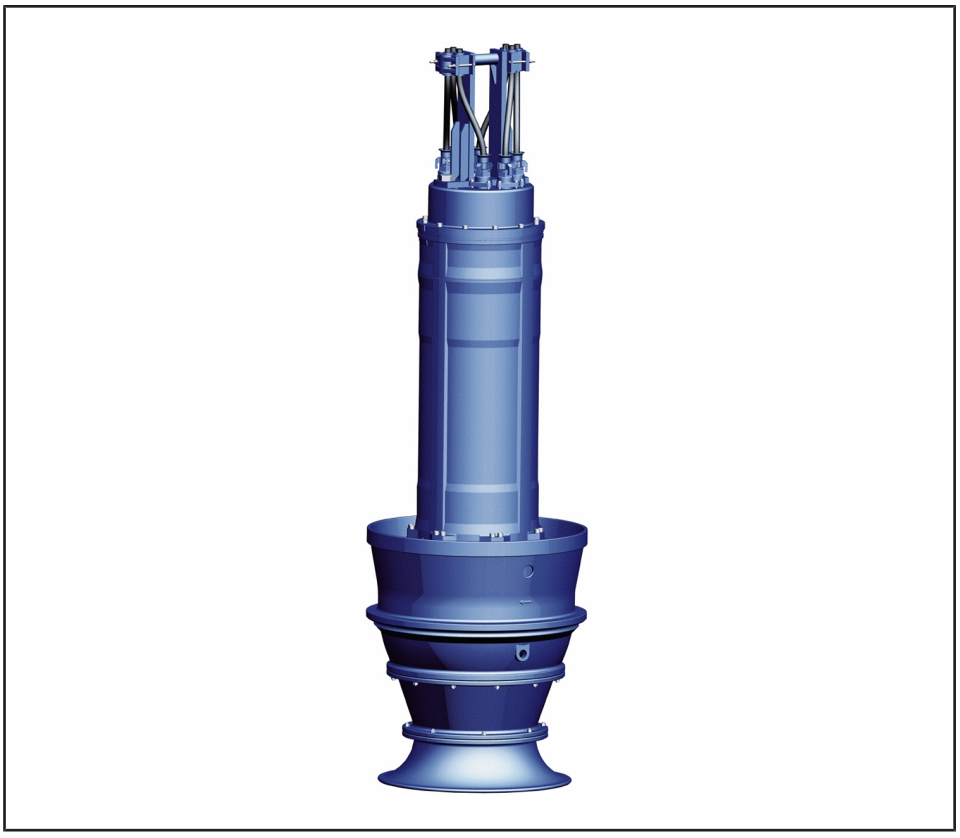
Submersible Pump in Discharge Tube

Amacan S

50 Hz
Amacan S ... - 535, Amacan S ... - 550,
Amacan S ... - 600, Amacan S ... - 615,
Amacan S ... - 620, Amacan S ... - 655,
Amacan S ... - 820

Installation/Operating Manual



Mat. No.: 01348408

CE

KSB

Legal information/Copyright

Installation/Operating Manual Amacan S

Original operating manual

Contents

Glossary

Certificate of decontamination

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

Close-coupled design

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

Submersible pump in discharge tube

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

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1 General

1.1 Principles

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

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

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

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

1.2 Installation of partly completed machinery

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

1.3 Target group

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

1.4 Other applicable documents

Table 1: Overview of other applicable documents

Document	Contents
Data sheet	Description of the technical data of the pump (set)
Hydraulic characteristic curve	Characteristic curves showing head, NPSH required, efficiency and power input
General assembly drawing[1)]	Sectional drawing of the pump set
Sub-supplier product literature[1)]	Operating manuals and other product literature describing accessories and integrated machinery components
Spare parts lists[1)]	Description of spare parts

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

1.5 Symbols

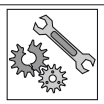
Table 2: Symbols used in this manual

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

1 If included in agreed scope of supply

1.6 Key to safety symbols/markings

Table 3: Definition of safety symbols/markings

Symbol	Description
DANGER	**DANGER** This signal word indicates a high-risk hazard which, if not avoided, will result in death or serious injury.
WARNING	**WARNING** This signal word indicates a medium-risk hazard which, if not avoided, could result in death or serious injury.
CAUTION	**CAUTION** This signal word indicates a hazard which, if not avoided, could result in damage to the machine and its functions.
	**General hazard** In conjunction with one of the signal words this symbol indicates a hazard which will or could result in death or serious injury.
	**Electrical hazard** In conjunction with one of the signal words this symbol indicates a hazard involving electrical voltage and identifies information about protection against electrical voltage.
	**Machine damage** In conjunction with the signal word CAUTION this symbol indicates a hazard for the machine and its functions.

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2 Safety

DANGER

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

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

2.1 General

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

2.2 Intended use

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

2.3 Personnel qualification and training

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

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

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

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

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

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

2.5 Safety awareness

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

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

2.6 Safety information for the operator/user

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

2.7 Safety information for maintenance, inspection and installation

- Modifications or alterations of the pump (set) are only permitted with the manufacturer's prior consent.
- Use only original spare parts or parts/components authorised by the manufacturer. The use of other parts/components can invalidate any liability of the manufacturer for resulting damage.
- The operator ensures that maintenance, inspection and installation are performed by authorised, qualified specialist personnel who are thoroughly familiar with the manual.
- Only carry out work on the pump (set) during standstill of the pump.
- Only perform work on the pump set when it has been disconnected from the power supply (de-energised).
- The pump (set) must have cooled down to ambient temperature.
- Pump pressure must have been released and the pump must have been drained.

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- 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 Unauthorised modes of operation

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

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

3 Transport/Storage/Disposal

3.1 Checking the condition upon delivery

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

3.2 Transport

DANGER

Improper transport

Danger to life from falling parts!

Damage to the pump set!

- ▷ Use the attachment point provided for attaching the lifting accessory.
- ▷ Never lift the pump set by the electric cables.
- ▷ Use the lifting chain/rope included in the scope of supply exclusively for lowering or lifting the pump set into/out of the pump sump.
- ▷ Securely attach the lifting chain/rope to the pump and crane.
- ▷ Use tested, marked and approved lifting accessories only.
- ▷ Observe the regional transport regulations.
- ▷ Observe the documentation of the lifting accessory manufacturer.
- ▷ The load-carrying capacity of the lifting accessory must be higher than the weight indicated on the name plate of the pump set to be lifted. Take into account any additional system components to be lifted.
- ▷ Maintain a safe distance during lifting operations (load may swing when being lifted).

3.2.1 Transporting the delivered pump set to the place of installation

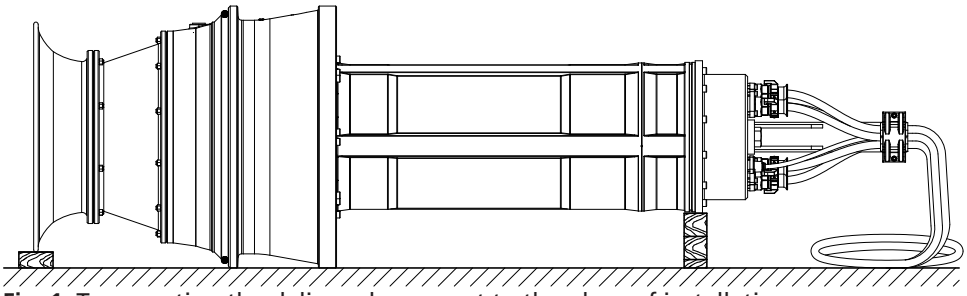

Fig. 1: Transporting the delivered pump set to the place of installation

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

3.2.2 Placing the pump set in a vertical or horizontal position

WARNING

Pump set tilting

Risk of squashing hands and feet!

- ▷ Suspend or support the pump set.

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⚠ WARNING

Placing the pump set on unsecured and uneven surfaces

Personal injury and damage to property!

- Always place the pump set on a solid and level surface with the pump set in a vertical position and the motor on top.
- Only place the pump set on a surface of sufficient load-carrying capacity.
- Use appropriate means to secure the pump set against tilting or tipping over.
- Refer to the weights given in the data sheet/on the name plate.

⚠ WARNING

Incorrect handling of the electric cable

Personal injury and damage to property!

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

⚠ WARNING

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

Personal injury and damage to property!

- Use one or two pieces of lifting equipment, depending on the pump (set) size.
- Use appropriate means to secure the pump set against tilting, tipping over or rolling off.
- Maintain a safe distance during lifting operations (load may swing when being lifted).
- Use additional supports for the transport holder to secure it against tilting.

⚠ WARNING

Improper lifting/moving of heavy assemblies or components

Personal injury and damage to property!

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

CAUTION

Improper storage

Damage to the electric cables!

- Support the electric cables at the cable gland to prevent permanent deformation.
- Only remove the protective caps from the electric cables at the time of installation.

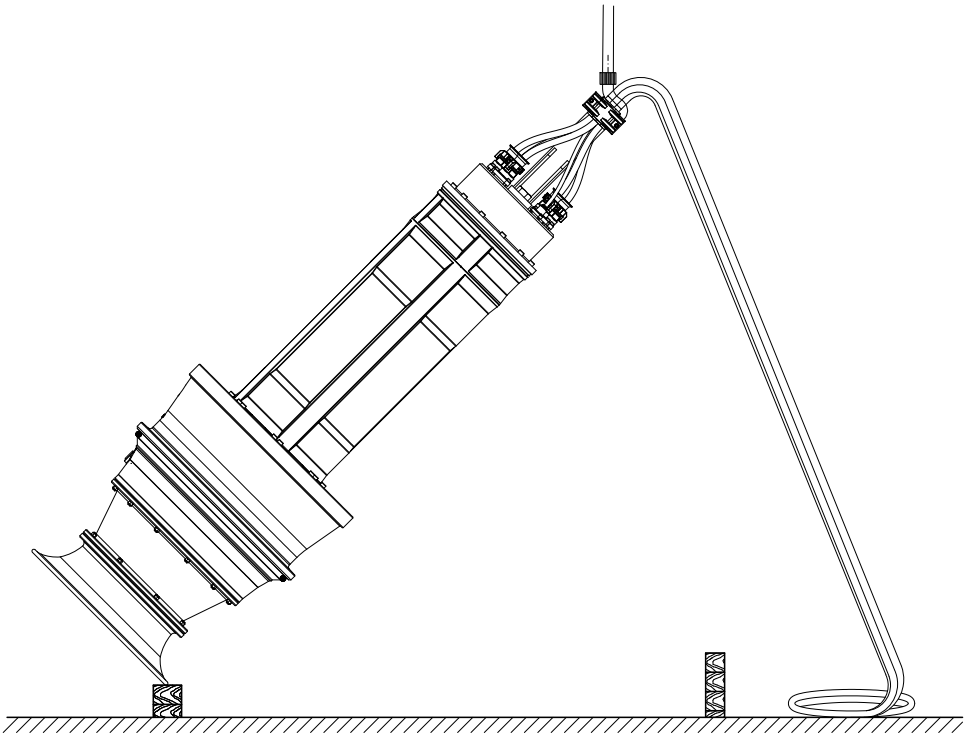

Fig. 2: Placing the pump set in a vertical or horizontal position

✓ Suitable lifting equipment has been selected (e.g. crane).

1. a) For one piece of lifting equipment: Attach the eyehook to the bail of the pump set.
   b) For two pieces of lifting equipment: Attach one eyehook to the bail of the pump set. **Then** suitably loop a rope around the pump set and attach this loop to the second crane hook.
2. Lift the pump set with the lifting equipment.
   ⇨ Guiding the pump set over the edge of the bellmouth or pump casing is only permissible on a wooden base!
   ⇨ Protect the power cable against kinking!
3. Place the pump set on a level, clean surface and protect it against tilting, tipping over or rolling off.

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.

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⚠ WARNING

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

Personal injury and damage to property!

- ▷ Use one or two pieces of lifting equipment, depending on the pump (set) size.
- ▷ 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

Incorrect handling of the electric cable

Personal injury and damage to property!

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

⚠ WARNING

Improper 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.

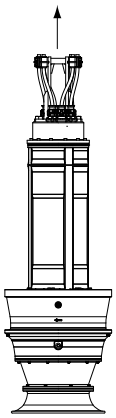

Fig. 3: Transporting the pump set

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

3.3 Storage/preservation

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

Store the pump set as follows:

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

⚠ WARNING

Pump set tilting

Risk of squashing hands and feet!

- ▷ Suspend or support the pump set.

CAUTION

Improper storage

Damage to the electric cables!

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

CAUTION

Damage during storage due to humidity, dirt or vermin

Corrosion/contamination of pump (set)!

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

CAUTION

Wet, contaminated or damaged openings and connections

Leakage or damage to the pump!

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

Table 4: Ambient conditions for storage

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

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

1. Rotate the impeller by hand once every three months.

3.4 Return to supplier

1. Drain the pump properly. (⇨ Section 7.3.2, Page 58)
2. Flush and clean the pump, particularly if it has been used for handling noxious, explosive, hot or other hazardous fluids.
3. If the pump has handled fluids whose residues could lead to corrosion damage in the presence of atmospheric humidity or could ignite upon contact with oxygen, the pump must also be neutralised, and anhydrous inert gas must be blown through the pump to ensure drying.
4. Always complete and enclose a certificate of decontamination when returning the pump.
   Indicate any safety measures and decontamination measures taken.
   (⇨ Section 11, Page 127)

NOTE

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

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3.5 Disposal

⚠ WARNING

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

Hazard to persons and the environment!

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

1. 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 for handling pure water, pre-screened river water and stormwater, waste water without long fibres or large solid particles, and activated sludge

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

For information as per European chemicals regulation (EC) No. 1907/2006 (REACH) see https://www.ksb.com/en-global/company/corporate-responsibility/reach.

4.3 Designation

Example: Amacan S 1000-655 / 250 8 UTG2

Table 5: Designation key

Code	Description	
Amacan	Type series	
S	Impeller type	
	S	Mixed flow impeller
1000	Nominal diameter of the discharge tube [mm]	
655	Nominal impeller diameter [mm]	
250	Motor size	
8	Number of motor poles	
UT	Motor version	
	UT	Non-explosion-proof
G2	Material variant	
	G2	Grey cast iron, standard material variant
	G3	Grey cast iron with Zn anodes, shaft made of 1.4057 stainless steel

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4.4 Name plate

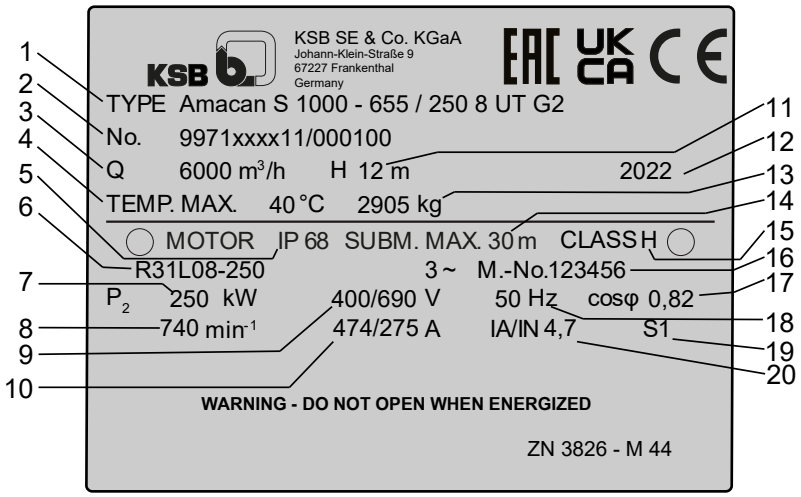


Fig. 4: Name plate: Pump set (example)

1	Designation	2	KSB order number
3	Flow rate	4	Maximum fluid temperature and ambient temperature
5	Enclosure	6	Motor type
7	Rated power	8	Rated speed
9	Rated voltage	10	Rated current
11	Head	12	Year of construction
13	Total weight	14	Maximum immersion depth ▽
15	Thermal class of winding insulation	16	Motor number
17	Power factor at rated operating point	18	Rated frequency
19	Duty type	20	Starting current ratio

4.5 Design details

Design

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

Drive

- Three-phase asynchronous squirrel-cage motor

Shaft seal

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

Impeller type

- Open or closed mixed flow impeller

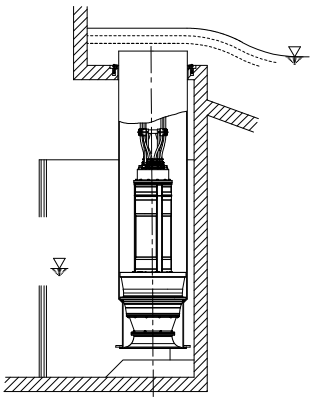
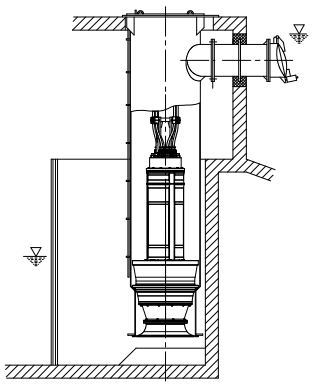
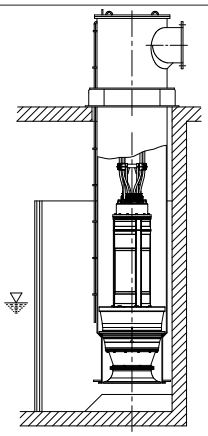
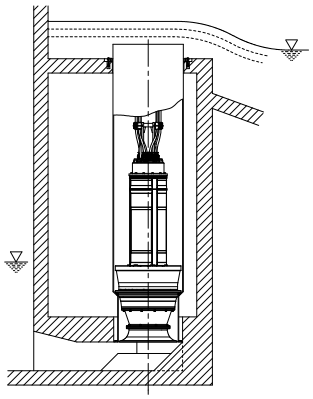
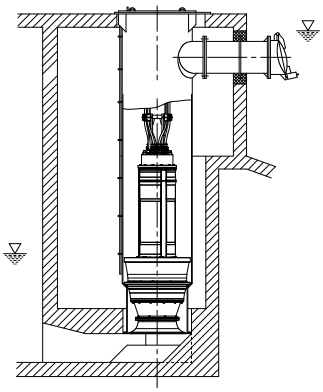
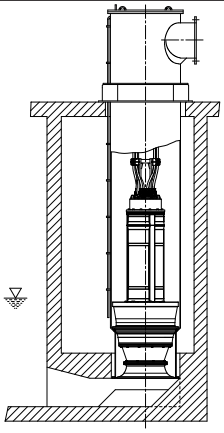
Bearings

- Grease-lubricated rolling element bearings

4.6 Installation types

Six types are available for selection[2)]:

Table 6: Overview of installation types

		
BU discharge tube Overflow design for installation in open intake chamber	**CU discharge tube** Design with underfloor discharge for installation in open intake chamber	**DU discharge tube** Design with above floor discharge nozzle for installation in open intake chamber
		
BG discharge tube Overflow design for installation in covered intake chamber with low suction-side water levels	**CG discharge tube** Design with underfloor discharge for installation in covered intake chamber with low suction-side water levels	**DG discharge tube** Design with above-floor discharge nozzle for installation in covered intake chamber with low suction-side water levels

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2 For information on the various designs (foundation measurements, intake chamber, etc.) refer to the general arrangement drawings.

4.7 Configuration and function

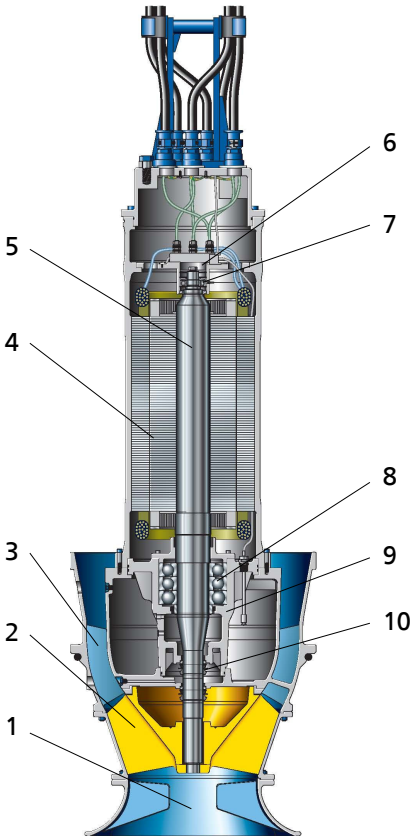

Fig. 5: Amacan with mixed flow impeller

1	Suction nozzle (bellmouth)	2	Impeller
3	Pump casing	4	Electric motor
5	Shaft	6	Bearing, drive end
7	Bearing bracket	8	Bearing, pump end
9	Bearing housing, pump end	10	Shaft seal

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

Function The fluid enters the pump axially via a suction nozzle (bellmouth) (1) and is accelerated outward in a rotating flow by the rotating impeller (2). The required energy is transmitted from the electric motor (4) to the impeller (2) via the shaft (5). In the pump casing (3) the kinetic energy of the fluid is converted into pressure energy. The rotational movement diverts the fluid flow into a mixed flow. The shaft passage through the casing is sealed towards the fluid with a shaft seal (10). The shaft (5) runs in two rolling element bearings (7 and 8), which are supported by the bearing housing (9) and the bearing bracket (6).

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

Monitoring equipment The pump sets are equipped with various sensors.

Standard

- Temperature monitoring of the motor
- Temperature monitoring at the lower bearing
- Leakage monitoring of mechanical seals
- Leakage sensors in the motor chamber and connection space

Option

- Temperature monitoring at the upper bearing
- Vibration sensor
- Additional winding temperature monitoring with Pt100 resistance thermometer

4.8 Scope of supply

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

- Pump set complete with power cables
- O-ring
- Back-up name plate

Optional accessories:

- Support rope
- Accessories for installing the cable guide:
  - Fitting
  - Turnbuckle
  - Support
  - Shackle
  - Cable clamps
- Cable support sleeves
- Discharge tube
- Flow-straightening vane to prevent floor vortices
- AmaControl 5 monitoring system

NOTE

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

4.9 Dimensions and weights

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

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5 Installation at Site

5.1 Safety regulations

DANGER

Improper installation in potentially explosive atmospheres

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 reservoir is filled at the factory with an environmentally-friendly, non-toxic lubricant.

Visual inspection for signs of oil leakage

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

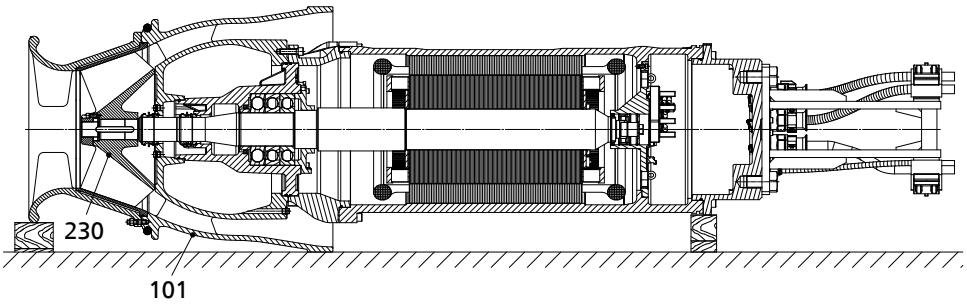

Fig. 6: Visual inspection for signs of oil leakage

For topping up the lubricant reservoir the pump set needs to be partly dismantled and reassembled.

Observe all safety instructions when carrying out the following steps of dismantling/ reassembly:

Table 7: Dismantling/reassembly steps

Sequence	Steps	See the following section
1	Placing the pump in a vertical position	(⇨ Section 3.2.2, Page 12)
2	Removing the bellmouth	(⇨ Section 7.5.3, Page 67)
3	Removing the impeller	(⇨ Section 7.5.4, Page 68)
4	Filling in the lubricant	(⇨ Section 7.4.1.4.2, Page 64)
5	Fitting the impeller	(⇨ Section 7.6.5, Page 79)
6	Fitting the bellmouth	(⇨ Section 7.6.6, Page 80)
7	Adjusting the clearance	(⇨ Section 7.6.7, Page 81)

5.2.4 Checking the direction of rotation

⚠ 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.
- ▷ Verify that the transport lock has been removed.
- ▷ Take suitable precautions (e.g. wear safety goggles).

⚠ WARNING

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

Personal injury and damage to property!

- ▷ Use one or two pieces of lifting equipment, depending on the pump (set) size.
- ▷ 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.

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CAUTION

Pump set running dry

Increased vibrations!

Damage to mechanical seals and bearings!

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

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

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

⚠ WARNING

Unintentional starting of the pump set

Risk of injury by moving components and shock currents!

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

5.3 Lowering the pump set into the discharge tube

DANGER

Improper transport

Danger to life from falling parts!

Damage to the pump set!

- Use the attachment point provided for attaching the lifting accessory.
- Never lift the pump set by the electric cables.
- Use the lifting chain/rope included in the scope of supply exclusively for lowering or lifting the pump set into/out of the pump sump.
- Securely attach the lifting chain/rope to the pump and crane.
- Use tested, marked and approved lifting accessories only.
- Observe the regional transport regulations.
- Observe the documentation of the lifting accessory manufacturer.
- The load-carrying capacity of the lifting accessory must be higher than the weight indicated on the name plate of the pump set to be lifted. Take into account any additional system components to be lifted.
- Maintain a safe distance during lifting operations (load may swing when being lifted).

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.

WARNING

Incorrect handling of the electric cable

Personal injury and damage to property!

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

WARNING

People falling into the unsecured discharge tube

Risk of personal injury!

- Take suitable precautions during the entire installation/removal process to protect people from falling into the open discharge tube.
- Fence off the work area appropriately.

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5.3.1 Information for correct installation

The **flow-straightening vane** is **indispensable** for the inlet conditions of the pump set. It prevents the development of a submerged vortex (floor vortex) which could cause a drop in performance, for example. To provide optimum inlet conditions, observe the following information:

1. **Observe the structural requirements!**
   Install the flow-straightening vane concentrically below the discharge tube, see general arrangement drawing.

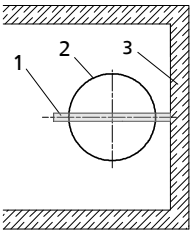

Fig. 7: Installation position of the flow-straightening vane

1	Flow-straightening vane	2	Discharge tube
3	Intake chamber		

2. **Observe the installation position of the pump set!**
   Lower the pump set into the discharge tube with the anti-swirl baffles (2) in the bellmouth aligned with the flow-straightening vane (3).
   Use the bail alignment of the pump set for orientation. The bail (1) is aligned with the anti-swirl baffles (2).

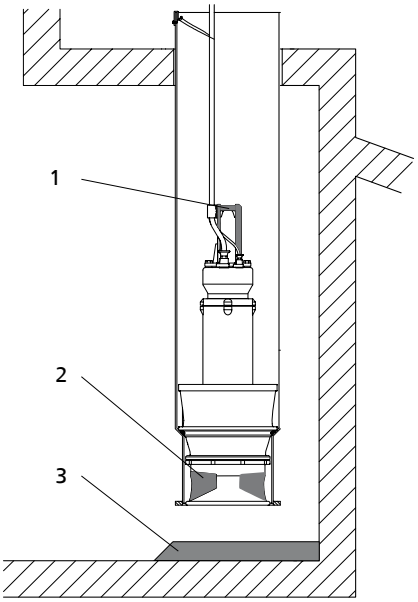

Fig. 8: Installation position of the pump set

1	Bail	2	Anti-swirl baffles
3	Flow-straightening vane		

5.3.2 Installing the pump set without support rope

CAUTION

Incorrect installation

Damage to the pump set!

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

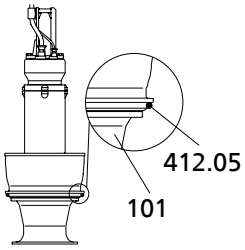

Fig. 9: Inserting the O-ring

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

1. If O-ring 412.05 is supplied but not fitted, insert it into pump casing 101.
2. Attach the crane hook the bail of the pump set.
3. Centre the pump set above the discharge tube. Slowly lower the pump set into the discharge tube until it is seated in the recommended position.
   (⇨ Section 5.3.1, Page 27)
4. Pull the 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.

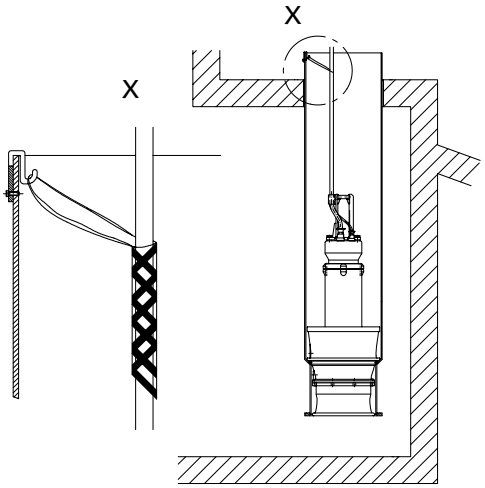

Fig. 10: Fastening the cable support sleeve

5.3.3 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.

