

Submersible Pump in Discharge Tube

Amacan K

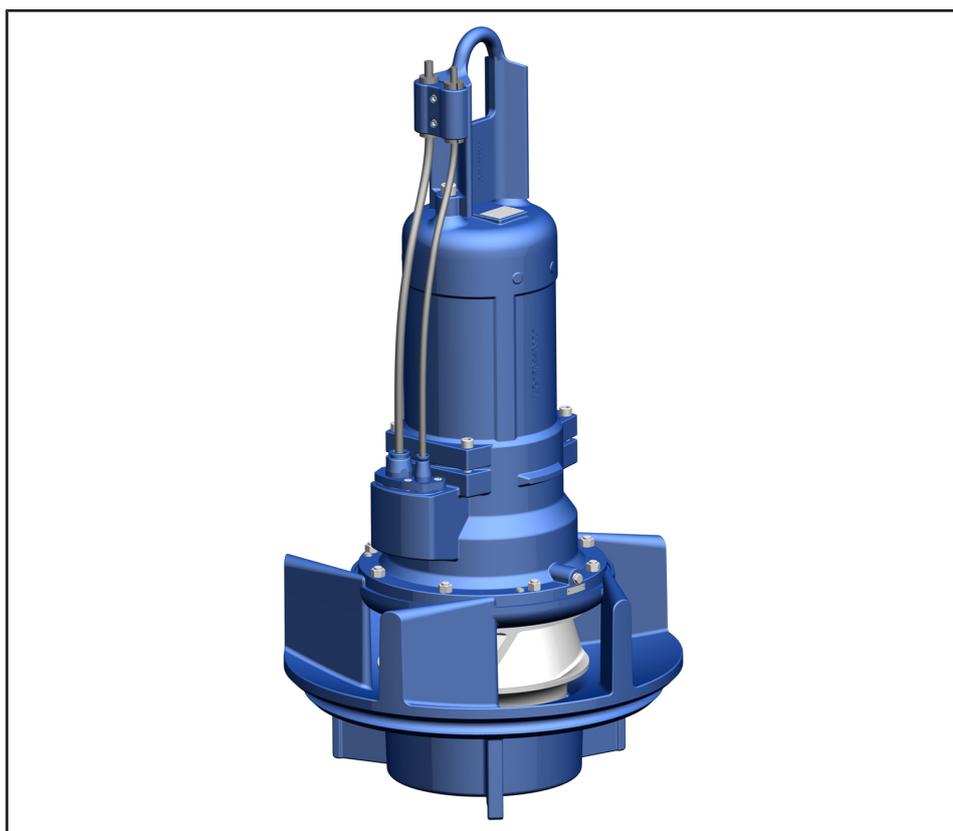
Sizes: 700-324 to 800-401

4 Poles: 30 4.E to 75 4.E

6 Poles: 22 6.E to 55 6.E

8 Poles: 11 8.E to 45 8.E

Installation/Operating Manual



Mat. No.: 05150169

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Installation/Operating Manual Amacan K

Original operating manual

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Glossary

Back pull-out unit

Pump without pump casing; partly completed machinery

Certificate of decontamination

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

Close-coupled design

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

Submersible pump in discharge tube

A submersible motor pump which is completely submerged and suspended in a discharge tube

1 General

1.1 Principles

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

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

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

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

1.2 Installation of partly completed machinery

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

1.3 Target group

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

1.4 Other applicable documents

Table 1: Overview of other applicable documents

Document	Contents
Data sheet	Description of the technical data of the pump (set)
Hydraulic characteristic curve	Characteristic curves showing head, NPSH required, 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

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

1.5 Symbols

Table 2: Symbols used in this manual

Symbol	Description
✓	Conditions which need to be fulfilled before proceeding with the step-by-step instructions
▷	Safety instructions
⇒	Result of an action
⇔	Cross-references
1. 2.	Step-by-step instructions
	Note Recommendations and important information on how to handle the product

¹⁾ If included in agreed scope of supply

1.6 Key to safety symbols/markings

Table 3: Definition of safety symbols/markings

Symbol	Description
	DANGER This signal word indicates a high-risk hazard which, if not avoided, will result in death or serious injury.
	WARNING This signal word indicates a medium-risk hazard which, if not avoided, could result in death or serious injury.
	CAUTION This signal word indicates a hazard which, if not avoided, could result in damage to the machine and its functions.
	Explosion protection This symbol identifies information about avoiding explosions in potentially explosive atmospheres in accordance with the UK regulation titled Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 2016.
	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 Safety

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

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

2.1 General

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

2.2 Intended use

- The pump (set) must only be operated in the fields of application and within the use limits specified in the other applicable documents.
- Only operate pumps/pump sets which are in perfect technical condition.
- Do not operate the pump (set) in partially assembled condition.
- Only use the pump to handle the fluids described in the data sheet or product literature of the pump model or variant.
- Never operate the pump without the fluid to be handled.
- Observe the limits for continuous duty 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).
- Observe the minimum flow rate and maximum flow rate indicated in the data sheet or product literature (to prevent overheating, mechanical seal damage, cavitation damage, bearing damage, etc).
- Always operate the pump (set) in the direction of rotation it is intended for.

2.2.1 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 application and operating limits specified in the data sheet or product literature regarding pressure, temperature, etc.
- Observe all safety information and instructions in this manual.

2.3 Personnel qualification and training

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

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

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

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

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

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

2.5 Safety awareness

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

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

2.6 Safety information for the operator/user

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

2.7 Safety information for maintenance, inspection and installation

- Modifications or alterations of the pump (set) are only permitted with the manufacturer's prior consent.
- Use only original spare parts or parts/components authorised by the manufacturer. The use of other parts/components can invalidate any liability of the manufacturer for resulting damage.
- The operator ensures that maintenance, inspection and installation are performed by authorised, qualified specialist personnel who are thoroughly familiar with the manual.
- Only carry out work on the pump (set) during standstill of the pump.

- Only perform work on the pump set when it has been disconnected from the power supply (de-energised).
- The pump (set) must have cooled down to ambient temperature.
- Pump pressure must have been released and the pump must have been drained.
- When taking the pump set out of service always adhere to the procedure described in the manual. (⇒ Section 6.3, Page 48)
- Decontaminate pumps which handle fluids posing a health hazard.
- As soon as the work has been completed, re-install and re-activate any safety-relevant devices and protective devices. Before returning the product to service, observe all instructions on commissioning. (⇒ Section 6.1, Page 44)

2.8 Unauthorised modes of operation

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

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

2.9 Explosion protection

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

Sections of the manual marked by the symbol opposite apply to explosion-proof pump sets also when temporarily operated outside potentially explosive atmospheres.

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

Special conditions apply to the operation of explosion-proof pump sets in accordance with the UK's *Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 2016*.

Especially adhere to the sections in this manual marked with the symbol opposite. The explosion-proof status of the pump is only assured if the pump is used in accordance with its intended use.

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

Prevent impermissible modes of operation.

2.9.1 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/Storage/Disposal

3.1 Checking the condition upon delivery

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

3.2 Transport

	DANGER
	<p>Improper transport Danger to life from falling parts! Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Use the attachment point provided for attaching the lifting accessory. ▷ Never lift the pump set by the electric cables. ▷ Use the lifting chain/rope included in the scope of supply exclusively for lowering or 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 the regional transport regulations. ▷ Observe the documentation of 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.

3.2.1 Transporting the pump set to the place of installation

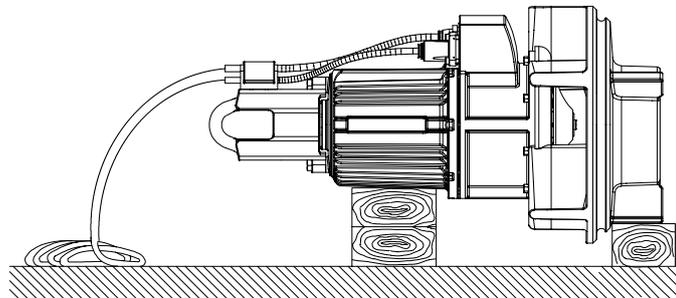


Fig. 1: Transport the pump set in its original packaging

- The pump set is supplied in a horizontal position on a suitable transport support.
- Use suitable lifting equipment to transport the pump set in its original packaging to its place of installation.
 Observe the marked centres of gravity and/or attachment points on the transport boxes!
 For the weight refer to the name plate or data sheet. (⇒ Section 4.4, Page 19)

3.2.2 Placing the pump set in a vertical or horizontal position

	WARNING
	<p>Pump set tilting Risk of squashing hands and feet!</p> <ul style="list-style-type: none"> ▷ Suspend or support the pump set.

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	<p>⚠ WARNING</p> <p>Placing the pump set on unsecured and uneven surfaces Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▷ Always place the pump set on a solid and level surface with the pump set in a vertical position and the motor on top. ▷ Only place the pump set on a surface of sufficient load-carrying capacity. ▷ Use appropriate means to secure the pump set against tilting or tipping over. ▷ Refer to the weights given in the data sheet/on the name plate.
	<p>⚠ WARNING</p> <p>Incorrect handling of the electric cable Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▷ Secure electric cables against falling down. ▷ Avoid electric cables being laid on surfaces without fastening. ▷ When moving the pump set keep at a safe distance to the electric cables.
	<p>⚠ WARNING</p> <p>Improper handling when placing the pump set in a vertical/horizontal position Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▷ Select suitable lifting equipment for the size of the pump. ▷ Use appropriate means to secure the pump set against tilting, tipping over or rolling off. ▷ Maintain a safe distance during lifting operations (load may swing when being lifted). ▷ Use additional supports for the transport holder to secure it against tilting.
	<p>⚠ WARNING</p> <p>Improper lifting/moving of heavy assemblies or components Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▷ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.
	<p>CAUTION</p> <p>Improper storage Damage to the electric cables!</p> <ul style="list-style-type: none"> ▷ Support the electric cables at the cable gland to prevent permanent deformation. ▷ Only remove the protective caps from the electric cables at the time of installation.

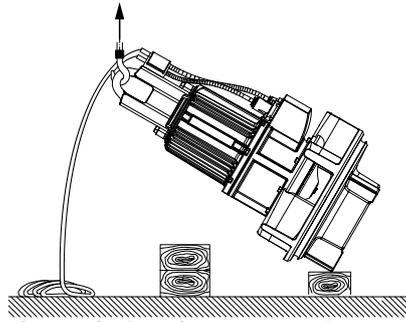


Fig. 2: Placing the pump set in an upright position

- ✓ Suitable lifting equipment has been selected.
 1. Attach the crane hook to the hoop of the pump set.
 2. Lift the pump set with the lifting equipment (e.g. crane).
 - ⇒ Guiding the pump set over the inlet of the pump casing is only permissible on a wooden base!
 - ⇒ Protect the power cable against kinking!
 3. Place the pump set on a level, clean surface and protect it against overturning or tipping over.

3.2.3 Transporting the pump set

	<p>⚠ WARNING</p>
	<p>Incorrect positioning/placing down Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▷ Position the pump set vertically with the motor on top. ▷ Use appropriate means to secure the pump set against tilting and tipping over. ▷ Refer to the weights given in the data sheet/on the name plate.
	<p>⚠ WARNING</p>
	<p>Incorrect handling of the power cable Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▷ Secure the power cable against falling down.
	<p>⚠ WARNING</p>
	<p>Improper lifting/moving of heavy assemblies or components Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▷ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.
	<p>⚠ WARNING</p>
	<p>Improper handling when placing the pump set in a vertical/horizontal position Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▷ Select suitable lifting equipment for the size of the pump. ▷ Use appropriate means to secure the pump set against tilting, tipping over or rolling off. ▷ Maintain a safe distance during lifting operations (load may swing when being lifted). ▷ Use additional supports for the transport holder to secure it against tilting.

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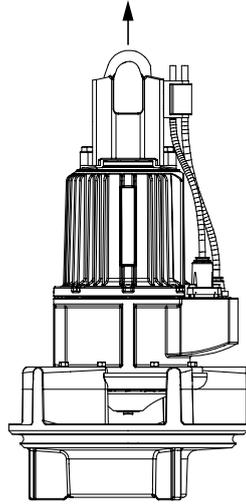


Fig. 3: Transporting the pump set in a vertical position

Use suitable lifting equipment to transport the pump set in the illustrated position.

3.3 Storage/preservation

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

Store the pump set as follows:

- In its original packaging: in a horizontal position
- Without packaging: in a vertical position with the motor on top

	<p>⚠ WARNING</p> <p>Pump set tilting Risk of squashing hands and feet!</p> <ul style="list-style-type: none"> ▷ Suspend or support the pump set.
	<p>CAUTION</p> <p>Improper storage Damage to the electric cables!</p> <ul style="list-style-type: none"> ▷ Support the electric cables at the cable gland to prevent permanent deformation. ▷ Only remove the protective caps from the electric cables at the time of installation.
	<p>CAUTION</p> <p>Damage during storage due to humidity, dirt or vermin Corrosion/contamination of pump (set)!</p> <ul style="list-style-type: none"> ▷ For outdoor storage cover the pump (set) and accessories with waterproof material and protect against condensation.
	<p>CAUTION</p> <p>Wet, contaminated or damaged openings and connections Leakage or damage to the pump!</p> <ul style="list-style-type: none"> ▷ Clean and cover pump openings and connections as required prior to putting the pump into storage.

Table 4: 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 in dry, vibration-free conditions and, if possible, in its original packaging.
 1. Rotate the impeller by hand once every three months.
 2. Spray-coat the inside wall of the pump casing and, in particular, the impeller clearance areas with a preservative.

	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 7.3.2, Page 55)
2. Flush and clean the pump, particularly if it has been used for handling noxious, explosive, hot or other hazardous fluids.
3. If the pump has handled fluids whose residues could lead to corrosion damage in the presence of atmospheric humidity or could ignite upon contact with oxygen, the pump must also be neutralised, and anhydrous inert gas must be blown through the pump to ensure drying.
4. Always complete and enclose a certificate of decontamination when returning the pump.
Indicate any safety measures and decontamination measures taken.
(⇒ Section 11, Page 101)

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

3.5 Disposal

	⚠ WARNING
	<p>Fluids, consumables and supplies posing a health hazard Hazard to persons and the environment!</p> <ul style="list-style-type: none"> ▷ Collect and dispose of any preservatives, flushing liquids and fluid residues. ▷ 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 product.
Collect greases and other lubricants during dismantling.
2. Separate and sort the 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.

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Electrical or electronic equipment marked with the adjacent symbol must not be disposed of in household waste at the end of its service life.

Contact your local waste disposal partner for returns.

If the used electrical or electronic equipment contains personal data, the operator is responsible for deleting it before the equipment is returned.

4 Description of the Pump (Set)

4.1 General description

- Submersible pump in discharge tube

Pump set for handling river water and stormwater, pre-screened domestic and industrial waste water as well as activated sludge

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

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

4.3 Designation

Example: Amacan K 800-400 / 22 6 UE G - IE3

Table 5: Designation key

Code	Description	
Amacan	Type series	
K	Impeller type	
	K	Channel impeller
800	Nominal diameter of the discharge tube [mm]	
400	Nominal impeller diameter [mm]	
22	Motor size	
6	Number of motor poles	
UE	Motor version	
	UE	Non-explosion-proof, for fluid temperatures of up to 40 °C
	XE	Explosion protection $\text{Ex II 2G Ex db h IIB T3 Gb}$, for fluid temperatures of up to 40 °C
	YE	Explosion protection $\text{Ex II 2G Ex db h IIB T4 Gb}$, for fluid temperatures of up to 40 °C
G	Material variant	
	G	Impeller made of grey cast iron, standard variant
	G1	Like G, with impeller made of duplex stainless steel
IE3	Motor efficiency classification ²⁾	
	.. ³⁾	No efficiency classification
	IE2	High Efficiency
	IE3	Premium Efficiency

²⁾ The IEC 60034-30 standard is not binding for submersible motor pumps. Efficiencies are calculated / determined by analogy with the measurement method specified in IEC 60034-2. The marking is used for submersible motors that achieve efficiency levels similar to those of standardised motors acc. to the IEC 60034-30 standard.

³⁾ Blank

4.4 Name plate

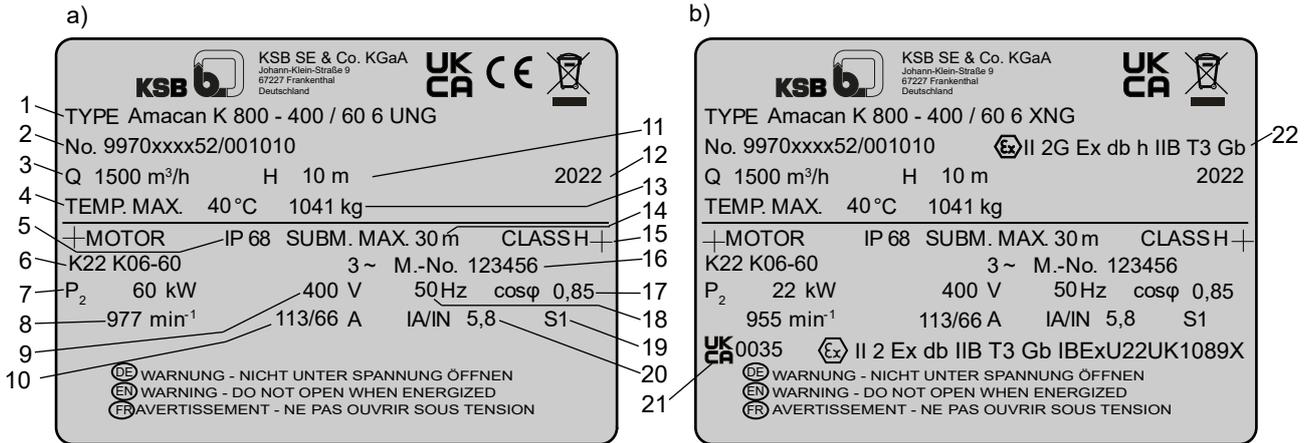


Fig. 4: Name plate (example) a) Standard pump set b) Explosion-proof pump set

1	Designation	2	KSB order number
3	Flow rate	4	Maximum fluid temperature and ambient temperature
5	Enclosure	6	Motor type
7	Rated power	8	Rated speed
9	Rated voltage	10	Rated current
11	Head	12	Year of construction
13	Total weight	14	Maximum submergence
15	Thermal class of winding insulation	16	Motor number
17	Power factor at rated operating point	18	Rated frequency
19	Duty type	20	Starting current ratio
21	Marking for potentially explosive atmospheres, submersible motor	22	Marking for potentially explosive atmospheres, pump set

4.5 Design details

Design

- Fully floodable submersible pump in discharge tube (submersible motor pump)
- Not self-priming
- Close-coupled design
- Single-stage
- Vertical installation

Installation

- Application-oriented installation types (⇒ Section 4.6, Page 20)

Drive

- Three-phase asynchronous squirrel-cage motor
- Type of protection Ex db IIB (applies to explosion-proof pump sets only)
- Enclosure: IP68 to EN 60529/IEC529

Shaft seal

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

Impeller type

- Application-oriented impeller type

Bearings

Drive end:

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

Pump-end:

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

4.6 Installation types

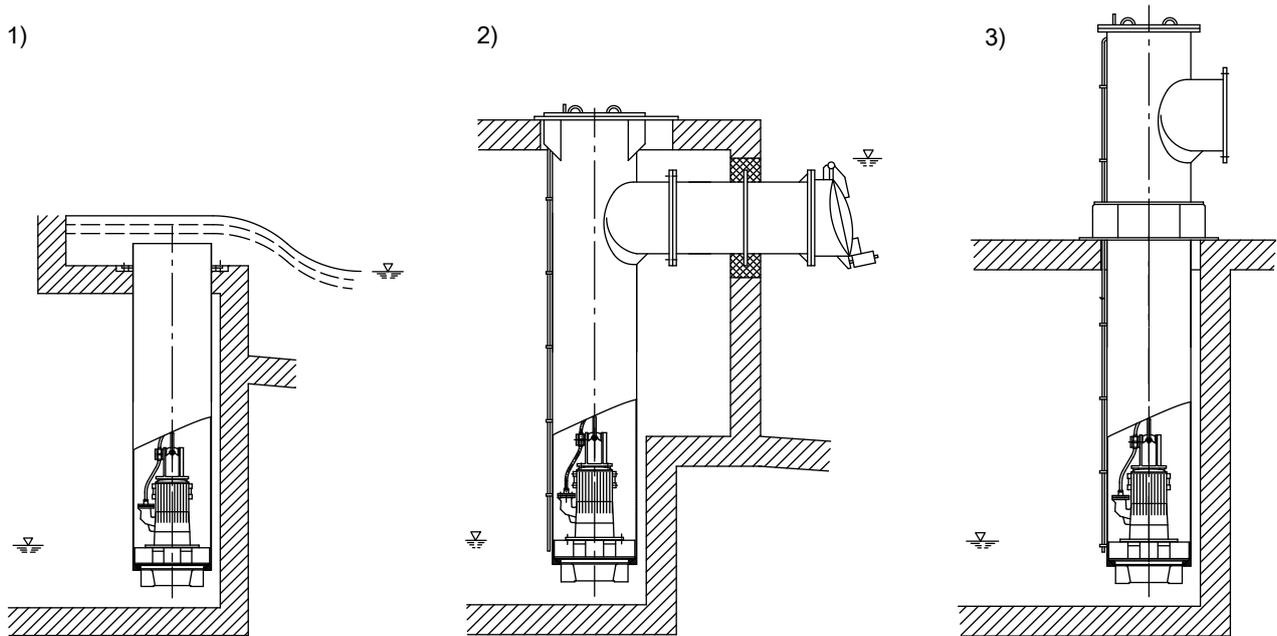


Fig. 5: Overview of installation types

1)	Installation type BU (overflow design)
2)	Installation type CU (underfloor discharge)
3)	Installation type DU (above-floor discharge nozzle)

4.7 Configuration and function

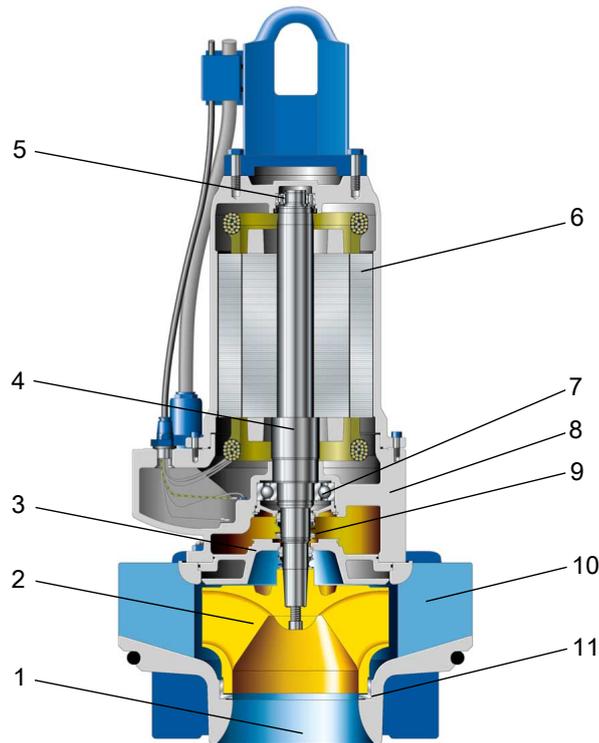


Fig. 6: Sectional drawing of an Amacan K

1	Inlet of the pump casing	7	Bearing, impeller end
2	Impeller	8	Bearing housing
3	Discharge cover	9	Shaft seal
4	Shaft	10	Pump casing
5	Bearing, drive end	11	Casing wear ring
6	Electric motor		

Design The pump is designed with an axial fluid inlet and a radial fluid 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 inlet of the pump casing (1) and is accelerated outward in a radial flow by the rotating impeller (2). The required energy is transmitted from the electric motor (6) to the impeller (2) via the shaft (4). In the pump casing (10) the kinetic energy of the fluid is converted into pressure energy. The rotational movement diverts the fluid flow in axial direction. The casing wear ring (11) prevents any fluid from flowing back from the casing into the inlet of the pump casing. At the rear side of the impeller, the shaft enters the hydraulic system via the discharge cover (3). The shaft passage through the discharge cover is sealed to the fluid handled with a shaft seal (9). The shaft runs in rolling element bearings (5, 7), which are supported by a bearing housing (8) and motor housing.

