

Submersible Pump in Discharge Tube

Amacan P

50 Hz

Amacan P 700 - 470

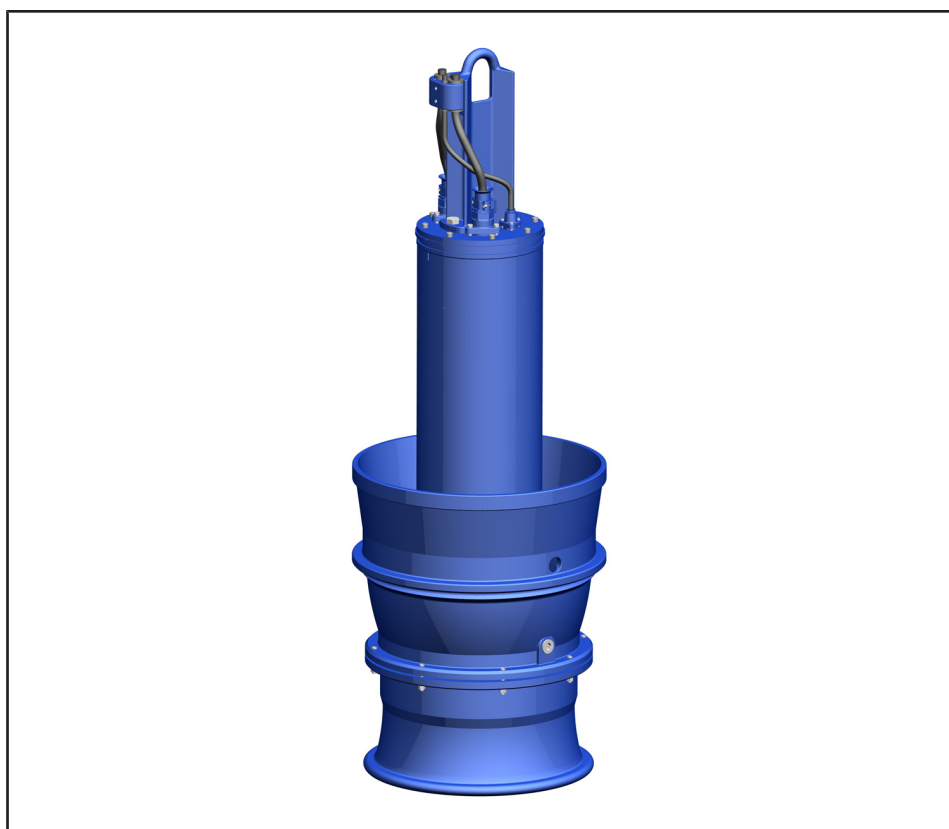
Amacan P 800/900 - 540

Amacan P 1000 - 700

Amacan P 1200 - 870

Amacan P 1500/1600 - 1060

Installation/Operating Manual



Mat. No.: 05152141

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Installation/Operating Manual Amacan P

Original operating manual

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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

ECB (ever clean blade) design

Self-cleaning vane profile

Submersible pump in discharge tube

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

1 General

1.1 Principles

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

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

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

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

1.2 Installation of partly completed machinery

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

1.3 Target group

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

1.4 Other applicable documents

Table 1: Overview of other applicable documents

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

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

1.5 Symbols

Table 2: Symbols used in this manual

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

¹ If included in agreed scope of supply

1.6 Key to safety symbols/markings

Table 3: Definition of safety symbols/markings

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



2 Safety

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

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

2.1 General

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

2.2 Intended use

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

2.3 Personnel qualification and training

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

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

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

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

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

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

2.5 Safety awareness

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

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

2.6 Safety information for the operator/user

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

2.7 Safety information for maintenance, inspection and installation

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

- When taking the pump set out of service always adhere to the procedure described in the manual. (⇒ Section 6.3, Page 48)
- Decontaminate pumps which handle fluids posing a health hazard.
- As soon as the work has been completed, re-install and re-activate any safety-relevant devices and protective devices. Before returning the product to service, observe all instructions on commissioning. (⇒ Section 6.1, Page 44)

2.8 Unauthorised modes of operation

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

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

2.9 Explosion protection



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

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

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

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

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

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

Prevent impermissible modes of operation.

2.9.1 Repair

Special regulations apply to repair work on explosion-proof pumps. Modifications or alterations of the pump set can affect explosion protection and are only permitted after consultation with the manufacturer.

Repair work at the flameproof joints must only be performed in accordance with the manufacturer's instructions. Repair to the values in Table 2 of EN 60079-1 is not permitted.

3 Transport/Storage/Disposal

3.1 Checking the condition upon delivery

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

3.2 Transport

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

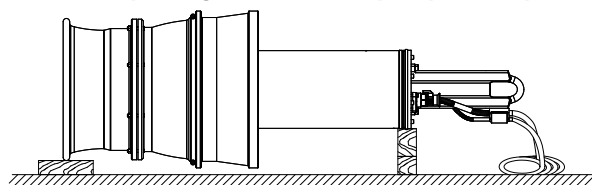


Fig. 1: Transporting the pump set in its original packaging

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

3.2.2 Placing the pump set in a vertical or horizontal position

	⚠ WARNING Pump set tilting Risk of squashing hands and feet! ▷ Suspend or support the pump set.
---	---

	⚠ 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.

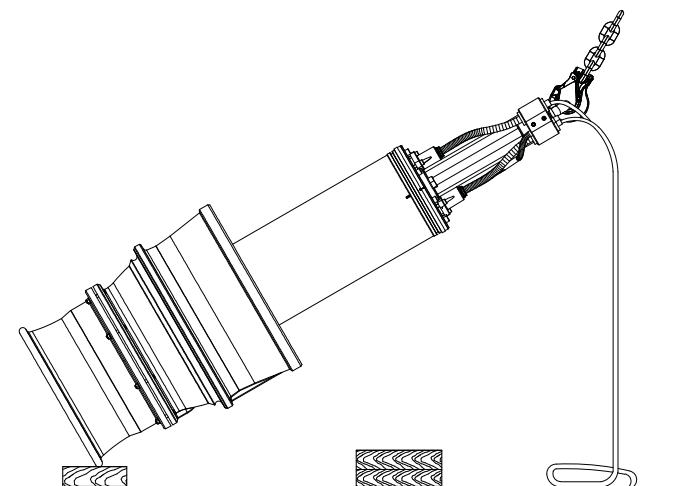


Fig. 2: Pulling the pump set upright with one crane

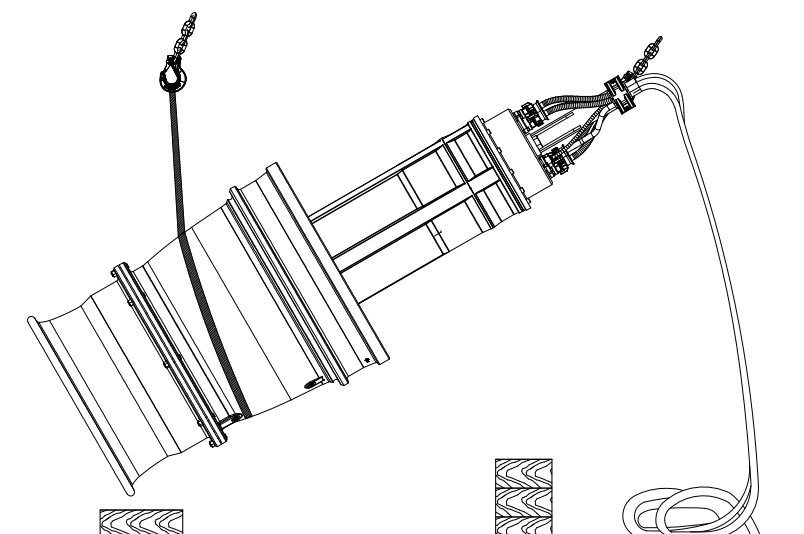


Fig. 3: Pulling the pump set upright with two cranes

✓ 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 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.
	⚠ 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.

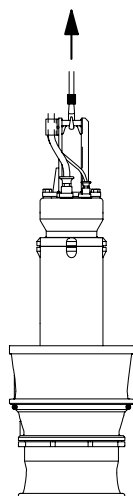


Fig. 4: Transporting the pump set in a vertical position

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

3.2.4 Transport lock

Pump sets from size Amacan P 1000 - 700 are supplied with a transport lock. Prior to checking the direction of rotation, lowering the pump into the discharge tube and commissioning, remove the transport lock, which is a metal plate between impeller and bellmouth.

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 as per operating instructions. (⇒ Section 7.3.2, Page 56)
2. Flush and clean the pump, particularly if it has been used for handling noxious, explosive, hot or other hazardous fluids.
3. If the pump has handled fluids whose residues could lead to corrosion damage in the presence of atmospheric humidity or could ignite upon contact with oxygen, the pump must also be neutralised, and anhydrous inert gas must be blown through the pump to ensure drying.
4. Always complete and enclose a certificate of decontamination when returning the pump.
Indicate any safety measures and decontamination measures taken.
(⇒ Section 11, Page 131)

**NOTE**

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

4 Description of the Pump (Set)

4.1 General description

- Submersible pump in discharge tube

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

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

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

4.3 Designation

Example: Amacan PA4 800-540 / 120 6UTG1

Table 5: Designation key

Code	Description
Amacan	Type series
P	Impeller type
P	Propeller
A	Pressure class
A	A
A	B
4	Number of blades
800	Nominal diameter of the discharge tube [mm]
540	Nominal impeller diameter [mm]
120	Motor size
6	Number of motor poles
UT	Motor version
UT	Non-explosion-proof, standard
XT	Explosion protection  II 2G Ex db h IIB T3 Gb
G1	Material variant
G1	Grey cast iron, standard material variant
G3	Grey cast iron with Zn anodes, shaft made of 1.4057 stainless steel

4.4 Name plate

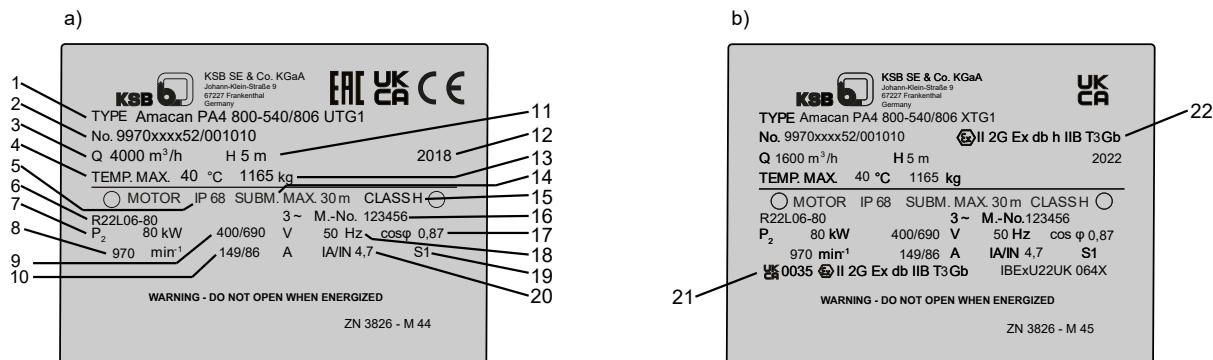


Fig. 5: Name plate (example) a) Standard pump set b) Explosion-proof pump set

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

4.5 Design details

Design

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

Drive

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

Shaft seal

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

Impeller type

- Axial propeller in ECB design

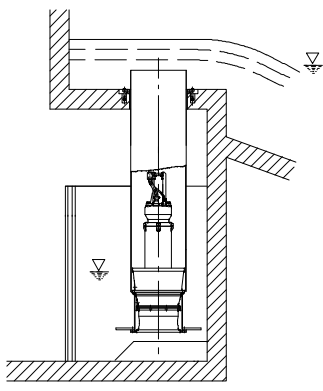
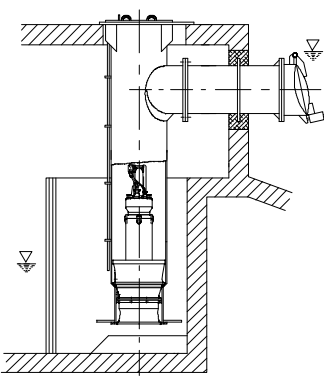
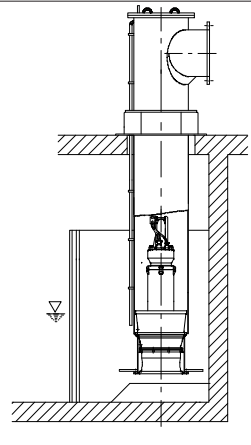
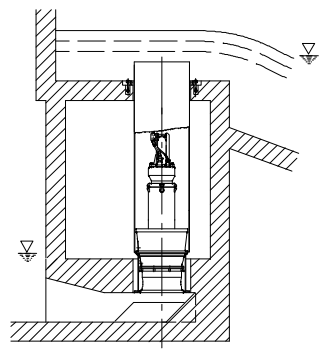
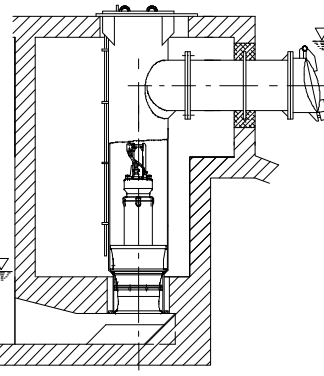
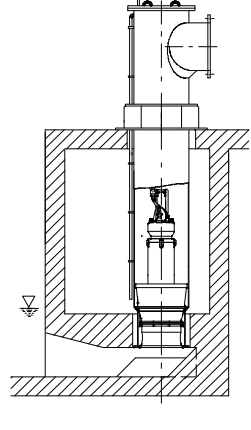
Bearings

- Grease-lubricated rolling element bearings

4.6 Installation types

Six different types are available for selection²⁾:

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

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

4.7 Configuration and function

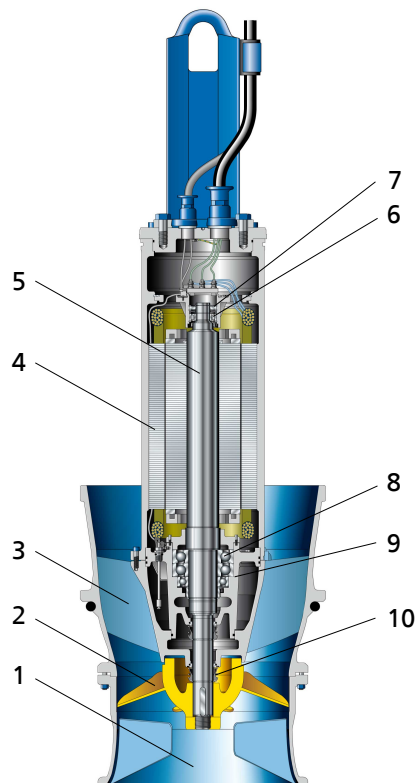


Fig. 6: Amacan with axial propeller

1	Suction nozzle (bellmouth)	2	Impeller
3	Pump bowl	4	Electric motor
5	Shaft	6	Bearing, motor 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 bowl (3) the kinetic energy of the fluid is converted into pressure energy and the rotational movement of the fluid flow is diverted in axial direction. The shaft passage through the casing is sealed towards the fluid with a shaft seal (10). The shaft (5) runs in two rolling element bearings (6 and 8), which are supported by the bearing housing (9) and the bearing bracket (7).

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 bearing³⁾
- 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



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.

³ Included in the standard design for size 1600-1060

5 Installation at Site

5.1 Safety regulations

 	 DANGER Improper installation in potentially explosive atmospheres Explosion hazard! Damage to the pump set! ▸ Comply with the applicable local explosion protection regulations. ▸ Observe the information in the data sheet and on the name plates of pump and motor.
	 DANGER 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 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.

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

Visual inspection for signs of oil leakage

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

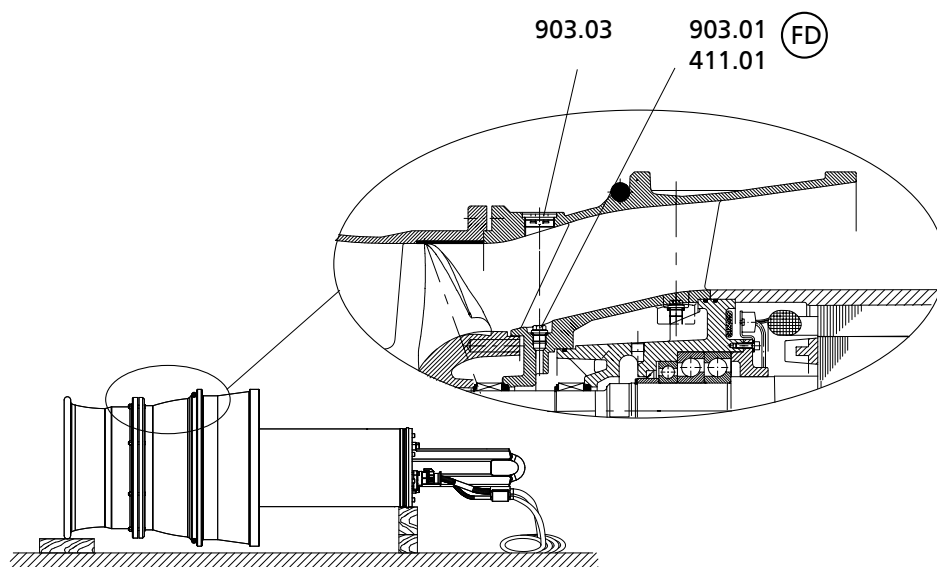


Fig. 7: Checking the lubricant level

Table 7: Symbols key

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

1. Place the pump set down in a horizontal position and make sure it cannot roll off. (⇒ Section 3.2.2, Page 12)
2. When placing it down, make sure that screw plug 903.03 is on top.
3. Remove screw plug 903.03.
4. Remove screw plug 903.01 and joint ring 411.01.
5. Shine a torch through the hole in the pump bowl to see the opening of the lubricant reservoir.
 - ⇒ If the lubricant level reaches the opening, fit screw plug 903.01 together with a new joint ring 411.01 as well as screw plug 903.03.
 - ⇒ If the lubricant level is below the opening, top up the lubricant. (⇒ Section 7.4.1.4.2, Page 61)
6. Re-insert and tighten screw plug 903.01 with new joint ring 411.01.
7. Re-insert and tighten screw plug 903.03.

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

5.2.4 Checking the direction of rotation

	⚠ DANGER Pump set running dry Explosion hazard! ▷ Check the direction of rotation of explosion-proof pump sets outside potentially explosive atmospheres.
	⚠ WARNING Improper handling when placing the pump set in a vertical/horizontal position Personal injury and damage to property! ▷ 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.
	⚠ 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).
	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. (⇒ Section 3.2.2, Page 12)
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 bowl 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 bowl.
- 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 Explosion hazard! Damage to the pump set! ▷ Comply with the applicable local explosion protection regulations. ▷ Observe the information in the data sheet and on the name plates of pump and motor.

	⚠ WARNING Incorrect handling of the electric cable Personal injury and damage to property! ▷ Secure electric cables against falling down. ▷ Avoid electric cables being laid on surfaces without fastening. ▷ When moving the pump set keep at a safe distance to the electric cables.
	⚠ WARNING People falling into the unsecured discharge tube Risk of personal injury! ▷ Take suitable precautions during the entire installation/removal process to protect people from falling into the open discharge tube. ▷ Fence off the work area appropriately.

5.3.1 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.

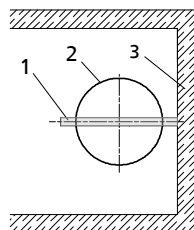


Fig. 8: Installation position of the flow-straightening vane

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).

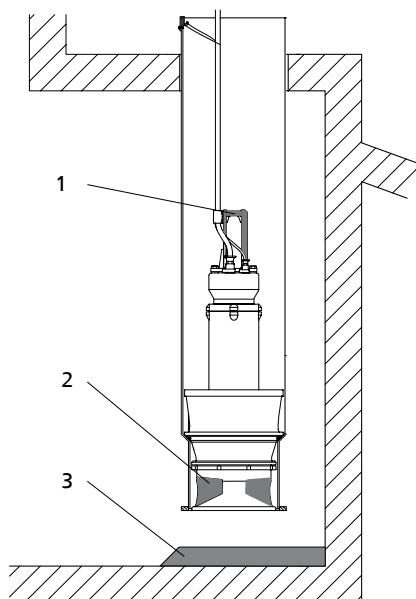


Fig. 9: Installation position of the pump set

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

5.3.2 Installation without support rope

	CAUTION
	Incorrect installation Damage to the pump set! ▷ Verify that the pump set is correctly seated in the discharge tube.

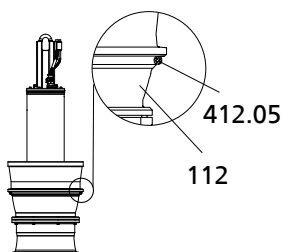


Fig. 10: Inserting the O-ring

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

1. If not already fitted, insert the supplied O-ring 412.05 into pump bowl 112.
2. Attach the crane hook to the bail of the pump set.
3. Centre the pump set above the discharge tube. Slowly lower the pump set into the discharge tube until it is seated in the recommended position.
(⇒ Section 5.3.1, Page 27)
4. Pull the electric cables up by hand. Fasten them to the sump construction with a cable support sleeve if required. Do not lift the pump set out of its seat.

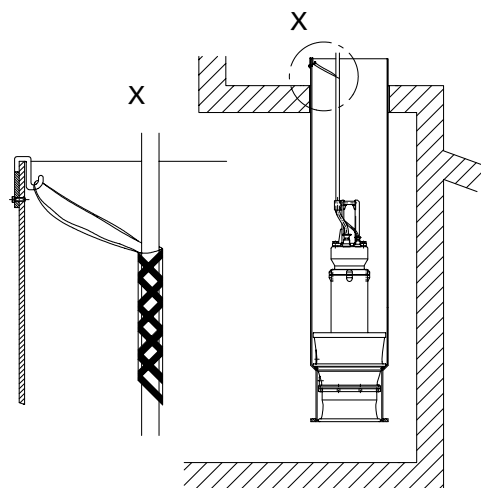


Fig. 11: Fastening the cable support sleeve

5.3.3 Installation 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.

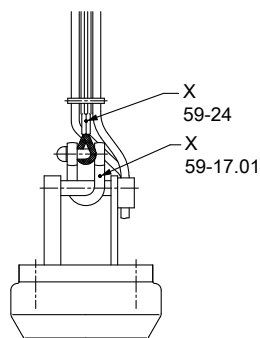


Fig. 12: X = indication of load-carrying capacity

59-24	Support rope
59-17.01	Shackle

	CAUTION
	Incorrect installation Damage to the pump set! ▶ Verify that the pump set is correctly seated in the discharge tube.
	WARNING
	Pump set drops during the installation or removal process Personal injury and damage to property! ▶ Never use the turnbuckle, shackle or discharge tube cover to lift the pump set. ▶ Always use lifting lug 59-47.
	NOTE
	Prior to fitting the turnbuckle, check that the corresponding split pin has not been cracked and/or chipped. If damaged, always use a new split pin.

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

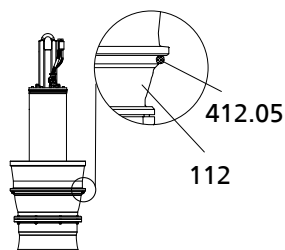


Fig. 13: Inserting the O-ring

1. If not already fitted, insert the supplied O-ring 412.05 into pump bowl 112.

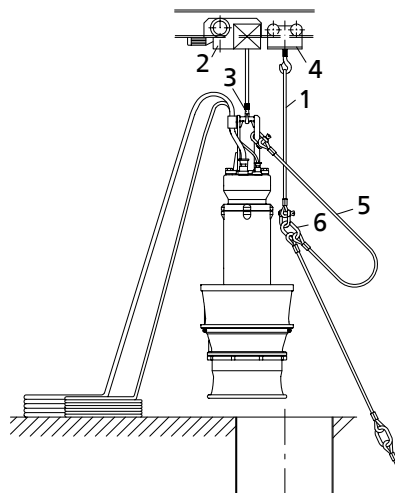


Fig. 14: Lifting and positioning the pump set

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. (⇒ Section 9.2, Page 98)
For a galvanised shackle, secure the pin at the shackle with Loctite 243.
For a stainless steel shackle, undo and tighten the pin twice and secure it with Loctite 243.
4. Check that the support rope is arranged correctly.
⇒ The free lifting lug (6) has to point away from the pump set
5. Partially unwind the support rope and electric cables.
6. Lower the pump set into the discharge tube until the bail is in an accessible position, protruding from the discharge tube.
7. Securely cover the discharge tube except for a gap which allows work to continue.
8. Attach the first lifting lug of the support rope (5) to the lifting rope (1) to securely position the pump set above the discharge tube.
9. Unclip the hook of the lifting equipment from the lifting lug of the support rope and run the lifting equipment to a higher level.

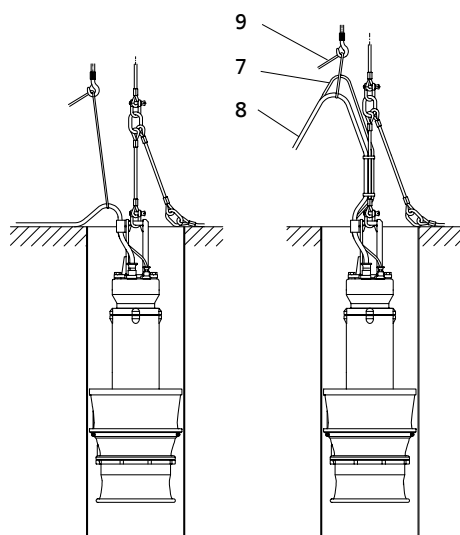


Fig. 15: Securing the control cable and power cable

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.

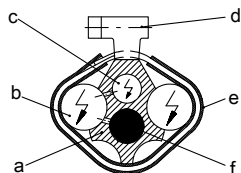


Fig. 16: Cross-section of the cable guide

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.

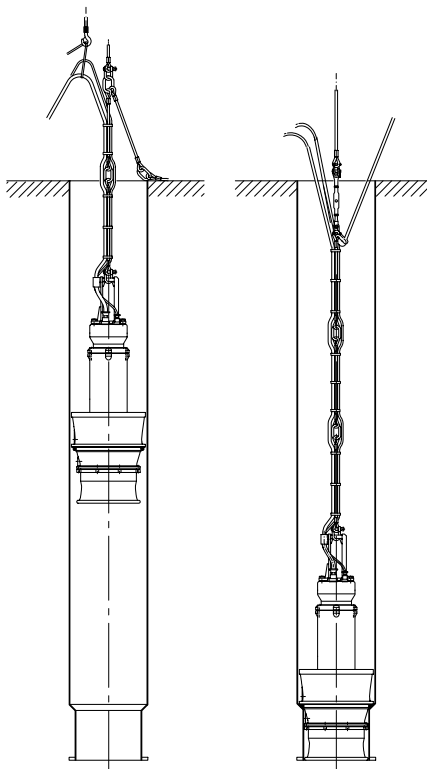


Fig. 17: Lowering the pump set

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. Unclick 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.
21. Make sure that the top loose lifting lug is attached to the cable bundle to prevent noise and wear caused by chafing.
22. Remove the safety cover from the discharge tube and mount the discharge tube cover. Seal the cable entries if any!

5.3.4 Installation 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.

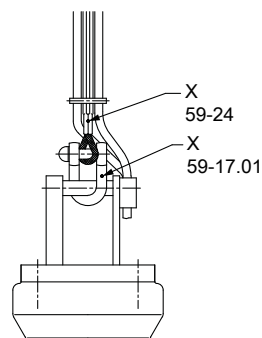


Fig. 18: X = indication of load-carrying capacity

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.

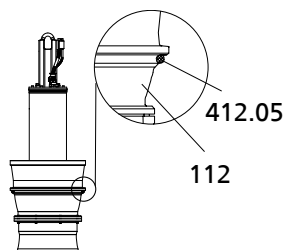


Fig. 19: Inserting the O-ring

1. If not already fitted, insert the supplied O-ring 412.05 into pump bowl 112.

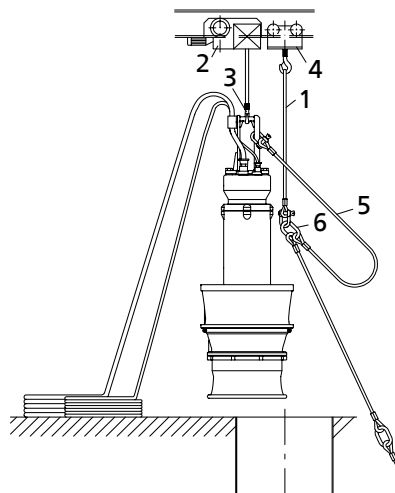


Fig. 20: Lifting and positioning the pump set

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

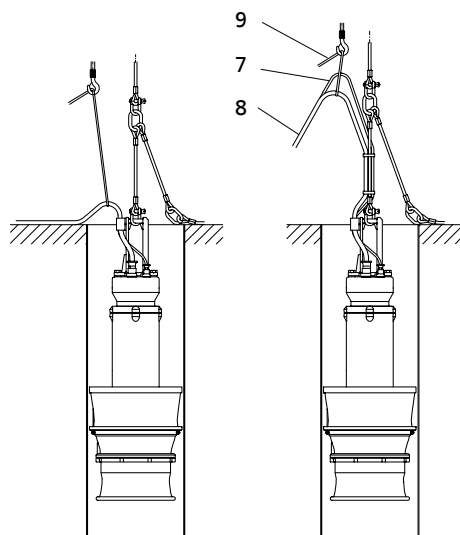


Fig. 21: Securing the control and power cables

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.

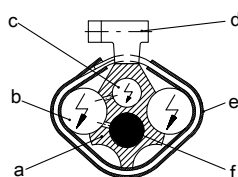


Fig. 22: Cross-section of the cable guide

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).