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

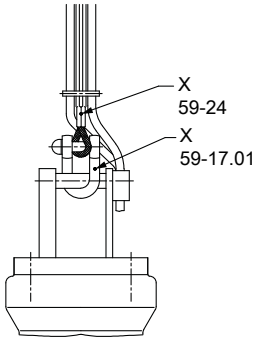

Fig. 11: X = indication of load-carrying capacity

59-24	Support rope
59-17.01	Shackle

CAUTION

Incorrect installation

Damage to the pump set!

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

⚠ WARNING

Pump set drops during the installation or removal process

Personal injury and damage to property!

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

NOTE

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

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

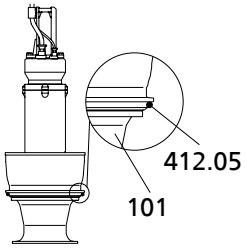

Fig. 12: Inserting the O-ring

1. If O-ring 412.05 is supplied but not fitted, insert it into pump casing 101.

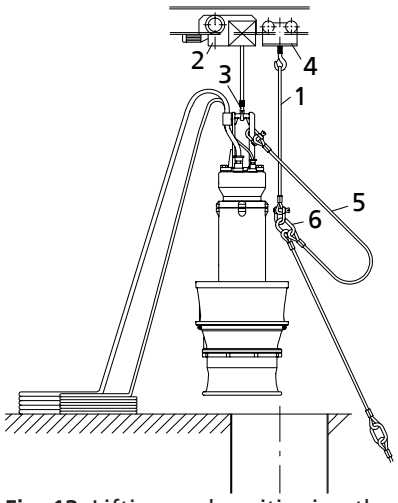

Fig. 13: Lifting and positioning the pump set

2. Secure the lifting chain or lifting rope (1) to the trolley (4) of the lifting equipment (2).
3. Attach the support rope (5) to the bail by its shackle.
   For a galvanised shackle, secure the pin at the shackle with Loctite 243.
   (⇨ Section 9.2, Page 95)
   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 electric cables.
6. Lower the pump set into the discharge tube until the bail is in an accessible position, protruding from the discharge tube.
7. Securely cover the discharge tube except for a gap which allows work to continue.

8. Attach the first lifting lug of the support rope (5) to the hoisting 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.

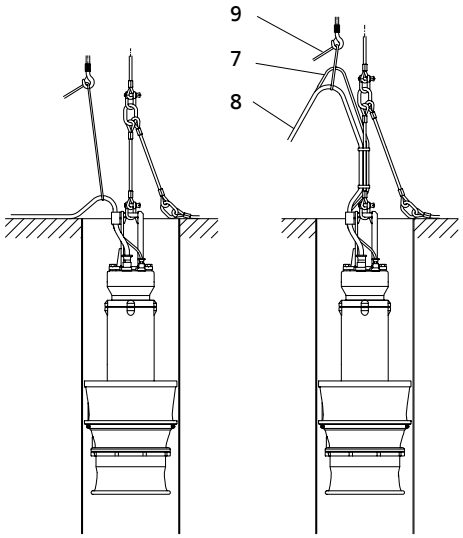

Fig. 14: Securing the control cable and power cable

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

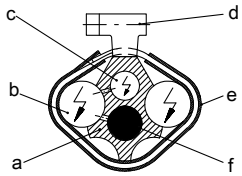

Fig. 15: Cross-section of the cable guide

12. Insert the support rope (f) and the control cable (c) into the spacer (a) and make sure that they are in their respective ducts.
13. Tighten the electric cables with the manila rope running over the crane hook.
14. Insert the power cables (b) into the hollows of the spacer (a) 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 electric 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 cable and control cable.

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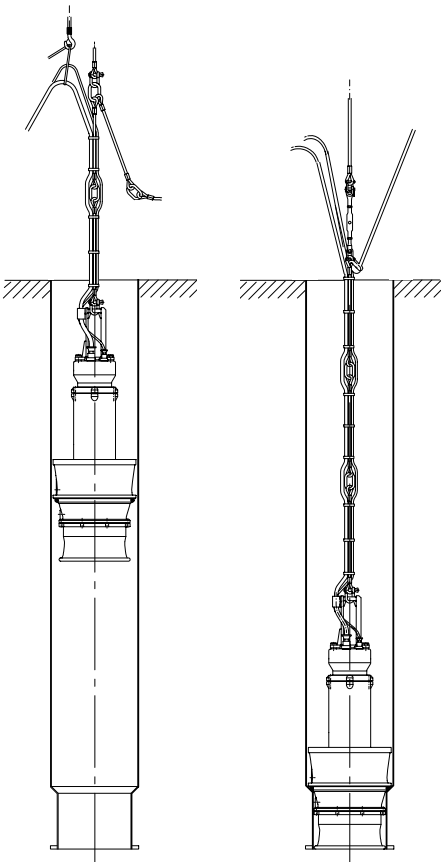

Fig. 16: Lowering the pump set

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 without lifting 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. Attach the top loose lifting lug to the cables 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.

5.3.4 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.

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

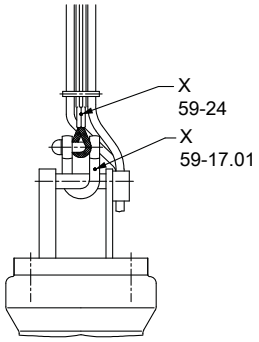

Fig. 17: X = indication of load-carrying capacity

59-24	Support rope
59-17.01	Shackle

CAUTION

Incorrect installation

Damage to the pump set!

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

⚠ WARNING

Pump set drops during the installation or removal process

Personal injury and damage to property!

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

NOTE

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

- ✓ Suitably sized lifting equipment is available.
- ✓ The support 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.

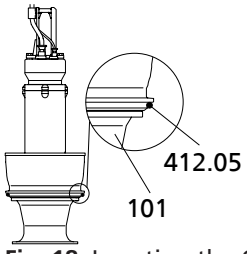

Fig. 18: Inserting the O-ring

1. If O-ring 412.05 is supplied but not fitted, insert it into pump casing 101.

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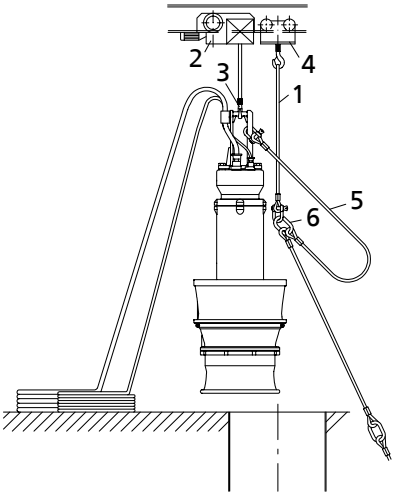

Fig. 19: Lifting and positioning the pump set

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 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.

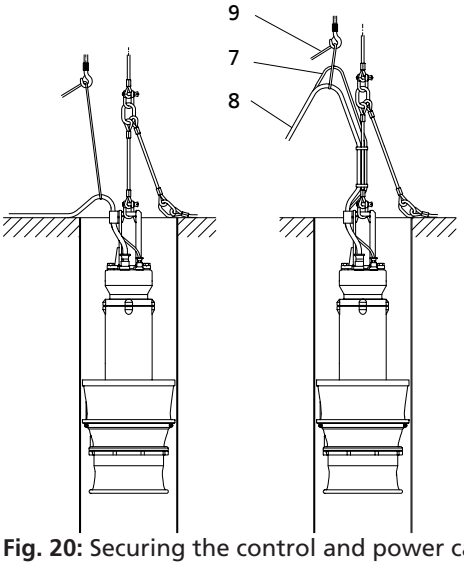

Fig. 20: Securing the control and power cables

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.

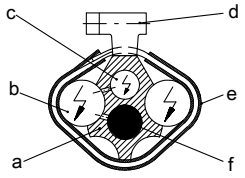

Fig. 21: Cross-section of the cable guide

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).

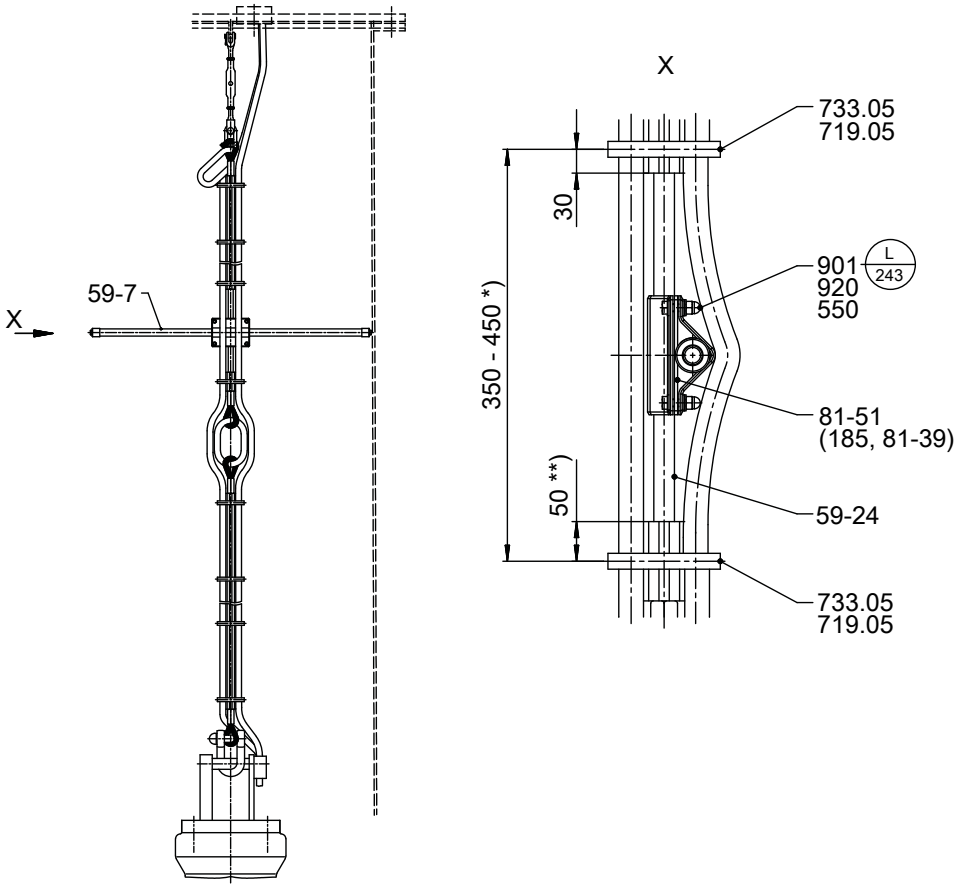

Fig. 22: Support rope with support, dimensions in [mm]
*) depending on the cable cross-section,
**) for 1 rope or 3 ropes = 30 mm

Table 8: Symbols key

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. (⇨ Section 9.2, Page 95)

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 fill the space 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.

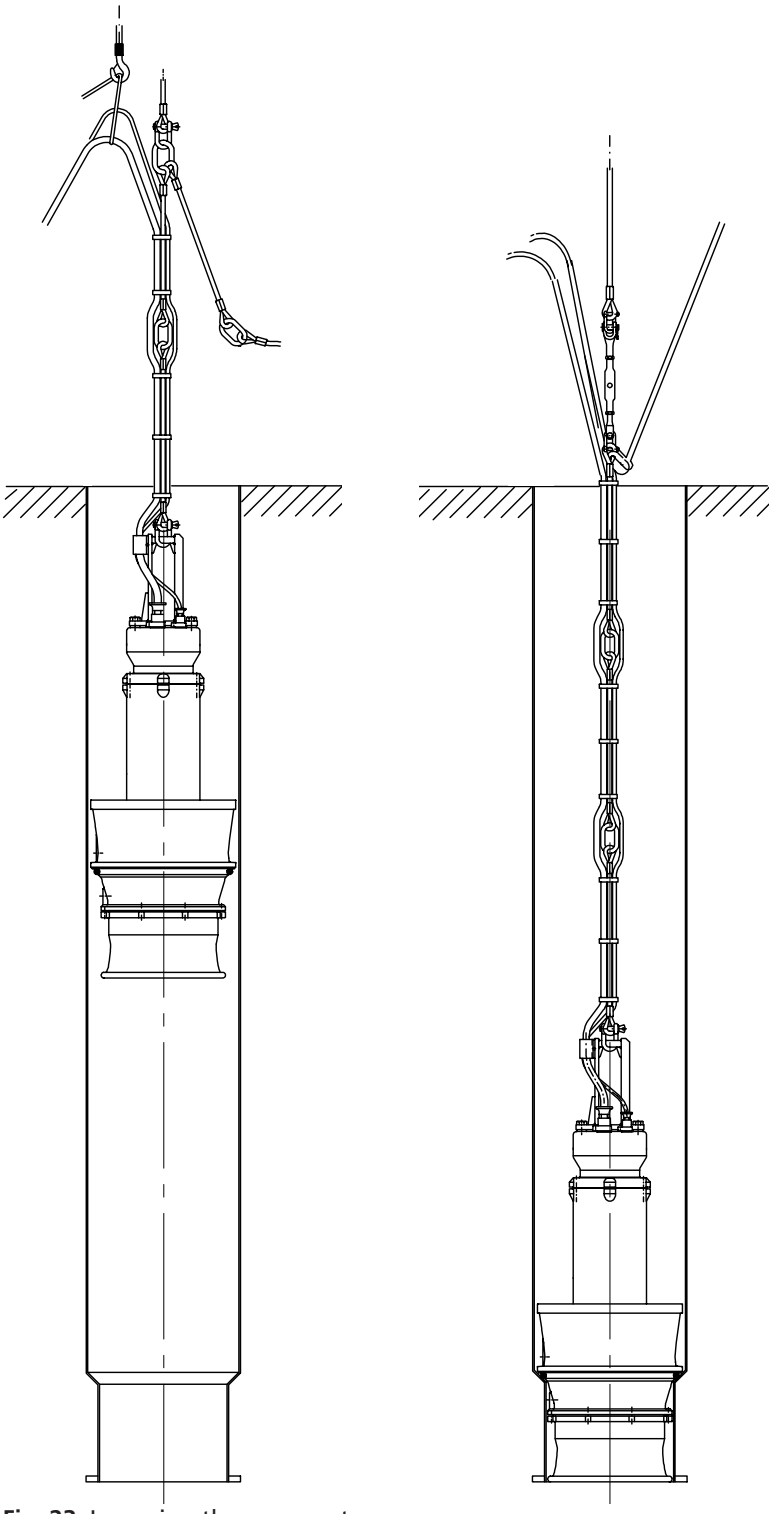

Fig. 23: Lowering the pump set

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 cables are tight but do 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.

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29. Attach the top loose lifting lug to the cables 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. (⇨ Section 9.3, Page 97)

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

NOTE

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

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

5.4.1.1 Setting the overload protection device

1. Protect the pump set against overloading by a thermal time-lag overload protection device in accordance with IEC 60947 and local regulations.
2. Set the overload protection device to the rated current specified on the name plate. (⇨ Section 4.4, Page 19)

5.4.1.2 Level control

DANGER

Pump set running dry

Explosion hazard!

- ▹ Never allow a pump set to run dry.

CAUTION

Fluid level below the specified minimum

Damage to the pump set by cavitation!

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

Automatic operation of the pump set in a sump / tank requires the use of level control equipment.
Observe the minimum fluid level indicated. (⇨ Section 6.2.4.3, Page 49)

5.4.1.3 Operation on a frequency inverter

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

NOTE

For pump sets with rated voltages exceeding 500 V, a dv/dt filter should be fitted at the output of the frequency inverter to reduce the rate of voltage rise to the limits specified in IEC 60034-25, Section 18. Otherwise a considerably reduced service life of the insulation system has to be expected.

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DANGER

Operation outside the permitted frequency range

Explosion hazard!

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

DANGER

Incorrect selection and setting of the frequency inverter

Explosion hazard!

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

Selection

When selecting a frequency inverter, check the following details:

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

Setting

Observe the following instructions for setting a frequency inverter:

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

Start-up

Observe the following instructions for starting the frequency inverter:

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

Operation

Observe the following limits during operation on a frequency inverter:

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

Electromagnetic compatibility

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

Interference immunity

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

5.4.1.4 Sensors

DANGER

Operating an incompletely connected pump set

Damage to the pump set!

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

CAUTION

Incorrect wiring

Damage to the sensors!

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

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

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

NOTE

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

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

For information on wiring and core marking see (⇨ Section 9.3, Page 97)

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

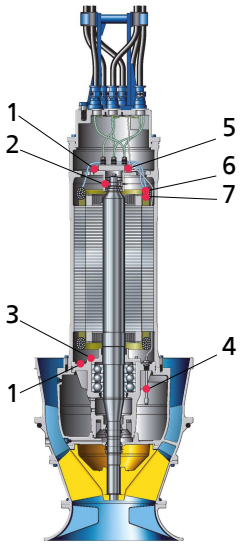

Fig. 24: Sensor positions

Position	Sensor	Standard	Optional
1	Leakage inside the motor (connection and winding space)	✘	-
2	Bearing temperature (upper bearing assembly)	-	✘
3	Bearing temperature (lower bearing assembly)	✘	-
4	Mechanical seal leakage	✘	-
5	Vibration sensor	-	✘
6	Motor temperature (PTC)	✘	-
7	Motor temperature (Pt100)	-	✘

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5.4.1.4.1 Motor temperature

DANGER

Insufficient cooling conditions

Explosion hazard!

Winding damage!

- ▷ Never operate a pump set without operational temperature monitoring.
- ▷ For explosion-proof pump sets use a thermistor tripping unit with manual reset.

Three series-connected PTC thermistors at terminals 10 and 11 monitor the winding temperature.
Use a thermistor tripping unit with manual reset.

Pt100 resistance thermometer

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

CAUTION

Temperature monitoring devices not properly connected

Winding damage!

- ▷ Never use the Pt100 resistance thermometers as the only means of monitoring the motor temperature.

5.4.1.4.2 Leakage inside the motor

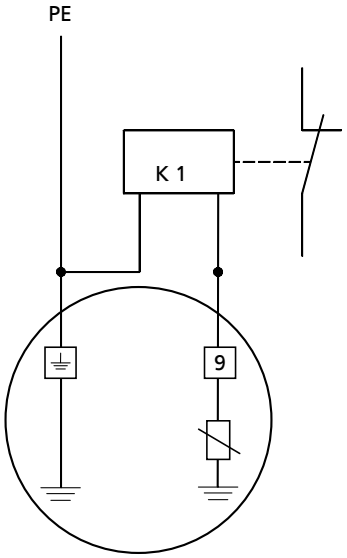
DANGER

Incorrect monitoring of leakage electrode

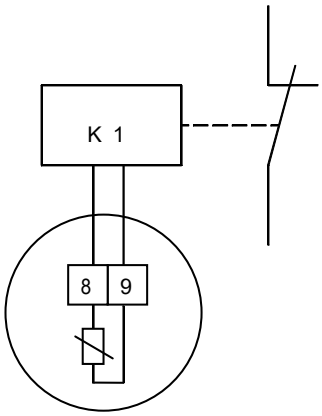
Explosion hazard!

Danger of death from electric shock!

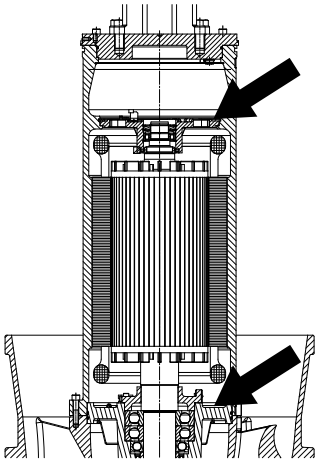
- ▷ Voltages must be < 30 V AC and tripping currents < 0.5 mA.



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 trip the motor at a tripping resistance between 3 and 60 kΩ.

Pump sets with vibration sensors

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

5.4.1.4.3 Mechanical seal leakage

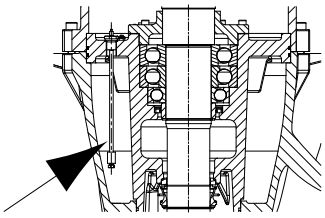


Fig. 25: Float switch

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

5.4.1.4.4 Bearing temperature

The lower bearing of the pump set is equipped with a bearing temperature sensor. This sensor is a Pt100 resistance thermometer (core identification 15 and 16). It must be connected to a temperature control device with a Pt100 input and two separate outputs for two different switching points (sensor circuit maximum 6 V / 2 mA).

Set the following limits:

- Alert at 130 °C
- Cut-out of the pump set at 150 °C

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

5.4.1.4.5 Vibration sensor

As an option, the pump set can be supplied with a vibration sensor in the area of the upper bearing.

The 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 standardised output (4 to 20 mA). This allows simple integration into existing PLC systems or process control systems.

Table 9: Technical data of the sensor

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

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Connecting the vibration sensor

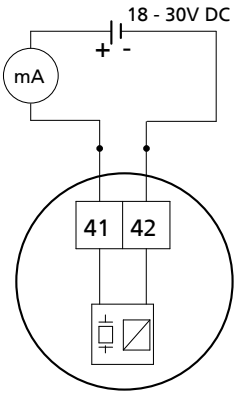

Fig. 26: Connecting the vibration sensor

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

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

5.4.2 Electrical connection

DANGER

Electrical connection work by unqualified personnel

Danger of death from electric shock!

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

WARNING

Incorrect connection to the mains

Damage to the power supply network, short circuit!

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

CAUTION

Improper routing of electric cables

Damage to the electric cables!

- ▷ Never move the electric cables at temperatures below -25 °C.
- ▷ Never kink or crush the electric cables.
- ▷ Never lift the pump set by the electric cables.
- ▷ Adjust the length of the electric cables to the site requirements.

CAUTION

Motor overload

Damage to the motor!

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

For the electrical connection observe the wiring diagrams (⇨ Section 9.3, Page 97) in the Annex and the information for planning the control system (⇨ Section 5.4.1, Page 38) .

The pump set is supplied with power cables.

Always use all electric cables provided and connect all marked cores of the sensor 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

Damage to the pump set!

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

DANGER

Using damaged power cables

Danger of death from electric shock!

- ▷ Never connect any 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.

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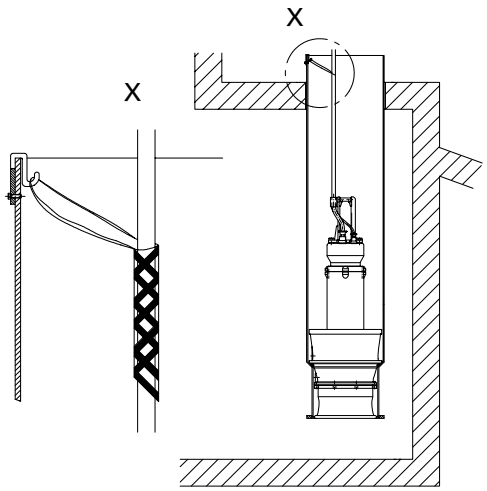

Fig. 27: Fastening the power cable

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

Potential equalisation

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

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

Operating the pump set without protective equipment

Electric shock!

Risk of injury!

Danger of death from drowning!

- ▷ Never start up the pump set without special protective equipment when there are persons in the tank.
- ▷ If persons come into contact with the fluid handled during pump operation (e.g. in sports facilities and leisure parks), the plant designer/operator must comply with the legal requirements.
- ▷ Provide special electrical and mechanical protective equipment compliant with the legal regulations.

WARNING

Operating the pump set without mechanical protective equipment

Risk of injury from solid matter in the fluid handled!

- ▷ If persons come into contact with the fluid handled during pump operation (e.g. in sports facilities and leisure parks), install mechanical protective equipment (e.g. a screen) on the discharge side of the pump set.

WARNING

People falling into the unsecured discharge tube

Risk of personal injury!

- ▷ Take suitable precautions during the entire installation/removal process to protect people from falling into the open discharge tube.
- ▷ Fence off the work area appropriately.

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

- The lubricant has been checked.
- The direction of rotation has been checked.
- The pump set has been properly connected to the power supply and is equipped with all protection devices.
- The pump set has been installed in the discharge tube as described in this manual.
- The minimum fluid level has been reached.
- After prolonged shutdown of the pump (set), the activities required for returning the equipment to service have been carried out. (⇨ Section 6.4, Page 50)
- Safety-relevant protective equipment must be installed and fully functional.

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6.1.2 Start-up

DANGER

Operating the pump set without protective equipment

Electric shock!

Risk of injury!

Danger of death from drowning!

- ▷ Never start up the pump set without special protective equipment when there are persons in the tank.
- ▷ If persons come into contact with the fluid handled during pump operation (e.g. in sports facilities and leisure parks), the plant designer/operator must comply with the legal requirements.
- ▷ Provide special electrical and mechanical protective equipment compliant with the legal regulations.

CAUTION

Re-starting while motor is still running down

Damage to the pump set!

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

✓ The fluid level is sufficiently high.

CAUTION

Start-up against a closed shut-off element

Damage to the pump set!

- ▷ Never operate the pump set against a closed shut-off element.

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

6.2 Operating limits

DANGER

Non-compliance with operating limits

Damage to the pump set!

- ▷ 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

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

6.2.2 Frequency of starts

CAUTION

Excessive frequency of starts

Risk of damage to the motor!

- ▷ Never exceed the specified frequency of starts.

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

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

CAUTION

Re-starting while motor is still running down

Damage to the pump set!

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

6.2.3 Operation on a frequency inverter

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

6.2.4 Fluid handled

6.2.4.1 Fluid temperature

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

CAUTION

Danger of freezing!

Damage to the pump set!

- ▷ Drain the pump set or protect it against freezing.

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

6.2.4.2 Density of the fluid handled

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

CAUTION

Impermissibly high density of the fluid handled

Motor overload!

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

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6.2.4.3 Minimum level of fluid handled

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 the corresponding general arrangement drawing).

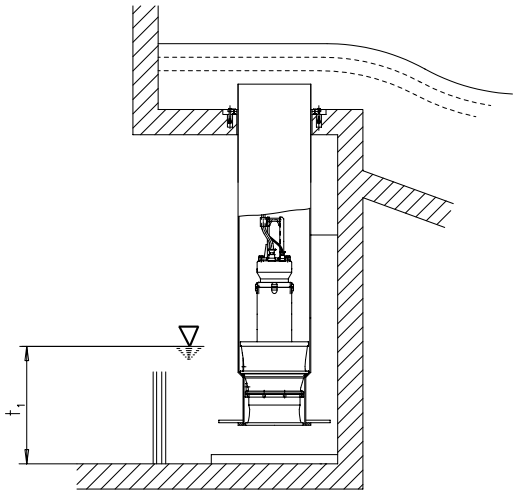

Fig. 28: Example: minimum level of fluid handled

6.2.4.4 Abrasive fluids

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

6.3 Shutdown/storage/preservation

6.3.1 Shutdown

CAUTION

Uncontrolled backflow of the fluid from the riser

Damage to the pump set!

- ▷ Prevent any **uncontrolled** backflow of the fluid handled with suitable means.
- ▷ **Control** the fluid backflow, e.g. by throttling the gate valve in the discharge line.

6.3.2 Measures to be taken for shutdown

DANGER

Electrical connection work by unqualified personnel

Danger of death from electric shock!

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

⚠ WARNING

Unintentional starting of the pump set

Risk of injury by moving components and shock currents!

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

⚠ WARNING

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

Risk of injury!

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

CAUTION

Danger of frost/freezing

Damage to the pump set!

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

The pump set remains installed

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

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

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

✓ All safety regulations are observed.

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

6.4 Returning to service

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

⚠ WARNING

Failure to re-install or re-activate protective devices

Risk of injury from moving parts or escaping fluid!

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

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NOTE

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

7 Servicing/Maintenance

7.1 Safety regulations

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

DANGER

Improper lifting/moving of heavy assemblies or components

Danger to life from falling parts!

Damage to the pump set!

- Use suitable transport equipment, lifting equipment and lifting tackle to move heavy assemblies or components.
- Use the attachment point provided for attaching the lifting accessory.
- Never lift the pump set by the electric cables.
- Use the lifting chain/rope included in the scope of supply exclusively for lowering or lifting the pump set into/out of the pump sump.
- Securely attach the lifting chain/rope to the pump and crane.
- Use tested, marked and approved lifting accessories only.
- Observe the regional transport regulations.
- Observe the documentation of the lifting accessory manufacturer.
- The load-carrying capacity of the lifting accessory must be higher than the weight indicated on the name plate of the pump set to be lifted. Take into account any additional system components to be lifted.
- Maintain a safe distance during lifting operations (load may swing when being lifted).

DANGER

Risk of falling when working at a great height

Danger to life by falling from a great height!

- Do not step onto the pump (set) during installation work or dismantling work.
- Pay attention to safety equipment, such as railings, covers, barriers, etc.
- Observe the applicable local health and occupational safety regulations and accident prevention regulations.

DANGER

Electrical connection work by unqualified personnel

Danger of death from electric shock!

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

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⚠ WARNING

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

Risk of injury!

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

⚠ WARNING

Unintentional starting of the pump set

Risk of injury by moving components and shock currents!

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

⚠ WARNING

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

Risk of injury! Damage to the submersible motor pump!

- ▷ Never insert your hands, other body parts or foreign objects into the impeller or impeller intake area.
- ▷ Always make sure the electrical connections are disconnected before checking whether the impeller rotates freely.

