Submersible Motor Pump

Amarex KRT

Dry installation

Installation/Operating Manual

Mat. No.: 01213714

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Installation/Operating Manual Amarex KRT

Original operating manual

Subject to technical modification without prior notice.

Contents

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

Discharge line

The pipeline which is connected to the discharge nozzle

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

Pump set

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

Suction lift line/suction head line

The pipeline which is connected to the suction nozzle

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, refer to the table below).

Table 1: Variants covered by this manual

Sizes	Impeller types	Material variant			
		Grey cast iron			
		G	G1	G2	GH
80-250	E, F	E, F	F	F	F
80-315	D	D	D	-	-
100-250	E, F, K	E, F, K	F, K	F	F, K
100-251	D	D	D	-	-
150-251	D	D	D	-	-
150-315	D, E, F, K	D, E, F, K	D, F, K	F	F, K
200-315	D, K	D,K	D, K	-	K
200-316	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 operating manual is aimed at the target group of trained and qualified specialist technical personnel. (⇨ Section 2.4 Page 9)

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) If agreed to be included in the scope of supply

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

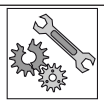
2 Safety

DANGER

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 2014/34/EU (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:

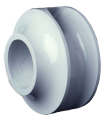
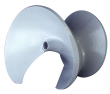
- Arrow indicating the direction of rotation
- Markings for connections
- Name plate

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 to handle the fluids described in the data sheet or product literature of the pump model.

- Never operate the system without the fluid to be handled.
- Observe the limits for continuous operation specified in the data sheet or product literature (Q_{min} and Q_{max}) (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 x Q_{opt} to minimise the risk of clogging/hardening.
- Avoid duty points for continuous operation at very low speeds and small flow rates (< 0.7 x Q_{opt}).
- 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 system (prevention of 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.

	Free-flow impeller (impeller type F)	**Suitable for the following fluids** fluids containing solids and stringy material as well as fluids with entrapped air or entrapped gas
	Closed single-channel impeller (impeller type E)	**Suitable for the following fluids:** fluids containing solids and stringy material
	Closed multi-channel impeller (impeller type K)	**Suitable for the following fluids:** contaminated, solids-laden, non-gaseous fluids without stringy material
	Open, diagonal single-vane impeller (impeller type D)	**Suitable for the following fluids** fluids containing solid substances and long fibres

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 or product literature regarding pressure, temperature, etc.
- Observe all safety information and instructions in this manual.

2.4 Personnel qualification and training

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

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

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

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

2.5 Consequences and risks caused by non-compliance with this manual

- Non-compliance with this operating manual 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, directives 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

- 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 maintenance, inspection and installation 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 33)
- Decontaminate pumps which handle fluids posing a health hazard.

- As soon as the work has been 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 30)

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

DANGER

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

Special conditions apply to the operation of an explosion-proof pump set to EC Directive 2014/34/EU (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 alterations of the pump set can 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.

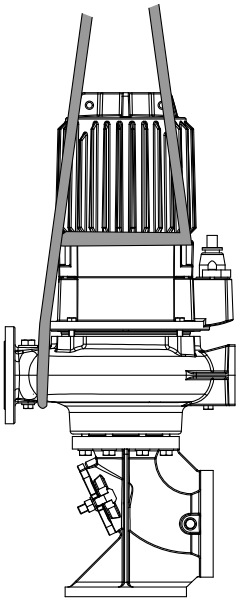
3.2 Transport

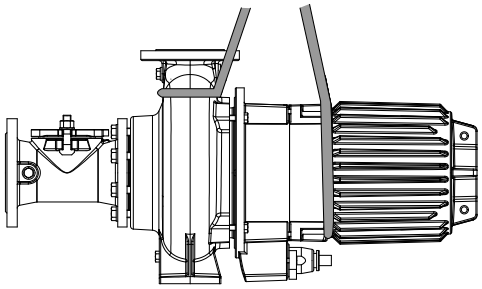
⚠ DANGER

Improper transport
Danger to life from falling parts!
Damage to the pump set!

- Use the attachment point provided (pump handle) for attaching lifting accessories.
- 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.

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





3.3 Storage/preservation

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

CAUTION

Improper storage
Damage to the power cables!

- ▷ 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.

CAUTION

Damage during storage by humidity, dirt, or vermin
Corrosion/contamination of the pump (set)!

- ▷ For outdoor storage cover the packed or unpacked pump (set) and accessories with waterproof material.

CAUTION

Wet, contaminated or damaged openings and connections
Leakage or damage to the pump!

- ▷ Clean and cover pump openings and connections as required prior to putting the pump into storage.

Table 5: Ambient conditions for storage

Ambient condition	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 42)
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 pump set has handled fluids whose residues could lead to corrosion damage in the presence of atmospheric humidity or could ignite upon contact with oxygen, the pump set must also be neutralised, and anhydrous inert gas must be blown through the pump to ensure drying.
4. Always complete and enclose a certificate of decontamination when returning the pump (set).
   Always indicate any safety and decontamination measures taken. (⇨ Section 11 Page 59)

NOTE

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

3.5 Disposal

⚠ WARNING

Fluids, consumables and supplies which are hot and/or pose a health hazard
Hazard to persons and the environment!

- ▹ 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 sewage and all types of waste water.

- Close-coupled pump with shaft seal
- Directly flanged standardised motor
- Direct drive electric motor

4.2 Designation

Example: KRTK 100-251 / 74XKG-H

Table 6: Designation key

Code	Description
KRT	Type series
K	Impeller type, e.g. K = channel impeller
100	Nominal discharge nozzle diameter (DN) [mm]
251	Maximum nominal impeller diameter [mm]
7	Motor size
4	Number of poles
X	Motor version, e.g. X = explosion-proof version
K	Dry installation (convection in air)
G	Material variant, e.g. G = complete pump in grey cast iron
H	Installation type, e.g. H = horizontal installation

4.3 Name plate

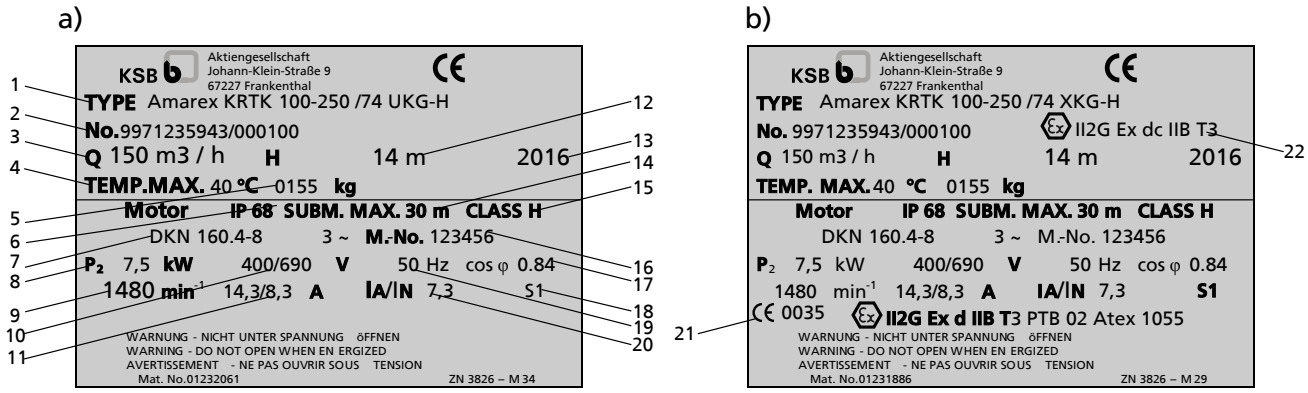


Fig. 1: Name plate (example) a) Standard pump set b) Explosion-proof pump set

1	Designation	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	Marking for explosion-proof pump sets

4.4 Design details

Design

- Fully floodable submersible motor pump

- Not self-priming
- Close-coupled design

Impeller type

- Various application-oriented impeller types

Shaft seal

- Two bi-directional mechanical seals in tandem arrangement, with liquid reservoir

Bearings

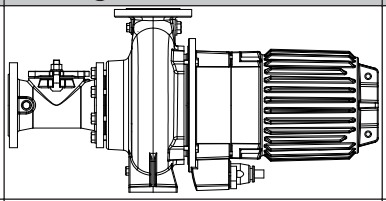
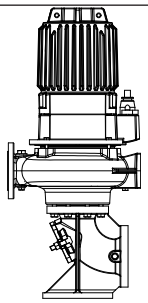
- Grease-lubricated bearings sealed for life
- Maintenance-free

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

Table 7: Types of installation

Type of installation	Drawing	Description
Horizontal dry installation (installation type H)		Pump set with directly flanged motor, horizontal installation
Vertical dry installation (installation type D)		Pump set with directly flanged motor, vertical installation, with suction duckfoot bend

4.6 Configuration and function

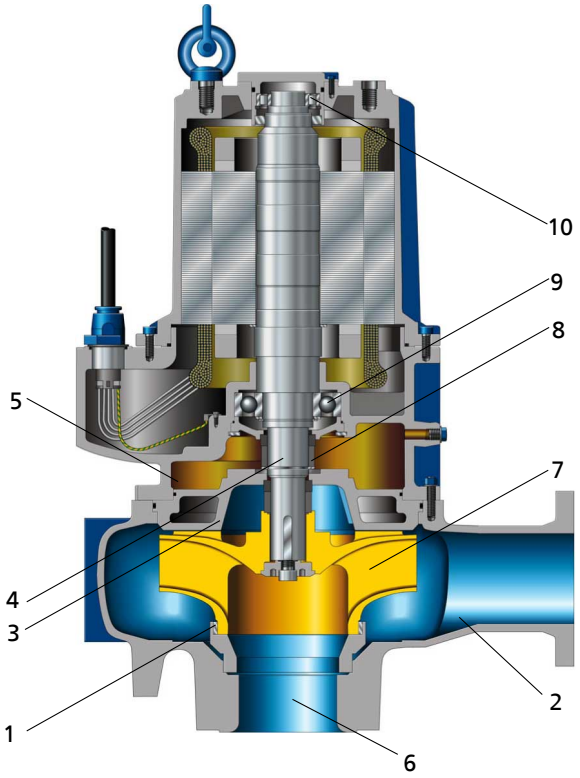


Fig. 2: Sectional drawing

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 to 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-directional mechanical seals in tandem arrangement. A lubricant reservoir in-between the seals ensures cooling and lubrication of the mechanical seals.

