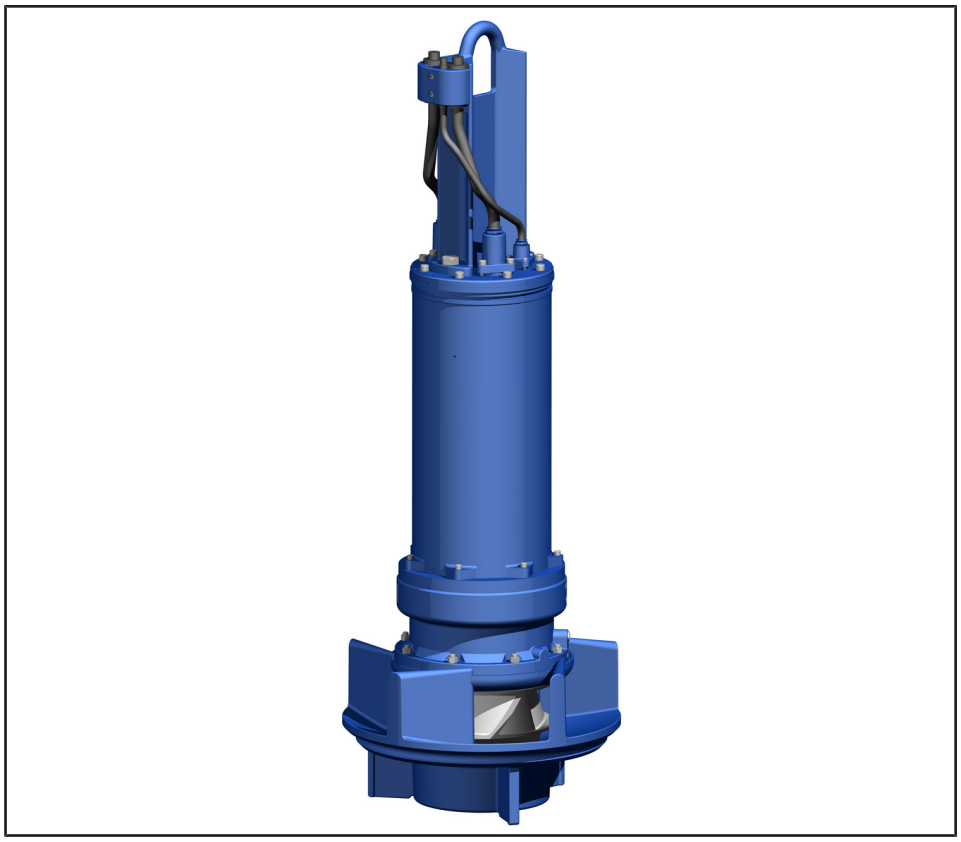
Submersible Pump in Discharge Tube

Amacan K

60 Hz
Sizes: 800-370 to 1200-630
6 Poles: 60 6.N to 80 6.N
8 Poles: 50 8.N to 350 8.N
10 Poles: 40 10.N to 150 10.N

Installation/Operating Manual



Mat. No.: 01117574

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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

If a product is to be returned to the manufacturer, the customer declares in a certificate of decontamination that the product has been properly drained to eliminate any environmental and health hazards arising from components in contact with the fluid handled.

Close-coupled design

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

Submersible pump in discharge tube

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

1 General

1.1 Principles

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

The 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 center 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

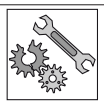
Table 2: Symbols used in this manual

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 agreed to be included in the 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.
	**General hazard** In conjunction with one of the signal words this symbol indicates a hazard which will or could result in death or serious injury.
	**Electrical hazard** In conjunction with one of the signal words this symbol indicates a hazard involving electrical voltage and identifies information about protection against electrical voltage.
	**Machine damage** In conjunction with the signal word CAUTION this symbol indicates a hazard for the machine and its functions.

2 Safety

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.

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

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 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 which are 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 which are described in the other applicable documents.
- Only operate pumps/pump sets which are in perfect technical condition.
- Do not operate the pump (set) in partially assembled condition.
- Only use the pump to handle the fluids described in the data sheet or product literature of the pump model 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 rates and maximum flow rates 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 operating limits and use 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 personnel 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 sufficiently trained specialist personnel training and instructing the personnel who will carry out the respective tasks. 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 these operating instructions

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

2.5 Safety awareness

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

- Accident prevention, health 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 shutting down the pump does not increase potential risk, fit an emergency stop control device in the immediate vicinity of the pump (set) during pump set installation.

2.7 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 authorized 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 is performed by authorized, qualified specialist personnel who are thoroughly familiar with the manual.
- Only carry out work on the pump (set) during standstill of the pump.
- Only perform work on the pump set when it has been disconnected from the power supply (de-energized).

- 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 46)

2.8 Unauthorized modes of operation

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

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

2.9 Explosion protection

Special conditions apply to the operation of explosion-proof pumps.

- The explosion-proof status of the pump set is only assured if the pump set is used in accordance with its intended use.
- The limits stated in the data sheet and on the name plate must not be exceeded under any circumstances.
- Correct monitoring of the motor temperature is imperative to ensure explosion protection.
- Observe the wiring diagrams.
- Never operate an explosion-proof pump set without temperature monitoring.
- Modifications or alteration of the pump set could affect explosion protection and are only permitted after consultation with the manufacturer.
- Only original spare parts and accessories authorized by the manufacturer must be used for explosion-proof pumps.

3 Transport/Temporary Storage/Disposal

3.1 Checking the condition upon delivery

1. On transfer of goods, check each packaging unit for damage.
2. In the event of in-transit damage, assess the exact damage, document it and notify KSB or the distributor and the insurance company 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 suspend the pump set by its power cable.
- ▷ 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 accessories must exceed 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 set to the place of installation

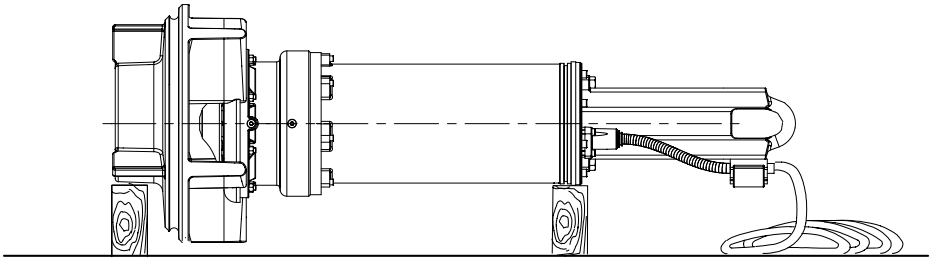


Fig. 1: Transport to the place of installation

- 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 centers of gravity and/or attachment points on the transport boxes.
  For the weight refer to the name plate or data sheet. (⇨ Section 4.3, Page 18)

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.

⚠ WARNING

Placing down 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 power cable

Personal injury and damage to property!

- ▷ Secure power cables against falling down.
- ▷ Avoid power cables being laid on surfaces without fastening.
- ▷ When moving the pump set keep at a safe distance to the power 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 power cables!

- ▷ Support the power cables at the cable entry to prevent permanent deformation.
- ▷ Only remove the protective caps from the power cables at the time of installation.

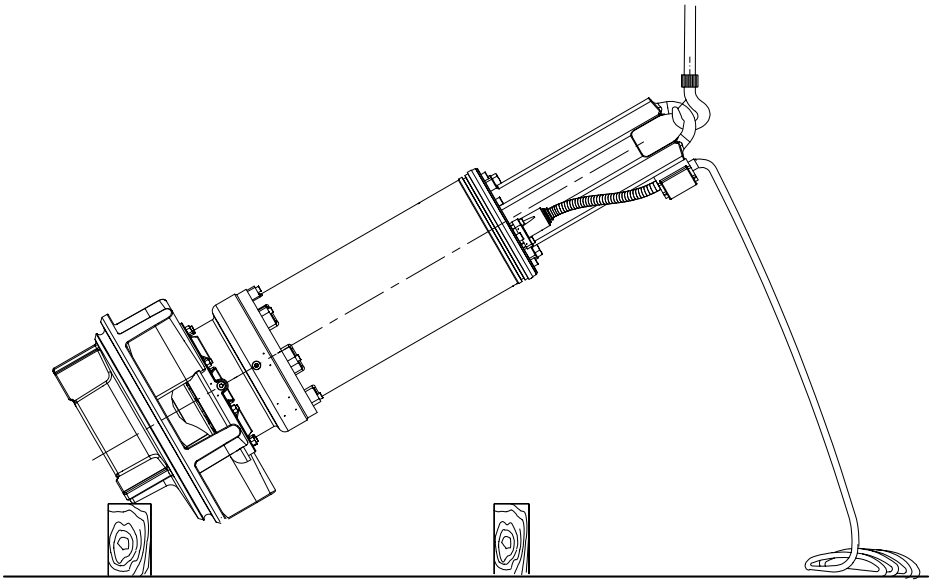


Fig. 2: Placing the pump set in a vertical/horizontal position

✓ Suitable lifting equipment has been selected.

1. Attach the crane hook of the crane to the bail of the pump set.
2. Lift the pump set with the lifting equipment (e.g. crane).
   ⇨ Guiding the pump set over the edge of the pump casing inlet is only permissible on a wooden base!
   ⇨ Protect the connection cable against kinking!
3. Place the pump set on a level, clean surface and protect it against tilting 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** **Improper handling of the power cable when placing the pump set in a vertical position or transporting it** Personal injury and damage to property! ▷ Secure power cables 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.

⚠ 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.

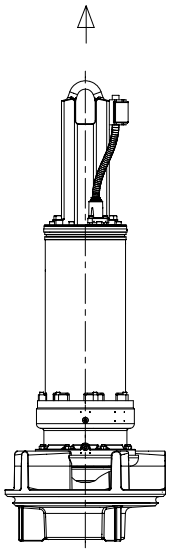


Fig. 3: Transporting the pump set in a vertical position

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 for pump set storage:

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 power cables!

- ▷ Support the power cables at the cable entry to prevent permanent deformation.
- ▷ Only remove the protective caps from the power cables at the time of installation.

CAUTION

Damage during storage due to humidity, dirt or vermin

Corrosion/contamination of the pump (set)!

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

CAUTION

Wet, contaminated or damaged openings and connections

Leakage or damage to the pump!

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

Table 4: Ambient conditions for storage

Ambient condition	Value
Relative humidity	5 % to 85 % (non-condensing)
Ambient temperature	-4 °F to 158 °F [-20 °C to +70 °C]

- Store the pump set under dry and vibration-free conditions, 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 57)
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 neutralized, 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.
   Always indicate any safety measures and decontamination measures taken.
   (⇨ Section 10, Page 132)

NOTE

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

3.5 Disposal

⚠ WARNING

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

Hazard to persons and the environment!

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

1. Dismantle the pump (set).
   Collect greases and other lubricants during dismantling.
2. Separate and sort the pump materials, e.g. by:
   - Metals
   - Plastics
   - Electronic waste
   - Greases and other lubricants
3. Dispose of materials in accordance with local regulations or in another controlled manner.

4 Description of the Pump (Set)

4.1 General description

- 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 Designation

Example: Amacan K 800-400 / 50 8 UN G - IE3

Table 5: Key to the designation

Code	Description	
Amacan	Type series	
K	Impeller type	
	K	Channel impeller
800	Nominal diameter of the discharge tube [mm]	
400	Nominal impeller diameter [mm]	
50	Motor size	
8	Number of motor poles	
UN	Motor version	
	UN	Without explosion protection
	XN	Explosion protection to NEC 500
G	Material variant	
	G	Impeller made of gray cast iron, standard variant
	G1	Like G, with impeller made of duplex stainless steel
IE3	Motor efficiency classification[2]	
	-[3]	No efficiency classification
	IE3	Premium Efficiency

4.3 Name plate

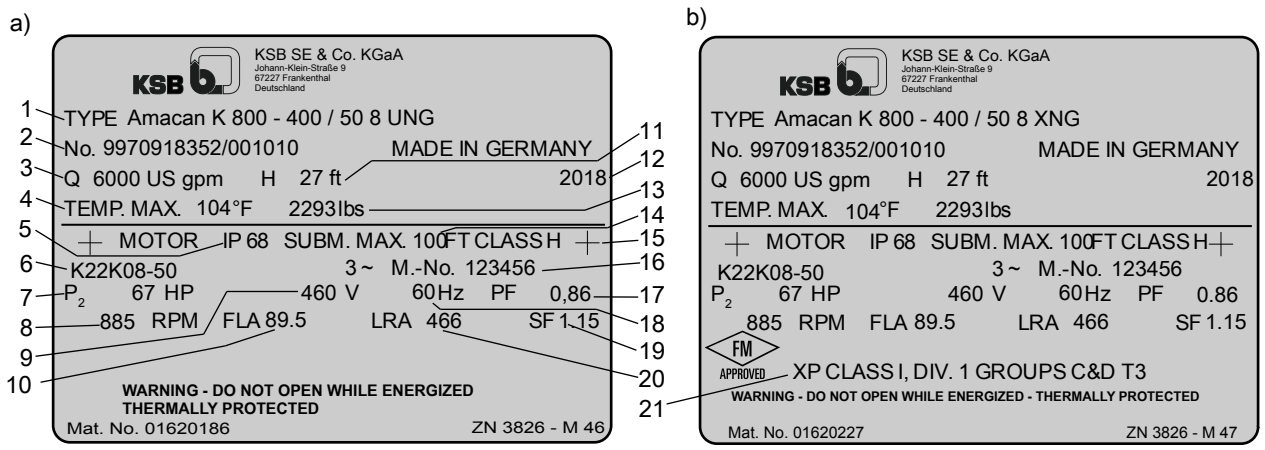


Fig. 4: Name plate (example) a) Standard pump set b) Explosion-proof pump set

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

3) Blank

1	Designation	2	KSB order number
3	Flow rate	4	Maximum fluid 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	Service factor	20	Starting current
21	Explosion protection marking		

4.4 Design details

Design

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

Installation types

- Application-oriented installation types (⇨ Section 4.5, Page 20)

Drive

- Three-phase asynchronous squirrel-cage motor
- Motors integrated in explosion-proof pump sets are supplied in Explosionproof Class I Division 1, Groups C&D, T3.

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

4.5 Types of installation

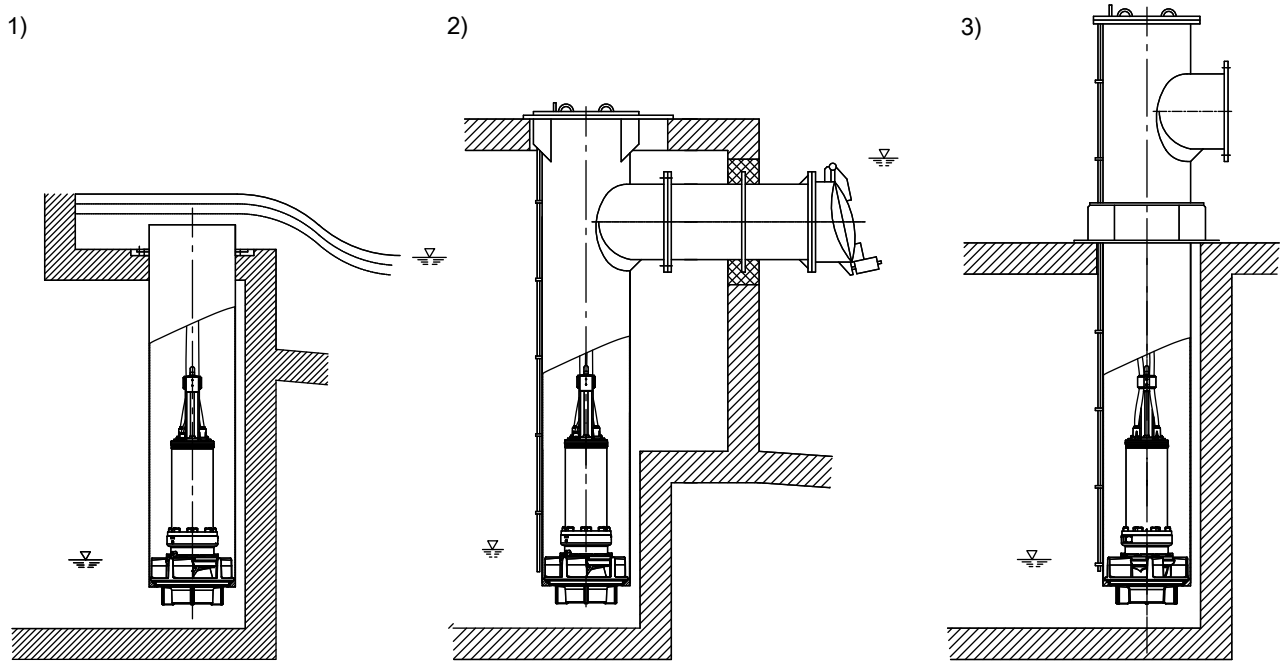


Fig. 5: Overview of installation types

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

4.6 Configuration and function

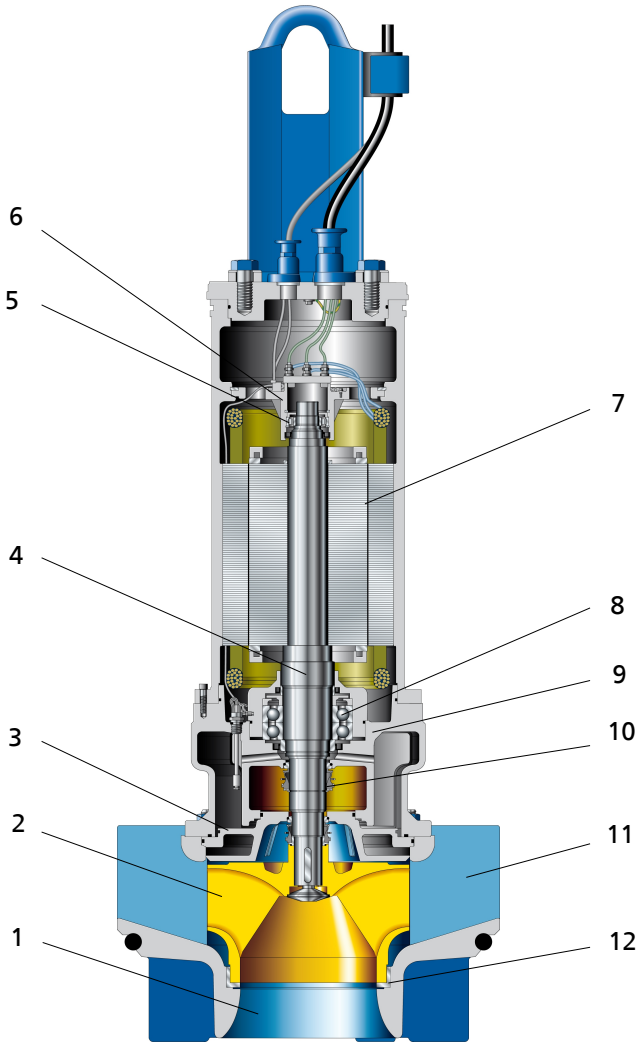


Fig. 6: Amacan with closed channel impeller

1	Inlet of the pump casing	2	Impeller
3	Discharge cover	4	Shaft
5	Bearing, drive end	6	Bearing bracket
7	Electric motor	8	Bearing, impeller end
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 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 pump casing inlet (1) and is accelerated outward by the rotating impeller (2) into a radial flow. 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 and the rotational movement of the fluid flow is diverted in axial direction. The casing wear ring (12) prevents any fluid handled from flowing back from the casing to the inlet of the pump casing. At the rear side of the impeller, the shaft enters the hydraulic system via the discharge cover (3). The shaft passage through the discharge cover is sealed to the fluid with a shaft seal (10). The shaft runs in rolling element bearings (5 and 8) which are supported by a bearing housing (9) and bearing bracket (6).

Sealing The pump is sealed by two bi-directional mechanical seals in tandem arrangement. A lubricant chamber 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

4.7 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:
  - Spacer
  - Turnbuckle
  - Support
  - Shackle
  - Cable clamps
- Cable support sleeves
- Discharge tube

4.8 Dimensions and weights

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

5 Installation at Site

5.1 Safety regulations

DANGER

Improper installation in potentially explosive atmospheres

Damage to the pump set!

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

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 chambers 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 the pump casing, impeller and transport holder, the lubricant chamber is filled properly.
2. If oil leakage is visible in the area of the pump casing, impeller and transport holder, top up the lubricant chamber.

⚠ 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. Unscrew and remove screw plug 903.03 with 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 and tighten screw plug 903.03 with a new joint ring 411.03.

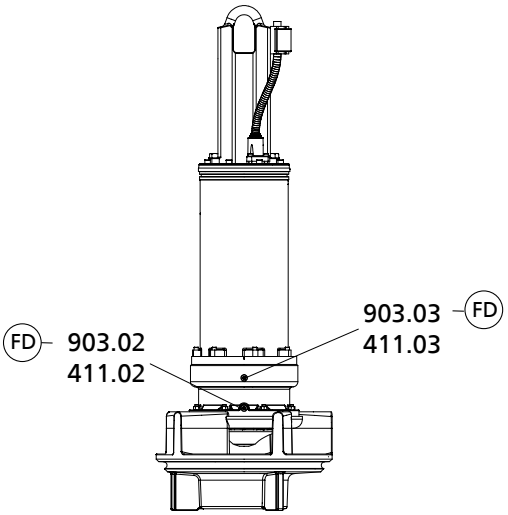


Fig. 7: Checking the lubricant level

903.03 411.03	Lubricant filler opening	903.02 411.02	Lubricant drain

Table 6: Key to the symbols and codes

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

NOTE

If more than 1.59 quart [1.5 l] 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 or 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 and/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 outside the fluid to be 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. When looking at the pump casing from the side, the impeller must turn in clockwise direction.
   - ⇨ 2. Verify the direction of rotation of the impeller against the arrow indicating the direction of rotation on the bearing bracket/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 pump set

Risk of injury by moving components and shock currents!

- ▷ Make sure that the pump set cannot be started up unintentionally.
- ▷ Always make sure the electrical connections are disconnected before carrying out work on the pump set.

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 suspend the pump set by its power cable.
- ▷ 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 accessories must exceed 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 submersible mixer!

- ▷ Comply with the applicable local explosion protection regulations.
- ▷ Observe the information given in the data sheet and on the name plate.

⚠ WARNING

Incorrect handling of the power cable

Personal injury and damage to property!

- ▷ Secure power cables against falling down.
- ▷ Avoid power cables being laid on surfaces without fastening.
- ▷ When moving the pump set keep at a safe distance to the power cables.

	**⚠ WARNING** **People falling into the unsecured discharge tube** Risk of personal injury! ▷ Take suitable precautions during the entire installation/dismantling 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 sits correctly on the bottom of the discharge tube.

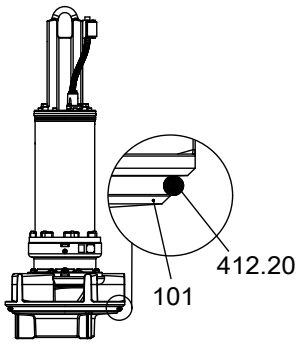


Fig. 8: Inserting the O-ring

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. Center 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.

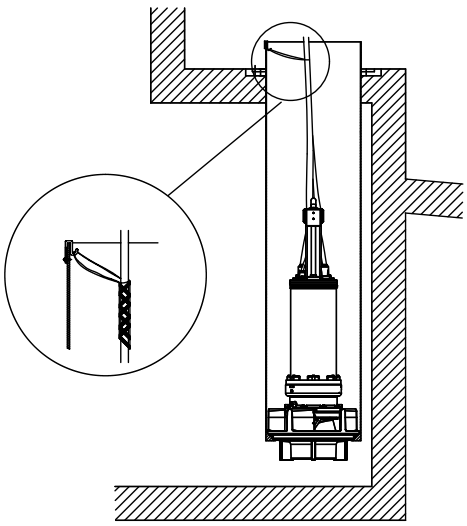


Fig. 9: Fastening the cable support sleeve

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.

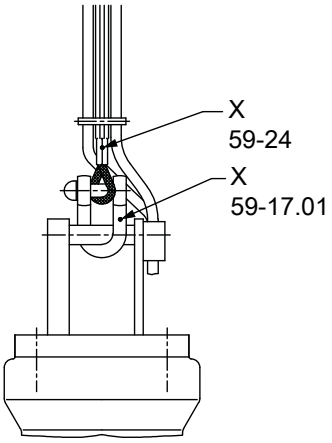


Fig. 10: X = indication of load-carrying capacity

59-24	Support rope
59-17.01	Shackle

CAUTION

Incorrect installation

Damage to the pump set!

- ▷ Verify that the pump set sits correctly on the bottom of 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.

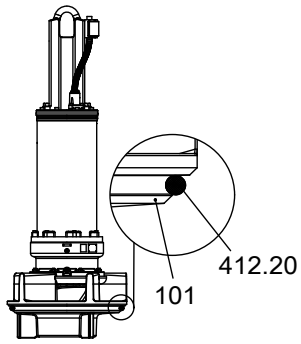


Fig. 11: Inserting the O-ring

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

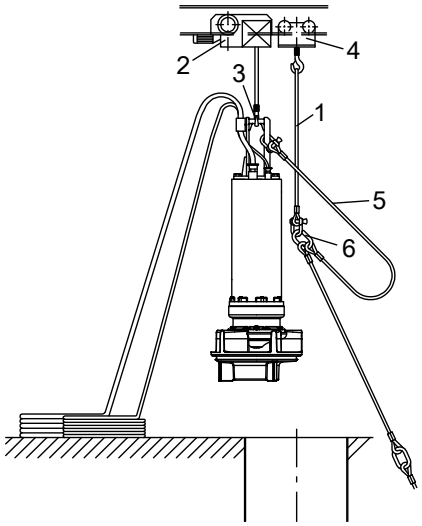


Fig. 12: Lifting and positioning the pump set

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 galvanized shackle, secure the pin at the shackle with Loctite 243.
   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.

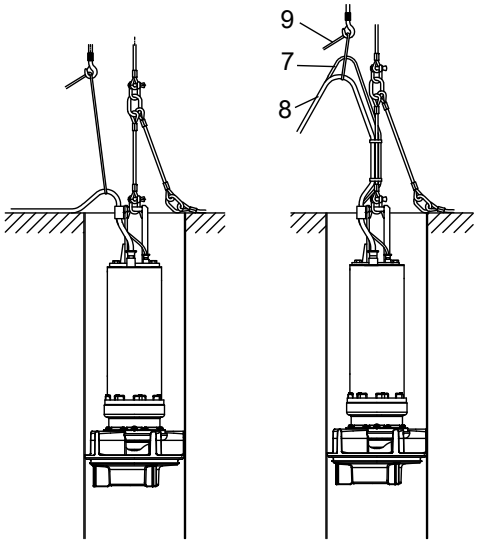


Fig. 13: Securing the control and power cables

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.

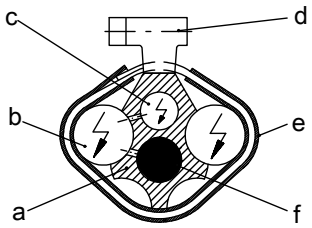


Fig. 14: Cross-section of the cable guide

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.

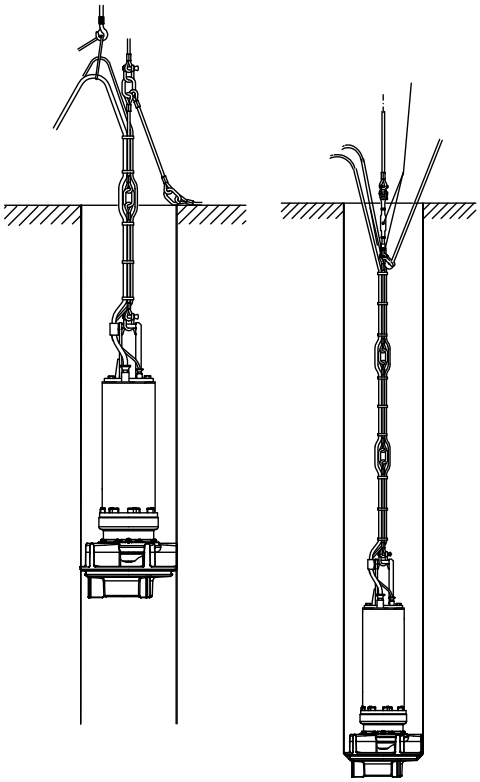


Fig. 15: Lowering the pump set

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 cable bundle is tight but does 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

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.

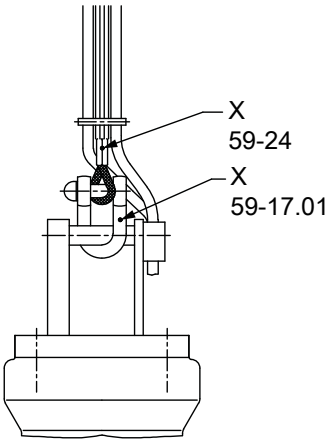


Fig. 16: X = indication of load-carrying capacity

59-24	Support rope
59-17.01	Shackle

CAUTION

Incorrect installation

Damage to the pump set!

- ▹ Verify that the pump set sits correctly on the bottom of 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 has been supplied pre-assembled and is available for use.
- ✓ The support rope has been visually inspected.
- ✓ The split pin of the turnbuckle has been checked for any damage.

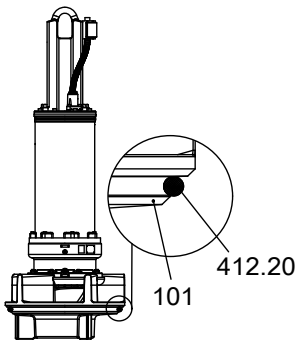


Fig. 17: Inserting the O-ring

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

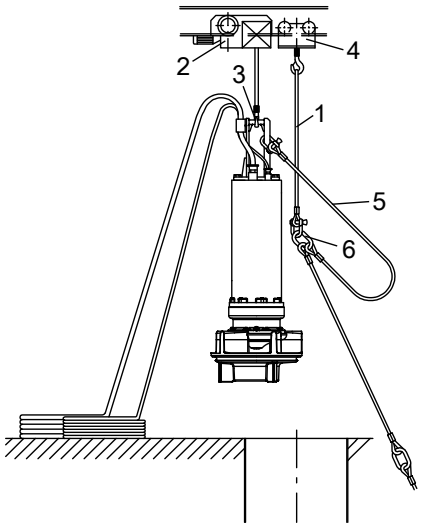


Fig. 18: Lifting and positioning the pump set

2. Secure the lifting chain or 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 free lifting lug (6) pointing away from the pump set.
4. Partially unwind the support rope and 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.