⚠ WARNING

Hot surface

Risk of injury!

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

⚠ WARNING

Improper lifting/moving of heavy assemblies or components

Personal injury and damage to property!

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

⚠ WARNING

Insufficient stability

Risk of crushing hands and feet!

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

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

NOTE

All maintenance work, service work and installation work can be carried out by KSB Service or authorised workshops. Find your contact in the attached Addresses booklet or visit https://www.ksb.com/en-global/contact.

Never use force when dismantling and reassembling the pump set.

7.2 Maintenance/inspection

KSB recommends the following regular maintenance schedule:

Table 10: Overview of maintenance work

Maintenance interval	Maintenance work	For details see ...
First check after at least 6 months; interval can be extended to 12 months (in sports facilities and leisure parks)	Visually inspect for corrosion.	(⇨ Section 7.3.6, Page 59)
Every 4000 hours, at least once a year	Measure the insulation resistance.	(⇨ Section 7.2.1.1, Page 54)
Every 8000 hours, at least every 3 years	Check the cable bundle.	(⇨ Section 7.3.3, Page 58)
	Check the earth conductor.	(⇨ Section 7.3.4, Page 58)
	Check the sensors.	(⇨ Section 7.2.1.2, Page 55)
	Check the mechanical seal leakage.	(⇨ Section 5.2.3, Page 23)
	Change the lubricant.	
Every 16,000 hours, at least every 5 years	Lubricate the rolling element bearings.	
	General overhaul	

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

7.2.1 Inspection work

7.2.1.1 Measuring the insulation resistance

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

✓ The pump set has been disconnected in the control cabinet.

✓ Use an insulation resistance measuring device.

✓ The recommended measuring voltage equals 500 V (maximum permissible 1000 V).

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

⇨ The insulation resistance of the core ends to chassis ground must not be lower than 1 MΩ.
If the resistance measured is lower, power cable and motor resistance must be measured separately. Disconnect the power cable from the motor for this purpose.

NOTE

If the insulation resistance of the power cable is lower than 1 MΩ, the power cable is defective and must be replaced.

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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 11: Resistance measurement

Measurement between terminals ...	Resistance
	[Ω]
10 and 11	200 - 1000
31 and 32 [3)]	100 - 120
33 and 34 [3)]	100 - 120
35 and 36 [3)]	100 - 120

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

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

Leakage sensors in the motor

Table 12: Resistance measurement of the leakage sensor in the motor

Measurement between terminals ...	Resistance
	[kΩ]
9 and earth conductor (PE)	> 60
8 and 9[4)]	> 60

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

Float switch (mechanical seal leakage)

Table 13: 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 14: Resistance measurement of the bearing temperature sensor

Measurement between terminals ...	Resistance
	[Ω]
15 and 16	100 to 120
16 and 17[5)]	100 to 120

3 Optional
4 Only for pump sets with vibration sensor
5 Optional

Vibration sensor

Table 15: Current measurement at vibration sensor

Measurement between terminals ...	Current value
41 and 42[6)]	Constant 4 mA during standstill

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 injury!

- ▷ Properly shut down the pump set.
- ▷ Close the shut-off elements in the suction line and discharge line.
- ▷ Drain the pump and release the pump pressure.
- ▷ Shut off any auxiliary feed lines.
- ▷ Allow the pump set to cool down to ambient temperature.

WARNING

Incorrect handling of the electric cable

Personal injury and damage to property!

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

WARNING

People falling into the unsecured discharge tube

Risk of personal injury!

- ▷ Take suitable precautions during the entire installation/removal process to protect people from falling into the open discharge tube.
- ▷ Fence off the work area appropriately.

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6 Optional

⚠ WARNING

Turnbuckle and shackle are not suitable for lifting the pump set

Risk of injury!

Damage to the pump set!

- ▷ Always use the lifting lugs of the support rope to lift the pump set.

- ✓ The power cables have been disconnected and secured against unintentional start-up.
- ✓ The discharge tube is open; its opening is securely covered except for a gap allowing work to continue.
- ✓ Suitable lifting equipment is provided.

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

NOTE

Prevent any loose parts from falling into the pump sump!

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

⚠ WARNING

Pump set tilting

Risk of squashing hands and feet!

- ▷ Suspend or support the pump set.

CAUTION

Improper storage

Damage to the power cables!

- ▷ Support the power cables at the cable entry to prevent permanent deformation.
- ▷ Protect the core ends against moisture.

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

7.3.2 Drainage/cleaning

⚠ WARNING

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

Hazard to persons and the environment!

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

1. Always flush the pump if it has been used for handling noxious, explosive, hot or other hazardous fluids.
2. Always flush and clean the pump before transporting it to the workshop. Provide a certificate of decontamination for the pump set.
(⇨ Section 11, Page 127)

7.3.3 Checking the cable bundle

When removing the pump set from the discharge tube check the support rope and attachment (shackle) and all electric cables for any damage. In addition, observe the operating manual of the lifting accessories. Replace any damaged components by original spare parts.

Longer cable bundles must be dismantled:

1. Undo 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 earth conductor

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

⚠ DANGER

Defective earth conductor

Electric shock!

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

7.3.5 Checking the leakage at the mechanical seal

⚠ WARNING

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

Hazard to persons and the environment!

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

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⚠ WARNING

Excess pressure inside the pump set

Risk of injury when opening the pump set!

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

NOTE

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

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

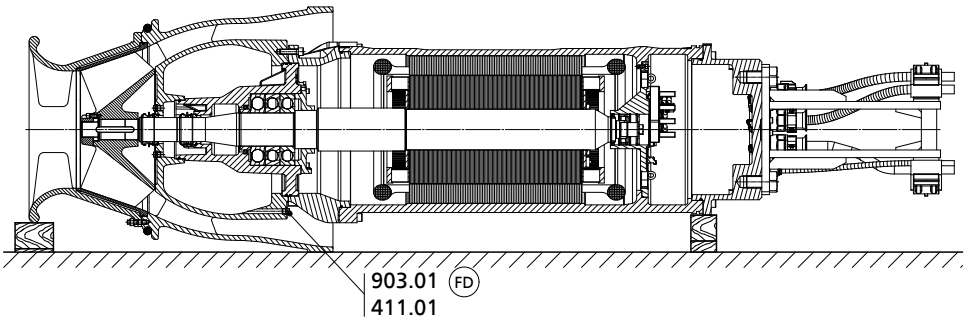

Fig. 29: Checking the mechanical seal leakage

Table 16: Symbols key

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

✓ A suitable container for the leakage is on hand.

✓ The pump set is positioned horizontally on a level surface and is protected against rolling off. (⇨ Section 3.2, Page 12)

1. Place the container underneath screw plug 903.01.
2. Remove screw plug 903.01 with joint ring 411.01. Observe the plate "Leakage drain".
3. Drain the leakage.
   ⇨ If there is no leakage or, after several years of operation, only a small amount, the mechanical seals are working properly. If the leakage exceeds 2 litres, the mechanical seals are defective and must be replaced.
4. Re-insert and tighten screw plug 903.01 with new joint ring 411.01.

7.3.6 Visually inspecting for corrosion.

✓ The pump set has been removed from the system.

1. Conduct a visual inspection of the pump set.
   ⇨ Clearly visible corrosion: Replace defective components and check corrosion protection.
   ⇨ No visible corrosion: Extend visual inspection interval to 12 months.

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 reservoir of the mechanical seal. Top it up if required.

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

7.4.1.1 Intervals

Replace the lubricant every 8000 operating hours but at least every 3 years.

7.4.1.2 Lubricant quality

The lubricant reservoir 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 17: Lubricant quality

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

Recommended lubricants:

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

WARNING

Lubricant contaminating fluid handled

Hazard to persons and the environment!

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

7.4.1.3 Lubricant quantity

Table 18: Lubricant quantity [l] depending on size

Size	Lubricant quantity [l]
800/850 - 535	2,8
850 - 550	2,8
900/1000 - 600	3,1
900/1000 - 615	3,1
900/1000 - 620	3,1
1000 - 655	4,6
1300 - 820	3,1

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7.4.1.4 Changing the lubricant

⚠ WARNING

Lubricants posing a health hazard and/or hot lubricants

Hazard to persons and the environment!

- When draining the lubricant take appropriate measures to protect persons and the environment.
- Wear safety clothing and a protective mask if required.
- Collect and dispose of any lubricants.
- Observe all legal regulations on the disposal of fluids posing a health hazard.

⚠ WARNING

Excess pressure inside the pump set

Risk of injury when opening the pump set!

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

⚠ WARNING

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

Personal injury and damage to property!

- Select suitable lifting equipment for the size of the pump.
- Use appropriate means to secure the pump set against tilting, tipping over or rolling off.
- Maintain a safe distance during lifting operations (load may swing when being lifted).
- Use additional supports for the transport holder to secure it against tilting.

7.4.1.4.1 Draining the lubricant

⚠ WARNING

Incorrect positioning/placing down

Personal injury and damage to property!

- Position the pump set vertically with the motor on top.
- Use appropriate means to secure the pump set against tilting and tipping over.
- Refer to the weights given in the data sheet/on the name plate.

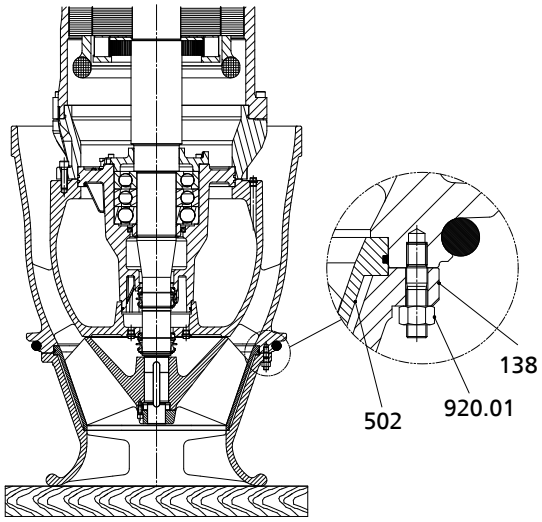

Fig. 30: Removing the bellmouth

✓ The pump has been placed in a vertical position with the bellmouth on wooden supports. It has been secured against tipping over.

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

1. Undo nuts 920.01.
2. Attach the crane hook to the bail and lift the pump set off the bellmouth with the casing wear ring.
3. Place the pump set in a horizontal position on wooden supports. Secure it against rolling off.

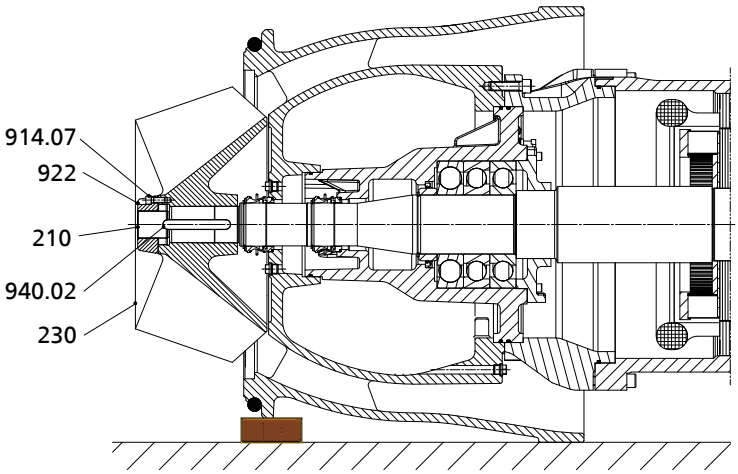

Fig. 31: Removing the impeller

4. Undo socket head cap screws 914.07 and impeller nut 922.
5. Pull impeller 230 off shaft 210.

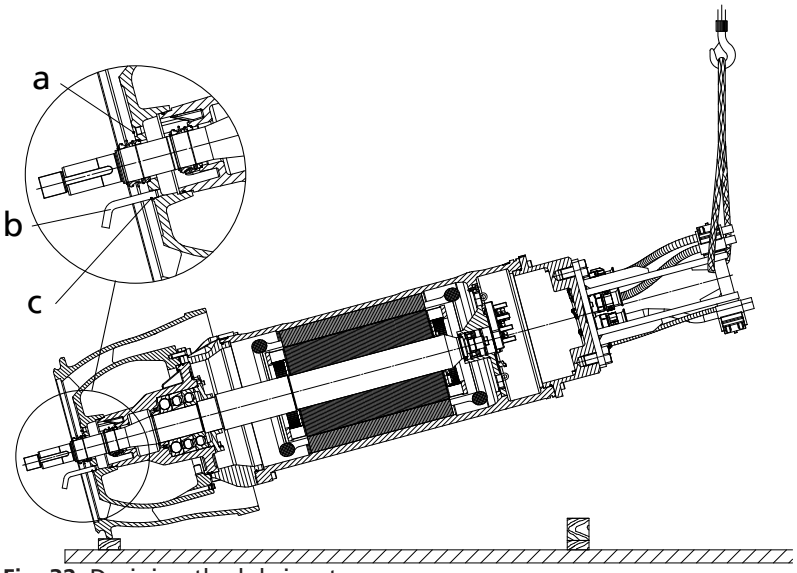

Fig. 32: Draining the lubricant

a	Oil filler plug	b	Tube
c	Oil drain (903.02, 411.02)		

The front face of pump casing 101 comes with **1 or 2 screw plugs**, depending on the pump size.

Version with 1 screw plug

1. Remove screw plug 903.02 and joint ring 411.02.
2. Screw in a sufficiently long tube (b) with G $^1/_2$ thread.
3. Carefully rotate the pump set until the tube points downwards.
4. Slowly lift the pump a little.
5. Collect the lubricant in a suitable container, determine its quantity and compare it with the specified lubricant quantity (⇨ Section 7.4.1.3, Page 60) .
   ⇨ If more than 1.5 litres of lubricant are required for topping up, this suggests a defect of the mechanical seal.
6. Properly dispose of the lubricant.
7. Remove the tube. Fit screw plug 903.02 (oil drain) and a new joint ring with liquid sealant.

Version with 2 screw plugs

1. Move the screw plug 903.02 and joint ring 411.02 which are the furthest from the shaft (oil drain) into upper position and remove them.
2. Screw in a sufficiently long tube (b) with G $^1/_2$ thread.
3. Carefully rotate the pump set until the tube points downwards.
4. Remove the upper screw plug (oil filler plug). (For venting purposes)
5. Slowly lift the pump a little.
6. Collect the lubricant in a suitable container, determine its quantity and compare it with the specified lubricant quantity (⇨ Section 7.4.1.3, Page 60) .
   ⇨ If more than 1.5 litres of lubricant are required for topping up, this suggests a defect of the mechanical seal.
7. Properly dispose of the lubricant.
8. Remove the tube. Fit screw plug 903.02 and a new joint ring. Apply a liquid sealant.

7.4.1.4.2 Filling in the lubricant

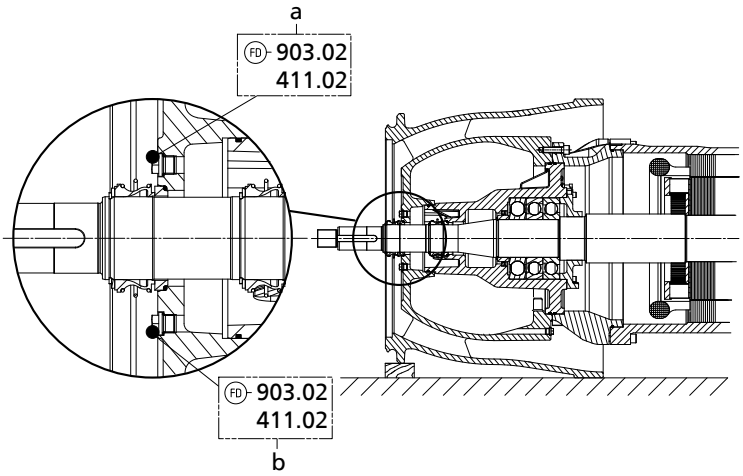

Fig. 33: Filling in the lubricant

a	Filler opening The **distance** between the shaft and the filler opening is **smaller** than the distance between the shaft and the drain opening.	b	Drain opening The **distance** between the shaft and the drain opening is **larger** than the distance between the shaft and the filler opening.

Table 19: Key to the symbols and codes

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

✓ The pump set has been placed in a horizontal position and protected against rolling off.

✓ Screw plug 903.02 and joint ring 411.02 have been removed from the filler opening.

✓ The drain opening is closed with screw plug 903.02 and joint ring 411.02.

1. Screw a sufficiently long tube with G 1/2 thread into the filler opening.
2. Fill the lubricant in through the tube until it overflows.
3. Remove the tube. Fit screw plug 903.02 and a new joint ring 411.02 with liquid sealant.

NOTE

For commissioning: If required, top up the lubricant. (⇨ Section 5.2.3, Page 23)
If more than 1.5 litres of lubricant are required for topping up, this suggests that the mechanical seal is defective and has to be replaced.

7.4.2 Lubricating the rolling element bearings

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

7.4.2.1 Intervals

Change the grease when carrying out a general overhaul but at least every 5 years.

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7.4.2.2 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 20: Lubricant characteristics

Base oil	Type	Thickener	NLGI grade (ISO 2137)	Worked penetration at 25 °C, 0.1 mm (ISO 2137)	Drop point (ISO 2176) [°C]	Application temperature range [°C]	Viscosity (DIN 51562) [mm²/s]	
							at 40 °C	at 100 °C
Ester oil	A	Polyurea	2	265 to 295	> 250	-40 to +180	100	11

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

- Type A: Klüberquiet BQH 72-102, made by Klüber Lubrication KG, München (⇨ Section 7.4.2.1, Page 64)

7.4.2.3 Grease quantity

Table 21: Grease quantity

Size	Grease type	Grease quantity [cm³]	
		Drive end	Pump end
800/850 - 535	Type A	30	800
850 - 550	Type A	30	800
900 - 600/615/620	Type A	30	800
1000 - 600/615/620	Type A	50	1850
1000 - 655	Type A	30	800/1850
1300 - 820	Type A	50	800/1850

7.5 Dismantling the pump set

7.5.1 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.

DANGER

Hazardous voltage

Danger of death from electric shock!

- Observe the safety rules for electrical work.
- Disconnect the equipment from the power supply.
- Secure the equipment against unintentional start-up.
- Verify that the equipment is de-energised.
- Earth and short-circuit the medium-voltage components.
- Cover any adjacent components that are connected to the power supply.

WARNING

Unqualified personnel performing work on the pump (set)

Risk of injury!

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

WARNING

Hot surface

Risk of injury!

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

WARNING

Improper lifting/moving of heavy assemblies or components

Personal injury and damage to property!

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

WARNING

Excess pressure inside the pump set

Risk of injury when opening the pump set!

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

WARNING

Components with sharp edges

Risk of cutting or shearing injuries!

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

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.

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Observe the general safety instructions and information.

For dismantling and reassembly observe the general assembly drawing.

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

7.5.2 Preparing the pump set

1. De-energise the pump set and secure it against unintentional start-up.
2. Remove the pump set from the discharge tube. (⇨ Section 7.3.1, Page 56)
3. Clean the pump set. (⇨ Section 7.3.2, Page 58)
4. Drain the lubricant. (⇨ Section 7.4.1.4, Page 61) (⇨ Section 7.4.1.4.1, Page 61)
5. Drain the leakage chamber and leave it open for the duration of the disassembly.

7.5.3 Removing the bellmouth

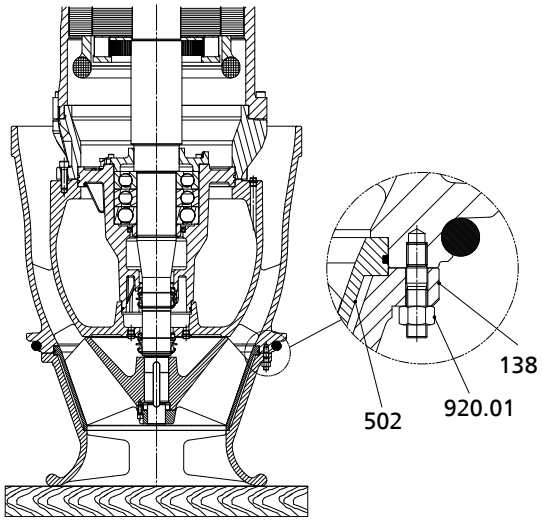

Fig. 34: Removing the bellmouth

✓ The pump set has been disconnected from the power supply and secured against unintentional start-up.

✓ The pump set has been placed in a vertical position with the bellmouth on wooden supports and secured against tipping over.

1. Undo nuts 920.01.
2. Attach the crane hook to the bail and lift the pump set off bellmouth 138. Casing wear ring 502 remains in bellmouth 138.
3. Place the pump set in a horizontal position on wooden supports and make sure it cannot roll off.

7.5.4 Removing the impeller

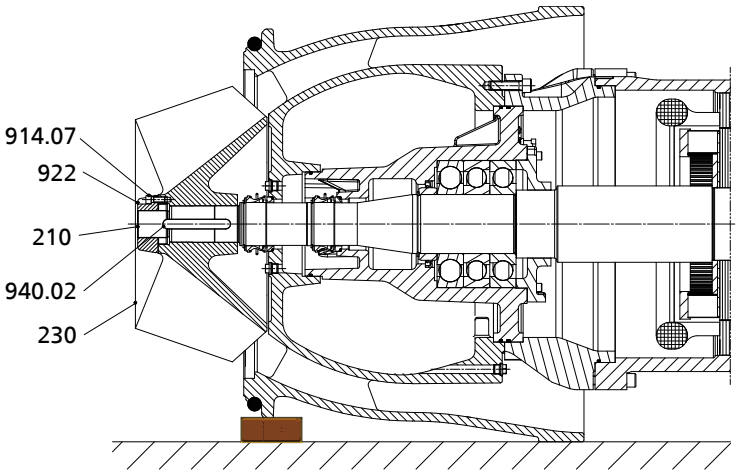

Fig. 35: Removing the impeller

✓ The pump has been placed in a horizontal position on wooden supports and is protected against rolling off.

✓ The leakage has been drained.

1. Undo socket head cap screw 914.07 and impeller nut 922.
2. Pull impeller 230 off shaft 210.
3. Remove keys 940.02 from shaft 210.
4. Protect the shaft thread against damage.

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7.5.5 Removing the mechanical seal

7.5.5.1 Impeller-end mechanical seal

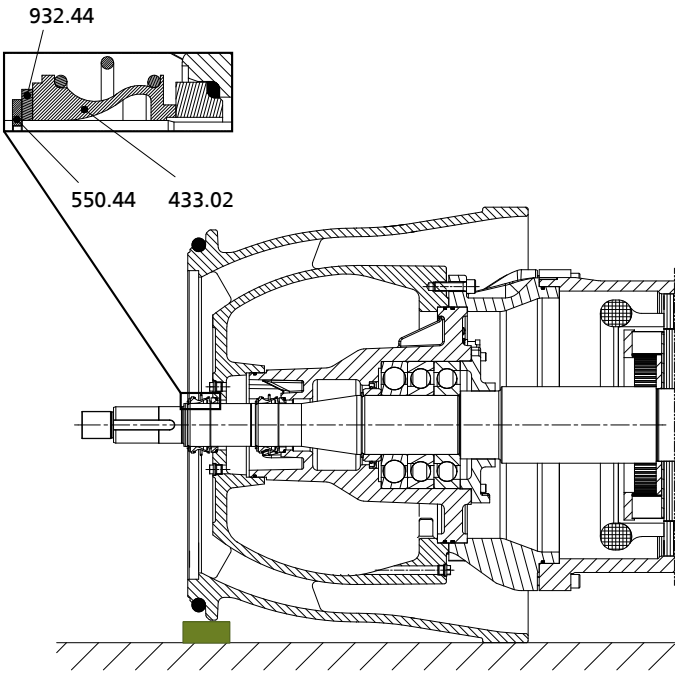

Fig. 36: Removing the impeller-end mechanical seal

- ✓ The pump set has been securely placed in a horizontal position on wooden supports.
- ✓ The impeller has been removed.
- ✓ The lubricant has been drained. (⇨ Section 7.4.1.4.1, Page 61)

1. Remove circlip 932.44 and disc 550.44.
2. Pull mechanical seal 433.02 off the shaft.

NOTE

To protect the mechanical seal against damage when pulling it off the shaft, placing a foil (no thicker than 0.03 mm) around the free shaft end is recommended.

7.5.5.2 Drive-end mechanical seal

DANGER

Improper lifting/moving/transporting of heavy assemblies or components

Danger to life from falling parts!

Damage to the pump set!

- ▷ Never rotate the rotor in the motor housing during dismantling/reassembly.
- ▷ Place the motor (unit) including rotor and bearing housing on a wooden support and protect it against rolling off.

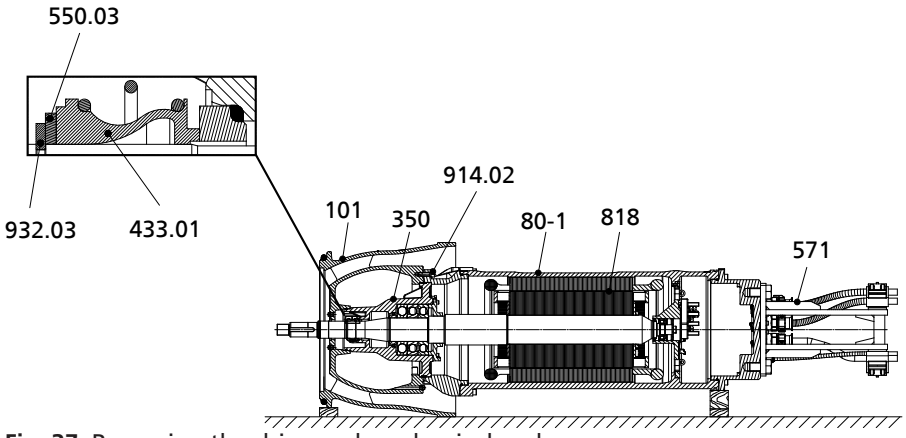

Fig. 37: Removing the drive-end mechanical seal

✓ The impeller-end mechanical seal has been removed.

1. Attach the pump set to the lifting equipment and pull it upright. (⇨ Section 3.2, Page 12) Place the pump set on the bellmouth with pump casing 101 down.
2. Undo hexagon socket head cap screws 914.02.
3. Attach the lifting tackle to bail 571 and lift the pump set out of pump casing 101.
4. Place motor unit 80-1 including rotor 818 with the bearing assembly and bearing housing 350 on a wooden support and protect it against rolling off. (⇨ Section 3.2, Page 12)
5. Remove circlip 932.03 and disc 550.03.
6. Carefully pull mechanical seal 433.01 and its mating ring off the shaft.

7.5.6 Dismantling the motor section

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

7.5.6.1 Removing the motor housing cover

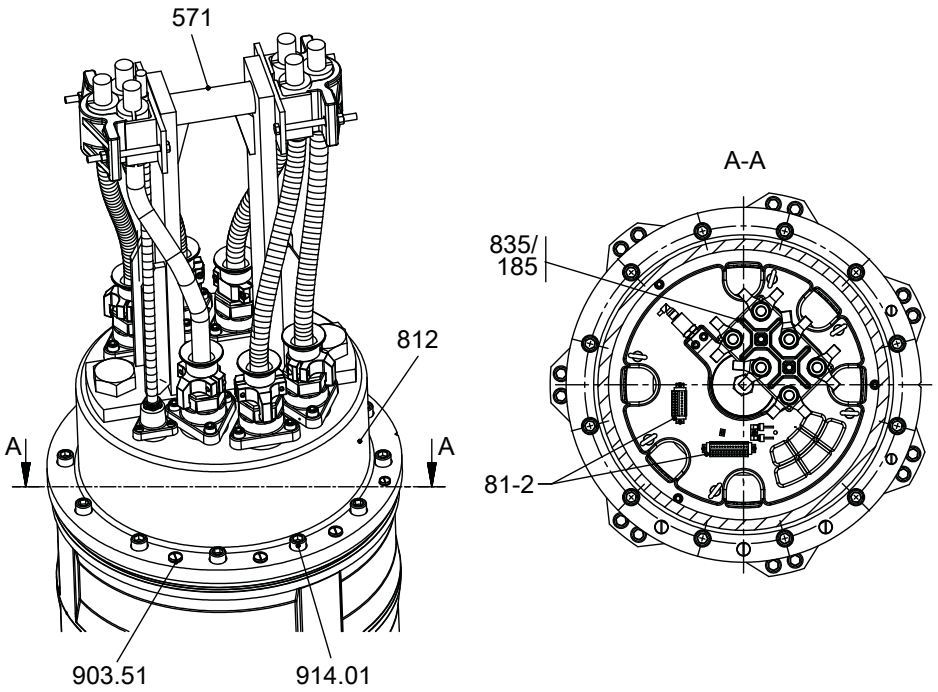

Fig. 38: Removing the motor housing cover

✓ Suitable lifting equipment is on hand.