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.

Monitoring equipment The pump sets are equipped with various sensors.

Standard

- Temperature monitoring of the motor
- Leakage sensors in the motor

Option

- Temperature monitoring at the lower bearing

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
- O-ring
- Back-up name plate

Optional accessories:

- Support rope
- Accessories for installing the cable guide:
 - Fitting
 - Turnbuckle
 - Support
 - Shackle
 - Cable clamps
- Cable support sleeves
- Discharge tube

4.9 Dimensions and weights

For dimensions and weights refer to the name plate or data sheet of the pump set.

5 Installation at Site

5.1 Safety regulations

	<p>⚠ DANGER</p> <p>Improper installation in potentially explosive atmospheres Explosion hazard! Damage to the pump set!</p> <ul style="list-style-type: none"> ▸ Comply with the applicable local explosion protection regulations. ▸ Observe the information in the data sheet and on the name plates of pump and motor.
	<p>⚠ DANGER</p> <p>Persons in the intake chamber during pump set operation Electric shock! Risk of injury!</p> <ul style="list-style-type: none"> ▸ Never start up the pump set when there are persons in the intake chamber.
	<p>⚠ WARNING</p> <p>Impermissible solid objects (tools, screws/bolts or similar) in the pump sump/inlet tank during pump start-up Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▸ Check the pump sump/inlet tank for impermissible solid objects before flooding, and remove, if necessary.

5.2 Checks to be carried out prior to installation

5.2.1 Checking the structural requirements

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

5.2.2 Checking the operating data

Before inserting the pump set into the discharge tube, verify the data on the name plate against the data given in the purchase order and the system data.

Back-up name plate

KSB's scope of supply includes a separate name plate attached to the end of the pump cable which indicates the pump and motor data.

1. Attach this name plate in a clearly visible position outside the discharge tube, e.g. at the control cabinet, pipeline or mounting bracket.

5.2.3 Checking the lubricant of the mechanical seal

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

The pump set is supplied in a horizontal position on a suitable transport support.

Visual inspection for signs of oil leakage

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

	 WARNING
	<p>Incorrect positioning/placing down Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▷ Position the pump set vertically with the motor on top. ▷ Use appropriate means to secure the pump set against tilting and tipping over. ▷ Refer to the weights given in the data sheet/on the name plate.

- ✓ Signs of oil leakage have been detected.
 1. Place the pump set in a vertical position. (⇒ Section 3.2.2, Page 12)
 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 7.4.1.4.2, Page 58)
 5. Fit screw plug 903.03 together with a new joint ring 411.03.

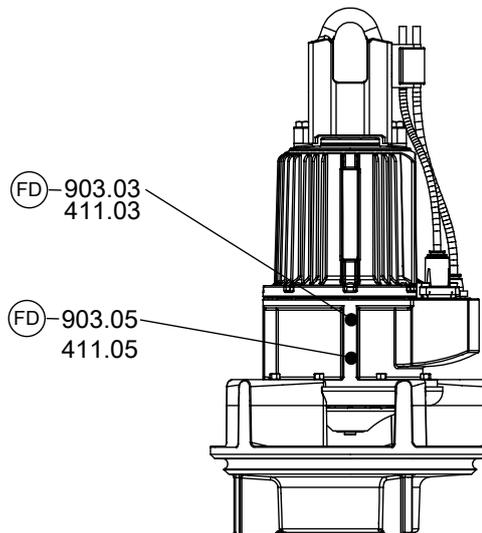


Fig. 7: Checking the lubricant level

903.03 411.03	Lubricant filler opening	903.05 411.05	Lubricant drain
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Table 6: Symbols key

Symbol	Description
	Always apply a liquid sealant (e.g. Hylomar SQ32M) to sealing surfaces marked with this symbol.

	NOTE
	<p>If more than 1.5 litres of lubricant are required for topping up, this suggests a defect of the mechanical seals.</p>

5.2.4 Checking the direction of rotation

	<div style="background-color: #e67e22; color: white; padding: 5px;">⚠ DANGER</div> <p>Pump set running dry Explosion hazard!</p> <ul style="list-style-type: none"> ▷ Check the direction of rotation of explosion-proof pump sets outside potentially explosive atmospheres.
	<div style="background-color: #f1c40f; color: white; padding: 5px;">⚠ WARNING</div> <p>Improper handling when placing the pump set in a vertical/horizontal position Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▷ Select suitable lifting equipment for the size of the pump. ▷ Use appropriate means to secure the pump set against tilting, tipping over or rolling off. ▷ Maintain a safe distance during lifting operations (load may swing when being lifted). ▷ Use additional supports for the transport holder to secure it against tilting.
	<div style="background-color: #f1c40f; color: white; padding: 5px;">⚠ WARNING</div> <p>Improper positioning of pump set when checking the direction of rotation Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▷ Use appropriate means to secure the pump set against tilting or tipping over.
	<div style="background-color: #f1c40f; color: white; padding: 5px;">⚠ WARNING</div> <p>Hands or foreign objects in the pump casing Risk of injuries, damage to the pump!</p> <ul style="list-style-type: none"> ▷ Never insert your hands or any other objects into the pump. ▷ Check that the inside of the pump is free from any foreign objects. ▷ Take suitable precautions (e.g. wear safety goggles).
	<div style="background-color: #f1c40f; color: white; padding: 5px;">CAUTION</div> <p>Pump set running dry Increased vibrations! Damage to mechanical seals and bearings!</p> <ul style="list-style-type: none"> ▷ Never operate the pump set for more than 60 seconds without the fluid handled.

Check the direction of rotation before installing the pump set, i.e. in dry condition.

1. Place the pump set in a vertical position on a level surface and secure it sufficiently against tipping over.
2. Connect the pump set to the power supply and start it up.
3. Use one of the following options to check the direction of rotation:
 - ⇒ 1. Look down into the pump casing and check that the impeller is turning clockwise.
 - ⇒ 2. Verify the direction of rotation of the impeller. The direction of rotation of the impeller must match the arrow indicating the direction of rotation on the bearing housing.
4. If the impeller rotates in the wrong direction of rotation, check and correct the electrical connection and the control system if applicable. Then check the direction of rotation again.

5. If the direction of rotation is correct, mark which core ends match which of the terminals in the control cabinet.
6. Disconnect the pump set from the power supply and secure it against unintentional start-up.

	WARNING
	<p>Unintentional starting of the pump set Risk of injury by moving components and shock currents!</p> <ul style="list-style-type: none"> ▷ Ensure that the pump set cannot be started unintentionally. ▷ Always make sure the electrical connections are disconnected before carrying out work on the pump set.

5.3 Lowering the pump set into the discharge tube

	DANGER
	<p>Improper transport Danger to life from falling parts! Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Use the attachment point provided for attaching the lifting accessory. ▷ Never lift the pump set by the electric cables. ▷ Use the lifting chain/rope included in the scope of supply exclusively for lowering or 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 the regional transport regulations. ▷ Observe the documentation of 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.

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

	WARNING
	<p>Incorrect handling of the electric cable Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▷ Secure electric cables against falling down. ▷ Avoid electric cables being laid on surfaces without fastening. ▷ When moving the pump set keep at a safe distance to the electric cables.

	<p>⚠ WARNING</p>
	<p>People falling into the unsecured discharge tube Risk of personal injury!</p> <ul style="list-style-type: none"> ▷ Take suitable precautions during the entire installation/removal process to protect people from falling into the open discharge tube. ▷ Fence off the work area appropriately.

5.3.1 Installation without support rope

	<p>CAUTION</p>
	<p>Incorrect installation Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Verify that the pump set is correctly seated in the discharge tube.

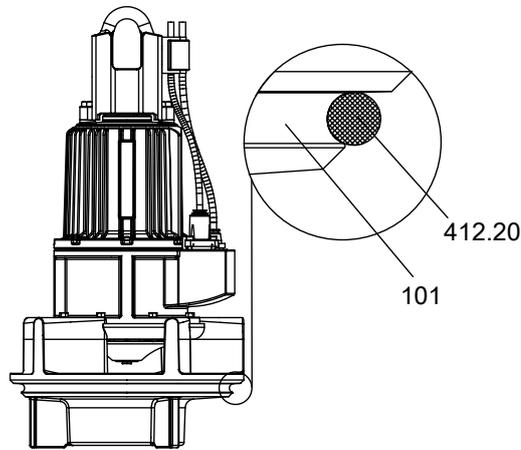


Fig. 8: Inserting the O-ring

Refer to and comply with the general arrangement drawing/outline drawing when installing the pump set.

1. If O-ring 412.20 is supplied but not fitted, insert it into pump casing 101.
2. Attach the crane hook to the bail of the pump set.
3. Centre the pump set above the discharge tube. Slowly lower the pump set into the discharge tube until it is seated in the recommended position.
4. Pull the electric cables up by hand. Fasten them to the sump construction with a cable support sleeve if required. Do not lift the pump set out of its seat.

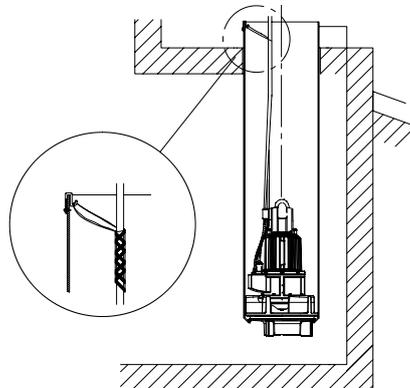


Fig. 9: Fastening the cable support sleeve

5.3.2 Installing the pump set with a support rope

Refer to and comply with the general arrangement drawing/outline drawing when installing the pump set.

Prior to installing the pump set, visually inspect the support rope. Do not exceed the permissible load-carrying capacity.

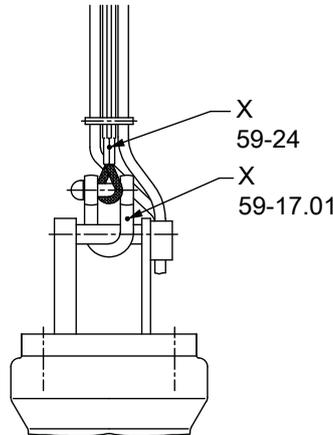


Fig. 10: X = indication of load-carrying capacity

59-24	Support rope
59-17.01	Shackle

	<p>CAUTION</p>
	<p>Incorrect installation Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Verify that the pump set is correctly seated in the discharge tube.
	<p>WARNING</p>
	<p>Pump set drops during the installation or removal process Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▷ Never use the turnbuckle , shackle or discharge tube cover to lift the pump set. ▷ Always use lifting lug 59-47.
	<p>NOTE</p>
	<p>Prior to fitting the turnbuckle, check that the corresponding split pin has not been cracked and/or chipped. If damaged, always use a new split pin.</p>

- ✓ Suitably sized lifting equipment is available.
- ✓ The support rope has been visually inspected.
- ✓ The split pin of the turnbuckle has been checked for any damage.

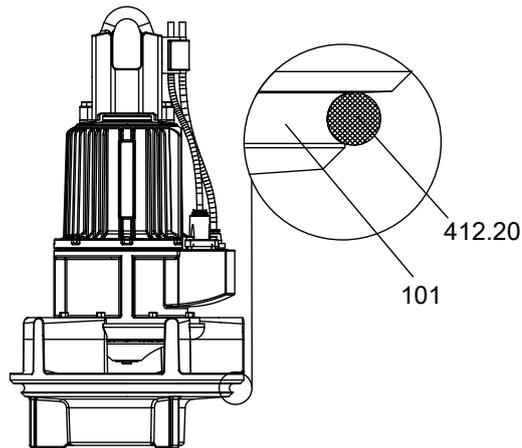


Fig. 11: Inserting the O-ring

1. If O-ring 412.20 is supplied but not fitted, insert it into pump casing 101.

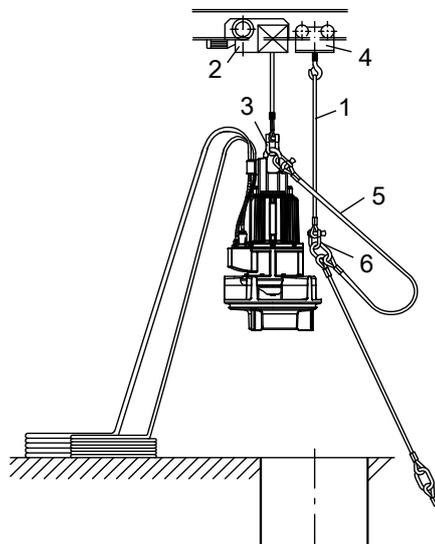


Fig. 12: Lifting and positioning the pump set

2. Secure the lifting chain or lifting rope (1) to the trolley (4) of the lifting equipment (2).
3. Attach the support rope (5) to the bail by its shackle.
For a galvanised shackle, secure the pin at the shackle with Loctite 243.
(⇒ Section 9.3, Page 78)
For a stainless steel shackle, undo and tighten the pin twice and secure it with Loctite 243.
4. Check that the support rope is arranged correctly.
⇒ The free lifting lug (6) has to point away from the pump set
5. Partially unwind the support rope and cables.
6. Lower the pump set into the discharge tube until the bail is in an accessible position, protruding from the discharge tube.
7. Securely cover the discharge tube except for a gap which allows work to continue.
8. Attach the first lifting lug of the support rope (5) to the lifting rope (1) to securely position the pump set above the discharge tube.
9. Unclip the hook of the lifting equipment from the lifting lug of the support rope and run the lifting equipment to a higher level.

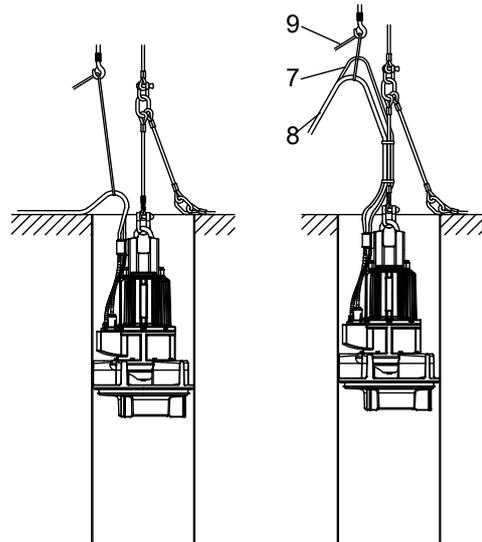


Fig. 13: Securing the control cable and power cables

10. Secure the control cable (7) and power cables (8) to the crane hook (3) of the lifting equipment with a manila rope (9).
11. Trim spacer (a) to fit between the two ferrules.

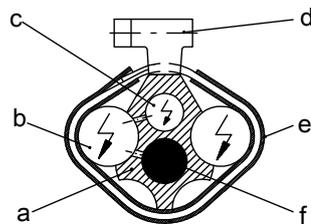


Fig. 14: Cross-section of the cable guide

12. Insert the support rope (f) and the control cable (c) into the spacer (a) and make sure that they are in their respective ducts.
13. Tighten the electric cables with the manila rope running over the crane hook.
14. Insert the power cables (b) into the hollows of the spacer (a).
15. Starting from the bottom, firmly clamp the power cables with hose clips (d) covered by a plastic sheath (e).
16. In the area of the lifting lug between the rope sections, lay all electric cables in loops and fasten them to the rope section above.
17. Progressively lower the pump set into the discharge tube while securing the cable bundle with evenly spaced sheathed hose clips.
18. Fit a heat shrink tube on any protruding sharp-edged rope ends (e.g. at the ferrule) to prevent any damage to the power cables and control cable.

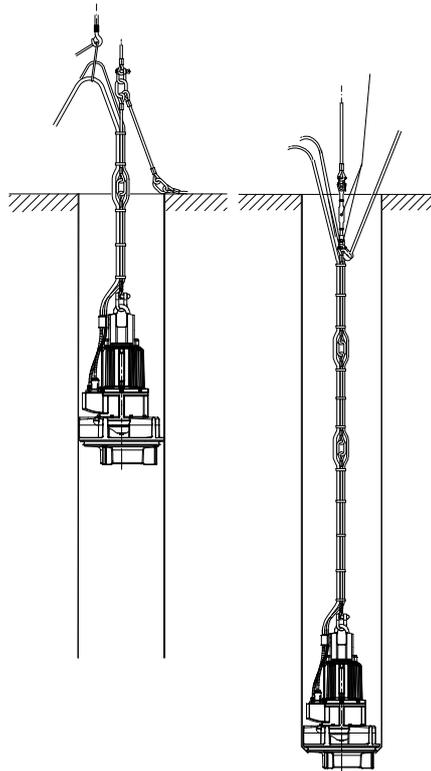


Fig. 15: Lowering the pump set

19. Finally, attach the support rope with shackle and turnbuckle to a suspension loop (provided in the discharge tube or structure). Secure the turnbuckle with a split pin. After inserting the split pin, bend over its two legs.
20. Tighten the turnbuckle until the cables are tight but do not lift the pump off its seat.
21. Unclip the hook of the lifting equipment from the lifting lug, free the electric cables from the manila rope and route them to the control cabinet.
22. Attach the top loose lifting lug to the cables to prevent noise and wear caused by chafing.
23. Remove the safety cover from the discharge tube and mount the discharge tube cover.
24. Seal the cable glands if any.

5.3.3 Installing the pump set with a support rope and support spacer

Refer to and comply with the general arrangement drawing/outline drawing when installing the pump set.

Prior to installing the pump set, visually inspect the support rope. Do not exceed the permissible load-carrying capacity.

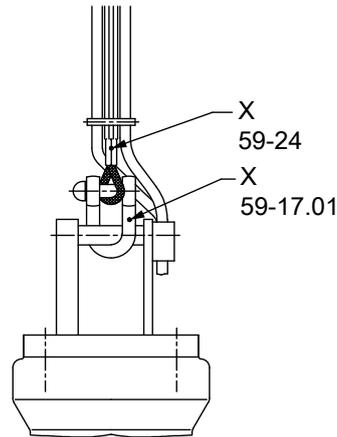
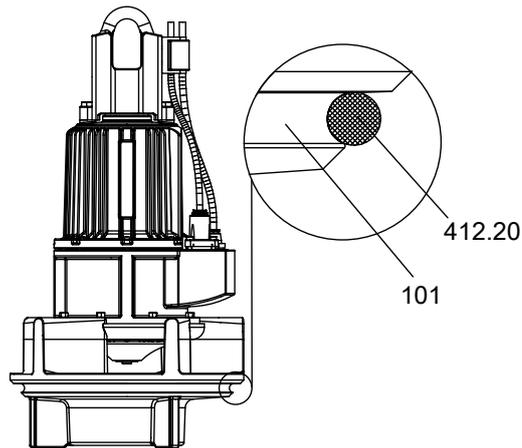


Fig. 16: X = indication of load-carrying capacity

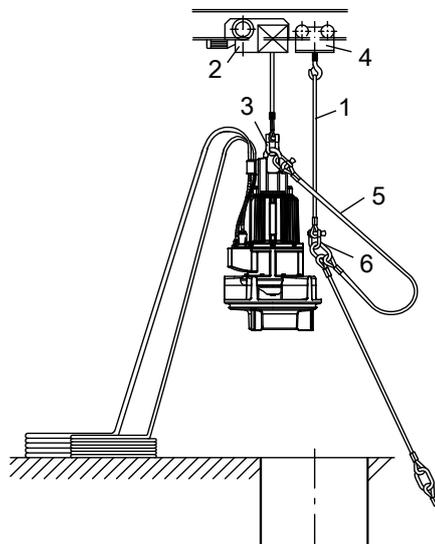
59-24	Support rope
59-17.01	Shackle

	<p>CAUTION</p>
	<p>Incorrect installation Damage to the pump set!</p> <ul style="list-style-type: none"> ▸ Verify that the pump set is correctly seated in the discharge tube.
	<p>WARNING</p>
	<p>Pump set drops during the installation or removal process Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▸ Never use the turnbuckle , shackle or discharge tube cover to lift the pump set. ▸ Always use lifting lug 59-47.
	<p>NOTE</p>
	<p>Prior to fitting the turnbuckle, check that the corresponding split pin has not been cracked and/or chipped. If damaged, always use a new split pin.</p>

- ✓ Suitably sized lifting equipment is available.
- ✓ The support has been supplied pre-assembled and is available for use.
- ✓ The support rope has been visually inspected.
- ✓ The split pin of the turnbuckle has been checked for any damage.


Fig. 17: Inserting the O-ring

1. If O-ring 412.20 is supplied but not fitted, insert it into pump casing 101.


Fig. 18: Lifting and positioning the pump set

2. Secure the lifting chain or lifting rope (1) to the trolley (4) of the lifting equipment (2).
3. Attach the support rope (5) to the bail by its shackle.
4. Check that the support rope is arranged correctly.
 - ⇒ The free lifting lug (6) has to point away from the pump set.
5. Partially unwind the support rope and electric cables.
6. Lower the pump set into the discharge tube until the bail is in an accessible position, protruding from the discharge tube.
7. Securely cover the discharge tube except for a gap which allows work to continue.
8. Attach the first lifting lug of the support rope (5) to the lifting rope (1) to securely position the pump set above the discharge tube.
9. Unclip the hook of the lifting equipment from the lifting lug of the support rope and run the lifting equipment to a higher level.

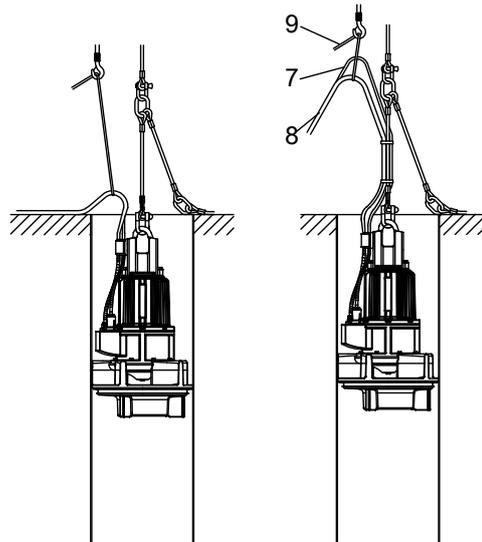


Fig. 19: Securing the control cable and power cables

10. Secure the control cable (7) and power cables (8) to the crane hook (3) of the lifting equipment with a manila rope (9).
11. Trim spacer (a) to fit between the two ferrules.

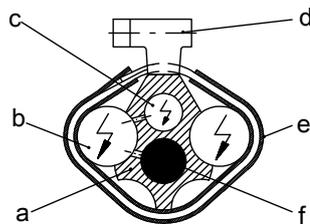


Fig. 20: Cross-section of the cable guide

12. Insert the support rope (f) and the control cable (c) into the spacer (a) and make sure that they are in their respective ducts.
13. Tighten the electric cables with the manila rope running over the crane hook.
14. Insert the power cables (b) into the hollows of the spacer (a).
15. Starting from the bottom, firmly clamp the power cables with hose clips (d) covered by a plastic sheath (e).
16. Progressively lower the pump set into the discharge tube while securing the cable bundle with evenly spaced sheathed cable clamps.
17. In the area of the lifting lug between the rope sections, lay all electric cables in loops and fasten them to the rope section above.
18. Fit a heat shrink tube on any protruding sharp-edged rope ends (e.g. at the ferrule) to prevent any damage to the power cables and control cable.
19. Trim the spacer (a) to suit the position of support 59-7 at the support rope (f) and the type of installation. Insert support rope and control cable (c).
20. Insert the power cables (b) into the hollows of the spacer (a) and firmly clamp the power cables with cable clamps (d).