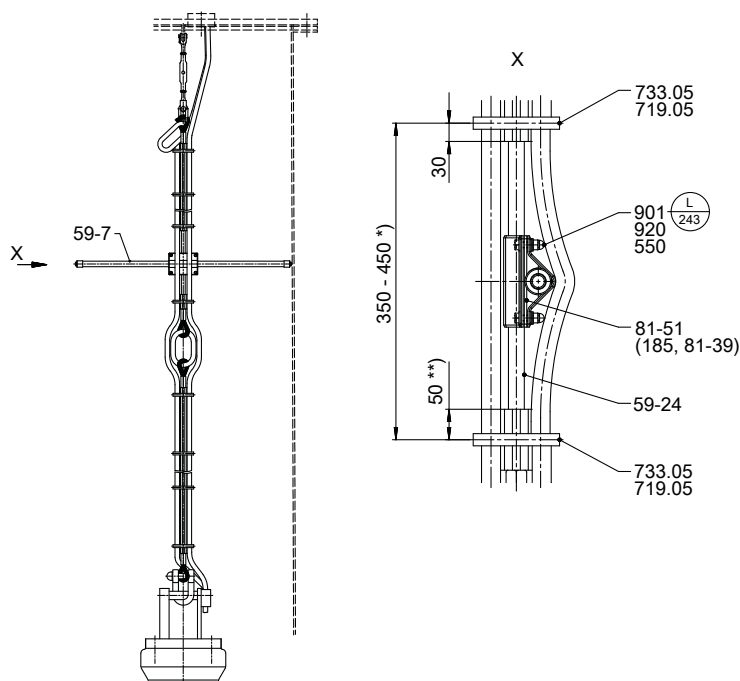


Fig. 23: Support rope with support, dimensions in mm

*) depending on the cable cross-section,

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

19. Clamp support 59-7 with guide plate 55-1 to the support rope (f).
20. Undo the screwed connection at the guide plate. Place clamp 81-39 of the guide plate around the support rope.
21. Fasten plate 185 of the guide plate including the rod made of glass fibre reinforced plastics to the clamp with hexagon head bolts 901, discs 550 and cap nuts 920. Tighten the connection and secure it with Loctite 243.
(⇒ Section 9.2, Page 98)



NOTE

The support must be clamped firmly to the support rope. If necessary, pad out clamp 81-39.

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

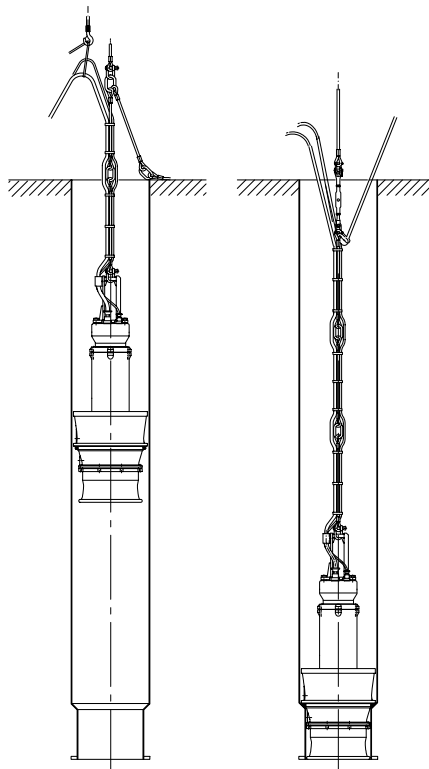


Fig. 24: Lowering the pump set

24. Progressively lower the pump set into the discharge tube. Secure the cables with cable clamps.
25. 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.
26. Tighten the turnbuckle until the cable bundle is tight but does not lift the pump off its seat.
27. 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.
28. Make sure that the top loose lifting lug is attached to the cable bundle to prevent noise and wear caused by chafing.
29. Remove the safety cover from the discharge tube and mount the discharge tube cover. 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 contained in the Annex. (⇒ Section 9.3, Page 100)

The pump set is supplied with power cables; it is wired for DOL starting. Star-delta starting is also possible, except for size Amacan P 1600 - 1060.

	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 mm² is required.
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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. (⇒ Section 6.2.1, Page 46)

5.4.1.1 Starting method

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

For reducing the starting current autotransformers or soft starters can be used. For selecting suitable devices observe the rated current of the motor.

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

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

5.4.1.2 Setting the overload protection device

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

5.4.1.3 Level control

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

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

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

5.4.1.4 Operation on a frequency inverter

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

	NOTE 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.
	 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.

5.4.1.5 Sensors

	⚠ DANGER Operating an incompletely connected pump set Explosion hazard! Damage to the pump set! ▷ Never start up a pump set with incompletely connected electric cables or non-operational monitoring devices.
	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 100)

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

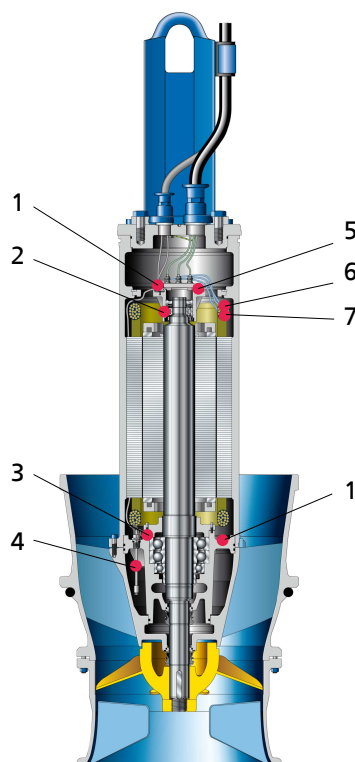


Fig. 25: Sensor positions

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

5.4.1.5.1 Motor temperature



⚠ DANGER

Insufficient cooling
Explosion hazard!
Winding damage!

- ▷ Never operate a pump set without operational temperature monitoring equipment.
- ▷ For explosion-proof pump sets use a thermistor motor protection relay with manual reset and certification for use in potentially explosive atmospheres for monitoring the temperature of explosion-proof motors in "flameproof enclosure" type of protection.

The motor is monitored by three series-connected PTC thermistors with terminals No. 10 and 11. Tripping must result in the pump set cutting out. Automatic re-start is not permitted.

On explosion-proof pump sets, they must be connected to a thermistor motor protection relay with manual reset and approval for use in potentially explosive atmospheres for monitoring the temperature of explosion-proof motors in "flameproof enclosure" type of protection.

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 300mV/3 mA).



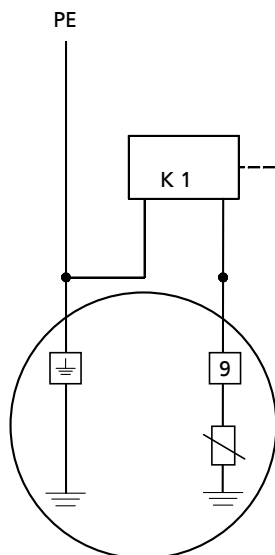
CAUTION

Temperature monitoring devices not properly connected
Winding damage!

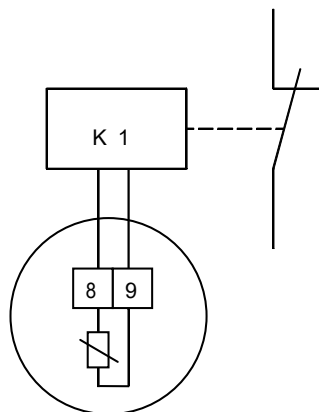
- ▷ Never use the Pt100 resistance thermometers as the only means of monitoring the motor temperature.

5.4.1.5.2 Leakage inside the motor

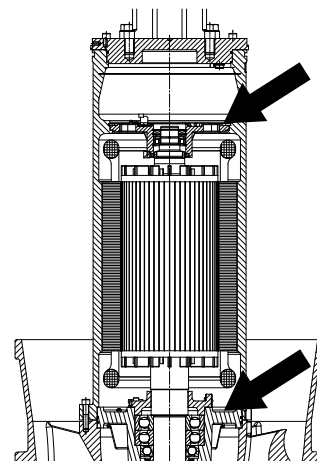
	 DANGER
	Incorrect monitoring of leakage electrode Explosion hazard! Danger of death from electric shock! ▷ Voltages must be < 30 V AC and tripping currents < 0.5 mA.



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.

5.4.1.5.3 Mechanical seal leakage

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.

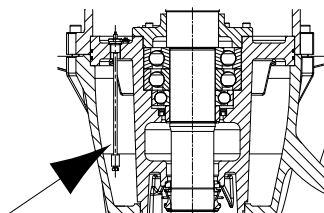


Fig. 26: Float switch

5.4.1.5.4 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.

5.4.1.5.5 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 8: Technical data of the sensor

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

Connecting the vibration sensor

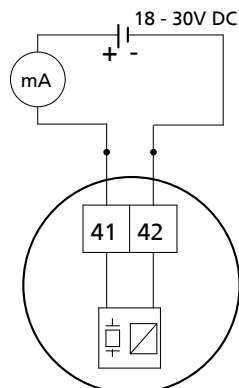


Fig. 27: Connecting the vibration sensor

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

- Alarm to be triggered at $v_{\text{eff}} = 11 \text{ mm/s}$
 - 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 $v_{\text{eff}} = 14 \text{ mm/s}$
 - 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 and explosion! ▷ Always have the electrical connections installed by an electrically qualified person. ▷ Observe regulations IEC 60364 and, for explosion-proof versions, BS 60079 .
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	⚠ WARNING Incorrect connection to the mains Damage to the power supply network, short circuit! ▷ Observe the technical specifications of the local energy supply companies.
	CAUTION Improper routing of electric cables Damage to the electric cables! ▷ Never move the electric cables at temperatures below -25 °C. ▷ Never kink or crush the electric cables. ▷ Never lift the pump set by the electric cables. ▷ Adjust the length of the electric cables to the site requirements.
	CAUTION Motor overload Damage to the motor! ▷ Protect the motor by a thermal time-lag overload protection device in accordance with IEC 60947 and local regulations.

For the electrical connection observe the circuit diagrams (⇒ Section 9.3, Page 100) in the Annex and the information for planning the control system (⇒ Section 5.4.1, Page 36) .

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

 	⚠ DANGER Incorrect wiring Explosion hazard! ▷ The connection point of the cable ends must be located outside of the potentially explosive atmosphere or inside electrical equipment approved to equipment category II2G.
 	⚠ DANGER Operating an incompletely connected pump set Explosion hazard! Damage to the pump set! ▷ Never start up a pump set with incompletely connected electric cables or non-operational monitoring devices.
	⚠ DANGER Connection of damaged electric cables Danger of death from electric shock! ▷ Check the electric cables for any damage before connecting them. ▷ Never connect damaged electric cables. ▷ Replace damaged electric cables.

	CAUTION
	Flow-induced motion Damage to the power cable! ▷ Run the power cable upwards without slack.

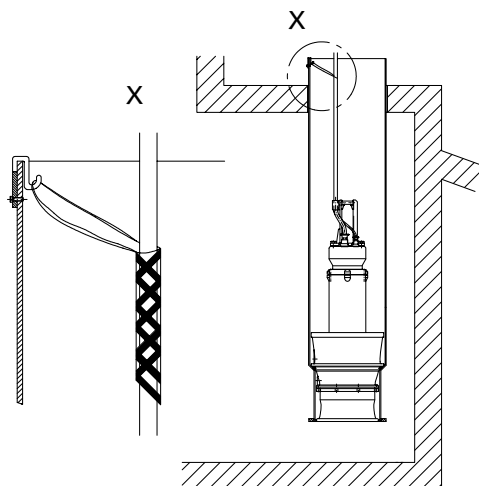


Fig. 28: Fastening the power cable

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

	 DANGER
	Touching the pump set during operation Electric shock! ▷ Make sure that the pump set cannot be touched during operation.

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 49)
- Safety-relevant protective equipment must be installed and fully functional.

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.
	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.

✓ The fluid level is sufficiently high.

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

6.2 Operating limits

 	 DANGER Non-compliance with operating limits Damage to the pump set! Explosion hazard! ▷ Comply with the operating data specified in the data sheet. ▷ Avoid operation below Q_{min}. ▷ Never operate an explosion-proof pump set at ambient temperatures or fluid temperatures exceeding those specified in the data sheet and/or on the name plate. ▷ Never operate the pump set outside the limits specified below.
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6.2.1 Operation on the power supply mains

	⚠ DANGER Permissible tolerances for operation on mains power exceeded Explosion hazard! ▸ Never operate an explosion-proof pump (set) outside the specified range.
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The mains voltage and mains frequency may fluctuate around the rated values as defined for zone B to IEC 60034-1. 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.
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To prevent high temperature increases in the motor and excessive loads on the motor, seal elements and bearings, the frequency of starts shall not exceed 10 starts per hour.

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

	CAUTION Re-starting while motor is still running down Damage to the pump set! ▸ Do not re-start the pump set before it has come to a standstill. ▸ Never start up the pump set while the pump is running in reverse.
---	--

6.2.3 Operation on a frequency inverter

	⚠ DANGER Operation outside the permitted frequency range Explosion hazard! ▸ Never operate an explosion-proof pump set outside the specified range.
---	--

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

6.2.4 Fluid handled

6.2.4.1 Fluid temperature

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

	CAUTION
	Danger of freezing! Damage to the pump set! ▷ Drain the pump set or protect it against freezing.

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

6.2.4.2 Density of the fluid handled

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

	CAUTION
	Impermissibly high density of the fluid handled Motor overload! ▷ Observe the information about fluid density in the data sheet. ▷ Make sure the motor has sufficient power reserves.

6.2.4.3 Minimum level of fluid handled

	 DANGER
	Pump set running dry Explosion hazard! ▷ Never allow an explosion-proof pump set to run dry!
	CAUTION
	Fluid level below the specified minimum Damage to the pump set by cavitation 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 "t₁" as a minimum (see general arrangement drawing/outline drawing).

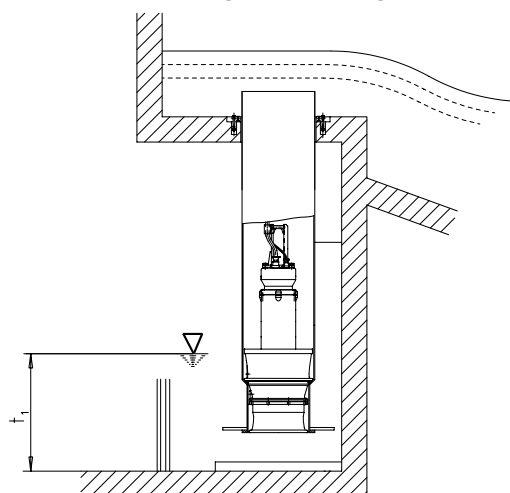


Fig. 29: Example: Minimum level of fluid handled

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 IEC 61557 regulations as well as any regional regulations.
	! WARNING
	Unintentional starting of the pump set Risk of injury by moving components and shock currents! ▷ Ensure that the pump set cannot be started unintentionally. ▷ Always make sure the electrical connections are disconnected before carrying out work on the pump set.
	! WARNING
	Fluids handled, consumables and supplies which are hot and/or pose a health hazard Risk of injury! ▷ Observe all relevant laws. ▷ When draining the fluid take appropriate measures to protect persons and the environment. ▷ Decontaminate pumps which handle fluids posing a health hazard.
	CAUTION
	Danger of frost/freezing Damage to the pump set! ▷ If there is any danger of frost/freezing, remove the pump set from the fluid handled and clean, preserve and store it.

The pump set remains installed

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

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

- ✓ All safety regulations are observed. (⇒ Section 7.1, Page 50)
- 1. Clean the pump set.
- 2. Spray-coat the inside wall of the pump casing and, in particular, the impeller clearance areas with a preservative.

6.4 Returning to service

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

Refer to and comply with the operating limits.

For returning the pump set to service after storage also follow the instructions for maintenance/inspection.

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

7 Servicing/Maintenance

7.1 Safety regulations

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

	 DANGER Sparks produced during servicing work Explosion hazard! ▷ Observe the safety regulations in force at the place of installation! ▷ Never open an energised pump set. ▷ Always perform maintenance work on explosion-proof pump sets outside potentially explosive atmospheres only.
 	 DANGER Improperly serviced pump set Explosion hazard! Damage to the pump set! ▷ Service the pump set regularly. ▷ Prepare a maintenance schedule with special emphasis on lubricants, electric cables, bearing assembly and shaft seal.
	 DANGER Electrical connection work by unqualified personnel Danger of death from electric shock! ▷ Always have the electrical connections installed by a trained and qualified electrician. ▷ Observe the IEC 61557 regulations as well as any regional regulations.
	 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.
	 WARNING Unintentional starting of the pump set Risk of injury by moving components and shock currents! ▷ Ensure that the pump set cannot be started unintentionally. ▷ Always make sure the electrical connections are disconnected before carrying out work on the pump set.
	 WARNING Hands, other body parts or foreign objects in the impeller or intake area Risk of injury! Damage to the submersible motor pump! ▷ Never insert your hands, other body parts or foreign objects into the impeller or impeller intake area. ▷ Always make sure the electrical connections are disconnected before checking whether the impeller rotates freely.
	 WARNING Fluids handled, consumables and supplies which are hot and/or pose a health hazard Risk of injury! ▷ Observe all relevant laws. ▷ When draining the fluid take appropriate measures to protect persons and the environment. ▷ Decontaminate pumps which handle fluids posing a health hazard.
	 WARNING Hot surface Risk of injury! ▷ Allow the pump set to cool down to ambient temperature.
	 WARNING Improper lifting/moving of heavy assemblies or components Personal injury and damage to property! ▷ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.

	 WARNING Insufficient stability Risk of crushing hands and feet! ▸ During assembly/dismantling, secure the pump (set)/pump parts to prevent tilting or tipping over.
---	--

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

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

	NOTE All maintenance work, service work and installation work can be carried out by KSB Service or authorised workshops. Find your contact in the attached Addresses booklet or visit https://www.ksb.com/en-global/contact.
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Never use force when dismantling and reassembling the pump set.

7.2 Maintenance/inspection

KSB recommends the following regular maintenance schedule:

Table 9: 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 58)
Every 4000 hours, at least once a year	Measure the insulation resistance.	(⇒ Section 7.2.1.1, Page 53)
Every 8000 hours, at least every 3 years	Check the cable bundle.	(⇒ Section 7.3.3, Page 57)
	Check the earth conductor.	(⇒ Section 7.3.4, Page 57)
	Check the sensors.	(⇒ Section 7.2.1.2, Page 54)
	Check the mechanical seal leakage.	(⇒ Section 7.3.5, Page 57)
	Change the lubricant.	(⇒ Section 7.4.1, Page 58)
Every 16,000 hours, at least every 5 years	Lubricate the rolling element bearings.	(⇒ Section 7.4.2, Page 61)
	General overhaul	

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

7.2.1 Inspection work

7.2.1.1 Measuring the insulation resistance

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

- ✓ The pump set has been disconnected in the control cabinet.
- ✓ Use an insulation resistance measuring device.
- ✓ The recommended measuring voltage equals 500 V (maximum permissible 1000 V).
 1. Measure the winding to chassis ground.
To do so, connect all winding ends together.
 2. Measure the winding temperature sensors to chassis ground.
To do so, connect all core ends of the winding temperature sensors together and connect all winding ends to chassis ground.
- ⇒ The insulation resistance of the core ends to chassis ground must not be lower than 1 MΩ.
If the resistance measured is lower, power cable and motor resistance must be measured separately. Disconnect the power cable from the motor for this purpose.



NOTE

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



NOTE

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

7.2.1.2 Checking the sensors

	CAUTION
	Excessive test voltage Damage to the sensors! ▶ Use a commercially available ohmmeter to measure the resistance.

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

Temperature sensors in the motor winding

Table 10: Resistance measurement

Measurement between terminals ...	Resistance
	[Ω]
10 and 11	200 - 1000
31 and 32 ⁴⁾	100 - 120
33 and 34 ⁴⁾	100 - 120
35 and 36 ⁴⁾	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 11: Resistance measurement of the leakage sensor in the motor

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

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

Float switch (mechanical seal leakage)

Table 12: Resistance measurement of the float switch

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

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

Bearing temperature sensor

Table 13: Resistance measurement of the bearing temperature sensors

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

Vibration sensor

Table 14: Current measurement at vibration sensor

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

⁴⁾ Optional

⁵⁾ Only for pump sets with vibration sensor

⁶⁾ Included in the standard design for size 1600-1060; for other sizes optional

⁷⁾ Optional

Functional test

Connect the vibration sensor. Measure the current in the measuring circuit with a suitable ammeter. (⇒ Section 5.4.1.5.5, Page 41)

7.3 Removing the pump set

7.3.1 Removing the pump set

	 DANGER Insufficient preparation of work on the pump (set) Risk of injury! ▷ Properly shut down the pump set. ▷ Close the shut-off elements in the suction line and discharge line. ▷ Drain the pump and release the pump pressure. ▷ Shut off any auxiliary feed lines. ▷ Allow the pump set to cool down to ambient temperature.
	 WARNING Incorrect handling of the electric cable Personal injury and damage to property! ▷ Secure electric cables against falling down. ▷ Avoid electric cables being laid on surfaces without fastening. ▷ When moving the pump set keep at a safe distance to the electric cables.
	 WARNING People falling into the unsecured discharge tube Risk of personal injury! ▷ Take suitable precautions during the entire installation/removal process to protect people from falling into the open discharge tube. ▷ Fence off the work area appropriately.
	 WARNING Turnbuckle and shackle are not suitable for lifting the pump set Risk of injury! Damage to the pump set! ▷ Always use the lifting lugs of the support rope to lift the pump set.

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

	NOTE Prevent any loose parts from falling into the pump sump!
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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.
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	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.
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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.
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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 131)

7.3.3 Checking the cable bundle

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

Longer sections of combined cables must be dismantled:

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

7.3.4 Checking the earth conductor

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

	⚠ DANGER
	Defective earth conductor Electric shock! ▶ Never switch on a pump set with a defective earth conductor.

7.3.5 Checking the mechanical seal for leakage

	⚠ WARNING
	Fluids handled, consumables and supplies which are hot and/or pose a health hazard Hazard to persons and the environment! ▶ Collect and properly dispose of flushing fluid and any fluid residues. ▶ Wear safety clothing and a protective mask if required. ▶ Observe all legal regulations on the disposal of fluids posing a health hazard.
	⚠ WARNING
	Excess pressure inside the pump set Risk of injury when opening the pump set! ▶ Take care when opening the inner chambers. Equalise the pressure.
	NOTE Slight wear of the mechanical seal is unavoidable. This will be aggravated by abrasive substances contained in the fluid handled.

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

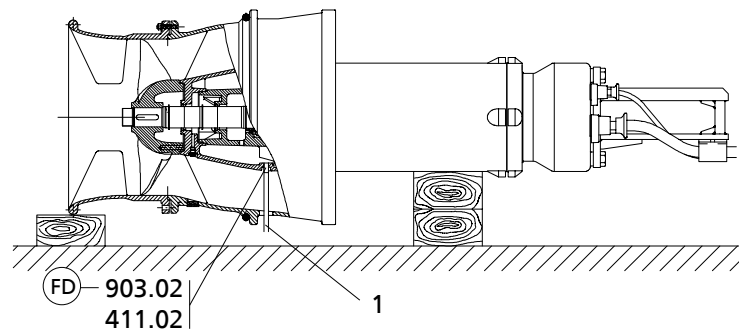


Fig. 30: Checking the leakage chamber

Table 15: Symbols key

Symbol	Description
	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 is positioned horizontally on a level surface and is protected against rolling off.
- 1. Place the container underneath screw plug 903.02.
- 2. Remove screw plug 903.02 and joint ring 411.02.
- 3. Screw in a sufficiently long tube (1) with G 1/2 thread.
- 4. Carefully rotate the pump set until the opening of the leakage chamber points downwards.
 - ⇒ If there is no leakage or, after several years of operation, only a small amount (less than 1.5 litres), the mechanical seals are working properly. If the leakage exceeds 1.5 litres, the mechanical seals are defective and must be replaced.
- 5. Unscrew the tube (1) from the pipe union.
- 6. Re-insert and tighten screw plug 903.02 with new joint ring 411.02.

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 16: Lubricant quality

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

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

	 WARNING
	Lubricant contaminating fluid handled Hazard to persons and the environment! ▷ Using machine oil is only permitted if the oil is disposed of properly.

7.4.1.3 Lubricant quantity

Table 17: Lubricant quantity [l] depending on size

Size	Lubricant quantity
	[l]
700 - 470	1,8
800 - 540	2,2
900 - 540	2,2
1000 - 700	2,5
1200 - 870	3,8
1500 - 1060	7,0
1600 - 1060	5,0

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

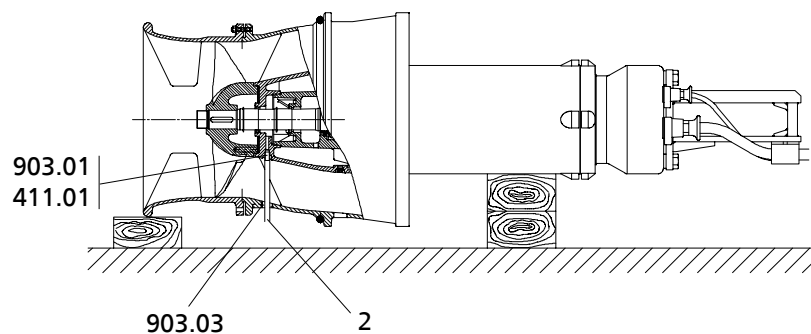


Fig. 31: Draining the lubricant

1. Place the pump set down in a horizontal position and make sure it cannot roll off.
2. Remove screw plug 903.03.
3. Remove screw plug 903.01 and joint ring 411.01.
4. Screw in a sufficiently long tube (2) with G 1/2 thread.
5. Carefully rotate the pump set until the tube points downwards.
6. Collect the lubricant in a suitable container and dispose of it.
7. Remove the tube. Fit screw plug 903.01 and joint ring 411.01 again.
8. Re-insert and tighten screw plug 903.03.

7.4.1.4.2 Filling in the lubricant

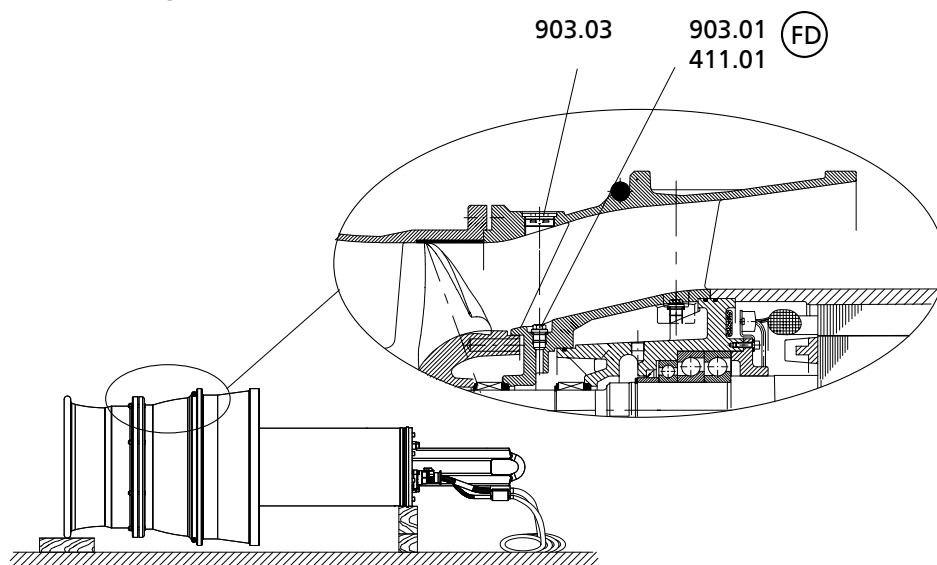


Fig. 32: Filling in the lubricant

Table 18: Symbols key

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

1. Place the pump set down in a horizontal position and make sure it cannot roll off.
2. Remove screw plug 903.03.
3. Remove screw plug 903.01 and joint ring 411.01.
4. Screw in a sufficiently long tube with G $\frac{1}{2}$ thread.
5. Fill the lubricant in through the tube.
6. Remove the tube. Fit screw plug 903.01 together with a new joint ring 411.01. Apply a liquid sealant.
7. Insert and tighten screw plug 903.03.

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.

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 19: 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
Ester oil and perfluorinated polyether oil	B	Polyurea	2	240 to 270	≥ 250	-40 to +200	160	27

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 München KG (⇒ Section 7.4.2.1, Page 61)
- Type B: Klübersynth BMQ 72-162, made by Klüber Lubrication München KG (⇒ Section 7.4.2.1, Page 61)

7.4.2.3 Grease quantity

Table 20: Grease quantity

Size	Grease type	Grease quantity	
		Motor end	Pump end
		[cm³]	[cm³]
700 - 470	Type A	30	600
800 - 540	Type A	30	600
900 - 540	Type A	30	600
1000 - 700	Type A	30	800
1200 - 870	Type A	30/50	800
1500 - 1060	Type A	50	1500
1600 - 1060	Type B	50	2900

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.

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 55)
3. Clean the pump set. (⇒ Section 7.3.2, Page 56)
4. Drain the lubricant. (⇒ Section 7.4.1.4, Page 59) (⇒ Section 7.4.1.4.1, Page 60)
5. Drain the leakage chamber and leave it open for the duration of the disassembly.

7.5.3 Removing the bellmouth

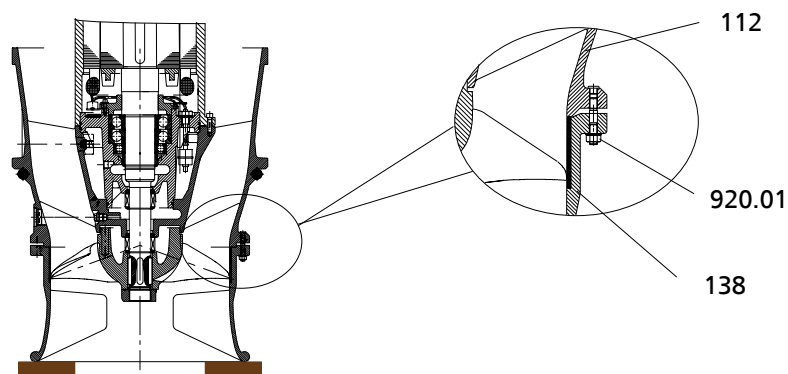


Fig. 33: Removing the bellmouth

- ✓ 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. It has been secured against tipping over.
1. Undo nuts 920.01.
 2. Attach the eye hook to the bail and lift the pump set off bellmouth 138.
 3. Place the pump set in a horizontal position on wooden supports. Secure it against rolling off.