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

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

7.5.6.2 Removing the cable gland and connection cable

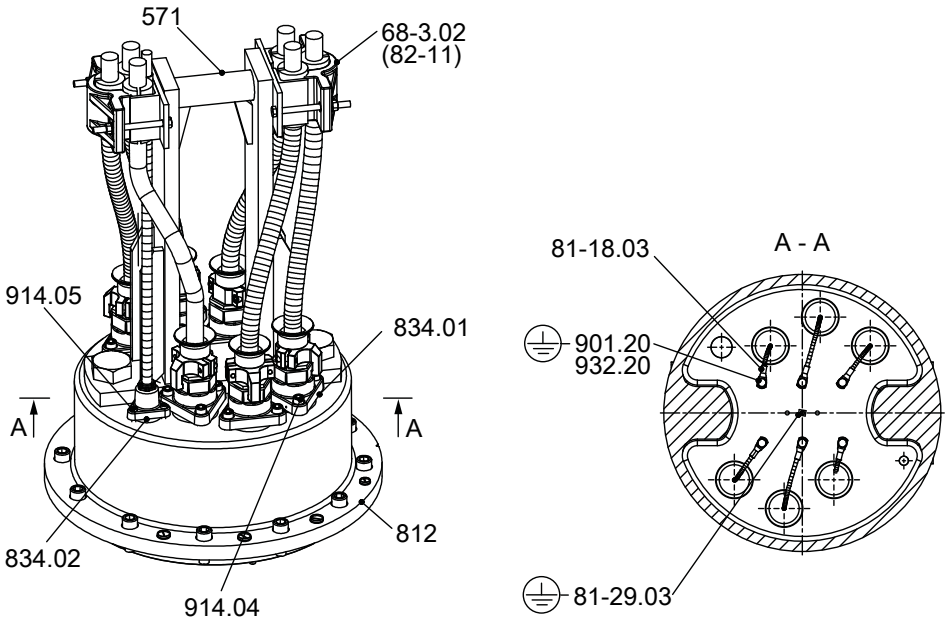

Fig. 39: Removing the cables and cable gland

Removing the power cable

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

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

Removing the sensor cable

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

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

NOTE

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

7.6 Reassembling the pump set

7.6.1 General information/Safety regulations

⚠ WARNING

Improper lifting/moving of heavy assemblies or components

Personal injury and damage to property!

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

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⚠ WARNING

Components with sharp edges

Risk of cutting or shearing injuries!

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

⚠ WARNING

Insufficient stability

Risk of crushing hands and feet!

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

CAUTION

Improper reassembly

Damage to the pump!

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

NOTE

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

Sequence Always re-assemble the pump (set) in accordance with the corresponding general assembly drawing and/or exploded view.

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

7.6.2 Installing the replacement cable gland

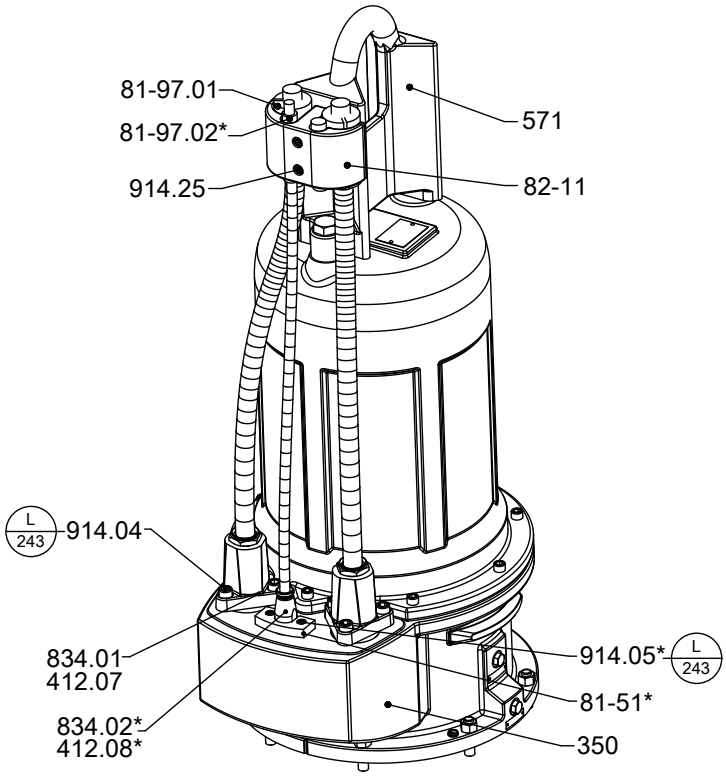

Fig. 40: Installing the power cable and cable gland

*: On specific designs only

Table 22: Symbols key

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

Installing the power cable, version without plug

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

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5. Pull a heat shrink tube over the connection point.
6. Insert cable gland 834.01 with the power cable and O-ring 412.07 into the opening provided.
7. Fasten cable gland 834.01 of the power cable with hexagon socket head cap screws 914.04 and secure the screwed connection with Loctite 243.

Installing the power cable, version with plug

1. Slide O-ring 412.07 onto the core ends of the power cable until the O-ring reaches the centring seat.
2. Connect the plug of the power cable with the plug of the pump set.
3. Insert cable gland 834.01 with the power cable and O-ring 412.07 into the opening provided.
4. Fasten cable gland 834.01 with clamping element 81-51 and hexagon socket head cap screws 914.04. Secure the screwed connection with Loctite 243.

Installing the control cable

1. Slide O-ring 412.08 onto the core ends of the control cable until the O-ring reaches the centring seat.
2. Connect the plug of the control cable with the plug of the pump set.
3. Insert cable gland 834.02 with the control cable and O-ring 412.08 into the opening provided.
4. Fasten cable gland 834.02 with clamping element 81-51 and hexagon socket head cap screws 914.05 and secure the screwed connection with Loctite 243.

Fastening the cover plate to the bail

1. Insert the power cable and control cable with cable protectors 81-97.01/02 into cover plate 82-11.
2. Screw the cover plate to bail 571 with hexagon socket head cap screws 914.25.
3. The electric cables must be taut when fitted.

7.6.3 Fitting the motor housing cover

DANGER

Electrical connection work by unqualified personnel

Danger of death from electric shock!

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

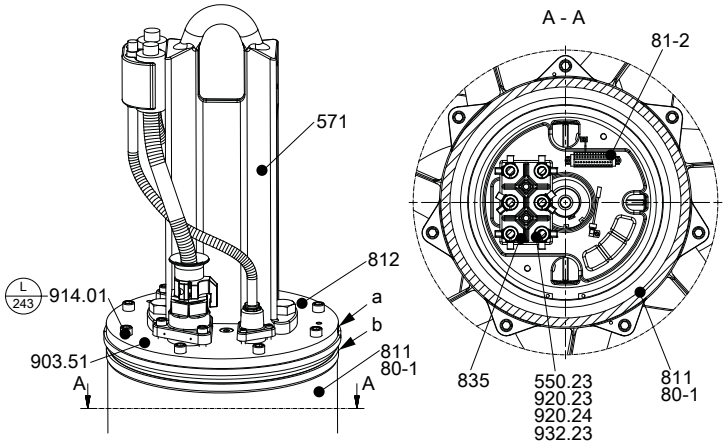

Fig. 41: Fitting the motor housing cover

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

Table 23: Symbols key

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

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

1. Attach lifting equipment to eyebolt 900.04 or bail 571 of motor housing cover 812. Lift up the motor housing cover 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 alignment grooves must be properly aligned.
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 cable and power cable together with cable ties.
5. Slowly lower motor housing cover 812 onto motor housing 811. Watch the alignment grooves in motor housing cover 812 and motor housing 811. The alignment grooves must be properly aligned.
6. Fasten motor housing cover 812 to motor housing 811 or motor unit 80-1 with socket head cap screws 914.01. Secure with Loctite 243. Observe the tightening torque! (⇨ Section 7.8, Page 84)
7. Cover the extraction threads with caps 903.51.
8. Perform a leak test on the motor. (⇨ Section 7.6.8.2, Page 82)

7.6.4 Installing the mechanical seal

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

- Only remove the protective wrapping of the contact faces immediately before assembly takes place.
- The shaft surface must be absolutely clean and undamaged.
- Immediately before installing the mechanical seal, wet the contact faces with a drop of oil.
- For easier installation of bellows-type mechanical seals, wet the inside diameter of the bellows or the O-rings with soapy water (not oil).
- Cover any grooves in the shaft into which the O-rings could slide with suitable means or assembly aids.
- To prevent any damage to the rubber bellows, place a thin foil (of approximately 0.1 to 0.3 mm thickness) around the free shaft stub.
  Slide the rotating assembly over the foil into its installation position.
  Then remove the foil.

7.6.4.1 Drive-end mechanical seal

⚠ DANGER

Improper lifting/moving/transporting of heavy assemblies or components

Danger to life from falling parts!

Damage to the pump set!

- ▷ Never rotate the rotor in the motor housing during dismantling/reassembly.
- ▷ Place the motor (unit) including rotor and bearing housing on a wooden support and protect it against rolling off.

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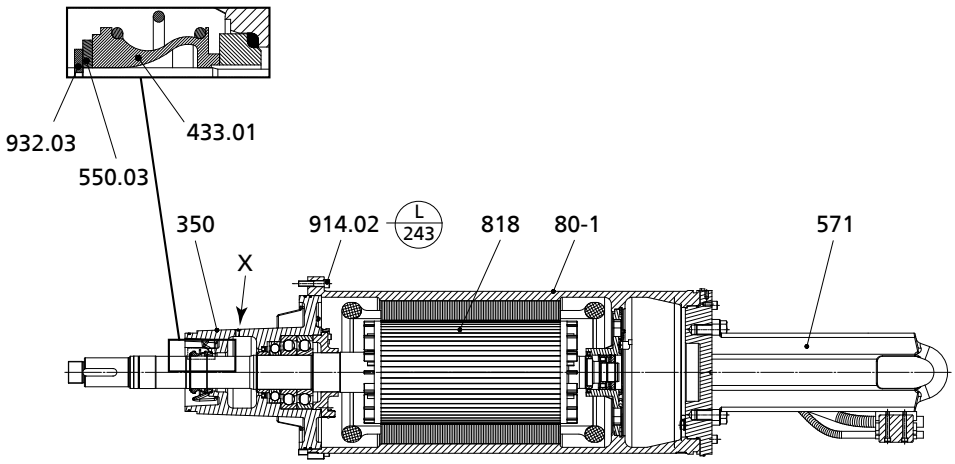

Fig. 42: Installing the drive-end mechanical seal, X = drilled hole for testing device

Table 24: Symbols key

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

✓ The pump set has been positioned horizontally on suitable wooden supports and is protected against rolling off. (⇨ Section 3.2, Page 12)

1. Use an assembly sleeve of a suitable diameter to press the mating ring of mechanical seal 433.01 together with the O-ring into the drilled seat of bearing housing 350.
2. Carefully guide on the bellows part of mechanical seal 433.01 until it rests against the mating ring.
3. Guide disc 550.03 and circlip 932.03 onto the shaft. Press the circlip in with an assembly sleeve until it is axially fastened in the shaft groove.
4. Screw the testing device into the leakage drain hole (X) of bearing housing 350 and perform a leak test.
5. Attach the crane hook to the bail and pull upright motor unit 80-1 including rotor 818 with bearing and bearing housing 350.
6. Place the pump set on the pump casing and bellmouth and fasten it with hexagon socket head cap screws 914.02.

7.6.4.1.1 Leak test when installing the mechanical seal

Observe the following values for leak testing:

- **Test medium:** compressed air
- **Test pressure:** 1 bar max.
- **Test period:** 5 minutes

1. The pressure must not drop during the test period.
   If the pressure does drop, check the sealing elements and screwed connections. Then perform another leak test.
2. If the test has been successful, remove the testing device. Do not close the leakage drain hole to allow drainage of any water ingress.

7.6.4.2 Impeller-end mechanical seal

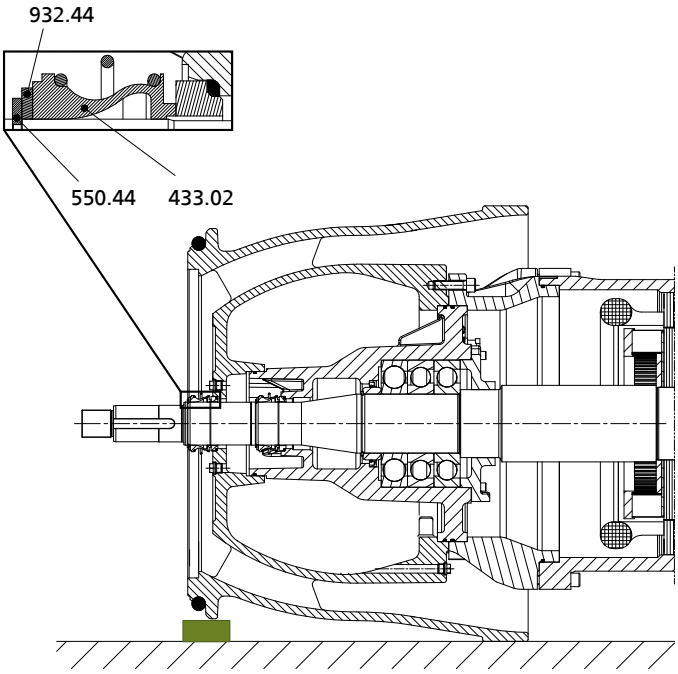

Fig. 43: Impeller-end mechanical seal

✓ The pump casing has been fastened to the motor.

✓ The pump set has been positioned horizontally on a wooden support. It has been secured against rolling off. (⇨ Section 3.2, Page 12)

1. Use an assembly sleeve of a suitable diameter to press the mating ring of mechanical seal 433.02 together with the O-ring into the drilled recess in the pump casing.
2. Carefully guide on the bellows part of the mechanical seal until it rests against the mating ring.
3. Slide disc 550.44 and circlip 932.44 onto the shaft. Press the circlip in with an assembly sleeve until it is axially fastened in the shaft groove.
4. Check the lubricant chamber for leakage.
5. Fill the lubricant reservoir with lubricant. Then close the lubricant reservoir.

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7.6.5 Fitting the impeller

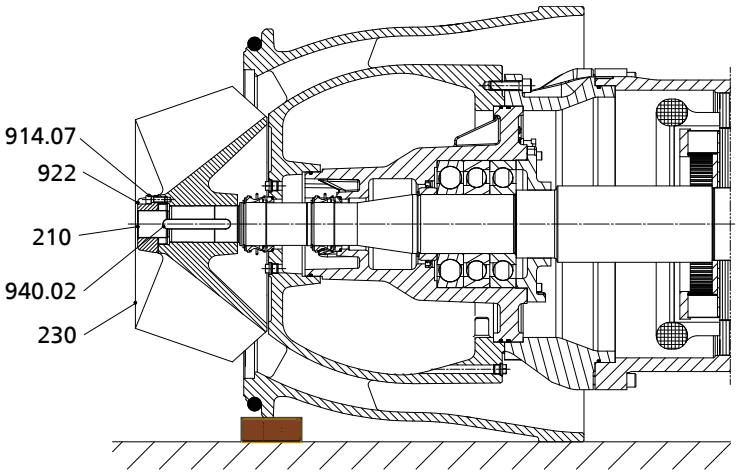

Fig. 44: Fitting the impeller

✓ The pump has been placed in a horizontal position on a wooden support and is protected against rolling off.

✓ The impeller-end mechanical seal 433.02 has been installed.

1. Insert and fit two keys 940.02 into the keyway.
2. Coat all sides of the shaft seat and shaft thread with an assembly paste which prevents seizure of the chrome steel parts.
3. Guide impeller 230 onto shaft 210 until it abuts against the shaft collar.
   ⇨ This is as far as the impeller can move along the shaft. This position results in the maximum possible clearance between bellmouth with casing wear ring and impeller vanes.
4. Screw impeller nut 922 onto the shaft thread.
5. Align the holes of impeller 230 and impeller nut 922 and fasten them with hexagon socket head cap screws 914.07.

7.6.6 Fitting the bellmouth

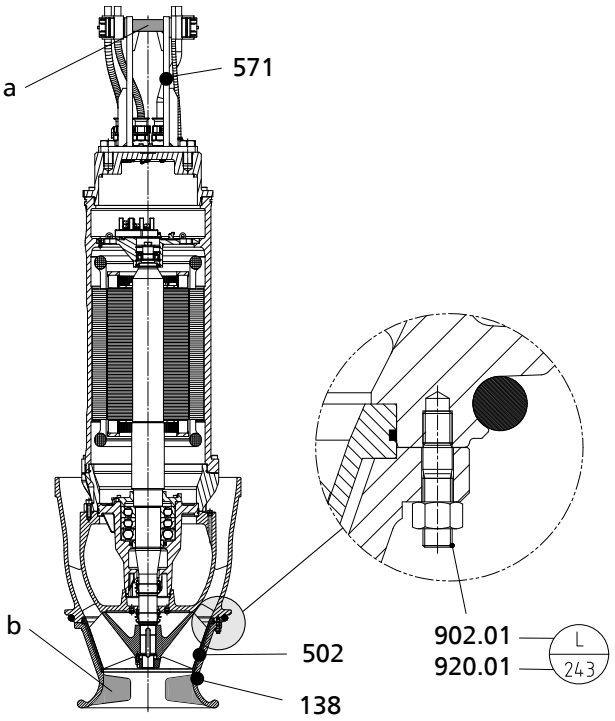

Fig. 45: Aligning and fitting the bellmouth

a	Bail	b	Baffles in the bellmouth

Table 25: Symbols key

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

✓ Bellmouth 138 has been positioned on wooden supports on a level and solid surface.

✓ Suitable lifting equipment is available.

✓ The pump set has been completely pre-assembled.

✓ Casing wear ring 502 has been fitted in bellmouth 138.

1. Attach lifting equipment to bail 571 and carefully pull the pump set upright.
2. Centre the pump set above bellmouth 138.
   NOTE Make sure that the pin of bail 571 for attaching the lifting tackle and the baffles in bellmouth 138 are aligned in the same direction.
3. Slowly lower the pump set. While lowering the pump set, make sure that studs 902.01 are aligned with the drilled holes.
4. Then lower the pump set until it sits on bellmouth 138.
5. Fasten all studs 902.01 with corresponding nuts 920.01. Observe the tightening torque. (⇨ Section 7.8, Page 84)

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7.6.7 Adjusting the clearance

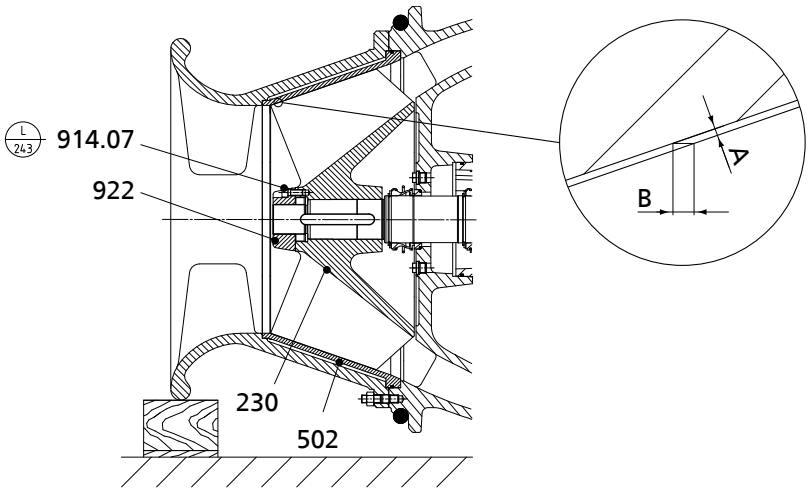

Fig. 46: Adjusting the clearance

Table 26: Key to the symbols and codes

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

✓ The pump has been placed on wooden supports in a horizontal position and is protected against rolling off.

✓ The pump set has been completely assembled.

1. Undo socket head cap screw 914.07 and impeller nut 922.
2. Screw bolts and/or threaded rods into the tapped holes on the face of impeller 230 to pull the impeller forward until the impeller vanes abut the bellmouth/ casing wear ring 502.

   ⇨ This is the maximum front position of the impeller (clearance = 0).
3. Screw on impeller nut 922 until it abuts the front face of the impeller hub.
4. Screw the impeller nut on further (by dimension "B") to move the impeller along the shaft until the specified clearance "A" is established.
5. Use a feeler gauge to measure and verify the adjusted clearance between the impeller vanes and casing wear ring 502. Perform this measurement at several points spaced around the circumference.
6. Align two tapped holes in the impeller hub with two holes in the impeller nut.

   ⇨ Screw impeller nut on slightly further until the holes match.

   ⇨ Do not loosen the nut to match the holes.
7. Secure the impeller nut with socket head cap screws 914.07 and a thread-locking agent. Rotate the pump rotor by hand to check the clearance. During rotation the impeller must not touch any part of the casing.

Table 27: Clearances "A" and "B"

Size Amacan S	Clearance "A" [mm]	Clearance "B" [mm]
800 - 535	$0.6\ ^{+0.2}/_{-0.1}$	$1.9\ ^{+0.6}/_{-0.3}$
850 - 535	$0.6\ ^{+0.2}/_{-0.1}$	$1.9\ ^{+0.6}/_{-0.3}$
850 - 550	$0.6\ ^{+0.2}/_{-0.1}$	$1.8\ ^{+0.6}/_{-0.3}$
900 - 600	$0.6\ ^{+0.2}/_{-0.1}$	$1.8\ ^{+0.6}/_{-0.3}$
1000 - 600	$0.6\ ^{+0.2}/_{-0.1}$	$1.8\ ^{+0.6}/_{-0.3}$
900 - 615	$0.6\ ^{+0.2}/_{-0.1}$	$1.8\ ^{+0.6}/_{-0.3}$
1000 - 615	$0.6\ ^{+0.2}/_{-0.1}$	$1.8\ ^{+0.6}/_{-0.3}$

Size Amacan S	Clearance "A" [mm]	Clearance "B" [mm]
1000 - 655	$0.75\ ^{+0.2}/_{-0.1}$	$2.7\ ^{+0.6}/_{-0.3}$
1300 - 820	$0.75\ ^{+0.2}/_{-0.1}$	$2.4\ ^{+0.6}/_{-0.3}$

7.6.8 Leak testing

7.6.8.1 Checking the lubricant reservoir for leakage

After reassembly, the mechanical seal area/lubricant reservoir must be checked for leakage. The leak test is performed at the lubricant filler opening.

Observe the following values for leak testing:

- **Test medium:** compressed air
- **Test pressure:** 1 bar maximum
- **Test duration:** 5 minutes

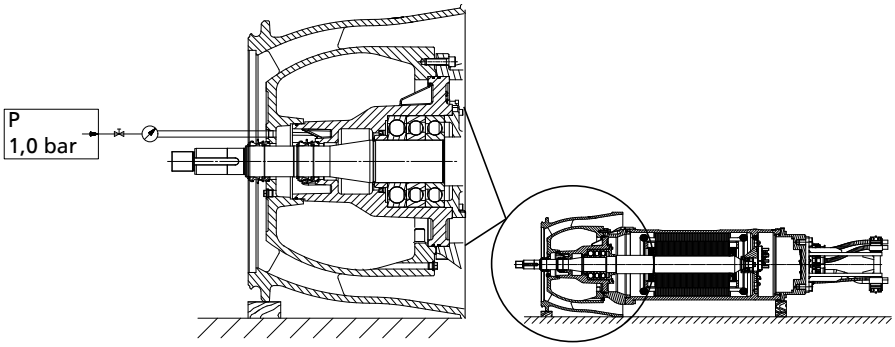

Fig. 47: Screwing in the testing device

✓ The impeller-end mechanical seal has been installed.

1. Screw the testing device tightly into the G 1/2 lubricant filler opening.
2. 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.
3. Repeat the leak test, if required.
4. If the leak test has been successful, fill in the lubricant.
   (⇨ Section 7.4.1.4.2, Page 64)
5. Close screw plug 903.01 with new joint ring 411.01 and liquid sealant.

7.6.8.2 Testing the motor for leakage

Observe the following values for leak testing:

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

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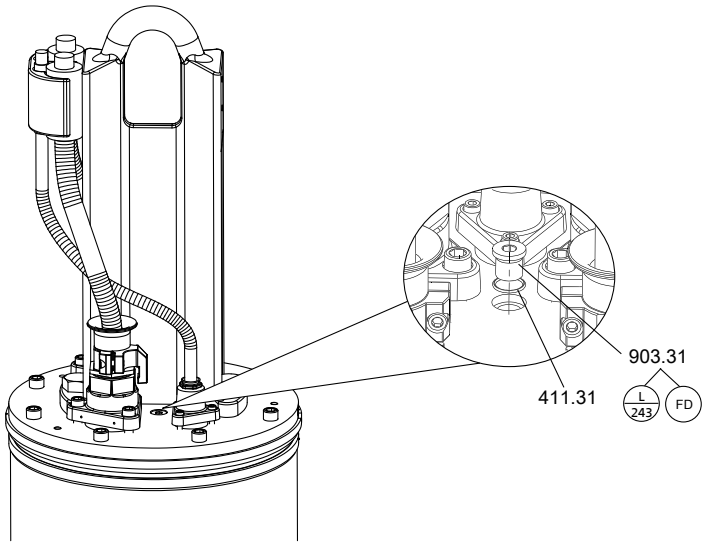

Fig. 48: Leak testing the motor

Table 28: Symbols key

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

1. Remove screw plug 903.31 and joint ring 411.31.
2. Screw the testing device tightly into the G 1/2 plug thread.
3. Carry out the leak test with the values specified above.
   - ⇨ The pressure must not drop during the test period.
   - ⇨ If the pressure does drop, check the sealing elements and screwed connections.
4. Repeat the leak test if required.
5. Remove the testing device.

DANGER

Screw plug leaking or missing

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, type 243) to screw plug 903.31.
7. Re-insert and tighten screw plug 903.31 with new joint ring 411.31.

7.7 Checking the electrical connection and motor

Once reassembly has been completed, carry out the steps described in (⇨ Section 7.2.1, Page 54) and (⇨ Section 7.3.4, Page 58) .

7.8 Tightening torques

Table 29: 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	Min-imum	Rated torque	Min-imum	Rated torque	Min-imum	Rated torque	Min-imum	Rated torque	Min-imum	Rated torque
M4	3,0	3,4	1,0	1,1	2,1	2,4	2,5	2,8	2,1	2,4
M5	6,1	6,8	2,0	2,2	4,3	4,8	5,0	5,6	4,3	4,8
M6	10.3	11	3,4	3,7	7,2	8,0	8,5	9,5	7,2	8,0
M8	25	28	8,2	9,1	18	19	21	23	18	19
M10	49	55	16	18	35	38	41	45	35	38
M12	85	94	28	31	59	66	70	78	59	66
M14	134	149	44	49	94	105	111	124	94	105
M16	209	232	69	76	147	163	173	192	147	163
M20	408	453	134	149	287	319	338	375	287	319
M24	704	782	231	257	495	550	583	648	495	550
M27	1025	1139	36	374	721	801	849	944	721	801
M30	1403	1559	460	511	986	1096	1162	1291	986	1096
M33	1888	2098	619	688	1327	1475	1563	1737	1327	1475
M36	2445	2717	802	891	1719	1910	2025	2250	1719	1910
M42	3904	4338	1281	1423	2745	3050	3233	3592	2745	3050
M48	5880	6534	1929	2144	4135	4594	4870	5411	4135	4594

NOTE

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

7.9 Spare parts stock

7.9.1 Ordering spare parts

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

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

Refer to the name plate for all data.

Also specify the following data:

- Part No. and description
- 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 30: Quantity of spare parts for recommended spare parts stock

Part No.	Description	Number of pumps (including stand-by pumps)						
		2	3	4	5	6	8	10 and more
230	Impeller	1	1	1	2	2	3	30 %
320 / 321	Rolling element bearing, pump end	1	1	2	2	3	4	50 %
322	Rolling element bearing, drive end	1	1	2	2	3	4	50 %
412.05 / 412.60	O-ring, for discharge tube cover	2	3	4	5	6	8	100 %
433.01	Mechanical seal, drive end	2	3	4	5	6	7	90 %
433.02	Mechanical seal, pump end	2	3	4	5	6	7	90 %
502	Casing wear ring	2	2	2	3	3	4	50 %
80-1	Motor unit	-	-	-	-	1	2	30 %
818	Rotor	-	-	-	-	1	2	30 %
834	Cable gland	1	1	2	2	2	3	40 %
99-9	Set of sealing elements, motor	4	6	8	8	9	10	100 %
99-9	Set of sealing elements, hydraulic system	4	6	8	8	9	10	100 %

8 Trouble-shooting

⚠ WARNING

Improper work to remedy faults

Risk of injury!

