



AmaCan P

NEMA

AmaCan P 400 - 290

AmaCan P 500 - 325

AmaCan P 600 - 351

AmaCan P 700 - 471

AmaCan P 800 - 471

Installation/Operating Manual



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Installation/Operating Manual AmaCan P

Original operating manual

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Glossary

Certificate of decontamination

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

Close-coupled design

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

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 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)
General arrangement drawing / outline drawing	Description of mating dimensions and installation dimensions for 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
Parameter list ¹⁾	Parameterization list for the frequency inverter (for motor versions UW/XW)

For accessories and/or integrated machinery components observe the product literature of the corresponding manufacturer.

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 If included in agreed scope of supply

Symbol	Description
1. 2.	Step-by-step instructions
	Note Recommendations and important information on how to handle the product

1.6 Key to safety symbols/markings

Table 3: Definition of safety symbols/markings

Symbol	Description
	DANGER This signal word indicates a high-risk hazard which, if not avoided, will result in death or serious injury.
	WARNING This signal word indicates a medium-risk hazard which, if not avoided, could result in death or serious injury.
	CAUTION This signal word indicates a hazard which, if not avoided, could result in damage to the machine and its functions.
	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.
	Warning: Strong magnetic field In conjunction with one of the signal words this symbol indicates a hazard involving magnetic fields and identifies information about protection against magnetic fields.
	Warning for persons with pacemaker In conjunction with one of the signal words this symbol indicates a hazard involving magnetic fields and identifies special information for persons with a pacemaker.



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 which are not taken into account.

2.2 Intended use

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

2.3 Personnel qualification and personnel training

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

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

Deficits in knowledge must be rectified by sufficiently trained specialist personnel training and instructing the personnel who will carry out the respective tasks. If required, the operator can commission the manufacturer/supplier to train the personnel.

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

2.4 Consequences and risks caused by non-compliance with these operating instructions

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

2.5 Safety awareness

In addition to the safety information contained in this 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 authorized by the manufacturer. The use of other parts/components can invalidate any liability of the manufacturer for resulting damage.
- The operator ensures that maintenance, inspection and installation is performed by authorized, qualified specialist personnel who are thoroughly familiar with the manual.
- Only carry out work on the pump (set) during standstill of the pump.
- Only perform work on the pump set when it has been disconnected from the power supply (de-energized).
- The pump (set) must have cooled down to ambient temperature.
- Pump pressure must have been released and the pump must have been drained.
- When taking the pump set out of service always adhere to the procedure described in the manual. (⇒ Section 6.3, Page 61)
- Decontaminate pumps which handle fluids posing a health hazard. (⇒ Section 7.3.2, Page 70)

- 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 57)
- The rotor of motor versions UW/XW is fitted with strong permanent magnets.
- For storing, transporting, dismantling or reassembling the magnet rotor observe the following special safety information.
 - Users of electronic or magnetizable aids, e.g. pacemakers, hearing aids, implants, etc. must not perform any work in the vicinity of the rotor. Keep a safety distance of at least 1.6 ft (0.5 m).
 - Mark the working area with special warnings.
 - Metal tools, keys, jewelry and similar items can be attracted by the magnetic force.
 - Electronic devices and data carriers, such as bank cards, security passes, etc. can become damaged in the vicinity of the magnet rotor.
 - The magnet rotor must only be machined (e.g. turned, milled, ground) by trained specialist personnel.

A permanent magnet synchronous motor generates voltage as soon as the shaft rotates.

- Prior to connecting the motor to the power supply, ensure that the shaft cannot be rotated.

2.8 Unauthorized 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

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

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

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.

2.10 Magnet rotor

	! DANGER Strong magnetic field in the pump rotor area Danger of death for persons with pacemaker! Interference with magnetic data carriers, electronic devices, components and instruments! Uncontrolled magnetic attraction forces between magnet-equipped components, tools or similar! ► Keep a safety distance of at least 1.6 ft (0.5 m).
---	---

Distance to pump sets

The safety distance refers to magnet-equipped rotors not yet installed in the pump set as well as to loose magnets, e.g. during assembly or dismantling of the motor. Only pump sets with motor version UW or XW have got rotors with permanent magnets.

In installed condition the magnetic field is fully shielded so that an assembled pump set does not pose a hazard as a result of magnetic fields (even to persons with pacemaker), neither during standstill nor during operation.

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 distributor and the insurance company about the damage in writing immediately.

3.2 Transport

	⚠ DANGER Improper transport Danger to life from falling parts! Damage to the pump set! ▷ Use the attachment point provided for attaching the lifting accessory. ▷ Never 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 set to the place of installation

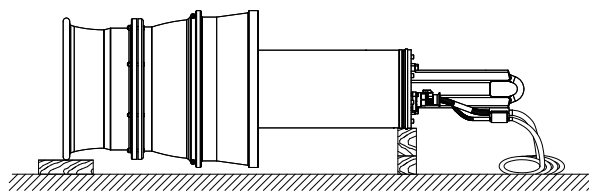


Fig. 1: Transporting the pump set in its original packaging

- 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 centers of gravity and/or attachment points on the transport boxes.
 For the weight refer to the name plate or data sheet.

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 away. ▷ Maintain a safe distance during lifting operations. The 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 entry to prevent permanent deformation. ▷ Only remove the protective caps from the electric cables at the time of installation.

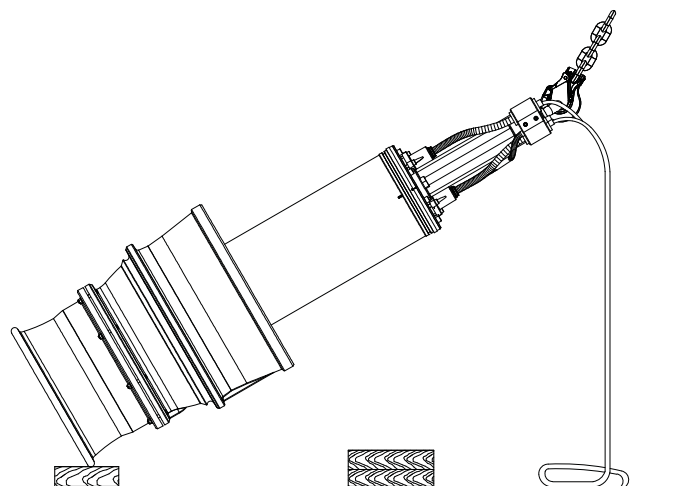


Fig. 2: Using one piece of lifting equipment to place the pump set in a vertical position

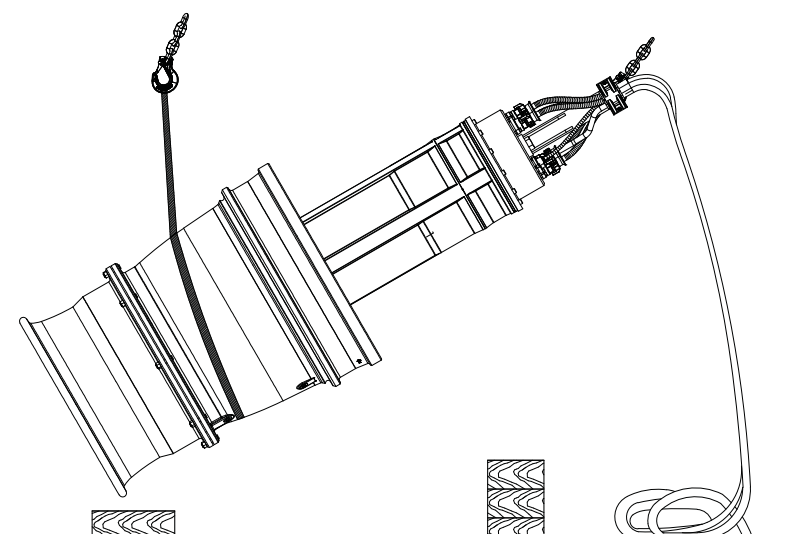


Fig. 3: Using two pieces of lifting equipment to place the pump set in a vertical position

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

1. a) If using one piece of lifting equipment: Attach the crane hook to the bail of the pump set.
b) If using two pieces of lifting equipment: Attach the crane hook of one crane to the bail of the pump set **and** loop a rope around the pump set and attach it to the crane hook of the second crane.
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.
	⚠ 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 away. ▷ Maintain a safe distance during lifting operations. The load may swing when being lifted. ▷ Use additional supports for the transport holder to secure it against tilting.

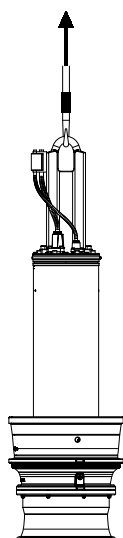


Fig. 4: Transporting the pump set in a vertical position

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 entry 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 the pump (set)! ▷ For outdoor storage cover the pump (set) or the packaged pump (set) and accessories with waterproof material.
	CAUTION Wet, contaminated or damaged openings and connections Leakage or damage to the pump! ▷ Clean and cover pump openings and connections as required prior to putting the pump into storage.

Table 4: Ambient conditions for storage

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

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

	NOTE Observe the manufacturer's instructions for application/removal of the preservative.
---	---

3.4 Return to supplier

1. Drain the pump as per operating instructions. (⇒ Section 7.3.2, Page 70)
2. Flush and clean the pump, particularly if it has been used for handling noxious, explosive, hot or other hazardous fluids.
3. If the pump has handled fluids whose residues could lead to corrosion damage in the presence of atmospheric humidity or could ignite upon contact with oxygen, the pump must also be neutralized, and anhydrous inert gas must be blown through the pump to ensure drying.
4. Always complete and enclose a certificate of decontamination when returning the pump.
Indicate any safety measures and decontamination measures taken.
(⇒ Section 10, Page 195)



NOTE

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

3.5 Disposal



DANGER

Strong magnetic field in the pump rotor area

Danger of death for persons with pacemaker!

Interference with magnetic data carriers, electronic devices, components and instruments!

Uncontrolled magnetic attraction forces between magnet-equipped components, tools or similar!

- ▷ Keep a safety distance of at least 1.6 ft (0.5 m).
- ▷ Observe the additional instructions. (⇒ Section 2.10, Page 12)



WARNING

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

Hazard to persons and the environment!

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

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

4 Description of the Pump (Set)

4.1 General description

- Submersible pump in discharge tube

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

4.2 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 PA3 400-290 / 15 6 UW G1 IE4

Table 5: Designation key

Code	Description	
AmaCan	Type series	
P	Impeller type	
	P	Propeller
A	Impeller variant	
	A	
3	Number of blades	
	3	
	4	
400	Nominal diameter of the discharge tube [mm]	
290	Nominal impeller diameter [mm]	
15	Motor size	
6	Number of motor poles	
UW	Motor version	
	UT, UV	Three-phase asynchronous motor, non-explosion-proof
	XT, XV	Three-phase asynchronous motor, explosion-proof
	UW	Three-phase synchronous motor, non-explosion-proof
	XW	Three-phase synchronous motor, explosion-proof
G1	Material variant	
	G1	Gray cast iron, standard material variant
	G2	Gray cast iron, casing wear ring made of stainless steel
	G3	Gray cast iron with Zn anodes, shaft made of A 276 type 431 stainless steel
IE4	Motor efficiency classification ²⁾	
	— ³⁾	No efficiency classification
	IE3	Premium Efficiency
	IE4	Super Premium Efficiency

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

4.4 Name plate

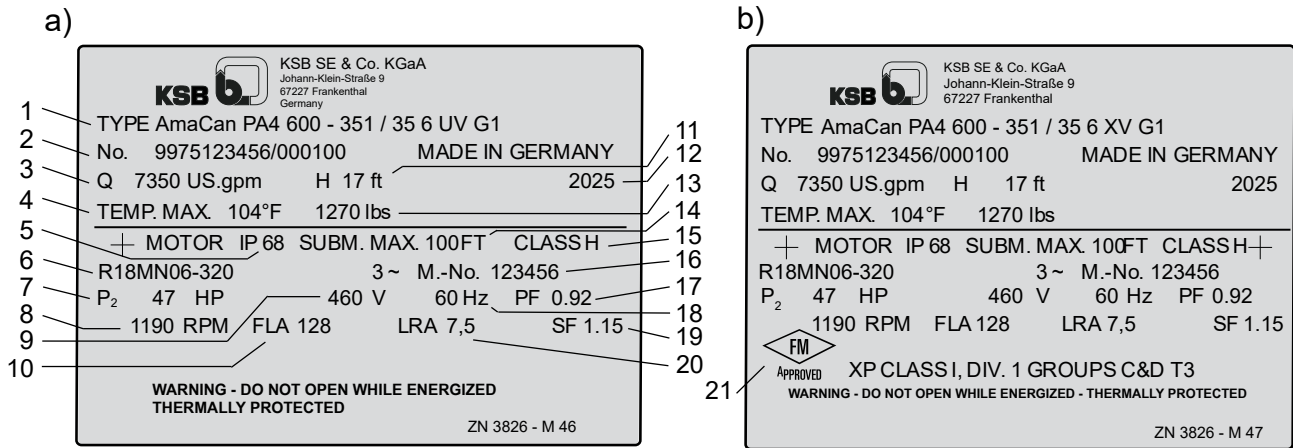


Fig. 5: Name plate (example) a) Standard pump set b) Explosion-proof pump set

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	Service factor	20	Starting current
21	Explosion protection marking		

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

- Motor versions UT, UV, XT, XV
 - Three-phase asynchronous squirrel-cage motor
 - Motors integrated in explosion-proof pump sets are supplied in Explosionproof Class I Division 1, Groups C&D, T3.
- Motor versions UW, XW
 - Three-phase synchronous motor with permanent-magnet rotor
 - Motors integrated in explosion-proof pump sets are supplied in Explosionproof Class I Division 1, Groups C&D, T3.

Shaft seal

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

Impeller type

- Axial propeller in ECB design⁴⁾

Bearings

- Grease-packed rolling element bearings

Monitoring equipment

Various sensor packages are available for pump/pump set monitoring:

- **Basic**
 - Motor temperature monitoring (PTC thermistor)
 - Leakage sensor in the motor space
 - Mechanical seal leakage sensor (float switch)
 - Bearing temperature monitoring, pump end (Pt100)⁵⁾
- **Basic+⁶⁾**
 - Motor temperature monitoring (PTC thermistor)
 - Leakage sensor in the motor space
 - Mechanical seal leakage sensor (float switch)
 - Bearing temperature monitoring, drive end (Pt100)⁷⁾
 - Bearing temperature monitoring, pump end (Pt100)
- **Premium**
 - Motor temperature monitoring (PTC thermistor)
 - Leakage sensor in the motor space
 - Mechanical seal leakage sensor (float switch)
 - Bearing temperature monitoring, drive end (Pt100)
 - Bearing temperature monitoring, pump end (Pt100)
 - Vibration monitoring
 - Motor temperature measurement (Pt100)

The sensor information can optionally be evaluated via AmaControl using the live diagnosis function:

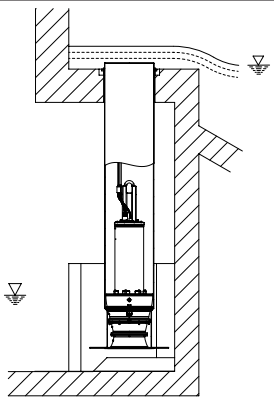
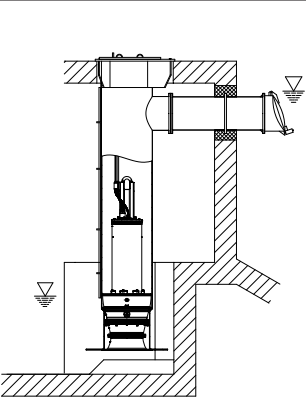
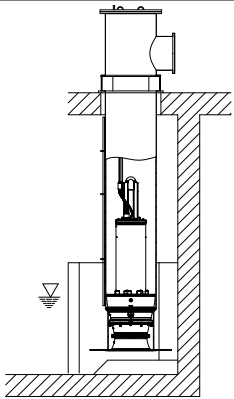
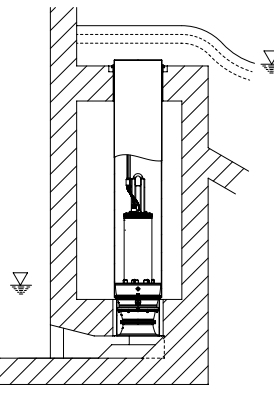
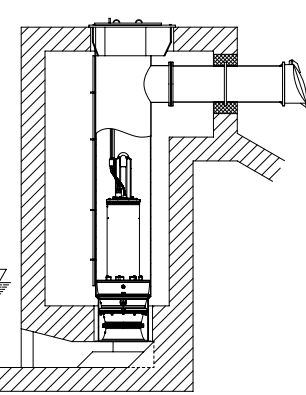
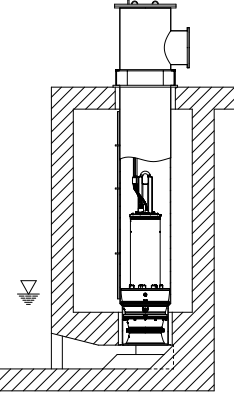
- Directly on site with the KSB INTspecter app
- In additional external systems via ModBus

4.6 Installation types

Nine design variants are available⁸⁾:

-
- 4** ECB = Self-cleaning blade profile (EverCleanBlade)
 - 5** Exception: Size 400-290 is not fitted with pump-end bearing temperature monitoring.
 - 6** Exception: Sizes 500-325 and 600-351 are not available with the sensor package Basic+.
 - 7** Exception: Size 400-290 is not fitted with drive-end bearing temperature monitoring.
 - 8** For information on the various designs (foundation dimensions, intake chamber, etc.) refer to the general arrangement drawings.

Table 6: Overview of installation types

		
BU ⁹ /BUS ¹⁰ discharge tube	CU ⁹ /CUS ¹⁰ discharge tube	DU ⁹ /DUS ¹⁰ discharge tube
Overflow design for installation in open intake chamber	Design with underfloor discharge line for installation in open intake chamber	Design with above floor discharge nozzle for installation in open intake chamber
		
BG ⁹ discharge tube	CG ⁹ discharge tube	DG ⁹ discharge tube
Overflow design for installation in covered intake chamber for low suction-side water levels	Design with underfloor discharge line for installation in covered intake chamber for low suction-side water levels	Design with above-floor discharge nozzle for installation in covered intake chamber for low suction-side water levels

⁹ Design without suction umbrella

¹⁰ Design with suction umbrella

4.7 Configuration and function

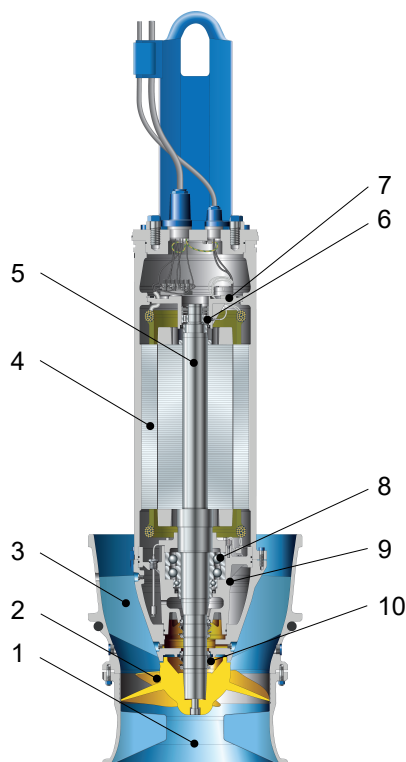


Fig. 6: AmaCan with axial propeller

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 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. The rotational movement diverts the fluid flow into an axial flow. The shaft passage through the casing is sealed towards the fluid with a shaft seal (10). The shaft (5) runs in two rolling element bearings (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 chamber in-between the seals ensures cooling and lubrication of the mechanical seals.

Monitoring equipment Standard

- Sensor package Basic

Option

- Sensor package Basic+
- Sensor package Premium with sensor system

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
- AmaControl 5 monitoring system

Optional accessories:

- Support rope
- Accessories for installing the cable guide:
 - Spacer
 - 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 KSB's scope of supply.
Attach this name plate 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 please refer to the name plate or data sheet of the pump set.

5 Installation at Site

5.1 Safety regulations

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

Lifting ropes and/or components can be made of plastic with low electrical conductivity that can, in principle, become electrostatically charged.

When such materials are used in potentially explosive atmospheres, a systematic electrostatic charging mechanism has to be ruled out.

If the system design and its inherent boundary conditions are such that a foreseeable electrostatic charging mechanism is created, using lifting ropes and/or plastic components with low electrical conductivity is impermissible in potentially explosive atmospheres.

	 DANGER
	Electrostatic charging of plastic components (e.g. lifting rope) Explosion hazard by electrostatic discharge! ▷ Make sure that no foreseeable electrostatic charging occurs that may cause the lifting ropes and/or plastic components to become electrostatically charged. ▷ If a foreseeable electrostatic charging mechanism exists, using lifting ropes and/or plastic components with low electrical conductivity is impermissible in potentially explosive atmospheres.

5.2.2 Checking the operating data

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

Back-up name plate

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

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

5.2.3 Checking the lubricant of the mechanical seal

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

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

Visual inspection for signs of oil leakage

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

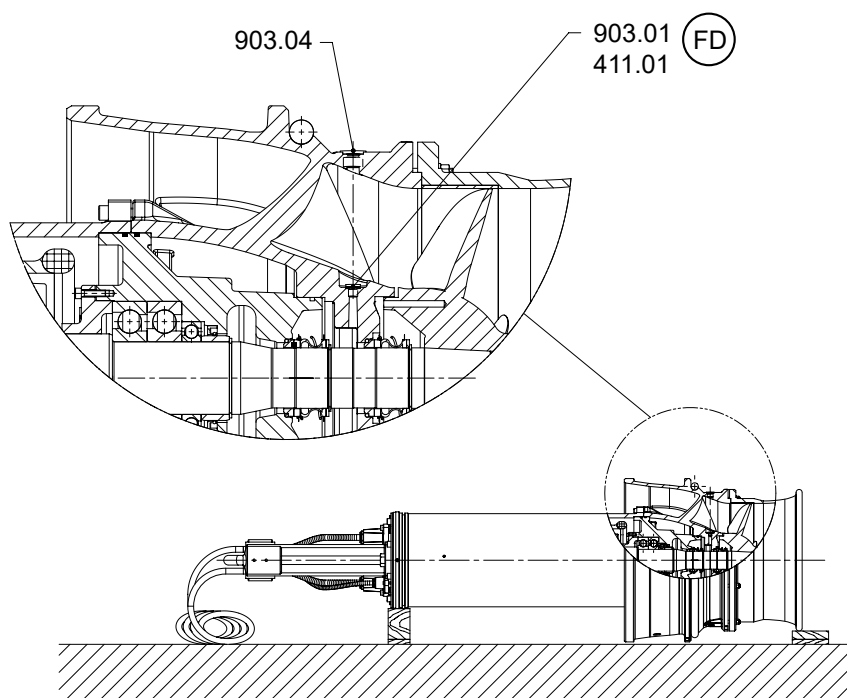


Fig. 7: Checking the lubricant level

Table 7: Key to the symbols

Symbol	Key
	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. Secure it against rolling away.
(⇒ Section 3.2.2, Page 13)
2. When placing it down, make sure that screw plug 903.04 is on top.
3. Remove screw plug 903.04.
4. Remove screw plug 903.01 and joint ring 411.01.
5. Shine a torch through the hole in the pump bowl to inspect the opening of the lubricant chamber.
 - ⇒ 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 903.04.
 - ⇒ If the lubricant level is below the opening, top up the lubricant.
6. Re-insert and tighten screw plug 903.01 with new joint ring 411.01.
7. Re-insert and tighten screw plug 903.04.



NOTE

If the remaining liquid lubricant equals less than 50 % of the required lubricant quantity (⇒ Section 7.4.1.3, Page 73) , this suggests a defect of the mechanical seals.

5.2.4 Checking the direction of rotation



DANGER

Pump set running dry

Explosion hazard!

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

	! WARNING Improper handling when placing the pump set in a vertical / horizontal position Personal injury and damage to property! ▷ 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 away. ▷ Maintain a safe distance during lifting operations. The 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 without the fluid to be handled for more than 60 seconds.

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/even surface and secure it sufficiently against tipping over. (⇒ Section 3.2.2, Page 13)
2. Connect the pump set to the power supply, parameterize the frequency inverter (if applicable), and start up the pump set.
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 rotates 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 direction of rotation is incorrect:
 - ⇒ Check the electrical connection and the control system (if any).
 - ⇒ For pump sets with frequency inverter: De-energize the frequency inverter.
 - ⇒ Check the direction of rotation again.
5. If the direction of rotation is correct, mark which core ends match which of the terminals in the control cabinet.
6. Disconnect the pump set from the power supply and secure it against unintentional start-up.

	! WARNING
	Unintentional starting of pump set Risk of injury by moving components and shock currents! ▷ Make sure that the pump set cannot be started up unintentionally. ▷ Always make sure the electrical connections are disconnected before carrying out work on the pump set.

5.3 Lowering the pump set into the discharge tube

	! DANGER
	Improper transport Danger to life from falling parts! Damage to the pump set! ▷ Use the attachment point provided for attaching the lifting accessory. ▷ Never 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 given in the data sheet and on the pump/motor name plates.

	! WARNING
	Incorrect handling of the electric cable Personal injury and damage to property! ▷ Secure electric cables against falling down. ▷ Avoid electric cables being laid on surfaces without fastening. ▷ When moving the pump set keep at a safe distance to the electric cables.



! WARNING

People falling into the unsecured discharge tube

Risk of personal injury!

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

5.3.1 Information on 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. For 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.

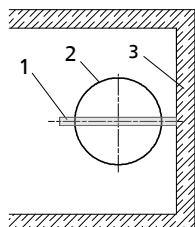


Fig. 8: Installation position of the flow-straightening vane

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).

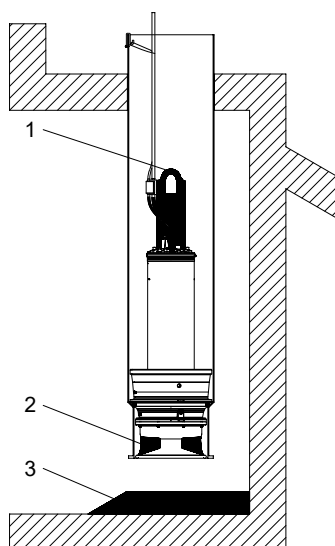


Fig. 9: Installation position of the pump set

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

5.3.2 Installation without lifting rope

	CAUTION Incorrect installation Damage to the pump set! ▸ Verify that the pump set sits correctly on the bottom of the discharge tube.
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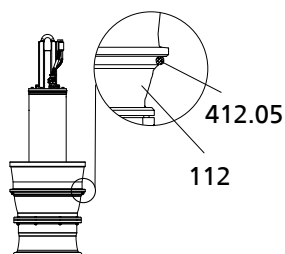


Fig. 10: Inserting the O-ring

Refer to and comply with the general arrangement 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. Center the pump set above the discharge tube. Slowly lower the pump set into the discharge tube until it is seated in the recommended position.
(⇒ Section 5.3.1, Page 30)
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.

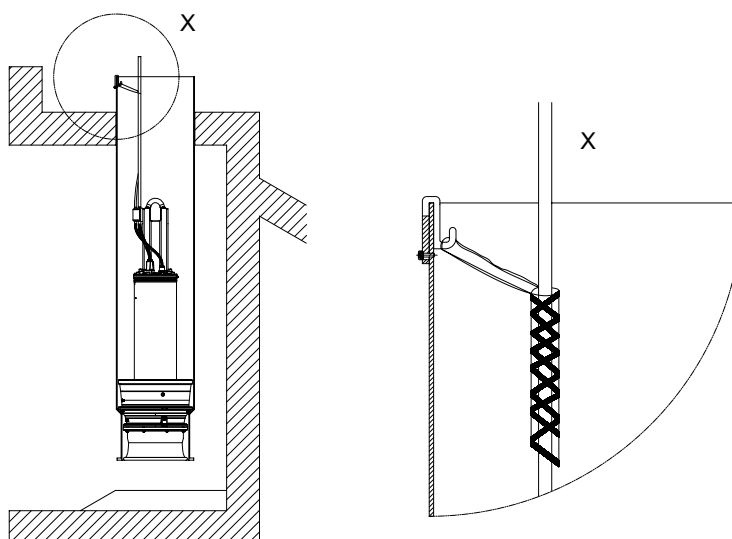


Fig. 11: Fastening the cable support sleeve

5.3.3 Installation with lifting rope

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

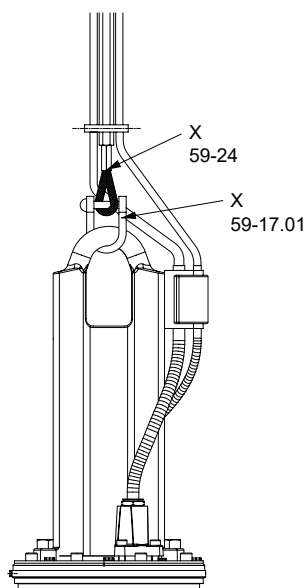


Fig. 12: X = indication of load-carrying capacity

59-24	Lifting rope
59-17.01	Shackle

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

	CAUTION Incorrect installation Damage to the pump set! ▸ Verify that the pump set sits correctly on the bottom of the discharge tube.
	WARNING Pump set drops during the installation or removal process Personal injury and damage to property! ▸ Never use the turnbuckle, shackle or discharge tube cover to lift the pump set. ▸ Always use lifting lug 59-47. See illustration of the cable bundle (⇒ Section 9.3, Page 123)
	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.

- ✓ One piece of suitably sized lifting equipment with at least two fastening points or two suitably sized pieces of lifting equipment are available.
- ✓ The lifting rope has been visually inspected.
- ✓ The split pin of the turnbuckle has been checked for any damage.

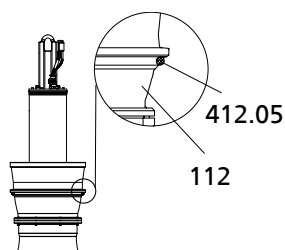


Fig. 13: Inserting the O-ring

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

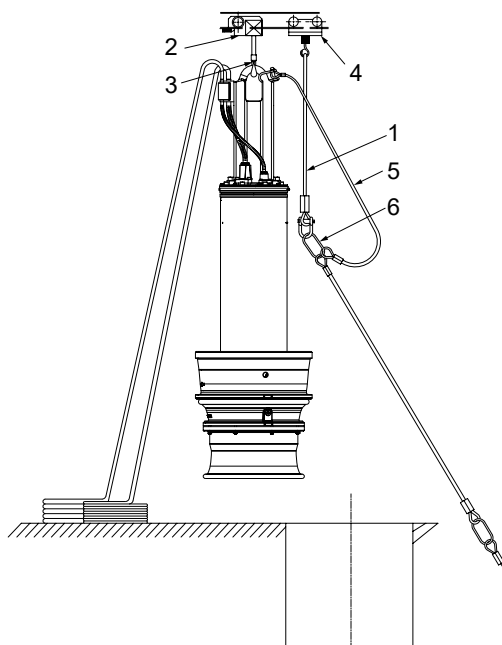


Fig. 14: Lifting and positioning the pump set

2. Secure the lifting chain or lifting rope (1) to the trolley (4) of the lifting equipment (2).
3. Attach the crane hook (3) to the bail.
4. Attach the lifting rope (5) to the bail by its shackle. (⇒ Section 9.3, Page 123)
 - ⇒ Make sure that the lifting rope is arranged correctly. The free lifting lug (6) has to point away from the pump set.
 - ⇒ For a galvanized shackle, secure the pin at the shackle with Loctite 243.
 - ⇒ For a stainless steel shackle, undo and tighten the pin twice and secure it with Loctite 243.
5. Partially unwind the lifting rope and power cables.
6. Attach the first lifting lug (6) to the lifting rope (1).
7. Lower the pump set into the discharge tube until the bail is in an accessible position, protruding from the discharge tube, and the pump set is suspended from the lifting rope (1).
8. Securely cover the discharge tube except for a gap which allows work to continue.
9. Unclip the crane hook (3) of the lifting equipment from the bail. Move the lifting equipment up higher.

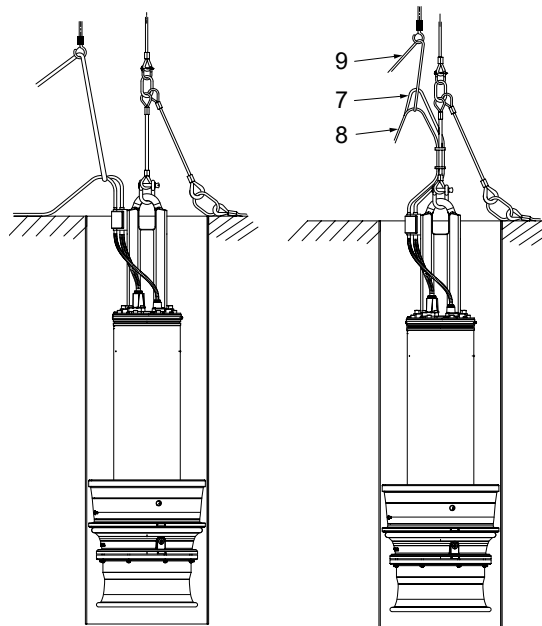


Fig. 15: Securing the power cable and sensor cable

10. Secure the sensor cable (7) and power cables (8) to the crane hook (3) of the lifting equipment with a manila rope (9).



NOTE

To prevent the power cables from chafing at the ferrules, wrapping the ferrules in self-amalgamating insulating tape is recommended.



Fig. 16: Ferrule wrapped in self-amalgamating insulating tape



Fig. 17: Spacer at ferrule

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

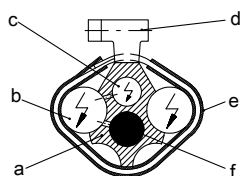


Fig. 18: Cross-section of the cable guide

12. Insert the lifting rope (f) and the sensor cable (c) into the spacer (a).

⇒ Make sure that the electric cables are in their respective ducts.

13. Tighten the power 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). Apply assembly paste to the cable clamps (d). Tighten the cable clamps hand-tight. Make sure the power cables are not crushed in this process (b) and are unable to slip out.



Fig. 19: Installation information for the cable clamps

15. Attach the crane hook (1) to the lifting lug (6) suspended from the lifting rope.

16. Attach the lifting rope to the next lifting lug.

17. Progressively lower the pump set into the discharge tube.

⇒ Secure the cable bundle with evenly spaced sheathed cable clamps until the pump set is suspended from the lifting rope (1).

18. Lay all power cables past the area of the lifting lug between the rope sections and fasten them to the rope section above.

19. Fit a heat shrink tube on any protruding sharp-edged rope ends (e.g. at the ferrule).

20. Repeat steps 17 to 19 until the pump set is located in its seat in the discharge tube.

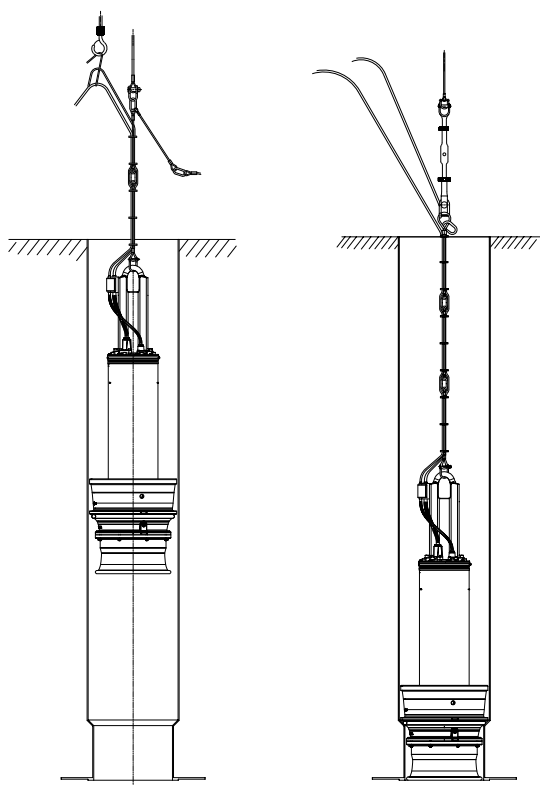


Fig. 20: Lowering the pump set

21. Attach the lifting rope with shackle and turnbuckle to a suspension loop (provided in the discharge tube or structure).
22. Secure the turnbuckle with a split pin.
 - ⇒ Insert the split pin. Bend back the two legs of the split pin in opposite directions.
 - ⇒ Attach the shackle of the turnbuckle to the upper thimble of the lifting rope. Do not attach the turnbuckle to the upper lifting lug.

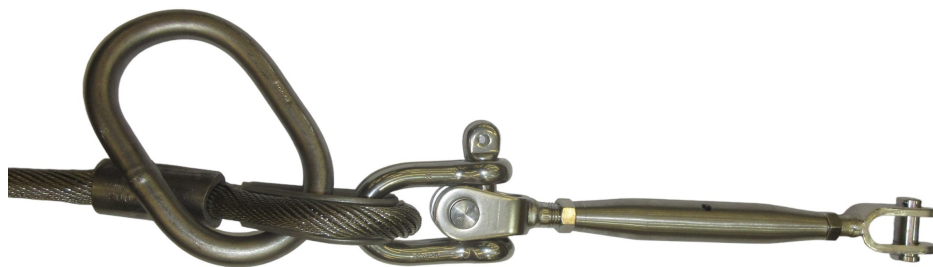


Fig. 21: Shackle/turnbuckle

23. Tighten the turnbuckle until the cable bundle is tight but does not lift the pump set off its seat.
24. Secure the turnbuckle against loosening with two locknuts.
25. Unclip the crane hook of the lifting equipment from the lifting lug. Free the power cables from the manila rope and route them to the control cabinet.
26. Tie the upper loosely suspended lifting lug to the cable bundle.
27. Remove the safety cover from the discharge tube. Fit the cover. Seal the cable entries if any.

5.3.4 Installing the pump set with a support rope and support

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

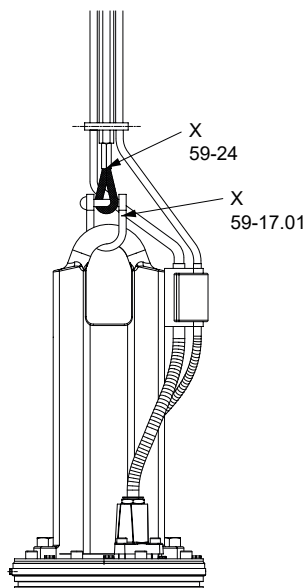


Fig. 22: X = indication of load-carrying capacity

59-24	Lifting rope
59-17.01	Shackle

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

	CAUTION
	Incorrect installation Damage to the pump set! ▸ Verify that the pump set sits correctly on the bottom of the discharge tube.
	WARNING
	Pump set drops during the installation or removal process Personal injury and damage to property! ▸ Never use the turnbuckle, shackle or discharge tube cover to lift the pump set. ▸ Always use lifting lug 59-47. See illustration of the cable bundle (⇒ Section 9.3, Page 123)
	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.

- ✓ One piece of suitably sized lifting equipment with at least two fastening points or two suitably sized pieces of lifting equipment are available.
- ✓ The support has been pre-assembled and is available.
- ✓ The lifting rope has been visually inspected.
- ✓ The split pin of the turnbuckle has been checked for any damage.

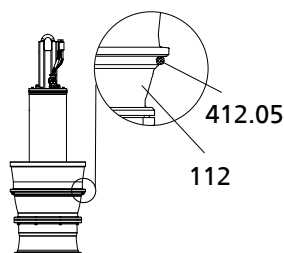


Fig. 23: Inserting the O-ring

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

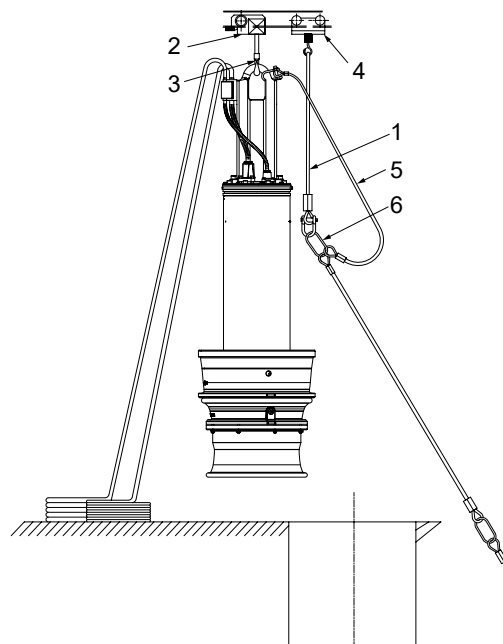


Fig. 24: Lifting and positioning the pump set

2. Secure the lifting chain or lifting rope (1) to the trolley (4) of the lifting equipment (2).
3. Attach the crane hook (3) to the bail.
4. Attach the lifting rope (5) to the bail by its shackle. (⇒ Section 9.3, Page 123)
 - ⇒ Make sure that the lifting rope is arranged correctly. The free lifting lug (6) has to point away from the pump set.
 - ⇒ For a galvanized shackle, secure the pin at the shackle with Loctite 243.
 - ⇒ For a stainless steel shackle, undo and tighten the pin twice and secure it with Loctite 243.
5. Partially unwind the lifting rope and power cables.
6. Attach the first lifting lug (6) to the lifting rope (1).
7. Lower the pump set into the discharge tube until the bail is in an accessible position, protruding from the discharge tube, and the pump set is suspended from the lifting rope (1).
8. Securely cover the discharge tube except for a gap which allows work to continue.
9. Unclip the crane hook (3) of the lifting equipment from the bail. Move the lifting equipment up higher.

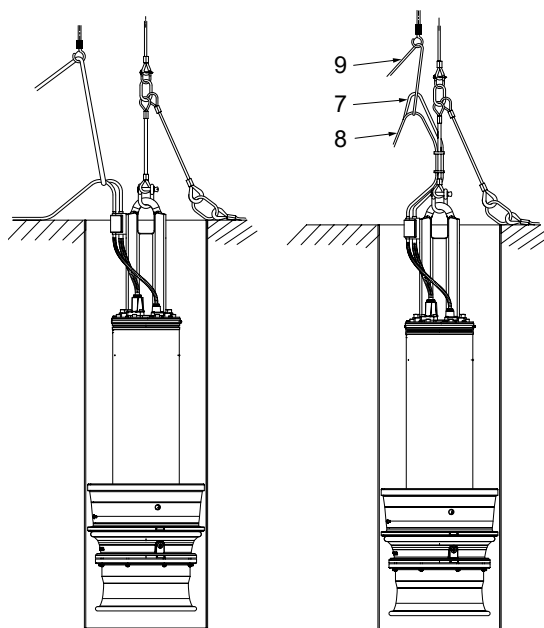


Fig. 25: Securing the power cable and sensor cable

10. Secure the sensor cable (7) and power cables (8) to the crane hook (3) of the lifting equipment with a manila rope (9).



NOTE

To prevent the power cables from chafing at the ferrules, wrapping the ferrules in self-amalgamating insulating tape is recommended.



Fig. 26: Ferrule wrapped in self-amalgamating insulating tape



Fig. 27: Spacer at ferrule

11. Trim the spacer (a) to fit between the two ferrules. If a support is used in this section, adjust the spacer (a) accordingly.

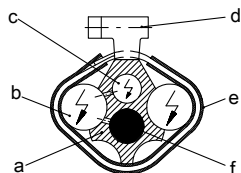


Fig. 28: Cross-section of the cable guide

12. Insert the lifting rope (f) and the sensor cable (c) into the spacer (a).

⇒ Make sure that the electric cables are in their respective ducts.

⇒ If a support is used in this rope section, observe the requirements (see general arrangement drawing).

13. Tighten the power 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). Apply assembly paste to the cable clamps (d). Tighten the cable clamps hand-tight. Make sure the power cables (b) are not crushed in this process and are unable to slip out.



Fig. 29: Installation information for the cable clamps

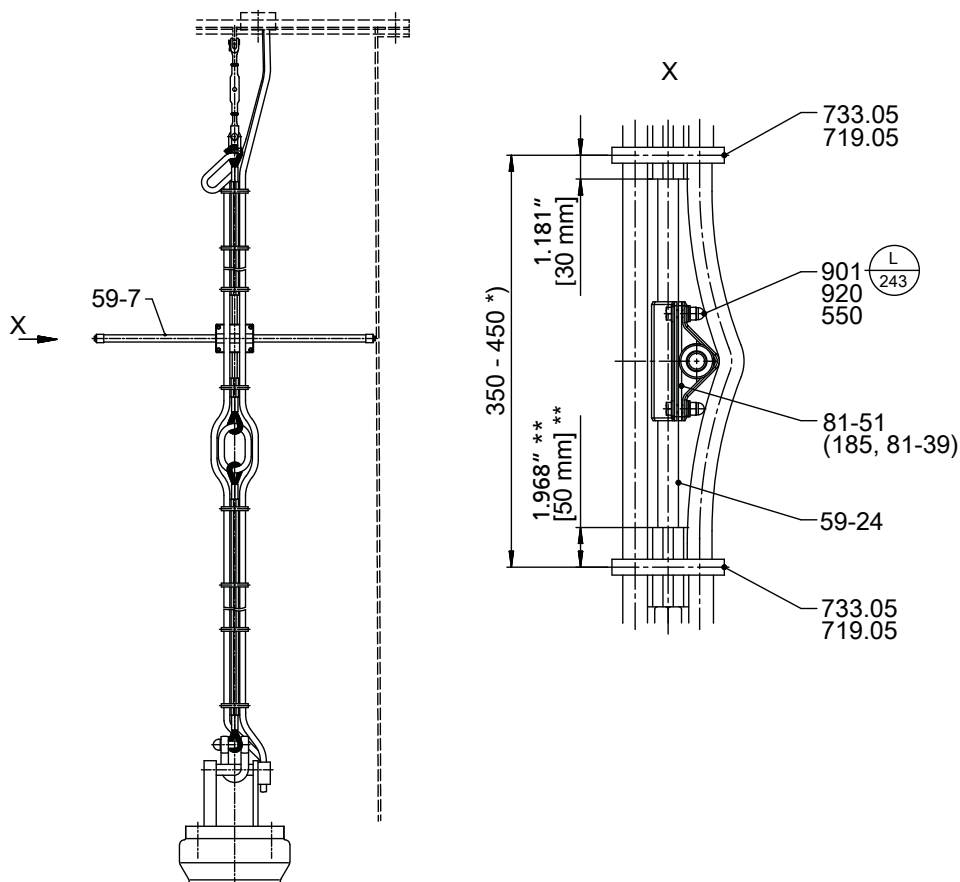


Fig. 30: Lifting rope with support

*) Depending on the cable cross-section,

**) For 1 rope or 3 ropes = 1.181 inch [30 mm]

Table 8: Key to the symbols

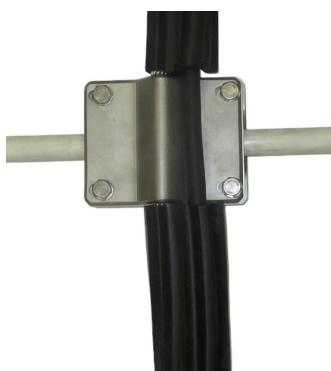
Symbol	Key
	Always secure screwed connections marked with this symbol with Loctite 243 .

15. Undo the screwed connection at clamping element 81-51.
16. Place clamp 81-39 of the clamping element around the lifting rope.
17. Fasten plate 185 and clamp 81-39 of the GFRP rod to rope clamp 81-39 with hexagon head bolts 901, discs 550 and cap nuts 920. Tighten the connection and secure it with Loctite 243.


NOTE

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

18. Trim the spacer to fill the space between the support and the next ferrule.


Fig. 31: Spacer at support

19. Guide the power cables and sensor cable along the support to the next cable clamp. Pull them taut and secure them with the clamp.
 - ⇒ If several supports are fitted, arrange the supports offset from each other by 90°.
20. Attach the crane hook (1) to the lifting lug (6) suspended from the lifting rope.
21. Attach the lifting rope to the next lifting lug.
22. Progressively lower the pump set into the discharge tube.
 - ⇒ Secure the cable bundle with evenly spaced sheathed cable clamps until the pump set is suspended from the lifting rope (1).
23. Lay all power cables past the area of the lifting lug between the rope sections and fasten them to the rope section above.
24. Fit a heat shrink tube on any protruding sharp-edged rope ends (e.g. at the ferrule).
25. Repeat this procedure until the pump set is located in its seat in the discharge tube.

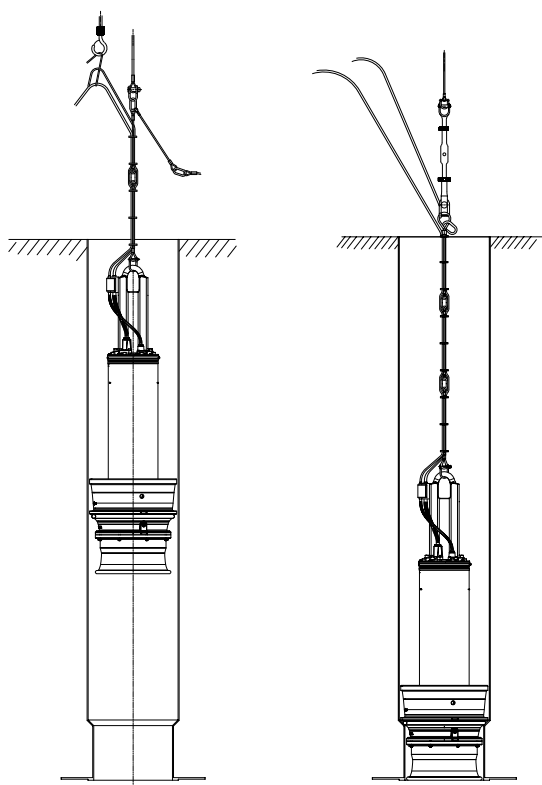


Fig. 32: Lowering the pump set

26. Attach the lifting rope with shackle and turnbuckle to a suspension loop (provided in the discharge tube or structure).
27. Secure the turnbuckle with a split pin.
 - ⇒ Insert the split pin. Bend back the two legs of the split pin in opposite directions.
 - ⇒ Attach the shackle of the turnbuckle to the upper thimble of the lifting rope. Do not attach the turnbuckle to the upper lifting lug.



Fig. 33: Shackle/turnbuckle

28. Tighten the turnbuckle until the cable bundle is tight but does not lift the pump set off its seat.
29. Secure the turnbuckle against loosening with two locknuts.
30. Unclip the crane hook of the lifting equipment from the lifting lug. Free the power cables from the manila rope and route them to the control cabinet.
31. Tie the upper loosely suspended lifting lug to the cable bundle.
32. Remove the safety cover from the discharge tube. Fit the cover. Seal the cable entries if any.

5.4 Electrical connection

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 9.4, Page 125) The pump set is supplied with power cables.

	NOTE
	When laying a cable between the control system and the pump set's connection point, make sure to have a sufficient number of cores for the sensors. A minimum cross-section of AWG 15 [1.5 mm²] is required.

5.4.1.1 Pump set with asynchronous motor (motor versions UT/XT/UV/XV)

The motors can be connected to electrical low-voltage grids with rated voltages and voltage tolerances to IEC 60038. Observe the permissible tolerances.

5.4.1.1.1 Setting the overload protection device

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

5.4.1.1.2 Starting method

Sizes 500-325 and 600-351 are wired in the motor for DOL starting.

Sizes 400-290, 700-471 and 800-471 have got a flexible wiring configuration. 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.

5.4.1.1.3 Operation on a frequency inverter

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

	NOTE For pump sets with rated voltages exceeding 500 V, a dv/dt filter must 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 intermediate-circuit inverters (VSI) with pulse width modulation (PWM) and carrier frequencies between 1 and 16 kHz are suitable.

Setting Observe the following instructions for setting a frequency inverter:

- Set the current limit to max. 1.2 times the rated current. The rated current is indicated on the name plate.
- Optionally, asynchronous motors can be operated using a V/f control concept or field-oriented control concept.
- For waste water applications, using the option of a quadratic load curve for saving energy is not recommended as this results in a higher breakaway torque.
- The voltage of the frequency inverter output must not exceed the rated voltage.