7.5.4 Removing the impeller

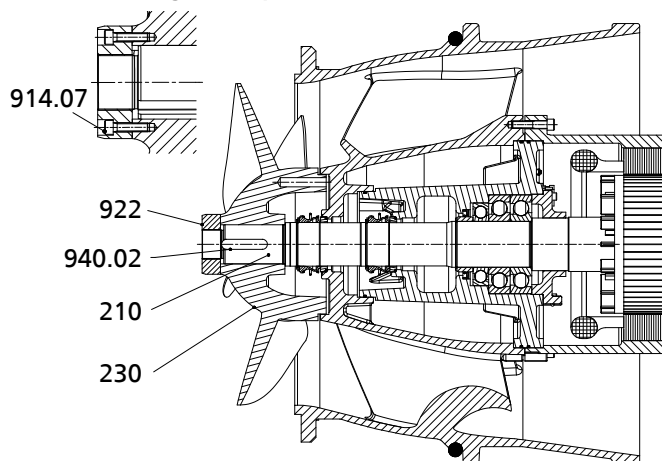


Fig. 34: Removing the impeller

- ✓ The pump set has been placed in a horizontal position on wooden supports. It has been secured against rolling off.
 - ✓ The lubricant and any leakage have been drained.
1. Undo hexagon 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.

7.5.5 Removing the mechanical seal

7.5.5.1 Impeller-end mechanical seal for pump sizes 700-... to 1200-...

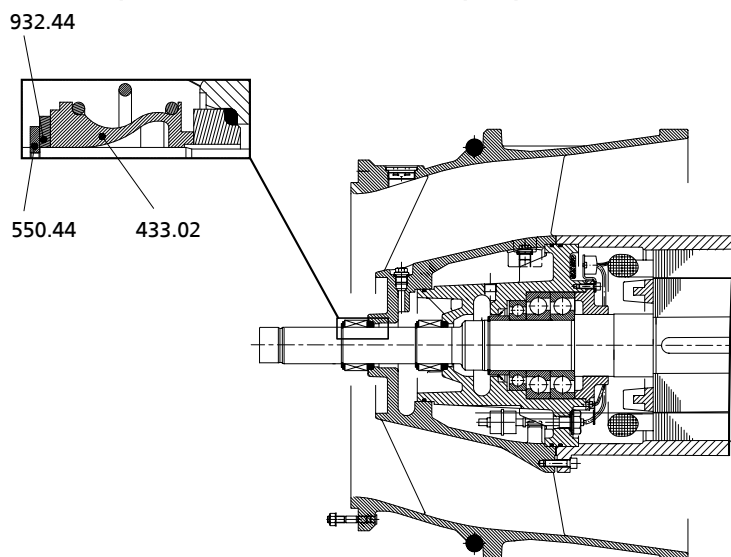


Fig. 35: Removing the impeller-end mechanical seal

- ✓ The pump set has been securely placed in a horizontal position on wooden supports.
 - ✓ The impeller has been removed.
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 0.3 mm) around the free shaft stub is recommended.

7.5.5.2 Impeller-end mechanical seal for pump sizes 1500-... to 1600-...

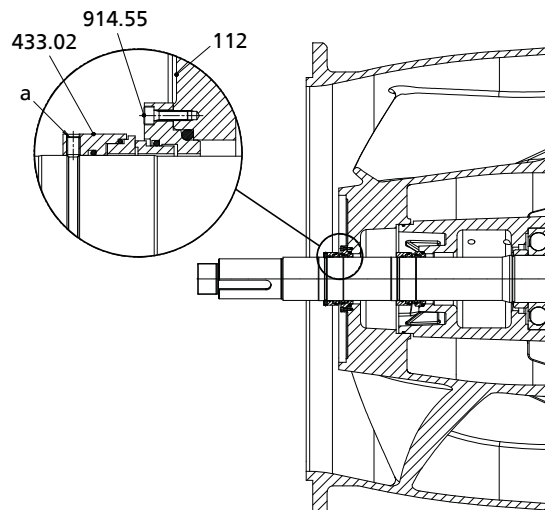


Fig. 36: Impeller-end mechanical seal

- ✓ The pump set has been placed in a horizontal position on wooden supports. It has been secured against rolling off.
 - ✓ The impeller has been removed.
1. Undo the grub screws (a) of mechanical seal 433.02. Pull the rotating assembly off the shaft.
 2. Undo hexagon socket head cap screw 914.55.
 3. Press the stationary seat of mechanical seal 433.02 out of pump bowl 112. To do so, use the jacking threads in the stationary seat of the mechanical seal. Depending on the size of the mechanical seal, the jacking threads are either M6 or M8.



NOTE

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

7.5.5.3 Drive-end mechanical seal for pump sizes 700-... to 1200-...



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.

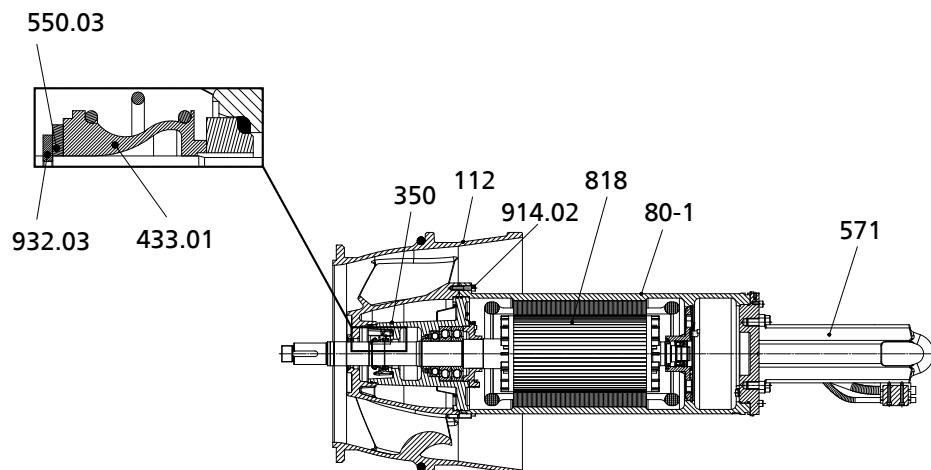


Fig. 37: Removing the drive-end mechanical seal

- ✓ The impeller-end mechanical seal has been removed.
 - ✓ The pump set has been placed in a horizontal position on wooden supports. It has been secured against rolling off.
1. Attach the pump set to the lifting equipment and pull it upright. Place the pump set with pump bowl 112 on the bellmouth again..
(⇒ Section 3.2.2, Page 12)
 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 bowl 112.
 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 3.2.2, 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.

7.5.5.4 Drive-end mechanical seal for pump sizes 1500-... to 1600-...

	 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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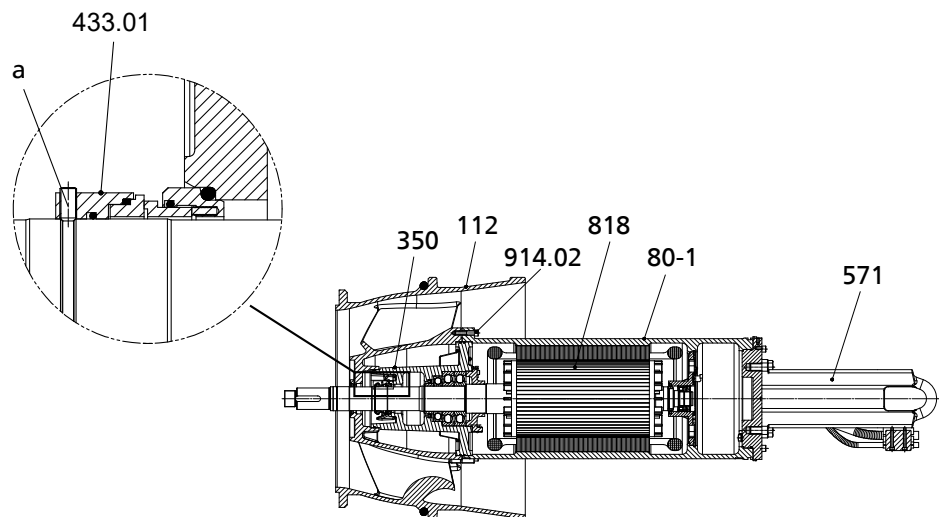


Fig. 38: Drive-end mechanical seal

- ✓ The impeller-end mechanical seal has been removed.
 - ✓ The pump set has been placed in a horizontal position on wooden supports. It has been secured against rolling off.
1. Attach the pump set to the lifting equipment and pull it upright. Place the pump set with pump bowl 112 on the bellmouth again.
(⇒ Section 3.2.2, Page 12)
 2. Undo hexagon socket head cap screws 914.02.
 3. Attach lifting equipment to bail 571. Lift the pump set out of pump bowl 112.
 4. Place motor unit 80-1 including rotor 818 with bearing and bearing housing 350 on a wooden support and protect the unit against rolling off.
(⇒ Section 3.2.2, Page 12)
 5. Undo the grub screws (a).
 6. Carefully pull mechanical seal 433.01 and its mating ring off the shaft.
 7. If mechanical seal 433.01 has an integral seat lock, dismantle it as described.
(⇒ Section 7.5.5.2, Page 66)

7.5.6 Dismantling the motor section

	NOTE Special regulations apply to repair work on explosion-proof pump sets. Modifications or alteration of the pump set may affect explosion protection and are only permitted after consultation with the manufacturer.
	NOTE The motors of explosion-proof pump sets are supplied in "flameproof enclosure" type of protection. Any work on the motor section which could affect explosion protection, such as re-winding and repair work involving machining, must be inspected and approved by an approved expert or performed by the motor manufacturer. No modifications must be made to the internal configuration of the motor space. Repair work at the flameproof joints must only be performed in accordance with the manufacturer's instructions. Repair in accordance with the values specified in BS 60079-1 Table 2 is not permitted.

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

7.5.6.1 Removing the motor housing cover

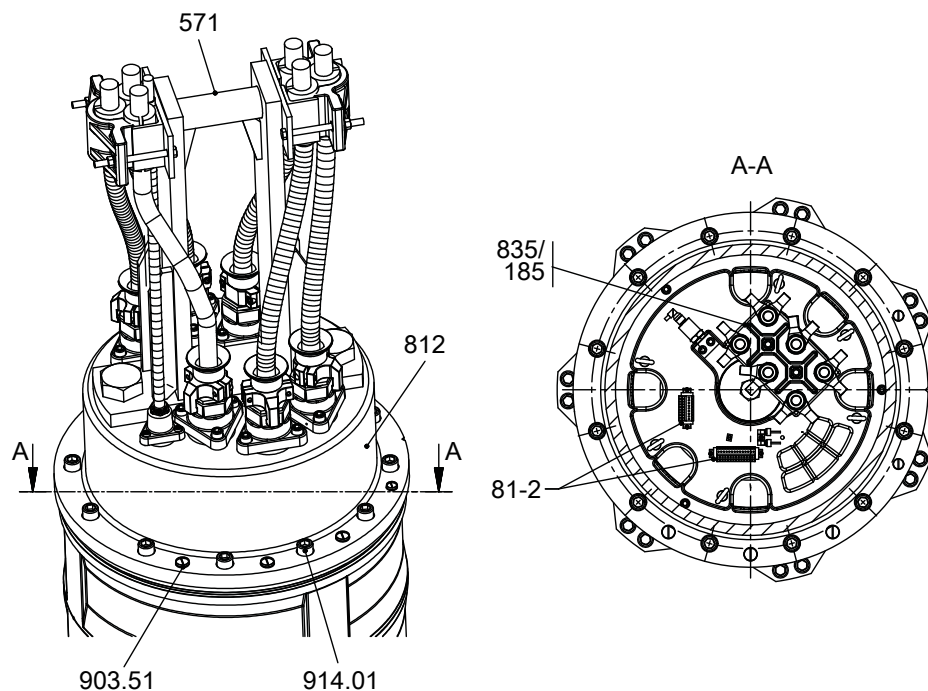


Fig. 39: Removing the motor housing cover

- ✓ 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

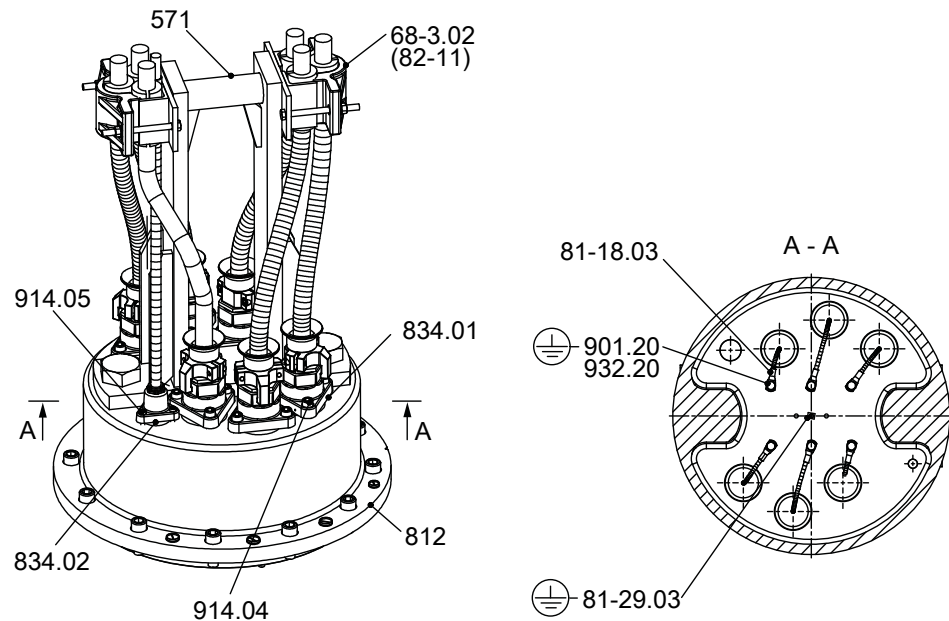


Fig. 40: Removing the cables and cable gland

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



⚠ DANGER

Wrong screws/bolts

Explosion hazard!

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

	 WARNING Screwed/bolted connections working loose Risk of injury! ▸ If persons come into contact with the fluid handled during pump operation (e.g. in sports facilities and leisure parks), apply a thread-locking agent (Loctite, type 243) to all screwed/bolted connections that are in contact with the fluid handled. Do not apply the thread-locking agent (Loctite, type 243) to the screw plugs.
	 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.
	 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.
	 WARNING Components with sharp edges Risk of cutting or shearing injuries! ▸ Always use appropriate caution for installation and dismantling work. ▸ Wear work gloves.
	 WARNING Insufficient stability Risk of crushing hands and feet! ▸ During assembly/dismantling, secure the pump (set)/pump parts to prevent tilting or tipping over.
	CAUTION Improper reassembly Damage to the pump! ▸ Reassemble the pump (set) in accordance with the general rules of sound engineering practice. ▸ Use original spare parts only.

	NOTE Before reassembling the motor section, check that all joints relevant to explosion protection (flamepaths) are undamaged. Any components with damaged flamepaths must be replaced. Only use original spare parts made by KSB for explosion-proof pumps. Observe the flamepath positions specified in the Annex (Flamepaths on explosion-proof motors). Secure all screwed/bolted connections closing off the flameproof enclosure with a thread-locking agent (Loctite Type 243).
	NOTE Apply liquid sealant to all screw plugs. Apply liquid sealant to all wetted clearances (e.g. Hylomar SQ 32M).

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

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

Tightening torques For reassembly, tighten all screws and bolts as specified in this manual.
(⇒ Section 7.8, Page 83)
In addition, secure all screwed/bolted connections closing off the flameproof enclosure with a thread-locking agent (Loctite, type 243).

7.6.2 Installing the replacement cable gland

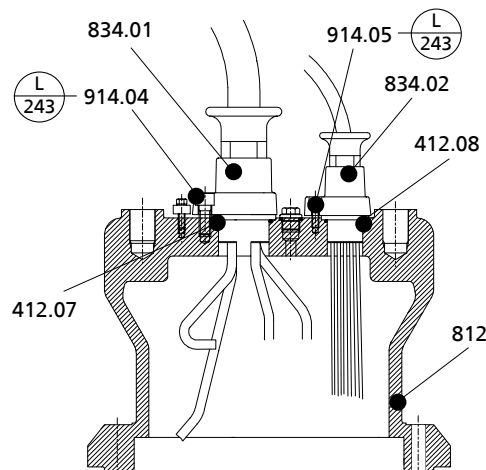


Fig. 41: Installing the cable gland

Table 21: Symbols key

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

- Installing the power cable**
- ✓ The motor housing cover has been removed, placed down and protected against rolling off.
 - 1. Adjust the lengths of the cable cores to those of the original cable gland.
 - 2. Attach core identifications matching the original cable gland.
 - 3. Slide O-ring 412.07 onto the core ends of the power cable and into the groove of the centring seat.

Installing the sensor cable

4. Insert cable gland 834.01 with the power cable and O-ring 412.07 into the opening provided.
 5. Fasten cable gland 834.01 with hexagon socket head cap screws 914.04. Secure the screwed connection with Loctite 243.
 6. Fit cable terminals to the core ends of the power cable.
- ✓ The motor housing cover has been removed, placed down and protected against rolling off.
1. Adjust the lengths of the cable cores to those of the original cable gland.
 2. Attach core identifications matching the original cable gland.
 3. Slide O-ring 412.08 over the short core ends of the sensor cable and into the groove of the centring seat.
 4. Insert cable gland 834.02 with the sensor cable and O-ring 412.08 into the opening provided.
 5. Fasten cable gland 834.02 with hexagon socket head cap screws 914.05 and secure the screwed connection with Loctite 243.

7.6.3 Fitting the motor housing cover

7.6.3.1 Fitting the motor housing cover — pump sizes 700 to 1500

	⚠ 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 IEC 61557 regulations as well as any regional regulations.

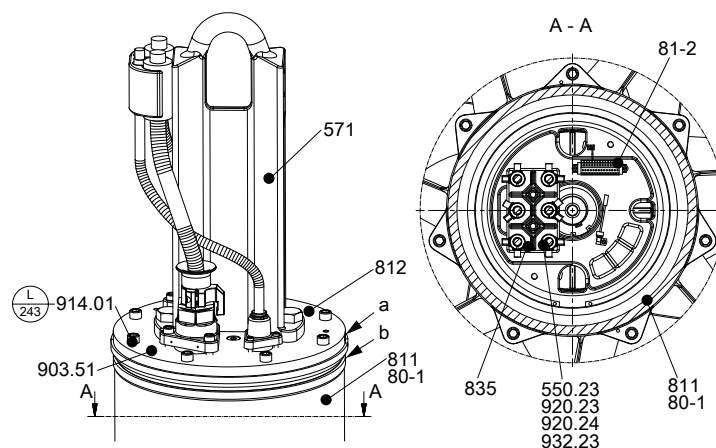


Fig. 42: Fitting the motor housing cover

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

Table 22: Symbols key

Symbol	Description
	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 83)
- 7. Cover the extraction threads with caps 903.51.
- 8. Perform a leak test on the motor. (⇒ Section 7.6.7.2, Page 82)

7.6.3.2 Fitting the motor housing cover — pump size 1600-...

	 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 IEC 61557 regulations as well as any regional regulations.

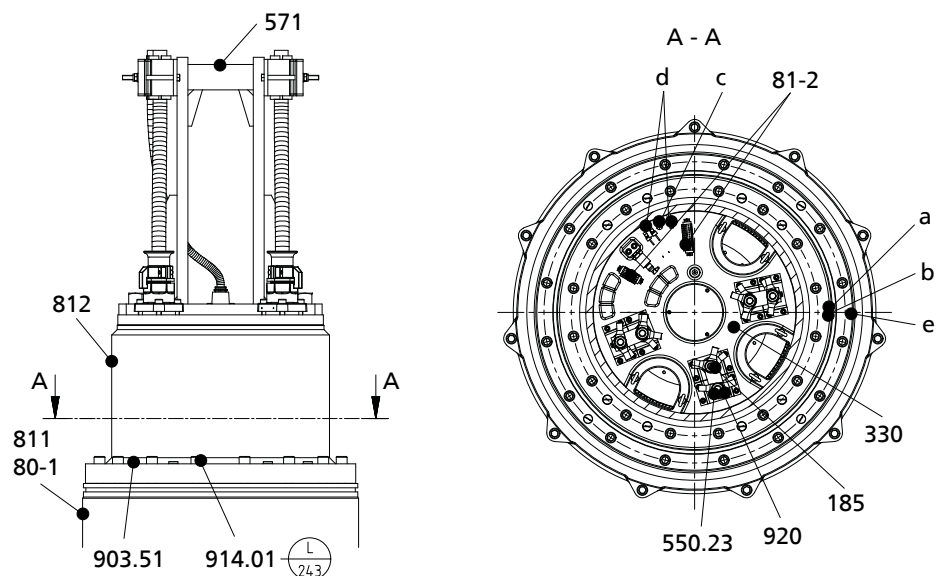


Fig. 43: Fitting the motor housing cover

a	Alignment groove of motors housing cover 812
b	Alignment groove of bearing bracket 330
c	Anti-rotation device of bearing bracket 330

1580.877/02-EN

d	Recess for anti-rotation device in motor housing cover 812
e	Alignment groove of motor housing 811, 80-1

Table 23: Symbols key

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

- ✓ A new O-ring has been inserted into the groove of bearing bracket 330.
- 1. Attach lifting tackle to bail 571, lift up motor housing cover 812 and lower it down onto motor housing 811 or motor unit 80-1 until only a gap remains which allows work to continue. Make sure that the alignment grooves of motor housing 811 and bearing bracket 330 are correctly aligned. Only in this position will the anti-rotation device (c) of bearing bracket 330 engage in the corresponding recess (d) in motor housing cover 812.
- 2. Connect plug 81-2 of the control cable to the corresponding connector.
- 3. Connect the power cable cores to terminal 185 with disc 550.23 and nuts 920 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 / motor unit 80-1 with hexagon socket head cap screws 914.01 and secure the connection with Loctite 243. Observe the tightening torques. (⇒ Section 7.8, Page 83)
- 7. Cover the jacking threads with caps 903.51.
- 8. Perform a leak test on the motor. (⇒ Section 7.6.7.2, 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 — pump sizes 700-... to 1200-...

	 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.
---	---

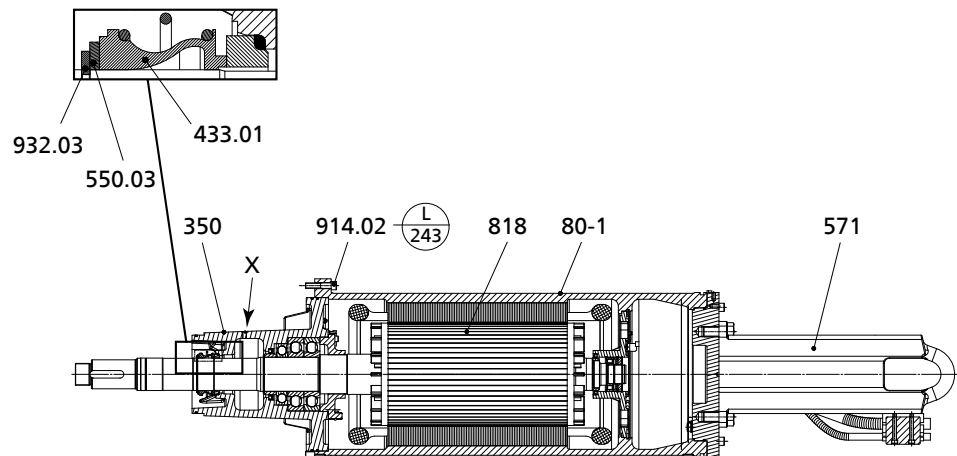


Fig. 44: Installing the drive-end mechanical seal

X	Drilled hole for testing device
---	---------------------------------

Table 24: Symbols key

Symbol	Description
	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.
- 1. Use an assembly sleeve of a suitable diameter to press the mating ring of mechanical seal 433.01 together with the O-ring into the drilled seat of bearing housing 350.
- 2. Carefully guide on the bellows part of mechanical seal 433.01 until it rests against the mating ring.
- 3. Guide disc 550.03 and circlip 932.03 onto the shaft. Press the circlip in with an assembly sleeve until it is axially fastened to the shaft groove.
- 4. Screw the testing device into the leakage drain hole (X) of bearing housing 350 and perform a leak test. (⇒ Section 7.6.4.1.1, Page 76)
- 5. Attach the eye hook to the bail and pull upright motor unit 80-1 including rotor 818 with bearing and bearing housing 350. (⇒ Section 3.2.2, Page 12)
- 6. Place the pump set on the pump bowl and bellmouth. Fasten it with hexagon socket head cap screws 914.02. Secure the screwed connection with a thread-locking agent (Loctite 243).

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 Drive-end mechanical seal — pump sizes 1500-... to 1600-...



! 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.

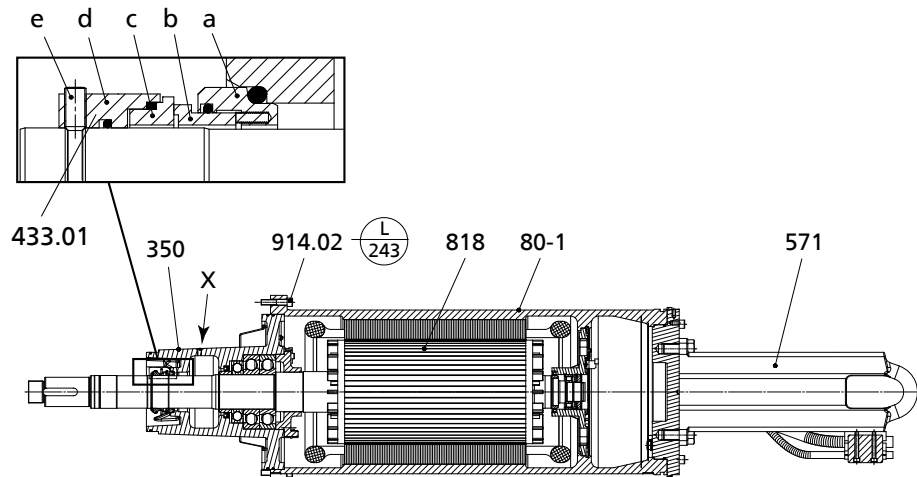


Fig. 45: Installing the drive-end mechanical seal

X	Drilled hole for testing device
---	---------------------------------

Table 25: Symbols key

Symbol	Description
	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.
- 1. Press the supporting ring (a) and primary ring (b) of mechanical seal 433.01 into the drilled seat of bearing housing 350 together with an O-ring.
- 2. Gently insert the mating ring (c) and the torque-transmitting element (d) until they rest against the primary ring (b).
- 3. Press the mechanical seal in with an assembly sleeve until the grub screws (e) can be tightened in the undercut of the shaft. Apply a thread-locking agent (Loctite 243) to the grub screws (e).
- 4. For mechanical seals with a stationary seat lock, bolt the stationary assembly (supporting ring (a) and primary ring(b)) to bearing housing 350. Secure the screwed connection with a thread-locking agent (Loctite 243).
- 5. Screw the testing device into the leakage drain hole (X) of bearing housing 350 and perform a leak test. (⇒ Section 7.6.4.1.1, Page 76)
- 6. Attach lifting equipment to bail 571 and pull upright motor unit 80-1 including rotor 818 with bearing and bearing housing 350. (⇒ Section 3.2.2, Page 12)
- 7. Place the pump set down on the pump bowl and bellmouth. Fasten it with hexagon socket head cap screws 914.02 and thread-locking agent (Loctite 243).

7.6.4.3 Impeller-end mechanical seal — pump sizes 700-... to 1200-...

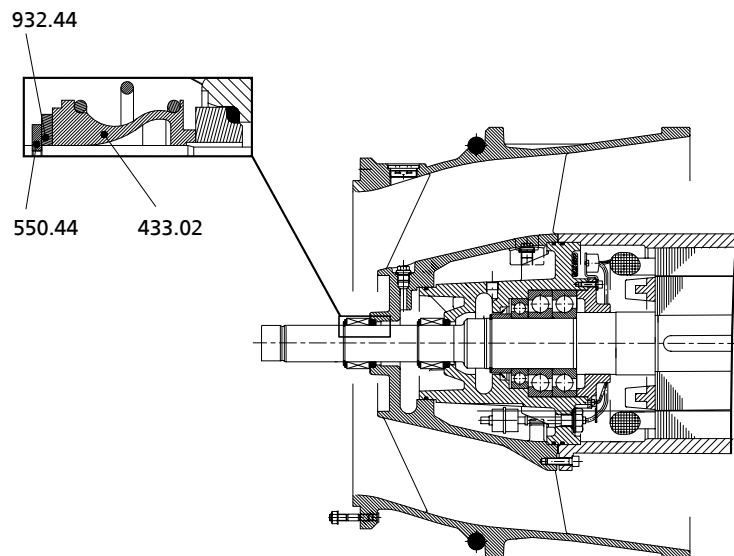


Fig. 46: Installing the impeller-end mechanical seal

- ✓ The pump bowl has been fastened to the motor.
 - ✓ The pump set has been positioned horizontally on a wooden support. It has been secured against rolling off.
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 bowl.
 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 the circlip is axially fastened in the shaft groove.
 4. Check the lubricant reservoir for leakage. (⇒ Section 7.6.7.1, Page 81)
 5. Fill the lubricant reservoir with lubricant. Then close the lubricant reservoir.