4.7 Noise characteristics

Table 8: Surface sound pressure level L_{pA} [2)]

Rated power P_2 [kW]	Pump set		
	2900 rpm [dB]	1450 rpm [dB]	960 rpm [dB]
4.0	68.5	62.0	60.5
5.5	70.0	63.5	63.0
7.5	71.0	65.0	63.5

4.8 Scope of supply

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

- Pump set complete with power cables
- Foundation rails (for horizontal installation)
- Suction-side double-flanged taper with inspection hole (optional)
- Suction duckfoot bend (for vertical installation)

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).

4.9 Dimensions and weights

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

2) Measured at a distance of 1 m from the pump outline (as per DIN 45635 Part 1 and 24)

5 Installation at Site

5.1 Safety regulations

⚠ DANGER

Improper installation in potentially explosive atmospheres
Explosion hazard!
Damage to the pump set!

- ▷ Comply with the applicable local explosion protection regulations.
- ▷ Observe the information in the data sheet and on the name plates of pump and motor.

5.2 Checks to be carried out prior to installation

Place of installation

⚠ WARNING

Installation on mounting surface which is unsecured and cannot support the load
Personal injury and damage to property!

- ▷ 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.
- ▷ Observe the weights indicated.

Resonances

Any resonances at the usual excitation frequencies (1 x and 2 x 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.

5.3 Checking the lubricant level

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

Visual inspection for signs of oil leakage

1. If no oil leakage is visible in the area of pump casing or impeller, the lubricant reservoir is filled properly.
2. If oil leakage is visible in the area of pump casing or impeller, top up the lubricant reservoir.

⚠ WARNING

Incorrect installation/placing down
Personal injury and damage to property!

- ▷ Position the pump set vertically 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.

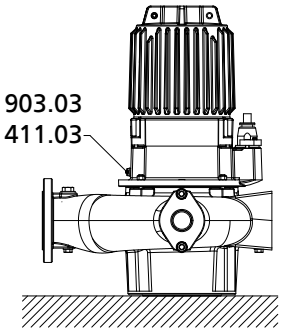


Fig. 3: Checking the lubricant level

✓ Signs of oil leakage have been detected.

1. Position the pump set as shown.
2. Secure the pump set against tipping over.
3. Remove screw plug 903.03 and joint ring 411.03.
4. Check the lubricant level.
   - ⇨ If the lubricant level reaches the opening, fit and tighten screw plug 903.03 with joint ring 411.03 again.
   - ⇨ If the lubricant level is below the opening, top up the lubricant. (⇨ Section 7.2.3.1.4 Page 40)
5. Fit screw plug 903.03 together with a new joint ring 411.03.

5.4 Checking the direction of rotation

	⚠ DANGER
	Pump set running dry Explosion hazard! ▹ Check the direction of rotation of explosion-proof pump sets outside potentially explosive atmospheres.

	⚠ WARNING
	Hands inside the pump casing Risk of injuries, damage to the pump! ▹ 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
	Pump set running dry Increased vibrations! Damage to mechanical seals and bearings! ▹ Never operate the pump set for more than 60 seconds outside the fluid to be handled.

✓ The pump set is installed as illustrated below and secured against rolling off.

✓ The pump set is connected to the power supply.

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.

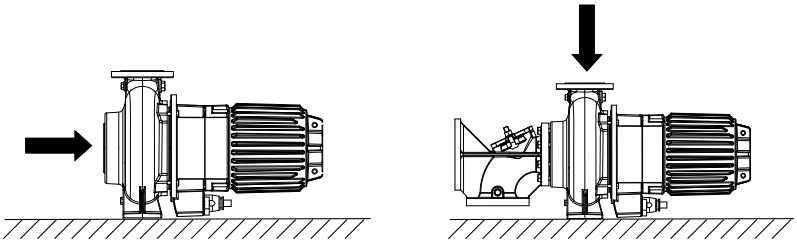


Fig. 4: Checking the direction of rotation

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.

5.5 Installing the pump set

Fastening

- Fasten the pump feet with or without foundation rails or the suction duckfoot bend to a concrete foundation with chemical anchors.

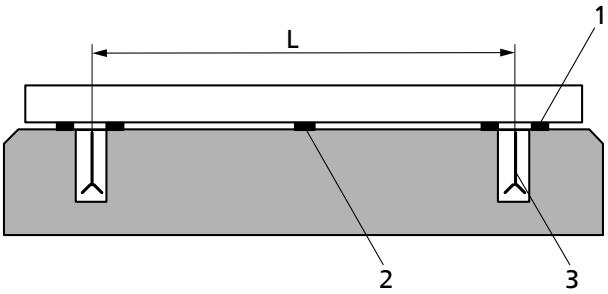


Fig. 5: Installation on a foundation with chemical anchors

L	Bolt-to-bolt distance	1	Shim
2	Shim	3	Chemical anchor

✓ The foundation has the required strength and characteristics.

✓ The foundation has been prepared in accordance with the dimensions given in the outline drawing/general arrangement drawing.

1. Position the pump set on the foundation and level it with the help of a spirit level placed on the shaft and discharge nozzle.
   Permissible deviation: 0.2 mm/m.
2. Use shims (1) for height compensation, if necessary.
   Always fit shims, if any, immediately to the left and right of the chemical anchors (3) between the baseplate/foundation frame and the foundation.
   For a bolt-to-bolt distance (L) ≥ 800 mm fit additional shims (2) halfway between the adjoining holes.
   All shims must lie perfectly flush.
3. Drill the holes as specified in the table "Chemical anchor dimensions". Then clean the holes.

⚠ WARNING

Improper handling of mortar cartridges
Skin sensitisation or irritation!

▷ Wear suitable protective clothing.

4. Insert the mortar cartridges into the drilled holes.
   Observe the curing times of the mortar cartridges!
5. Insert threaded bolts into the corresponding drilled holes with an electric tool (e.g. impact drill, hammer drill).

6. After the curing time (see table), tighten the chemical anchors (3) evenly and tightly.
7. Grout the baseplate using low-shrinkage concrete.

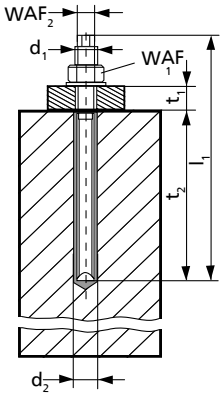


Fig. 6: Dimensions

Table 9: Chemical anchor dimensions

Size ($d_1 \times l_1$)	d_2	t_1	t_2	WAF 1	WAF 2	M_{d1}
	[mm]	[mm]	[mm]	[mm]	[mm]	[Nm]
M10 × 130	12	22	90	17	6	20
M12 × 160	14	25	110	19	8	40
M16 × 190	18	35	125	24	12	60
M20 × 260	25	65	170	30	14	120
M24 × 300[3)]	28	65	210	36	17	180
M30 × 380[3)]	35	65	280	46	-	400

Table 10: Curing times of mortar cartridge

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

5.6 Piping

5.6.1 Connecting the piping

⚠ DANGER

Impermissible loads acting on the pump nozzles
Danger to life from leakage of hot, toxic, corrosive or flammable fluids!

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

NOTE

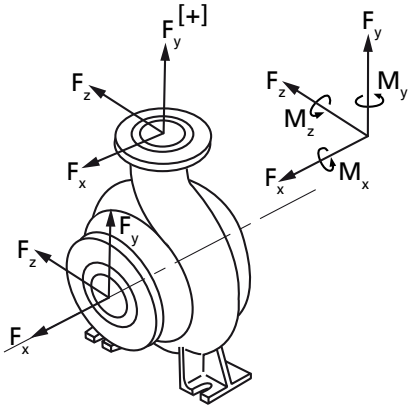
Installing check and shut-off elements in the system is recommended, depending on the type of plant and pump. However, such elements must not obstruct proper drainage or hinder disassembly of the pump.

- ✓ Suction lift lines have been laid with a rising slope, suction head lines with a downward slope towards the pump.
- ✓ A flow stabilisation section having a length equivalent to at least twice the diameter of the suction flange has been provided upstream of the suction flange.
- ✓ The nominal diameters of the pipelines are equal to or greater than the nominal diameters of the pump nozzles.
- ✓ Adapters to larger nominal diameters are designed with a diffuser angle of approx. 8° to avoid excessive pressure losses.
- ✓ The pipelines have been anchored in close proximity to the pump and connected without transmitting any stresses or strains.

3) Mounting accessories of the respective manufacturer are required.

1. Thoroughly clean, flush and blow through all vessels, pipelines and connections (especially of new installations).
2. Before installing the pump in the piping, remove the flange covers on the suction and discharge nozzles of the pump.
3. Connect the pump nozzles to the piping.

5.6.2 Permissible forces and moments at the pump nozzles



Forces and moments at the pump nozzles

The resulting permissible forces have been determined according to

$$F_{res\ D} \leq \sqrt{F_x^2 + F_z^2}$$

$$F_{res\ S} \leq \sqrt{F_y^2 + F_z^2}$$

The data on forces and moments apply to static piping loads only. If the limits are exceeded, they must be checked and verified.
If a computerised strength analysis is required, values are available on request only. The values are only applicable if the pump is installed on a completely grouted baseplate and bolted to a rigid and level foundation.