Start-up Observe the following instructions for starting up a frequency inverter:

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

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

- Only utilize up to 95 % of the rated power P_2 indicated on the name plate.
- Frequency range 30 to 60 Hz

Electromagnetic compatibility

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

Interference immunity

The submersible motor pump generally meets interference immunity requirements. For monitoring the sensors installed the operator must ensure sufficient interference immunity by appropriately selecting and laying the power cables in the plant. No modifications are required on the power/control cable of the submersible motor pump. Suitable analyzing devices must be selected. This applies in particular to the leakage sensor inside the motor.

5.4.1.2 Pump set with synchronous motor (motor versions UW/XW)

The motor of the pump set is an alternating current machine dimensioned for operation on a frequency inverter in accordance with IEC 60034-25.

	 DANGER
	Incorrect electrical connection Damage to the submersible motor ▸ Never connect the pump set directly to the power supply network. ▸ Always operate the pump set together with a suitable frequency inverter.

- The pump set must always be operated on a suitable frequency inverter.
- The motor has to be wired in star configuration for this purpose.
- Observe the wiring diagrams. (⇒ Section 9.4, Page 125)

	 DANGER Power failure or power interruption while the motor is rotating, or pump running in reverse (motor versions UW/XW) Danger from electric shock! Frequency inverter overloaded! Fire hazard! ▷ Prevent reverse rotation of the pump set with suitable means. ▷ Protect the frequency inverter against a power failure. ▷ Use uninterruptible power supply systems during the process of stopping the pumps. ▷ Never switch off the power supply at the frequency inverter while the motor is rotating.
	 DANGER Performing work at the motor terminals (motor versions UW/XW) when the frequency inverter has been switched off Danger from electric shock! ▷ When performing any work at the motor terminals, protect the rotor unit against rotating.
	 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.

The PumpDrive R frequency inverter is recommended for this pump set. Frequency inverters made by other manufacturers can be used but are not recommended.

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

- Observe the electrical data of the pump set for dimensioning the frequency inverter.
- Only voltage source inverters (VSI) with pulse width modulation (PWM) and carrier frequencies between 1 and 16 kHz are suitable.
- Integrated overvoltage/undervoltage protection
- Overcurrent protection of the submersible motor pump
- Efficient sensor-less variable speed control of synchronous motors with embedded magnets
- Motor protection in the event of a locked rotor
- Ramp setpoint input

The following functions are relevant for selecting a suitable frequency inverter:

- A frequency inverter with field-oriented control should have automatic controller parameterization / motor adjustment.
- If automatic parameterization is not possible, the motor parameters for manual setting have to be used.

- For KSB's parameterization help for the recommended PumpDrive R frequency inverter, see the other applicable documentation.

Setting Observe the following instructions for setting a frequency inverter:

- For controlling the synchronous motor, the motor parameters have to be identified and documented. The recommended PumpDrive R frequency inverter uses automatic motor adaptation (AMA) for this process.
- If the selected frequency inverter is not designed with automatic motor adaptation, KSB's parameterization help is required for setting them manually.

Start-up Observe the following instructions for starting up a frequency inverter:

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

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

- Do not exceed the rating indicated on the name plate.
- Frequency range: 50 to 100 % of the rated frequency indicated on the name plate

Shutdown Parameterize the frequency inverter in such a way that the motor only comes to a standstill after complete backflow of the fluid to prevent the motor from rotating backwards. This can be achieved by using sufficiently long stop ramps, for example, or load-dependent stopping (special function of the frequency inverter, e.g. Smart Logic).
Only disconnect the frequency inverter from the power supply network after the motor has come to a standstill and no fluid backflow can occur.

	 DANGER
	Power failure or power interruption while the motor is rotating, or pump running in reverse (motor versions UW/XW) Danger from electric shock! Frequency inverter overloaded! Fire hazard! ▷ Prevent reverse rotation of the pump set with suitable means. ▷ Protect the frequency inverter against a power failure. ▷ Use uninterruptible power supply systems during the process of stopping the pumps. ▷ Never switch off the power supply at the frequency inverter while the motor is rotating.

In the event of a power failure, the pump set runs in reverse as the water column in the discharge tube will flow back. If this is added to by the fluid handled flowing back into the discharge tube, the reverse rotation speed may become critically high. It may induce overvoltage at the motor terminals and result in the destruction of the frequency inverter.

Take suitable measures to prevent destruction of the frequency inverter, e.g. include a contactor between the submersible motor and the frequency inverter, install a swing check valve, use a suitable discharge tube outlet design, provide a back-up power supply system, etc.

Electromagnetic compatibility

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

Interference immunity

The submersible motor pump generally meets interference immunity requirements. For monitoring the sensors installed the operator must ensure sufficient interference immunity by appropriately selecting and laying the power cables in the plant. No

modifications are required on the power/control cable of the submersible motor pump. Suitable analyzing devices must be selected. This applies in particular to the leakage sensor inside the motor.

5.4.1.2.1 Parameterization of the PumpDrive R frequency inverter

For commissioning the submersible pump in discharge tube, set the following parameters in the parameter menu on the display **in the specified sequence**.

1. For commissioning, cancel the display/function **Smart Start** by pressing the *Back* button.
 2. Press the *Off* button.
 3. Press the *Main Menu* button.
 4. Select parameter group 0 and proceed as specified in (⇒ Table 9) .
 5. Select parameter group 1 and proceed as specified in (⇒ Table 10) .
 6. Select parameter group 1, menu items 1-29 and proceed as specified in (⇒ Table 11) .
 7. Select parameter group 3 and proceed as specified in (⇒ Table 12) .
 8. Select parameter group 4 and proceed as specified in (⇒ Table 13) .
- ⇒ Parameterization has been completed.
- ⇒ The submersible pump in discharge tube is ready for operation.

Table 9: Parameter group 0 - operation/display

Menu item	Parameter to be set
0-0	Basic Settings
0-01	Language
0-02	Motor Speed Unit
0-2	LCP Display
0-20	Display Line 1.1 Small

Table 10: Parameter group 1 - motor/load

Menu item	Parameter to be set / Notes
1-1	Motor Selection
1-01	Motor Control Principle
1-10	Motor Construction
1-2	Motor Data
1-23	Motor Frequency
1-24	Motor Current
1-25	Motor Nominal Speed
1-26	Motor Cont. Rated Torque
1-3	Adv. Motor Data
1-39	Motor Poles

 The default setting of terminal 27 digital input (5-12) is the function **Coast inverse**. This setting must not be changed. Automatic motor adaptation (AMA) only starts via the function **Hand on** if terminal 27 is supplied with 24 V. To do so connect terminal 12/13 to AmaControl 5, pin 11 (relay 1), and connect pin 14 (relay 1) to terminal 27.

Table 11: Parameter group 1 - motor/load

Menu item	Parameter to be set / Notes
1-2	Motor Data
1-29	Automatic Motor Adaptation (AMA) Select [1]. This starts the complete motor adaptation (AMA). - Follow the instructions on the display. - After completion of the adaptation, press the <i>OK</i> button. - Press the <i>Main Menu</i> button to go to the Parameter groups screen.

Table 12: Parameter group 3 – Setpoint/ramps

Menu item	Parameter to be set / Notes
3-0	Reference Limits
3-02	Minimum Reference Read the value for the Rated frequency off the name plate, halve this value , enter it and press <i>OK</i> to confirm.
3-03	Maximum Reference Read the value for the Rated frequency off the name plate, enter it and press <i>OK</i> to confirm.
3-1	References
3-10	Preset Reference Confirm variable [0] by pressing <i>OK</i> . Change the value to 100 % and press <i>OK</i> to confirm.
3-4	Ramp 1
3-41	Ramp 1 Ramp Up Time Change the displayed value to 5 seconds and press <i>OK</i> to confirm.
3-42	Ramp 1 Ramp Down Time Change the displayed value to 60 seconds¹¹⁾ and press <i>OK</i> to confirm.

Table 13: Parameter group 4 - limits/warnings

Menu item	Parameter to be set
4-1	Motor Limits
4-12	Motor Speed Low Limit [Hz] Read the value for the Rated frequency off the name plate, half this value , enter it and press <i>OK</i> to confirm.
4-14	Motor Speed High Limit [Hz] Read the value for the Rated frequency off the name plate, enter it and press <i>OK</i> to confirm.
4-18	Current Limit Change the displayed value to maximum 120 % of the rated current and press <i>OK</i> to confirm.
4-19	Max Output Frequency Change the displayed value to maximum 101 % of the rated frequency and press <i>OK</i> to confirm.

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.

¹¹ This only serves as a reference value. Parameterize the frequency inverter in such a way that the motor only comes to a standstill after complete backflow of the fluid to prevent the motor from rotating backwards. See the **Shutdown** sub-section. (⇒ Section 5.4.1.2, Page 44)

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

5.4.1.4 Sensors

5.4.1.4.1 Pump set with standard sensors

	! DANGER Operating an incompletely connected pump set Damage to the pump set! ▷ Never start up a pump set with incompletely connected power cables or non-operational monitoring devices.
	CAUTION Incorrect connection Damage to the sensors! ▷ Observe the limits stated in the following sections of this manual when connecting the sensors.
	NOTE Reliable and safe operation of the pump within the scope of our warranty is only possible if the sensor signals are properly analyzed as stipulated in this manual.

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

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

For information on wiring and core marking see (⇒ Section 9.4, Page 125)

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

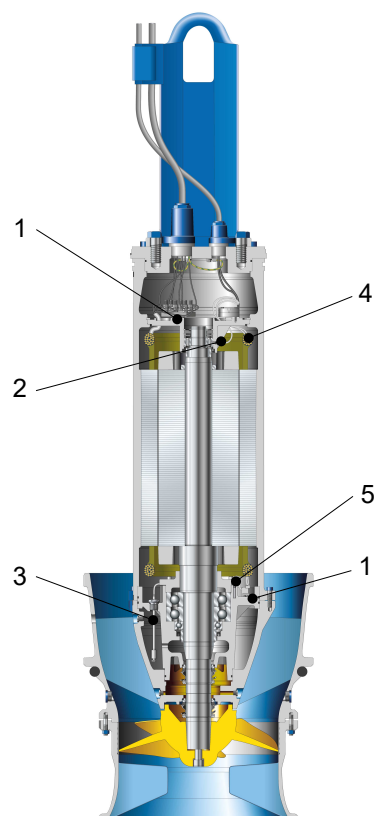


Fig. 34: Sensor positions

Table 14: Overview of sensors

Item	Sensor	Basic	Basic+ ¹²⁾
1	Leakage sensor in the motor space	X	X
2	Bearing temperature monitoring, motor end (Pt100)	-	X ¹³⁾
3	Mechanical seal leakage sensor (float switch)	X	X
4	Motor temperature monitoring (PTC thermistor)	X	X
5	Bearing temperature monitoring, pump end (Pt100)	X ¹⁴⁾	X

5.4.1.4.1.1 Motor temperature

	 DANGER
	Insufficient cooling Explosion hazard! Winding damage! ▶ Never operate a pump set without operational temperature monitoring. ▶ For explosion-proof pump sets use a thermistor tripping unit with manual reset.

Three series-connected thermistors (PTC) at terminals 10 and 11 monitor the winding temperature. They must be combined with a thermistor tripping unit with manual reset.

¹² Exception: Sizes 500-325 and 600-351 are not available with the sensor package Basic+.

¹³ Exception: Size 400-290 is not fitted with motor-end bearing temperature monitoring.

¹⁴ Exception: Size 400-290 is not fitted with pump-end bearing temperature monitoring.

5.4.1.4.1.2 Leakage inside the motor

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

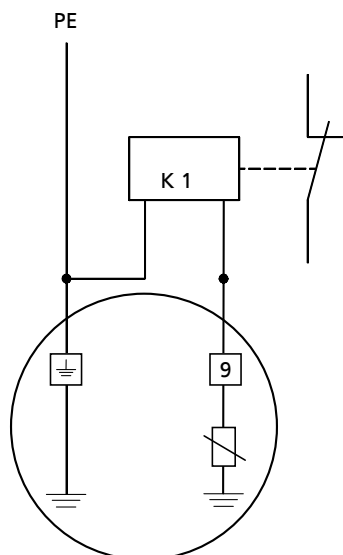


Fig. 35: Wiring of the electrode relay

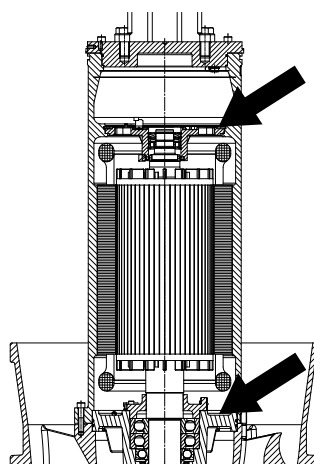


Fig. 36: Position of the electrodes in the motor housing

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 at an electrical resistance between 3 kΩ and 60 kΩ.

5.4.1.4.1.3 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.

5.4.1.4.1.4 Bearing temperature

The pump-end bearing of the pump set is equipped with a bearing temperature sensor. This sensor is a Pt100 resistance thermometer (core marking 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).

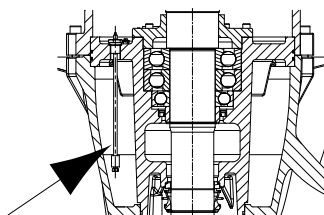


Fig. 37: Float switch

Motor versions UV/XV/UW/XW

Set the following limits:

- Alert at 230 °F [110 °C]
- Cut-out of the pump set at 266 °F [130 °C]

Motor versions UT/XT

Set the following limits:

- Alert at 266 °F (130 °C)
- Cut-out of the pump set at 302 °F (150 °C)

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

5.4.1.4.2 Pump set with sensor system (sensor package Premium)

	! DANGER Operating an incompletely connected pump set Explosion hazard! Damage to the pump set! ▸ Never start up a pump set with an incompletely connected power cable or non-operational monitoring devices.
	CAUTION Incorrect connection Damage to the sensors! ▸ Observe the limits stated in the following sections of this manual when connecting the sensors.

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

All sensors are located inside the submersible motor pump and are connected to the sensor unit located in the connection space of the submersible motor.

Sensor signals are analyzed via the AmaControl 5 monitoring system.

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

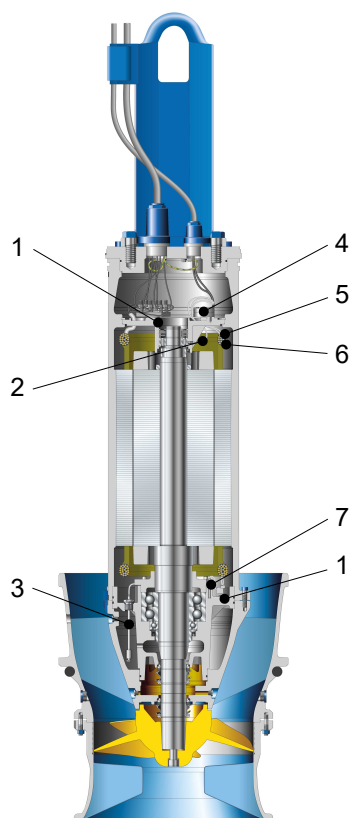


Fig. 38: Sensor positions

Table 15: Overview of sensors (sensor package Premium)

Item	Sensor	Sensor type
1	Leakage sensor in the motor space	Conductive
2	Bearing temperature monitoring, motor end	1 × Pt100
3	Leakage sensor at the mechanical seal	Float switch
4	Vibration monitoring	Integrated
5	Motor temperature monitoring	PTC thermistor
6	Motor temperature measurement	1 × Pt100
7	Bearing temperature monitoring, pump end	1 × Pt100



NOTE

Using the associated AmaControl 5 monitoring system is essential for ensuring safe and reliable submersible motor pump operation, and maintaining the warranty.

For the electrical connection of the monitoring system observe the wiring diagram and the installation/operating manual of the associated AmaControl 5 monitoring system.

5.4.1.4.2.1 Parameterizing the AmaControl 5 monitoring system

1. Prior to commissioning, parameterize the AmaControl 5 monitoring system.
2. Download the parameter files via AmaControl Select under <https://ksb-amacontrol-select.tecmotion.de/>.
3. Observe the operating manual of the AmaControl 5 monitoring system for parameterization.

All relevant data are pre-set with the parameterization files.

Table 16: Overview, warning values and trip values for AmaCan P with motor versions UT/XT

Sensor	Warning	Tripping
Temperature 1 (Pt100 temperature sensor, bearing)	266 °F [130 °C]	302 °F [150 °C]
Temperature 3 (Pt100 temperature sensor, motor)	None	None
Motor temperature PTC	-	Not parameterizable
Leakage 1 (leakage sensor in the motor)	-	< 60 kΩ
Switching input (mechanical seal)	-	NC
Vibration sensor	0.43 in/s [11 mm/s]	0.55 in/s [14 mm/s]

Table 17: Overview, warning values and trip values for AmaCan P with motor versions UV/XV/UW/XW

Sensor	Warning	Tripping
Temperature 1 (Pt100 temperature sensor, bearing)	230 °F [110 °C]	266 °F [130 °C]
Temperature 3 (Pt100 temperature sensor, motor)	None	None
Motor temperature PTC	-	Not parameterizable
Leakage 1 (leakage sensor in the motor)	-	< 60 kΩ
Switching input (mechanical seal)	-	NC
Vibration sensor	0.43 in/s [11 mm/s]	0.55 in/s [14 mm/s]

When using the AmaControl 5 monitoring system for monitoring the current, the warning value and trip value have to be parameterized manually.

- Set the warning value to the rated current indicated on the name plate.
- The trip value should be 1.2 times the warning value.

5.4.2 Electrical connection

	 DANGER Electrical connection work by unqualified personnel Danger to life from electric shock! - Always have the electrical connections installed by a trained electrician. - Observe the IEC 60364 regulations as well as any regional regulations.
	 WARNING Incorrect connection to the mains Damage to the power supply network, short circuit! Observe the technical specifications of the local energy supply companies.
	CAUTION Improper routing of power cables Damage to the power cables! - Never move the power cables at temperatures below -13 °F [-25 °C]. - Never kink or crush the power cables. - Never lift the pump set by the power cables. - Adjust the length of the power cables to the site requirements.

	CAUTION
	Motor overload Damage to the motor! ▸ Protect the motor by a thermal time-lag overload protection device in accordance with IEC 60947 and local regulations.

For the electrical connection observe the wiring diagrams (⇒ Section 9.4, Page 125) in the Annex and the information for planning the control system .

The pump set is supplied with power cables.

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

For a pump set with AmaControl 5 monitoring system, connect the shielded power cables in the control cabinet.

	 DANGER
	Incorrect connection Explosion hazard! ▸ The connection point of the cable ends must be located outside of the potentially explosive atmosphere in a grounded control cabinet.

	 DANGER
	Operating an incompletely connected pump set Damage to the pump set! ▸ Never start up a pump set with incompletely connected power cables or non-operational monitoring devices.

	 DANGER
	Using damaged power cables Danger of death from electric shock! ▸ Never connect damaged power cables. ▸ Visually inspect the power cable before connecting it. ▸ Replace the power cable, if it is damaged.

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

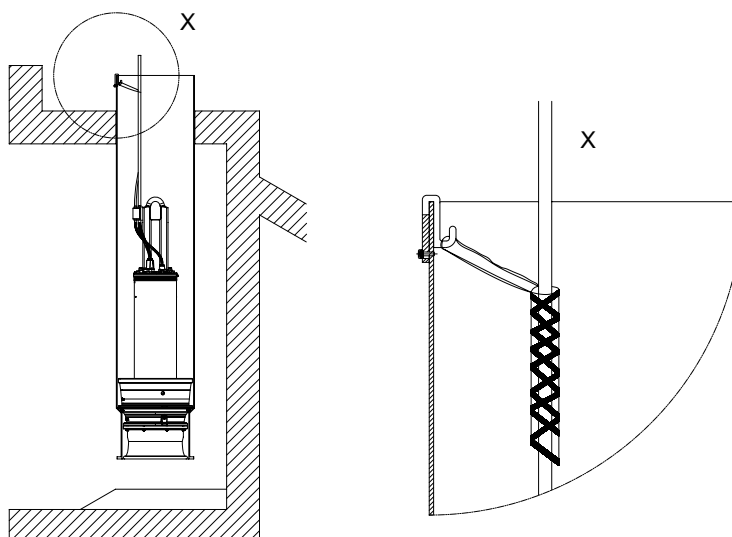


Fig. 39: Fastening the power cable

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

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

	⚠ DANGER Incorrect connection Explosion hazard! ▸ Explosion-proof pump sets installed in a tank must never be retrofitted with an external potential equalization connection!
	⚠ DANGER Touching the pump set during operation Electric shock! ▸ Make sure that the pump set cannot be touched during operation.

6 Commissioning/Start-up/Shutdown

6.1 Commissioning/start-up

6.1.1 Prerequisites for commissioning/start-up

	 DANGER 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/dismantling process to protect people from falling into the open discharge tube. ▷ Fence off the work area appropriately.

Prior to commissioning , 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 62)
- 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 the pump set while the pump is running in reverse.
---	--

✓ The fluid level is sufficiently high.

	CAUTION Start-up against a closed shut-off element Damage to the pump set! ▷ Never start up the pump set against a closed shut-off element.
---	---

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

6.2 Operating limits

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

6.2.1 Operation on the power supply mains

	! DANGER Non-compliance with permissible supply voltage tolerances Explosion hazard! ▷ Never operate an explosion-proof pump (set) outside the specified range.
---	---

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

6.2.2 Frequency of starts

	CAUTION
	Excessive frequency of starts Damage to the motor! ▶ Never exceed the specified frequency of starts.

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

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

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

6.2.3 Operation on a frequency inverter

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

	CAUTION
	Pumping solids-laden fluids at reduced speed Increased wear and clogging! ▶ Never operate the pump set with flow velocities below approx. 25 in./s [0.7 m/s] in horizontal pipes and approx. 45 in./s [1.2 m/s] in vertical pipes.

Motor versions UT/XT/UV/XV:

- Frequency range 30 to 60 Hz

Motor versions UW/XW:

- Frequency range: 50 to 100 % of the rated frequency indicated on the name plate

6.2.4 Fluid handled

6.2.4.1 Fluid temperature

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

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

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

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

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

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.

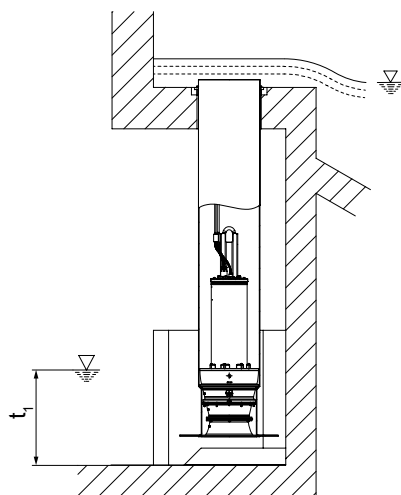


Fig. 40: Minimum level of fluid handled t₁

6.2.4.4 Abrasive fluids

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

6.3 Shutdown/storage/preservation

6.3.1 Shutdown

	⚠ DANGER Power failure or power interruption while the motor is rotating, or pump running in reverse (motor versions UW/XW) Danger from electric shock! Frequency inverter overloaded! Fire hazard! ▷ Prevent reverse rotation of the pump set with suitable means. ▷ Protect the frequency inverter against a power failure. ▷ Use uninterruptible power supply systems during the process of stopping the pumps. ▷ Never switch off the power supply at the frequency inverter while the motor is rotating.
---	--

In the event of a power failure, the pump set runs in reverse as the water column in the discharge tube will flow back. If this is added to by the fluid handled flowing back into the discharge tube, the reverse rotation speed may become critically high. It may induce overvoltage at the motor terminals and result in the destruction of the frequency inverter.

Take suitable measures to prevent destruction of the frequency inverter, e.g. include a contactor between the submersible motor and the frequency inverter, install a swing check valve, use a suitable discharge tube outlet design, provide a back-up power supply system, etc.

	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 to life from electric shock! ▷ Always have the electrical connections installed by a trained electrician. ▷ Observe the IEC 60364 regulations as well as any regional regulations.
	⚠ WARNING Unintentional starting of pump set Risk of injury by moving components and shock currents! ▷ Make sure that the pump set cannot be started up unintentionally. ▷ Always make sure the electrical connections are disconnected before carrying out work on the pump set.

	! WARNING Fluids handled, consumables and operating supplies which are hot or pose a health hazard Risk of personal injury! ▷ Observe all relevant laws. ▷ When draining the fluid take appropriate measures to protect persons and the environment. ▷ Decontaminate pumps which handle fluids posing a health hazard.
	CAUTION Danger of frost/freezing Damage to the pump set! ▷ If there is any danger of frost/freezing, remove the pump set from the fluid handled and clean, preserve and store it.

The pump set remains installed

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

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

- ✓ All safety regulations are observed.
- 1. Clean the pump set.
- 2. Preserve the pump set.

6.4 Returning to service

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

For returning the pump set to service, observe the instructions on commissioning/start-up. (⇒ Section 6.1, Page 57)

Refer to and comply with the operating limits.

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

7 Servicing/Maintenance

7.1 Safety regulations

The operator ensures that all maintenance, all inspections and all installation work is performed by authorized, qualified specialist personnel who are thoroughly familiar with the manual.

	 DANGER Performing work at the motor terminals (motor versions UW/XW) when the frequency inverter has been switched off Danger from electric shock! ▷ When performing any work at the motor terminals, protect the rotor unit against rotating.
 	 DANGER Strong magnetic field in the pump rotor area Danger of death for persons with pacemaker! Interference with magnetic data carriers, electronic devices, components and instruments! Uncontrolled magnetic attraction forces between magnet-equipped components, tools or similar! ▷ Keep a safety distance of at least 1.6 ft (0.5 m). ▷ Observe the additional instructions. (⇒ Section 2.10, Page 12)
	 DANGER Sparks produced during maintenance work Explosion hazard! ▷ Observe the safety regulations in force at the place of installation. ▷ Never open a pump set that is connected to the power supply. ▷ Always perform maintenance work on pump sets outside potentially explosive atmospheres.
	 DANGER Improperly serviced pump set Explosion hazard! Damage to the pump set! ▷ Service the pump set regularly. ▷ Prepare a maintenance schedule with special emphasis on lubricants, power cable, bearing assembly and shaft seal.

	 DANGER Improper lifting/moving of heavy assemblies or components Danger to life from falling parts! Damage to the pump set! ▶ Use suitable transport devices, 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 Electrical connection work by unqualified personnel Danger to life from electric shock! ▶ Always have the electrical connections installed by a trained electrician. ▶ Observe the IEC 60364 regulations as well as any regional regulations.
	 DANGER Risk of falling when working at great heights Danger to life by falling from great heights! ▶ Do not step onto the pump (set) during installation work or dismantling work. ▶ Pay attention to safety equipment, such as railings, covers, barriers, etc. ▶ Observe the applicable local occupational safety regulations and accident prevention regulations.
	 WARNING Unintentional starting of pump set Risk of injury by moving components and shock currents! ▶ Make sure that the pump set cannot be started up unintentionally. ▶ Always make sure the electrical connections are disconnected before carrying out work on the pump set.

	! WARNING Hands, other body parts or foreign objects in the impeller or intake area Risk of injury! Damage to the submersible motor pump! ▷ Never insert your hands, other body parts or foreign objects into the impeller and/or impeller intake area. ▷ Always make sure that the electrical connections are disconnected before checking that the impeller can rotate freely.
	! WARNING Fluids handled, consumables and operating supplies which are hot or pose a health hazard Risk of personal injury! ▷ Observe all relevant laws. ▷ When draining the fluid take appropriate measures to protect persons and the environment. ▷ Decontaminate pumps which handle fluids posing a health hazard.
	! WARNING Hot surface Risk of personal injury! ▷ Allow the pump set to cool down to ambient temperature.
	! WARNING Insufficient stability Risk of crushing hands and feet! ▷ During assembly/dismantling, secure the pump (set)/pump parts against tilting or tipping over.
	! WARNING Corrosion on the pump set 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), check the pump set for corrosion regularly and adhere to the maintenance interval specified.
	NOTE Special regulations apply to repair work on explosion-proof pump sets. Modifications or alteration of the pump sets can affect explosion protection and are only permitted after consultation with the manufacturer.
	NOTE All maintenance work, service work and installation work can be carried out by KSB Service or authorized workshops. Find your contact in the attached Addresses booklet or visit https://www.ksb.com/en-global/contact.

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

Never use force when dismantling and reassembling the pump set.

7.2 Maintenance/inspection

KSB recommends the following regular maintenance schedule:

Table 18: Overview of maintenance work

Maintenance interval	Maintenance task	For details see ...
- First check after 6 months min. - Interval can be extended to 12 months	If used in sports facilities and leisure parks, check visually for corrosion.	(⇒ Section 7.3.7, Page 72)
	For a pump set in material variant G3 perform the first check after 6 months. Replace the sacrificial anodes if necessary. If the sacrificial anodes show little wear, the maintenance interval can be extended to 12 months.	(⇒ Section 7.8, Page 100)
- Every 4000 h - At least once a year	Check the insulation resistance.	(⇒ Section 7.2.1.2, Page 66)
	Check the lifting rope.	(⇒ Section 7.2.1.1, Page 66)
- Every 8000 h - At least every 3 years	Check the cable bundle.	(⇒ Section 7.3.3, Page 70)
	Check the lifting accessories.	(⇒ Section 7.3.4, Page 71)
	Check the ground conductor.	(⇒ Section 7.3.5, Page 71)
	Check the sensors.	(⇒ Section 7.2.1.3, Page 67)
	Check the mechanical seal leakage.	(⇒ Section 5.2.3, Page 26)
	Change the liquid lubricant.	(⇒ Section 7.4.1.4, Page 73)
- Every 24000 h - At least every 5 years	Lubricate or replace the rolling element bearings.	(⇒ Section 7.4.2, Page 75)
	For a pump set in material variant G3 replace the sacrificial anode if this has not already been done as part of a previous inspection.	(⇒ Section 7.8, Page 100)
	General overhaul	

7.2.1 Inspection work

7.2.1.1 Checking the lifting rope

1. Check the lifting rope for sufficient tension.
2. If necessary, re-tighten the lifting rope via the turnbuckle.

7.2.1.2 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 is 500 V (maximum permissible voltage: 1000 V).
 1. Measure the winding to chassis ground.
To do so, connect all winding ends together.
 2. Measure the winding temperature sensor to chassis ground.
To do so, connect all core ends of the winding temperature sensor 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. The power cable 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.

7.2.1.3 Checking the sensors

7.2.1.3.1 Checking the sensors, pump set with standard 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 19: Resistance measurement

Measurement between terminals ...	Resistance [Ω]
10 and 11	200 - 1000

If the specified tolerances are exceeded, disconnect the connection cable at the pump set and repeat the check inside the motor.

If the tolerances are exceeded here, too, the motor part must be opened and overhauled. The temperature sensors are fitted in the stator winding and cannot be replaced.

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

Leakage sensor in the motor

Table 20: Resistance measurement of the leakage sensor in the motor

Measurement between terminals ...	Electrical resistance [kΩ]
9 and ground conductor (PE)	> 60

Lower resistances suggest water ingress into the motor. In this case the motor section must be opened and serviced.

Float switch (mechanical seal leakage)

Table 21: Resistance measurement of the float switch

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

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

Bearing temperature sensors

Table 22: Resistance measurement of the bearing temperature sensors

Measurement between terminals ...	Electrical resistance [Ω]
15 and 16	100 to 120
16 and 17 ¹⁵⁾	100 to 120

7.2.1.3.2 Checking the sensors, pump set with sensor system

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

The tests described below measure the resistance. The actual function of the sensors is not tested in this process.

The regular maintenance schedule includes checking the resistances on the display of AmaControl 5. Direct measurement from the outside is not possible.

If the following limits are exceeded, the submersible motor pump has to be removed.

1. To clarify a potential sensor error, open the connection space of the pump set.
2. Disconnect the sensor in question from the integrated sensor unit.

⇒ Only now can the electrical resistance be measured with an ohmmeter.

Temperature sensors at the motor winding

Table 23: Resistance measurement of the temperature sensors at the motor winding

Display at AmaControl	Check with ohmmeter	Resistance
Sensor	Measurement between cores	[Ω]
Motor temperature - PTC	10 and 11	100 to 1000
Temperature 3 - Pt100	31 and 32	100 to 120

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.

Bearing temperature sensor

Table 24: Resistance measurement of the bearing temperature sensor

Display at AmaControl	Check with ohmmeter	Resistance
Sensor	Measurement between cores	[Ω]
Temperature 1 - Pt100	15 and 16	100 to 120
Temperature 2 - Pt100	16 and 17	100 to 120

If the tolerances indicated are exceeded, the bearing temperature sensor will have to be replaced.

Leakage sensor in the motor

Table 25: Resistance measurement of the leakage sensor in the motor

Display at AmaControl	Check with ohmmeter	Resistance
Sensor	Measurement between cores	[kΩ]
Leakage 1	9 and ground conductor (PE)	> 60

Lower resistances suggest water ingress into the motor. In this case the motor section must be opened and serviced.

Mechanical seal leakage sensor (float switch)

Table 26: Resistance measurement of the leakage sensor at the mechanical seal (float switch)

Display at AmaControl	Check with ohmmeter	Resistance
Sensor	Measurement between cores	[Ω]
Leakage 3 - float switch	3 and 4	< 1

Lower values indicate water ingress into the lubricant chamber. In this case, check the pump-end mechanical seal.

7.3 Removing the pump set from the piping

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/dismantling process to protect people from falling into the open discharge tube. ▷ Fence off the work area appropriately.
	 WARNING Turnbuckle and shackle are not suitable for lifting the pump set. Risk of personal injury! Damage to the pump set! ▷ Always use the eyebolts of the support rope to lift the pump set.
✓ The power cables have been disconnected and secured against accidental start-up. ✓ The discharge tube is open; its opening is securely covered except for a gap allowing work to continue. ✓ Suitable lifting equipment is available. 1. Attach the lifting chain or lifting rope to the trolley. 2. Free the uppermost lifting lug from the cable bundle, attach it to the crane hook and run the lifting equipment to a higher level. 3. Open and disconnect the turnbuckle.	
	NOTE Loose parts must not fall into the pump sump!

4. Pull the pump set up until it reaches the second lifting lug of the cable bundle.

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

	WARNING
	Pump set tilting Risk of squashing hands and feet! ▷ Suspend or support the pump set.
	CAUTION
	Improper storage Damage to the power cables! ▷ Support the power cables at the cable entry to prevent permanent deformation. ▷ Protect the core ends against humidity.

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

7.3.2 Drainage/cleaning

	WARNING
	Fluids handled, consumables and operating supplies which are hot or pose a health hazard Hazard to persons and the environment! ▷ Collect and properly dispose of the flushing fluid and of any residues of the fluid handled. ▷ Wear protective clothing and a protective mask if required. ▷ Observe all legal regulations on the disposal of fluids posing a health hazard.

1. Always flush the pump if it has been used for handling noxious, explosive, hot or other hazardous fluids.
2. Always flush and clean the pump before transporting it to the workshop.
Always complete and enclose a certificate of decontamination when returning the pump set. (⇒ Section 10, Page 195)

7.3.3 Checking the cable bundle

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

Longer cable bundles must be dismantled:

1. Undo the cable clamps.
2. Remove the spacer.
3. Roll up the power 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 lifting accessories

- ✓ The pump set has been lifted out of the discharge tube and cleaned.
 1. Check the bail including fasteners (screws/bolts) for any visible damage.
 2. Replace any damaged parts by original spare parts.

7.3.5 Checking the ground conductor

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

	⚠ DANGER Defective ground conductor Electric shock! ▸ Never switch on a pump set with a defective ground conductor.
---	---

7.3.6 Checking the mechanical seal leakage

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

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

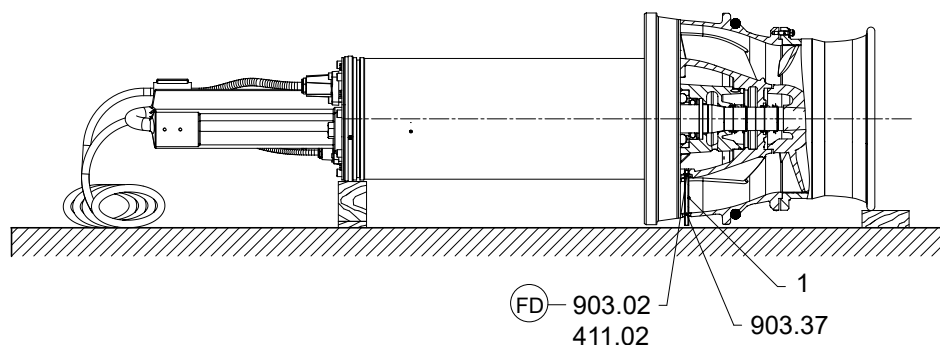


Fig. 41: Checking the leakage chamber

Table 27: Key to the symbols

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

- ✓ A suitable container for the leakage is available.
- ✓ The pump set is positioned horizontally on a level/even surface and is protected against rolling away.
- 1. Place the container underneath screw plug 903.02.
- 2. If applicable, remove screw plug 903.37.
- 3. Remove screw plug 903.02 with joint ring 411.02.
- 4. Screw in a sufficiently long tube (1) with G 1/2 thread.
- 5. 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, the mechanical seals are working properly. If the leakage exceeds 1.05 quart [1.0 liter], the mechanical seals are defective and must be replaced.
- 6. Unscrew and remove the tube (1).
- 7. Re-insert and tighten screw plug 903.02 with new joint ring 411.02.
- 8. If applicable, re-insert and tighten screw plug 903.37.

7.3.7 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 chamber of the mechanical seal. Top it up if required.
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The mechanical seal is supplied with lubricant from the lubricant chamber.

7.4.1.1 Intervals

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

7.4.1.2 Lubricant quality

The lubricant chamber is filled at the factory with environmentally friendly, non-toxic lubricant (unless otherwise specified by the customer).

The following lubricants can be used to lubricate the mechanical seals:

Recommended lubricant quality

Alternative

- Environmentally friendly, non-toxic white oil of medical quality
- Thin-bodied paraffin oil, non-toxic
- Propylene glycol / water mixture with corrosion inhibitors for frost protection down to -4 °F [-20 °C].

Table 28: Lubricant quality

Description	Properties	
Paraffin oil or white oil	Kinematic viscosity at 104 °F [40 °C]	< 0.065 ft/s ² [< 20 mm/s ²]
	Flash point (to Cleveland)	> 320 °F [> 160 °C]
	Solidification point (pour point)	< 5 °F [< -15 °C]



WARNING

Contamination of fluid handled by lubricant

Hazard to persons and the environment!

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

7.4.1.3 Lubricant quantity

Table 29: Lubricant quantity

Size	Lubricant quantity	
	[quart]	[l]
400 - 290	0.21	0.2
500 - 325	0.21	0.2
600 - 351	0.95	0.9
700 - 471	1.90	1.8
800 - 471	1.90	1.8

7.4.1.4 Changing the lubricant



WARNING

Lubricants posing a health hazard and/or hot lubricants

Hazard to persons and the environment!

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

	! WARNING Excess pressure inside the pump set Risk of personal injury when opening the pump set! ▸ Be careful when opening the inner chambers. Balance the pressure.
	! WARNING Improper handling when placing the pump set in a vertical/horizontal position Personal injury and damage to property! ▸ Select suitable lifting equipment for the size of the pump. ▸ Use appropriate means to secure the pump set against tilting, tipping over or rolling off. ▸ Maintain a safe distance during lifting operations (load may swing when being lifted). ▸ Use additional supports for the transport holder to secure it against tilting.

7.4.1.4.1 Draining the lubricant

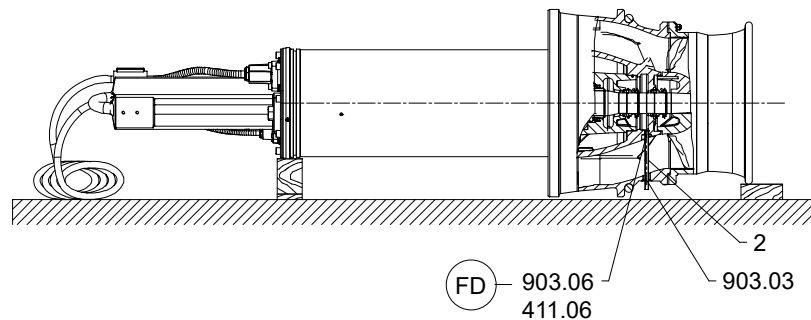


Fig. 42: Draining the liquid lubricant

Table 30: Key to the symbols

Symbol	Key
(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. Secure it against rolling away.
2. If applicable, remove screw plug 903.03.
⇒ Screw plug 903.03 is marked with label/plate 970.03 (oil drain).
3. Remove screw plug 903.06 and joint ring 411.06.
4. Screw in a sufficiently long tube (2) with G 1/4 thread.
5. Carefully rotate the pump set until the tube points downwards.

	NOTE Undoing screw plug 903.01 will make the lubricant drain faster.
---	---

6. Collect the liquid lubricant in a suitable container. Determine the quantity of liquid lubricant collected and compare it with the specified lubricant quantity .
⇒ If the remaining liquid lubricant equals less than 50 % of the required lubricant quantity , this suggests a defect of the mechanical seals.
7. Properly dispose of the liquid lubricant.
8. Remove the tube. Close screw plug 903.06 with joint ring 411.06 again.
9. Re-insert and tighten screw plug 903.03.

7.4.1.4.2 Filling in the lubricant

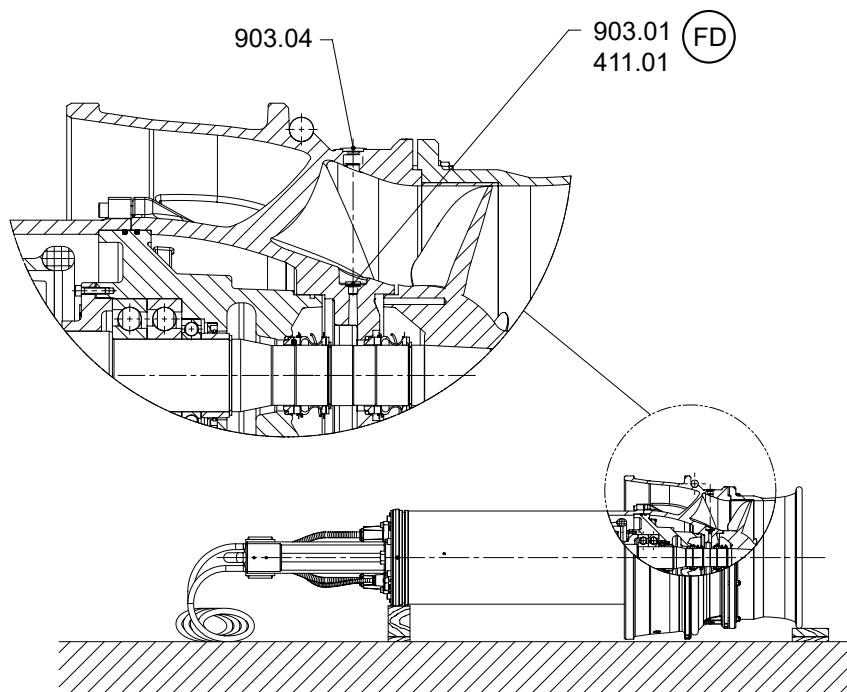


Fig. 43: Filling in the lubricant

Table 31: Key to the symbols

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

- ✓ Screw plug 903.06 has been screwed in with joint ring 411.06.
 - ✓ The pump set has been placed in a horizontal position and protected against rolling away.
1. If applicable, remove screw plug 903.04.
 2. Remove screw plug 903.01 and joint ring 411.01.
 3. Screw in a sufficiently long tube with G 1/4 thread.
 4. Fill the lubricant in through the tube.
 5. Remove the tube. Apply a liquid sealant to screw plug 903.01. Screw the plug in together with a new joint ring 411.01.
 6. Screw in screw plug 903.04.

7.4.2 Lubrication and lubricant change of rolling element bearings

		WARNING
		Shaft seal ring overheating Explosion hazard! Bearings overheating! ▷ When fitting new shaft seal rings, apply grease to the sealing lip.

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.

In addition, having the rolling element bearings replaced by KSB Service is recommended.

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 32: Lubricant characteristics

Base oil	Type	Thickener	NLGI grade (ISO 2137)	Worked penetration at 77 °F [25 °C], 0.1 mm (DIN 51818)	Drop point (ISO 2176)	Application temperature range	Viscosity (DIN 51562) [mm²/s]	
							at 104 °F [40 °C]	at 212 °F [100 °C]
Ester oil	A	Polyurea	2	265 to 295	>482 °F [≥250 °C]	-40 °F to +356 °F [-40 °C to +180 °C]	100	11

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

- Type A: Klüberquiet BQH 72-102, made by Klüber Lubrication München KG

7.4.2.3 Grease quantity

Table 33: Grease quantity

Size	Grease type	Grease quantity			
		Drive end		Pump end	
400 - 290	Type A	0.3 ounces	10 cm³	1.4 ounces	40 cm³
500 - 325	Type A	0.3 ounces	10 cm³	2 ounces	60 cm³
600 - 351	Type A	0.5 ounces	15 cm³	3.4 ounces	100 cm³
700 - 471	Type A	1.0 ounces	30 cm³	15 ounces	450 cm³
800 - 471	Type A	1.0 ounces	30 cm³	15 ounces	450 cm³

7.5 Dismantling the pump set

7.5.1 General information/Safety regulations

 	DANGER
	Strong magnetic field in the pump rotor area Danger of death for persons with pacemaker! Interference with magnetic data carriers, electronic devices, components and instruments! Uncontrolled magnetic attraction forces between magnet-equipped components, tools or similar! ▷ Keep a safety distance of at least 1.6 ft (0.5 m). ▷ Observe the additional instructions. (⇒ Section 2.10, Page 12)

	 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 to life 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-energized. ▶ Ground 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 personal injury! ▶ Always have repair work and maintenance work performed by specially trained, qualified personnel.
	 WARNING Hot surface Risk of personal injury! ▶ Allow the pump set to cool down to ambient temperature.
	 WARNING Improper lifting/moving of heavy assemblies or components Personal injury and damage to property! ▶ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.
	 WARNING Excess pressure inside the pump set Risk of personal injury when opening the pump set! ▶ Be careful when opening the inner chambers. Balance the pressure.

	! WARNING Components with sharp edges Risk of cutting or shearing injuries! ▷ Always use appropriate caution for installation and dismantling work. ▷ Wear work gloves.
	! WARNING Pump set tilting or rolling off Risk of personal injury! ▷ Make sure the pump set is secured against tilting during the entire dismantling process. ▷ For dismantling the pump set in a horizontal position, secure it against rolling off.

- Observe the 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-energize the pump set and secure it against unintentional start-up.
2. Remove the pump set from the discharge tube. (⇒ Section 7.3.1, Page 69)
3. Clean the pump set. (⇒ Section 7.3.2, Page 70)
4. Drain the lubricant. (⇒ Section 7.4.1.4, Page 73)
5. Drain the leakage chamber and leave it open for the duration of the disassembly.

7.5.3 Removing the bellmouth

7.5.3.1 Removing the bellmouth and casing wear ring, sizes 400 and 500

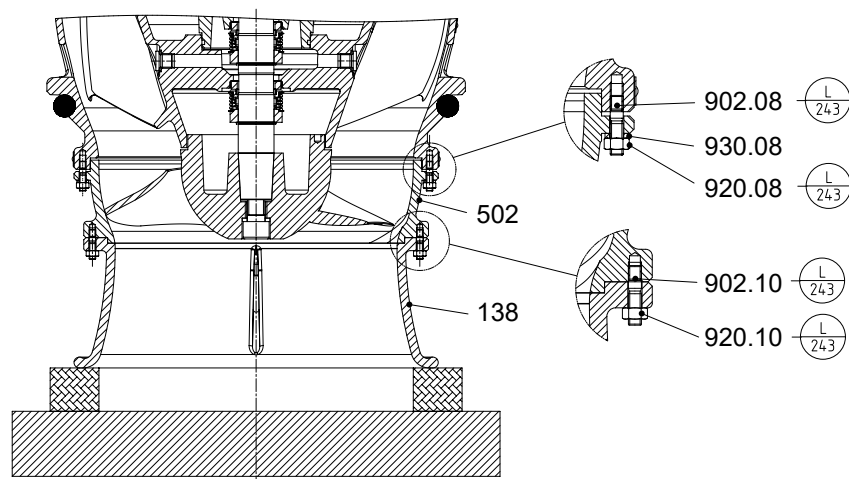


Fig. 44: Removing the bellmouth and casing wear ring

Table 34: Key to the symbols

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

- ✓ 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 nut 920.08 and remove it together with lock washer 930.08.
 2. Attach the crane hook to the bail. Lift the pump set off casing wear ring 502.
 3. Place the pump set down in a horizontal position on wooden supports. Secure it against rolling away.
 4. Remove nuts 920.10 from studs 902.10. Store them carefully.

7.5.3.2 Removing the bellmouth, sizes 600 to 800

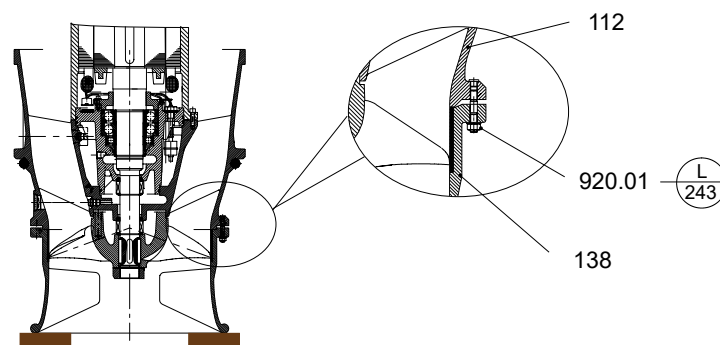


Fig. 45: Removing the bellmouth

Table 35: Key to the symbols

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

- ✓ 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 crane hook to the bail and lift the pump set off bellmouth 138.
 3. Place the pump set down in a horizontal position on wooden supports. Secure it against rolling away.

7.5.4 Removing the impeller

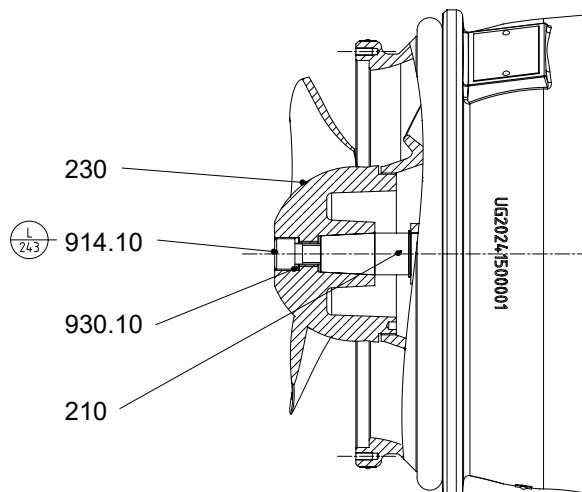


Fig. 46: Removing the impeller

- ✓ The pump set has been placed in a horizontal position on wooden supports. It has been secured against rolling away.
 - ✓ The lubricant and any leakage have been drained.
 - ✓ The bellmouth and casing wear ring have been removed.
1. Undo hexagon socket head cap screw 914.10. Remove it together with lock washer 930.10.
 2. Screw the forcing screw into the impeller hub. Remove impeller 230 from shaft 210.

7.5.5 Removing the mechanical seal

7.5.5.1 Removing the impeller-end mechanical seal

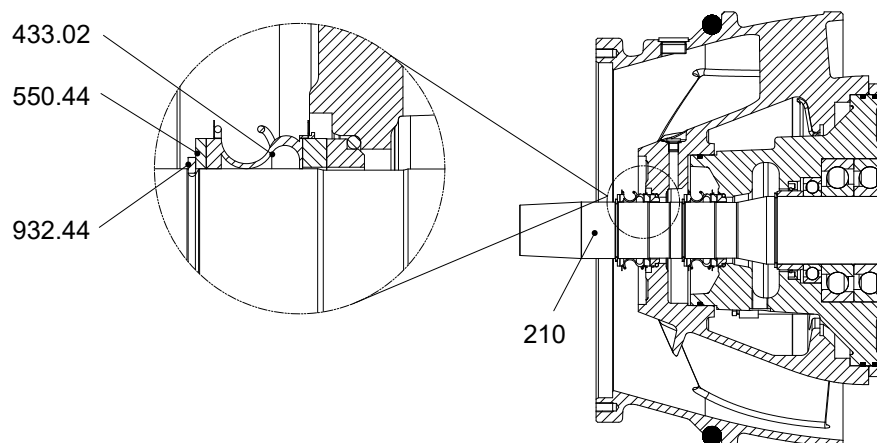


Fig. 47: Removing the impeller-end mechanical seal

- ✓ The pump set has been placed in a horizontal position on wooden supports. It has been secured against rolling away. (⇒ Section 3.2, Page 13)
 - ✓ The impeller has been removed.
1. Remove circlip 932.44 and disc 550.44.
 2. Carefully pull mechanical seal 433.02 and its mating ring off the shaft.
 - ⇒ If, unlike in the illustration, a HJ97G mechanical seal has been fitted, also undo the grub screws at the mechanical seal. Carefully pull the mechanical seal off the shaft.