7.6.4.4 Impeller-end mechanical seal — pump sizes 1500-... to 1600-...

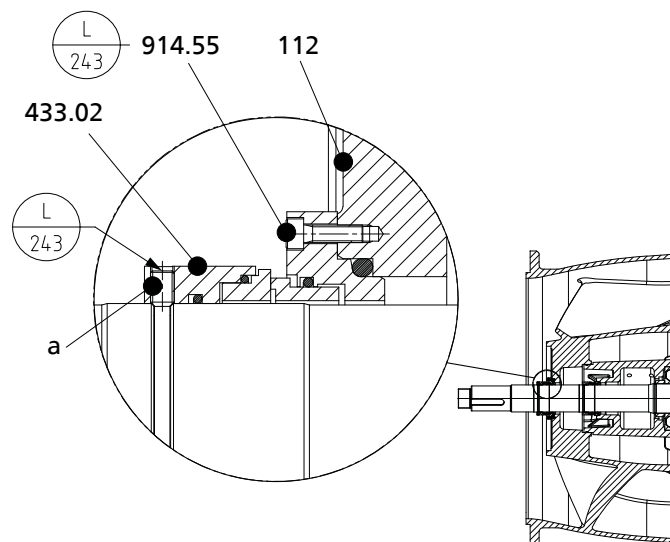


Fig. 47: Impeller-end mechanical seal

Table 26: Symbols key

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

- ✓ The pump bowl has been fastened to the motor.
- ✓ The pump set has been positioned horizontally on a wooden support. It has been secured against rolling off.
- 1. Fit the stationary assembly of mechanical seal 433.02 to pump bowl 112 with hexagon socket head cap screw 914.55. Secure hexagon socket head cap screw 914.55 with a thread-locking agent (Loctite 243).
- 2. Slide the rotating assembly of mechanical seal 433.02 onto the shaft.
- 3. Press the mechanical seal in with an assembly sleeve until the grub screws (a) can be tightened in the undercut of the shaft. Apply a thread-locking agent (Loctite 243) to the grub screws (a).
- 4. Check the lubricant chamber for leakage. (⇒ Section 7.6.7.1, Page 81)
- 5. Fill the lubricant reservoir with lubricant. Then close the lubricant reservoir.

7.6.5 Fitting the impeller

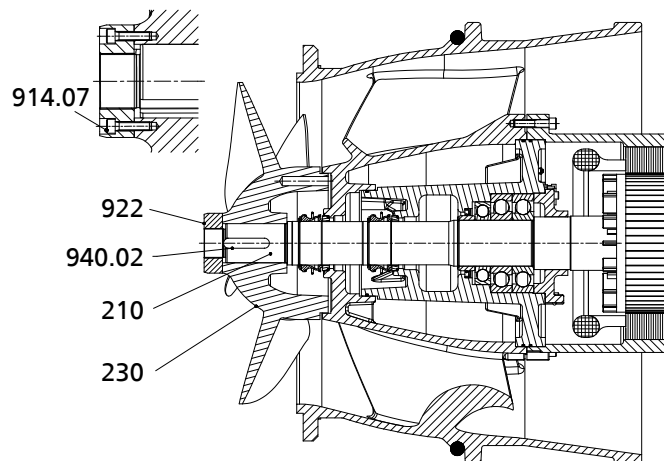


Fig. 48: Fitting the impeller

- ✓ The pump set has been positioned horizontally on a wooden support. It has been secured against rolling off.
- ✓ The impeller-end mechanical seal 433.02 has been installed.
- 1. Insert/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.
- 4. Screw impeller nut 922 onto the shaft thread until impeller nut 922 and shaft 210 are flush.
- 5. Align the holes of impeller 230 and impeller nut 922. Insert and tighten hexagon socket head cap screws 914.07.

7.6.6 Fitting the bellmouth

7.6.6.1 Fitting the bellmouth for pressure class A

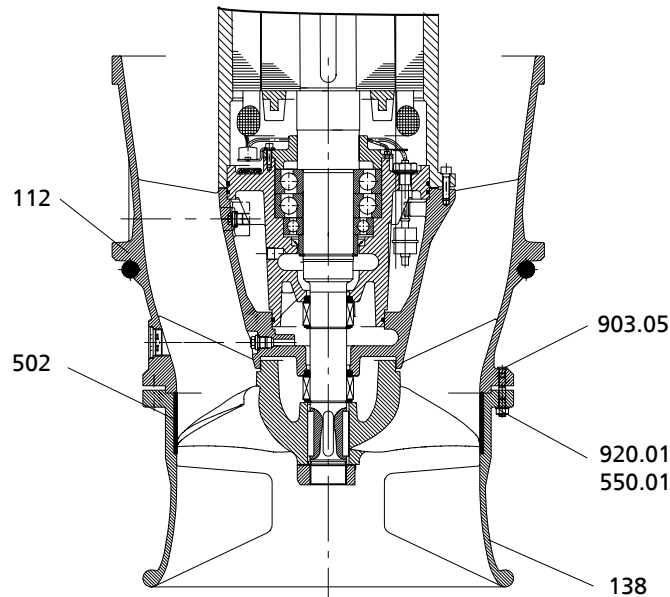


Fig. 49: Impeller of pressure class A

- ✓ Bellmouth 138 has been positioned on wooden supports on a level and solid surface.
 - ✓ Suitable lifting equipment is provided.
 - ✓ The pump set has been completely pre-assembled.
 - ✓ A new casing wear ring 502 has been fitted in bellmouth 138.
1. Attach the lifting tackle 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 920.01 are aligned with the drilled holes.
 4. Then lower the pump set until it sits on bellmouth 138.
 5. Fasten all studs 920.01 with corresponding nuts 920.01 and discs 550.01.
Observe the tightening torque! (⇒ Section 7.8, Page 83)
 6. Close the threaded holes with screw plugs 903.05.

Table 27: Diameter of the casing wear ring [mm]

Size	Nominal diameter
700 - 470	470 + 0,1
800 - 540	540 + 0,2
900 - 540	540 + 0,2
1000 - 700	700 + 0,3
1200 - 870	870 + 0,3
1500 - 1060	1060 + 0,3
1600 - 1060	1060 + 0,3

7.6.6.2 Fitting the bellmouth for pressure class B

At impellers of pressure class B, the outer contour of the vanes and the inner contour of the casing wear ring are spherical.

For this pressure class the clearance is axially adjusted with the impeller nut.

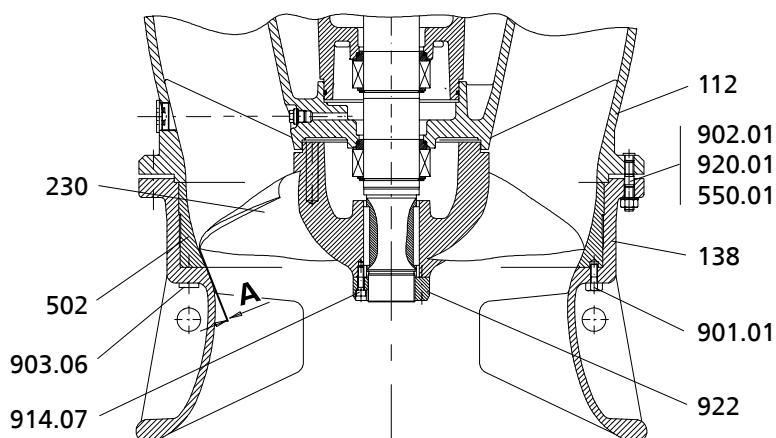


Fig. 50: Impeller of pressure class B

- ✓ Bellmouth 138 has been positioned on wooden supports on a level and solid surface.
 - ✓ Suitable lifting equipment is provided.
 - ✓ The pump set has been completely pre-assembled.
 - ✓ A new casing wear ring 502 has been fitted in bellmouth 138.
1. Attach the lifting tackle 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 920.01 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 and discs 550.01.
Observe the tightening torque! (⇒ Section 7.8, Page 83)
 6. Close the threaded holes with screw plugs 903.05.
 7. Loosen the impeller nut to adjust clearance "A" between impeller 230 and casing wear ring 502.
 8. Use a sensor to check that the required clearance "A" is met, see the following table.
 9. Align the holes of impeller 230 and impeller nut 922. Insert and tighten socket head cap screw 914.07.

Table 28: Clearance "A" [mm]

Size	Standard dimension A	Increased clearance A ⁸⁾
700 - 470	0,4	1,2
800 - 540	0,5	1,3
900 - 540	0,5	1,5
1000 - 700	0,7	1,7
1200 - 870	0,9	2,0
1500 - 1060	1,1	2,0
1600 - 1060	1,1	2,0

7.6.7 Leak testing

7.6.7.1 Testing 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.

⁸ For activated sludge or fluids containing long fibres

Observe the following values for leak testing:

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

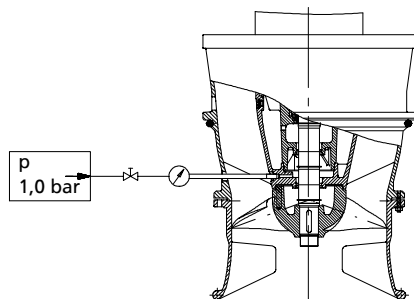


Fig. 51: Screwing in the testing device

1. Unscrew and remove the screw plug and joint ring of the lubricant reservoir.
2. Screw the testing device tightly into the lubricant filler opening.
3. Carry out the leak test with the values specified above.
The pressure must not drop during the test period.
If the pressure does drop, check the seals and screwed connections.
Then perform another leak test.
4. If the leak test has been successful, fill in the lubricant.
(⇒ Section 7.4.1.4.2, Page 61)

7.6.7.2 Checking the motor for leakage

Observe the following values for leak testing:

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

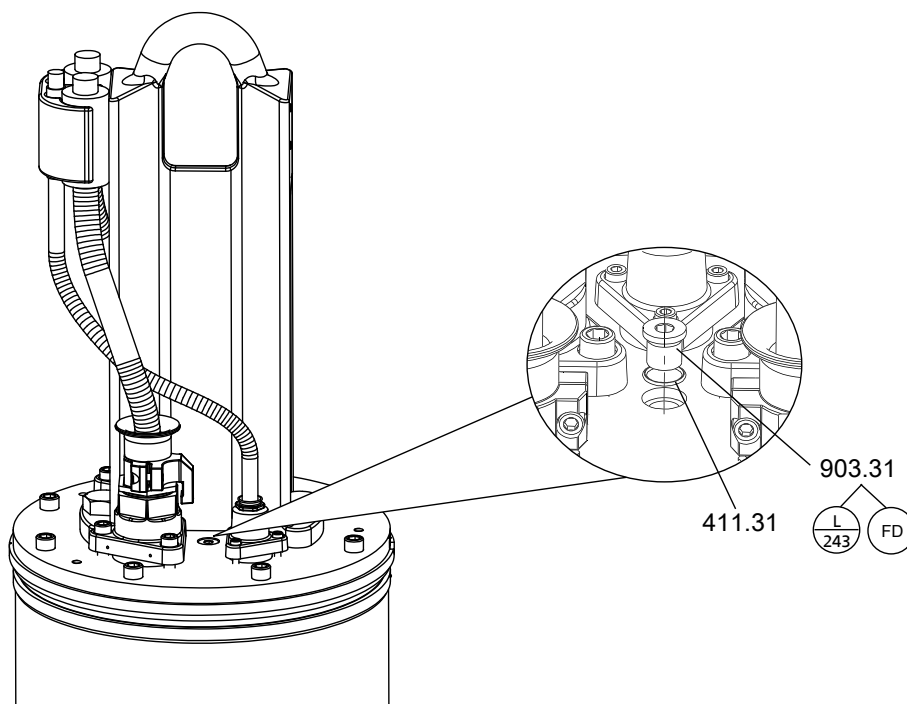


Fig. 52: Checking the motor for leakage

Table 29: Symbols key

Symbol	Description
	Always secure screwed connections marked with this symbol with Loctite 243 .
	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 $\frac{1}{2}$ plug thread.
3. Carry out the leak test with the values specified above.
 - ⇒ The pressure must not drop during the test period.
 - ⇒ If the pressure does drop, check the seals and screwed connections.
4. Repeat the leak test if required.
5. Remove the testing device.




⚠ DANGER

Screw plug leaking or missing
 Explosion hazard!
 Damage to the motor!

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

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

7.7 Checking the electrical connection and motor

Once reassembly has been completed, carry out the steps described in (⇒ Section 7.2.1, Page 53) and (⇒ Section 7.3.4, Page 57).

7.8 Tightening torques

Table 30: Tightening torques [Nm] depending on thread, steel grade and property class

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

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



NOTE

If using an adjustable torque wrench or 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 31: 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 %

Part No.	Description	Number of pumps (including stand-by pumps)						
		2	3	4	5	6	8	10 and more
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.
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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 32: Trouble-shooting

A	B	C	D	E	Possible causes	Remedy ⁹⁾
-	X	-	-	X	Water level lowered too much during operation	Check supply and capacity of system (sump floor area). Check level control equipment.
X	X	-	-	X	Total pressure corresponding to $NPSH_{\text{pump}}$ too high Total pressure corresponding to $NPSH_{\text{system}}$ too low	Increase fluid level on the suction side. Clean screening equipment, if required.
X	X	X	-	X	Penetration of air into the pump due to formation of an air pocket - Suction-side water level too low	Increase the suction-side water level. If this is not possible or unsuccessful, please contact KSB.
X	X	X	-	X	Unfavourable flow to the pump inlet	Improve the flow to the intake chamber (contact KSB).
-	X	X	-	X	Pump running in off-design conditions - part load/overload	Check the pump's operating data.
X	X	-	X	X	Pump clogged by deposits	Clean intake and pump components.
-	X	X	X	X	Wear	Replace worn components by new ones.
-	X	-	X	X	Impermissible air or gas content in the fluid handled	Contact KSB.
-	-	-	-	X	System-induced vibrations	Contact KSB.
-	-	X	-	X	Wrong direction of rotation	Check the electrical connection of motor and control system, if any.
X	-	-	-	-	No voltage	Check electrical connections. Contact the energy supplier.
X	-	-	-	-	Motor winding or electric cable are defective.	Replace with original KSB cable or contact KSB.
-	-	X	-	X	Worn or defective rolling element bearings	Contact KSB.
X	-	-	-	-	The thermistor tripping unit with manual reset for temperature limiter has tripped the pump as a result of the permissible winding temperature being exceeded.	Have cause determined and eliminated by qualified and trained personnel.
X	-	-	-	-	Motor has been tripped by leakage monitor.	Have cause determined and eliminated by qualified and trained personnel.

⁹⁾ 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 ⁹⁾
X	-	-	-	-	Mechanical seal monitor has tripped.	Have cause determined and eliminated by qualified and trained personnel.
X	-	-	-	-	Bearing temperature monitor has tripped.	Have cause determined and eliminated by qualified and trained personnel.

9 Related Documents

9.1 General assembly drawing

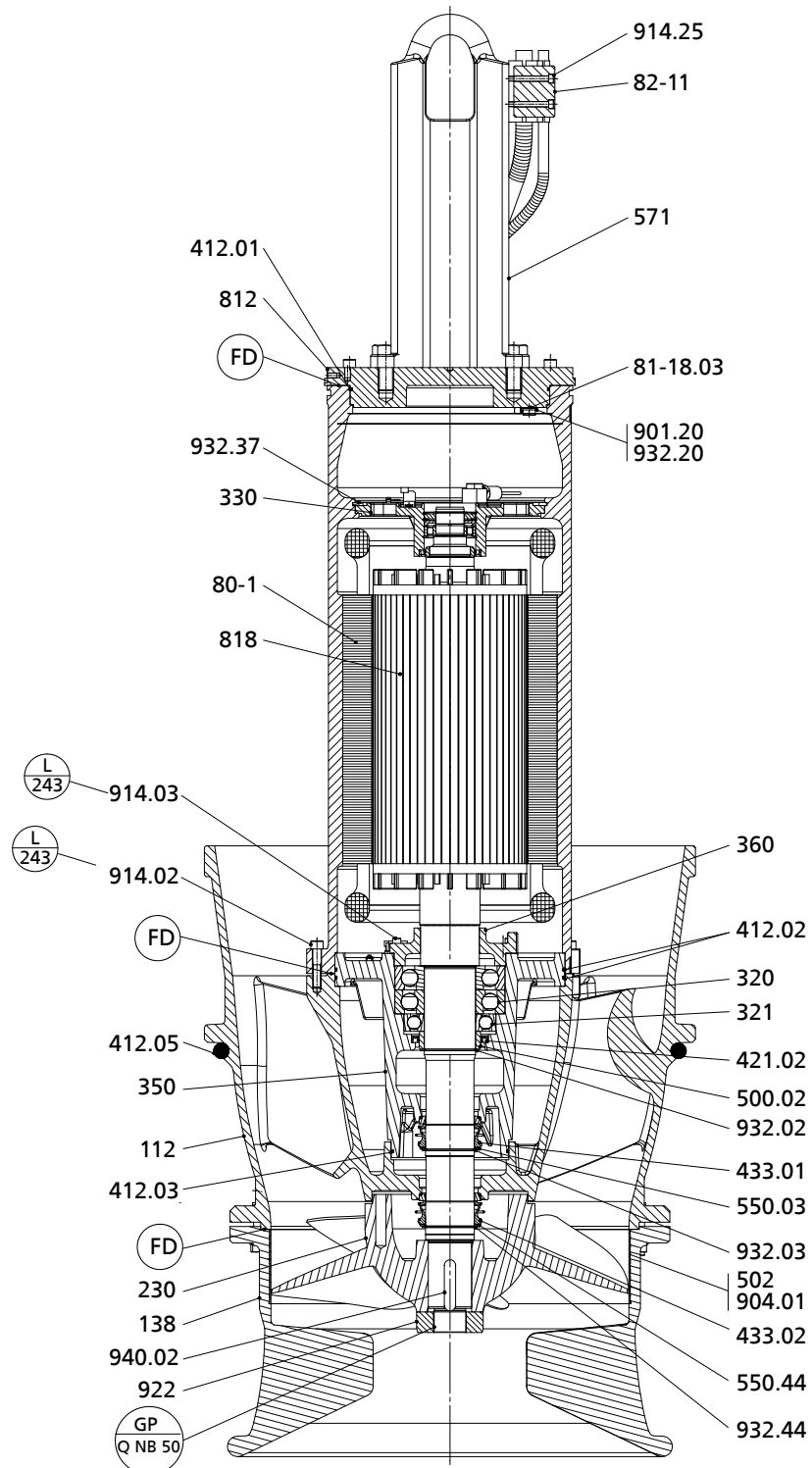


Fig. 53: General assembly drawing

Connection of cable gland and holder	Motor sizes: 47 6 ... 205 6 30 8 ... 160 8 60 10 ... 120 10	
	Motor sizes: 205 8 ... 290 8 200 10 ... 470 10 130 12 ... 680 12 210 14 ... 440 14	
Bearing temperature sensors	Motor end	
	Pump end	

Table 34: Detailed views of the general assembly drawing

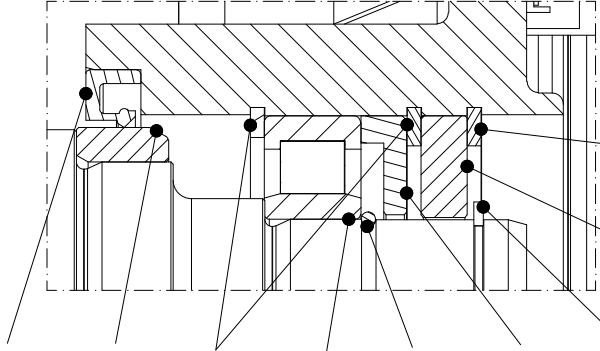
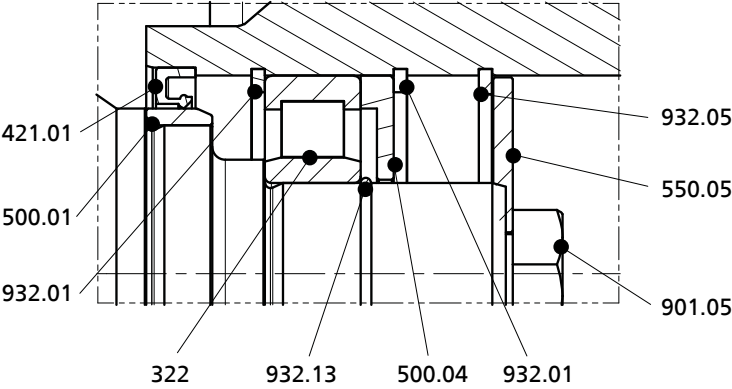
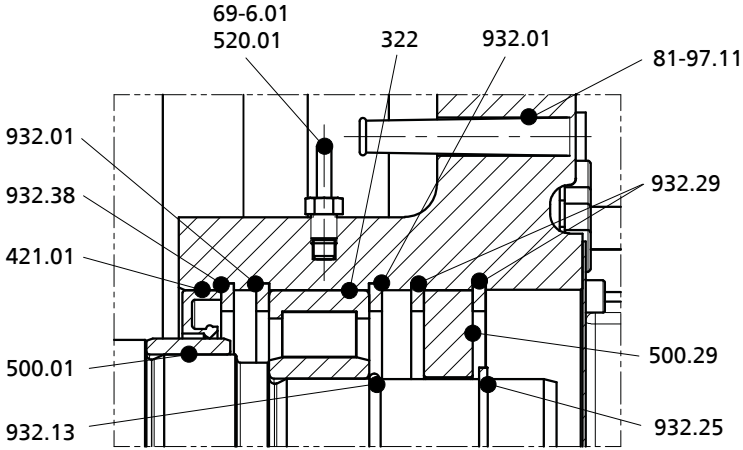
Bearing assembly, motor end	Motor sizes: 47 6 ... 205 6 30 8 ... 290 8 60 10 ... 250 10 130 12 ... 190 12	
	Motor sizes: 310 10 ... 470 10 250 12 ... 410 12 210 14 ... 240 14	
	Motor sizes: 450 12 ... 680 12 370 14 ... 440 14	

Table 35: Detailed views of the general assembly drawing

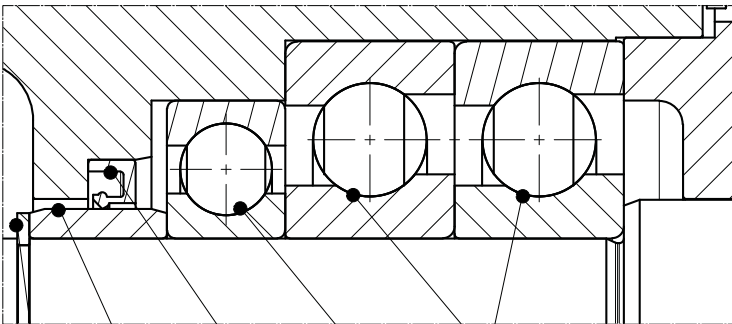
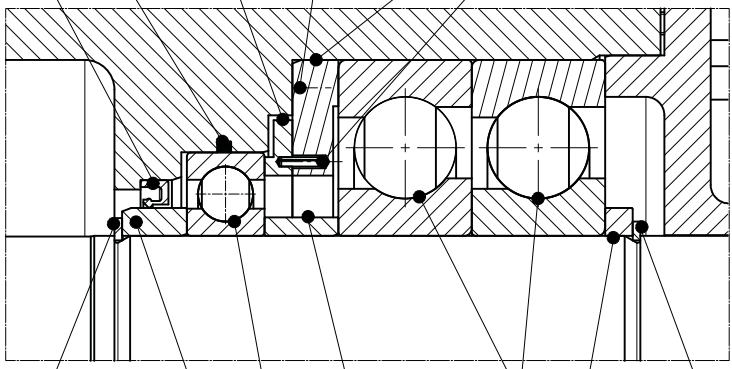
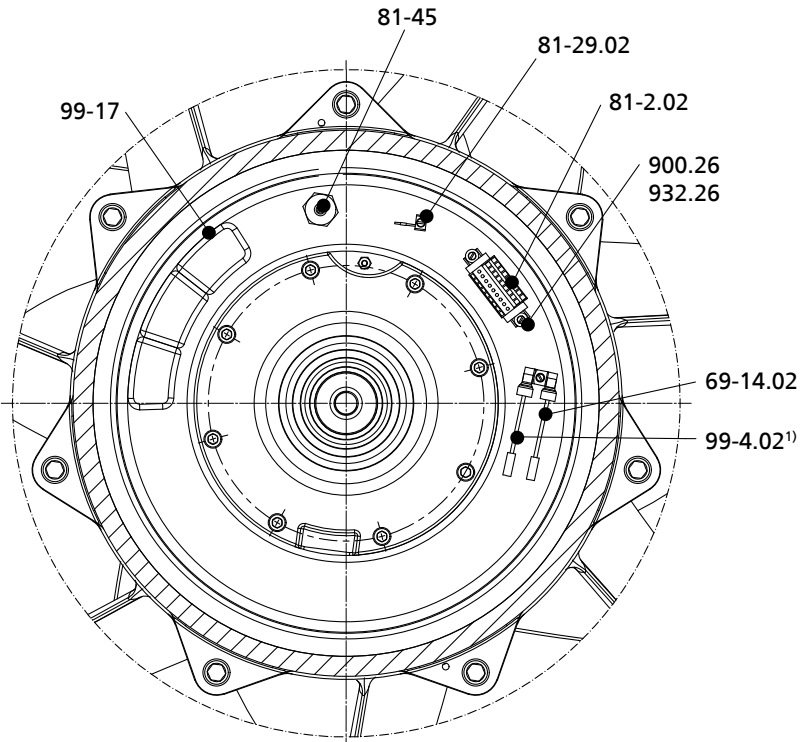
Pump-end bearing assembly	Motor sizes: 47 6 ... 205 6 30 8 ... 290 8 60 10 ... 470 10 130 12 ... 410 12 210 14 ... 340 14	 932.02 500.02 421.02 321 320
	Motor sizes: 450 12 ... 680 12 370 14 ... 440 14	 421.02 412.57 484.02 950.02 483.02 561.02 932.02 512.02 321 504.02 320 50-3.12 932.12
Sensors, bearing housing	 81-45 81-29.02 81-2.02 99-17 900.26 932.26 69-14.02 99-4.02¹⁾ ¹⁾ Only for version with vibration sensor 69-8.50	

Table 36: Detailed views of the general assembly drawing

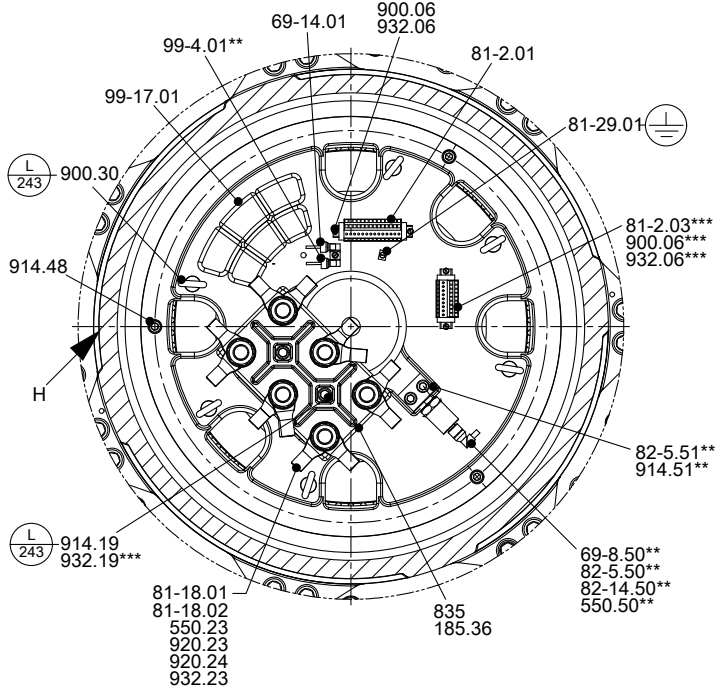
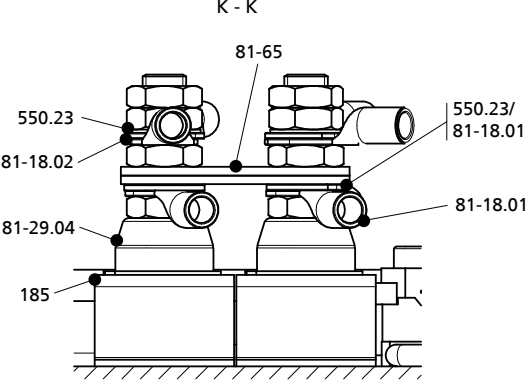
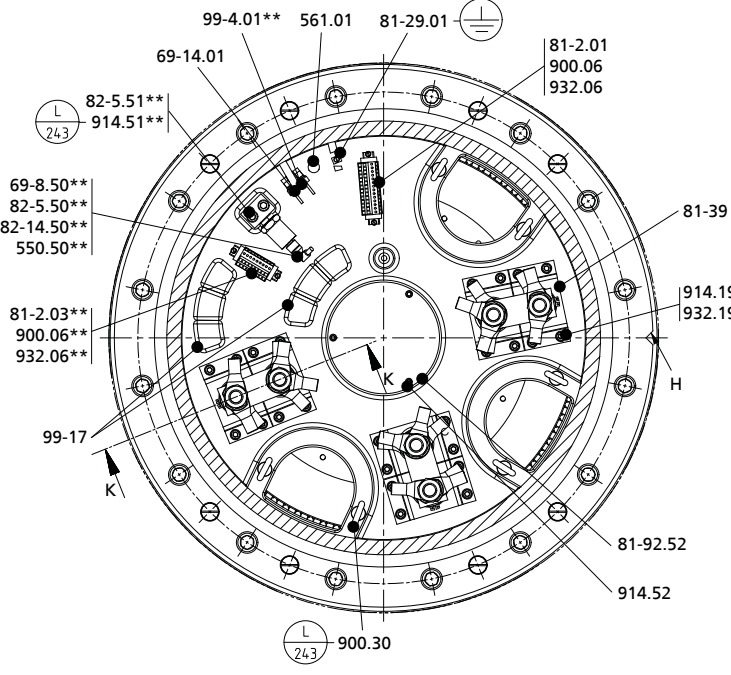
Sensors/terminals, bearing bracket	Motor sizes: 47 6 ... 205 6 30 8 ... 290 8 60 10 ... 470 10 130 12 ... 410 12 210 14 ... 340 14	 ** Only for version with vibration sensor 69-8.50 *** On specific sizes only H = alignment groove
 K - K	Motor sizes: 450 12 ... 680 12 370 14 ... 440 14	 ** Only for version with vibration sensor 69-8.50 H = alignment groove