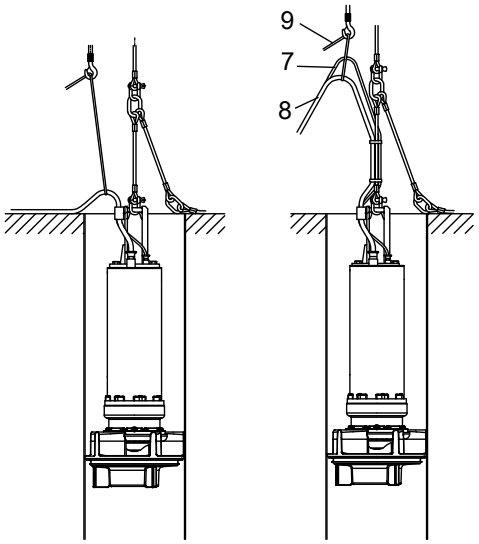


Fig. 19: Securing the control and power cables

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.

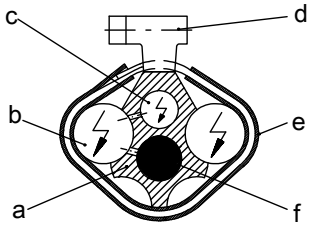


Fig. 20: Cross-section of the cable guide

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 cables with the manila rope running over the crane hook.
13. 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).
14. Progressively lower the pump set into the discharge tube while securing the cable bundle with evenly spaced sheathed cable clamps.
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. 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.
17. Trim the spacer (a) to suit the position of support 59-7 at the support rope (f) and the type of installation. Insert the support rope and control cable (c).
18. Insert the power cables (b) into the hollows of the spacer (a) and firmly clamp the power cables with cable clamps (d).

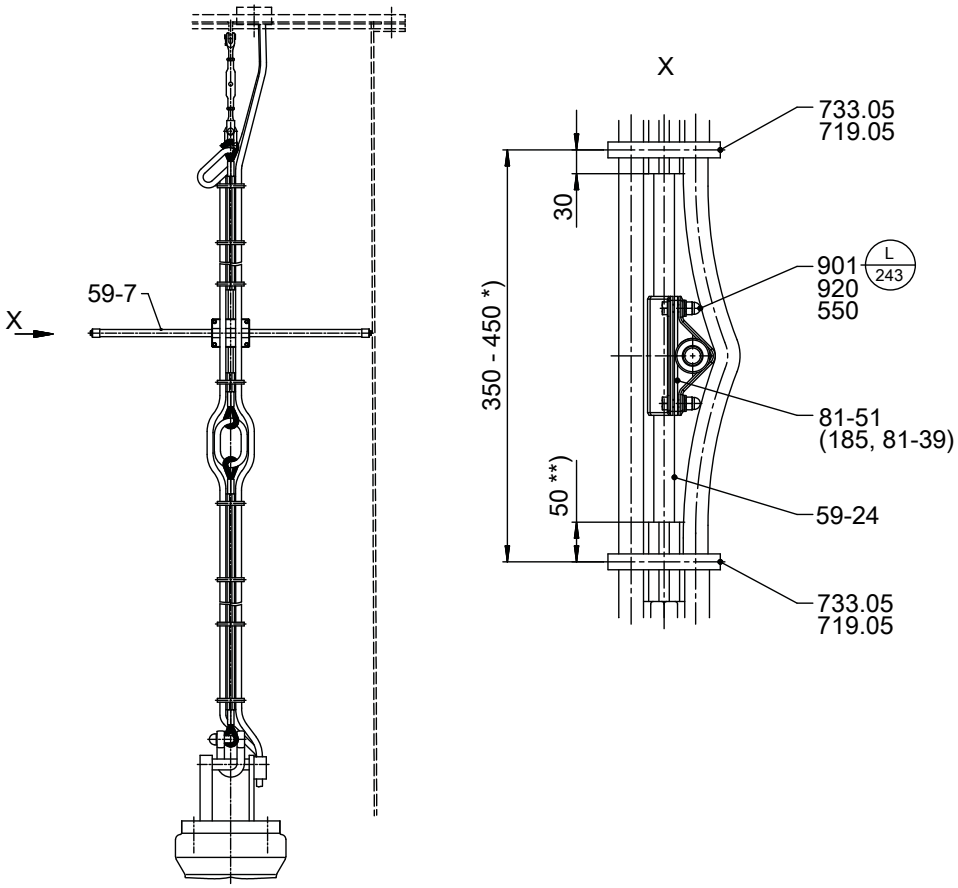


Fig. 21: Support rope with support
*) depending on the cable cross-section,
**) for 1 rope or 3 ropes = 1.181 inch [30 mm]

Table 7: Key to the symbols and codes

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

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

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.

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

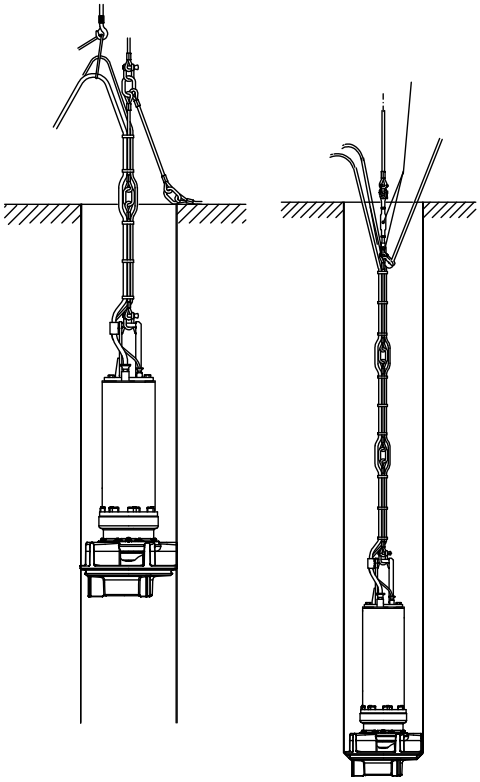


Fig. 22: Lowering the pump set

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

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

5.4 Electrical system

5.4.1 Information for planning the control system

For the electrical connection of the pump set observe the wiring diagrams.
(⇨ Section 9.4, Page 102)
The pump set is supplied with connection cables; it is wired for DOL starting. Star-delta starting is also possible.

NOTE

When laying a cable between the control system and the pump set's connection point, 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 rated voltages and voltage tolerances to IEC 60038. The permissible tolerances must be observed.

5.4.1.1 Overload protection

1. Protect the pump set against overloading by a thermal time-lag overload protection device in accordance with IEC 60947 and local regulations.
2. Set the overload protection device to the rated current specified on the name plate. (⇨ Section 4.3, Page 18)

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

5.4.1.3 Operation on a frequency inverter

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

DANGER

Operation outside the permitted frequency range

Explosion hazard!

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

DANGER

Incorrect selection and setting of the frequency inverter

Explosion hazard!

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

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

- Data provided by the manufacturer
- Electrical data of the pump set, particularly the nominal current
- Only voltage intermediate-circuit 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 up a frequency inverter:

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

Operation Observe the following limits when operating the pump set on a frequency inverter:

- Only utilize up to 95 % of the motor rating P_2 indicated on the name plate.
- Frequency range 30 to 60 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 analyzing devices must be selected. This applies in particular to the leakage sensor inside the motor.

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 power cables or non-operational monitoring devices.

CAUTION

Incorrect connection

Damage to the sensors!

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

The pump set features sensors that avoid hazards and damage to the pump set.

NOTE

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

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

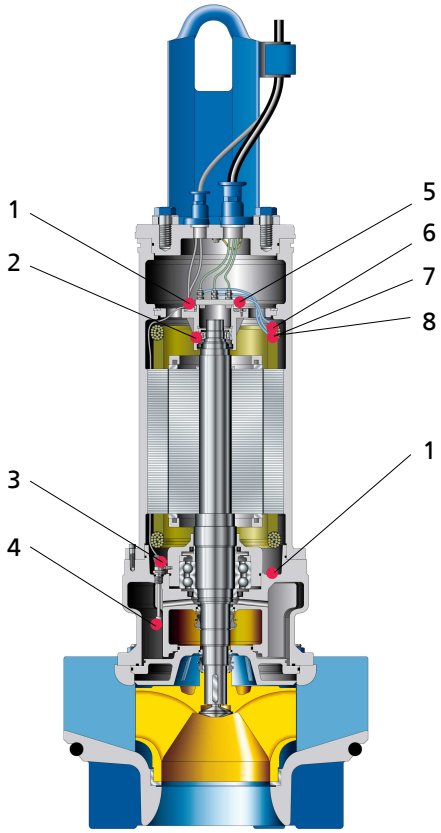


Fig. 23: Sensor positions

Position	Sensor	Standard		Optional
		Motor version		
		UN	XN	
1	Leakage inside the motor (connection and winding space)	✗	✗	-
2	Bearing temperature (upper, drive-end bearing)	-	-	✗
3	Bearing temperature (lower, impeller-end bearing)	✗	✗	-
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.
- ▷ For explosion-proof pump sets use a thermistor tripping unit with manual reset.

The pump set features double monitoring of the winding temperature.
Two bimetal switches (terminals 21 and 22, max. 250 V AC/2 A) serve as temperature control devices which open when the winding temperature is too high. Opening of the contacts must result in the pump set cutting out. Automatic re-starting is permissible.
For explosion-proof pump sets, the three additional, series-connected (PTC) thermistors with terminals 10 and 11 must be used. They must be combined with a thermistor tripping unit with manual reset.

Resistance thermometer (Pt100)

As an option, in addition to the above, the motor can be fitted with resistance thermometers (Pt100) in the winding. These can be used for reading the motor temperature (sensor circuit maximum 6 V/2 mA).

5.4.1.4.2 Leakage inside the motor

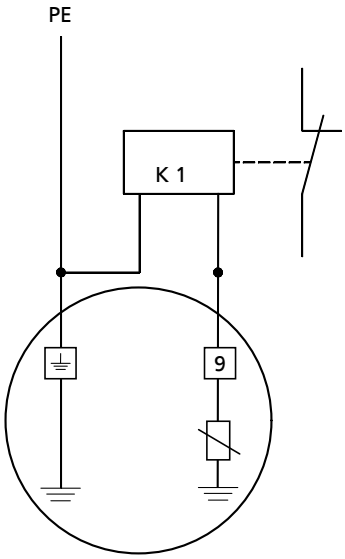
DANGER

Incorrect monitoring of leakage electrode

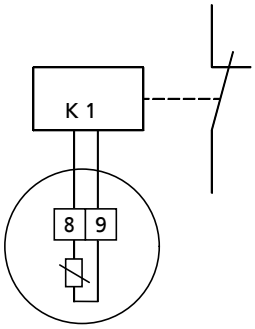
Explosion hazard!

Danger of death from electric shock!

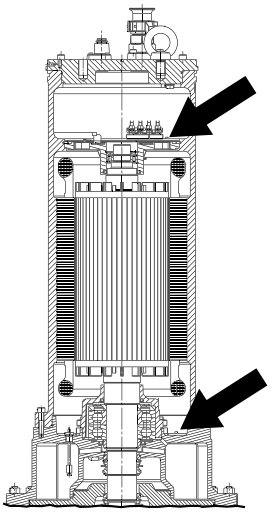
▷ Voltages must be < 30 V AC and tripping currents < 0.5 mA.



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 meet the following requirements:

- Sensor circuit 10 to 30 V AC
- Tripping current ≤ 0.5 mA

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 Mechanical seal leakage

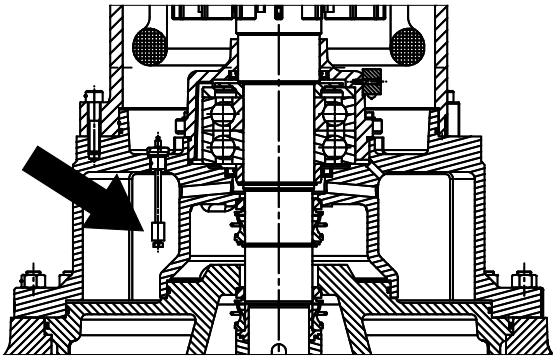


Fig. 24: Float switch

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 (impeller-end) bearing of the pump set is equipped with a bearing temperature sensor. This sensor is a Pt100 resistance thermometer (core identification 15 and 16). Connect the sensor 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 266 °F [130 °C]
- Cut-out of the pump set at 302 °F [150 °C]

As an option, the upper (drive-end) 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 features temperature monitoring of the upper (drive-end) 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 (drive-end) bearing.

The vibration sensor measures the root-mean-square value of the radial vibration velocity at the upper bearing. The sensor has an integrated signal converter with a standardized output (4 to 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 - 0.79 in/s RMS [0 - 20 mm/s]
Measuring error	< 5 %
Long-term stability	+/- 1 % in 10 years
Maximum shock load	1.1 lb [500 g]
Frequency range	2 Hz - 1000 Hz
Resonant frequency	> 18 kHz
Output impedance	200 Ω max.
Voltage supply	18 - 30 V (smoothed)
Load (maximum working resistance)	50 - 100 Ω

Connecting the vibration sensor

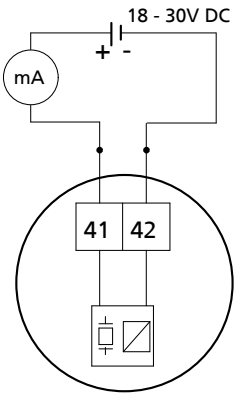


Fig. 25: Connecting the vibration sensor

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

- Alarm to be triggered at v_{eff} = 0.43 in/s [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} = 0.55 in/s [14 mm/s]

– If this vibration velocity is exceeded, continued pump set operation may result in damage.
– Immediately take suitable measures to reduce vibrations or switch off the pump set.

5.4.2 Connection to power supply

DANGER

Electrical connection work by unqualified personnel

Danger of death from electric shock!

- ▹ Always have the electrical connections installed by a trained electrician.
- ▹ Observe IEC 60364 regulations as well as any locally applicable regulations.

WARNING

Incorrect connection to the mains

Damage to the mains network, short circuit!

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

CAUTION

Improper routing of power cables

Damage to the power cables!

- ▹ Never move the power cables at temperatures below -13 °F [-25 °C].
- ▹ Never kink or crush the power cables.
- ▹ Never lift the pump set by the power cables.
- ▹ Adjust the length of the power cables to the site requirements.

CAUTION

Motor overload

Damage to the motor!

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

For the electrical connection of the pump set observe the wiring 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 connection cables. Always use all cables provided and connect all marked cores of the control cable.

DANGER

Incorrect connection

Explosion hazard!

- ▹ The connection point of the cable ends must be located outside hazardous areas or in an area approved for electrical equipment.

DANGER

Operating an incompletely connected pump set

Explosion hazard!

Damage to the pump set!

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

DANGER

Using damaged power cables

Danger of death from electric shock!

- ▷ Never connect damaged power cables.
- ▷ Visually inspect the power cable before connecting it.
- ▷ Replace the power cable, if it is damaged.

CAUTION

Flow-induced motion

Damage to the power cable!

- ▷ Run the power cable upwards without slack.

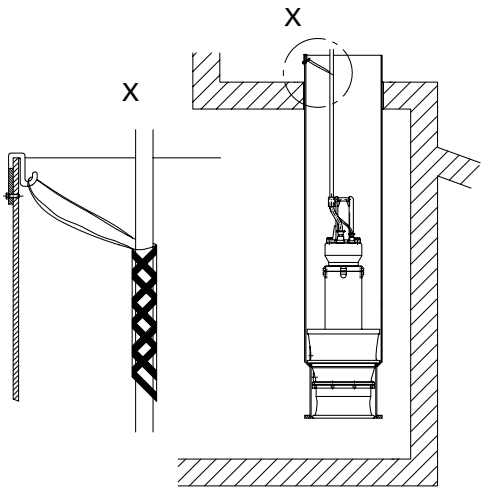


Fig. 26: Fastening the power cable

1. Run the power cables directly upwards without slack, and fasten.
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 of the individual cores at the cable ends.

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

DANGER

Incorrect connection

Explosion hazard!

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

DANGER

Touching the pump set during operation

Electric shock!

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

6 Commissioning/Start-up/Shutdown

6.1 Commissioning/start-up

6.1.1 Prerequisites for commissioning/start-up

DANGER

Persons in the tank during pump operation

Electric shock!

Risk of personal 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 devices in compliance with legal provisions and regulations.

WARNING

People falling into the unsecured discharge tube

Risk of personal injury!

- ▷ Take suitable precautions during the entire installation/dismantling 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 electric 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 pump (set) 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 personal injury!

Danger of death from drowning!

- ▷ Never start up the pump set when there are persons in the tank.

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 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

Increased vibrations!

Damage to mechanical seals and bearings!

- ▷ Never start up 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!

- ▷ Comply with the operating data indicated in the data sheet.
- ▷ Avoid operation below Q_{min}.
- ▷ Never operate an explosion-proof pump set at ambient temperatures or fluid temperatures exceeding those specified in the data sheet and/or on the name plate.
- ▷ Never operate the pump set outside the limits specified below.

6.2.1 Operation on the power supply mains

DANGER

Non-compliance with permissible supply voltage tolerances

Explosion hazard!

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

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

6.2.2 Frequency of starts

CAUTION

Excessive frequency of starts

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, sealing elements and bearings, the frequency of starts shall not exceed 6 starts per hour.

These values apply to mains start-up (DOL or with star-delta contactor, autotransformer, soft starter). These limits do 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 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 30 to 60 Hz.

6.2.4 Fluid handled

6.2.4.1 Temperature of the fluid handled

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

CAUTION

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 changes in proportion to the density of the fluid handled.

CAUTION

Impermissibly high density of fluid handled

Motor overload!

- Observe the information on 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 and air-entraining vortices!

- 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 (see general arrangement drawing/outline drawing).

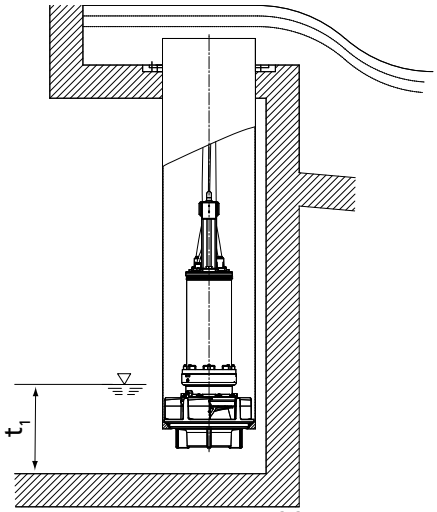


Fig. 27: Minimum level of fluid handled

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 is to be expected. In this case, reduce the commonly recommended inspection intervals.

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 electrician.
- Observe IEC 60364 regulations as well as any locally applicable regulations.

⚠ WARNING

Unintentional starting of pump set

Risk of injury by moving components and shock currents!

- ▹ Make sure that the pump set cannot be started up unintentionally.
- ▹ Always make sure the electrical connections are disconnected before carrying out work on the pump set.

⚠ WARNING

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

Risk of personal 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 for approximately one minute.
   This will prevent the formation of deposits within the pump and the pump intake area.

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

✓ All safety regulations are observed.

1. Clean the pump set.
2. Preserve the pump set.

6.4 Returning to service

For returning the pump set to service, observe the items on commissioning/start-up. (⇨ Section 6.1, Page 46)

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 54)

⚠ WARNING

Failure to re-install or re-activate protective equipment/devices

Risk of personal injury from moving parts or escaping fluid!

- ▹ As soon as the work is completed, re-install and/or 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 all maintenance, all inspections and all installation work is performed by authorized, qualified specialist personnel who are thoroughly familiar with the manual.

DANGER

Sparks produced during maintenance work

Explosion hazard!

- Observe the safety regulations in force at the place of installation.
- Never open a pump set that is connected to the power supply.
- Always perform maintenance work on pump sets outside potentially explosive atmospheres.

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, shaft seal and coupling.

DANGER

Electrical connection work by unqualified personnel

Danger of death from electric shock!

- Always have electrical connection work carried out by a trained electrician.
- Observe the provisions of the EN 60079 standard.

DANGER

Risk of falling when working at great heights

Danger to life by falling from great heights!

- 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 occupational safety regulations and accident prevention regulations.

WARNING

Unintentional starting of pump set

Risk of injury by moving components and shock currents!

- Make sure that the pump set cannot be started up unintentionally.
- Always make sure the electrical connections are disconnected before carrying out work on the pump set.

⚠ WARNING

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

Risk of personal injury! Damage to the submersible motor pump!

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

⚠ WARNING

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

Risk of personal 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 personal 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 against tilting or tipping over.

NOTE

Special regulations apply to repair work on explosion-proof pump sets. Modifications or alteration of the pump sets can 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 (set) with a minimum of maintenance expenditure and work.

NOTE

All maintenance work, service work and installation work can be carried out by KSB Service or authorized workshops. Find your contact in the attached "Addresses" booklet or on the Internet at "www.ksb.com/contact".

Never use force when dismantling and reassembling the pump set.

7.2 Servicing/inspection

KSB recommends the following regular maintenance schedule:

Table 9: Overview of maintenance work

Maintenance interval	Maintenance work	For details see ...
Every 4000 hours, but at least 1 × year	Measuring the insulation resistance	(⇨ Section 7.2.1.1, Page 54)
Every 8000 hours, but at least every 2 years	Checking the cables	(⇨ Section 7.3.3, Page 58)
	Checking the ground conductor	(⇨ Section 7.3.4, Page 58)
	Checking the sensors	(⇨ Section 7.2.1.2, Page 55)
	Checking the mechanical seal leakage	(⇨ Section 7.3.5, Page 58)
	Changing the lubricant	(⇨ Section 7.4, Page 59)
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 maximum measuring voltage is 500 V (maximum permissible voltage 1000 V).

1. Measure the winding to chassis ground.
   To do so, connect all winding ends together.
2. Measure the winding temperature sensor 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 connection cable at the pump set and repeat the check inside the motor.
If the tolerances are exceeded here, too, the motor part must 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 ground conductor (PE)	> 60
8 and 9[5)]	> 60

Lower resistance values would 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 sensors

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 the vibration sensor

Measurement between terminals ...	Current value
41 and 42	Constant 4 mA during standstill

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

Functional test
Connect the vibration sensor. Measure the current in the measuring circuit with a suitable ammeter. (⇨ Section 5.4.1.4.5, Page 42)

7.3 Removing the pump set

7.3.1 Removing the pump set

⚠ DANGER

Insufficient preparation of work on the pump (set)
Risk of personal 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 power cable
Personal injury and damage to property!
- ▹ Secure power cables against falling down.
- ▹ Avoid power cables being laid on surfaces without fastening.
- ▹ When moving the pump set keep at a safe distance to the power cables.

⚠ WARNING

People falling into the unsecured discharge tube
Risk of personal injury!
- ▹ Take suitable precautions during the entire installation/dismantling 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 personal injury!
Damage to the pump set!
- ▹ Always use the eyebolts of the support rope to lift the pump set.

✓ The power cables have been disconnected and secured against accidental start-up.

✓ The discharge tube is open; its opening is securely covered except for a gap allowing work to continue.

✓ Suitable lifting equipment is available.

1. Attach the lifting chain or lifting rope to the trolley.
2. Free the uppermost lifting lug from the cable bundle, attach it to the crane hook and run the lifting equipment to a higher level.
3. Open and disconnect the turnbuckle.

NOTE

Loose parts must not fall 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 humidity.

12. Do not disconnect the pump set from the hook of the lifting equipment to prevent the pump set from tipping over.
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 operating supplies which are hot or pose a health hazard

Hazard to persons and the environment!

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

1. Always flush the pump if it has been used for handling noxious, explosive, hot or other hazardous fluids.
2. Always flush and clean the pump before transporting it to the workshop. Always complete and enclose a certificate of decontamination when returning the pump set. (⇨ Section 10, Page 132)

7.3.3 Checking the cable bundle

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

Longer cable bundles must be dismantled:

1. Free the cable clamps.
2. Remove the spacer.
3. Roll up the electric 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 ground conductor

1. Measure the resistance between ground conductor and chassis ground. The resistance must be lower than 1 Ω.
2. Replace any damaged components by original spare parts.

DANGER

Defective ground conductor

Electric shock!

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

7.3.5 Checking the mechanical seal leakage

WARNING

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

Hazard to persons and the environment!

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

WARNING

Excess pressure inside the pump set

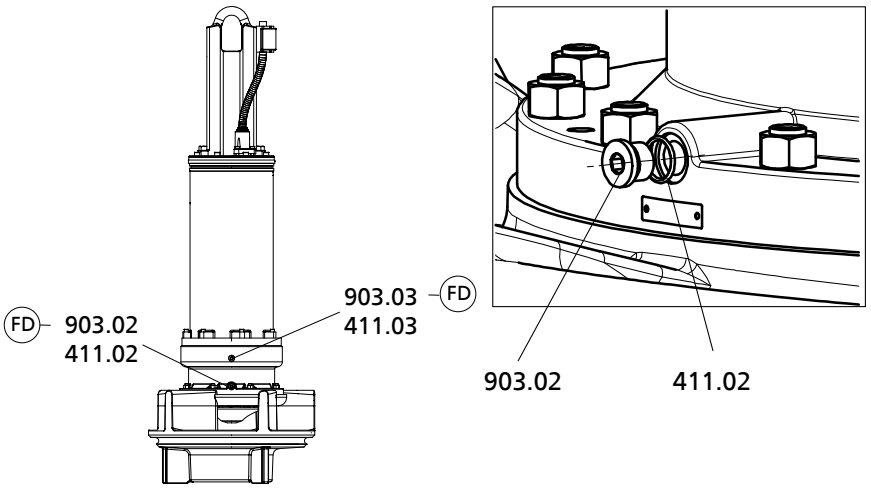
Risk of personal injury when opening the pump set!

- ▷ Be careful when opening the inner chambers. Balance 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: Key to the symbols and codes

Symbol	Description
FD	Always apply a **liquid sealing agent** (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. Unscrew and remove screw plug 903.02 with 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 2.11 quart [2 liters], the mechanical seals are defective and must be replaced.
4. Fit and tighten screw plug 903.02 with a 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

Explosion hazard!

Damage to the pump set!

▹ Regularly check the condition of the lubricant in the lubricant chamber of the mechanical seal. Top it up if required.

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

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

Table 16: Lubricant quality

Description	Properties	
Paraffin oil or white oil. Alternative: motor oil grades SAE 10W to SAE 20W	Kinematic viscosity at 104 °F [40 °C]	< 0.065 ft/s² [< 20 mm/s²]
	Flash point (to Cleveland)	> 320 °F [> 160 °C]
	Solidification point (pour point)	< -5 °F [< -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

Contamination of fluid handled by lubricant

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 depending on the hydraulic system and motor

Size	Lubricant quantity depending on the motor							
	60 6.N 80 6.N 50 8.N 65 8.N 75 8.N		90 8.N 110 8.N 130 8.N 40 10.N 60 10.N 75 10.N 90 10.N		150 8.N 185 8.N 220 8.N 110 10.N 150 10.N		260 8.N 300 8.N 350 8.N	
	[quart]	[l]	[quart]	[l]	[quart]	[l]	[quart]	[l]
800-370	4,2	4,0	-	-	-	-	-	-
800-400	4,2	4,0	-	-	-	-	-	-
800-401	4,2	4,0	-	-	-	-	-	-
1000-420	5,0	4,7	7,4	7,0	-	-	-	-
1000-500	5,0	4,7	7,4	7,0	7,4	7,0	-	-
1200-630	-	-	8,9	8,5	7,4	7,0	11,1	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 personal injury when opening the pump set!

- Be careful when opening the inner chambers. Balance 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.

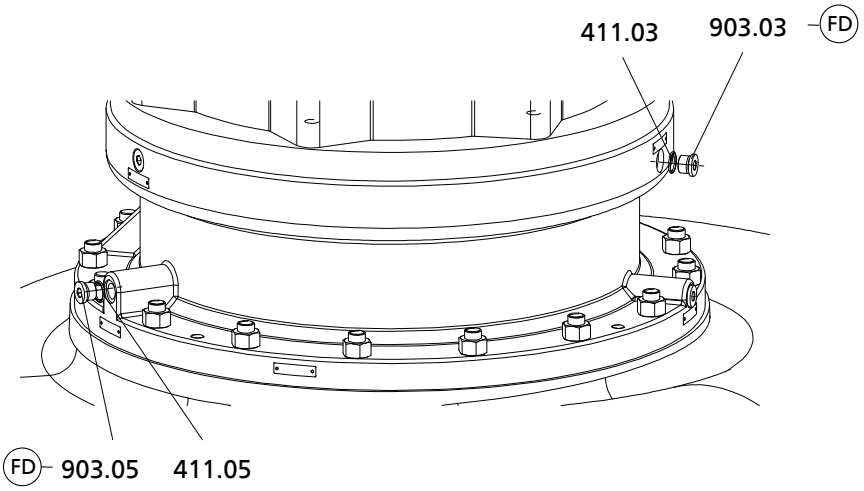


Fig. 28: Changing the lubricant

903.03 411.03	Lubricant filler opening	903.05 411.05	Lubricant drain

Table 18: Key to the symbols and codes

Symbol	Description
FD	Always apply a **liquid sealing agent** (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. Unscrew and remove screw plug 903.03 with joint ring 411.03.
   Observe the plate "Oil filler plug".
3. Unscrew and remove screw plug 903.05 with 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 chamber overflows.
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 bearing (radial bearing) of the pump set is grease-packed and maintenance-free.
The lower bearings must 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 77 °F [25 °C], 0.1 mm (DIN 51818)	Drop point (ISO 2176)	Application temperature range [°C]	Viscosity at 104 °F [40 °C] (DIN 51562)
A	Mineral oil	Lithium complex soap	2 or 3	220 to 295	> 527 °F [>275 °C]	-4 °F to 320 °F [-20 °C to +160 °C]	≤120
B	Ester oil	Polyurea	2	265 to 295	>482 °F [>250 °C]	-40 °F to +356 °F [-40 °C to +180 °C]	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

Motor	60 6.N 50 8.N	80 6.N 65 8.N 75 8.N	90 8.N 110 8.N 130 8.N 40 10.N 60 10.N 75 10.N 90 10.N	150 8.N 185 8.N 220 8.N 110 10.N 150 10.N	260 8.N 300 8.N 350 8.N
Grease quantity	2,5 oz [70 g]	3,2 oz [90 g]	3,9 oz [110 g]	5,6 oz [160 g]	6,3 oz [180 g]
Grease type[7)]	Type A	Type A	Type A	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.

7) Also see the section on grease quality.

⚠ WARNING

Hands inside the pump casing

Risk of injuries, damage to the pump!

- ▷ Never insert your hands or any other objects into the pump if the pump has not been de-energized and secured against unintentional start-up.

CAUTION

Incomplete re-lubrication

Bearing damage!

