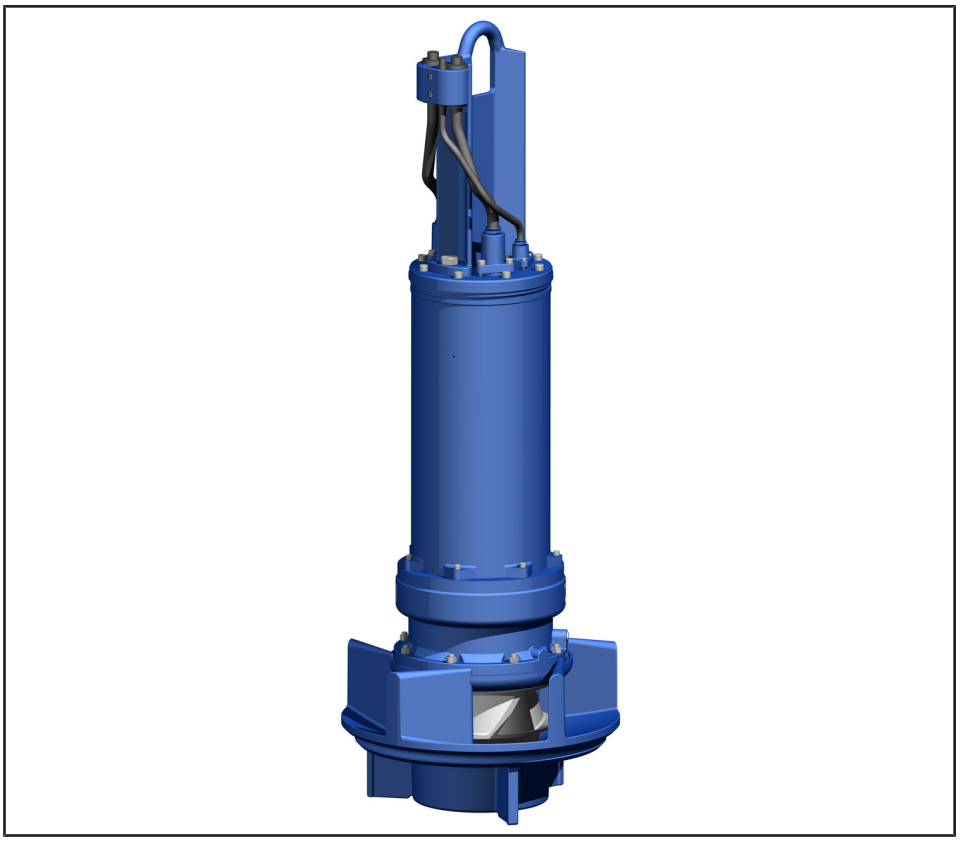
Submersible Pump in Discharge Tube

Amacan K

Size: 700-330 to 1200-630

4 Poles: 95 4.N
6 Poles: 60 6.N to 440 6.N
8 Poles: 90 8.N to 185 8.N
10 Poles: 40 10.N to 75 10.N

Installation/Operating Manual



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CE

KSB

Legal information/Copyright

Installation/Operating Manual Amacan K

Original operating manual

Subject to technical modification without prior notice.

Contents

Glossary

Back pull-out unit

Pump without pump casing; partly completed machinery

Certificate of decontamination

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

Close-coupled design

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

Submersible pump in discharge tube

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

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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

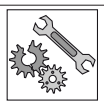
Table 2: Symbols used in this manual

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

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2 Safety

DANGER

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.

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- 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 49)
- 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 45)

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

DANGER

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

Sections of the manual marked by the 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 EU Directive *2014/34/EU (ATEX)*.

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

Improper transport

Danger to life from falling parts!

Damage to the pump set!

- ▷ 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 delivered pump to the place of installation

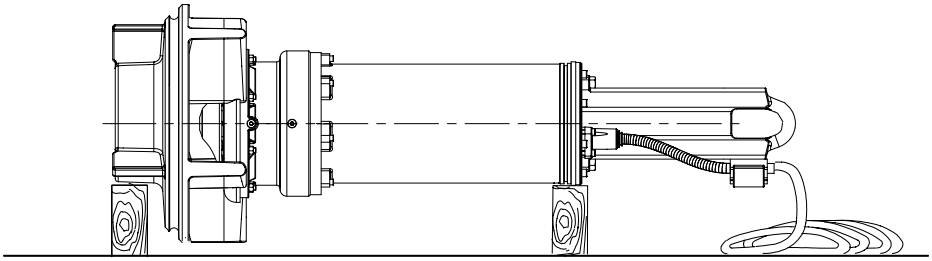

Fig. 1: Transport to the place of installation

- 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

Pump set tilting

Risk of squashing hands and feet!

- ▷ Suspend or support the pump set.

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⚠ WARNING

Placing the pump set on unsecured and uneven surfaces

Personal injury and damage to property!

- 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.

⚠ WARNING

Incorrect handling of the electric cable

Personal injury and damage to property!

- 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.

⚠ WARNING

Improper handling when placing the pump set in a vertical/horizontal position

Personal injury and damage to property!

- 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.

⚠ WARNING

Improper lifting/moving of heavy assemblies or components

Personal injury and damage to property!

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

CAUTION

Improper storage

Damage to the electric cables!

- 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.

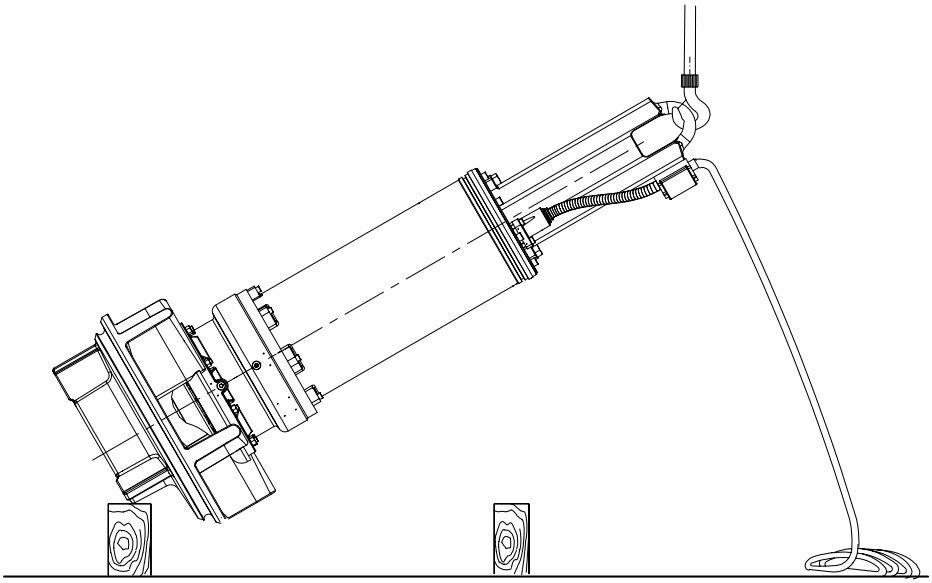

Fig. 2: Placing the pump set in a vertical/horizontal position

✓ 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

	**⚠ WARNING** **Incorrect positioning/placing down** Personal injury and damage to property! ▹ Position the pump set vertically with the motor on top. ▹ Use appropriate means to secure the pump set against tilting and tipping over. ▹ Refer to the weights given in the data sheet/on the name plate.
	**⚠ WARNING** **Incorrect handling of the power cable** Personal injury and damage to property! ▹ Secure the power cable against falling down.
	**⚠ WARNING** **Improper lifting/moving of heavy assemblies or components** Personal injury and damage to property! ▹ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.

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⚠ WARNING

Improper handling when placing the pump set in a vertical/horizontal position

Personal injury and damage to property!

- ▷ 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.

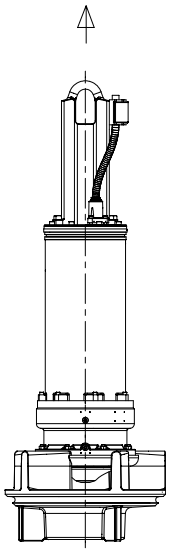

Fig. 3: Transporting the pump set in a vertical position

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

⚠ WARNING

Pump set tilting

Risk of squashing hands and feet!

- ▷ Suspend or support the pump set.

CAUTION

Improper storage

Damage to the electric cables!

- ▷ 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.

CAUTION

Damage during storage due to humidity, dirt or vermin

Corrosion/contamination of pump (set)!

- ▷ For outdoor storage cover the pump (set) and accessories with waterproof material and protect against condensation.

CAUTION

Wet, contaminated or damaged openings and connections

Leakage or damage to the pump!

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

Table 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 56)
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 122)

NOTE

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

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3.5 Disposal

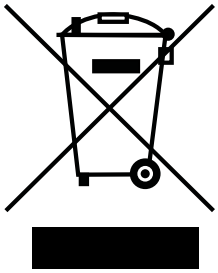
⚠ WARNING

Fluids, consumables and supplies posing a health hazard

Hazard to persons and the environment!

- ▷ 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.



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 / 60 6 UN 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]	
60	Motor size	
6	Number of motor poles	
UN	Motor version	
	UN	Non-explosion-proof, for fluid temperatures of up to 40 °C
	XN	Explosion protection Ⓔx II 2G Ex db h IIB T3 Gb, for fluid temperatures of up to 40 °C
	YN	Explosion protection Ⓔx 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

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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

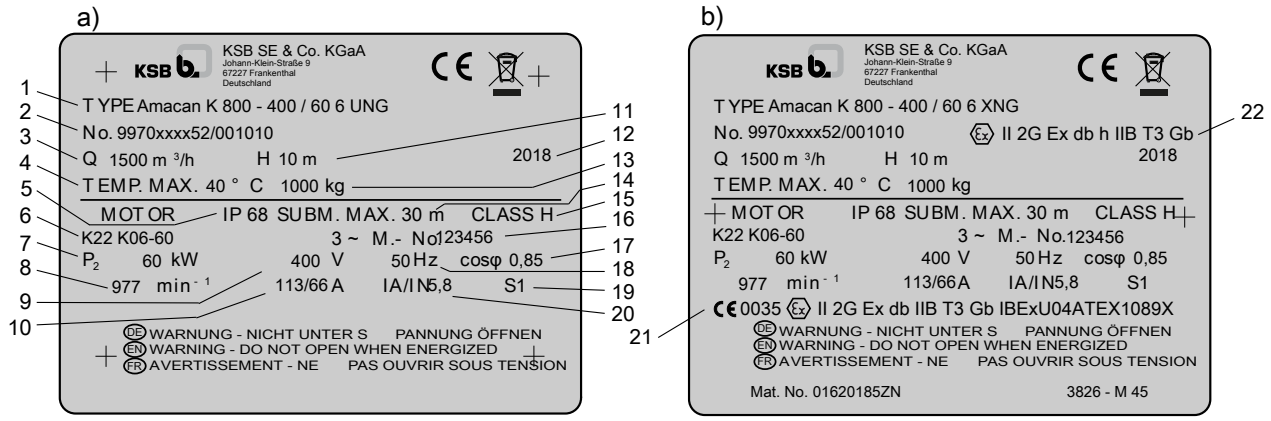

Fig. 4: Name plate (example) a) Standard pump set b) Explosion-proof pump set

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	ATEX marking for the submersible motor	22	ATEX marking for the 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:

- Can be re-lubricated

4.6 Types of installation

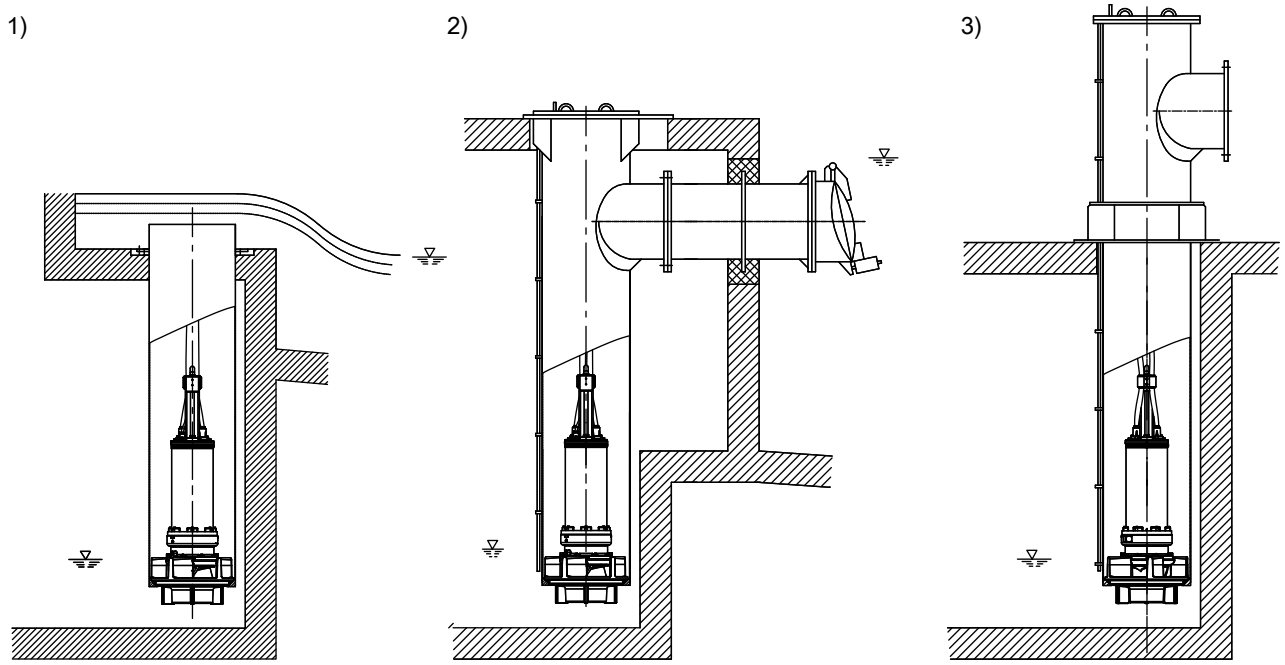

Fig. 5: Overview of installation types

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

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4.7 Configuration and function

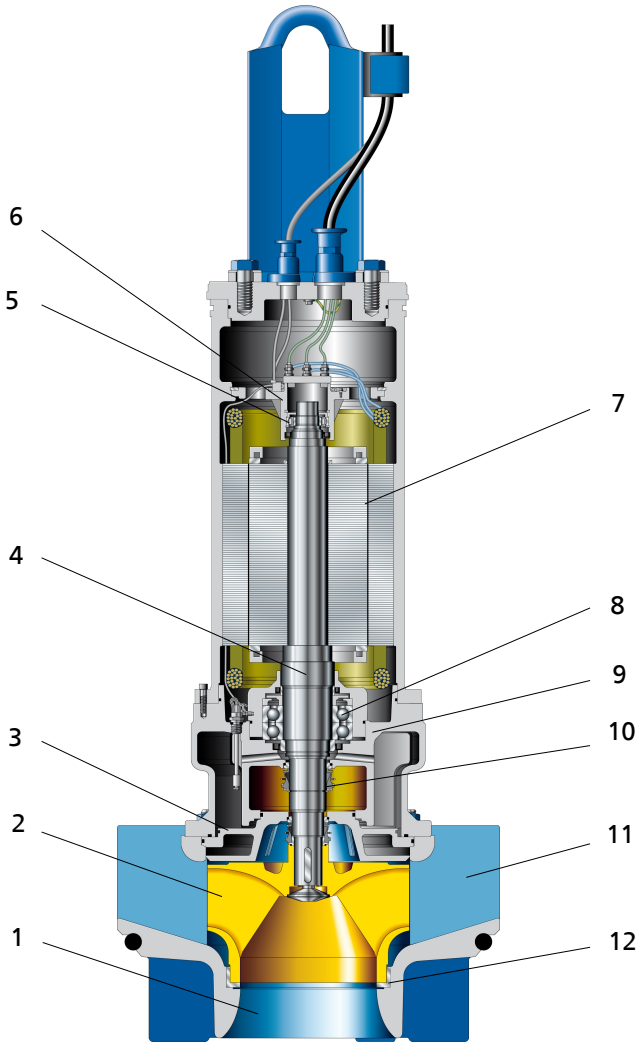

Fig. 6: Amacan with closed channel impeller

1	Inlet of the pump casing	2	Impeller
3	Discharge cover	4	Shaft
5	Bearing, drive end	6	Bearing bracket
7	Electric motor	8	Impeller-end bearing
9	Bearing housing	10	Shaft seal
11	Pump casing	12	Casing wear ring

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 (7) to the impeller (2) via the shaft (4). In the pump casing (11) 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 (12) 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 casing via the discharge cover (3). The shaft passage through the discharge cover is sealed towards the fluid by a shaft seal (10). The shaft runs in rolling element bearings (5 and 8), which are supported by a bearing housing (9) and a bearing bracket (6).

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
- Temperature monitoring at the lower (impeller-end) bearing
- Leakage monitoring of the mechanical seal system
- Leakage sensors in the motor/connection space

Option

- Temperature monitoring at the upper (drive-end) bearing
- Vibration sensor
- Additional winding temperature monitoring with Pt100

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.

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5 Installation at Site

5.1 Safety regulations

DANGER

Improper installation in potentially explosive atmospheres

Explosion hazard!

Damage to the pump set!

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

DANGER

Persons in the intake chamber during pump set operation

Electric shock! Risk of injury!

- ▹ Never start up the pump set when there are persons in the intake chamber.

WARNING

Impermissible solid objects (tools, screws/bolts or similar) in the pump sump/inlet tank during pump start-up

Personal injury and damage to property!

- ▹ 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

Incorrect positioning/placing down

Personal injury and damage to property!

- ▷ Position the pump set vertically with the motor on top.
- ▷ Use appropriate means to secure the pump set against 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.
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.
5. Fit screw plug 903.03 together with a new joint ring 411.03.

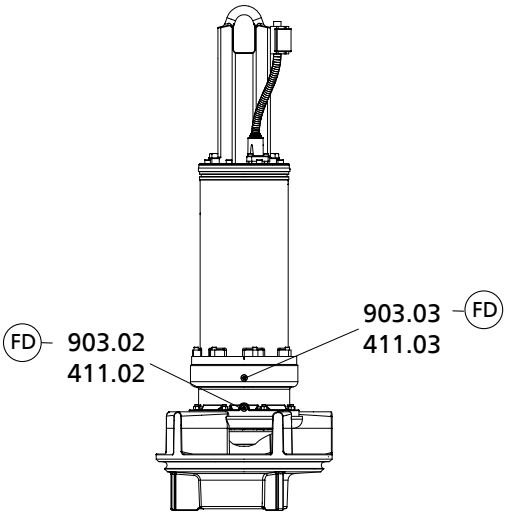

Fig. 7: Checking the lubricant level

903.03 411.03	Lubricant filler opening	903.02 411.02	Lubricant drain

Table 6: Symbols key

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

NOTE

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

5.2.4 Checking the direction of rotation

DANGER

Pump set running dry

Explosion hazard!

- Check the direction of rotation of explosion-proof pump sets outside potentially explosive atmospheres.

WARNING

Improper handling when placing the pump set in a vertical/horizontal position

Personal injury and damage to property!

- 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.

WARNING

Improper positioning of pump set when checking the direction of rotation

Personal injury and damage to property!

- Use appropriate means to secure the pump set against tilting or tipping over.

WARNING

Hands or foreign objects in the pump casing

Risk of injuries, damage to the pump!

- 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).

CAUTION

Pump set running dry

Increased vibrations!

Damage to mechanical seals and bearings!

- 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

Unintentional starting of the pump set

Risk of injury by moving components and shock currents!

- ▷ 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

Improper transport

Danger to life from falling parts!

Damage to the pump set!

- ▷ 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

Improper installation in potentially explosive atmospheres

Explosion hazard!

Damage to the pump set!

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

⚠ WARNING

Incorrect handling of the electric cable

Personal injury and damage to property!

- ▷ 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

People falling into the unsecured discharge tube

Risk of personal injury!

- ▷ 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 Installing the pump set without support rope

CAUTION

Incorrect installation

Damage to the pump set!

- ▷ Verify that the pump set is correctly seated in the discharge tube.

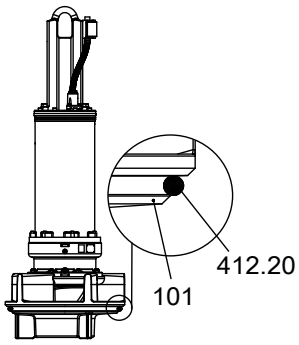

Fig. 8: Inserting the O-ring

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.

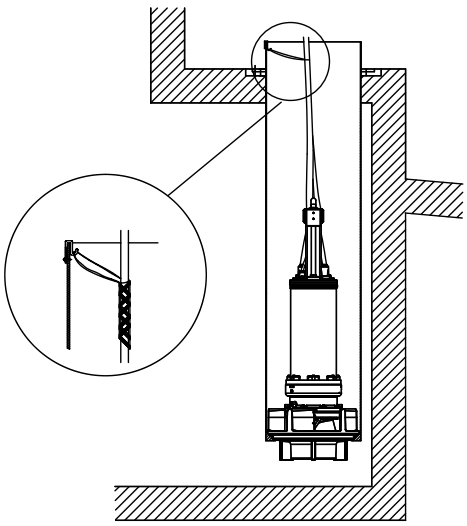

Fig. 9: Fastening the cable support sleeve

5.3.2 Installing the pump set with a support rope

Always 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.

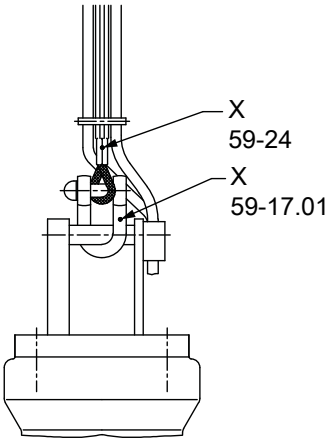

Fig. 10: X = indication of load-carrying capacity

59-24	Support rope
59-17.01	Shackle

CAUTION

Incorrect installation

Damage to the pump set!

- ▹ Verify that the pump set is correctly seated in the discharge tube.

⚠ WARNING

Pump set drops during the installation or removal process

Personal injury and damage to property!

- ▹ Never use the turnbuckle , shackle or discharge tube cover to lift the pump set.
- ▹ Always use lifting lug 59-47.

NOTE

Prior to fitting the turnbuckle, check that the corresponding split pin has not been cracked or chipped. If damaged, always use a new split pin.

- ✓ 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.

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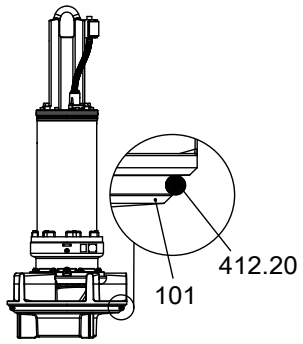

Fig. 11: Inserting the O-ring

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

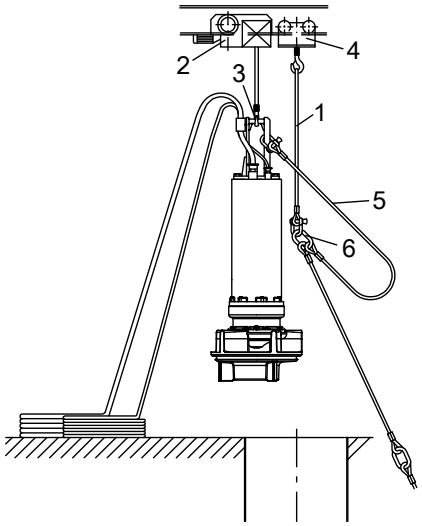

Fig. 12: Lifting and positioning the pump set

2. Secure the lifting chain or 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 100)
   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.

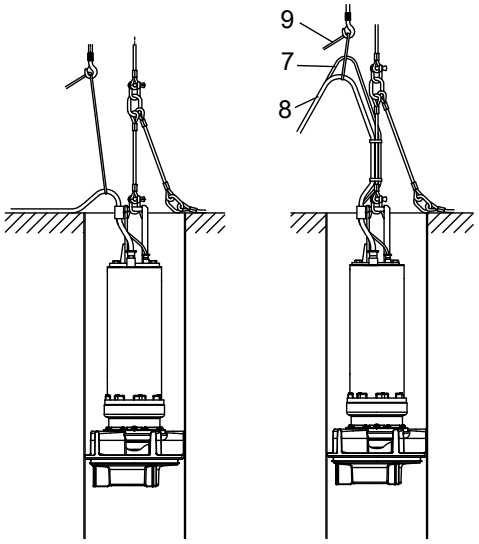

Fig. 13: Securing the control and power cables

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 the spacer (a) to fit between the two ferrules.

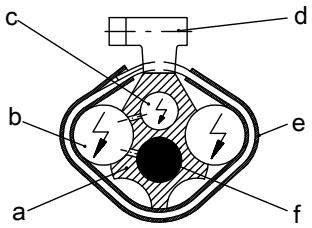

Fig. 14: Cross-section of the cable guide

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 cables with the manila rope running over the crane hook.
14. Insert the power cables (b) into the hollows of the spacer (a) and, starting from the bottom, firmly clamp the power cables with cable clamps (d) covered by a plastic sheath (e).
15. In the area of the lifting lug between the rope sections, lay all cables in loops and fasten them to the rope section above.
16. Progressively lower the pump set into the discharge tube while securing the cable bundle with evenly spaced sheathed cable clamps.
17. Fit a heat shrink tube on any protruding sharp-edged rope ends (e.g. at the ferrule) to prevent any damage to the power and control cables.

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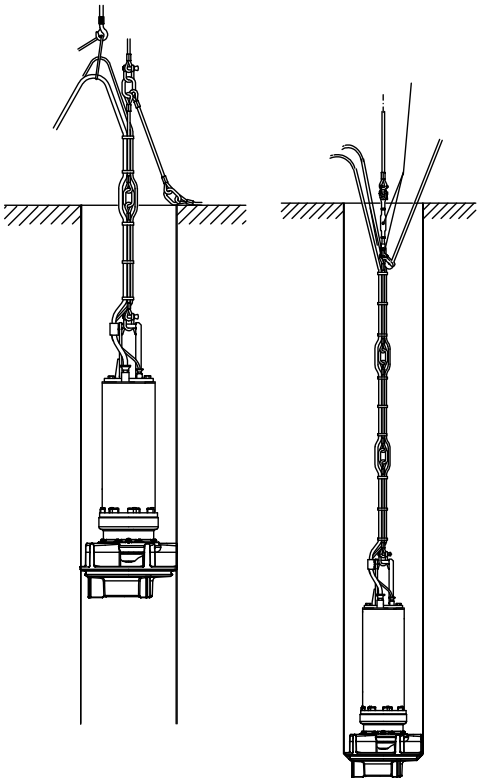

Fig. 15: Lowering the pump set

18. 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.
19. Tighten the turnbuckle until the cables are tight but do not lift the pump off its seat.
20. Unclip the hook of the lifting equipment from the lifting lug, free the cables from the manila rope and route them to the control cabinet.
21. Make sure that the top loose lifting lug is attached to the cable bundle to prevent noise and wear caused by chafing.
22. Remove the safety cover from the discharge tube and mount the discharge tube cover. Seal the cable entries 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.