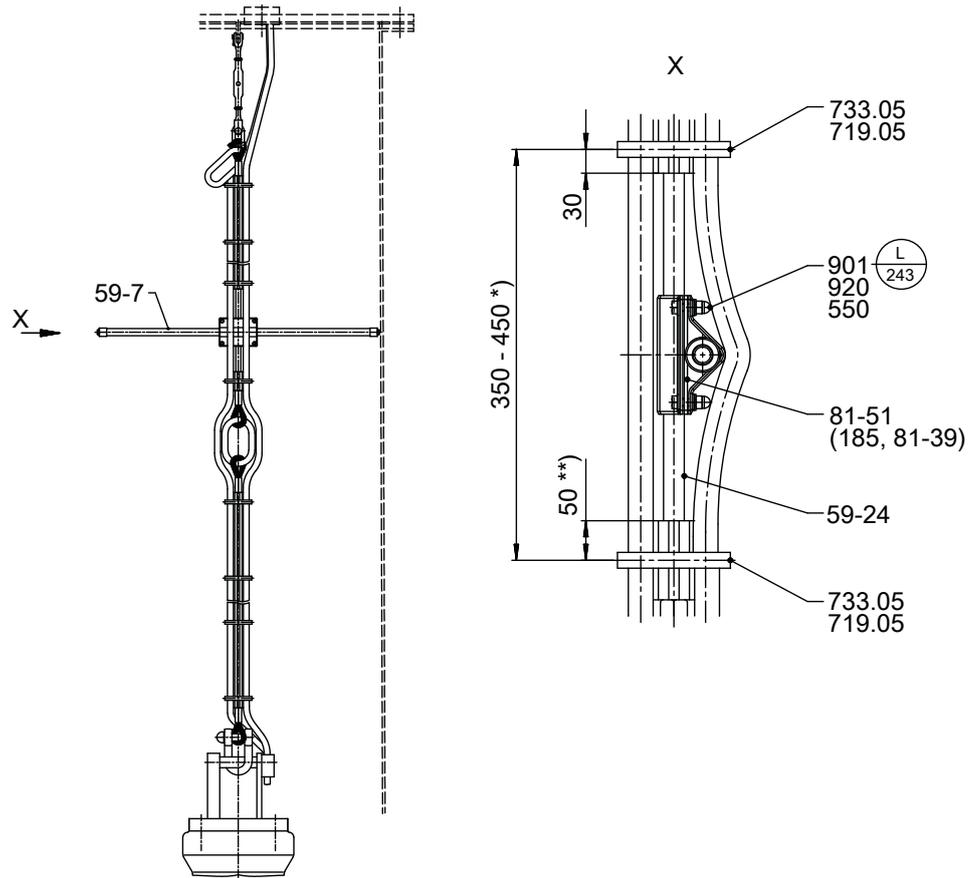


Fig. 21: Support rope with support, dimensions in [mm]

*) depending on the cable cross-section,

***) for 1 rope or 3 ropes = 30 mm

Table 7: Symbols key

Symbol	Description
	Always secure screwed connections marked with this symbol with Loctite 243 .

21. Clamp support 59-7 with clamping element 81-51 to the support rope (f).
22. Undo the screwed connection at clamping element 81-51.
23. Place clamp 81-39 of the clamping element around the support rope.
24. Fasten plate 185 and clamp 81-39 of the GFRP rod to rope clamp 81-39 with hexagon head bolts 901, discs 550 and cap nuts 920. Tighten the connection and secure it with Loctite 243. (⇒ Section 9.3, Page 78)

	NOTE
	The support must be firmly clamped to the support rope, and the GFRP rod must be firmly clamped to the support. If necessary, pad out clamps 81-39.

25. Trim the spacer to fill the space between the two ferrules and accommodate the support.
26. Guide the power cables and control cable along the support to the next cable clamp. Pull them taut and secure them with the clamp.

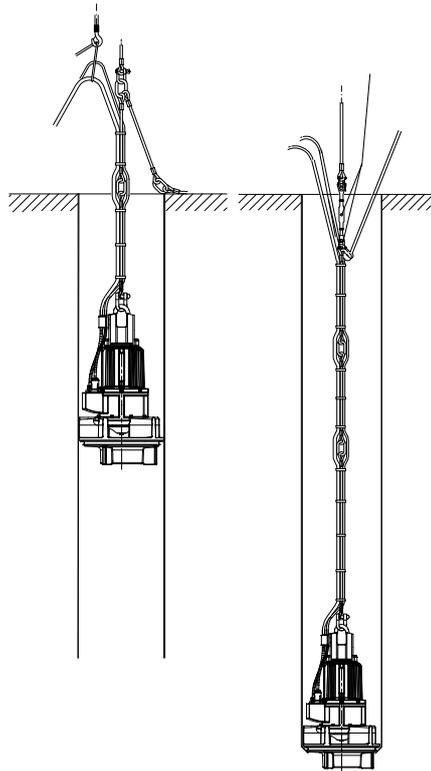


Fig. 22: Lowering the pump set

27. Progressively lower the pump set into the discharge tube. Secure the cable bundle with cable clamps.
28. Finally, attach the support rope with shackle and turnbuckle to a suspension loop (provided in the discharge tube or structure). Secure the turnbuckle with a split pin. After inserting the split pin, bend over its two legs.
29. Tighten the turnbuckle until the cable bundle is tight but does not lift the pump off its seat.
30. Unclip the hook of the lifting equipment from the lifting lug, free the electric cables from the manila rope and route them to the control cabinet.
31. Attach the top loose lifting lug to the cable bundle to prevent noise and wear caused by chafing.
32. Remove the safety cover from the discharge tube and mount the discharge tube cover.
33. Seal the cable entries if any.

5.4 Electrical system

5.4.1 Information for planning the control system

For the electrical connection of the pump set observe the wiring diagrams.
(⇒ Section 9.4, Page 80)

	NOTE
	<p>When laying a cable between the control system and the pump set's connection point, verify that the number of cores is sufficient for the sensors. A minimum cross-section of 1.5 mm² is required.</p>

The motors can be connected to electrical low-voltage grids with mains voltages and voltage tolerances to IEC 60038. The permissible tolerances must be observed.

5.4.1.1 Starting method

The pump set is wired for DOL starting. Star-delta starting is technically possible. This excludes:

- Pump sets with two power cables 4G16 and 8G1.5 (⇒ Section 9.4.4, Page 83)

For reducing the starting current autotransformers or soft starters can be used. For selecting suitable devices observe the rated current of the motor. (⇒ Section 4.4, Page 19)

At least three times the rated current is required for reliable start-up. The run-up time must not exceed 4 seconds.

After start-up of the pump, a soft starter must always be bypassed.

5.4.1.2 Setting the overload protection device

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. (⇒ Section 4.4, Page 19)

5.4.1.3 Level control

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

Automatic operation of the pump set in a tank requires the use of level control equipment.

Observe the minimum level of fluid handled. (⇒ Section 6.2.4.3, Page 47)

5.4.1.4 Operation on a frequency inverter

The pump set is driven by an induction machine to IEC 60034-12 designed for fixed speed operation. In accordance with IEC 60034-25, section 18, the pump set is suitable for operation on a frequency inverter.

	NOTE
	<p>For pump sets with rated voltages exceeding 500 V, a dv/dt filter should be fitted at the output of the frequency inverter to reduce the rate of voltage rise to the limits specified in IEC 60034-25, Section 18. Otherwise a considerably reduced service life of the insulation system has to be expected.</p>
	⚠ DANGER
	<p>Operation outside the permitted frequency range Explosion hazard!</p> <p>▷ Never operate an explosion-proof pump set outside the specified range.</p>

	DANGER
	<p>Incorrect selection and setting of the frequency inverter Explosion hazard!</p> <ul style="list-style-type: none"> ▷ 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. The rated current is 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 rated power 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.

5.4.1.5 Sensors

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

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

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

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

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

All sensors are located inside the pump set and are connected to the sensor cable. For information on wiring and core marking see (⇒ Section 9.4, Page 80)

The individual sensors and the limit values to be set are described in the following sections.

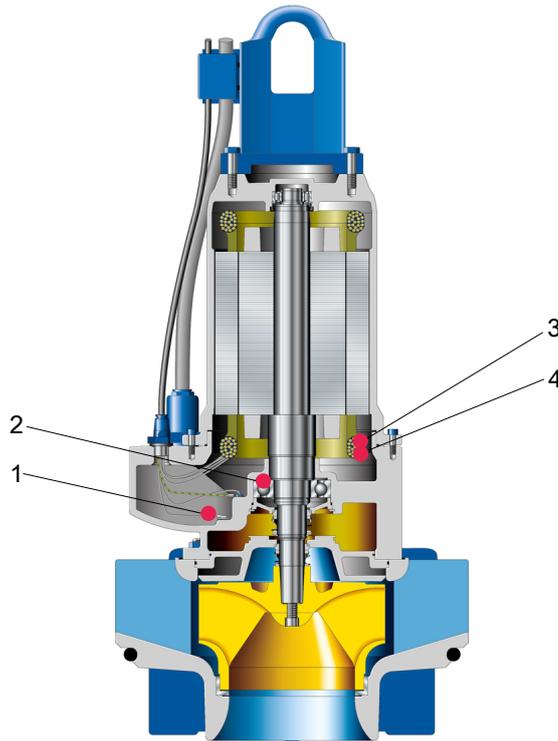


Fig. 23: Sensor positions

Position	Sensor	Standard	Optional
		Motor versions UE, XE, YE	
1	Leakage inside the motor (connection and winding space)	X	-
2	Bearing temperature (lower bearing)	-	X
3	Motor temperature (bimetal)	X	-
4	Motor temperature (PTC)	X	-

5.4.1.5.1 Motor temperature

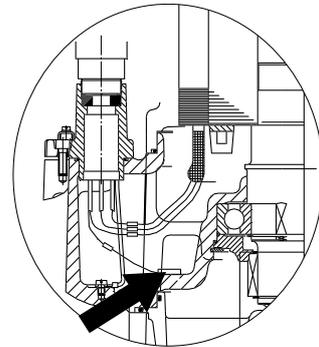
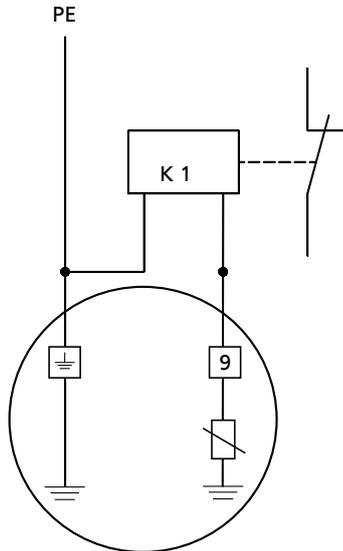
	<p>⚠ DANGER</p>
	<p>Insufficient cooling Explosion hazard! Winding damage!</p> <ul style="list-style-type: none"> ▷ Never operate a pump set without operational temperature monitoring equipment. ▷ For explosion-proof pump sets use a thermistor motor protection relay with manual reset and certification for use in potentially explosive atmospheres for monitoring the temperature of explosion-proof motors in "flameproof enclosure" type of protection.

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

For explosion-proof pump sets, the three additional, series-connected (PTC) thermistors with terminals 10 and 11 must be used. They must be connected to a thermistor motor protection relay with manual reset that is approved for use in potentially explosive atmospheres for monitoring the temperature of explosion-proof motors in "flameproof enclosure" type of protection.

5.4.1.5.2 Leakage inside the motor

	<p>⚠ DANGER</p>
	<p>Incorrect monitoring of leakage electrode Explosion hazard! Danger of death from electric shock!</p> <ul style="list-style-type: none"> ▷ Voltages must be < 30 V AC and tripping currents < 0.5 mA.



Wiring of the electrode relay (standard)

Position of the electrodes 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 (core marking 9). Tripping of the electrode relay must result in the pump set cutting out.

The electrode relay (K1) must trip the motor at a tripping resistance between 3 and 60 kΩ.

5.4.1.5.3 Bearing temperature

As an option, the pump set can be supplied with temperature monitoring in the area of the pump-end bearings.

Check in the data sheet whether the pump set is equipped with bearing temperature monitoring.

The bearing temperature sensor is a Pt100 resistance thermometer. It must be connected to a temperature control device with a Pt100 input and two separate outputs for two different switching points (sensor circuit maximum 6 V/2 mA).

Set the following limits:

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

5.4.2 Electrical connection

	⚠ DANGER
	<p>Electrical connection work by unqualified personnel Danger of death from electric shock!</p> <ul style="list-style-type: none"> ▸ Always have the electrical connections installed by a trained electrician. ▸ Observe regulations IEC 60364 and, for explosion-proof versions, BS 60079 .
	⚠ WARNING
	<p>Incorrect connection to the mains Damage to the power supply network, short circuit!</p> <ul style="list-style-type: none"> ▸ Observe the technical specifications of the local energy supply companies.
	CAUTION
	<p>Improper routing of electric cables Damage to the electric cables!</p> <ul style="list-style-type: none"> ▸ Never move the electric cables at temperatures below -25 °C. ▸ Never kink or crush the electric cables. ▸ Never lift the pump set by the electric cables. ▸ Adjust the length of the electric cables to the site requirements.
	CAUTION
	<p>Motor overload Damage to the motor!</p> <ul style="list-style-type: none"> ▸ Protect the motor by a thermal time-lag overload protection device in accordance with IEC 60947 and local regulations.

For the electrical connection observe the circuit diagrams (⇒ Section 9.4, Page 80) in the Annex and the information for planning the control system .

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

	⚠ DANGER
	<p>Incorrect wiring Explosion hazard!</p> <ul style="list-style-type: none"> ▸ 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.

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

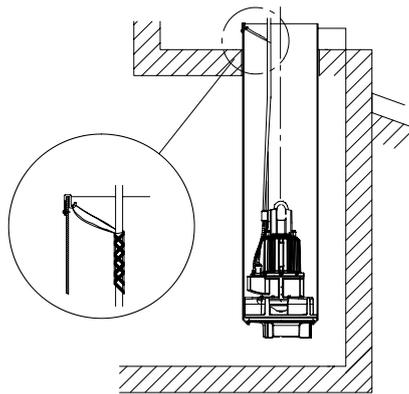


Fig. 24: Fastening the connection cable

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

Potential equalisation The pump set is not fitted with an external potential equalisation connection (risk of corrosion).

	<p>! DANGER</p> <p>Incorrect wiring Explosion hazard!</p> <ul style="list-style-type: none"> ▶ Explosion-proof pump sets installed in a tank must never be retrofitted with an external potential equalisation connection!
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 **DANGER**

Touching the pump set during operation

Electric shock!

- ▷ Make sure that the pump set cannot be touched during operation.

6 Commissioning/Start-up/Shutdown

6.1 Commissioning/Start-up

6.1.1 Prerequisites for commissioning/start-up

	<p style="background-color: #e67e22; color: white; padding: 5px;">⚠ DANGER</p> <p>Persons in the tank during pump operation Electric shock! Risk of injury! Danger of death from drowning!</p> <ul style="list-style-type: none"> ▷ Never start up the pump set without special protective equipment when there are persons in the tank. ▷ If persons come into contact with the fluid handled during pump operation (e.g. in sports facilities and leisure parks), the plant designer/operator must comply with the legal requirements. ▷ Provide special electrical and mechanical protective equipment compliant with the legal regulations.
	<p style="background-color: #f1c40f; color: white; padding: 5px;">⚠ WARNING</p> <p>People falling into the unsecured discharge tube Risk of personal injury!</p> <ul style="list-style-type: none"> ▷ Take suitable precautions during the entire installation/removal process to protect people from falling into the open discharge tube. ▷ Fence off the work area appropriately.

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

- The lubricant has been checked.
- The direction of rotation has been checked.
- The pump set has been properly connected to the power supply and is equipped with all protection devices.
- The pump set has been installed in the discharge tube as described in this manual.
- The minimum fluid level has been reached.
- After prolonged shutdown of the pump (set), the activities required for returning the equipment to service have been carried out. (⇒ Section 6.4, Page 49)
- Safety-relevant protective equipment must be installed and fully functional.

6.1.2 Start-up

	DANGER
	<p>Persons in the tank during pump operation Electric shock! Risk of injury! Danger of death from drowning!</p> <ul style="list-style-type: none"> ▷ Never start up the pump set without special protective equipment when there are persons in the tank. ▷ If persons come into contact with the fluid handled during pump operation (e.g. in sports facilities and leisure parks), the plant designer/operator must comply with the legal requirements. ▷ Provide special electrical and mechanical protective equipment compliant with the legal regulations.

	CAUTION
	<p>Re-starting while motor is still running down Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Do not re-start the pump set before it has come to a standstill. ▷ Never start up the pump set while the pump is running in reverse.

✓ The fluid level is sufficiently high.

	CAUTION
	<p>Start-up against a closed shut-off element Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Never operate the pump set against a closed shut-off element.

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

6.2 Operating limits

	DANGER
	<p>Non-compliance with operating limits Damage to the pump set! Explosion hazard!</p> <ul style="list-style-type: none"> ▷ Comply with the operating data specified in the data sheet. ▷ Avoid operation below Q_{min}. ▷ Never operate an explosion-proof pump set at ambient temperatures or fluid temperatures exceeding those specified in the data sheet and/or on the name plate. ▷ Never operate the pump set outside the limits specified below.

6.2.1 Operation on the power supply mains

	⚠ DANGER
	<p>Permissible tolerances for operation on mains power exceeded Explosion hazard!</p> <ul style="list-style-type: none"> ▸ Never operate an explosion-proof pump (set) outside the specified range.

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

6.2.2 Frequency of starts

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

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

	CAUTION
	<p>Re-starting while motor is still running down Damage to the pump set!</p> <ul style="list-style-type: none"> ▸ Do not re-start the pump set before it has come to a standstill. ▸ Never start up the pump set while the pump is running in reverse.

6.2.3 Operation on a frequency inverter

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

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

6.2.4 Fluid handled

6.2.4.1 Fluid temperature

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

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

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

6.2.4.2 Density of the fluid handled

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

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

6.2.4.3 Minimum level of fluid handled

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

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

The pump set is ready for operation when the fluid level has reached dimension "t₁" as a minimum.

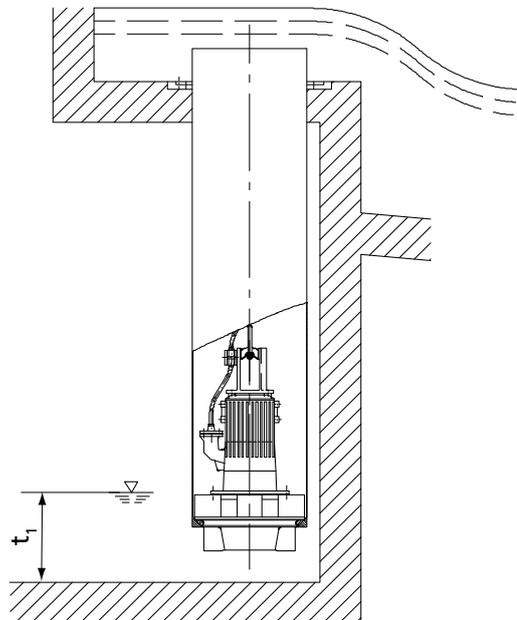


Fig. 25: Minimum level of fluid handled

6.2.4.4 Abrasive fluids

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

6.3 Shutdown/storage/preservation

6.3.1 Shutdown

	CAUTION
	<p>Uncontrolled backflow of the fluid from the riser Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Prevent any uncontrolled backflow of the fluid handled with suitable means. ▷ Control the fluid backflow, e.g. by throttling the gate valve in the discharge line.

6.3.2 Measures to be taken for shutdown

	⚠ DANGER
	<p>Electrical connection work by unqualified personnel Danger of death from electric shock!</p> <ul style="list-style-type: none"> ▷ Always have the electrical connections installed by a trained and qualified electrician. ▷ Observe the IEC 61557 regulations as well as any regional regulations.

	⚠ WARNING
	<p>Unintentional starting of the pump set Risk of injury by moving components and shock currents!</p> <ul style="list-style-type: none"> ▷ Ensure that the pump set cannot be started unintentionally. ▷ Always make sure the electrical connections are disconnected before carrying out work on the pump set.

	⚠ WARNING
	<p>Fluids handled, consumables and supplies which are hot and/or pose a health hazard Risk of injury!</p> <ul style="list-style-type: none"> ▷ Observe all relevant laws. ▷ When draining the fluid take appropriate measures to protect persons and the environment. ▷ Decontaminate pumps which handle fluids posing a health hazard.

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

The pump set remains installed

- ✓ Make sure sufficient fluid is available for the functional check run of the pump set.
1. For prolonged shutdown periods, start up the pump set regularly once every three months. Let it run for about one minute.
 This will prevent the formation of deposits within the pump and the pump intake area.

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

✓ All safety regulations are observed. (⇒ Section 7.1, Page 50)

1. Clean the pump set.
2. Spray-coat the inside wall of the pump casing and, in particular, the impeller clearance areas with a preservative.

6.4 Returning to service

For returning the pump set to service, observe the instructions on commissioning/start-up. (⇒ Section 6.1, Page 44)

Refer to and comply with the operating limits.

For returning the pump set to service after storage also follow the instructions for maintenance/inspection. (⇒ Section 7.2, Page 52)

	<p>⚠ WARNING</p>
	<p>Failure to re-install or re-activate protective devices Risk of injury from moving parts or escaping fluid!</p> <p>▷ As soon as the work is completed, properly re-install and re-activate any safety-relevant devices and protective devices.</p>
	<p>NOTE</p>
	<p>On pumps/pump sets older than 5 years we recommend replacing all elastomer seals.</p>

7 Servicing/Maintenance

7.1 Safety regulations

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

	<p>⚠ DANGER</p> <p>Sparks produced during servicing work Explosion hazard!</p> <ul style="list-style-type: none"> ▷ Observe the safety regulations in force at the place of installation! ▷ Never open an energised pump set. ▷ Always perform maintenance work on explosion-proof pump sets outside potentially explosive atmospheres only.
	<p>⚠ DANGER</p> <p>Improperly serviced pump set Explosion hazard! Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Service the pump set regularly. ▷ Prepare a maintenance schedule with special emphasis on lubricants, electric cables, bearing assembly and shaft seal.
	<p>⚠ DANGER</p> <p>Electrical connection work by unqualified personnel Danger of death from electric shock!</p> <ul style="list-style-type: none"> ▷ Always have the electrical connections installed by a trained and qualified electrician. ▷ Observe the IEC 61557 regulations as well as any regional regulations.
	<p>⚠ DANGER</p> <p>Risk of falling when working at a great height Danger to life by falling from a great height!</p> <ul style="list-style-type: none"> ▷ Do not step onto the pump (set) during installation work or dismantling work. ▷ Pay attention to safety equipment, such as railings, covers, barriers, etc. ▷ Observe the applicable local health and occupational safety regulations and accident prevention regulations.
	<p>⚠ WARNING</p> <p>Unintentional starting of the pump set Risk of injury by moving components and shock currents!</p> <ul style="list-style-type: none"> ▷ Ensure that the pump set cannot be started unintentionally. ▷ Always make sure the electrical connections are disconnected before carrying out work on the pump set.

	<p>⚠ WARNING</p> <p>Hands, other body parts or foreign objects in the impeller or intake area Risk of injury! Damage to the submersible motor pump!</p> <ul style="list-style-type: none"> ▷ Never insert your hands, other body parts or foreign objects into the impeller or impeller intake area. ▷ Always make sure the electrical connections are disconnected before checking whether the impeller rotates freely.
	<p>⚠ WARNING</p> <p>Fluids handled, consumables and supplies which are hot and/or pose a health hazard Risk of injury!</p> <ul style="list-style-type: none"> ▷ Observe all relevant laws. ▷ When draining the fluid take appropriate measures to protect persons and the environment. ▷ Decontaminate pumps which handle fluids posing a health hazard.
	<p>⚠ WARNING</p> <p>Hot surface Risk of injury!</p> <ul style="list-style-type: none"> ▷ Allow the pump set to cool down to ambient temperature.
	<p>⚠ WARNING</p> <p>Improper lifting/moving of heavy assemblies or components Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▷ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.
	<p>⚠ WARNING</p> <p>Insufficient stability Risk of crushing hands and feet!</p> <ul style="list-style-type: none"> ▷ During assembly/dismantling, secure the pump (set)/pump parts to prevent tilting or tipping over.
	<p>NOTE</p> <p>Special regulations apply to repair work on explosion-proof pump sets. Modification or alteration of the pump set may affect explosion protection and are only permitted after consultation with the manufacturer.</p>
<p>A regular maintenance schedule will help avoid expensive repairs and contribute to trouble-free, reliable operation of the pump, pump set and pump parts with a minimum of servicing/maintenance expenditure and work.</p>	
	<p>NOTE</p> <p>All maintenance work, service work and installation work can be carried out by KSB Service or authorised workshops. For contact details refer to the enclosed "Addresses" booklet or visit "www.ksb.com/contact" on the Internet.</p>

Never use force when dismantling and reassembling the pump set.