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

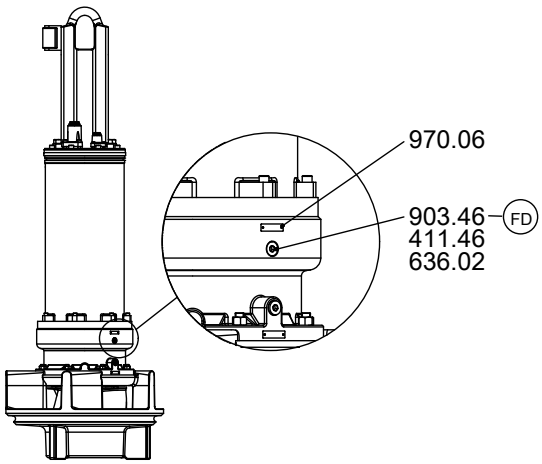


Fig. 29: Lubricating nipple

Part No.	Description
970.06	**Sign** with the following text: Schmierung Waelzlager Lubrication antifriction bearing
903.46 411.46 636.02	Lubricant filler opening

Table 21: Key to the symbols and codes

Symbol	Description
FD	Always apply a **liquid sealing agent** (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.

CAUTION

Pump set running dry

Increased vibrations!

Damage to mechanical seals and bearings!

- ▷ Never operate the pump set for more than 60 seconds outside the fluid to be handled.

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 power cables after reassembly. (⇨ Section 7.2.1, Page 54)

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 personal injury!

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

⚠ WARNING

Hot surface

Risk of personal 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 personal injury when opening the pump set!

- ▷ Be careful when opening the inner chambers. Balance 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.

	**⚠ 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-energize the pump set and secure it against unintentional start-up.
2. Remove the pump set from the discharge tube. (⇨ Section 7.3.1, Page 56)
3. Clean the pump set. (⇨ Section 7.3.2, Page 57)
4. Drain the lubricant. (⇨ Section 7.4.1.4, Page 61)
5. Drain the leakage chamber and leave it open for the duration of the disassembly.

7.6.3 Removing the back pull-out unit

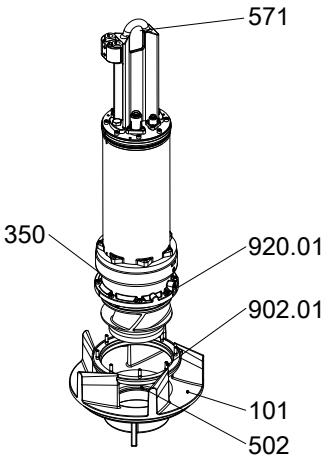


Fig. 30: Removing the back pull-out unit

✓ Suitable lifting equipment is available.

1. Attach the crane hook to bail 571 to secure the back pull-out unit.
2. Undo screwed connection 902.01 and 920.01. Pull the complete back pull-out unit out of pump casing 101 with the crane at bail 571.
3. Place the back pull-out unit in a safe and dry assembly 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.

Table 22: Overview of forcing screw for tapered fit and puller for cylindrical fit, by pump size

Size	Tapered fit		Cylindrical fit					
	60 6.N	80 6.N 65 8.N	50 8.N	75 8.N	90 8.N 110 8.N 130 8.N 40 10.N 60 10.N 75 10.N 90 10.N	150 8.N 185 8.N 220 8.N 110 10.N 150 10.N	260 8.N 300 8.N	350 8.N
800-370	-	ADS5	-	-	-	-	-	-
800-400	-	ADS5	-	-	-	-	-	-
800-401	ADS5	ADS5	-	-	-	-	-	-
1000-420	-	-	AV3	AV3	AV4	-	-	-
1000-500	-	-	-	AV3	AV4	AV4	-	-
1200-630	-	-	-	-	AV4	AV4	AV4	AV4

NOTE

Pull off the impeller using a special impeller removal tool or forcing screw.

NOTE

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

Impeller fastening elements M20

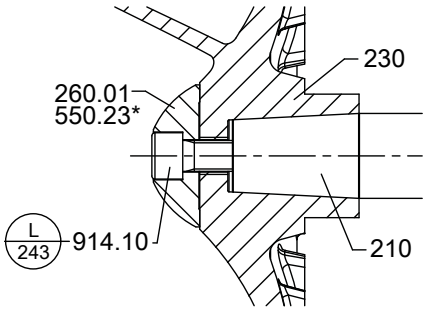


Fig. 31: Removing the impeller

*: On specific designs only

✓ The back pull-out unit has been placed in a horizontal position on wooden supports and 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 of 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

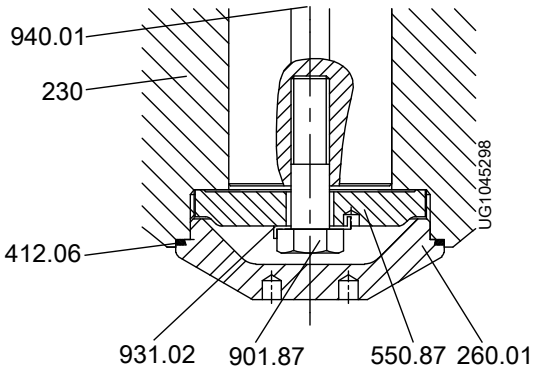


Fig. 32: Impeller fastening elements

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.

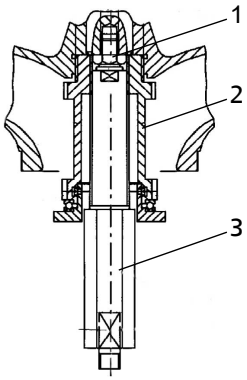


Fig. 33: Special impeller fitting and removal tool

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 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 we recommend placing a foil (no thicker than 0.3 mm) around the free shaft stub.

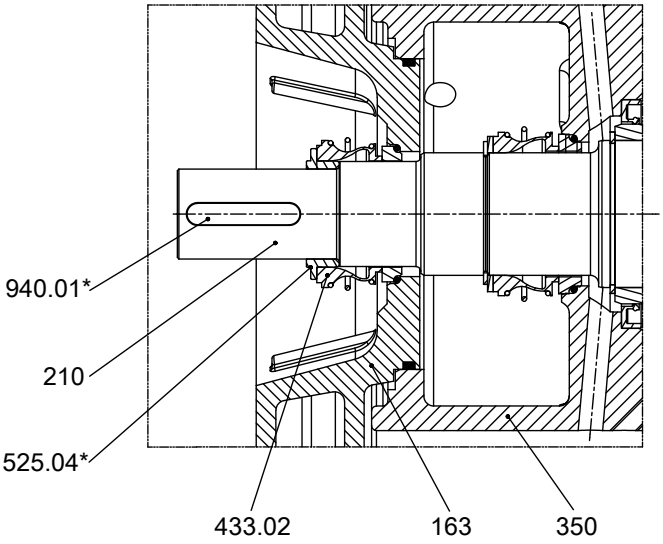


Fig. 34: Drawing of the impeller-end mechanical seal for motors 60 6.N, 80 6.N, 50 8.N, 65 8.N, 75 8.N, 90 8.N, 110 8.N., 130 8.N, 150 8.N, 185 8.N, 220 8.N, 40 10.N, 60 10.N, 75 10.N, 90 10.N, 110 10.N, 150 10.N

*: Not for tapered fit

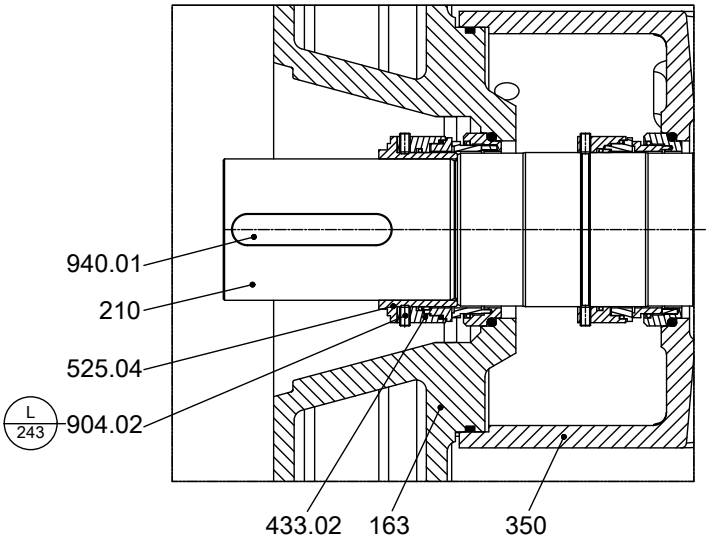


Fig. 35: Drawing of the impeller-end mechanical seal for motors 260 8.N, 300 8.N, 350 8.N

Table 23: Key to the symbols and codes

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[8] 904.01.
2. Pull the rotating assembly of mechanical seal 433.01 and disc[9] 550.03 off shaft 210.

8) For motors 150 8.N, 185 8.N only
9) If any

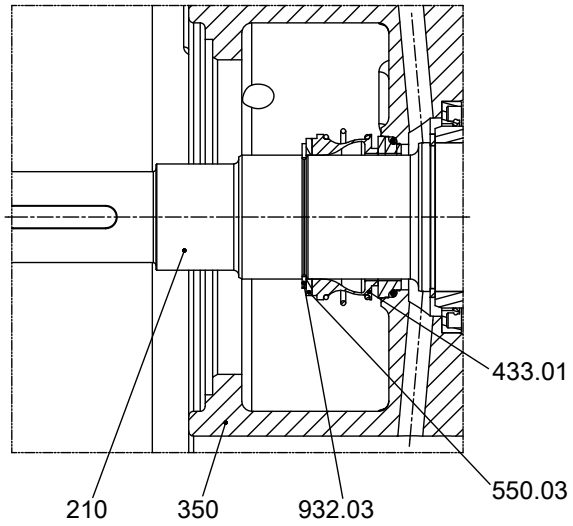


Fig. 36: Drawing of the drive-end mechanical seal for motors 60 6.N, 80 6.N, 50 8.N, 65 8.N, 75 8.N, 90 8.N, 110 8.N., 130 8.N, 40 10.N, 60 10.N, 75 10.N, 90 10.N

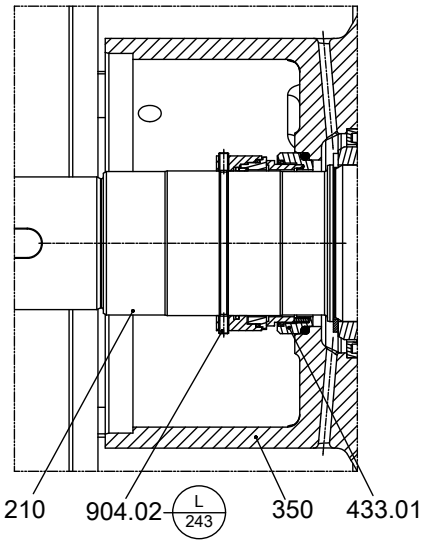


Fig. 37: Drawing of the drive-end mechanical seal for motors 150 8.N, 185 8.N, 220 8.N, 260 8.N, 300 8.N, 350 8.N, 110 10.N, 150 10.N

Table 24: Key to the symbols and codes

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 sets can 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 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.

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

7.6.6.1 Removing the motor housing cover

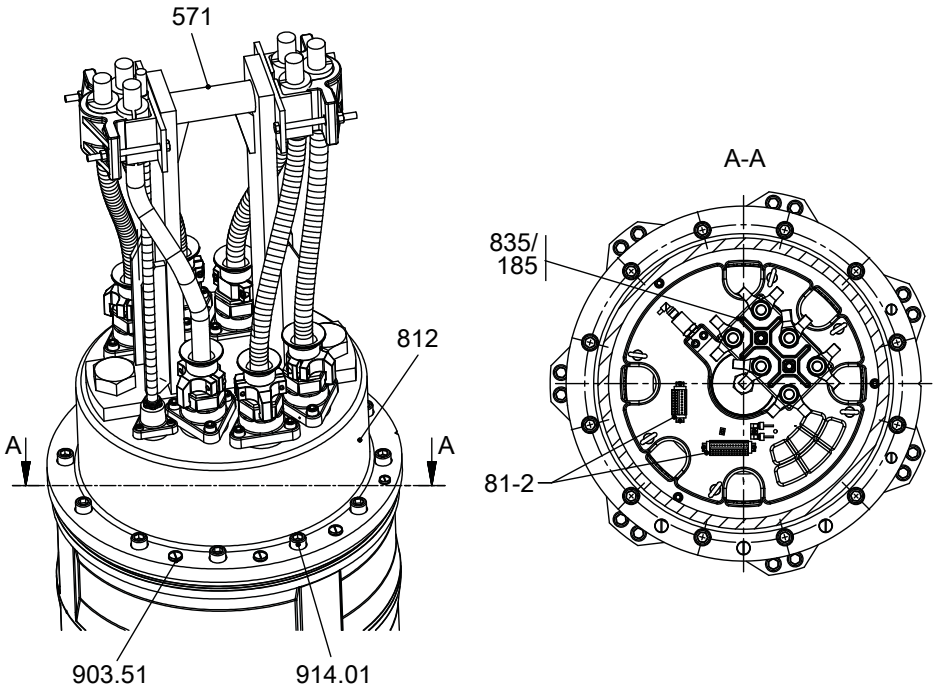


Fig. 38: Removing the motor housing cover

✓ 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 jacking 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 power cable cores from terminal board 835 and terminal 185.
8. Place motor housing cover 812 down and secure it against rolling off.

7.6.6.2 Dismantling the cable gland with connection cable

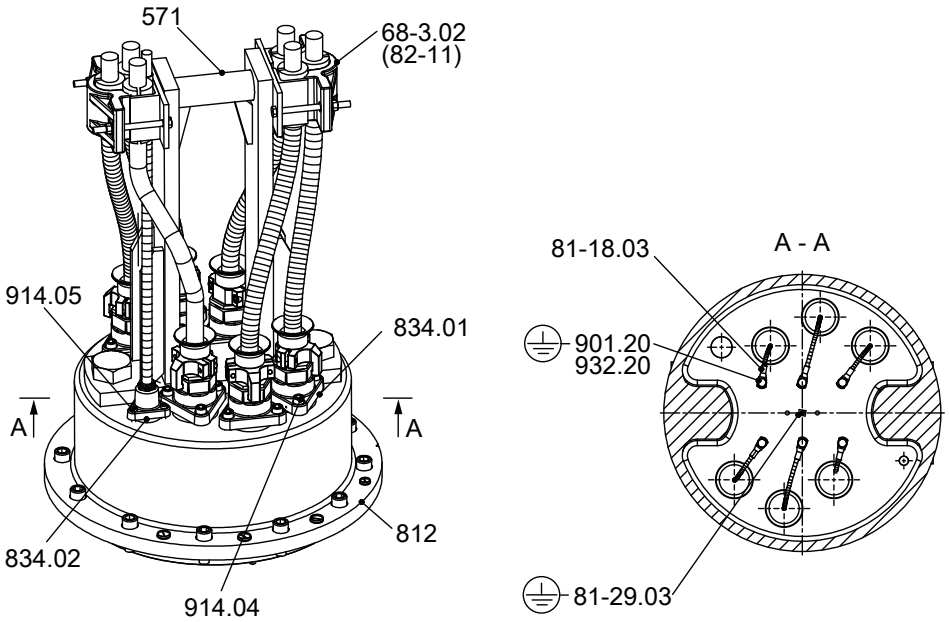


Fig. 39: Removing the connection cable and cable gland

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 ground conductor on the inside of motor housing cover 812. If a shielded cable is used, disconnect the shield as well.
3. Undo screws 914.04 of cable gland 834.01.
4. Pull cable gland 834.01 out of the centering 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 of cable gland 834.02.
3. Pull cable gland 834.02 out of the centering seat in motor housing cover 812.

NOTE

Noting down the marking and length of the cable cores to facilitate fitting the replacement cable gland is recommended.

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 against 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. Secure all screwed 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

When reassembling the pump set, tighten all screws/bolts as indicated.
In addition, secure all screwed connections closing off the flameproof enclosure with a thread-locking agent (Loctite Type 243).

7.7.2 Installing the replacement cable gland

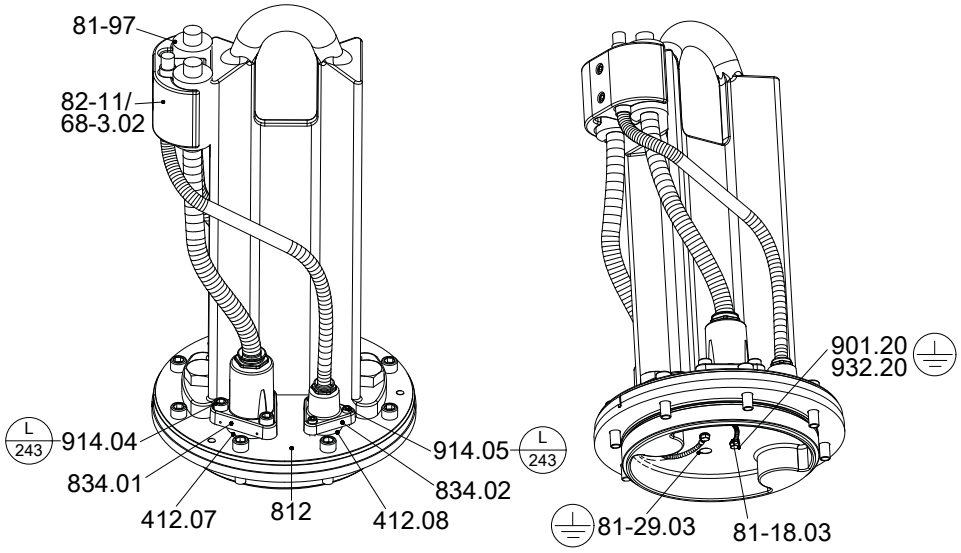


Fig. 40: Installing the cable gland

Table 25: Key to the symbols and codes

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 those of the original cable gland.
2. Attach core identifications matching the original cable gland.
3. Slide O-ring 412.07 onto the core ends of the power cable and into the groove of the centering 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 ground conductor (green/yellow) to the inside of 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 those of the original cable gland.
2. Attach core identifications matching the original cable gland.
3. Slide O-ring 412.08 over the short core ends of the control cable and into the groove of the centering 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 hexagon socket head cap screws 914.05. 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 electrician.
- Observe IEC 60364 regulations as well as any locally applicable regulations.

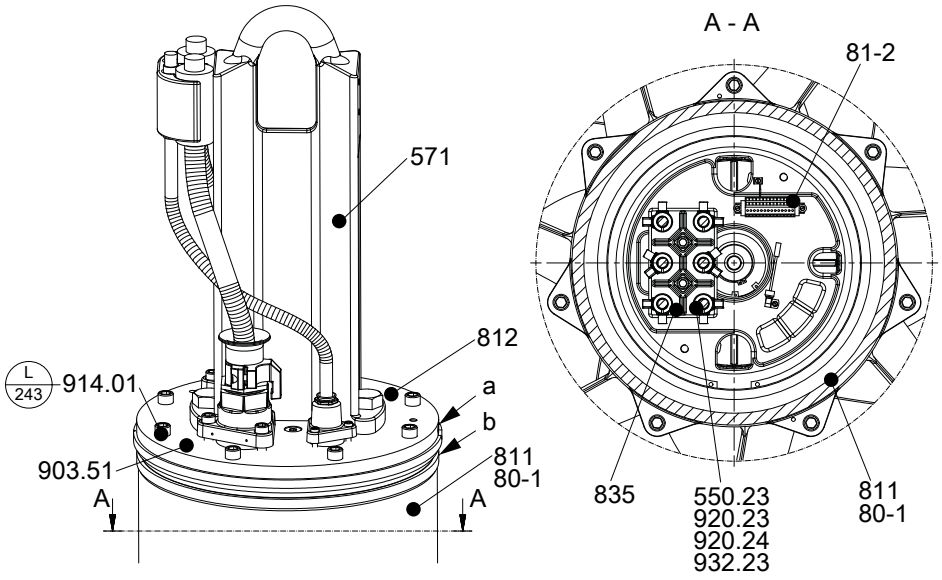


Fig. 41: Fitting the motor housing cover

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

Table 26: Key to the symbols and codes

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 down 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 85)
7. Cover the jacking threads with caps 903.51.
8. Perform a leak test on the motor. (⇨ Section 7.7.7.3, Page 83)

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.
- Make sure the surface of the shaft is absolutely clean and undamaged.
- Immediately before installing the mechanical seal, wet the contact faces with a drop of oil.
- For easier installation of a bellows-type mechanical seal, wet the inner bellows diameter and the O-rings with soapy water (not oil).
- Prevent the O-rings from sliding into any grooves in the shaft by lining the relevant grooves with suitable means.
- To prevent any damage to the rubber bellows, place a thin foil of approximately 0.0039 to 0.0118 inch [0.1 to 0.3 mm] around the free shaft stub.
  Slip the rotating assembly over the foil into its installation position.
  Then remove the foil.

7.7.4.1 Installing the drive-end mechanical seal

Motors 60 6.N, 80 6.N, 50 8.N, 65 8.N, 75 8.N, 90 8.N, 110 8.N., 130 8.N, 40 10.N, 60 10.N, 75 10.N, 90 10.N

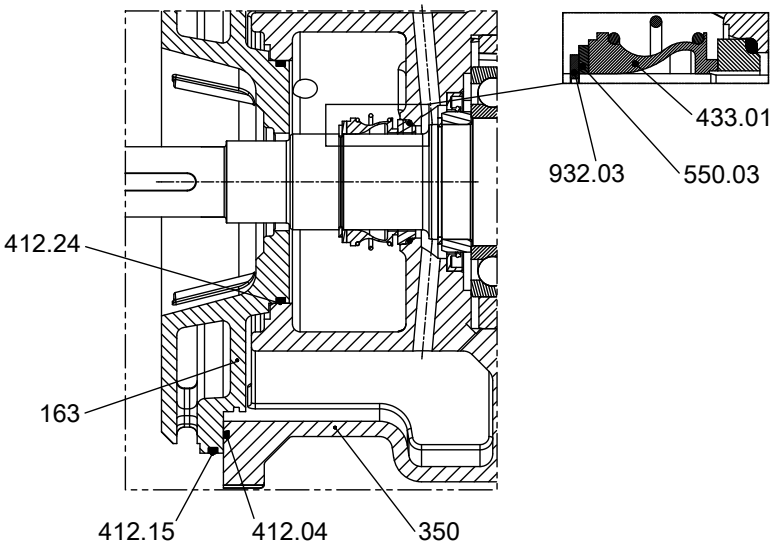


Fig. 42: Installing the drive-end mechanical seal for motors 60 6.N, 80 6.N, 50 8.N, 65 8.N, 75 8.N, 90 8.N, 110 8.N., 130 8.N, 40 10.N, 60 10.N, 75 10.N, 90 10.N

✓ The back pull-out unit has been positioned horizontally 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. Slide disc 550.03 and circlip 932.03 onto the shaft. Press the circlip in with an assembling 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 150 8.N, 185 8.N, 220 8.N, 260 8.N, 300 8.N, 350 8.N, 110 10.N, 150 10.N

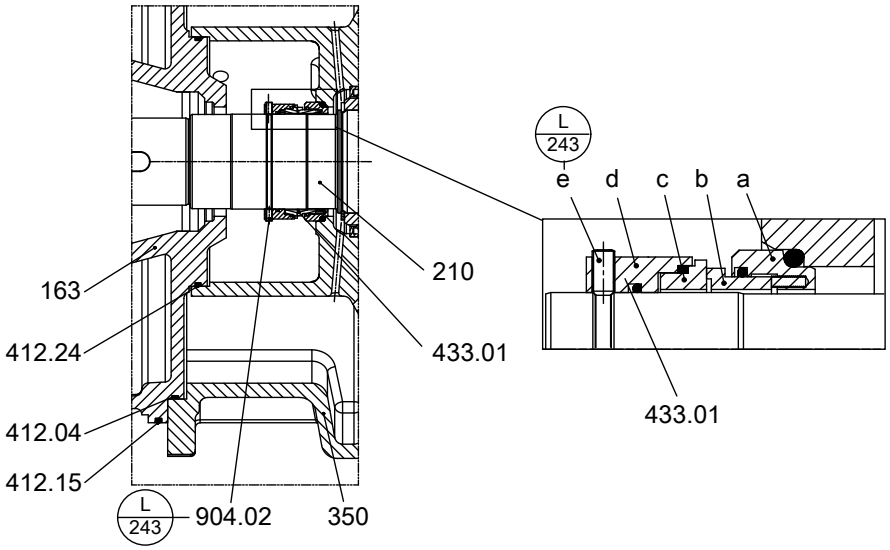


Fig. 43: Installing the drive-end mechanical seal for motors 150 8.N, 185 8.N, 220 8.N, 260 8.N, 300 8.N, 350 8.N, 110 10.N, 150 10.N

Table 27: Key to the symbols and codes

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

✓ The back pull-out unit has been positioned horizontally 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 together with an O-ring into the drilled seat of bearing housing 350.
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 assembling 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 60 6.N, 80 6.N, 50 8.N, 65 8.N, 75 8.N, 90 8.N, 110 8.N., 130 8.N, 150 8.N, 185 8.N, 220 8.N, 40 10.N, 60 10.N, 75 10.N, 90 10.N, 110 10.N, 150 10.N

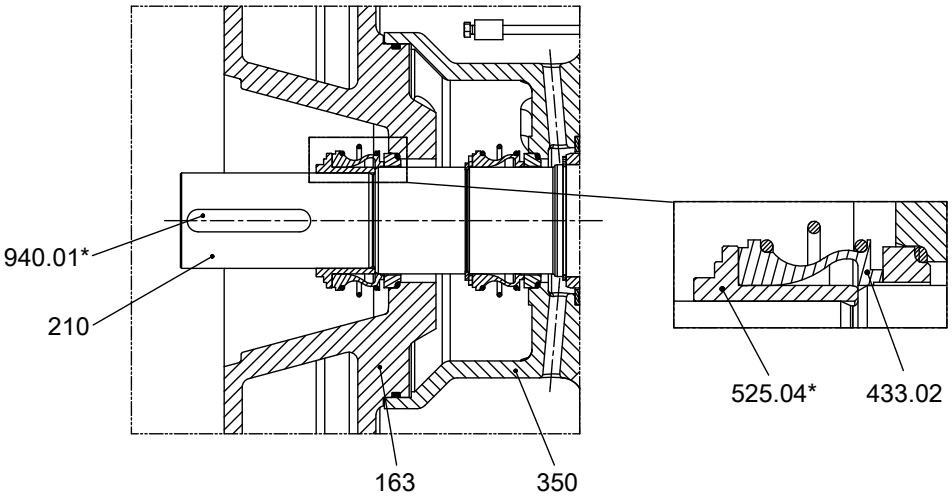


Fig. 44: Installing the impeller-end mechanical seal for motors 60 6.N, 80 6.N, 50 8.N, 65 8.N, 75 8.N, 90 8.N, 110 8.N., 130 8.N, 150 8.N, 185 8.N, 220 8.N, 40 10.N, 60 10.N, 75 10.N, 90 10.N, 110 10.N, 150 10.N

*: 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 260 8.N, 300 8.N, 350 8.N

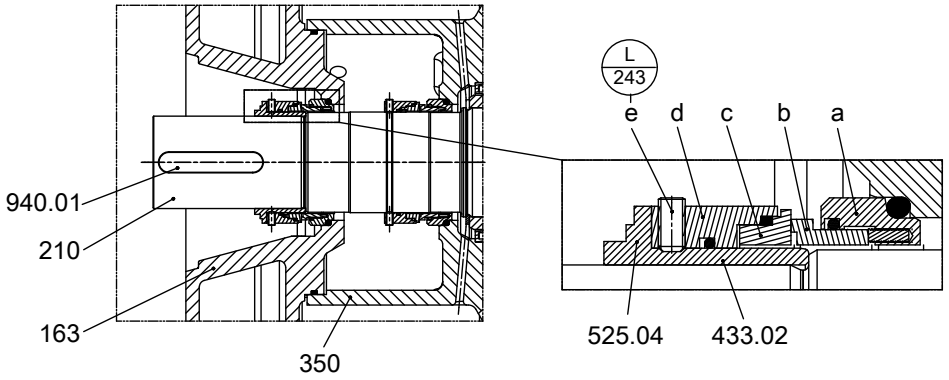


Fig. 45: Installing the impeller-end mechanical seal for motors 260 8.N, 300 8.N, 350 8.N

Table 28: Key to the symbols and codes

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 hole 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.

Table 29: Impeller fastening elements

Size	Tapered fit		Cylindrical fit					
	60 6.N	80 6.N 65 8.N	50 6.N	75 8.N	90 8.N 110 8.N 130 8.N 40 10.N 60 10.N 75 10.N 90 10.N	150 8.N 185 8.N 220 8.N 110 10.N 150 10.N	260 8.N 300 8.N	350 8.N
800-370	-	M20	-	-	-	-	-	-
800-400	-	M20	-	-	-	-	-	-
800-401	M20	M20	-	-	-	-	-	-
1000-420	-	-	M85 × 2	M85 × 2	M125 × 2	-	-	-
1000-500	-	-	-	M85 × 2	M125 × 2	M125 × 2	-	-
1200-630	-	-	-	-	M125 × 2	M125 × 2	M125 × 2	M125 × 2

Impeller fastening elements M20

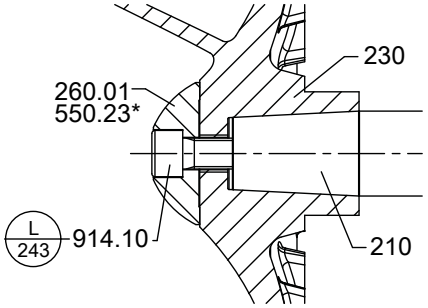


Fig. 46: Fitting the impeller

*: 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.

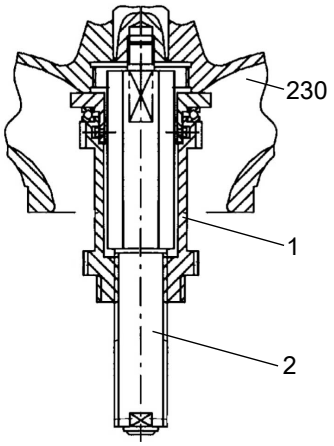


Fig. 47: Special impeller fitting and removal tool

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.

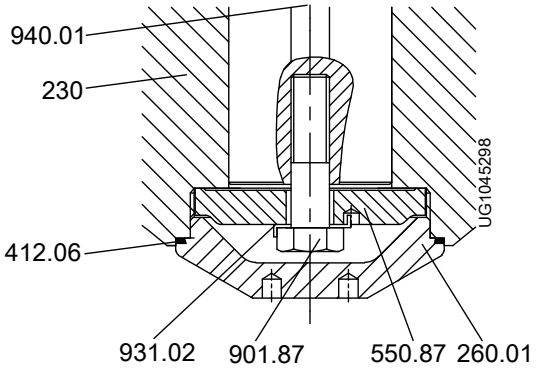


Fig. 48: Impeller fastening elements

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.