NOTE

To protect the mechanical seal against damage when pulling it off the shaft, placing a foil (no thicker than max. 0.01 inch [0.3 mm]) around the free shaft end is recommended.

7.5.5.2 Removing the drive-end mechanical seal



DANGER

Improper lifting/moving/transporting of heavy assemblies or components

Danger to life from falling parts!

Damage to the pump set!

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

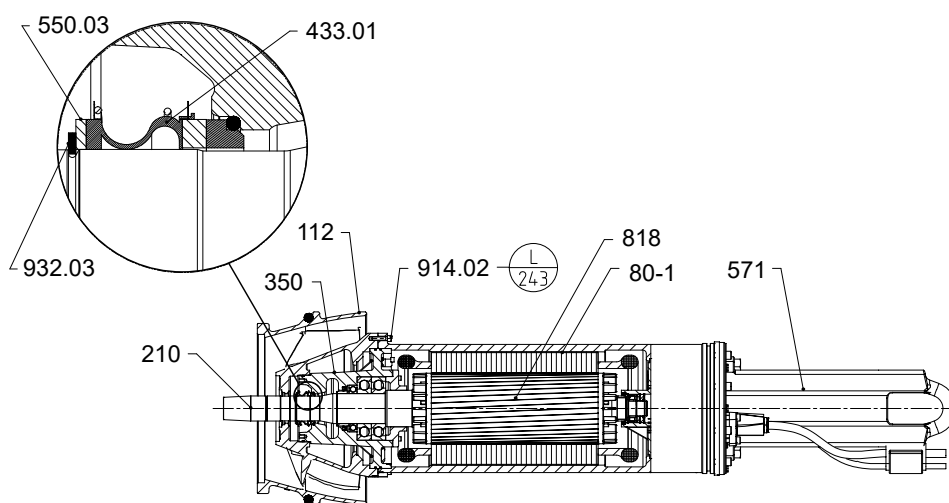


Fig. 48: Removing the drive-end mechanical seal

Table 36: Key to the symbols

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

- ✓ The impeller-end mechanical seal has been removed.
- 1. Attach the pump set to bail 571 and pull it upright.
- 2. Place the pump set with pump bowl 112 down on the casing wear ring again.
- 3. Undo hexagon socket head cap screws 914.02.
- 4. Attach the lifting tackle to bail 571 and lift the pump set out of pump bowl 112.
- 5. 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 away.
- 6. Remove circlip 932.03 and disc 550.03.
- 7. Carefully pull mechanical seal 433.01 and its mating ring off the shaft.



NOTE

To protect the mechanical seal against damage when pulling it off the shaft, placing a foil (no thicker than max. 0.01 inch [0.3 mm]) around the free shaft end is recommended.

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 sets can affect explosion protection and are only permitted after consultation with the manufacturer.
	NOTE The motors of explosion-proof pump sets are supplied in "flameproof enclosure" type of protection. Any work on the motor section which could affect explosion protection, such as re-winding and repair work involving machining, must be inspected by an approved expert or performed by the motor manufacturer. No modifications must be made to the internal configuration of the motor space. Repair work at the flameproof joints must only be performed in accordance with the manufacturer's instructions.

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

7.5.6.1 Removing the motor housing cover

Pump set with standard sensors

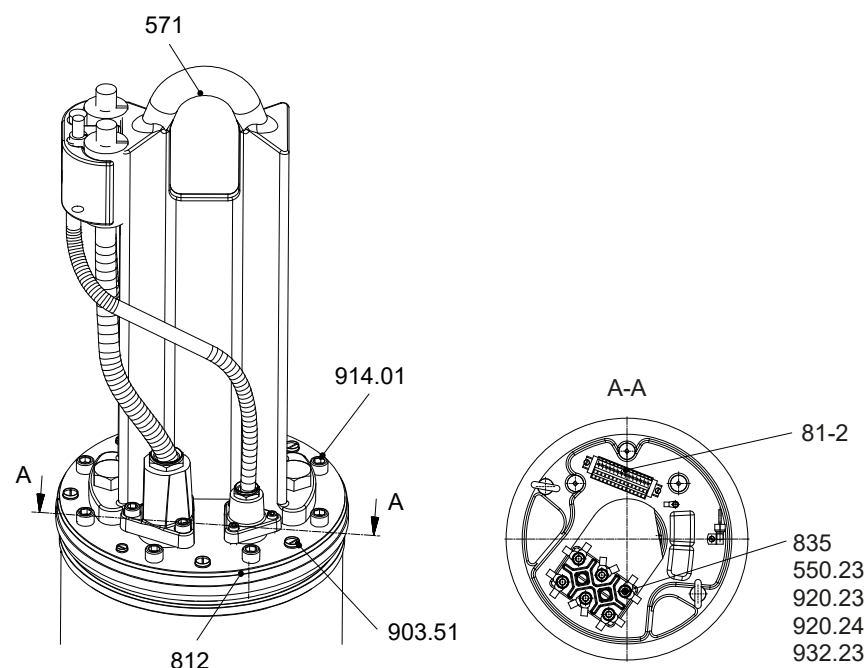


Fig. 49: Removing the motor housing cover, pump set with standard sensors, motor versions UT/XT

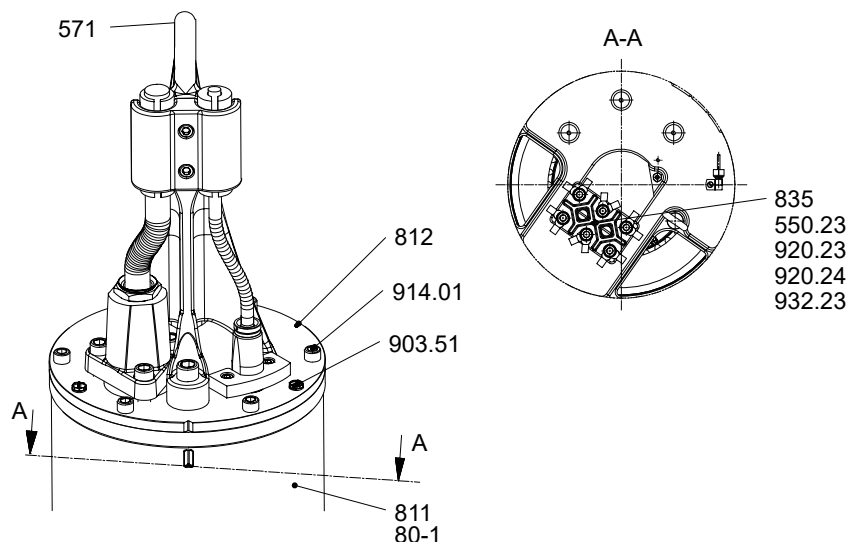


Fig. 50: Removing the motor housing cover, pump set with standard sensors, motor versions UV/XV/UW/XW

- ✓ Suitable lifting equipment is available.
 - ✓ The pump set has been disconnected from the power supply. It has been securely placed on a level/even surface in a vertical position.
1. Attach bail 571 to the lifting equipment.
 2. Undo hexagon socket head cap screws 914.01.
 3. Carefully lift up motor housing cover 812. If the motor housing cover cannot be lifted up, use the jacking threads located underneath caps 903.51.
 4. Remove the cable ties.
 5. Lift motor housing cover 812 up further until the power cables and sensor cable can be disconnected.
 6. If applicable, disconnect plug 81-2 of the sensor cable from the corresponding connector block ¹⁶⁾ or disconnect the plug-type connection ¹⁷⁾.
 7. Disconnect all cores of the power cables from terminal board 835¹⁸⁾ and remove the power cables together with disc 550.23, circlip 932.23 and nuts 920.23/920.24. Carefully store the discs, circlip and nut. Undo the plug-type connection ¹⁹⁾.
 8. Place down motor housing cover 812. Secure it against rolling away.

¹⁶ Applies to AmaCan P 700-471 and AmaCan P 800-471

¹⁷ Applies to AmaCan P 500-325 and AmaCan P 600-351

¹⁸ Applies to AmaCan P 500-325, AmaCan P 600-351, AmaCan P 700-471 and AmaCan P 800-471

¹⁹ Applies to AmaCan P 400-290

Pump set with sensor system

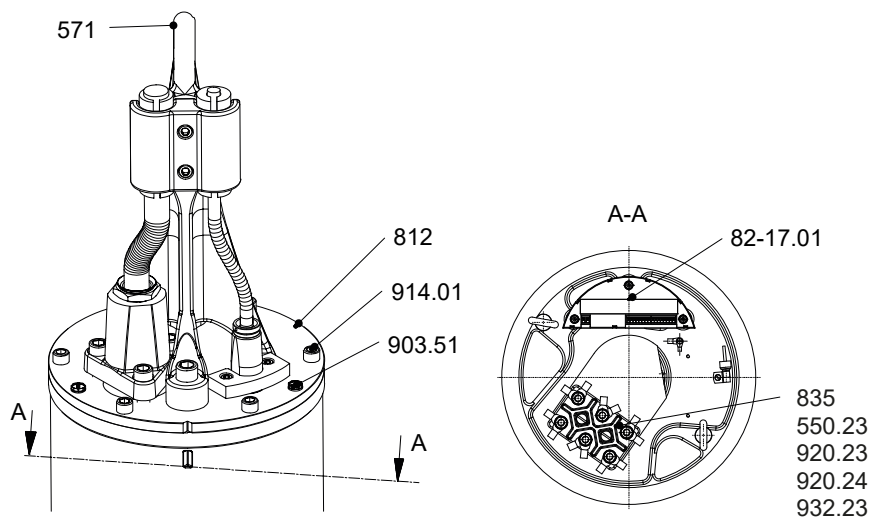


Fig. 51: Removing the motor housing cover, pump set with sensor system

- ✓ Suitable lifting equipment is available.
 - ✓ The pump set has been disconnected from the power supply. It has been securely placed on a level/even surface in a vertical position.
1. Attach bail 571 to the lifting equipment.
 2. Undo hexagon socket head cap screws 914.01.
 3. Carefully lift up motor housing cover 812. If the motor housing cover cannot be lifted up, use the jacking threads located underneath caps 903.51.
 4. Remove the cable ties.
 5. Lift motor housing cover 812 up further until the power cables and sensor cable can be disconnected.
 6. Undo the cores of the sensor cable from sensor unit 82-17.01.
 7. Disconnect all cores of the power cables from terminal board 835¹⁸⁾ and remove the power cables together with disc 550.23, circlip 932.23 and nuts 920.23/920.24. Carefully store the discs, circlip and nut. Undo the plug-type connection¹⁹⁾.
 8. Place down motor housing cover 812. Secure it against rolling away.

7.5.6.2 Removing the cable gland with connection cable

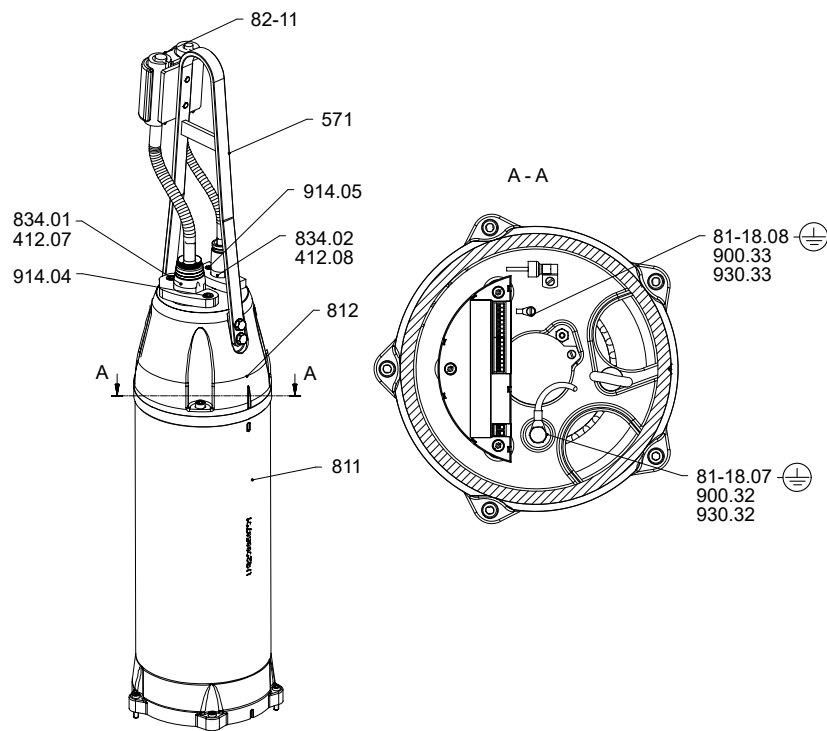


Fig. 52: Size 400-290: Removing the cable gland with cable

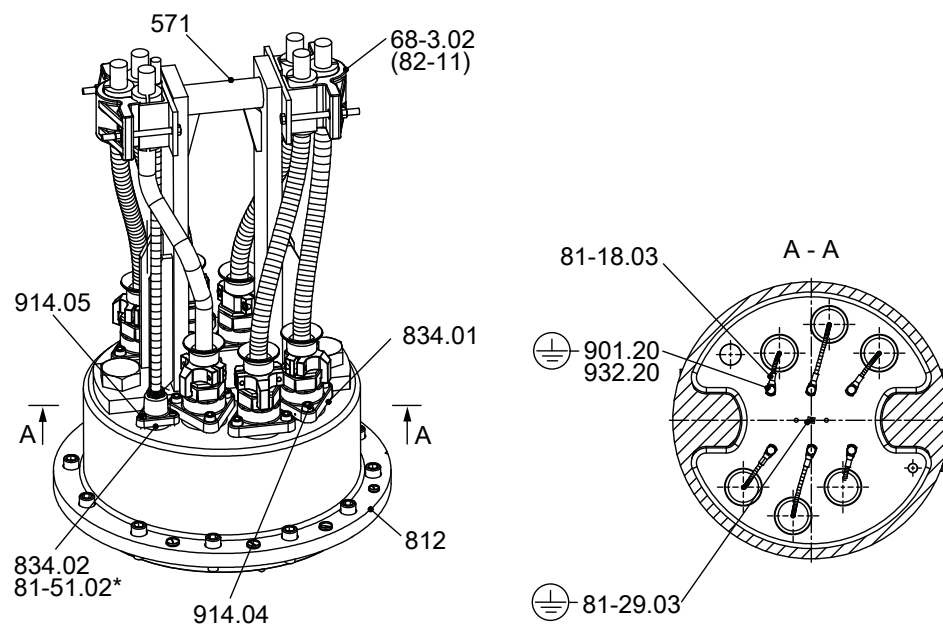


Fig. 53: Sizes 500-325, 600-351, 700-471 and 800-471: Removing the cable gland with cable

* If applicable

Removing the power cable

- ✓ The motor housing cover has been removed, placed down and secured against rolling away.
- 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.

7.6 Reassembling the pump set

7.6.1 General information/Safety regulations

 	 DANGER Strong magnetic field in the pump rotor area Danger of death for persons with pacemaker! Interference with magnetic data carriers, electronic devices, components and instruments! Uncontrolled magnetic attraction forces between magnet-equipped components, tools or similar! ▷ Keep a safety distance of at least 1.6 ft (0.5 m). ▷ Observe the additional instructions. (⇒ Section 2.10, Page 12)
	 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.
	 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 Improper lifting/moving of heavy assemblies or components Personal injury and damage to property! ▷ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.
	 WARNING Components with sharp edges Risk of cutting or shearing injuries! ▷ Always use appropriate caution for installation and dismantling work. ▷ Wear work gloves.
	 WARNING Insufficient stability Risk of crushing hands and feet! ▷ During assembly/dismantling, secure the pump (set)/pump parts against tilting or tipping over.

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

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

Assembly adhesives Avoid the use of assembly adhesives if possible.

Tightening torques For reassembly, tighten all screws and bolts as indicated.
In addition, secure all screwed connections closing off the flameproof enclosure with a thread-locking agent (Loctite, type 243).

7.6.2 Installing the replacement cable gland

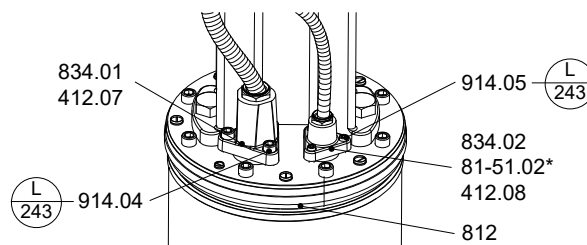


Fig. 55: Installing the cable gland

* If applicable

Table 37: Key to the symbols

Symbol	Key
	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 secured against rolling away.
- 1. Adjust the lengths of the cable cores to the original cable gland.
- 2. Attach core identifications matching the original cable gland.
- 3. Slide O-ring 412.07 onto the core ends of the power cable and into the groove of the centering seat.
- 4. Insert cable gland 834.01 with the power cable and O-ring 412.07 into the opening provided.
- 5. Fasten cable gland 834.01 with hexagon socket head cap screws 914.04. Secure the screwed connection with Loctite 243.
- 6. Fit cable terminals to the core ends of the power cable ²²⁾. Connect the core ends of the power cable to the plug-type connection ²³⁾.

Installing the sensor cable
Pump set with standard sensors, sizes 500 to 800

- ✓ The motor housing cover has been removed, placed down and secured against rolling away.
- 1. Adjust the lengths of the cable cores to 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 centering seat.
- 4. Insert cable gland 834.02 with the sensor cable and O-ring 412.08 into the opening provided.
- 5. Tighten and secure the cable gland.
 - ⇒ **Motor versions UT/XT:** Fasten cable gland 834.02 with hexagon socket head cap screws 914.05 and secure the screwed connection with Loctite 243.
 - ⇒ **Motor versions UV/XV/UW/XW:** Fasten cable gland 834.02 with clamping element 81-51.02 and hexagon socket head cap screws 914.05 and secure the screwed connection with Loctite 243.

Pump set with sensor system, sizes 400 to 800

- ✓ The motor housing cover has been removed, placed down and secured against rolling away.
- 1. Adjust the lengths of the cable cores to 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 centering 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 clamping element 81-51.02 and hexagon socket head cap screws 914.05 and secure the screwed connection with Loctite 243.

²² Applies to AmaCan P 500-325, AmaCan P 600-351, AmaCan P 700-471 and AmaCan P 800-471

²³ Applies to AmaCan P 400-290

7.6.3 Fitting the motor housing cover



⚠ DANGER

Electrical connection work by unqualified personnel

Danger to life from electric shock

- ▷ Always have the electrical connections installed by an electrically qualified person.
- ▷ Observe regulation IEC 60364 as well as the applicable regional regulations.

Pump set with standard sensors

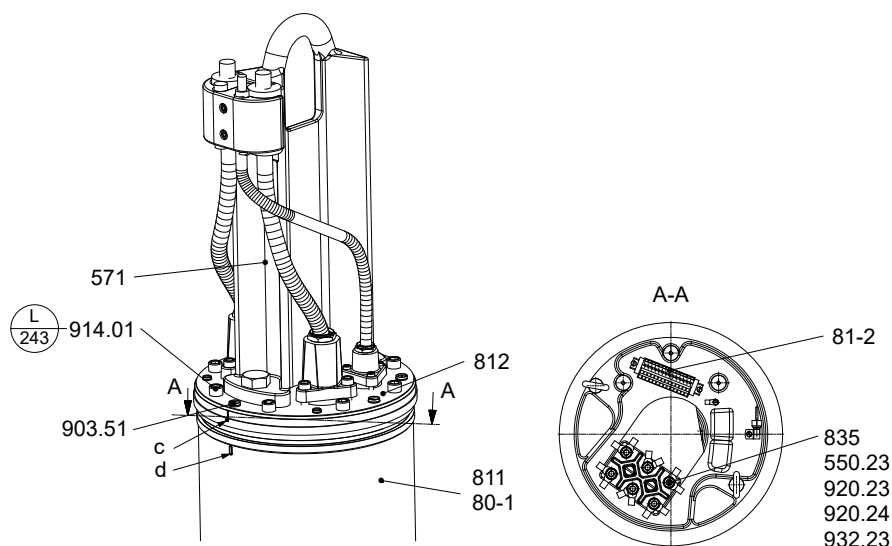


Fig. 56: Fitting the motor housing cover, pump set with standard sensors, motor versions UT/XT

c	Alignment grooves of motor housing cover 812
d	Alignment groove of motor housing 811

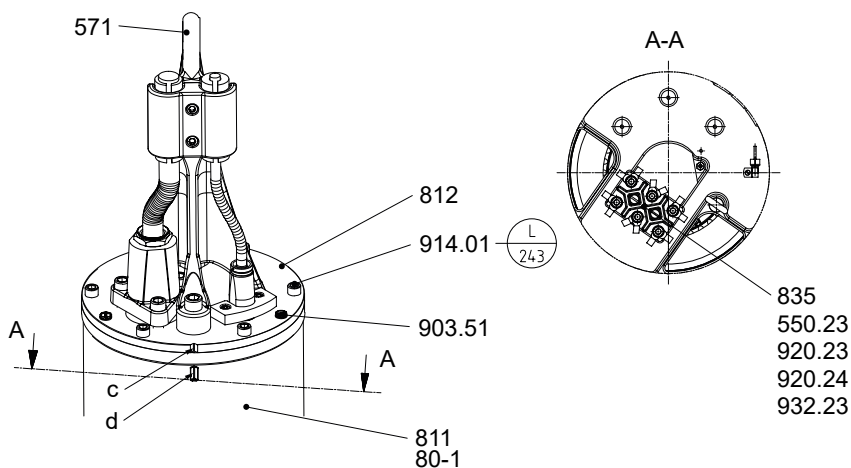


Fig. 57: Fitting the motor housing cover, pump set with standard sensors, motor versions UV/XV/UW/XW

c	Alignment grooves of motor housing cover 812
d	Alignment groove of motor housing 811

Table 38: Key to the symbols

Symbol	Key
(L 243)	Always secure screwed connections marked with this symbol with Loctite 243 .

- ✓ The cable glands have been installed.
- ✓ A new O-ring has been inserted into the groove of motor housing cover 812.
- 1. Attach lifting equipment to bail 571 of motor housing cover 812.
 - ⇒ Lower motor housing cover 812 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. Motor versions UT/XT: Connect plug 81-2 of the sensor cable to the corresponding connector block.
Motor versions UV/XV/UW/XW: Connect the plug-type connection.
- 3. Connect all cores of the power cables to terminal board 835 with disc 550.23, circlip 932.23 and nuts 920.23/920.24 in accordance with the wiring diagram (⇒ Section 9.4, Page 125).²⁴⁾
Connect the plug-type connection.²⁵⁾
- 4. Tie the cores together with cable ties.
- 5. Slowly lower motor housing cover 812 down onto motor housing 811.
 - ⇒ Watch the alignment grooves in motor housing cover 812 and motor housing 811. The 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.
- 7. Cover the jacking threads with caps 903.51.
- 8. Perform a leak test on the motor.

Pump set with sensor system

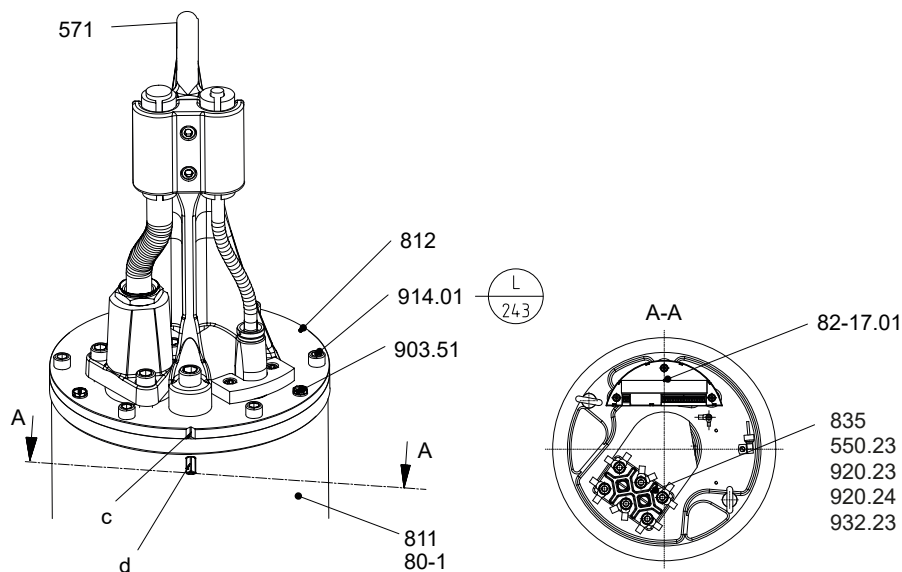


Fig. 58: Fitting the motor housing cover, pump set with sensor system

c	Alignment grooves of motor housing cover 812
d	Alignment groove of motor housing 811

Table 39: Key to the symbols

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

²⁴ Applies to AmaCan P 500-325, AmaCan P 600-351, AmaCan P 700-471 and AmaCan P 800-471

²⁵ Applies to AmaCan P 400-290

- ✓ The cable glands have been installed.
- ✓ A new O-ring has been inserted into the groove of motor housing cover 812.
- 1. Attach lifting equipment to bail 571 of motor housing cover 812.
 - ⇒ Lower motor housing cover 812 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 the individual cores of the sensor cable to sensor unit 82-17.01.
- 3. Connect all cores of the power cables to terminal board 835 with disc 550.23, circlip 932.23 and nuts 920.23/920.24 in accordance with the wiring diagram (⇒ Section 9.4, Page 125).²⁶⁾
Connect the plug-type connection.²⁷⁾
- 4. Tie the cores together with cable ties.
- 5. Slowly lower motor housing cover 812 down onto motor housing 811.
 - ⇒ Watch the alignment grooves in motor housing cover 812 and motor housing 811. The 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.
- 7. Cover the jacking threads with caps 903.51.
- 8. Perform a leak test on the motor.

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 seal faces immediately before assembly takes place.
- Make sure the surface of the shaft is absolutely clean and undamaged.
- Immediately before installing the mechanical seal, wet the seal faces with a drop of oil.
- For easier installation of a bellows-type mechanical seal, wet the inner bellows diameter and/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 tools.
- To prevent any damage to the rubber bellows, place a thin foil of approximately 0.0039 to 0.0118 inch [0.1 to 0.3 mm] around the free shaft stub.
Slide the rotating assembly over the foil into its installation position.
Then remove the foil.

7.6.4.1 Drive-end mechanical seal

	 DANGER
	Improper lifting/moving/transporting of heavy assemblies or components Danger to life from falling parts! Damage to the pump set! ▷ Never rotate the rotor in the motor housing during dismantling/reassembly. ▷ Place the motor (unit) including rotor and bearing housing on a wooden support and protect it against rolling off.

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²⁶ Applies to AmaCan P 500-325, AmaCan P 600-351, AmaCan P 700-471 and AmaCan P 800-471

²⁷ Applies to AmaCan P 400-290

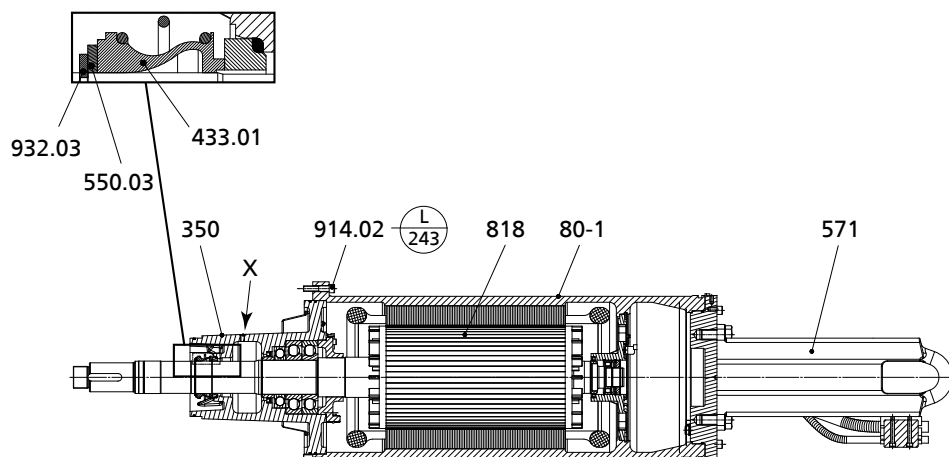


Fig. 59: Installing the drive-end mechanical seal

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

Table 40: Key to the symbols

Symbol	Key
	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 away.
- 1. Use an assembly sleeve of a suitable diameter to insert the mating ring of mechanical seal 433.01 together with the O-ring into the drilled seat of bearing housing 350.
- 2. Carefully guide on the bellows part of mechanical seal 433.01 until it rests against the mating ring.
- 3. Guide disc 550.03 and circlip 932.03 onto the shaft. Press the circlip in with an assembly sleeve until it is axially fastened in the shaft groove.
- 4. Screw the testing device into the leakage drain hole (X) of bearing housing 350 and perform a leak test.
- 5. Attach the crane hook to the bail and pull upright motor unit 80-1 including rotor 818 with bearing and bearing housing 350. (⇒ Section 3.2.2, Page 13)
- 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).

7.6.4.2 Impeller-end mechanical seal

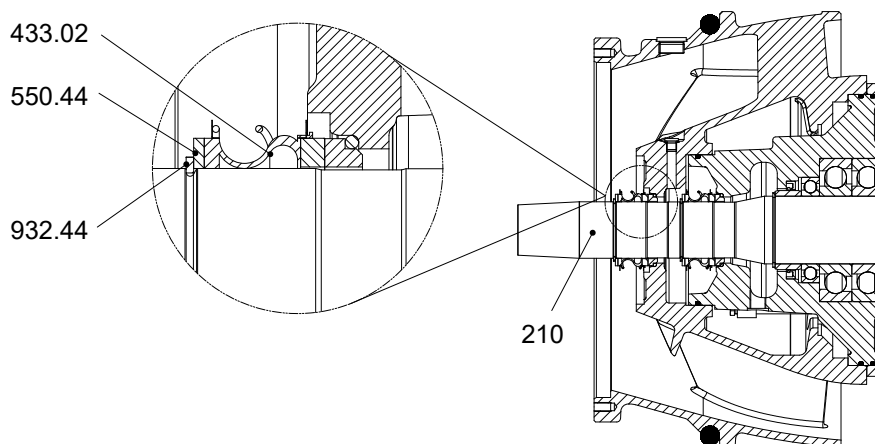


Fig. 60: Installing the impeller-end mechanical seal

- ✓ 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 away.
- 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.
 - ⇒ If, unlike in the illustration, a HJ97G mechanical seal has been fitted, also tighten the grub screws at the mechanical seal.
- 4. Check the lubricant chamber for leakage. (⇒ Section 7.6.8.1, Page 98)
- 5. Fill the lubricant chamber with lubricant. Then close the lubricant chamber.

7.6.5 Fitting the impeller

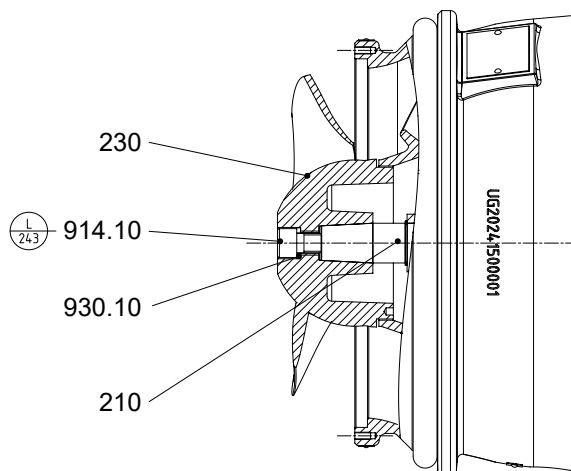


Fig. 61: Fitting the impeller with tapered fit

Table 41: Key to the symbols

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

- ✓ The pump set has been placed in a horizontal position on wooden supports. It has been secured against rolling away.
- ✓ The impeller-end mechanical seal 433.02 has been installed.
- 1. Suspend impeller 230 and slide it onto the shaft end.
- 2. Screw in impeller screw 914.10 with lock washer 930.10. Tighten with a torque wrench. Observe the tightening torques. (⇒ Section 7.9, Page 103)



NOTE

For an impeller mounted on the shaft with a tapered fit, make sure that the tapered fit between impeller and shaft is undamaged and assembled free from grease.

7.6.6 Fitting the casing wear ring, sizes: 400-290 and 500-325

- ✓ Bellmouth 138 and casing wear ring 502 have been positioned on wooden supports on a level/even and solid surface.
- ✓ Suitable lifting equipment is available.
- ✓ The pump set has been completely pre-assembled.
- ✓ Nuts 920.10 have been removed from studs 902.10.

- ✓ The casing wear ring has been checked for wear. If necessary, the casing wear ring has been replaced.
 - ✓ The thread of hexagon socket head cap screws 914.24 protrudes from casing wear ring 502 by at least reference dimension B.
1. Suspend the pump set from bail 571. Carefully pull it upright.
 2. Center the pump set above bellmouth 138.
Note: Casing wear ring 502 is loosely positioned on bellmouth 138.
 3. Slowly lower the pump set.
 - ⇒ During the lowering process, make sure that studs 902.08 engage in the clearance holes of pump bowl 112.
 4. Fully lower the pump set onto casing wear ring 502.
 5. Fit all nuts 920.08 together with lock washers 930.08 and tighten them lightly.
 6. Lift the pump set off bellmouth 138. Place it in a horizontal position on suitable wooden supports. Secure it against rolling away.

7.6.6.1 Adjusting the clearance, sizes: 400-290 and 500-325

	WARNING
	Improper dismantling Risk of injury from falling parts!
	▶ When adjusting the clearance, never undo all nuts 920.08 at the same time.

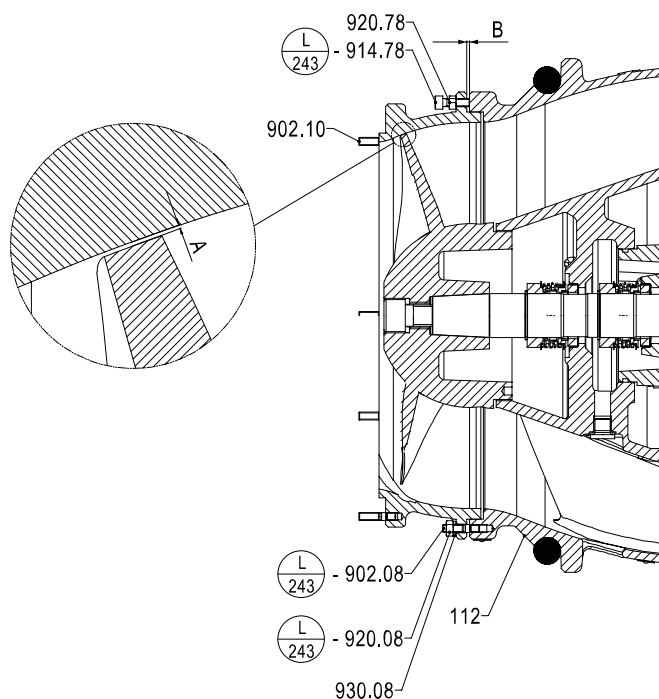


Fig. 62: Adjusting the clearance

Table 42: Key to the symbols

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

- ✓ The pump set has been placed in a horizontal position on wooden supports. It has been secured against rolling away.
- ✓ The pump set has been completely assembled.

1. Undo studs 902.08. Wet them with Loctite 243 one after the other. Then screw them back in again.
2. Wet hexagon socket head cap screw 914.78 and nuts 920.08 with Loctite 243 one after the other.
3. Adjust the clearance.
 - ⇒ If clearance A is too small, loosen all nuts 920.08 evenly and, at the same time, tighten hexagon socket head cap screws 914.78 evenly.
 - ⇒ If clearance A is too large, loosen all hexagon socket head cap screws 914.78 evenly and, at the same time, tighten all nuts 920.08 evenly.
4. Measure clearance A between impeller vane and casing wear ring at the vane leading edge of the impeller with a feeler gage.
5. When clearance A has been adjusted correctly, tighten nuts 920.08. Then tighten hexagon socket head cap screws 914.78. Observe the tightening torque.
(⇒ Section 7.9, Page 103)
6. Tighten nuts 920.78 to secure hexagon socket head cap screws 914.78.
7. Check by rotating the pump rotor by hand.
 - ⇒ During rotation the impeller must not touch any part of the casing.
8. If necessary, re-adjust the clearance.

Table 43: Dimensions for standard clearances A and B

Size	Clearance A		Reference clearance B	
	[inch]	[mm]	[inch]	[mm]
AmaCan P 400-290	0.012 +/-0.002	0.30 +/-0.05	0.078	2
AmaCan P 500-325	0.012 +/-0.002	0.30 +/-0.05	0.078	2

Table 44: Dimensions for increased clearances A and B

Size	Clearance A		Reference clearance B	
	[inch]	[mm]	[inch]	[mm]
AmaCan P 400-290	0.024 +/-0.002	0.60 +/- 0.05	0.078	2
AmaCan P 500-325	0.024 +/-0.002	0.60 +/- 0.05	0.078	2

7.6.7 Fitting the bellmouth

7.6.7.1 Removing the bellmouth, sizes: 400 and 500

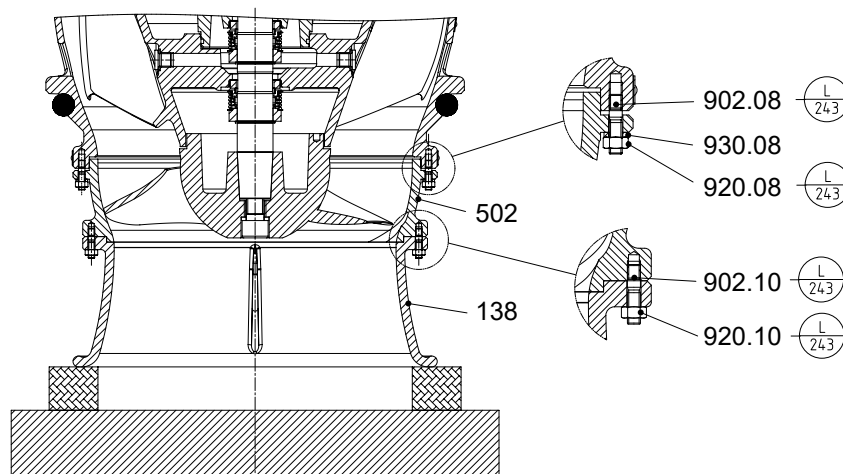
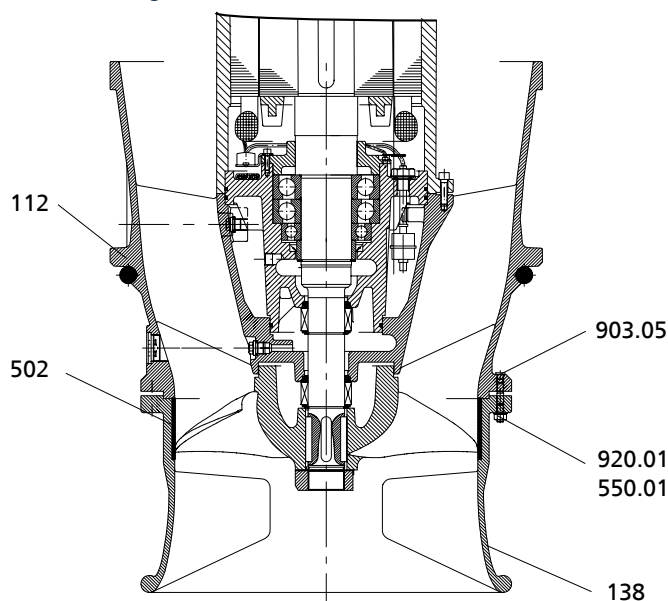

Fig. 63: Fitting the bellmouth

Table 45: Key to the symbols

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

- ✓ Bellmouth 138 has been positioned on wooden supports on a level/even and solid surface.
- ✓ Suitable lifting equipment is available.
- ✓ The pump set has been completely pre-assembled.
 1. Attach the pump set to bail 571 and pull it upright.
 2. Center the pump set above bellmouth 138.
 - ⇒ Verify that the alignment grooves are properly aligned.
 3. Slowly lower the pump set.
 - ⇒ While lowering the pump set, make sure that studs 902.01 are aligned with the drilled holes.
 4. Then lower the pump set until it sits on bellmouth 138.
 5. Fasten all studs 902.10 with corresponding nuts 920.10. Secure with Loctite 243. Observe the tightening torque.

7.6.7.2 Fitting the bellmouth, sizes: from 600


Fig. 64: Impeller of pressure class A

- ✓ Bellmouth 138 has been positioned on wooden supports on a level and solid surface.
- ✓ Suitable lifting equipment is available.
- ✓ The pump set has been completely pre-assembled.
- ✓ A new casing wear ring 502 has been fitted in bellmouth 138.
 1. Attach lifting equipment to bail 571 and carefully pull the pump set upright.
 2. Center the pump set above bellmouth 138.

Note: Make sure that the pin of bail 571 for attaching the lifting equipment and the anti-swirl baffles in bellmouth 138 are aligned in the same direction.
 3. Slowly lower the pump set. While lowering the pump set, make sure that studs 902.01 are aligned with the drilled holes.
 4. Then lower the pump set until it sits on bellmouth 138.
 5. Fasten all studs 902.01 with corresponding nuts 920.01 and discs 550.01. Observe the tightening torques. (⇒ Section 7.9, Page 103)

6. Close the threaded holes with screw plugs 903.05.

Table 46: Diameter of the casing wear ring

Size	Nominal diameter	
	[inch]	[mm]
600 - 351	13780 + 0.004	350 + 0.1
700 - 471	18504 + 0.004	470 + 0.1
800 - 471	18504 + 0.004	470 + 0.1

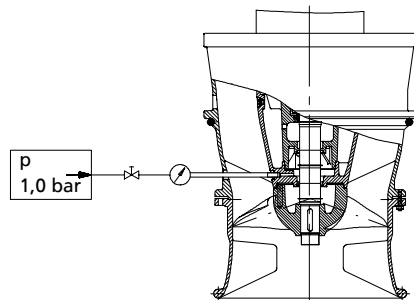
7.6.8 Leak testing

7.6.8.1 Checking the lubricant chamber for leakage

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

Observe the following values for leak testing:

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


Fig. 65: Screwing in the testing device

1. Remove screw plug 903.04 and joint ring 411.04 from the lubricant chamber.
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 sealing elements and screwed connections.
Repeat the leak test.
4. If the leak test has been successful, fill in the lubricant.

7.6.8.2 Leak testing the motor

For leak testing the motor, the G1/2 threaded hole of screw plug 903.31 can be used. Otherwise the leak test has to be performed via the opening for the power cables.

Observe the following values for leak testing:

- **Test medium:** nitrogen
- **Test pressure:** maximum 11.6 psi [0.8 bar]
- **Test duration:** 2 minutes

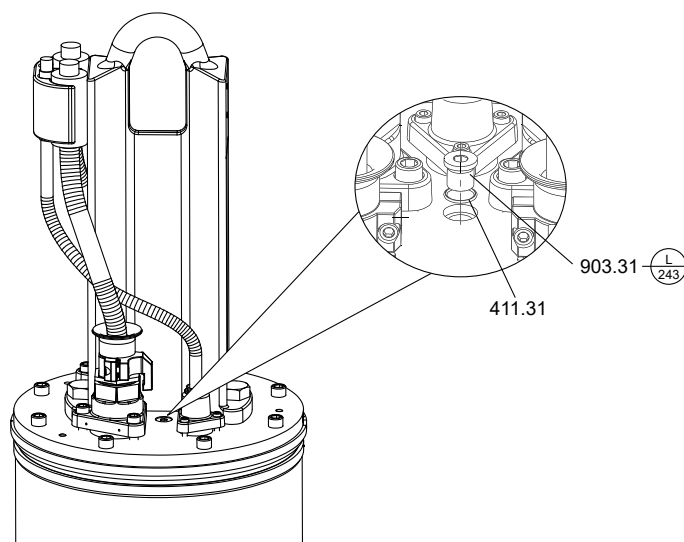


Fig. 66: Leak testing the motor

Table 47: Key to the symbols

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

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

	 DANGER
	Screw plug leaking or missing Explosion hazard! Damage to the motor! ▷ Never start up a pump set without screw plug 903.31. ▷ Apply a thread-locking agent (Loctite 243) to screw plug 903.31.

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

7.7 Checking the connection of power supply and motor

Once reassembly has been completed, carry out the steps described in (⇒ Section 7.2.1, Page 66) and (⇒ Section 7.3.5, Page 71) .

7.8 Replacing the sacrificial anode

7.8.1 Interval

On pump sets with sacrificial anodes (material variant G3), 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.
- Replace the sacrificial anodes at least every 5 years or every 24,000 operating hours.

7.8.2 Replacing the sacrificial anodes at the bail

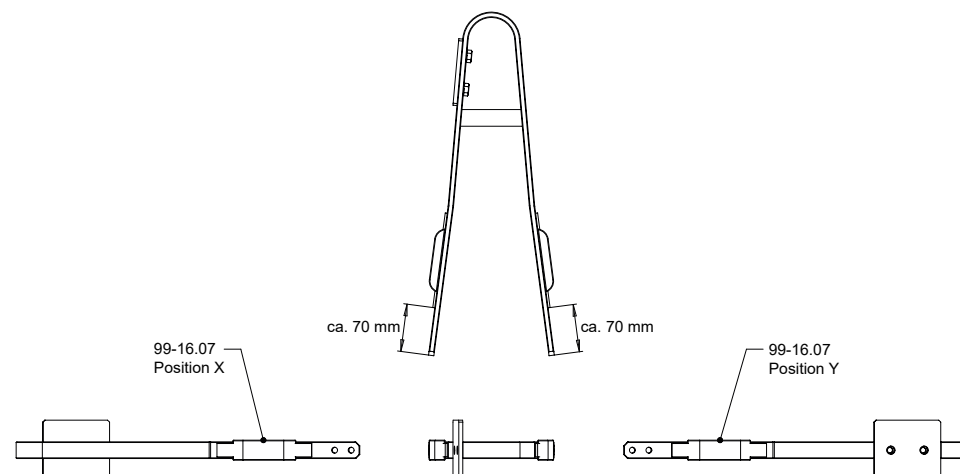


Fig. 67: AmaCan P 400-290: Positions of sacrificial anodes at the bail

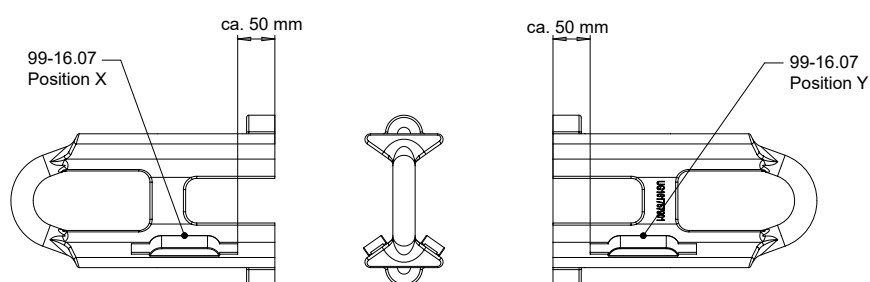


Fig. 68: AmaCan P 500-325: Positions of sacrificial anodes at the bail

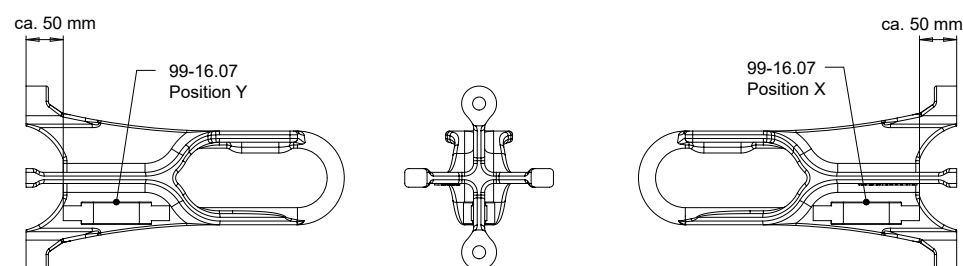


Fig. 69: AmaCan P 600-351: Positions of sacrificial anodes at the bail

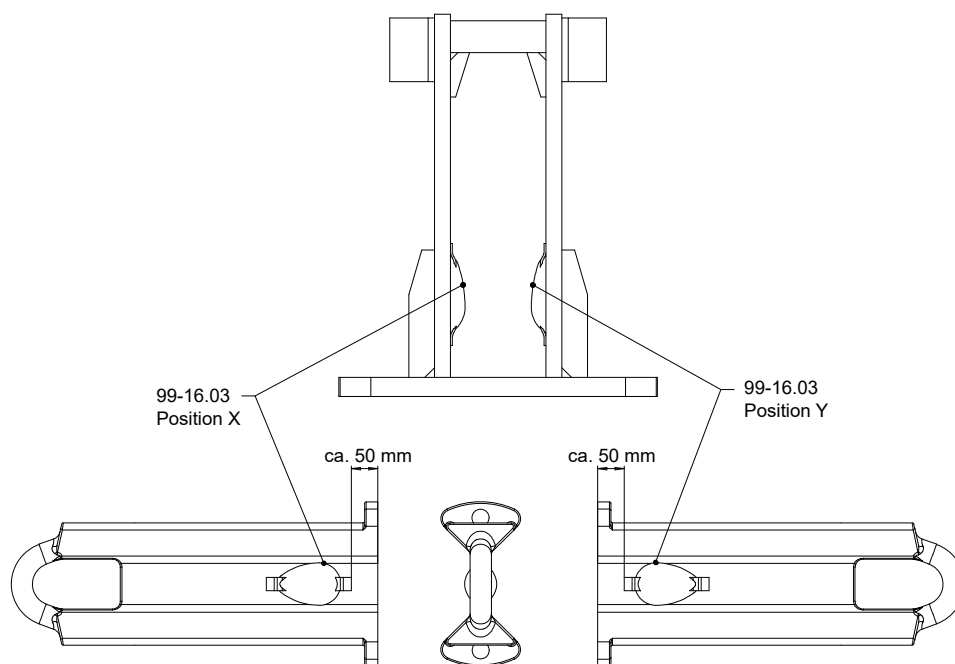


Fig. 70: AmaCan P 700-471 and AmaCan P 800-471: Positions of sacrificial anodes at the bail

Table 48: Combinations of sacrificial anodes at the bail

Size	Quantity and weight		Material of sacrificial anodes
	For position X	For position Y	
400-290	1×0.55 lbs / 1×0.25 kg	1×0.55 lbs / 1×0.25 kg	Zinc
500-325	1×0.55 lbs / 1×0.25 kg	1×0.55 lbs / 1×0.25 kg	Zinc
500-325	1×0.55 lbs / 1×0.25 kg	1×0.55 lbs / 1×0.25 kg	Zinc
700-471	1×1.98 lbs / 1×0.9 kg	-	Zinc
800-471	1×1.98 lbs / 1×0.9 kg	-	Zinc

✓ The pump set is positioned horizontally on a level/even surface and is protected against rolling away.

1. Remove sacrificial anodes 99-16. Clean the surface.
2. Weld new sacrificial anodes to the lugs. We recommend using new sacrificial anodes made by KSB.