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

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

A Pump is running, but does not deliver

B Pump delivers insufficient flow rate

C Excessive current/power input

D Insufficient discharge head

E Vibrations and noise during pump operation

Table 31: Trouble-shooting

A	B	C	D	E	Possible causes	Remedy[7)]
-	✗	-	-	✗	Water level lowered too much during operation	Check supply and capacity of system (sump floor area). Check level control equipment.
✗	✗	-	-	✗	Total pressure corresponding to $NPSH_{pump}$ too high Total pressure corresponding to $NPSH_{system}$ too low	Increase fluid level on the suction side. Clean screening equipment, if required.
✗	✗	✗	-	✗	Penetration of air into the pump due to formation of an air pocket - Suction-side water level too low	Increase the suction-side water level. If this is not possible or unsuccessful, please contact KSB.
✗	✗	✗	-	✗	Unfavourable flow to the pump inlet	Improve the flow to the intake chamber (contact KSB).
-	✗	✗	-	✗	Pump running in off-design conditions - part load/overload	Check the pump's operating data.
✗	✗	-	✗	✗	Pump clogged by deposits	Clean intake and pump components.
-	✗	✗	✗	✗	Wear	Replace worn parts.
-	✗	-	✗	✗	Impermissible air or gas content in the fluid handled	Contact KSB.
-	-	-	-	✗	System-induced vibrations	Contact KSB.
-	-	✗	-	✗	Wrong direction of rotation	Check the electrical connection of motor and control system, if any.
✗	-	-	-	-	No voltage	Check electrical connections. Contact the energy supplier.
✗	-	-	-	-	Motor winding or electric cable are defective.	Replace with original KSB cable or contact KSB.
-	-	✗	-	✗	Worn or defective rolling element bearings	Contact KSB.
✗	-	-	-	-	The thermistor tripping unit with manual reset for temperature limiter has tripped the pump as a result of the permissible winding temperature being exceeded.	Have cause determined and eliminated by qualified and trained personnel.
✗	-	-	-	-	Motor has been tripped by leakage monitor.	Have cause determined and eliminated by qualified and trained personnel.
✗	-	-	-	-	Mechanical seal monitor has tripped.	Have cause determined and eliminated by qualified and trained personnel.

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

A	B	C	D	E	Possible causes	Remedy[7)]
✗	-	-	-	-	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

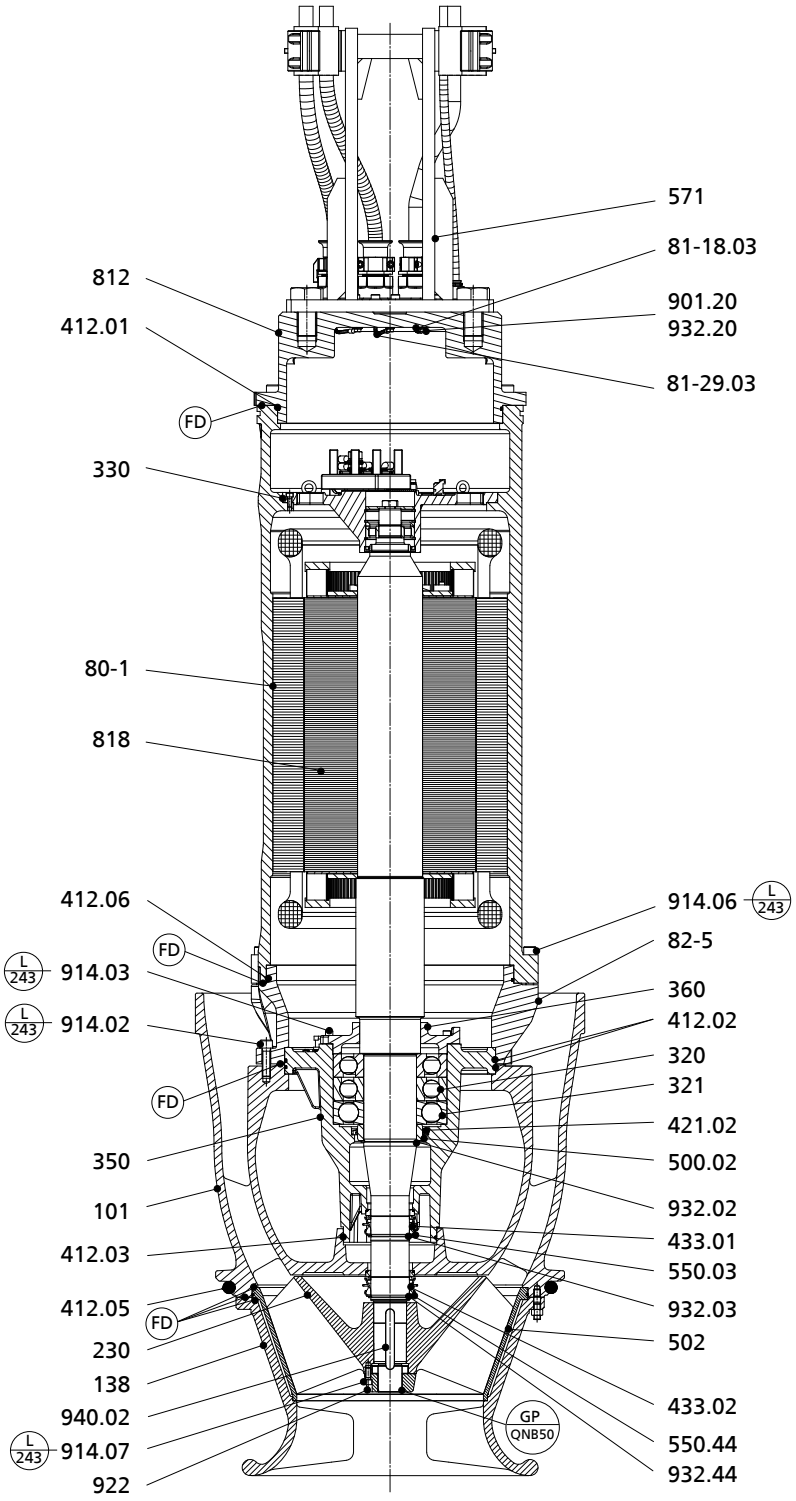

Fig. 49: General assembly drawing

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Table 32: Detailed views of the general assembly drawing

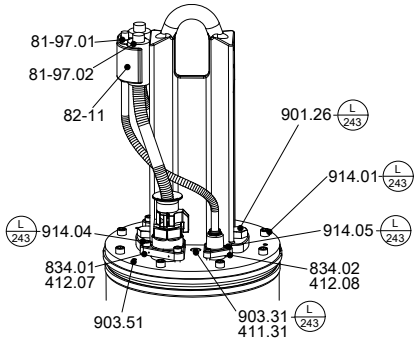
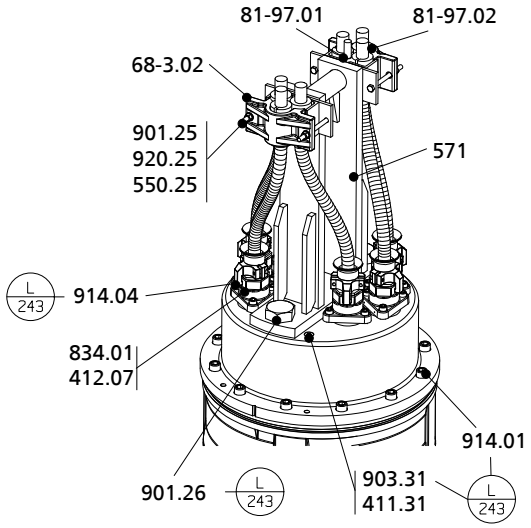
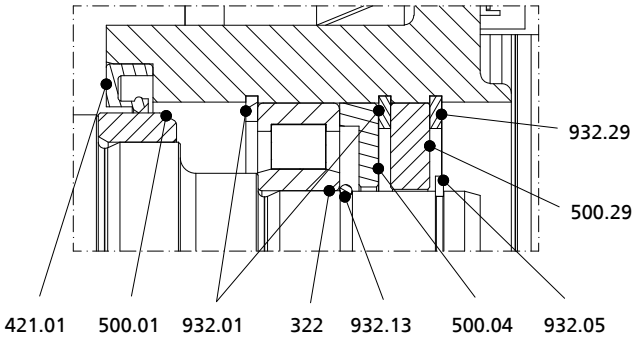
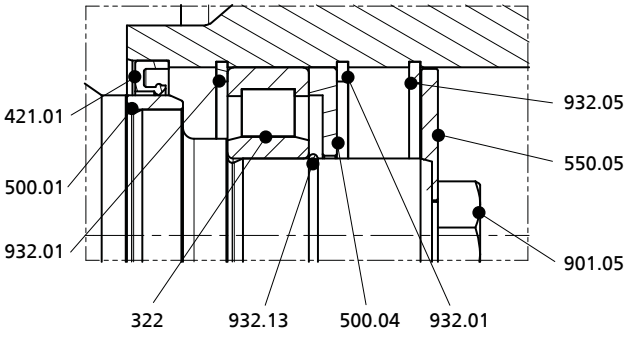
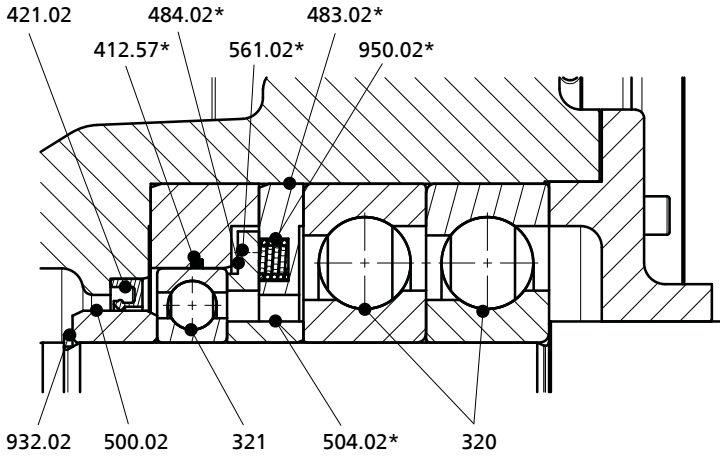
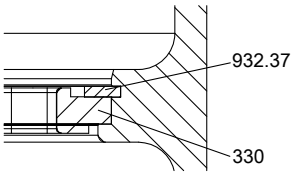
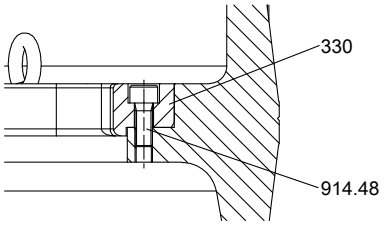
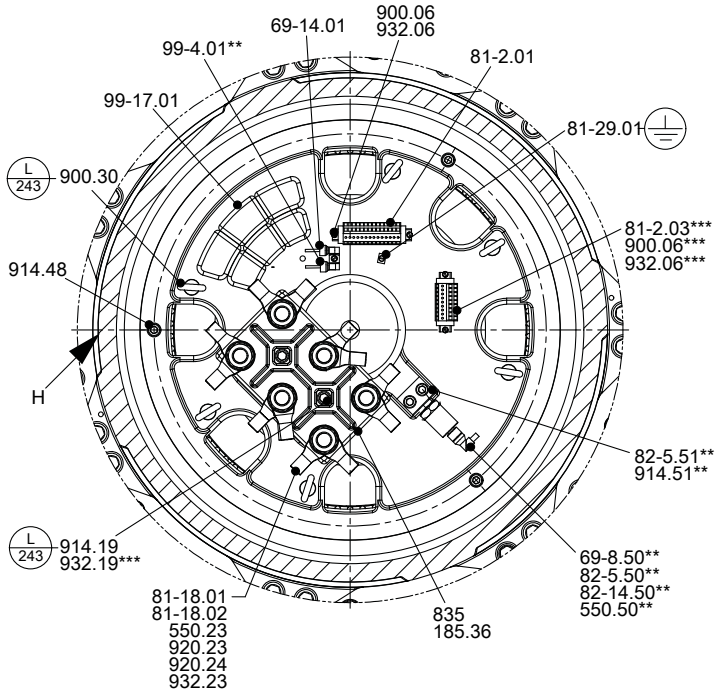
Connection of cable gland and fastening	**Motor sizes:** 120 6 ... 340 6 85 8 ... 290 8 200 10 ... 250 10	
	Motor sizes: 415 6 350 8 320 10 ... 420 10	
Bearing, drive end	**Motor sizes:** 120 6 ... 340 6 85 8 ... 290 8 200 10 ... 250 10	
	Motor sizes: 415 6 350 8 320 10 ... 420 10	

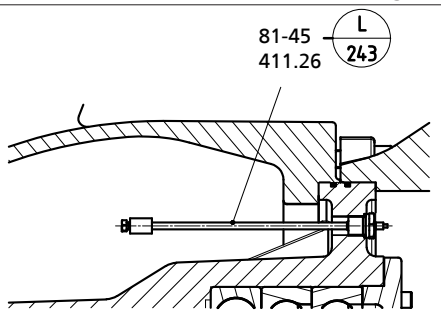
Table 33: Detailed views of the general assembly drawing

Bearing, pump end	**Motor sizes:** 120 6 ... 415 6 85 8 ... 350 8 200 10 ... 420 10	 * On specific sizes only
Bearing bracket fastening	**Motor sizes** 120 6 ... 205 6 85 8 ... 120 8	
	Motor sizes 250 6 ... 415 6 205 8 ... 350 8 200 10 ... 420 10	

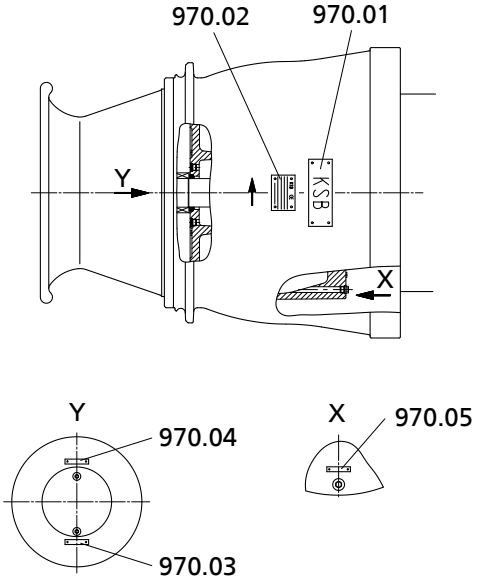


** Only for variants with vibration sensor 69-8.50
*** Only on specific sizes
H = alignment groove

Bearing bracket - sensors and terminals

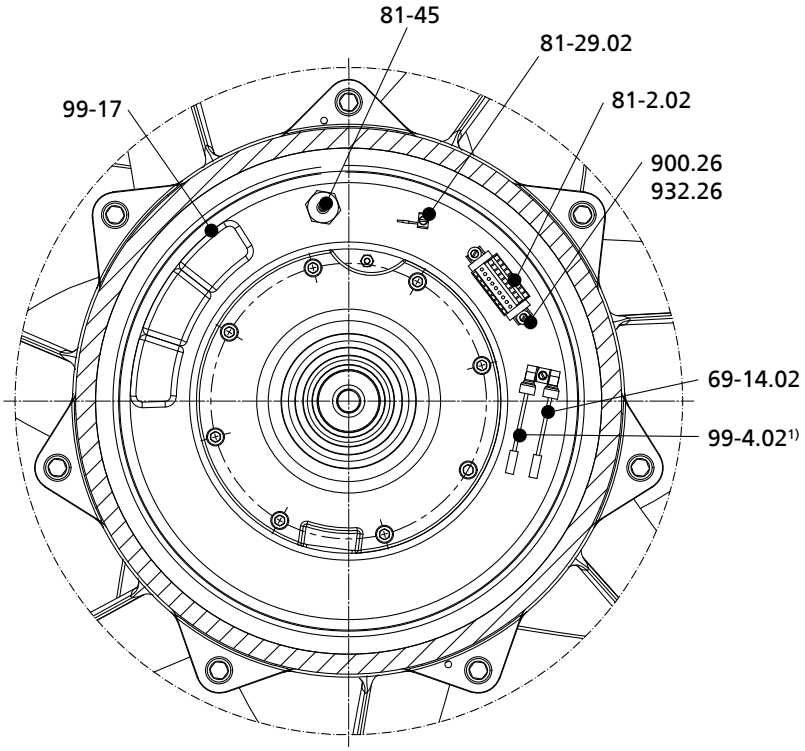


Float switch



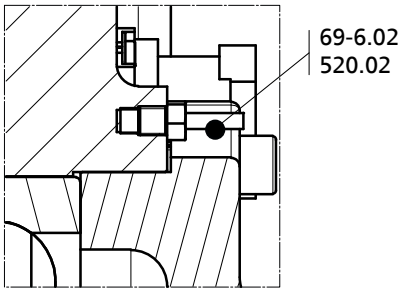
970.01 company name plate
970.02 name plate
970.03 oil drain
970.04 oil filler plug
970.05 leakage drain

Labels/plates

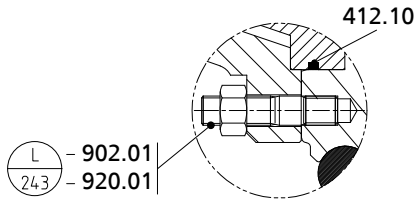


1) Only for versions with vibration sensor 69-8.50

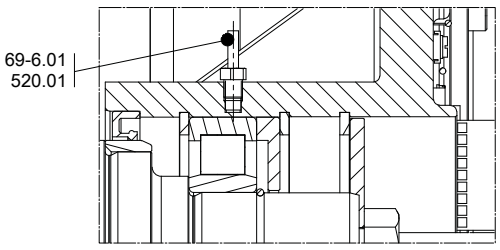
Bearing housing - sensors



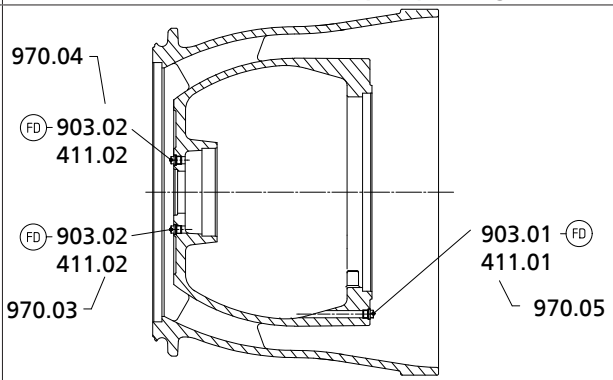
Pump-end bearing temperature sensor



Screwed connection bellmouth/pump casing



Drive-end bearing temperature sensor



970.03 oil drain
970.04 oil filler plug
970.05 leakage drain

Lubricant and leakage chamber

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Table 34: List of components

Part No.	Description	Part No.	Description
110	Pump casing	80-1	Motor unit
138	Bellmouth	81-18.01/.02/.03	Cable socket

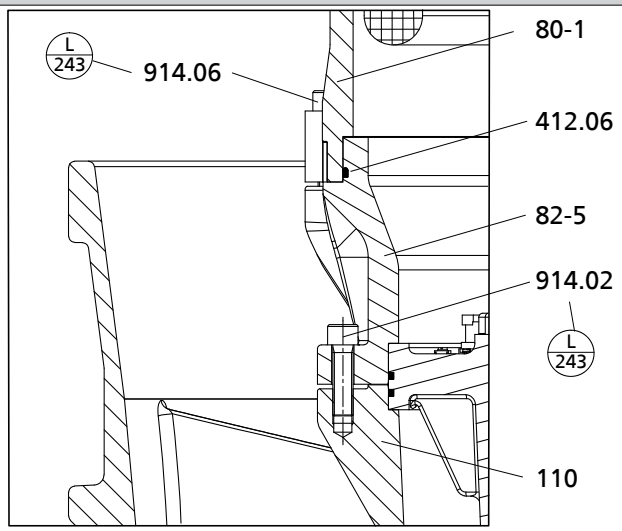
Part No.	Description	Part No.	Description
185	Plate	81-2.01/.02	Connector
230	Impeller	81-29.01/.02	Terminal
320	Angular contact ball bearing	81-45	Float switch
321	Deep groove ball bearing	81-97.01/.02	Cable protector
322	Radial roller bearing	82-5.50/.51	Adapter
330	Bearing bracket	82-11	Strain relief device
350	Bearing housing	82-14.50	Cable
360	Bearing cover	812	Motor housing cover
411.01/.02/.26/.31	Joint ring	818	Rotor
412.01/.02/.03/.05/.06/.07/.08/.10/.57	O-ring	834.01/.02	Cable gland
421.01/.02	Lip seal	835	Terminal board
433.01/.02	Mechanical seal	99-4.01/.02	Conversion kit
483.02	Spring casing	99-17	Desiccant
484.02	Spring plate	900.06/.26/.30	Screw
500.01/.02/.04/.29	Ring	901.02/.05/.20/.25	Hexagon head bolt
502	Casing wear ring	902.01	Stud
504.02	Spacer ring	903.01/.02/.31	Screw plug
520.01/.02	Sleeve	914.01/.02/.03/.04/.05/.06/.07/.19/.48/.51	Socket head cap screw
550.01/.03/.05/.23/.25/.44/.50	Disc	920.01/.23/.24/.25	Nut
561.02	Grooved pin	922	Impeller nut
571	Bail	932.01/.02/.03/.05/.06/.13/.20/.23/.25/.26/.29/.44	Circlip
68-3	Cover plate	940.02	Key
69-6.01/.02/.03	Temperature sensor	950.02	Spring
69-8.50	Sensor	970.01/.02/.03/.04/.05	Label/plate
69-14.01/.02	Leakage monitor		

Table 35: 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 sealant** (e.g. Hylomar SQ32M) to sealing surfaces marked with this symbol.
GP Q NB 50	Use a **lubricant paste** (e.g. Altemp Q NB 50).

9.1.1 Special features

Table 36: Special features

Section	Detailed view
Model with adapter	

Part No.	Description	Part No.	Description
110	Pump casing	82-5	Adapter
412.06	O-ring	914.02/.06	Hexagon socket head cap screw
80-1	Motor unit		