Table 11: Forces and moments at the pump nozzles

Sizes	Suction nozzle [daN]				Discharge nozzle [daN]					Suction nozzle [daNm]			Discharge nozzle [daNm]		
	F_x (+ -)	F_y (+ -)	F_z (+ -)	F_{res} (+ -)	F_x (+ -)	F_{yTens} (+)	F_{yPress} (-)	F_z (+ -)	F_{res} (+ -)	M_x (+ -)	M_y (+ -)	M_z (+ -)	M_x (+ -)	M_y (+ -)	M_z (+ -)
80 - 250 80 - 315	180	115	140	180	115	70	140	95	150	135	100	65	95	70	50
100 - 250 100 - 251	180	115	140	180	140	90	180	115	180	135	100	65	135	100	65
150 - 251 150 - 315	310	205	250	320	250	155	310	205	320	230	175	115	230	175	115
200 - 315 200 - 316	490	310	380	490	380	235	490	310	490	350	255	175	350	255	175

5.6.3 Vacuum balance line

NOTE

Where fluid has to be pumped out of a vessel under vacuum, installing a vacuum balance line is recommended.

The following rules apply to vacuum balance lines:

- Minimum nominal line diameter 25 mm.
- The line extends above the highest permissible fluid level in the vessel.

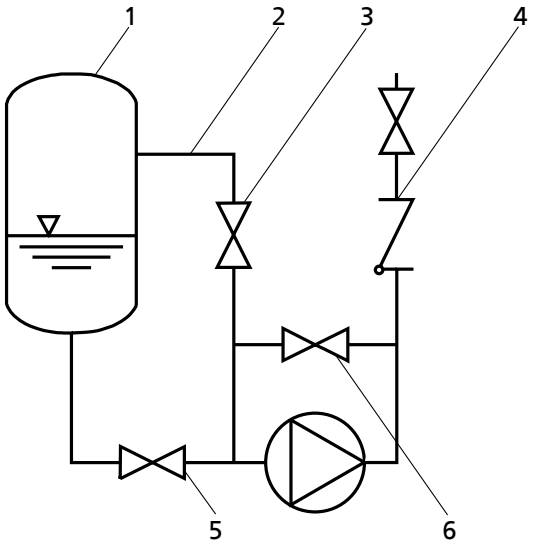


Fig. 7: Vacuum balance system

1	Vessel under vacuum	2	Vacuum balance line
3	Shut-off element	4	Swing check valve
5	Main shut-off element	6	Vacuum-tight shut-off element

NOTE

An additional line fitted with a shut-off valve (from the pump discharge nozzle to the balance line) facilitates venting of the pump before start-up.

5.7 Auxiliary connections

⚠ WARNING

Screw plugs subjected to pressure
Risk of injuries by parts flying off and escaping fluid!

- Never use screw plugs for releasing pressure from the pump casing.
- Always use suitable venting devices (e.g. vent valve).

The following auxiliary connections are available:

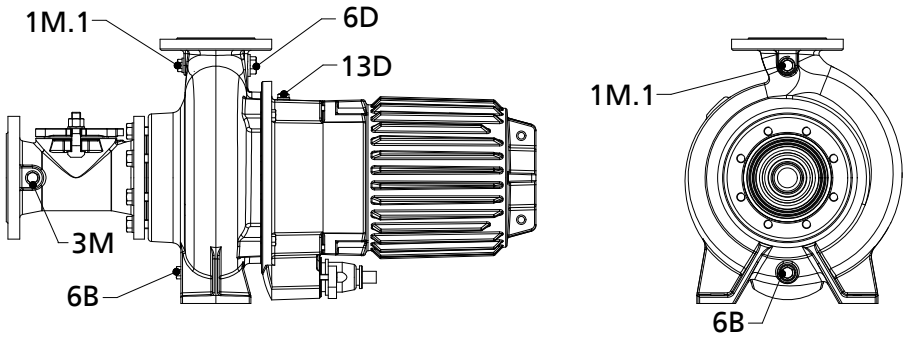


Fig. 8: Auxiliary connections

Table 12: Sizes of auxiliary connections

Pipe connection	Description	Size	
		80–250 80–315 100–250 100–251 150–251 100–316	150–315 200–315 200–316
1 M.1	Pressure gauge	G $^1/_2$	
6 D	Vent	G 1	
3 M	Pressure/vacuum gauge	G $^1/_2$	
6 B	Casing drain	G $^1/_2$	G 1
13 D	Oil filling	G $^1/_2$	

5.8 Electrical system

5.8.1 Information for planning the control system

For the electrical connection of the pump set observe the wiring diagram. (⇨ Section 9.2 Page 56)
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 mm² is required.

The motors can be connected to electrical low-voltage grids with rated voltages and voltage tolerances to EN 60038 or to other grids or power supply facilities with a maximum rated voltage tolerance of ± 10 %.

5.8.1.1 Overload protection

1. Protect the pump set against overloading by a thermal time-lag overload protection device in accordance with IEC 60947 and local regulations.
2. Set the overload protection device to the rated current specified on the name plate.

5.8.1.2 Operation on a frequency inverter

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

⚠ DANGER

Operation outside the permitted frequency range
Explosion hazard!

▷ Never operate an explosion-proof pump set outside the specified range.

⚠ DANGER

Incorrect selection and setting of the frequency inverter
Explosion hazard!

▷ Observe the following information on selecting and setting a frequency inverter.

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

- Only voltage source inverters (VSI) with pulse width modulation (PWM) and carrier frequencies between 1 and 16 kHz are suitable.

Setting

Observe the following instructions for setting a frequency inverter:

- Set the current limit to max. 1.2 times the rated current indicated on the name plate.

Start-up

Observe the following instructions for starting the frequency inverter:

- Ensure short start ramps (maximum 5 seconds).
- Only start variable speed control after 2 minutes at the earliest.
  Pump start-up with long start ramps and low frequency may cause clogging.

Operation

Observe the following limits during operation on a frequency inverter:

- Only utilise up to 95 % of the motor rating P_2 indicated on the name plate.
- Frequency range 25 to 50 Hz

Electromagnetic compatibility

Operation on a frequency inverter produces interference 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 any given limits always observe the EMC information provided by the inverter manufacturer. If the inverter manufacturer recommends a shielded power cable, make sure to use a submersible motor pump with shielded power cables.

Interference immunity

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

5.8.1.3 Sensors

DANGER

Operating an incompletely connected pump set
Explosion hazard!
Damage to the pump set!

▷ Never start up a pump set with incompletely connected power connection cables or non-operational monitoring devices.

CAUTION

Incorrect wiring
Damage to the sensors!

▷ Observe the limits stated in the following sections of this manual when connecting the sensors.

The pump set features sensors designed to prevent hazards and damage to the pump set.

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

NOTE

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 this manual.

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

5.8.1.3.1 Motor temperature

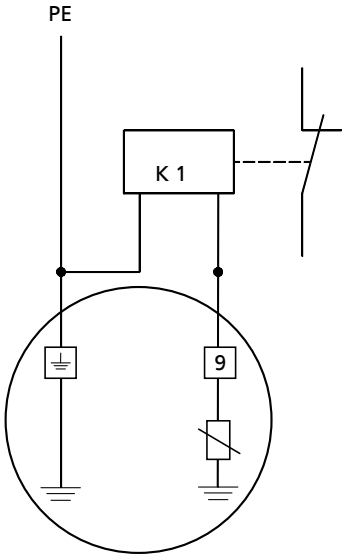
DANGER

Insufficient cooling conditions
Explosion hazard!
Winding damage!

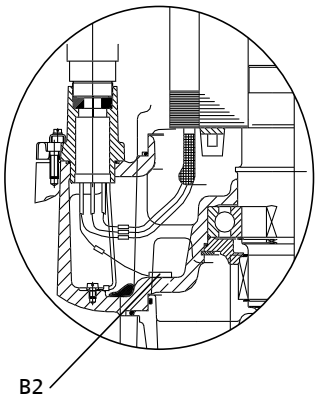
- Never operate a pump set without operational temperature monitoring.
- For explosion-proof pump sets use a thermistor tripping unit for monitoring the temperature of explosion-proof motors in "flameproof enclosure" Ex d type of protection. Use a thermistor relay with manual reset and a type test certificate in accordance with the applicable standards for explosion 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.

5.8.1.3.2 Leakage inside the motor



Wiring of the electrode relay



Position of the electrode in the motor housing

An electrode fitted inside the motor monitors the winding space (B2) for leakage. The electrode is intended for connection to an electrode relay (conductor marking 9). Tripping of the electrode relay must result in the pump set cutting out.

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

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

5.8.2 Electrical connection

DANGER

Electrical connection work by unqualified personnel
Danger of death from electric shock!

- Always have the electrical connections installed by a trained and qualified electrician.
- Observe regulations IEC 60364 and, for explosion-proof models, EN 60079.

⚠ WARNING

Incorrect connection to the mains
Damage to the mains network, short circuit!

- ▷ Observe the technical specifications of the local energy supply companies.

CAUTION

Improper routing of power cable
Damage to the power cables!

- ▷ 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.

CAUTION

Motor overload
Damage to the motor!

- ▷ Protect the motor by a thermal time-lag overload protection device in accordance with IEC 60947 and local regulations.

For the electrical connection observe the wiring diagrams in the Annex and the information for planning the control system .

The pump set is supplied complete with connection cables. Always use all cables provided and connect all marked cores of the control cable.

⚠ DANGER

Incorrect wiring
Explosion hazard!

- ▷ The connection point of the cable ends must be located outside of the potentially explosive atmosphere or inside electrical equipment approved to equipment category II2G.