7.8.3 Replacing the sacrificial anodes at the bellmouth

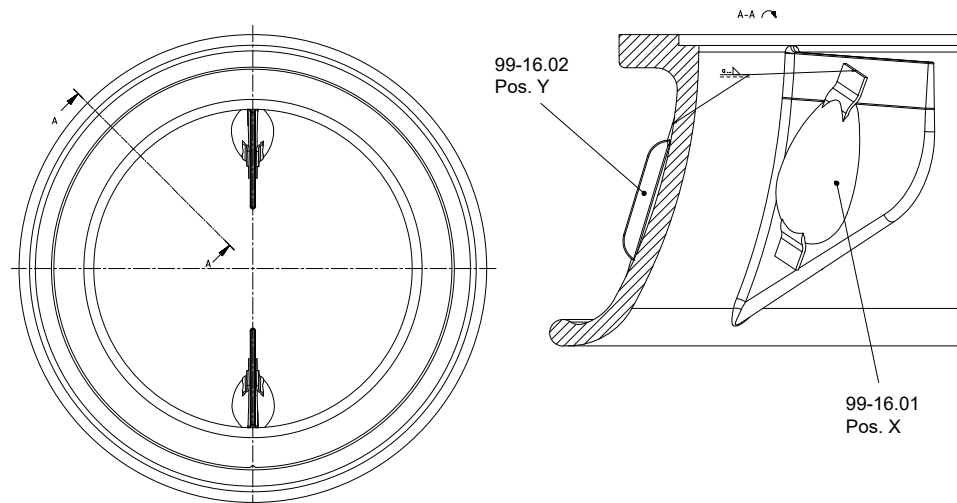


Fig. 71: Sacrificial anodes at the bellmouth

- Information on position X: Distribute the number of sacrificial anodes on both sides of the vanes. The stays for welding on may be shortened.
- Information on position Y: Evenly distribute the number of sacrificial anodes over the circumference. The stays for welding on may be shortened. Rotating the sacrificial anodes is permissible.

Table 49: Combinations of sacrificial anodes at the bellmouth

Size	Quantity and weight at position X	Quantity and weight at position Y	Material of sacrificial anodes
400-290	-	4×0.55 lbs / 4×0.25 kg	Zinc
500-325	4×0.55 lbs / 4×0.25 kg	2×0.55 lbs / 2×0.25 kg	Zinc
600-351	4×0.55 lbs / 4×0.25 kg	4×0.55 lbs / 4×0.25 kg	Zinc
700-471	4×0.55 lbs / 4×0.25 kg	4×0.55 lbs / 4×0.25 kg	Zinc
800-471	4×0.55 lbs / 4×0.25 kg	4×0.55 lbs / 4×0.25 kg	Zinc

- ✓ The pump set is positioned horizontally on a level/even surface and is protected against rolling away.

- Remove sacrificial anodes 99-16.01 and 99-16.02. Clean the surface.
- Weld new sacrificial anodes to the lugs. We recommend using new sacrificial anodes made by KSB.

7.8.4 Replacing sacrificial anodes at the pump bowl

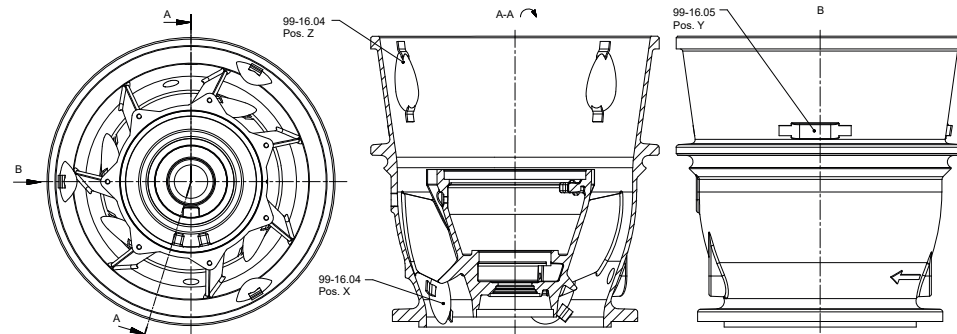


Fig. 72: Sacrificial anodes at the pump bowl

- Information on positions X, Y and Z: Evenly distribute the number of sacrificial anodes over the circumference. The stays for welding on may be shortened. Rotating the sacrificial anodes is permissible.

Table 50: Combinations of sacrificial anodes at the pump bowl

Size	Quantity and weight			Material of sacrificial anodes
	For position X	For position Y	For position Z	
400-290	2×1.98 lbs / 2×0.9 kg	-	-	Zinc
500-325	2×1.98 lbs / 2×0.9 kg	3×0.55 lbs / 3×0.25 kg	-	Zinc
600-351	-	4×0.55 lbs / 4×0.25 kg	3×1.98 lbs / 3×0.9 kg	Zinc
700-471	5×1.98 lbs / 5×0.9 kg	4×0.55 lbs / 4×0.25 kg	-	Zinc
800-471	5×1.98 lbs / 5×0.9 kg	4×0.55 lbs / 4×0.25 kg	-	Zinc

- ✓ The pump set is positioned horizontally on a level/even surface and is protected against rolling away.
- ✓ The bellmouth, casing wear ring and impeller have been removed.
 1. Remove sacrificial anodes 99-16.04 and 99-16.05. Clean the surface.
 2. Weld new sacrificial anodes to the lugs. We recommend using new sacrificial anodes made by KSB.

7.9 Tightening torques

Table 51: Tightening torques [lbf ft] depending on thread, steel grade and property class

Steel grade	-		A2, A4		A2, A4		C3		1.4410		1.4462	
Property class	8.8		-50		-70		-80		$R_{p0.2} \geq 530 \text{ N/mm}^2$		$R_{p0.2} \geq 450 \text{ N/mm}^2$	
Thread	Mini-mum	Rated value	Mini-mum	Rated value	Mini-mum	Rated value	Mini-mum	Rated value	Mini-mum	Rated value	Mini-mum	Rated value
M4	2,2	2,5	0,7	0,8	1,5	1,7	2,2	2,5	1,8	2,1	1,5	1,7
M5	4,5	5,0	1,5	1,6	3,2	3,5	4,5	5,0	3,7	4,1	3,2	3,5
M6	7,6	8,4	2,5	2,7	5,3	5,9	7,4	8,1	6,3	7,0	5,3	5,9
M8	18	21	6	7	13	14	18	21	15	17	13	14
M10	36	41	12	13	26	28	36	41	30	33	26	28
M12	62	69	21	23	43	49	63	69	52	52	43	49
M14	99	110	32	36	69	77	99	110	82	91	69	77
M16	154	171	51	56	108	120	154	171	128	142	108	120
M20	301	334	99	110	212	235	301	334	249	277	212	235
M24	519	577	170	190	365	406	519	577	430	478	365	406
M27	756	840	248	276	532	591	756	840	626	696	532	591
M30	1035	1150	339	377	727	808	1035	1150	857	952	727	808
M33	1393	1547	457	507	977	1088	1393	1547	1153	1281	977	1088
M36	1803	2004	592	657	1268	1409	1803	2004	1494	1660	1268	1409
M42	2879	3200	945	1050	2025	2250	2879	3200	2385	2649	2025	2250
M48	4337	4819	1423	1581	3050	3388	4337	4819	3592	3991	3050	3388

Table 52: Tightening torques [Nm] depending on thread, steel grade and property class

Steel grade	-		A2, A4		A2, A4		C3		1.4410		1.4462	
Property class	8.8		-50		-70		-80		$R_{p0.2} \geq 530 \text{ N/mm}^2$		$R_{p0.2} \geq 450 \text{ N/mm}^2$	
Thread	Mini-mum	Rated value	Mini-mum	Rated value	Mini-mum	Rated value	Mini-mum	Rated value	Mini-mum	Rated value	Mini-mum	Rated value
M4	3,0	3,4	1,0	1,1	2,1	2,4	3,0	3,4	2,5	2,8	2,1	2,4
M5	6,1	6,8	2,0	2,2	4,3	4,8	6,1	6,8	5,0	5,6	4,3	4,8
M6	10,3	11	3,4	3,7	7,2	8,0	10	11	8,5	9,5	7,2	8,0
M8	25	28	8,2	9,1	18	19	25	28	21	23	18	19
M10	49	55	16	18	35	38	49	55	41	45	35	38
M12	85	94	28	31	59	66	85	94	70	78	59	66
M14	134	149	44	49	94	105	134	149	111	124	94	105
M16	209	232	69	76	147	163	209	232	173	192	147	163

Steel grade			A2, A4		A2, A4		C3		1.4410		1.4462	
Property class	8.8		-50		-70		-80		$R_{p0,2} \geq 530 \text{ N/mm}^2$		$R_{p0,2} \geq 450 \text{ N/mm}^2$	
Thread	Mini- mum	Rated value	Mini- mum	Rated value	Mini- mum	Rated value	Mini- mum	Rated value	Mini- mum	Rated value	Mini- mum	Rated value
M20	408	453	134	149	287	319	408	453	338	375	287	319
M24	704	782	231	257	495	550	704	782	583	648	495	550
M27	1025	1139	36	374	721	801	1025	1139	849	944	721	801
M30	1403	1559	460	511	986	1096	1403	1559	1162	1291	986	1096
M33	1888	2098	619	688	1327	1475	1888	2098	1563	1737	1327	1475
M36	2445	2717	802	891	1719	1910	2445	2717	2025	2250	1719	1910
M42	3904	4338	1281	1423	2745	3050	3904	4338	3233	3592	2745	3050
M48	5880	6534	1929	2144	4135	4594	5880	6534	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.

7.10 Spare parts stock

7.10.1 Ordering spare parts

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

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

Refer to the name plate for all data.

Also supply the following data:

- Part No. and description (⇒ Section 9.1, Page 107)
- Quantity of spare parts
- Shipping address
- Mode of dispatch (freight, mail, express freight, air freight)

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

Table 53: 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 %
104-502	Casing wear ring kit	2	2	2	3	3	4	50 %
105-300	Bearing assembly kit	1	1	2	2	3	4	50 %
105-433	Mechanical seal kit	2	3	4	5	6	8	90 %
105-930	Safety device kit	1	1	1	2	2	3	30 %
99-9	Sealing element kit	4	6	8	8	9	10	100 %
1412	O-Ring, discharge tube cover	2	3	4	5	6	8	100 %
1412	O-ring, discharge tube cover, large	2	3	4	5	6	8	100 %
180-1	Motor unit	-	-	-	-	1	2	30 %

Part No.	Description	Number of pumps (including stand-by pumps)						
		2	3	4	5	6	8	10 and more
183-1	Monitoring equipment kit	-	-	-	-	1	2	30 %
1818	Rotor	-	-	-	-	1	2	30 %
1834	Cable gland for power cable	1	1	2	2	2	3	40 %
1834	Cable gland for sensor cable	1	1	2	2	2	3	40 %

8 Trouble-shooting

	 WARNING Improper remedial work Risk of personal injury! ► For any work performed in order to remedy faults observe the relevant information given in this operating manual and/or the product literature provided by the accessories manufacturers.
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If problems occur that are not described in the following table, consultation with 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 54: Trouble-shooting

A	B	C	D	E	Possible cause	Remedy ²⁸⁾
-	X	-	-	X	Water level dropping excessively 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	Unfavorable flow to the pump inlet	Improve the flow to the intake chamber (contact KSB).
-	X	X	-	X	Pump running in off-design conditions - part load/overload	Check the pump's operating data.
X	X	-	X	X	Pump clogged by deposits	Clean intake and pump components.
-	X	X	X	X	Wear	Replace worn parts 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 connection of the motor and control system, if any.
X	-	-	-	-	No voltage	Check the electrical installation. Contact the energy supplier.
X	-	-	-	-	Motor winding or electric cable defective	Replace with original KSB cable, or contact KSB.
-	-	X	-	X	Worn or defective rolling element bearings	Contact KSB.
X	-	-	-	-	The thermistor tripping unit with manual reset for temperature limiter has tripped the pump as a result of the permissible winding temperature being exceeded.	Have cause determined and eliminated by qualified and trained personnel.
X	-	-	-	-	Motor has been tripped by leakage monitor.	Have cause determined and eliminated by qualified and trained personnel.
X	-	-	-	-	Mechanical seal monitor has tripped.	Have cause determined and eliminated by qualified and trained personnel.
X	-	-	-	-	Bearing temperature monitor has tripped.	Have cause determined and eliminated by qualified and trained personnel.

²⁸ 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!

9.1 General assembly drawing with list of components

9.1.1 General assembly drawing, sizes 400-290, 500-325

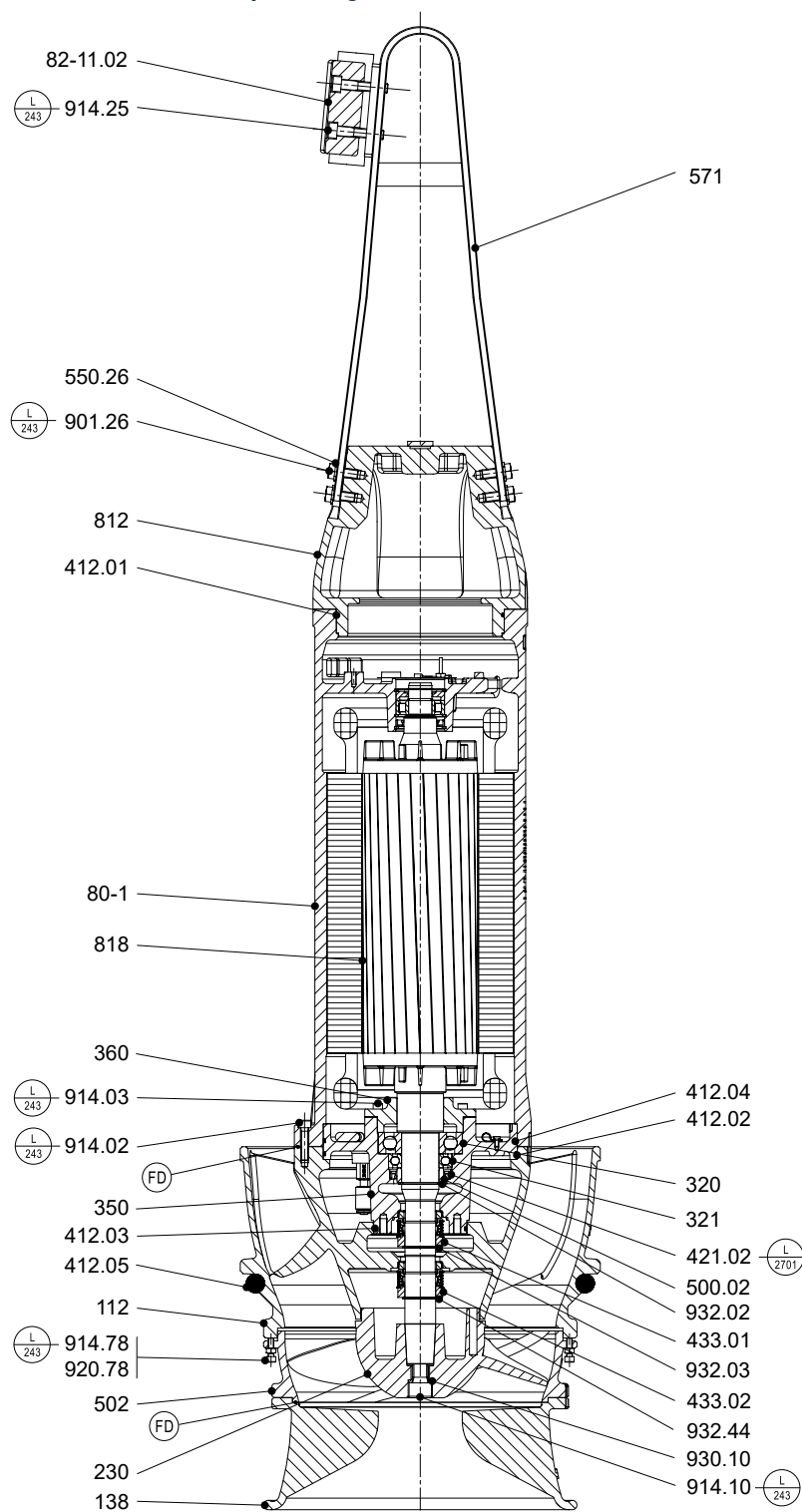


Fig. 73: General assembly drawing, sizes 400-290, 500-325

Table 55: Key to the symbols

Symbol	Key
	Always secure screwed connections marked with this symbol with Loctite 243 .
	Always secure screwed connections marked with this symbol with Loctite 2701 .
	Always apply a liquid sealant (e.g. Hylomar SQ32M) to sealing surfaces marked with this symbol.

Table 56: List of components

Part No.	Description	Part No.	Description
112	Pump bowl	550.26	Disc
138	Bellmouth	571	Bail
230	Impeller	80-1	Motor unit
320	Angular contact ball bearing	82-11.02	Strain relief device
321	Deep groove ball bearing	812	Motor housing cover
350	Bearing housing	818	Rotor
360	Bearing cover	901.26	Hexagon head bolt
412.01/.02/.03/.04/.05	O-ring	914.02/.03/.10/.25/.78	Hexagon socket head cap screw
421.02	Lip seal	920.78	Nut
433.01/.02	Mechanical seal	930.10	Safety device
500.02	Ring	932.02/.03/.44	Circlip
502	Casing wear ring		

9.1.2 General assembly drawing, sizes 600-351, 700-471, 800-471

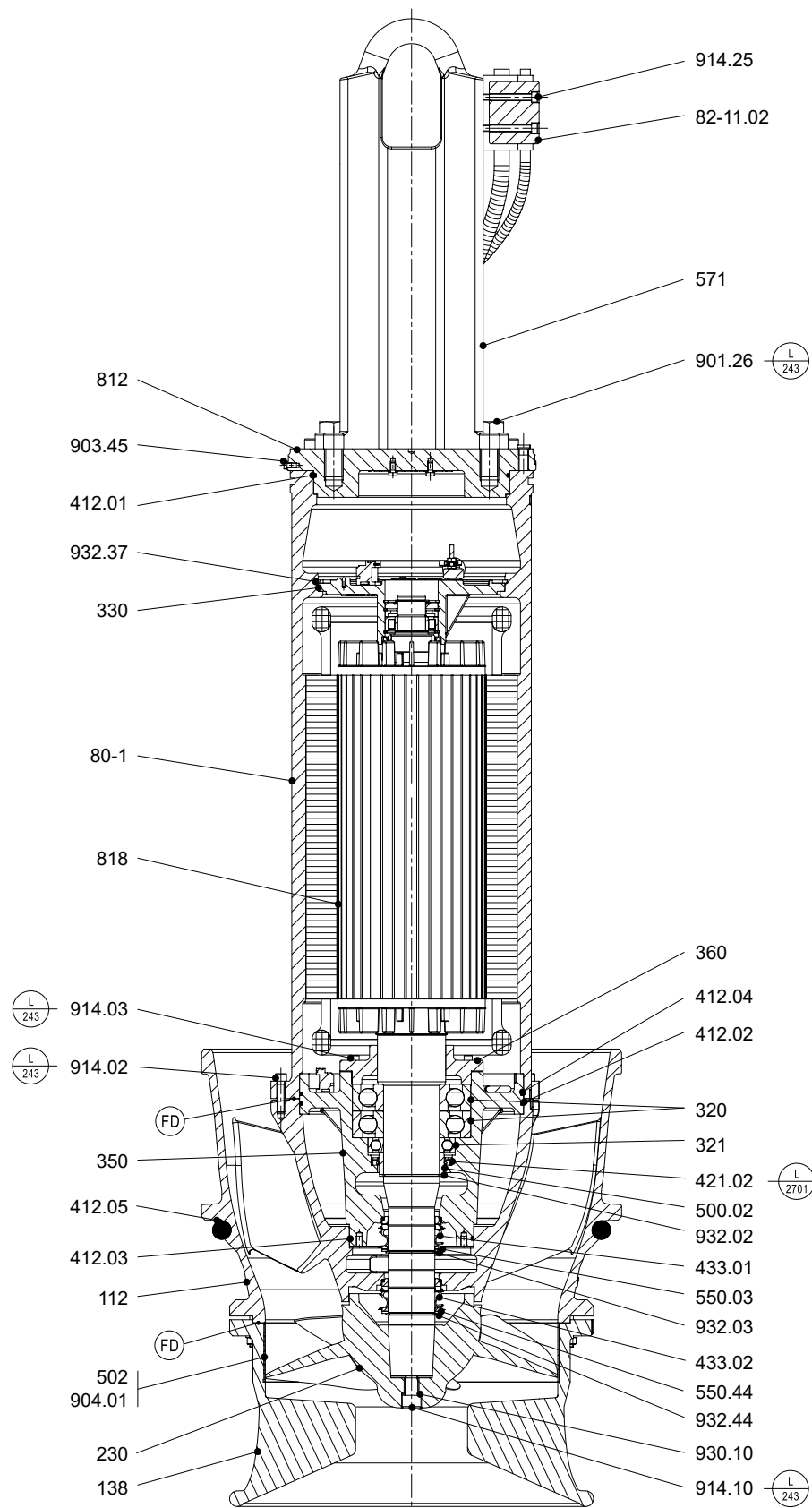


Fig. 74: General assembly drawing, sizes 600-351, 700-471, 800-471

Table 57: Key to the symbols

Symbol	Key
	Always secure screwed connections marked with this symbol with Loctite 243 .
	Always secure screwed connections marked with this symbol with Loctite 2701 .
	Always apply a liquid sealant (e.g. Hylomar SQ32M) to sealing surfaces marked with this symbol.

Table 58: List of components

Part No.	Description	Part No.	Description
112	Pump bowl	550.44	Disc
138	Bellmouth	571	Bail
230	Impeller	80-1	Motor unit
320	Angular contact ball bearing	82-11.02	Strain relief device
321	Deep groove ball bearing	812	Motor housing cover
330	Bearing bracket	818	Rotor
350	Bearing housing	901.26	Hexagon head bolt
360	Bearing cover	903.45	Screw plug
412.01/.02/.03/.04/.05	O-ring	904.01	Grub screw
421.02	Lip seal	914.02/.03/.10/.25	Hexagon socket head cap screw
433.01/.02	Mechanical seal	930.10	Safety device
500.02/.03	Ring	932.02/.03/.37/.44	Circlip
502	Casing wear ring		

9.2 Detailed views

9.2.1 Cable gland and fastening

Size:
400-290

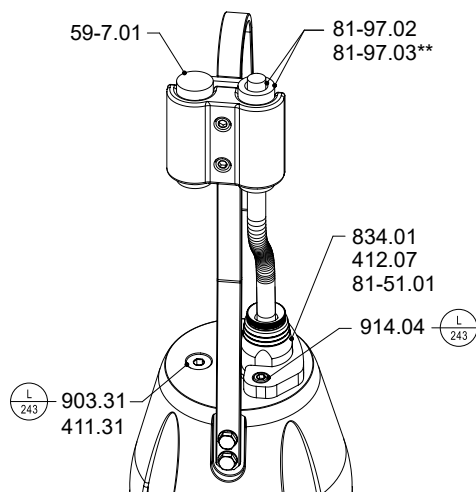


Fig. 75: Cable gland and fastening, size: 400-290 with **one cable gland**

** For specific sizes only

Size:
400-290

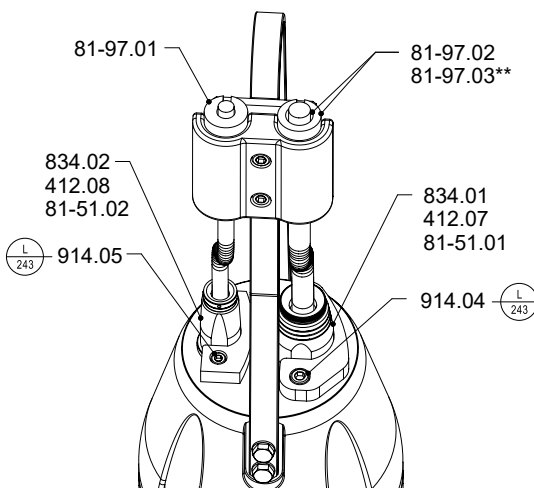


Fig. 76: Cable gland and fastening, size: 400-290 with **two cable glands**

** For specific sizes only

Sizes:
500-325
600-351

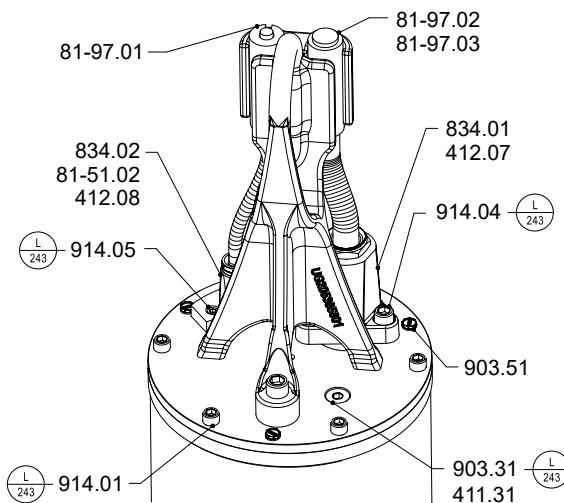


Fig. 77: Cable gland and fastening, sizes: 500-325, 600-351

** For specific sizes only

Sizes:
700-471
800-471

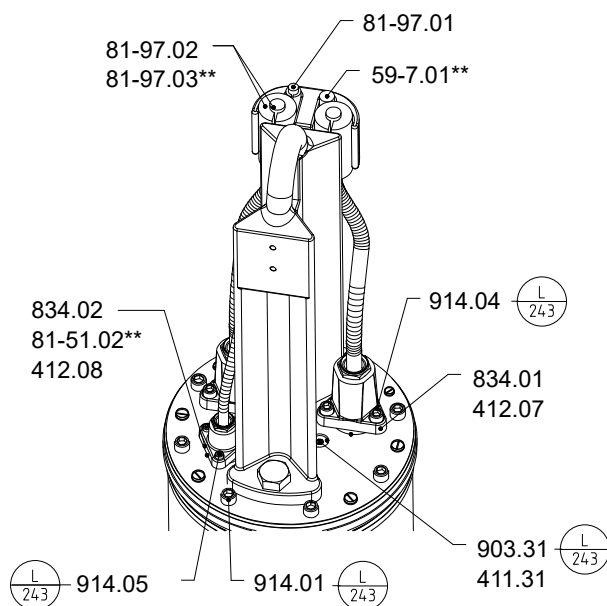


Fig. 78: Cable gland and fastening, sizes: 700-471, 800-471

** For specific sizes only

Table 59: Key to the symbols

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

Table 60: List of components

Part No.	Description	Part No.	Description
411.31	Joint ring	81-97.01/.02/.03	Cable protector
412.07/.08	O-ring	834.01/.02	Cable gland
59-7.01	Support	903.31	Screw plug
81-51.01/.02	Clamping element	914.01/.04/.05	Hexagon socket head cap screw

9.2.2 Bearing temperature sensor

Sizes:
400-290
500-325
600-351

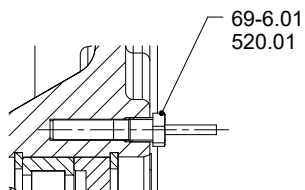


Fig. 79: Bearing temperature sensor, motor-end, optional, sizes: 400-290, 500-325

Sizes:
700-471
800-471

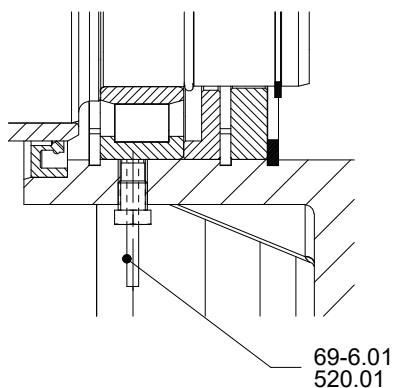


Fig. 80: Bearing temperature sensor, motor end, optional, sizes: 600-351, 700-471, 800-471

Sizes:
400-290
500-325
600-351
700-471
800-471

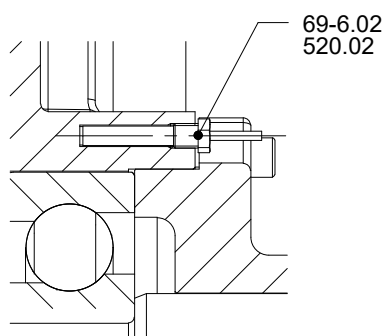


Fig. 81: Bearing temperature sensor, pump end

Table 61: List of components

Part No.	Description	Part No.	Description
520.01/.02	Sleeve	69-6.01/.02	Temperature sensor

9.2.3 Bearings

Sizes:
400-290
500-325
600-351

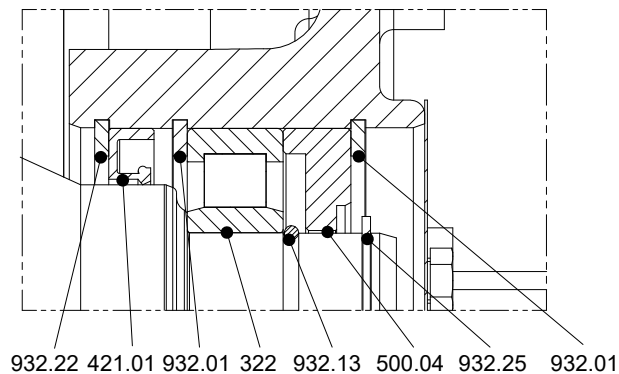


Fig. 82: Bearing, motor end, sizes: 400-290, 500-325, 600-351

Sizes:
700-471
800-471

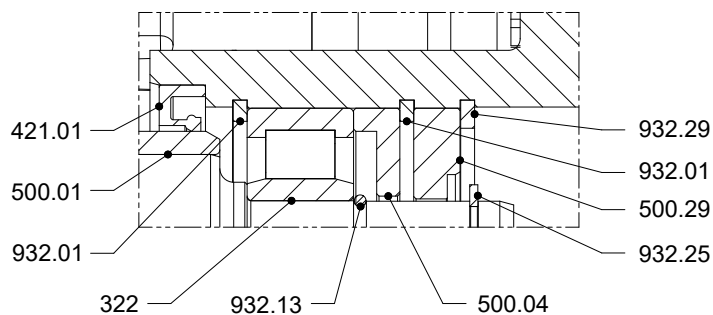


Fig. 83: Bearing, motor end, sizes: 700-471, 800-471

Sizes:
400-290
500-325
600-351

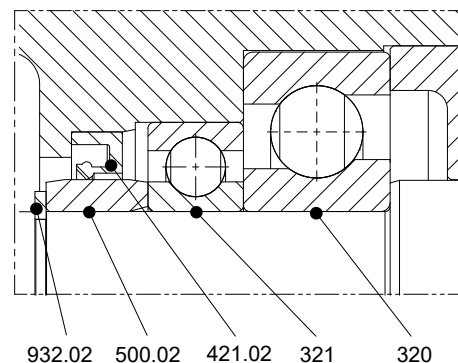


Fig. 84: Bearing, pump end, sizes: 400-290, 500-325

Sizes:
700-471
800-471

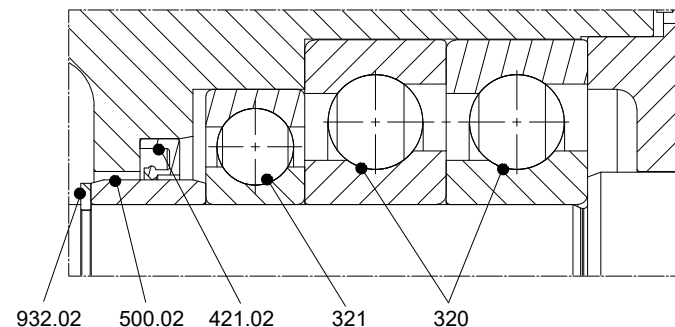


Fig. 85: Bearing, pump end, sizes: 600-351, 700-471, 800-471

Table 62: List of components

Part No.	Description	Part No.	Description
320	Rolling element bearing	421.01/.02	Lip seal
321	Radial ball bearing	500.01/.02/.04/.29	Ring
322	Radial roller bearing	932.01/.02/.13/.22/.25/.29	Circlip

9.2.4 Sensors, bearing housing

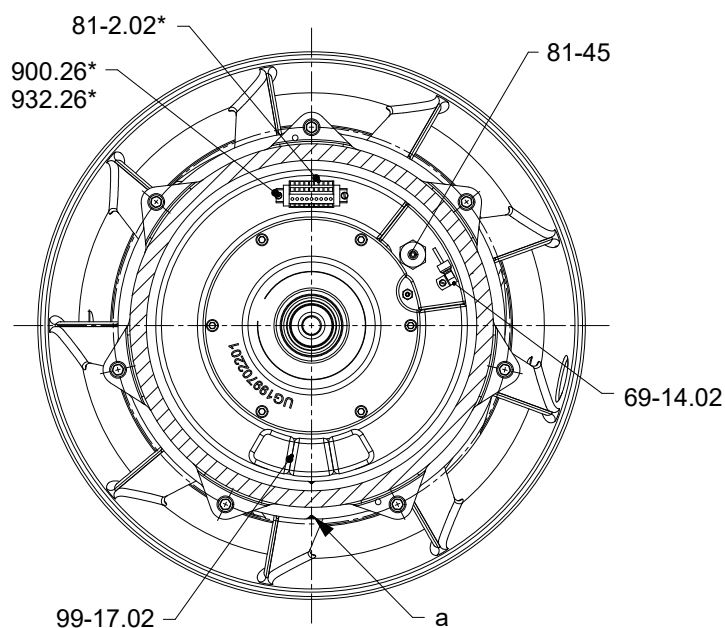


Fig. 86: Sensors, bearing housing
* = Not applicable to size 400-290

Size:
400-290

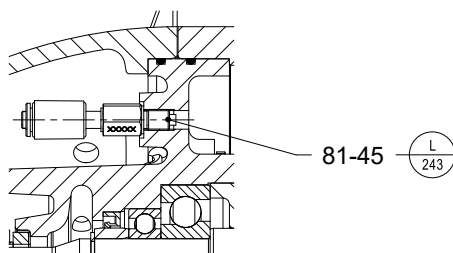


Fig. 87: Float switch, size: 400-290

Sizes:
500-325
600-351
700-471
800-471

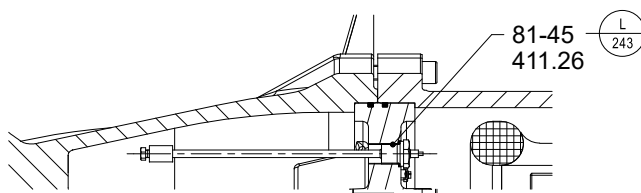


Fig. 88: Float switch, sizes: 500-325, 600-351, 700-471, 800-471

Table 63: Key to the symbols

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

Table 64: List of components

Part No.	Description	Part No.	Description
411.26	Joint ring	99-17.02	Desiccant
69-14.02	Leakage sensor	900.26	Bolt/screw
81-2.02	Plug	932.02	Circlip
81-45	Float switch	a	Alignment groove

9.2.5 Sensors/terminals, bearing bracket

Size:
400-290

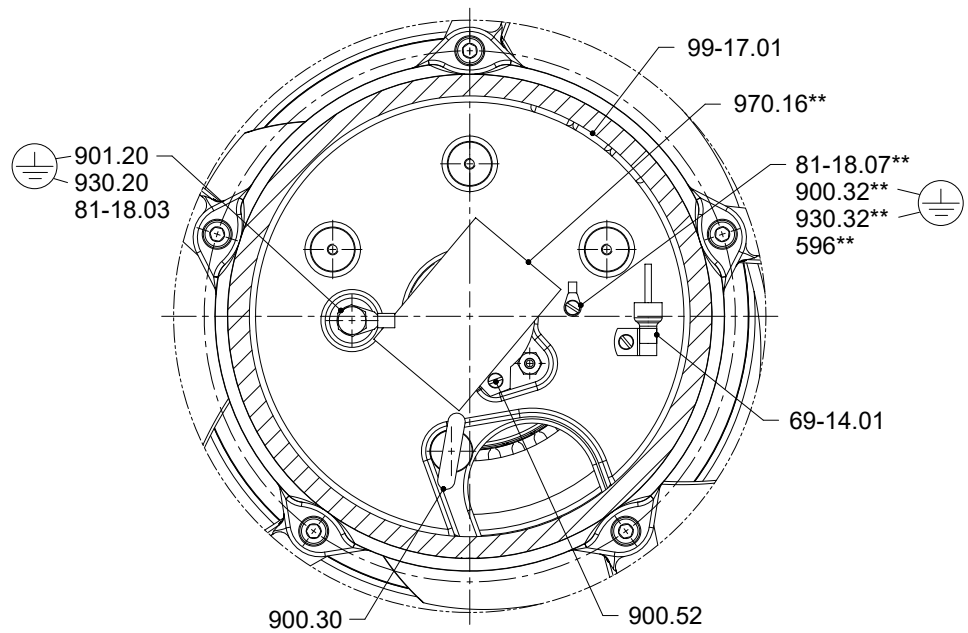


Fig. 89: Pump set with standard sensors, sensors/terminals, bearing bracket, size: 400-290

** For specific sizes only

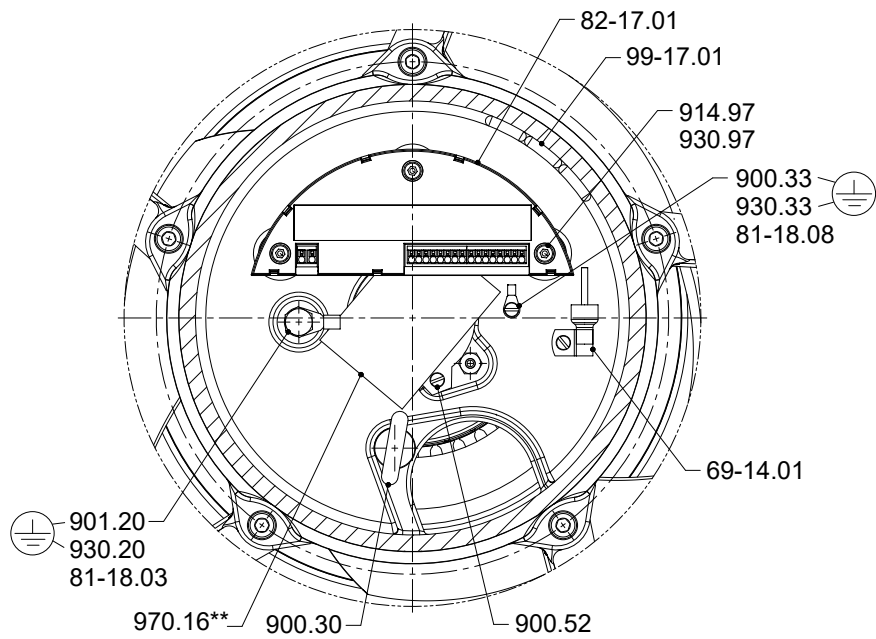


Fig. 90: Pump set with sensor system, sensors/terminals, bearing bracket, size: 400-290

** For specific sizes only

Sizes:
500-325
600-351
700-471
800-471

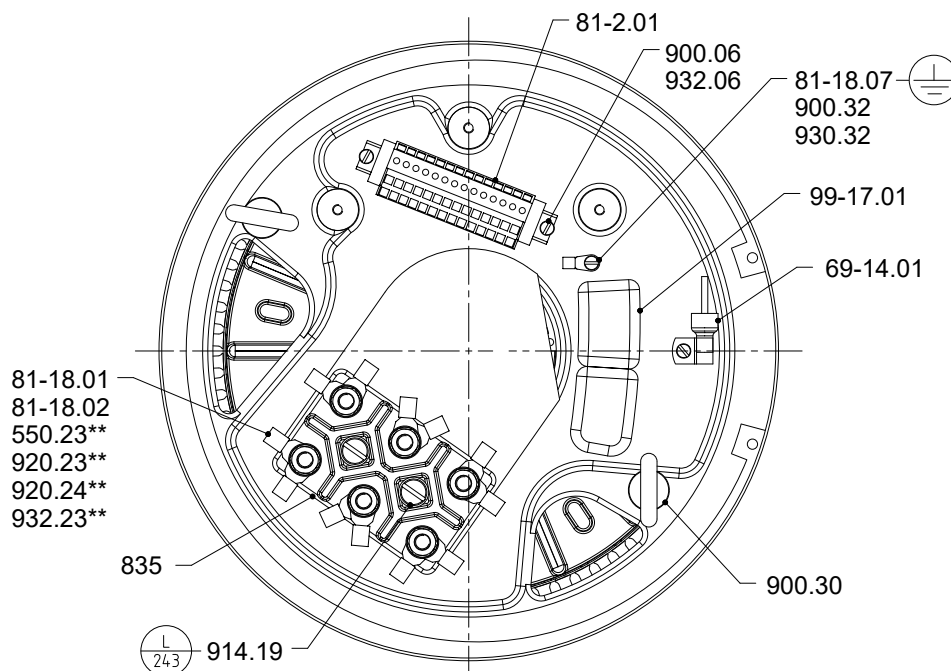


Fig. 91: Pump set with standard sensors, sensors/terminals, bearing bracket, sizes: 500-325, 600-351, 700-471, 800-471

** For specific sizes only

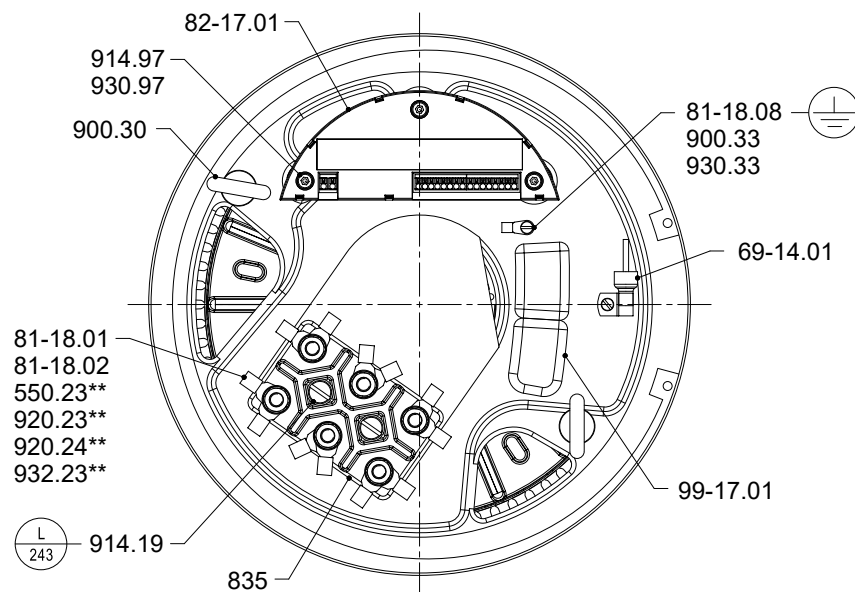


Fig. 92: Pump set with sensor system, sensors/terminals, bearing bracket, sizes: 500-325, 600-351, 700-471, 800-471

** For specific sizes only

Table 65: Key to the symbols

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

Table 66: List of components

Part No.	Description	Part No.	Description
550.23	Disc	900.06/.30/.32/.33/.52	Bolt/screw
596	Wire	901.20	Hexagon head bolt
69-14.01	Leakage sensor	914.19/.97	Hexagon socket head cap screw

Part No.	Description	Part No.	Description
81-18.01/.02/.03/.07/.08	Cable terminal	920.23/.24	Nut
81-2.01	Plug	930.20/.32/.33/.97	Safety device
82-17.01	Integrated electronics	932.06/.23	Circlip
835	Terminal board	970.16	Label/plate
99-17.01	Desiccant		

9.2.6 Bearing bracket fastening

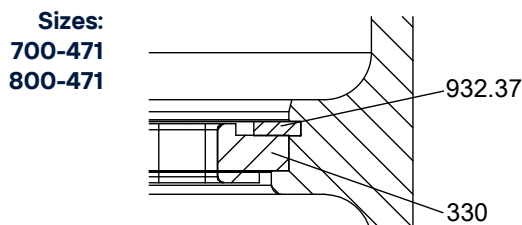


Fig. 93: Bearing bracket fastening, sizes: 700-471, 800-471

Table 67: List of components

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

9.2.7 Screw/bolt/stud connection bellmouth/casing wear ring/pump bowl

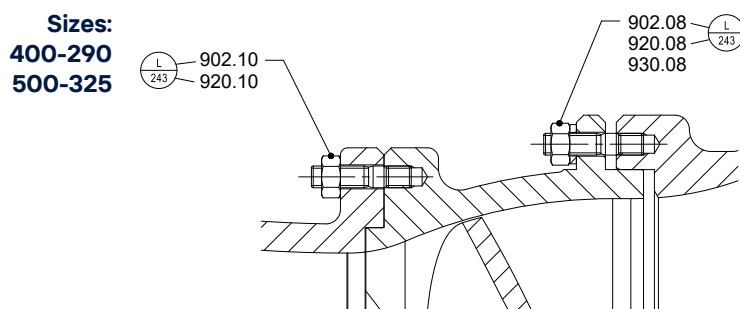


Fig. 94: Screw/bolt/stud connection bellmouth/casing wear ring/pump bowl, sizes: 400-290, 500-325

Table 68: Key to the symbols

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

Table 69: List of components

Part No.	Description	Part No.	Description
902.08/.10	Stud	930.08	Safety device
920.08/.10	Nut		

9.2.8 Screw/bolt/stud connection bellmouth/pump bowl

Sizes:
600-351
700-471
800-471

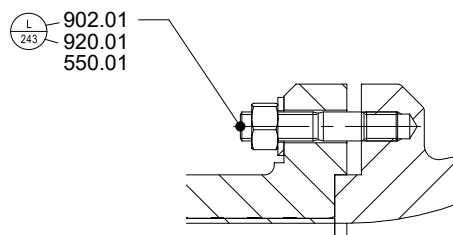


Fig. 95: Screw/bolt/stud connection bellmouth/pump bowl, sizes: 600-351, 700-471, 800-471

Table 70: Key to the symbols

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

Table 71: List of components

Part No.	Description	Part No.	Description
550.01	Disc	920.01	Nut
902.01	Stud		

9.2.9 Mechanical seal with covered spring

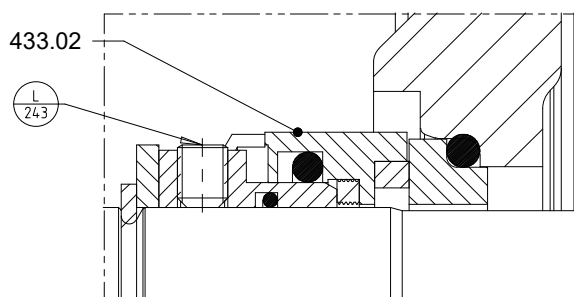


Fig. 96: Mechanical seal with covered spring

Table 72: Key to the symbols

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

Table 73: List of components

Part No.	Description	Part No.	Description
433.02	Mechanical seal		

9.2.10 Lubricant inlet

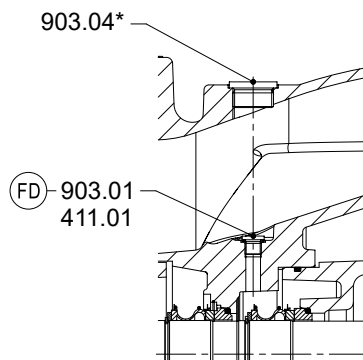


Fig. 97: Lubricant inlet

* = Not applicable to size 400-290

Table 74: Key to the symbols

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

Table 75: List of components

Part No.	Description	Part No.	Description
411.01	Joint ring	903.01/.04	Screw plug

9.2.11 Lubricant drain

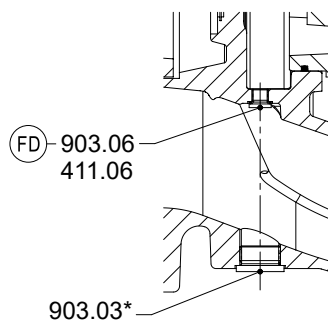


Fig. 98: Lubricant drain

* = Not applicable to size 400-290

Table 76: Key to the symbols

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

Table 77: List of components

Part No.	Description	Part No.	Description
411.06	Joint ring	903.03/.06	Screw plug

9.2.12 Leakage chamber drain

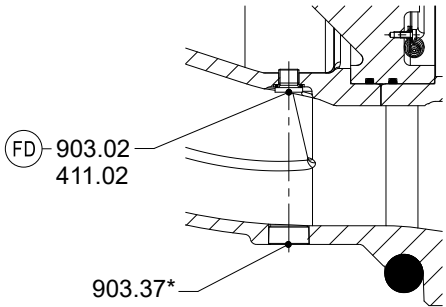


Fig. 99: Leakage chamber drain
 * = Not applicable to sizes 400-290, 700-471, 800-471

Table 78: Key to the symbols

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

Table 79: List of components

Part No.	Description	Part No.	Description
411.02	Joint ring	903.02/.37	Screw plug

9.2.13 Labels/plates

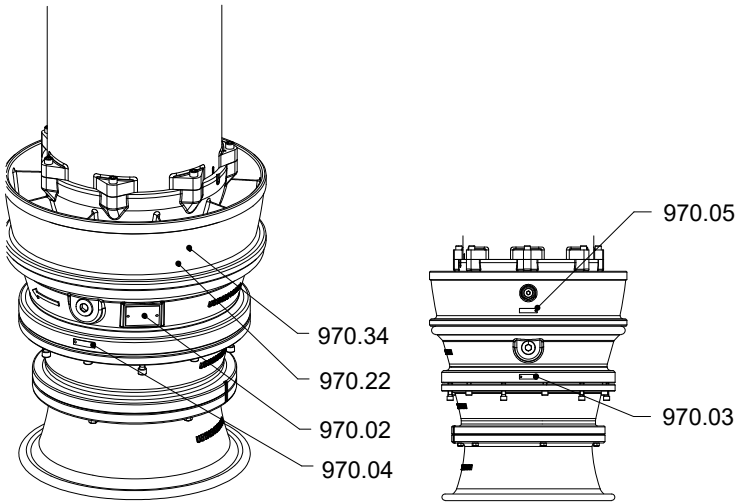


Fig. 100: Labels/plates

Table 80: List of components

Part No.	Description	Part No.	Description
970.02	Label/plate: name plate	970.05	Label/plate: leakage drain
970.03	Label/plate: lubricant drain	970.22	Label/plate: warning sign
970.04	Label/plate: lubricant filler plug	970.34	Label/plate:

9.2.14 Model with adapter

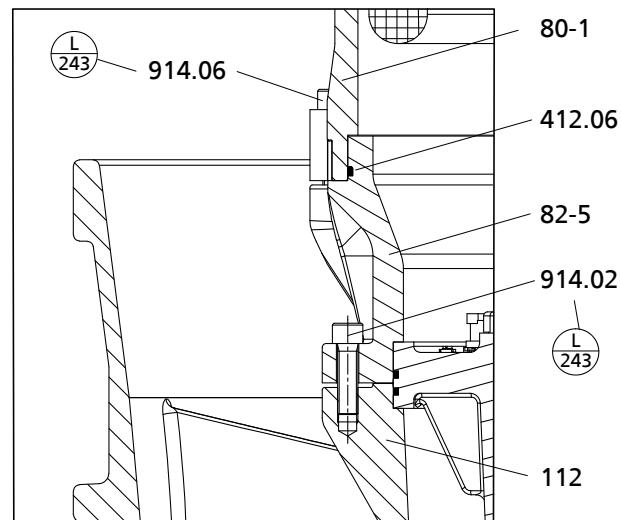


Fig. 101: Model with adapter

Table 81: Key to the symbols

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

Table 82: List of components

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

9.3 Cable bundle

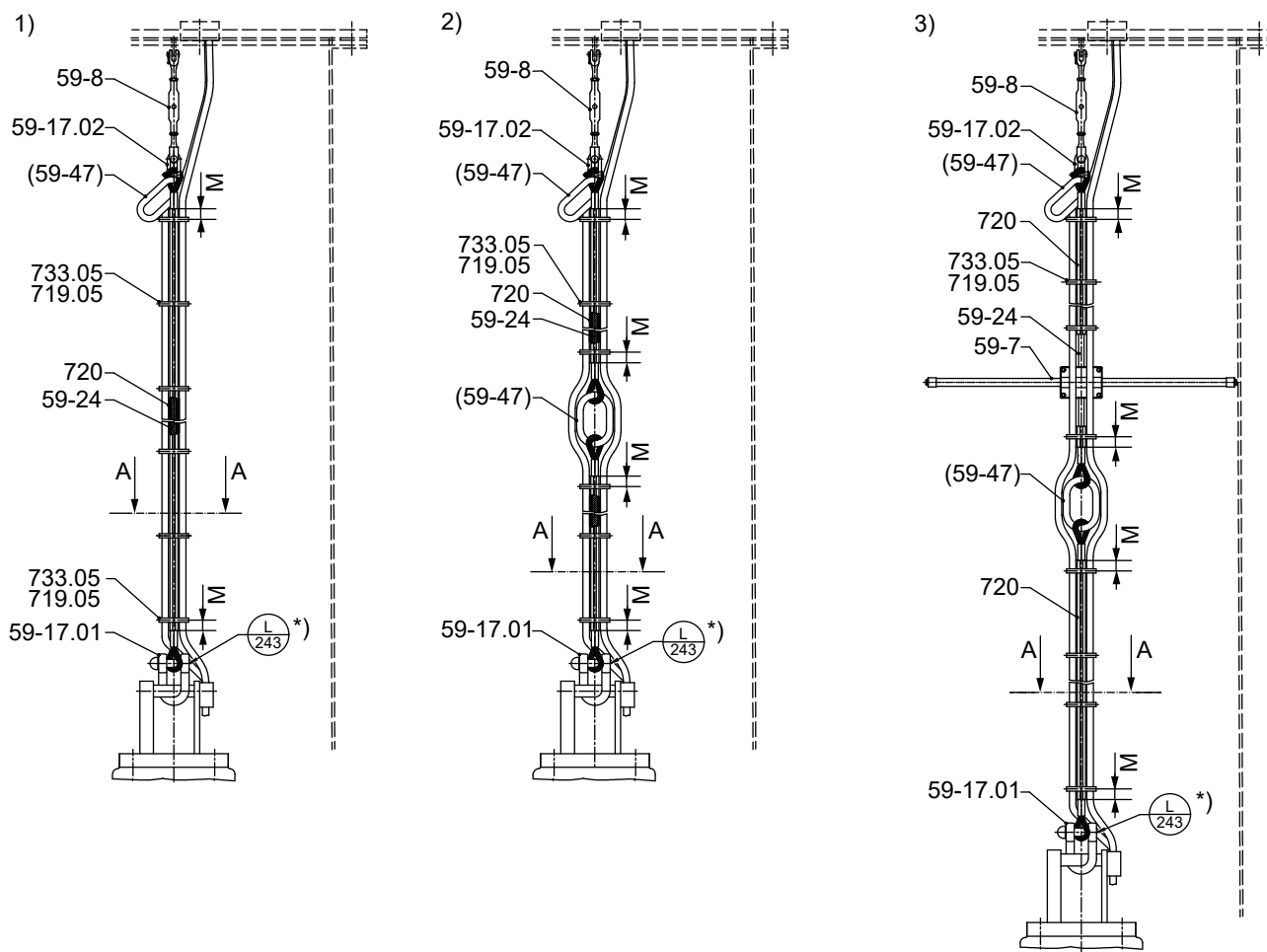


Fig. 102: Cable bundle. * Only required for galvanized version

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



NOTE

Dimension M = 2 inches [50 mm]

Table 83: Key to the symbols

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

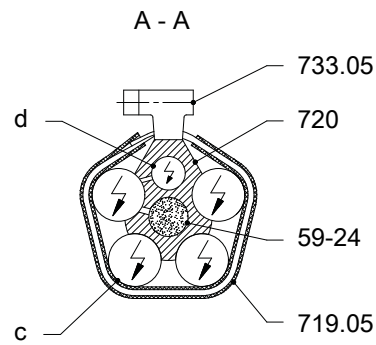


Fig. 103: Section A - A, position of power cable, sensor cable and lifting rope

c	Power cable	d	Sensor cable
---	-------------	---	--------------

Table 84: List of components 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	Spacer
59-24	Rope/lifting rope	733.05	Cable clamp

9.4 Wiring diagrams

9.4.1 Wiring diagrams for motor versions UT/XT

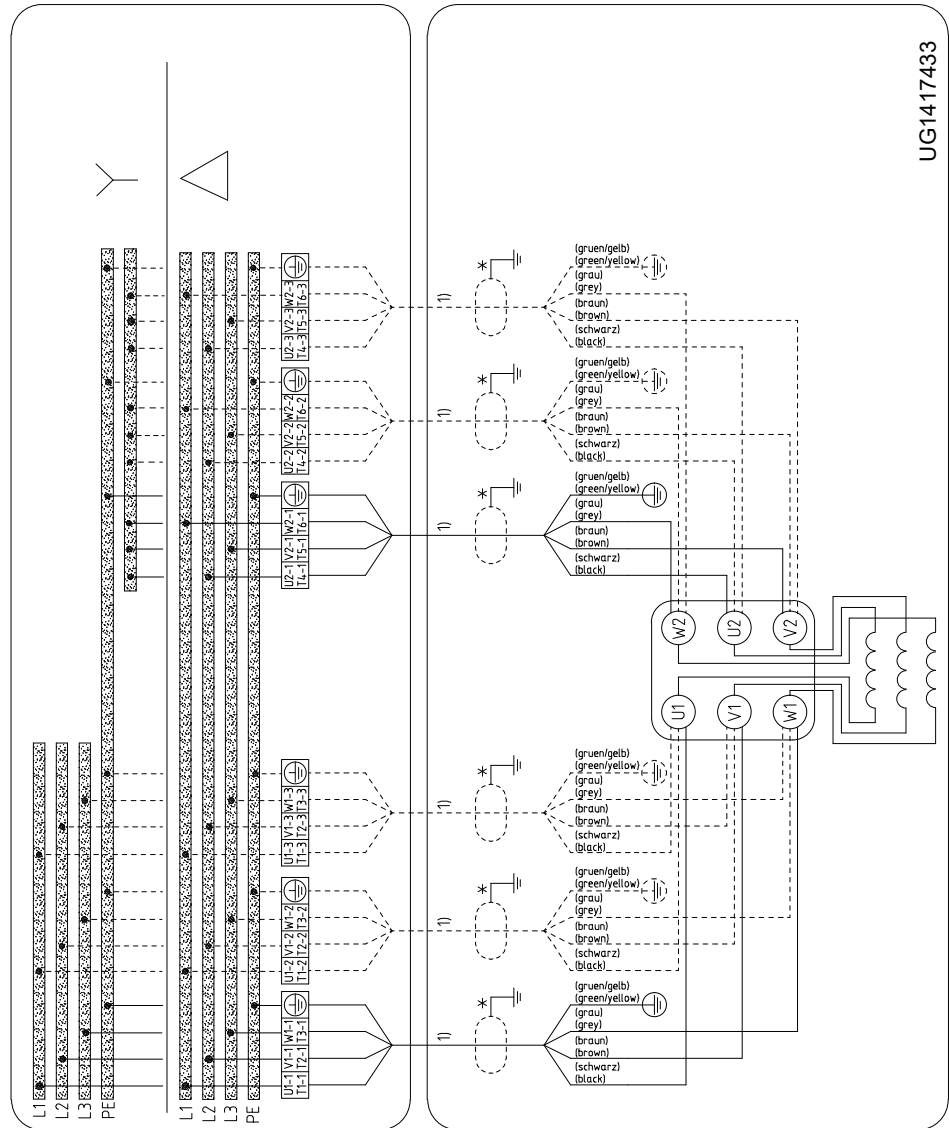


Fig. 104: Wiring diagram for motor versions UT/XT

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

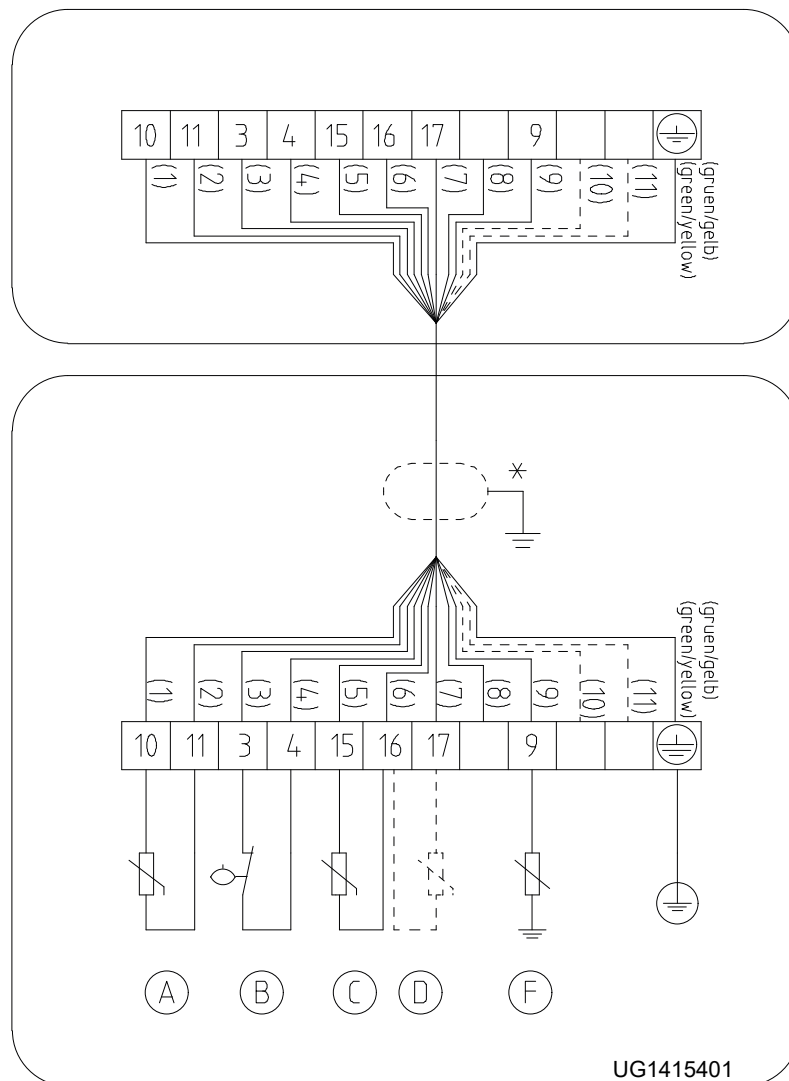
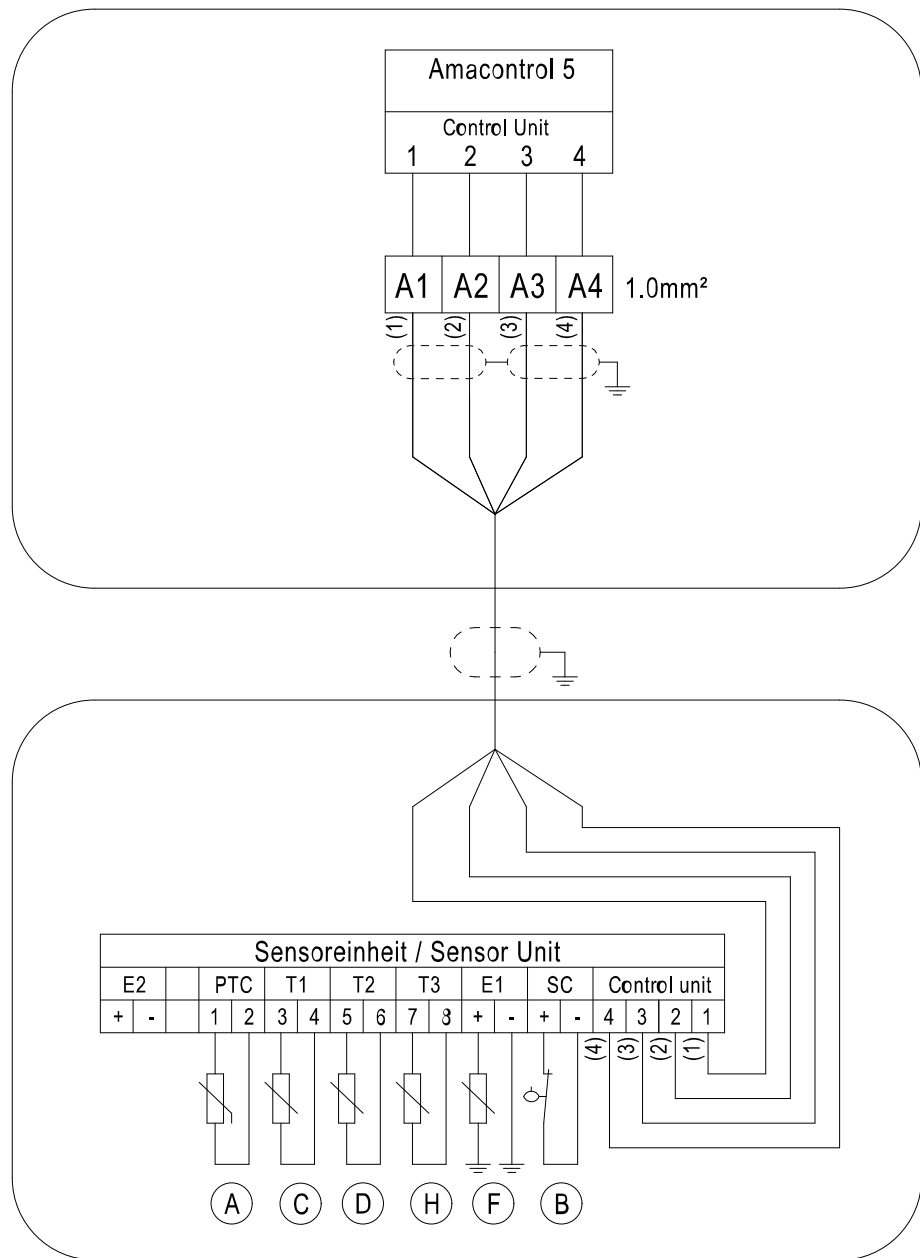


Fig. 105: Wiring diagram for the sensors, motor versions UT/XT - **sensor package Basic/Basic+**

(A)	Motor temperature (PTC)
(B)	Mechanical seal leakage
(C)	Bearing temperature (pump end)
(D)	Bearing temperature (motor end)
(F)	Leakage inside the motor
*	Shielded cable option



UG2048584

Fig. 106: Wiring diagram for the sensors, motor versions UT/XT - **sensor package Premium**

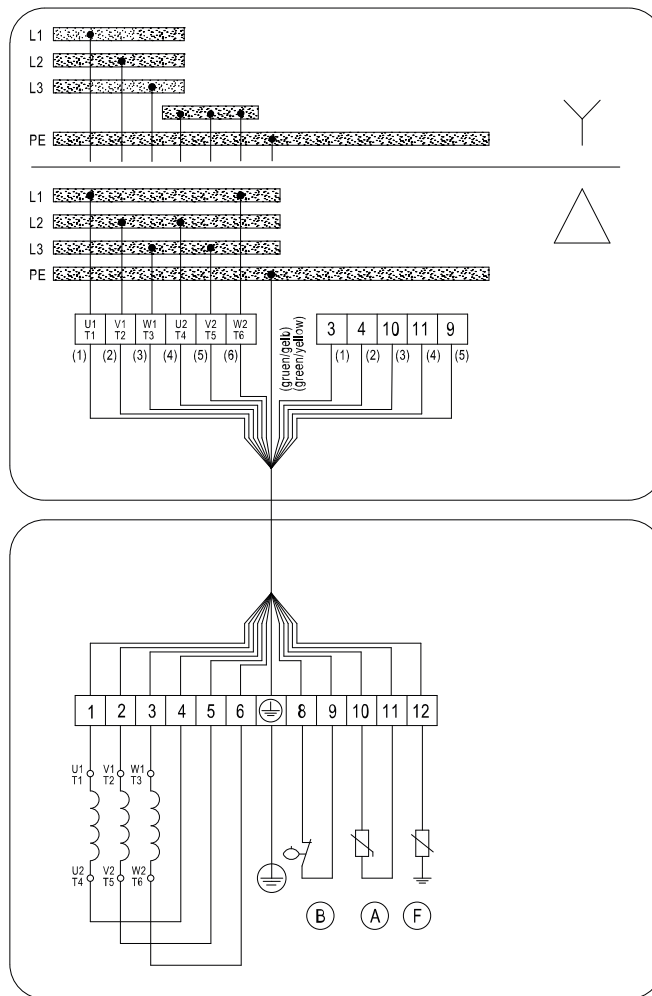
Ⓐ	Motor temperature (PTC)
Ⓑ	Mechanical seal leakage
Ⓒ	Bearing temperature (pump end)
Ⓓ	Bearing temperature (motor end)
Ⓕ	Leakage inside the motor
Ⓗ	Motor temperature (Pt100)

9.4.2.1 Sensor package Basic

UG2140761

Fig. 107: Wiring diagram, motor versions UV/XV - sensor package Basic - power cables 12G1.5 / 12G2.5

Ⓐ	Motor temperature (PTC)
Ⓑ	Mechanical seal leakage
Ⓔ	Leakage inside the motor
*	Shielded cable option



UG2140761

Fig. 108: Wiring diagram, motor versions UV/XV - sensor package Basic - power cables
7G4+5×1.5 / 7G6+5×1.5 / 7G10+5×1.5

Ⓐ	Motor temperature (PTC)
Ⓑ	Mechanical seal leakage
Ⓕ	Leakage inside the motor

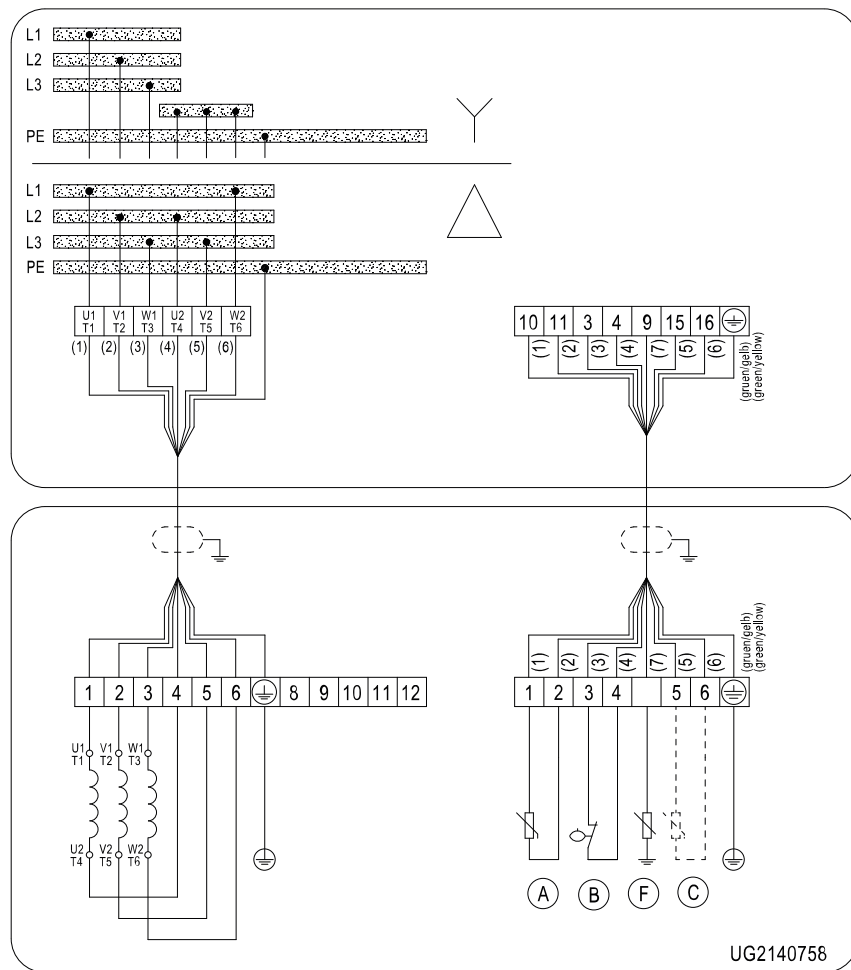


Fig. 109: Wiring diagram, motor versions UV/XV - sensor package Basic/Basic+ - power cables 7G6 / 8G1.5

Ⓐ	Motor temperature (PTC)
Ⓑ	Mechanical seal leakage
Ⓒ	Bearing temperature (pump end)
Ⓔ	Leakage inside the motor
*	Shielded cable option

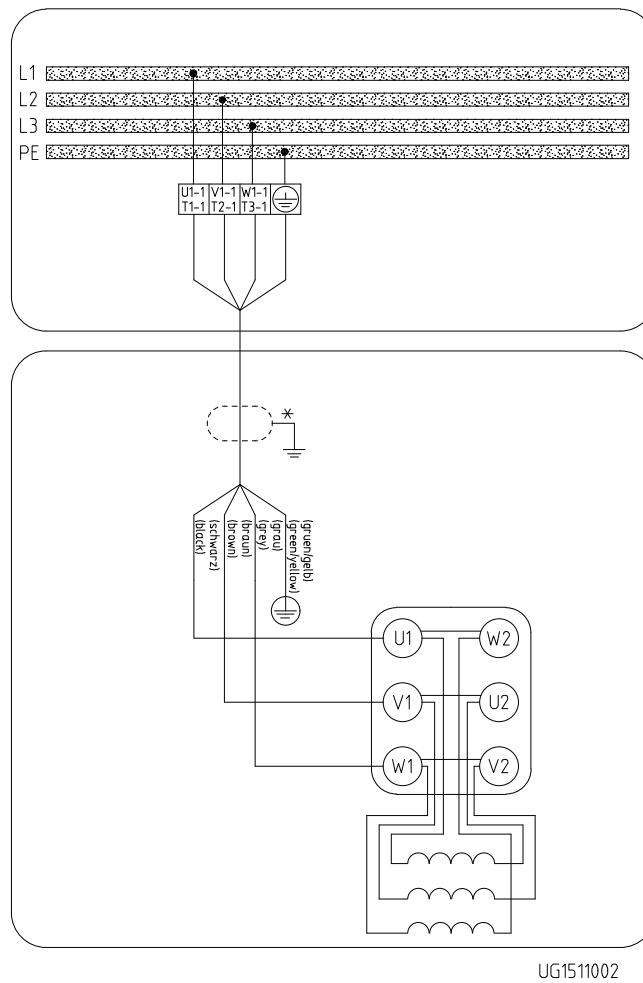


Fig. 110: Wiring diagram, motor versions UV/XV - sensor package Basic - power cables 4GX + 2×(2×1)

*	Shielded cable option
---	-----------------------

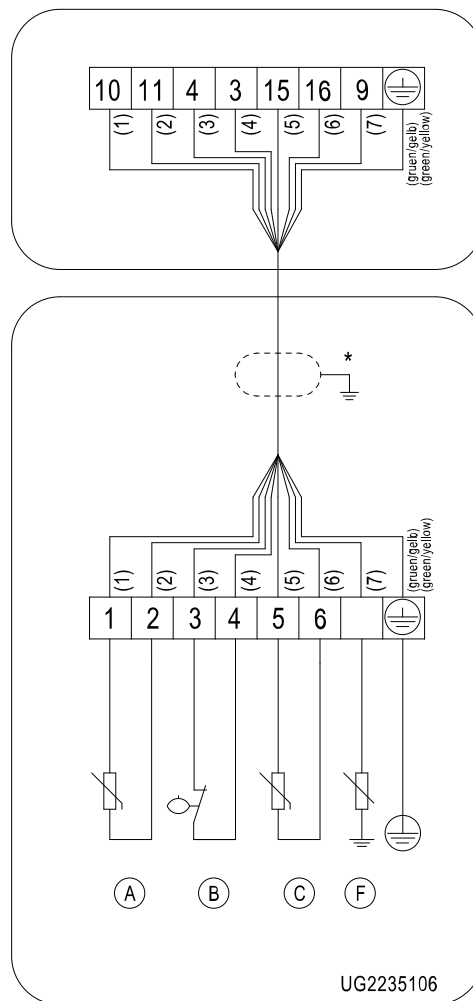


Fig. 111: Wiring diagram, sensors, motor versions UV/XV - sensor package Basic - power cables 4GX + 2x(2x1)

Ⓐ	Motor temperature (PTC)
Ⓑ	Mechanical seal leakage
Ⓒ	Bearing temperature (pump end)
Ⓔ	Leakage inside the motor
*	Shielded cable option

Ⓐ	Motor temperature (PTC)
Ⓑ	Mechanical seal leakage
Ⓒ	Bearing temperature (pump end)
Ⓕ	Leakage inside the motor
*	Shielded cable option

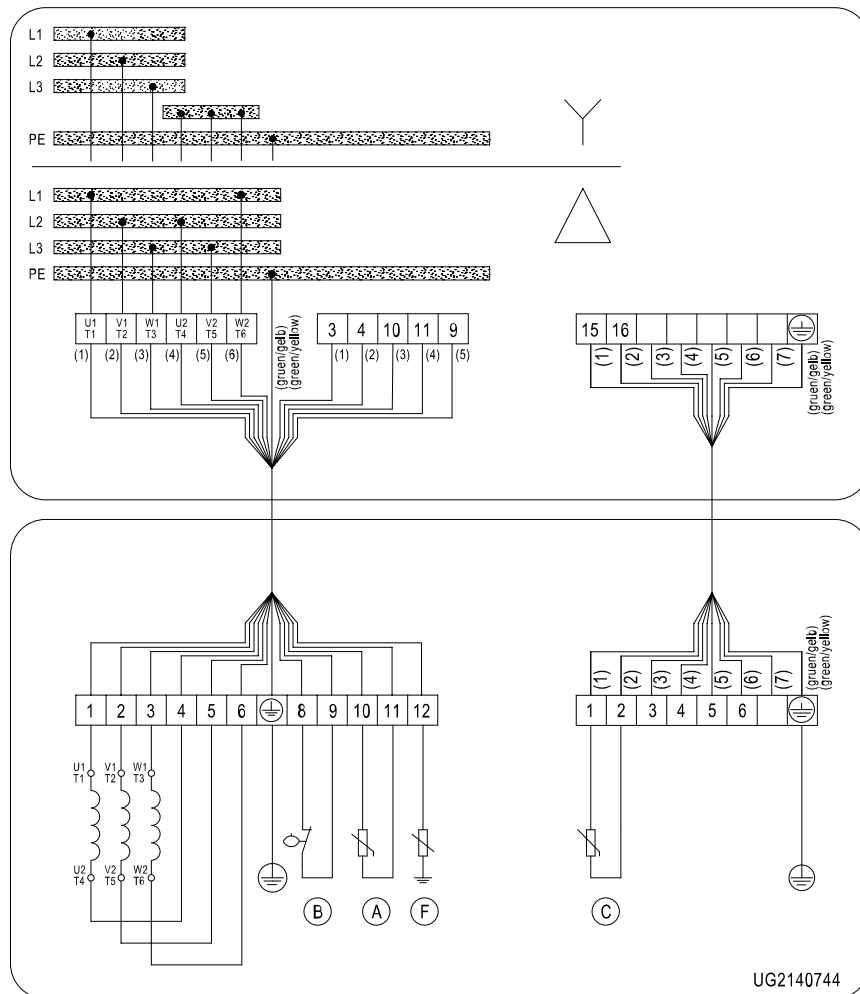


Fig. 113: Wiring diagram, motor versions UV/XV - sensor package Basic+ - power cables 7GX+5x1.5 + 8G1.5

Ⓐ	Motor temperature (PTC)
Ⓑ	Mechanical seal leakage
Ⓒ	Bearing temperature (pump end)
Ⓔ	Leakage inside the motor

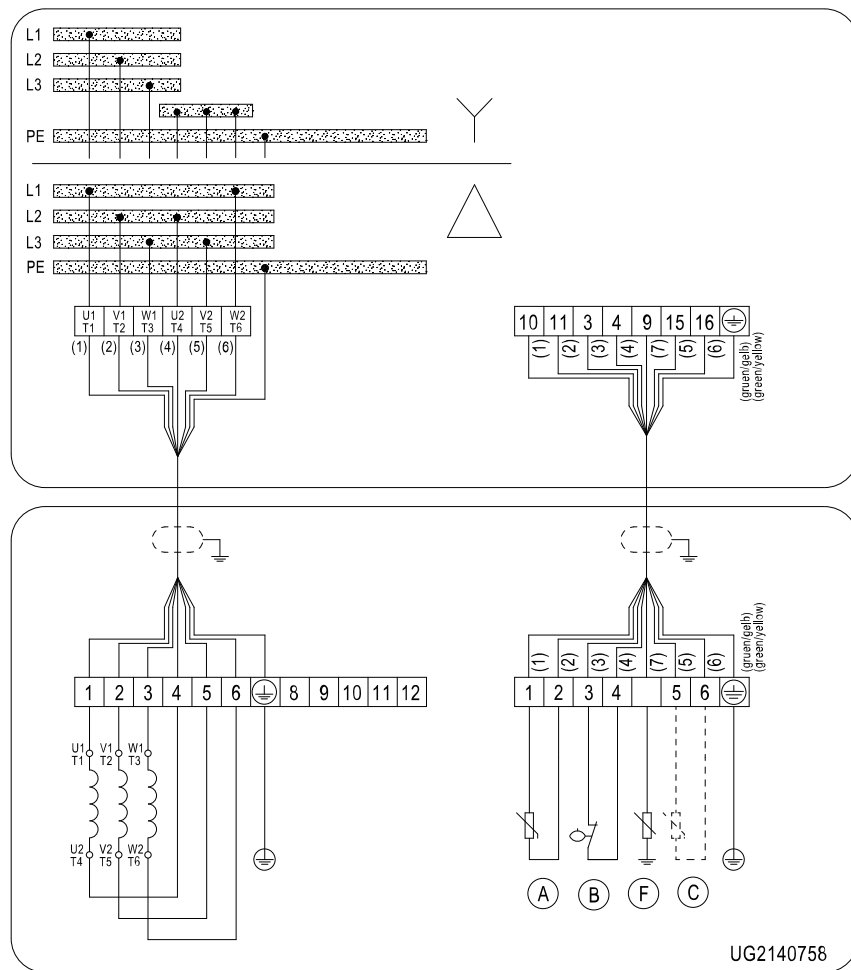


Fig. 114: Wiring diagram, motor versions UV/XV - sensor package Basic+ - power cables 7G6 / 8G1.5

Ⓐ	Motor temperature (PTC)
Ⓑ	Mechanical seal leakage
Ⓒ	Bearing temperature (pump end)
Ⓕ	Leakage inside the motor
*	Shielded cable option

9.4.2.3 Sensor package Premium

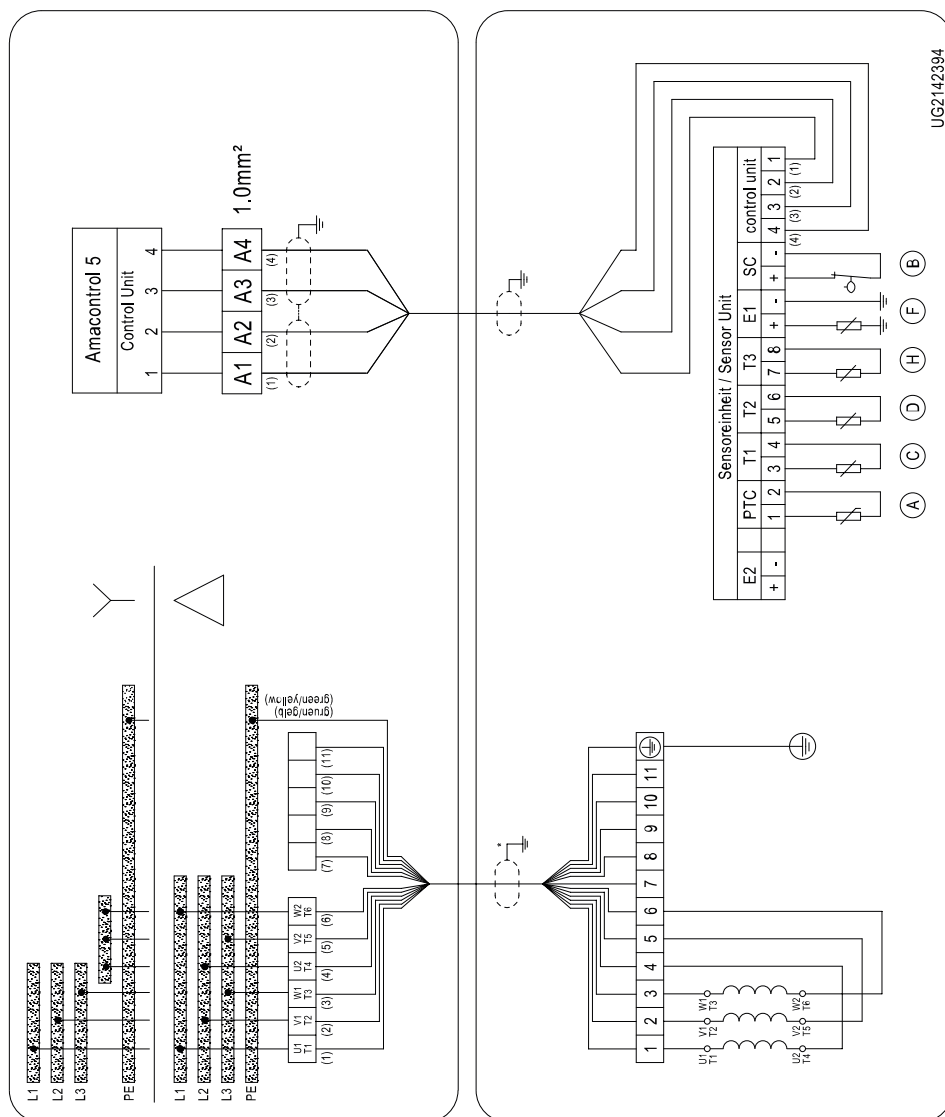


Fig. 115: Wiring diagram, motor versions UV/XV - sensor package Premium - power cables 12G1.5 / 12G2.5 + 2×(2×1)

Ⓐ	Motor temperature (PTC)
Ⓑ	Mechanical seal leakage
Ⓒ	Bearing temperature (pump end)
Ⓓ	Bearing temperature (motor end)
Ⓕ	Leakage inside the motor
Ⓗ	Motor temperature (Pt100)
*	Shielded cable option

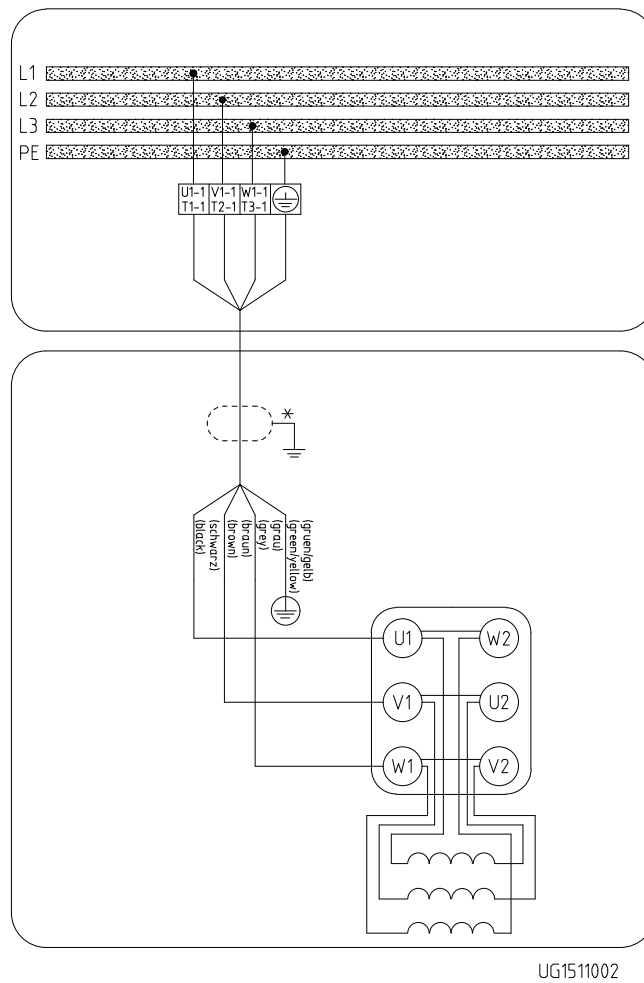


Fig. 116: Wiring diagram, motor versions UV/XV - sensor package Premium - power cables 4GX + 2×(2×1)

*	Shielded cable option
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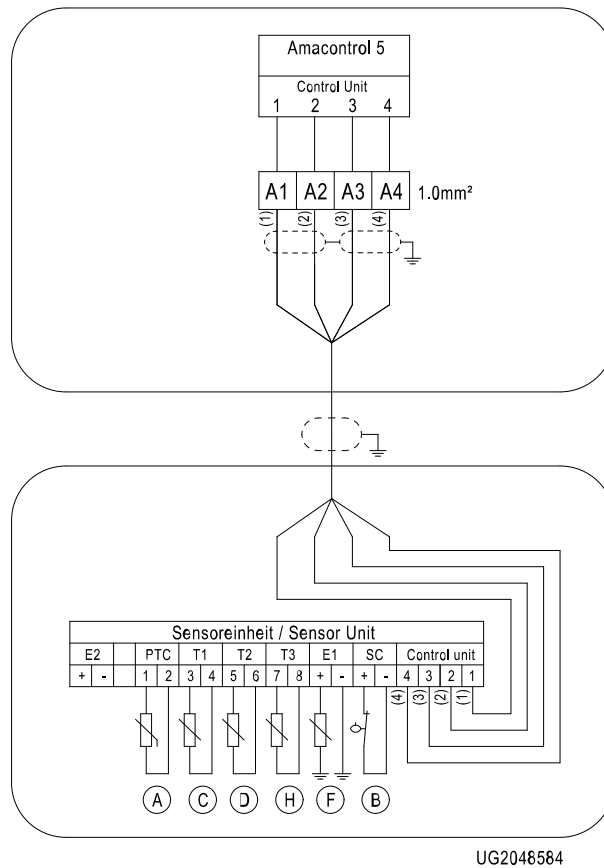


Fig. 117: Wiring diagram, sensors, motor versions UV/XV - sensor package Premium - power cables 4GX + 2x(2x1)

Ⓐ	Motor temperature (PTC)
Ⓑ	Mechanical seal leakage
Ⓒ	Bearing temperature (pump end)
Ⓓ	Bearing temperature (motor end)
Ⓕ	Leakage inside the motor
Ⓗ	Motor temperature (Pt100)

9.4.3 Wiring diagrams for motor versions UW/XW

9.4.3.1 Sensor package Basic/Basic+

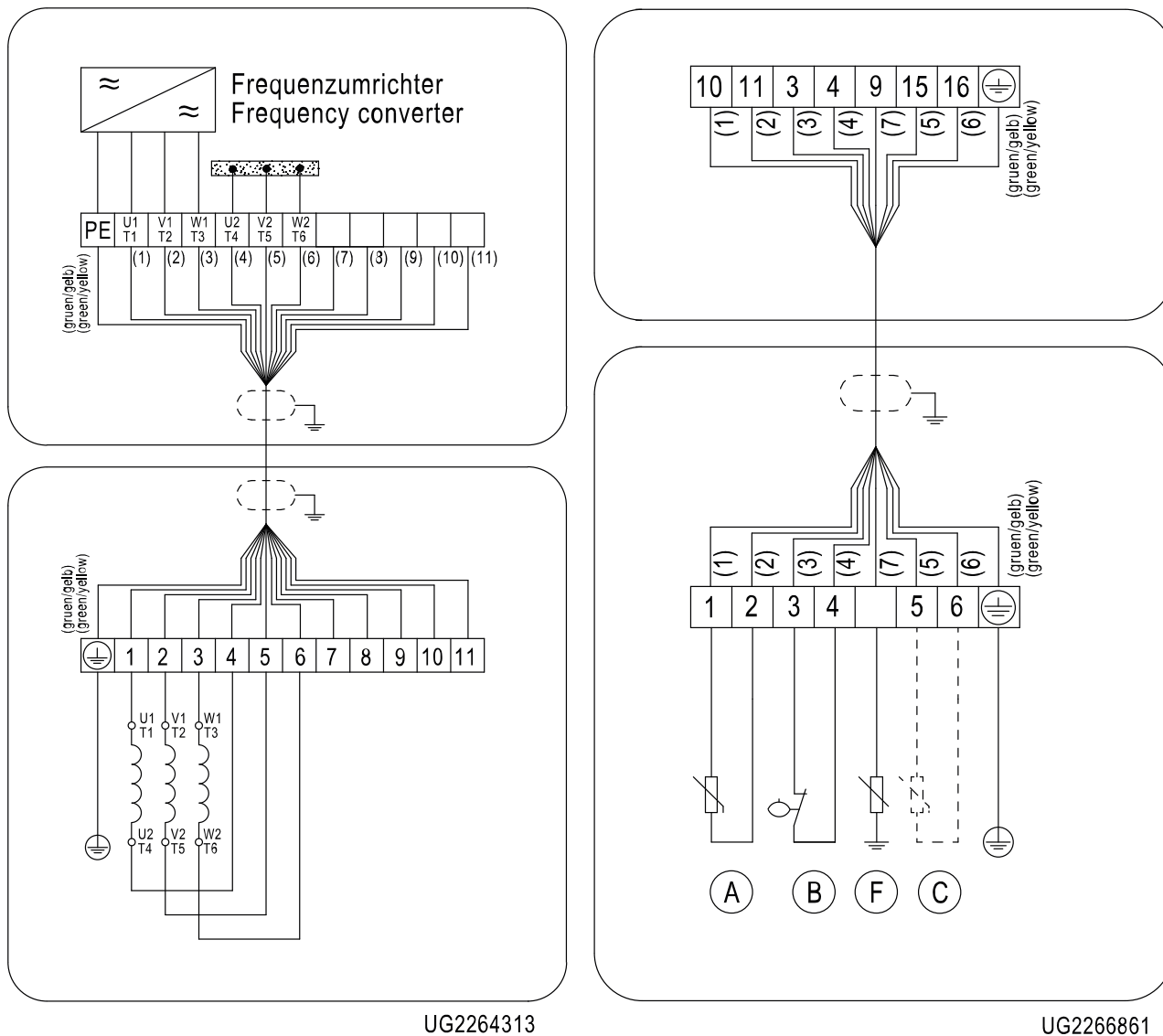


Fig. 118: Wiring diagram, motor versions UW/XW - sensor package Basic/Basic+ - power cables 12G2.5 + 8G1.5 / 12G2.5

Ⓐ	Motor temperature (PTC)
Ⓑ	Mechanical seal leakage
Ⓒ	Bearing temperature (pump end, optional)
Ⓔ	Leakage inside the motor

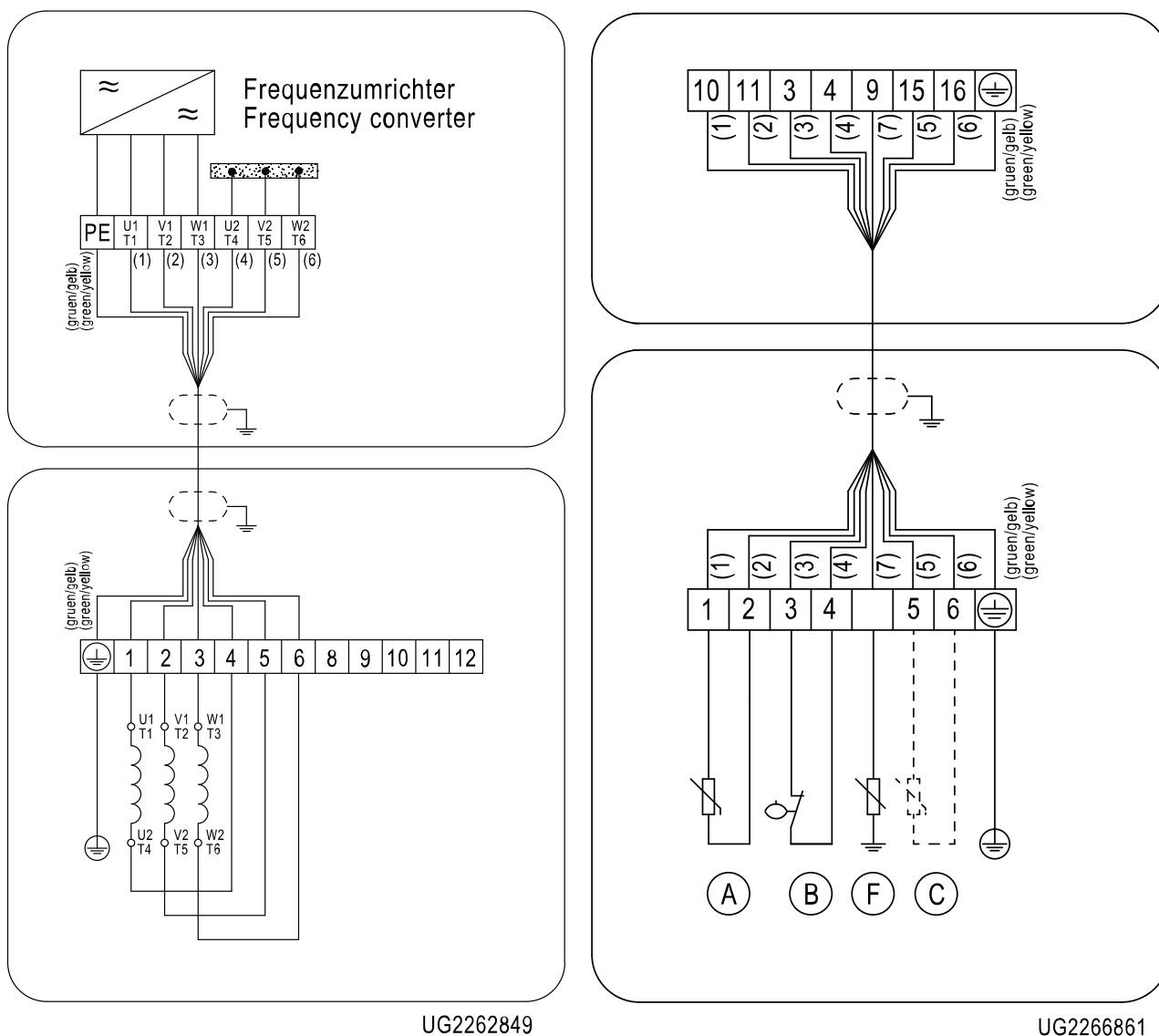


Fig. 119: Wiring diagram, motor versions UW/XW - sensor package Basic/Basic+ - power cables 7G6 + 8G1.5

Ⓐ	Motor temperature (PTC)
Ⓑ	Mechanical seal leakage
Ⓒ	Bearing temperature (pump end, optional)
Ⓕ	Leakage inside the motor

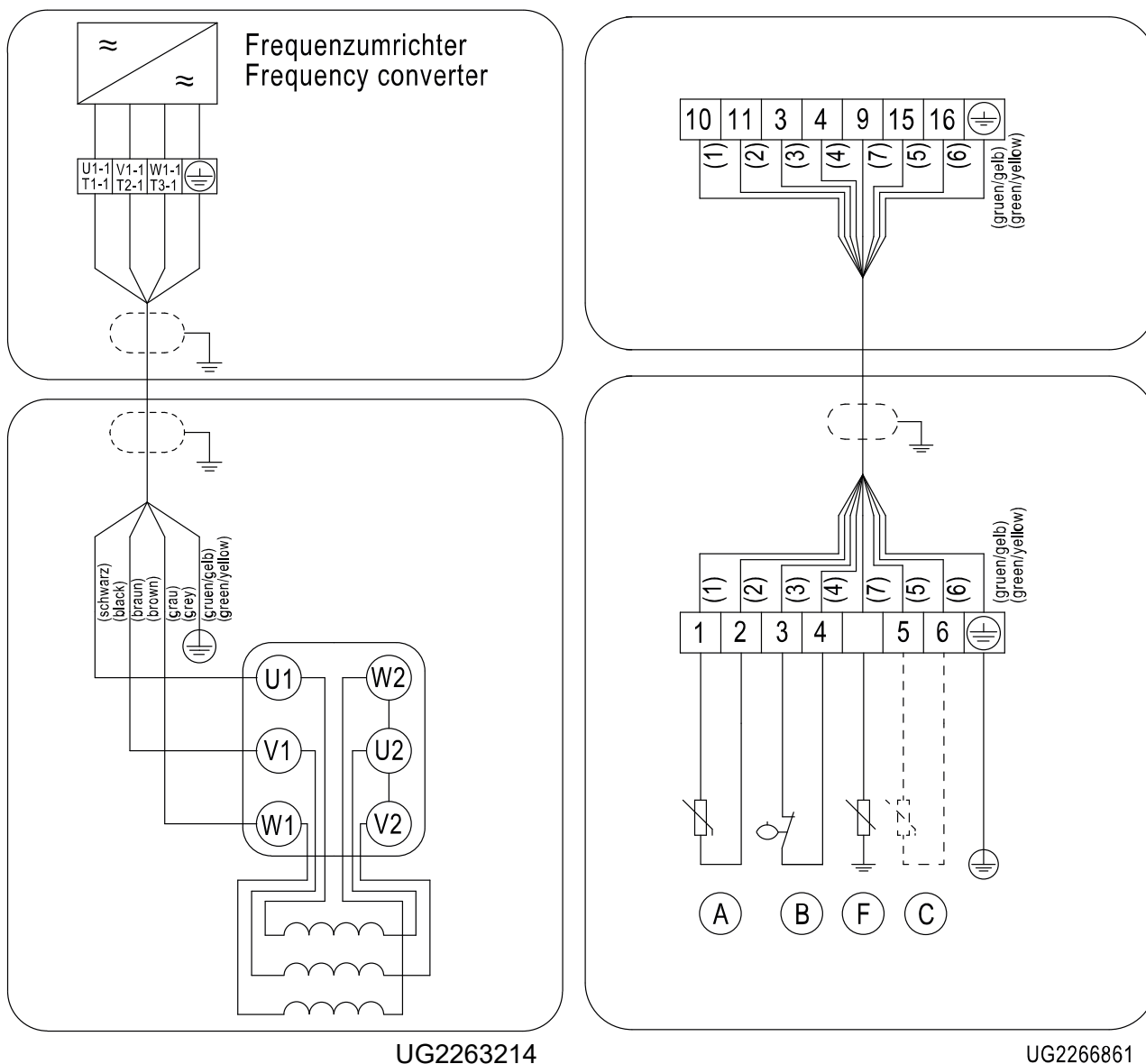


Fig. 120: Wiring diagram, motor versions UW/XW - sensor package Basic/Basic+ - power cables 4GX + 8G1.5

(A)	Motor temperature (PTC)
(B)	Mechanical seal leakage
(C)	Bearing temperature (pump end, optional)
(F)	Leakage inside the motor

9.4.3.2 Sensor package Premium

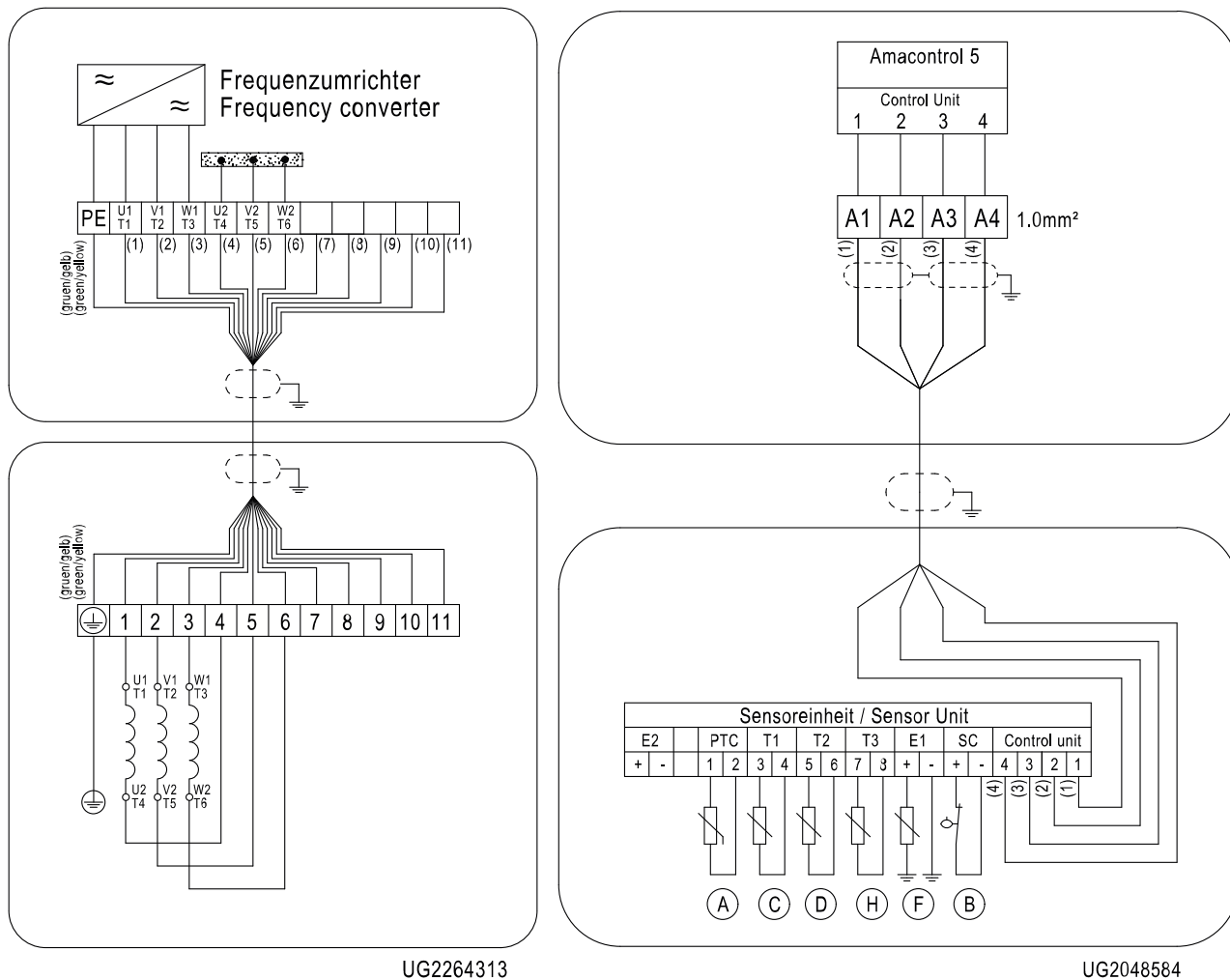


Fig. 121: Wiring diagram, motor versions UW/XW - sensor package Premium - power cables 12G1.5 + 2×(2×1)