Table 37: Key to the symbols and codes

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

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9.2 Cable bundle

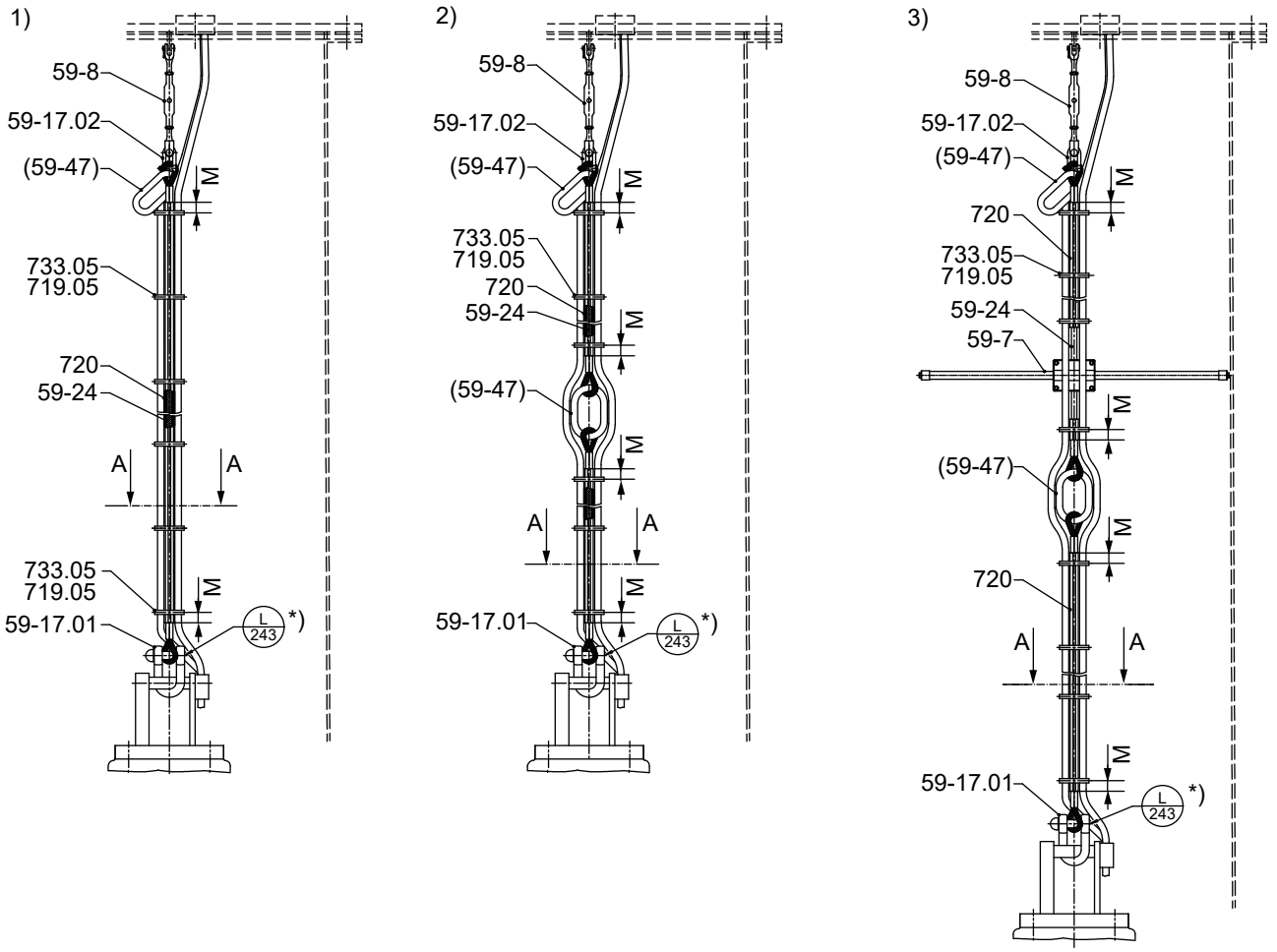

Fig. 50: Cable bundle

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

*): Only required for galvanised version

NOTE

Distance M = 50 mm

Table 38: Symbols key

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

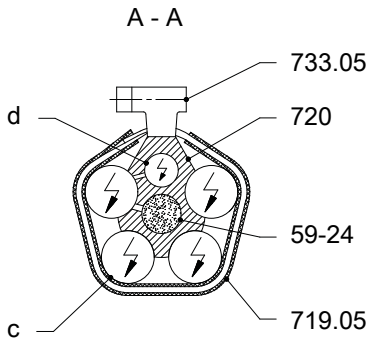

Fig. 51: Section A - A, position of power cable, control cable and support rope

c	Power cable	d	Control cable

Table 39: List of spare parts of the cable bundle

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

9.3 Wiring diagrams

9.3.1 Wiring diagram for power cable

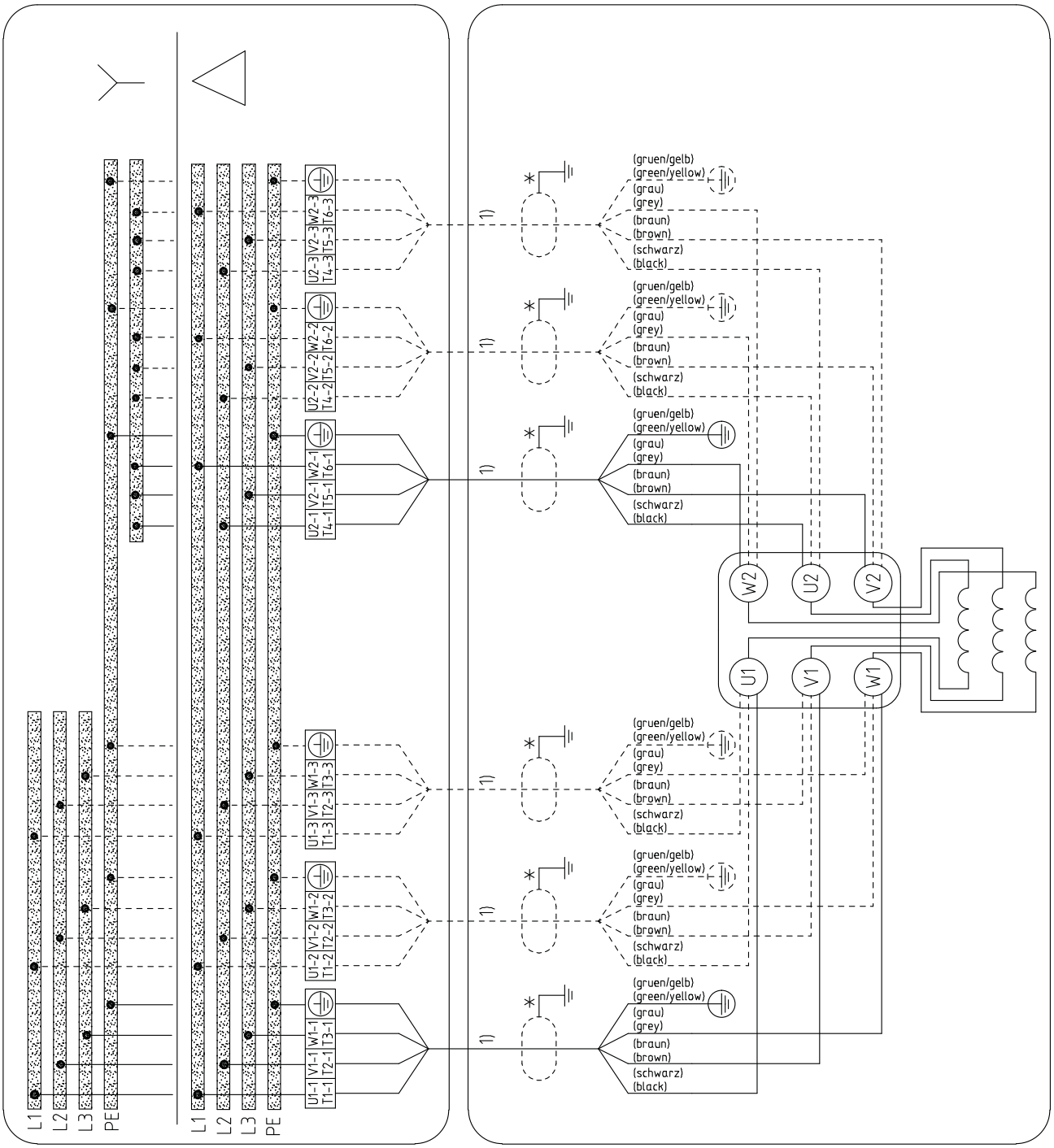

Fig. 52: Wiring diagram for power cable

* Shielded cable option

[1)] Up to 3 parallel cable pairs possible

9.3.2 Wiring diagrams for the sensors

Standard pump sets

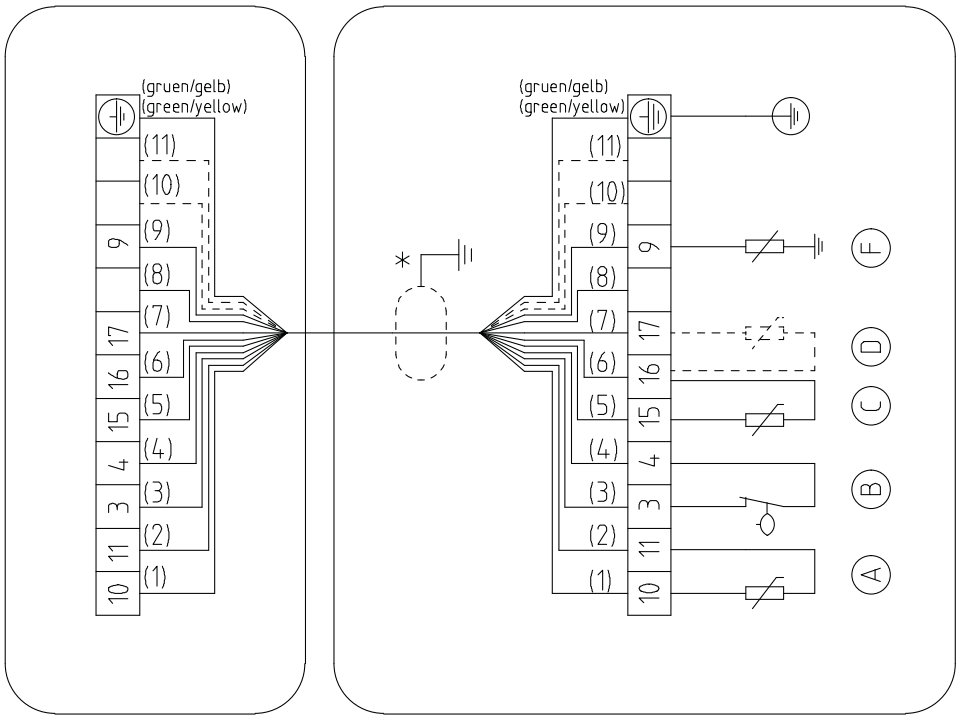

Fig. 53: Wiring diagram for sensors of standard pump sets

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

Pump sets with additional monitoring by vibration sensor

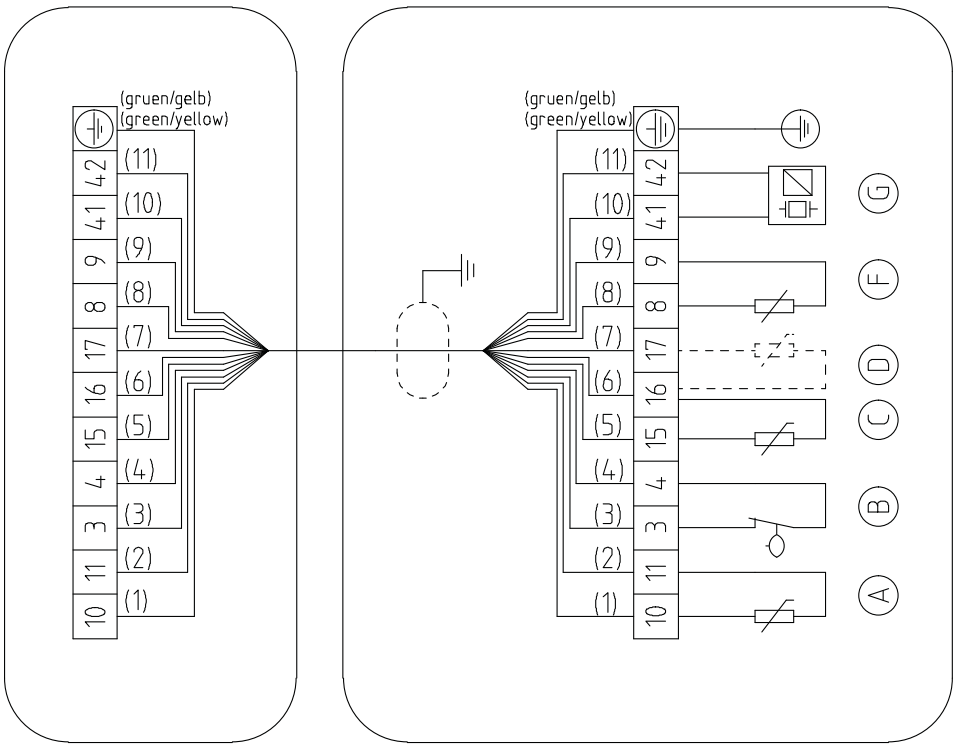

Fig. 54: Wiring diagram for sensors of pump sets with additional monitoring by vibration sensor

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

Pump sets with additional Pt100 motor temperature monitoring

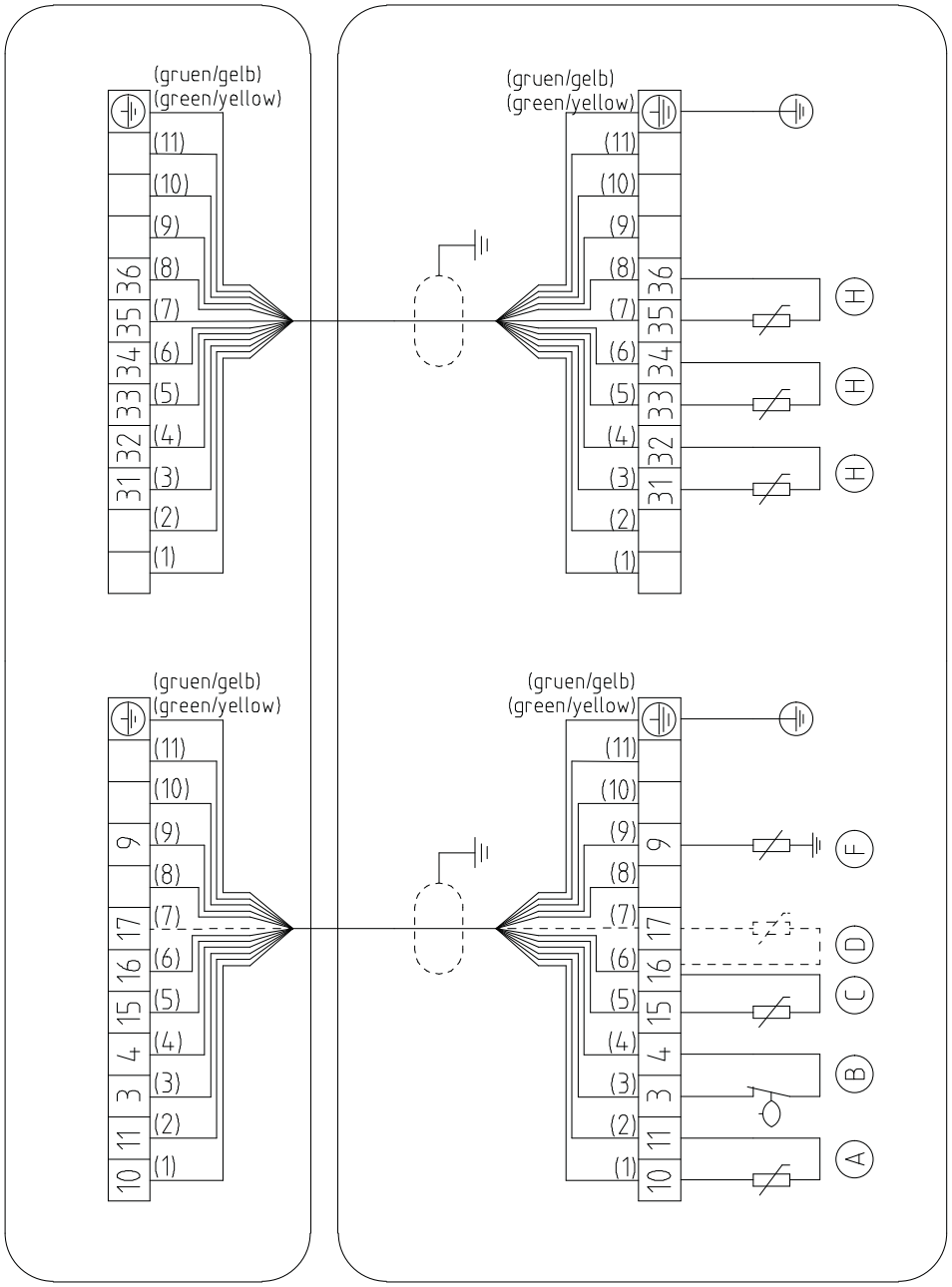

Fig. 55: Wiring diagram for sensors of pump sets with additional motor temperature monitoring (Pt100)

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

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Pump sets with additional Pt100 motor temperature monitoring and vibration sensor

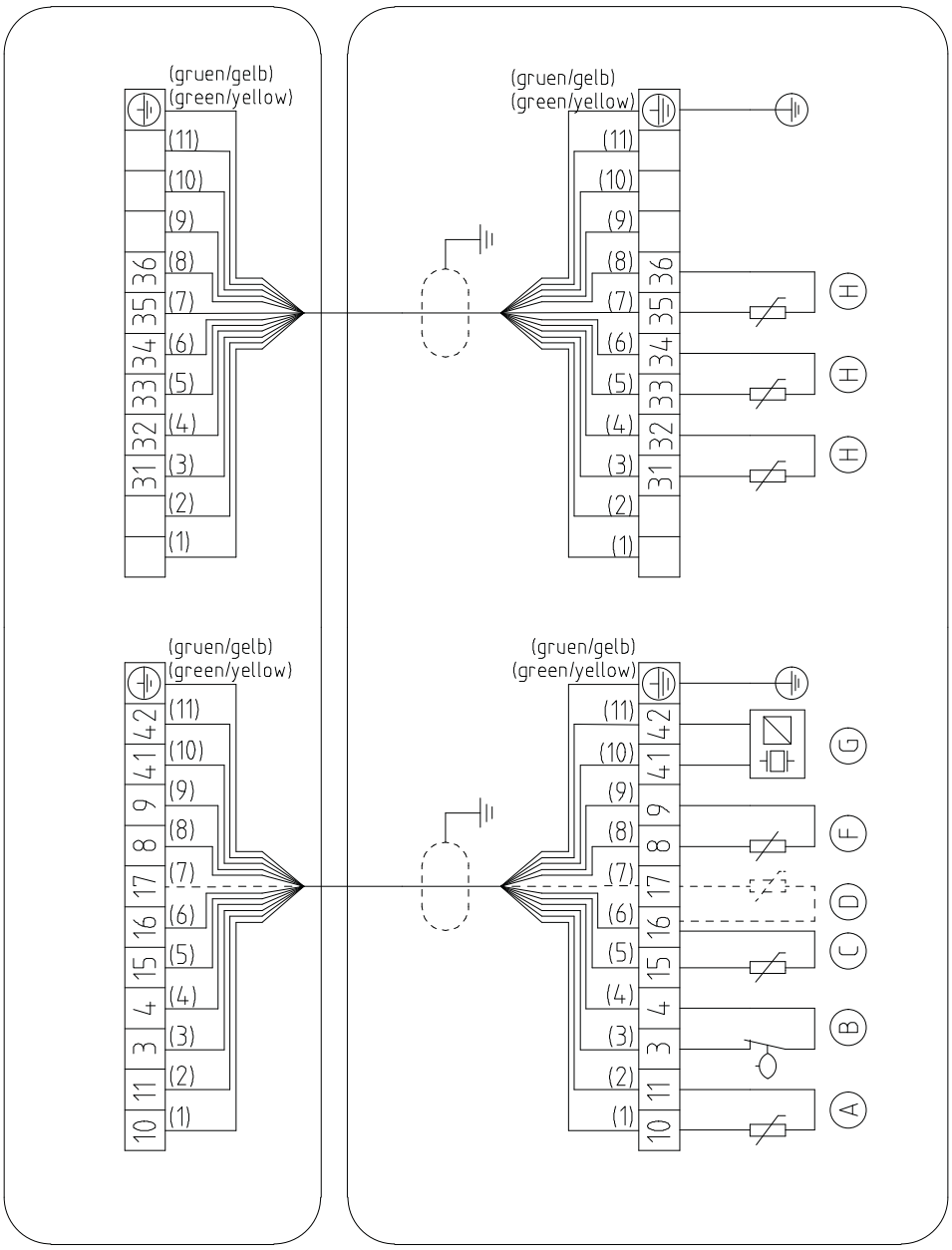

Fig. 56: Wiring diagram for sensors of pump sets with additional Pt100 motor temperature monitoring and vibration sensor

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

9.4 Dimensions

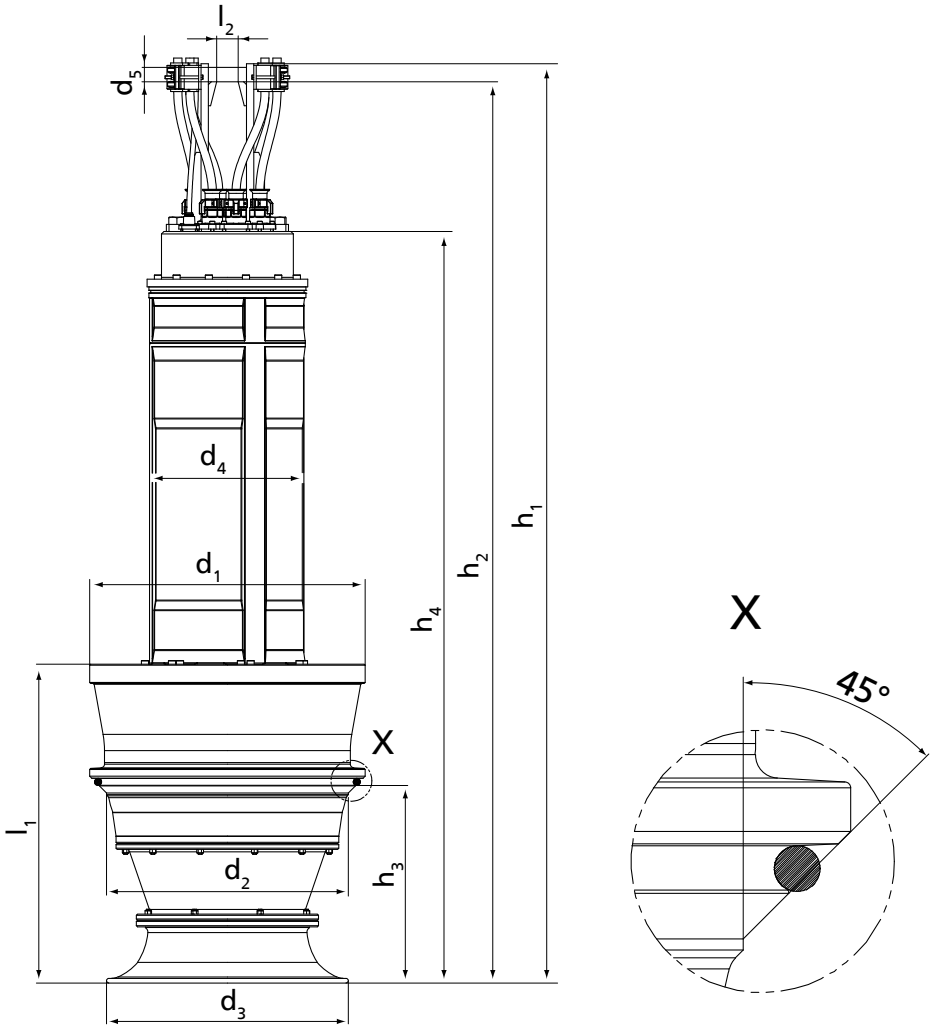

Fig. 57: Dimensions of the pump set

Table 40: Dimensions of the pump set [mm]

Size	Motor size	Number of poles	h_1	h_2	h_3	h_4	d_1	d_2	d_3	d_4	d_5	l_1	l_2	[kg][8]
800 - 535	120	6	2720	2680	350	2030	775	670	700	385	40	885	80	1500
800 - 535	155	6	2740	2700	350	2050	775	670	700	475	40	885	80	1690
800 - 535	180	6	2740	2700	350	2050	775	670	700	475	40	885	80	1785
800 - 535	205	6	2740	2700	350	2050	775	670	700	475	40	885	80	1840
850 - 535	250	6	3150	3090	350	2550	775	670	700	555	50	885	90	2440
850 - 550	155	6	2780	2740	415	2090	826	720	700	475	40	865	80	1735
850 - 550	180	6	2780	2740	415	2090	826	720	700	475	40	865	80	1830
850 - 550	205	6	2780	2740	415	2090	826	720	700	475	40	865	80	1885
850 - 550	250	6	3190	3130	415	2590	826	720	700	555	50	865	90	2480
850 - 550	290	6	3190	3130	415	2590	826	720	700	555	50	865	90	2655
850 - 550	85	8	2780	2740	415	2090	826	720	700	475	40	865	80	1700
850 - 550	120	8	2780	2740	415	2090	826	720	700	475	40	865	80	1710
900 - 600	250	6	3145	3085	450	2545	875	780	750	555	50	895	90	2580

8 Pump set complete with 10 m power cable and 5 m support rope

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Size	Motor size	Number of poles	h_1	h_2	h_3	h_4	d_1	d_2	d_3	d_4	d_5	l_1	l_2	[kg][8)]
900 - 600	290	6	3145	3085	450	2545	875	780	750	555	50	895	90	2740
900 - 600	340	6	3145	3085	450	2545	875	780	750	555	50	895	90	2885
900 - 615	250	6	3120	3060	450	2520	870	760	730	555	50	815	90	2785
900 - 615	290	6	3120	3060	450	2520	870	760	730	555	50	815	90	2955
900 - 615	340	6	3120	3060	450	2520	870	760	730	555	50	815	90	3090
900 - 620	250	6	3105	3045	405	2505	875	755	645	555	50	970	90	2650
900 - 620	290	6	3105	3045	405	2505	875	755	645	555	50	970	90	2825
900 - 620	340	6	3105	3045	405	2505	875	755	645	555	50	970	90	2955
1000 - 600	415	6	3595	3520	450	2895	875	780	750	650	60	895	90	3570
1000 - 615	415	6	3570	3495	450	2870	960	760	730	650	60	1190	90	3780
1000 - 620	415	6	3555	3480	405	2855	875	755	645	650	60	970	90	3650
1000 - 655	205	8	3235	3175	550	2635	975	855	900	555	50	1220	90	2775
1000 - 655	250	8	3235	3175	550	2635	975	855	900	555	50	1220	90	2905
1000 - 655	290	8	3235	3175	550	2635	975	855	900	555	50	1220	90	3070
1000 - 655	350	8	3685	3610	550	2985	975	855	900	650	60	1220	90	3770
1300 - 820	200	10	3280	3220	600	2680	1200	970	1050	555	50	1195	90	3720
1300 - 820	250	10	3280	3220	600	2680	1200	970	1050	555	50	1195	90	3970
1300 - 820	310	10	3580	3505	600	2880	1200	970	1050	650	60	1195	90	4590
1300 - 820	365	10	3805	3730	600	3105	1200	970	1050	650	60	1195	90	4990
1300 - 820	420	10	3805	3730	600	3105	1200	970	1050	650	60	1195	90	5140

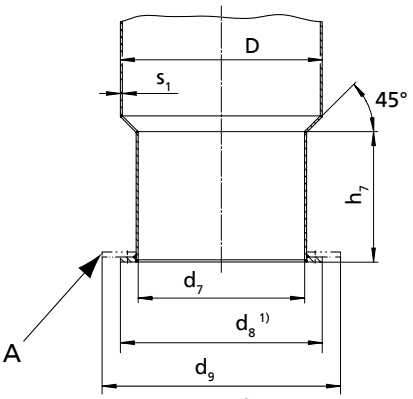


Fig. 58: Dimensions of the discharge tube

A	Suction umbrella; option for reducing the minimum water level
1)	This dimension depends on the type of installation, see general arrangement drawings

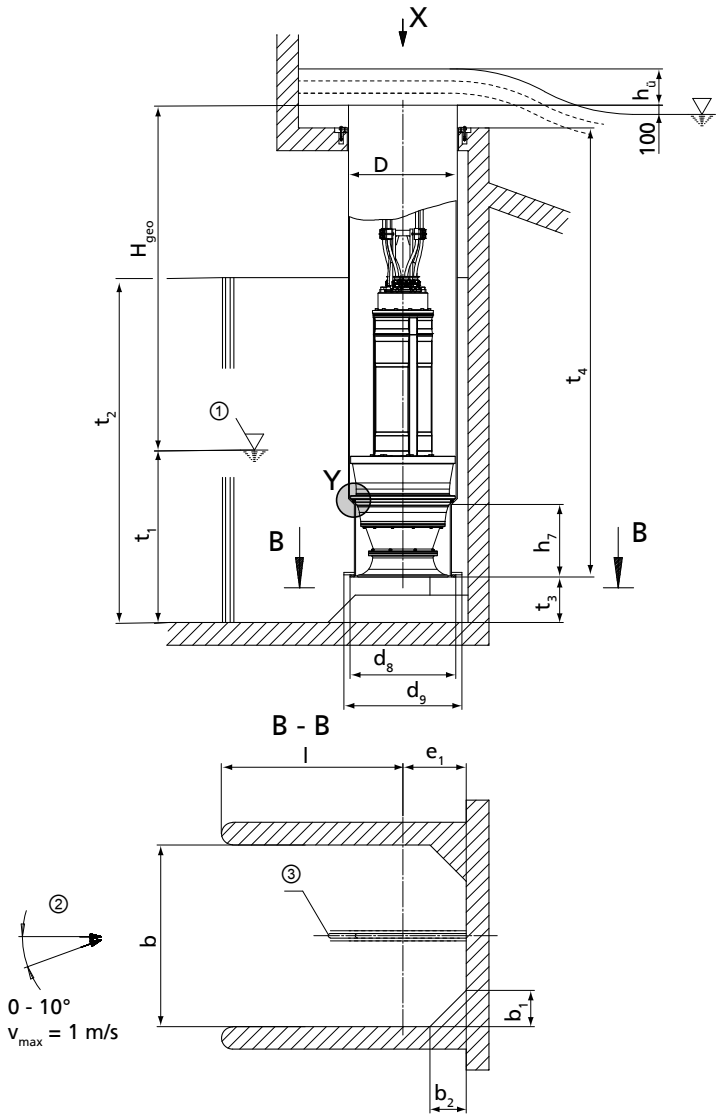
Table 41: Dimensions of the discharge tube [mm]

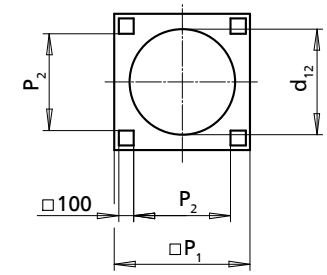
Size	Motor size	Number of poles	D	d_7	d_9	h_7	s_1
800 - 535	120	6	813	720	1300	325	8
800 - 535	155	6	813	720	1300	325	8
800 - 535	180	6	813	720	1300	325	8
800 - 535	205	6	813	720	1300	325	8
850 - 535	250	6	868	720	1300	325	8
850 - 550	155	6	868	740	1300	375	8
850 - 550	180	6	868	740	1300	375	8

Size	Motor size	Number of poles	D	d_7	d_9	h_7	s_1
850 - 550	205	6	868	740	1300	375	8
850 - 550	250	6	868	740	1300	375	8
850 - 550	290	6	868	740	1300	375	8
850 - 550	85	8	868	740	1300	375	8
850 - 550	120	8	868	740	1300	375	8
900 - 600	250	6	914	800	1300	415	10
900 - 600	290	6	914	800	1300	415	10
900 - 600	340	6	914	800	1300	415	10
900 - 615	250	6	914	780	1300	420	10
900 - 615	290	6	914	780	1300	420	10
900 - 615	340	6	914	780	1300	420	10
900 - 620	250	6	914	770	1300	365	10
900 - 620	290	6	914	770	1300	365	10
900 - 620	340	6	914	770	1300	365	10
1000 - 600	415	6	1016	800	1300	415	10
1000 - 615	415	6	1016	780	1300	420	10
1000 - 620	415	6	1016	770	1300	365	10
1000 - 655	205	8	1016	920	1500	515	10
1000 - 655	250	8	1016	920	1500	515	10
1000 - 655	290	8	1016	920	1500	515	10
1000 - 655	350	8	1016	920	1500	515	10
1300 - 820	200	10	1320	1080	1800	545	12
1300 - 820	250	10	1320	1080	1800	545	12
1300 - 820	310	10	1320	1080	1800	545	12
1300 - 820	365	10	1320	1080	1800	545	12
1300 - 820	420	10	1320	1080	1800	545	12

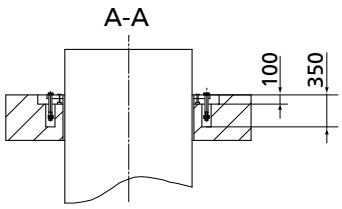
9.5 General arrangement drawings

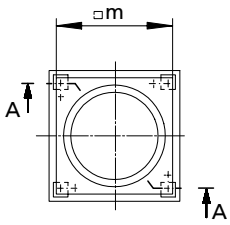
9.5.1 Installation type BU



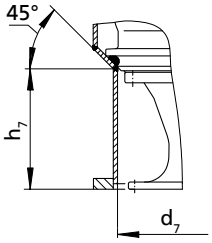


Foundation recesses[9)]





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



Detailed view Y:
seating ring

①: Minimum water level (values see diagram on the next page),
②: Approach flow,
③: Flow-straightening vane (⇨ Section 9.5.7, Page 123)

Table 42: Dimensions [mm]

Size	D	b	b_1		b_2		d_7	d_8	d_9	d_{12}
			Suction umbrella		Suction umbrella					
			✘	✓	✘	✓				
			d_8	d_9	d_8	d_9				
800-535	813	1500	300	-	300	-	720	810	1300	850
850-535	868	1500	300	-	300	-	720	865	1300	920
850-550	868	1500	300	-	300	-	740	865	1300	920

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

Size	D	b	b_1		b_2		d_7	d_8	d_9	d_{12}
			Suction umbrella		Suction umbrella					
			✘	✓	✘	✓				
			d_8	d_9	d_8	d_9				
900-600	914	1500	300	-	300	-	800	910	1300	970
900-615	914	1800	360	-	360	-	780	910	1300	970
900-620	914	1250	250	-	250	-	770	910	1050	970
1000-600	1016	1500	300	-	300	-	800	1015	1300	1070
1000-615	1016	1800	360	-	360	-	780	1015	1300	1070
1000-620	1016	1250	250	-	250	-	770	1015	1050	1070
1000-655	1016	1800	360	-	360	-	920	1015	1500	1070
1300-820	1320	2300	460	-	460	-	1080	1320	1800	1380

Table 43: Dimensions [mm]

Size	e_1[10]		h_7	$l_{min.}$	m	p_1	p_2	t_3[10]	$t_{4\ min.}$[11]
	Suction umbrella								
	✘	✓							
	d_8	d_9							
800-535	500	750	325	1000	910	1000	740	380	2800
850-535	525	750	325	975	980	1050	790	380	3210
850-550	525	750	375	975	980	1050	790	380	3250
900-600	550	750	415	950	1050	1120	860	380	3200
900-615	550	750	420	1250	1050	1120	860	440	3200
900-620	550	620	365	700	1050	1120	860	320	3200
1000-600	600	750	415	900	1150	1220	960	380	3650
1000-615	600	750	420	1200	1150	1220	960	440	3650
1000-620	600	620	365	650	1150	1220	960	320	3650
1000-655	600	850	515	1200	1150	1220	960	440	3750
1300-820	750	1000	545	1550	1460	1520	1260	560	3900

t_2 = 1.1 × water level, maximum 2 × t_1 (depending on head H and structure)
Height of corner lining (b_1 and b_2) like t_2

Permissible tolerances:

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

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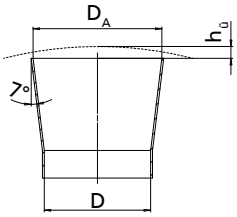
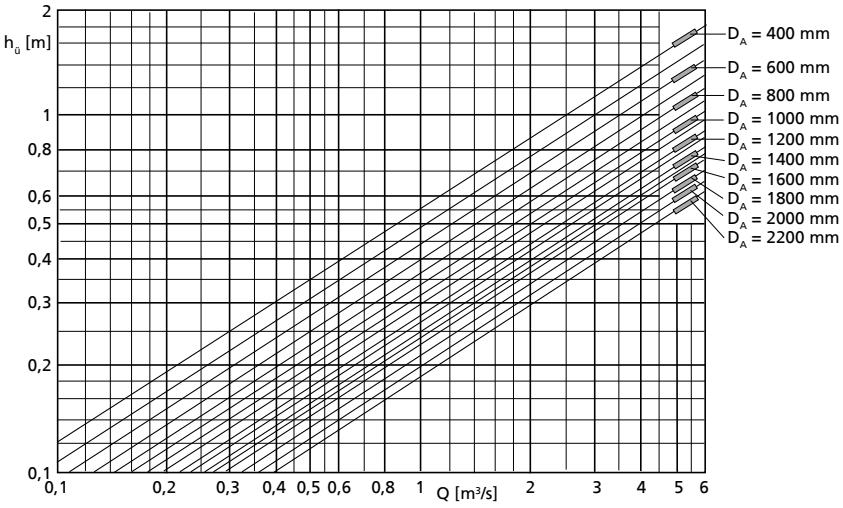
10 Observe this dimension.
11 Value for maximum motor length



Overflow head
$h_ü$

Loss diagram



Loss diagram

Calculation formulas:

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

ΔH_v

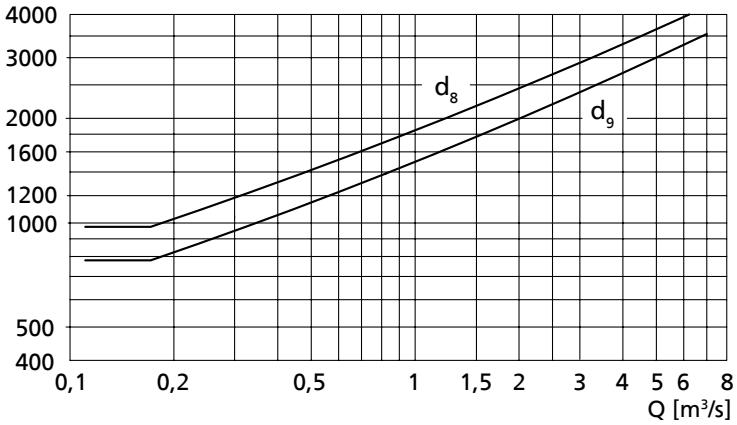
- Overflow head $h_ü$ (see diagram)
- Loss in the riser (pipe friction)
- Outlet loss $v^2/2\ g$ (v refers to D_A)

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

Minimum water level diagram

Open chamber

t_1 [mm]

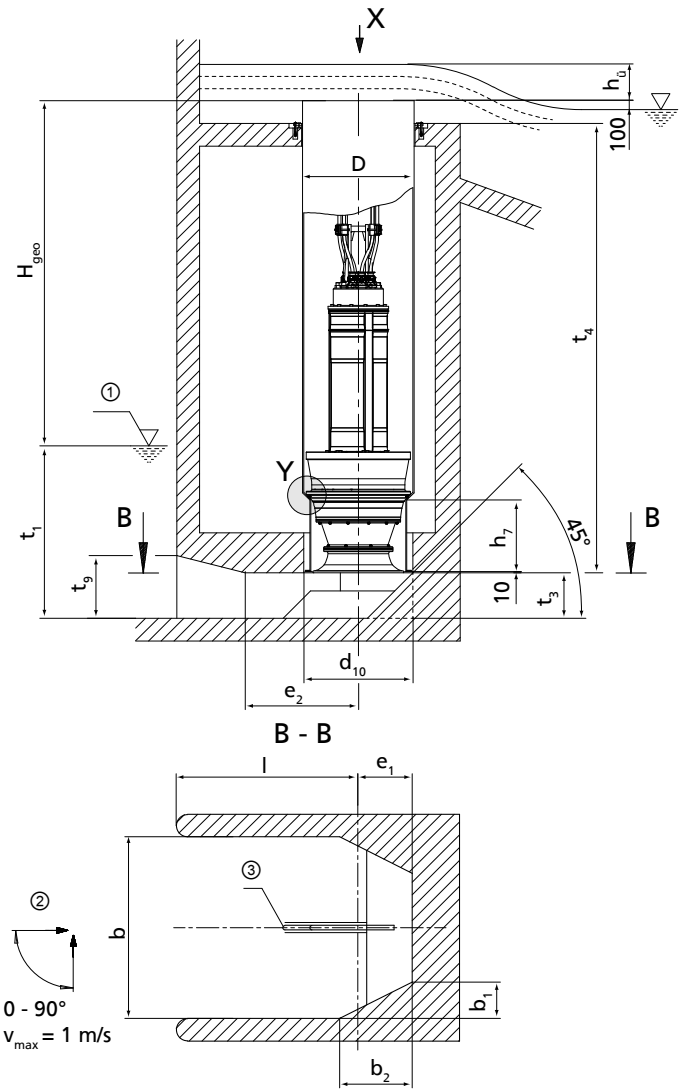


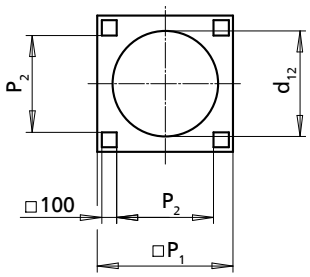
Minimum water level

d_8 = Design: **without** suction umbrella (standard)

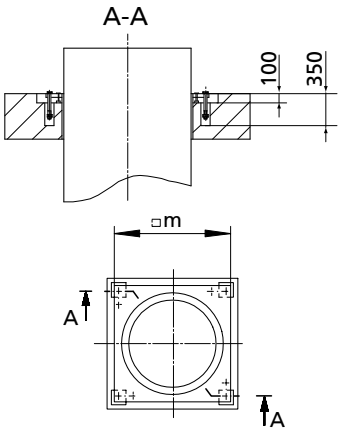
d_9 = Design: **with** suction umbrella

9.5.2 Installation type BG

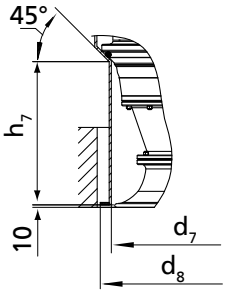




Foundation recesses[12)]



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



Detailed view Y:
seating ring

①: Minimum water level (values see diagram on the next page),
②: Approach flow,
③: Flow-straightening vane (⇨ Section 9.5.7, Page 123)

Table 44: Dimensions [mm]

Size	D	b	b_1	b_2	d_7	d_8	d_{10}	d_{12}	e_1[13)]
800-535	813	1500	300	600	720	840	885	850	450
850-535	868	1500	300	600	720	840	885	920	450
850-550	868	1500	300	600	740	840	885	920	450
900-600	914	1500	300	600	800	820	860	970	450
900-615	914	1800	360	720	780	910	955	970	520
900-620	914	1250	250	500	770	790	830	970	415

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

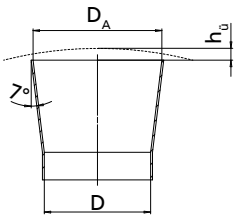
Size	D	b	b_1	b_2	d_7	d_8	d_{10}	d_{12}	e_1 [13)]
1000-600	1016	1500	300	600	800	820	860	1070	450
1000-615	1016	1800	360	720	780	1000	1040	1070	520
1000-620	1016	1250	250	500	770	790	830	1070	415
1000-655	1016	1800	360	720	920	1000	1040	1070	520
1300-820	1320	2300	460	920	1080	1300	1360	1380	680

Table 45: Dimensions [mm]

Size	e_2	h_7	l_{min}	m	p_1	p_2	t_3 [13)]	$t_{4\ min}$ [14)]	t_9
800-535	750	325	1500	910	1000	740	380	2800	570
850-535	750	325	1500	980	1050	790	380	3210	570
850-550	750	375	1500	980	1050	790	380	3250	570
900-600	750	415	1500	1050	1120	860	380	3200	570
900-615	900	420	1800	1050	1120	860	440	3200	660
900-620	625	365	1250	1050	1120	860	320	3200	470
1000-600	750	415	1500	1150	1220	960	380	3650	570
1000-615	900	420	1800	1150	1220	960	440	3650	660
1000-620	625	365	1250	1150	1220	960	320	3650	470
1000-655	900	515	1800	1150	1220	960	440	3750	660
1300-820	1150	545	2300	1460	1520	1260	560	3900	850

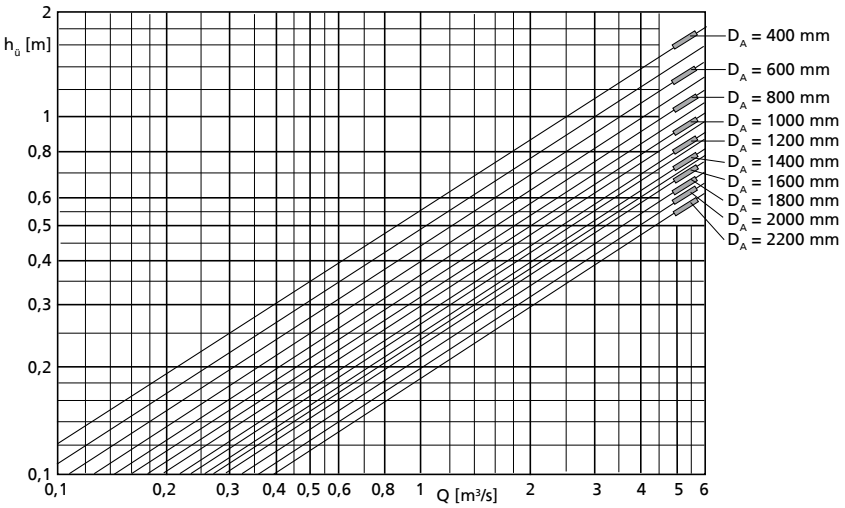
Permissible tolerances:

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



Overflow head $h_ü$

Loss diagram



Loss diagram

Calculation formulas:

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

ΔH_v

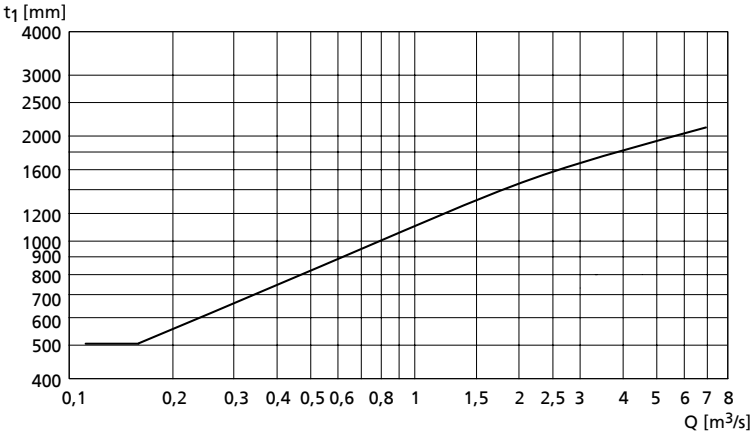
- Overflow head $h_ü$ (see diagram)
- Loss in the riser (pipe friction)
- Outlet loss $v^2/2\ g$ (v refers to D_A)

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

14 Value for maximum motor length

Minimum water level diagram

Covered chamber



Minimum water level

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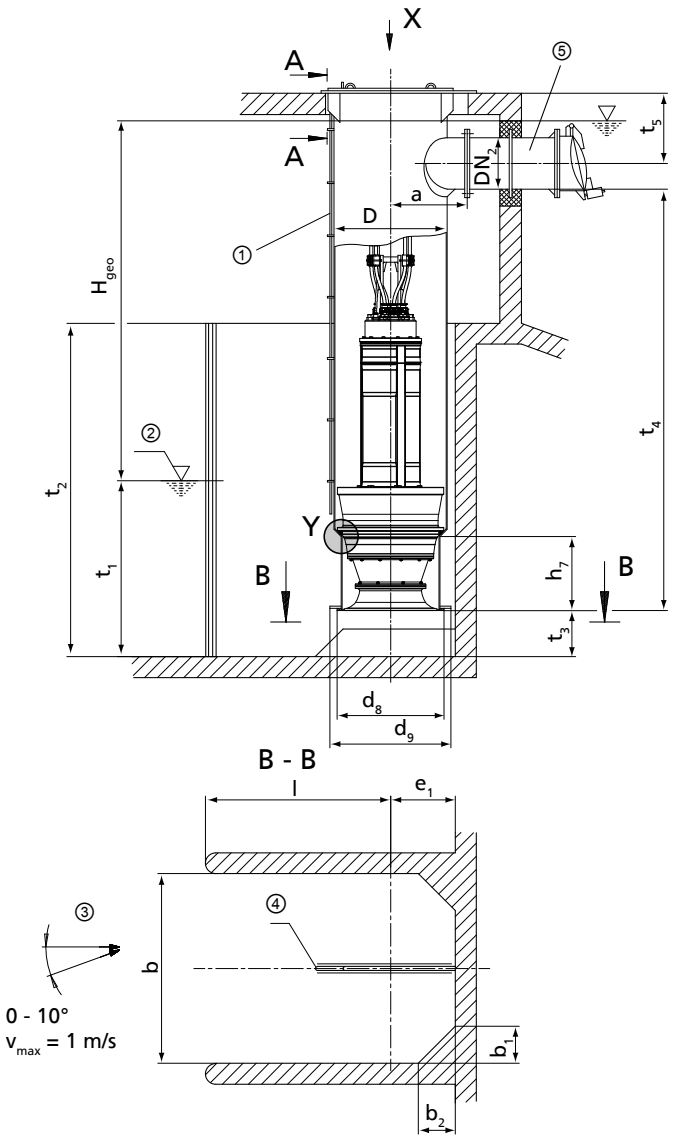
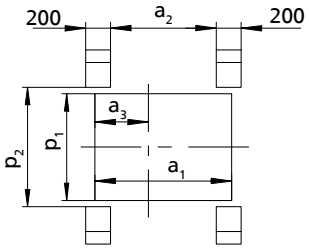
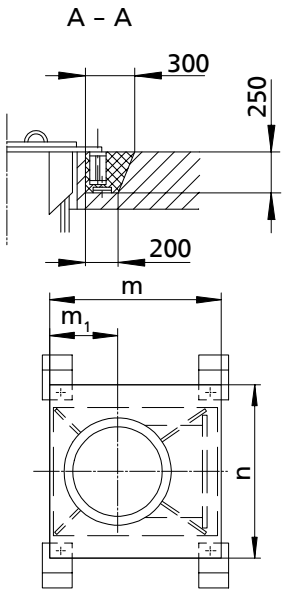
9.5.3 Installation type CU

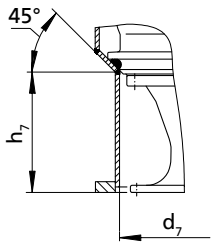




Foundation recesses[15)]



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



Detailed view Y:
seating ring

①: Vent line,
②: Minimum water level (values see diagram on the next page),
③: Approach flow,
④: Flow-straightening vane (⇨ Section 9.5.7, Page 123) ,
⑤: Connect the discharge line to the discharge tube without transmitting any stresses or strains.

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

Table 46: Dimensions [mm]

Size	D	DN_2 min	DN_2 max	a	a_1	a_2	a_3	b	b_1		b_2		d_7
									Suction umbrella		Suction umbrella		
									✘	✓	✘	✓	
									d_8	d_9	d_8	d_9	
800-535	813	500	800	700	1220	970	480	1500	300	-	300	-	720
850-535	868	500	800	730	1275	1020	505	1500	300	-	300	-	720
850-550	868	500	800	730	1275	1020	505	1500	300	-	300	-	740
900-600	914	600	900	760	1320	1070	530	1500	300	-	300	-	800
900-615	914	600	900	760	1320	1070	530	1800	360	-	360	-	780
900-620	914	600	900	760	1320	1070	530	1250	250	-	250	-	770
1000-600	1016	700	1000	810	1430	1160	580	1500	300	-	300	-	800
1000-615	1016	700	1000	810	1430	1160	580	1800	360	-	360	-	780
1000-620	1016	700	1000	810	1430	1160	580	1250	250	-	250	-	770
1000-655	1016	700	1000	810	1430	1160	580	1800	360	-	360	-	920
1300-820	1320	1000	1300	960	1720	1470	720	2300	460	-	460	-	1080

Table 47: Dimensions [mm]

Size	d_8	d_9	e_1 [16]		h_7	l_{min}	m	m_1	n	p_1	p_2	t_3 [16]	$t_{4\ min}$ [17]	t_5 [18]
			Suction umbrella											
			✘	✓										
			d_8	d_9										
800-535	810	1300	500	750	325	1000	1270	505	1375	1075	1175	380	2800	835
850-535	865	1300	525	750	325	975	1325	530	1375	1075	1175	380	3250	835
850-550	865	1300	525	750	375	975	1325	530	1375	1075	1175	380	3250	835
900-600	910	1300	550	750	415	950	1380	560	1480	1180	1280	380	3200	925
900-615	910	1300	550	750	420	1250	1380	560	1480	1180	1280	440	3200	925
900-620	910	1050	550	620	365	700	1380	560	1480	1180	1280	320	3200	925
1000-600	1015	1300	600	750	415	900	1520	625	1620	1280	1380	380	3650	980
1000-615	1015	1300	600	750	420	1200	1520	625	1620	1280	1380	440	3650	980
1000-620	1015	1050	600	620	365	650	1520	625	1620	1280	1380	320	3650	980
1000-655	1015	1500	600	850	515	1200	1520	625	1620	1280	1380	440	3750	980
1300-820	1320	1800	750	1000	545	1550	1810	765	1960	1620	1720	560	3900	1180

t_2 = 1.1 × water level, maximum 2 × t_1 (depending on head H and structure)
Height of corner lining (b_1 and b_2) like t_2

Permissible tolerances:

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

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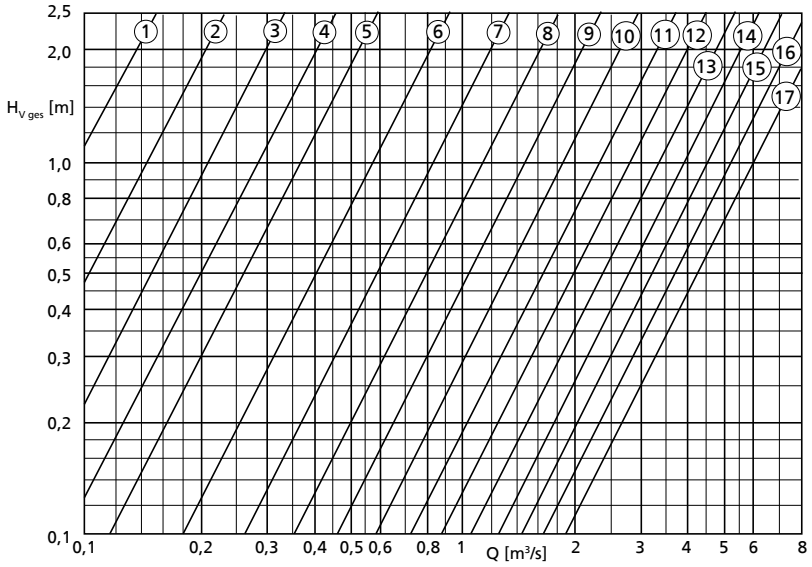
16 Observe this dimension.
17 Value for maximum motor length
18 Designed for DN2max.

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)

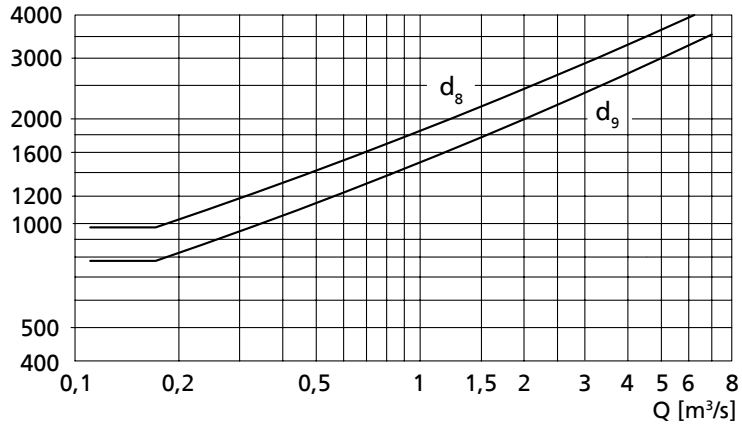
$H_{V\,ges.}$ comprises:

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

Minimum water level diagram

Open chamber

t_1 [mm]

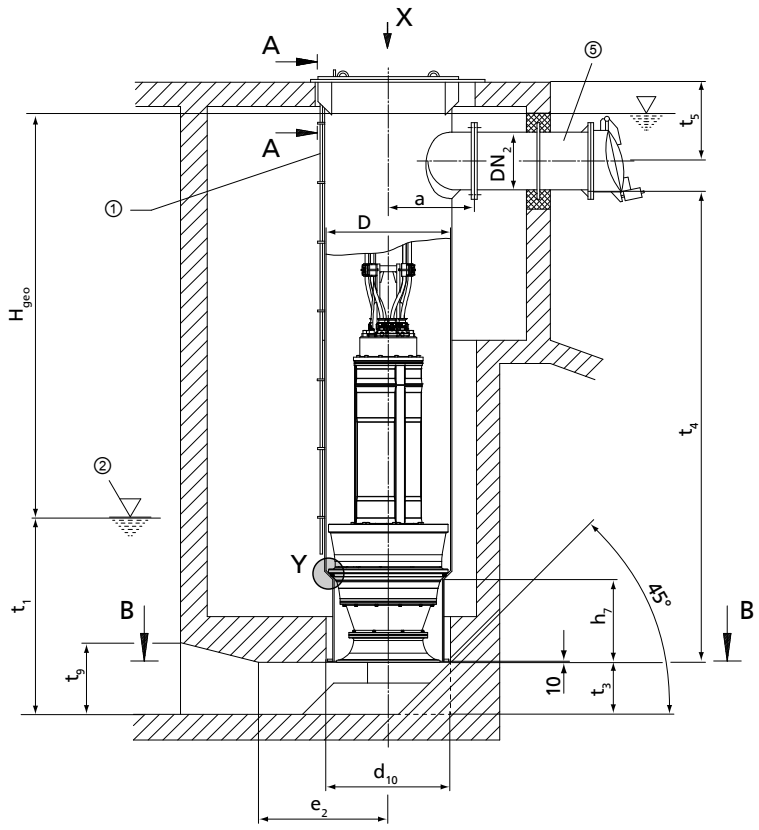


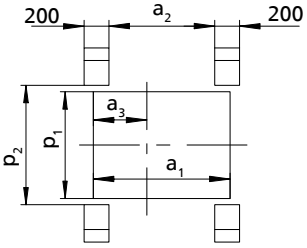
Minimum water level

d_8 = Design: **without** suction umbrella (standard)

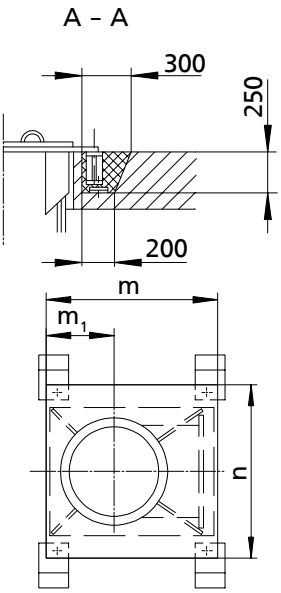
d_9 = Design: **with** suction umbrella

9.5.4 Installation type CG



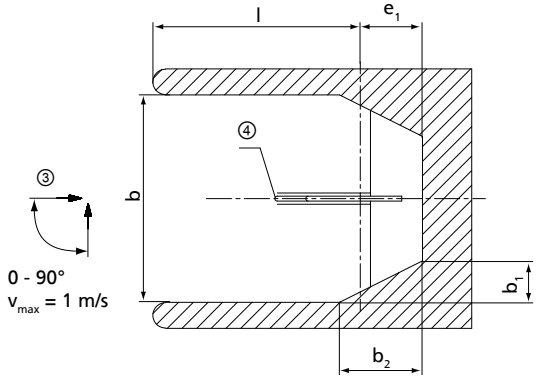


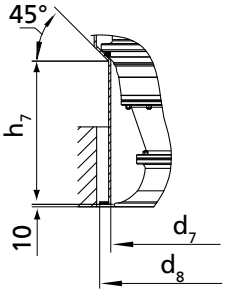
Foundation recesses [19)]



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

B - B





Detailed view Y:
seating ring

①: Vent line,
②: Minimum water level (values see diagram on the next page),
③: Approach flow,
④: Flow-straightening vane (⇨ Section 9.5.7, Page 123) ,
⑤: Connect the discharge line to the discharge tube without transmitting any stresses or strains.