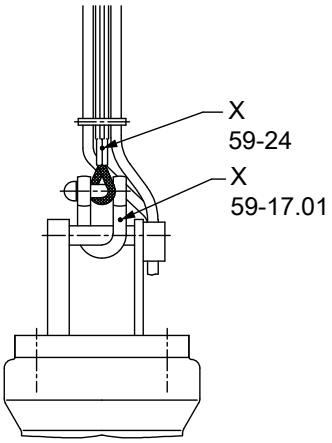

Fig. 16: X = indication of load-carrying capacity

59-24	Support rope
59-17.01	Shackle

CAUTION

Incorrect installation

Damage to the pump set!

- ▹ Verify that the pump set is correctly seated in the discharge tube.

⚠ WARNING

Pump set drops during the installation or removal process

Personal injury and damage to property!

- ▹ Never use the turnbuckle , shackle or discharge tube cover to lift the pump set.
- ▹ Always use lifting lug 59-47.

NOTE

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.

- ✓ 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.

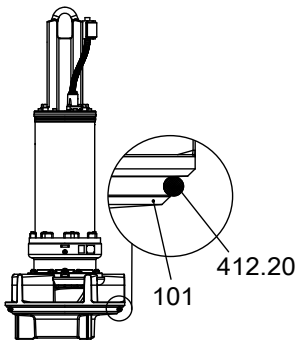

Fig. 17: Inserting the O-ring

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

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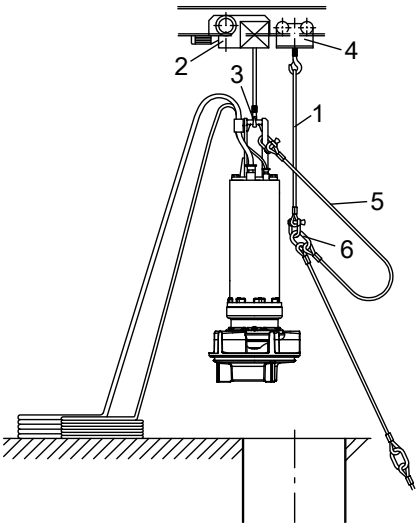

Fig. 18: Lifting and positioning the pump set

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. Check that the support rope is arranged with the lifting lug (6) pointing away from the pump set.
4. Partially unwind the support rope and electric cables.
5. Lower the pump set into the discharge tube until the bail is in an accessible position, protruding from the discharge tube.
6. Securely cover the discharge tube except for a gap which allows work to continue.
7. 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.
8. Unclip the hook of the lifting equipment from the lifting lug of the support rope and run the lifting equipment to a higher level.

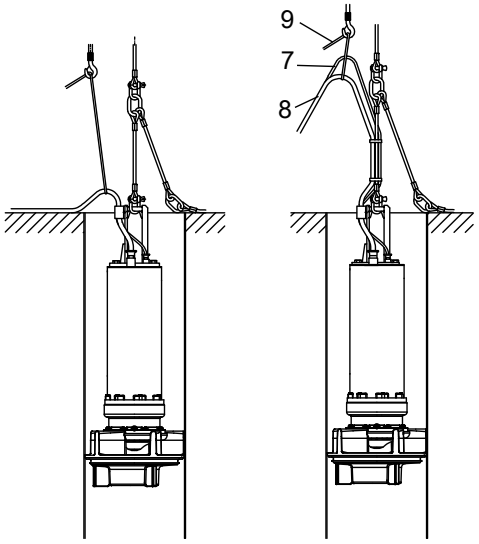

Fig. 19: Securing the control cable and power cables

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

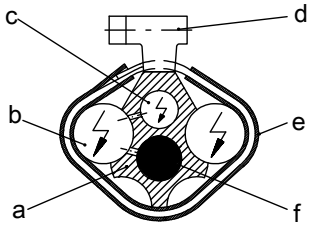

Fig. 20: Cross-section of the cable guide

11. Insert the support rope (f) and the control cable (c) into the spacer (a) and make sure that they are in their respective ducts.
12. Tighten the electric cables with the manila rope running over the crane hook.
13. Insert the power cables (b) into the hollows of the spacer (a).
14. Starting from the bottom, firmly clamp the power cables (b) with cable clamps (d) covered by a plastic sheath (e).
15. Progressively lower the pump set into the discharge tube while securing the cable bundle with evenly spaced sheathed cable clamps.
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. 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.
18. 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).
19. Insert the power cables (b) into the hollows of the spacer (a) and firmly clamp the power cables with cable clamps (d).

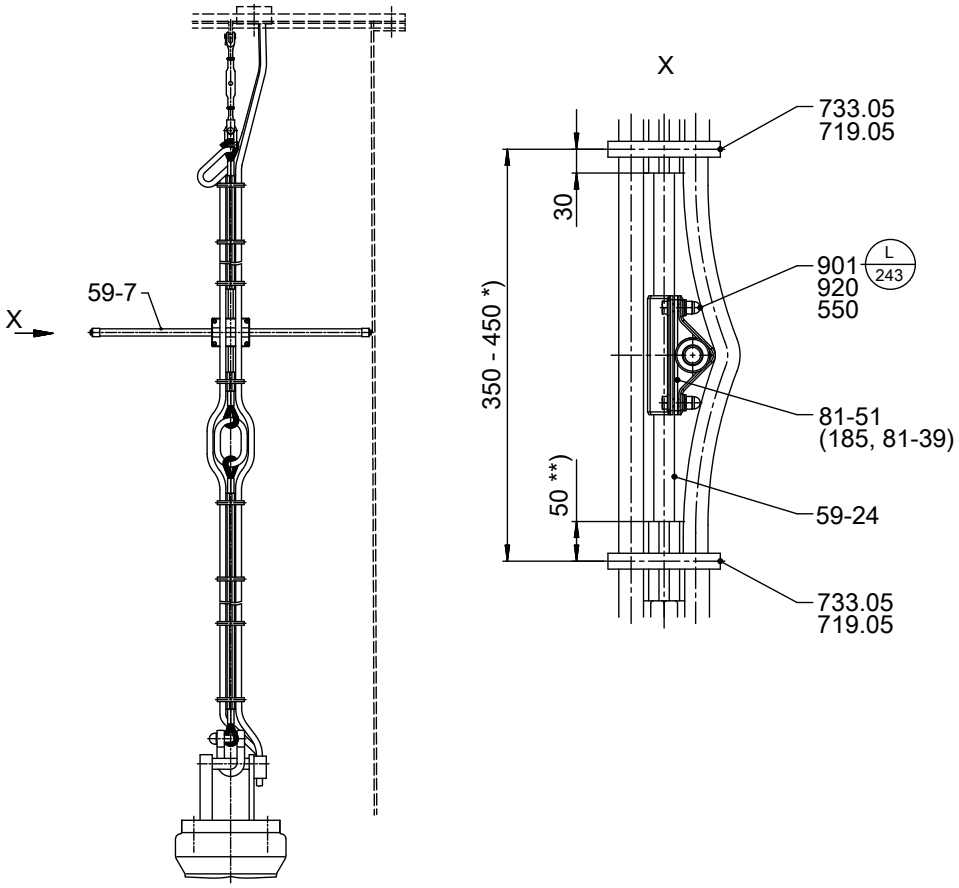

Fig. 21: Support rope with support, dimensions in [mm]
*) depending on the cable cross-section,
**) for 1 rope or 3 ropes = 30 mm

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Table 7: Symbols key

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

20. Clamp support 59-7 with clamping element 81-51 to the support rope (f).
21. Undo the screwed connection at clamping element 81-51.
22. Place clamp 81-39 of the clamping element around the support rope.
23. 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 100)

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.

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

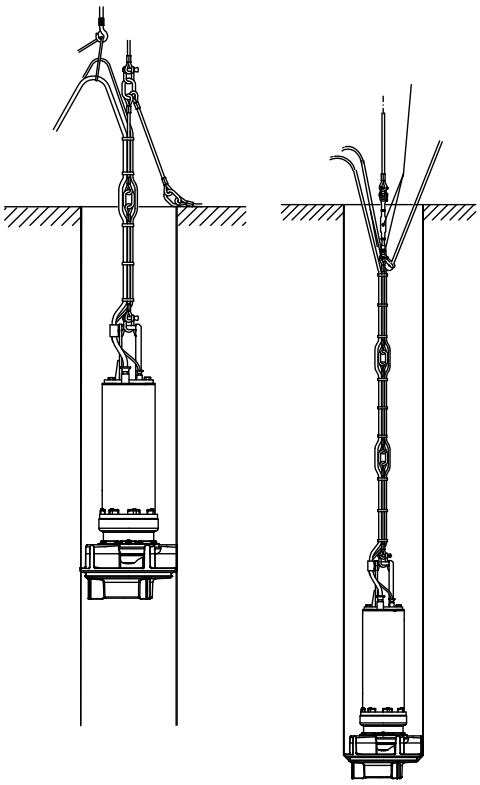

Fig. 22: Lowering the pump set

26. Progressively lower the pump set into the discharge tube. Secure the cable bundle with cable clamps.
27. 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.
28. Tighten the turnbuckle until the cables are tight but do not lift the pump off its seat.
29. 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.
30. Attach the top loose lifting lug to the cables to prevent noise and wear caused by chafing.

31. Remove the safety cover from the discharge tube and mount the discharge tube cover.
32. Seal the cable entries if any.

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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. (⇨ Section 9.4, Page 102)

The pump set is supplied with power cables; it is wired for DOL starting. Star-delta starting is possible.

NOTE

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 mm^2 is required.

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 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)

5.4.1.2 Level control

DANGER

Pump set running dry

Explosion hazard!

- ▹ Never allow an explosion-proof pump set to run dry!

CAUTION

Fluid level below the specified minimum

Damage to the pump set by cavitation!

- ▹ Never allow the fluid level to drop below the specified minimum.

Automatic operation of the pump set in a tank requires the use of level control equipment.
Observe the minimum level of fluid handled. (⇨ Section 6.2.4.3, Page 48)

5.4.1.3 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

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.

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DANGER

Operation outside the permitted frequency range

Explosion hazard!

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

DANGER

Incorrect selection and setting of the frequency inverter

Explosion hazard!

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

Selection

When selecting a frequency inverter, check the following details:

- Data provided by the manufacturer
- Electrical data of the pump set, particularly the rated current
- Only voltage source inverters (VSI) with pulse width modulation (PWM) and carrier frequencies between 1 and 16 kHz are suitable.

Setting

Observe the following instructions for setting a frequency inverter:

- Set the current limit to max. 1.2 times the rated current. 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.

5.4.1.4 Sensors

DANGER

Operating an incompletely connected pump set

Explosion hazard!

Damage to the pump set!

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

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CAUTION

Incorrect wiring

Damage to the sensors!

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

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

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

NOTE

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

All sensors are located inside the pump set and are connected to the sensor cable.

For information on wiring and core marking see (⇨ Section 9.4, Page 102)

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

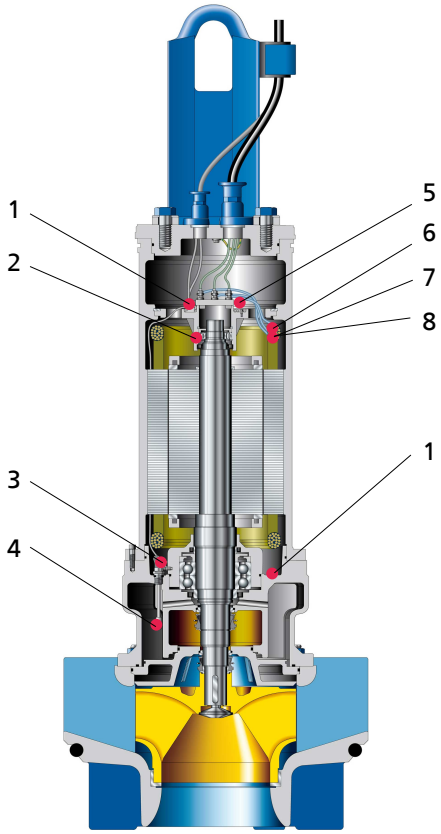

Fig. 23: Sensor positions

Position	Sensor	Standard		Optional
		Motor version UN	Motor versions XN, YN	
1	Leakage inside the motor (connection and winding space)	✗	✗	-
2	Bearing temperature (upper bearing assembly)	-	-	✗
3	Bearing temperature (lower bearing assembly)	✗	✗	-

Position	Sensor	Standard		Optional
		Motor version UN	Motor versions XN, YN	
4	Mechanical seal leakage	✗	✗	-
5	Vibration sensor	-	-	✗
6	Motor temperature (bimetal)	✗	✗	-
7	Motor temperature (PTC)	-	✗	-
8	Motor temperature (Pt100)	-	-	✗

5.4.1.4.1 Motor temperature

⚠ DANGER

Insufficient cooling

Explosion hazard!

Winding damage!

- ▷ 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 ATEX certification 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 and ATEX certification for monitoring the temperature of explosion-proof motors with "flameproof enclosure" type of protection.

5.4.1.4.2 Leakage inside the motor

⚠ DANGER

Incorrect monitoring of leakage electrode

Explosion hazard!

Danger of death from electric shock!

- ▷ Voltages must be < 30 V AC and tripping currents < 0.5 mA.

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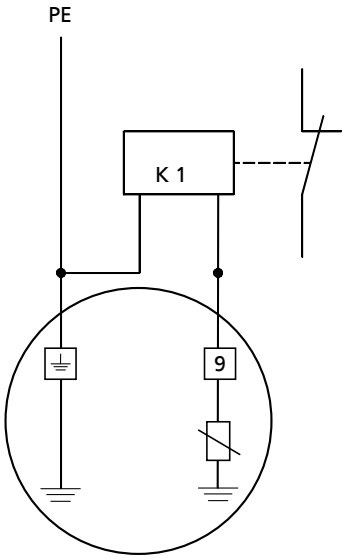
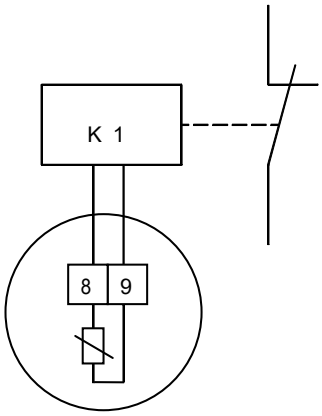
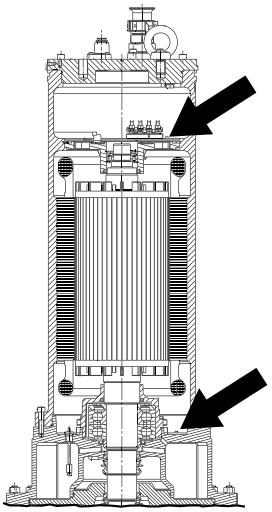


Wiring of the electrode relay (standard)



Wiring of the electrode relay (pump sets with vibration sensor only)



Position of the electrodes in the motor housing

Electrodes fitted inside the motor monitor the winding and connection space for leakage. Both electrodes are connected in parallel (core identification 9). They must be connected to an electrode relay. 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.

Pump sets with vibration sensors

A different wiring system is used for the electrodes of pump sets with vibration sensors.

5.4.1.4.3 Leakage at the mechanical seal

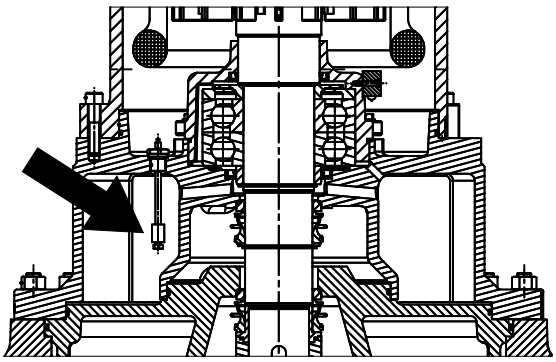


Fig. 24: Float switch

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

5.4.1.4.4 Bearing temperature

The lower bearing of the pump set is equipped with a bearing temperature sensor. This sensor is a Pt100 resistance thermometer (core identification 15 and 16). 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 130 °C
- Cut-out of the pump set at 150 °C

As an option, the upper bearing can also be equipped with a temperature sensor (core identification 16 and 17). Its connection and settings are identical with the above. Check in the data sheet whether the pump set is equipped with temperature monitoring of the upper bearing.

5.4.1.4.5 Vibration sensor

As an option, the pump set can be supplied with a vibration sensor in the area of the upper bearing. The sensor is matched to KSB's diagnosis systems.

The vibration sensor measures the root-mean-square value of the radial vibration velocity at the motor-end bearing. The vibration sensor has an integrated signal converter with a standardised output (4 - 20 mA). This allows simple integration into existing PLC systems or process control systems.

Table 8: Technical data of the sensor

Characteristic	Value
Measuring range	4 - 20 mA at 0 - 20 mm/s
Measurement error	< 5 %
Long-term stability	+/- 1 % in 10 years
Maximum shock load	500 g
Frequency range	2 Hz - 1000 Hz
Resonant frequency	> 18 kHz
Output impedance	max. 200 Ohm
Power supply	18 - 30 V (smoothed)
Load (maximum working resistance)	50 - 100 Ohm

Connecting the vibration sensor

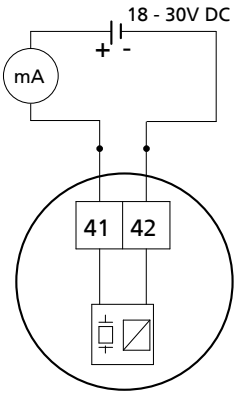


Fig. 25: Connecting the vibration sensor

We recommend the following settings for vibration monitoring with the (optional) vibration sensor fitted at the factory:

- Alarm to be triggered at v_{eff} = 11 mm/s
  - This vibration limit requires remedial action.
  - In general, pump operation may continue until the causes of the change in vibration level have been detected and remedies have been determined.
- Cut-out at v_{eff} = 14 mm/s
  - If this vibration velocity is exceeded, continued pump set operation may result in damage.
  - Suitable action to reduce vibrations should be taken immediately, or the pump set should be switched off.

5.4.2 Electrical connection

DANGER

Electrical connection work by unqualified personnel

Danger of death from electric shock!

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

WARNING

Incorrect connection to the mains

Damage to the power supply network, short circuit!

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

CAUTION

Improper routing of electric cables

Damage to the electric cables!

- 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

Motor overload

Damage to the motor!

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

For the electrical connection observe the circuit diagrams (⇨ Section 9.4, Page 102) in the Annex and the information for planning the control system (⇨ Section 5.4.1, Page 37) .

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

DANGER

Incorrect wiring

Explosion hazard!

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

DANGER

Operating an incompletely connected pump set

Explosion hazard!

Damage to the pump set!

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

DANGER

Connection of damaged electric cables

Danger of death from electric shock!

- Check the electric cables for any damage before connecting them.
- Never connect damaged electric cables.
- Replace damaged electric cables.

CAUTION

Flow-induced motion

Damage to the power cable!

- Run the power cable upwards without slack.

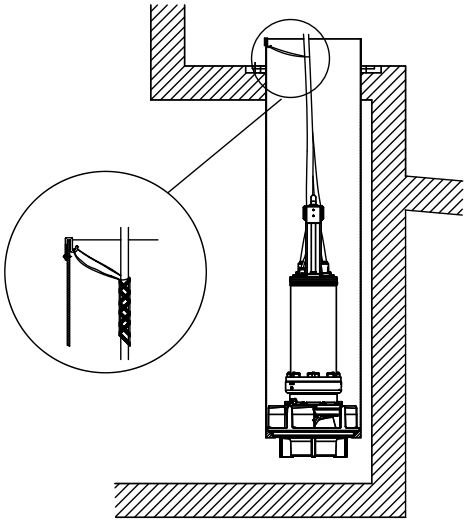


Fig. 26: Fastening the power cables

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.

Terminal for the potential equalisation conductor

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

DANGER

Incorrect wiring

Explosion hazard!

- Explosion-proof pump sets installed in a tank must never be retrofitted with an external potential equalisation connection!

DANGER

Touching the pump set during operation

Electric shock!

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

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6 Commissioning/Start-up/Shutdown

6.1 Commissioning/Start-up

6.1.1 Prerequisites for commissioning/start-up

DANGER

Persons in the tank during pump operation

Electric shock!

Risk of injury!

Danger of death from drowning!

- ▷ 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.

WARNING

People falling into the unsecured discharge tube

Risk of personal injury!

- ▷ 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 50)
- Safety-relevant protective equipment must be installed and fully functional.

6.1.2 Start-up

DANGER

Persons in the tank during pump operation

Electric shock!

Risk of injury!

Danger of death from drowning!

- ▷ 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

Re-starting while motor is still running down

Damage to the pump set!

- ▷ Do not re-start the pump set before it has come to a standstill.
- ▷ Never start up the pump set while the pump is running in reverse.

✓ The fluid level is sufficiently high.

CAUTION

Start-up against a closed shut-off element

Damage to the pump set!

- ▷ 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

Non-compliance with operating limits

Damage to the pump set!

Explosion hazard!

- ▷ 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.

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6.2.1 Operation on the power supply mains

DANGER

Permissible tolerances for operation on mains power exceeded

Explosion hazard!

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

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

6.2.2 Frequency of starts

CAUTION

Excessive frequency of starts

Risk of damage to the motor!

- 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

Re-starting while motor is still running down

Damage to the pump set!

- Do not re-start the pump set before it has come to a standstill.
- Never start up the pump set while the pump is running in reverse.

6.2.3 Operation on a frequency inverter

DANGER

Operation outside the permitted frequency range

Explosion hazard!

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

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

Danger of freezing!

Damage to the pump set!

- 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

Impermissibly high density of the fluid handled

Motor overload!

- ▷ 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

Pump set running dry

Explosion hazard!

- ▷ Never allow an explosion-proof pump set to run dry!

CAUTION

Fluid level below the specified minimum

Damage to the pump set by cavitation!

- ▷ 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 "t_1" as a minimum.

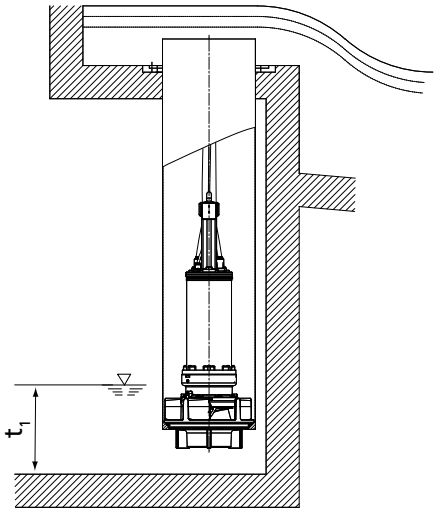

Fig. 27: Minimum level of fluid handled

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.

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6.3 Shutdown/storage/preservation

6.3.1 Shutdown

CAUTION

Uncontrolled backflow of the fluid from the riser

Damage to the pump set!

- 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

Electrical connection work by unqualified personnel

Danger of death from electric shock!

- Always have the electrical connections installed by a trained and qualified electrician.
- Observe the EN 61557 regulations as well as any regional regulations.

WARNING

Unintentional starting of the pump set

Risk of injury by moving components and shock currents!

- 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

Fluids handled, consumables and supplies which are hot and/or pose a health hazard

Risk of injury!

- Observe all relevant laws.
- When draining the fluid take appropriate measures to protect persons and the environment.
- Decontaminate pumps which handle fluids posing a health hazard.

CAUTION

Danger of frost/freezing

Damage to the pump set!

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

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.

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

✓ All safety regulations are observed. (⇨ Section 7.1, Page 51)

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 45)

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 53)

⚠ WARNING

Failure to re-install or re-activate protective devices

Risk of injury from moving parts or escaping fluid!

▹ As soon as the work is completed, properly re-install and re-activate any safety-relevant devices and protective devices.

NOTE

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

7 Servicing/Maintenance

7.1 Safety regulations

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

DANGER

Sparks produced during servicing work

Explosion hazard!

- Observe the safety regulations in force at the place of installation!
- Never open an energised pump set.
- Always perform maintenance work on explosion-proof pump sets outside potentially explosive atmospheres only.

DANGER

Improperly serviced pump set

Explosion hazard!

Damage to the pump set!

- Service the pump set regularly.
- Prepare a maintenance schedule with special emphasis on lubricants, electric cables, bearing assembly and shaft seal.

DANGER

Electrical connection work by unqualified personnel

Danger of death from electric shock!

- Always have the electrical connections installed by a trained and qualified electrician.
- Observe the EN 61557 regulations as well as any regional regulations.

DANGER

Risk of falling when working at a great height

Danger to life by falling from a great height!

- 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.

WARNING

Unintentional starting of the pump set

Risk of injury by moving components and shock currents!

- 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

Hands, other body parts or foreign objects in the impeller or intake area

Risk of injury! Damage to the submersible motor pump!

- ▷ 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.

⚠ WARNING

Fluids handled, consumables and supplies which are hot and/or pose a health hazard

Risk of injury!

- ▷ Observe all relevant laws.
- ▷ When draining the fluid take appropriate measures to protect persons and the environment.
- ▷ Decontaminate pumps which handle fluids posing a health hazard.

⚠ WARNING

Hot surface

Risk of injury!

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

⚠ WARNING

Improper lifting/moving of heavy assemblies or components

Personal injury and damage to property!

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

⚠ WARNING

Insufficient stability

Risk of crushing hands and feet!

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

NOTE

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

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

NOTE

All maintenance 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.

Never use force when dismantling and reassembling the pump set.

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7.2 Maintenance/inspection

KSB recommends the following regular maintenance schedule:

Table 9: 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 53)
Every 8000 hours, at least every 2 years	Checking the cable bundle	(⇨ Section 7.3.3, Page 57)
	Checking the earth conductor	(⇨ Section 7.3.4, Page 57)
	Checking the sensors	(⇨ Section 7.2.1.2, Page 54)
	Checking the mechanical seal leakage	(⇨ Section 7.3.5, Page 57)
	Changing the lubricant	(⇨ Section 7.4, Page 58)
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

Excessive test voltage

Damage to the sensors!

▷ Use a commercially available ohmmeter to measure the resistance.

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

Temperature sensors in the motor winding

Table 10: Resistance measurement

Measurement between terminals ...	Resistance [Ω]
21 and 22	< 1
10 and 11	200 to 1000
31 and 32[4)]	100 to 120
33 and 34[4)]	100 to 120
35 and 36[4)]	100 to 120

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.

If the sensors are defective, use the back-up sensors provided at the same place in the stator winding.

Leakage sensors in the motor

Table 11: Resistance measurement of the leakage sensor in the motor

Measurement between terminals ...	Resistance [kΩ]
9 and earth conductor (PE)	> 60
8 and 9[5)]	> 60

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

Float switch (mechanical seal leakage)

Table 12: Resistance measurement of the float switch

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

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

Bearing temperature sensor

Table 13: Resistance measurement of the bearing temperature sensor

Measurement between terminals ...	Resistance [Ω]
15 and 16	100 to 120
16 and 17[6)]	100 to 120

Vibration sensor

Table 14: Current measurement at vibration sensor

Measurement between terminals ...	Current value
41 and 42[7)]	Constant 4 mA during standstill

4 Optional
5 Only for pump sets with vibration sensor
6 Optional
7 Optional

Functional test
Connect the vibration sensor. Measure the current in the measuring circuit with a suitable ammeter.