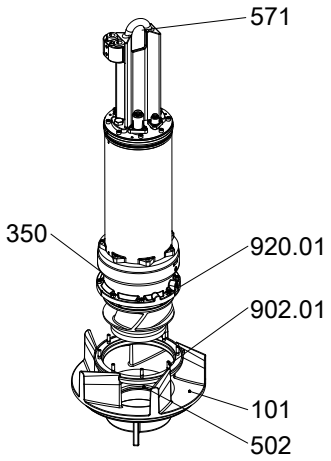


Fig. 49: Installing the back pull-out unit

✓ 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

7.7.7.1 Checking the lubricant chamber for leakage

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

Observe the following values for leak testing:

- **Test medium:** compressed air
- **Test pressure:** maximum 14.5 psi [1 bar]
- **Test period:** 5 minutes

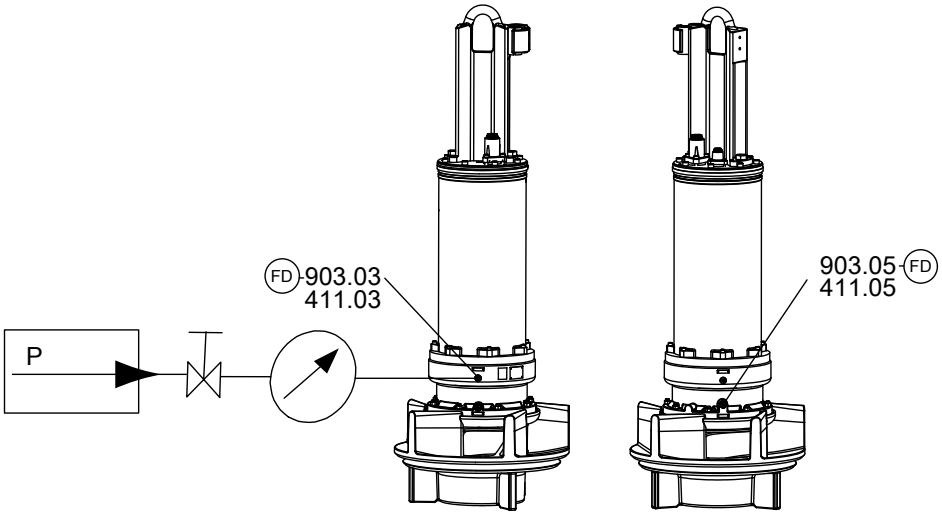


Fig. 50: Leak testing the lubricant chamber

903.03 411.03	Lubricant filler opening	903.05 411.05	Lubricant drain

Table 30: Key to the symbols and codes

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

1. Remove screw plug 903.03 and joint ring 411.03 from the lubricant chamber.
2. Screw the testing device tightly into the G½ 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. 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 the lubricant. (⇨ Section 7.4.1.4, Page 61)

7.7.7.2 Checking the leakage chamber for leakage

After reassembly, the mechanical seal area/lubricant chamber must be tested 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:** 11.6 psi [0.8 bar] maximum
- **Test duration:** 2 minutes
- **Opening:** hole of screw plug 903.02

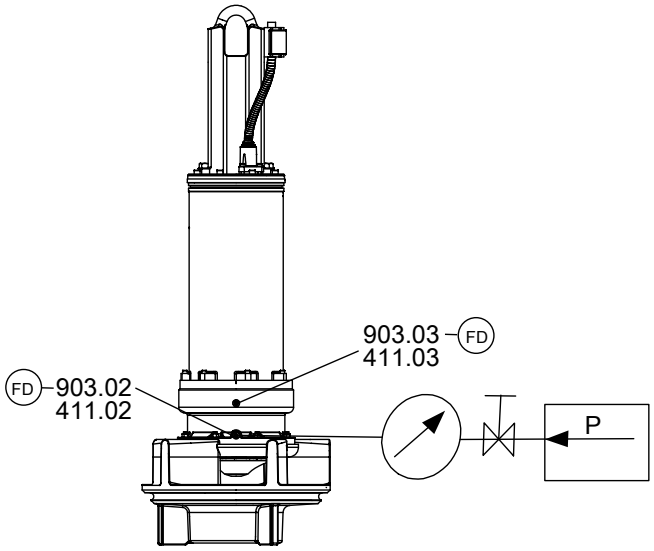


Fig. 51: Leak testing the leakage chamber

903.02 411.02	Leakage drain	903.03 411.03	Lubricant filler opening

Table 31: Key to the symbols and codes

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

1. Remove screw plug 903.02 and joint ring 411.02 from the leakage chamber.
2. Screw the testing device tightly into the G½ 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. 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:** maximum 11.6 psi [0.8 bar]
- **Test duration:** 2 minutes

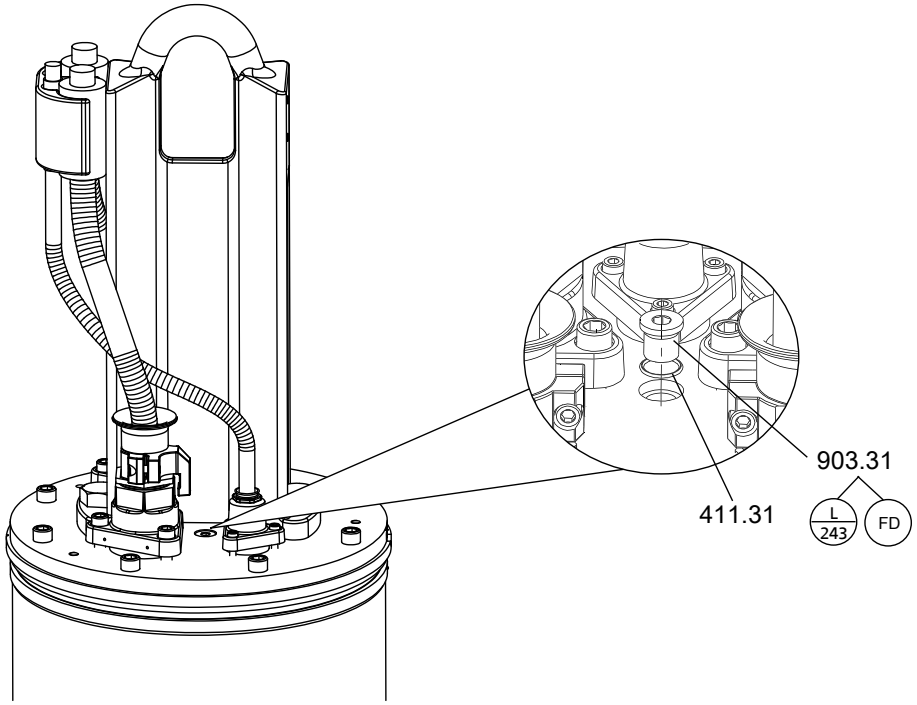


Fig. 52: Leak testing the motor

Table 32: Key to the symbols and codes

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

1. Undo and remove screw plug 903.31 with 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 screw plug 903.31.
- ▹ Apply a thread-locking agent (Loctite 243) to screw plug 903.31.

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 33: Tightening torques [lbf ft] 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 value	Minimum	Rated value	Minimum	Rated value	Minimum	Rated value	Minimum	Rated value
M4	2,2	2,5	0,7	0,8	1,5	1,7	1,8	2,1	1,5	1,7
M5	4,5	5,0	1,5	1,6	3,2	3,5	3,7	4,1	3,2	3,5
M6	7,6	8,4	2,5	2,7	5,3	5,9	6,3	7,0	5,3	5,9
M8	18	21	6	7	13	14	15	17	13	14
M10	36	41	12	13	26	28	30	33	26	28
M12	62	69	21	23	43	49	52	52	43	49
M14	99	110	32	36	69	77	82	91	69	77
M16	154	171	51	56	108	120	128	142	108	120
M20	301	334	99	110	212	235	249	277	212	235
M24	519	577	170	190	365	406	430	478	365	406
M27	756	840	248	276	532	591	626	696	532	591
M30	1035	1150	339	377	727	808	857	952	727	808
M33	1393	1547	457	507	977	1088	1153	1281	977	1088
M36	1803	2004	592	657	1268	1409	1494	1660	1268	1409
M42	2879	3200	945	1050	2025	2250	2385	2649	2025	2250
M48	4337	4819	1423	1581	3050	3388	3592	3991	3050	3388

Table 34: 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 value	Minimum	Rated value	Minimum	Rated value	Minimum	Rated value	Minimum	Rated value
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

When using adjustable torque wrenches or drivers, select a value in the indicated range between the minimum and the rated value.

7.9 Spare parts stock

7.9.1 Ordering spare parts

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

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

Refer to the name plate for all data.

Also supply the following data:

- Part No. and description (⇨ Section 9.1, Page 89)
- Quantity of spare parts
- Shipping address
- Mode of dispatch (freight, mail, express freight, air freight)

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

Table 35: Quantity of spare parts for recommended spare parts stock[10)]

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 %

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

8 Trouble-shooting

⚠ WARNING

Improper remedial work

Risk of personal injury!

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

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

A Pump is running but does not deliver

B Pump delivers insufficient flow rate

C Excessive current/power input

D Insufficient discharge head

E Vibrations and noise during pump operation

Table 36: Trouble-shooting

A	B	C	D	E	Possible cause	Remedy[11)]
-	✗	-	-	✗	Water level dropping excessively 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.
✗	✗	✗	-	✗	Unfavorable 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 by new ones.
-	✗	-	✗	✗	Impermissible air or gas content in the fluid handled	Contact KSB.
-	-	-	-	✗	System-induced vibrations	Contact KSB.
-	-	✗	-	✗	Wrong direction of rotation	Check the connection of the motor and control system, if any.
✗	-	-	-	-	No voltage	Check the electrical installation. Contact the energy supplier.
✗	-	-	-	-	Motor winding or electric cable 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.

11) 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 cause	Remedy[11)]
✗	-	-	-	-	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

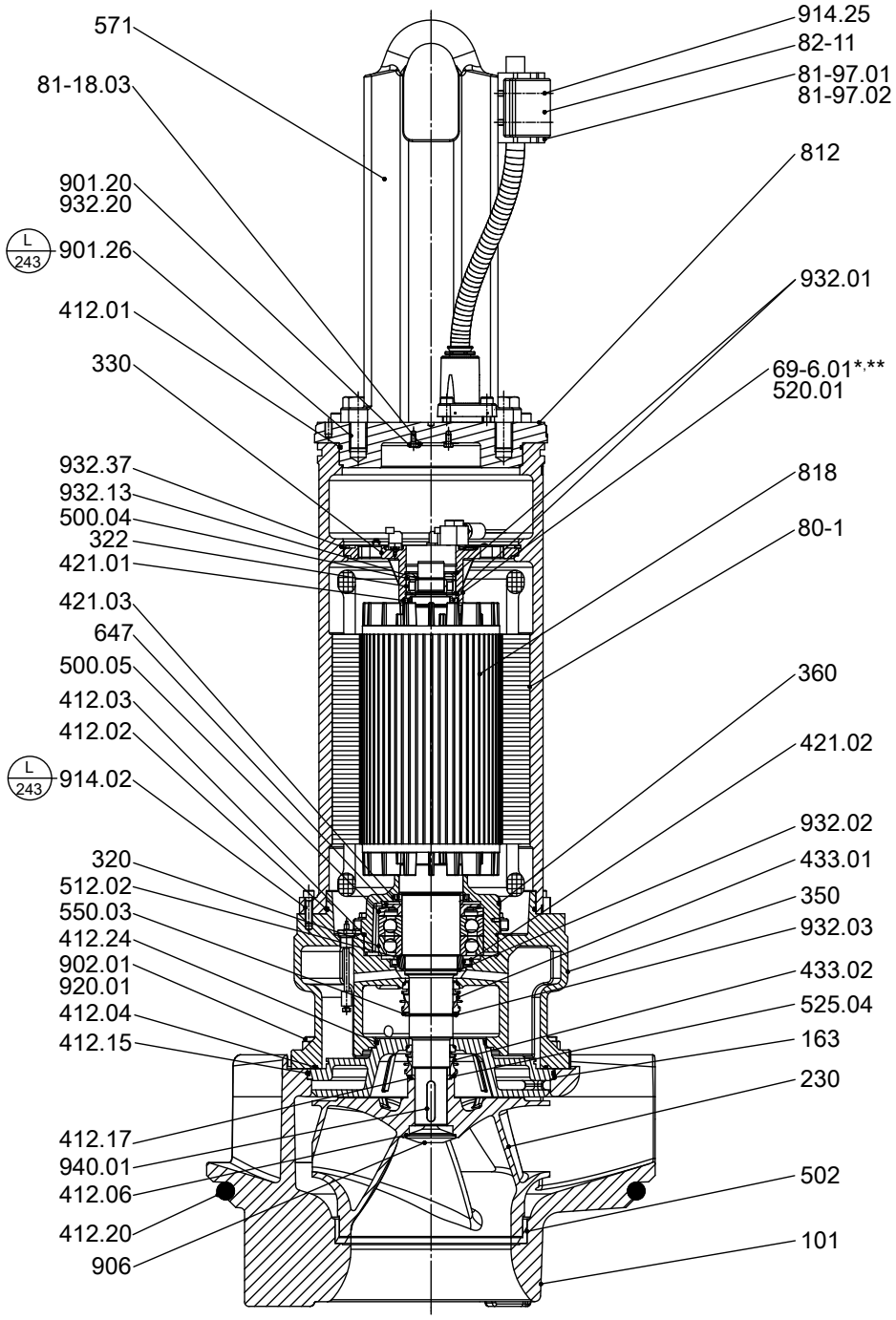


Fig. 53: General assembly drawing

*: On specific designs only

**: Optional

Table 37: Key to the symbols and codes

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

Table 38: 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 bearing	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 Detailed views

9.2.1 Side views

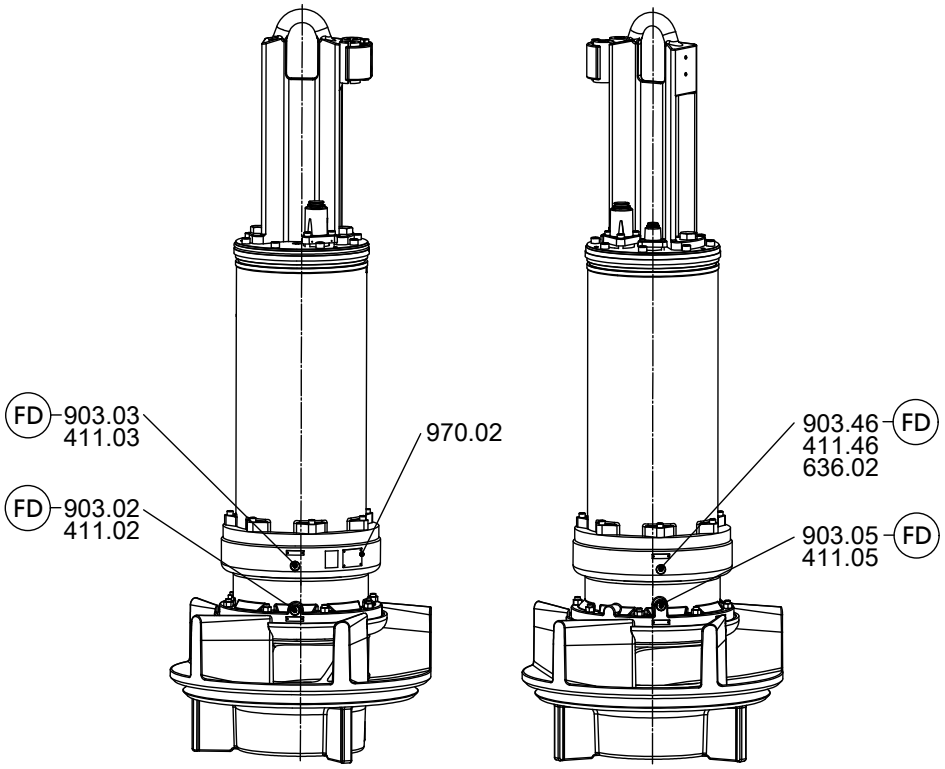


Fig. 54: Side views

Table 39: Key to the symbols and codes

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

Table 40: 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

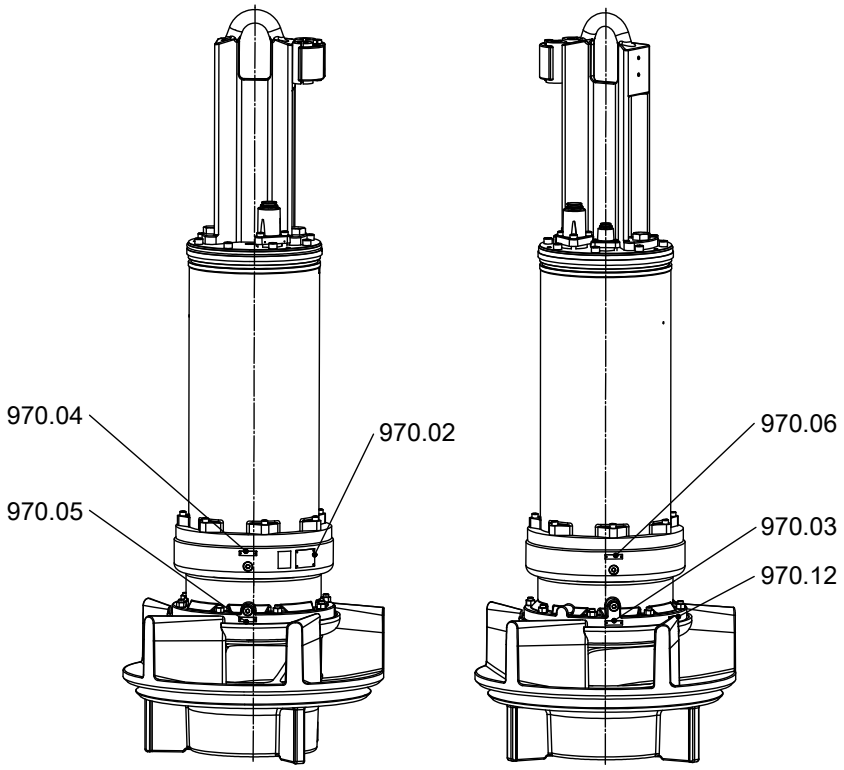


Fig. 55: Labels/plates

Table 41: 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 60 6.N, 80 6.N, 50 8.N, 65 8.N, 75 8.N, 90 8.N, 110 8.N, 130 8.N, 40 10.N, 60 10.N, 75 10.N, 90 10.N

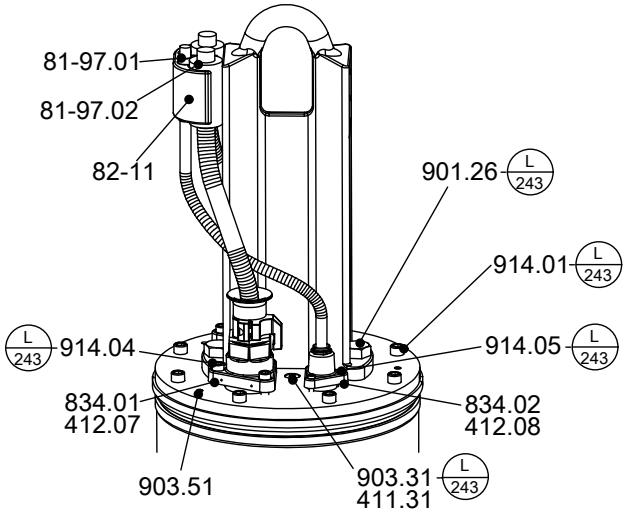


Fig. 56: Cable gland and fastening, motors 60 6.N, 80 6.N, 50 8.N, 65 8.N, 75 8.N, 90 8.N, 110 8.N, 130 8.N, 40 10.N, 60 10.N, 75 10.N, 90 10.N

Table 42: Key to the symbols and codes

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	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 150 8.N, 185 8.N, 220 8.N, 260 8.N, 300 8.N, 350 8.N, 110 10.N, 150 10.N

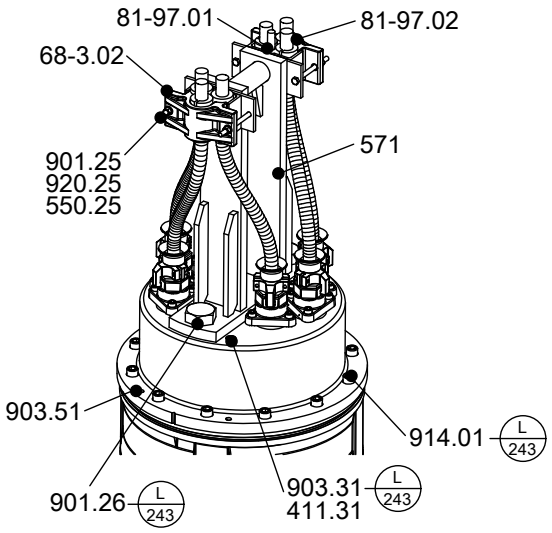


Fig. 57: Cable gland and fastening, motors 150 8.N, 185 8.N, 220 8.N, 260 8.N, 300 8.N, 350 8.N, 110 10.N, 150 10.N

Table 44: Key to the symbols and codes

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

Table 45: 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 assembly, motor end

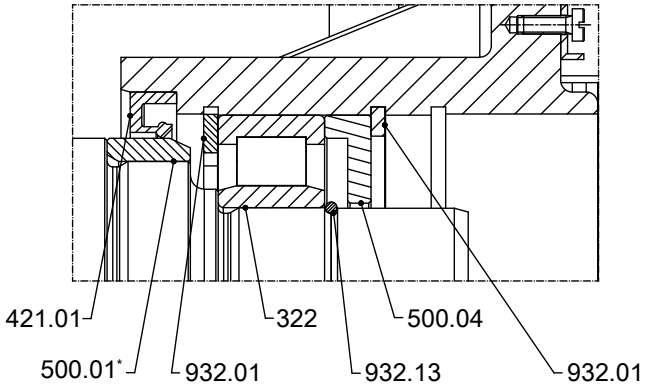


Fig. 58: Bearing assembly, motor end

*: Only on motors: 150 8.N, 185 8.N, 220 8.N, 260 8.N, 300 8.N, 350 8.N, 110 10.N, 150 10.N

Table 46: 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

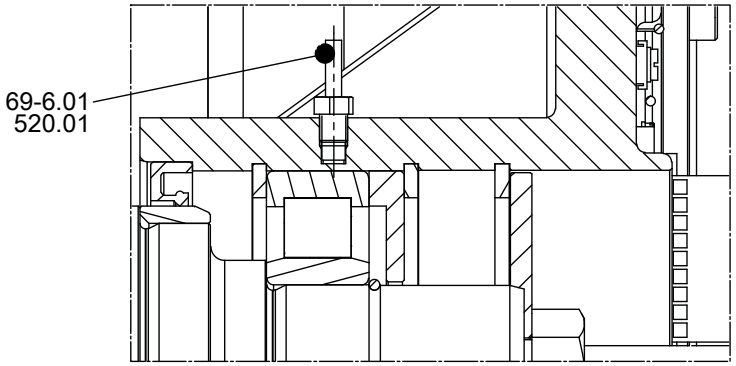


Fig. 59: Bearing temperature sensor, motor end

Table 47: List of components

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

Impeller end

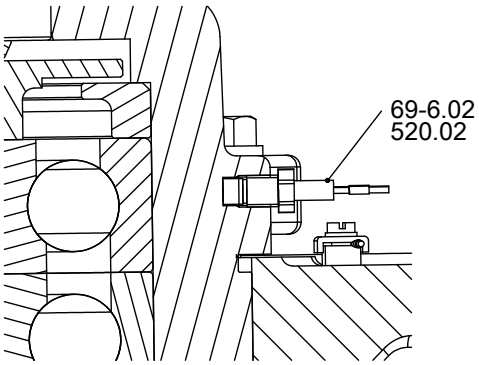


Fig. 60: Bearing temperature sensor, impeller end

Table 48: List of components

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

9.2.6 Bearing bracket fastening

Motors 60 6.N, 80 6.N, 50 8.N, 65 8.N, 75 8.N, 90 8.N, 110 8.N, 130 8.N, 40 10.N, 60 10.N, 75 10.N, 90 10.N

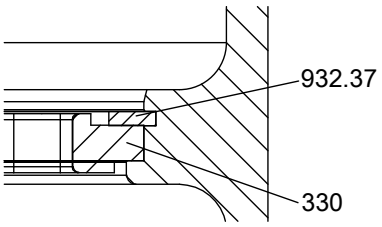


Fig. 61: Bearing bracket fastening

Table 49: List of components

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

Motors 150 8.N, 185 8.N, 220 8.N, 260 8.N, 300 8.N, 350 8.N, 110 10.N, 150 10.N

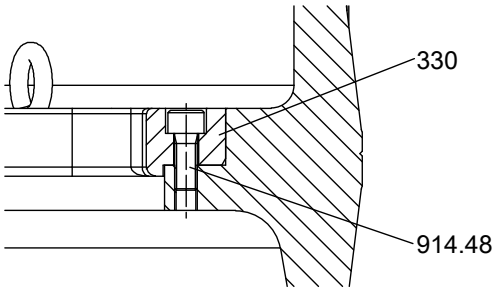


Fig. 62: Bearing bracket fastening

Table 50: 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

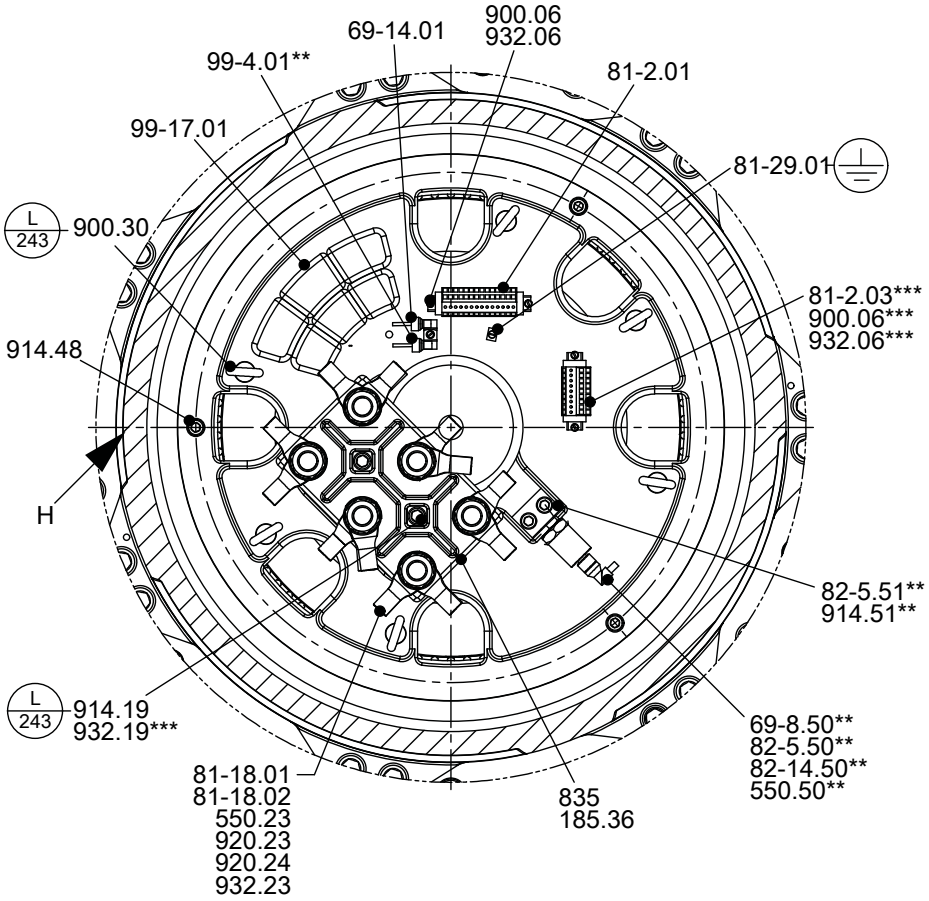


Fig. 63: Bearing bracket, sensors and terminals

H: alignment groove

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

***: Specific sizes only

Table 51: Key to the symbols and codes

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
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 sensor	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

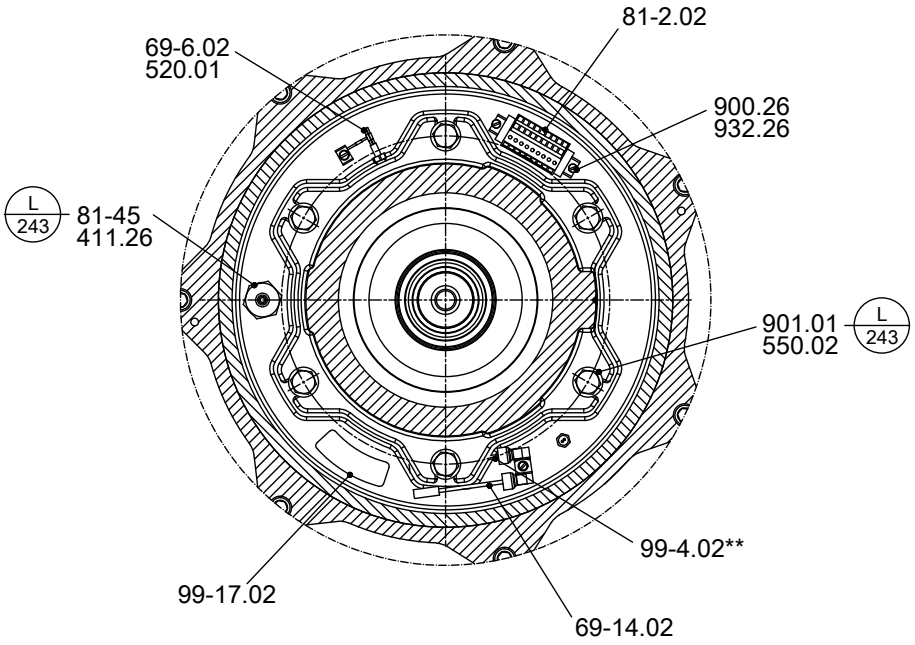


Fig. 64: Bearing housing, sensors

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

Table 53: Key to the symbols and codes

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
520.01	Sleeve	900.26	Bolt/screw
69-6.02	Temperature sensor	901.01	Hexagon head bolt
69-14.02	Leakage sensor	99-4.02	Conversion kit
81-2.02	Plug	99-17.02	Desiccant