Table 37: Detailed views of the general assembly drawing

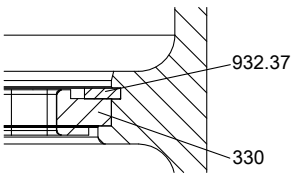
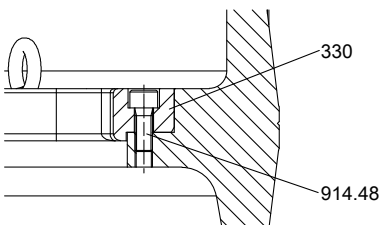
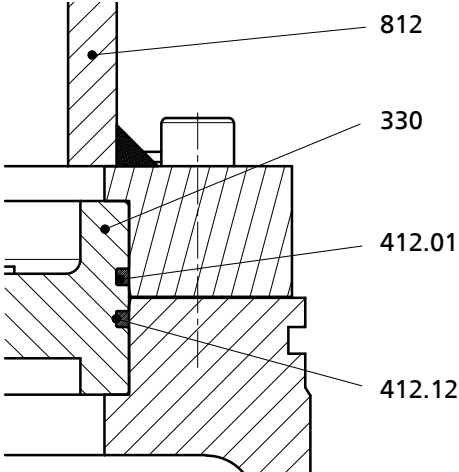
Bearing bracket fastening	Motor sizes: 47 6 ... 205 6 30 8 ... 160 8 60 10 ... 120 10	
	Motor sizes: 205 8 ... 290 8 155 10 ... 470 10 130 12 ... 410 12 210 14 ... 340 14	
	Motor sizes: 450 12 ... 680 12 370 14 ... 440 14	

Table 38: Detailed views of the general assembly drawing

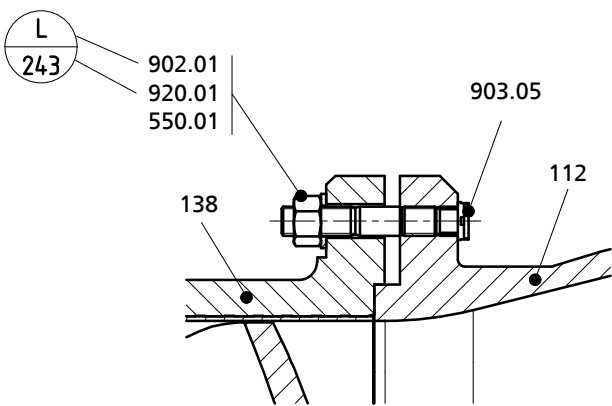
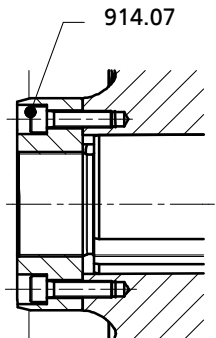
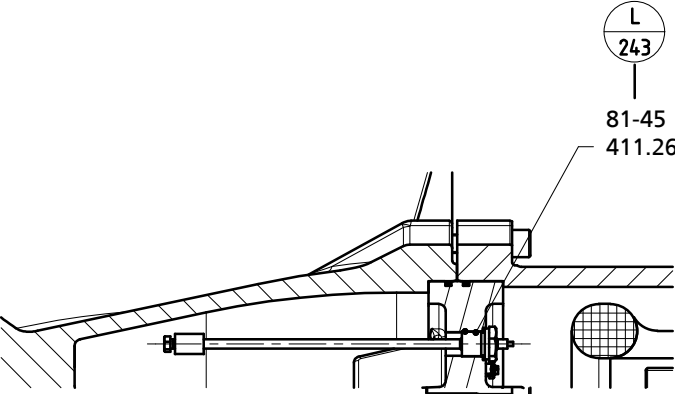
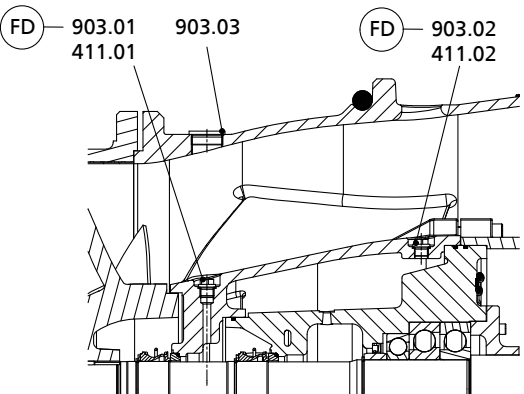
Screwed connection bellmouth / pump bowl	
Impeller fastening elements	
Float switch	
Lubricant reservoir and leakage chamber	

Table 39: Detailed views of the general assembly drawing

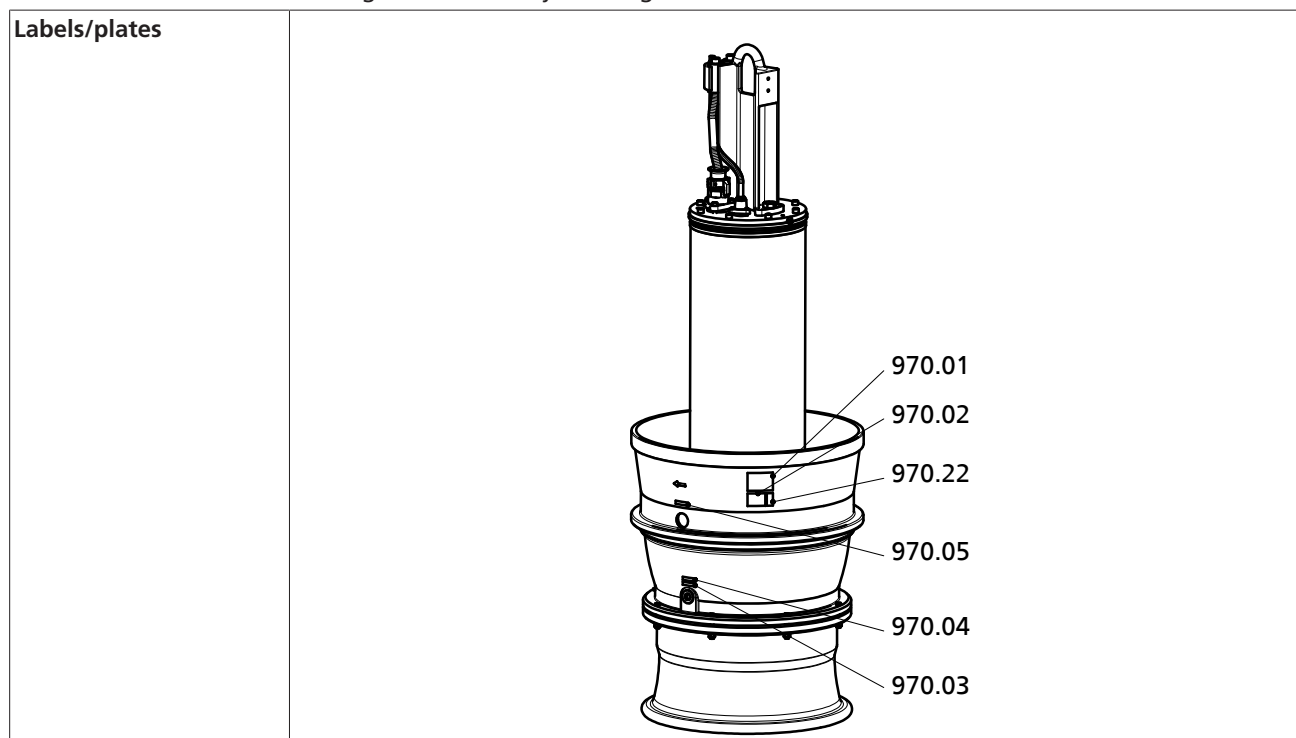


Table 40: Symbols key

Symbol	Description
	Always secure screwed connections marked with this symbol with Loctite 243 .
	Always apply a liquid sealant (e.g. Hylomar SQ32M) to sealing surfaces marked with this symbol.
	Use a lubricant paste (e.g. Altemp Q NB 50).

Table 41: List of components

Part No.	Description	Part No.	Description
112	Pump bowl	81-18.01/.02	Cable terminal
138	Bellmouth	81-2.01/.02/.03	Connector
185	Plate	81-29.01/.02/.04	Terminal
230	Impeller	81-39	Clamp
320	Angular contact ball bearings	81-45	Float switch
321	Deep groove ball bearing	81-65	Star connector
322	Radial roller bearing	81-92	Cover plate
330	Bearing bracket	81-97.01/.02/.11	Cable protector
350	Bearing housing	82-5.50/.51	Adapter
360	Bearing cover	82-11	Strain relief device
411.01/.02/.26/.31	Joint ring	82-14.50	Cable with plug
412.01/.02/.03/.05/.07/.08.	O-ring	812	Motor housing cover
421.01/.02	Lip seal	818	Rotor
433.01/.02	Mechanical seal	834.01/.02	Cable gland
50-3.12	Backing ring	835	Terminal board
500.01/.02/.04/.29	Ring	99-4.01/02	Conversion kit
502	Casing wear ring	99-17	Desiccant
504.02	Spacer ring	900.06/.26/.30	Screw

Part No.	Description	Part No.	Description
512.02	Wear ring	901.05/.20/.25/.26	Hexagon head bolt
520.01/.02	Sleeve	902.01	Stud
550.01/.03/.05/.23/.25/.44/.50	Disc	903.01/.02/.03/.05/.31/.51	Screw plug
561.01	Grooved pin	904.01	Grub screw
571	Bail	914.01/.02/.03/.04/.05/.07/.19/.25/.48/.51/.52	Hexagon socket head cap screw
68-3	Cover plate	920.01/.23/.24/.25	Nut
69-6	Temperature sensor	922	Impeller nut
69-8	Sensor	932.01/.02/.03/.05/.06/.12/.13/.19/.20/.23/.25/.26/.29/.37/.38/.44	Circlip
69-14	Leakage sensor	940.02	Key
80-1	Motor unit	970.01/.02/.03/.04/.05/.22	Label/plate

9.1.1 Special features

Table 42: Special features

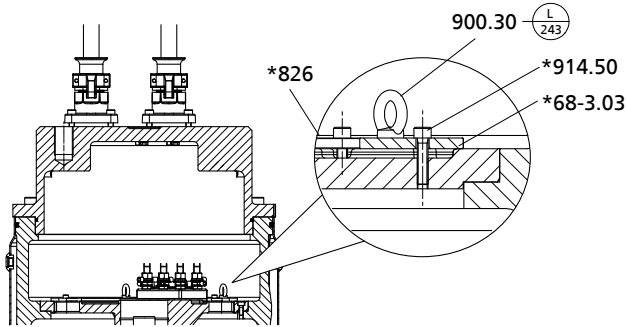
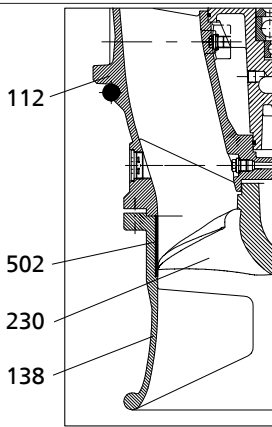
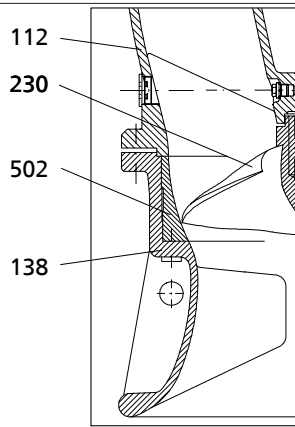
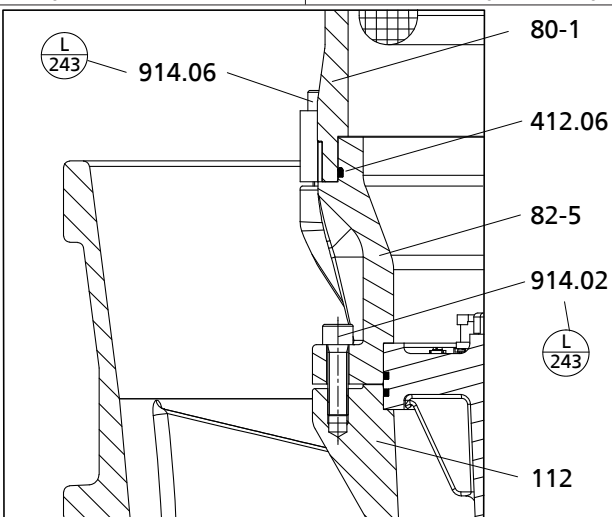
Description	Detailed view
Connection space for R35 motors 310 10 ... 470 10 250 12 ... 410 12 210 14 ... 340 14	 * Explosion-proof versions only
Hydraulic system	 Hydraulic system A  Hydraulic system B
Version with adapter	

Table 43: Symbols key

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

Part No.	Description	Part No.	Description
112	Pump bowl	502	Casing wear ring
138	Bellmouth	80-1	Motor unit

Part No.	Description	Part No.	Description
230	Impeller	82-5	Adapter
412.06	O-ring	914.02/.06/.50	Hexagon socket head cap screw

9.2 Cable bundle

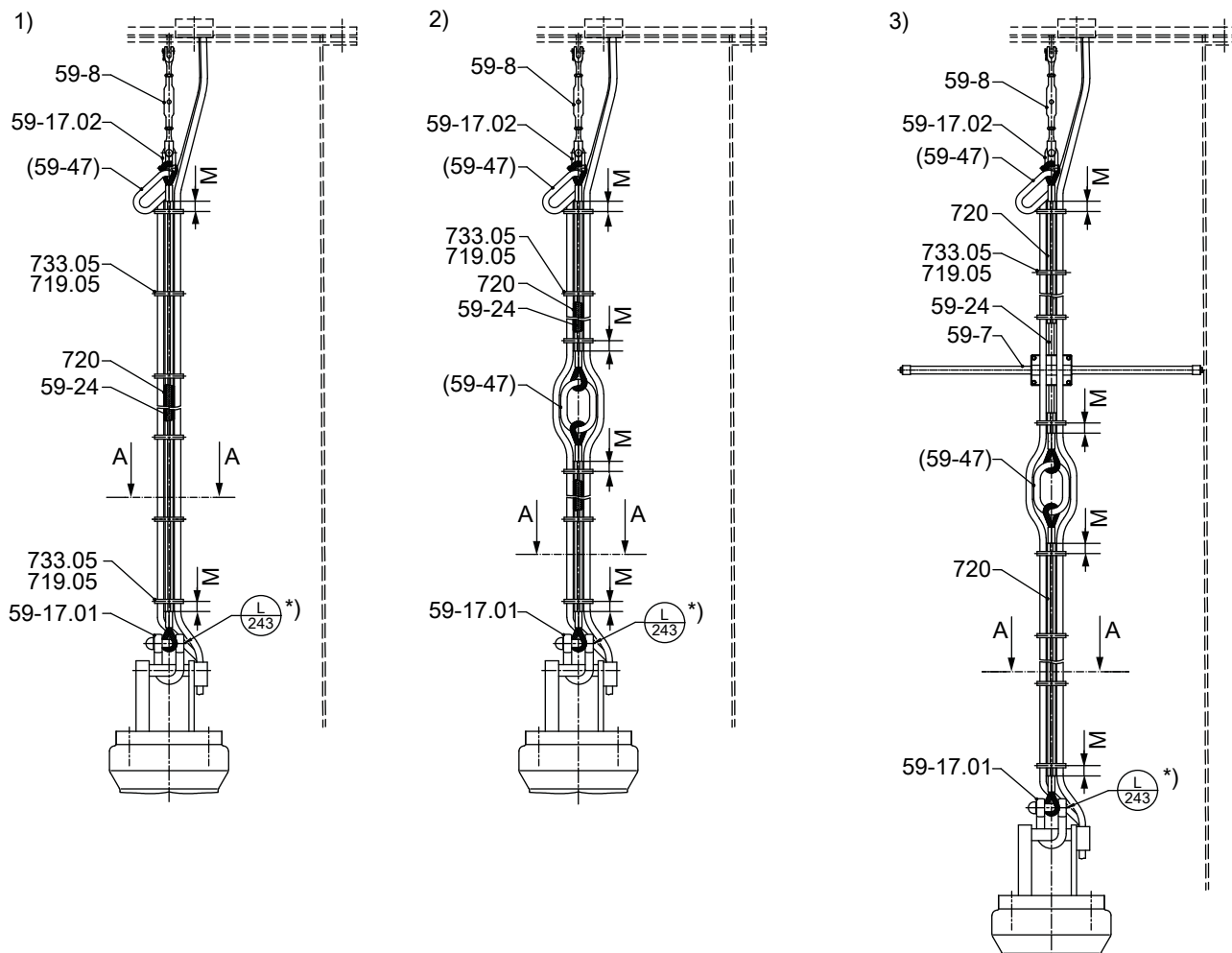


Fig. 54: Cable bundle

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

*) : Only required for galvanised version (⇒ Section 5.3.3, Page 29)

	NOTE
	Distance M = 50 mm

Table 44: Symbols key

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

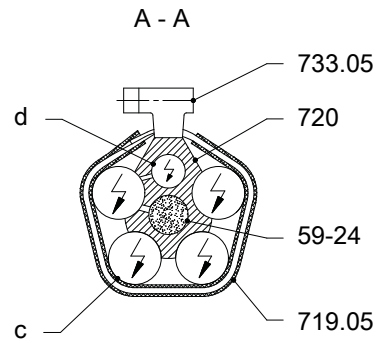


Fig. 55: Section A - A, position of power cable, control cable and support rope

c	Power cable	d	Control cable
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Table 45: 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 the power cable 700-470...1500-1060

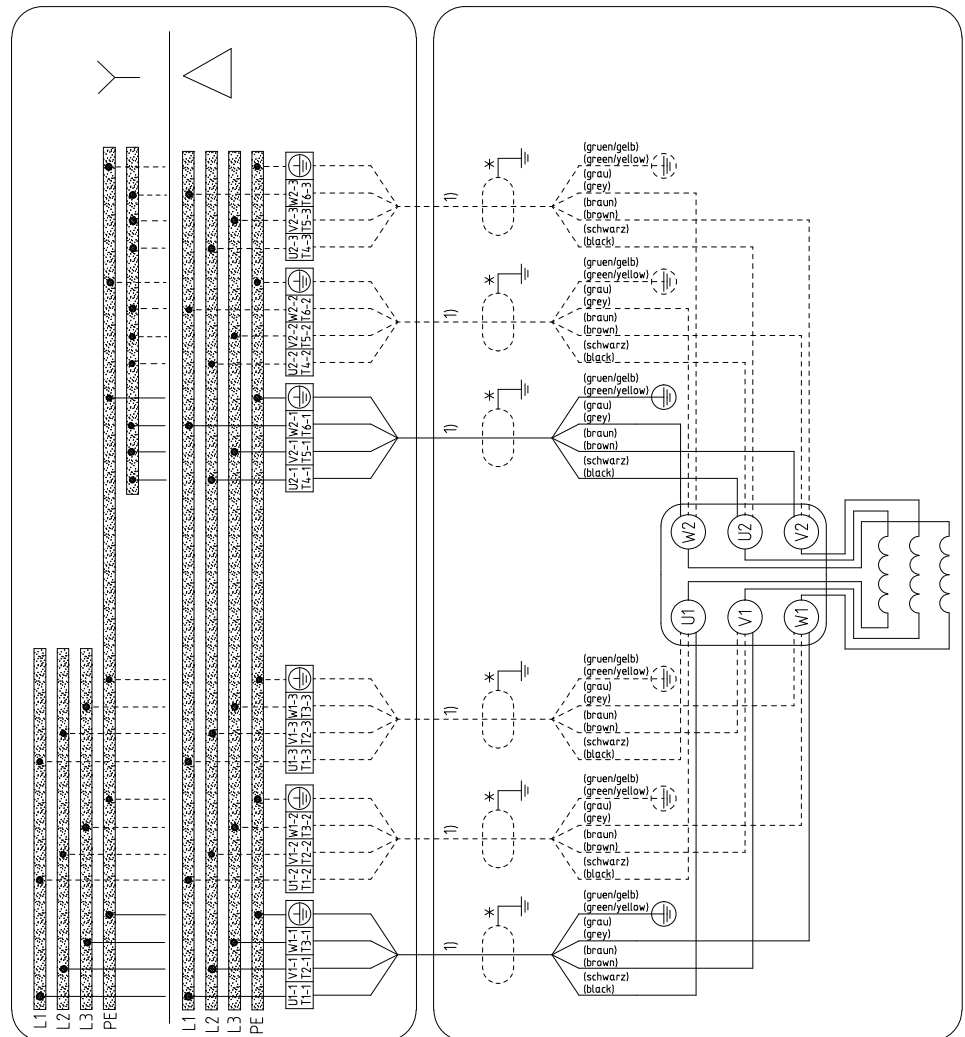


Fig. 56: Wiring diagram for the power cable 700-470...1500-1060

* Shielded cable optional

¹⁾ Up to 3 parallel cable pairs possible

9.3.2 Wiring diagram for the power cable 1600-1060

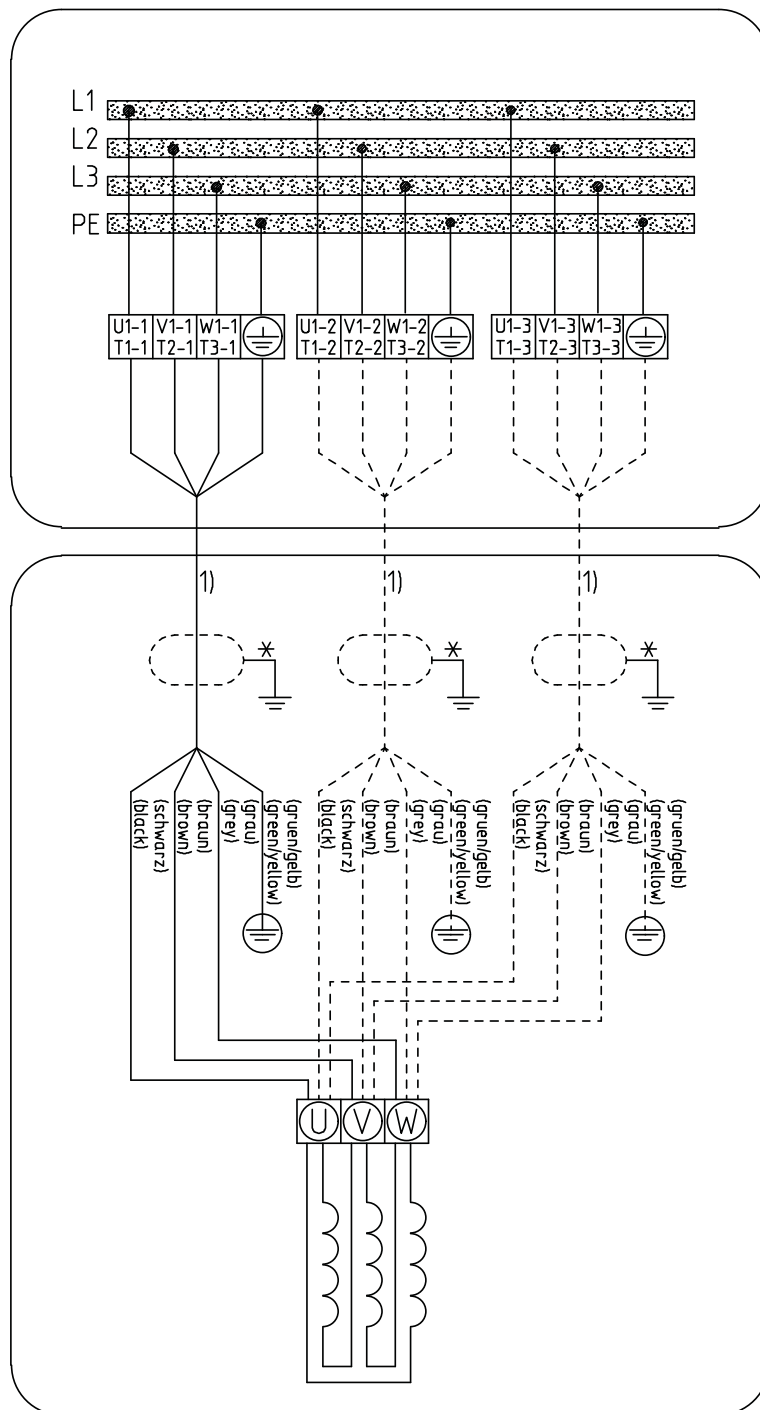


Fig. 57: Wiring diagram for the power cable 1600-1060

* Shielded cable optional

¹⁾ Up to 8 parallel cable pairs possible

9.3.3 Wiring diagrams for the sensors

Standard
pump sets

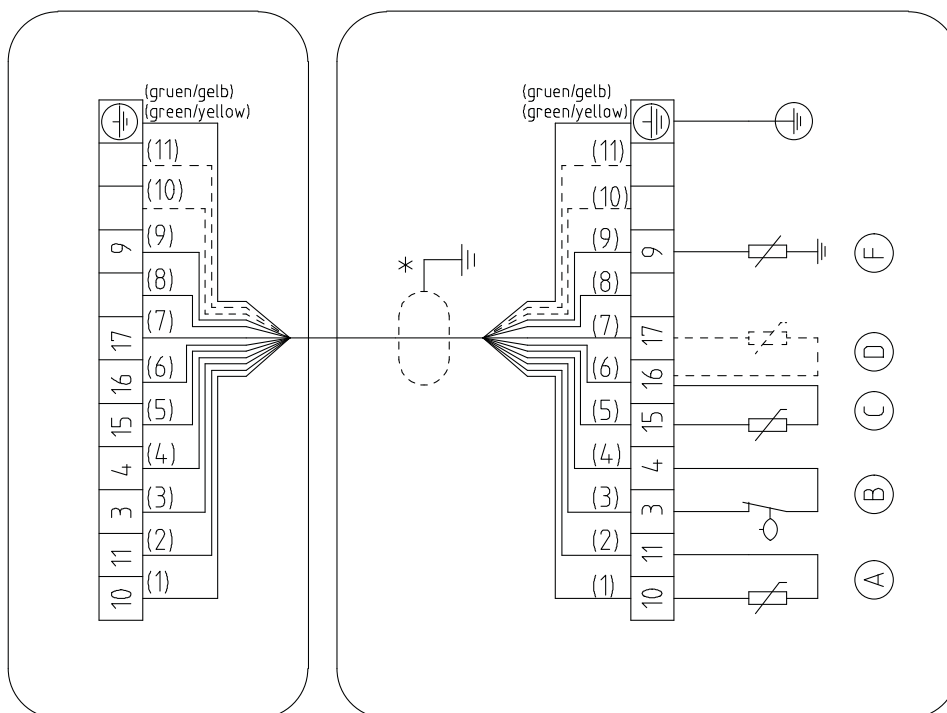


Fig. 58: Wiring diagram for sensors of standard pump sets

*	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

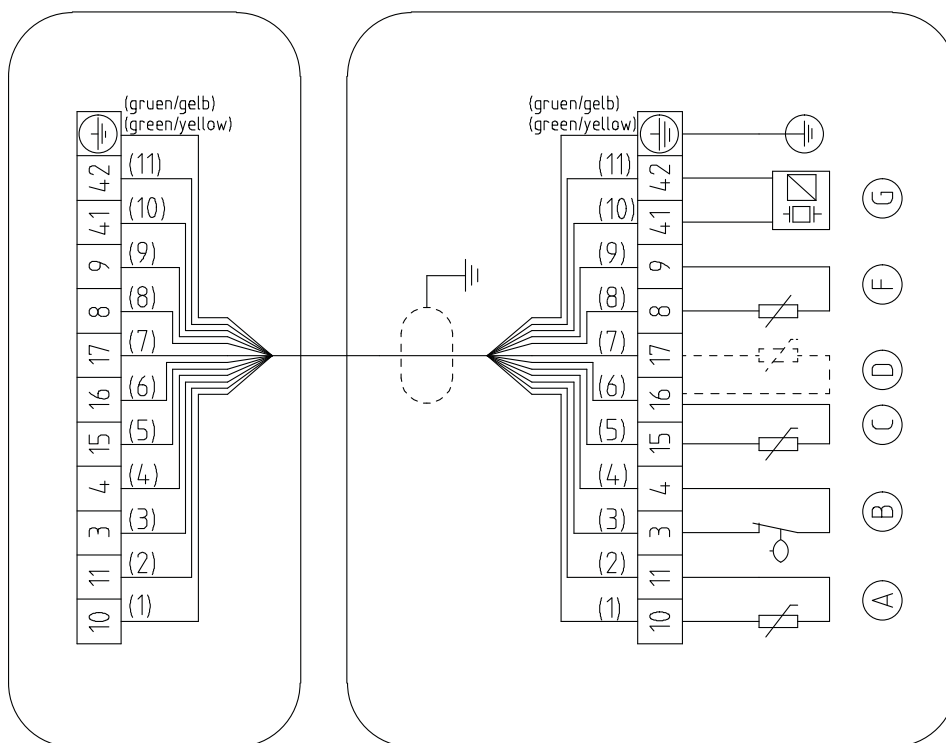


Fig. 59: Wiring diagram for sensors of pump sets with additional monitoring by vibration sensor