7.3 Removing the pump set

7.3.1 Removing the pump set

⚠ DANGER

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

- ▹ 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.

⚠ WARNING

Incorrect handling of the electric cable
Personal injury and damage to property!

- ▹ 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.

⚠ WARNING

People falling into the unsecured discharge tube
Risk of personal injury!

- ▹ 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

Turnbuckle and shackle are not suitable for lifting the pump set
Risk of injury!
Damage to the pump set!

- ▹ 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

Prevent any loose parts from falling into the pump sump!

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

Pump set tilting

Risk of squashing hands and feet!

- ▹ Suspend or support the pump set.

CAUTION

Improper storage

Damage to the power cables!

- ▹ 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

Fluids handled, consumables and supplies which are hot and/or pose a health hazard

Hazard to persons and the environment!

- ▹ Collect and properly dispose of flushing fluid and any 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 122)

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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

Defective earth conductor

Electric shock!

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

7.3.5 Checking the mechanical seal for leakage

⚠ WARNING

Fluids handled, consumables and supplies which are hot and/or pose a health hazard

Hazard to persons and the environment!

- ▷ Collect and properly dispose of flushing fluid and any fluid residues.
- ▷ Wear safety clothing and a protective mask if required.
- ▷ Observe all legal regulations on the disposal of fluids posing a health hazard.

⚠ WARNING

Excess pressure inside the pump set

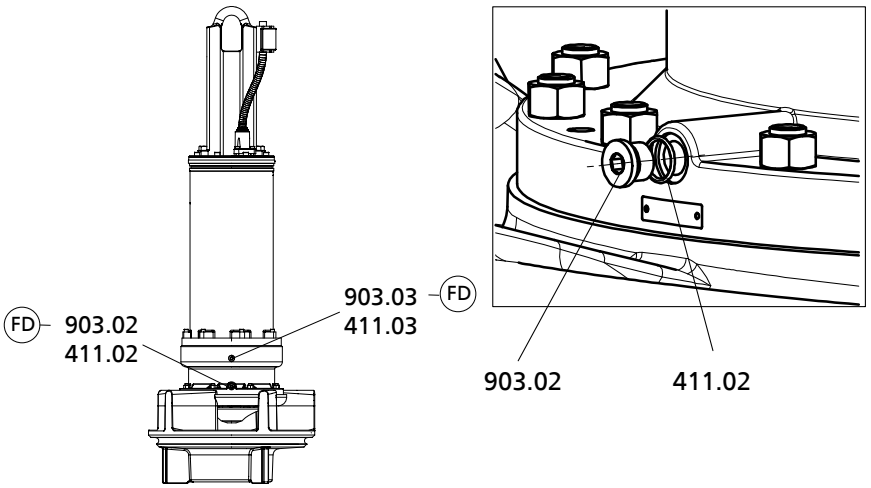
Risk of injury when opening the pump set!

- ▷ Take care when opening the inner chambers. Equalise the pressure.

NOTE

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

Checking the leakage chamber serves to assess the function of the drive-end mechanical seal.



Draining the leakage — Lubricant drain

903.03 411.03	Lubricant filler opening	903.02 411.02	Leakage drain

Table 15: Symbols key

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

✓ A suitable container for the leakage is on hand.

✓ The pump set has been placed in a vertical position on a level surface and protected against tipping over.

1. Hold the container underneath screw plug 903.02.
2. Remove screw plug 903.02 and joint ring 411.02.
3. Drain the leakage.
   ⇨ If there is no leakage or, after several years of operation, only a small amount, the mechanical seals are working properly. If the leakage exceeds 2 litres, the mechanical seals are defective and must be replaced.
4. Re-insert and tighten screw plug 903.02 with new joint ring 411.02.

7.4 Lubrication and lubricant change

7.4.1 Lubricating the mechanical seal

⚠ DANGER

Excessive temperatures at the shaft seal

Damage to the pump set!

▹ 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 8000 operating hours but at least every 2 years.

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:

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Table 16: 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

Lubricant contaminating fluid handled

Hazard to persons and the environment!

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

7.4.1.3 Lubricant quantity

Table 17: Lubricant quantity [l] depending on the motor

Size	Lubricant quantity depending on the motor			
	95 4.N 60 6.N 80 6.N 100 6.N	120 6.N 140 6.N 165 6.N 90 8.N 110 8.N 130 8.N 40 10.N 60 10.N 75 10.N	190 6.N 225 6.N 260 6.N 150 8.N 185 8.N	320 6.N 360 6.N 400 6.N 440 6.N
700-330	4,0	-	-	-
800-400	4,0	-	-	-
800-401	4,0	-	-	-
1000-420	4,7	7,0	-	-
1000-421	4,7	7,0	-	-
1000-500	4,7	7,0	7,5	-
1200-630	-	8,5	7,0	10,5

7.4.1.4 Changing the lubricant

⚠ WARNING

Lubricants posing a health hazard and/or hot lubricants

Hazard to persons and the environment!

▷ When draining the lubricant take appropriate measures to protect persons and the environment.

▷ Wear safety clothing and a protective mask if required.

▷ Collect and dispose of any lubricants.

▷ Observe all legal regulations on the disposal of fluids posing a health hazard.

	**⚠ WARNING** **Excess pressure inside the pump set** Risk of injury when opening the pump set! ▷ Take care when opening the inner chambers. Equalise the pressure.

	**⚠ WARNING** **Improper handling when placing the pump set in a vertical/horizontal position** Personal injury and damage to property! ▷ 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.

7.4.1.4.1 Draining the lubricant

	**⚠ WARNING** **Incorrect positioning/placing down** Personal injury and damage to property! ▷ Position the pump set vertically with the motor on top. ▷ Use appropriate means to secure the pump set against tilting and tipping over. ▷ Refer to the weights given in the data sheet/on the name plate.

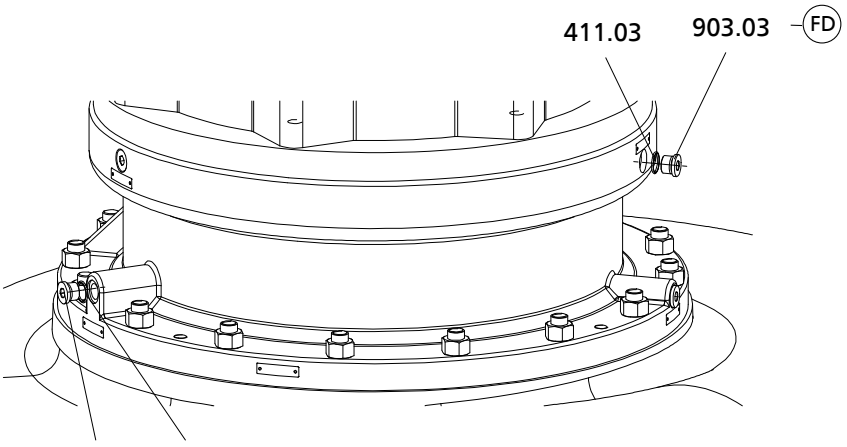

Fig. 28: Changing the lubricant

903.03 411.03	Lubricant filler opening	903.05 411.05	Lubricant drain

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Table 18: Symbols key

Symbol	Description
FD	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.

✓ A suitable container for collecting the lubricant is on hand.

1. Place a suitable container under screw plug 903.05.
2. Undo and remove screw plug 903.03 and joint ring 411.03.
   Observe the plate "Oil filler plug".
3. Undo and 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 and screw it back in together with new joint ring 411.05.

7.4.1.4.2 Filling in the lubricant

✓ 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 59)
2. Apply a liquid sealant to screw plug 903.03 and screw it back in together with new joint ring 411.03.

7.4.2 Lubricating the rolling element bearings

The upper (radial) bearing is grease-packed and maintenance-free.
The lower bearings can be re-lubricated; they need to be re-lubricated as part of the maintenance work.

7.4.2.1 Grease quality

CAUTION

Mix of different grease types

Damage to the pump set!

- ▷ Make sure to use the right type of grease.
- ▷ Never mix different types of grease.

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

Table 19: Lubricant characteristics

Type	Base oil	Thickener	NLGI grade (DIN 51518)	Worked penetration at 25 °C, 0.1 mm (DIN 51818)	Drop point (ISO 2176)	Application temperature range [°C]	Viscosity at 40 °C (DIN 51562)
A	Mineral oil	Lithium complex soap	2 or 3	220 to 295	>275 °C	-20 to +160	≤120
B	Ester oil	Polyurea	2	265 to 295	250 °C	-40 to +180	100

The re-lubrication and maintenance intervals apply to the grease type originally used by the manufacturer:

- Type A
  - Multis Complex EP2, made by TOTAL
- Type B
  - Klüberquiet BQH 72-102, made by Klüber Lubrication München KG

7.4.2.2 Grease quantity for re-lubrication

Table 20: Grease quantity

Grease	Motor					
	60 6.N	95 4.N 80 6.N 100 6.N	120 6.N 140 6.N 165 6.N 90 8.N 110 8.N 130 8.N 40 10.N 60 10.N 75 10.N	190 6.N 225 6.N 260 6.N 150 8.N 185 8.N	320 6.N 360 6.N	400 6.N 440 6.N
Quantity	70 g	90 g	110 g	160 g	180 g	180 g
Grade[8)]	Type A	Type A	Type A	Type B	Type B	Type B

7.4.2.3 Re-lubrication

Lubricating nipple

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

DANGER

Dry running

Explosion hazard!

- Re-lubricate explosion-proof pump sets outside potentially explosive atmospheres.

WARNING

Hands inside the pump casing

Risk of injuries, damage to the pump!

- Always disconnect the pump set from the power supply and secure it against unintentional start-up before inserting your hands or other objects into the pump.

CAUTION

Incomplete re-lubrication

Bearing damage!

- Always re-lubricate the bearings with the pump set in operation.

8 Also see the section on grease quality.

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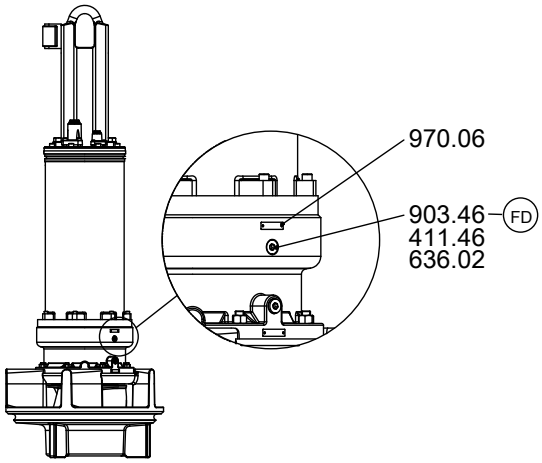

Fig. 29: Lubricating nipple

Part No.	Description
970.06	**Sign** with the following text: Schmierung Waelzlager Lubrication antifriction bearing
903.46 411.46 636.02	Lubricant filler opening
FD	Always apply a **liquid sealant** (e.g. Hylomar SQ32M) to sealing surfaces marked with this symbol.

✓ The pump set has been positioned on a level surface.

✓ The pump set is secured against tipping over.

1. Remove screw plug 903.46 and joint ring 411.46.
2. Connect the pump set to the power supply. (⇨ Section 5.4.2, Page 43)

CAUTION

Pump set running dry

Increased vibrations!

Damage to mechanical seals and bearings!

▹ Never operate the pump set for more than 60 seconds without the fluid handled.

3. Start up the pump set.
4. Fill in grease via lubricating nipple 636.02.
5. Disconnect the pump set from the power supply again and make sure it cannot be started up unintentionally.
6. Apply a liquid sealant to screw plug 903.46 and screw it back in together with new joint ring 411.46.

7.5 Checking the connection of motor/power supply

Check the electric cables after reassembly. (⇨ Section 7.2.1, Page 53)

7.6 Dismantling the pump set

7.6.1 General information/Safety regulations

DANGER

Improper transport

Danger to life from falling parts!

Damage to the pump set!

- 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.

WARNING

Unqualified personnel performing work on the pump (set)

Risk of injury!

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

WARNING

Hot surface

Risk of injury!

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

WARNING

Improper lifting/moving of heavy assemblies or components

Personal injury and damage to property!

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

WARNING

Excess pressure inside the pump set

Risk of injury when opening the pump set!

- Take care when opening the inner chambers. Equalise the pressure.

WARNING

Components with sharp edges

Risk of cutting or shearing injuries!

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

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⚠ WARNING

Pump set tilting or rolling off

Risk of personal injury!

- ▹ 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.

7.6.2 Preparing the pump set

1. De-energise the pump set and secure it against unintentional start-up.
2. Remove the pump set from the discharge tube. (⇨ Section 7.3.1, Page 55)
3. Clean the pump set. (⇨ Section 7.3.2, Page 56)
4. Drain the lubricant. (⇨ Section 7.4.1.4, Page 59)
5. Drain the leakage chamber and leave it open for the duration of the disassembly. (⇨ Section 7.3.5, Page 57)

7.6.3 Removing the back pull-out unit

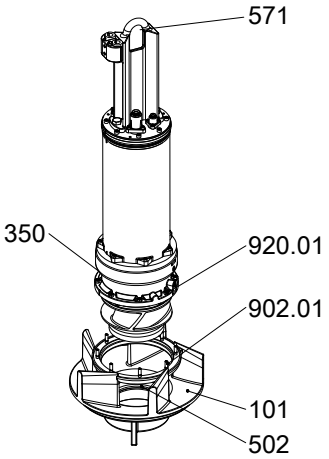

Fig. 30: Removing the back pull-out unit

✓ 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.

7.6.4 Removing the impeller

The procedures for removing the impeller differ depending on the hydraulic system and motor in question.

Table 21: Overview of forcing screw for tapered fit and puller for cylindrical fit, by pump size

Size	Tapered fit		Cylindrical fit					
	60 6.N	95 4.N 80 6.N	60 6.N	80 6.N 100 6.N	120 6.N 140 6.N 165 6.N 90 8.N 110 8.N 130 8.N 40 10.N 60 10.N 75 10.N	190 6.N 225 6.N 260 6.N 150 8.N 185 8.N	320 6.N 360 6.N	400 6.N 440 6.N
700-330	-	ADS5	-	-	-	-	-	-
800-400	ADS5	ADS5	-	-	-	-	-	-
800-401	-	ADS5	-	-	-	-	-	-
1000-420	-	-	AV3	AV3	AV4	-	-	-
1000-421	-	-	AV3	AV3	AV4	-	-	-
1000-500	-	-	-	AV3	AV4	AV4	-	-
1200-630	-	-	-	-	AV4	AV4	AV4	AV4

NOTE

Use a special puller or forcing screw to pull off the impeller.

NOTE

The special puller and forcing screw are not included in the scope of supply. They can be ordered separately from KSB.

Impeller fastening elements M20:

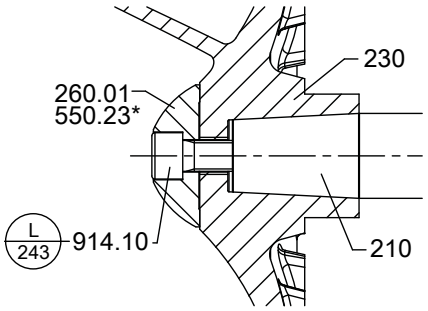

Fig. 31: Removing the impeller

*: 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.

Impeller fastening elements M85 × 2, M125 × 2

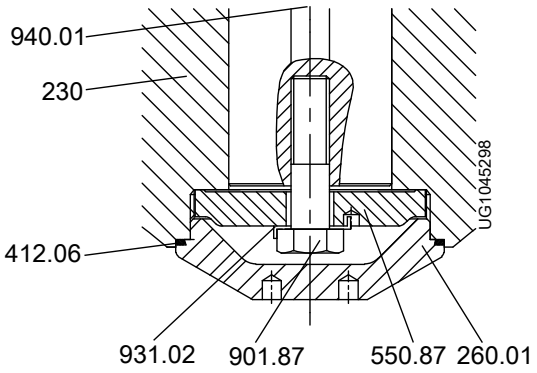

Fig. 32: Impeller fastening elements

1. Unscrew impeller hub cap 260.01 using a special wrench (right-hand thread).
2. Remove O-ring 412.06.
3. Unbend lock washer 931.02, undo hexagon head bolt 901.87 and remove them together with disc 550.87.
4. Pull off impeller 230 with a special impeller fitting and removal tool.

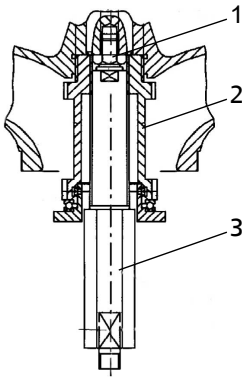

Fig. 33: Special impeller fitting and removal tool

5. Screw hexagon head bolt 1 into the shaft end to prevent any damage to the shaft thread.
6. Screw part 2 into the impeller.
7. Screw fully threaded stud 3 into part 2 and pull off the impeller.
8. Remove key 940.01.

7.6.5 Removing the mechanical seal

7.6.5.1 Removing the impeller-end 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.

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

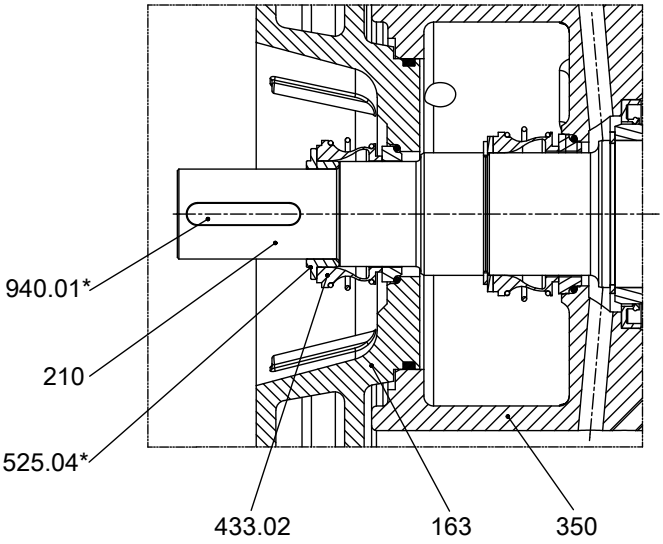

Fig. 34: Drawing of the impeller-end mechanical seal for motors 95 4.N, 60 6.N, 80 6.N, 100 6.N, 120 6.N, 140 6.N, 165 6.N, 190 6.N, 225 6.N, 260 6.N, 90 8.N, 110 8.N., 130 8.N, 150 8.N, 185 8.N, 40 10.N, 60 10.N, 75 10.N

*: Not for tapered fit

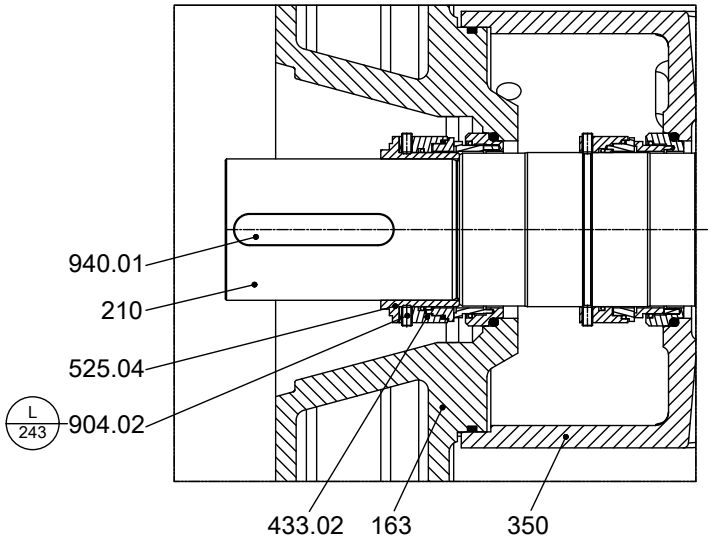

Fig. 35: Drawing of impeller-end mechanical seal for motors 320 6.N, 360 6.N, 400 6.N, 440 6.N

Table 22: Symbols key

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

7.6.5.2 Removing the drive-end mechanical seal

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

1. Remove circlip 932.03 or grub screws[9)] 904.01.
2. Pull the rotating assembly of mechanical seal 433.01 and disc[10)] 550.03 off shaft 210.

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9 Only for motors 190 6.N, 225 6.N, 260 6.N, 320 6.N, 360 6.N, 400 6.N, 440 6.N, 150 8.N, 185 8.N

10 If any

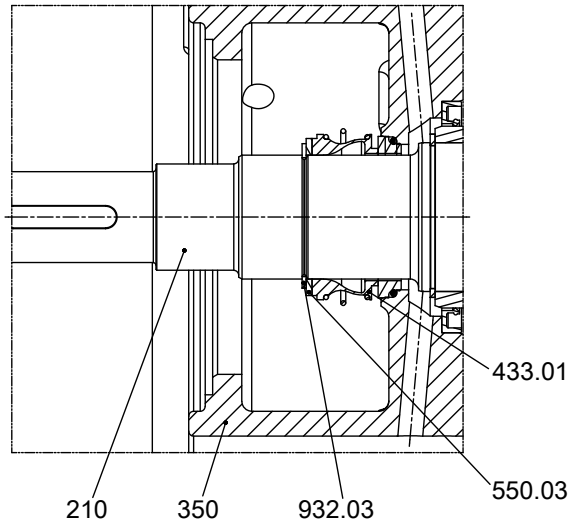

Fig. 36: Drawing of drive-end mechanical seal for motors 95 4.N, 60 6.N, 80 6.N, 100 6.N, 120 6.N, 140 6.N, 165 6.N, 90 8.N, 110 8.N., 130 8.N, 40 10.N, 60 10.N, 75 10.N

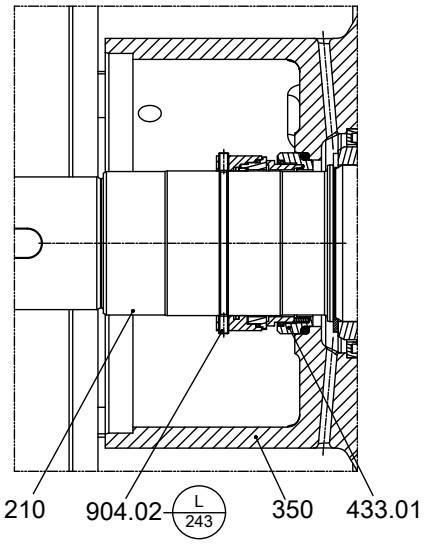

Fig. 37: Drawing of drive-end mechanical seal for motors 190 6.N, 225 6.N, 260 6.N, 320 6.N, 360 6.N, 400 6.N, 440 6.N, 150 8.N, 185 8.N

Table 23: Symbols key

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

7.6.6 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 EN 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.

7.6.6.1 Removing the motor housing cover

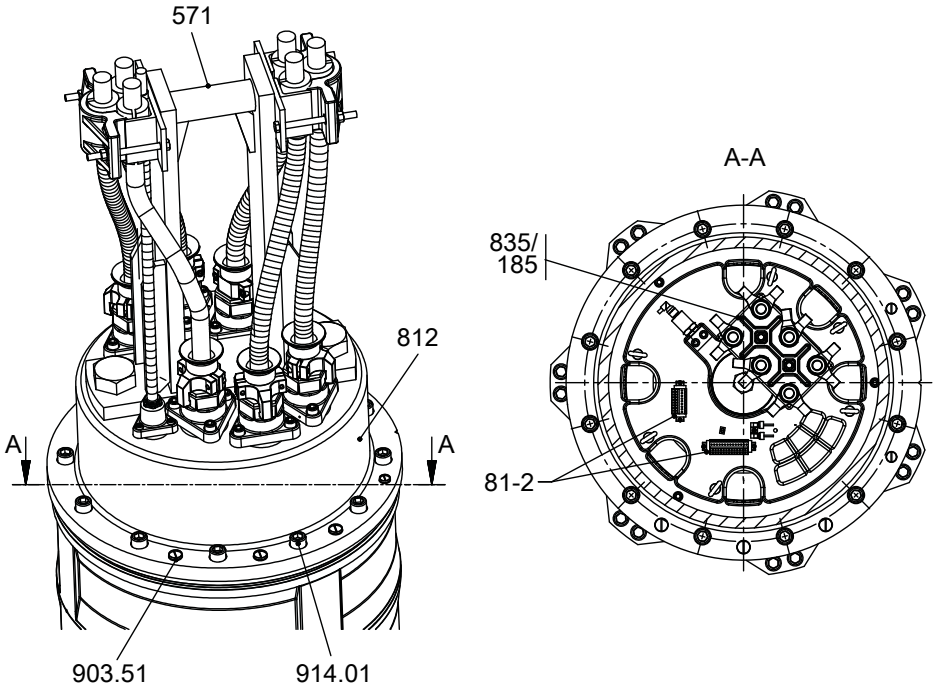

Fig. 38: Removing the motor housing cover

✓ Suitable lifting equipment is on hand.

✓ The pump set has been disconnected from the power supply. It has been securely placed on a level surface in a vertical position.

1. Attach lifting equipment to eyebolt 900.04 or bail 571.
2. Undo hexagon socket head cap screws 914.01.
3. Carefully lift off motor housing cover 812. If the motor housing cover cannot be lifted off, use the extraction threads located underneath caps 903.51.
4. Remove the cable ties.
5. Lift motor housing cover 812 up further until the power cables and control cable can be disconnected.
6. Disconnect plug 81-2 of the control cable from the corresponding connector.
7. Disconnect the cores of the power cable from terminal stud 185 on terminal board 835.
8. Place motor housing cover 812 down and secure it against rolling off.

7.6.6.2 Removing the cable gland and connection cable

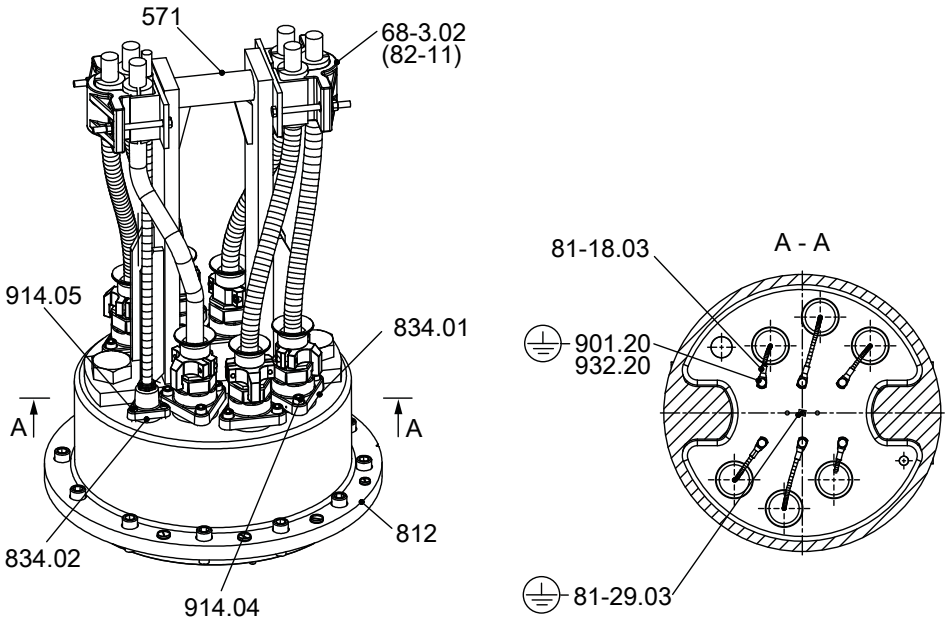

Fig. 39: Removing the connection cable and cable gland

Removing the power cable

✓ The motor housing cover has been removed, placed down and protected against rolling off.