9.2.9 Float switch

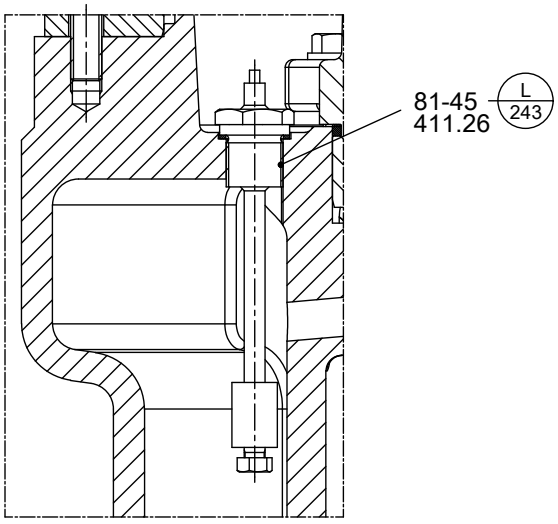


Fig. 65: Float switch

Table 55: Key to the symbols and codes

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

Table 56: List of components

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

9.2.10 Lubricant chamber and leakage chamber

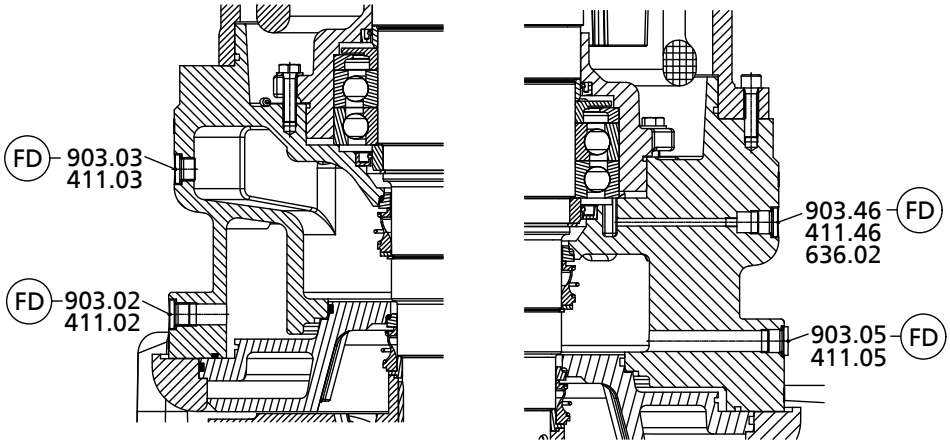


Fig. 66: Lubricant chamber and leakage chamber

Table 57: Key to the symbols and codes

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

Table 58: 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 260 8.N, 300 8.N, 350 8.N

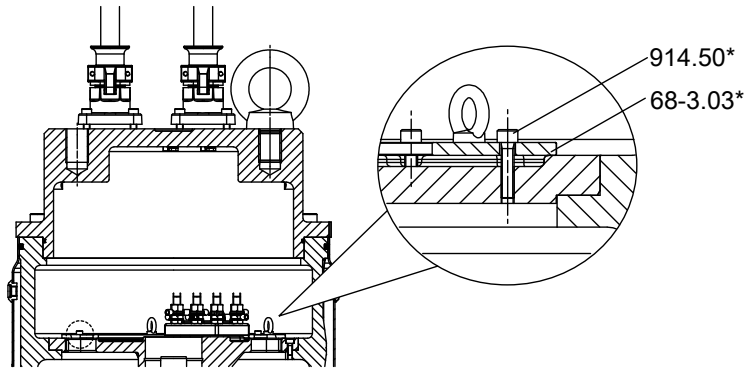


Fig. 67: Connection space of K35 motors

*: Explosion-proof versions only

Table 59: 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 800-370, 800-400, 800-401

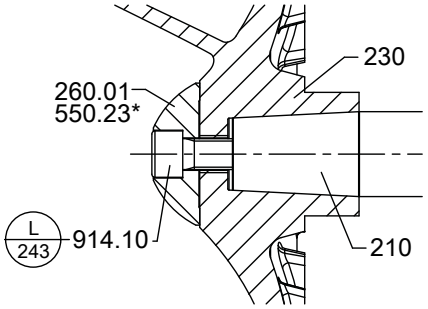


Fig. 68: Impeller fastening elements, sizes 800-370, 800-400, 800-401

*: On specific designs only

Table 60: Key to the symbols and codes

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

Table 61: 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, 1000-500, 1200-630

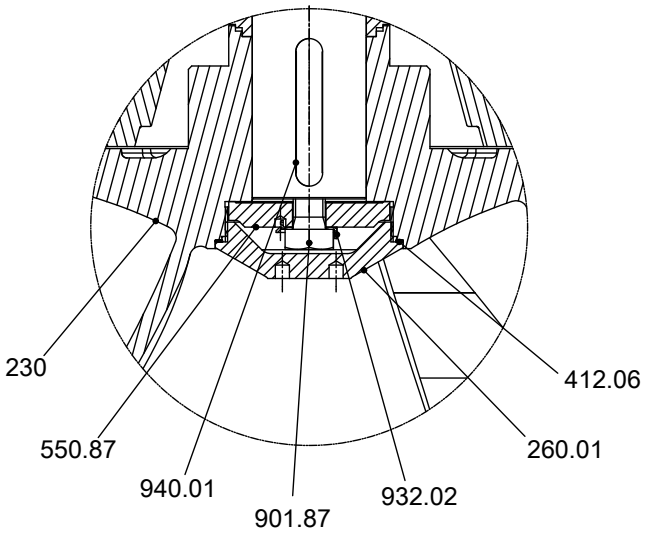


Fig. 69: Impeller fastening elements, sizes 1000-420, 1000-500, 1200-630

Table 62: List of components

Part No.	Description	Part No.	Description
230	Impeller	901.87	Hexagon head bolt
260.01	Impeller hub cap	932.02	Circlip

Part No.	Description	Part No.	Description
412.06	O-ring	940.01	Key
550.87	Disc		

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

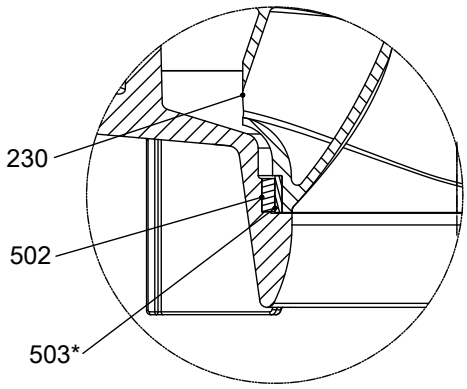


Fig. 70: Version with casing wear ring and impeller wear ring (optional)

*: On specific designs only

Table 63: List of components

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

9.3 Cable bundle

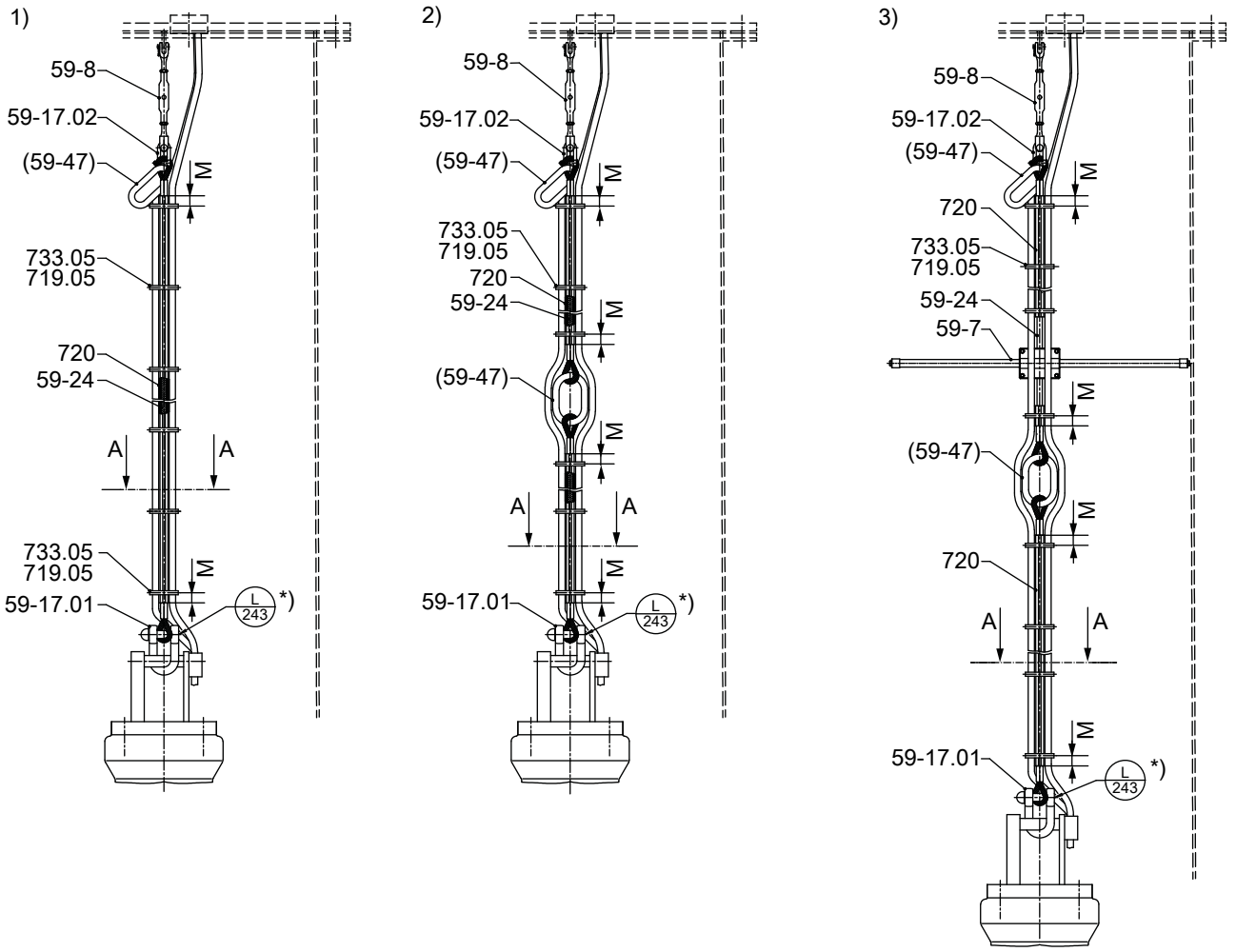


Fig. 71: Cable bundle

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

*): Only required for galvanized version (⇨ Section 5.3.3, Page 31)

NOTE

Dimension M = 2 inches [50 mm]

Table 64: Key to the symbols and codes

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

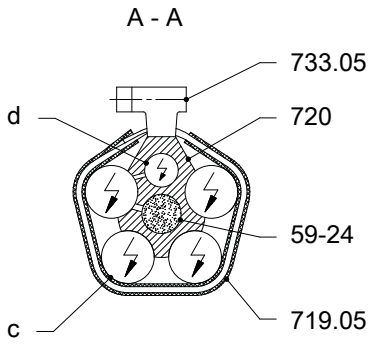


Fig. 72: Cross-section A - A, position of power cable, control cable and rope

c	Power cable	d	Control cable

Table 65: List of components of the cable bundle

Part number	Description	Part number	Description
59-7	Support	59-47	Lifting lug
59-8	Turnbuckle	719.05	Sheath
59-17.01/.02	Shackle	720	Spacer
59-24	Rope / support rope	733.05	Cable clamp

9.4 Wiring diagrams

9.4.1 Wiring diagram for the power cables

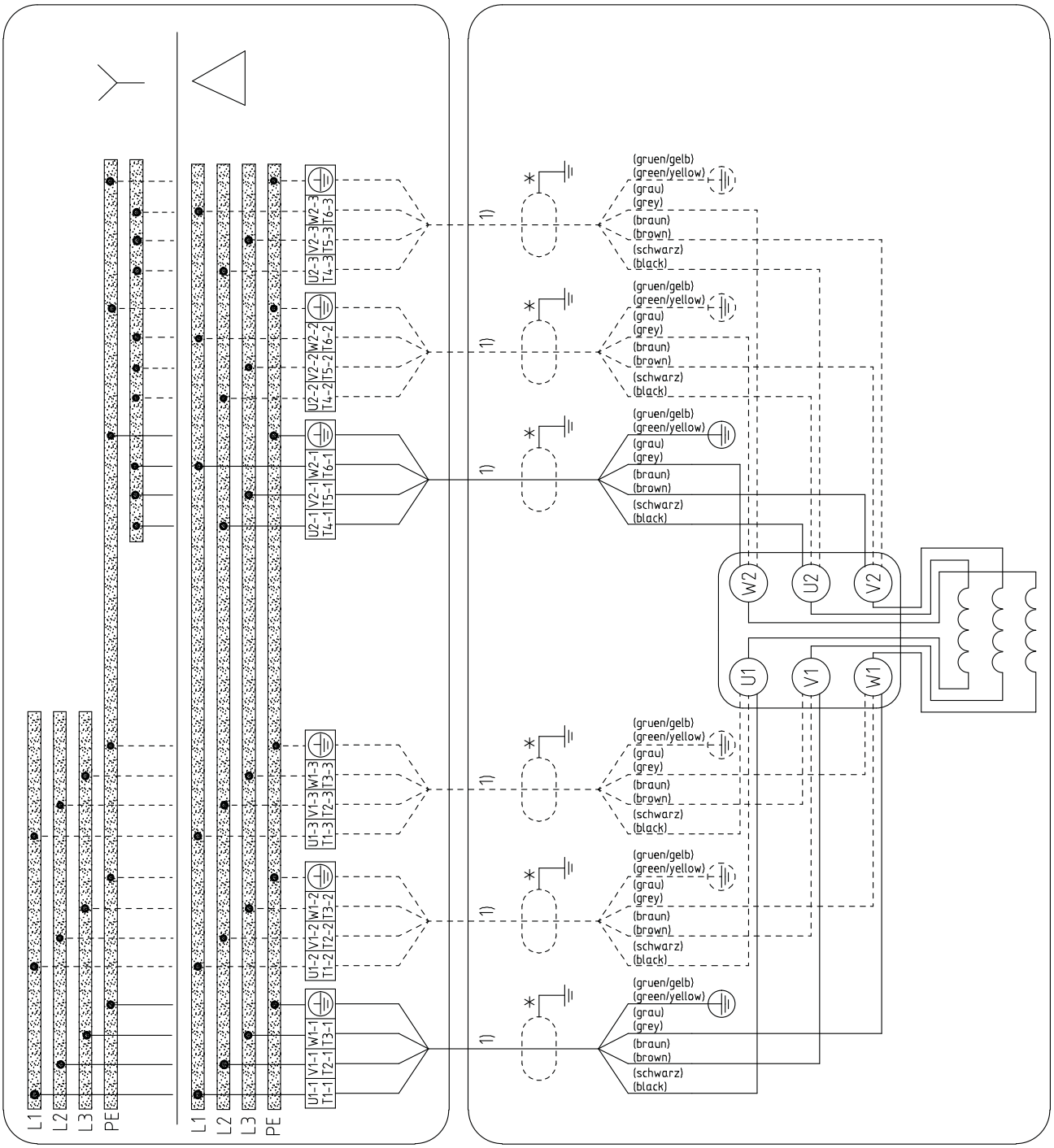


Fig. 73: Wiring diagram for the power cables

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

9.4.2 Wiring diagram for the sensors

Standard pump set

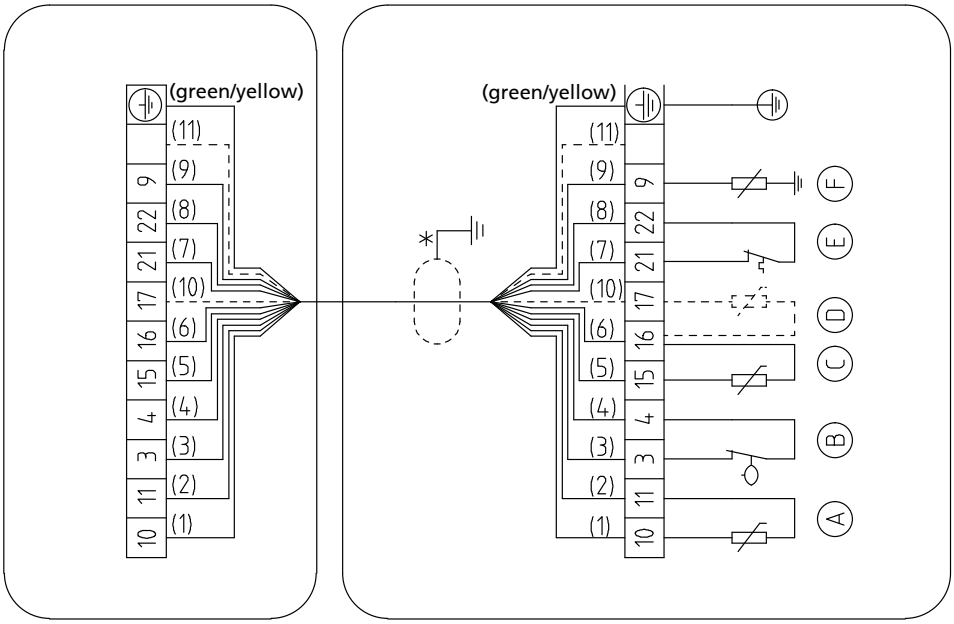


Fig. 74: Wiring diagram for sensors of standard pump sets

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

Pump sets with additional monitoring by vibration sensor

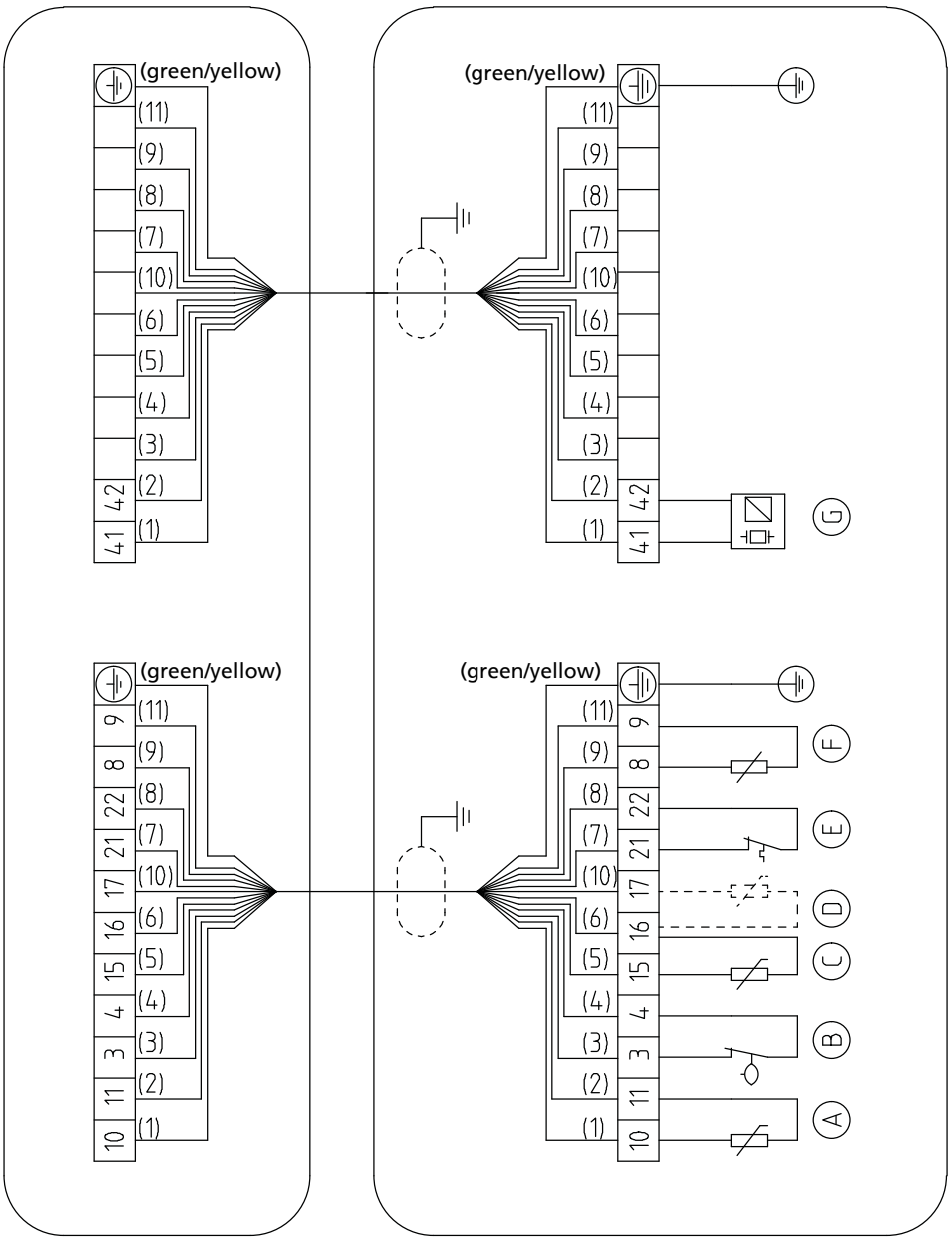


Fig. 75: Sensor wiring diagram for pump sets with additional monitoring by vibration sensor

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

Pump sets with additional Pt100 motor temperature monitoring

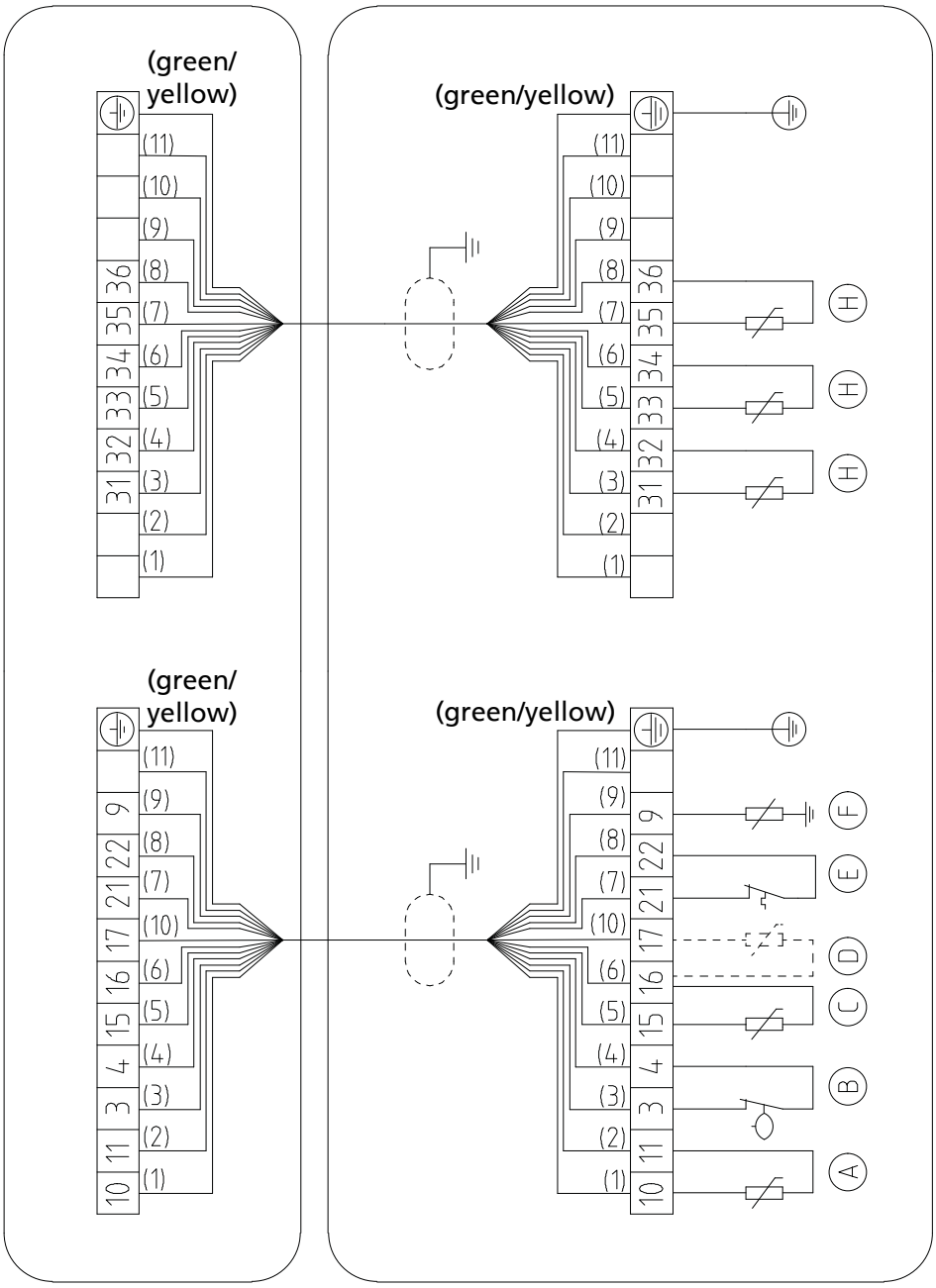


Fig. 76: Sensor wiring diagram for pump sets with additional Pt100 motor temperature monitoring

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

Pump sets with additional Pt100 motor temperature monitoring and vibration sensor

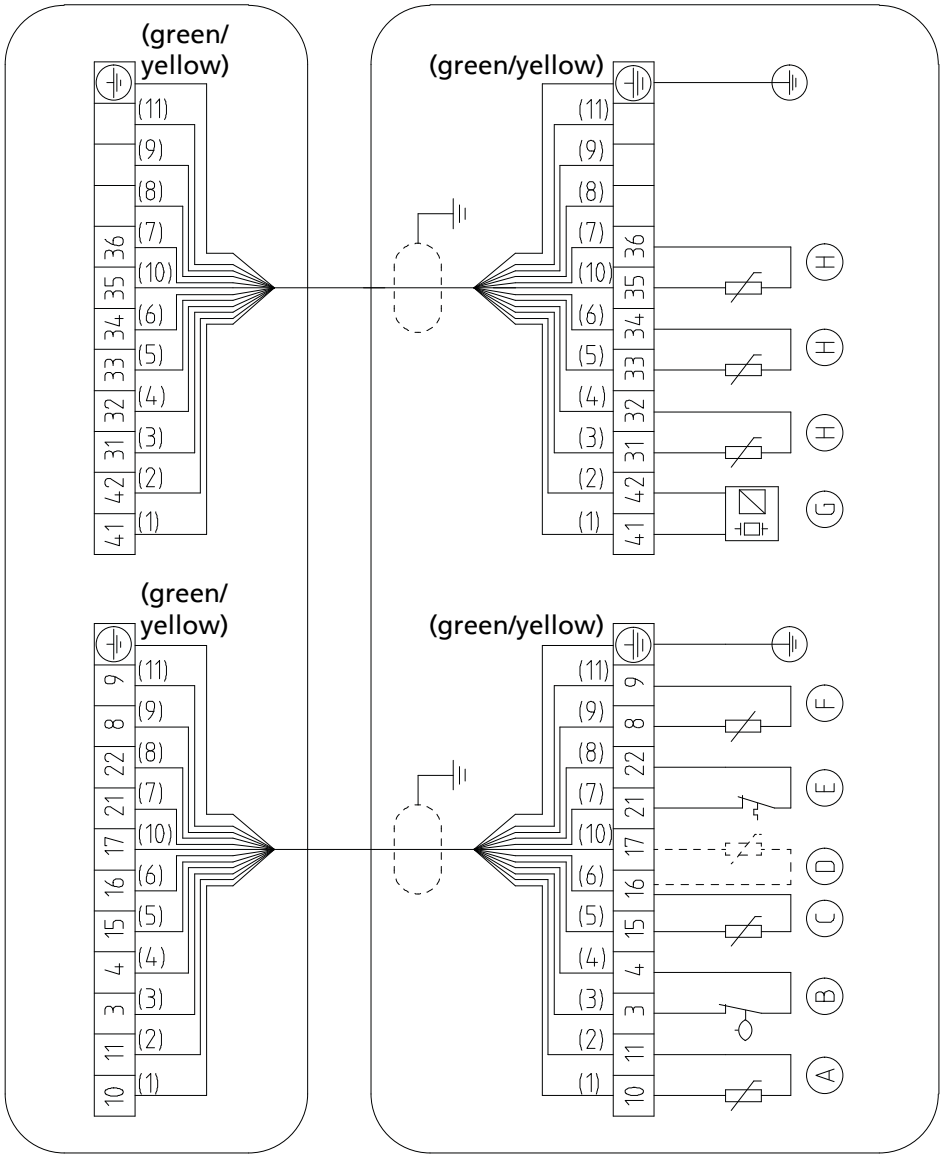


Fig. 77: Sensor wiring diagram for pump sets with additional Pt100 motor temperature monitoring and vibration sensor

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

9.5 Flamepaths on explosion-proof motors

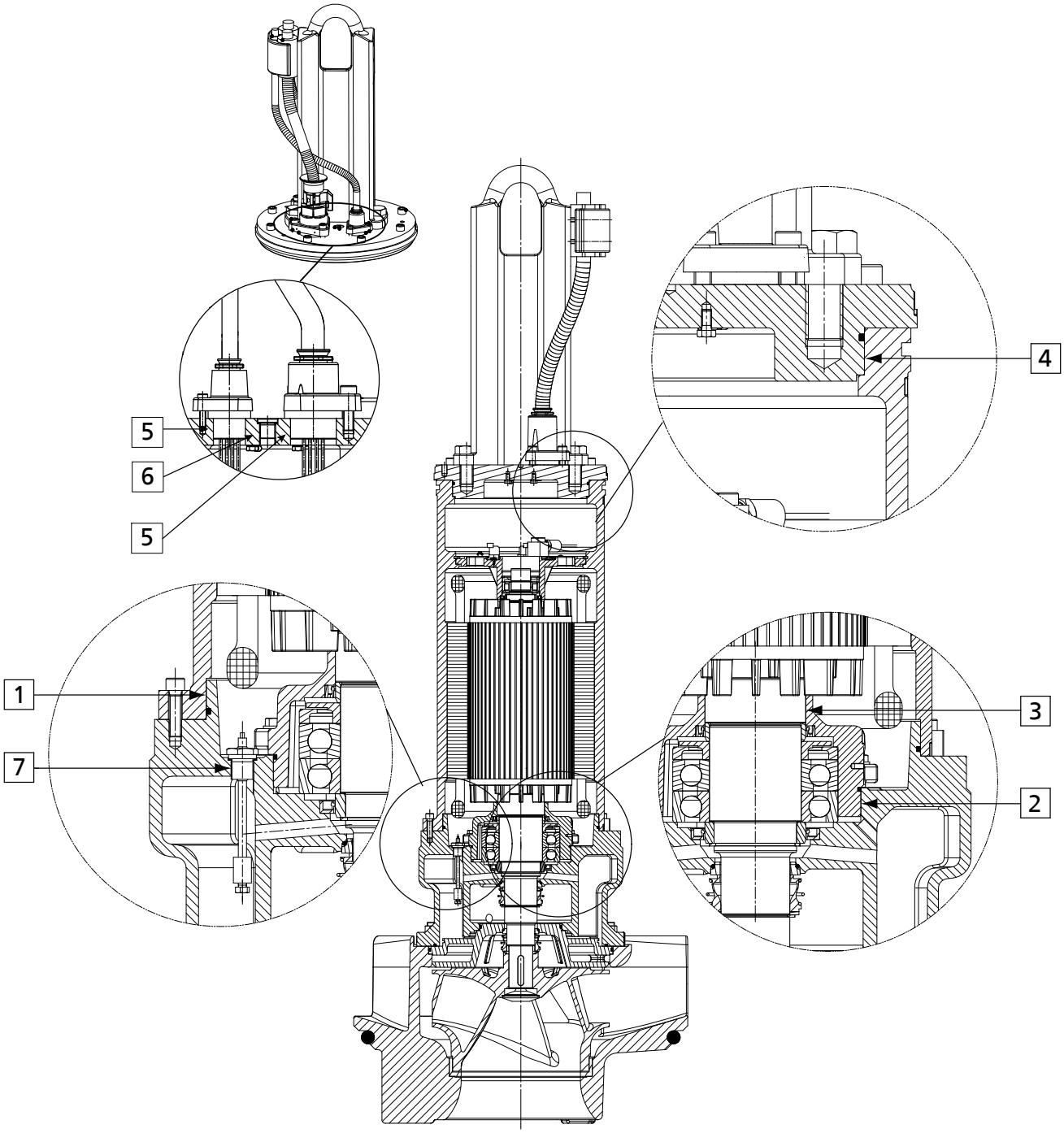


Fig. 78: Flamepaths for explosion-proof motors

9.6 Sectional drawings of the mechanical seal

Motors 60 6.N, 80 6.N, 50 8.N, 65 8.N, 75 8.N, 90 8.N, 110 8.N, 130 8.N, 40 10.N, 60 10.N, 75 10.N, 90 10.N