Ⓐ	Motor temperature (PTC)
Ⓑ	Mechanical seal leakage
Ⓒ	Bearing temperature (pump end)
Ⓓ	Bearing temperature (motor end)
Ⓔ	Leakage inside the motor
Ⓕ	Motor temperature (Pt100)

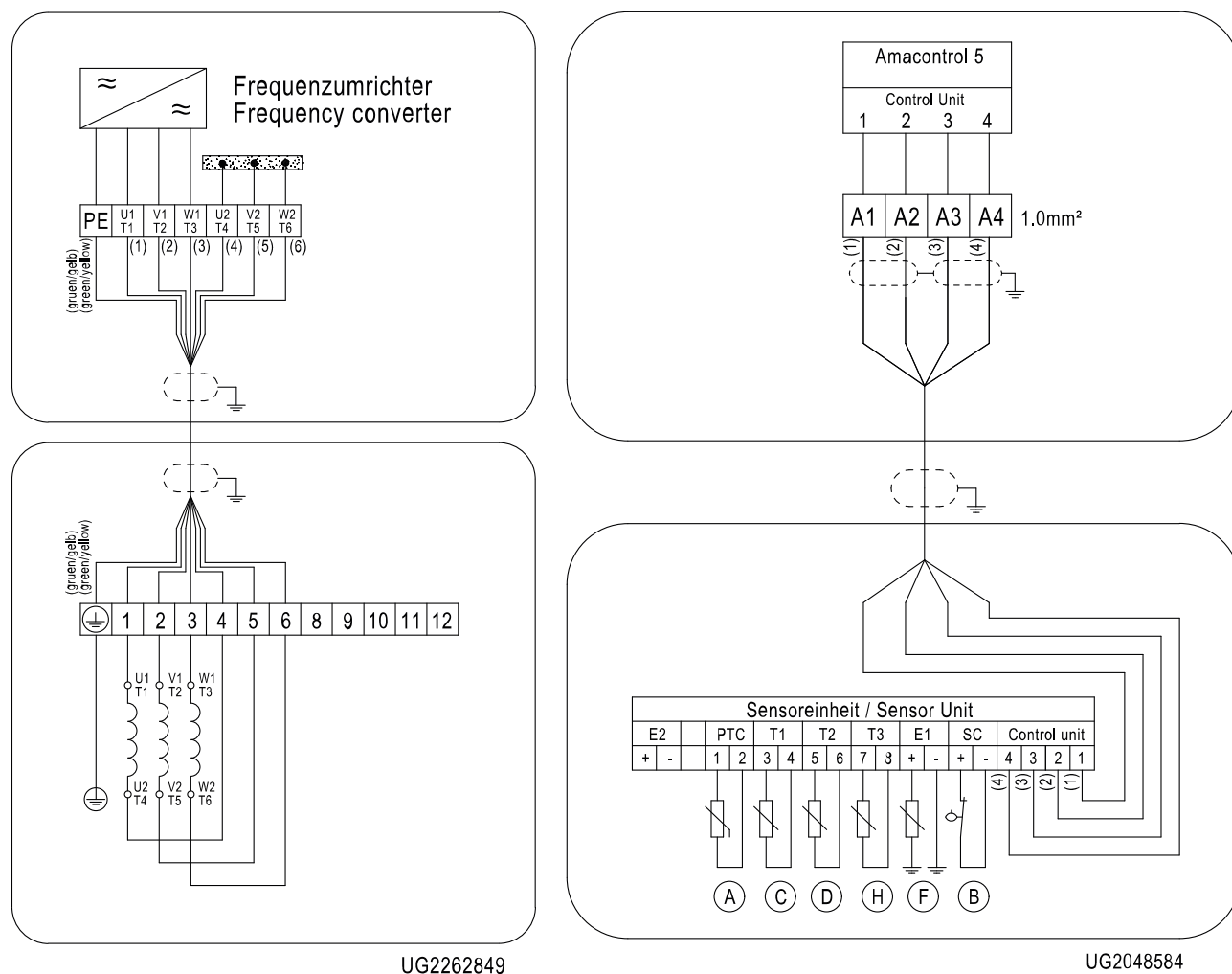


Fig. 122: Wiring diagram, motor versions UW/XW - sensor package Premium - power cable 7G6 + 2×(2×1)

Ⓐ	Motor temperature (PTC)
Ⓑ	Mechanical seal leakage
Ⓒ	Bearing temperature (pump end)
Ⓓ	Bearing temperature (motor end)
Ⓕ	Leakage inside the motor
Ⓗ	Motor temperature (Pt100)

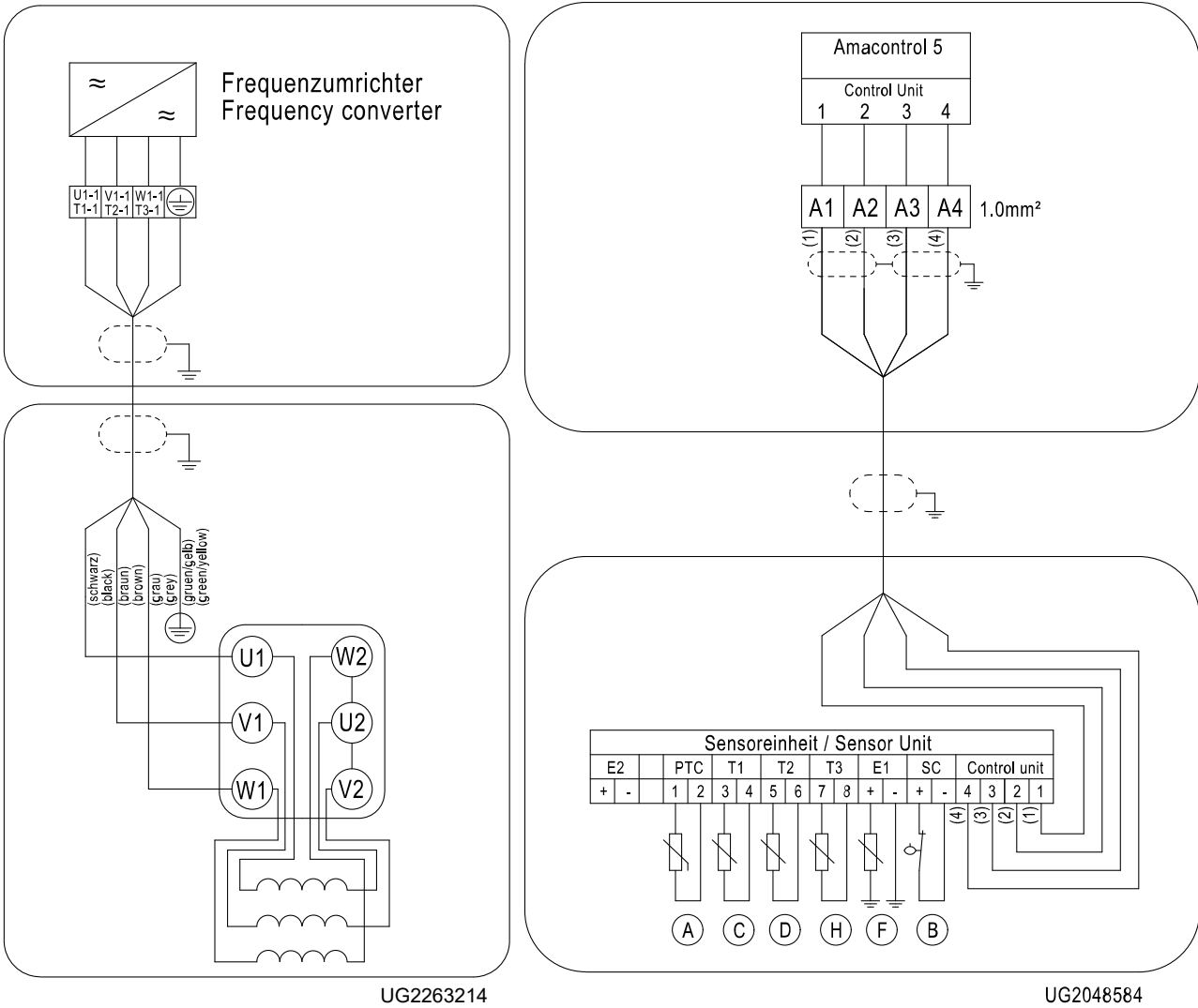


Fig. 123: Wiring diagram, motor versions UW/XW - sensor package Premium - power cable 4GX + 2×(2×1)

Ⓐ	Motor temperature (PTC)
Ⓑ	Mechanical seal leakage
Ⓒ	Bearing temperature (pump end)
Ⓓ	Bearing temperature (motor end)
Ⓔ	Leakage inside the motor
Ⓗ	Motor temperature (Pt100)

9.5 Flamepaths on explosion-proof motors

Motors of motor version XT

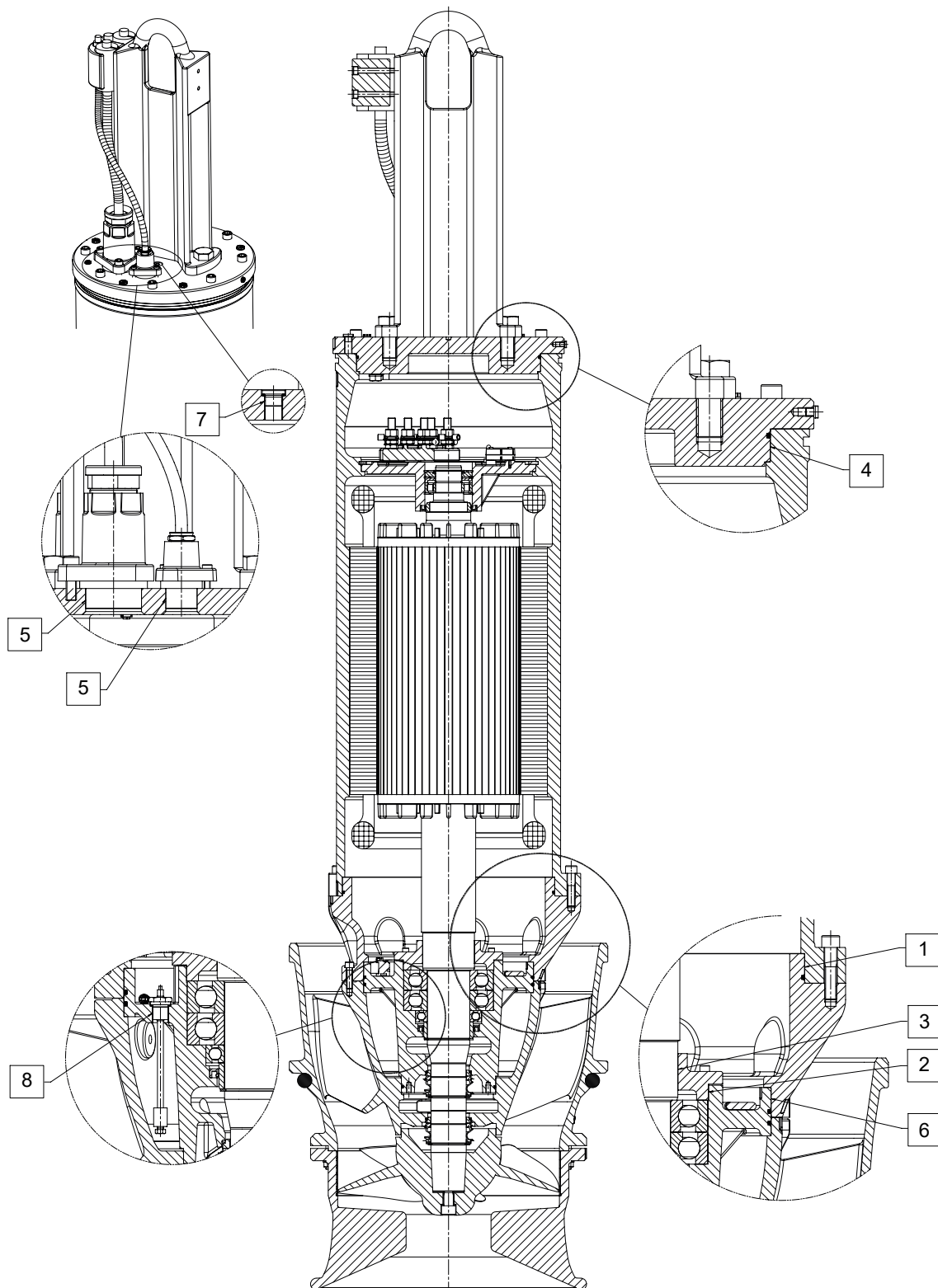


Fig. 124: Flamepaths, pump set, motor version XT

1, 2, 3, 4, 5, 6 ²⁹⁾ , 7, 8	Flamepaths
--	------------

²⁹ For version with adapter only

Motors of motor versions XV, XW

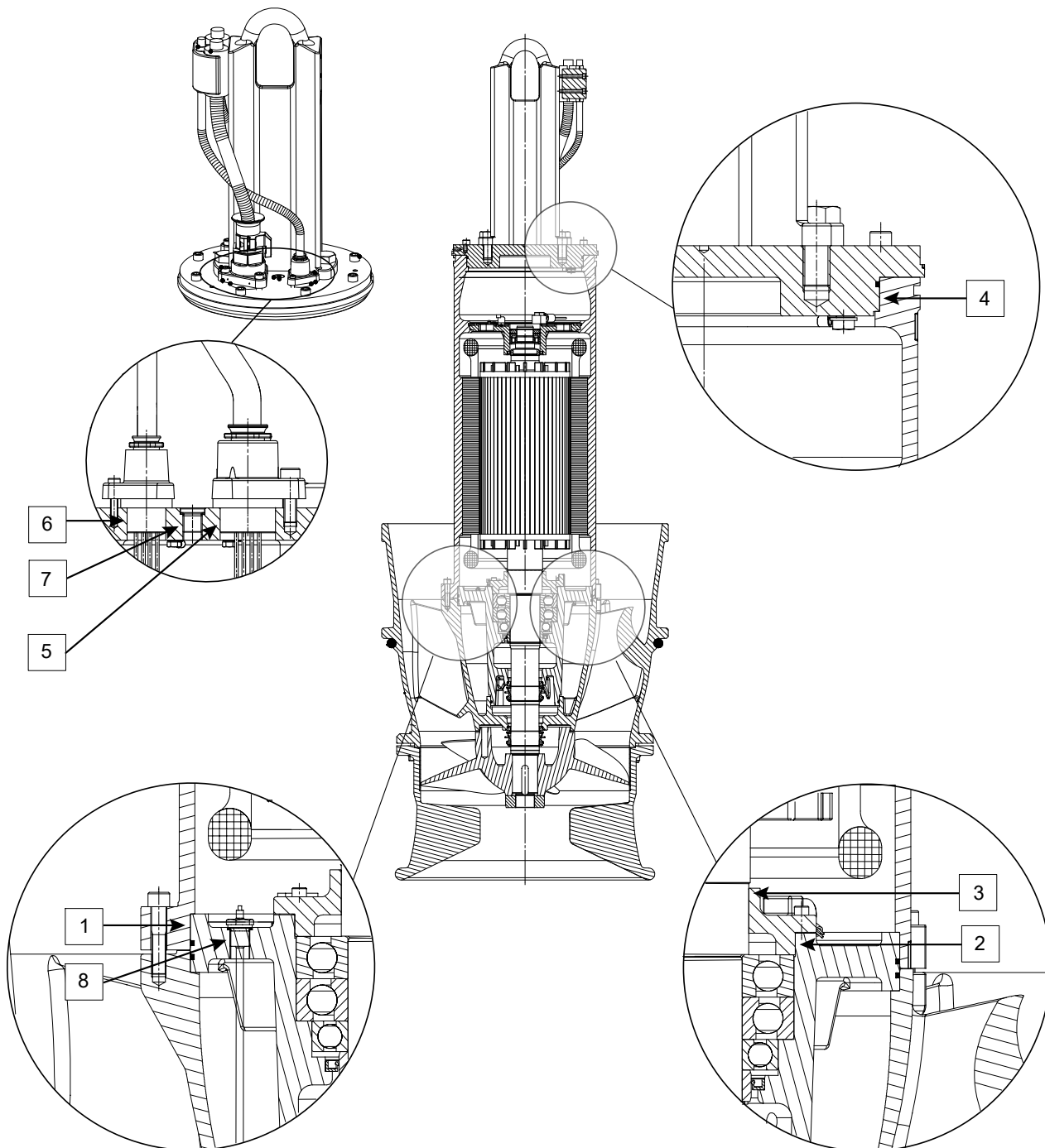


Fig. 125: Flamepaths, pump set, motor versions XV, XW

1, 2, 3, 4, 5, 6, 7, 8	Flamepaths
------------------------	------------

9.6 Pump set dimensions

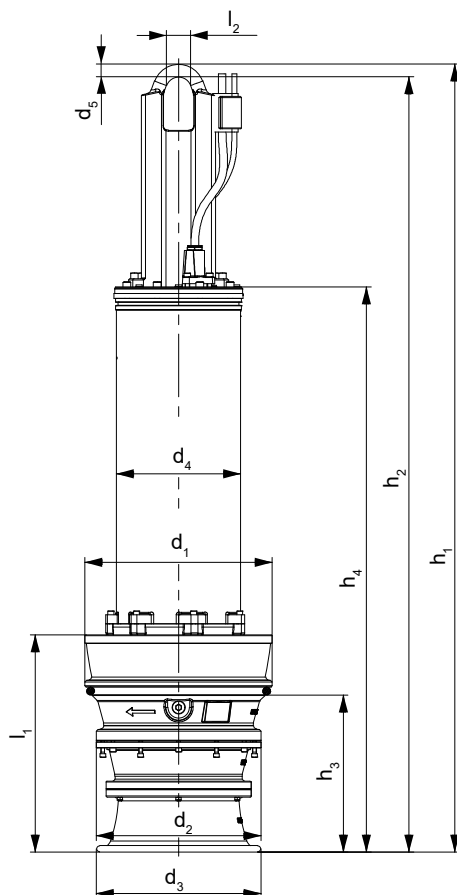


Fig. 126: Pump set dimensions

Table 85: Pump set dimensions [inch]

Size	Motor size	Num-ber of poles	Motor version	d ₁	d ₂	d ₃	d ₄	d ₅	h ₁	h ₂	h ₃	h ₄	l ₁	l ₂	[lbs] ³⁰⁾
				[inch]											
400-290	15	4	UV/XV	15 1/5	13 2/9	13 2/9	8 8/9	1/3	62 5/9	62 1/4	9 1/7	44 7/8	15 2/7	2 3/4	525
400-290	18	4	UV/XV	15 1/5	13 2/9	13 2/9	8 8/9	1/3	62 5/9	62 1/4	9 1/7	44 7/8	15 2/7	2 3/4	545
400-290	21	4	UV/XV	15 1/5	13 2/9	13 2/9	8 8/9	1/3	62 5/9	62 1/4	9 1/7	44 7/8	15 2/7	2 3/4	555
400-290	7	6	UV/XV/ UW/XW	15 1/5	13 2/9	13 2/9	8 8/9	1/3	62 5/9	62 1/4	9 1/7	44 7/8	15 2/7	2 3/4	485
400-290	11	6	UV/XV/ UW/XW	15 1/5	13 2/9	13 2/9	8 8/9	1/3	62 5/9	62 1/4	9 1/7	44 7/8	15 2/7	2 3/4	520
400-290	18	6	UW/XW	15 1/5	13 2/9	13 2/9	8 8/9	1/3	62 5/9	62 1/4	9 1/7	44 7/8	15 2/7	2 3/4	555
500-325	22	4	UV/XV	18 8/9	14 2/3	16 1/2	10 5/8	11/6	68 1/5	612/7	17	48 1/2	24 2/5	2 3/4	800
500-325	30	4	UV/XV	18 8/9	14 2/3	16 1/2	10 5/8	11/6	68 1/5	612/7	17	48 1/2	24 2/5	2 3/4	850
500-325	34	4	UV/XV	18 8/9	14 2/3	16 1/2	10 5/8	11/6	68 1/5	612/7	17	48 1/2	24 2/5	2 3/4	900
500-325	40	4	UV/XV	18 8/9	14 2/3	16 1/2	10 5/8	11/6	68 1/5	612/7	17	48 1/2	24 2/5	2 3/4	955
500-325	16	6	UW/XW	18 8/9	14 2/3	16 1/2	10 5/8	11/6	68 1/5	612/7	17	48 1/2	24 2/5	2 3/4	800
500-325	18	6	UV/XV	18 8/9	14 2/3	16 1/2	10 5/8	11/6	68 1/5	612/7	17	48 1/2	24 2/5	2 3/4	795
500-325	23	6	UW/XW	18 8/9	14 2/3	16 1/2	10 5/8	11/6	68 1/5	612/7	17	48 1/2	24 2/5	2 3/4	850
500-325	30	6	UW/XW	18 8/9	14 2/3	16 1/2	10 5/8	11/6	68 1/5	612/7	17	48 1/2	24 2/5	2 3/4	850
500-325	40	6	UW/XW	18 8/9	14 2/3	16 1/2	10 5/8	11/6	68 1/5	612/7	17	48 1/2	24 2/5	2 3/4	955
600-351	25	6	UV/XV	22 4/9	19	19	12	1	70 3/4	69 5/6	22	53 8/9	32 2/7	2 3/4	1220
600-351	30	6	UV/XV	22 4/9	19	19	12	1	70 3/4	69 5/6	22	53 8/9	32 2/7	2 3/4	1220

³⁰ Pump set in material variant G3, with 33 ft [10 m] power cable and 16.4 ft [5 m] support rope. The indicated weights are reference values only. Refer to the data sheet for the exact weight.

Size	Motor size	Number of poles	Motor version	d ₁	d ₂	d ₃	d ₄	d ₅	h ₁	h ₂	h ₃	h ₄	l ₁	l ₂	[lbs] ³⁰⁾
				[inch]											
600-351	35	6	UV/XV	22 4/9	19	19	12	1	70 3/4	69 5/6	22	53 8/9	32 2/7	2 3/4	1260
600-351	40	6	UV/XV	22 4/9	19	19	12	1	70 3/4	69 5/6	22	53 8/9	32 2/7	2 3/4	1320
600-351	26	8	UW/XW	22 4/9	19	19	12	1	70 3/4	69 5/6	22	53 8/9	32 2/7	2 3/4	1210
600-351	38	8	UW/XW	22 4/9	19	19	12	1	70 3/4	69 5/6	22	53 8/9	32 2/7	2 3/4	1270
700-471	60	6	UT/XT	26 4/7	23	23	15 1/6	14/7	86 2/9	84 2/3	16 8/9	59	29	3 1/7	2120
700-471	80	6	UT/XT	26 4/7	23	23	15 1/6	14/7	94	92 1/2	16 8/9	66 8/9	29	3 1/7	2405
700-471	100	6	UT/XT	26 4/7	23	23	15 1/6	14/7	94	92 1/2	16 8/9	66 8/9	29	3 1/7	2505
700-471	120	6	UT/XT	26 4/7	23	23	15 1/6	14/7	94	92 1/2	16 8/9	66 8/9	29	3 1/7	2550
700-471	30	8	UT/XT	26 4/7	23	23	15 1/6	14/7	86 2/9	84 2/3	16 8/9	59	29	3 1/7	2120
700-471	40	8	UT/XT	26 4/7	23	23	15 1/6	14/7	86 2/9	84 2/3	16 8/9	59	29	3 1/7	2145
700-471	50	8	UT/XT	26 4/7	23	23	15 1/6	14/7	86 2/9	84 2/3	16 8/9	59	29	3 1/7	2175
700-471	55	8	UT/XT	26 4/7	23	23	15 1/6	14/7	94	92 1/2	16 8/9	66 8/9	29	3 1/7	2405
700-471	70	8	UT/XT	26 4/7	23	23	15 1/6	14/7	94	92 1/2	16 8/9	66 8/9	29	3 1/7	2405
700-471	95	8	UT/XT	26 4/7	23	23	15 1/6	14/7	94	92 1/2	16 8/9	66 8/9	29	3 1/7	2545
800-471	155	6	UT/XT	26 4/7	23	23	18 5/7	14/7	106 3/4	105 1/6	16 8/9	79 1/2	29	3 1/7	3470
800-471	120	8	UT/XT	26 4/7	23	23	18 5/7	14/7	106 3/4	105 1/6	16 8/9	79 1/2	29	3 1/7	3245
800-471	140	8	UT/XT	26 4/7	23	23	18 5/7	14/7	106 3/4	105 1/6	16 8/9	79 1/2	29	3 1/7	3425

Table 86: Pump set dimensions

Size	Motor size	Number of poles	Motor version	d ₁	d ₂	d ₃	d ₄	d ₅	h ₁	h ₂	h ₃	h ₄	l ₁	l ₂	[kg] ³¹⁾
				[mm]											
400-290	15	4	UV/XV	386	336	336	226	8	1589	1581	232	1140	388	70	236
400-290	18	4	UV/XV	386	336	336	226	8	1589	1581	232	1140	388	70	246
400-290	21	4	UV/XV	386	336	336	226	8	1589	1581	232	1140	388	70	250
400-290	7	6	UV/XV/ UW/XW	386	336	336	226	8	1589	1581	232	1140	388	70	219
400-290	11	6	UV/XV/ UW/XW	386	336	336	226	8	1589	1581	232	1140	388	70	236
400-290	18	6	UW/XW	386	336	336	226	8	1589	1581	232	1140	388	70	250
500-325	22	4	UV/XV	480	372	420	270	30	1732	1557	433	1232	620	70	361
500-325	30	4	UV/XV	480	372	420	270	30	1732	1557	433	1232	620	70	385
500-325	34	4	UV/XV	480	372	420	270	30	1732	1557	433	1232	620	70	407
500-325	40	4	UV/XV	480	372	420	270	30	1732	1557	433	1232	620	70	432
500-325	16	6	UW/XW	480	372	420	270	30	1732	1557	433	1232	620	70	362
500-325	18	6	UV/XV	480	372	420	270	30	1732	1557	433	1232	620	70	359
500-325	23	6	UW/XW	480	372	420	270	30	1732	1557	433	1232	620	70	385
500-325	30	6	UW/XW	480	372	420	270	30	1732	1557	433	1232	620	70	385
500-325	40	6	UW/XW	480	372	420	270	30	1732	1557	433	1232	620	70	432
600-351	25	6	UV/XV	570	485	485	303	23	1797	1774	559	1369	820	70	552
600-351	30	6	UV/XV	570	485	485	303	23	1797	1774	559	1369	820	70	552
600-351	35	6	UV/XV	570	485	485	303	23	1797	1774	559	1369	820	70	570
600-351	40	6	UV/XV	570	485	485	303	23	1797	1774	559	1369	820	70	597
600-351	26	8	UW/XW	570	485	485	303	23	1797	1774	559	1369	820	70	548
600-351	38	8	UW/XW	570	485	485	303	23	1797	1774	559	1369	820	70	575
700-471	60	6	UT/XT	675	585	585	385	40	2190	2150	429	1499	735	80	960
700-471	80	6	UT/XT	675	585	585	385	40	2390	2350	429	1699	735	80	1089
700-471	100	6	UT/XT	675	585	585	385	40	2390	2350	429	1699	735	80	1136
700-471	120	6	UT/XT	675	585	585	385	40	2390	2350	429	1699	735	80	1155

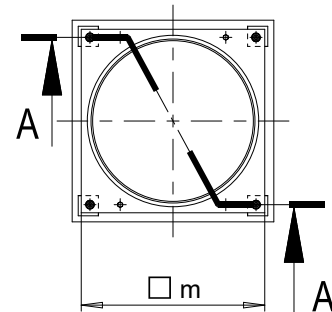
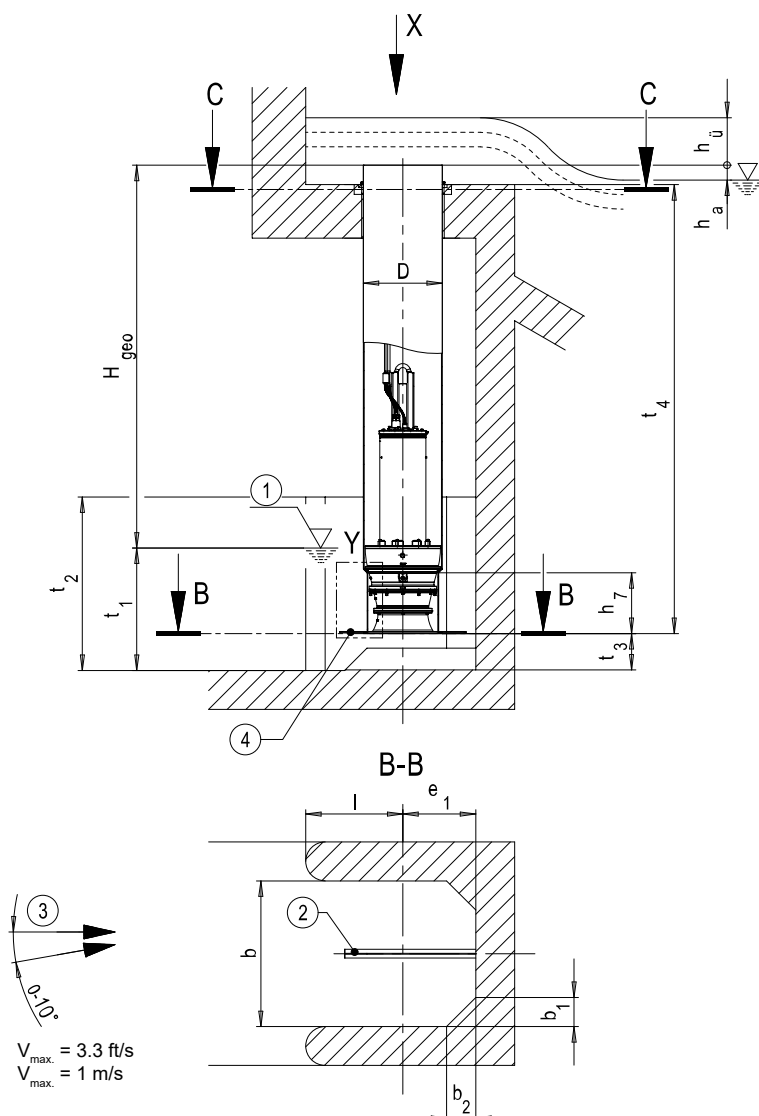
31 Pump set in material variant G3, with 10-meter power cable and 5-meter support rope. The indicated weights are reference values only. Refer to the data sheet for the exact weight.

Size	Motor size	Number of poles	Motor version	d ₁	d ₂	d ₃	d ₄	d ₅	h ₁	h ₂	h ₃	h ₄	l ₁	l ₂	[kg] ⁽³¹⁾
				[mm]											
700-471	30	8	UT/XT	675	585	585	385	40	2190	2150	429	1499	735	80	960
700-471	40	8	UT/XT	675	585	585	385	40	2190	2150	429	1499	735	80	972
700-471	50	8	UT/XT	675	585	585	385	40	2190	2150	429	1499	735	80	986
700-471	55	8	UT/XT	675	585	585	385	40	2390	2350	429	1699	735	80	1089
700-471	70	8	UT/XT	675	585	585	385	40	2390	2350	429	1699	735	80	1090
700-471	95	8	UT/XT	675	585	585	385	40	2390	2350	429	1699	735	80	1153
800-471	155	6	UT/XT	675	585	585	475	40	2711	2671	429	2020	735	80	1574 ⁽³¹⁾
800-471	120	8	UT/XT	675	585	585	475	40	2711	2671	429	2020	735	80	1472
800-471	140	8	UT/XT	675	585	585	475	40	2711	2671	429	2020	735	80	1552

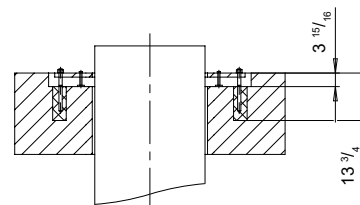
9.7 General arrangement drawings

9.7.1 General arrangement drawings [inch]

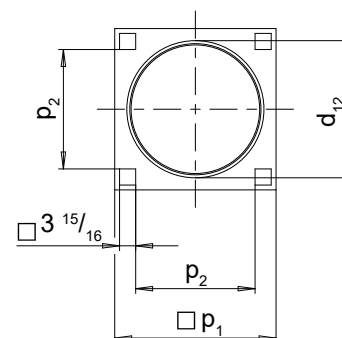
9.7.1.1 Installation types BU/BUS



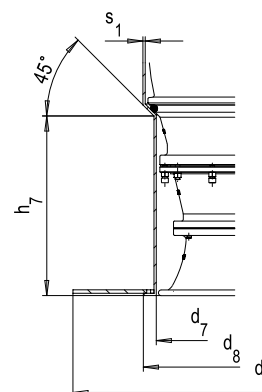
Detail X: Support plate of the discharge tube



Section A-A: Foundation recesses, dimensions in [inch]



Section A-A: Foundation recesses, dimensions in [inch]³²⁾



Detail Y: Seating ring

³²⁾ All dimensions for foundation recesses apply to discharge tube design without intermediate flange.

Table 87: Dimensions

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				
	[inch]									
400-290	16	34 2/3	6 8/9	–	6 8/9	–	13 7/9	16	25 3/5	17 5/7
500-325	20	49 1/5	9 5/6	–	9 5/6	–	17 1/3	19 7/8	31 1/2	21 2/3
600-351	24	49 1/5	9 5/6	–	9 5/6	–	19 2/3	24	31 1/2	25 3/5
700-471	28	59	11 4/5	–	11 4/5	–	23 5/8	28	43 1/3	29 1/2
800-471	32	59	11 4/5	–	11 4/5	–	23 5/8	28	43 1/3	33 1/2

Table 88: Dimensions

Size	e ₁ ³³⁾		h _a	h ₇	l _{min.}	m	p ₁	p ₂	s ₁	t ₃ ³³⁾	t _{4 min.} ³⁴⁾
	Suction umbrella										
	✗	✓									
	d ₈	d ₉									
	[inch]										
400-290	11 4/5	16 3/4	4	8 6/7	19 2/3	19 2/3	23 5/8	13 2/5	2/7	8 1/4	65
500-325	13 7/9	19 2/3	4	16 1/2	33 1/2	23 5/8	27 5/9	17 1/3	2/7	10 5/8	68 8/9
600-351	15 3/4	19 2/3	4	21 1/4	33 1/2	27 5/9	31 1/2	21 1/4	1/3	12 3/5	70 6/7
700-471	17 5/7	25 3/5	4	16 1/2	41 1/3	31 1/2	35 3/7	25 1/5	1/3	15	94 1/2
800-471	17 5/7	25 3/5	4	16 1/2	41 1/3	35 5/6	39 3/8	29 1/7	1/3	15	108 1/4

t₂ = 1.1 x water level, maximum 2 x t₁

Height of corner lining (b₁ and b₂) like t₂

Permissible dimensional tolerances:

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

Loss diagram

Calculation formulas:

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

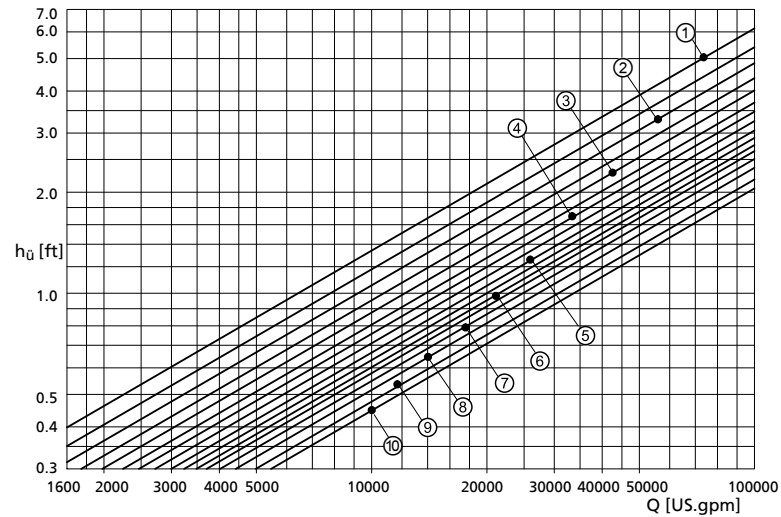
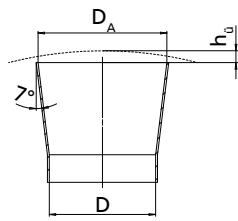
$$\Delta H_v$$

- Overflow head h₀ (see diagram)
- Loss in the riser (pipe friction)
- Outlet loss v² / 2g (v refers to D_A)

Overflow head h₀ 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.

33 Observe this dimension.

34 Value for maximum motor length



- ① - $D_A = 15 \frac{3}{4}$ inch
- ② - $D_A = 23 \frac{5}{8}$ inch
- ③ - $D_A = 31 \frac{1}{2}$ inch
- ④ - $D_A = 39 \frac{3}{8}$ inch
- ⑤ - $D_A = 47 \frac{1}{4}$ inch
- ⑥ - $D_A = 55 \frac{1}{8}$ inch
- ⑦ - $D_A = 63$ inch
- ⑧ - $D_A = 70 \frac{7}{8}$ inch
- ⑨ - $D_A = 78 \frac{3}{4}$ inch
- ⑩ - $D_A = 86 \frac{5}{8}$ inch

Minimum water level diagrams

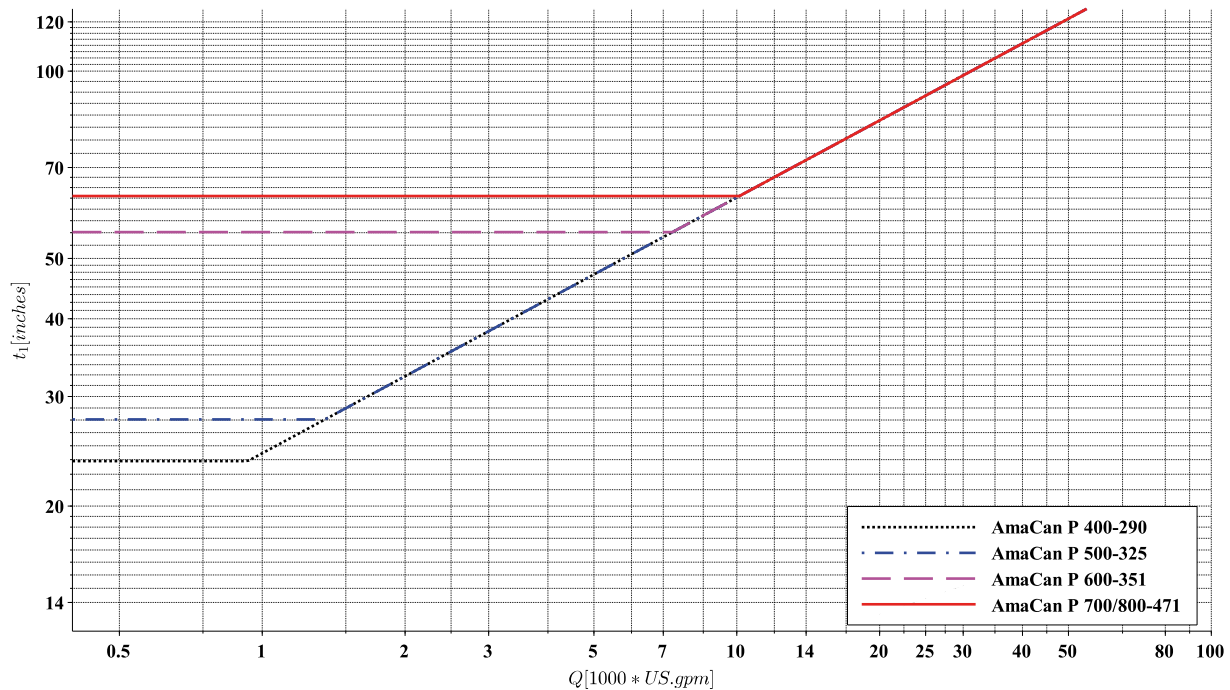


Fig. 127: Open intake chamber, design without suction umbrella $\emptyset d_8$

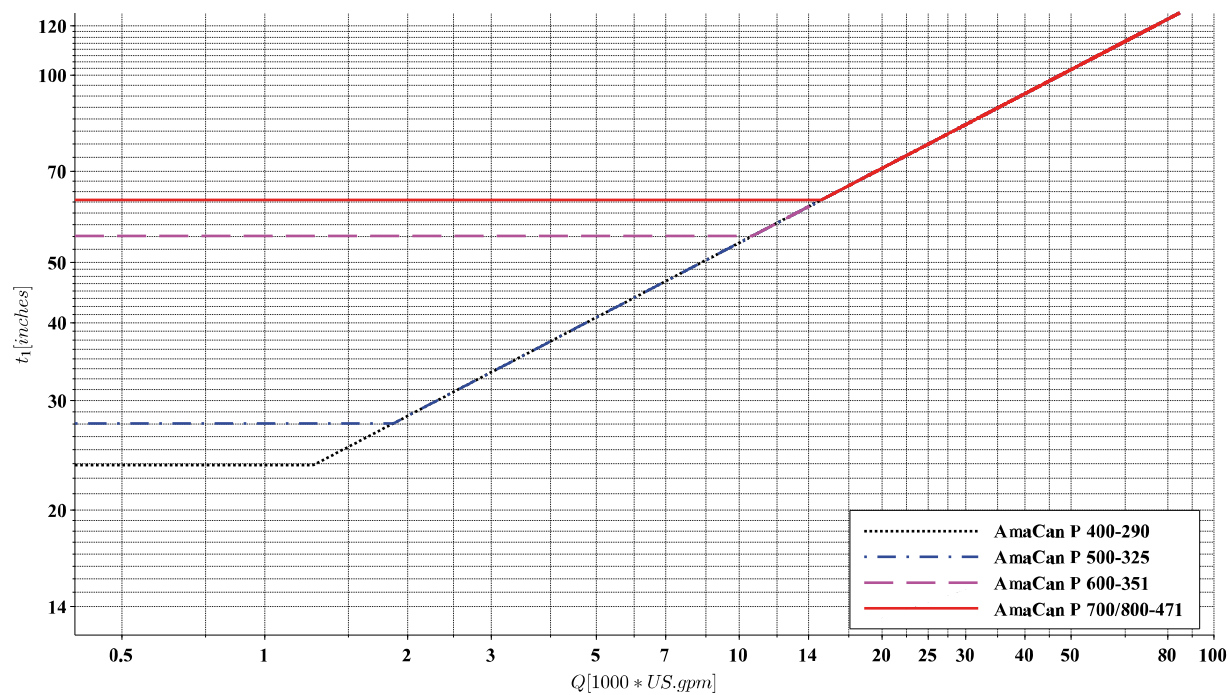
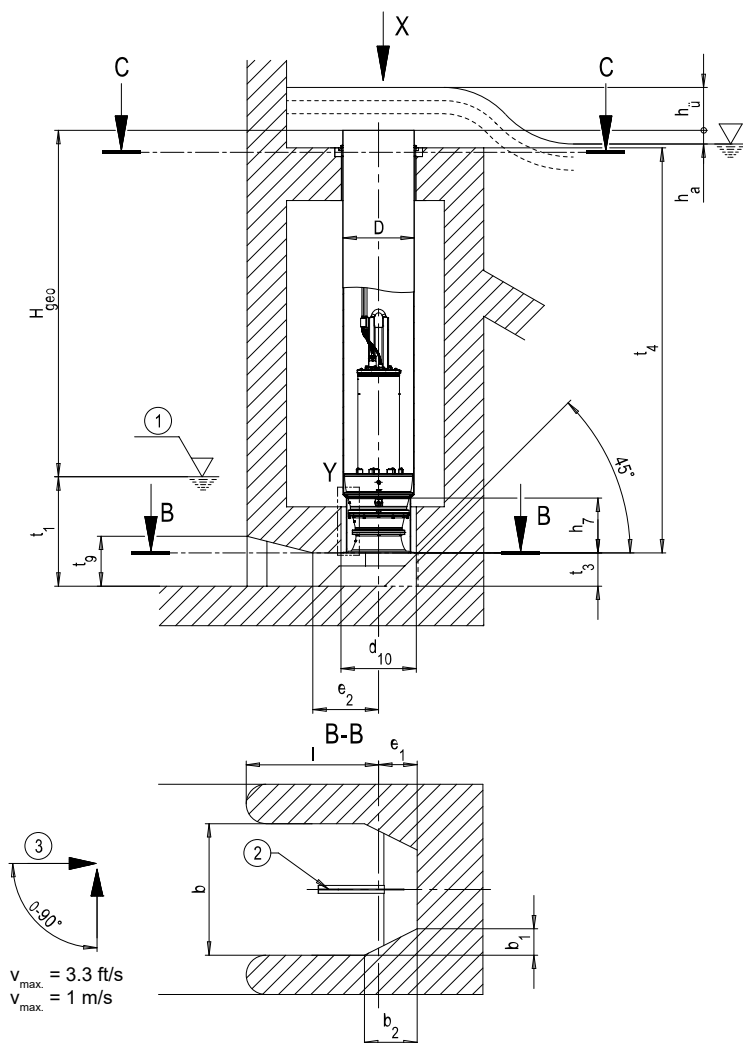
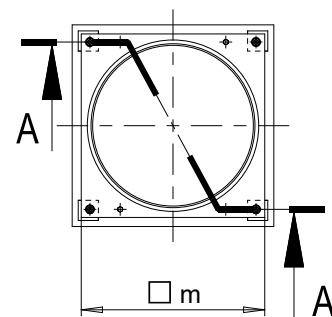


Fig. 128: Open intake chamber, design with suction umbrella $\varnothing d_g$

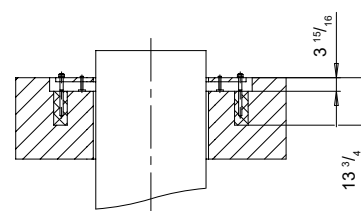
9.7.1.2 Installation type BG



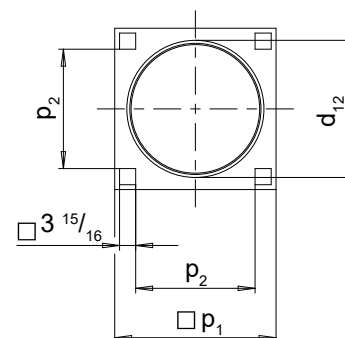
- ①: Minimum water level (values see diagrams on the following pages)
- ②: Flow-straightening vane (⇒ Section 9.7.1.7, Page 171)
- ③: Approach flow



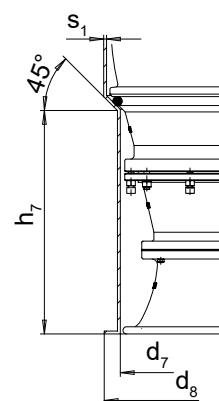
Detail X: Support plate of the discharge tube



Section A-A: Foundation recesses, dimensions in [inch]



Section A-A: Foundation recesses, dimensions in [inch]³⁵⁾



Detail Y: Seating ring

³⁵⁾ All dimensions for foundation recesses apply to discharge tube design without intermediate flange.

Table 89: Dimensions [inch]

Size	D	b	b ₁	b ₂	d ₇	d ₈	d ₁₀	d ₁₂	e ₁ ³⁶⁾	e ₂	h _a
400-290	16	34 2/3	6 8/9	13 7/9	13 7/9	16	18	17 5/7	10 3/7	17 1/3	4
500-325	20	49 1/5	9 5/6	19 2/3	17 1/3	19 7/8	21 6/7	21 2/3	14 3/4	24 3/5	4
600-351	24	49 1/5	9 5/6	19 2/3	19 2/3	24	26	25 3/5	14 3/4	24 3/5	4
700-471	28	59	11 4/5	23 5/8	23 5/8	28	30	29 1/2	17 5/7	29 1/2	4
800-471	32	59	11 4/5	23 5/8	23 5/8	28	30	33 1/2	17 5/7	29 1/2	4

Table 90: Dimensions [inch]

Size	h _r	l _{min.}	m	p ₁	p ₂	s ₁	t ₃ ³⁷⁾	t _{4 min.} ³⁸⁾	t ₉
400-290	8 6/7	34 2/3	19 2/3	23 5/8	13 2/5	2/7	8 1/4	65	13
500-325	16 1/2	49 1/5	23 5/8	27 5/9	17 1/3	2/7	10 5/8	68 8/9	14 3/4
600-351	21 1/4	49 1/5	27 5/9	31 1/2	21 1/4	1/3	12 3/5	70 6/7	18 1/2
700-471	16 1/2	59	31 1/2	35 3/7	25 1/5	1/3	15	94 1/2	22 4/9
800-471	16 1/2	59	35 5/6	39 3/8	29 1/7	1/3	15	108 1/4	22 4/9

Permissible dimensional tolerances:

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

Loss diagram

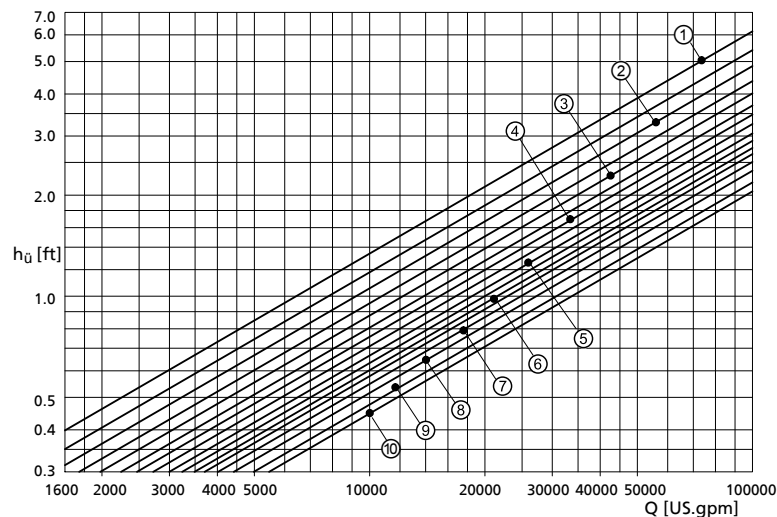
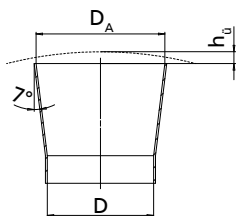
Calculation formulas:

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

$$\Delta H_v$$

- 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.