1. Remove cover plate 82-11 or 68-3.02 from bail 571. Take out the cable gland 834.01/02 needing to be replaced.
2. Disconnect the earth connector on the inside of motor housing cover 812. If a shielded cable is used, disconnect the shield as well.
3. Undo screws 914.04 at cable gland 834.01.
4. Pull cable gland 834.01 out of the centring seat in motor housing cover 812.

Removing the control cable

✓ The motor housing cover has been removed, placed down and protected against rolling off.

1. Disconnect the cores of the control cable from plug 81-2.
2. Undo screws 914.05 at cable gland 834.02.
3. Pull cable gland 834.02 out of the centring seat in motor housing cover 812.

NOTE

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

7.7 Reassembling the pump set

7.7.1 General information/Safety regulations

DANGER

Wrong screws/bolts

Explosion hazard!

- Always use the original screws/bolts for assembling an explosion-proof pump set.
- Never use screws/bolts of different dimensions or of a lower property class.

⚠ WARNING

Improper lifting/moving of heavy assemblies or components

Personal injury and damage to property!

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

⚠ WARNING

Components with sharp edges

Risk of cutting or shearing injuries!

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

⚠ WARNING

Insufficient stability

Risk of crushing hands and feet!

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

CAUTION

Improper reassembly

Damage to the pump!

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

NOTE

Before reassembling the motor section, check that all joints relevant to explosion protection (flamepaths) are undamaged. Any components with damaged flamepaths must be replaced. 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). Secure all screwed/bolted connections closing off the flameproof enclosure with a thread-locking agent (Loctite Type 243).

NOTE

Apply liquid sealant to all screw plugs.
Apply liquid sealant to all wetted clearances (e.g. Hylomar SQ 32M).

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 84)
In addition, secure all screwed connections closing off the flameproof enclosure with a thread-locking agent (Loctite Type 243).

7.7.2 Installing the replacement cable gland

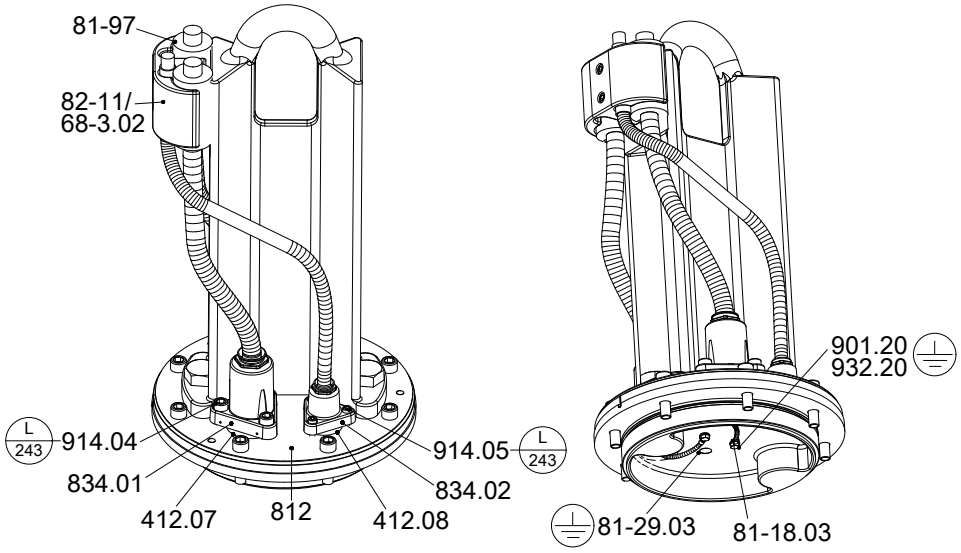

Fig. 40: Installing the cable gland

Table 24: Symbols key

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

Installing the power cable

✓ The motor housing cover has been removed, placed down and protected against rolling off.

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. Insert cable gland 834.01 with the power cable and O-ring 412.07 into the opening provided.
5. Fasten cable gland 834.01 with hexagon socket head cap screws 914.04. Secure the screwed connection with Loctite 243.
6. Fit cable terminals to the core ends of the power cable.
7. Fasten the earth conductor (green/yellow) to the inside of the motor housing cover 812 with bolt 901.20 and spring washer 932.20.
8. If shielded cables are used, connect the shield to terminal 81-29.03 on the inside of motor housing cover 812.

Installing the control cable

✓ The motor housing cover has been removed, placed down and protected against rolling off.

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. Guide O-ring 412.08 onto the short core ends of the control cable and into the groove of the centring seat.
4. Insert cable gland 834.02 with the control cable and O-ring 412.08 into the opening provided.

5. Fasten cable gland 834.02 with socket head cap screws 914.05 and secure the screwed connection with Loctite 243.
6. Connect plug 81-2 to the control cable cores.

Fastening the cover plate to the bail

✓ The motor housing cover has been removed, placed down and protected against rolling off.

✓ The power cable has been fitted as described in this manual.

✓ The control cable has been fitted as described in this manual.

1. Insert the power and control cables with cable protector 81-97 into cover plate 82-11 or 68-3.02.
2. Fasten the cover plate to the bail.

7.7.3 Fitting the motor housing cover

DANGER

Electrical connection work by unqualified personnel

Danger of death from electric shock!

- Always have the electrical connections installed by a trained and qualified electrician.
- Observe the EN 61557 regulations as well as any regional regulations.

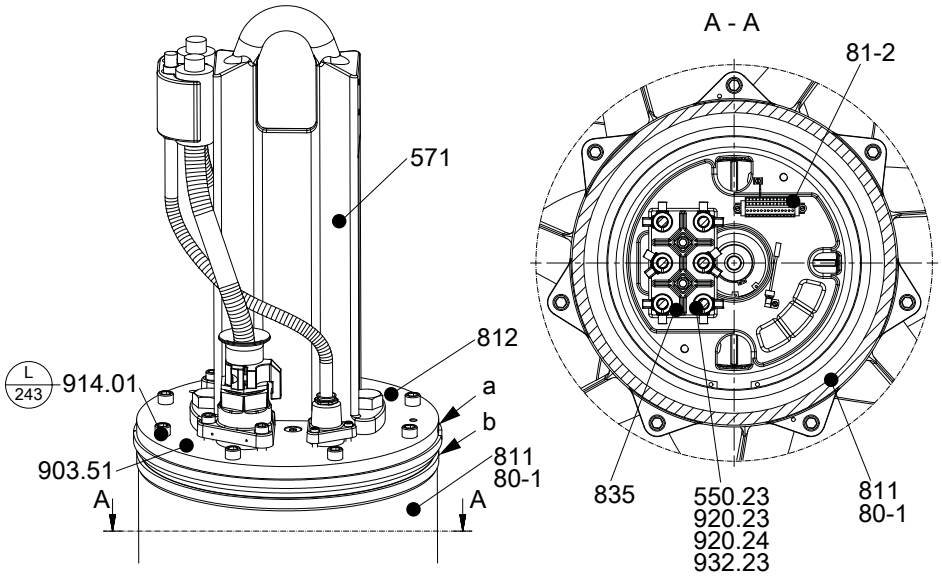

Fig. 41: Fitting the motor housing cover

a	Alignment grooves of motor housing cover 812
b	Alignment groove of motor housing 811

Table 25: Symbols key

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

✓ A new O-ring has been inserted into the groove of motor housing cover 812.

1. Attach the lifting equipment to bail 571, lift up motor housing cover 812 and lower it down onto motor housing 811 or motor unit 80-1 until only a gap remains which allows work to continue. Watch the alignment grooves in motor housing cover 812 and motor housing 811. The grooves must be aligned correctly.
2. Connect plug 81-2 of the control cable to the corresponding connector.
3. Connect the power cable cores to terminal board 835 with disc 550.23, circlip 932.23 and nuts 920.23/920.24 in accordance with the wiring diagram.
4. Tie the cores of the control and power cables together with cable ties.
5. Slowly lower motor housing cover 812 onto motor housing 811. Watch the alignment grooves in motor housing cover 812 and motor housing 811. The grooves must be aligned correctly.
6. Fasten motor housing cover 812 to motor housing 811 or motor unit 80-1 with hexagon socket head cap screws 914.01 and secure them with Loctite 243. Observe the tightening torque. (⇨ Section 7.8, Page 84)
7. Cover the jacking threads with caps 903.51.
8. Perform a leak test on the motor. (⇨ Section 7.7.7.3, Page 82)

7.7.4 Installing the mechanical seal

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

- Only remove the protective wrapping of the contact faces immediately before assembly takes place.
- The shaft surface must be absolutely clean and undamaged.
- Immediately before installing the mechanical seal, wet the contact faces with a drop of oil.
- For easier installation of bellows-type mechanical seals, wet the inside diameter of the bellows or the O-rings with soapy water (not oil).
- Cover any grooves in the shaft into which the O-rings could slide with suitable means or assembly aids.
- 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.

7.7.4.1 Installing the drive-end mechanical seal

Motors 95 4.N, 60 6.N, 80 6.N, 100 6.N, 120 6.N, 140 6.N, 165 6.N, 90 8.N, 110 8.N., 130 8.N, 40 10.N, 60 10.N, 75 10.N

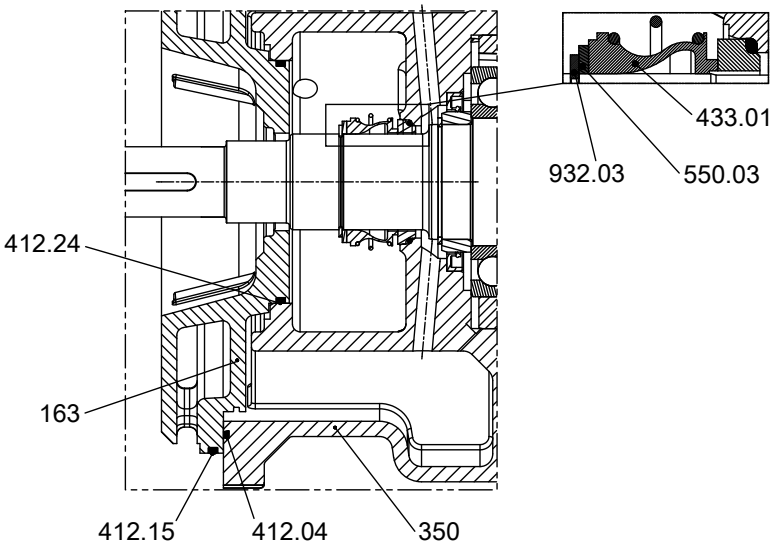

Fig. 42: Installing the drive-end mechanical seal for motors 95 4.N, 60 6.N, 80 6.N, 100 6.N, 120 6.N, 140 6.N, 165 6.N, 90 8.N, 110 8.N., 130 8.N, 40 10.N, 60 10.N, 75 10.N

✓ The back pull-out unit has been placed in a horizontal position on suitable wooden supports and is protected against rolling off.

1. Use an assembly sleeve of a suitable diameter to press the mating ring of mechanical seal 433.01 together with the O-ring into the drilled seat of bearing housing 350.
2. Carefully guide on the bellows part of mechanical seal 433.01 until it rests against the mating ring.
3. Guide disc 550.03 and circlip 932.03 onto the shaft. Press the circlip in with an assembly sleeve until it is axially fastened to the shaft groove.
4. Insert O-rings 412.04, 412.15 and 412.24 into discharge cover 163. Then press discharge cover 163 into bearing bracket 350 as far as it will go.

Motors 190 6.N, 225 6.N, 260 6.N, 320 6.N, 360 6.N, 400 6.N, 440 6.N, 150 8.N, 185 8.N

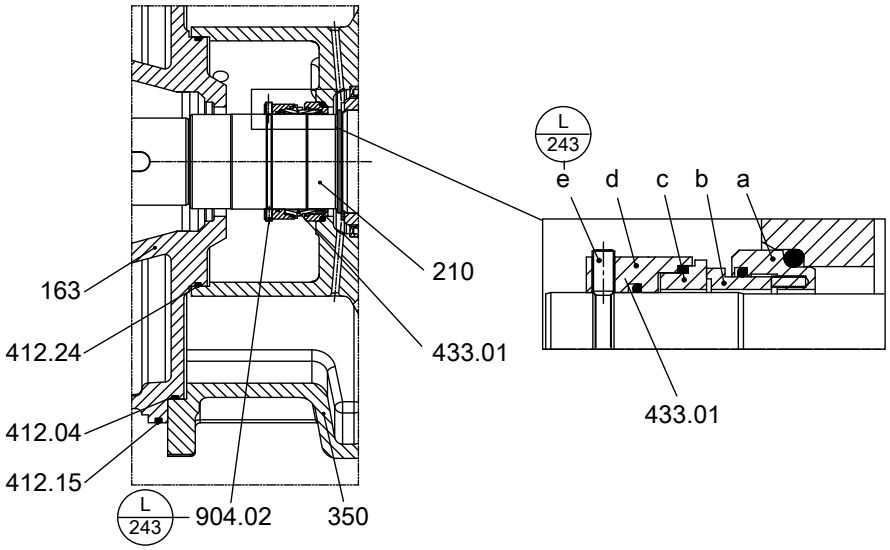

Fig. 43: Installing the drive-end mechanical seal for motors 190 6.N, 225 6.N, 260 6.N, 320 6.N, 360 6.N, 400 6.N, 440 6.N, 150 8.N, 185 8.N

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Table 26: Symbols key

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

✓ The back pull-out unit has been placed in a horizontal position on suitable wooden supports and is protected against rolling off.

1. Press the supporting ring (a) and primary ring (b) of mechanical seal 433.01 into the drilled seat of bearing housing 350 together with an O-ring.
2. Gently insert the mating ring (c) and the torque-transmitting element (d) until they rest against the primary ring (b).
3. Press the mechanical seal in with an assembly sleeve until the grub screws (e) can be tightened in the undercut of the shaft. Apply a thread-locking agent (Loctite 243) to the grub screws (e).
4. Insert O-rings 412.04, 412.15 and 412.24 into discharge cover 163. Then press discharge cover 163 into bearing bracket 350 as far as it will go.

7.7.4.2 Installing the impeller-end mechanical seal

Motors 95 4.N, 60 6.N, 80 6.N, 100 6.N, 120 6.N, 140 6.N, 165 6.N, 190 6.N, 225 6.N, 260 6.N, 90 8.N, 110 8.N., 130 8.N, 150 8.N, 185 8.N, 40 10.N, 60 10.N, 75 10.N

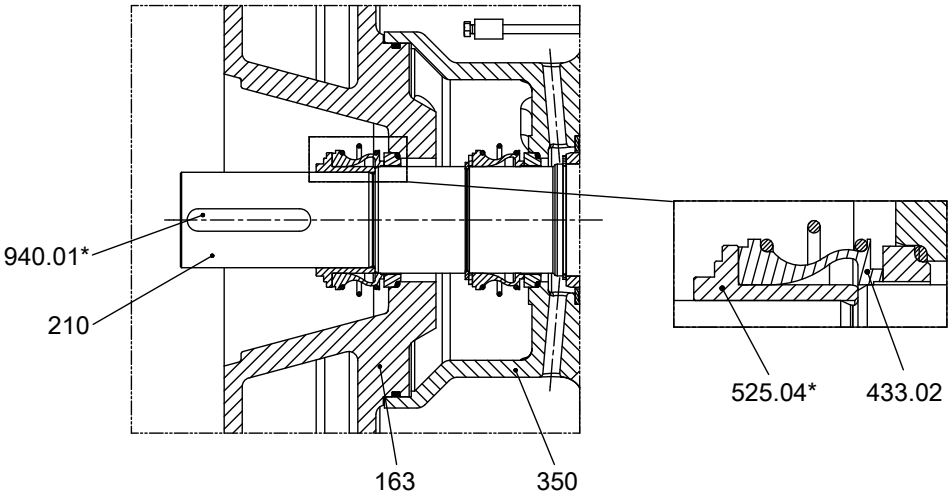

Fig. 44: Installing the impeller-end mechanical seal for motors 95 4.N, 60 6.N, 80 6.N, 100 6.N, 120 6.N, 140 6.N, 165 6.N, 190 6.N, 225 6.N, 260 6.N, 90 8.N, 110 8.N., 130 8.N, 150 8.N, 185 8.N, 40 10.N, 60 10.N, 75 10.N

*: Not for tapered fit

✓ Discharge cover 163 is installed in bearing housing 350.

✓ The back pull-out unit has been placed in a horizontal position on a wooden support and is protected against rolling off.

1. Use an assembly sleeve of a suitable diameter to push the mating ring of mechanical seal 433.02 together with the O-ring into the drilled seat of discharge cover 163.
2. Use spacer sleeve 525.04 to carefully push in the bellows part of the mechanical seal until it rests against the shaft shoulder.
3. If required, press the assembly sleeve against the spacer sleeve and insert key 940.01 into the shaft.

Motors 320 6.N, 360 6.N, 400 6.N, 440 6.N

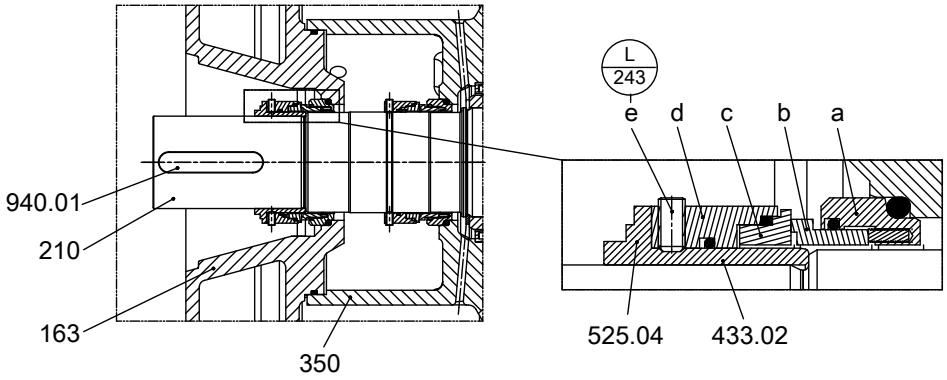

Fig. 45: Installing the impeller-end mechanical seal for motors 320 6.N, 360 6.N, 400 6.N, 440 6.N

Table 27: Symbols key

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

✓ Discharge cover 163 is installed in bearing housing 350.

✓ The back pull-out unit has been placed in a horizontal position on a wooden support and is protected against rolling off.

1. Press the supporting ring (a) and primary ring (b) of mechanical seal 433.02 into the drilled seat of discharge cover 163 together with an O-ring.
2. Use spacer sleeve 525.04 to carefully slide on the mating ring (c) and the torque-transmitting element (d) until they rest against the shaft shoulder.
3. Press the assembly sleeve against the spacer sleeve. If applicable, insert keys 940.01 into the shaft and tighten the grub screws (e). Apply a thread-locking agent (Loctite 243) to the grub screws (e).

7.7.5 Fitting the impeller

The procedures for fitting the impeller differ depending on the hydraulic system and motor in question. (⇨ Section 7.6.4, Page 65)

Table 28: Impeller fastening elements

Size	Tapered fit		Cylindrical fit					
	60 6.N	95 4.N 80 6.N	60 6.N	80 6.N 100 6.N	120 6.N 140 6.N 165 6.N 90 8.N 110 8.N 130 8.N 40 10.N 60 10.N 75 10.N	190 6.N 225 6.N 260 6.N 150 8.N 185 8.N	320 6.N 360 6.N	400 6.N 440 6.N
700-330	-	M20	-	-	-	-	-	-
800-400	M20	M20	-	-	-	-	-	-
800-401	-	M20	-	-	-	-	-	-
1000-420	-	-	M85 × 2	M85 × 2	M125 × 2	-	-	-
1000-421	-	-	M85 × 2	M85 × 2	M125 × 2	-	-	-
1000-500	-	-	-	M85 × 2	M125 × 2	M125 × 2	-	-
1200-630	-	-	-	-	M125 × 2	M125 × 2	M125 × 2	M125 × 2

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Impeller fastening elements M20

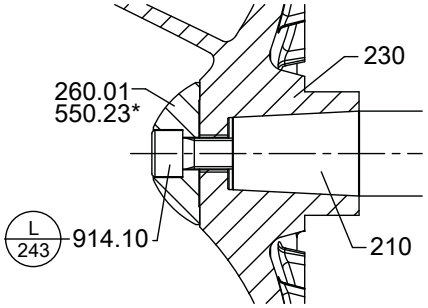

Fig. 46: Fitting the impeller

*: On specific designs only

NOTE

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

✓ 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.

Impeller fastening elements M85 × 2, M125 × 2

✓ The back pull-out unit has been placed in a horizontal position on wooden supports. It has been secured against rolling off.

✓ The mechanical seals and keys have been properly installed.

1. Insert key 940.01.
2. Mount impeller 230 with a special impeller fitting and removal tool.

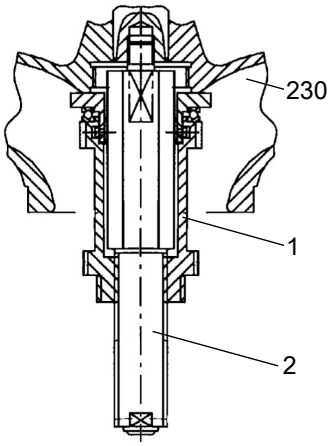

Fig. 47: Special impeller fitting and removal tool

3. Screw part 2 of the special impeller fitting and removal tool into the shaft end of the pump set.
4. Screw part 1 to fully threaded stud part 2.

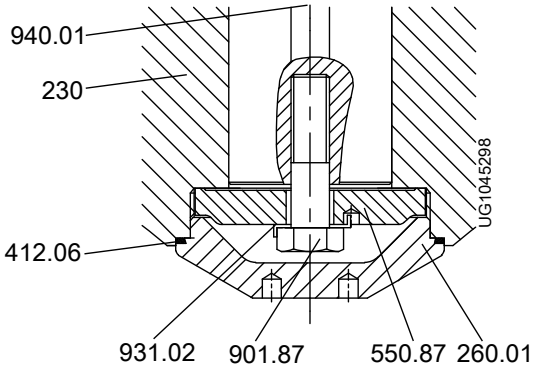

Fig. 48: Impeller fastening elements

5. Screw in hexagon head bolt 901.87 with disc 550.87. Bend over lock washer 931.02.
6. Insert O-ring 412.06.
7. Screw in impeller hub cap 260.01 using a special wrench (right-hand thread).

7.7.6 Installing the back pull-out unit

NOTE

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

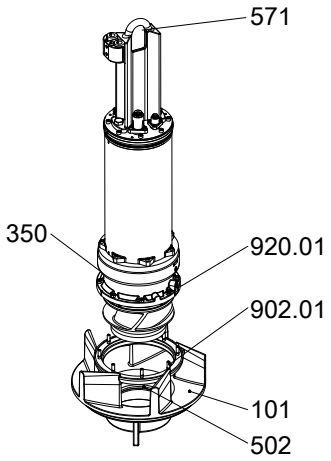

Fig. 49: Installing the back pull-out unit

✓ Pump casing 101 has been positioned on a wooden support on a level and solid surface.

✓ Suitable lifting equipment is on hand.

✓ The back pull-out unit has been completely pre-assembled.

1. Use a rubber mallet to insert casing wear ring 502 into pump casing 101 as far as it will go.
2. Attach the lifting equipment to bail 571 and carefully pull the back pull-out unit upright.
3. Insert the complete back pull-out unit into pump casing 101.
4. Evenly tighten screwed connection 920.01 between pump casing and bearing housing 350.

7.7.7 Leak testing

After reassembly, the mechanical seal area (lubricant reservoir and leakage chamber) and the motor must be tested for leakage.

7.7.7.1 Checking the lubricant reservoir for leakage

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:** 1 bar maximum
- **Test duration:** 5 minutes

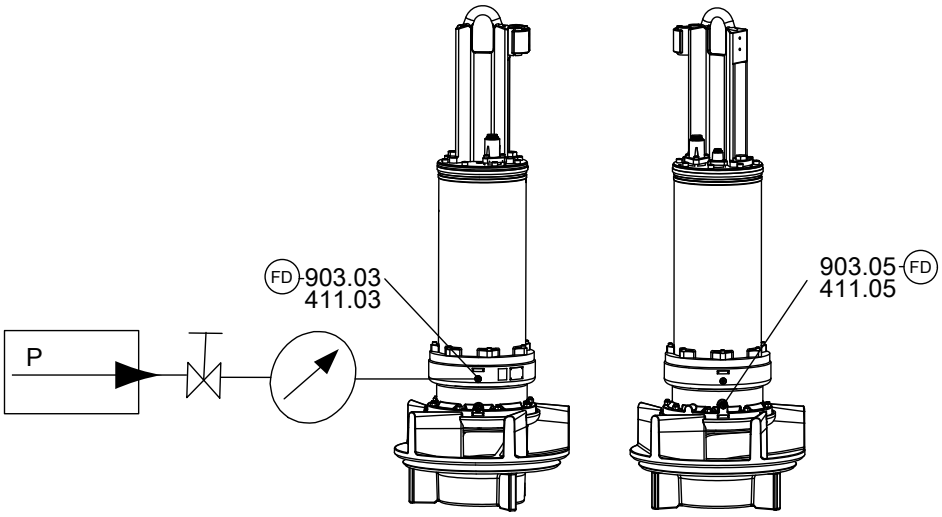

Fig. 50: Leak testing the lubricant reservoir

903.03 411.03	Lubricant filler opening	903.05 411.05	Lubricant drain

Table 29: Symbols key

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

1. Undo screw plug 903.03 and joint ring 411.03 of the lubricant reservoir.
2. Screw the testing device tightly into the G 1/2 plug thread.
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 sealing elements and screwed connections.
4. Repeat the leak test if required.
5. If the leak test has been successful, remove the testing device. Apply a thread-locking agent to the screw plug and screw it back in together with a new joint ring.
6. Fill in lubricant. (⇨ Section 7.4.1.4, Page 59)

7.7.7.2 Checking the leakage chamber for leakage

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
- **Opening:** hole of screw plug 903.02

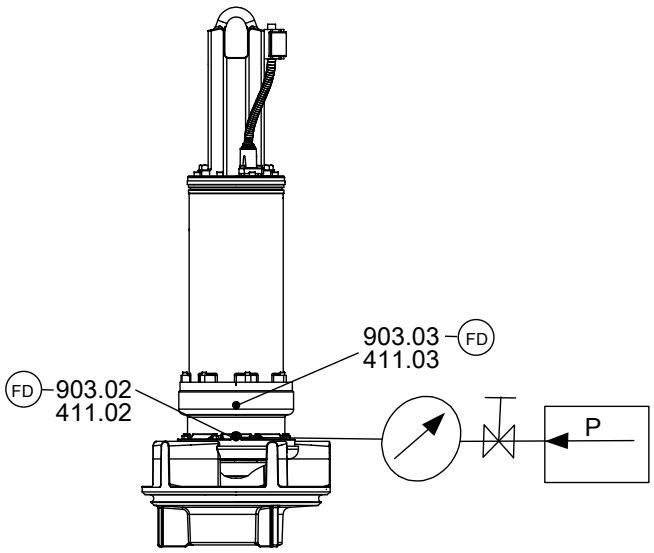

Fig. 51: Leak testing the leakage chamber

903.02 411.02	Leakage drain	903.03 411.03	Lubricant filler opening

Table 30: Symbols key

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

1. Undo screw plug 903.02 and joint ring 411.02 from the leakage chamber.
2. Screw the testing device tightly into the G 1/2 plug thread.
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 sealing elements and screwed connections.
4. Repeat the leak test if required.
5. If the leak test has been successful, remove the testing device.
   Apply a thread-locking agent to the screw plug and screw it back in together with a new joint ring.