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

Table 48: Dimensions [mm]

Size	D	DN_2 min	DN_2 max	a	a_1	a_2	a_3	b	b_1	b_2	d_7	d_8	d_{10}
800-535	813	500	800	700	1220	970	480	1500	300	600	720	840	885
850-535	868	500	800	730	1275	1020	505	1500	300	600	720	840	885
850-550	868	500	800	730	1275	1020	505	1500	300	600	740	840	885
900-600	914	600	900	760	1320	1070	530	1500	300	600	800	820	860
900-615	914	600	900	760	1320	1070	530	1800	360	720	780	910	955
900-620	914	600	900	760	1320	1070	530	1250	250	500	770	790	830
1000-600	1016	700	1000	810	1430	1160	580	1500	300	600	800	820	860
1000-615	1016	700	1000	810	1430	1160	580	1800	360	720	780	1000	1040
1000-620	1016	700	1000	810	1430	1160	580	1250	250	500	770	790	830
1000-655	1016	700	1000	810	1430	1160	580	1800	360	720	920	1000	1040
1300-820	1320	1000	1300	960	1720	1470	720	2300	460	920	1080	1300	1360

Table 49: Dimensions [mm]

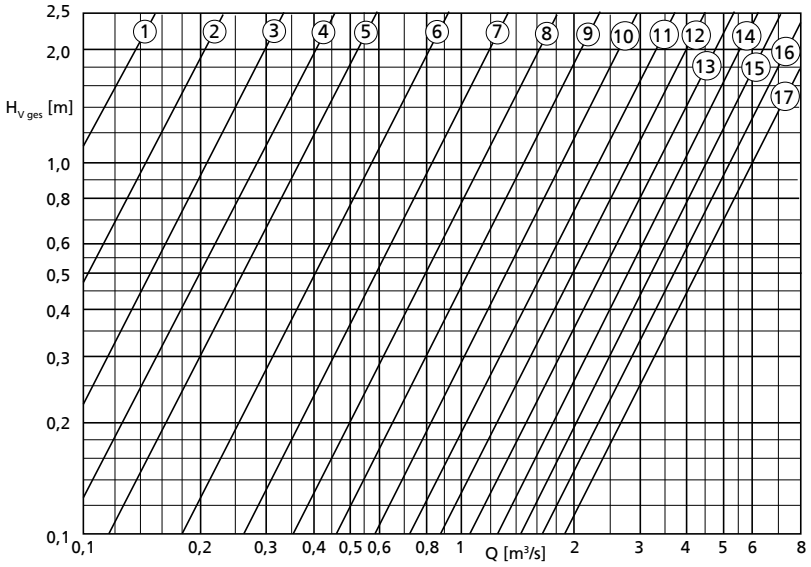
Size	e_1 [20]	e_2	h_7	l_{min}	m	m_1	n	p_1	p_2	t_3 [20]	t_4 min [21]	t_5 min [22]	t_9
800-535	450	750	325	1500	1270	505	1375	1075	1175	380	2800	835	570
850-535	450	750	325	1500	1325	530	1375	1075	1175	380	3250	835	570
850-550	450	750	375	1500	1325	530	1375	1075	1175	380	3250	835	570
900-600	450	750	415	1500	1380	560	1480	1180	1280	380	3200	925	570
900-615	520	900	420	1800	1380	560	1480	1180	1280	440	3200	925	660
900-620	415	625	365	1250	1380	560	1480	1180	1280	320	3200	925	470
1000-600	450	750	415	1500	1520	625	1620	1280	1380	380	3650	980	570
1000-615	520	900	420	1800	1520	625	1620	1280	1380	440	3650	980	660
1000-620	415	625	365	1250	1520	625	1620	1280	1380	320	3650	980	470
1000-655	520	900	515	1800	1520	625	1620	1280	1380	440	3750	980	660
1300-820	680	1150	545	2300	1810	765	1960	1620	1720	560	3900	1180	850

Permissible tolerances:

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

20 Observe this dimension.
21 Value for maximum motor length
22 Designed for DN2max.

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:

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

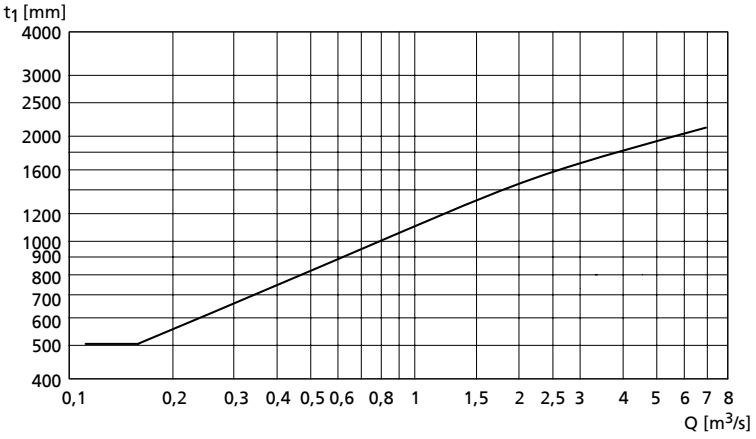
ΔH_v - Loss in the riser (pipe friction)
- $H_{v\,ges.}$ (see diagram)

$H_{V\,ges.}$ comprises:

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

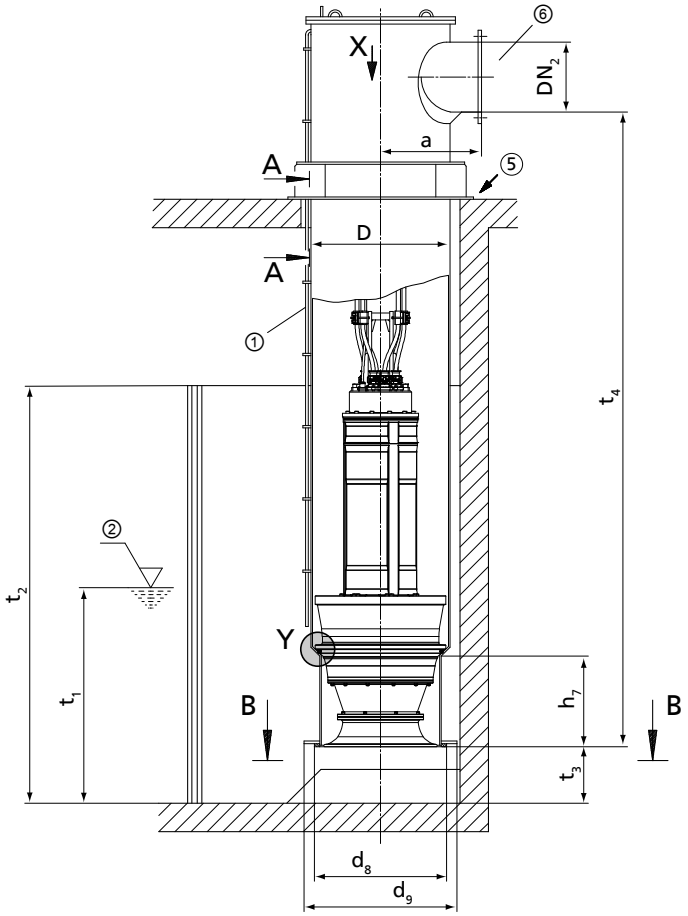
Minimum water level diagram

Covered chamber

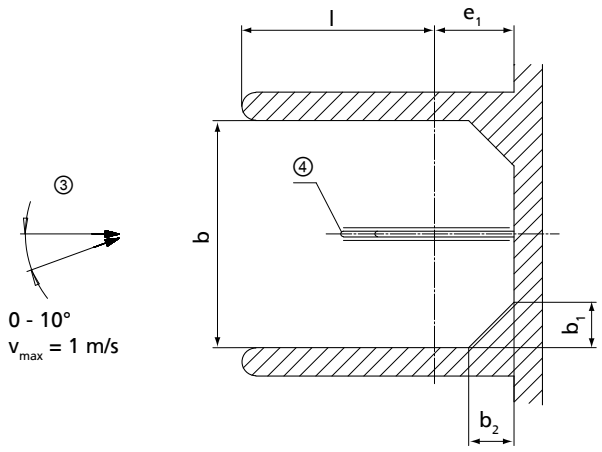


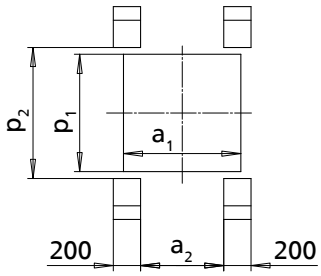
Minimum water level

9.5.5 Installation type DU



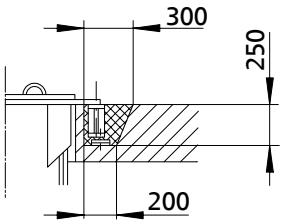
B - B

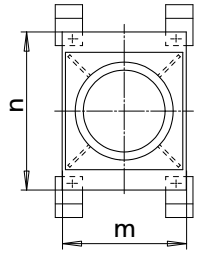




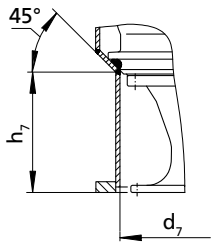
Foundation recesses [23)]

A – A





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



Detailed view Y:
seating ring

①: Vent line,
②: Minimum water level (values see diagram on the next page),
③: Approach flow,
④: Flow-straightening vane (⇨ Section 9.5.7, Page 123) ,
⑤: Not pressure-proof,
⑥: Connect the discharge line to the discharge tube without transmitting any stresses or strains.

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

Table 50: Dimensions [mm]

Size	D	DN_2 min	DN_2 max	a	a_1	a_2	b	b_1		b_2		d_7
								Suction umbrella		Suction umbrella		
								✘	✓	✘	✓	
								d_8	d_9	d_8	d_9	
800-535	813	500	800	700	960	710	1500	300	-	300	-	720
850-535	868	500	800	730	1010	760	1500	300	-	300	-	720
850-550	868	500	800	730	1010	760	1500	300	-	300	-	740
900-600	914	600	900	760	1060	810	1500	300	-	300	-	800
900-615	914	600	900	760	1060	810	1800	360	-	360	-	780
900-620	914	600	900	760	1060	810	1250	250	-	250	-	770
1000-600	1016	700	1000	810	1160	910	1500	300	-	300	-	800
1000-615	1016	700	1000	810	1160	910	1800	360	-	360	-	780
1000-620	1016	700	1000	810	1160	910	1250	250	-	250	-	770
1000-655	1016	700	1000	810	1160	910	1800	360	-	360	-	920
1300-820	1320	1000	1300	960	1460	1210	2300	460	-	460	-	1080

Table 51: Dimensions [mm]

Size	d_8	d_9	e_1[24]		h_7	l_{min}	m	n	p_1	p_2	t_3[24]	t_4 min[25]
			Suction umbrella									
			✘	✓								
			d_8	d_9								
800-535	810	1300	500	750	325	1000	1030	1260	960	1060	380	2800
850-535	865	1300	525	750	325	975	1080	1310	1010	1110	380	3250
850-550	865	1300	525	750	375	975	1080	1310	1010	1110	380	3250
900-600	910	1300	550	750	415	950	1130	1360	1060	1160	380	3200
900-615	910	1300	550	750	420	1250	1130	1360	1060	1160	440	3200
900-620	910	1050	550	620	365	700	1130	1360	1060	1160	320	3200
1000-600	1015	1300	600	750	415	900	1240	1500	1160	1260	380	3650
1000-615	1015	1300	600	750	420	1200	1240	1500	1160	1260	440	3650
1000-620	1015	1050	600	620	365	650	1240	1500	1160	1260	320	3650
1000-655	1015	1500	600	850	515	1200	1240	1500	1160	1260	440	3750
1300-820	1320	1800	750	1000	545	1550	1540	1800	1460	1560	560	3900

t_2 = 1.1 × water level, maximum 2 × t_1 (depending on head H and structure)
Height of corner lining (b_1 and b_2) like t_2

Permissible tolerances:

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

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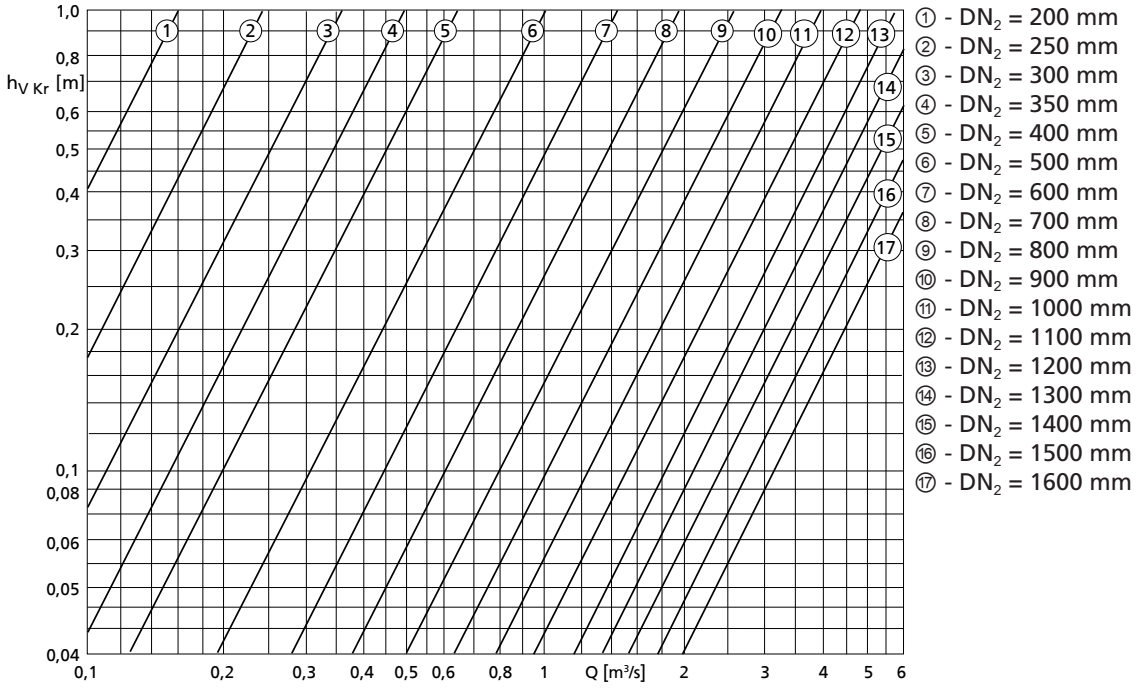
24 Observe this dimension.
25 Value for maximum motor length

Loss diagram



Calculation formulas:

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

ΔH_v

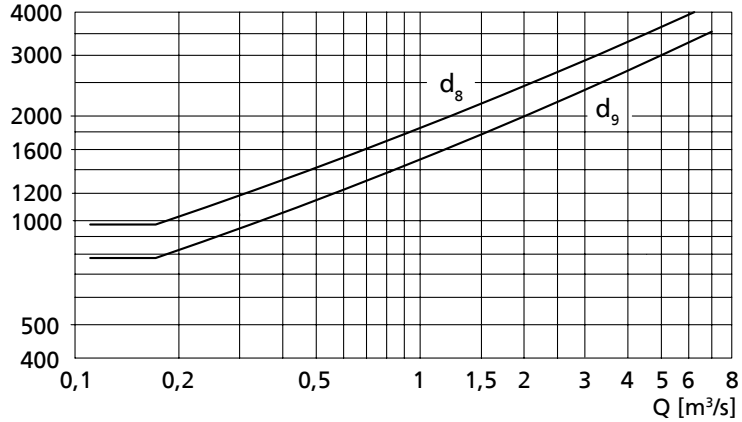
- Loss in the elbow $h_{V\,Kr}$ (see diagram)
- Loss in the riser (pipe friction)
- $H_{V\,System}$ (valves, etc.)

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

Minimum water level diagram

Open chamber

t_1 [mm]

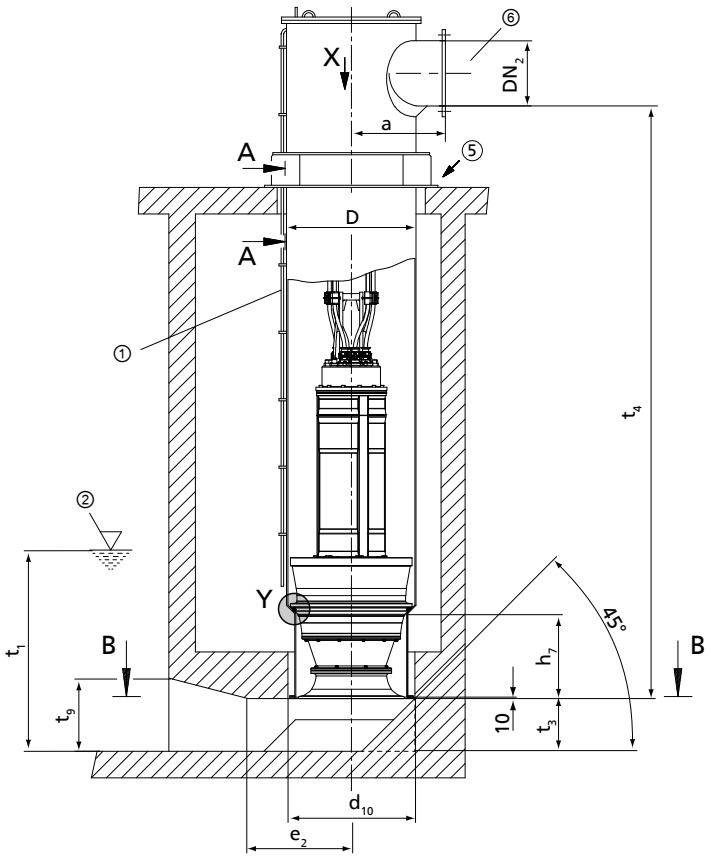


Minimum water level

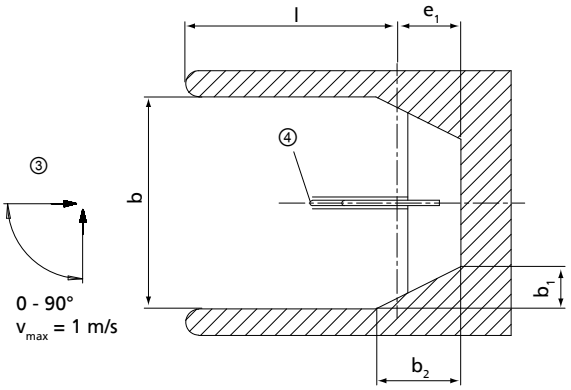
d_8 = Design: **without** suction umbrella (standard)

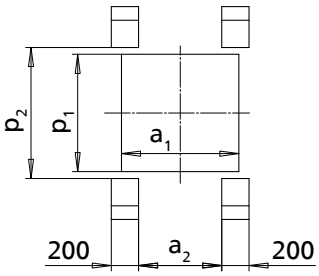
d_9 = Design: **with** suction umbrella

9.5.6 Installation type DG



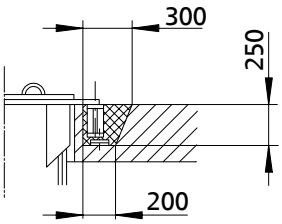
B - B

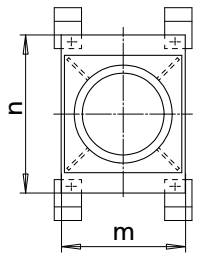




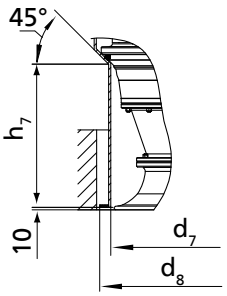
Foundation recesses [26)]

A – A





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



Detailed view Y:
seating ring

①: Vent line,
②: Minimum water level (values see diagram on the next page),
③: Approach flow,
④: Flow-straightening vane (⇨ Section 9.5.7, Page 123) ,
⑤: Not pressure-proof,
⑥: Connect the discharge line to the discharge tube without transmitting any stresses or strains.

Table 52: Dimensions [mm]

Size	D	DN_2 min	DN_2 max	a	a_1	a_2	b	b_1	b_2	d_7	d_8	d_{10}
800-535	813	500	800	700	960	710	1500	300	600	720	840	885
850-535	868	500	800	730	1010	760	1500	300	600	720	840	885

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

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Size	D	DN_2 min	DN_2 max	a	a_1	a_2	b	b_1	b_2	d_7	d_8	d_{10}
850-550	868	500	800	730	1010	760	1500	300	600	740	840	885
900-600	914	600	900	760	1060	810	1500	300	600	800	820	860
900-615	914	600	900	760	1060	810	1800	360	720	780	910	955
900-620	914	600	900	760	1060	810	1250	250	500	770	790	830
1000-600	1016	700	1000	810	1160	910	1500	300	600	800	820	860
1000-615	1016	700	1000	810	1160	910	1800	360	720	780	1000	1040
1000-620	1016	700	1000	810	1160	910	1250	250	500	770	790	830
1000-655	1016	700	1000	810	1160	910	1800	360	720	920	1000	1040
1300-820	1320	1000	1300	960	1460	1210	2300	460	920	1080	1300	1360

Table 53: Dimensions [mm]

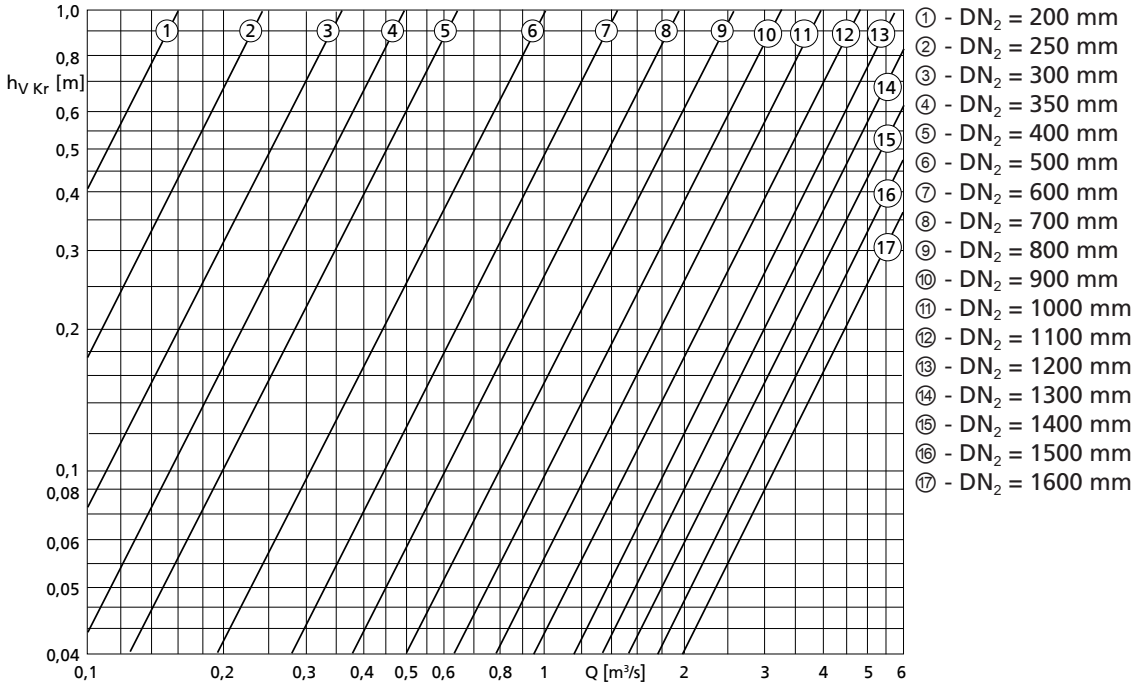
Size	e_1[27)]	e_2	h_7	l_{min}	m	n	p_1	p_2	t_3[27)]	t_4 min[28)]	t_9
800-535	450	750	325	1500	1030	1260	960	1060	380	2800	570
850-535	450	750	325	1500	1080	1310	1010	1110	380	3250	570
850-550	450	750	375	1500	1080	1310	1010	1110	380	3250	570
900-600	450	750	415	1500	1130	1360	1060	1160	380	3200	570
900-615	520	900	420	1800	1130	1360	1060	1160	440	3200	660
900-620	415	625	365	1250	1130	1360	1060	1160	320	3200	470
1000-600	450	750	415	1500	1240	1500	1160	1260	380	3650	570
1000-615	520	900	420	1800	1240	1500	1160	1260	440	3650	660
1000-620	415	625	365	1250	1240	1500	1160	1260	320	3650	470
1000-655	520	900	515	1800	1240	1500	1160	1260	440	3750	660
1300-820	680	1150	545	2300	1540	1800	1460	1560	560	3900	850

Permissible tolerances:

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

27 Observe this dimension.
28 Value for maximum motor length

Loss diagram



Calculation formulas:

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

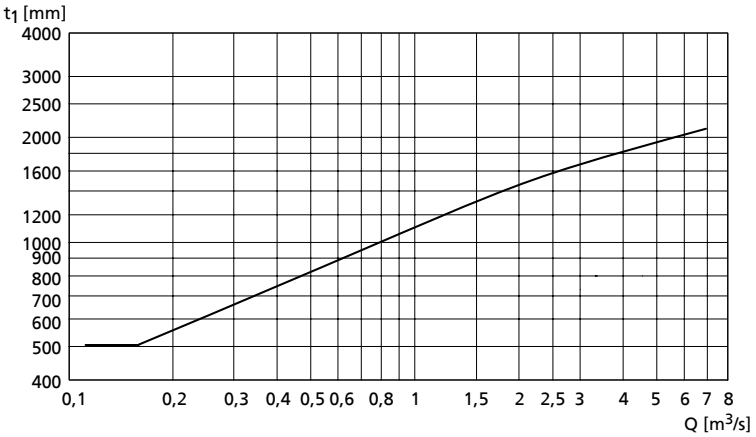
ΔH_v

- 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.

Minimum water level diagram

Covered chamber



Minimum water level

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9.5.7 Dimensions of the flow-straightening vane

Design of the intake chamber wall surfaces (to prevent vortex formation)

The flow-straightening vane is indispensable for the inlet conditions of the pump set. It prevents the development of a submerged vortex (floor vortex) which could cause a drop in performance, for example. In addition, the floor and wall surfaces of the intake chamber should be designed as a rough concrete surface. Rough surfaces minimise the separation of boundary layers that may cause wall and floor vortices.

Flow-straightening vane and intake chamber

- The anti-swirl baffles in the bellmouth must be aligned with the flow-straightening vane.
- The bail of the pump is oriented in the same direction as the anti-swirl baffles in the bellmouth.

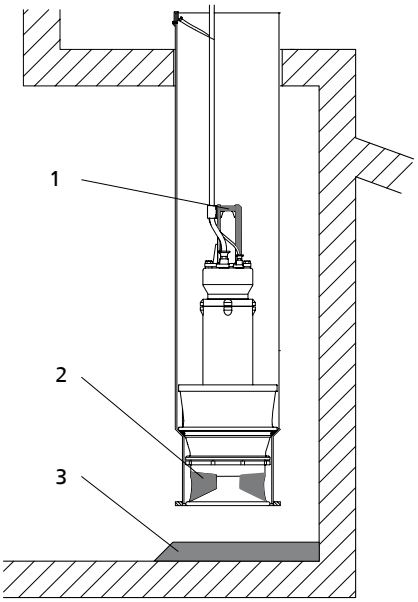
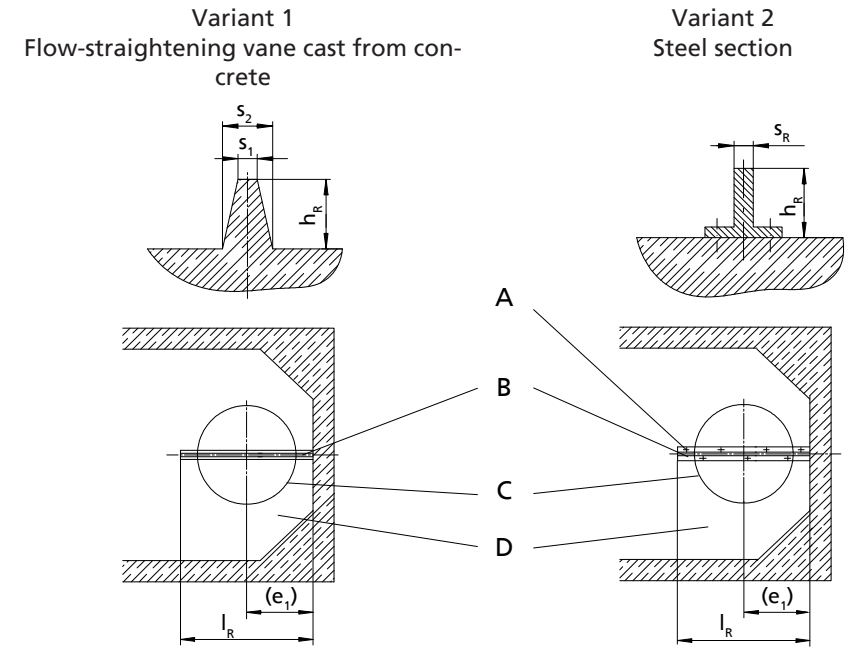


Fig. 59: Installation position of the pump set

1	Bail
2	Anti-swirl baffles
3	Flow-straightening vane



A	Bolted to the floor of the intake chamber
B	Flow-straightening vane centred beneath the discharge tube
C	Discharge tube
D	Intake chamber

Installation types BU, CU, DU

Table 54: Dimensions [mm]

Size	h_R	s_R	s_1	s_2	$(e_1)^{29)}$		$l_R^{30)}$	
					Suction umbrella		Suction umbrella	
					✘	✓	✘	✓
					d_8	d_9	d_8	d_9
650-364	150	10	20	60	420	540	835	955
650-365	150	10	20	60	420	540	835	955
650-404	150	10	20	60	420	540	835	955
650-405	190	10	20	70	420	540	875	1050
800-505	190	10	20	70	500	620	1050	1150
800-535	230	10	25	90	500	750	1100	1350
850-535	230	10	25	90	525	750	1100	1350
850-550	230	10	25	90	525	750	1100	1350
900-600	230	10	25	90	550	750	1200	1500
900-615	265	12	25	100	550	750	1300	1500
900-620	190	10	20	70	550	620	1050	1150
1000-600	230	10	25	90	600	750	1200	1500
1000-615	265	12	25	100	600	750	1300	1500
1000-620	190	10	20	70	600	620	1150	1150
1000-655	265	12	25	100	600	850	1300	1500
1300-820	335	12	30	120	750	1000	1625	1875

Installation types BG, CG, DG

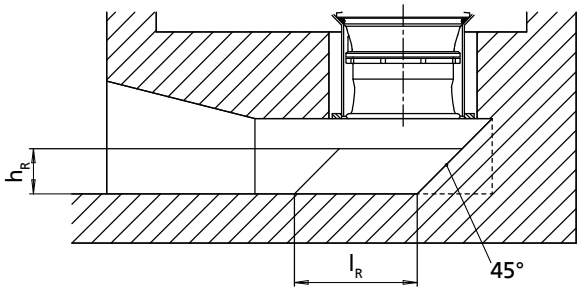


Fig. 60: Flow-straightening vane for covered intake chamber

Table 55: Dimensions [mm]

Size	h_R	s_R	s_1	s_2
650-364	150	10	20	60
650-365	150	10	20	60
650-404	150	10	20	60
650-405	190	10	20	70
800-505	190	10	20	70

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29 See installation examples for types BU, CU and DU

30 Length IR of the flow-straightening vane must be adjusted to the 45° angle of the intake chamber.

Size	h_R	s_R	s_1	s_2
800-535	230	10	25	90
850-535	230	10	25	90
850-550	230	10	25	90
900-600	230	10	25	90
900-615	265	12	25	100
900-620	190	10	20	70
1000-600	230	10	25	90
1000-615	265	12	25	100
1000-620	190	10	20	70
1000-655	265	12	25	100
1300-820	335	12	30	120

10 EU Declaration of Conformity

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

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

Amacan K, Amacan P, Amacan S

KSB order number: .....

- is in conformity with the provisions of the following directives / regulations as amended from time to time:
  - Pump (set): 2006/42/EC Machinery Directive

The manufacturer also declares that

- the following harmonised international standards[31)] have been applied:
  - ISO 12100
  - EN 809
  - EN 60034-1, EN 60034-5/A1

Person authorised to compile the technical file:

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

The EU Declaration of Conformity was issued in/on:

Place, date

.....[32)].....

Name

Function

Company
Address

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

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

11 Certificate of Decontamination

Type: .....

Order number /

Order item number[33]: .....

Delivery date: .....

Application: .....

Fluid handled[33]: .....

Please tick where applicable[33]:

☐ Corrosive

☐ Oxidising

☐ Flammable

☐ Explosive

☐ Hazardous to health

☐ Seriously hazardous to health

☐ Toxic

☐ Radioactive

☐ Bio-hazardous

☐ Safe

Reason for return:[33]: .....

Comments: .....

.....

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

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

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

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

☐ No special safety precautions are required for further handling.

☐ The following safety precautions are required for flushing fluids, fluid residues and disposal:

.....

.....

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

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

1589.83/08-EN

33 Required field

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1589.83/08-EN (01348408)

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