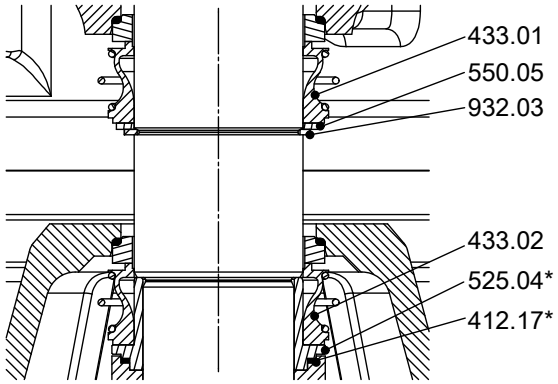


Fig. 79: Mechanical seal for motors 60 6.N, 80 6.N, 50 8.N, 65 8.N, 75 8.N, 90 8.N, 110 8.N, 130 8.N, 40 10.N, 60 10.N, 75 10.N, 90 10.N

*: Not for tapered fit

Table 66: 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 150 8.N, 185 8.N, 220 8.N, 110 10.N, 150 10.N

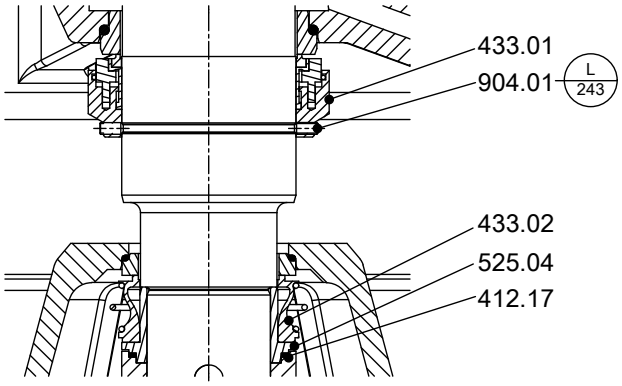


Fig. 80: Mechanical seal for motors 150 8.N, 185 8.N, 220 8.N, 110 10.N, 150 10.N

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	Grub screw

Table 68: Key to the symbols and codes

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

Mechanical seal with covered spring, standard for motors 260 8.N, 300 8.N, 350 8.N

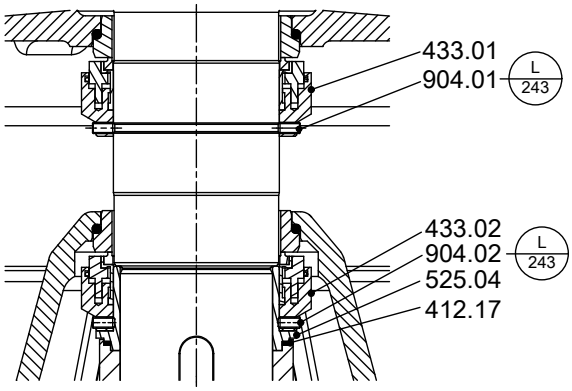


Fig. 81: Mechanical seal with covered spring, standard for motors 260 8.N, 300 8.N, 350 8.N

Table 69: 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 70: Key to the symbols and codes

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

Mechanical seal with covered spring, optional for motors 60 6.N, 80 6.N, 50 8.N, 65 8.N, 75 8.N, 90 8.N, 110 8.N, 130 8.N, 150 8.N, 185 8.N, 220 8.N, 40 10.N, 60 10.N, 75 10.N, 90 10.N, 110 10.N, 150 10.N

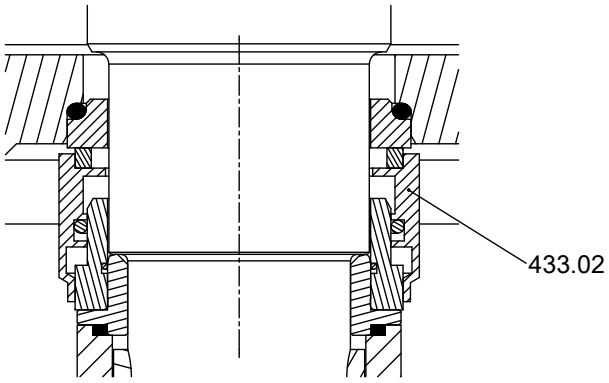


Fig. 82: Mechanical seal with covered spring, optional for motors 60 6.N, 80 6.N, 50 8.N, 65 8.N, 75 8.N, 90 8.N, 110 8.N, 130 8.N, 150 8.N, 185 8.N, 220 8.N, 40 10.N, 60 10.N, 75 10.N, 90 10.N, 110 10.N, 150 10.N

Table 71: List of components

Part No.	Description	Part No.	Description
433.02	Mechanical seal		

9.7 Dimensions

9.7.1 Motor version UN, XN [inch]

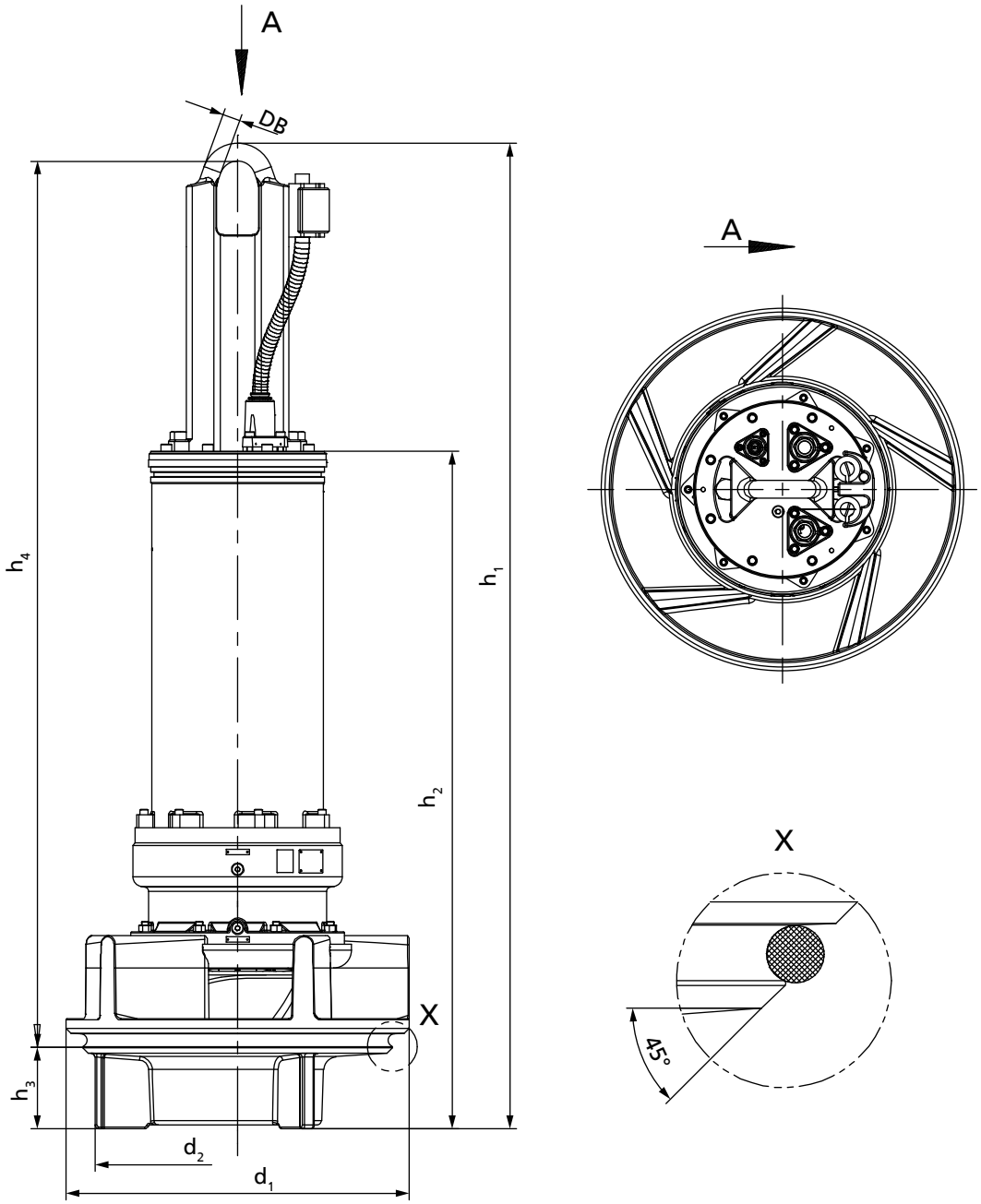


Fig. 83: Pump set dimensions

Table 72: Pump set dimensions [inch]

Size	Motor	d_1	d_2	DB	h_1	h_2	h_3	h_4	[lbs][12)]
800-370	80 6.N	$29^{15}/_{16}$	$25^{3}/_{16}$	$1^{9}/_{16}$	$90^{3}/_{4}$	$63^{9}/_{16}$	$5^{13}/_{16}$	$83^{7}/_{16}$	2293
800-400	65 8.N	$30^{5}/_{16}$	$25^{3}/_{16}$	$1^{9}/_{16}$	$94^{7}/_{8}$	$67^{11}/_{16}$	$7^{3}/_{16}$	86	2447
800-401	60 6.N	$30^{5}/_{16}$	$25^{3}/_{16}$	$1^{9}/_{16}$	87	$59^{13}/_{16}$	$7^{3}/_{16}$	$78^{1}/_{8}$	2249
800-401	80 6.N	$30^{5}/_{16}$	$25^{3}/_{16}$	$1^{9}/_{16}$	$94^{7}/_{8}$	$67^{11}/_{16}$	$7^{3}/_{16}$	86	2469
800-401	65 8.N	$30^{5}/_{16}$	$25^{3}/_{16}$	$1^{9}/_{16}$	$94^{7}/_{8}$	$67^{11}/_{16}$	$7^{3}/_{16}$	86	2469
1000-420	50 8.N	$38^{3}/_{16}$	$33^{1}/_{16}$	$1^{9}/_{16}$	$90^{15}/_{16}$	$63^{3}/_{4}$	$8^{1}/_{4}$	$81^{1}/_{8}$	2800

12) Pump set with 10 m power cable (460 V)

Size	Motor	d_1	d_2	DB	h_1	h_2	h_3	h_4	[lbs][12]
1000-420	75 8.N	$38^{3}/_{16}$	$33^{1}/_{16}$	$1^{9}/_{16}$	$98^{13}/_{16}$	$71^{5}/_{8}$	$8^{1}/_{4}$	89	3197
1000-420	90 8.N	$38^{3}/_{16}$	$33^{1}/_{16}$	$1^{9}/_{16}$	$103^{3}/_{8}$	$76^{3}/_{16}$	$8^{1}/_{4}$	$93^{1}/_{2}$	3219
1000-420	110 8.N	$38^{3}/_{16}$	$33^{1}/_{16}$	$1^{9}/_{16}$	$103^{3}/_{8}$	$76^{3}/_{16}$	$8^{1}/_{4}$	$93^{1}/_{2}$	3836
1000-500	75 8.N	$38^{3}/_{16}$	$32^{5}/_{16}$	$1^{9}/_{16}$	99	$71^{7}/_{8}$	$8^{1}/_{16}$	$89^{3}/_{8}$	3219
1000-500	90 8.N	$38^{3}/_{16}$	$32^{5}/_{16}$	$1^{9}/_{16}$	$103^{9}/_{16}$	$76^{3}/_{8}$	$8^{1}/_{16}$	$93^{7}/_{8}$	3748
1000-500	110 8.N	$38^{3}/_{16}$	$32^{5}/_{16}$	$1^{9}/_{16}$	$103^{9}/_{16}$	$76^{3}/_{8}$	$8^{1}/_{16}$	$93^{7}/_{8}$	3880
1000-500	130 8.N	$38^{3}/_{16}$	$32^{5}/_{16}$	$1^{9}/_{16}$	$103^{9}/_{16}$	$76^{3}/_{8}$	$8^{1}/_{16}$	$93^{7}/_{8}$	4012
1000-500	150 8.N	$38^{3}/_{16}$	$32^{5}/_{16}$	$1^{15}/_{16}$	$113^{9}/_{16}$	$89^{15}/_{16}$	$8^{1}/_{16}$	$103^{9}/_{16}$	5512
1000-500	185 8.N	$38^{3}/_{16}$	$32^{5}/_{16}$	$1^{15}/_{16}$	$113^{9}/_{16}$	$89^{15}/_{16}$	$8^{1}/_{16}$	$103^{9}/_{16}$	5864
1000-500	40 10.N	$38^{3}/_{16}$	$32^{5}/_{16}$	$1^{9}/_{16}$	$103^{9}/_{16}$	$76^{3}/_{8}$	$8^{1}/_{16}$	$93^{7}/_{8}$	3593
1000-500	60 10.N	$38^{3}/_{16}$	$32^{5}/_{16}$	$1^{9}/_{16}$	$103^{9}/_{16}$	$76^{3}/_{8}$	$8^{1}/_{16}$	$93^{7}/_{8}$	3682
1000-500	75 10.N	$38^{3}/_{16}$	$32^{5}/_{16}$	$1^{9}/_{16}$	$103^{9}/_{16}$	$76^{3}/_{8}$	$8^{1}/_{16}$	$93^{7}/_{8}$	3814
1200-630	130 8.N	$44^{7}/_{8}$	$37^{13}/_{16}$	$1^{9}/_{16}$	$105^{11}/_{16}$	$78^{9}/_{16}$	$10^{9}/_{16}$	$93^{11}/_{16}$	4608
1200-630	150 8.N	$44^{7}/_{8}$	$37^{13}/_{16}$	$1^{15}/_{16}$	$115^{3}/_{4}$	$92^{1}/_{8}$	$10^{9}/_{16}$	$103^{1}/_{8}$	5997
1200-630	185 8.N	$44^{7}/_{8}$	$37^{13}/_{16}$	$1^{15}/_{16}$	$115^{3}/_{4}$	$92^{1}/_{8}$	$10^{9}/_{16}$	$103^{1}/_{8}$	6349
1200-630	220 8.N	$44^{7}/_{8}$	$37^{13}/_{16}$	$1^{15}/_{16}$	$115^{3}/_{4}$	$92^{1}/_{8}$	$10^{9}/_{16}$	$103^{1}/_{8}$	6856
1200-630	260 8.N	$44^{7}/_{8}$	$37^{13}/_{16}$	$2^{3}/_{8}$	$126^{3}/_{16}$	$98^{5}/_{8}$	$10^{9}/_{16}$	$113^{3}/_{16}$	7915
1200-630	300 8.N	$44^{7}/_{8}$	$37^{13}/_{16}$	$2^{3}/_{8}$	$135^{1}/_{16}$	$107^{1}/_{2}$	$10^{9}/_{16}$	$132^{5}/_{16}$	8532
1200-630	350 8.N	$44^{7}/_{8}$	$37^{13}/_{16}$	$2^{3}/_{8}$	$135^{1}/_{16}$	$107^{1}/_{2}$	$10^{9}/_{16}$	$132^{5}/_{16}$	9502
1200-630	60 10.N	$44^{7}/_{8}$	$37^{13}/_{16}$	$1^{9}/_{16}$	$105^{11}/_{16}$	$78^{9}/_{16}$	$10^{9}/_{16}$	$93^{11}/_{16}$	4255
1200-630	75 10.N	$44^{7}/_{8}$	$37^{13}/_{16}$	$1^{9}/_{16}$	$105^{11}/_{16}$	$78^{9}/_{16}$	$10^{9}/_{16}$	$93^{11}/_{16}$	4387
1200-630	90 10.N	$44^{7}/_{8}$	$37^{13}/_{16}$	$1^{9}/_{16}$	$105^{11}/_{16}$	$78^{9}/_{16}$	$10^{9}/_{16}$	$93^{11}/_{16}$	4541
1200-630	110 10.N	$44^{7}/_{8}$	$37^{13}/_{16}$	$1^{15}/_{16}$	$115^{3}/_{4}$	$92^{1}/_{8}$	$10^{9}/_{16}$	$103^{1}/_{8}$	5842
1200-630	150 10.N	$44^{7}/_{8}$	$37^{13}/_{16}$	$1^{15}/_{16}$	$115^{3}/_{4}$	$92^{1}/_{8}$	$10^{9}/_{16}$	$103^{1}/_{8}$	6173

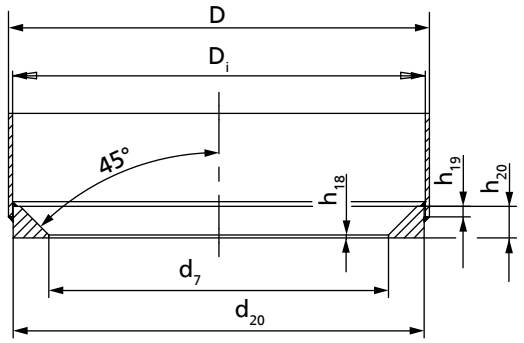


Fig. 84: Seating ring dimensions

Table 73: Seating ring dimensions [inch]

Size	Motor	D[13]	D_i	d_7	d_{20}	h_{18}	h_{19}	h_{20}
800-370	80 6.N	32	$31^{3}/_{8}$	$25^{13}/_{16}$	$31^{1}/_{4}$	$^{3}/_{16}$	$^{13}/_{16}$	$2^{3}/_{8}$
800-400	65 8.N	32	$31^{3}/_{8}$	$25^{13}/_{16}$	$31^{1}/_{4}$	$^{3}/_{16}$	$^{13}/_{16}$	$2^{3}/_{8}$
800-401	60 6.N	32	$31^{3}/_{8}$	$25^{13}/_{16}$	$31^{1}/_{4}$	$^{3}/_{16}$	$^{13}/_{16}$	$2^{3}/_{8}$
800-401	80 6.N	32	$31^{3}/_{8}$	$25^{13}/_{16}$	$31^{1}/_{4}$	$^{3}/_{16}$	$^{13}/_{16}$	$2^{3}/_{8}$
800-401	65 8.N	32	$31^{3}/_{8}$	$25^{13}/_{16}$	$31^{1}/_{4}$	$^{3}/_{16}$	$^{13}/_{16}$	$2^{3}/_{8}$
1000-420	50 8.N	40	$39^{3}/_{16}$	$33^{11}/_{16}$	$39^{1}/_{16}$	$^{3}/_{16}$	$^{13}/_{16}$	$2^{3}/_{8}$
1000-420	75 8.N	40	$39^{3}/_{16}$	$33^{11}/_{16}$	$39^{1}/_{16}$	$^{3}/_{16}$	$^{13}/_{16}$	$2^{3}/_{8}$
1000-420	90 8.N	40	$39^{3}/_{16}$	$33^{11}/_{16}$	$39^{1}/_{16}$	$^{3}/_{16}$	$^{13}/_{16}$	$2^{3}/_{8}$
1000-420	110 8.N	40	$39^{3}/_{16}$	$33^{11}/_{16}$	$39^{1}/_{16}$	$^{3}/_{16}$	$^{13}/_{16}$	$2^{3}/_{8}$
1000-500	75 8.N	40	$39^{3}/_{16}$	$33^{11}/_{16}$	$39^{1}/_{16}$	$^{3}/_{16}$	$^{13}/_{16}$	$2^{3}/_{8}$
1000-500	90 8.N	40	$39^{3}/_{16}$	$33^{11}/_{16}$	$39^{1}/_{16}$	$^{3}/_{16}$	$^{13}/_{16}$	$2^{3}/_{8}$
1000-500	110 8.N	40	$39^{3}/_{16}$	$33^{11}/_{16}$	$39^{1}/_{16}$	$^{3}/_{16}$	$^{13}/_{16}$	$2^{3}/_{8}$

13) D for recommended wall thickness of the discharge tube (see dimension s1 in the general arrangement drawings or in General Arrangement Drawings booklet 1579.396)

Size	Motor	D[13]	D_i	d_7	d_{20}	h_{18}	h_{19}	h_{20}
1000-500	130 8.N	40	$39^{3}/_{16}$	$33^{11}/_{16}$	$39^{1}/_{16}$	$^{3}/_{16}$	$^{13}/_{16}$	$2^{3}/_{8}$
1000-500	150 8.N	40	$39^{3}/_{16}$	$33^{11}/_{16}$	$39^{1}/_{16}$	$^{3}/_{16}$	$^{13}/_{16}$	$2^{3}/_{8}$
1000-500	185 8.N	40	$39^{3}/_{16}$	$33^{11}/_{16}$	$39^{1}/_{16}$	$^{3}/_{16}$	$^{13}/_{16}$	$2^{3}/_{8}$
1000-500	40 10.N	40	$39^{3}/_{16}$	$33^{11}/_{16}$	$39^{1}/_{16}$	$^{3}/_{16}$	$^{13}/_{16}$	$2^{3}/_{8}$
1000-500	60 10.N	40	$39^{3}/_{16}$	$33^{11}/_{16}$	$39^{1}/_{16}$	$^{3}/_{16}$	$^{13}/_{16}$	$2^{3}/_{8}$
1000-500	75 10.N	40	$39^{3}/_{16}$	$33^{11}/_{16}$	$39^{1}/_{16}$	$^{3}/_{16}$	$^{13}/_{16}$	$2^{3}/_{8}$
1200-630	130 8.N	$48^{1}/_{16}$	$47^{1}/_{16}$	$39^{15}/_{16}$	$46^{15}/_{16}$	$^{3}/_{16}$	$^{13}/_{16}$	$2^{3}/_{8}$
1200-630	150 8.N	$48^{1}/_{16}$	$47^{1}/_{16}$	$39^{15}/_{16}$	$46^{15}/_{16}$	$^{3}/_{16}$	$^{13}/_{16}$	$2^{3}/_{8}$
1200-630	185 8.N	$48^{1}/_{16}$	$47^{1}/_{16}$	$39^{15}/_{16}$	$46^{15}/_{16}$	$^{3}/_{16}$	$^{13}/_{16}$	$2^{3}/_{8}$
1200-630	220 8.N	$48^{1}/_{16}$	$47^{1}/_{16}$	$39^{15}/_{16}$	$46^{15}/_{16}$	$^{3}/_{16}$	$^{13}/_{16}$	$2^{3}/_{8}$
1200-630	260 8.N	$48^{1}/_{16}$	$47^{1}/_{16}$	$39^{15}/_{16}$	$46^{15}/_{16}$	$^{3}/_{16}$	$^{13}/_{16}$	$2^{3}/_{8}$
1200-630	300 8.N	$48^{1}/_{16}$	$47^{1}/_{16}$	$39^{15}/_{16}$	$46^{15}/_{16}$	$^{3}/_{16}$	$^{13}/_{16}$	$2^{3}/_{8}$
1200-630	350 8.N	$48^{1}/_{16}$	$47^{1}/_{16}$	$39^{15}/_{16}$	$46^{15}/_{16}$	$^{3}/_{16}$	$^{13}/_{16}$	$2^{3}/_{8}$
1200-630	60 10.N	$48^{1}/_{16}$	$47^{1}/_{16}$	$39^{15}/_{16}$	$46^{15}/_{16}$	$^{3}/_{16}$	$^{13}/_{16}$	$2^{3}/_{8}$
1200-630	75 10.N	$48^{1}/_{16}$	$47^{1}/_{16}$	$39^{15}/_{16}$	$46^{15}/_{16}$	$^{3}/_{16}$	$^{13}/_{16}$	$2^{3}/_{8}$
1200-630	90 10.N	$48^{1}/_{16}$	$47^{1}/_{16}$	$39^{15}/_{16}$	$46^{15}/_{16}$	$^{3}/_{16}$	$^{13}/_{16}$	$2^{3}/_{8}$
1200-630	110 10.N	$48^{1}/_{16}$	$47^{1}/_{16}$	$39^{15}/_{16}$	$46^{15}/_{16}$	$^{3}/_{16}$	$^{13}/_{16}$	$2^{3}/_{8}$
1200-630	150 10.N	$48^{1}/_{16}$	$47^{1}/_{16}$	$39^{15}/_{16}$	$46^{15}/_{16}$	$^{3}/_{16}$	$^{13}/_{16}$	$2^{3}/_{8}$

9.7.2 Motor version UN, XN [mm]

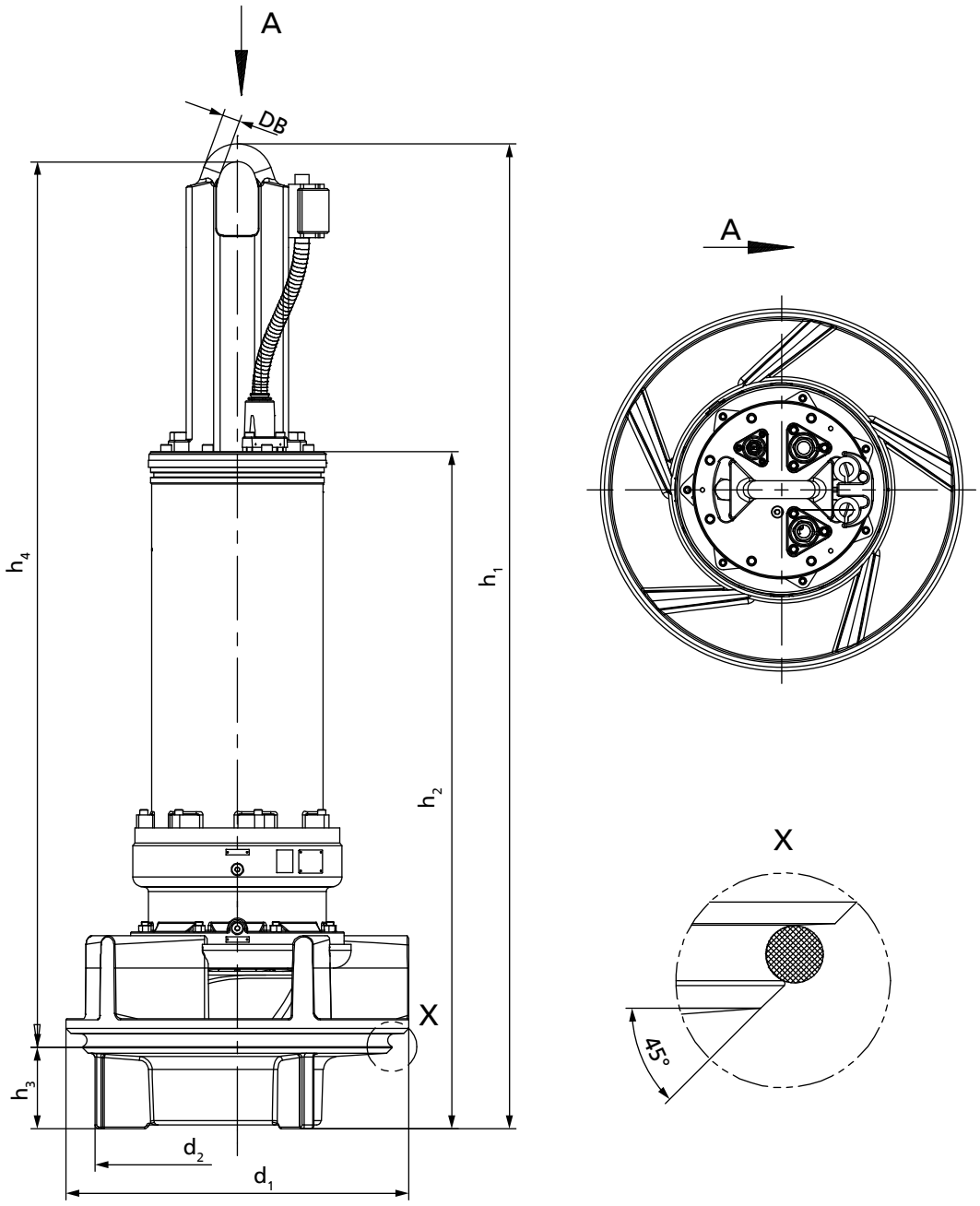


Fig. 85: Pump set dimensions

Table 74: Pump set dimensions [mm]

Size	Motor	d_1	d_2	DB	h_1	h_2	h_3	h_4	[kg][14]
800-370	80 6.N	760	640	40	2305	1615	148	2120	1040
800-400	65 8.N	770	640	40	2410	1720	183	2185	1110
800-401	60 6.N	770	640	40	2210	1520	183	1985	1020
800-401	80 6.N	770	640	40	2410	1720	183	2185	1120
800-401	65 8.N	770	640	40	2410	1720	183	2185	1120
1000-420	50 8.N	970	840	40	2310	1620	209	2060	1270
1000-420	75 8.N	970	840	40	2510	1820	209	2260	1450
1000-420	90 8.N	970	840	40	2625	1935	209	2375	1460

14) Pump set with 10 m power cable (460 V)