7.7.7.3 Checking the motor for leakage

Observe the following values for leak testing:

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

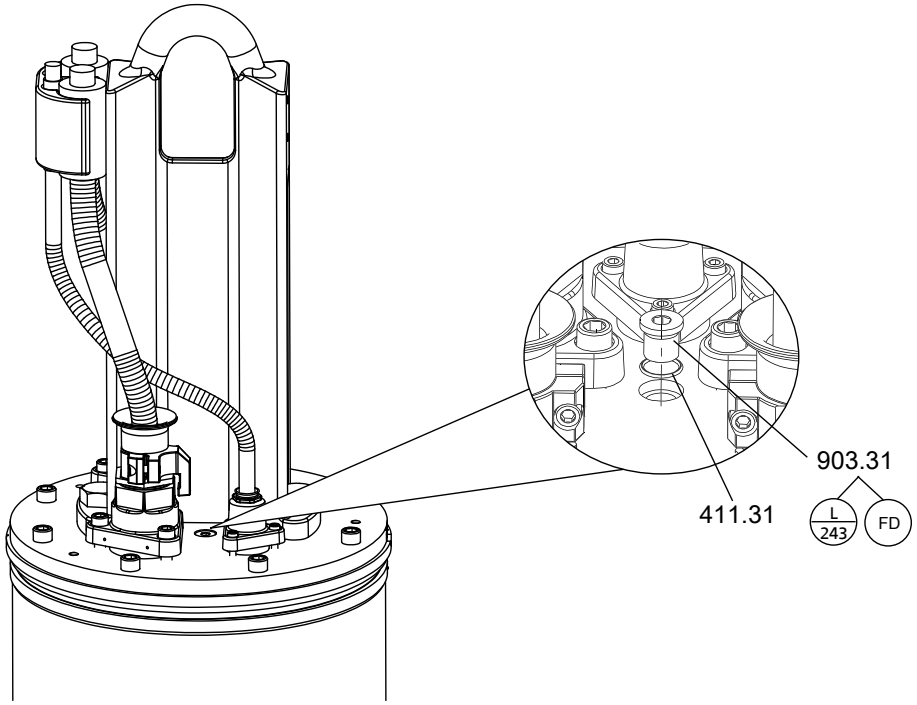

Fig. 52: Checking the motor for leakage

Table 31: Symbols key

Symbol	Description
L 243	Always secure screwed connections marked with this symbol with **Loctite 243** .
FD	Always apply a **liquid sealant** (e.g. Hylomar SQ32M) to sealing surfaces marked with this symbol.

1. Remove screw plug 903.31 and joint ring 411.31.
2. Screw the testing device tightly into the G $^{1}/_{2}$ plug thread.
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.
4. Repeat the leak test if required.
5. Remove the testing device.

DANGER

Screw plug leaking or missing

Explosion hazard!

Damage to the motor!

- ▹ Never start up a pump set without fitting the screw plug.
- ▹ Apply a thread-locking agent (Loctite 243) to the screw plug.

6. Apply a thread-locking agent (Loctite 243) to screw plug 903.31.
7. Re-insert and tighten screw plug 903.31 with new joint ring 411.31.

7.8 Tightening torques

Table 32: 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		$R_{p0.2} \geq 530$ N/mm²		$R_{p0,2} \geq 450$ N/mm²	
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
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 88)
- Quantity of spare parts
- Shipping address
- Mode of dispatch (freight, mail, express freight, air freight)

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

Table 33: Quantity of spare parts for recommended spare parts stock[11)]

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, drive end	2	3	4	5	6	7	90 %
433.02	Mechanical seal, impeller end	2	3	4	5	6	7	90 %
322	Rolling element bearing, drive end	1	1	2	2	3	4	50 %
320	Rolling element bearing, impeller 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 %

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

8 Trouble-shooting

⚠ WARNING

Improper work to remedy faults

Risk of injury!

- ▷ For any work performed to remedy faults, observe the relevant information given in this operating manual and/or in the product literature provided by the accessories manufacturer.

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 34: Trouble-shooting

A	B	C	D	E	Possible causes	Remedy[12)]
-	✗	-	-	✗	Water level lowered too much during operation	Check supply and capacity of system (sump floor area). Check level control equipment.
✗	✗	-	-	✗	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.
✗	✗	✗	-	✗	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.
✗	✗	✗	-	✗	Unfavourable flow to the pump inlet	Improve the flow to the intake chamber (contact KSB).
-	✗	✗	-	✗	Pump running in off-design conditions - part load/overload	Check the pump's operating data.
✗	✗	-	✗	✗	Pump clogged by deposits	Clean intake and pump components.
-	✗	✗	✗	✗	Wear	Replace worn parts.
-	✗	-	✗	✗	Impermissible air or gas content in the fluid handled	Contact KSB.
-	-	-	-	✗	System-induced vibrations	Contact KSB.
-	-	✗	-	✗	Wrong direction of rotation	Check the electrical connection of motor and control system, if any.
✗	-	-	-	-	No voltage	Check electrical connections. Contact the energy supplier.
✗	-	-	-	-	Motor winding or electric cable are defective.	Replace with original KSB cable or contact KSB.
-	-	✗	-	✗	Worn or defective rolling element bearings	Contact KSB.
✗	-	-	-	-	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.
✗	-	-	-	-	Motor has been tripped by leakage monitor.	Have cause determined and eliminated by qualified and trained personnel.
✗	-	-	-	-	Mechanical seal monitor has tripped.	Have cause determined and eliminated by qualified and trained personnel.

12 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[12)]
✗	-	-	-	-	Bearing temperature monitor has tripped.	Have cause determined and eliminated by qualified and trained personnel.
-	✗	-	✗	-	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 UN, XN, YN

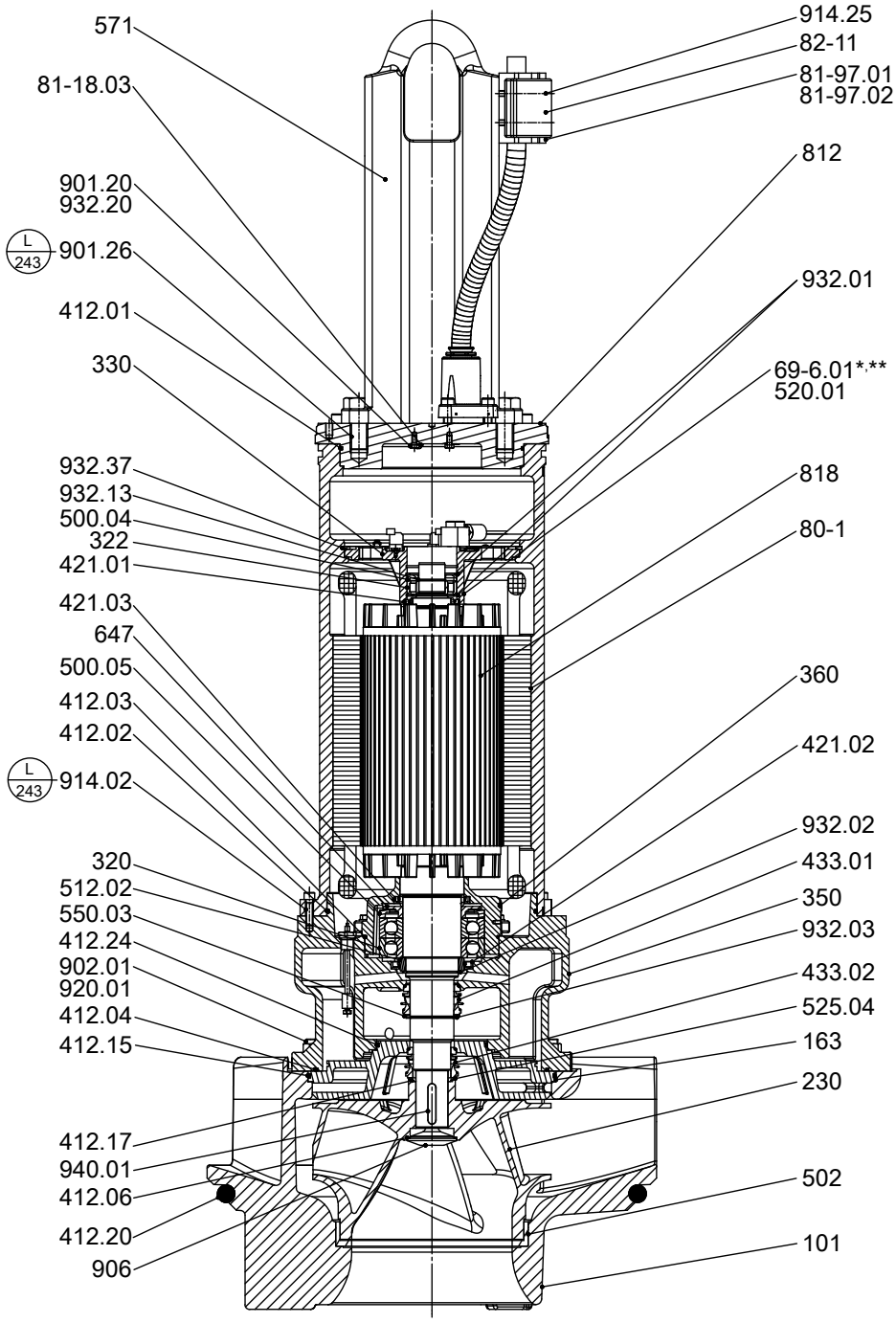

Fig. 53: General assembly drawing

*: On specific designs only

**: Optional

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Table 35: Symbols key

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

Table 36: List of components

Part No.	Description	Part No.	Description
101	Pump casing	571	Bail
163	Discharge cover	69-6.01/.02	Temperature sensor
230	Impeller	647	Grease regulator
320	Rolling element bearings	80-1	Motor unit
322	Radial roller bearing	81-18.03	Cable terminal
330	Bearing bracket	81-97.01/.02	Cable protector
350	Bearing housing	82-11	Strain relief device
360	Bearing cover	812	Motor housing cover
412.01/.02/.03/.04/.06/.15/.17/.20/.24	O-ring	818	Rotor
421.01/.02	Lip seal	901.20/.26	Hexagon head bolt
433.01/.02	Mechanical seal	902.01	Stud
500.03/.04/.05	Ring	906	Impeller screw
502	Casing wear ring	914.02/.25	Hexagon socket head cap screw
512.02	Wear ring	920.01	Nut
520.01/.02	Sleeve	932.01/.02/.03/.13/.20/.37	Circlip
525.04	Spacer sleeve	940.01	Key
550.03	Disc		

9.2 Detail drawings

9.2.1 Side views

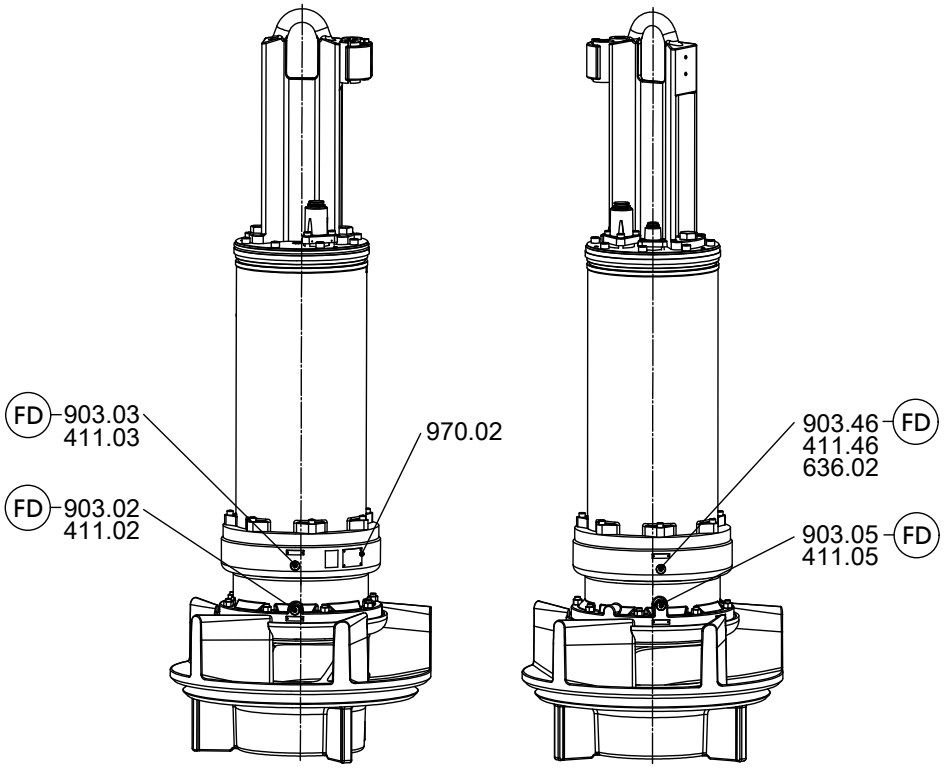

Fig. 54: Side views

Table 37: Symbols key

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

Table 38: List of components

Part No.	Description	Part No.	Description
411.02/.03/.05/.46	Joint ring	903.02/.03/.05/.46	Screw plug
636.02	Lubricating nipple	970.02	Label/plate

9.2.2 Labels/plates

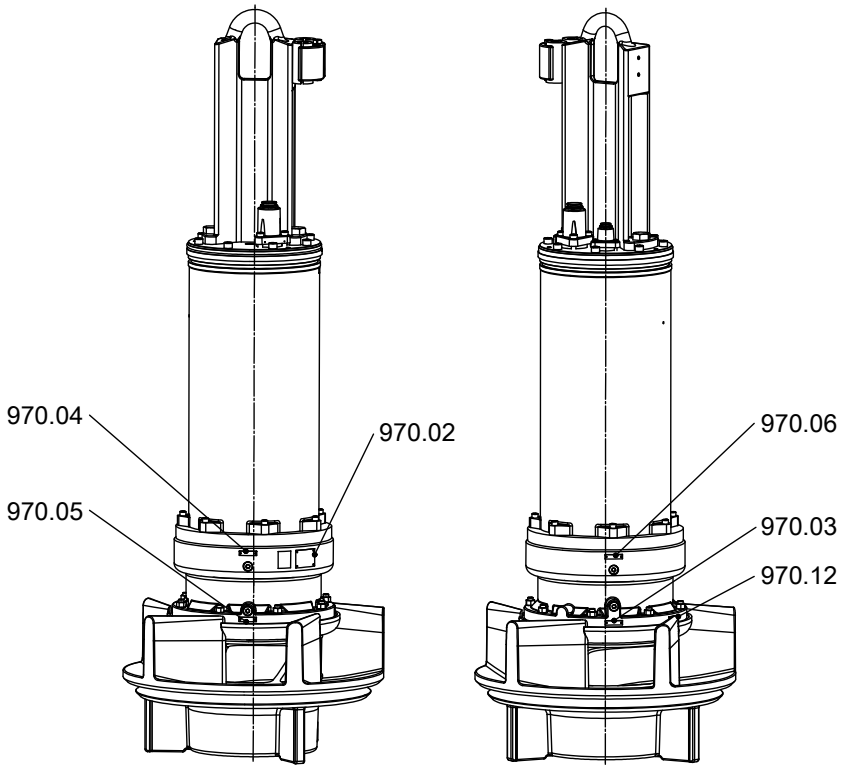

Fig. 55: Labels/plates

Table 39: List of components

Part No.	Description	Part No.	Description
970.02/.03/.04/.05/.06/.12	Label/plate		

9.2.3 Cable gland and fastening

Motors 95 4.N, 60 6.N, 80 6.N, 100 6.N, 120 6.N, 140 6.N, 165 6.N, 90 8.N, 110 8.N, 130 8.N, 40 10.N, 60 10.N, 75 10.N

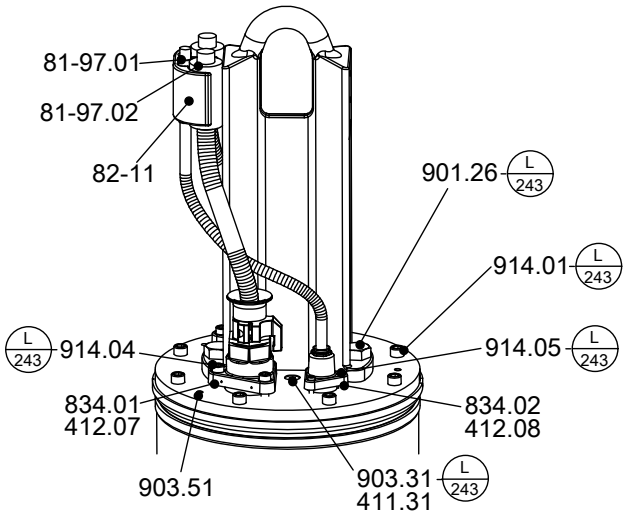

Fig. 56: Cable gland and fastening, motors 95 4.N, 60 6.N, 80 6.N, 100 6.N, 120 6.N, 140 6.N, 165 6.N, 90 8.N, 110 8.N, 130 8.N, 40 10.N, 60 10.N, 75 10.N

Table 40: Symbols key

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

Table 41: List of components

Part No.	Description	Part No.	Description
411.31	Joint ring	834.01/.02	Cable gland
412.07/.08	O-ring	901.26	Hexagon head bolt
81-97.01/.02	Cable protector	903.31/.51	Screw plug
82-11	Strain relief device	914.01/.04/.05	Hexagon head bolt

Motors 190 6.N, 225 6.N, 260 6.N, 320 6.N, 360 6.N, 400 6.N, 440 6.N, 150 8.N, 185 8.N

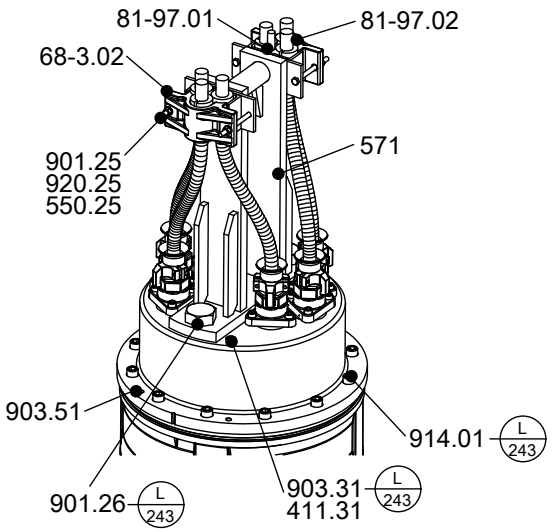

Fig. 57: Cable gland and fastening, motors 190 6.N, 225 6.N, 260 6.N, 320 6.N, 360 6.N, 400 6.N, 440 6.N, 150 8.N, 185 8.N

Table 42: Symbols key

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

Table 43: List of components

Part No.	Description	Part No.	Description
411.31	Joint ring	901.25/.26	Hexagon head bolt
550.25	Disc	903.31/.51	Screw plug
571	Bail	914.01	Hexagon head bolt
68-3.02	Cover plate	920.25	Nut
81-97.01/.02	Cable protector	970.02	Label/plate

9.2.4 Bearing, motor end

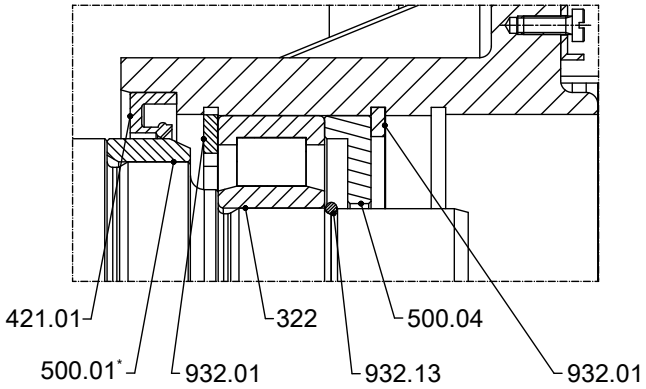

Fig. 58: Bearing assembly, motor end

*: Only for motors: 190 6.N, 225 6.N, 260 6.N, 320 6.N, 360 6.N, 400 6.N, 440 6.N, 150 8.N, 185 8.N

Table 44: List of components

Part No.	Description	Part No.	Description
322	Radial roller bearing	500.01/.04	Ring
421.01	Lip seal	932.01/.13	Circlip

9.2.5 Bearing temperature sensors

Motor end

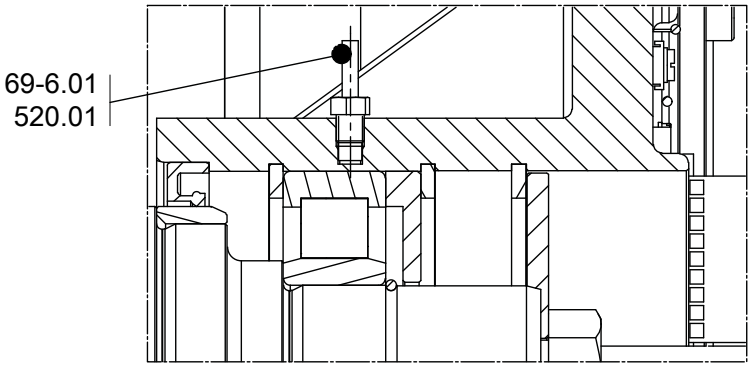

Fig. 59: Bearing temperature sensor, motor end

Table 45: List of components

Part No.	Description	Part No.	Description
520.01	Sleeve	69-6.01	Temperature sensor

Impeller end

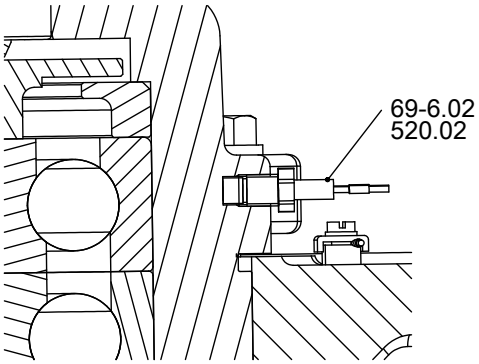

Fig. 60: Bearing temperature sensor, impeller end

Table 46: List of components

Part No.	Description	Part No.	Description
520.02	Sleeve	69-6.02	Temperature sensor

9.2.6 Bearing bracket fastening

Motors 95 4.N, 60 6.N, 80 6.N, 100 6.N, 120 6.N, 140 6.N, 165 6.N, 90 8.N, 110 8.N, 130 8.N, 40 10.N, 60 10.N, 75 10.N

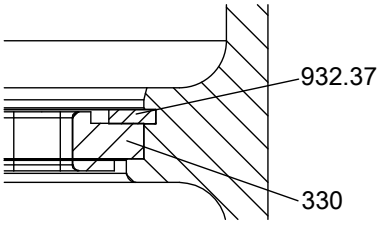

Fig. 61: Bearing bracket fastening

Table 47: List of components

Part No.	Description	Part No.	Description
330	Bearing bracket	932.37	Circlip

Motors 190 6.N, 225 6.N, 260 6.N, 320 6.N, 360 6.N, 400 6.N, 440 6.N, 150 8.N, 185 8.N

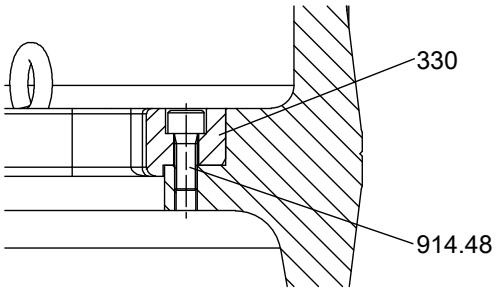

Fig. 62: Bearing bracket fastening

Table 48: List of components

Part No.	Description	Part No.	Description
330	Bearing bracket	914.48	Hexagon socket head cap screw

9.2.7 Bearing bracket, sensors and terminals

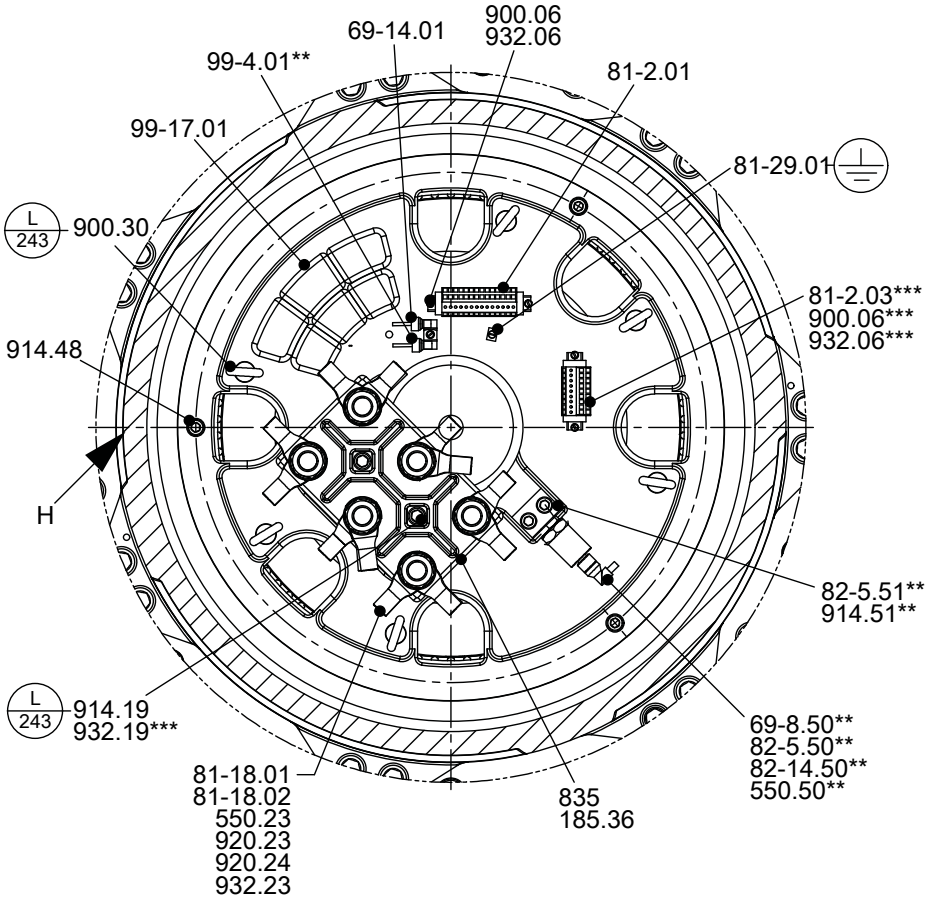

Fig. 63: Bearing bracket, sensors and terminals

H: alignment groove

**: Only for version with measurement transmitter 69-8.50 (vibration sensor)

***: On specific sizes only

Table 49: Symbols key

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

Table 50: List of components

Part No.	Description	Part No.	Description
185.36	Plate	82-14.50	Cable with plug
550.23/.50	Disc	835	Terminal board
69-8.50	Measurement transmitter	900.06/.30	Bolt/screw
69-14.01	Leakage monitor	914.19/.48/.51	Hexagon socket head cap screw
81-18.01/.02	Cable terminal	920.23/.24	Nut
81-2.01/.03	Plug	932.06/.19/.23	Circlip
81-29.01	Terminal	99-17.01	Desiccant
82-5.50/.51	Adapter	99-4.01	Conversion kit