7.2 Maintenance/inspection

KSB recommends the following regular maintenance schedule:

Table 8: Overview of maintenance work

Maintenance interval	Servicing/maintenance work	For details see ...
Every 4000 hours, at least once a year	Measuring the insulation resistance	(⇒ Section 7.2.1.1, Page 52)
Every 10,000 hours, at least every 3 years	Checking the cable bundle	(⇒ Section 7.3.3, Page 55)
	Checking the earth conductor	(⇒ Section 7.3.4, Page 55)
	Checking the sensors	(⇒ Section 7.2.1.2, Page 52)
	Changing the lubricant	(⇒ Section 7.4, Page 56)
Every 5 years	General overhaul	

On pump sets with sacrificial anodes, the sacrificial anodes must initially be checked after 6 months. If necessary, the sacrificial anodes must be replaced. If the sacrificial anodes show little wear, the maintenance interval can be extended to 12 months.

7.2.1 Inspection work

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

7.2.1.2 Checking the sensors

	CAUTION
	<p>Excessive test voltage Damage to the sensors!</p> <p>▷ Use a commercially available ohmmeter to measure the resistance.</p>

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

The sensors supplied with the pump set may not include the maximum scope of supply described in this section.

Temperature sensors in the motor winding

Table 9: Resistance measurement

Measurement between terminals ...	Resistance
	[Ω]
21 and 22	< 1
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 10: 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 serviced.

Bearing temperature sensor (optional)

Table 11: Resistance measurement of the bearing temperature sensor

Measurement between terminals ...	Resistance
	[Ω]
15 and 16	100 to 120

7.3 Removing the pump set

7.3.1 Removing the pump set

	<p>⚠ DANGER</p>
	<p>Insufficient preparation of work on the pump (set) Risk of injury!</p> <ul style="list-style-type: none"> ▷ Properly shut down the pump set. ▷ Close the shut-off elements in the suction line and discharge line. ▷ Drain the pump and release the pump pressure. ▷ Shut off any auxiliary feed lines. ▷ Allow the pump set to cool down to ambient temperature.
	<p>⚠ WARNING</p>
	<p>Incorrect handling of the electric cable Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▷ Secure electric cables against falling down. ▷ Avoid electric cables being laid on surfaces without fastening. ▷ When moving the pump set keep at a safe distance to the electric cables.

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	 WARNING
	<p>People falling into the unsecured discharge tube Risk of personal injury!</p> <ul style="list-style-type: none"> ▷ Take suitable precautions during the entire installation/removal process to protect people from falling into the open discharge tube. ▷ Fence off the work area appropriately.

	 WARNING
	<p>Turnbuckle and shackle are not suitable for lifting the pump set Risk of injury! Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Always use the lifting lugs of the support rope to lift the pump set.

- ✓ The power cables have been disconnected and secured against unintentional start-up.
- ✓ The discharge tube is open; its opening is securely covered except for a gap allowing work to continue.
- ✓ Suitable lifting equipment is provided.
 1. Attach the lifting chain or lifting rope to the trolley.
 2. Free the uppermost lifting lug from the cables, attach it to the crane hook and run the lifting equipment to a higher level.
 3. Open and disconnect the turnbuckle.

	NOTE
	<p>Prevent any loose parts from falling into the pump sump!</p>

4. Pull the pump set up until it reaches the second lifting lug of the cable bundle.
5. Attach the lifting chain or lifting rope with the shackle to the first lifting lug (together with the crane hook).
6. Unclip the crane hook and attach it to the second lifting lug.
7. Pull the pump set up until it reaches the third lifting lug. Free the lifting chain or lifting rope from the first lifting lug and attach it to the third lifting lug.
8. Pull the pump set up until it reaches the fourth lifting lug. Unclip the crane hook and attach it to the fourth lifting lug.
9. Repeat this procedure until the pump bail is located above the discharge tube, then attach it to the crane hook.
10. Remove the safety cover from the discharge tube.
11. Extract the pump set from the discharge tube, move it sideways and place it down.

	 WARNING
	<p>Pump set tilting Risk of squashing hands and feet!</p> <ul style="list-style-type: none"> ▷ Suspend or support the pump set.

	CAUTION
	<p>Improper storage Damage to the power cables!</p> <ul style="list-style-type: none"> ▷ Support the power cables at the cable entry to prevent permanent deformation. ▷ Protect the core ends against moisture.

12. To prevent the pump set from tipping over, do not disconnect it from the hook of the lifting equipment.
13. Clean the pump set (e.g. with water).
14. Collect and properly dispose of any cleaning liquid.

7.3.2 Drainage/cleaning

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

1. Always flush the pump if it has been used for handling noxious, explosive, hot or other hazardous fluids.
2. Always flush and clean the pump before transporting it to the workshop. Provide a certificate of decontamination for the pump set. (⇒ Section 11, Page 101)

7.3.3 Checking the cable bundle

When removing the pump set from the discharge tube, check the hoisting rope and the cables for any damage. Replace any damaged components by original spare parts.

Longer sections of combined cables must be dismantled:

1. Remove the cables from the cable clamps.
2. Remove the spacer.
3. Roll up the cables and place them next to the pump set.
4. Undo the shackle to separate the support rope from the pump set.

7.3.4 Checking the earth conductor

1. Measure the resistance between earth conductor and earth. The resistance must be below 1 Ω.
2. Replace any damaged components by original spare parts.

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

7.4 Lubrication and lubricant change

7.4.1 Lubricating the mechanical seal

	DANGER
	<p>Excessive temperatures at the shaft seal Damage to the pump set!</p> <ul style="list-style-type: none"> ▸ Regularly check the condition of the lubricant in the lubricant reservoir of the mechanical seal. Top it up if required.

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

7.4.1.1 Intervals

Replace the lubricant every 10,000 operating hours but at least every 3 years.
 (⇒ Section 7.2, Page 52)

7.4.1.2 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 12: Lubricant quality

Description	Properties	
Paraffin oil or white oil. Alternative: motor oil grades SAE 10W to SAE 20W	Kinematic viscosity at 40 °C	< 20 mm ² /s
	Flash point (to Cleveland)	> 160 °C
	Solidification point (pour point)	< -15 °C

- Recommended lubricants:**
- 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
	<p>Lubricant contaminating fluid handled Hazard to persons and the environment!</p> <ul style="list-style-type: none"> ▸ Using machine oil is only permitted if the oil is disposed of properly.

7.4.1.3 Lubricant quantity

Table 13: Lubricant quantity [l] depending on the motor

Size	Lubricant quantity depending on the motor	
	30 4.E 37 4.E 22 6.E 30 6.E 11 8.E 15 8.E 18 8.E 22 8.E	45 4.E 55 4.E 65 4.E 75 4.E 31 6.E 37 6.E 45 6.E 55 6.E 30 8.E 37 8.E 45 8.E
	[l]	[l]
700-324	6,5	-
700-330	6,5	-
700-371	6,5	-
800-324	-	6,6
800-330	-	6,6
800-370	6,5	6,6
800-371	-	6,6
800-400	6,5	6,6
800-401	6,5	6,6

7.4.1.4 Changing the lubricant

	<p>⚠ WARNING</p> <p>Lubricants posing a health hazard and/or hot lubricants Hazard to persons and the environment!</p> <ul style="list-style-type: none"> ▷ 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.
	<p>⚠ WARNING</p> <p>Excess pressure inside the pump set Risk of injury when opening the pump set!</p> <ul style="list-style-type: none"> ▷ Take care when opening the inner chambers. Equalise the pressure.
	<p>⚠ WARNING</p> <p>Improper handling when placing the pump set in a vertical/horizontal position Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▷ Select suitable lifting equipment for the size of the pump. ▷ Use appropriate means to secure the pump set against tilting, tipping over or rolling off. ▷ Maintain a safe distance during lifting operations (load may swing when being lifted). ▷ Use additional supports for the transport holder to secure it against tilting.

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7.4.1.4.1 Draining the lubricant

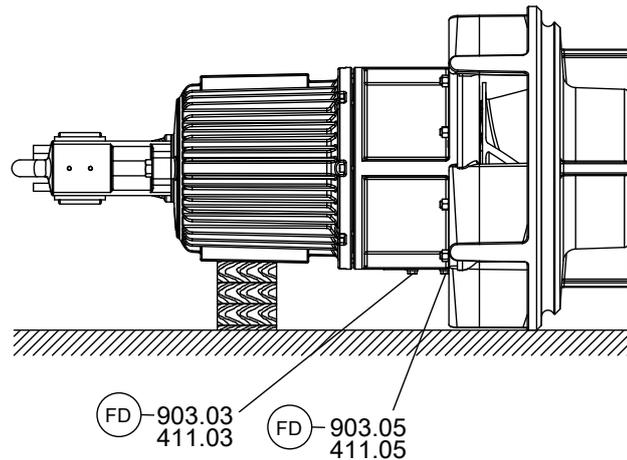


Fig. 26: Draining the lubricant

903.03 411.03	Lubricant filler opening	903.05 411.05	Lubricant drain
------------------	--------------------------	------------------	-----------------

Table 14: Symbols key

Symbol	Description
	Always apply a liquid sealant (e.g. Hylomar SQ32M) to sealing surfaces marked with this symbol.

- ✓ The pump set is positioned horizontally on a clean and level surface and is protected against rolling off.
- ✓ A suitable container for collecting the lubricant is on hand.
 1. Place a suitable container under screw plug 903.05.
 2. Remove screw plug 903.03 and joint ring 411.03. Observe the plate "Oil filler plug".
 3. Remove screw plug 903.05 and joint ring 411.05. Observe the plate "Oil drain".
 4. Drain the lubricant and dispose of it properly.
 5. Apply a liquid sealant to screw plug 903.05. Screw it back in together with new joint ring 411.05.

7.4.1.4.2 Filling in the lubricant

	 WARNING
	<p>Incorrect positioning/placing down Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▷ Position the pump set vertically with the motor on top. ▷ Use appropriate means to secure the pump set against tilting and tipping over. ▷ Refer to the weights given in the data sheet/on the name plate.

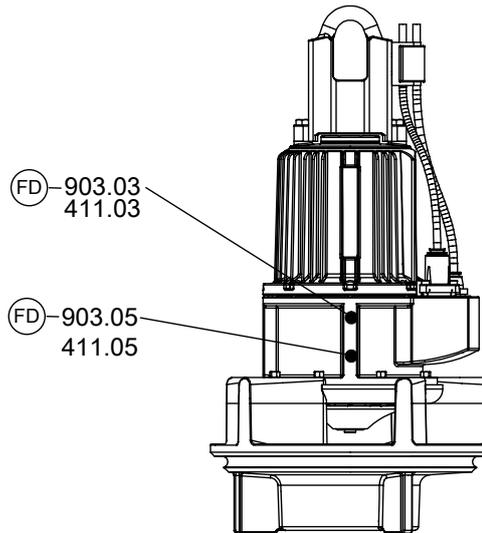


Fig. 27: Filling in the lubricant

903.03 411.03	Lubricant filler opening	903.05 411.05	Lubricant drain
------------------	--------------------------	------------------	-----------------

Table 15: Symbols key

Symbol	Description
	Always apply a liquid sealant (e.g. Hylomar SQ32M) to sealing surfaces marked with this symbol.

- ✓ The pump set has been placed in a vertical position on a clean and level surface and protected against tipping over.
- 1. Fill the lubricant through the lubricant filler opening until the lubricant reservoir overflows. (⇒ Section 7.4.1.3, Page 57)
- 2. Apply a liquid sealant to screw plug 903.03. Screw it back in together with new joint ring 411.03.

7.4.2 Lubricating the rolling element bearings

The pump set is equipped with grease-lubricated, maintenance-free rolling element bearings.

7.5 Dismantling the pump set

7.5.1 General information/Safety regulations

	DANGER
	<p>Improper transport Danger to life from falling parts! Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Use the attachment point provided (eyebolt, lifting lug or bail) for attaching lifting accessories. ▷ Never suspend the pump set by its power cable. ▷ Never use the lifting ropes included in KSB's scope of supply for lifting loads other than the KSB product supplied. ▷ Securely attach the lifting ropes to the pump and crane.

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	<p>⚠ WARNING</p> <p>Unqualified personnel performing work on the pump (set) Risk of injury!</p> <ul style="list-style-type: none"> ▷ Always have repair work and maintenance work performed by specially trained, qualified personnel.
	<p>⚠ WARNING</p> <p>Hot surface Risk of injury!</p> <ul style="list-style-type: none"> ▷ Allow the pump set to cool down to ambient temperature.
	<p>⚠ WARNING</p> <p>Improper lifting/moving of heavy assemblies or components Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▷ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.
	<p>⚠ WARNING</p> <p>Excess pressure inside the pump set Risk of injury when opening the pump set!</p> <ul style="list-style-type: none"> ▷ Take care when opening the inner chambers. Equalise the pressure.
	<p>⚠ WARNING</p> <p>Components with sharp edges Risk of cutting or shearing injuries!</p> <ul style="list-style-type: none"> ▷ Always use appropriate caution for installation and dismantling work. ▷ Wear work gloves.
	<p>⚠ WARNING</p> <p>Pump set tilting or rolling off Risk of personal injury!</p> <ul style="list-style-type: none"> ▷ Make sure the pump set is secured against tilting during the entire dismantling process. ▷ For dismantling the pump set in a horizontal position, secure it against rolling off.

Observe the general safety instructions and information.
For dismantling and reassembly observe the general assembly drawing.
In the event of damage you can always contact our service departments.

7.5.2 Preparing the pump set

1. De-energise the pump set and secure it against unintentional start-up.
2. The pump set has been removed from the discharge tube.
(⇒ Section 7.3.1, Page 53)
3. The pump set has been cleaned. (⇒ Section 7.3.2, Page 55)
4. The lubricant has been drained.

7.5.3 Removing the back pull-out unit

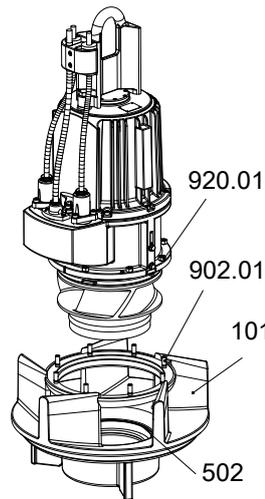


Fig. 28: Removing the back pull-out unit

✓ Suitable lifting equipment is provided.

1. Attach the crane hook to bail 571 to secure the back-pull out unit.
2. Undo screwed connection 902.01 and 920.01. Attach lifting gear to bail 571 and pull the complete back pull-out unit out of pump casing 101 with a crane.
3. Place the back pull-out unit in a safe and dry installation area and secure it against tipping over or rolling off.

7.5.4 Removing the impeller

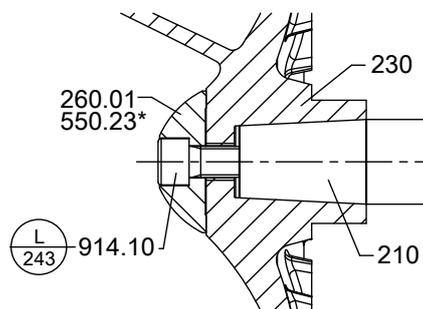


Fig. 29: Removing the impeller

*: On specific designs only

- ✓ The back pull-out unit has been placed in a horizontal position on wooden supports. It has been secured against rolling off.
 - ✓ The lubricant and any leakage have been drained.
1. Undo and remove hexagon socket head cap screw 914.10.
 - ⇒ The impeller/shaft connection is a tapered fit.
 2. Remove impeller hub cap 260.01 or disc 550.23.
 - ⇒ For dismantling the impeller, a jacking thread is provided at the impeller hub.
 3. Screw in the forcing screw and remove impeller 230.



NOTE

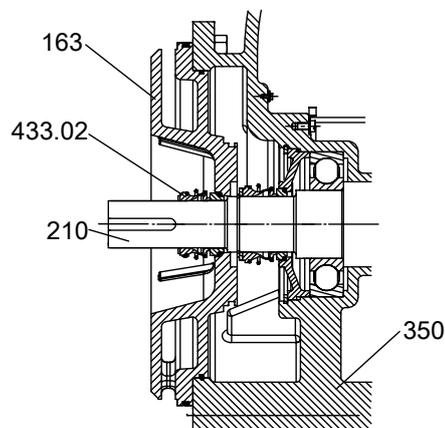
The forcing screw is not included in the scope of supply. It can be ordered separately from KSB.

Table 16: Forcing screws

Size	Forcing screw	
	Thread	Code
700-324	M24	ADS 9
700-330	M24	ADS 9
700-371	M24	ADS 9
800-324	M24	ADS 9
800-330	M24	ADS 9
800-370	M24	ADS 9
800-371	M24	ADS 9
800-400	M24	ADS 9
800-401	M24	ADS 9

7.5.5 Removing the mechanical seal

7.5.5.1 Removing the impeller-end mechanical seal


Fig. 30: Removing the mechanical seal

- ✓ The back pull-out unit has been securely placed in a horizontal position on wooden supports.
1. Pull the rotating assembly of mechanical seal 433.02 and spacer sleeve 525.04 (if applicable) off shaft 210.
 2. Remove discharge cover 163 from bearing housing 350.
 3. Press the stationary seat of mechanical seal 433.02 out of discharge cover 163.

7.5.5.2 Removing the drive-end mechanical seal

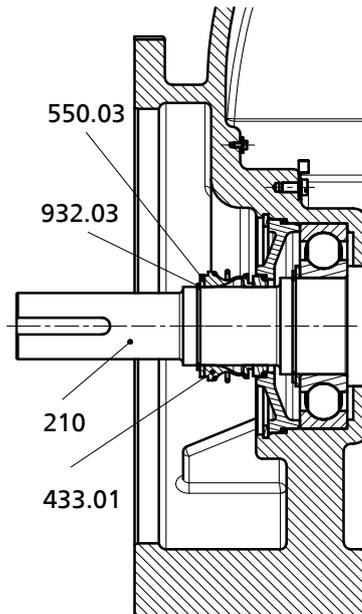


Fig. 31: Removing the mechanical seal

✓ The impeller and the impeller-end mechanical seal have been removed.

1. Remove circlip 932.03 and disc 550.03.
2. Carefully pull mechanical seal 433.01 and the mating ring of the mechanical seal off shaft 210.

	NOTE
To protect the mechanical seal against damage when pulling it off the shaft it is recommended to place a foil (no thicker than 0.3 mm) around the free shaft stub.	

7.5.6 Dismantling the motor section

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

	NOTE
The motors of explosion-proof pump sets are supplied in "flameproof enclosure" type of protection. Any work on the motor section which could affect explosion protection, such as re-winding and repair work involving machining, must be inspected and approved by an approved expert or performed by the motor manufacturer. 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. Repairs in accordance with the values specified in BS 60079-1, tables 1 and 2, are not permitted.	

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

7.5.7 Removing the cable gland and connection cable

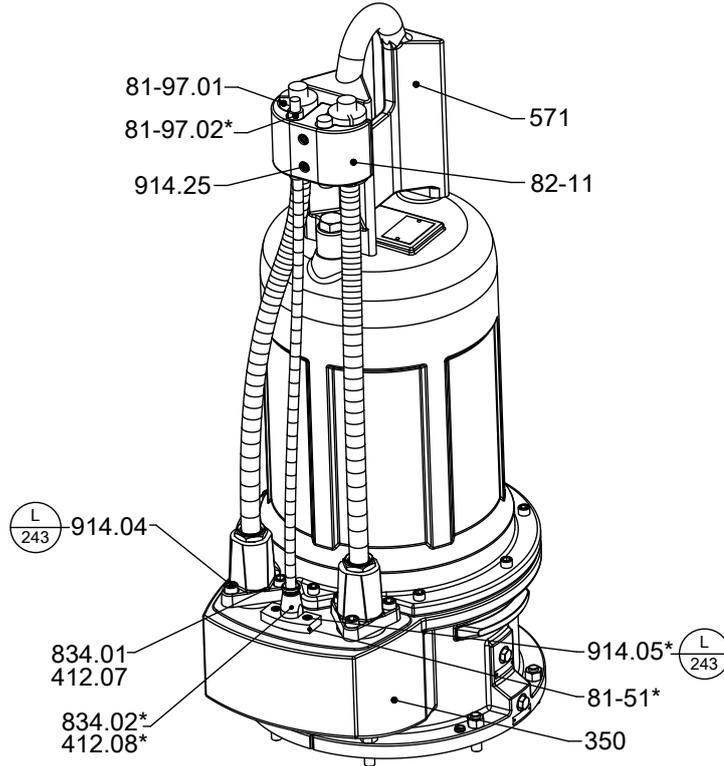


Fig. 32: Removing the cables and cable gland

*: On specific designs only

Table 17: Symbols key

Symbol	Description
	Always secure screwed connections marked with this symbol with Loctite 243 .

1. Undo hexagon socket head cap screws 914.25. Remove cover plate 82-11 from bail 571.
2. Take out the cable gland needing to be replaced.
3. Undo screwed connection 914.04 and/or 914.05 of cable gland 834.01/02.
4. Pull cable gland 834.01/02 out of the centring seat in bearing housing 350.
5. Separate cable gland 834.01 of the power cable by cutting it off at the connector or by pulling the plug.
6. Separate cable gland 834.02* of the control cable from the pump set by pulling the plug.

	NOTE
	Keeping a record of the core identification and lengths is recommended. This will facilitate installing the replacement cable gland.

7.6 Reassembling the pump set

7.6.1 General information/Safety regulations

	<p>⚠ DANGER</p> <p>Wrong screws/bolts Explosion hazard!</p> <ul style="list-style-type: none"> ▷ Always use the original screws/bolts for assembling an explosion-proof pump set. ▷ Never use screws/bolts of different dimensions or of a lower property class.
	<p>⚠ WARNING</p> <p>Improper lifting/moving of heavy assemblies or components Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▷ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.
	<p>⚠ WARNING</p> <p>Components with sharp edges Risk of cutting or shearing injuries!</p> <ul style="list-style-type: none"> ▷ Always use appropriate caution for installation and dismantling work. ▷ Wear work gloves.
	<p>⚠ WARNING</p> <p>Insufficient stability Risk of crushing hands and feet!</p> <ul style="list-style-type: none"> ▷ During assembly/dismantling, secure the pump (set)/pump parts to prevent tilting or tipping over.
	<p>CAUTION</p> <p>Improper reassembly Damage to the pump!</p> <ul style="list-style-type: none"> ▷ Reassemble the pump (set) in accordance with the general rules of sound engineering practice. ▷ Use original spare parts only.
	<p>NOTE</p> <p>Before reassembling the motor section, check that all joints relevant to explosion protection (flamepaths) are undamaged. Any components with damaged flamepaths must be replaced. Only use original spare parts made by KSB for explosion-proof pumps. Observe the flamepath positions specified in the Annex (Flamepaths on explosion-proof motors). (⇒ Section 9.5, Page 85) Secure all screwed/bolted connections closing off the flameproof enclosure with a thread-locking agent (Loctite Type 243).</p>
	<p>NOTE</p> <p>Apply liquid sealant to all screw plugs. Apply liquid sealant to all wetted clearances (e.g. Hylomar SQ 32M).</p>

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

- Sealing elements**
- O-rings
 - Check O-rings for any damage and replace by new O-rings, if required.
 - Never use O-rings that have been made by cutting an O-ring cord to size and gluing the ends together.
 - Assembly adhesives
 - Avoid the use of assembly adhesives, if possible.