Ⓐ	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

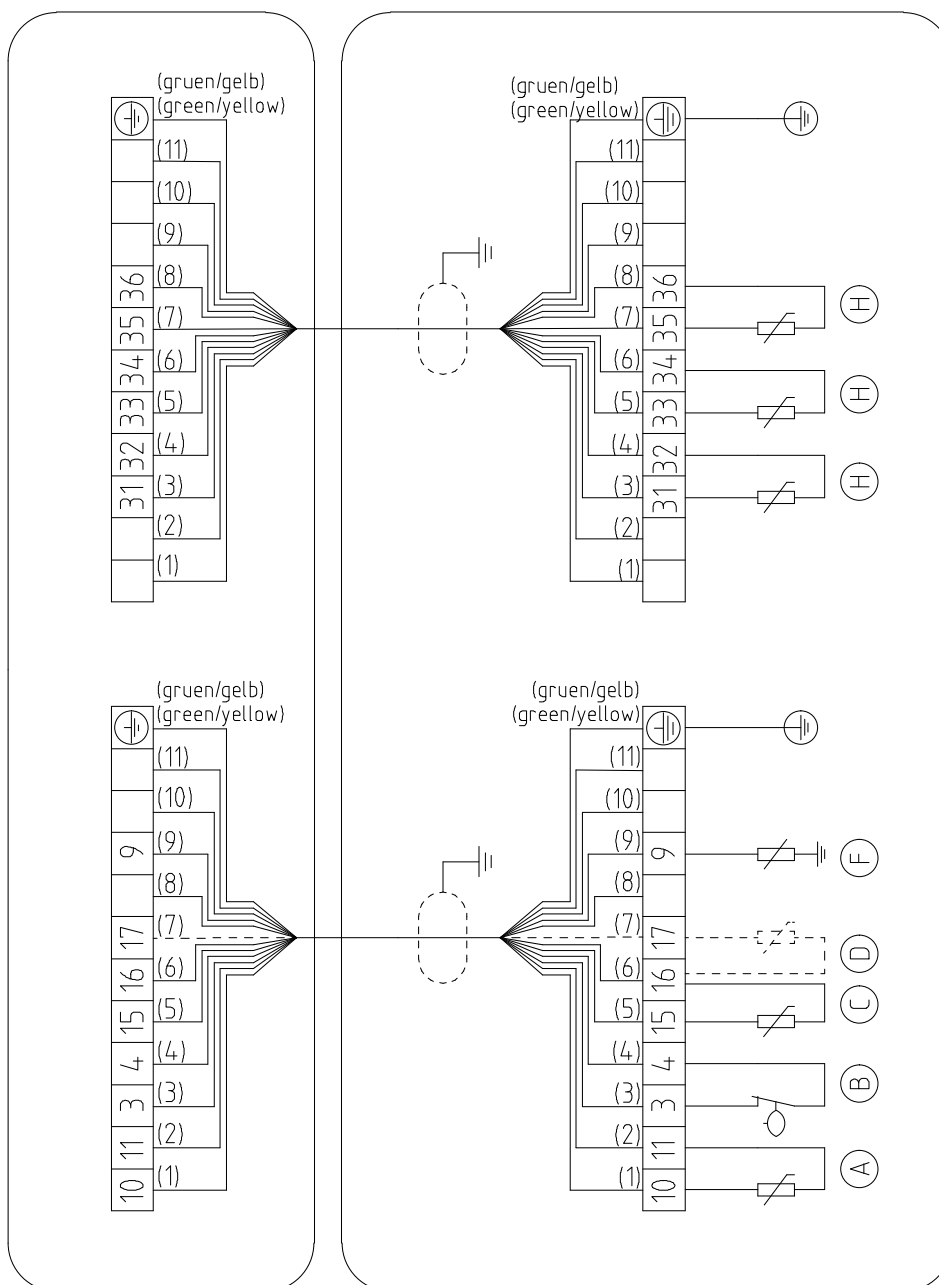


Fig. 60: Wiring diagram for sensors of pump sets with additional motor temperature monitoring (Pt100)

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

Pump sets with additional
Pt100 motor temperature
monitoring and vibration
sensor

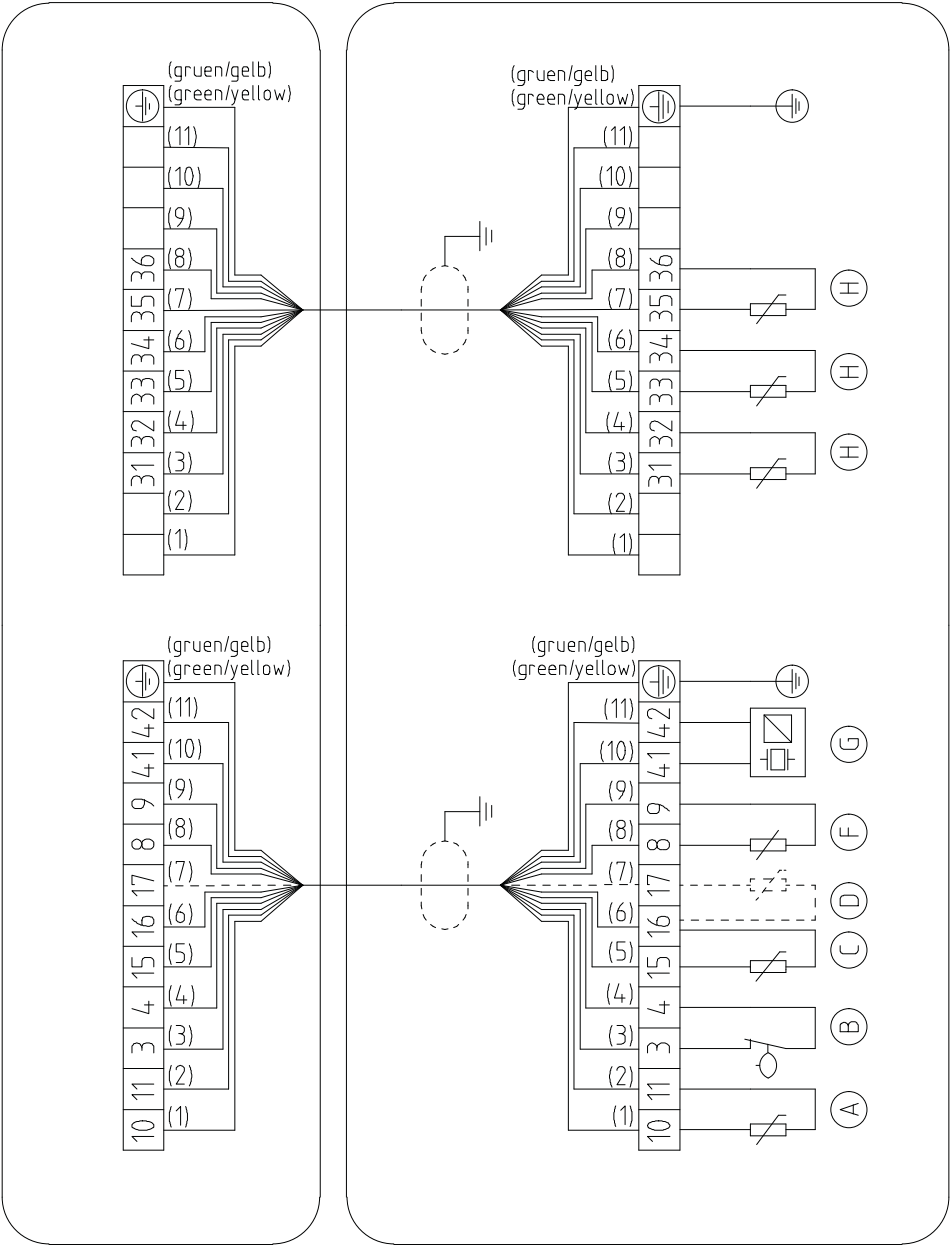


Fig. 61: Wiring diagram for sensors of pump sets with additional Pt100 motor temperature monitoring and vibration sensor

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

9.4 Flamepaths on explosion-proof motors

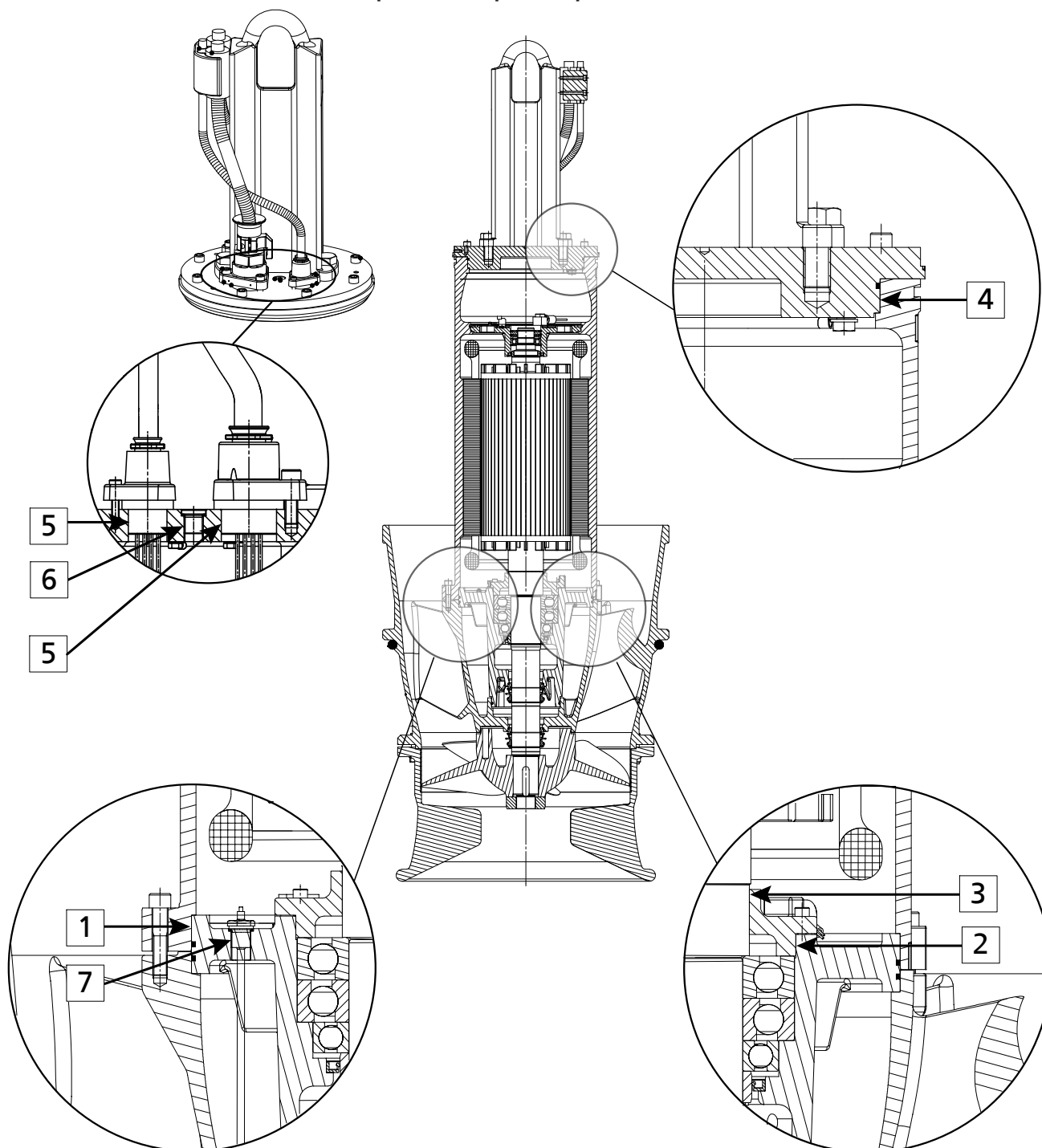


Fig. 62: Flamepaths for explosion-proof motors

9.5 Dimensions

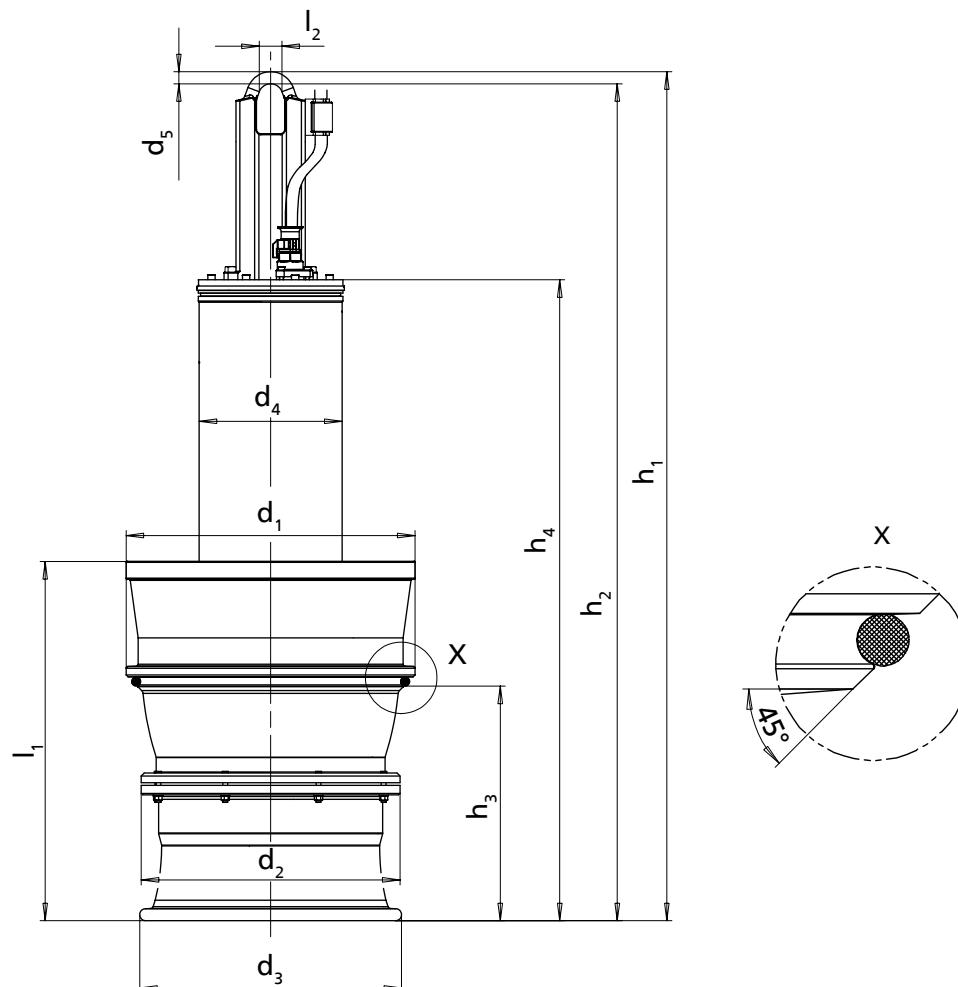


Fig. 63: Outline drawing of the pump set

Table 46: Dimensions of the pump set

Size	Motor size	Number of poles	d ₁	d ₂	d ₃	d ₄	d ₅	h ₁	h ₂	h ₃	h ₄	l ₁	l ₂	[kg] ¹⁰⁾
A 700 - 470	47	6	675	585	585	385	40	2190	2150	430	1500	735	80	885
A 700 - 470	60	6	675	585	585	385	40	2190	2150	430	1500	735	80	925
A 700 - 470	80	6	675	585	585	385	40	2390	2350	430	1700	735	80	1015
A 700 - 470	100	6	675	585	585	385	40	2390	2350	430	1700	735	80	1070
A 700 - 470	30	8	675	585	585	385	40	2190	2150	430	1500	735	80	905
A 700 - 470	40	8	675	585	585	385	40	2190	2150	430	1500	735	80	910
B 700 - 470	60	6	675	585	585	385	40	2190	2150	430	1500	735	80	955
B 700 - 470	80	6	675	585	585	385	40	2390	2350	430	1700	735	80	1045
B 700 - 470	100	6	675	585	585	385	40	2390	2350	430	1700	735	80	1100
B 700 - 470	120	6	675	585	585	385	40	2390	2350	430	1700	735	80	1170
A 800 - 540	80	6	770	660	660	385	40	2445	2405	550	1755	945	80	1165
A 800 - 540	100	6	770	660	660	385	40	2445	2405	550	1755	945	80	1220
A 800 - 540	120	6	770	660	660	385	40	2445	2405	550	1755	945	80	1290
A 800 - 540	40	8	770	660	660	385	40	2245	2205	550	1555	945	80	1060
A 800 - 540	55	8	770	660	660	385	40	2445	2405	550	1755	945	80	1165
A 800 - 540	70	8	770	660	660	385	40	2445	2405	550	1755	945	80	1165
A 800 - 540	100	8	770	660	660	385	40	2445	2405	550	1755	945	80	1290

¹⁰⁾ Pump set with 10-metre power cable (400 V) and 5-metre support rope

Size	Motor size	Number of poles	d ₁	d ₂	d ₃	d ₄	d ₅	h ₁	h ₂	h ₃	h ₄	l ₁	l ₂	[kg] ¹⁰⁾
B 800 - 540	120	6	770	660	660	385	40	2445	2405	550	1755	945	80	1315
A 900 - 540	155	6	860	660	660	475	40	2615	2575	570	1925	1045	80	1555
A 900 - 540	180	6	860	660	660	475	40	2615	2575	570	1925	1045	80	1655
B 900 - 540	155	6	860	660	660	475	40	2615	2575	570	1925	1045	80	1580
B 900 - 540	180	6	860	660	660	475	40	2615	2575	570	1925	1045	80	1680
B 900 - 540	205	6	860	660	660	475	40	2615	2575	570	1925	1045	80	1735
A 1000 - 700	120	8	960	860	870	475	40	2820	2780	780	2130	1195	80	1990
A 1000 - 700	160	8	960	860	870	475	40	2820	2780	780	2130	1195	80	2160
A 1000 - 700	205	8	960	860	870	555	50	3230	3170	780	2630	1195	90	2765
A 1000 - 700	250	8	960	860	870	555	50	3230	3170	780	2630	1195	90	2895
A 1000 - 700	290	8	960	860	870	555	50	3230	3170	780	2630	1195	90	3060
A 1000 - 700	60	10	960	860	870	475	40	2820	2780	780	2130	1195	80	1910
A 1000 - 700	90	10	960	860	870	475	40	2820	2780	780	2130	1195	80	2010
A 1000 - 700	120	10	960	860	870	475	40	2820	2780	780	2130	1195	80	2095
B 1000 - 700	160	8	960	860	870	475	40	2820	2780	780	2130	1195	80	2200
B 1000 - 700	205	8	960	860	870	555	50	3230	3170	780	2630	1195	90	2805
B 1000 - 700	250	8	960	860	870	555	50	3230	3170	780	2630	1195	90	2935
B 1000 - 700	290	8	960	860	870	555	50	3230	3170	780	2630	1195	90	3100
A 1200 - 870	200	10	1150	1050	1050	555	50	3290	3230	1015	2690	1405	90	3340
A 1200 - 870	250	10	1150	1050	1050	555	50	3290	3230	1015	2690	1405	90	3590
A 1200 - 870	310	10	1150	1050	1050	650	60	3740	3665	1015	3040	1405	90	4360
A 1200 - 870	365	10	1150	1050	1050	650	60	3965	3890	1015	3265	1405	90	4730
A 1200 - 870	420	10	1150	1050	1050	650	60	3965	3890	1015	3265	1405	90	4990
A 1200 - 870	130	12	1150	1050	1050	555	50	3290	3230	1015	2690	1405	90	3140
A 1200 - 870	190	12	1150	1050	1050	555	50	3290	3230	1015	2690	1405	90	3560
A 1200 - 870	251	12	1150	1050	1050	650	60	3740	3665	1015	3040	1405	90	4360
B 1200 - 870	250	10	1150	1050	1050	555	50	3290	3230	1015	2690	1405	90	3710
B 1200 - 870	310	10	1150	1050	1050	650	60	3740	3665	1015	3040	1405	90	4480
B 1200 - 870	365	10	1150	1050	1050	650	60	3965	3890	1015	3265	1405	90	4850
B 1200 - 870	420	10	1150	1050	1050	650	60	3965	3890	1015	3265	1405	90	5110
B 1200 - 870	470	10	1150	1050	1050	650	60	3965	3890	1015	3265	1405	90	5290
A 1500 - 1060	250	12	1430	1300	1300	650	60	3775	3700	1475	3075	1860	90	5220
A 1500 - 1060	320	12	1430	1300	1300	650	60	4000	3925	1475	3330	1860	90	5680
A 1500 - 1060	370	12	1430	1300	1300	650	60	4000	3925	1475	3330	1860	90	5840
A 1500 - 1060	410	12	1430	1300	1300	650	60	4000	3925	1475	3330	1860	90	6020
A 1500 - 1060	210	14	1430	1300	1300	650	60	4000	3925	1475	3330	1860	90	5530
A 1500 - 1060	270	14	1430	1300	1300	650	60	4000	3925	1475	3330	1860	90	5730
A 1500 - 1060	340	14	1430	1300	1300	650	60	4000	3925	1475	3330	1860	90	5970
B 1500 - 1060	370	12	1430	1300	1300	650	60	4000	3925	1475	3330	1860	90	6020
B 1500 - 1060	410	12	1430	1300	1300	650	60	4000	3925	1475	3330	1860	90	6200
A 1600-1060	450	12	1540	1350	1300	760	70	4085	3995	1260	3375	1800	100	7050
A 1600-1060	500	12	1540	1350	1300	760	70	4085	3995	1260	3375	1800	100	7500
A 1600-1060	560	12	1540	1350	1300	775	70	4385	4295	1260	3675	1800	100	7990
A 1600-1060	620	12	1540	1350	1300	775	70	4385	4295	1260	3675	1800	100	8200
B 1600-1060	450	12	1540	1350	1300	760	70	4085	3995	1260	3375	1800	100	7230
B 1600-1060	500	12	1540	1350	1300	760	70	4085	3995	1260	3375	1800	100	7680
B 1600-1060	560	12	1540	1350	1300	775	70	4385	4295	1260	3675	1800	100	8170
B 1600-1060	620	12	1540	1350	1300	775	70	4385	4295	1260	3675	1800	100	8380
B 1600-1060	680	12	1540	1350	1300	775	70	4385	4295	1260	3675	1800	100	8660

Size	Motor size	Number of poles	d ₁	d ₂	d ₃	d ₄	d ₅	h ₁	h ₂	h ₃	h ₄	l ₁	l ₂	[kg] ⁽¹⁰⁾
A 1600-1060	370	14	1540	1350	1300	760	70	4085	3995	1260	3375	1800	100	7050
A 1600-1060	410	14	1540	1350	1300	760	70	4085	3995	1260	3375	1800	100	7370

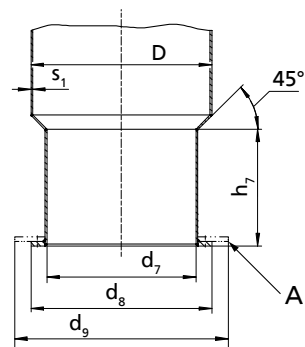


Fig. 64: Outline drawing of the discharge tube

A	Suction umbrella; option for reducing the minimum water level
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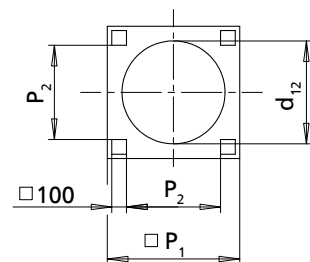
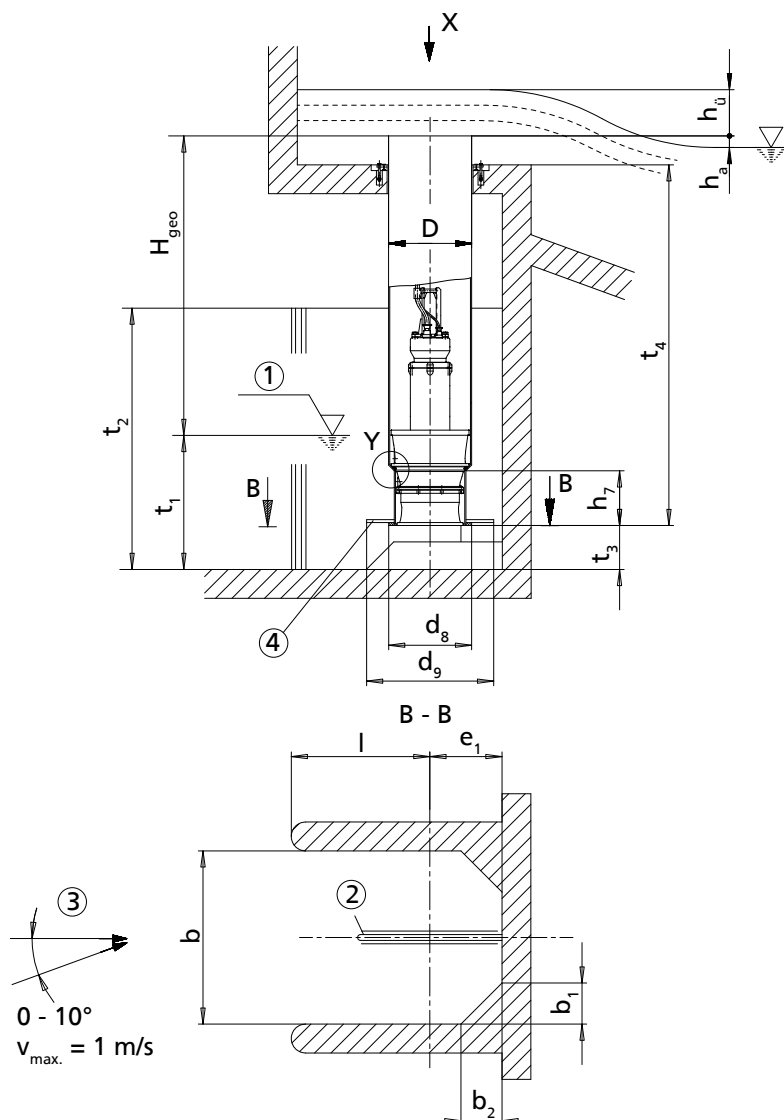
Table 47: Dimensions of the discharge tube [mm]

Size	Motor size	Number of poles	D	d ₇	d ₈	d ₉	h ₇	s ₁
A 700 - 470	47	6	711	600	710	1100	420	8
A 700 - 470	60	6	711	600	710	1100	420	8
A 700 - 470	80	6	711	600	710	1100	420	8
A 700 - 470	100	6	711	600	710	1100	420	8
A 700 - 470	30	8	711	600	710	1100	420	8
A 700 - 470	40	8	711	600	710	1100	420	8
B 700 - 470	60	6	711	600	710	1100	420	8
B 700 - 470	80	6	711	600	710	1100	420	8
B 700 - 470	100	6	711	600	710	1100	420	8
B 700 - 470	120	6	711	600	710	1100	420	8
A 800 - 540	80	6	813	680	810	1250	525	8
A 800 - 540	100	6	813	680	810	1250	525	8
A 800 - 540	120	6	813	680	810	1250	525	8
A 800 - 540	40	8	813	680	810	1250	525	8
A 800 - 540	55	8	813	680	810	1250	525	8
A 800 - 540	70	8	813	680	810	1250	525	8
A 800 - 540	100	8	813	680	810	1250	525	8
B 800 - 540	120	6	813	680	810	1250	525	8
A 900 - 540	155	6	914	700	910	1250	515	8
A 900 - 540	180	6	914	700	910	1250	515	8
B 900 - 540	155	6	914	700	910	1250	515	8
B 900 - 540	180	6	914	700	910	1250	515	8
B 900 - 540	205	6	914	700	910	1250	515	8
A 1000 - 700	120	8	1016	880	1015	1600	765	10
A 1000 - 700	160	8	1016	880	1015	1600	765	10
A 1000 - 700	205	8	1016	880	1015	1600	765	10
A 1000 - 700	250	8	1016	880	1015	1600	765	10
A 1000 - 700	290	8	1016	880	1015	1600	765	10
A 1000 - 700	60	10	1016	880	1015	1600	765	10
A 1000 - 700	90	10	1016	880	1015	1600	765	10
A 1000 - 700	120	10	1016	880	1015	1600	765	10
B 1000 - 700	160	8	1016	880	1015	1600	765	10

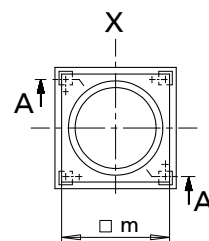
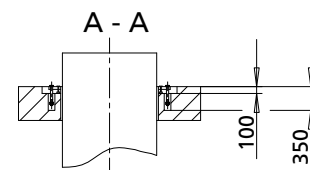
Size	Motor size	Number of poles	D	d ₇	d ₈	d ₉	h ₇	s ₁
B 1000 - 700	205	8	1016	880	1015	1600	765	10
B 1000 - 700	250	8	1016	880	1015	1600	765	10
B 1000 - 700	290	8	1016	880	1015	1600	765	10
A 1200 - 870	200	10	1220	1070	1220	2000	1000	12
A 1200 - 870	250	10	1220	1070	1220	2000	1000	12
A 1200 - 870	310	10	1220	1070	1220	2000	1000	12
A 1200 - 870	365	10	1220	1070	1220	2000	1000	12
A 1200 - 870	420	10	1220	1070	1220	2000	1000	12
A 1200 - 870	130	12	1220	1070	1220	2000	1000	12
A 1200 - 870	190	12	1220	1070	1220	2000	1000	12
A 1200 - 870	251	12	1220	1070	1220	2000	1000	12
B 1200 - 870	250	10	1220	1070	1220	2000	1000	12
B 1200 - 870	310	10	1220	1070	1220	2000	1000	12
B 1200 - 870	365	10	1220	1070	1220	2000	1000	12
B 1200 - 870	420	10	1220	1070	1220	2000	1000	12
B 1200 - 870	470	10	1220	1070	1220	2000	1000	12
A 1500 - 1060	250	12	1525	1330	1520	2450	1460	12
A 1500 - 1060	320	12	1525	1330	1520	2450	1460	12
A 1500 - 1060	370	12	1525	1330	1520	2450	1460	12
A 1500 - 1060	410	12	1525	1330	1520	2450	1460	12
A 1500 - 1060	210	14	1525	1330	1520	2450	1460	12
A 1500 - 1060	270	14	1525	1330	1520	2450	1460	12
A 1500 - 1060	340	14	1525	1330	1520	2450	1460	12
B 1500 - 1060	370	12	1525	1330	1520	2450	1460	12
B 1500 - 1060	410	12	1525	1330	1520	2450	1460	12
A 1600 - 1060	450	12	1625	1420	1620	2450	1230	12
A 1600 - 1060	500	12	1625	1420	1620	2450	1230	12
A 1600 - 1060	560	12	1625	1420	1620	2450	1230	12
A 1600 - 1060	620	12	1625	1420	1620	2450	1230	12
B 1600 - 1060	450	12	1625	1420	1620	2450	1230	12
B 1600 - 1060	500	12	1625	1420	1620	2450	1230	12
B 1600 - 1060	560	12	1625	1420	1620	2450	1230	12
B 1600 - 1060	620	12	1625	1420	1620	2450	1230	12
B 1600 - 1060	680	12	1625	1420	1620	2450	1230	12
A 1600 - 1060	370	14	1625	1420	1620	2450	1230	12
A 1600 - 1060	410	14	1625	1420	1620	2450	1230	12

9.6 Wiring diagrams

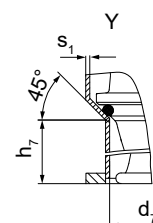
9.6.1 Installation type BU



Foundation recesses¹¹⁾



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 following pages)
- ②: Flow-straightening vane (⇒ Section 9.6.7, Page 128)
- ③: Approach flow
- ④: Suction umbrella - Option for reducing the minimum water level t_1

Table 48: 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				
700-470	711	1500	300	—	300	—	600	710	1100	750
800-540	813	1800	360	—	360	—	680	810	1250	850
900-540	914	1800	360	—	360	—	700	910	1250	970
1000-700	1016	2300	460	—	460	—	880	1015	1600	1070
1200-870	1220	2800	560	—	560	—	1070	1220	2000	1280
1500-1060	1524	3500	700	—	700	—	1330	1520	2450	1590
1600-1060	1625	3500	700	—	700	—	1420	1620	2450	1690

¹¹⁾ All dimensions for foundation recesses apply to discharge tube design without intermediate flange.