- ① - $D_A = 15 \frac{3}{4}$ inch
- ② - $D_A = 23 \frac{5}{8}$ inch
- ③ - $D_A = 31 \frac{1}{2}$ inch
- ④ - $D_A = 39 \frac{3}{8}$ inch
- ⑤ - $D_A = 47 \frac{1}{4}$ inch
- ⑥ - $D_A = 55 \frac{1}{8}$ inch
- ⑦ - $D_A = 63$ inch
- ⑧ - $D_A = 70 \frac{7}{8}$ inch
- ⑨ - $D_A = 78 \frac{3}{4}$ inch
- ⑩ - $D_A = 86 \frac{5}{8}$ inch

36 Observe this dimension.
37 Observe this dimension.
38 Value for maximum motor length

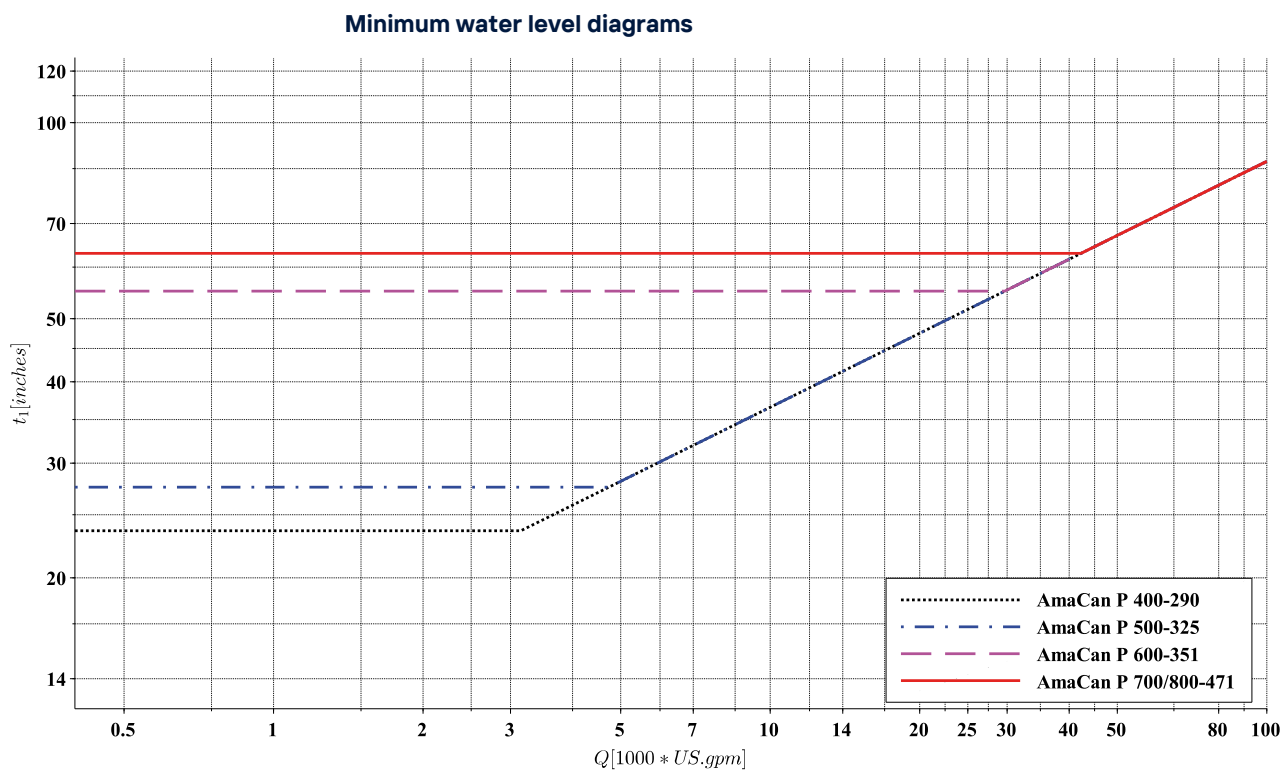
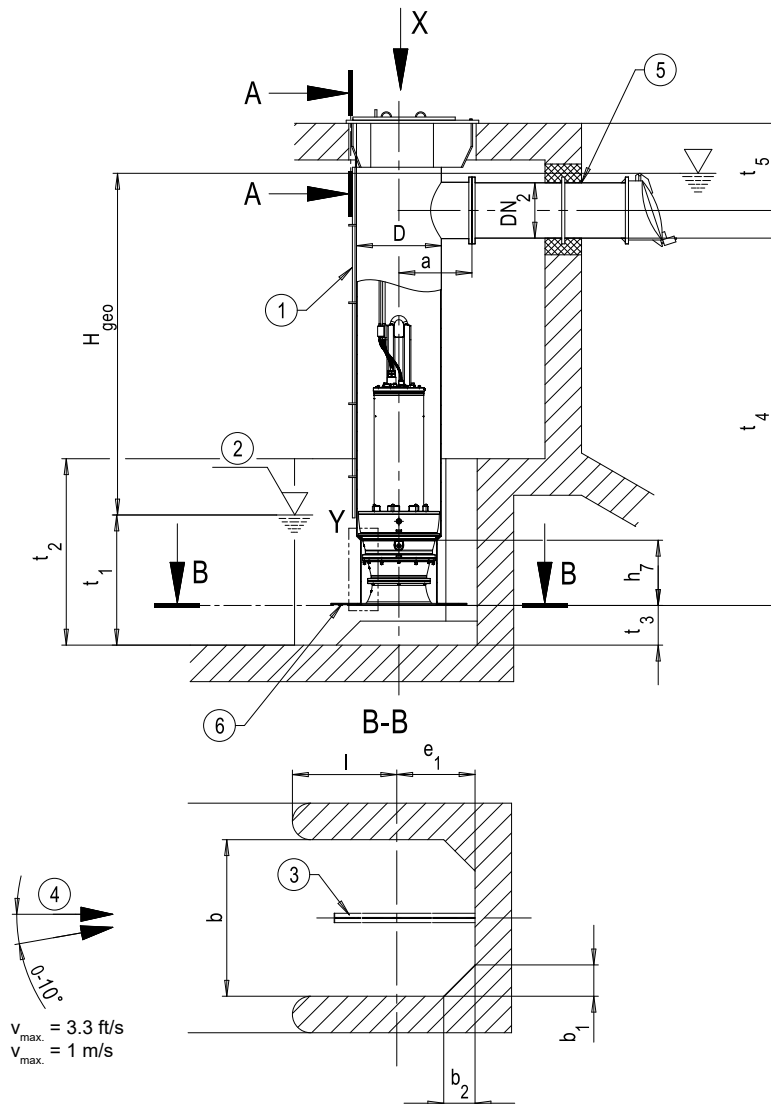
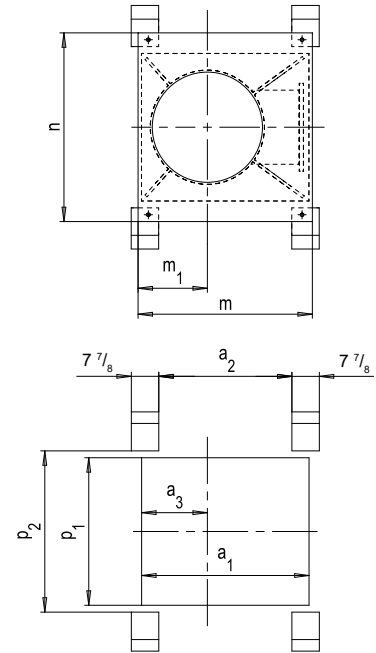


Fig. 129: Installation type BG: Covered intake chamber

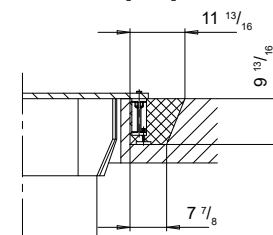
9.7.1.3 Installation types CU/CUS



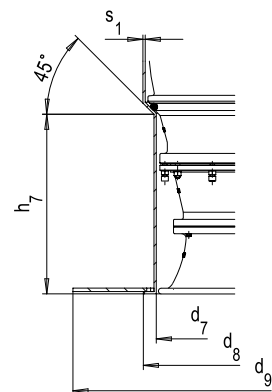
- ①: Vent line
- ②: Minimum water level (values see diagram on the next pages)
- ③: Flow-straightening vane ($\Rightarrow$ Section 9.7.1.7, Page 171)
- ④: Approach flow
- ⑤: Connect the discharge pipe to the discharge tube without transmitting any stresses or strains.
- ⑥: Suction umbrella; option for reducing the minimum water level t_1



Detail X: Support plate of the discharge tube, foundation recesses³⁹⁾ Dimensions in [inch]



Section A-A: Foundation recesses, dimensions in [inch]



Detail Y: Seating ring

³⁹ All dimensions for foundation recesses apply to discharge tube design without intermediate flange.

Table 91: Dimensions [inch]

Size	DN _{2 min.}	DN _{2 max.}	D	a	a ₁	a ₂	a ₃	b	b ₁		b ₂		d ₇
									Suction umbrella		Suction umbrella		
									✗	✓	✗	✓	
									d ₈	d ₉	d ₈	d ₉	
400-290	9 5/6	15 3/4	16	16 1/2	28 1/3	18 1/2	10 5/6	34 2/3	6 8/9	–	6 8/9	–	13 7/9
500-325	11 4/5	19 2/3	20	20 6/7	34 2/3	24 4/5	12 4/5	49 1/5	9 5/6	–	9 5/6	–	17 1/3
600-351	13 7/9	23 5/8	24	24	39 3/8	29 1/2	15	49 1/5	9 5/6	–	9 5/6	–	19 2/3
700-471	15 3/4	27 5/9	28	25 3/5	44	34 1/4	17	59	11 4/5	–	11 4/5	–	23 5/8
800-471	19 2/3	31 1/2	32	27 5/9	48	38 1/5	18 8/9	59	11 4/5	–	11 4/5	–	23 5/8

Table 92: Dimensions [inch]

Size	d ₈	d ₉	e ₁ ⁴⁰⁾		h ₇	l _{min.}	m	m ₁	n	p ₁	p ₂	s ₁	t ₃ ⁴⁰⁾	t _{4 min.} ⁴¹⁾	t _{5 min.} ⁴²⁾
			Suction umbrella												
			✗	✓											
			d ₈	d ₉											
400-290	16	25 3/5	11 4/5	16 3/4	8 6/7	19 2/3	30 1/3	11 4/5	37 4/5	26	30	2/7	8 1/4	68 8/9	24 2/5
500-325	19 7/8	31 1/2	13 7/9	19 2/3	16 1/2	33 1/2	36 3/5	13 7/9	41 3/4	30	33 6/7	2/7	10 5/8	72 5/6	26 3/8
600-351	24	31 1/2	15 3/4	19 2/3	21 1/4	33 1/2	41 1/3	16	45 2/3	33 6/7	37 4/5	1/3	12 3/5	74 4/5	28 1/3
700-471	28	43 1/3	17 5/7	25 3/5	16 1/2	41 1/3	46	18	49 3/5	37 4/5	41 3/4	1/3	15	98 3/7	30 1/3
800-471	28	43 1/3	17 5/7	25 3/5	16 1/2	41 1/3	50	19 7/8	54 1/7	42 1/3	46 1/4	1/3	15	112 1/5	32 7/8

t₂ = 1.1 x water level, maximum 2 x t₁

Height of corner lining (b₁ and b₂) like t₂

Permissible dimensional tolerances:

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

Loss diagram

Calculation formulas:

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

$$\Delta H_v$$

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

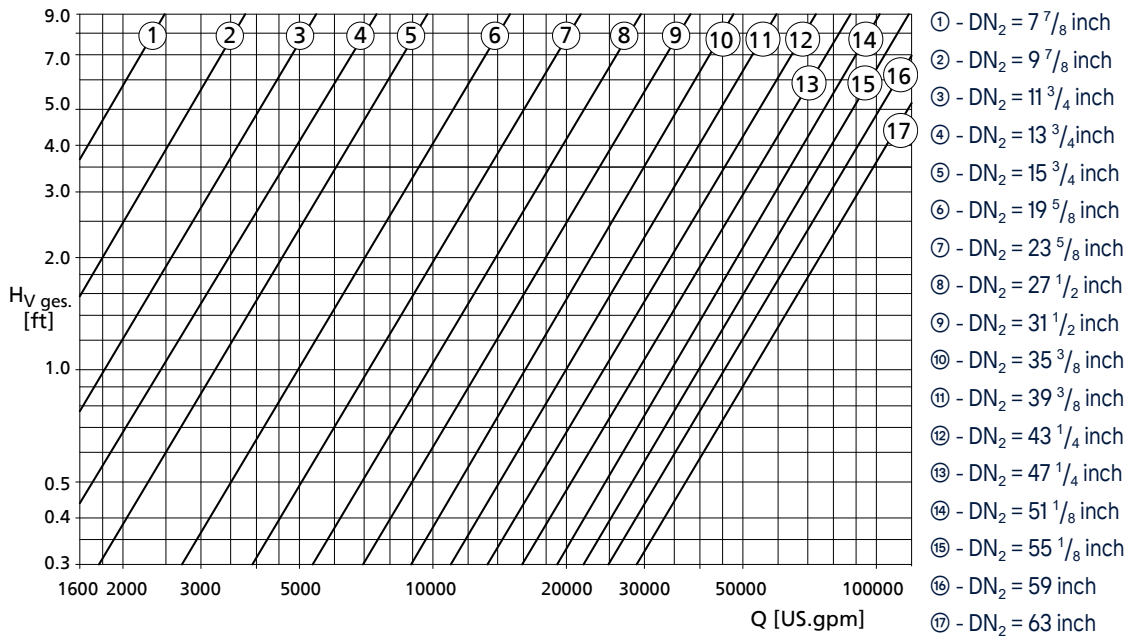
H_{v ges.} comprises:

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

⁴⁰ Observe this dimension.

⁴¹ Value for maximum motor length

⁴² Selected for DN2 max.



Minimum water level diagrams

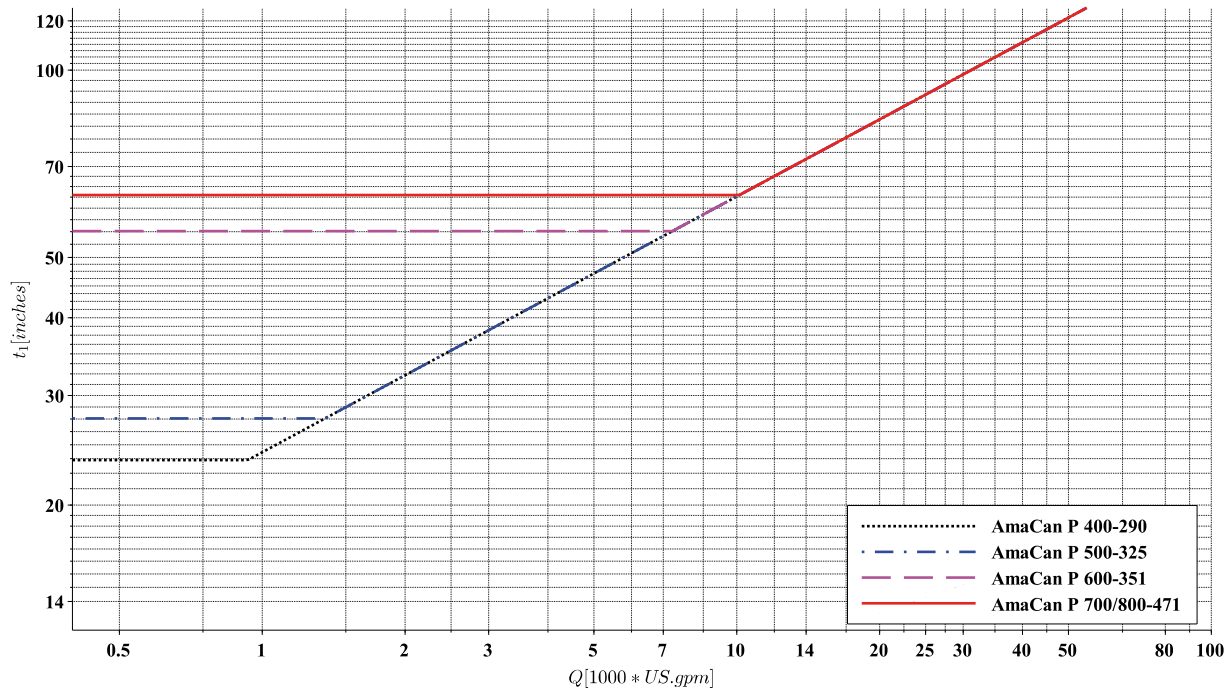


Fig. 130: Installation type CU: Open intake chamber, design without suction umbrella Ø d₈

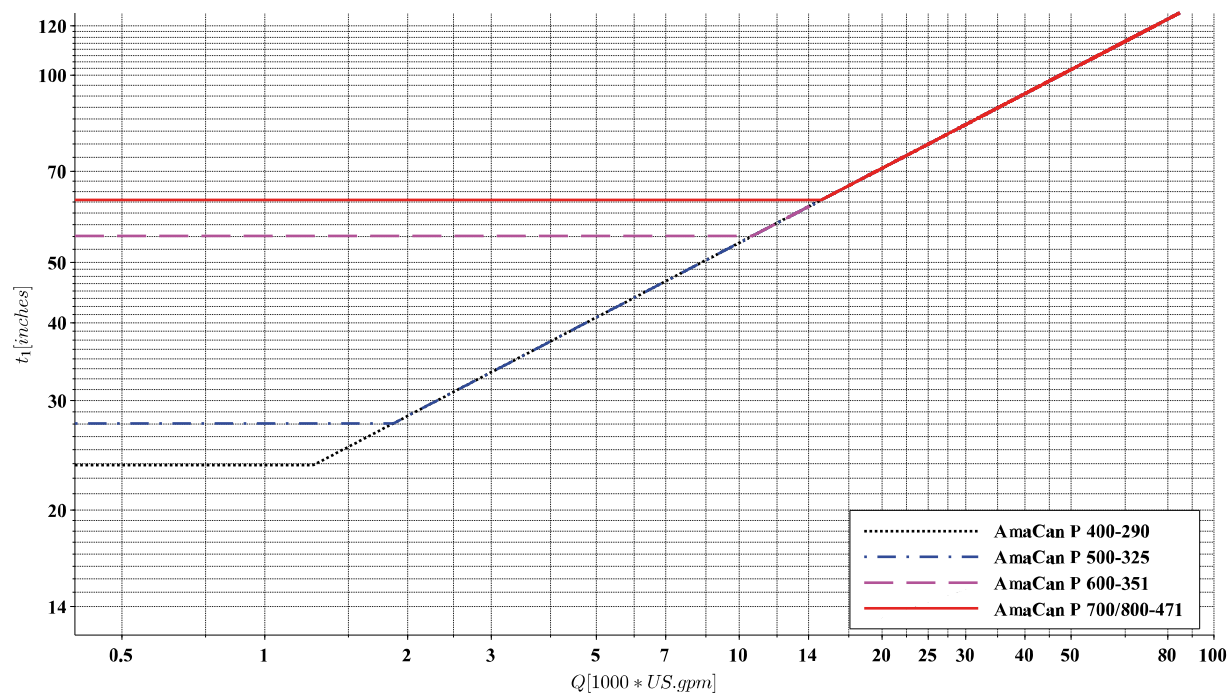
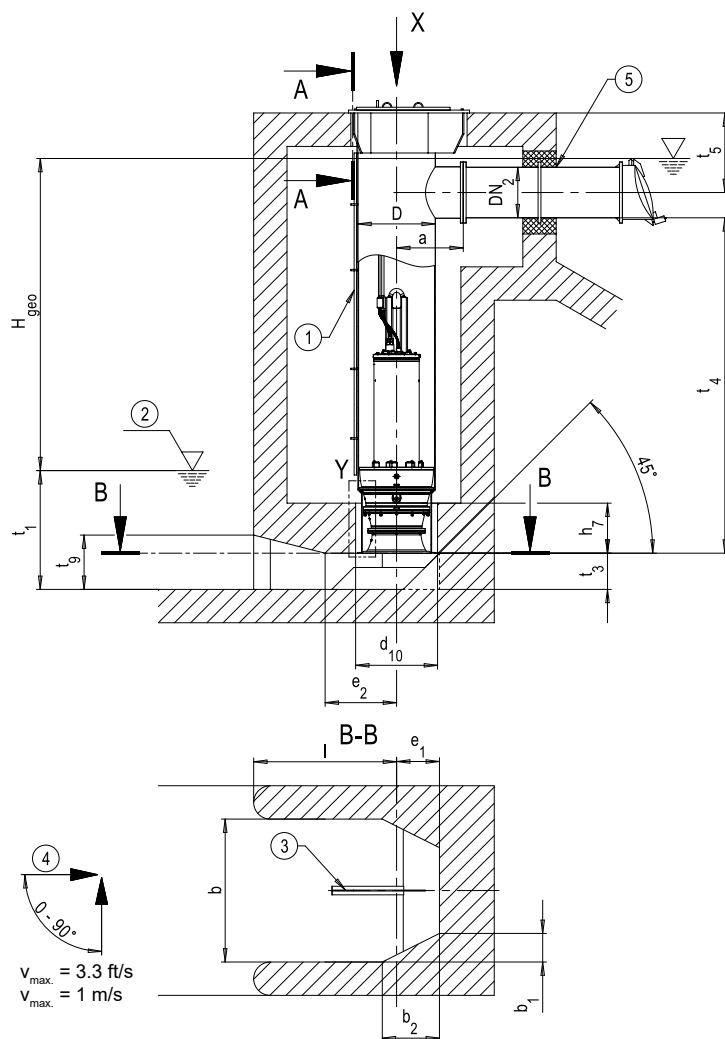
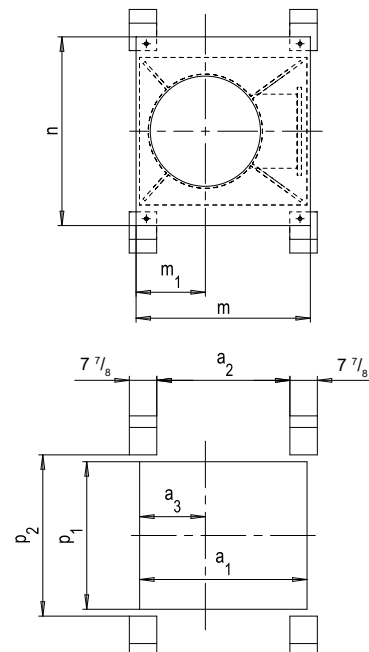


Fig. 131: Installation type CUS: Open intake chamber, design with suction umbrella $\varnothing d_g$

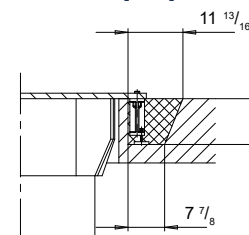
9.7.1.4 Installation type CG



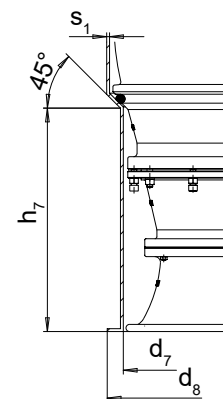
- ①: Vent line
- ②: Minimum water level (values see diagram on the next pages)
- ③: Flow-straightening vane (⇒ Section 9.7.1.7, Page 171)
- ④: Approach flow
- ⑤: Connect the discharge pipe to the discharge tube without transmitting any stresses or strains.



Detail X: Support plate of the discharge tube, foundation recesses⁴³⁾, dimensions in [inch]



Section A-A: Foundation recesses, dimensions in [inch]



Detail Y: Seating ring

Table 93: Dimensions [inch]

Size	DN ₂ min.	DN ₂ max.	D	a	a ₁	a ₂	a ₃	b	b ₁	b ₂	d ₇	d ₈	d ₁₀
400-290	9 5/6	15 3/4	16	16 1/2	28 1/3	18 1/2	10 5/6	34 2/3	6 8/9	13 7/9	13 7/9	16	18
500-325	11 4/5	19 2/3	20	20 6/7	34 2/3	24 4/5	12 4/5	49 1/5	9 5/6	19 2/3	17 1/3	19 7/8	21 6/7
600-351	13 7/9	23 5/8	24	24	39 3/8	29 1/2	15	49 1/5	9 5/6	19 2/3	19 2/3	24	26

⁴³ All dimensions for foundation recesses apply to discharge tube design without intermediate flange.

Size	DN ₂ min.	DN ₂ max.	D	a	a ₁	a ₂	a ₃	b	b ₁	b ₂	d ₇	d ₈	d ₁₀
700-471	15 3/4	27 5/9	28	25 3/5	44	34 1/4	17	59	114/5	23 5/8	23 5/8	28	30
800-471	19 2/3	31 1/2	32	27 5/9	48	38 1/5	18 8/9	59	114/5	23 5/8	23 5/8	28	30

Table 94: Dimensions [inch]

Size	e ₁ ⁴⁴⁾	e ₂	h ₇	l _{min.}	m	m ₁	n	p ₁	p ₂	s ₁	t ₃ ⁴⁴⁾	t _{4 min.} ⁴⁵⁾	t _{5 min.} ⁴⁶⁾	t ₉
400-290	10 3/7	17 1/3	8 6/7	34 2/3	30 1/3	11 4/5	37 4/5	26	30	2/7	8 1/4	68 8/9	24 2/5	13
500-325	14 3/4	24 3/5	16 1/2	49 1/5	36 3/5	13 7/9	41 3/4	30	33 6/7	2/7	10 5/8	72 5/6	26 3/8	14 3/4
600-351	14 3/4	24 3/5	21 1/4	49 1/5	41 1/3	16	45 2/3	33 6/7	37 4/5	1/3	12 3/5	74 4/5	28 1/3	18 1/2
700-471	17 5/7	29 1/2	16 1/2	59	46	18	49 3/5	37 4/5	41 3/4	1/3	15	98 3/7	30 1/3	22 4/9
800-471	17 5/7	29 1/2	16 1/2	59	50	19 7/8	54 1/7	42 1/3	46 1/4	1/3	15	112 1/5	32 7/8	22 4/9

Permissible dimensional tolerances:

- Tolerances in building construction to DIN 18202, Part 4, Group B
- Welded design: 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

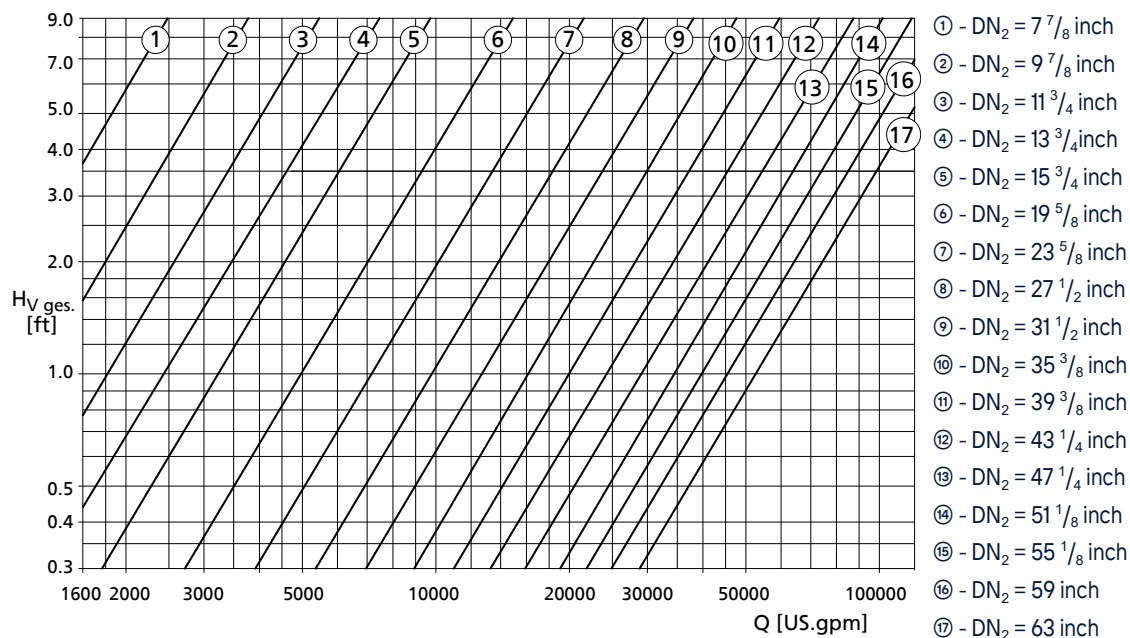
Calculation formulas:

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

$$\Delta H_v$$

H_{v ges.} comprises:

- Loss in the riser (pipe friction)
- H_{v ges.} (see diagram)
- Elbow
- Discharge pipe length = 5 x DN₂
- Swing check valve
- Outlet losses v²/2g



⁴⁴ Observe this dimension.

⁴⁵ Value for maximum motor length

⁴⁶ Selected for DN2 max.

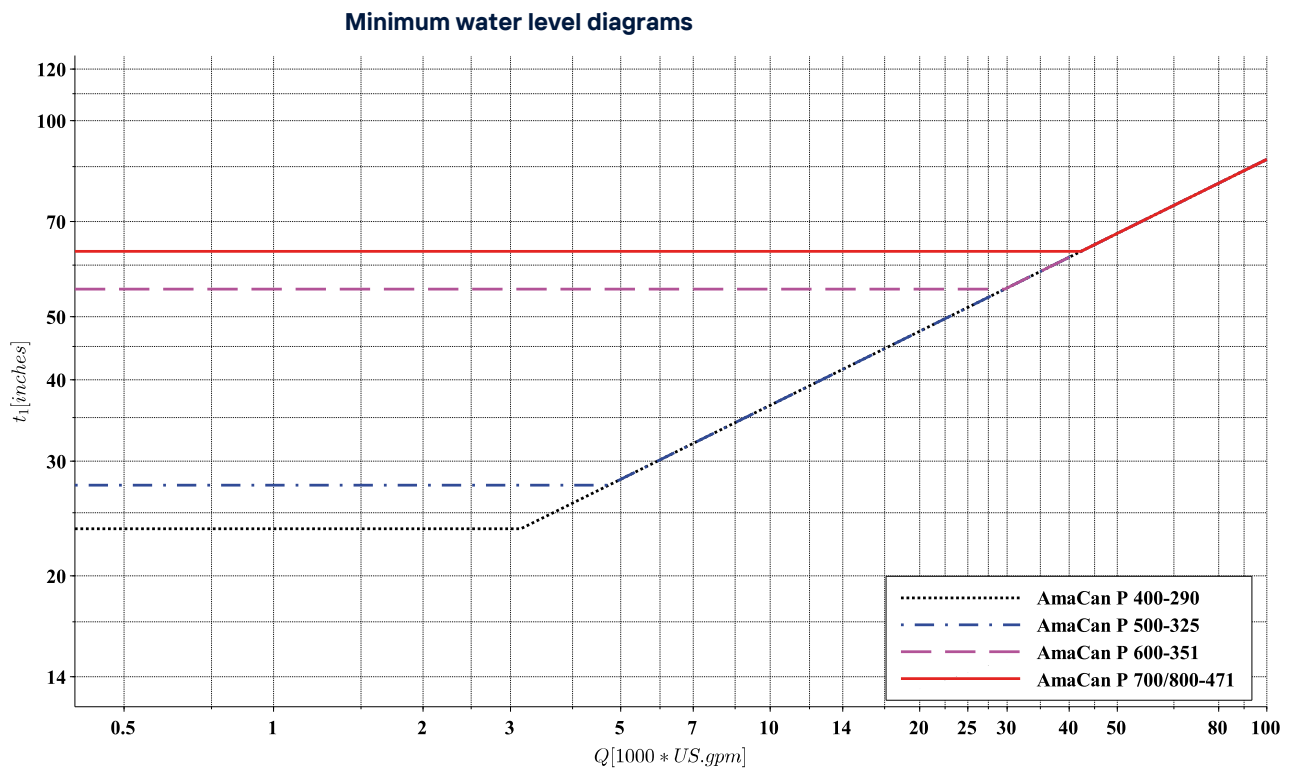
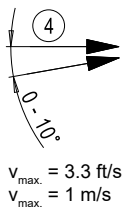
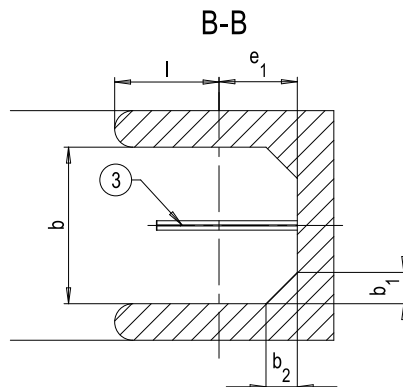
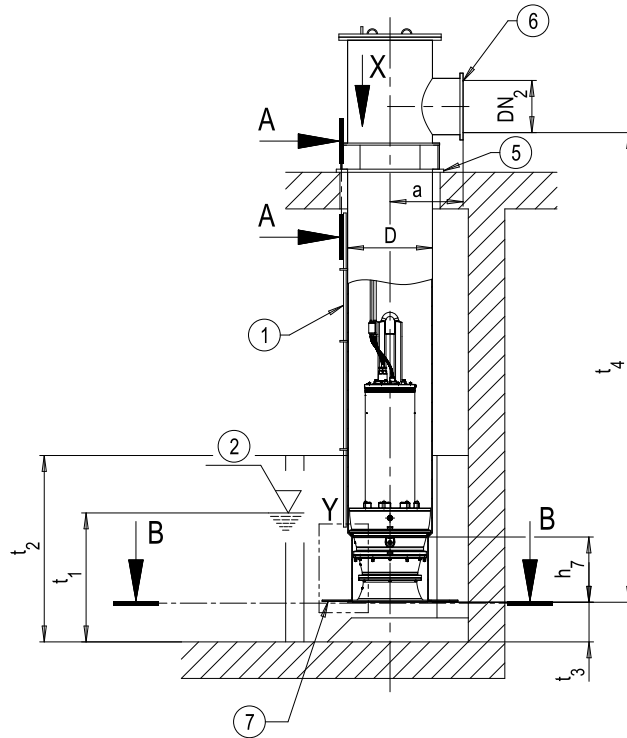
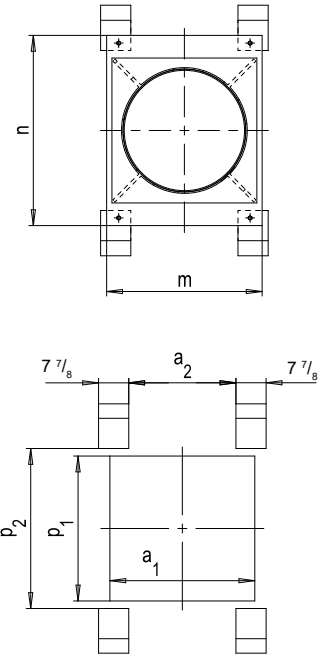


Fig. 132: Installation type CG: Covered intake chamber

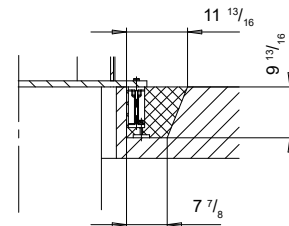
9.7.1.5 Installation types DU/DUS



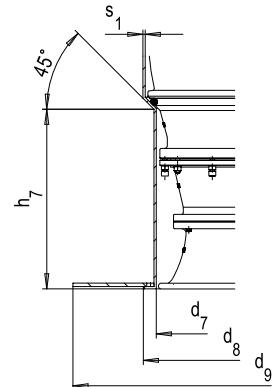
- ①: Vent line
- ②: Minimum water level (values see diagram on the next pages)
- ③: Flow-straightening vane (⇒ Section 9.7.1.7, Page 171)
- ④: Approach flow
- ⑤: Not pressure-proof
- ⑥: Connect the discharge pipe to the discharge tube without transmitting any stresses or strains.
- ⑦: Suction umbrella; option for reducing the minimum water level t_1



Detail X: Support plate of the discharge tube, foundation recesses⁴⁷⁾ Dimensions in [inch]



Section A-A: Foundation recesses, dimensions in [inch]



Detail Y: Seating ring

⁴⁷ All dimensions for foundation recesses apply to discharge tube design without intermediate flange.

Table 95: Dimensions [inch]

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
400-290	9 5/6	15 3/4	16	16 1/2	21 2/3	11 4/5	34 2/3	6 8/9	–	6 8/9	–
500-325	11 4/5	19 2/3	20	20 6/7	25 3/5	15 3/4	49 1/5	9 5/6	–	9 5/6	–
600-351	13 7/9	23 5/8	24	24	30	20	49 1/5	9 5/6	–	9 5/6	–
700-471	15 3/4	27 5/9	28	25 3/5	33 6/7	24	59	11 4/5	–	11 4/5	–
800-471	19 2/3	31 1/2	32	27 5/9	37 4/5	28	59	11 4/5	–	11 4/5	–

Table 96: Dimensions [inch]

Size	d ₇	d ₈	d ₉	e ₁ ⁽⁴⁸⁾		h ₇	l _{min.}	m	n	p ₁	p ₂	s ₁	t ₃ ⁽⁴⁸⁾	t _{4 min.} ⁽⁴⁹⁾
				Suction umbrella										
				✗	✓									
				d ₈	d ₉									
400-290	13 7/9	16	25 3/5	11 4/5	16 3/4	8 6/7	19 2/3	24 2/5	33 6/7	212/3	25 3/5	2/7	8 1/4	68 8/9
500-325	17 1/3	19 7/8	31 1/2	13 7/9	19 2/3	16 1/2	33 1/2	28 1/3	37 4/5	25 3/5	29 1/2	2/7	10 5/8	72 5/6
600-351	19 2/3	24	31 1/2	15 3/4	19 2/3	21 1/4	33 1/2	32 2/3	41 3/4	30	33 6/7	1/3	12 3/5	74 4/5
700-471	23 5/8	28	43 1/3	17 5/7	25 3/5	16 1/2	41 1/3	36 3/5	45 2/3	33 6/7	37 4/5	1/3	15	98 3/7
800-471	23 5/8	28	43 1/3	17 5/7	25 3/5	16 1/2	41 1/3	40 5/9	49 3/5	37 4/5	41 3/4	1/3	15	112 1/5

t₂ = 1.1 x water level, maximum 2 x t₁

Height of corner lining (b₁ and b₂) like t₂

Permissible dimensional tolerances:

- Tolerances in building construction to DIN 18202, Part 4, Group B
- Welded design: 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:

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

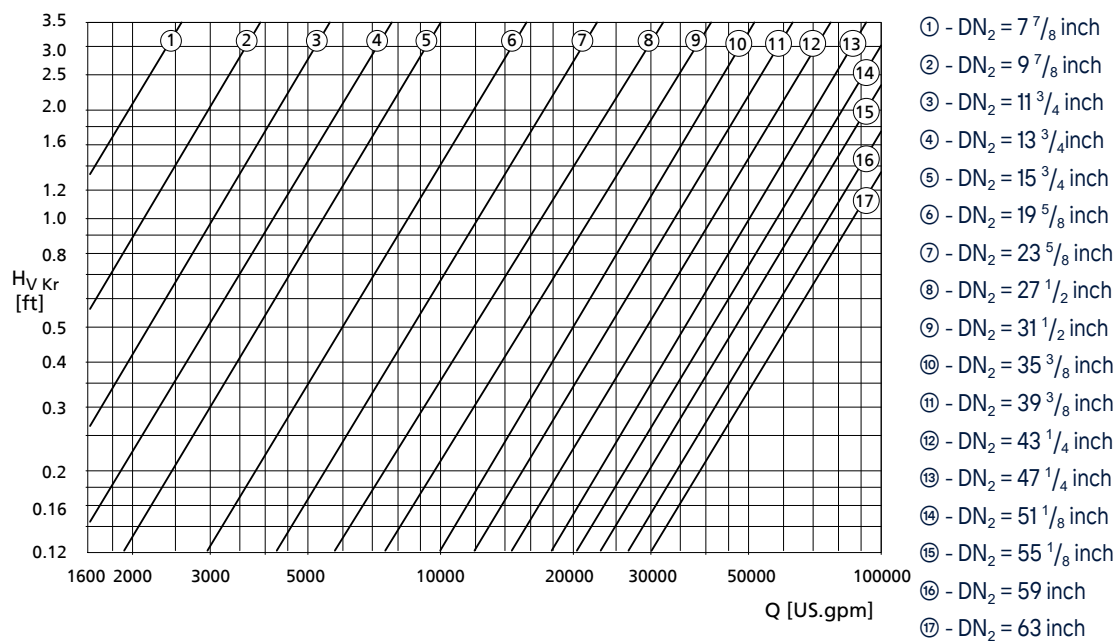
$$\Delta H_v$$

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

H_{v Anl.} must be determined for the specific system.

⁴⁸ Observe this dimension.

⁴⁹ Value for maximum motor length



Minimum water level diagrams

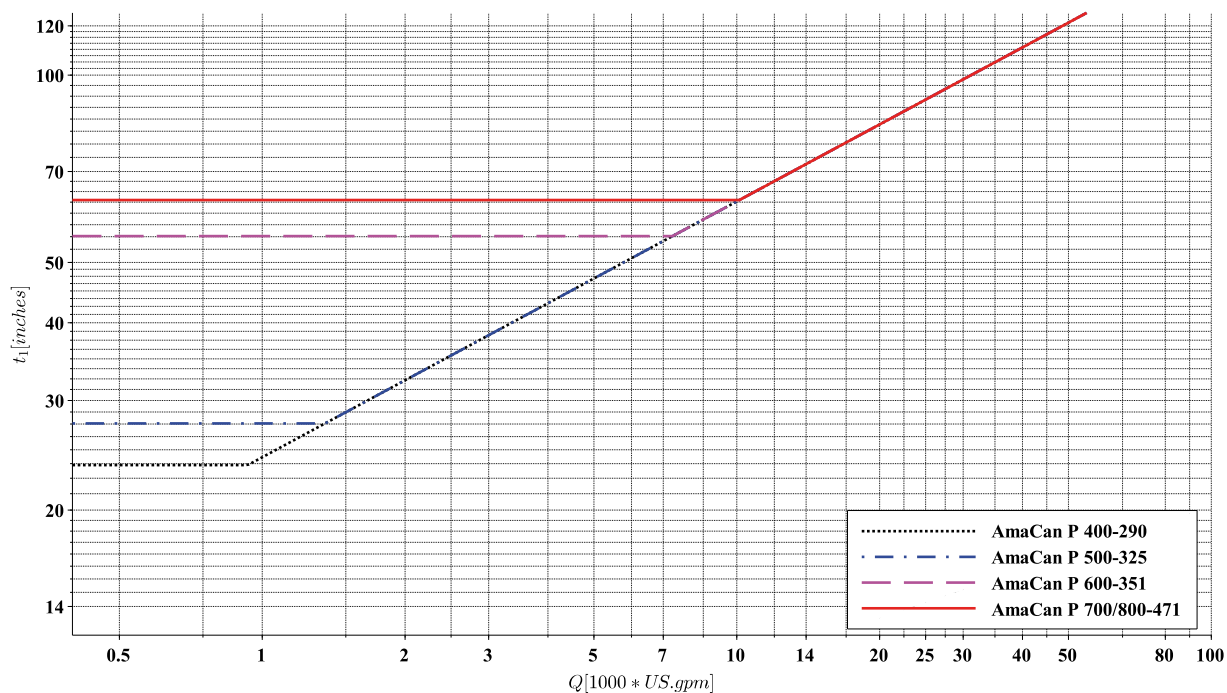


Fig. 133: Installation type DU: Open intake chamber, design without suction umbrella Ø d₈

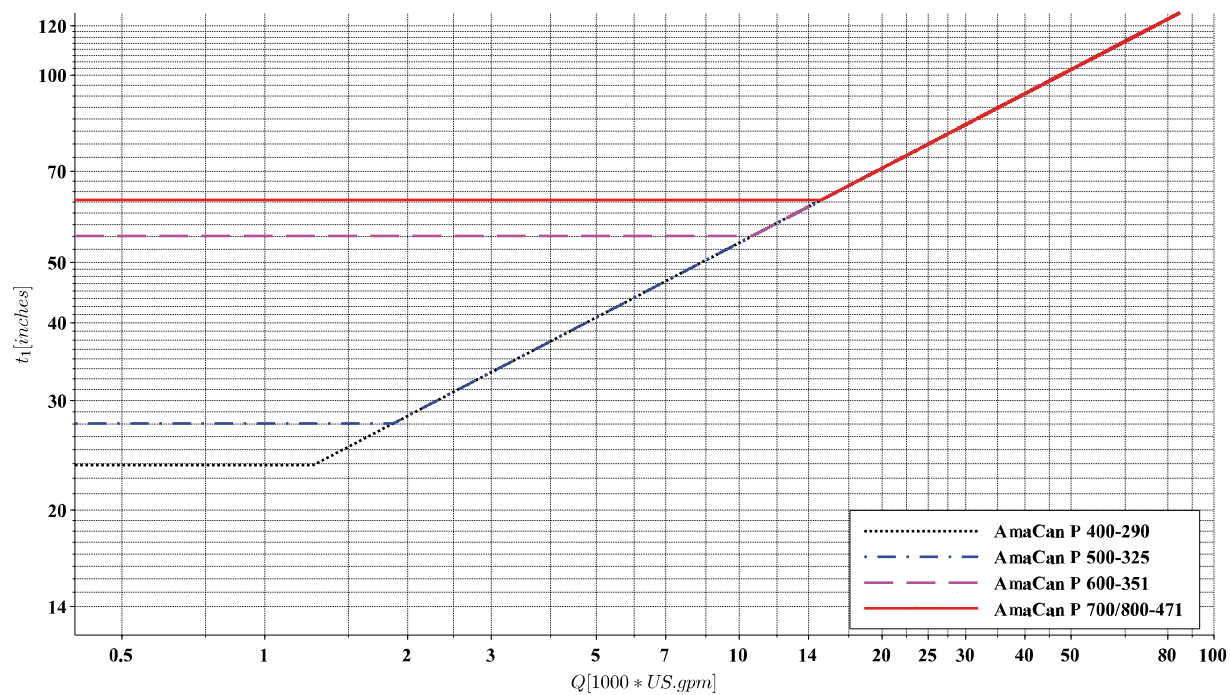
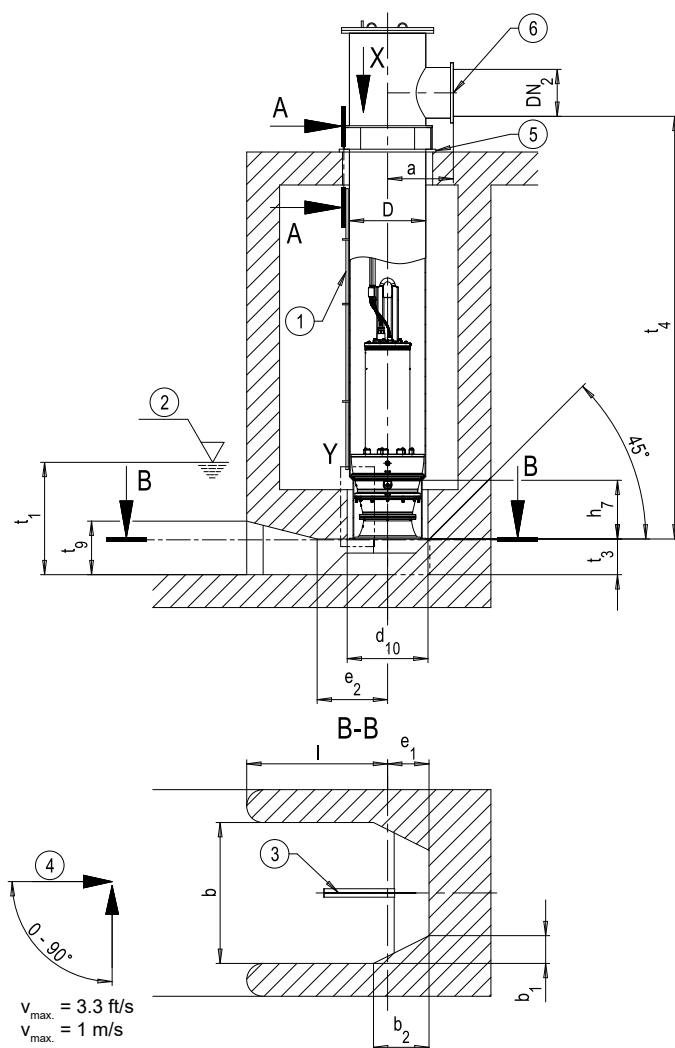
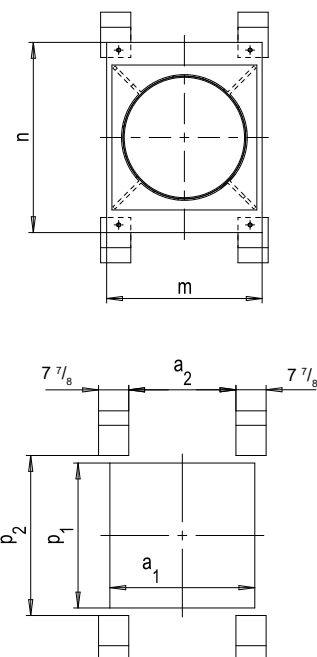


Fig. 134: Installation type DUS: Open intake chamber, design with suction umbrella Ø d_g

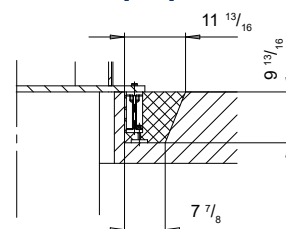
9.7.1.6 Installation type DG



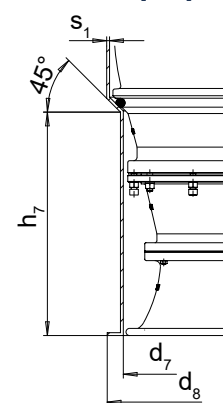
- ①: Vent line
 ②: Minimum water level (values see diagram on the next pages)
 ③: Flow-straightening vane (⇒ Section 9.7.1.7, Page 171)
 ④: Approach flow
 ⑤: Not pressure-proof
 ⑥: Connect the discharge pipe to the discharge tube without transmitting any stresses or strains.



Detail X: Support plate of the discharge tube, foundation recesses⁵⁰⁾ Dimensions in [inch]



Section A-A: Foundation recesses, dimensions in [inch]



Detail Y: Seating ring

Table 97: Dimensions [inch]

Size	DN _{2 min.}	DN _{2 max.}	D	a	a ₁	a ₂	b	b ₁	b ₂	d ₇	d ₈	d ₁₀
400-290	9 5/6	15 3/4	16	16 1/2	21 2/3	11 4/5	34 2/3	6 8/9	13 7/9	13 7/9	16	18
500-325	11 4/5	19 2/3	20	20 6/7	25 3/5	15 3/4	49 1/5	9 5/6	19 2/3	17 1/3	19 7/8	21 6/7
600-351	13 7/9	23 5/8	24	24	30	20	49 1/5	9 5/6	19 2/3	19 2/3	24	26

⁵⁰ All dimensions for foundation recesses apply to discharge tube design without intermediate flange.