Size	Motor	d_1	d_2	DB	h_1	h_2	h_3	h_4	[kg][14]
1000-420	110 8.N	970	840	40	2625	1935	209	2375	1740
1000-500	75 8.N	970	820	40	2515	1825	205	2270	1460
1000-500	90 8.N	970	820	40	2630	1940	205	2385	1700
1000-500	110 8.N	970	820	40	2630	1940	205	2385	1760
1000-500	130 8.N	970	820	40	2630	1940	205	2385	1820
1000-500	150 8.N	970	820	50	2885	2285	205	2630	2500
1000-500	185 8.N	970	820	50	2885	2285	205	2630	2660
1000-500	40 10.N	970	820	40	2630	1940	205	2385	1630
1000-500	60 10.N	970	820	40	2630	1940	205	2385	1670
1000-500	75 10.N	970	820	40	2630	1940	205	2385	1730
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	220 8.N	1140	960	50	2940	2340	268	2620	3110
1200-630	260 8.N	1140	960	60	3205	2505	268	2875	3590
1200-630	300 8.N	1140	960	60	3430	2730	268	3360	3870
1200-630	350 8.N	1140	960	60	3430	2730	268	3360	4310
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
1200-630	90 10.N	1140	960	40	2685	1995	268	2380	2060
1200-630	110 10.N	1140	960	50	2940	2340	268	2620	2650
1200-630	150 10.N	1140	960	50	2940	2340	268	2620	2800

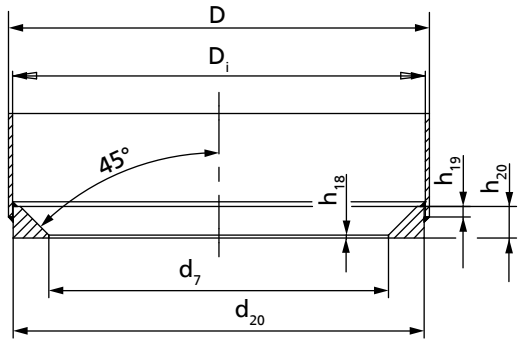


Fig. 86: Seating ring dimensions

Table 75: Seating ring dimensions [mm]

Size	Motor	D[15]	D_i	d_7	d_{20}	h_{18}	h_{19}	h_{20}
800-370	80 6.N	813	797	656	793	5	20	60
800-400	65 8.N	813	797	656	793	5	20	60
800-401	60 6.N	813	797	656	793	5	20	60
800-401	80 6.N	813	797	656	793	5	20	60
800-401	65 8.N	813	797	656	793	5	20	60
1000-420	50 8.N	1016	996	856	992	5	20	60
1000-420	75 8.N	1016	996	856	992	5	20	60
1000-420	90 8.N	1016	996	856	992	5	20	60
1000-420	110 8.N	1016	996	856	992	5	20	60
1000-500	75 8.N	1016	996	856	992	5	20	60
1000-500	90 8.N	1016	996	856	992	5	20	60
1000-500	110 8.N	1016	996	856	992	5	20	60
1000-500	130 8.N	1016	996	856	992	5	20	60
1000-500	150 8.N	1016	996	856	992	5	20	60

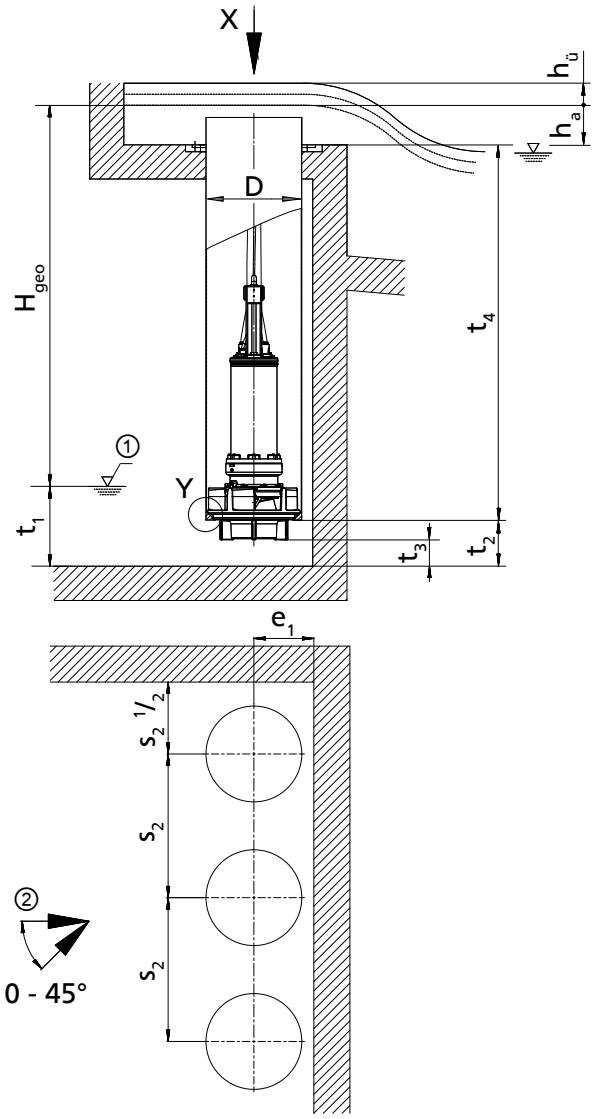
15) D for recommended wall thickness of the discharge tube (see dimension s1 in the general arrangement drawings or in General Arrangement Drawings booklet 1579.396)

Size	Motor	D[15)]	D_i	d_7	d_{20}	h_{18}	h_{19}	h_{20}
1000-500	185 8.N	1016	996	856	992	5	20	60
1000-500	40 10.N	1016	996	856	992	5	20	60
1000-500	60 10.N	1016	996	856	992	5	20	60
1000-500	75 10.N	1016	996	856	992	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	220 8.N	1220	1196	1015	1192	5	20	60
1200-630	260 8.N	1220	1196	1015	1192	5	20	60
1200-630	300 8.N	1220	1196	1015	1192	5	20	60
1200-630	350 8.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
1200-630	90 10.N	1220	1196	1015	1192	5	20	60
1200-630	110 10.N	1220	1196	1015	1192	5	20	60
1200-630	150 10.N	1220	1196	1015	1192	5	20	60

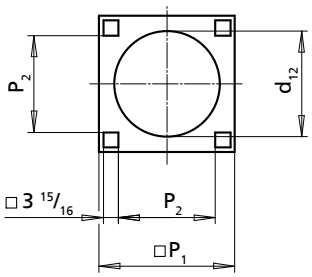
16) All dimensions for foundation recesses apply to discharge tube design without intermediate flange.

9.8 General arrangement drawings

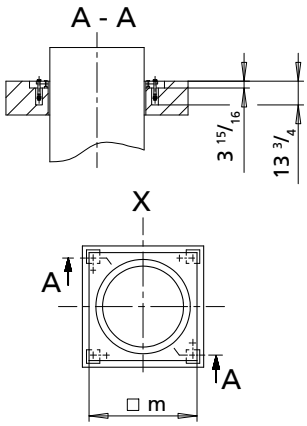
9.8.1 Installation type BU, motor version UN, XN



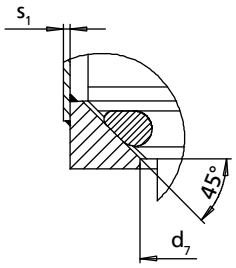
①: Minimum water level (values see diagram on the following page)
②: Approach flow



Foundation recesses[16)]



Detail X:
Support plate of the discharge tube
Drawing: without pump



Detail Y:
seating ring

Table 76: Dimensions [inch]

Size	D	d_7	d_{12}	e_1[17)]	h_a	m	p_1	p_2	$s_{1\ min.}$	$s_{2\ min.}$	t_2[17)]	t_3	$t_{4\ min.}$[18)]
800-370	32	25 13/16	33 7/16	18 7/8	3 15/16	35 13/16	39 3/8	29 1/8	5/16	47 1/4	13	7 7/8	92 1/2
800-400	32	25 13/16	33 7/16	18 7/8	3 15/16	35 13/16	39 3/8	29 1/8	5/16	55 1/8	16 1/8	9 13/16	96 7/16
800-401	32	25 13/16	33 7/16	18 7/8	3 15/16	35 13/16	39 3/8	29 1/8	5/16	55 1/8	16 1/8	9 13/16	96 7/16
1000-420	40	33 11/16	42 1/8	23 5/8	3 15/16	45 1/4	48 1/16	37 13/16	3/8	63	17 1/8	9 13/16	104 5/16
1000-500	40	33 11/16	42 1/8	23 5/8	3 15/16	45 1/4	48 1/16	37 13/16	3/8	70 7/8	18 7/8	11 13/16	114 3/16
1200-630	48 1/16	39 15/16	50 3/8	27 9/16	3 15/16	53 9/16	55 7/8	45 11/16	1/2	88 9/16	23 1/16	13 3/4	135 13/16

17) Observe this dimension.
18) 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

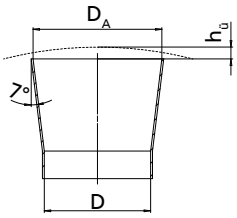
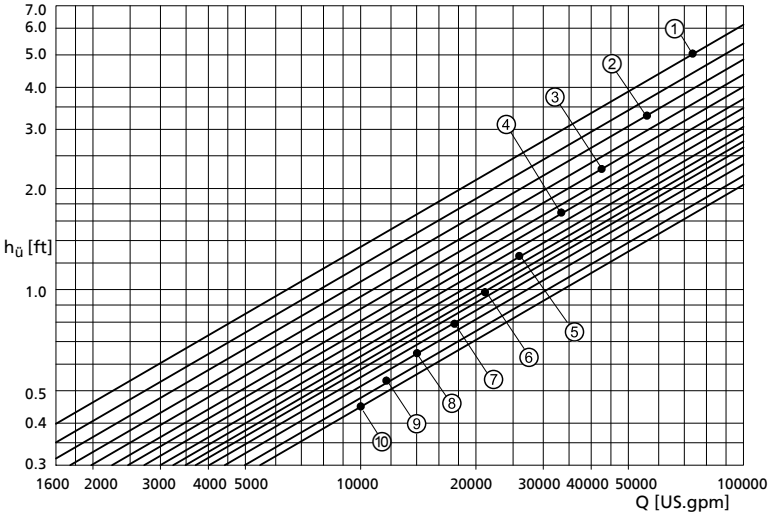


Illustration of the overflow head $h_ü$

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 $v^2 / 2g$ (v refers to D_A)

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

Minimum water level diagram

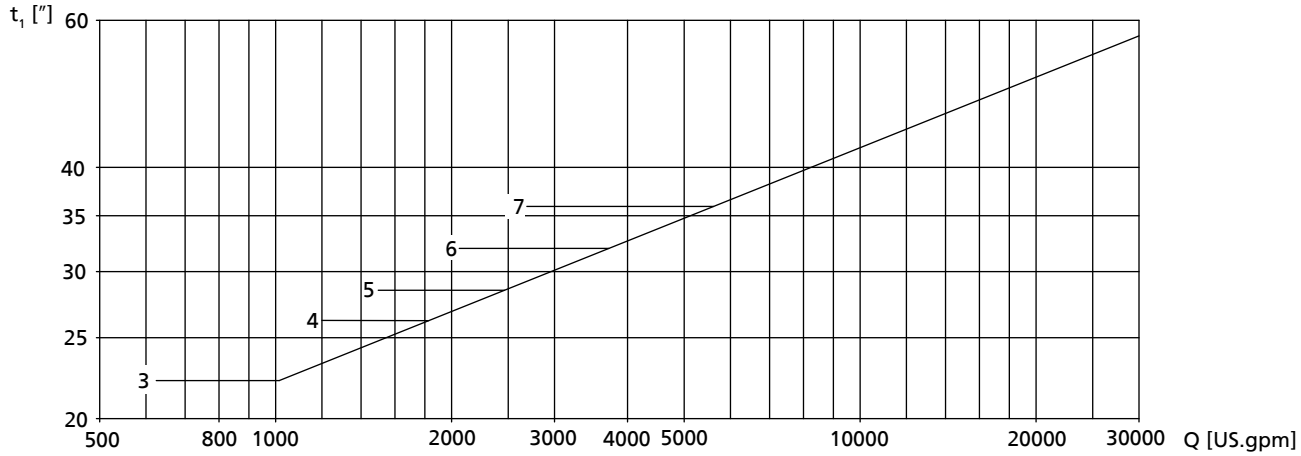
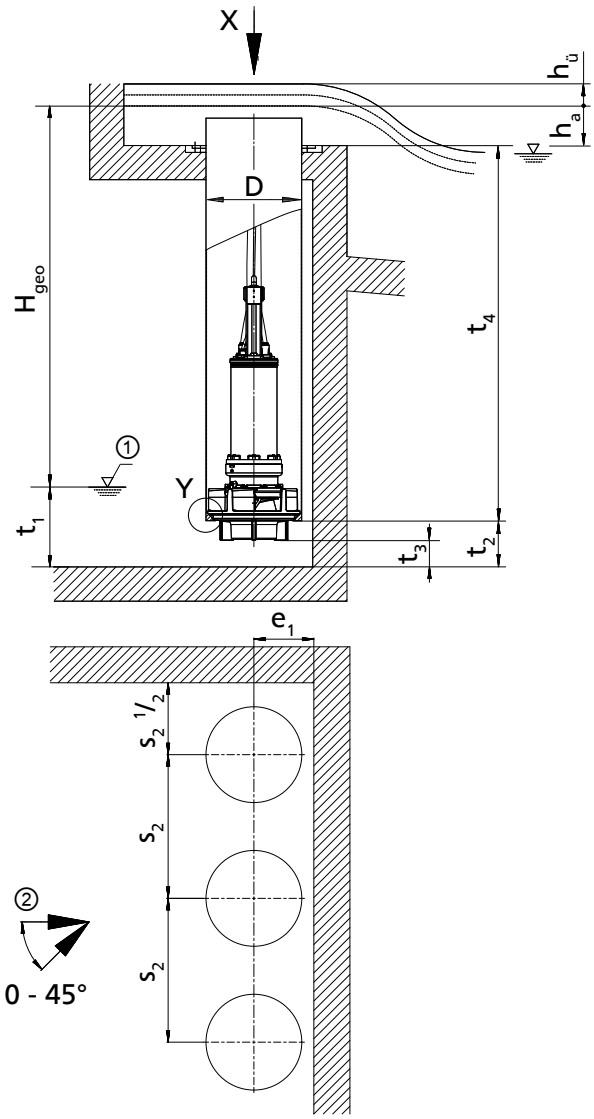


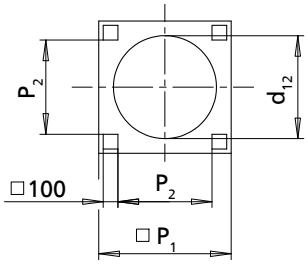
Fig. 87: Minimum water level diagram, motor version UN, XN

3	Amacan K 800-370
4	Amacan K 800-400, 800-401
5	Amacan K 1000-420
6	Amacan K 1000-500
7	Amacan K 1200-630

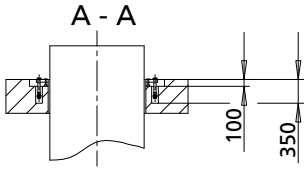
9.8.2 Installation type BU, motor version UN, XN

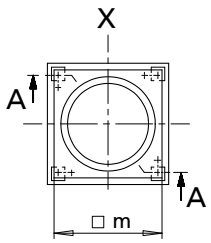


①: Minimum water level (values see diagram on the following page)
②: Approach flow

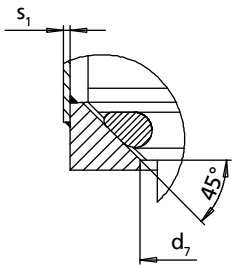


Foundation recesses[19)]





Detail X:
Support plate of the discharge tube
Drawing: without pump



Detail Y:
seating ring

Table 77: Dimensions [mm]

Size	D	d_7	d_{12}	e_1 [20)]	h_a	m	p_1	p_2	$s_{1\ min.}$	$s_{2\ min.}$	t_2 [20)]	t_3	$t_{4\ min.}$ [21)]
800-370	813	656	850	480	100	910	1000	740	8	1150	330	200	2350
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
1000-500	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

19) All dimensions for foundation recesses apply to discharge tube design without intermediate flange.
20) Observe this dimension.
21) 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

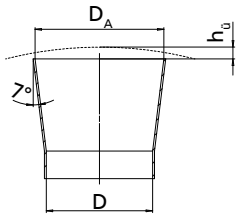
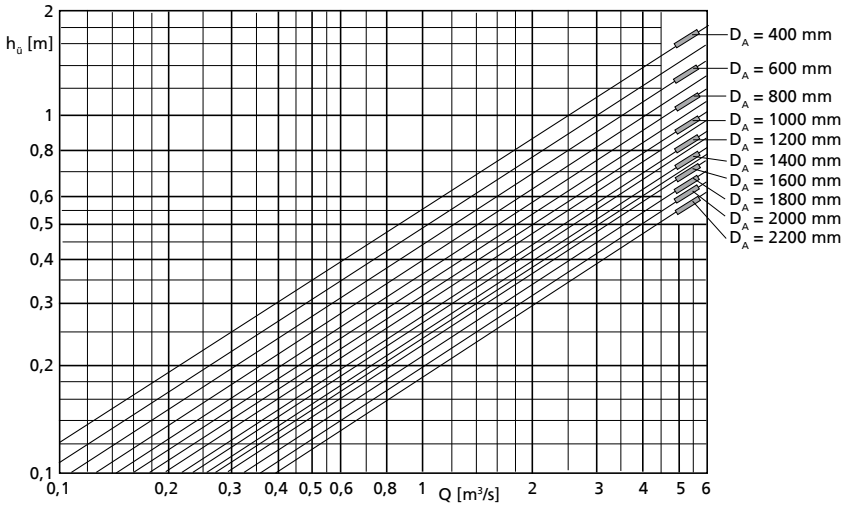


Illustration of the overflow head $h_{ü}$

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 design ∅ D_A. The characteristic curve values only apply to unimpeded outlet in all directions; otherwise they are approximate values only.

Minimum water level diagram

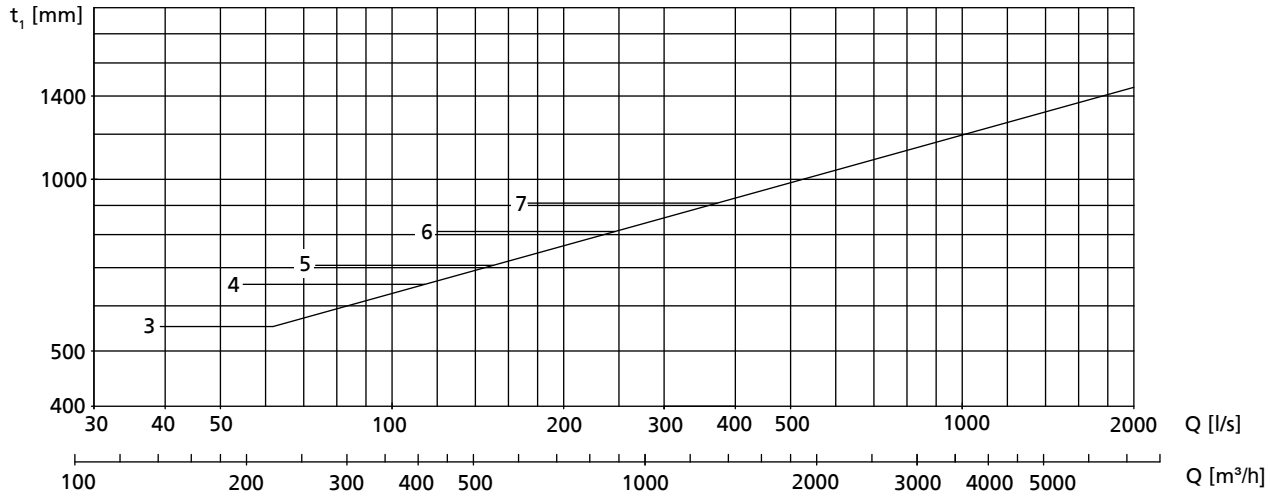
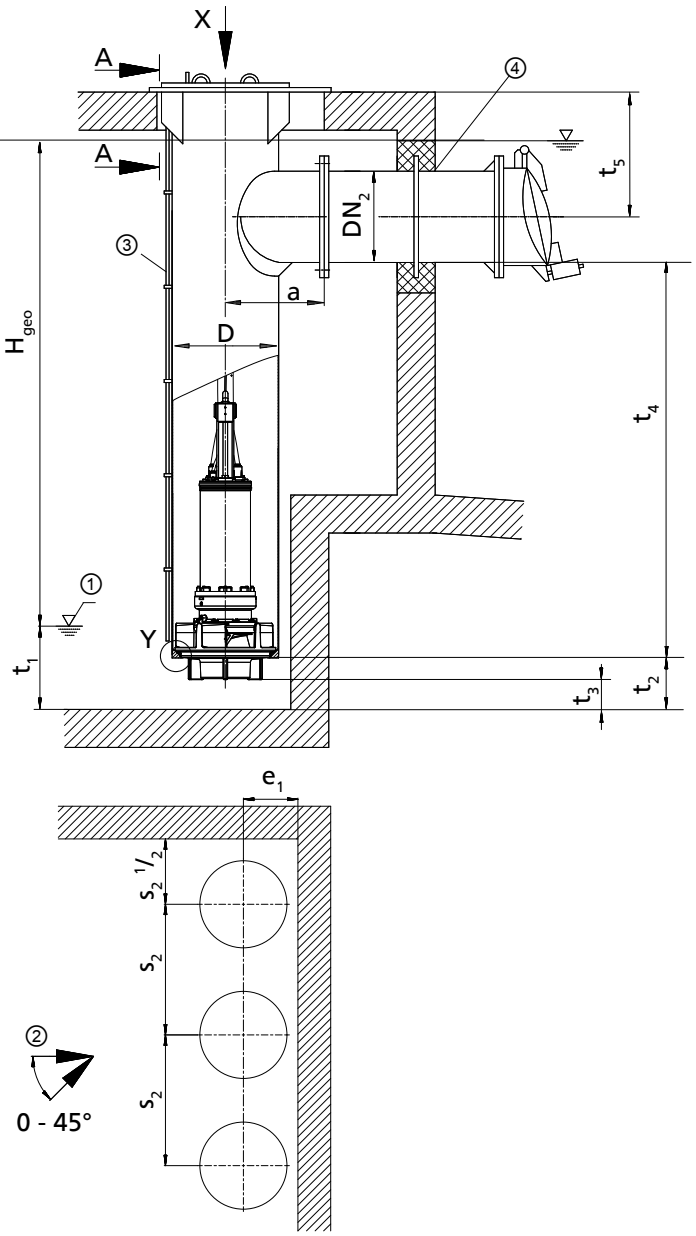
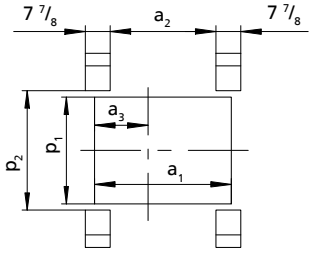


Fig. 88: Minimum water level diagram, motor version UN, XN

3	Amacan K 800-370
4	Amacan K 800-400, 800-401
5	Amacan K 1000-420
6	Amacan K 1000-500
7	Amacan K 1200-630

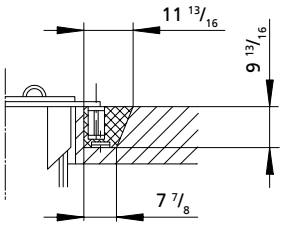
9.8.3 Installation type CU, motor version UN, XN



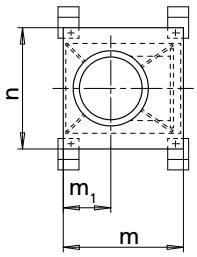


Foundation recesses[22)]

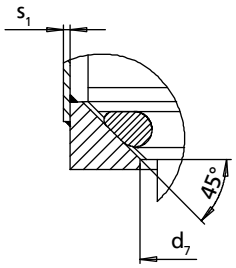
A – A



Section A - A:



Detail X:
Support plate of the discharge tube
Drawing: without pump



Detail Y:
seating ring

①: Minimum water level (values 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.

Table 78: Dimensions [inch]

Size	D	$DN_{2\ min.}$	$DN_{2\ max.}$	a	a_1 [23)]	a_2 [23)]	a_3 [23)]	d_7	e_1 [24)]	m [23)]	m_1 [23)]	n [23)]
800-370	32	15 3/4	27 9/16	27 9/16	48 1/16	38 3/16	18 7/8	25 13/16	18 7/8	50	19 7/8	49 5/8
800-400	32	15 3/4	27 9/16	27 9/16	48 1/16	38 3/16	18 7/8	25 13/16	18 7/8	50	19 7/8	49 5/8
800-401	32	15 3/4	27 9/16	27 9/16	48 1/16	38 3/16	18 7/8	25 13/16	18 7/8	50	19 7/8	49 5/8
1000-420	40	23 5/8	35 7/16	31 7/8	56 5/16	45 11/16	22 13/16	33 11/16	23 5/8	59 13/16	24 5/8	58 1/4

22) All dimensions for foundation recesses apply to discharge tube design without intermediate flange.
23) Selected for DN2max
24) Observe this dimension.

Size	D	$DN_{2\ min.}$	$DN_{2\ max.}$	a	a_1 [23]	a_2 [23]	a_3 [23]	d_7	e_1 [24]	m [23]	m_1 [23]	n [23]
1000-500	40	$23^{5}/_{8}$	$35^{7}/_{16}$	$31^{7}/_{8}$	$56^{5}/_{16}$	$45^{11}/_{16}$	$22^{13}/_{16}$	$33^{11}/_{16}$	$23^{5}/_{8}$	$59^{13}/_{16}$	$24^{5}/_{8}$	$58^{1}/_{4}$
1200-630	$48^{1}/_{16}$	$35^{7}/_{16}$	$47^{1}/_{4}$	$35^{13}/_{16}$	$64^{3}/_{16}$	$53^{15}/_{16}$	$26^{15}/_{16}$	$39^{15}/_{16}$	$27^{9}/_{16}$	$67^{11}/_{16}$	$28^{9}/_{16}$	$72^{13}/_{16}$

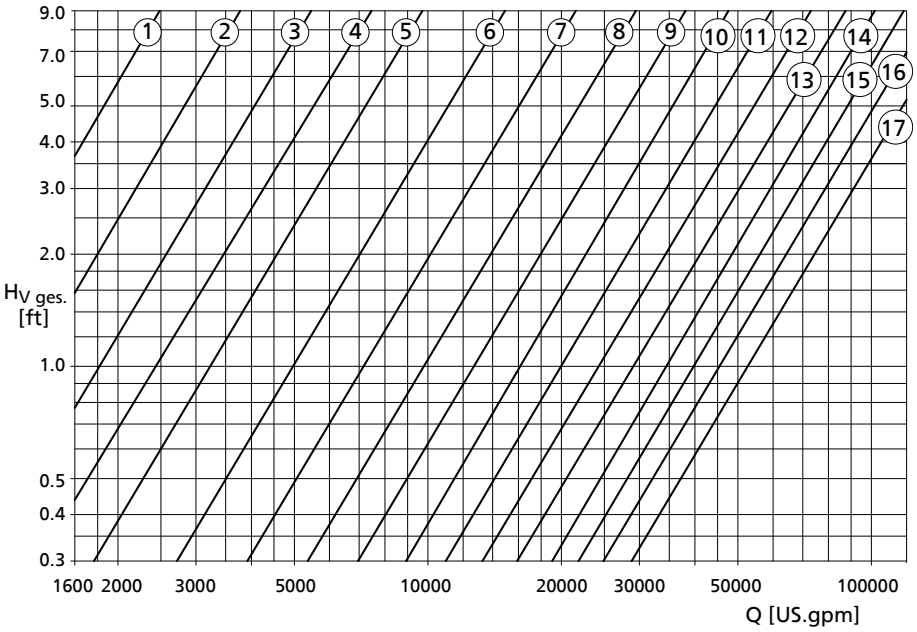
Table 79: Dimensions [inch]

Size	p_1 [23]	p_2 [23]	$s_{1\ min.}$	$s_{2\ min.}$	t_2 [24]	t_3	$t_{4\ min.}$ [25]	$t_{5\ min.}$ [23]
800-370	$37^{13}/_{16}$	$41^{3}/_{4}$	$^{5}/_{16}$	$47^{1}/_{4}$	13	$7^{7}/_{8}$	$94^{1}/_{2}$	$30^{5}/_{16}$
800-400	$37^{13}/_{16}$	$41^{3}/_{4}$	$^{5}/_{16}$	$55^{1}/_{8}$	$16^{1}/_{8}$	$9^{13}/_{16}$	$98^{7}/_{16}$	$30^{5}/_{16}$
800-401	$37^{13}/_{16}$	$41^{3}/_{4}$	$^{5}/_{16}$	$55^{1}/_{8}$	$16^{1}/_{8}$	$9^{13}/_{16}$	$98^{7}/_{16}$	$30^{5}/_{16}$
1000-420	$46^{7}/_{16}$	$50^{3}/_{8}$	$^{3}/_{8}$	63	$17^{1}/_{8}$	$9^{13}/_{16}$	$106^{5}/_{16}$	$36^{7}/_{16}$
1000-500	$46^{7}/_{16}$	$50^{3}/_{8}$	$^{3}/_{8}$	$70^{7}/_{8}$	$18^{7}/_{8}$	$11^{13}/_{16}$	$116^{1}/_{8}$	$36^{7}/_{16}$
1200-630	$59^{7}/_{16}$	$63^{3}/_{8}$	$^{1}/_{2}$	$88^{9}/_{16}$	$23^{1}/_{16}$	$13^{3}/_{4}$	$137^{13}/_{16}$	$43^{5}/_{16}$

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

$H_{v\ ges.}$ comprises:

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

25) Value for maximum motor length

Minimum water level diagram

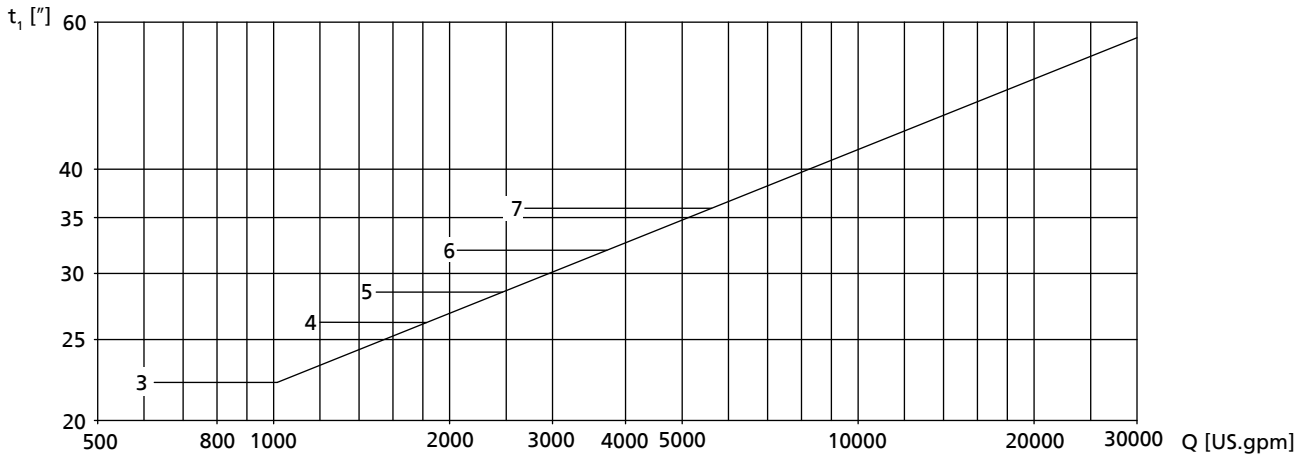
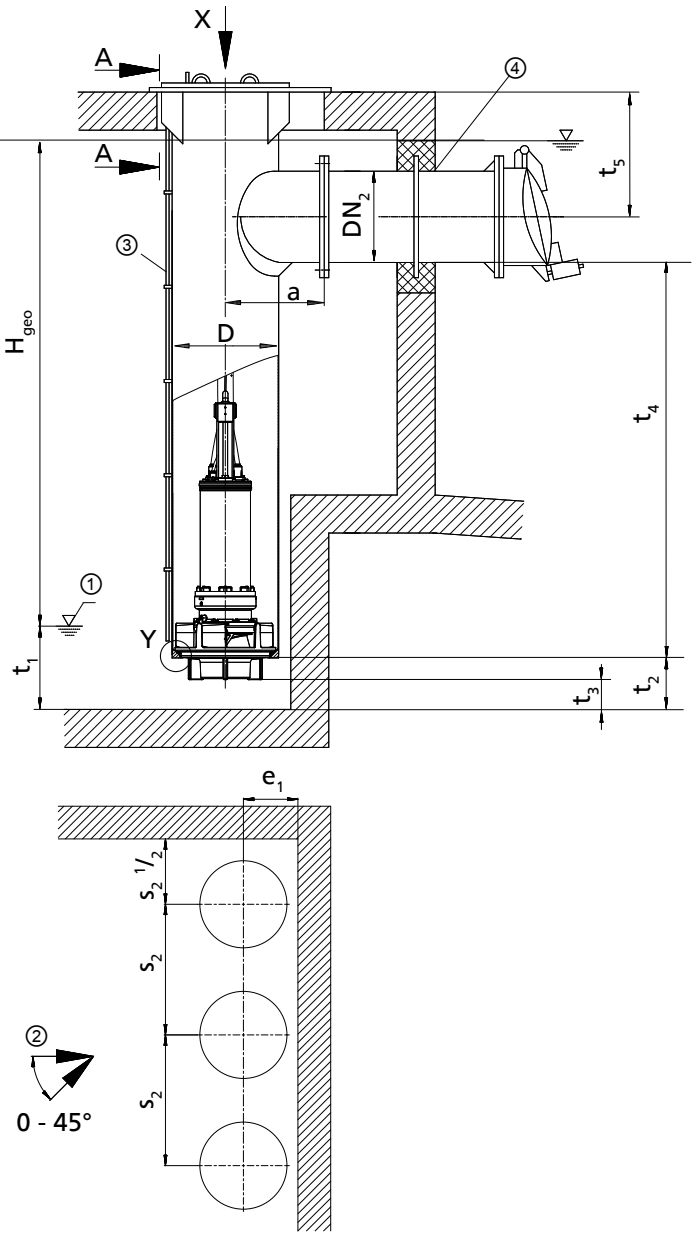


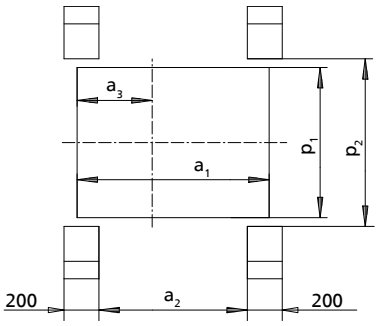
Fig. 89: Minimum water level diagram, motor version UN, XN

3	Amacan K 800-370
4	Amacan K 800-400, 800-401
5	Amacan K 1000-420
6	Amacan K 1000-500
7	Amacan K 1200-630

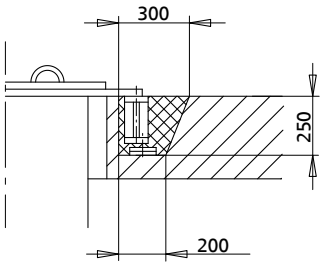
26) All dimensions for foundation recesses apply to discharge tube design without intermediate flange.