Tightening torques For reassembly, tighten all screws and bolts as specified in this manual. (⇒ Section 7.8, Page 71)
 In addition, secure all screwed connections closing off the flameproof enclosure with a thread-locking agent (Loctite Type 243).

7.6.2 Installing the replacement cable gland

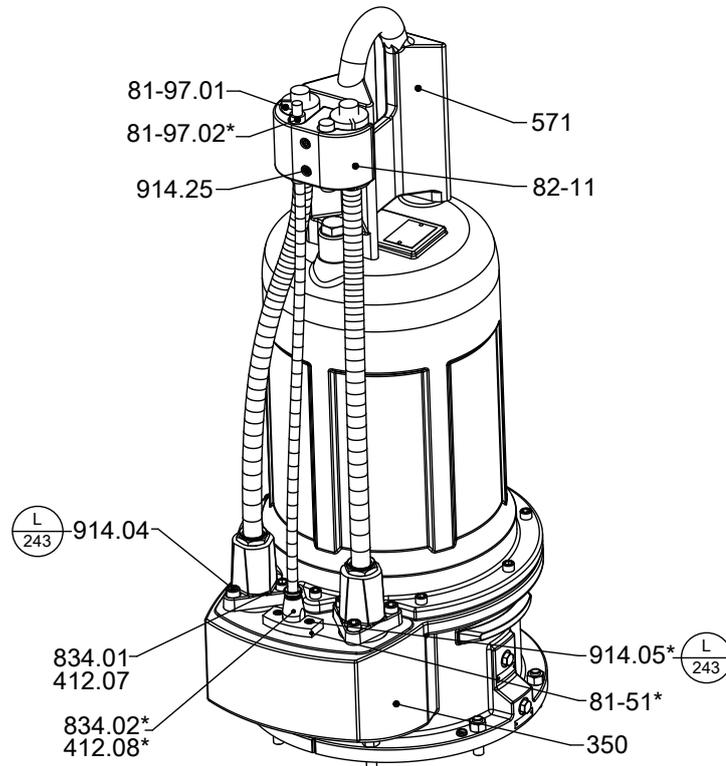


Fig. 33: Installing the power cable and cable gland

*: On specific designs only

Table 18: Symbols key

Symbol	Description
	Always secure screwed connections marked with this symbol with Loctite 243 .

Installing the power cable, version without plug

1. Adjust the lengths of the cable cores to the original cable gland.
2. Attach the core identification to match the original cable gland.
3. Slide O-ring 412.07 onto the core ends of the power cable and into the groove of the centring seat.
4. Use a connector to connect the strands of motor and cable gland.
5. Pull a heat shrink tube over the connection point.

- | | |
|--|---|
| Installing the power cable, version with plug | <ol style="list-style-type: none"> 6. Insert cable gland 834.01 with the power cable and O-ring 412.07 into the opening provided. 7. Fasten cable gland 834.01 of the power cable with hexagon socket head cap screws 914.04 and secure the screwed connection with Loctite 243. |
| Installing the control cable | <ol style="list-style-type: none"> 1. Slide O-ring 412.07 onto the core ends of the power cable until the O-ring reaches the centring seat. 2. Connect the plug of the power cable with the plug of the pump set. 3. Insert cable gland 834.01 with the power cable and O-ring 412.07 into the opening provided. 4. Fasten cable gland 834.01 with clamping element 81-51 and hexagon socket head cap screws 914.04. Secure the screwed connection with Loctite 243. |
| Fastening the cover plate to the bail | <ol style="list-style-type: none"> 1. Slide O-ring 412.08 onto the core ends of the control cable until the O-ring reaches the centring seat. 2. Connect the plug of the control cable with the plug of the pump set. 3. Insert cable gland 834.02 with the control cable and O-ring 412.08 into the opening provided. 4. Fasten cable gland 834.02 with clamping element 81-51 and hexagon socket head cap screws 914.05 and secure the screwed connection with Loctite 243. |
| | <ol style="list-style-type: none"> 1. Insert the power cable and control cable with cable protectors 81-97.01/02 into cover plate 82-11. 2. Screw the cover plate to bail 571 with hexagon socket head cap screws 914.25. 3. The electric cables must be taut when fitted. |

7.6.3 Reassembling the motor section

	NOTE
	<p>Before reassembling the motor section, check that all joints relevant to explosion protection (flamepaths) are undamaged. Any components with damaged flamepaths must be replaced. Only use original spare parts made by KSB for explosion-proof pumps. Observe the flamepath positions specified in the Annex (Flamepaths on explosion-proof motors). (⇒ Section 9.5, Page 85) Secure all screwed/bolted connections closing off the flameproof enclosure with a thread-locking agent (Loctite Type 243).</p>
	⚠ DANGER
	<p>Wrong screws/bolts Explosion hazard!</p> <ul style="list-style-type: none"> ▷ Always use the original screws/bolts for assembling an explosion-proof pump set. ▷ Never use screws/bolts of different dimensions or of a lower property class.

7.6.4 Installing the mechanical seals

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.
- Cover any grooves in the shaft into which the O-rings could slide with suitable means and/or assembly aids.

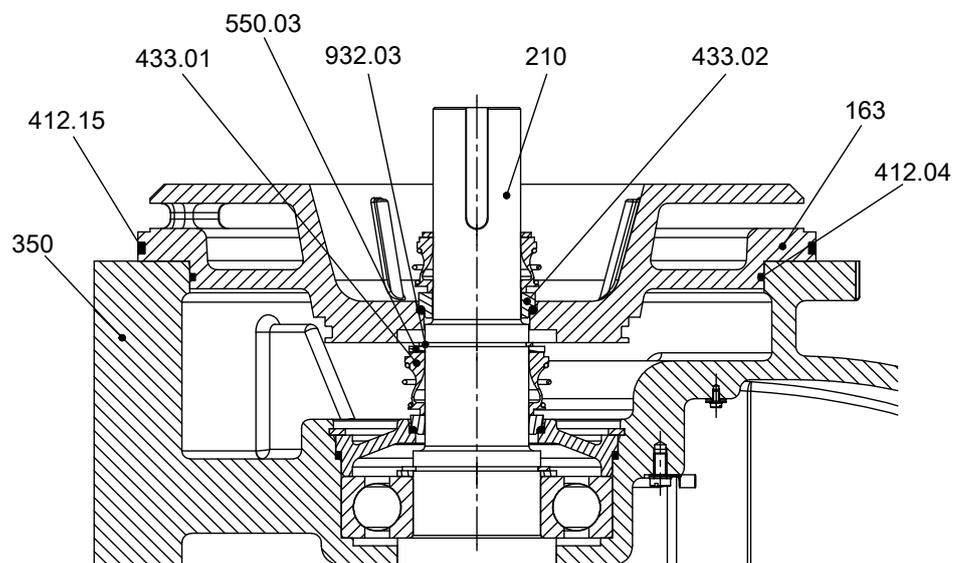


Fig. 34: Fitting the mechanical seals

- ✓ The shaft and rolling element bearings have been properly fitted in the motor.
1. Guide drive-end mechanical seal 433.01 with disc 550.03 on shaft 210 and secure it with circlip 932.03.
 2. Insert O-rings 412.04 and 412.15 into discharge cover 163, and press them into bearing housing 350 as far as they will go.
 3. Guide the pump-end mechanical seal 433.02 onto shaft 210.

For special mechanical seals with covered spring, tighten the grub screw at the rotating assembly and secure it with Loctite before fitting the impeller.

(⇒ Section 9.6.2, Page 86) Observe installation dimension A.

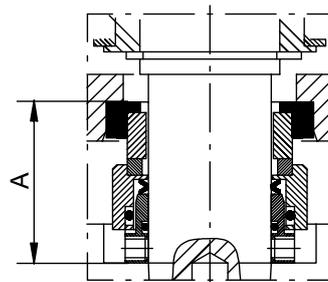


Fig. 35: Installation dimension A

Table 19: Installation dimension A

Size	Installation dimension A
	[mm]
700-324	48.3
700-330	48.3
700-371	48.3
800-324	48.3
800-330	48.3
800-370	48.3
800-371	48.3
800-400	48.3
800-401	48.3

7.6.5 Fitting the impeller

	CAUTION
	<p>Use of grease or other permanent lubricants Torque transmission impeded / overheating of and damage to the pump!</p> <ul style="list-style-type: none"> ▶ Never use grease or other permanent lubricants for fitting the torque-transmitting elements of a mechanical seal. ▶ Use soft soap to reduce any friction caused during assembly. ▶ Never coat the mechanical seal faces with grease or oil.

The impeller is reassembled with an impeller fitting tool.

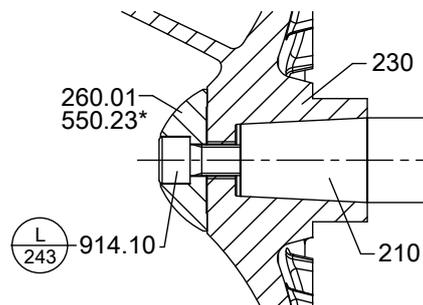


Fig. 36: Fitting the impeller

*: On specific designs only

	NOTE
	<p>For bearing brackets with tapered fit make sure that the tapered fit of impeller and shaft is undamaged and assembled free from grease.</p>

- ✓ The shaft and rolling element bearings have been properly installed.
 - ✓ The mechanical seals have been properly installed.
1. Slide impeller 230 onto the shaft end.
 2. Apply Loctite 243 as thread-locking agent to the thread of the impeller screw.
 3. Screw in impeller screw 914.10 and disc 550.23 if any. Tighten with a torque wrench. Observe the tightening torques.

Table 20: Tightening torques for impeller screws

Size	Thread	Tightening torque
		[Nm]
700-324	M20	290
700-330	M20	290

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Size	Thread	Tightening torque
		[Nm]
700-371	M20	290
800-324	M20	290
800-330	M20	290
800-370	M20	290
800-371	M20	290
800-400	M20	290
800-401	M20	290

7.6.6 Installing the back pull-out unit

	NOTE
	<p>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.</p>

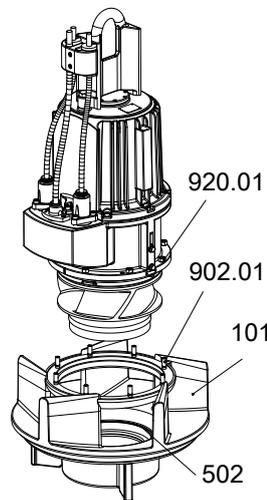


Fig. 37: Installing the back pull-out unit

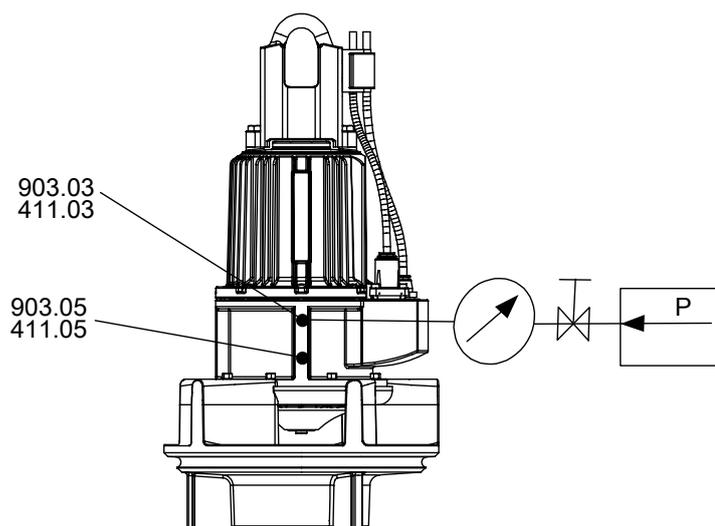
1. Use a rubber mallet to insert casing wear ring 502 into pump casing 101 as far as it will go.
2. Insert the complete back pull-out unit into pump casing 101.
3. Evenly tighten screwed connection 920.01 between the pump casing and the bearing housing.

7.6.7 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. 38: Screwing in the testing device

1. Undo and remove screw plug 903.03 and joint ring 411.03 of the lubricant reservoir.
2. Screw the testing device tightly into the lubricant filler opening.
3. Carry out the leak test with the values specified above.
The pressure must not drop during the test period.
If the pressure does drop, check the seals and screwed connections.
Repeat the leak test.
4. If the leak test has been successful, fill in the lubricant.
5. Fit and tighten screw plug 903.03 and joint ring 411.03 of the lubricant reservoir.

7.7 Checking the connection of motor/power supply

Check the electric cables after reassembly. (⇒ Section 7.2.1, Page 52)

7.8 Tightening torques

Table 21: Tightening torques [Nm] depending on thread, steel grade and property class

Steel grade	-		A2, A4		A2, A4		1.4410		1.4462	
Property class	8.8		-50		-70		$R_{p0.2} \geq 530 \text{ N/mm}^2$		$R_{p0.2} \geq 450 \text{ N/mm}^2$	
Thread	Minimum	Rated torque	Minimum	Rated torque	Minimum	Rated torque	Minimum	Rated torque	Minimum	Rated torque
M4	3,0	3,4	1,0	1,1	2,1	2,4	2,5	2,8	2,1	2,4
M5	6,1	6,8	2,0	2,2	4,3	4,8	5,0	5,6	4,3	4,8
M6	10,3	11	3,4	3,7	7,2	8,0	8,5	9,5	7,2	8,0
M8	25	28	8,2	9,1	18	19	21	23	18	19
M10	49	55	16	18	35	38	41	45	35	38
M12	85	94	28	31	59	66	70	78	59	66
M14	134	149	44	49	94	105	111	124	94	105
M16	209	232	69	76	147	163	173	192	147	163
M20	408	453	134	149	287	319	338	375	287	319
M24	704	782	231	257	495	550	583	648	495	550
M27	1025	1139	36	374	721	801	849	944	721	801
M30	1403	1559	460	511	986	1096	1162	1291	986	1096
M33	1888	2098	619	688	1327	1475	1563	1737	1327	1475
M36	2445	2717	802	891	1719	1910	2025	2250	1719	1910

Steel grade	-		A2, A4		A2, A4		1.4410		1.4462	
Property class	8.8		-50		-70		$R_{p0.2} \geq 530 \text{ N/mm}^2$		$R_{p0.2} \geq 450 \text{ N/mm}^2$	
Thread	Minimum	Rated torque	Minimum	Rated torque	Minimum	Rated torque	Minimum	Rated torque	Minimum	Rated torque
M42	3904	4338	1281	1423	2745	3050	3233	3592	2745	3050
M48	5880	6534	1929	2144	4135	4594	4870	5411	4135	4594


NOTE

If using an adjustable torque wrench or screwdriver, adjust it to a value within the indicated range between the minimum and the rated torque.

7.9 Spare parts stock

7.9.1 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 4.4, Page 19)

Also specify the following data:

- Part number and description (⇒ Section 9.1, Page 75)
- Quantity of spare parts
- Shipping address
- Mode of dispatch (freight, mail, express freight, air freight)

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

Table 22: Quantity of spare parts for recommended spare parts stock⁴⁾

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 %
322	Rolling element bearing, motor end	1	1	2	2	3	4	50 %
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 %
412.20	O-ring for sealing the discharge tube	2	3	4	5	6	8	100 %

⁴⁾ For two years of continuous operation or 17,800 operating hours

8 Trouble-shooting

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

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

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

Table 23: Trouble-shooting

A	B	C	D	E	Possible causes	Remedy ⁵⁾
-	X	-	-	X	Water level lowered too much during operation	Check supply and capacity of system (sump floor area). Check level control equipment.
X	X	-	-	X	Total pressure corresponding to $NPSH_{pump}$ too high Total pressure corresponding to $NPSH_{system}$ too low	Increase fluid level on the suction side. Clean screening equipment, if required.
X	X	X	-	X	Penetration of air into the pump due to formation of an air pocket - Suction-side water level too low	Increase the suction-side water level. If this is not possible or unsuccessful, please contact KSB.
X	X	X	-	X	Unfavourable flow to the pump inlet	Improve the flow to the intake chamber (contact KSB).
-	X	X	-	X	Pump running in off-design conditions - part load/overload	Check the pump's operating data.
X	X	-	X	X	Pump clogged by deposits	Clean intake and pump components.
-	X	X	X	X	Wear	Replace worn parts.
-	X	-	X	X	Impermissible air or gas content in the fluid handled	Contact KSB.
-	-	-	-	X	System-induced vibrations	Contact KSB.
-	-	X	-	X	Wrong direction of rotation	Check the electrical connection of motor and control system, if any.
X	-	-	-	-	No voltage	Check electrical connections. Contact the energy supplier.
X	-	-	-	-	Motor winding or electric cable are defective.	Replace with original KSB cable or contact KSB.
-	-	X	-	X	Worn or defective rolling element bearings	Contact KSB.
X	-	-	-	-	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.
X	-	-	-	-	Motor has been tripped by leakage monitor.	Have cause determined and eliminated by qualified and trained personnel.
X	-	-	-	-	Mechanical seal monitor has tripped.	Have cause determined and eliminated by qualified and trained personnel.

⁵⁾ The pump pressure must be released before attempting to remedy faults on parts which are subjected to pressure. Disconnect the pump set from the power supply!

A	B	C	D	E	Possible causes	Remedy ⁵⁾
X	-	-	-	-	Bearing temperature monitor has tripped.	Have cause determined and eliminated by qualified and trained personnel.
-	X	-	X	-	In case of star-delta configuration: motor running in star configuration only	Check star-delta contactor.

9 Related Documents

9.1 General assembly drawing with list of components

9.1.1 Motor versions UE, XE, YE

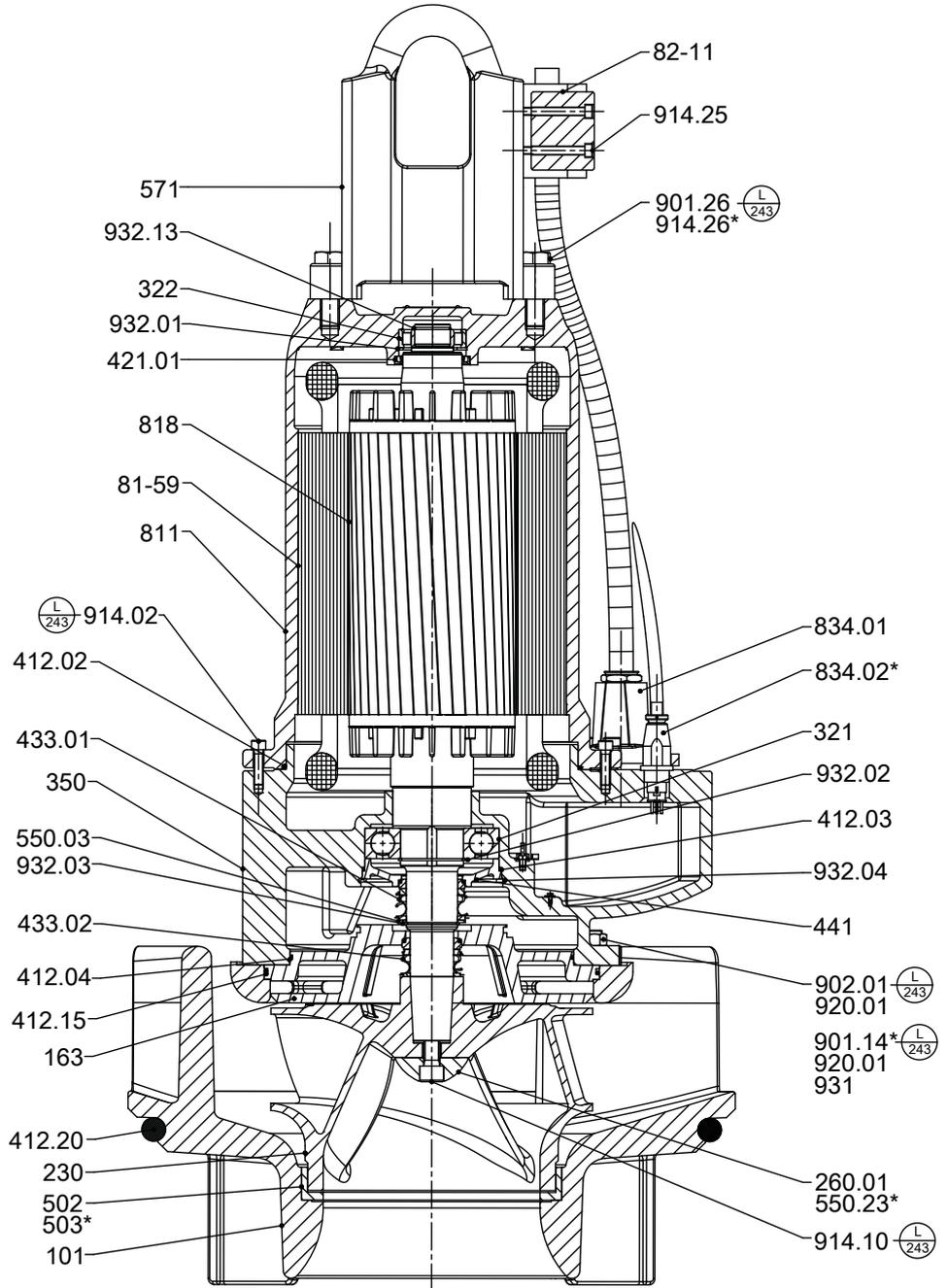


Fig. 39: General assembly drawing, motor versions UE, XE, YE

*: On specific designs only

Table 24: Symbols key

Symbol	Description
	Always secure screwed connections marked with this symbol with Loctite 243 .

Table 25: List of components

Part No.	Description	Part No.	Description
101	Pump casing	550.03/.23	Disc
163	Discharge cover	571	Bail
230	Impeller	81-59	Stator
260.01	Impeller hub cap	811	Motor housing
321	Radial ball bearing	818	Rotor
322	Radial roller bearing	82-11	Strain relief device
350	Bearing housing	834.01/.02	Cable gland
412.02/.03/.04/.15/.20	O-ring	901.14/.20/.26	Hexagon head bolt
421.01	Lip seal	902.01	Stud
433.01/.02	Mechanical seal	914.02/.10/.25/.26	Hexagon socket head cap screw
441	Shaft seal housing	920.01	Nut
502	Casing wear ring	931	Lock washer
503	Impeller wear ring	932.01/.02/.03/.04/.13	Circlip

9.2 Detail drawings

9.2.1 Cable gland

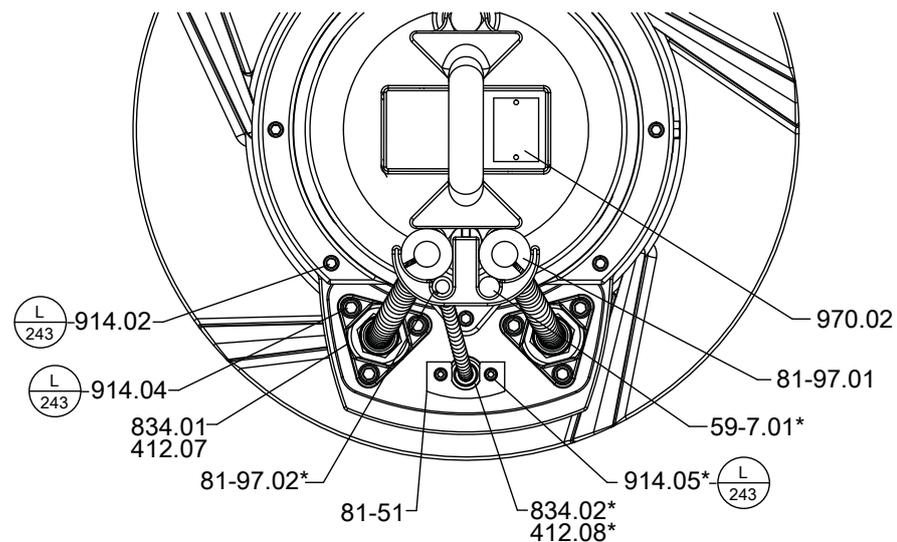


Fig. 40: Cable gland

*: On specific designs only

Table 26: Symbols key

Symbol	Description
	Always secure screwed connections marked with this symbol with Loctite 243 .