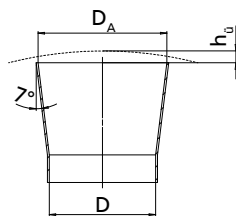
Table 49: Dimensions [mm]

Size	e ₁ ¹²⁾		h ₇	h _a	l _{min.}	m	p ₁	p ₂	t ₃ ¹²⁾	t _{4 min.} ¹³⁾
	Suction umbrella									
	✗	✓								
	d ₈	d ₉								
700-470	450	650	420	100	1050	800	900	640	380	2300
800-540	500	700	525	100	1300	910	1000	740	440	2350
900-540	550	700	515	100	1300	1050	1120	860	440	2500
1000-700	600	900	765	100	1700	1150	1220	960	560	3050
1200-870	700	1100	1000	100	2100	1360	1420	1160	680	3750
1500-1060	850	1300	1460	100	2650	1680	1750	1480	860	3900
1600-1060	900	1300	1230	100	2600	1780	1850	1580	860	4350

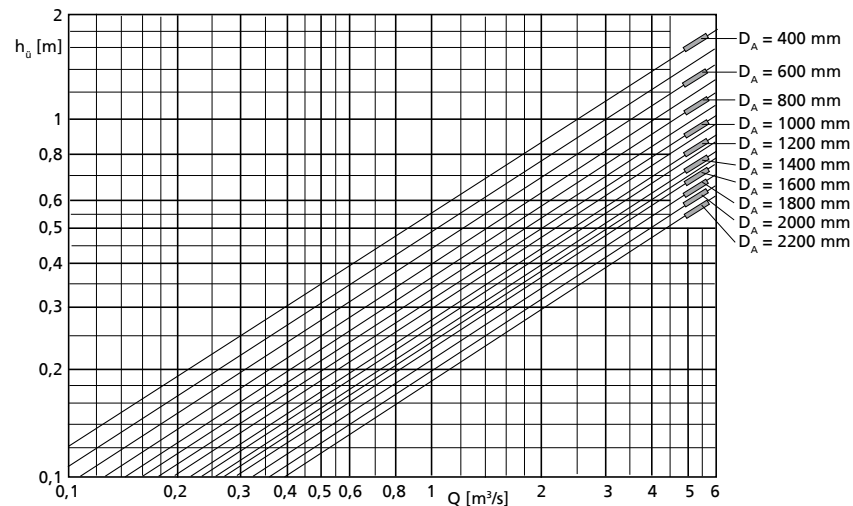
$t_2 = 1.1 \times \text{water level, maximum } 2 \times t_1$
Height of corner lining (b_1 and b_2) like t_2

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



Overflow head
 h_u

Loss diagram

Loss diagram

Calculation formulas:

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

$$\Delta H_v$$

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

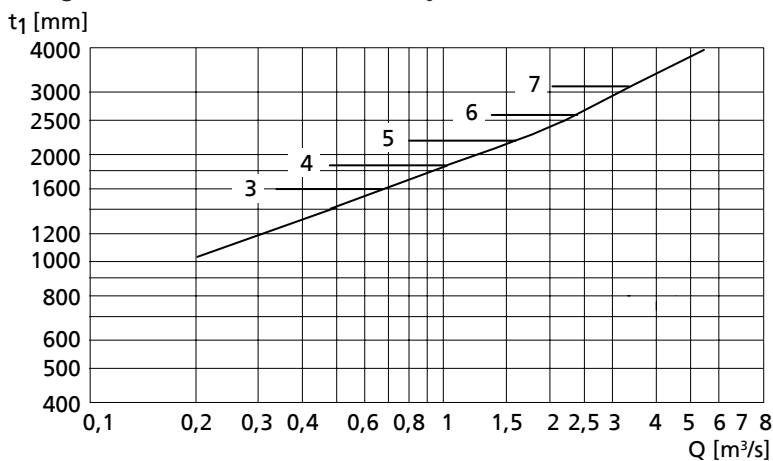
Overflow head h_u depends on Q and the discharge diameter D_A . The characteristic curve values only apply to unimpeded outlet in all directions; otherwise they are approximate values only.

¹² Observe the dimension.

¹³ Value for maximum motor length

Minimum water level diagrams

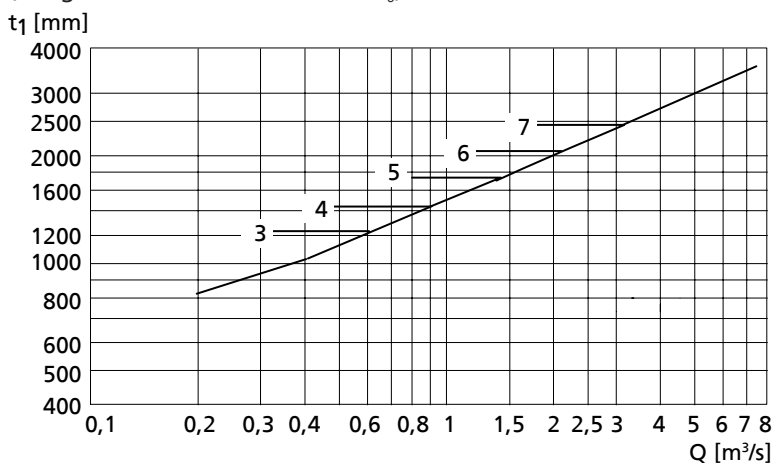
Open intake chamber
(design without suction umbrella $\varnothing d_8$)



Key

- 3 - Amacan P 700 - 470
- 4 - Amacan P 800/900 - 540
- 5 - Amacan P 1000 - 700
- 6 - Amacan P 1200 - 870
- 7 - Amacan P 1500/1600-1060

Open intake chamber
(design with suction umbrella $\varnothing d_9$)



9.6.2 Installation type BG

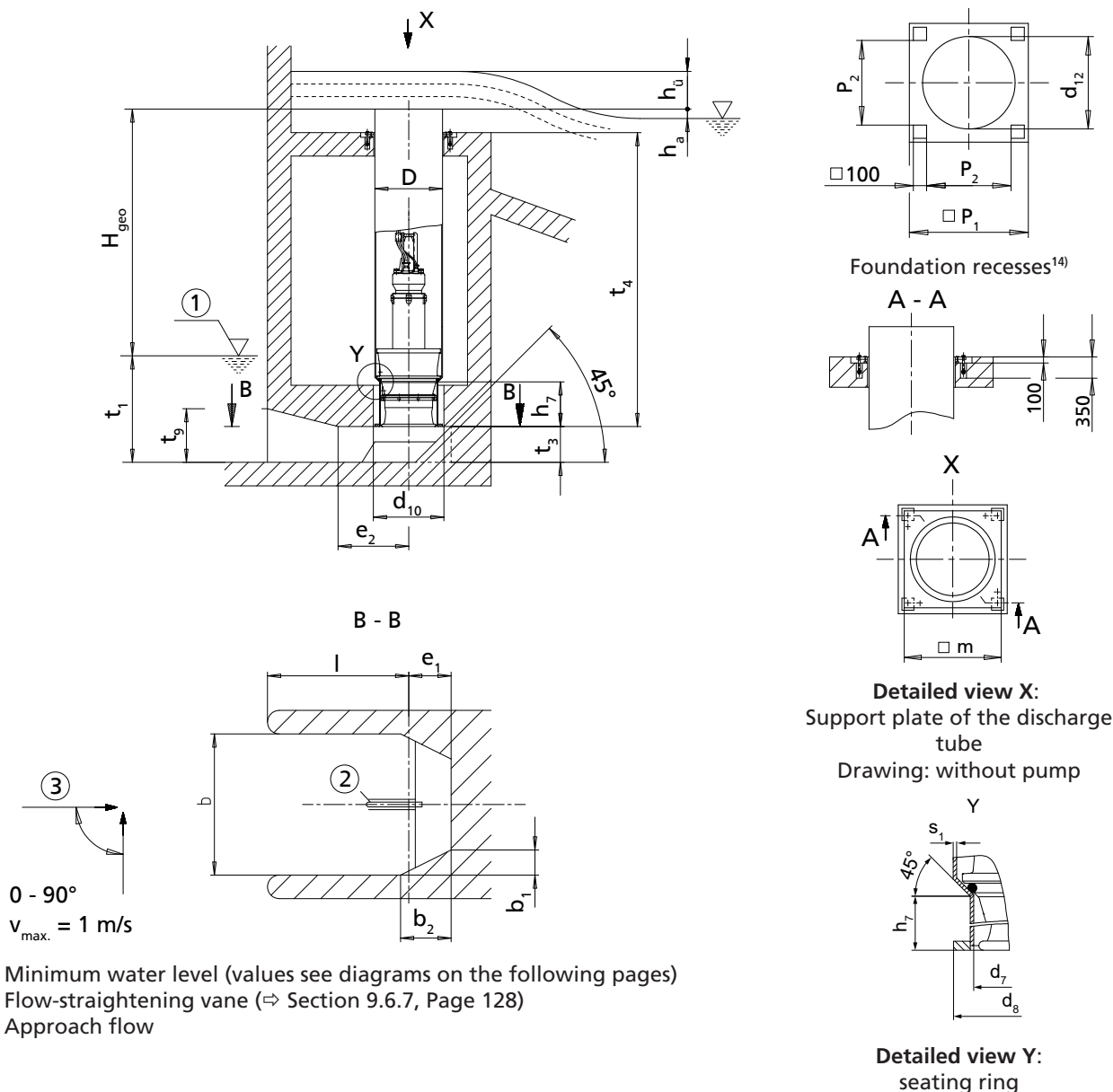


Table 50: Dimensions [mm]

Size	D	b	b ₁	b ₂	d ₇	d ₈	d ₁₀	d ₁₂	e ₁ ¹⁵⁾	e ₂
700-470	711	1500	300	600	600	710	740	750	450	750
800-540	813	1800	360	720	680	810	860	850	519	900
900-540	914	1800	360	720	700	910	960	970	519	900
1000-700	1016	2300	460	920	880	1015	1080	1070	673	1150
1200-870	1220	2800	560	1120	1070	1220	1290	1280	833	1400
1500-1060	1524	3500	700	1400	1330	1520	1600	1590	1048	1750
1600-1060	1625	3500	700	1400	1420	1620	1700	1690	1048	1750

Table 51: Dimensions [mm]

Size	h _a	h ₇	l _{min.}	m	p ₁	p ₂	t ₃ ¹⁵⁾	t _{4 min.} ¹⁶⁾	t ₉
700-470	100	420	1500	800	910	640	380	2300	570
800-540	100	525	1800	910	1000	740	440	2350	660

¹⁴ All dimensions for foundation recesses apply to discharge tube design without intermediate flange.

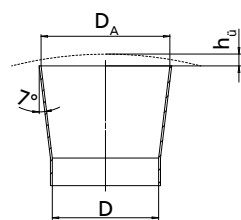
¹⁵ Observe the dimension.

¹⁶ Value for maximum motor length

Size	h_a	h_7	$l_{min.}$	m	p_1	p_2	$t_3^{15)}$	$t_{4 min.}^{16)}$	t_9
900-540	100	515	1800	1050	1120	860	440	2500	660
1000-700	100	765	2300	1150	1220	960	560	3050	850
1200-870	100	1000	2800	1360	1420	1160	680	3750	1050
1500-1060	100	1460	3500	1680	1750	1480	860	3900	1320
1600-1060	100	1230	3500	1780	1850	1580	860	4350	1320

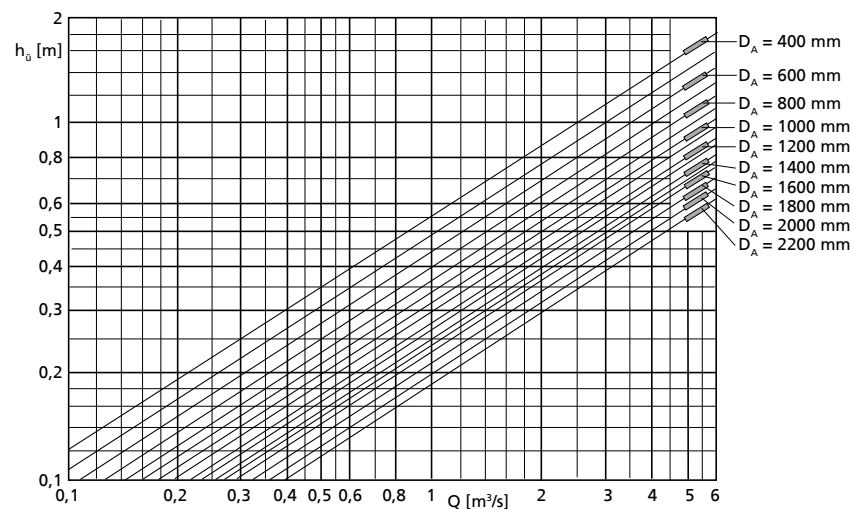
Permissible tolerances:

- 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_u

Loss diagram



Loss diagram

Calculation formulas:

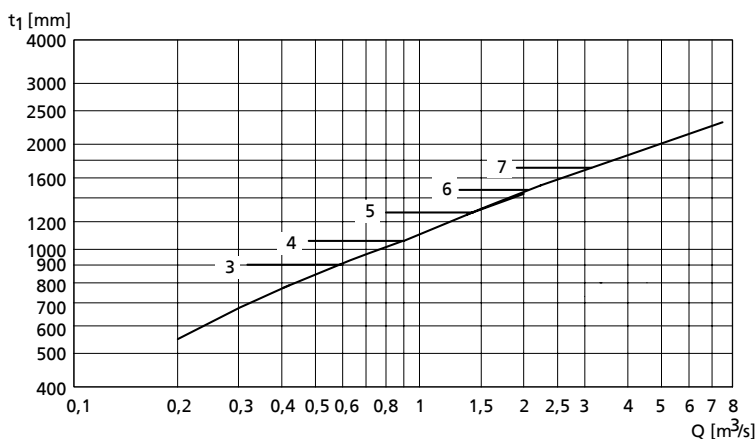
$$H = H_{geo} + \Delta H_v$$

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

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

Minimum water level diagram

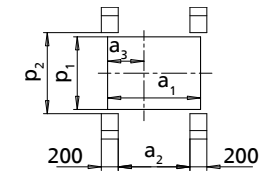
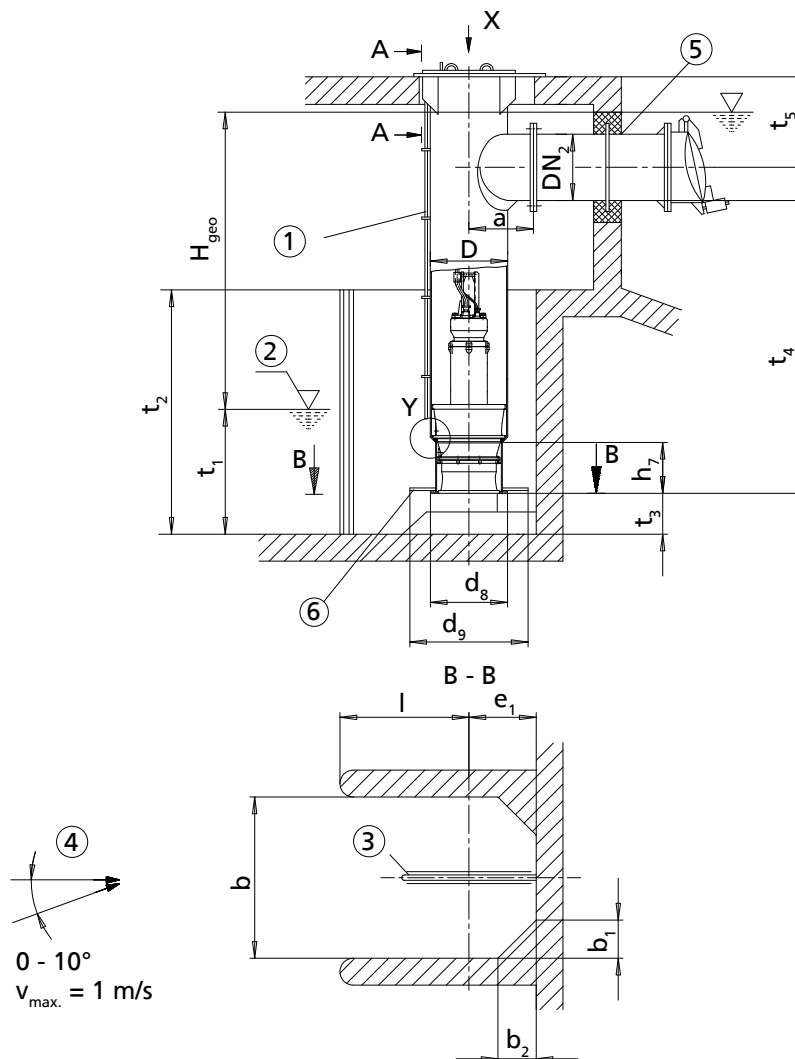
Covered intake chamber



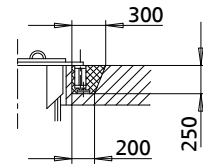
Key

- 3 - Amacan P 700 - 470
- 4 - Amacan P 800/900 - 540
- 5 - Amacan P 1000 - 700
- 6 - Amacan P 1200 - 870
- 7 - Amacan P 1500/1600 - 1060

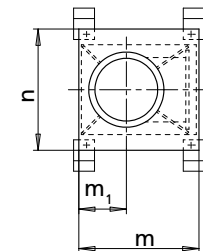
9.6.3 Installation type CU



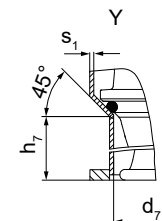
Foundation recesses¹⁷⁾



Section 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 following pages)
- ③: Flow-straightening vane (⇒ Section 9.6.7, Page 128)
- ④: Approach flow
- ⑤: Connect the discharge pipe to the discharge tube without transmitting any stresses or strains.
- ⑥: Suction umbrella - Option for reducing the minimum water level t_1

Table 52: Dimensions [mm]

Size	DN ₂ min.	DN ₂ max.	D	a	a ₁ ¹⁸⁾	a ₂ ¹⁸⁾	a ₃ ¹⁸⁾	b	b ₁		b ₂	
									Suction umbrella		Suction umbrella	
									✗	✓	✗	✓
									d ₈	d ₉	d ₈	d ₉
700-470	400	700	711	650	1120	870	430	1500	300	—	300	—
800-540	500	800	813	700	1220	970	480	1800	360	—	360	—
900-540	600	900	914	760	1320	1070	530	1800	360	—	360	—
1000-700	700	1000	1016	810	1430	1160	580	2300	460	—	460	—
1200-870	900	1200	1220	910	1630	1360	680	2800	560	—	560	—
1500-1060	1200	1500	1524	1060	1960	1690	850	3500	700	—	700	—
1600-1060	1300	1600	1625	1110	2080	1810	920	3500	700	—	700	—

¹⁷⁾ All dimensions for foundation recesses apply to discharge tube design without intermediate flange.

¹⁸⁾ Designed for DN₂ max.

Table 53: Dimensions [mm]

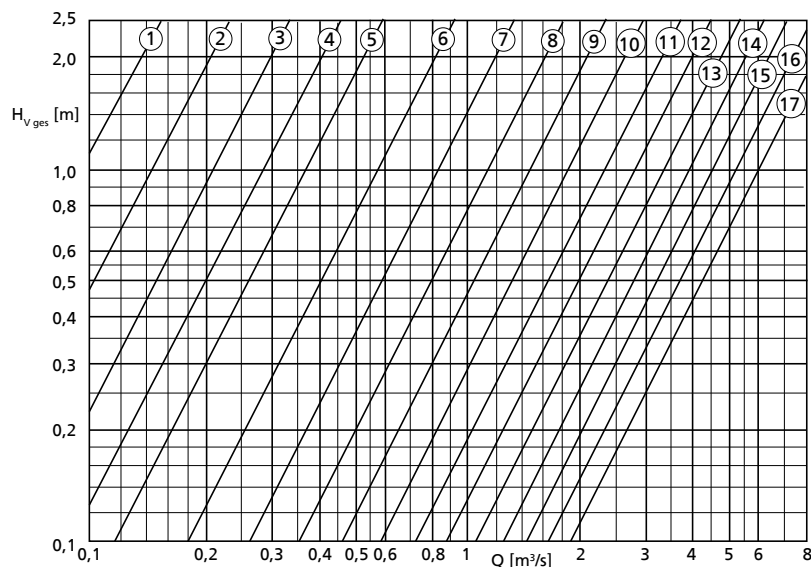
Size	d ₇	d ₈	d ₉	e ₁ ⁽¹⁹⁾		h ₇	l _{min.}	m ⁽¹⁸⁾	m ₁ ⁽¹⁸⁾	n ⁽¹⁸⁾	p ₁ ⁽¹⁸⁾	p ₂ ⁽¹⁸⁾	t ₃ ⁽¹⁹⁾	t _{4 min.} ⁽²⁰⁾	t _{6 min.} ⁽¹⁸⁾
				Suction umbrella											
				X	✓										
				d ₈	d ₉										
700-470	600	710	1100	450	650	420	1050	1170	455	1260	960	1060	380	2400	770
800-540	680	810	1250	500	700	525	1300	1270	505	1375	1075	1175	440	2450	835
900-540	700	910	1250	550	700	515	1300	1380	560	1480	1180	1280	440	2650	925
1000-700	880	1015	1600	600	900	765	1700	1520	625	1620	1280	1380	560	3250	980
1200-870	1070	1220	2000	700	1100	1000	2100	1720	725	1850	1510	1610	680	4000	1100
1500-1060	1330	1520	2450	850	1300	1460	2650	2050	895	2180	1840	1940	860	4050	1300
1600-1060	1420	1620	2450	900	1300	1230	2600	2170	965	2280	1940	2040	860	4450	1380

t₂ = 1.1 × water level, maximum 2 × t₁
Height of corner lining (b₁ and b₂) like t₂

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

Loss diagram



- ① - DN₂ = 200 mm
- ② - DN₂ = 250 mm
- ③ - DN₂ = 300 mm
- ④ - DN₂ = 350 mm
- ⑤ - DN₂ = 400 mm
- ⑥ - DN₂ = 500 mm
- ⑦ - DN₂ = 600 mm
- ⑧ - DN₂ = 700 mm
- ⑨ - DN₂ = 800 mm
- ⑩ - DN₂ = 900 mm
- ⑪ - DN₂ = 1000 mm
- ⑫ - DN₂ = 1100 mm
- ⑬ - DN₂ = 1200 mm
- ⑭ - DN₂ = 1300 mm
- ⑮ - DN₂ = 1400 mm
- ⑯ - DN₂ = 1500 mm
- ⑰ - DN₂ = 1600 mm

Calculation formulas:

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

$$\Delta H_v$$

- Loss in the riser (pipe friction)
- H_{V ges.} (see diagram)

H_{V ges.} comprises:

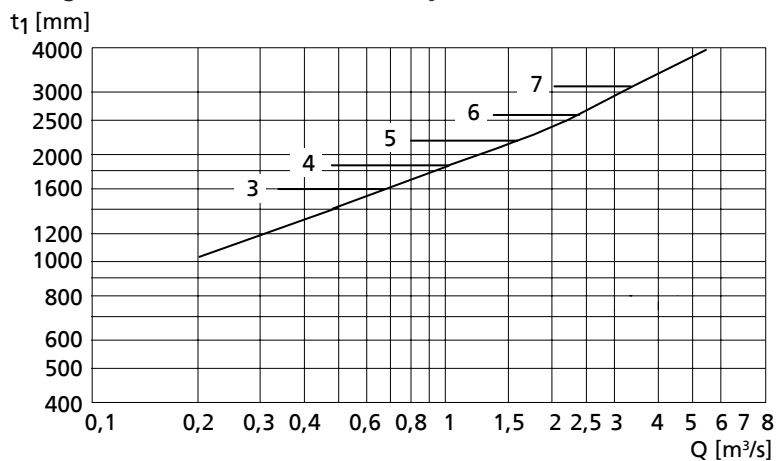
- Elbow
- Discharge pipe length = 5 × DN₂
- Swing check valve
- Outlet losses v²/2g

¹⁹ Observe the dimension.

²⁰ Value for maximum motor length

Minimum water level diagrams

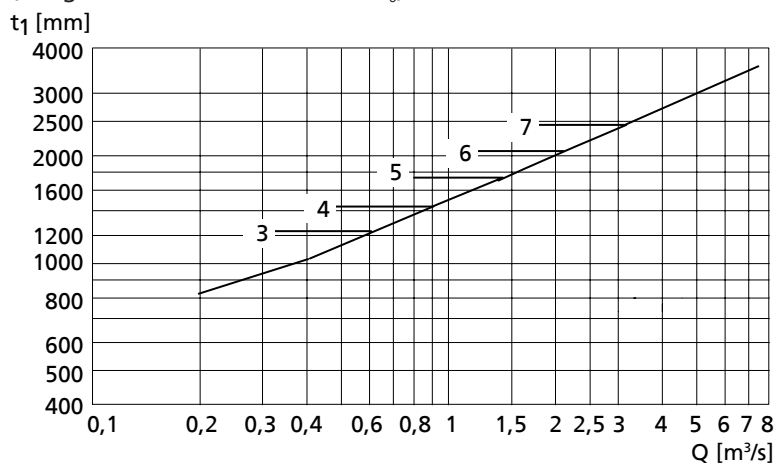
Open intake chamber
(design without suction umbrella $\varnothing d_8$)



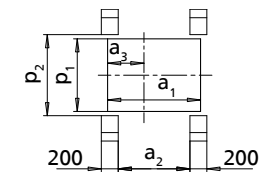
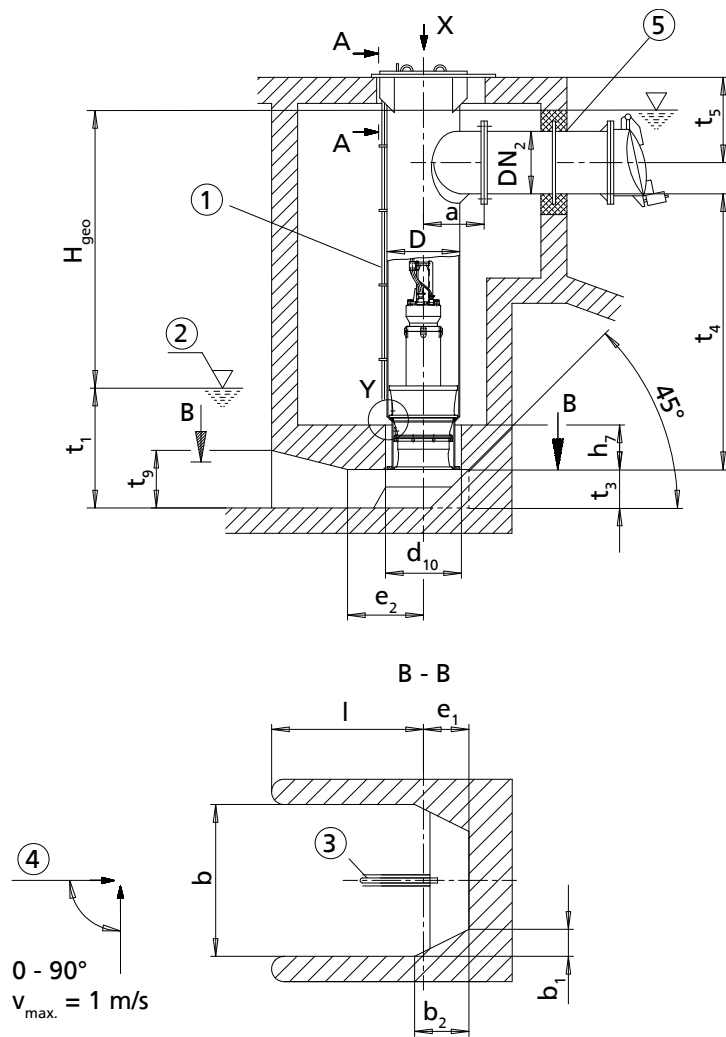
Key

- 3 - Amacan P 700 - 470
- 4 - Amacan P 800/900 - 540
- 5 - Amacan P 1000 - 700
- 6 - Amacan P 1200 - 870
- 7 - Amacan P 1500/1600-1060

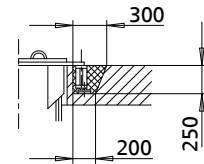
Open intake chamber
(design with suction umbrella $\varnothing d_9$)



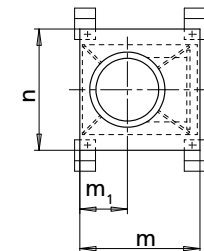
9.6.4 Installation type CG



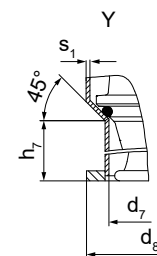
Foundation recesses²¹⁾



Section 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 following pages)
- ③: Flow-straightening vane (⇒ Section 9.6.7, Page 128)
- ④: Approach flow
- ⑤: Connect the discharge pipe to the pump without transmitting any stresses or strains.

Table 54: Dimensions [mm]

Size	DN _{2 min.}	DN _{2 max.}	D	a	a ₁ ²²⁾	a ₂ ²²⁾	a ₃ ²²⁾	b	b ₁	b ₂	d ₇	d ₈	d ₁₀
700-470	400	700	711	650	1120	870	430	1500	300	600	600	710	740
800-540	500	800	813	700	1220	970	480	1800	360	720	680	810	860
900-540	600	900	914	760	1320	1070	530	1800	360	720	700	910	960
1000-700	700	1000	1016	810	1430	1160	580	2300	460	920	880	1015	1080
1200-870	900	1200	1220	910	1630	1360	680	2800	560	1120	1070	1220	1290
1500-1060	1200	1500	1524	1060	1960	1690	850	3500	700	1400	1330	1520	1600
1600-1060	1300	1600	1625	1110	2080	1810	920	3500	700	1400	1420	1620	1700

²¹⁾ All dimensions for foundation recesses apply to discharge tube design without intermediate flange.

