on explosion-proof motors

Table 38: Overview of flamepaths

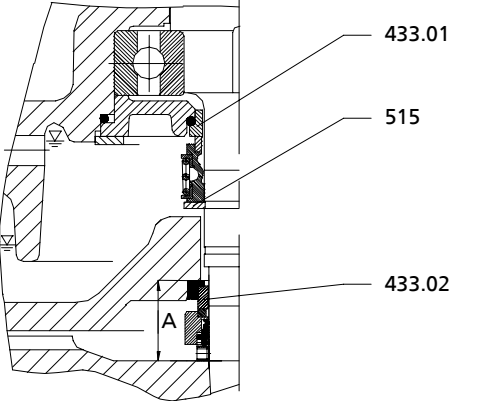
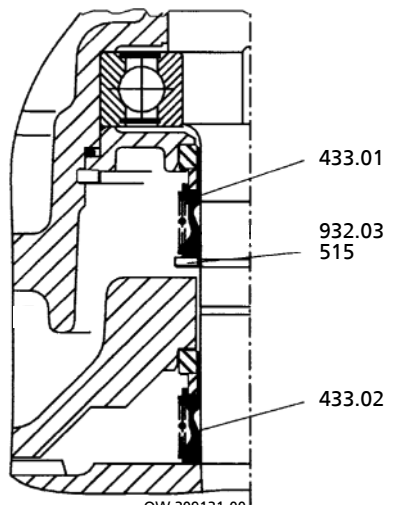
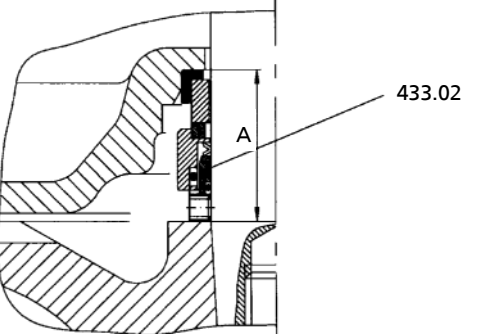
Motor sizes	Pump set
5 2, 6 2, 8 2, 12 2, 17 2, 22 2, 25 2, 23 2, 4 4, 5 4, 7 4, 11 4, 16 4, 19 4, 21 4, 23 4, 29 4, 4 6, 6 6, 9 6, 12 6, 15 6, 19 6, 20 6, 26 6,	
1, 2, 3	Flamepath

Motor sizes	Pump set
37 2, 55 2 35 4, 50 4, 65 4 32 6, 40 6, 50 6 26 8, 35 8	
1,2, 3, 4, 5 Flamepaths	

9.4 Sectional drawings of the mechanical seal

Table 39: Sectional drawings of the mechanical seal

Section	Sectional drawing		
Hydraulics sizes 40-250 80-250 100-240 100-250 Motor sizes 5 2, 6 2, 8 2, 12 2, 17 2, 22 2, 25 2 4 4, 5 4, 7 4, 11 4, 16 4, 19 4, 21 4	433.01	Mechanical seal (bellows-type mechanical seal)	<p>OW 309130-00</p>
	515	Taper lock ring	
	433.02	Mechanical seal (bellows-type mechanical seal)	

Section	Sectional drawing		
	433.01	Mechanical seal (bellows-type mechanical seal)	 <p style="text-align: center;">OW 309130-05</p>
	515	Taper lock ring	
	433.02	Mechanical seal (mechanical seal with covered springs - HJ)	
<p>Hydraulics sizes 80-251 80-315 100-315 150-315 200-315/316 D 80-315 D 100-251 D 100-315/316 D 150-251 D 150-315 D 200-315</p> <p>Motor sizes 5 2, 6 2, 8 2, 12 2, 17 2, 22 2, 23 2, 25 2, 4 4, 5 4, 7 4, 11 4, 16 4, 19 4, 21 4, 23 4, 29 4 4 6, 6 6, 9 6, 12 6, 15 6, 19 6</p>	433.01	Mechanical seal (bellows-type mechanical seal)	 <p style="text-align: center;">OW 309131-00</p>
	515	Taper lock ring	
	433.02	Mechanical seal (bellows-type mechanical seal)	
	433.02	Mechanical seal (mechanical seal with covered springs - HJ)	 <p style="text-align: center;">OW 309131-05</p>

Section	Sectional drawing		
Hydraulics sizes 100-400/401 150/151-400/401 200-330 200-400 250-400/401 300-400/401 D 80-315 D 100-315	433.01	Mechanical seal (bellows-type mechanical seal)	
	550.03	Disc	
	932.03	Circlip	
	433.02	Mechanical seal (bellows-type mechanical seal)	
	550.44	Disc	
D 80-315 D 100-315	412.17	O-ring	
Motor sizes 37 2, 55 2 23 4, 29 4, 35 4, 50 4, 65 4 20 6, 26 6, 32 6, 40 6, 50 6 10 8, 17 8, 21 8, 26 8, 35 8	433.02	Mechanical seal (mechanical seal with covered springs - HJ)	

9.5 Transportable wet-installed model

Table 40: Design with support foot

Description	Sectional drawing	
Sizes of hydraulic system 40-250 80-250 100-240 100-250 D 150-251 D 150-315	<p>Material variant G</p>	<p>Material variant H</p>
Sizes of hydraulic system 100-315/316 150-315	<p>Material variants G, GH</p>	<p>Material variant H</p>
Sizes of hydraulic system 80-315 100-240 100-250 100-315 150-315	<p>Material variant C1</p>	<p>Material variant C2</p>
Sizes of hydraulic system 200-315/316 D 80-315 D 100-251 D 100-315 D 100-316		

Table 41: List of components

Part No.	Description	Part No.	Description
182	Foot	892	Foot plate
183	Support foot	901	Hexagon head bolt
59-17	Shackle	902	Stud
59-24	Rope	914	Hexagon socket head cap screw
595	Buffer	920	Nut
885	Chain	932	Circlip

10 EC Declaration of Conformity

Manufacturer: **KSB Aktiengesellschaft
Johann-Klein-Straße 9
67227 Frankenthal (Germany)**

The manufacturer herewith declares that **the product:**

Amarex KRT

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/A1,
 - EN 60034-1, EN 60034-5/A1

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

.....¹¹⁾.....

Name
Function
Company
Address
Address

¹¹⁾ A signed, legally binding declaration of conformity is supplied with the product.

11 Certificate of Decontamination

Type
 Order number/
 Order item number¹²⁾

Delivery date

Field of application:

Fluid pumped¹²⁾:

Please tick where applicable¹²⁾:



Radioactive



Explosive



Corrosive



Toxic



Harmful



Bio-hazardous



Highly flammable



Safe

Reason for return¹²⁾:

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

¹²⁾ Required fields

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