9.2.8 Bearing housing, sensors

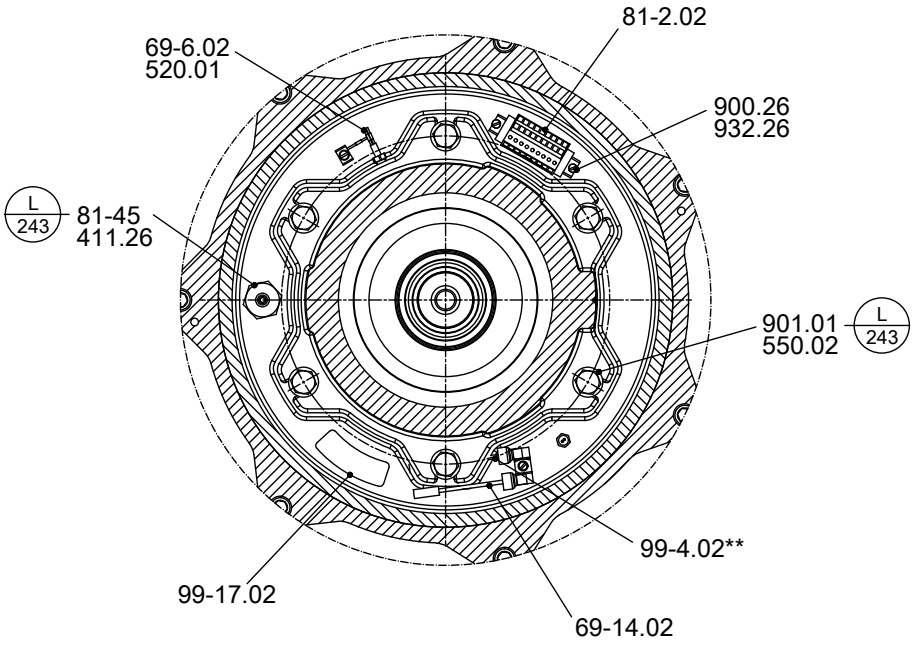

Fig. 64: Bearing housing, sensors

**: Only for version with measurement transmitter 69-8.50 (vibration sensor)

Table 51: Symbols key

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

Table 52: List of components

Part No.	Description	Part No.	Description
411.26	Joint ring	81-45	Float switch
520.01	Sleeve	900.26	Bolt/screw
69-6.02	Temperature sensor	901.01	Hexagon head bolt
69-14.02	Leakage monitor	99-4.02	Conversion kit
81-2.02	Plug	99-17.02	Desiccant

9.2.9 Float switch

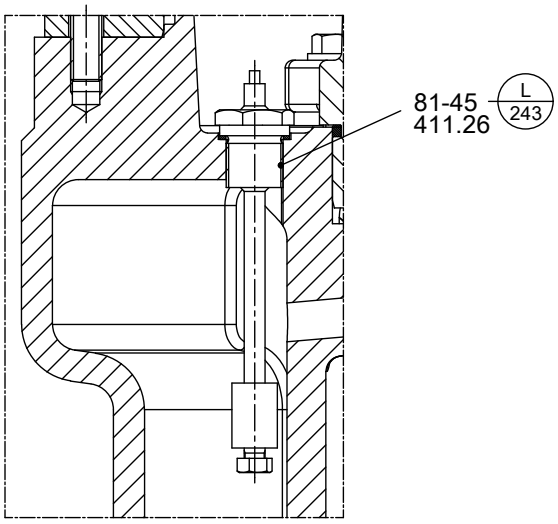

Fig. 65: Float switch

Table 53: Symbols key

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

Table 54: List of components

Part No.	Description	Part No.	Description
411.26	Joint ring	81-45	Float switch

9.2.10 Lubricant reservoir and leakage chamber

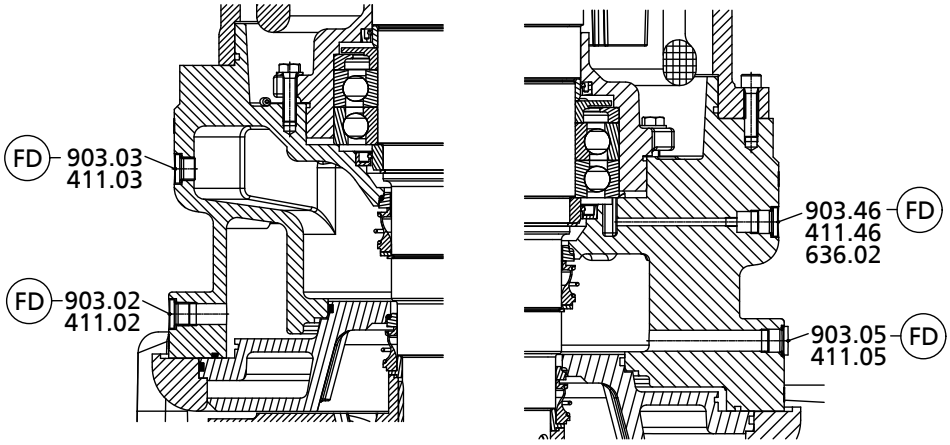

Fig. 66: Lubricant reservoir and leakage chamber

Table 55: Symbols key

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

Table 56: List of components

Part No.	Description	Part No.	Description
411.02/.03/.05/.46	Joint ring	903.02/.03/.05/.46	Screw plug
636.02	Lubricating nipple		

9.2.11 Connection space of K35 motors

Motors 320 6.N, 360 6.N, 400 6.N, 440 6.N

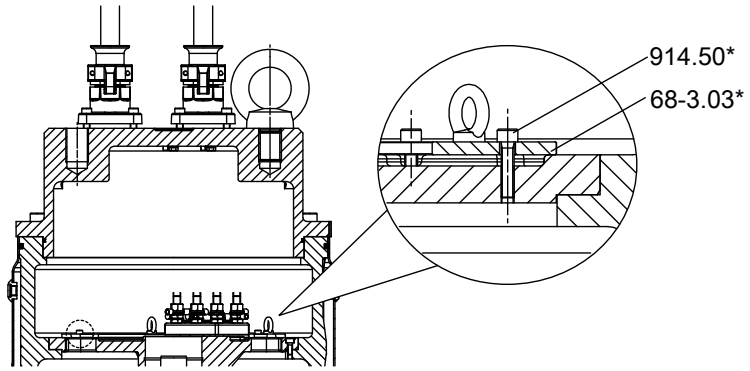

Fig. 67: Connection space of K35 motors

*: Explosion-proof versions only

Table 57: List of components

Part No.	Description	Part No.	Description
68-3.03	Cover plate	914.50	Hexagon socket head cap screw

9.2.12 Impeller fastening elements

Sizes 700-330, 800-400, 800-401

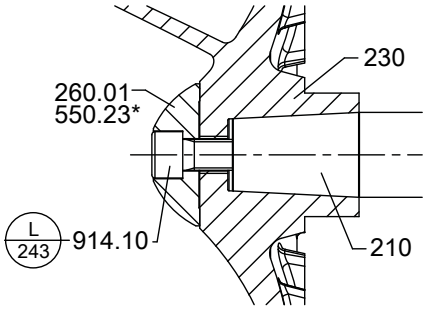

Fig. 68: Impeller fastening elements, sizes 700-330, 800-400, 800-401

*: On specific designs only

Table 58: Symbols key

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

Table 59: List of components

Part No.	Description	Part No.	Description
210	Shaft	550.23	Disc
230	Impeller	914.10	Hexagon socket head cap screw
260.01	Impeller hub cap		

Sizes 1000-420, 1000-421, 1000-500, 1200-630

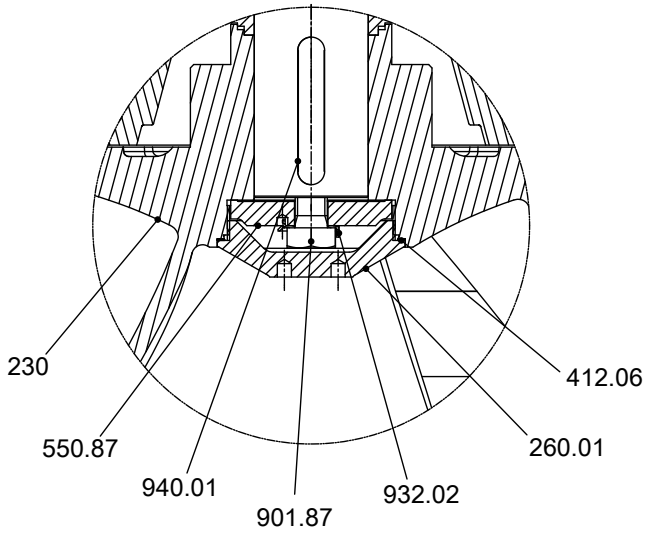

Fig. 69: Impeller fastening elements, sizes 1000-420, 1000-421, 1000-500, 1200-630

Table 60: List of components

Part No.	Description	Part No.	Description
230	Impeller	901.87	Hexagon head bolt
260.01	Impeller hub cap	932.02	Circlip
412.06	O-ring	940.01	Key
550.87	Disc		

9.2.13 Version with casing wear ring and impeller wear ring (optional)

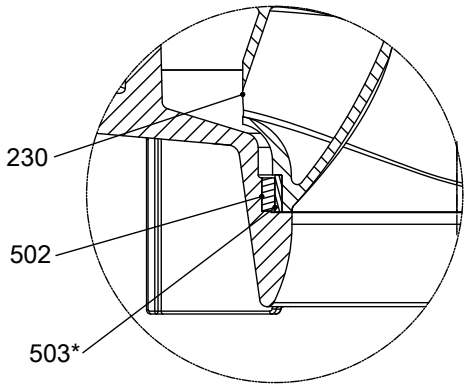

Fig. 70: Version with casing wear ring and impeller wear ring (optional)

*: On specific designs only

Table 61: List of components

Part No.	Description	Part No.	Description
230	Impeller	503	Impeller wear ring
502	Casing wear ring		

9.3 Cable bundle

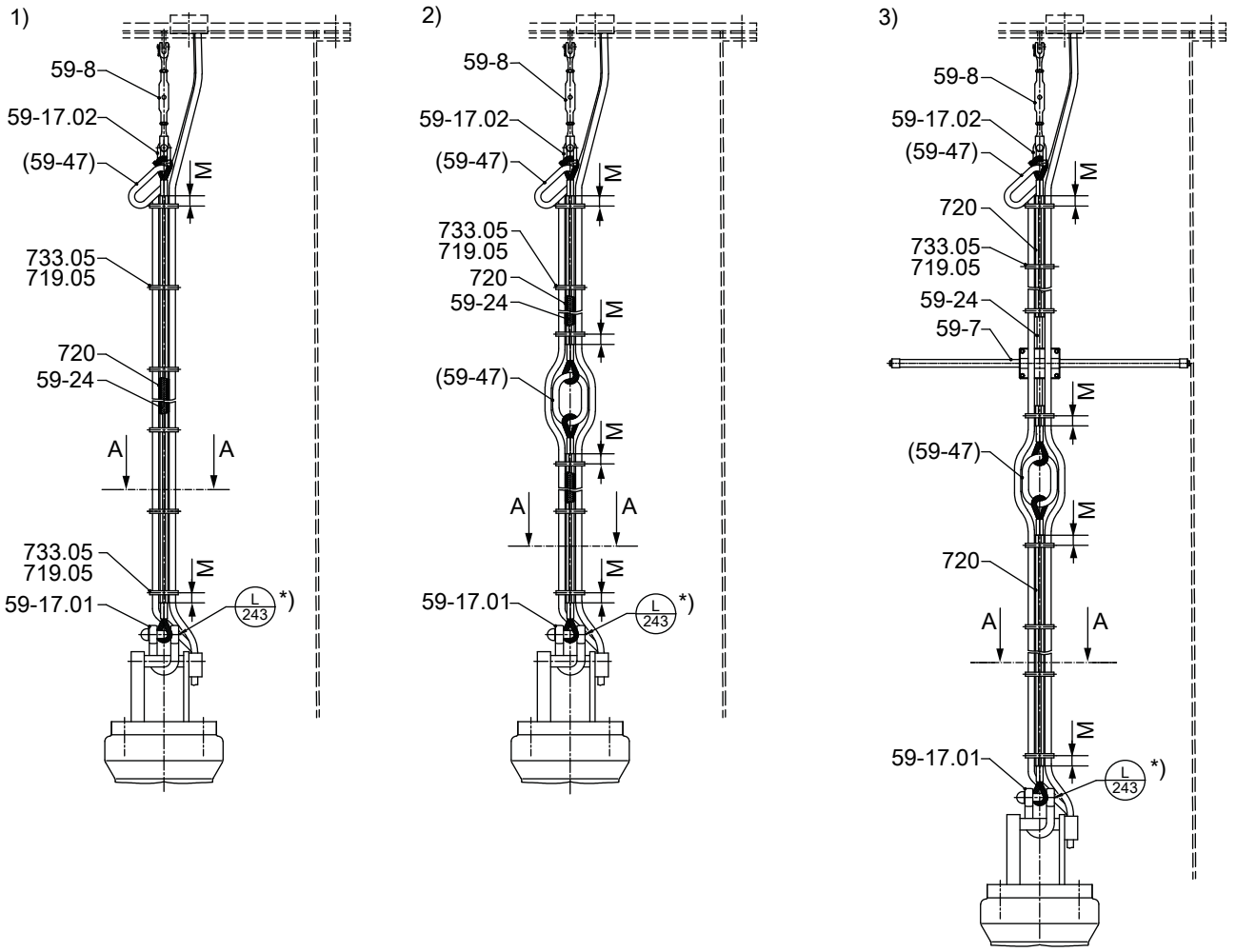

Fig. 71: Cable bundle

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

*): Only required for galvanised version

NOTE

Distance M = 50 mm

Table 62: Symbols key

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

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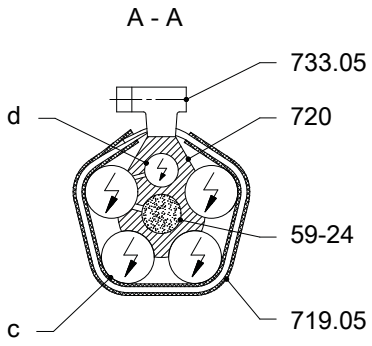

Fig. 72: Section A - A, position of power cable, control cable and support rope

c	Power cable	d	Control cable

Table 63: 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 power cable

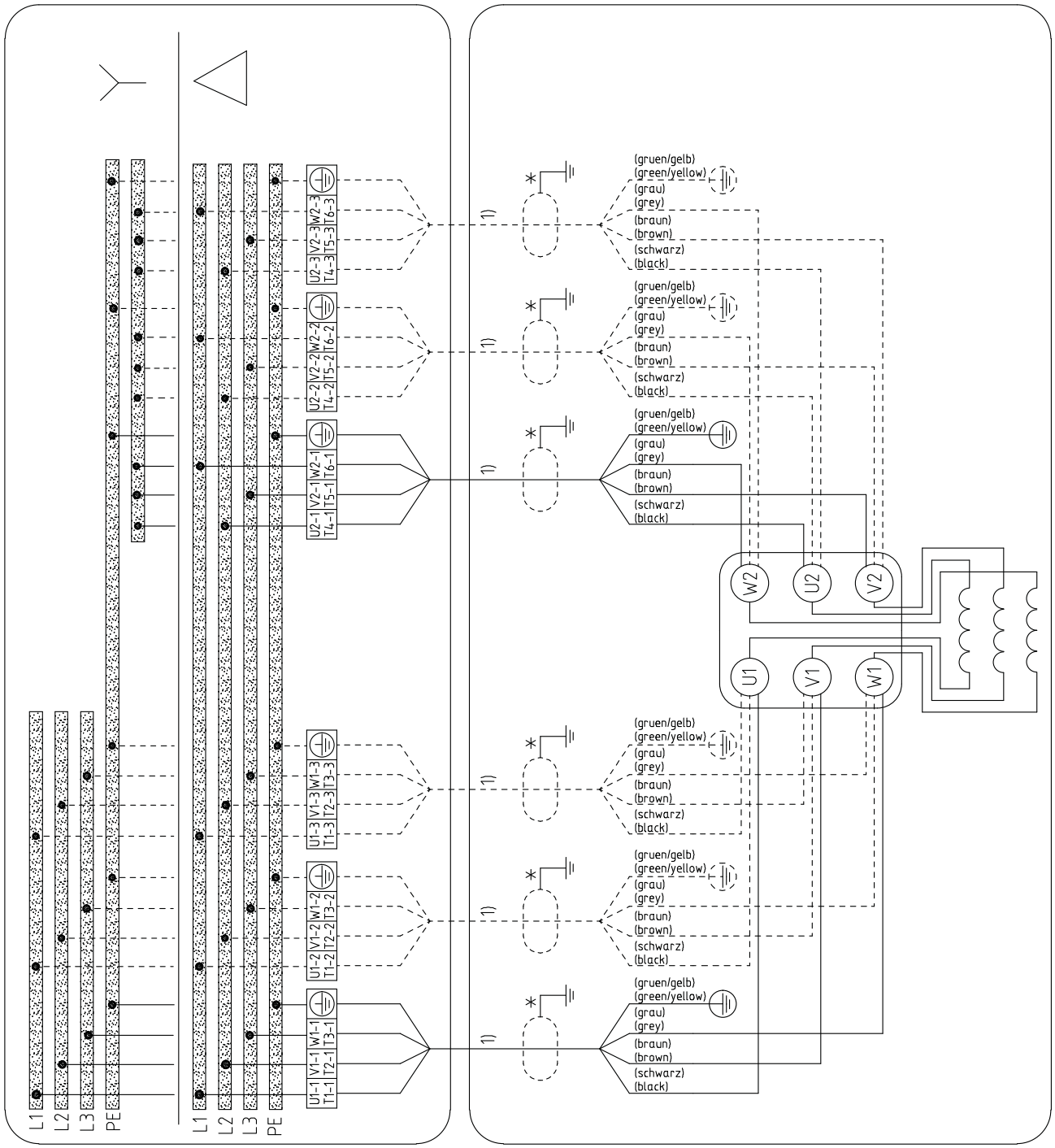

Fig. 73: Wiring diagram for power cable

* Shielded cable option
[1)] Up to 3 parallel cable pairs possible

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9.4.2 Wiring diagram for the sensors

Standard pump set

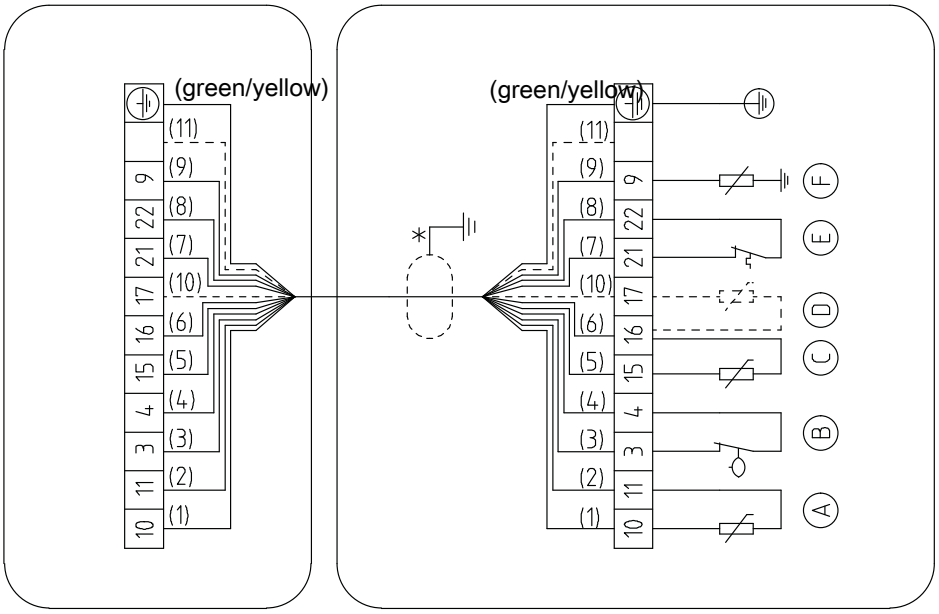

Fig. 74: Wiring diagram for sensors of standard pump sets

*	Shielded cable option
Ⓐ	Motor temperature (PTC)
Ⓑ	Mechanical seal leakage
Ⓒ	Bearing temperature (lower bearing assembly)
Ⓓ	Bearing temperature (upper bearing assembly, optional)
Ⓔ	Motor temperature
Ⓕ	Leakage inside the motor

Pump sets with additional monitoring by vibration sensor

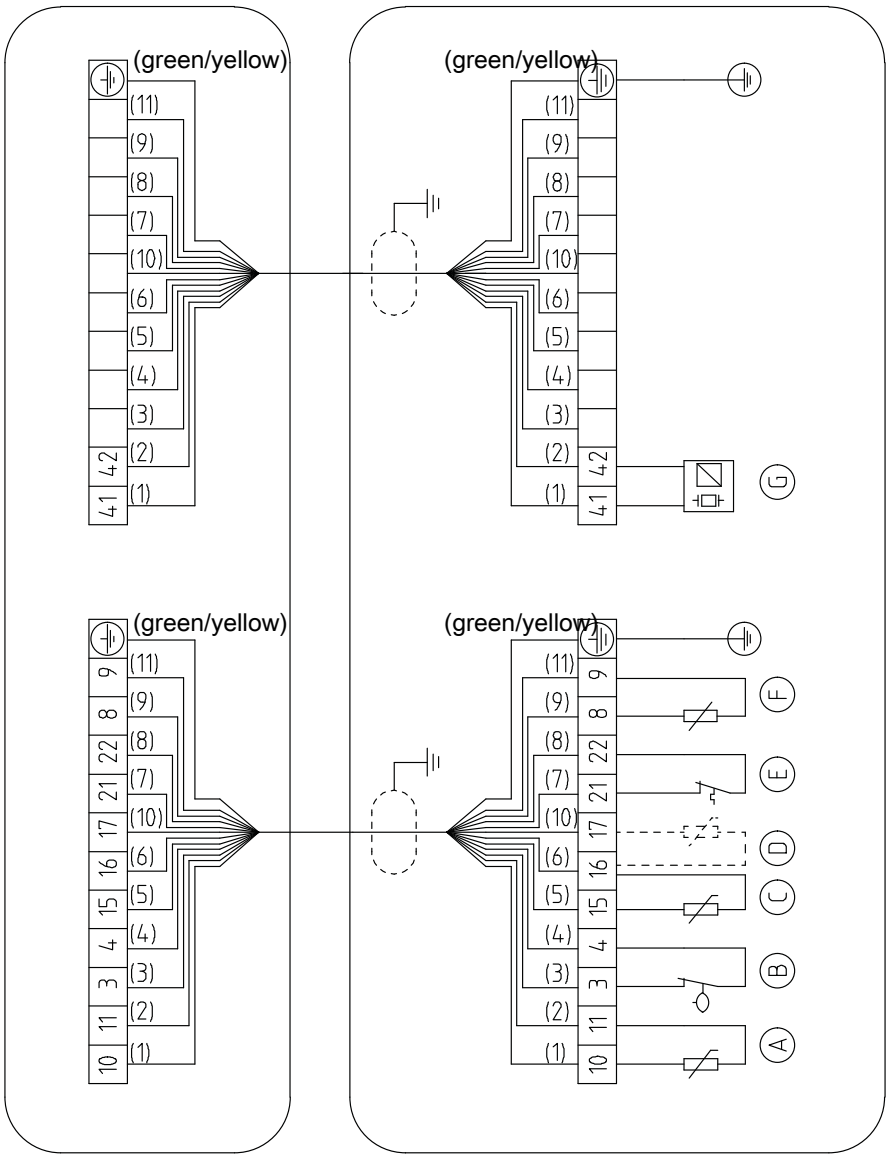

Fig. 75: Sensor wiring diagram for pump sets with additional monitoring by vibration sensor

Ⓐ	Motor temperature (PTC)
Ⓑ	Mechanical seal leakage
Ⓒ	Bearing temperature (lower bearing assembly)
Ⓓ	Bearing temperature (upper bearing assembly, optional)
Ⓔ	Motor temperature
Ⓕ	Leakage inside the motor
Ⓖ	Vibration sensor

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Pump sets with additional Pt100 motor temperature monitoring