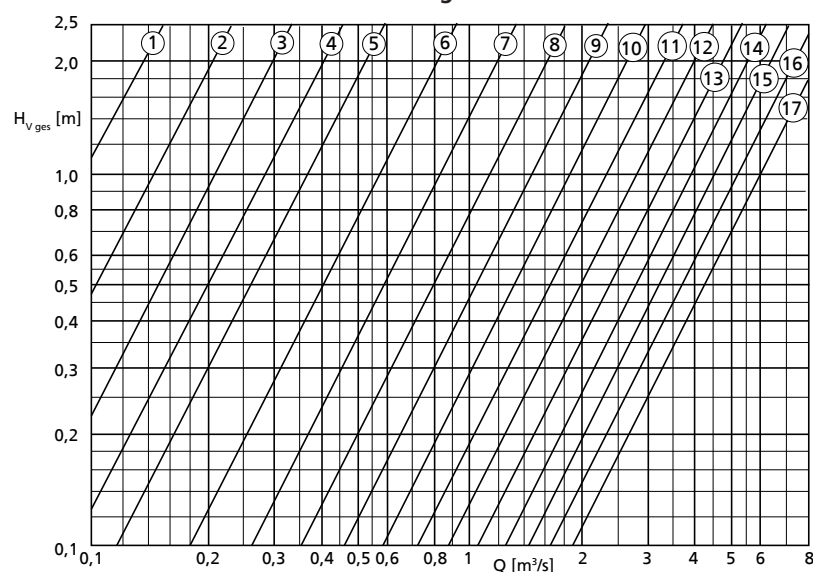
²²⁾ Designed for DN₂ max.

Table 55: Dimensions [mm]

Size	$e_1^{23)}$	e_2	h_7	$l_{min.}$	$m^{22)}$	$m_1^{22)}$	$n^{22)}$	$p_1^{22)}$	$p_2^{22)}$	$t_3^{23)}$	$t_{4 min.}^{24)}$	$t_{5 min.}^{22)}$	t_9
700-470	450	750	420	1500	1170	455	1260	960	1060	380	2400	770	570
800-540	519	900	525	1800	1270	505	1375	1075	1175	440	2450	835	660
900-540	519	900	515	1800	1380	560	1480	1180	1280	440	2650	925	660
1000-700	673	1150	765	2300	1520	625	1620	1280	1380	560	3250	980	850
1200-870	833	1400	1000	2800	1720	725	1850	1510	1610	680	4000	1100	1050
1500-1060	1048	1750	1460	3500	2050	895	2180	1840	1940	860	4050	1300	1320
1600-1060	1048	1750	1230	3500	2170	965	2280	1940	2040	860	4450	1380	1320

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

Loss diagram


- ① - DN₂ = 200 mm
- ② - DN₂ = 250 mm
- ③ - DN₂ = 300 mm
- ④ - DN₂ = 350 mm
- ⑤ - DN₂ = 400 mm
- ⑥ - DN₂ = 500 mm
- ⑦ - DN₂ = 600 mm
- ⑧ - DN₂ = 700 mm
- ⑨ - DN₂ = 800 mm
- ⑩ - DN₂ = 900 mm
- ⑪ - DN₂ = 1000 mm
- ⑫ - DN₂ = 1100 mm
- ⑬ - DN₂ = 1200 mm
- ⑭ - DN₂ = 1300 mm
- ⑮ - DN₂ = 1400 mm
- ⑯ - DN₂ = 1500 mm
- ⑰ - DN₂ = 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:

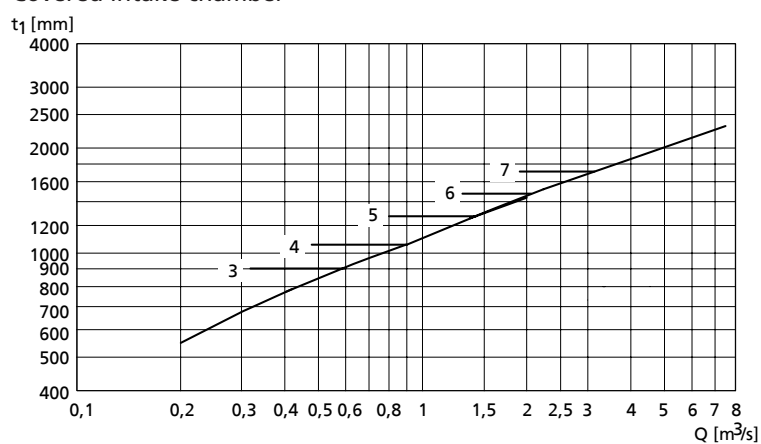
- Elbow
- Discharge pipe length = 5 x DN₂
- Swing check valve
- Outlet losses $v^2/2g$

²³ Observe the dimension.

²⁴ Value for maximum motor length

Minimum water level diagram

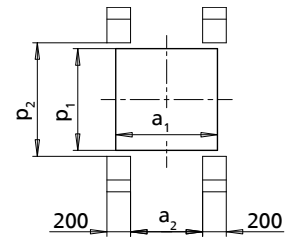
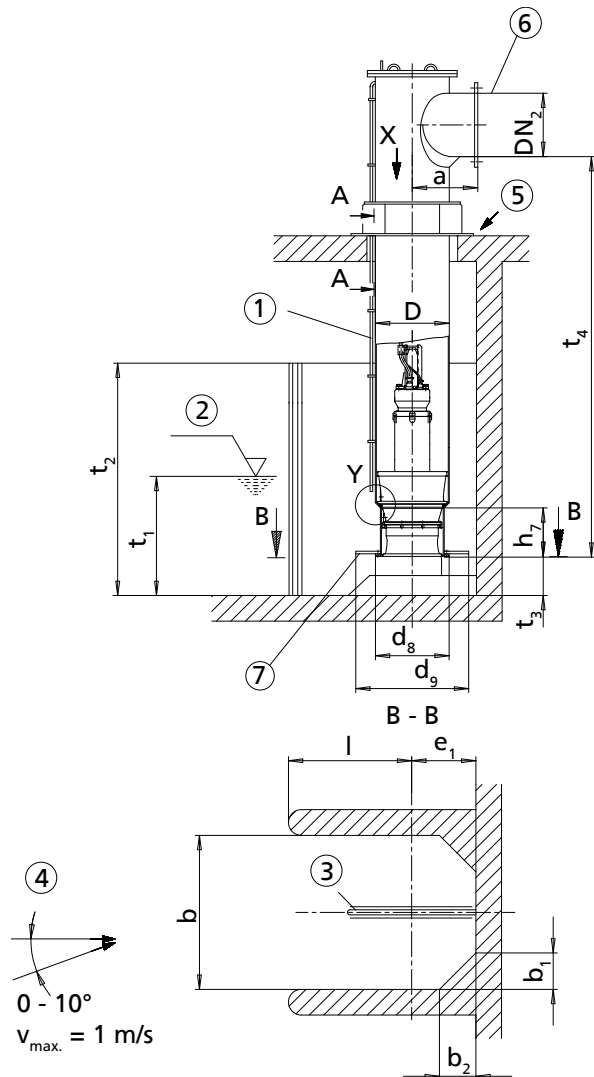
Covered intake chamber



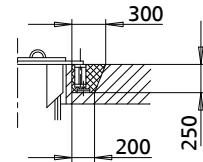
Key

- 3 - Amacan P 700 - 470
- 4 - Amacan P 800/900 - 540
- 5 - Amacan P 1000 - 700
- 6 - Amacan P 1200 - 870
- 7 - Amacan P 1500/1600 - 1060

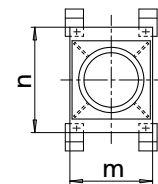
9.6.5 Installation type DU



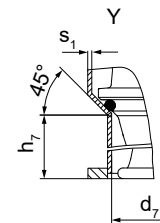
Foundation recesses²⁵⁾



Section 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 following pages)
- ③: Flow-straightening vane (⇒ Section 9.6.7, Page 128)
- ④: Approach flow
- ⑤: Not pressure-proof
- ⑥ Connect the discharge pipe to the discharge tube without transmitting any stresses or strains.
- ⑦: Suction umbrella - Option for reducing the minimum water level t_1

Table 56: Dimensions [mm]

Size	DN ₂ min.	DN ₂ max.	D	a	a ₁	a ₂	b	b ₁		b ₂	
								Suction umbrella		Suction umbrella	
								X	✓	X	✓
								d ₈	d ₉	d ₈	d ₉
700-470	400	700	711	650	860	610	1500	300	—	300	—
800-540	500	800	813	700	960	710	1800	360	—	360	—
900-540	600	900	914	760	1060	810	1800	360	—	360	—
1000-700	700	1000	1016	810	1160	910	2300	460	—	460	—
1200-870	900	1200	1220	910	1360	1110	2800	560	—	560	—
1500-1060	1200	1500	1524	1060	1670	1420	3500	700	—	700	—
1600-1060	1300	1600	1625	1110	1770	1520	3500	700	—	700	—

²⁵⁾ All dimensions for foundation recesses apply to discharge tube design without intermediate flange.

Table 57: Dimensions [mm]

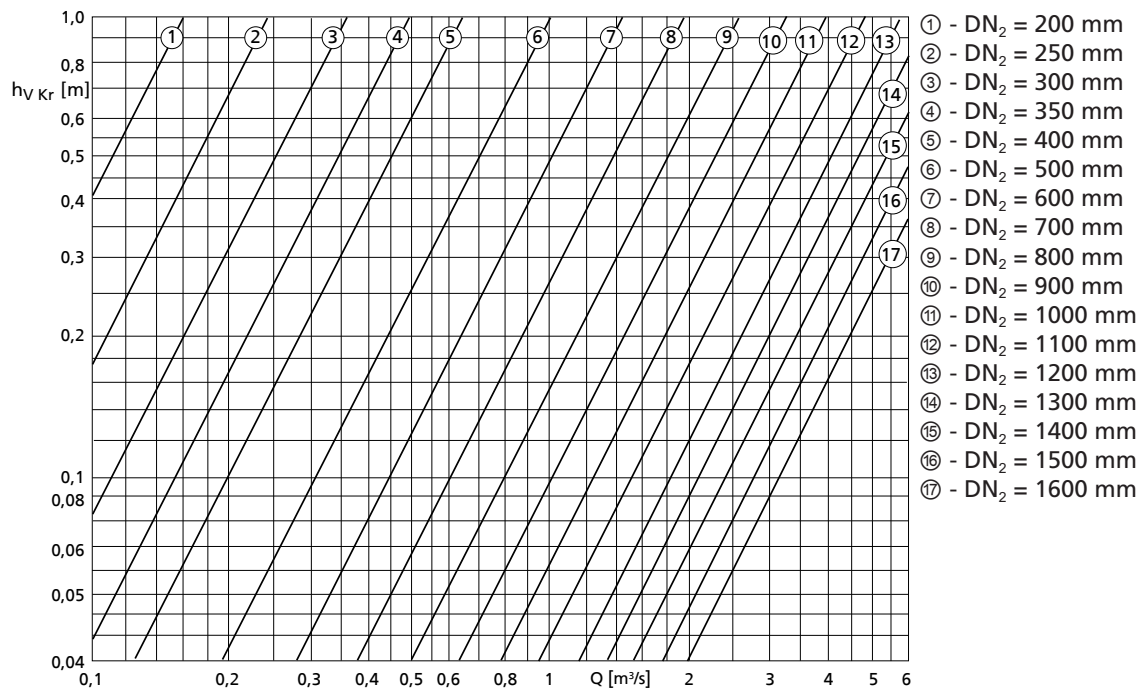
Size	d ₇	d ₈	d ₉	e ₁ ²⁶⁾		h ₇	l _{min.}	m	n	p ₁	p ₂	t ₃ ²⁶⁾	t _{4 min.} ²⁷⁾
				Suction umbrella									
				✗	✓								
				d ₈	d ₉								
700-470	600	710	1100	450	650	420	1050	930	1160	860	960	380	2400
800-540	680	810	1250	500	700	525	1300	1030	1260	960	1060	440	2450
900-540	700	910	1250	550	700	515	1300	1130	1360	1060	1160	440	2650
1000-700	880	1015	1600	600	900	765	1700	1240	1500	1160	1260	560	3250
1200-870	1070	1220	2000	700	1100	1000	2100	1440	1700	1360	1460	680	4000
1500-1060	1330	1520	2450	850	1300	1460	2650	1760	2010	1670	1770	860	4050
1600-1060	1420	1620	2450	900	1300	1230	2600	1870	2130	1770	1870	860	4450

t₂ = 1.1 × water level, maximum 2 × t₁
Height of corner lining (b₁ and b₂) like t₂

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

Loss diagram



Calculation formulas:

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

ΔH_v

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

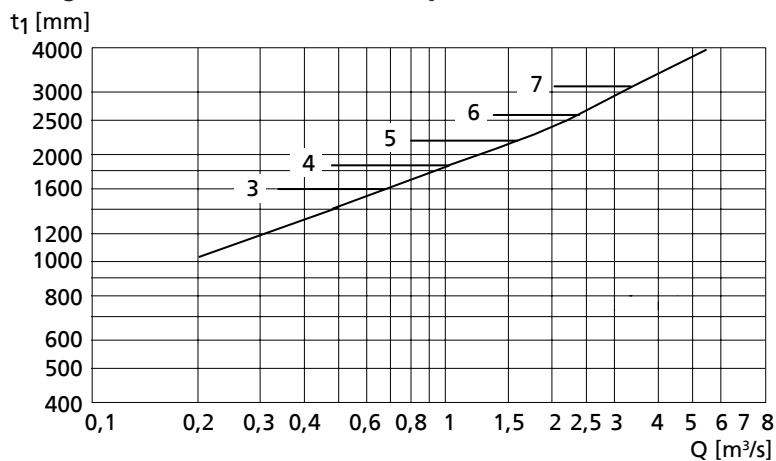
$H_{v \text{ System}}$ must be determined for the specific system.

²⁶ Observe the dimension.

²⁷ Value for maximum motor length

Minimum water level diagrams

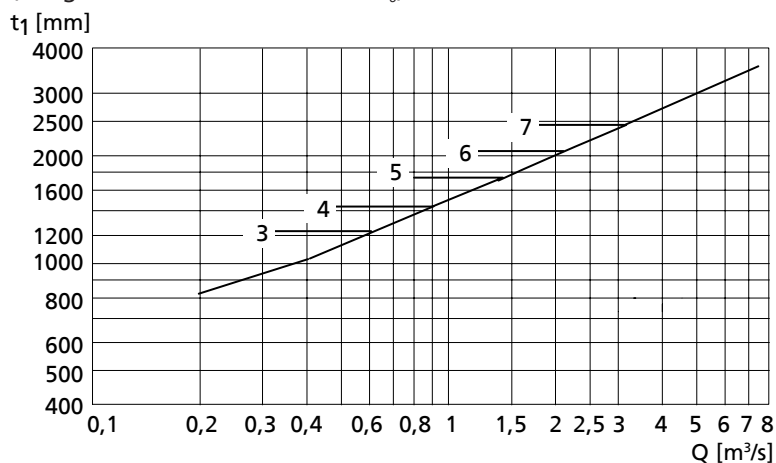
Open intake chamber
(design without suction umbrella $\varnothing d_8$)



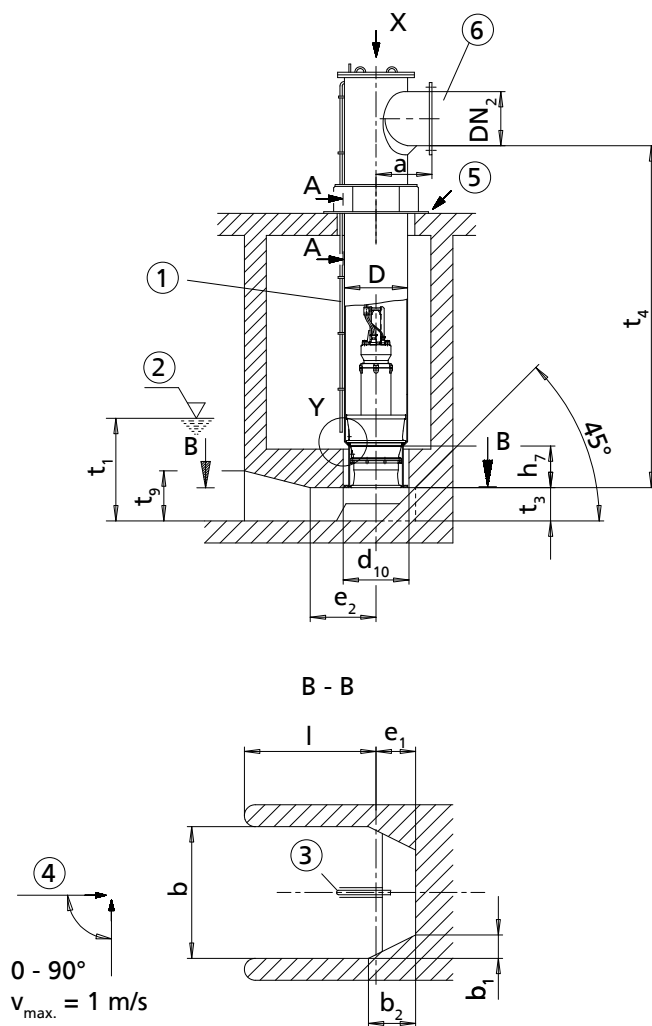
Key

- 3 - Amacan P 700 - 470
- 4 - Amacan P 800/900 - 540
- 5 - Amacan P 1000 - 700
- 6 - Amacan P 1200 - 870
- 7 - Amacan P 1500/1600-1060

Open intake chamber
(design with suction umbrella $\varnothing d_9$)



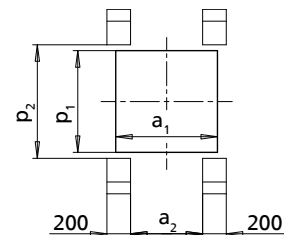
9.6.6 Installation type DG



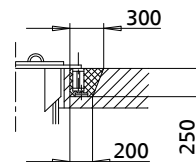
- ①: Vent line
- ②: Minimum water level (values see diagram on the following pages)
- ③: Flow-straightening vane (⇒ Section 9.6.7, Page 128)
- ④: Approach flow
- ⑤: Not pressure-proof
- ⑥: Connect the discharge pipe to the pump without transmitting any stresses or strains.

Table 58: Dimensions [mm]

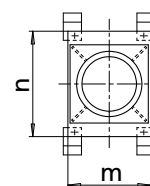
Size	DN _{2 min.}	DN _{2 max.}	D	a	a ₁	a ₂	b	b ₁	b ₂	d ₇	d ₈	d ₁₀
700-470	400	700	711	650	860	610	1500	300	600	600	710	740
800-540	500	800	813	700	960	710	1800	360	720	680	810	860
900-540	600	900	914	760	1060	810	1800	360	720	700	910	960
1000-700	700	1000	1016	810	1160	910	2300	460	920	880	1015	1080
1200-870	900	1200	1220	910	1360	1110	2800	560	1120	1070	1220	1290
1500-1060	1200	1500	1524	1060	1670	1420	3500	700	1400	1330	1520	1600
1600-1060	1300	1600	1625	1110	1770	1520	3500	700	1400	1420	1620	1700



Foundation recesses²⁸⁾



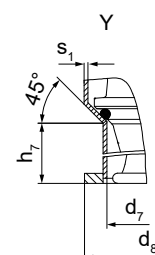
Section A - A:



Detailed view X:

Support plate of the discharge tube

Drawing: without pump



Detailed view Y:

seating ring

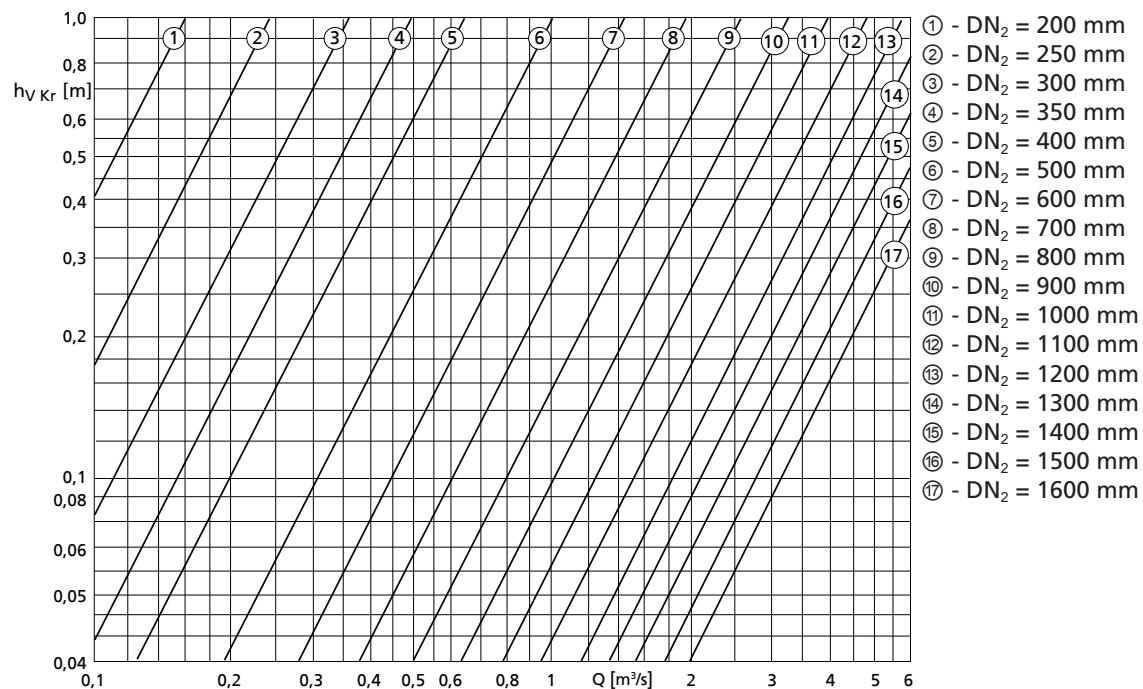
²⁸⁾ All dimensions for foundation recesses apply to discharge tube design without intermediate flange.

Table 59: Dimensions [mm]

Size	$e_1^{29)}$	e_2	h_7	$l_{min.}$	m	n	p_1	p_2	$t_3^{29)}$	$t_{4 min.}^{30)}$	t_9
700-470	450	750	420	1500	930	1160	860	960	380	2400	570
800-540	519	900	525	1800	1030	1260	960	1060	440	2450	660
900-540	519	900	515	1800	1130	1360	1060	1160	440	2650	660
1000-700	673	1150	765	2300	1240	1500	1160	1260	560	3250	850
1200-870	833	1400	1000	2800	1440	1700	1360	1460	680	4000	1050
1500-1060	1048	1750	1460	3500	1760	2010	1670	1770	860	4050	1320
1600-1060	1048	1750	1230	3500	1870	2130	1770	1870	860	4450	1320

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 ISO 7005/2, DIN 2501 PN6

Loss diagram


Calculation formulas:

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

$$\Delta H_v$$

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

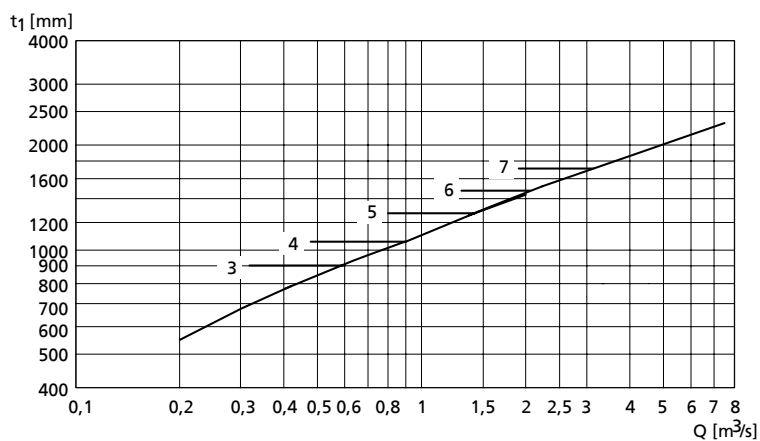
$H_{V System}$ must be determined for the specific system.

²⁹ Observe the dimension.

³⁰ Value for maximum motor length

Minimum water level diagram

Covered intake chamber



Key

- 3 - Amacan P 700 - 470
- 4 - Amacan P 800/900 - 540
- 5 - Amacan P 1000 - 700
- 6 - Amacan P 1200 - 870
- 7 - Amacan P 1500/1600 - 1060

9.6.7 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.

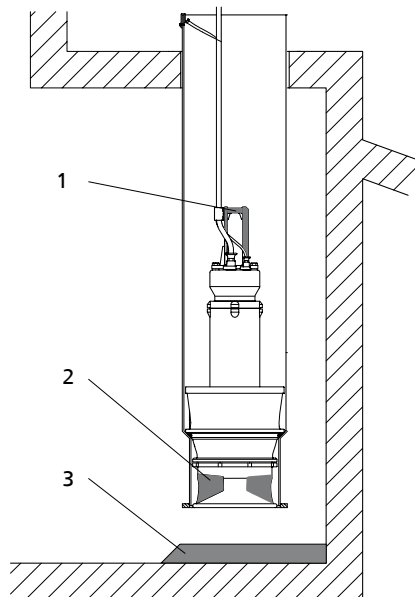
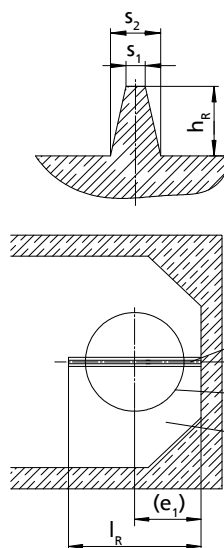


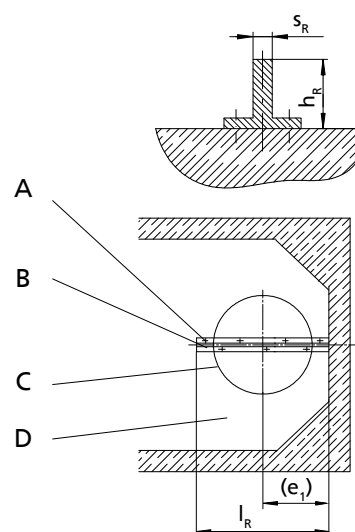
Fig. 65: Installation position of the pump set

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

Variant 1
Flow-straightening vane cast from concrete



Variant 2
Steel section



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 60: Dimensions [mm]

Size	h_R	s_1	s_2	s_R	(e_1)		$l_R^{31)}$	
					Suction umbrella		Suction umbrella	
					$\times$	$\checkmark$	$\times$	$\checkmark$
					d_8	d_9	d_8	d_9
500-270	120	15	60	10	350	400	670	720
600-350	190	20	70	10	400	500	875	940
700-470	230	25	90	10	450	650	1000	1200
800-540	265	25	100	12	500	700	1165	1300
900-540	265	25	100	12	550	700	1165	1300
1000-700	335	30	120	12	600	900	1375	1675
1200-870	410	30	120	12	700	1100	1650	2050
1500-1060	515	40	140	12	850	1300	2050	2500
1600-1060	515	40	140	12	900	1300	2050	2500

Installation types BG, CG, DG

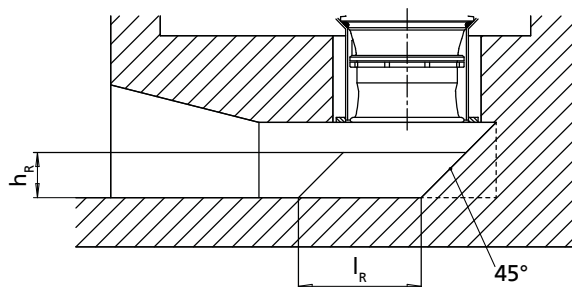


Fig. 66: Flow-straightening vane for covered intake chamber

Table 61: Dimensions [mm]

Size	h_R	s_1	s_2	s_R	l_R
500-270	120	15	60	10	430
600-350	190	20	70	10	545
700-470	230	25	90	10	650
800-540	265	25	100	12	740
900-540	265	25	100	12	790
1000-700	335	30	120	12	940
1200-870	410	30	120	12	1150
1500-1060	515	40	140	12	1450
1600-1060	515	40	140	12	1500

³¹ Adjust length l_R of the flow straightening vane to the 45° angle of the intake chamber.

10 UK Declaration of Conformity

Manufacturer:

KSB SE & Co. KGaA
Johann-Klein-Straße 9

67227 Frankenthal (Germany)

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

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

Amacan K, Amacan P, Amacan S

KSB order number:

- is in conformity with the provisions of the following directives / regulations as amended from time to time:
 - Pump (set): Supply of Machinery (Safety) Regulations 2008
 - Electrical components³²⁾: The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012

The manufacturer also declares that

- the following *designated standards*³³⁾ have been applied:
 - ISO 12100
 - EN 809
 - EN 60034-1, EN 60034-5/A1

Person authorised to compile the technical file:

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

The UK Declaration of Conformity was issued in/on:

Place, date

.....³⁴⁾.....

Name
 Function
 Company
 Address

³²⁾ Where applicable

³³⁾ Apart from the standards listed here referring to the *Supply of Machinery (Safety) Regulations 2008*, further standards are observed for explosion-proof versions (*Equipment and Protective Systems Intended for use in Potentially Explosive Atmospheres Regulations 2016*) as applicable and are listed in the legally binding UK Declaration of Conformity.

³⁴⁾ A signed, legally binding UK Declaration of Conformity is supplied with the product.

11 Certificate of Decontamination

Type:
Order number /
Order item number³⁵:
Delivery date:
Application:
Fluid handled³⁵:

Please tick where applicable³⁵:



Corrosive



Oxidising



Flammable



Explosive



Hazardous to health



Seriously hazardous to health



Toxic



Radioactive



Bio-hazardous



Safe

Reason for return:³⁵:
Comments:
.....

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

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

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

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

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

.....
.....

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

.....
Place, date and signature

.....
Address

.....
Company stamp

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