Table 27: List of components

Part No.	Description	Part No.	Description
412.07/.08	O-ring	834.01/.02	Cable gland
59-7.01	Support	914.02/.04/.05	Hexagon head bolt
81-51	Clamping element	970.02	Label/plate
81-97.01/.02	Cable protector		

9.2.2 Bearing temperature sensor and leakage monitoring

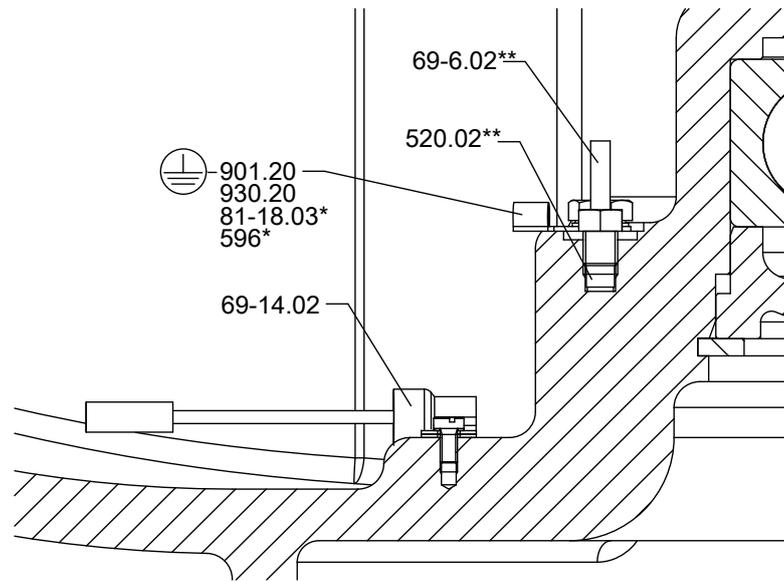


Fig. 41: Bearing temperature sensor and leakage monitoring

*: On specific designs only

** : Optional

Table 28: List of components

Part No.	Description	Part No.	Description
520.02	Sleeve	81-18.03	Cable terminal
596	Wire	901.20	Hexagon head bolt
69-6.02	Temperature sensor	930.20	Safety device
69-14.02	Leakage sensor		

9.3 Cable bundle

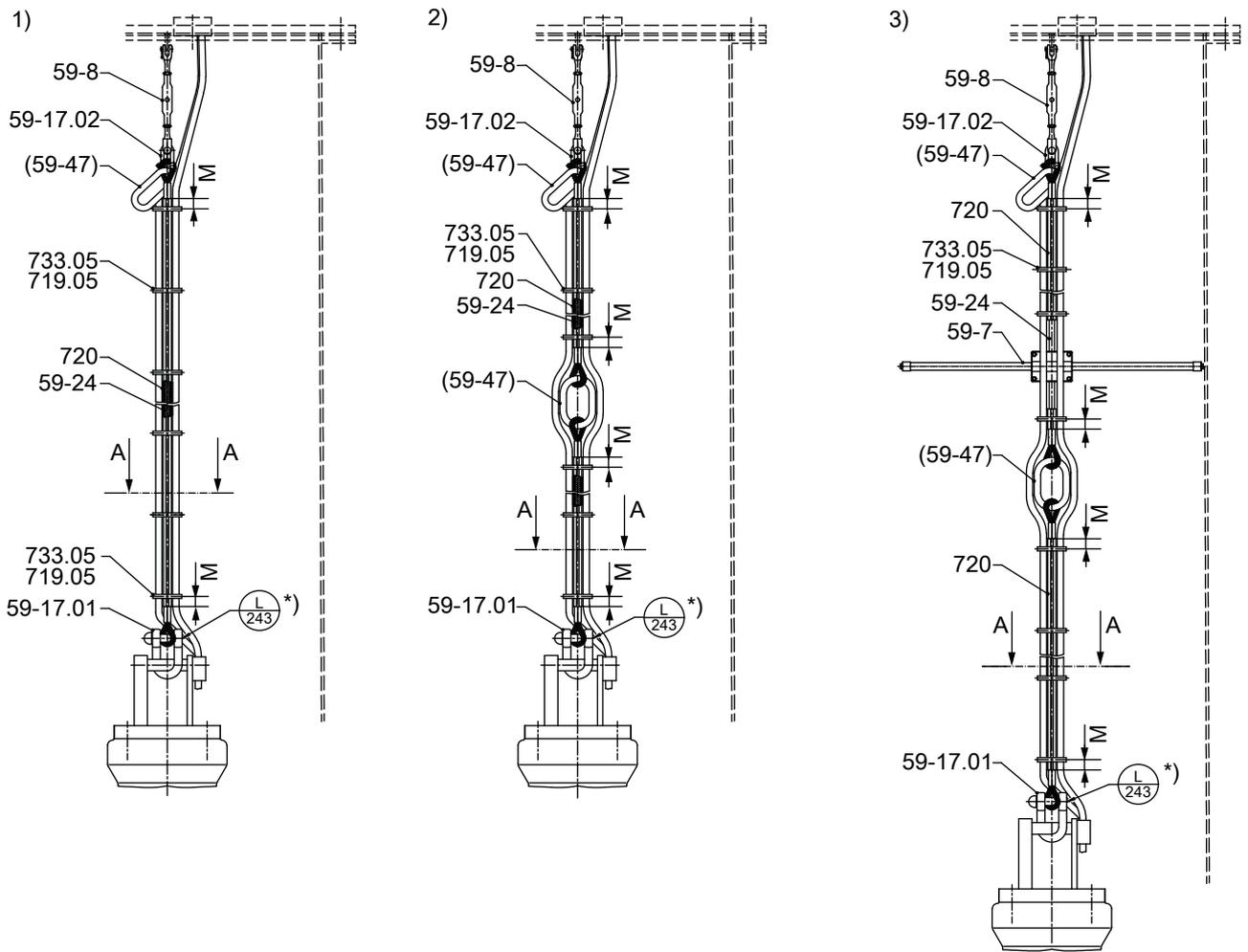


Fig. 42: Cable bundle

1)	Basic design
2)	Design with lifting lug
3)	Design with support

*) : Only required for galvanised version (⇒ Section 5.3.3, Page 31)

	NOTE
	Distance M = 50 mm

Table 29: Symbols key

Symbol	Description
	Always secure screwed connections marked with this symbol with Loctite 243 .

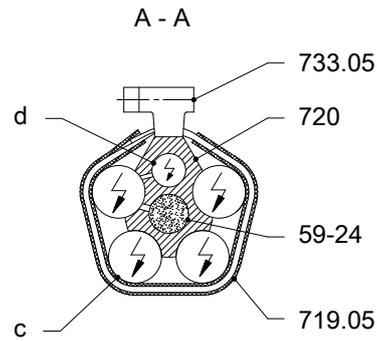


Fig. 43: Section A - A, position of power cable, control cable and support rope

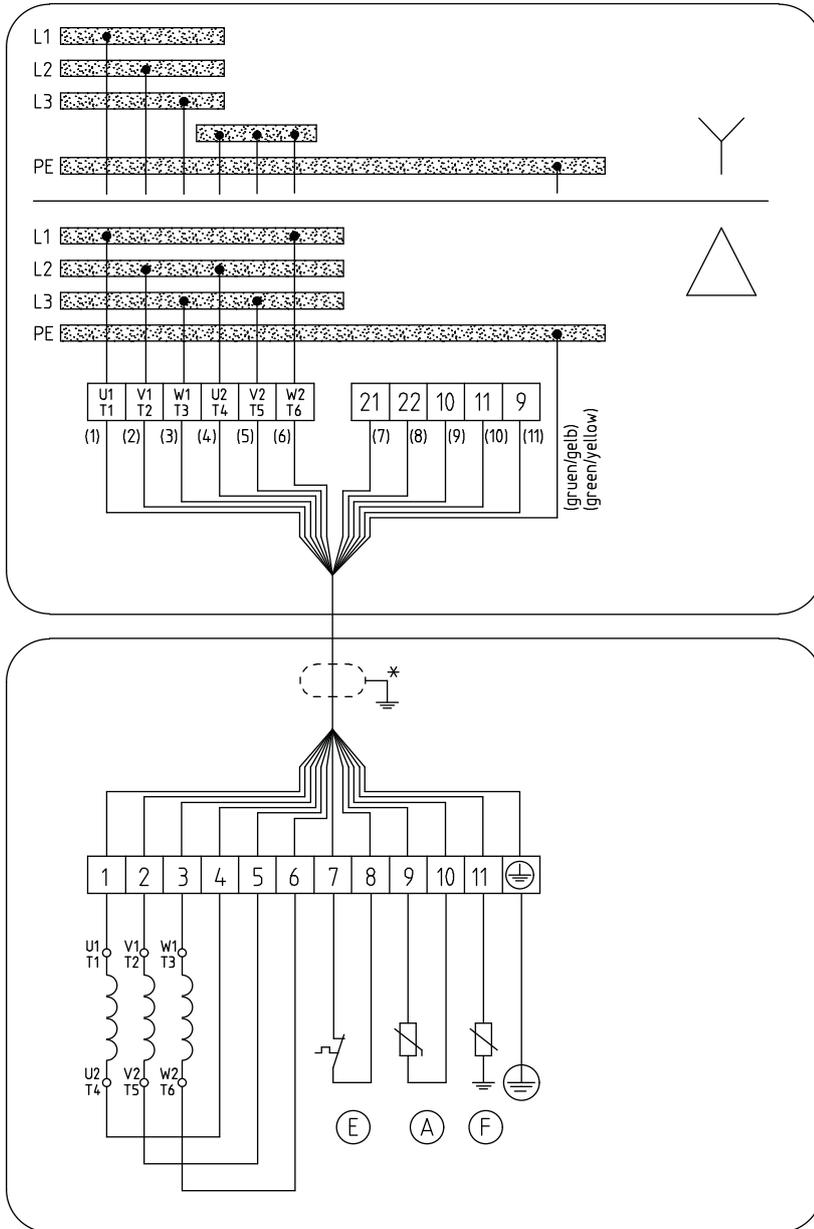
c	Power cable	d	Control cable
---	-------------	---	---------------

Table 30: List of spare parts of the cable bundle

Part No.	Description	Part No.	Description
59-7	Support	59-47	Lifting lug
59-8	Turnbuckle	719.05	Flexible tube
59-17.01/.02	Shackle	720	Fitting
59-24	Rope / support rope	733.05	Hose clip

9.4 Wiring diagrams

9.4.1 Wiring diagram for one power cable 12G1.5 or 12G2.5

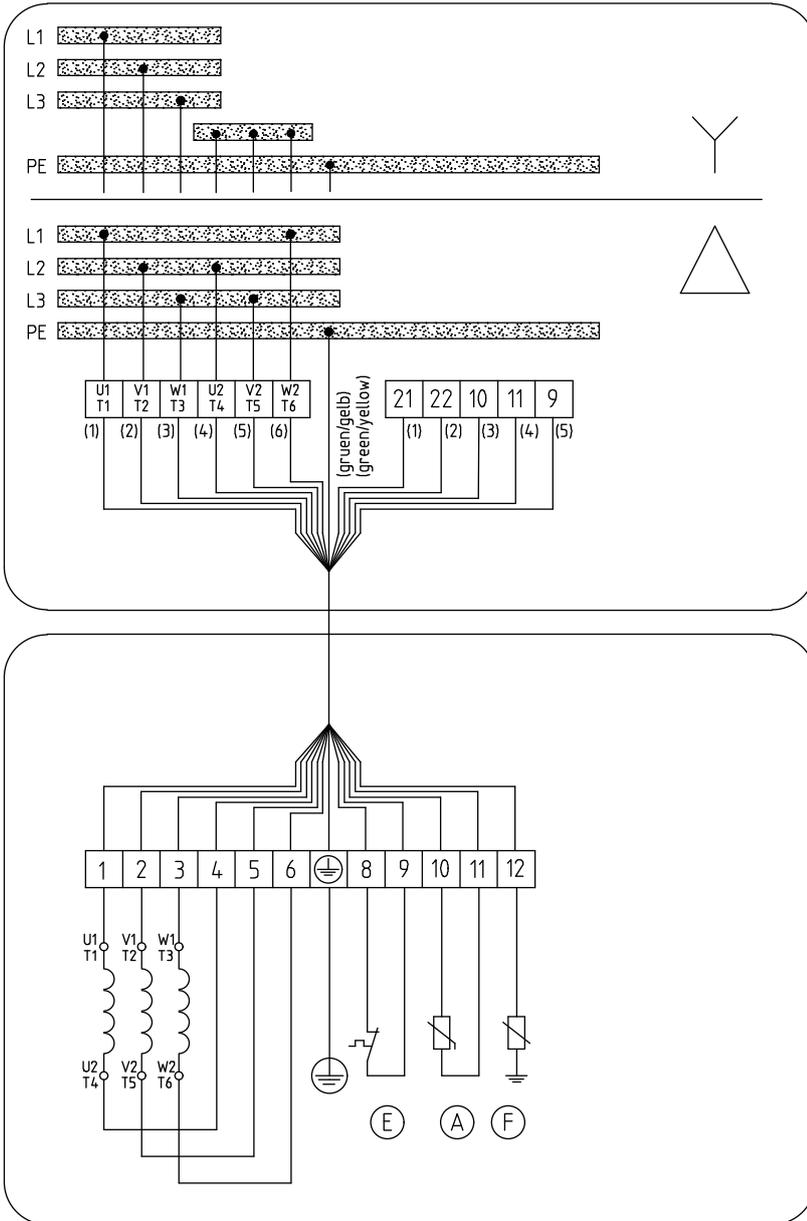


UG1377002

Fig. 44: Wiring diagram for pump sets with one power cable 12G1.5 or 12G2.5

(A)	Motor temperature (PTC thermistor)
(E)	Motor temperature
(F)	Leakage inside the motor
*	Shielded cable option

9.4.2 Wiring diagram for one power cable 7G4 + 5x1.5, 7G6 + 5x1.5 or 7G10 + 5x1.5

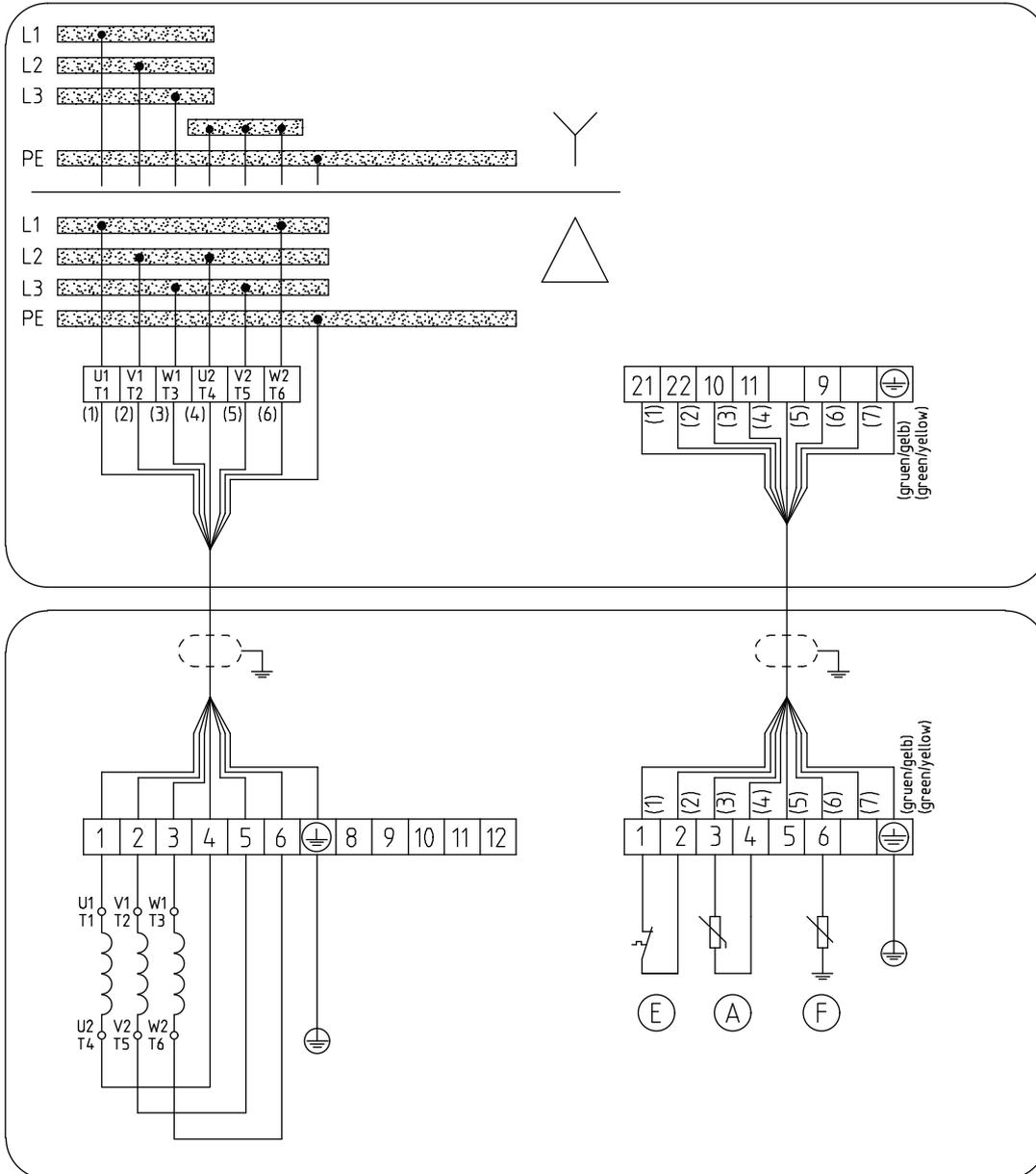


UG1377002

Fig. 45: Wiring diagram for pump sets with one power cable 7G4 + 5x1.5, 7G6 + 5x1.5 or 7G10 + 5x1.5

Ⓐ	Motor temperature (PTC thermistor)
Ⓔ	Motor temperature
Ⓕ	Leakage inside the motor

9.4.3 Wiring diagram for two power cables 7G6 and 8G1.5 (shielded version)

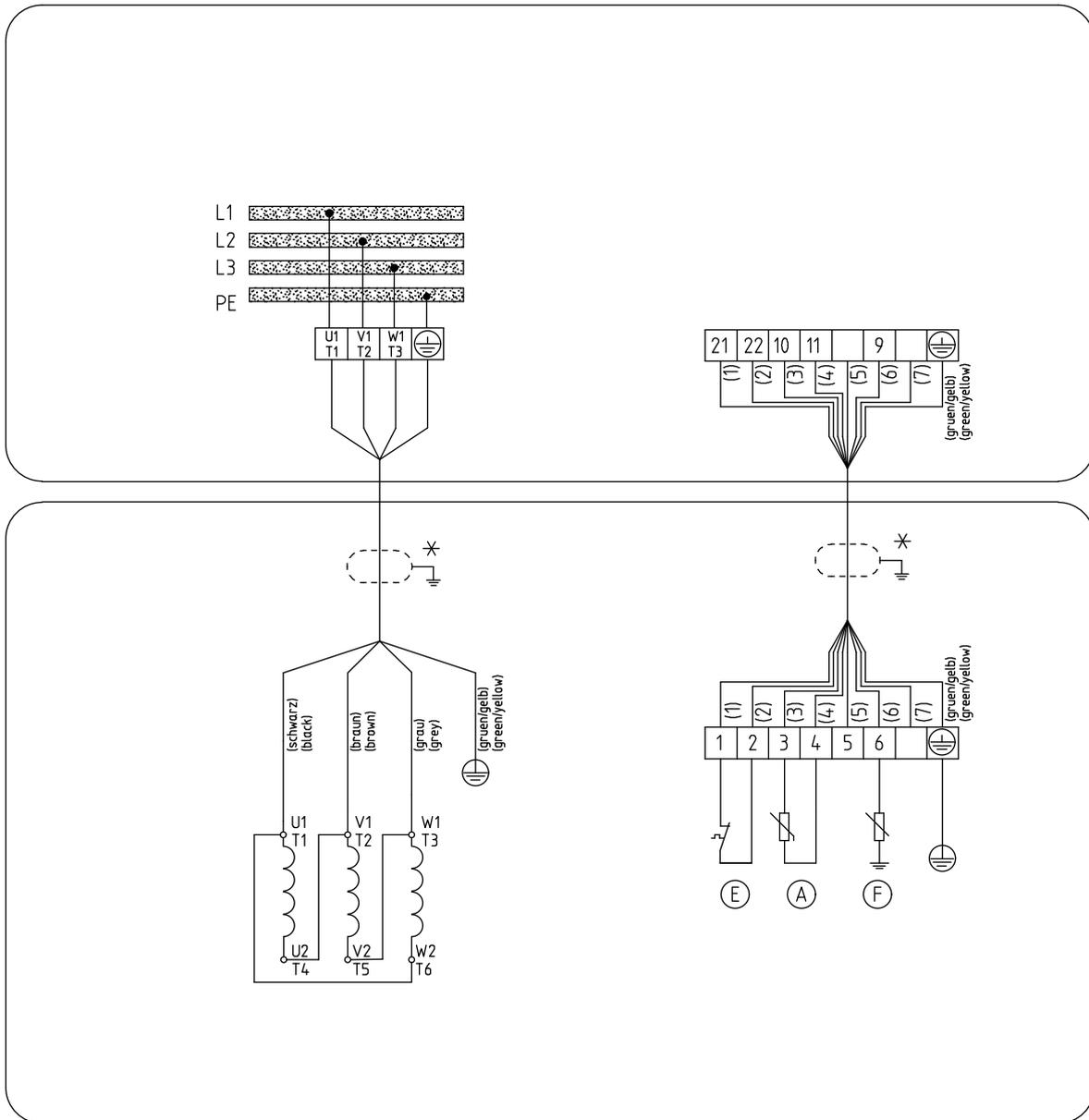


UG1572553

Fig. 46: Wiring diagram for pump sets with two power cables 7G6 and 8G1.5

Ⓐ	Motor temperature (PTC thermistor)
Ⓔ	Motor temperature
Ⓕ	Leakage inside the motor

9.4.4 Wiring diagram for one power cable 4G16 and one control cable 8G1.5



UG1572545

Fig. 47: Wiring diagram for one power cable 4G16 and one control cable 8G1.5

Ⓐ	Motor temperature (PTC thermistor)
Ⓔ	Motor temperature
Ⓕ	Leakage inside the motor
*	Shielded cable option

9.4.5 Wiring diagram for two power cables 4GXX (AWG X-4) and one control cable 8G1.5 (AWG 15-8) for pumps with optional bearing temperature monitoring