⚠ DANGER

Operating an incompletely connected pump set
Explosion hazard!
Damage to the pump set!

- ▷ Never start up a pump set with incompletely connected power connection cables or non-operational monitoring devices.

Potential equalisation

The pump set is fitted with an external PE connection.

⚠ DANGER

Incorrect wiring
Danger of death from electric shock!

- ▷ Never operate the pump set without connecting the PE conductor.

5.9 Priming and venting the pump

DANGER

Risk of potentially explosive atmosphere by mixing of incompatible fluids in the auxiliary piping
Risk of burns!
Explosion hazard!

- ▹ Make sure that the barrier fluid and quench liquid are compatible with the fluid pumped.

DANGER

Risk of potentially explosive atmosphere inside the pump
Explosion hazard!

- ▹ The pump internals in contact with the fluid to be handled, including the seal chamber and auxiliary systems must be filled with the fluid to be handled at all times.
- ▹ Provide sufficient inlet pressure.
- ▹ Provide an appropriate monitoring system.

DANGER

Shaft seal failure caused by insufficient lubrication
Hot or toxic fluid could escape!
Damage to the pump!

- ▹ Before starting up the pump set, vent the pump and suction line and prime both with the fluid to be handled.

1. Vent the pump and suction line and prime both with the fluid to be handled.
2. Fully open the shut-off element in the suction line.
3. Fully open all auxiliary connections (barrier fluid, flushing liquid, etc).

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 pump has been vented.
- The direction of rotation has been checked.
- All auxiliary connections required are connected and operational.
- The lubricant has been checked.
- After prolonged shutdown of the pump (set), the activities required for returning the pump (set) to service have been carried out.

6.1.2 Start-up

⚠ DANGER

Non-compliance with the permissible pressure and temperature limits if the pump is operated with the suction and/or discharge line closed.
Explosion hazard!
Leakage of hot or toxic fluids!

- ▷ Never operate the pump with the shut-off elements in the suction line and/or discharge line closed.
- ▷ Only start up the pump set with the discharge-side shut-off element slightly or fully open.

⚠ DANGER

Excessive temperatures due to dry running or excessive gas content in the fluid handled
Explosion hazard!
Damage to the pump set!

- ▷ Never operate the pump set without liquid fill.
- ▷ Prime the pump as per operating instructions. (⇨ Section 5.9 Page 29)
- ▷ Always operate the pump within the permissible operating range.

✓ The pump, suction line and discharge line have been vented and primed with the fluid to be handled.

1. Fully open the shut-off element in the suction head/suction lift line.
2. Close/slightly open the shut-off element in the discharge line; fully open the shut-off element if a check valve is installed.
3. Start up the motor.
4. Immediately after the pump has reached full rotational speed, swiftly open the shut-off element in the discharge line and adjust it to comply with the duty point.

6.1.3 Shutdown

1. Close the shut-off element in the discharge line.
   If the discharge line is equipped with a check valve, the shut-off element may remain open as long as there is back pressure.

2. Switch off the motor, making sure that the unit runs down smoothly to a standstill.

Prolonged shutdown periods

For prolonged shutdown, close the shut-off element in the suction line.

Danger of frost/freezing

If there is any danger of frost/freezing, drain the pump and protect it against freezing.

6.2 Operating limits

DANGER

Non-compliance with operating limits
Damage to the pump set!

- 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 Maximum operating pressure

CAUTION

Permissible operating pressure exceeded
Damage to connections and seals!

- Never exceed the operating pressure specified in the data sheet.

Table 13: Maximum operating pressure

Size	Maximum operating pressure
80-315	10 bar
80-250, 100-250/-251, 150-251, 150-315, 200-315/-316	6 bar

6.2.2 Frequency of starts

CAUTION

Excessive frequency of starts
Risk of damage to the motor!

- Never exceed the specified frequency of starts.

CAUTION

Re-starting while motor is still running down
Damage to the pump set!

- 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.

To prevent high temperature increases in the motor and excessive loads on the motor, seal elements and bearings, the frequency of starts shall not exceed 10 start-ups per hour.

These values apply to mains start-up (DOL or with star-delta contactor, autotransformer, soft starter). This limitation does not apply to operation on a frequency converter.

6.2.3 Supply voltage

⚠ DANGER

Non-compliance with permissible supply voltage tolerances
Explosion hazard

- ▷ Never operate an explosion-proof pump (set) outside the specified range.

The maximum permissible deviation in supply voltage is ±10% of the rated voltage. The voltage difference between the individual phases must not exceed 1 %.

6.2.4 Operation on a frequency inverter

⚠ DANGER

Operation outside the permitted frequency range
Explosion hazard!

- ▷ Never operate an explosion-proof pump set outside the specified range.

CAUTION

Pumping solids-laden fluids at reduced speed
Increased wear and clogging!

- ▷ 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.

6.2.5 Fluid handled

6.2.5.1 Temperature of the fluid handled

CAUTION

Impermissibly high temperature of fluid handled
Damage to the pump!

- ▷ Prolonged operation against a closed shut-off element is not permitted (heating up of the fluid).
- ▷ Observe the temperature limits in the data sheet and in the section on operating limits.

6.2.5.2 Density of the fluid handled

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

CAUTION

Impermissibly high density of the fluid handled
Motor overload!

- ▷ Observe the information on fluid density in the data sheet.
- ▷ Make sure the motor has sufficient power reserves.

6.2.5.3 Abrasive fluids

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

6.3 Shutdown/storage/preservation

6.3.1 Measures to be taken for shutdown

The pump (set) remains installed

⚠ WARNING

Unintentional starting of pump set
Risk of injury by moving parts!

- ▹ Ensure 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.

⚠ WARNING

Fluids, consumables and supplies which are hot and/or pose a health hazard
Risk of injury!

- ▹ 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.

CAUTION

Danger of frost/freezing
Damage to the pump set!

- ▹ If there is any danger of frost/freezing, remove the pump set from the fluid handled and clean, preserve and store it.

✓ Sufficient fluid is supplied for the operation check run of the pump.

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

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

✓ The pump has been properly drained (⇨ Section 7.3 Page 42) and the safety instructions for dismantling the pump have been observed. (⇨ Section 7.4.1 Page 42)

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 close the pump nozzles (e.g. with plastic caps or similar).
3. Oil or grease all exposed machined parts and surfaces of the pump (with silicone-free oil and grease, food-approved if required) to protect them against corrosion.
   Observe the additional instructions (⇨ Section 3.3 Page 12) .

6.4 Returning to service

For returning the pump to service observe the sections on commissioning/start-up and the operating limits.

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

⚠ WARNING

Failure to re-install or re-activate protective devices
Risk of personal injury from moving parts or escaping fluid!

- ▷ As soon as the work is complete, re-install and/or re-activate any safety-relevant and protective devices.

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 maintenance, inspection and installation is performed by authorised, qualified specialist personnel who are thoroughly familiar with the manual.

⚠ DANGER

Sparks produced during servicing work
Explosion hazard!

- 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.

⚠ DANGER

Risk of falling when working at great heights
Danger to life by falling from a great height!

- Pay attention to safety equipment, such as railings, covers, barriers, etc.
- Observe the applicable local occupational safety and accident prevention regulations.

⚠ WARNING

Unintentional starting of pump set
Risk of injury by moving parts!

- Ensure 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.

⚠ WARNING

Hands, other body parts or foreign objects in the propeller or propeller intake area
Risk of injury! Damage to the submersible motor pump!

- Never insert your hands, other body parts or foreign objects into the propeller or propeller intake area.
- Check that the propeller can rotate freely.

⚠ WARNING

Fluids, consumables and supplies which are hot and/or pose a health hazard
Risk of injury!

- 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.

⚠ WARNING

Hot surface
Risk of injury!

- Allow the pump set to cool down to ambient temperature.

⚠ WARNING

Improper lifting/moving of heavy assemblies or components
Personal injury and damage to property!

- Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.

⚠ WARNING

Insufficient stability
Risk of crushing hands and feet!

- During assembly/dismantling, secure the pump (set)/pump parts to prevent tipping or falling over.

NOTE

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.

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

NOTE

All maintenance, service and installation work can be carried out by KSB Service or authorised workshops. For contact details please refer to the enclosed "Addresses" booklet or visit "www.ksb.com/contact" on the Internet.

Never use force when dismantling and reassembling the pump set.

7.2 Maintenance/inspection

KSB recommends the following regular maintenance schedule:

Table 14: Overview of maintenance work

Maintenance interval	Maintenance work	For details see ...
Every 4000 operating hours[4)]	Insulation resistance measurement	(⇨ Section 7.2.2.2 Page 37)
	Check the power cables	(⇨ Section 7.2.2.1 Page 37)
Every 10,000 operating hours[5)]	Check the sensors	(⇨ Section 7.2.2.3 Page 38)
	Change the lubricant	(⇨ Section 7.2.3.1.4 Page 40)
Every five years	General overhaul	

7.2.1 Supervision of operation

⚠ DANGER

Risk of potentially explosive atmosphere inside the pump
Explosion hazard!

- The pump internals in contact with the fluid to be handled, including the seal chamber and auxiliary systems must be filled with the fluid to be handled at all times.
- Provide sufficient inlet pressure.
- Provide an appropriate monitoring system.

4) At least once a year
5) At least every three years

CAUTION

Increased wear due to dry running
Damage to the pump set!

- ▷ Never operate the pump set without liquid fill.
- ▷ Never close the shut-off element in the suction line and/or supply line during pump operation.

CAUTION

Impermissibly high temperature of fluid handled
Damage to the pump!

- ▷ Prolonged operation against a closed shut-off element is not permitted (heating up of the fluid).
- ▷ Observe the temperature limits in the data sheet and in the section on operating limits.