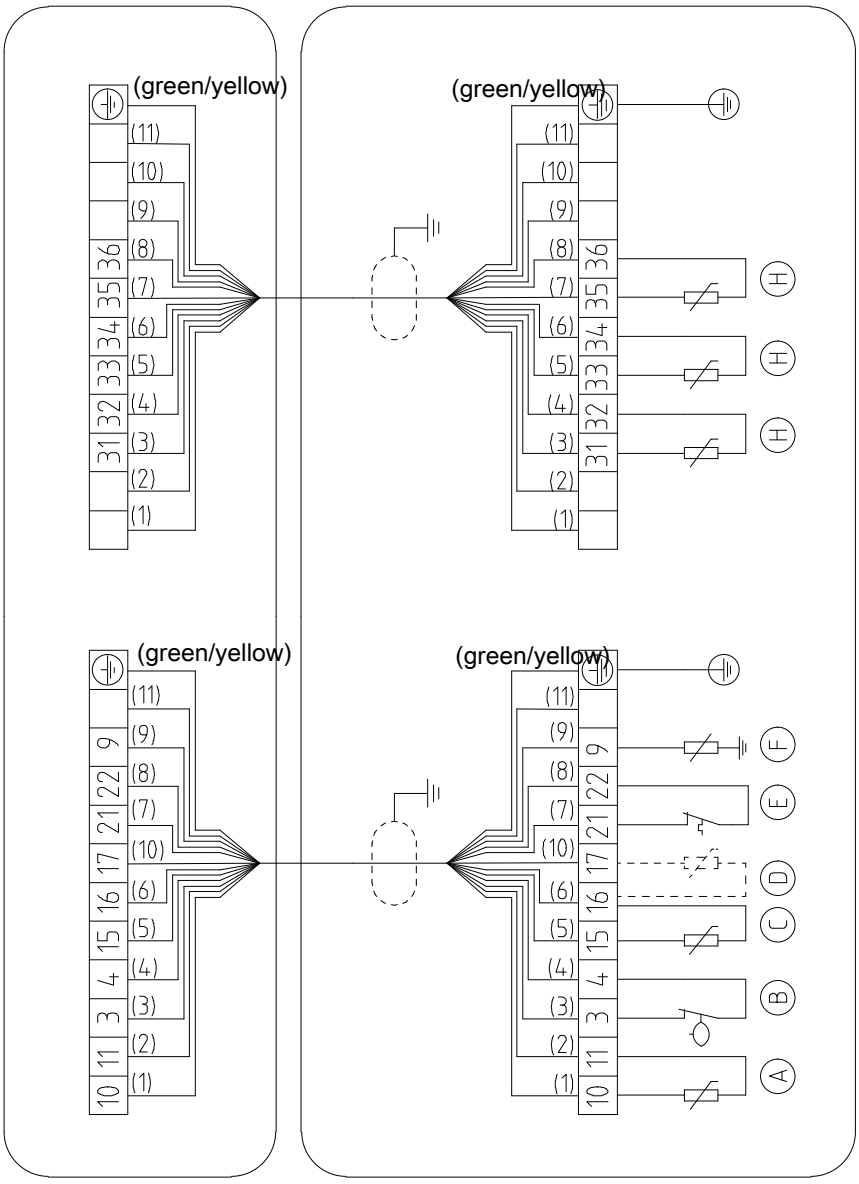

Fig. 76: Sensor wiring diagram for pump sets with additional Pt100 motor temperature monitoring

Ⓐ	Motor temperature (PTC)
Ⓑ	Mechanical seal leakage
Ⓒ	Bearing temperature (lower bearing assembly)
Ⓓ	Bearing temperature (upper bearing assembly, optional)
Ⓔ	Motor temperature
Ⓕ	Leakage inside the motor
Ⓗ	Motor temperature (Pt100)

Pump sets with additional Pt100 motor temperature monitoring and vibration sensor

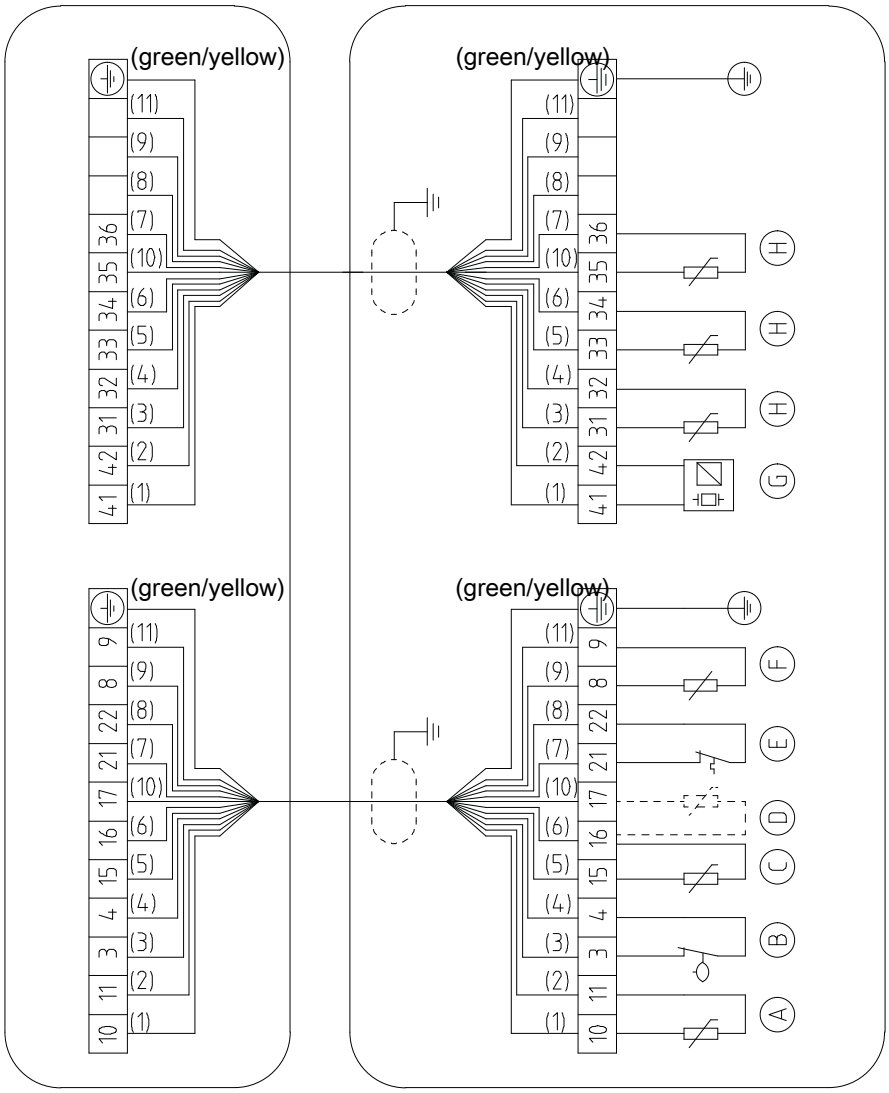

Fig. 77: Sensor wiring diagram for pump sets with additional Pt100 motor temperature monitoring and vibration sensor

Ⓐ	Motor temperature (PTC)
Ⓑ	Mechanical seal leakage
Ⓒ	Bearing temperature (lower bearing assembly)
Ⓓ	Bearing temperature (upper bearing assembly, optional)
Ⓔ	Motor temperature
Ⓕ	Leakage inside the motor
Ⓖ	Vibration sensor
Ⓗ	Motor temperature (Pt100)

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9.5 Flamepaths on explosion-proof motors

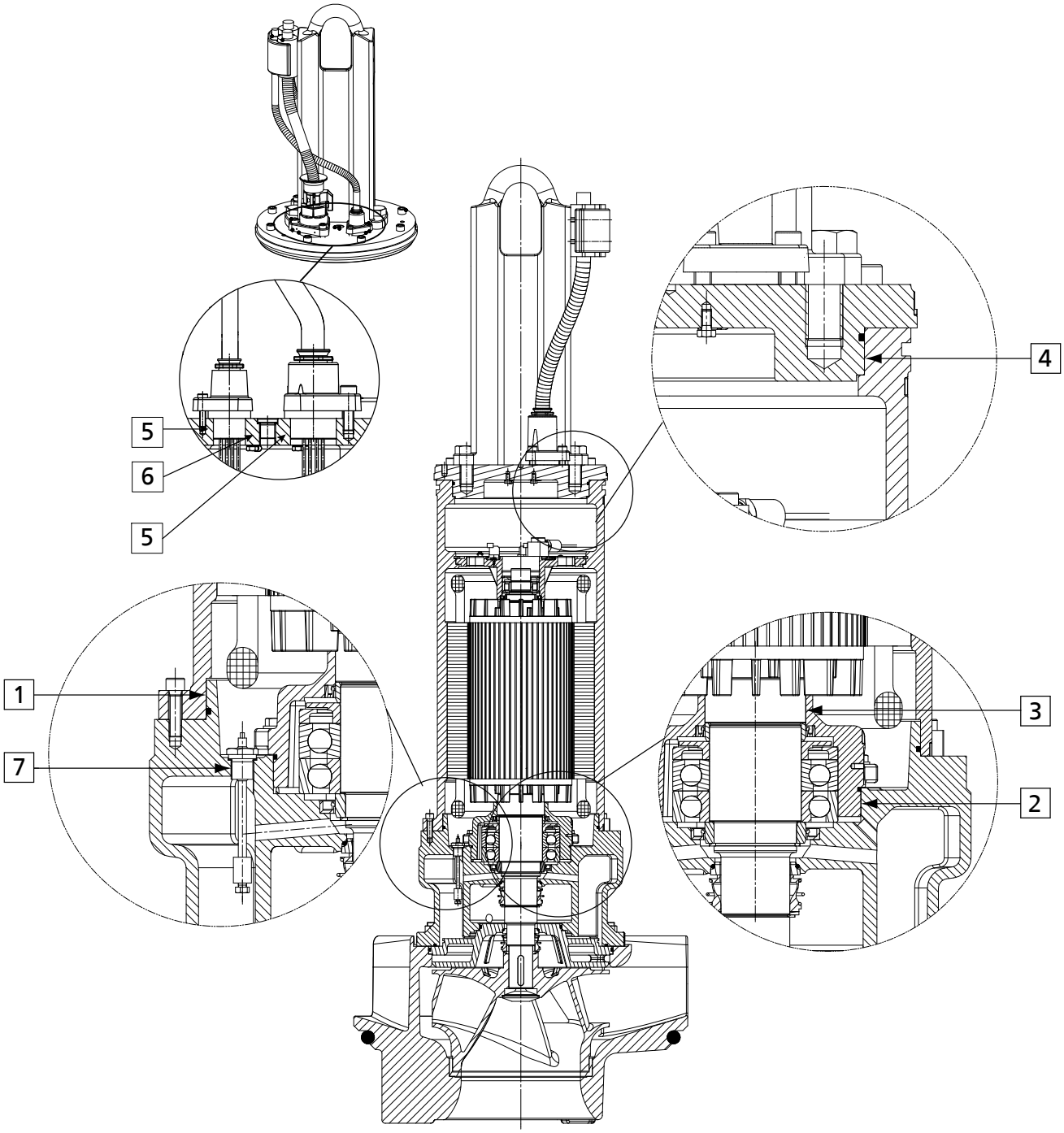

Fig. 78: Flamepaths for explosion-proof motors

9.6 Installation drawings of the mechanical seal

Motors 95 4.N, 60 6.N, 80 6.N, 100 6.N, 120 6.N, 140 6.N, 165 6.N, 90 8.N, 110 8.N, 130 8.N, 40 10.N, 60 10.N, 75 10.N

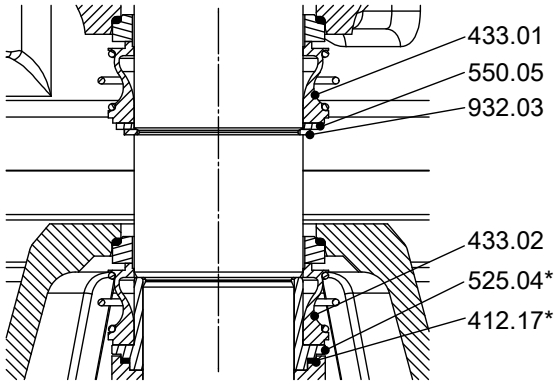

Fig. 79: Mechanical seal for motors 95 4.N, 60 6.N, 80 6.N, 100 6.N, 120 6.N, 140 6.N, 165 6.N, 90 8.N, 110 8.N, 130 8.N, 40 10.N, 60 10.N, 75 10.N

*: Not for tapered fit

Table 64: List of components

Part No.	Description	Part No.	Description
412.17	O-ring	550.05	Disc
433.01/.02	Mechanical seal	932.03	Circlip
525.04	Spacer sleeve		

Motors 190 6.N, 225 6.N, 260 6.N, 150 8.N, 185 8.N

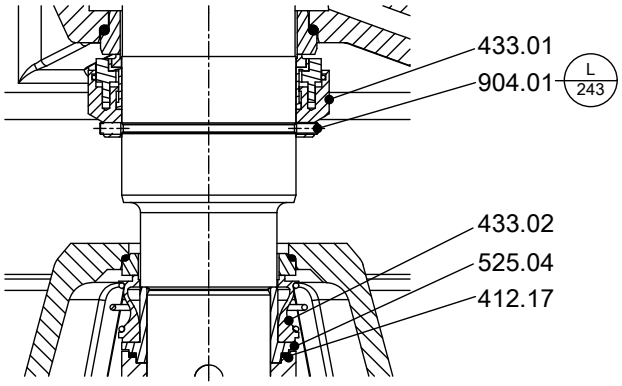

Fig. 80: Mechanical seal for motors 190 6.N, 225 6.N, 260 6.N, 150 8.N, 185 8.N

Table 65: List of components

Part No.	Description	Part No.	Description
412.17	O-ring	525.04	Spacer sleeve
433.01/.02	Mechanical seal	904.01	Grub screw

Table 66: Symbols key

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

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Mechanical seal with covered spring, standard for motors 320 6.N, 360 6.N, 400 6.N, 440 6.N

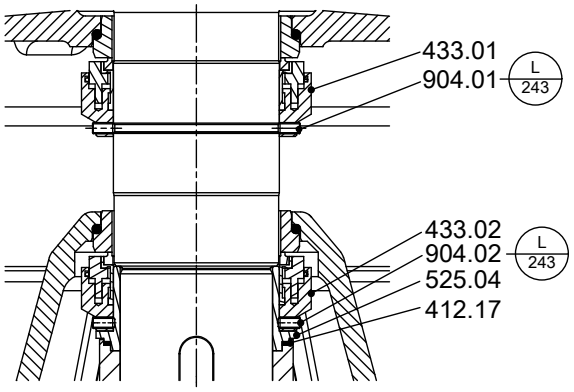

Fig. 81: Mechanical seal with covered spring, standard for motors 320 6.N, 360 6.N, 400 6.N, 440 6.N

Table 67: List of components

Part No.	Description	Part No.	Description
412.17	O-ring	525.04	Spacer sleeve
433.01/.02	Mechanical seal	904.01/.02	Grub screw

Table 68: Symbols key

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

Mechanical seal with covered spring, optional for motors 95 4.N, 60 6.N, 80 6.N, 100 6.N, 120 6.N, 140 6.N, 165 6.N, 190 6.N, 225 6.N, 260 6.N, 90 8.N, 110 8.N., 130 8.N, 150 8.N, 185 8.N, 40 10.N, 60 10.N, 75 10.N

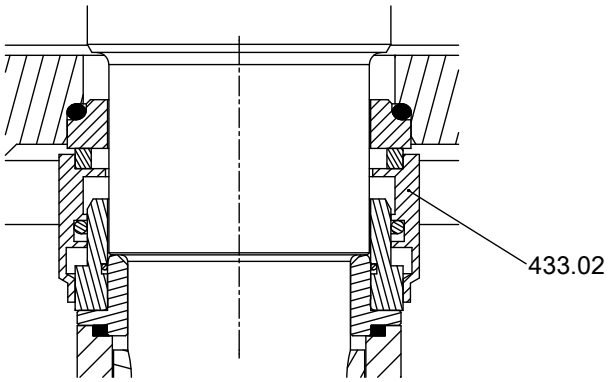

Fig. 82: Mechanical seal with covered spring, optional for motors 95 4.N, 60 6.N, 80 6.N, 100 6.N, 120 6.N, 140 6.N, 165 6.N, 190 6.N, 225 6.N, 260 6.N, 90 8.N, 110 8.N., 130 8.N, 150 8.N, 185 8.N, 40 10.N, 60 10.N, 75 10.N

Table 69: List of components

Part No.	Description	Part No.	Description
433.02	Mechanical seal		

9.7 Dimensions

9.7.1 Motor version UN, XN, YN

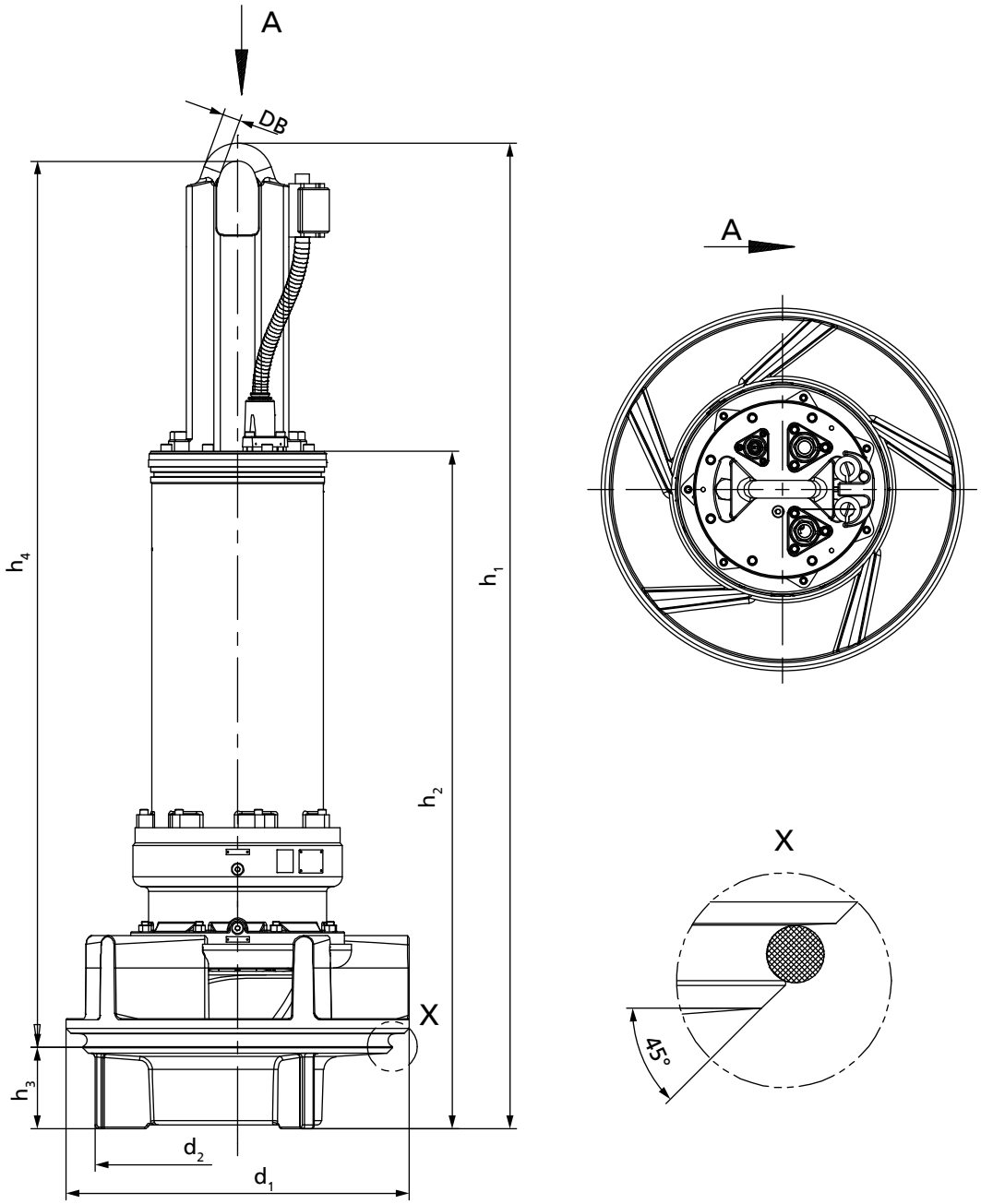

Fig. 83: Pump set dimensions

Table 70: Pump set dimensions [mm]

Size	Motor	d_1	d_2	DB	h_1	h_2	h_3	h_4	[kg][13]
700-330	95 4.N	670	556	40	2355	1665	151	2165	1000
800-400	60 6.N	770	640	40	2210	1520	183	1985	1000
800-400	80 6.N	770	640	40	2410	1720	183	2185	1110
800-401	80 6.N	770	640	40	2410	1720	183	2185	1120
1000-420	60 6.N	970	840	40	2310	1620	209	2060	1280
1000-420	80 6.N	970	840	40	2510	1820	209	2260	1380

13 Pump set with 10 m power cable (400 V)

Size	Motor	d_1	d_2	DB	h_1	h_2	h_3	h_4	[kg][13]
1000-420	100 6.N	970	840	40	2510	1820	209	2260	1460
1000-420	120 6.N	970	840	40	2625	1935	209	2375	1700
1000-420	140 6.N	970	840	40	2625	1935	209	2375	1750
1000-421	60 6.N	970	840	40	2310	1620	209	2060	1280
1000-421	80 6.N	970	840	40	2510	1820	209	2260	1380
1000-421	100 6.N	970	840	40	2510	1820	209	2260	1460
1000-421	120 6.N	970	840	40	2625	1935	209	2375	1700
1000-421	140 6.N	970	840	40	2625	1935	209	2375	1750
1000-500	80 6.N	970	820	40	2515	1825	205	2270	1390
1000-500	100 6.N	970	820	40	2515	1825	205	2270	1470
1000-500	120 6.N	970	820	40	2630	1940	205	2385	1710
1000-500	140 6.N	970	820	40	2630	1940	205	2385	1760
1000-500	165 6.N	970	820	40	2630	1940	205	2385	1830
1000-500	190 6.N	970	820	50	2885	2285	205	2630	2500
1000-500	225 6.N	970	820	50	2885	2285	205	2630	2670
1200-630	190 6.N	1140	960	50	2940	2340	268	2620	2730
1200-630	225 6.N	1140	960	50	2940	2340	268	2620	2890
1200-630	260 6.N	1140	960	50	2940	2340	268	2620	3120
1200-630	320 6.N	1140	960	60	3205	2505	268	2875	3740
1200-630	360 6.N	1140	960	60	3205	2505	268	2875	3880
1200-630	400 6.N	1140	960	60	3430	2730	268	3360	4190
1200-630	440 6.N	1140	960	60	3430	2730	268	3360	4390
1200-630	90 8.N	1140	960	40	2685	1995	268	2380	1960
1200-630	110 8.N	1140	960	40	2685	1995	268	2380	2020
1200-630	130 8.N	1140	960	40	2685	1995	268	2380	2090
1200-630	150 8.N	1140	960	50	2940	2340	268	2620	2720
1200-630	185 8.N	1140	960	50	2940	2340	268	2620	2880
1200-630	40 10.N	1140	960	40	2685	1995	268	2380	1890
1200-630	60 10.N	1140	960	40	2685	1995	268	2380	1930
1200-630	75 10.N	1140	960	40	2685	1995	268	2380	1990

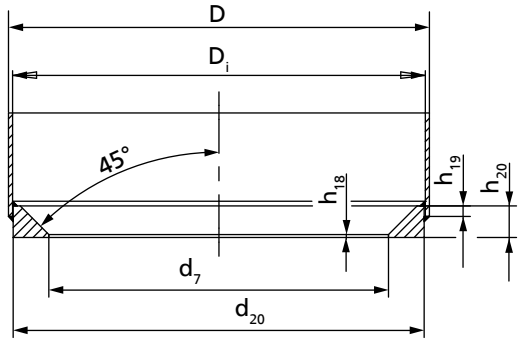

Fig. 84: Seating ring dimensions

Table 71: Seating ring dimensions [mm]

Size	Motor	D[14]	D_i	d_7	d_{20}	h_{18}	h_{19}	h_{20}
700-330	95 4.N	711	695	570	691	5	20	60
800-400	60 6.N	813	797	656	793	5	20	60
800-400	80 6.N	813	797	656	793	5	20	60
800-401	80 6.N	813	797	656	793	5	20	60
1000-420	60 6.N	1016	996	856	992	5	20	60
1000-420	80 6.N	1016	996	856	992	5	20	60

14 D for recommended wall thickness of the discharge tube (see dimension s1 in the general arrangement drawings or in General Arrangement Drawings booklet 1579.39)

Size	Motor	D[14)]	D_i	d_7	d_{20}	h_{18}	h_{19}	h_{20}
1000-420	100 6.N	1016	996	856	992	5	20	60
1000-420	120 6.N	1016	996	856	992	5	20	60
1000-420	140 6.N	1016	996	856	992	5	20	60
1000-421	60 6.N	1016	996	856	992	5	20	60
1000-421	80 6.N	1016	996	856	992	5	20	60
1000-421	100 6.N	1016	996	856	992	5	20	60
1000-421	120 6.N	1016	996	856	992	5	20	60
1000-421	140 6.N	1016	996	856	992	5	20	60
1000-500	80 6.N	1016	996	856	992	5	20	60
1000-500	100 6.N	1016	996	856	992	5	20	60
1000-500	120 6.N	1016	996	856	992	5	20	60
1000-500	140 6.N	1016	996	856	992	5	20	60
1000-500	165 6.N	1016	996	856	992	5	20	60
1000-500	190 6.N	1016	996	856	992	5	20	60
1000-500	225 6.N	1016	996	856	992	5	20	60
1200-630	190 6.N	1220	1196	1015	1192	5	20	60
1200-630	225 6.N	1220	1196	1015	1192	5	20	60
1200-630	260 6.N	1220	1196	1015	1192	5	20	60
1200-630	320 6.N	1220	1196	1015	1192	5	20	60
1200-630	360 6.N	1220	1196	1015	1192	5	20	60
1200-630	400 6.N	1220	1196	1015	1192	5	20	60
1200-630	440 6.N	1220	1196	1015	1192	5	20	60
1200-630	90 8.N	1220	1196	1015	1192	5	20	60
1200-630	110 8.N	1220	1196	1015	1192	5	20	60
1200-630	130 8.N	1220	1196	1015	1192	5	20	60
1200-630	150 8.N	1220	1196	1015	1192	5	20	60
1200-630	185 8.N	1220	1196	1015	1192	5	20	60
1200-630	40 10.N	1220	1196	1015	1192	5	20	60
1200-630	60 10.N	1220	1196	1015	1192	5	20	60
1200-630	75 10.N	1220	1196	1015	1192	5	20	60

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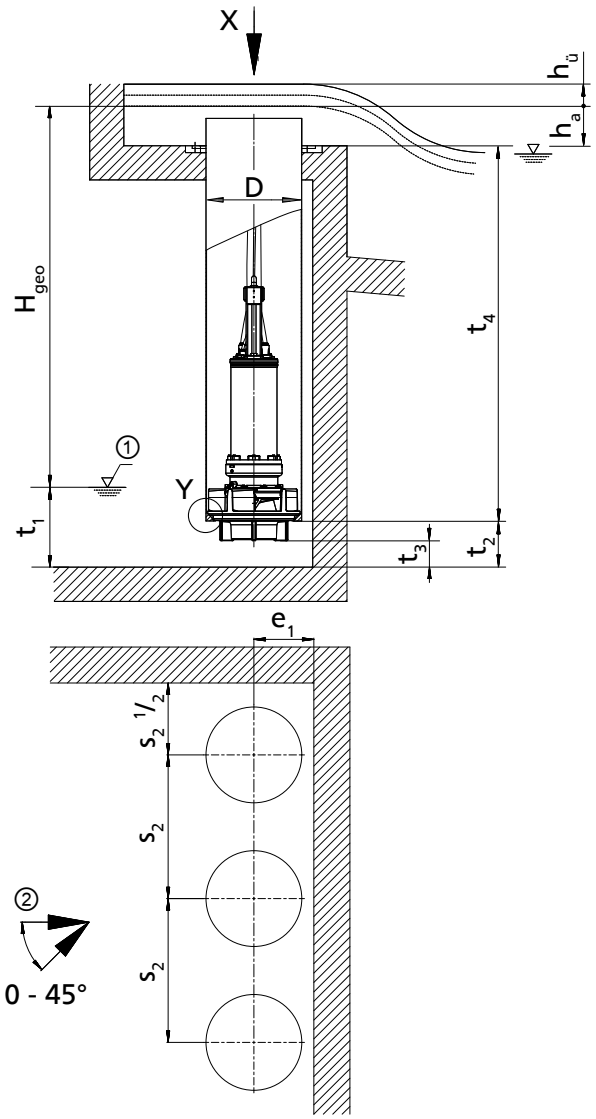
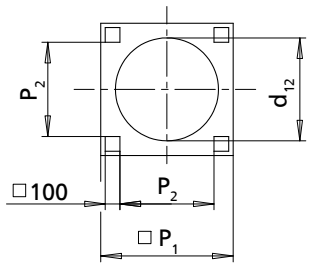
9.8 General arrangement drawings