9.8.4 Installation type CU, motor version UN, XN

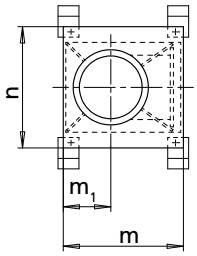




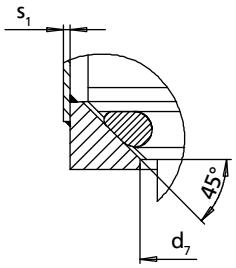
Foundation recesses[26)]



Section A - A:



Detail X:
Support plate of the discharge tube
Drawing: without pump



Detail Y:
seating ring

①: Minimum water level (values 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.

Table 80: Dimensions [mm]

Size	D	$DN_{2\ min.}$	$DN_{2\ max.}$	a	a_1 [27)]	a_2 [27)]	a_3 [27)]	d_7	e_1 [28)]	m [27)]	m_1 [27)]	n [27)]
800-370	813	400	700	700	1220	970	480	656	480	1270	505	1260
800-400	813	400	700	700	1220	970	480	656	480	1270	505	1260
800-401	813	400	700	700	1220	970	480	656	480	1270	505	1260
1000-420	1016	600	900	810	1430	1160	580	856	600	1520	625	1480

27) Selected for DN2max
28) Observe this dimension.

Size	D	$DN_{2\ min.}$	$DN_{2\ max.}$	a	a_1 [27]	a_2 [27]	a_3 [27]	d_7	e_1 [28]	m [27]	m_1 [27]	n [27]
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

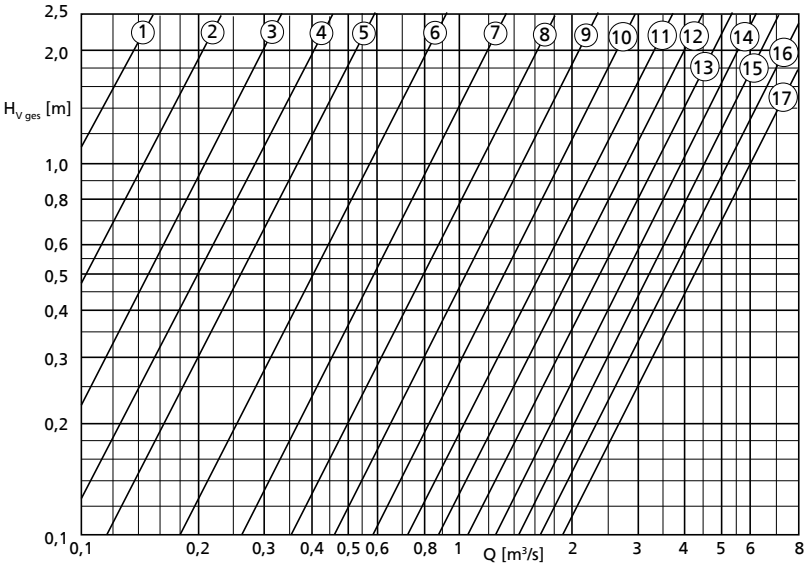
Table 81: Dimensions [mm]

Size	p_1 [27]	p_2 [27]	$s_{1\ min.}$	$s_{2\ min.}$	t_2 [28]	t_3	$t_{4\ min.}$ [29]	$t_{5\ min.}$ [27]
800-370	960	1060	8	1150	330	200	2400	770
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
1000-500	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)

$H_{v\ ges.}$ comprises:

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

29) Value for maximum motor length

Minimum water level diagram

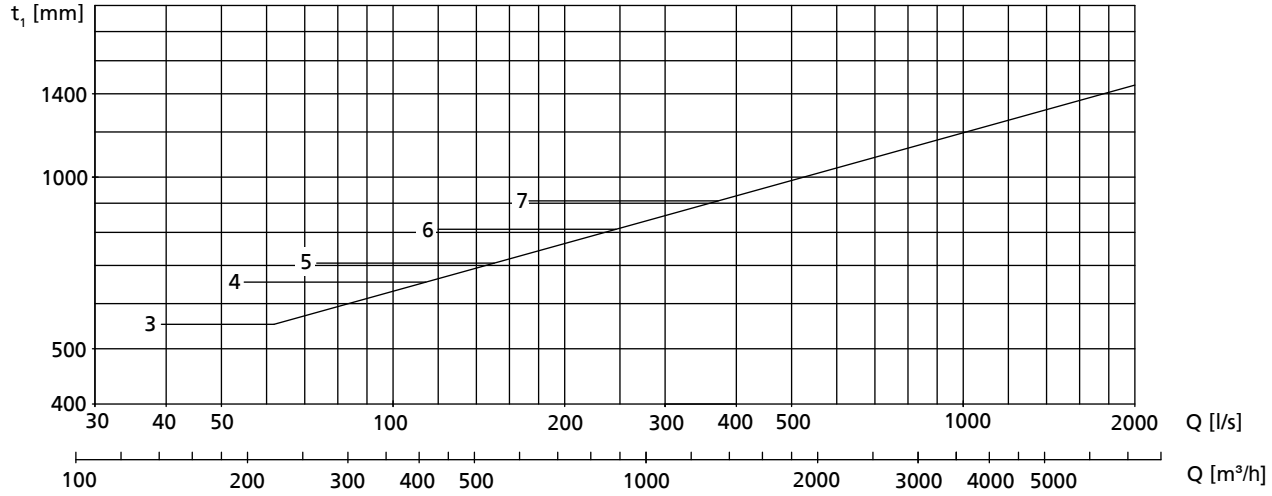
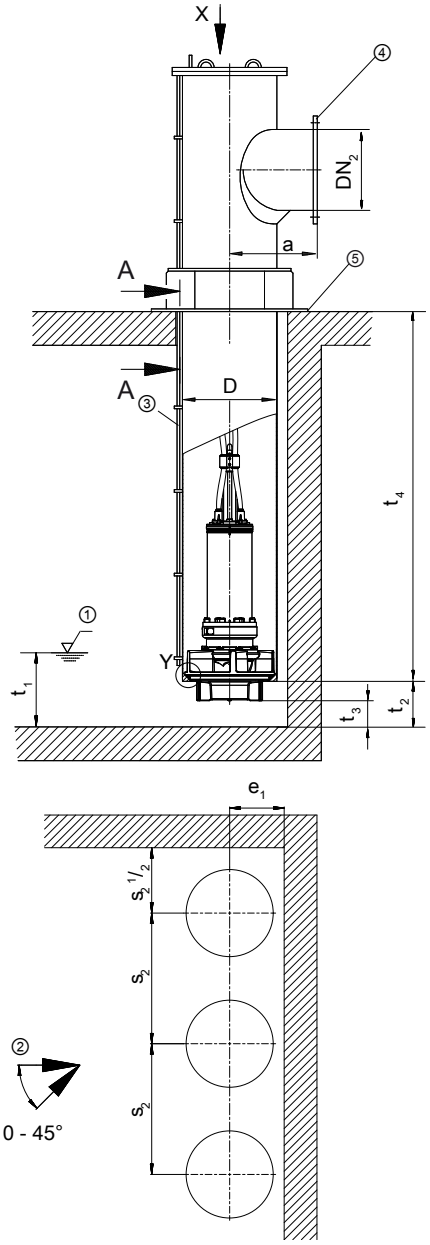


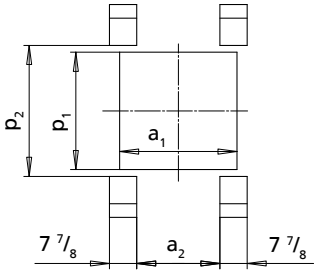
Fig. 90: Minimum water level diagram, motor version UN, XN

3	Amacan K 800-370
4	Amacan K 800-400, 800-401
5	Amacan K 1000-420
6	Amacan K 1000-500
7	Amacan K 1200-630

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

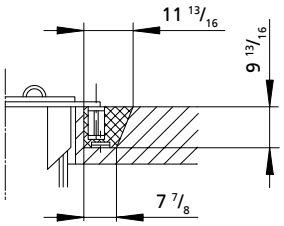
9.8.5 Installation type DU, motor version UN, XN



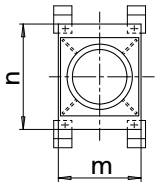


Foundation recesses[30)]

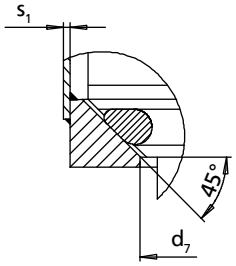
A – A



Section A - A:



Detail X:
Support plate of the discharge tube
Drawing: without pump



Detailed view Y:
Seating ring

①: Minimum water level (values 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 82: Dimensions [inch]

Size	D	$DN_{2\ min.}$	$DN_{2\ max.}$	a	a_1	a_2	d_7	e_1[31)]	m	n	p_1
800-370	32	$15^{3}/_{4}$	$27^{9}/_{16}$	$27^{9}/_{16}$	$37^{13}/_{16}$	$27^{15}/_{16}$	$25^{13}/_{16}$	$18^{7}/_{8}$	$40^{9}/_{16}$	$49^{5}/_{8}$	$37^{13}/_{16}$
800-400	32	$15^{3}/_{4}$	$27^{9}/_{16}$	$27^{9}/_{16}$	$37^{13}/_{16}$	$27^{15}/_{16}$	$25^{13}/_{16}$	$18^{7}/_{8}$	$40^{9}/_{16}$	$49^{5}/_{8}$	$37^{13}/_{16}$
800-401	32	$15^{3}/_{4}$	$27^{9}/_{16}$	$27^{9}/_{16}$	$37^{13}/_{16}$	$27^{15}/_{16}$	$25^{13}/_{16}$	$18^{7}/_{8}$	$40^{9}/_{16}$	$49^{5}/_{8}$	$37^{13}/_{16}$
1000-420	40	$23^{5}/_{8}$	$35^{7}/_{16}$	$31^{7}/_{8}$	$45^{11}/_{16}$	$35^{13}/_{16}$	$33^{11}/_{16}$	$23^{5}/_{8}$	$48^{13}/_{16}$	$59^{1}/_{16}$	$45^{11}/_{16}$
1000-500	40	$23^{5}/_{8}$	$35^{7}/_{16}$	$31^{7}/_{8}$	$45^{11}/_{16}$	$35^{13}/_{16}$	$33^{11}/_{16}$	$23^{5}/_{8}$	$48^{13}/_{16}$	$59^{1}/_{16}$	$45^{11}/_{16}$
1200-630	$48^{1}/_{16}$	$35^{7}/_{16}$	$47^{1}/_{4}$	$35^{13}/_{16}$	$53^{9}/_{16}$	$43^{11}/_{16}$	$39^{15}/_{16}$	$27^{9}/_{16}$	$56^{11}/_{16}$	$66^{15}/_{16}$	$53^{9}/_{16}$

31) Observe this dimension.

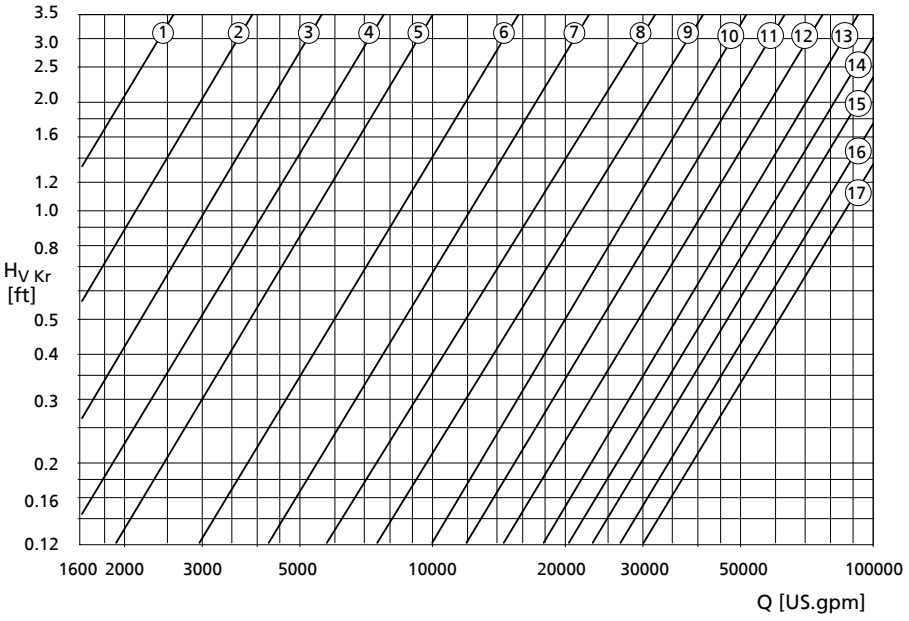
Table 83: Dimensions [inch]

Size	p_2	$s_{1\ min.}$	$s_{2\ min.}$	t_2 [31)]	t_3	$t_{4\ min.}$ [32)]
800-370	$41^{3}/_{4}$	$^{5}/_{16}$	$47^{1}/_{4}$	13	$7^{7}/_{8}$	$94^{1}/_{2}$
800-400	$41^{3}/_{4}$	$^{5}/_{16}$	$55^{1}/_{8}$	$16^{1}/_{8}$	$9^{13}/_{16}$	$98^{7}/_{16}$
800-401	$41^{3}/_{4}$	$^{5}/_{16}$	$55^{1}/_{8}$	$16^{1}/_{8}$	$9^{13}/_{16}$	$98^{7}/_{16}$
1000-420	$49^{5}/_{8}$	$^{3}/_{8}$	63	$17^{1}/_{8}$	$9^{13}/_{16}$	$106^{5}/_{16}$
1000-500	$49^{5}/_{8}$	$^{3}/_{8}$	$70^{7}/_{8}$	$18^{7}/_{8}$	$11^{13}/_{16}$	$116^{1}/_{8}$
1200-630	$57^{1}/_{2}$	$^{1}/_{2}$	$88^{9}/_{16}$	$23^{1}/_{16}$	$13^{3}/_{4}$	$137^{13}/_{16}$

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 - $DN_2 = 7\ ^{7}/_{8}$ inch
② - $DN_2 = 9\ ^{7}/_{8}$ inch
③ - $DN_2 = 11\ ^{3}/_{4}$ inch
④ - $DN_2 = 13\ ^{3}/_{4}$inch
⑤ - $DN_2 = 15\ ^{3}/_{4}$ inch
⑥ - $DN_2 = 19\ ^{5}/_{8}$ inch
⑦ - $DN_2 = 23\ ^{5}/_{8}$ inch
⑧ - $DN_2 = 27\ ^{1}/_{2}$ inch
⑨ - $DN_2 = 31\ ^{1}/_{2}$ inch
⑩ - $DN_2 = 35\ ^{3}/_{8}$ inch
⑪ - $DN_2 = 39\ ^{3}/_{8}$ inch
⑫ - $DN_2 = 43\ ^{1}/_{4}$ inch
⑬ - $DN_2 = 47\ ^{1}/_{4}$ inch
⑭ - $DN_2 = 51\ ^{1}/_{8}$ inch
⑮ - $DN_2 = 55\ ^{1}/_{8}$ inch
⑯ - $DN_2 = 59$ inch
⑰ - $DN_2 = 63$ inch

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.

32) Value for maximum motor length

Minimum water level diagram

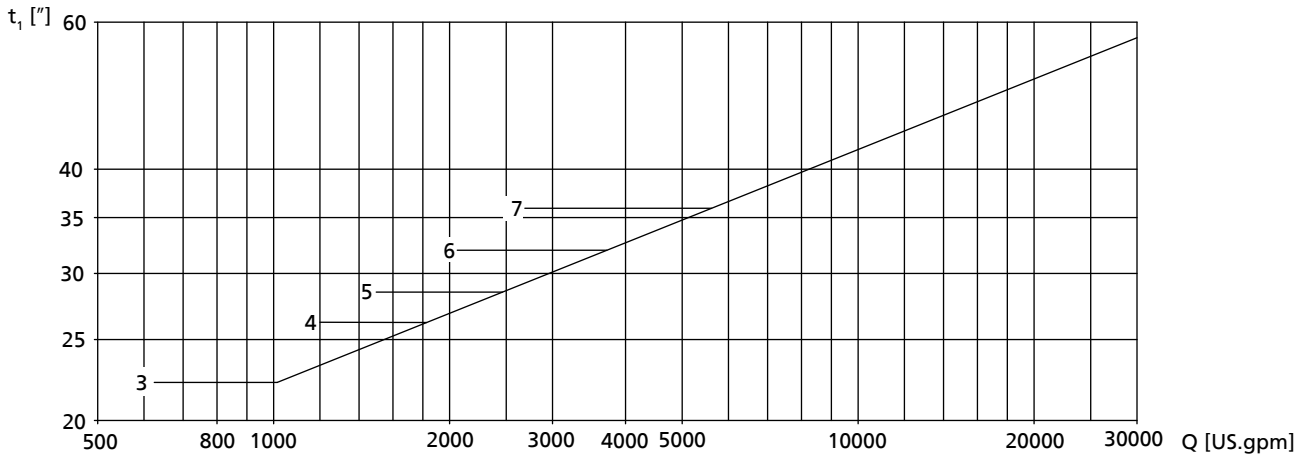
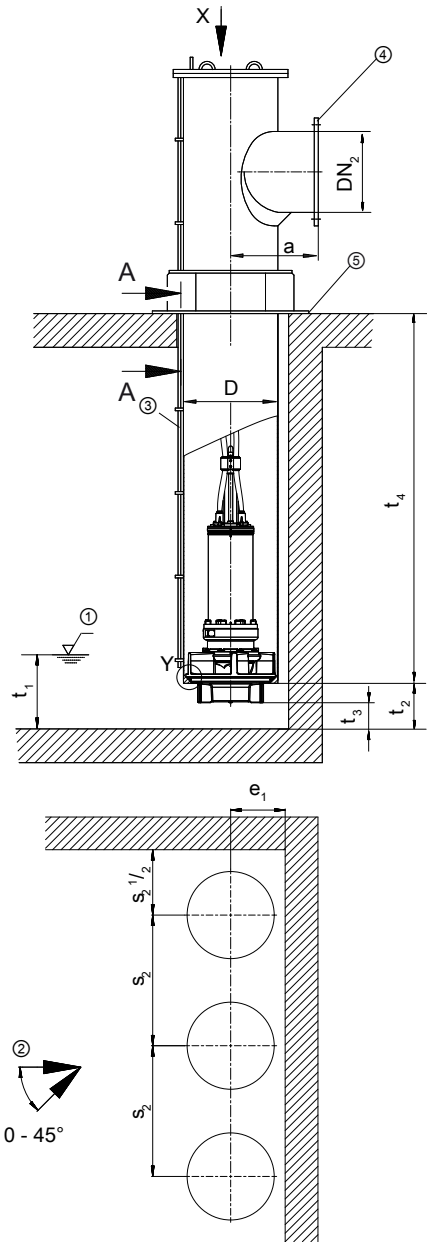


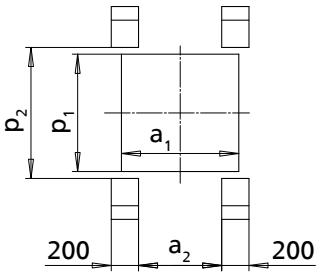
Fig. 91: Minimum water level diagram, motor version UN, XN

3	Amacan K 800-370
4	Amacan K 800-400, 800-401
5	Amacan K 1000-420
6	Amacan K 1000-500
7	Amacan K 1200-630

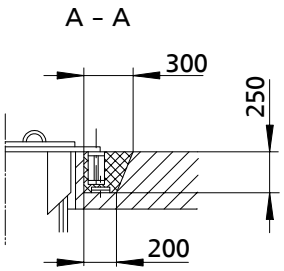
33) All dimensions for foundation recesses apply to discharge tube design without intermediate flange.

9.8.6 Installation type DU, motor version UN, XN

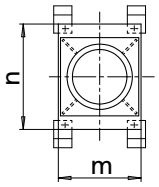




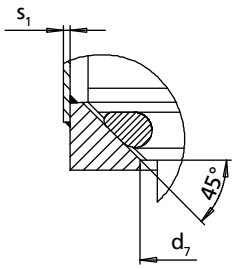
Foundation recesses[33)]



Section A - A:



Detail X:
Support plate of the discharge tube
Drawing: without pump



Detailed view Y:
Seating ring

①: Minimum water level (values 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 84: Dimensions [mm]

Size	D	$DN_{2\ min.}$	$DN_{2\ max.}$	a	a_1	a_2	d_7	e_1[34)]	m	n	p_1
800-370	813	400	700	700	960	710	656	480	1030	1260	960
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
1000-500	1016	600	900	810	1160	910	856	600	1240	1500	1160
1200-630	1200	900	1200	910	1360	1110	1015	700	1440	1700	1360

34) Observe this dimension.

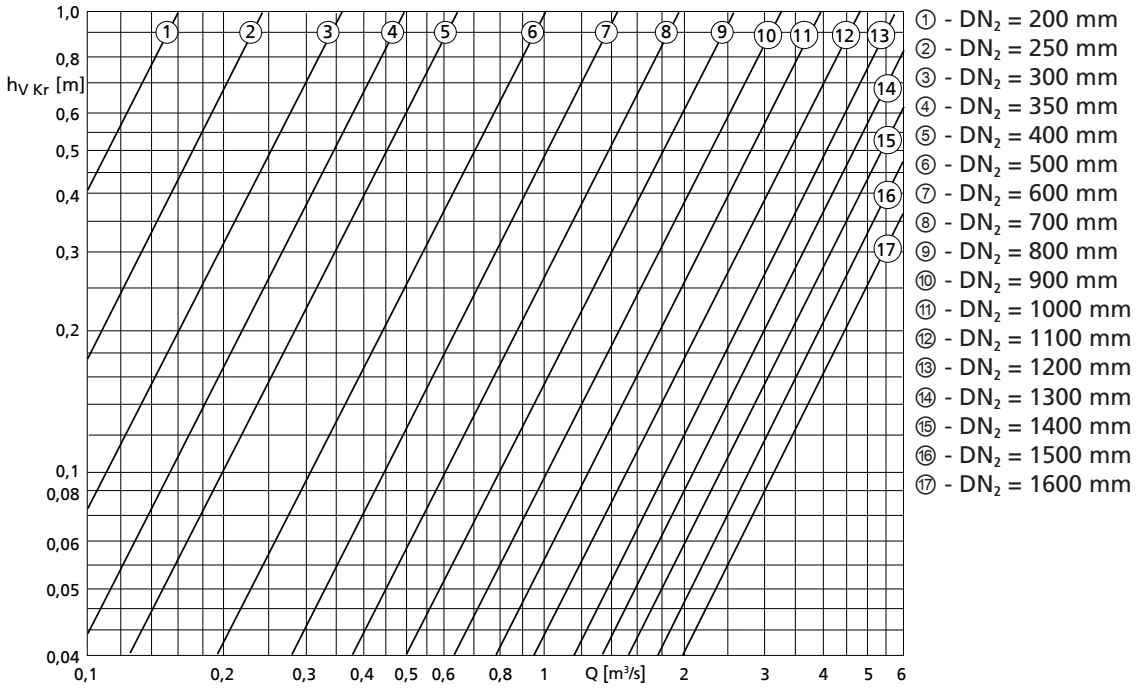
Table 85: Dimensions [mm]

Size	p_2	$s_{1\ min.}$	$s_{2\ min.}$	t_2 [34)]	t_3	$t_{4\ min.}$ [35)]
800-370	1060	8	1150	330	200	2400
800-400	1060	8	1400	410	250	2500
800-401	1060	8	1400	410	250	2500
1000-420	1260	10	1600	435	250	2700
1000-500	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.

35) Value for maximum motor length

Minimum water level diagram

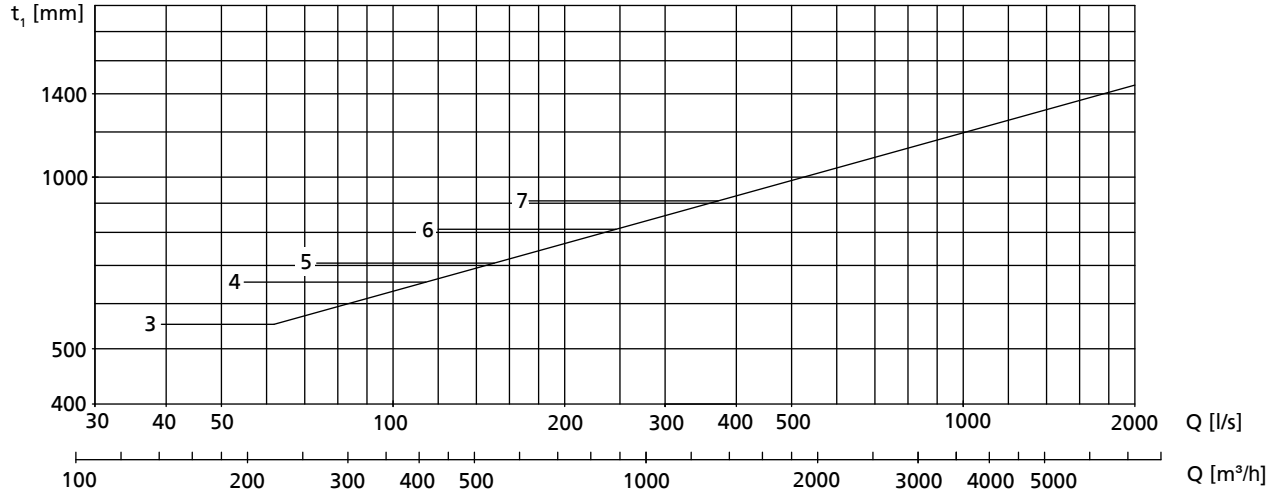


Fig. 92: Minimum water level diagram, motor version UN, XN

3	Amacan K 800-370
4	Amacan K 800-400, 800-401
5	Amacan K 1000-420
6	Amacan K 1000-500
7	Amacan K 1200-630

10 Certificate of Decontamination

Type: .....

Order number/
order item number[36]: .....

Delivery date: .....

Field of application: .....

Fluid handled[36]: .....

Please check where applicable[36]:

☐ Radioactive

☐ Explosive

☐ Corrosive

☐ Toxic

☐ Harmful

☐ Bio-hazardous

☐ Highly flammable

☐ Safe

Reason for return[36]: .....

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 any hazardous chemicals as well as from 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

36) Required fields

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1579.808/04-EN-US (01117574)

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