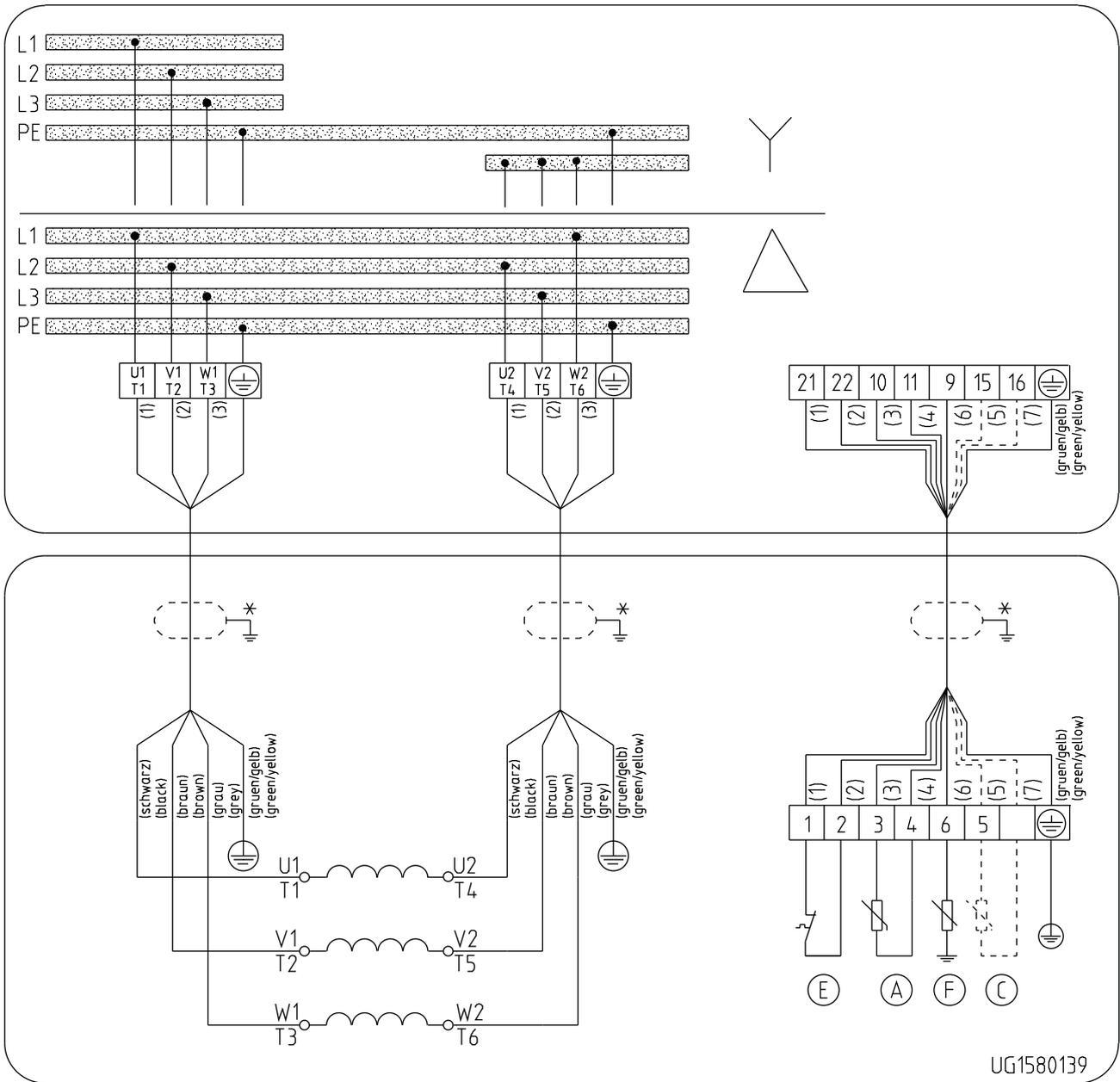


Fig. 48: Wiring diagram for pump sets of installation types P or S with two power cables 4GXX (AWG X-4) and one control cable 8G1.5 (AWG 15-8) for pumps with optional bearing temperature monitoring

(A)	Motor temperature (PTC thermistor)
(C)	Bearing temperature (lower bearing assembly, optional)
(E)	Motor temperature
(F)	Leakage inside the motor
*	Shielded cable option

9.5 Flamepaths on explosion-proof motors

9.5.1 Motor versions XE, YE

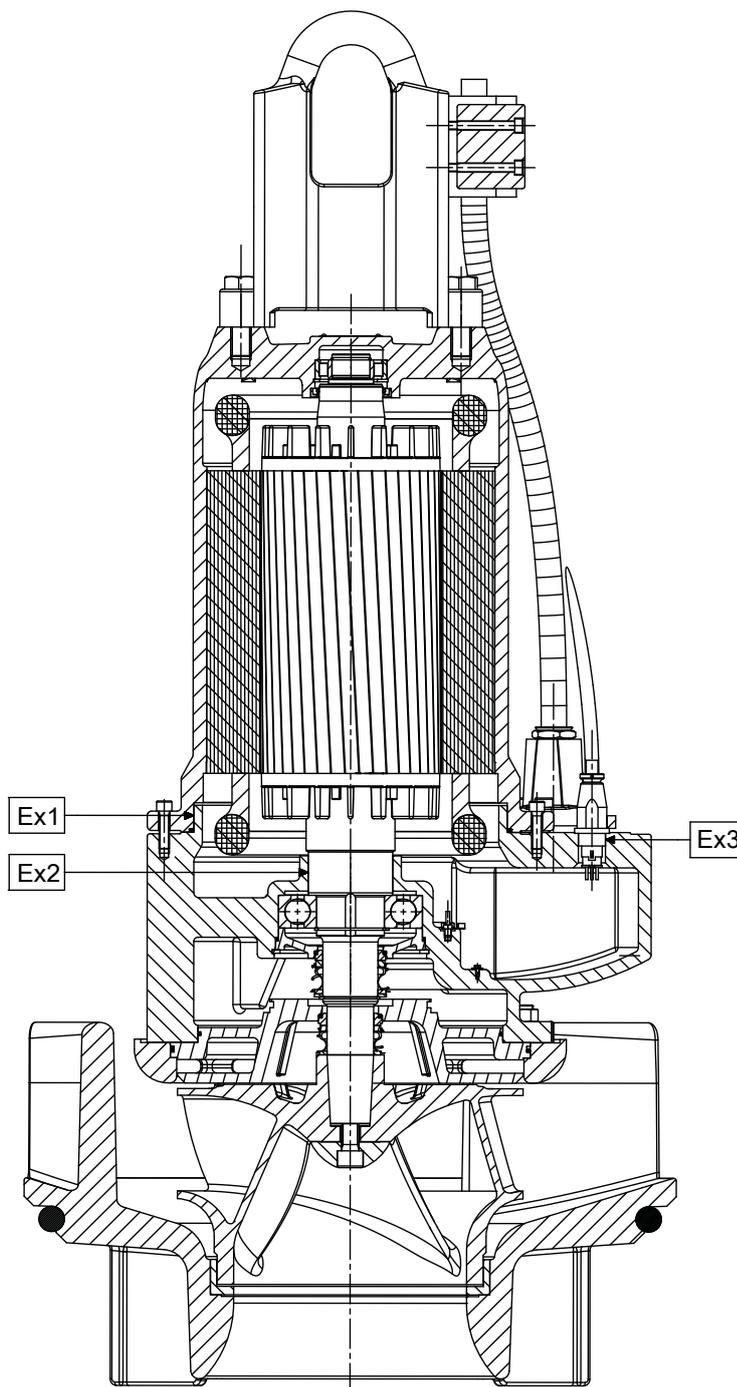


Fig. 49: Motor versions XE, YE

9.6 Sectional drawings of the mechanical seal

9.6.1 Bellows-type mechanical seal

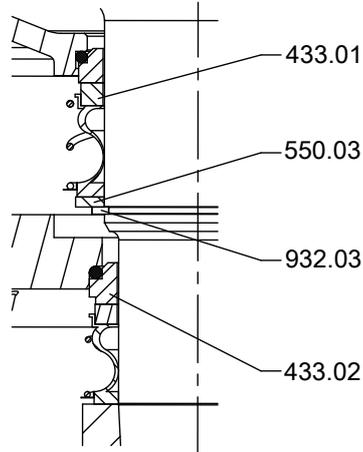


Fig. 50: Installation drawing for bellows-type mechanical seal

Table 31: Bellows-type mechanical seal

Part No.	Description	Part No.	Description
433.01/02	Mechanical seal	932.03	Circlip
550.03	Disc		

9.6.2 Mechanical seal with covered springs (HJ)

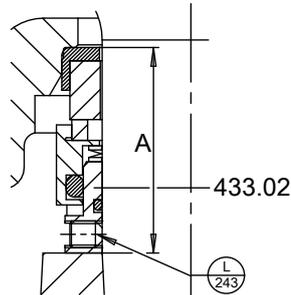


Fig. 51: Installation drawing for mechanical seal with covered springs (HJ)

A: installation dimension (⇒ Section 7.6.4, Page 68)

Table 32: Symbols key

Symbol	Description
	Always secure screwed connections marked with this symbol with Loctite 243 .

Table 33: Mechanical seal with covered springs (HJ)

Part No.	Description	Part No.	Description
433.02	Mechanical seal		

9.7 Dimensions

9.7.1 Motor version UE, XE, YE

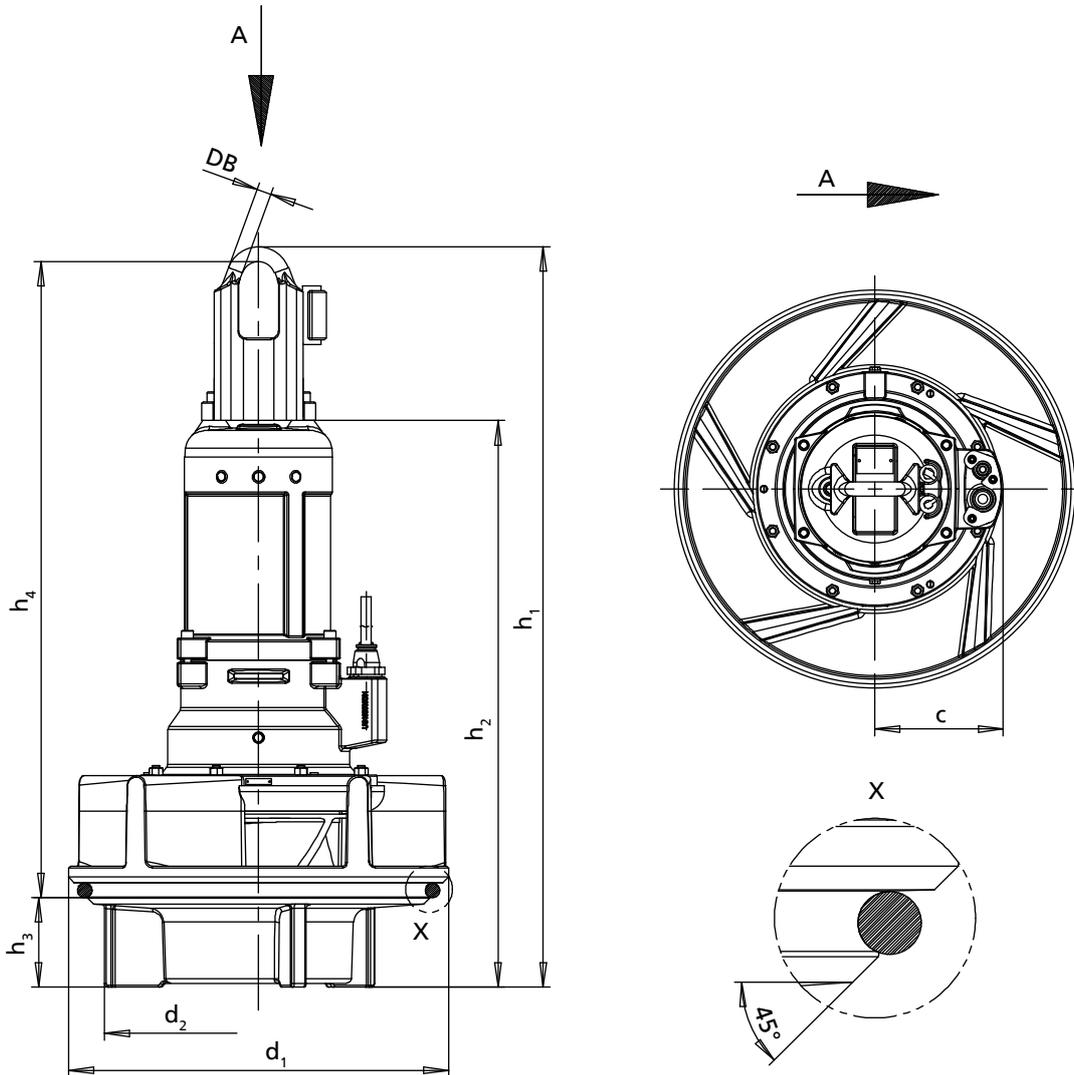


Fig. 52: Pump set dimensions

Table 34: Pump set dimensions [mm]

Size	Motor	c	d ₁	d ₂	DB	h ₁	h ₂	h ₃	h ₄	[kg] ⁶⁾
700-324	22 6.E	260	670	556	30	1460	1105	151	1280	500
700-324	11 8.E	260	670	556	30	1460	1105	151	1280	480
700-324	15 8.E	260	670	556	30	1460	1105	151	1280	480
700-324	18 8.E	260	670	556	30	1460	1105	151	1280	500
700-330	30 4.E	260	670	556	30	1460	1105	151	1280	490
700-330	37 4.E	260	670	556	30	1460	1105	151	1280	530
700-330	22 6.E	260	670	556	30	1460	1105	151	1280	490
700-371	22 6.E	260	670	556	30	1460	1105	151	1280	520
700-371	11 8.E	260	670	556	30	1460	1105	151	1280	490
700-371	15 8.E	260	670	556	30	1460	1105	151	1280	490
700-371	18 8.E	260	670	556	30	1460	1105	151	1280	520

1579.8107/01-EN

⁶⁾ Pump set with 10 m connection cable (400 V)

Size	Motor	c	d ₁	d ₂	DB	h ₁	h ₂	h ₃	h ₄	[kg] ⁶⁾
800-324	31 6.E	355	670	556	40	1435	1060	151	1245	650
800-324	37 6.E	355	670	556	40	1435	1060	151	1245	650
800-330	45 4.E	355	670	556	40	1435	1060	151	1245	620
800-330	55 4.E	355	670	556	40	1435	1060	151	1245	650
800-330	65 4.E	355	670	556	40	1580	1205	151	1390	710
800-330	75 4.E	355	670	556	40	1580	1205	151	1390	740
800-330	31 6.E	355	670	556	40	1435	1060	151	1245	650
800-330	37 6.E	355	670	556	40	1435	1060	151	1245	650
800-370	22 6.E	260	760	640	30	1410	1055	148	1230	560
800-370	30 6.E	260	760	640	30	1410	1055	148	1230	590
800-370	31 6.E	355	760	640	40	1385	1010	148	1200	710
800-370	37 6.E	355	760	640	40	1385	1010	148	1200	710
800-370	45 6.E	355	760	640	40	1530	1155	148	1345	720
800-371	31 6.E	355	670	556	40	1435	1060	151	1245	670
800-371	37 6.E	355	670	556	40	1435	1060	151	1245	670
800-400	22 6.E	260	770	640	30	1515	1160	183	1300	620
800-400	30 6.E	260	770	640	30	1515	1160	183	1300	650
800-400	37 6.E	355	770	640	40	1490	1115	183	1270	770
800-400	45 6.E	355	770	640	40	1635	1260	183	1415	790
800-400	55 6.E	355	770	640	40	1635	1260	183	1415	840
800-400	11 8.E	260	770	640	30	1515	1160	183	1300	600
800-400	15 8.E	260	770	640	30	1515	1160	183	1300	600
800-400	18 8.E	260	770	640	30	1515	1160	183	1300	620
800-400	22 8.E	260	770	640	30	1515	1160	183	1300	650
800-400	30 8.E	355	770	640	40	1490	1115	183	1270	770
800-400	37 8.E	355	770	640	40	1635	1260	183	1415	790
800-400	45 8.E	355	770	640	40	1635	1260	183	1415	850
800-401	22 6.E	260	770	640	30	1515	1160	183	1300	630
800-401	30 6.E	260	770	640	30	1515	1160	183	1300	660
800-401	31 6.E	355	770	640	40	1490	1115	183	1270	780
800-401	37 6.E	355	770	640	40	1490	1115	183	1270	780
800-401	45 6.E	355	770	640	40	1635	1260	183	1415	800
800-401	55 6.E	355	770	640	40	1635	1260	183	1415	850
800-401	11 8.E	260	770	640	30	1515	1160	183	1300	610
800-401	15 8.E	260	770	640	30	1515	1160	183	1300	610
800-401	18 8.E	260	770	640	30	1515	1160	183	1300	630
800-401	22 8.E	260	770	640	30	1515	1160	183	1300	660
800-401	30 8.E	355	770	640	40	1490	1115	183	1270	780
800-401	37 8.E	355	770	640	40	1635	1260	183	1415	800

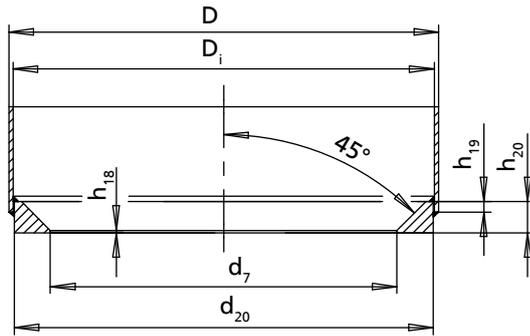


Fig. 53: Seating ring dimensions

Table 35: Seating ring dimensions [mm]

Size	Motor	D ⁷⁾	D ₁	d ₇	d ₂₀	h ₁₈	h ₁₉	h ₂₀
700-324	22 6.E	711	695	570	691	5	20	60
700-324	11 8.E	711	695	570	691	5	20	60
700-324	15 8.E	711	695	570	691	5	20	60
700-324	18 8.E	711	695	570	691	5	20	60
700-330	30 4.E	711	695	570	691	5	20	60
700-330	37 4.E	711	695	570	691	5	20	60
700-330	22 6.E	711	695	570	691	5	20	60
700-371	22 6.E	711	695	570	691	5	20	60
700-371	11 8.E	711	695	570	691	5	20	60
700-371	15 8.E	711	695	570	691	5	20	60
700-371	18 8.E	711	695	570	691	5	20	60
800-324	31 6.E	813	797	570	793	5	20	60
800-324	37 6.E	813	797	570	793	5	20	60
800-330	45 4.E	813	797	570	793	5	20	60
800-330	55 4.E	813	797	570	793	5	20	60
800-330	65 4.E	813	797	570	793	5	20	60
800-330	75 4.E	813	797	570	793	5	20	60
800-330	31 6.E	813	797	570	793	5	20	60
800-330	37 6.E	813	797	570	793	5	20	60
800-370	22 6.E	813	797	656	793	5	20	60
800-370	30 6.E	813	797	656	793	5	20	60
800-370	31 6.E	813	797	656	793	5	20	60
800-370	37 6.E	813	797	656	793	5	20	60
800-370	45 6.E	813	797	656	793	5	20	60
800-371	31 6.E	813	797	570	793	5	20	60
800-371	37 6.E	813	797	570	793	5	20	60
800-400	22 6.E	813	797	656	793	5	20	60
800-400	30 6.E	813	797	656	793	5	20	60
800-400	37 6.E	813	797	656	793	5	20	60
800-400	45 6.E	813	797	656	793	5	20	60
800-400	55 6.E	813	797	656	793	5	20	60
800-400	11 8.E	813	797	656	793	5	20	60
800-400	15 8.E	813	797	656	793	5	20	60
800-400	18 8.E	813	797	656	793	5	20	60

⁷ D for recommended wall thickness of the discharge tube (see dimension s1 in the General Arrangement Drawings)

Size	Motor	D ⁷⁾	D _i	d ₇	d ₂₀	h ₁₈	h ₁₉	h ₂₀
800-400	22 8.E	813	797	656	793	5	20	60
800-400	30 8.E	813	797	656	793	5	20	60
800-400	37 8.E	813	797	656	793	5	20	60
800-400	45 8.E	813	797	656	793	5	20	60
800-401	22 6.E	813	797	656	793	5	20	60
800-401	30 6.E	813	797	656	793	5	20	60
800-401	31 6.E	813	797	656	793	5	20	60
800-401	37 6.E	813	797	656	793	5	20	60
800-401	45 6.E	813	797	656	793	5	20	60
800-401	55 6.E	813	797	656	793	5	20	60
800-401	11 8.E	813	797	656	793	5	20	60
800-401	15 8.E	813	797	656	793	5	20	60
800-401	18 8.E	813	797	656	793	5	20	60
800-401	22 8.E	813	797	656	793	5	20	60
800-401	30 8.E	813	797	656	793	5	20	60
800-401	37 8.E	813	797	656	793	5	20	60

9.8 General arrangement drawings

9.8.1 Installation type BU, motor version UE, XE, YE

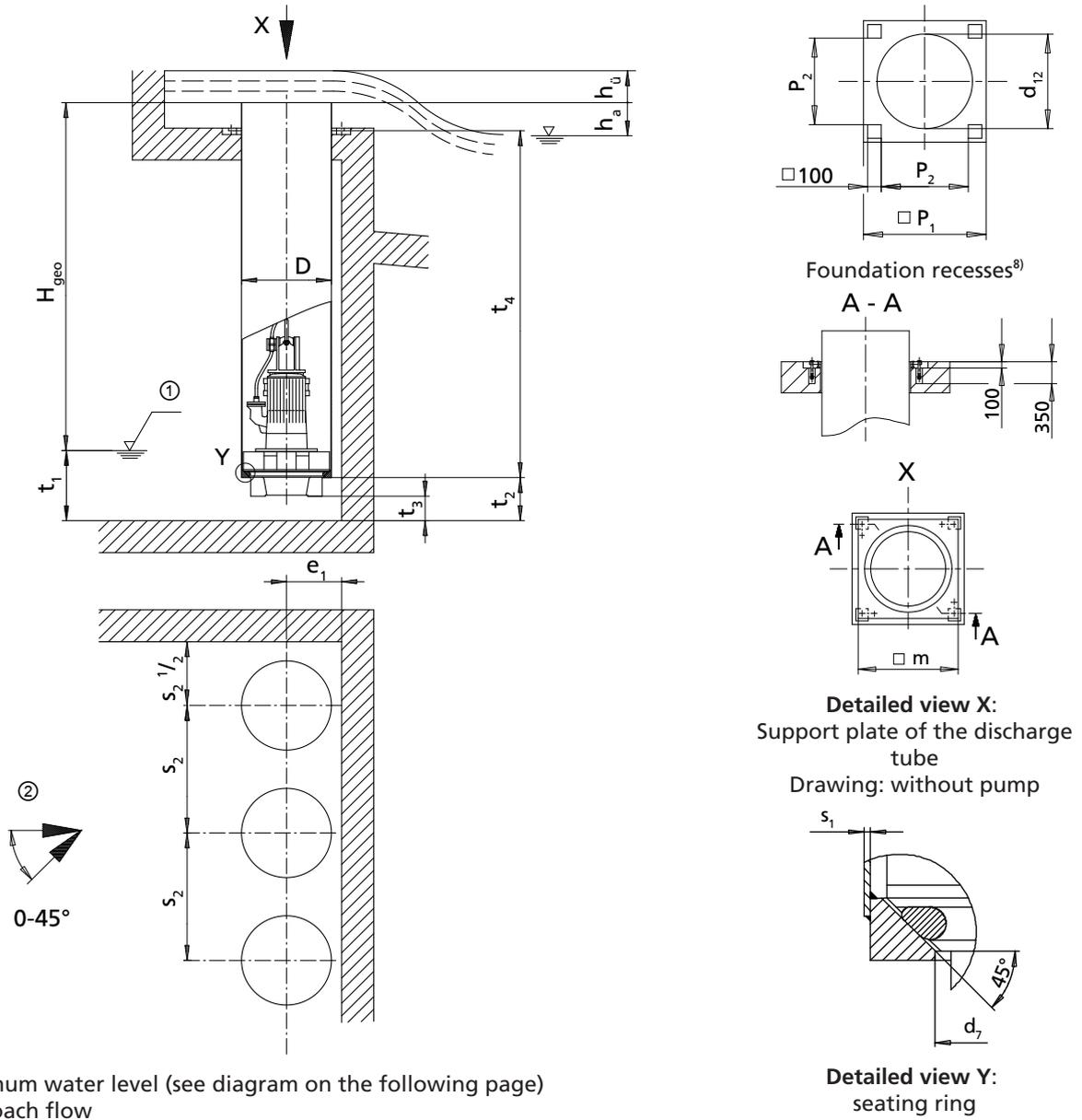


Table 36: Dimensions [mm]

Size	D	d ₇	d ₁₂	e ₁ ⁹⁾	h _a	m	p ₁	p ₂	s _{1 min}	s _{2 min}	t ₂ ⁹⁾	t ₃	t _{4 min} ¹⁰⁾
700-324	711	570	750	430	100	800	900	640	8	1150	330	200	1500
700-330	711	570	750	430	100	800	900	640	8	1150	330	200	1500
700-371	711	570	750	430	100	800	900	640	8	1150	330	200	1500
800-324	813	570	850	480	100	910	1000	740	8	1150	330	200	1500
800-330	813	570	850	480	100	910	1000	740	8	1150	330	200	1650
800-370	813	656	850	480	100	910	1000	740	8	1150	330	200	1550
800-371	813	570	850	480	100	910	1000	740	8	1150	330	200	1500

⁸ All dimensions for foundation recesses apply to discharge tube design without intermediate flange.