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

- The pump must run quietly and free from vibrations at all times.
- Check the correct functioning of any auxiliary connections.
- Monitor the stand-by pump.
  To make sure that the stand-by pumps are ready for operation, start them up once a week.
- Check the flexible elements of the coupling or belts and replace them, if required.

7.2.2 Inspection work

7.2.2.1 Checking the power supply cable

Visual inspection

✓ The pump set has been cleaned.

1. Inspect the power supply cable for visible damage.
2. Replace any damaged components by original spare parts.

Earth conductor test

✓ The pump set has been cleaned.

1. Measure the resistance between earth conductor and earth.
   The resistance must be lower than 1 Ω.
2. Replace any damaged components by original spare parts. (⇨ Section 7.7.1 Page 50)

⚠ DANGER

Defective earth conductor
Electric shock!

- ▷ Never switch on a pump set with a defective earth conductor.

7.2.2.2 Measuring the insulation resistance

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

✓ 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 to chassis ground.
   To do so, connect all winding ends together.

2. Measure the winding temperature sensors to chassis ground.
   To do so, connect all core ends of the winding temperature sensors together and connect all winding ends to chassis ground.

⇨ The insulation resistance of the core ends to chassis ground 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 of the power cable is lower than 1 MΩ, the power 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.

7.2.2.3 Checking the sensors

CAUTION

Excessive test voltage
Damage to the sensors!

▷ Use a commercially available ohmmeter to measure the resistance.

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 15: Resistance measurement of the temperature sensors in the motor winding

Measurement between terminals ...	Resistance
	[Ω]
10 and 11	200 to 750

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 16: Resistance measurement of the leakage sensor in the motor

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

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

7.2.2.4 Visual inspection through the inspection hole

If there are problems with clogging, the inside of the casing and the impeller can be checked via the inspection hole.

	**⚠ WARNING** **Fluids, consumables and supplies which are hot and/or pose a health hazard** Hazard to persons and the environment! ▷ 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.

	**⚠ WARNING** **Hands or foreign objects inside the pump casing** Risk of injuries, damage to the pump! ▷ Check that the inside of the pump is free from any foreign objects. Remove any foreign objects. ▷ Never insert your hands or any other objects into the pump, if the pump set has not been disconnected from the power supply and secured against unintentional start-up.

If a problem has occurred which requires visual inspection, observe the following instructions:

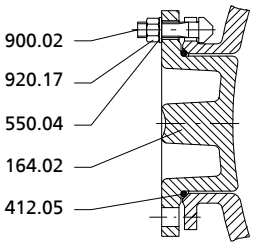


Fig. 9: Inspection hole in the casing

Opening the inspection hole

- Close the shut-off element on the suction side.
- Switch off the drive and make sure it cannot be re-started unintentionally.
- Close the shut-off element on the discharge side.
- Open the drain plug (auxiliary connection 6B).
- Collect and dispose of any liquid residues.
- Unscrew nuts 920.17 at the inspection hole and remove inspection cover 164.02.
- Perform a visual inspection with a lamp or similar.

Closing the inspection hole

- Fit new O-ring 412.05.
- Fit inspection cover 164.02.
- Place discs 550.04 and nuts 920.17 on screws 900.02 and tighten.
- Observe the instructions on commissioning/start-up. (⇨ Section 6.1.1 Page 30)

7.2.3 Lubrication and lubricant change

7.2.3.1 Lubricating the mechanical seal

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

7.2.3.1.1 Intervals

Replace the lubricant every 10,000 operating hours but at least every 3 years.

7.2.3.1.2 Lubricant quality

The lubricant reservoir is filled at the factory with an environmentally friendly, non-toxic lubricant of medical quality (unless otherwise specified by the customer).
The following lubricants can be used to lubricate the mechanical seals:

Table 17: Oil quality

Description	Properties	
Paraffin oil or white oil Alternative: motor oil grades SAE 10W to SAE 20W	Kinematic viscosity at 40 °C	< 20 mm²/s
	Flash point (to Cleveland)	+160 °C
	Solidification point (pour point)	-15 °C

Recommended oil types:

- Merkur WOP 40 PB, made by SASOL
- Merkur white oil Pharma 40, made by DEA
- Thin-bodied paraffin oil No. 7174, made by Merck
- Equivalent brands of medical quality, non-toxic
- Water-glycol mixture

⚠ WARNING

Lubricant contaminating fluid handled
Hazard to persons and the environment!

- ▷ Using machine oil is only permitted if the oil is disposed of properly.

7.2.3.1.3 Lubricant quantity

Table 18: Lubricant quantity [l] depending on size and motor

Size	Motor
	4 4, 5 4,7 4 4 6, 6 6
80-250	1,7
100-250	
100-251	
150-251	
80-315	3,0
150-315	
200-315	
200-316	

7.2.3.1.4 Changing the lubricant

⚠ WARNING

Incorrect installation/placing down
Personal injury and damage to property!

- ▷ Position the pump set vertically 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.

	**⚠ 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.

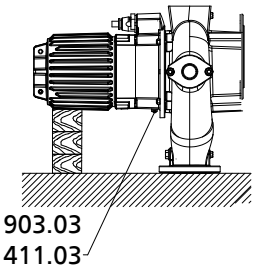


Fig. 10: Draining the lubricant

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.

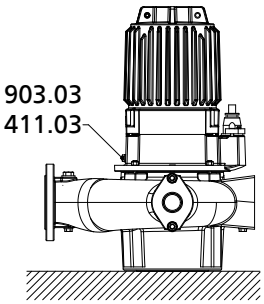


Fig. 11: Filling in the lubricant

2. Fill the lubricant through the lubricant filler opening until the lubricant reservoir overflows.
3. Close screw plug 903.03 again, fitting a new joint ring 411.03.

7.2.3.2 Lubricating the rolling element bearings

The rolling element bearings of the pump sets are grease-packed and maintenance-free.

7.3 Drainage/cleaning

⚠ WARNING

Fluids, consumables and supplies which are hot and/or pose a health hazard
Hazard to persons and the environment!

- ▹ 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.

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 be flushed through, neutralised, and anhydrous inert gas must be blown through the pump for drying purposes.

Use connection 6B to drain the fluid handled. (⇨ Section 5.7 Page 24)

7.4 Dismantling the pump set

7.4.1 General information/Safety regulations

⚠ WARNING

Unqualified personnel performing work on the pump (set)
Risk of injury!

- ▹ Always have repair and maintenance work performed by specially trained, qualified personnel.

⚠ WARNING

Hot surface
Risk of injury!

- ▹ Allow the pump set to cool down to ambient temperature.

⚠ WARNING

Improper lifting/moving of heavy assemblies or components
Personal injury and damage to property!

- ▹ 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 35)

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

For dismantling and reassembly refer to the general assembly drawing.

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

⚠ DANGER

Insufficient preparation of work on the pump (set)
Risk of injury!

- ▹ 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.

7.4.2 Separating the pump from the piping

✓ The pump set has been switched off properly.
✓ The shut-off elements in suction and discharge lines have been closed.
✓ Any auxiliary connections have been closed.
✓ The pump is drained and the pump pressure has been released.
1. Separate any auxiliary connections.
2. Remove the discharge and suction nozzles from the piping.

NOTE

After the pump set has been dismantled, the suction casing should be cleaned with water. Suitable protective clothing is recommended.

7.4.3 Removing the pump set

⚠ WARNING

Pump set tipping over
Risk of squashing hands and feet!
▹ Suspend or support the pump set.

✓ The steps in (⇨ Section 7.4.2 Page 43) have been carried out.
1. Suspend the pump set as specified for transport.
2. Depending on the type of installation, undo the foundation bolts at the pump foot or at the sole plate.
3. Place the pump set in a horizontal position.

7.4.4 Dismantling the pump section

Dismantle the pump section in accordance with the relevant general assembly drawing.

7.4.4.1 Removing the back pull-out unit

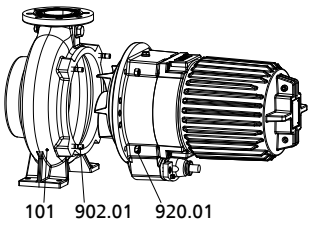


Fig. 12: Removing the back pull-out unit

1. Undo screwed connections 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 installation area and secure it against tipping over or rolling off.

7.4.4.2 Removing the impeller

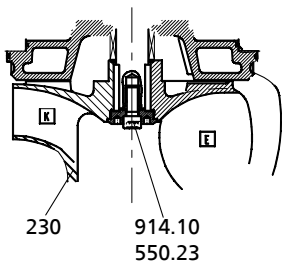


Fig. 13: Removing the impeller

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.

NOTE

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

Table 19: Forcing screws for pulling off the impeller

Size	Impeller types	Forcing screw	
		Thread	Code
40-252	F, K, S	M16	ADS 8
50-215	F	M10	ADS 0
50-126	S	M10	ADS 0
50-216	F	M10	ADS 6
65-215/217	F	M10	ADS 6
65-216	E	M12	ADS 7
65-253	K	M20	ADS 2
80-215/216/217	F	M10	ADS 6
80-216	E	M12	ADS 7
65-253	K	M20	ADS 2
80-252	F	M16	ADS 8
80-253/255	E, F, K	M20	ADS 2
80-315/316	D, F	M20	ADS 2
100-215	F	M10	ADS 6
100-254	F, K	M16	ADS 8
100/150-253	D	M16	ADS 3
100-315/316/317	E, F, K	M20	ADS 2
100-315/316	D	M20	ADS 4
150-315/317	E, F, K	M20	ADS 2
150/200-315	D	M20	ADS 4
200-315/316/317/318	K	M20	ADS 2

7.4.4.3 Dismantling the mechanical seal

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

7.4.4.3.1 Removing 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 motor housing 811 or bearing housing 350.
3. Press the stationary seat of mechanical seal 433.02 out of discharge cover 163.