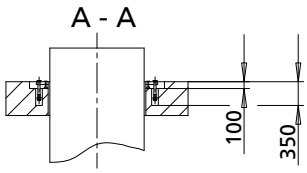
9.8.1 Installation type BU, motor version UN, XN, YN

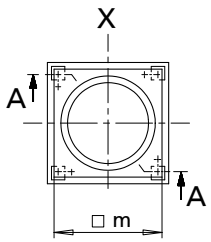


①: Minimum water level (see diagram on the following page)
②: Approach flow

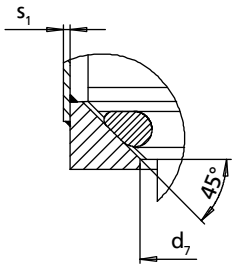


Foundation recesses[15)]





Detailed view X:
Support plate of the discharge tube
Drawing: without pump



Detailed view Y:
seating ring

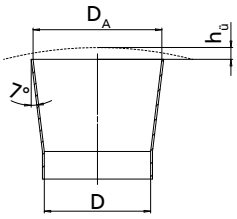
Table 72: Dimensions [mm]

Size	D	d_7	d_{12}	e_1[16)]	h_a	m	p_1	p_2	$s_{1\ min}$	$s_{2\ min}$	t_2[16)]	t_3	$t_{4\ min}$[17)]
700-330	711	570	750	430	100	800	900	640	8	1150	330	200	2400
800-400	813	656	850	480	100	910	1000	740	8	1400	410	250	2450
800-401	813	656	850	480	100	910	1000	740	8	1400	410	250	2450
1000-420	1016	856	1070	600	100	1150	1220	960	10	1600	435	250	2650
1000-421	1016	856	1070	600	100	1150	1220	960	10	1600	435	250	2650
1000-500	1016	856	1070	600	100	1150	1220	960	10	1800	480	300	2900
1200-630	1220	1015	1280	700	100	1360	1420	1160	12	2250	585	350	3450

15 All dimensions for foundation recesses apply to discharge tube design without intermediate flange.
16 Observe this dimension.
17 Value for maximum motor length

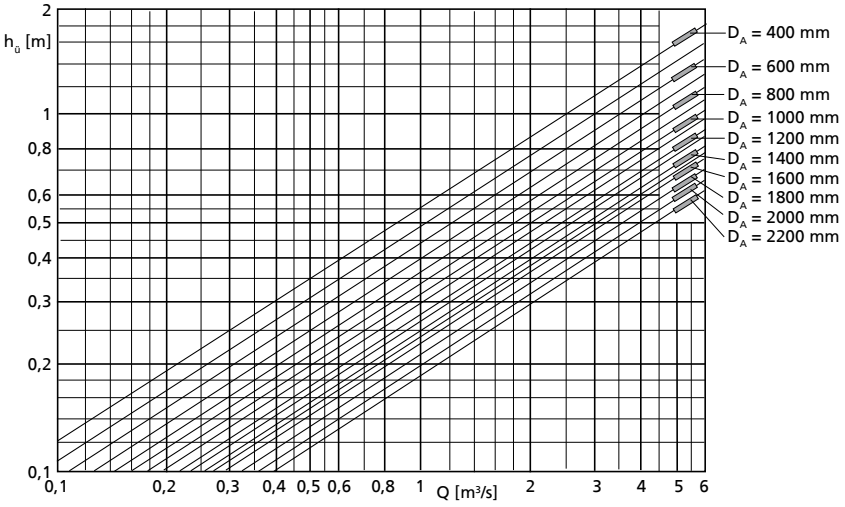
Permissible deviations:

- 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



Overflow head $h_ü$

Loss diagram



Loss diagram

Calculation formulas:

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

ΔH_v

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

Overflow head $h_ü$ 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

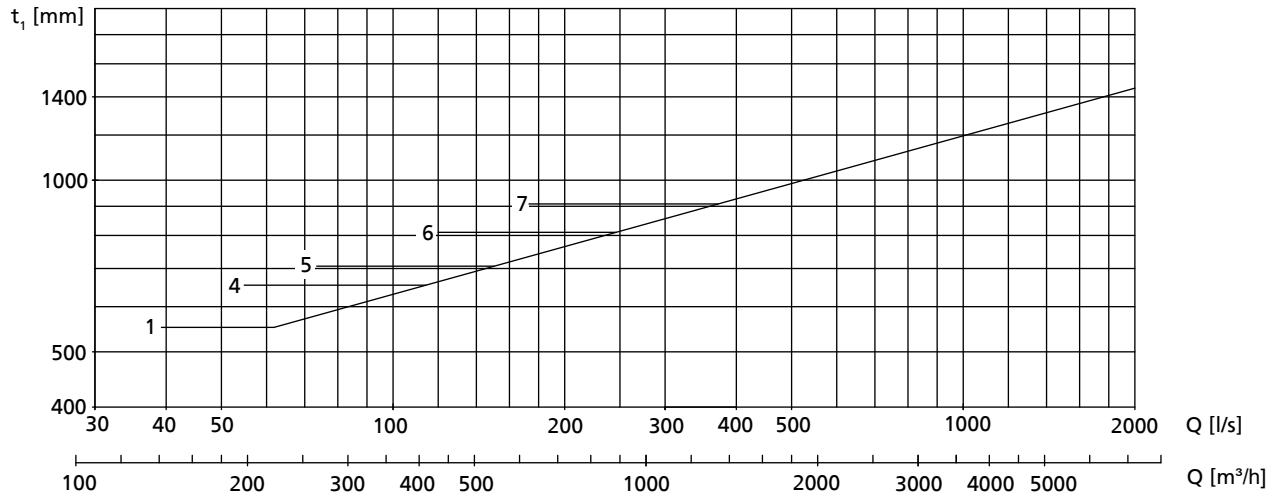


Fig. 85: Minimum water level diagram, motor version UN, XN, YN

1	Amacan K 700-330
4	Amacan K 800-400, 800-401
5	Amacan K 1000-420, 1000-421

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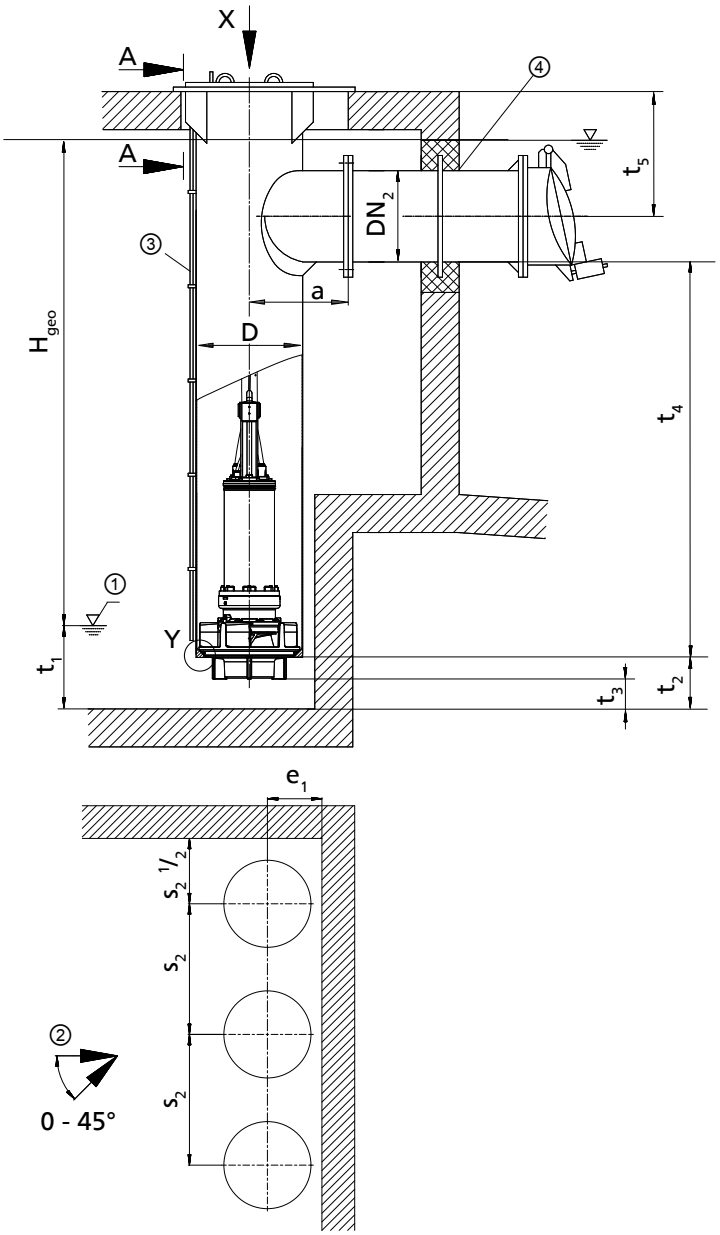
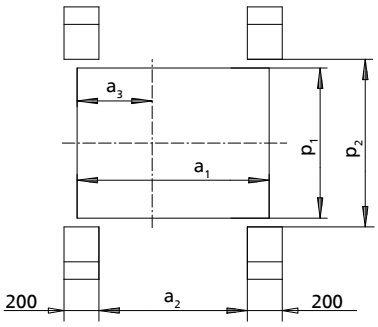
6	Amacan K 1000-500
7	Amacan K 1200-630

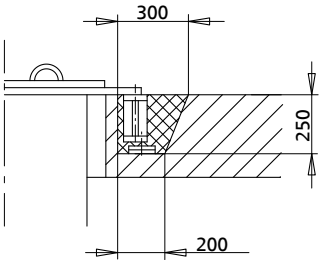
9.8.2 Installation type CU, motor version UN, XN, YN



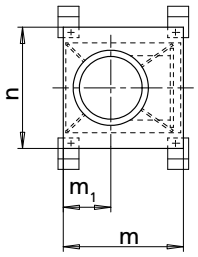
①: Minimum water level (see diagram on the following page)
②: Approach flow
③: Vent line
④: Connect the discharge pipe to the discharge tube without transmitting any stresses or strains.



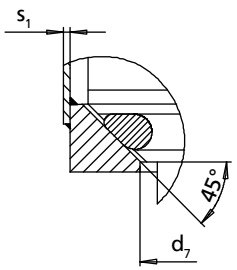
Foundation recesses[18)]



Section A - A:



Detailed view X:
Support plate of the discharge tube
Drawing: without pump



Detailed view Y:
seating ring

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

Table 73: Dimensions [mm]

Size	D	$DN_{2\ min}$	$DN_{2\ max}$	a	a_1 [19]	a_2 [19]	a_3 [19]	d_7	e_1 [20]	m [19]	m_1 [19]	n [19]
700-330	711	300	600	650	1120	870	430	570	430	1170	455	1160
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
1000-420	1016	600	900	810	1430	1160	580	856	600	1520	625	1480
1000-421	1016	600	900	810	1430	1160	580	856	600	1520	625	1480
1000-500	1016	600	900	810	1430	1160	580	856	600	1520	625	1480
1200-630	1220	900	1200	910	1630	1360	680	1015	700	1720	725	1850

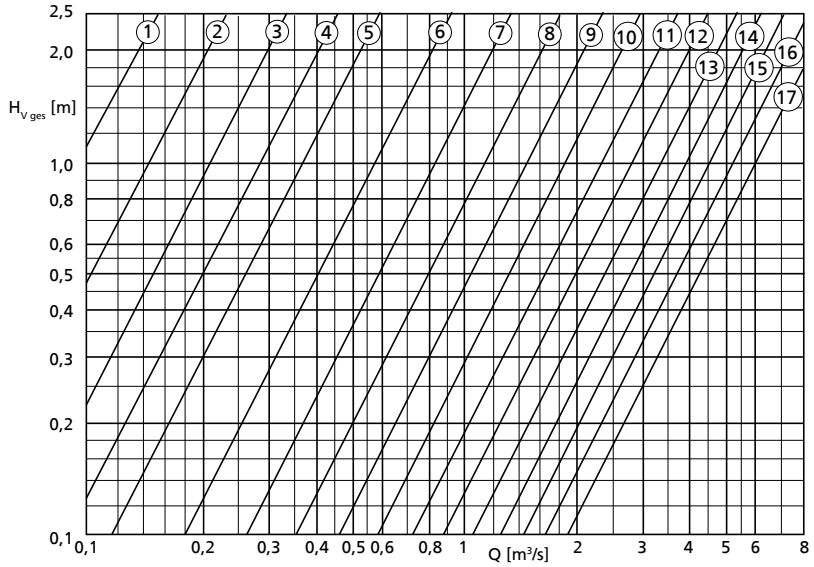
Table 74: Dimensions [mm]

Size	p_1 [19]	p_2 [19]	$s_{1\ min}$	$s_{2\ min}$	t_2 [20]	t_3	$t_{4\ min}$ [21]	$t_{5\ min}$ [19]
700-330	860	960	8	1150	330	200	2450	720
800-400	960	1060	8	1400	410	250	2500	770
800-401	960	1060	8	1400	410	250	2500	770
1000-420	1180	1280	10	1600	435	250	2700	925
1000-421	1180	1280	10	1600	435	250	2700	925
1000-500	1180	1280	10	1800	480	300	2950	925
1200-630	1510	1610	12	2250	585	350	3500	1100

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



① - DN_2 = 200 mm
② - DN_2 = 250 mm
③ - DN_2 = 300 mm
④ - DN_2 = 350 mm
⑤ - DN_2 = 400 mm
⑥ - DN_2 = 500 mm
⑦ - DN_2 = 600 mm
⑧ - DN_2 = 700 mm
⑨ - DN_2 = 800 mm
⑩ - DN_2 = 900 mm
⑪ - DN_2 = 1000 mm
⑫ - DN_2 = 1100 mm
⑬ - DN_2 = 1200 mm
⑭ - DN_2 = 1300 mm
⑮ - DN_2 = 1400 mm
⑯ - DN_2 = 1500 mm
⑰ - DN_2 = 1600 mm

Calculation formulas:

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

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

19 Designed for DN2 max
20 Observe this dimension.
21 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

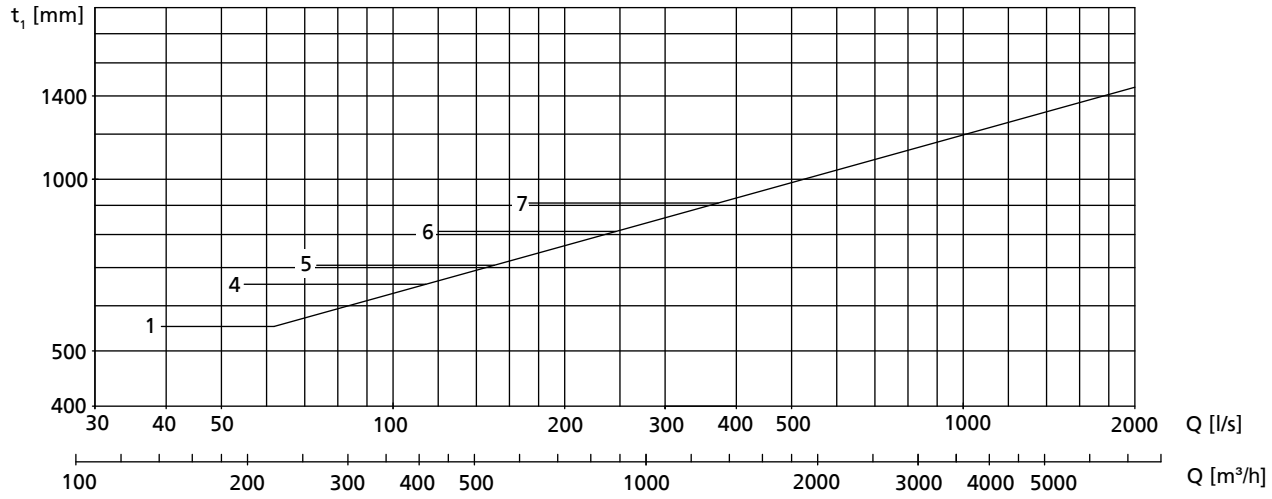
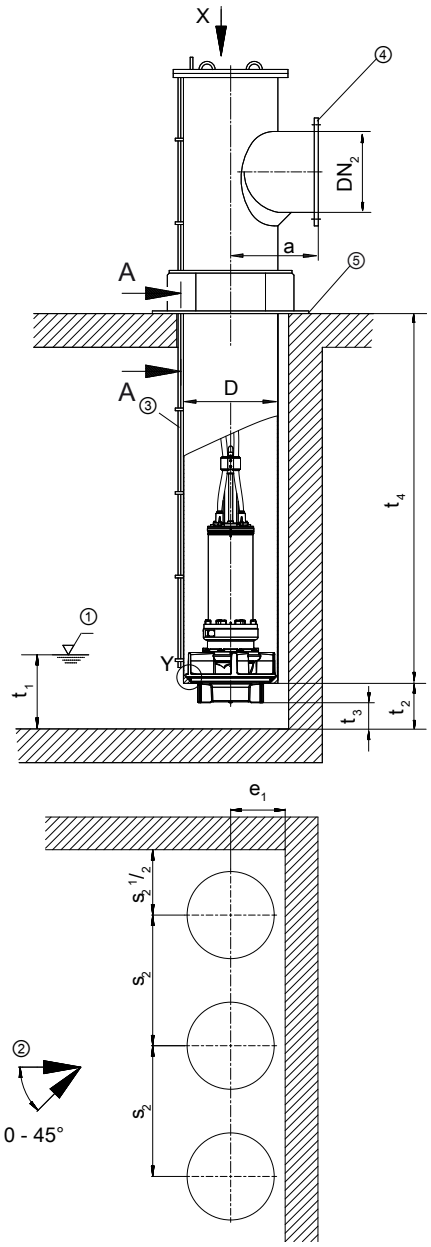
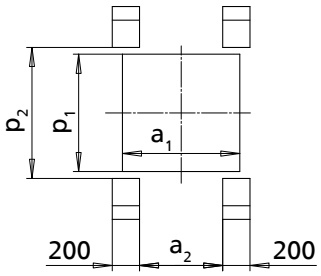


Fig. 86: Minimum water level diagram, motor version UN, XN, YN

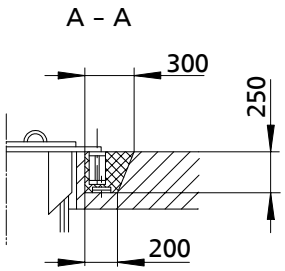
1	Amacan K 700-330
4	Amacan K 800-400, 800-401
5	Amacan K 1000-420, 1000-421
6	Amacan K 1000-500
7	Amacan K 1200-630

9.8.3 Installation type DU, motor version UN, XN, YN

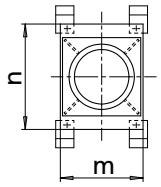




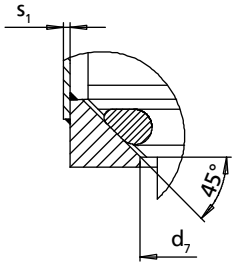
Foundation recesses[22)]



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 line to the discharge tube without transmitting any stresses or strains.
⑤: Not pressure-proof

Table 75: Dimensions [mm]

Size	D	$DN_{2\ min}$	$DN_{2\ max}$	a	a_1	a_2	d_7	e_1[23)]	m	n	p_1
700 - 330	711	300	600	650	860	610	570	430	930	1160	860
800 - 400	813	400	700	700	960	710	656	480	1030	1260	960
800 - 401	813	400	700	700	960	710	656	480	1030	1260	960
1000 - 420	1016	600	900	810	1160	910	856	600	1240	1500	1160
1000 - 421	1016	600	900	810	1160	910	856	600	1240	1500	1160

22 All dimensions for foundation recesses apply to discharge tube design without intermediate flange.
23 Observe this dimension.

Size	D	$DN_{2\ min}$	$DN_{2\ max}$	a	a_1	a_2	d_7	e_1 [23]	m	n	p_1
1000 - 500	1016	600	900	810	1160	910	856	600	1240	1500	1160
1200 - 630	1200	900	1200	910	1360	1110	1015	700	1440	1700	1360

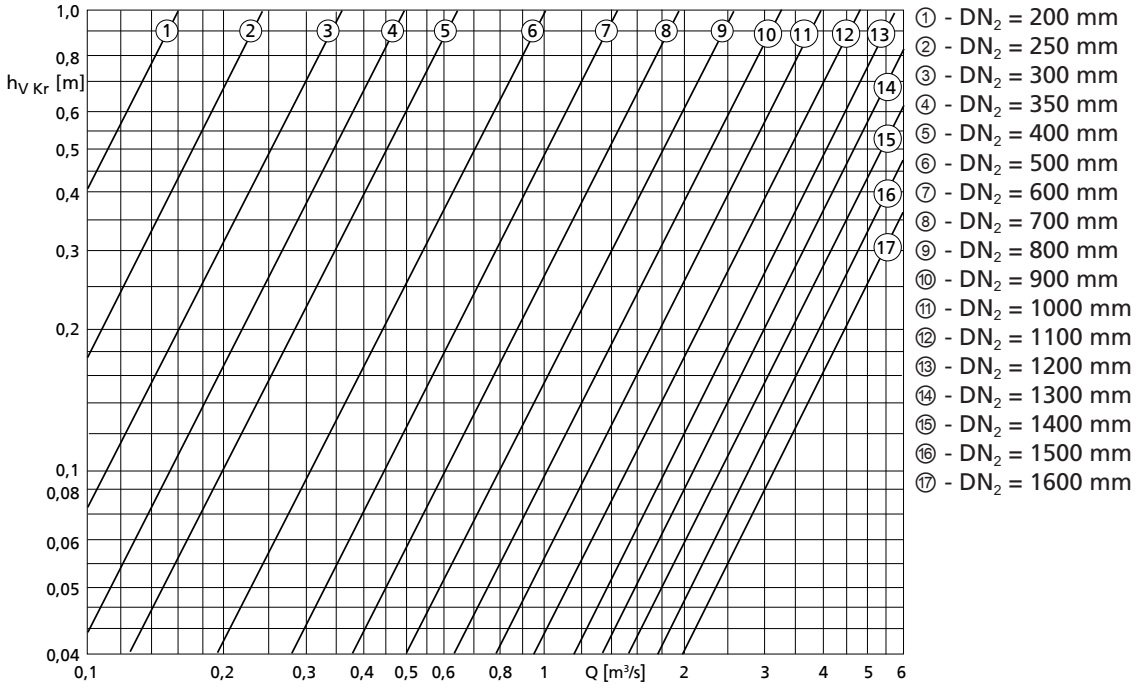
Table 76: Dimensions [mm]

Size	p_2	$s_{1\ min}$	$s_{2\ min}$	t_2 [23]	t_3	$t_{4\ min}$ [24]
700 - 330	960	8	1150	330	200	2450
800 - 400	1060	8	1400	410	250	2500
800 - 401	1060	8	1400	410	250	2500
1000 - 420	1260	10	1600	435	250	2700
1000 - 421	1260	10	1600	435	250	2700
1000 - 500	1260	10	1800	480	300	2950
1200 - 630	1460	12	2250	585	350	3500

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:

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

ΔH_v

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

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

24 Value for maximum motor length

Minimum water level diagram

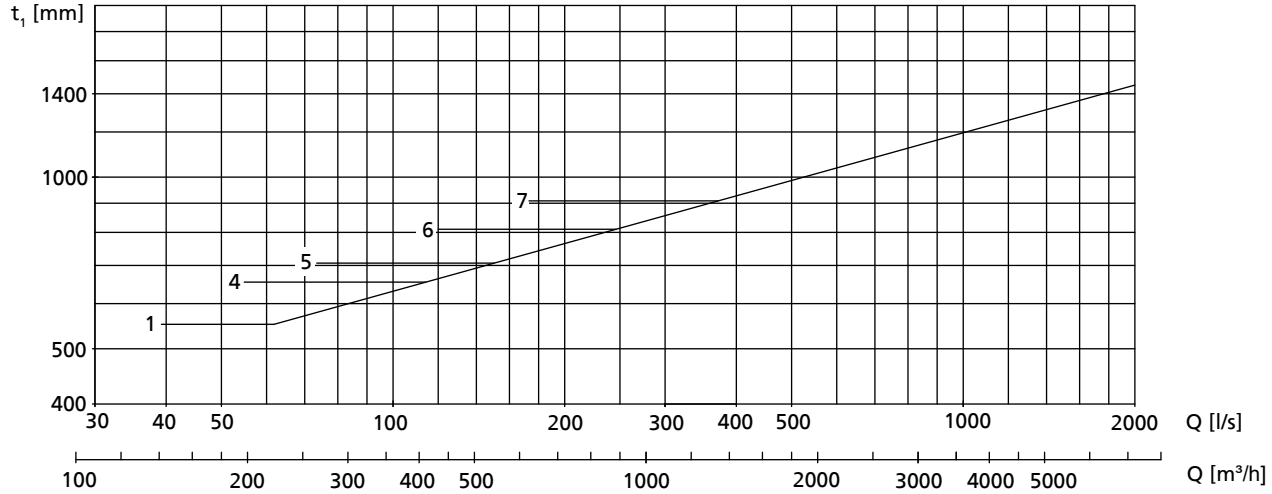


Fig. 87: Minimum water level diagram, motor version UN, XN, YN

1	Amacan K 700-330
4	Amacan K 800-400, 800-401
5	Amacan K 1000-420, 1000-421
6	Amacan K 1000-500
7	Amacan K 1200-630

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10 EU Declaration of Conformity

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

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): 2006/42/EC Machinery Directive

The manufacturer also declares that

- the following harmonised international standards[25)] have been applied:
  - ISO 12100
  - EN 809
  - EN 60034-1, EN 60034-5/A1

Person authorised to compile the technical file:

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

The EU Declaration of Conformity was issued in/on:

Place, date

.....[26)].....

Name

Function

Company
Address

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

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

11 Certificate of Decontamination

Type: .....

Order number /

Order item number[27]: .....

Delivery date: .....

Application: .....

Fluid handled[27]: .....

Please tick where applicable[27]:

☐ Corrosive

☐ Oxidising

☐ Flammable

☐ Explosive

☐ Hazardous to health

☐ Seriously hazardous to health

☐ Toxic

☐ Radioactive

☐ Bio-hazardous

☐ Safe

Reason for return:[27]: .....

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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27 Required field

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