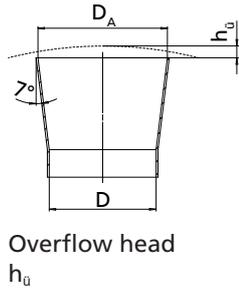
⁹ Observe this dimension.

¹⁰ Value for maximum motor length

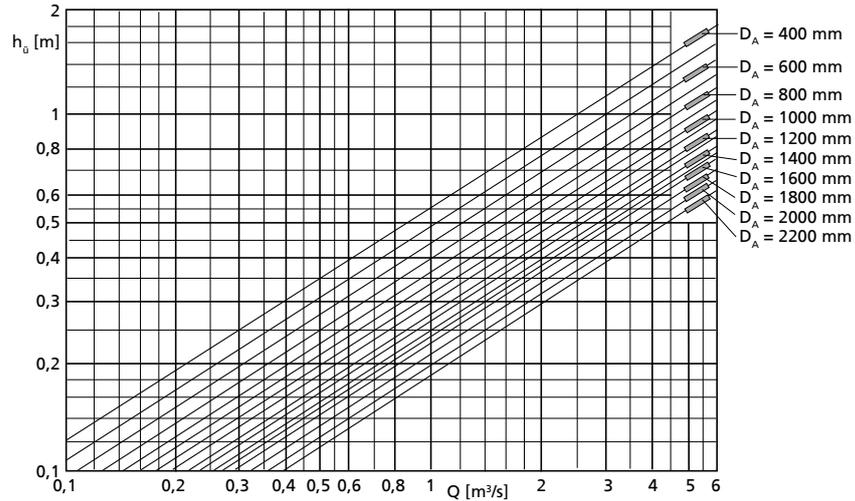
Size	D	d ₇	d ₁₂	e ₁ ⁹⁾	h _a	m	p ₁	p ₂	s _{1 min}	s _{2 min}	t ₂ ⁹⁾	t ₃	t _{4 min} ¹⁰⁾
800-400	813	656	850	480	100	910	1000	740	8	1400	410	250	1700
800-401	813	656	850	480	100	910	1000	740	8	1400	410	250	1700

Permissible deviations:

- Tolerances in building construction to DIN 18202, Part 4, Group B
- Welded design: B/F to DIN EN ISO 13920
- Tolerances for conical seat (detailed view Y): ISO 2768-mH



Loss diagram



Loss diagram

Calculation formulas:

$$H = H_{geo} + \Delta H_v$$

- ΔH_v
- Overflow head h_u (see diagram)
 - Loss in the riser (pipe friction)
 - Outlet loss $v^2/2g$ (v refers to D_A)

Overflow head h_u depends on Q and the discharge diameter D_A . The characteristic curve values only apply to unimpeded outlet in all directions; otherwise they are approximate values only.

Minimum water level diagram

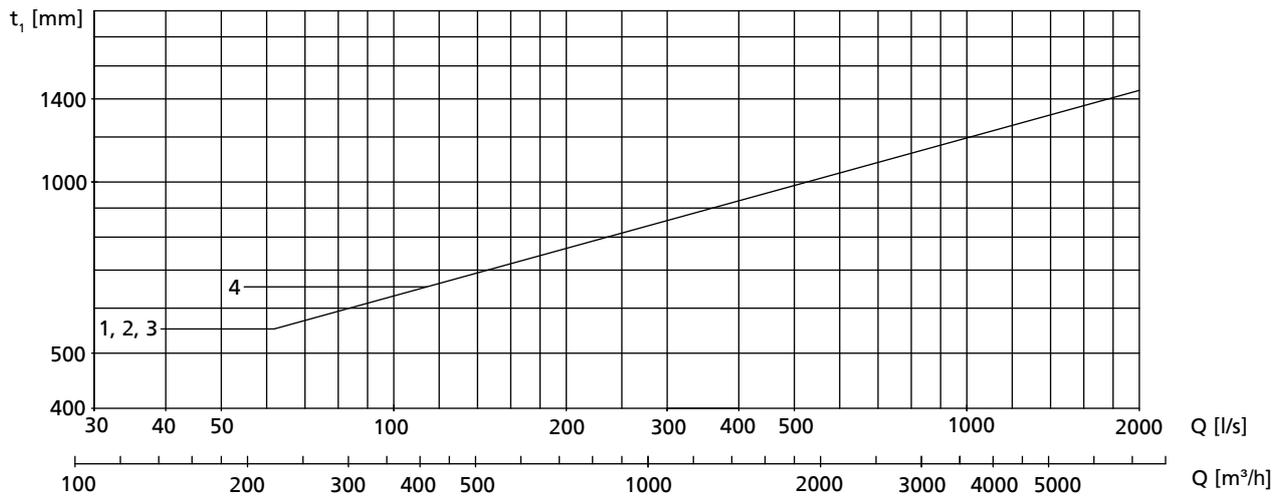


Fig. 54: Minimum water level diagram, motor version UE, XE, YE

1	Amacan K 700-330, 800-330
2	Amacan K 700-324, 700-371, 800-324, 800-371
3	Amacan K 800-370
4	Amacan K 800-400, 800-401

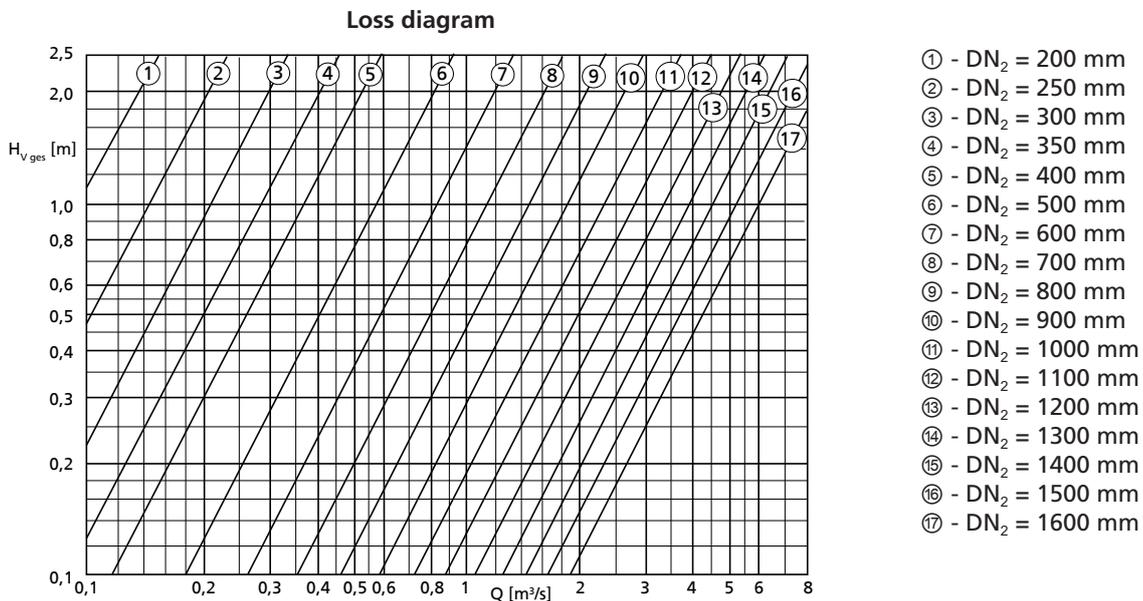
Size	D	DN ₂ min	DN ₂ _{max}	a	a ₁ ¹²⁾	a ₂ ¹²⁾	a ₃ ¹²⁾	d ₇	e ₁ ¹³⁾	m ¹²⁾	m ₁ ¹²⁾	n ¹²⁾
800-330	813	400	700	700	1220	970	480	570	480	1270	505	1260
800-370	813	400	700	700	1220	970	480	656	480	1270	505	1260
800-371	813	400	700	700	1220	970	480	570	480	1270	505	1260
800-400	813	400	700	700	1220	970	480	656	480	1270	505	1260
800-401	813	400	700	700	1220	970	480	656	480	1270	505	1260

Table 38: Dimensions [mm]

Size	p ₁ ¹²⁾	p ₂ ¹²⁾	s ₁ min	s ₂ min	t ₂ ¹³⁾	t ₃	t ₄ min ¹⁴⁾	t ₅ min ¹²⁾
700-324	860	960	8	1150	330	200	1550	720
700-330	860	960	8	1150	330	200	1550	720
700-371	860	960	8	1150	330	200	1550	720
800-324	960	1060	8	1150	330	200	1550	770
800-330	960	1060	8	1150	330	200	1700	770
800-370	960	1060	8	1150	330	200	1600	770
800-371	960	1060	8	1150	330	200	1550	770
800-400	960	1060	8	1400	410	250	1700	770
800-401	960	1060	8	1400	410	250	1750	770

Permissible deviations:

- Tolerances in building construction to DIN 18202, Part 4, Group B
- Welded design: B/F to DIN EN ISO 13920
- Tolerances for conical seat (detailed view Y): ISO 2768-mH
- Discharge flanges to DIN EN 1092-1 PN6 / DIN EN 1092-2 PN6



Calculation formulas:

$$H = H_{geo} + \Delta H_v$$

- ΔH_v
- Loss in the riser (pipe friction)
 - $H_{v\,ges.}$ (see diagram)

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¹⁴ Value for maximum motor length

$H_{V ges.}$ comprises:

- Elbow
- Discharge pipe length = 5 x DN_2
- Swing check valve
- Outlet losses $v^2/2g$

Minimum water level diagram

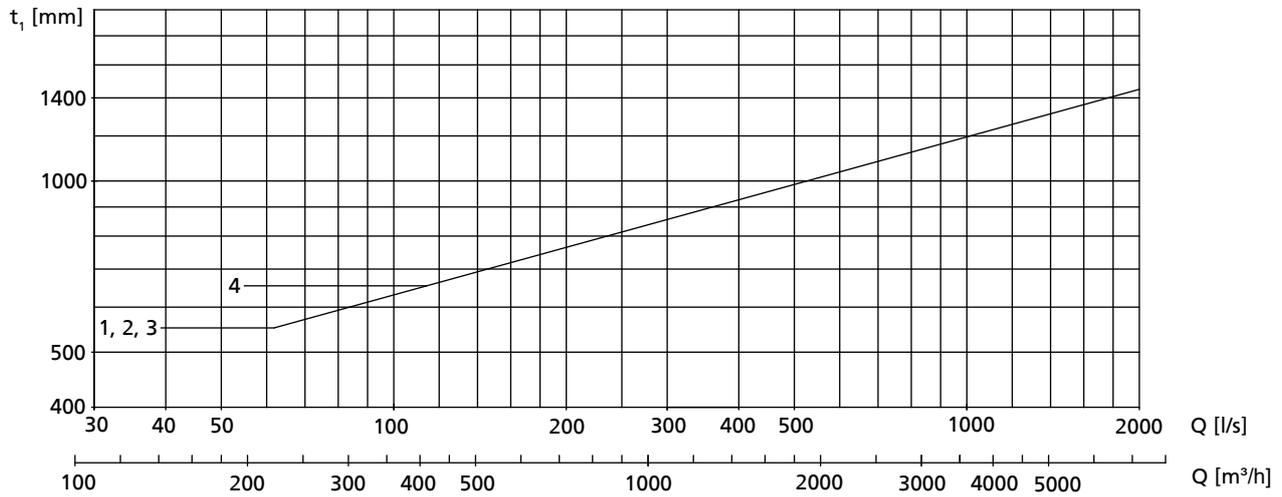
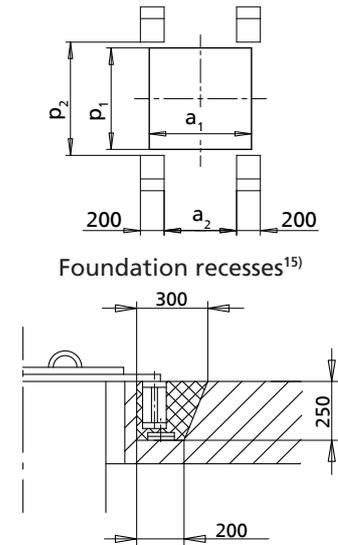
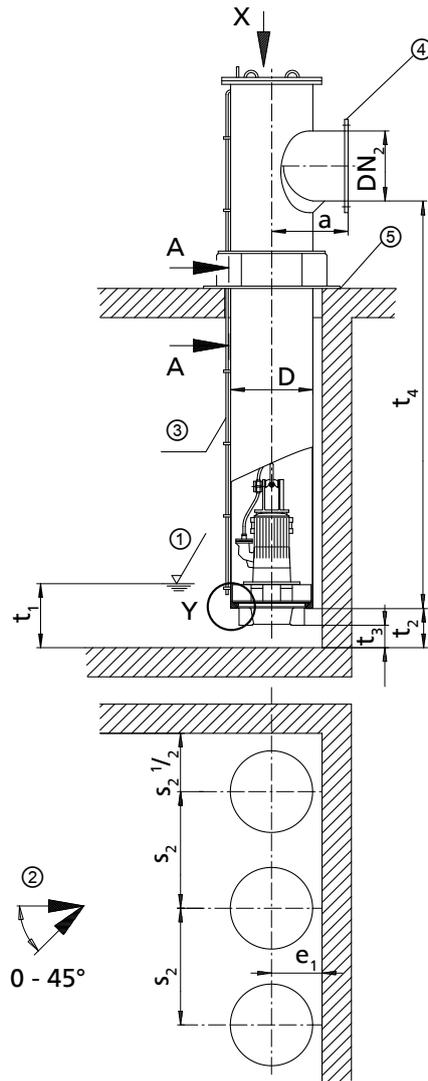


Fig. 55: Minimum water level diagram, motor version UE, XE, YE

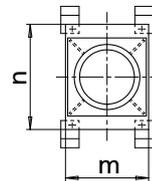
1	Amacan K 700-330, 800-330
2	Amacan K 700-324, 700-371, 800-324, 800-371
3	Amacan K 800-370
4	Amacan K 800-400, 800-401

9.8.3 Installation type DU, motor version UE, XE, YE



Foundation recesses¹⁵⁾

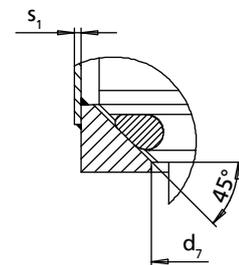
Section A - A:



Detailed view X:

Support plate of the discharge tube

Drawing: without pump



Detailed view Y:
seating ring

- ①: Minimum water level (see diagram on the following page)
- ②: Approach flow
- ③: Vent line
- ④: Connect the discharge pipe to the discharge tube without transmitting any stresses or strains.
- ⑤: Not pressure-proof

Table 39: Dimensions [mm]

Size	D	DN _{2 min}	DN _{2 max}	a	a ₁	a ₂	d ₇	e ₁ ¹⁶⁾	m	n
700-324	711	300	600	650	860	610	570	430	930	1160
700-330	711	300	600	650	860	610	570	430	930	1160
700-371	711	300	600	650	860	610	570	430	930	1160
800-324	813	400	700	700	960	710	570	480	1030	1260
800-330	813	400	700	700	960	710	570	480	1030	1260
800-370	813	400	700	700	960	710	656	480	1030	1260
800-371	813	400	700	700	960	710	570	480	1030	1260
800-400	813	400	700	700	960	710	656	480	1030	1260
800-401	813	400	700	700	960	710	656	480	1030	1260

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¹⁵ All dimensions for foundation recesses apply to discharge tube design without intermediate flange.

¹⁶ Observe this dimension.

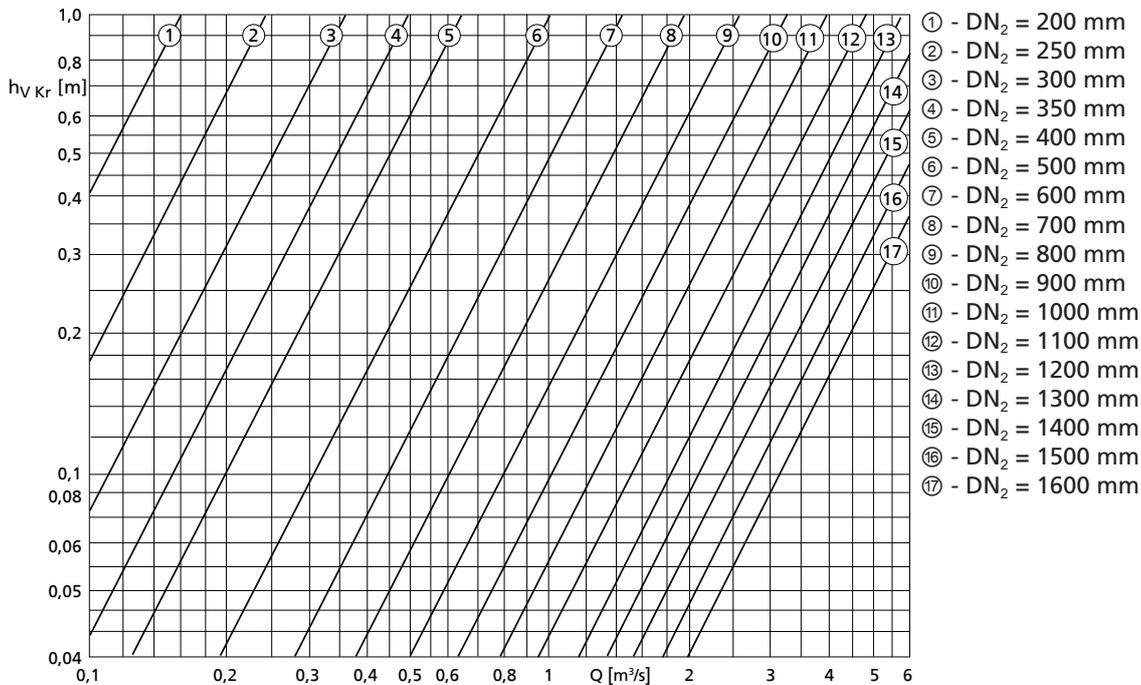
Table 40: Dimensions [mm]

Size	p ₁	p ₂	S _{1 min}	S _{2 min}	t ₂ ¹⁶⁾	t ₃	t _{4 min} ¹⁷⁾
700-324	860	960	8	1150	330	200	1550
700-330	860	960	8	1150	330	200	1550
700-371	860	960	8	1150	330	200	1550
800-324	960	1060	8	1150	330	200	1550
800-330	960	1060	8	1150	330	200	1700
800-370	960	1060	8	1150	330	200	1600
800-371	960	1060	8	1150	330	200	1550
800-400	960	1060	8	1400	410	250	1750
800-401	960	1060	8	1400	410	250	1750

Permissible deviations:

- Tolerances in building construction to DIN 18202, Part 4, Group B
- Welded design: B/F to DIN EN ISO 13920
- Tolerances for conical seat (detailed view Y): ISO 2768-mH
- Discharge flanges to DIN EN 1092-1 PN6 / DIN EN 1092-2 PN6

Loss diagram



Calculation formulas:

$$H = H_{\text{geo}} + \Delta H_v$$

$$\Delta H_v$$

- Loss in the elbow $h_{v, Kr}$ (see diagram)
- Loss in the riser (pipe friction)
- $H_{V, \text{System}}$ (valves, etc.)

$H_{V, \text{System}}$ must be determined for the specific system.

¹⁷ Value for maximum motor length

Minimum water level diagram

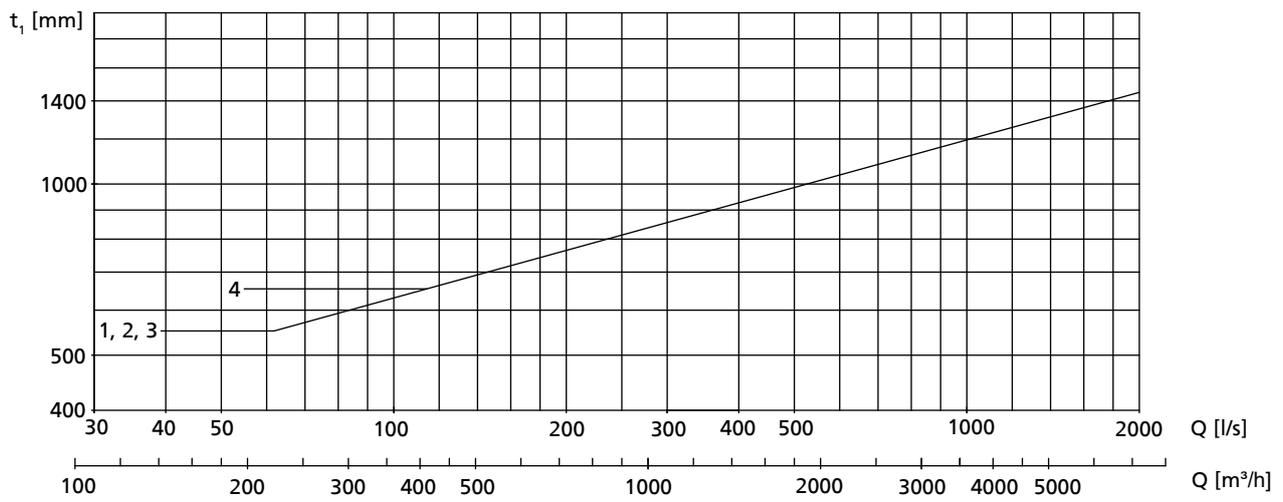


Fig. 56: Minimum water level diagram, motor version UE, XE, YE

1	Amacan K 700-330, 800-330
2	Amacan K 700-324, 700-371, 800-324, 800-371
3	Amacan K 800-370
4	Amacan K 800-400, 800-401

10 UK Declaration of Conformity

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

This UK Declaration of Conformity is issued under the sole responsibility of the manufacturer.

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

Amacan K, Amacan P, Amacan S

KSB order number:

- is in conformity with the provisions of the following directives / regulations as amended from time to time:
 - Pump (set): Supply of Machinery (Safety) Regulations 2008
 - Electrical components¹⁸⁾: The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012

The manufacturer also declares that

- the following harmonised international standards¹⁹⁾ 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 UK Declaration of Conformity was issued in/on:

Place, date

.....²⁰⁾.....

Name
Function
Company
Address

¹⁸ Where applicable

¹⁹ Apart from the standards listed here referring to the *Supply of Machinery (Safety) Regulations 2008*, further standards are observed for explosion-proof versions (*Equipment and Protective Systems Intended for use in Potentially Explosive Atmospheres Regulations 2016*) as applicable and are listed in the legally binding UK Declaration of Conformity.

²⁰ A signed, legally binding UK Declaration of Conformity is supplied with the product.

11 Certificate of Decontamination

Type:

Order number /
Order item number²¹⁾:

Delivery date:

Application:

Fluid handled²¹⁾:

Please tick where applicable²¹⁾:



Corrosive



Oxidising



Flammable



Explosive



Hazardous to health



Seriously hazardous to health



Toxic



Radioactive



Bio-hazardous



Safe

Reason for return:²¹⁾

Comments:

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

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

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

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

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

.....
.....

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

.....
Place, date and signature

.....
Address

.....
Company stamp

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²¹ Required field

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