7.4.4.3.2 Removing the drive-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.

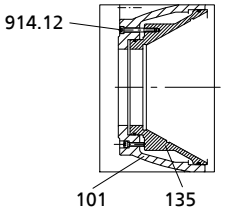


Fig. 14: Removing the wear plate

7.4.4.4 Removing the wear plate

✓ The back pull-out unit has been separated from the pump casing.
✓ The inside of the casing has been cleaned.
✓ The wear plate needs to be replaced as a result of visual inspection.

1. Undo socket head cap screws 914.12.
2. Remove wear plate 135 and O-rings 412.34.

7.4.5 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 part 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 cable 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

Improper lifting/moving of heavy assemblies or components
Personal injury and damage to property!

- ▹ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.

⚠ WARNING

Components with sharp edges
Risk of cutting or shearing injuries!

- ▹ Always use appropriate caution for installation and dismantling work.
- ▹ Wear work gloves.

CAUTION

Improper reassembly
Damage to the pump!

- ▹ Reassemble the pump (set) in accordance with the general rules of sound engineering practice.
- ▹ Use original spare parts only.

NOTE

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.

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.
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 to ensure trouble-free operation of the mechanical seal:

- Only remove the protective wrapping of the contact faces immediately before assembly takes place.
- The shaft surface must be absolutely clean and undamaged.
- Immediately before installing 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 (not oil).
- To prevent any damage to the rubber bellows, place a thin foil (of approximately 0.1 to 0.3 mm thickness) around the free shaft stub.
  Slide 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 on shaft 210 and secure it with taper lock ring 515.
2. Insert O-rings 412.04 and 412.15 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.

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.

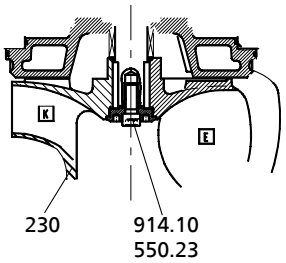


Fig. 15: Fitting the impeller

✓ 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. Tighten them with a torque wrench.

Table 20: Tightening torque for the impeller screw

Size	Thread	Tightening torque [Nm]
80-250, 100-250, 150-251, D 100-251	M 10	35
F, E, K 100-251, 80-315, 150-315, 200-315	M 16	150

7.5.2.3 Installing the back pull-out unit

7.5.2.3.1 Design with axial clearance

NOTE

After casing wear rings with a radial clearance have been fitted in pump casing 101, they have the required inside diameter and do not need to be readjusted.

NOTE

The axial clearance must be adjusted quickly before the Loctite hardens.

1. Apply Loctite 2701 to the outside diameter of the casing wear ring.
2. Use a rubber mallet to push casing wear ring 502 into pump casing 101 as far as it will go.
3. Insert the complete back pull-out unit into the pump casing.
4. Evenly tighten screwed connection 902.01 and 920.01 between pump casing and bearing bracket.

CAUTION

Axial displacement of the rotor
Damage to shaft seal and bearings!

▹ Always adjust and check the axial clearance with the pump set in a vertical position.

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

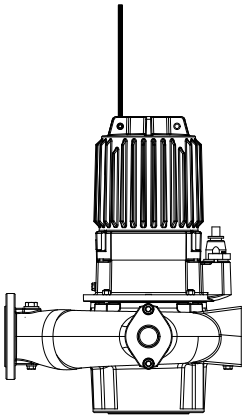


Fig. 16: Suspending the pump set

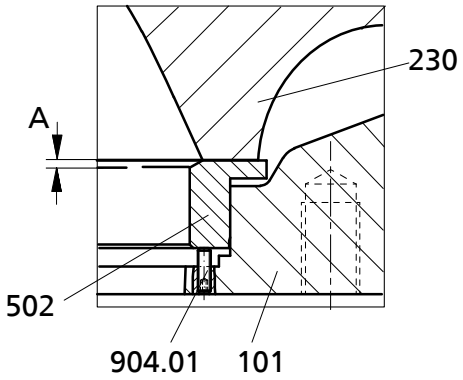


Fig. 17: Fitting the casing wear ring

A	Clearance of 0.3 ± 0.1 mm

7. Lift off the pump set and adjust the axial clearance.

7.5.2.3.2 Design with wear plate

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

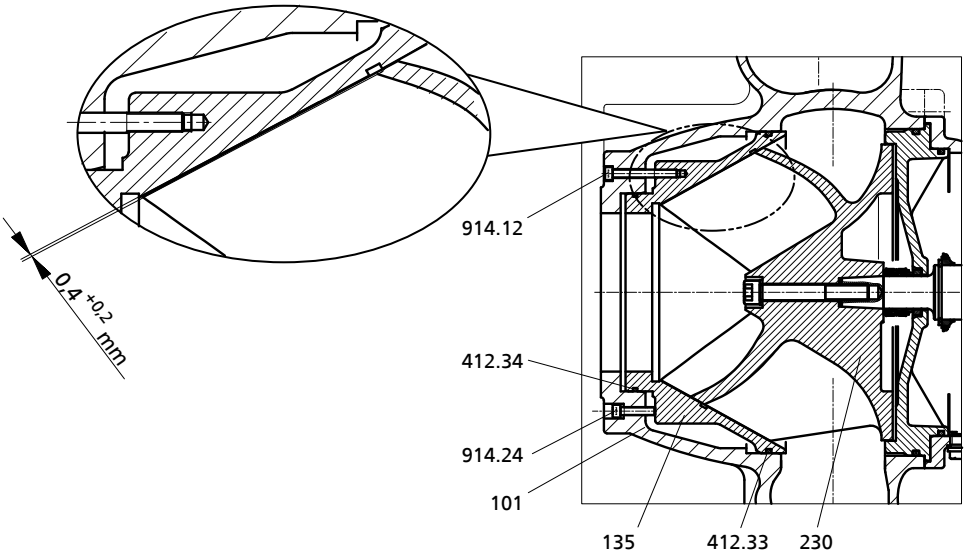


Fig. 18: Fitting the wear plate

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 902.01 and 920.01 between pump casing and bearing bracket.

7.5.3 Reassambling the motor section

NOTE

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/bolted connections closing off the flameproof enclosure with a thread-locking agent (Loctite type 243).

⚠ DANGER

Wrong screws/bolts
Explosion hazard!

- 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 checked for leakage. The leak test is performed at the lubricant filler opening.

Observe the following values for leak testing:

- **Test medium:** compressed air
- **Test pressure:** 0.8 bar maximum
- **Test duration:** 2 minutes

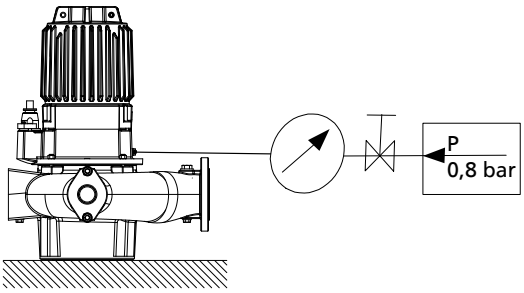


Fig. 19: Screwing in the testing device

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.
   Then perform another leak test.
4. If the leak test has been successful, fill in the lubricant.

7.5.5 Checking the connection of motor/power supply

Once reassembly has been completed, carry out the steps described in (⇨ Section 7.2.2 Page 37) .

7.6 Tightening torques

7.6.1 Tightening torques

Table 21: Tightening torques

Thread	Tightening torque[6]
	[Nm]
M6	7
M8	17
M10	35
M12	60
M16	150

7.7 Spare parts stock

7.7.1 Ordering spare parts

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

- Order number
- Order item number
- Type series
- Size
- Year of construction
- Motor number

Refer to the name plate for all data. (⇨ Section 4.3 Page 15)

Also specify the following data:

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

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

Table 22: Quantity of spare parts for recommended spare parts stock[7]

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 %

6) Property class: A4-70

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

8 Trouble-shooting

⚠ WARNING

Improper work to remedy faults
Risk of injury!

- ▷ For any work to remedy faults observe the relevant information in this manual or in the relevant accessory manufacturer's product literature.

If problems occur that are not described in the following table, consultation with the KSB 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

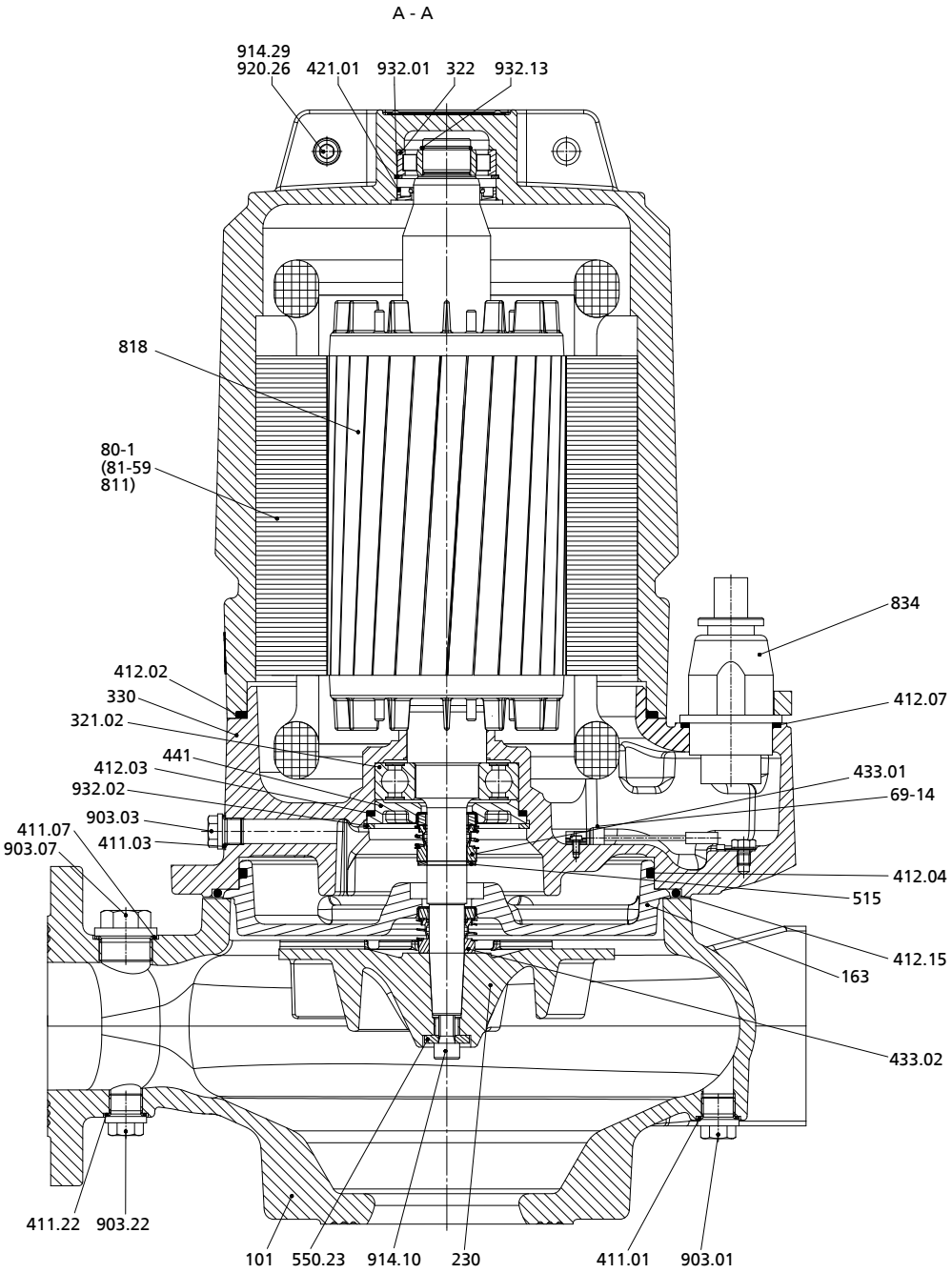
Table 23: Trouble-shooting

A	B	C	D	E	Possible cause	Remedy
-	✗	-	-	-	Pump delivers against an excessively high pressure.	Re-adjust to duty point.
-	✗	-	-	-	Gate valve in the discharge line is not fully open.	Fully open the gate valve.
-	-	✗	-	✗	Pump is running in the off-design range (low flow/overload).	Check the pump's operating data.
✗	-	-	-	-	Pump or piping are not completely vented.	Vent and/or prime the pump and piping; fit a vent valve if required.
✗	✗	-	✗	✗	Inlet line clogged by deposits	Clean the intake or inlet line, pump components and lift check valve.
-	-	✗	-	✗	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.
-	✗	✗	✗	✗	Wear	Replace worn components by new ones.
✗	✗	-	✗	-	Defective riser (pipe and sealing element)	Replace defective riser pipes, replace sealing elements.
-	✗	-	✗	✗	Impermissible air or gas content in the fluid handled	Contact KSB.
-	-	-	-	✗	System-induced vibrations	Contact KSB.
-	✗	✗	✗	✗	Wrong direction of rotation	Check the electrical connection of motor and control system, if any.
-	✗	-	✗	-	Wrong supply voltage	Check the power cable. Check the cable connections.
✗	-	-	-	-	No voltage	Check the electrical installation. Contact the energy supplier.
-	-	-	-	✗	Worn or defective rolling element bearings	Contact KSB.
-	✗	-	✗	-	In case of star-delta configuration: motor running in star configuration only	Check star-delta contactor.
✗	-	-	-	-	Defective motor winding	Contact KSB.
-	✗	-	-	-	Suction lift is too high, NPSHavailable (positive suction head) is too low.	Check the inlet line for clogging, clean if necessary; fully open the shut-off element in the inlet line.
✗	-	-	-	-	Motor has been tripped by leakage monitor.	Have cause determined and eliminated by qualified and trained personnel.
✗	-	-	-	-	The thermistor tripping unit with manual reset for temperature limiter has tripped the pump as a result of the permissible winding temperature being exceeded.	Have cause determined and eliminated by qualified and trained personnel.

9 Related Documents

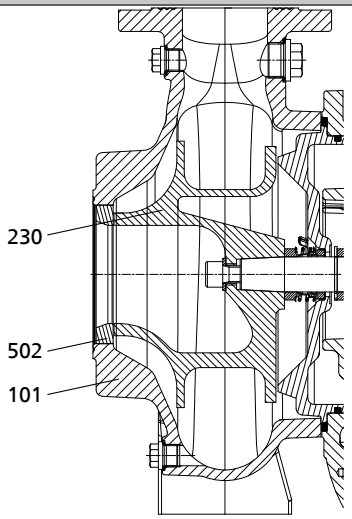
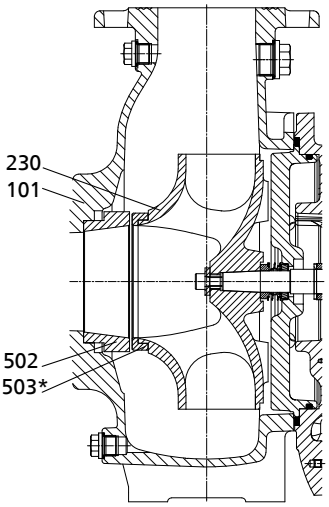
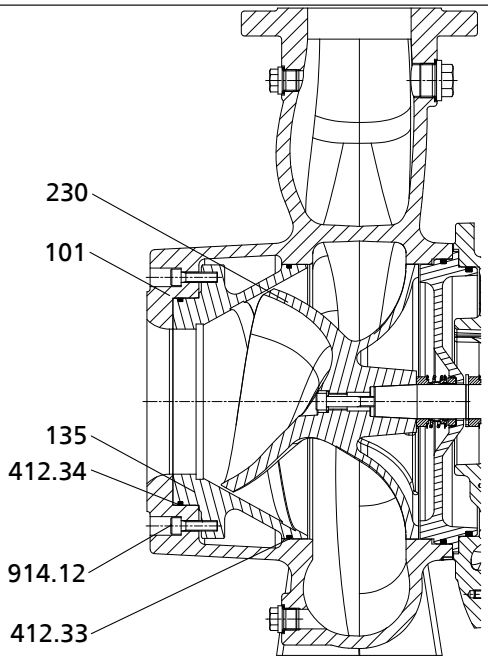
9.1 General assembly drawing

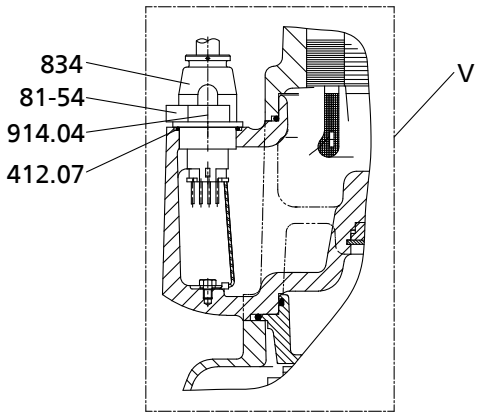
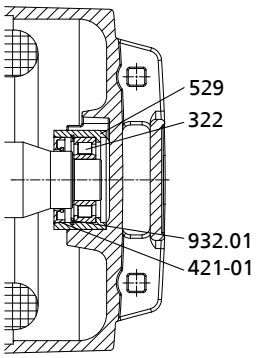
Motors
4 4, 5 4, 7 4,
4 6, 6 6



General assembly drawing (impeller type F)

Table 24: Detailed views of the general assembly drawing

Section	Detailed view
Impeller type E	
Impeller type K * If applicable	
Impeller type D	

Section	Detailed view
Cable gland	
Upper bearing **Motors** 4 4, 5 4, 4 6	

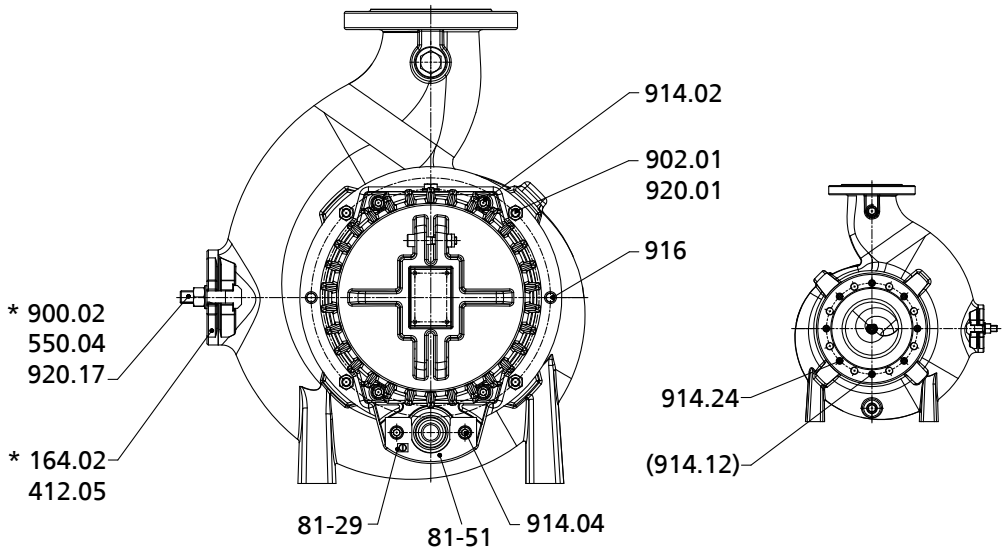
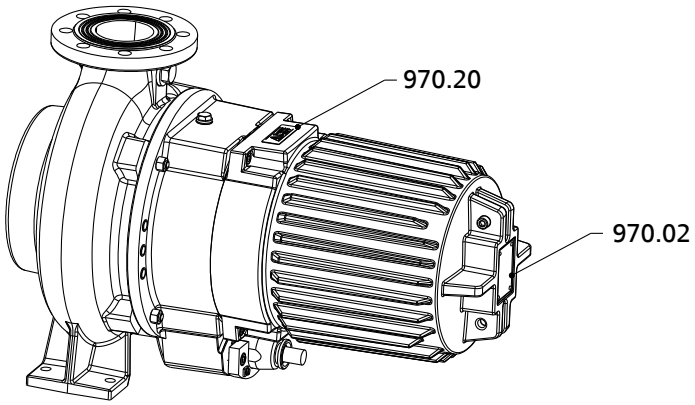
Section	Detailed view
Connections	 * Not for impeller type F/E 80-250 impeller type D 80-315
Plates	

Table 25: List of components

Part No.	Description	Part No.	Description
69-14	Leakage monitor	433.01/.02	Mechanical seal
80-1	Motor unit	441	Shaft seal housing
81-29	Terminal	502	Casing wear ring
81-51	Clamping element	503[8)]	Impeller wear ring
101	Pump casing	515	Locking ring
135	Wear plate	529	Bearing sleeve
163	Discharge cover	550.04/.23	Disc
164.02[9)]	Inspection cover	818	Rotor
230	Impeller	834	Cable gland
321.02	Radial ball bearing	900.02[9)]	Screw
322	Radial roller bearing	902.01	Stud
330	Bearing bracket	903.01/.03/.07/.22	Screw plug
411.01/03/07/22/	Joint ring	914.02/.04/.10/.12/.24/.26	Hexagon socket head cap screw

8) If any

9) Not for F,E 80-250; D 80-315

Part No.	Description	Part No.	Description
412./.02/.03/.04/.05/.07/.15/.33/.34	O-ring	916	Plug
421.01	Lip seal	920.01/.17/.26	Nut
		932.01/.02/.13	Circlip

9.2 Wiring diagram

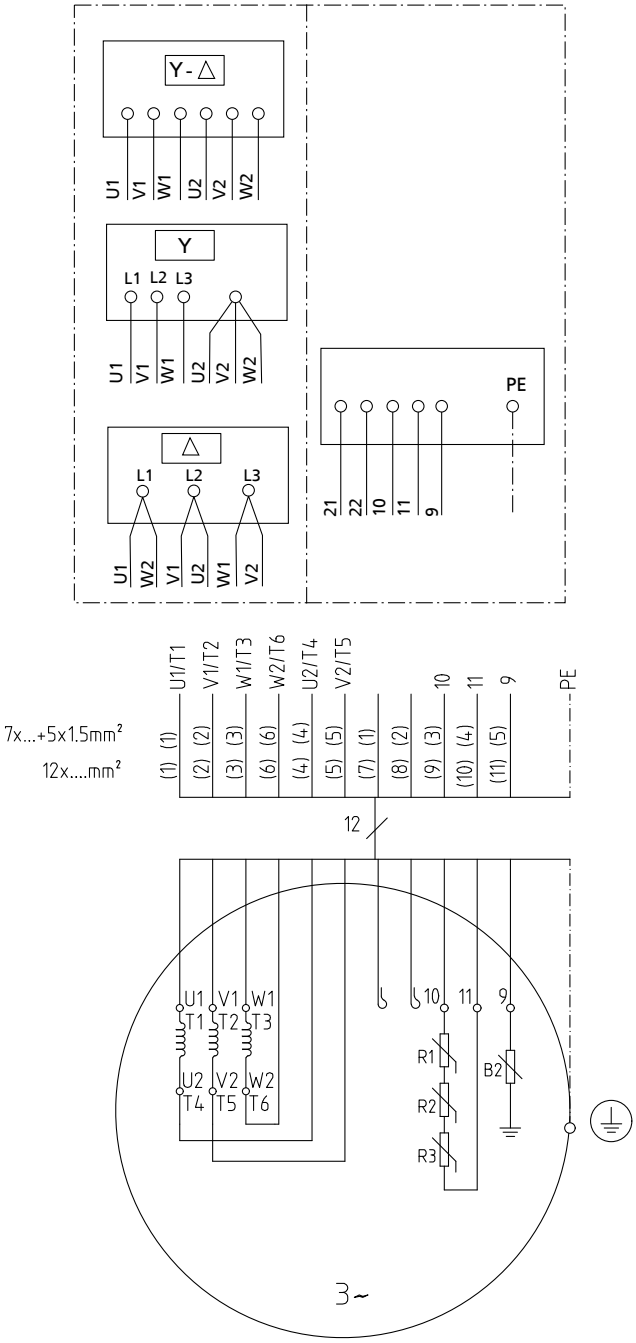
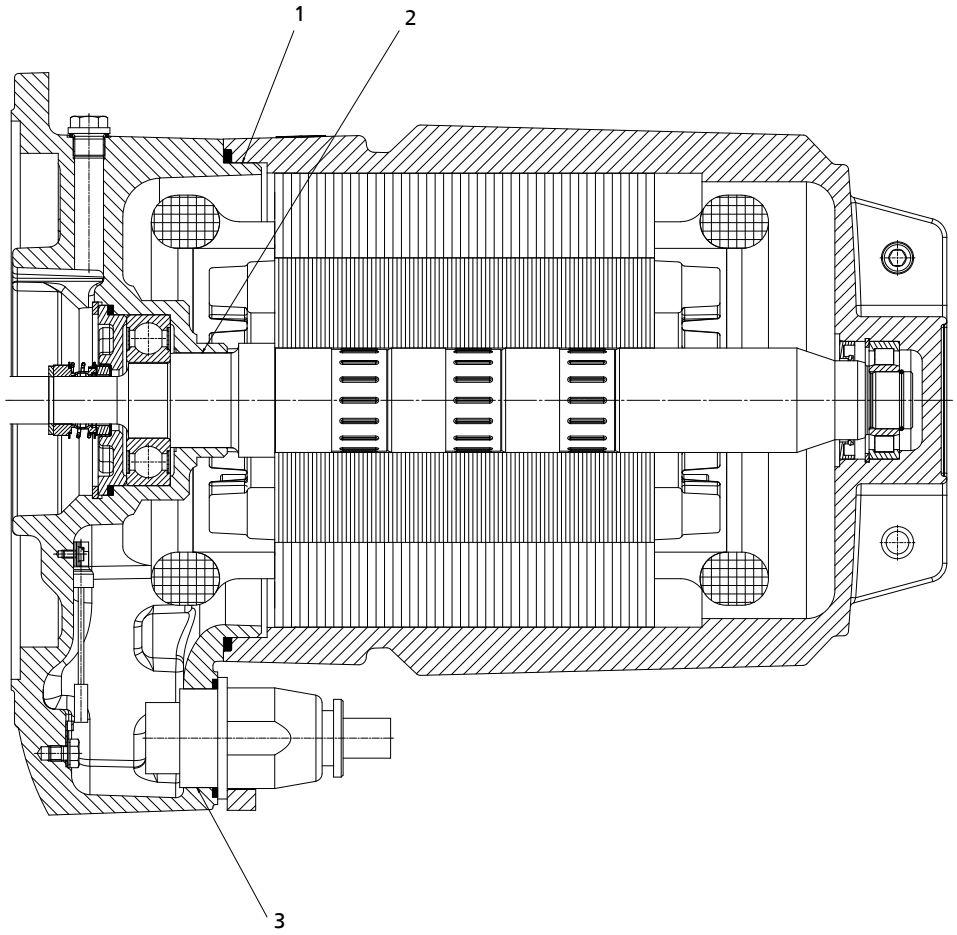


Fig. 20: Wiring diagram

R1-R3	Temperature sensor	B2	Leakage monitor

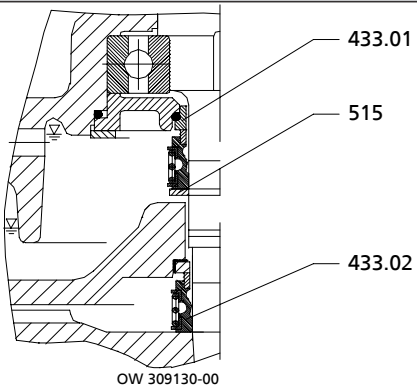
9.3 Flamepaths on explosion-proof motors

Table 26: Overview of flamepaths

Motors	Pump set	
4 4, 5 4, 7 4, 4 6, 6 6		
	1,2, 3	Flamepaths

9.4 Installation drawings of the mechanical seal

Table 27: Sectional drawings of the mechanical seal

Section	Sectional drawing		
Motors 4 4, 5 4, 7 4, 4 6, 6 6	433.01	Mechanical seal (bellows-type mechanical seal)	
	515	Locking ring	
	433.02	Mechanical seal (bellows-type mechanical seal)	

10 EU 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
  - 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 EU Declaration of Conformity was issued in/on:

Place, date

.....[10)].....

Name

Function
Company
Address

10) A signed, legally binding EU Declaration of Conformity is supplied with the product.

11 Certificate of Decontamination

Type: .....
Order number/
Order item number[11]: .....

Delivery date: .....

Field of application: .....

Fluid handled[11]: .....

Please tick where applicable[11]:

☐
Radioactive

☐
Explosive

☐
Corrosive

☐
Toxic

☐
Harmful

☐
Bio-hazardous

☐
Highly flammable

☐
Safe

Reason for return[11]: .....

Comments: .....

.....

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

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

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

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

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

.....

.....

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

.....	.....	.....
Place, date and signature	Address	Company stamp

11) Required fields

Index

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