Size	DN _{2 min.}	DN _{2 max.}	D	a	a ₁	a ₂	b	b ₁	b ₂	d ₇	d ₈	d ₁₀
700-471	15 3/4	27 5/9	28	25 3/5	33 6/7	24	59	11 4/5	23 5/8	23 5/8	28	30
800-471	19 2/3	31 1/2	32	27 5/9	37 4/5	28	59	11 4/5	23 5/8	23 5/8	28	30

Table 98: Dimensions [inch]

Size	e ₁ ⁵¹⁾	e ₂	h ₇	l _{min.}	m	n	p ₁	p ₂	s ₁	t ₃ ⁵¹⁾	t _{4 min.} ⁵²⁾	t ₉
400-290	10 3/7	17 1/3	8 6/7	34 2/3	24 2/5	33 6/7	21 2/3	25 3/5	2/7	8 1/4	68 8/9	13
500-325	14 3/4	24 3/5	16 1/2	49 1/5	28 1/3	37 4/5	25 3/5	29 1/2	2/7	10 5/8	72 5/6	14 3/4
600-351	14 3/4	24 3/5	21 1/4	49 1/5	32 2/3	41 3/4	30	33 6/7	1/3	12 3/5	74 4/5	18 1/2
700-471	17 5/7	29 1/2	16 1/2	59	36 3/5	45 2/3	33 6/7	37 4/5	1/3	15	98 3/7	22 4/9
800-471	17 5/7	29 1/2	16 1/2	59	40 5/9	49 3/5	37 4/5	41 3/4	1/3	15	112 1/5	22 4/9

Permissible dimensional tolerances:

- Tolerances in building construction to DIN 18202, Part 4, Group B
- Welded design: 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

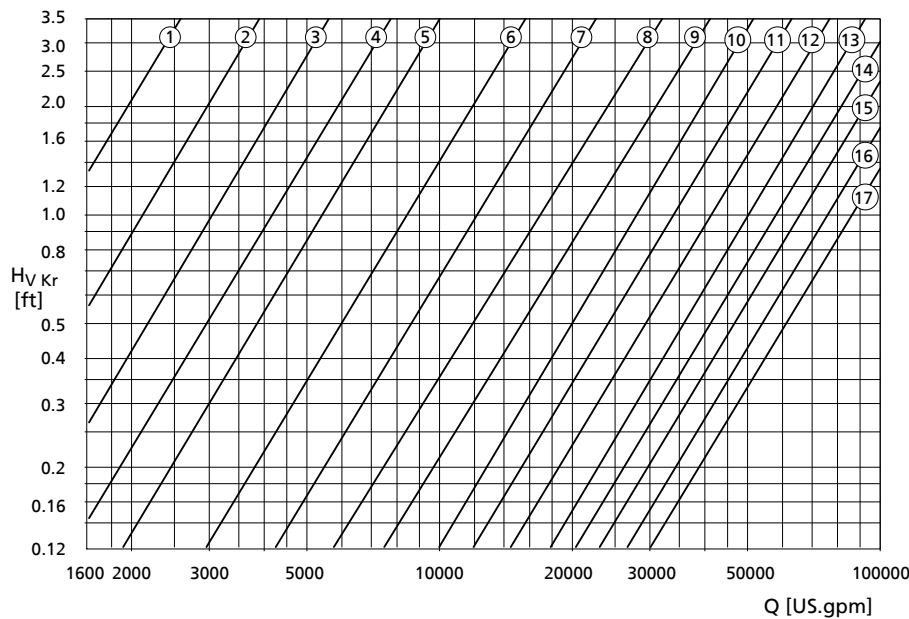
Calculation formulas:

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

$$\Delta H_v$$

- Loss in the elbow h_{vKr} (see diagram)
- Loss in the riser (pipe friction)
- $H_{vAnl.}$ (valves, etc.)

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



- ① - DN₂ = 7 7/8 inch
- ② - DN₂ = 9 7/8 inch
- ③ - DN₂ = 11 3/4 inch
- ④ - DN₂ = 13 3/4 inch
- ⑤ - DN₂ = 15 3/4 inch
- ⑥ - DN₂ = 19 5/8 inch
- ⑦ - DN₂ = 23 5/8 inch
- ⑧ - DN₂ = 27 1/2 inch
- ⑨ - DN₂ = 31 1/2 inch
- ⑩ - DN₂ = 35 3/8 inch
- ⑪ - DN₂ = 39 3/8 inch
- ⑫ - DN₂ = 43 1/4 inch
- ⑬ - DN₂ = 47 1/4 inch
- ⑭ - DN₂ = 51 1/8 inch
- ⑮ - DN₂ = 55 1/8 inch
- ⑯ - DN₂ = 59 inch
- ⑰ - DN₂ = 63 inch

⁵¹ Observe this dimension.

⁵² Value for maximum motor length

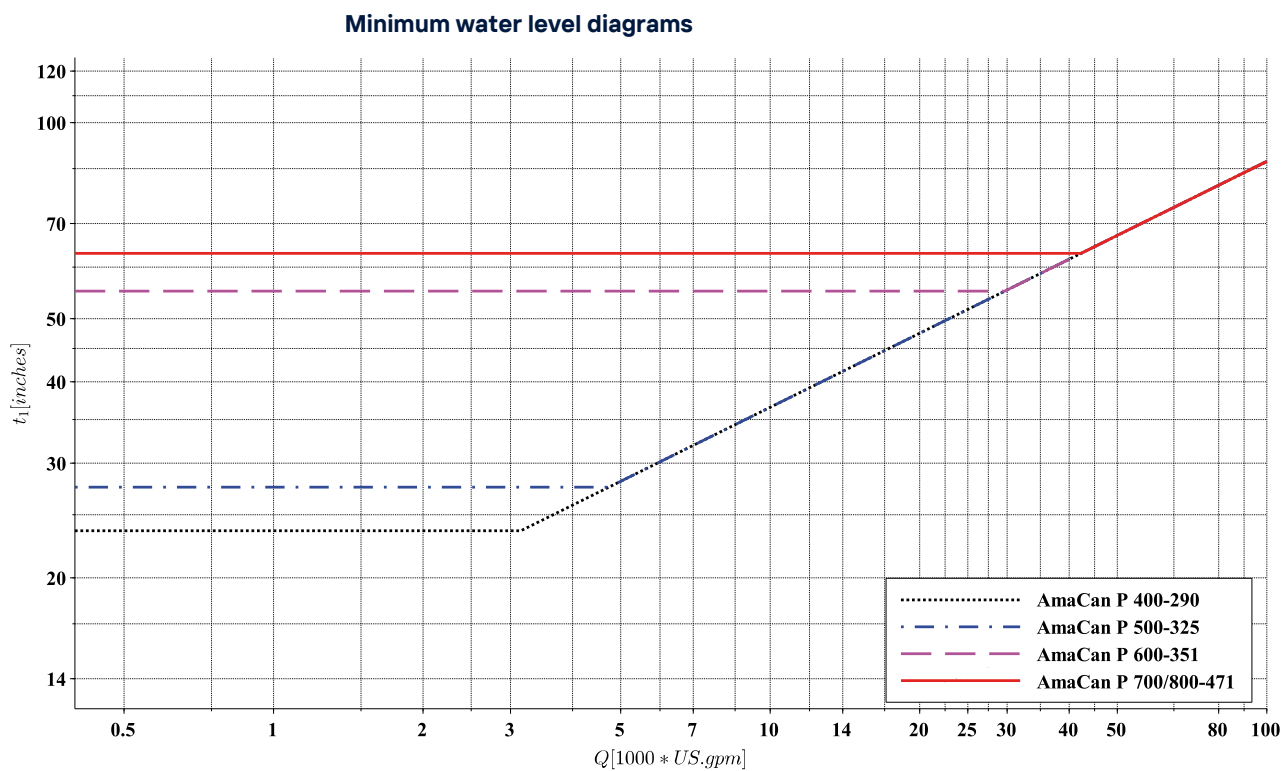


Fig. 135: Covered intake chamber

9.7.1.7 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 minimize 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.

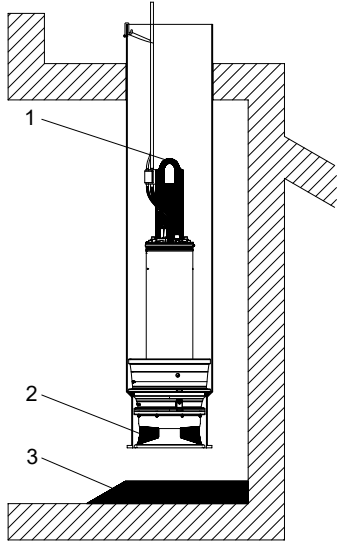
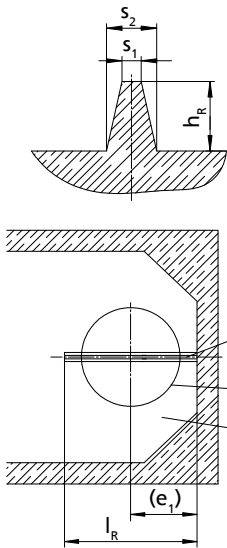


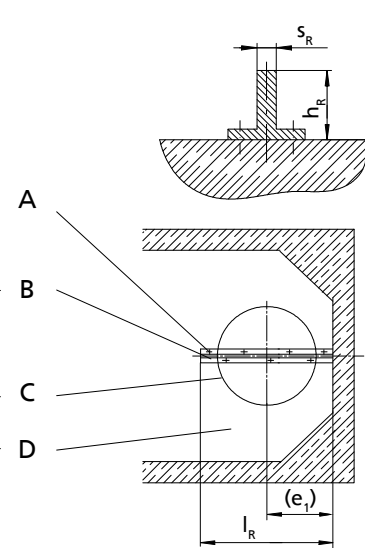
Fig. 136: Installation position of the pump set

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 centered beneath the discharge tube

C	Discharge tube
D	Intake chamber

Installation types BU, BUS, CU, CUS, DU, DUS

Table 99: Dimensions [inch]

Size	h_R	s_1	s_2	s_R	(e_1)		l_R	
					Suction umbrella		Suction umbrella	
					$\times$	$\checkmark$	$\times$	$\checkmark$
					d_8	d_9	d_8	d_9
400-290	5 1/8	3/5	2 1/3	2/5	11 4/5	16 3/4	21 1/4	29 1/2
500-325	7 1/2	4/5	2 3/4	2/5	13 7/9	19 2/3	27 5/9	37
600-351	7 1/2	4/5	2 3/4	2/5	15 3/4	19 2/3	34 4/9	37
700-471	9	1	3 1/2	2/5	17 5/7	25 3/5	39 3/8	47 1/4
800-471	9	1	3 1/2	2/5	17 5/7	25 3/5	39 3/8	47 1/4

Installation types BG, CG, DG

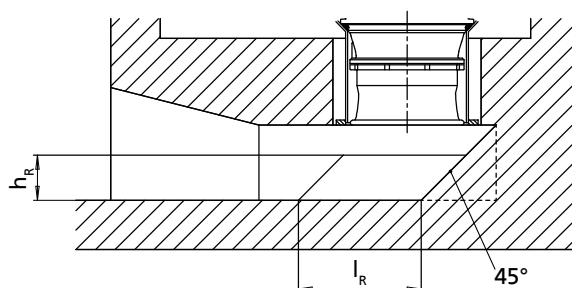


Fig. 137: Flow-straightening vane for covered intake chamber

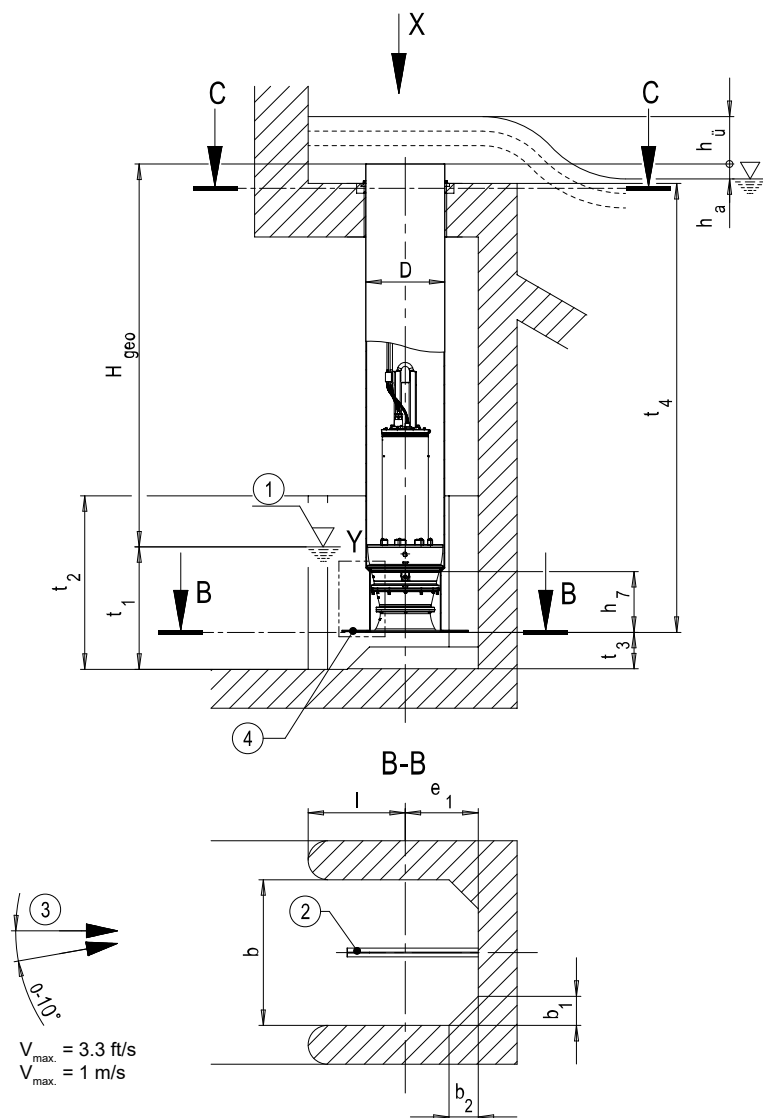
Table 100: Dimensions [inch]

Size	h_R	s_1	s_2	s_R	$l_R^{53)}$
400-290	5 1/8	3/5	2 1/3	2/5	12 3/5
500-325	7 1/2	4/5	2 3/4	2/5	18 8/9
600-351	7 1/2	4/5	2 3/4	2/5	21 1/2
700-471	9	1	3 1/2	2/5	25 3/5
800-471	9	1	3 1/2	2/5	25 3/5

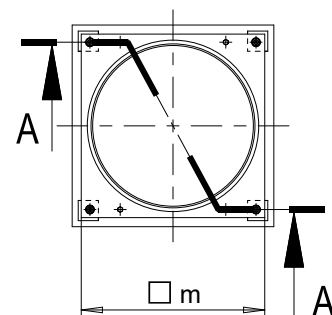
53 Adjust length l_R of the flow-straightening vane to the 45° angle of the intake chamber.

9.7.2 General arrangement drawings [mm]

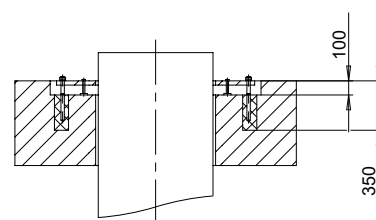
9.7.2.1 Installation types BU/BUS



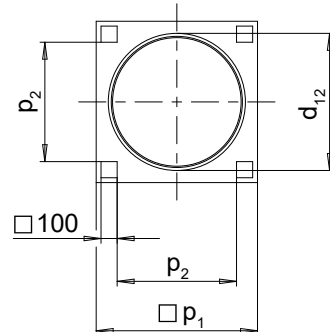
- ①: Minimum water level (values see diagram on the next pages)
- ②: Flow-straightening vane ($\Rightarrow$ Section 9.7.2.7, Page 193)
- ③: Approach flow
- ④: Suction umbrella; option for reducing the minimum water level t_1



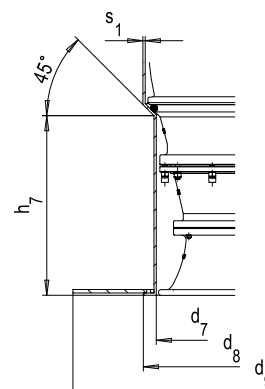
Detail X: Support plate of the discharge tube



Section A-A: Foundation recesses, dimensions in [mm]



Section C-C: Foundation recesses⁵⁴⁾
Dimensions in [mm]



Detail Y: Seating ring

⁵⁴ All dimensions for foundation recesses apply to discharge tube design without intermediate flange.

Table 101: 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				
400-290	406	880	175	–	175	–	350	405	650	450
500-325	508	1250	250	–	250	–	440	505	800	550
600-351	610	1250	250	–	250	–	500	610	800	650
700-471	711	1500	300	–	300	–	600	710	1100	750
800-471	813	1500	300	–	300	–	600	710	1100	850

Table 102: Dimensions [mm]

Size	e ₁ ⁵⁵⁾		h _a	h ₇	l _{min.}	m	p ₁	p ₂	s ₁	t ₃ ⁵⁵⁾	t _{4 min.} ⁵⁶⁾
	Suction umbrella										
	✗	✓									
	d ₈	d ₉									
400-290	300	425	100	225	500	500	600	340	7	210	1650
500-325	350	500	100	420	850	600	700	440	7	270	1750
600-351	400	500	100	540	850	700	800	540	8	320	1800
700-471	450	650	100	420	1050	800	900	640	8	380	2400
800-471	450	650	100	420	1050	910	1000	740	8	380	2750

Loss diagram

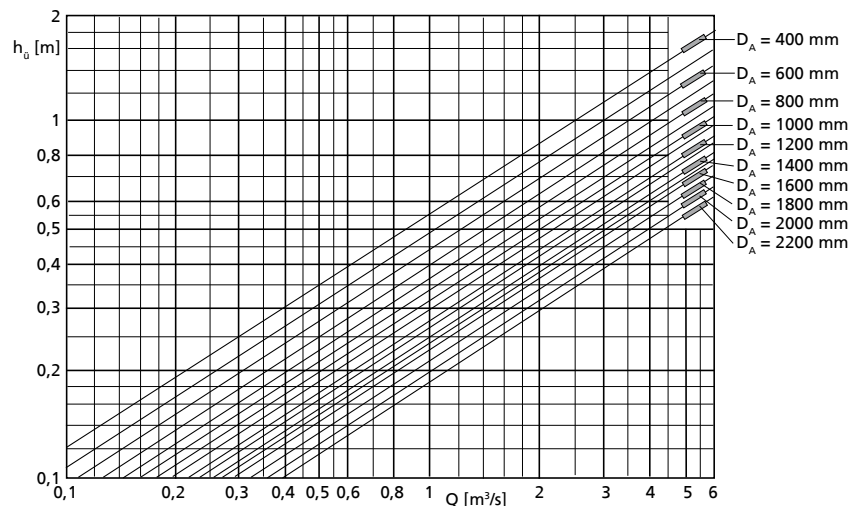
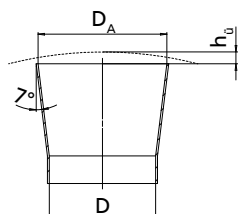
Calculation formulas:

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

$$\Delta H_v$$

- 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.



⁵⁵ Observe this dimension.

⁵⁶ Value for maximum motor length

Minimum water level diagrams

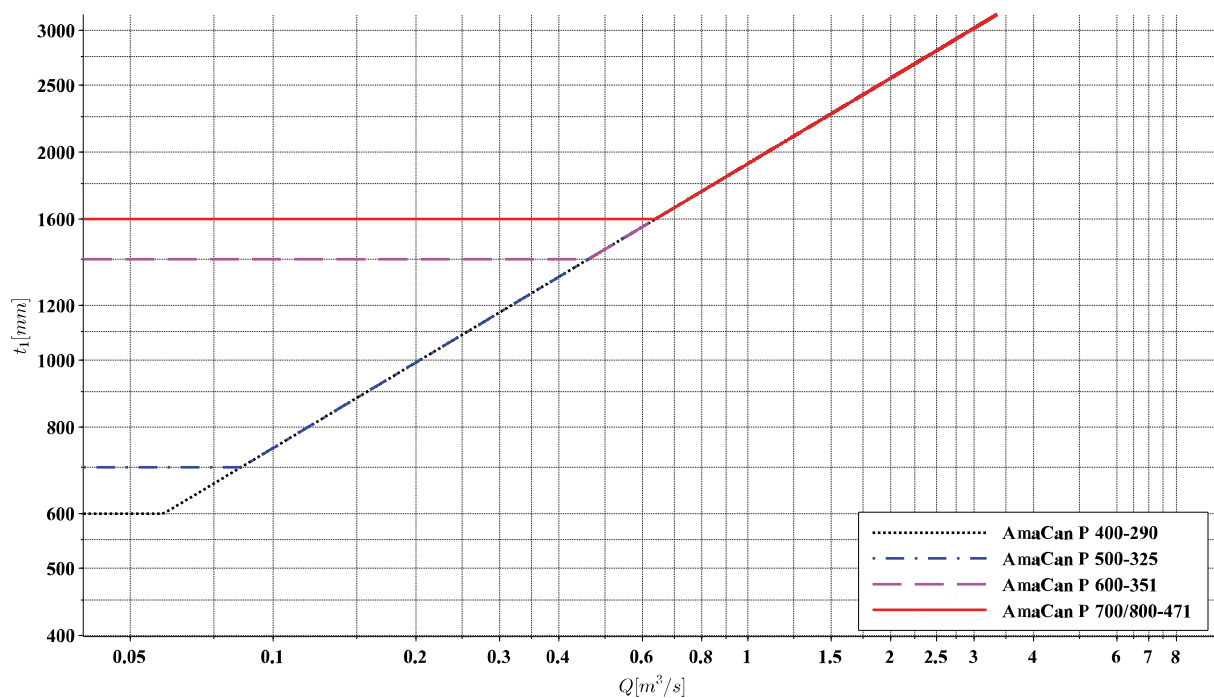


Fig. 138: Installation type BU: Open intake chamber, design without suction umbrella Ø d₈

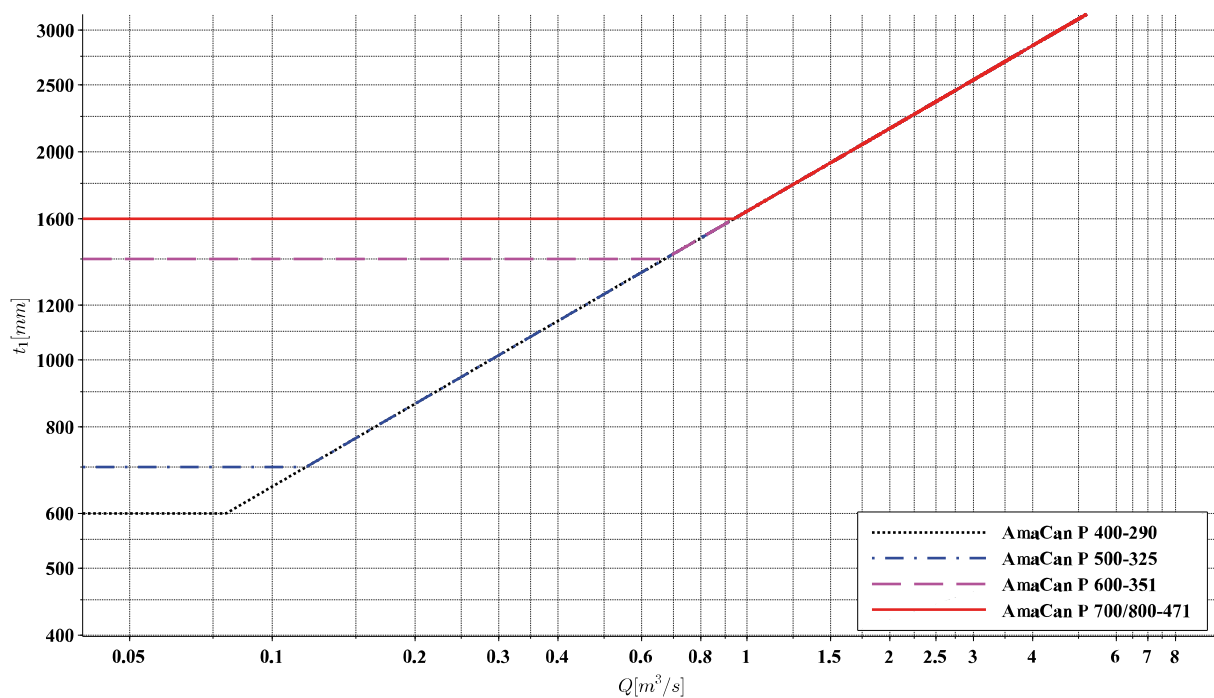
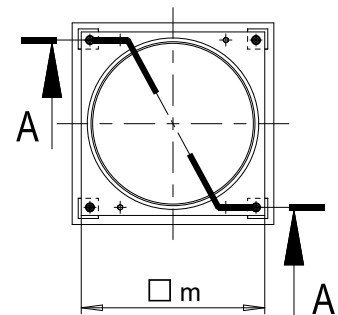
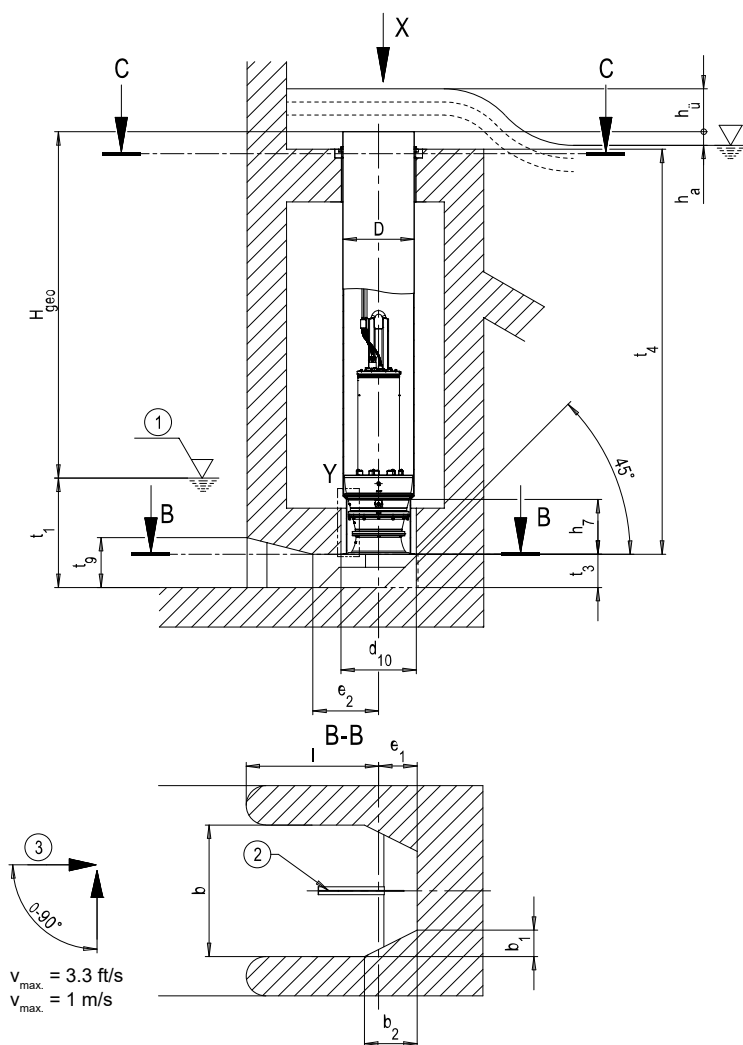
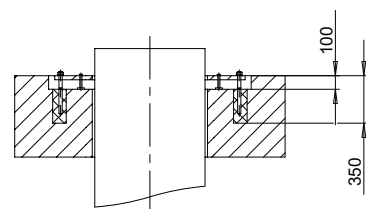


Fig. 139: Installation type BUS: Open intake chamber, design with suction umbrella Ø d₉

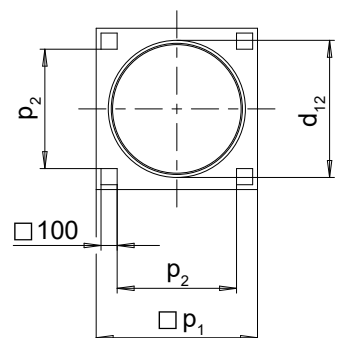
9.7.2.2 Installation type BG



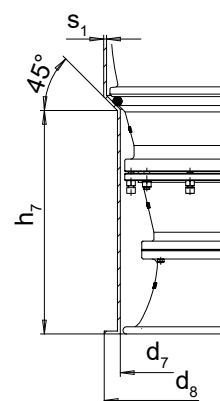
Detail X: Support plate of the discharge tube



Section A-A: Foundation recesses, dimensions in [mm]



Section C-C: Foundation recesses⁵⁷⁾ Dimensions in [mm]



Detail Y: Seating ring

⁵⁷ All dimensions for foundation recesses apply to discharge tube design without intermediate flange.

Table 103: Dimensions [mm]

Size	D	b	b ₁	b ₂	d ₇	d ₈	d ₁₀	d ₁₂	e ₁ ⁵⁸⁾	e ₂	h _a
400-290	406	880	175	350	350	405	455	450	265	440	100
500-325	508	1250	250	500	440	505	555	550	375	625	100
600-351	610	1250	250	500	500	610	660	650	375	625	100
700-471	711	1500	300	600	600	710	760	750	450	750	100
800-471	813	1500	300	600	600	710	760	850	450	750	100

Table 104: Dimensions [mm]

Size	h _r	l _{min.}	m	p ₁	p ₂	s ₁	t ₃ ⁵⁹⁾	t _{4 min.} ⁶⁰⁾	t ₉
400-290	225	880	500	600	340	7	210	1650	330
500-325	420	1250	600	700	440	7	270	1750	375
600-351	540	1250	700	800	540	8	320	1800	470
700-471	420	1500	800	900	640	8	380	2400	570
800-471	420	1500	910	1000	740	8	380	2750	570

Permissible dimensional tolerances:

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

Loss diagram

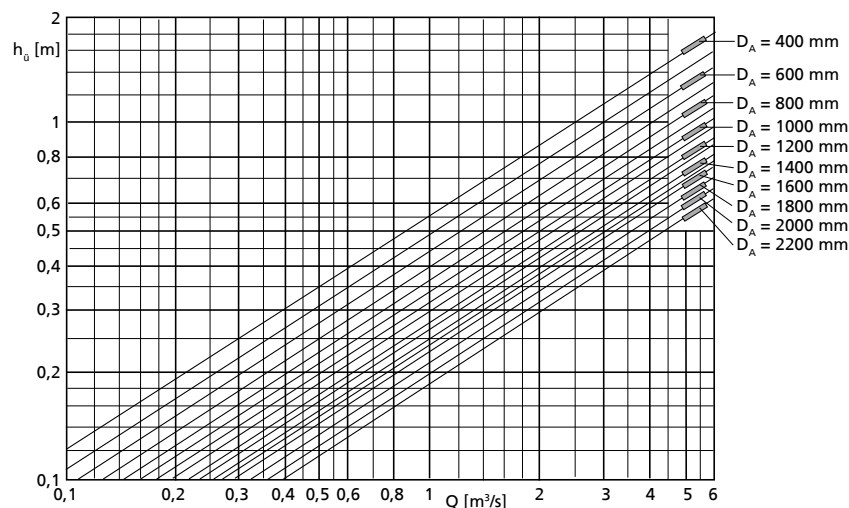
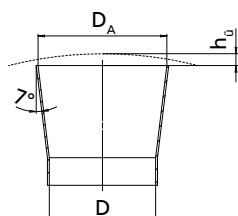
Calculation formulas:

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

$$\Delta H_v$$

- Overflow head h_0 (see diagram)
- Loss in the riser (pipe friction)
- Outlet loss $v^2 / 2g$ (v refers to D_A)

Overflow head h_0 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.



⁵⁸ Observe this dimension.

⁵⁹ Observe this dimension.

⁶⁰ Value for maximum motor length

Minimum water level diagrams

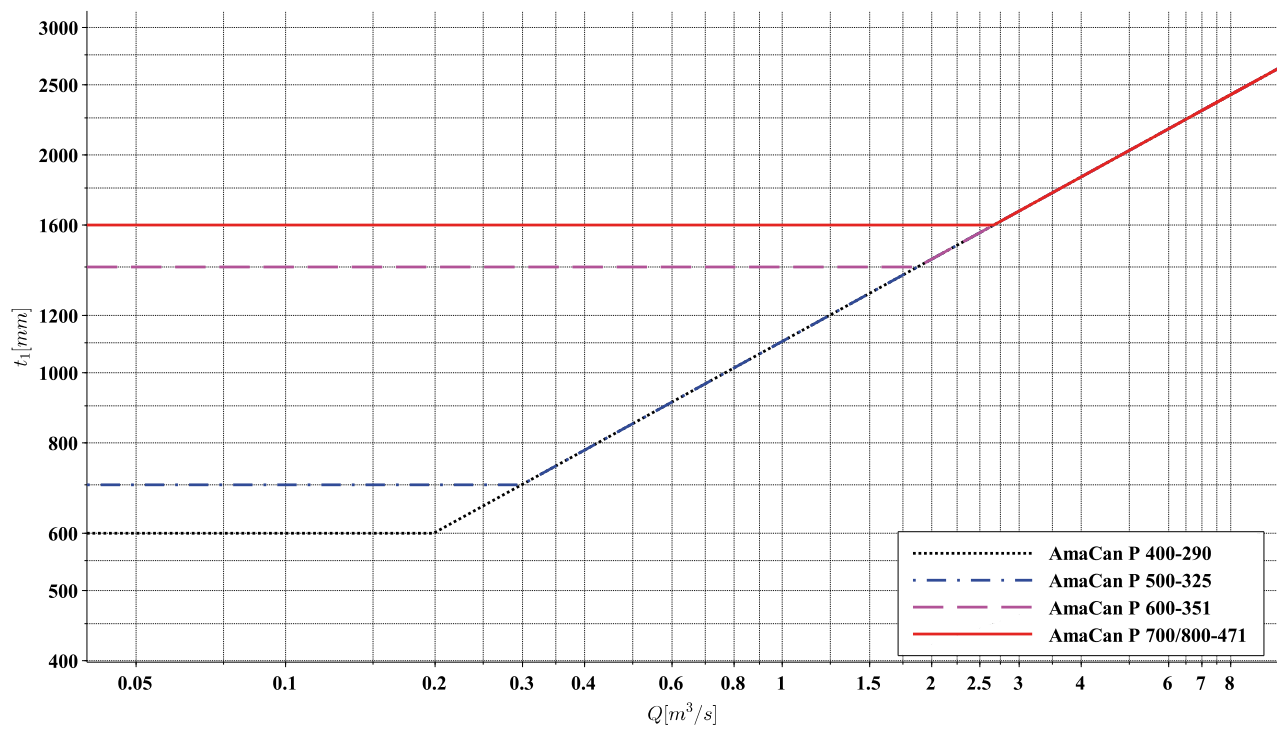
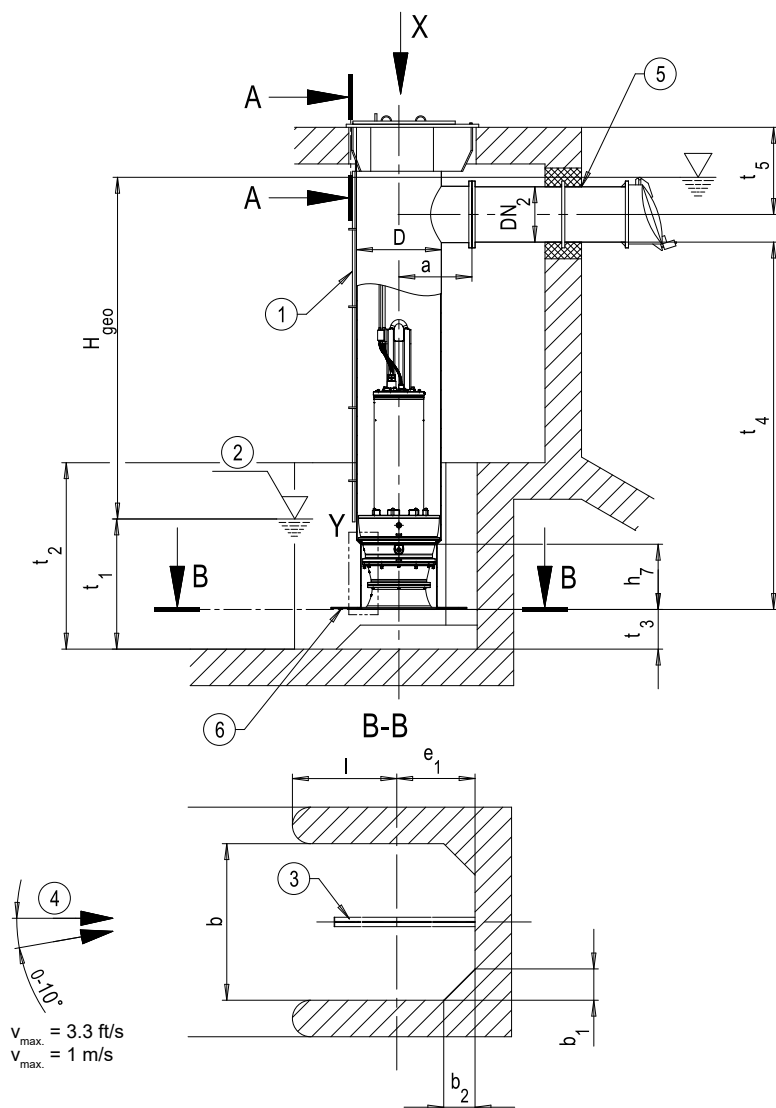
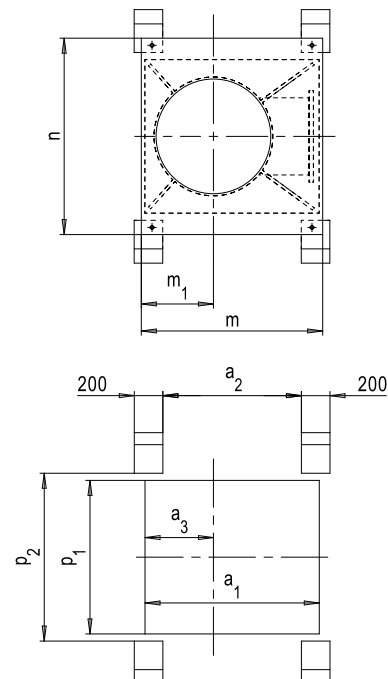


Fig. 140: Installation type BG: Covered intake chamber

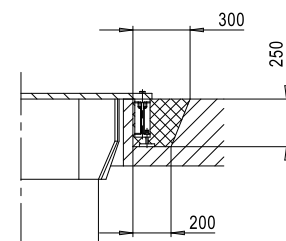
9.7.2.3 Installation types CU/CUS



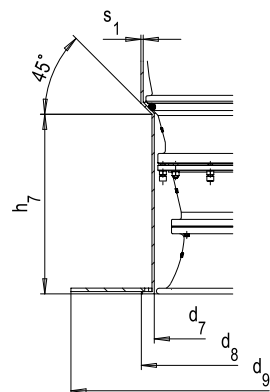
- ①: Vent line
- ②: Minimum water level (values see diagram on the next pages)
- ③: Flow-straightening vane (⇒ Section 9.7.2.7, Page 193)
- ④: Approach flow
- ⑤: Connect the discharge pipe to the discharge tube without transmitting any stresses or strains.
- ⑥: Suction umbrella; option for reducing the minimum water level t_1



Detail X: Support plate of the discharge tube, foundation recesses⁶¹⁾ Dimensions in [mm]



Section A-A: Foundation recesses, dimensions in [mm]



Detail Y: Seating ring

⁶¹ All dimensions for foundation recesses apply to discharge tube design without intermediate flange.

Table 105: Dimensions [mm]

Size	DN _{2 min.}	DN _{2 max.}	D	a	a ₁	a ₂	a ₃	b	b ₁		b ₂		d ₇
									Suction umbrella		Suction umbrella		
									✗	✓	✗	✓	
									d ₈	d ₉	d ₈	d ₉	
400-290	250	400	406	420	720	470	275	880	175	–	175	–	350
500-325	300	500	508	530	880	630	325	1250	250	–	250	–	440
600-351	350	600	610	610	1000	750	380	1250	250	–	250	–	500
700-471	400	700	711	650	1120	870	430	1500	300	–	300	–	600
800-471	500	800	813	700	1220	970	480	1500	300	–	300	–	600

Table 106: Dimensions [mm]

Size	d ₈	d ₉	e ₁ ⁶²⁾		h ₇	l _{min.}	m	m ₁	n	p ₁	p ₂	s ₁	t ₃ ⁶²⁾	t _{4 min.} ⁶³⁾	t _{5 min.} ⁶⁴⁾
			Suction umbrella												
			✗	✓											
			d ₈	d ₉											
400-290	405	650	300	425	225	500	770	300	960	660	760	7	210	1750	620
500-325	505	800	350	500	420	850	930	350	1060	760	860	7	270	1850	670
600-351	610	800	400	500	540	850	1050	405	1160	860	960	8	320	1900	720
700-471	710	1100	450	650	420	1050	1170	455	1260	960	1060	8	380	2500	770
800-471	710	1100	450	650	420	1050	1270	505	1375	1075	1175	8	380	2850	835

t₂ = 1.1 x water level, maximum 2 x t₁

Height of corner lining (b₁ and b₂) like t₂

Permissible dimensional tolerances:

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

Loss diagram

Calculation formulas:

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

$$\Delta H_v$$

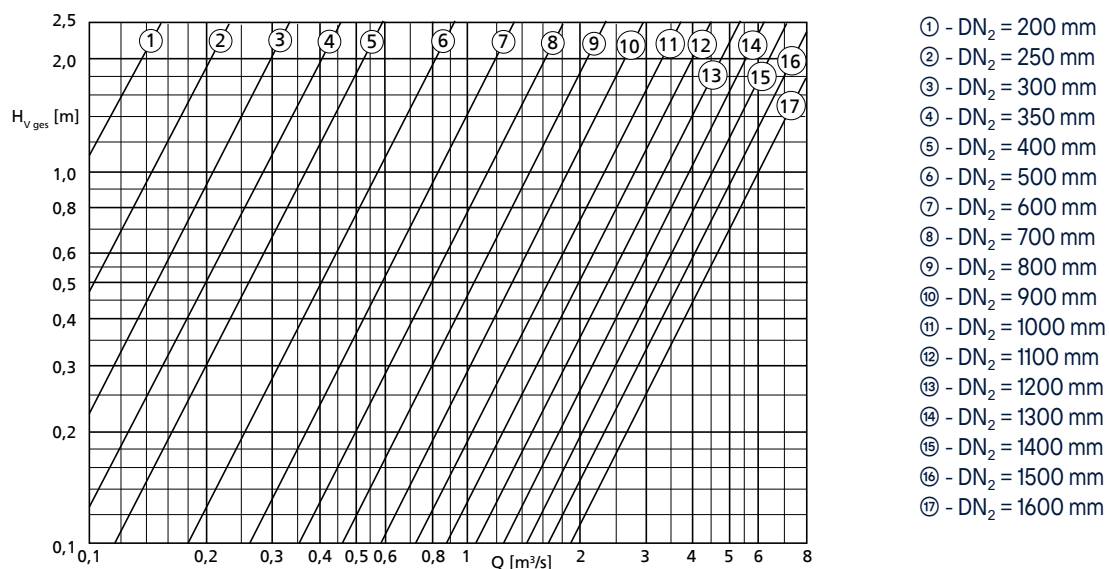
H_{v ges.} comprises:

- Loss in the riser (pipe friction)
- H_{v ges.} (see diagram)
- Elbow
- Discharge pipe length = 5 x DN₂
- Swing check valve
- Outlet losses v²/2g

⁶² Observe this dimension.

⁶³ Value for maximum motor length

⁶⁴ Selected for DN2 max.



Minimum water level diagrams

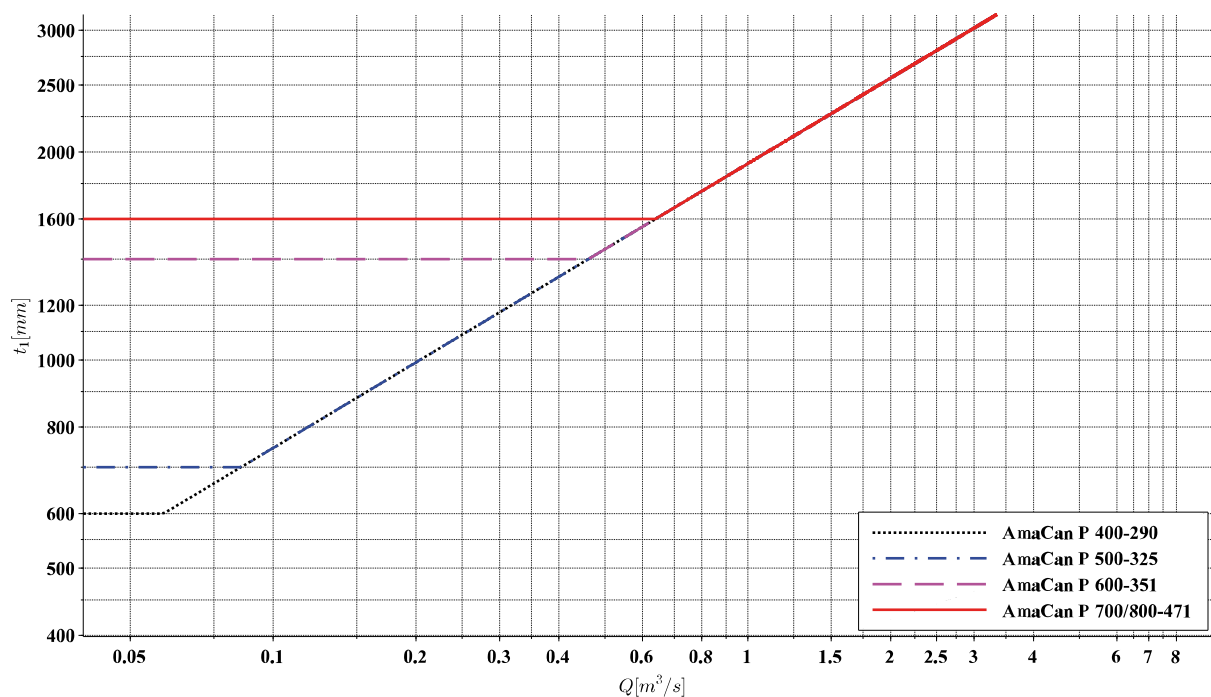


Fig. 141: Installation type CU: Open intake chamber, design without suction umbrella Ø d_g

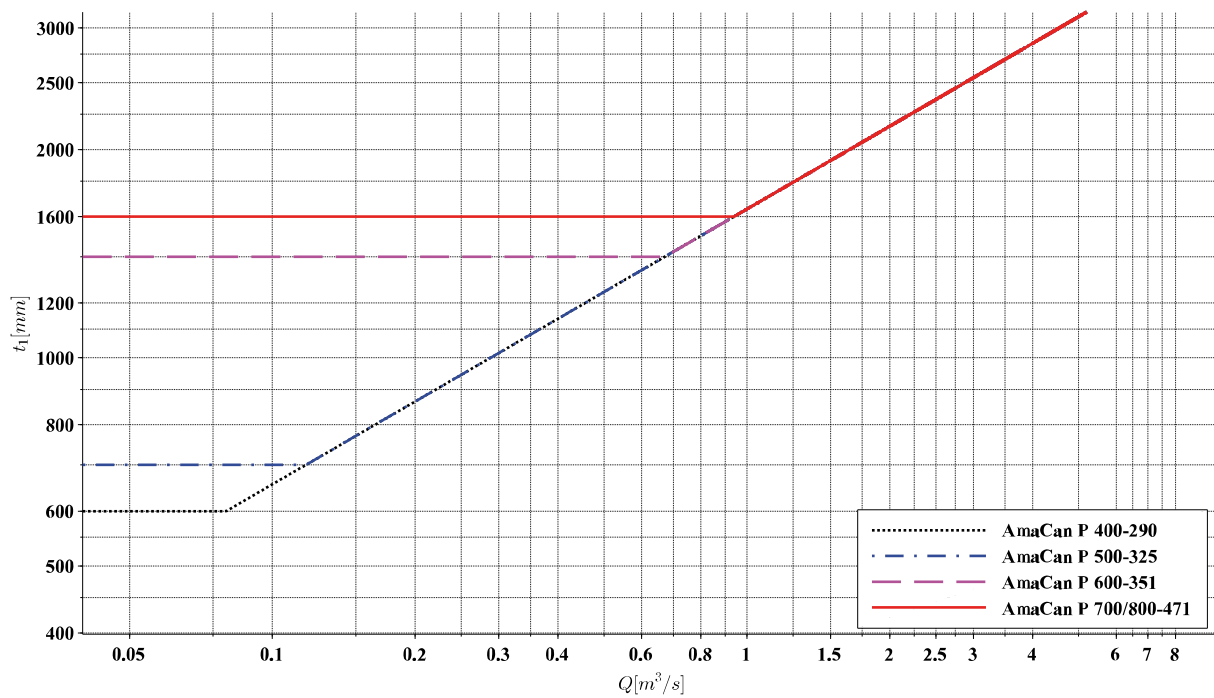
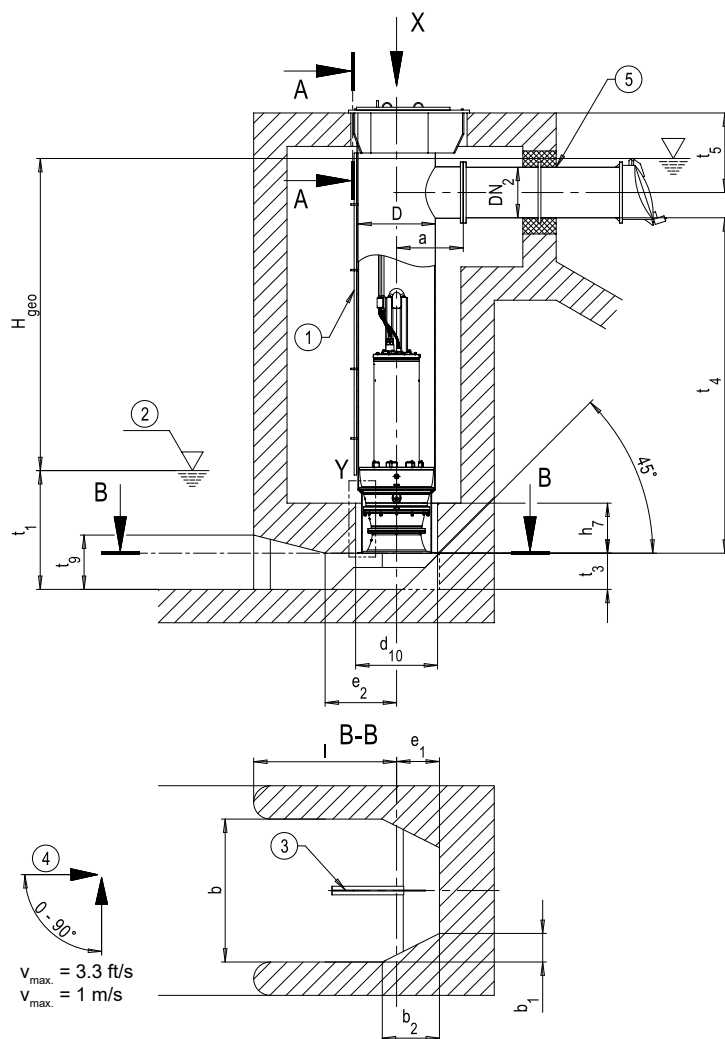
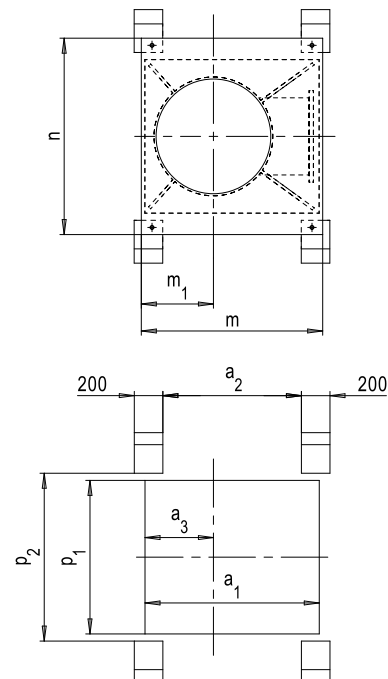


Fig. 142: Installation type CUS: Open intake chamber, design with suction umbrella Ø d_g

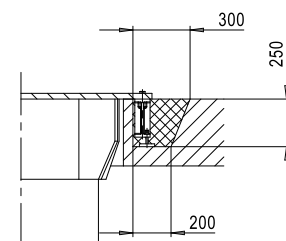
9.7.2.4 Installation type CG



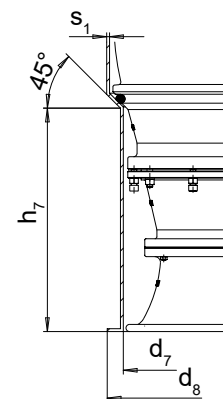
- ①: Vent line
- ②: Minimum water level (values see diagram on the next page)
- ③: Flow-straightening vane (⇒ Section 9.7.2.7, Page 193)
- ④: Approach flow
- ⑤: Connect the discharge pipe to the discharge tube without transmitting any stresses or strains.



Detail X: Support plate of the discharge tube, foundation recesses⁶⁵⁾ Dimensions in [mm]



Section A-A: Foundation recesses, dimensions in [mm]



Detail Y: Seating ring

Table 107: Dimensions [mm]

Size	DN ₂ min.	DN ₂ max.	D	a	a ₁	a ₂	a ₃	b	b ₁	b ₂	d ₇	d ₈	d ₁₀
400-290	250	400	406	420	720	470	275	880	175	350	350	405	455
500-325	300	500	508	530	880	630	325	1250	250	500	440	505	555
600-351	350	600	610	610	1000	750	380	1250	250	500	500	610	660

⁶⁵ All dimensions for foundation recesses apply to discharge tube design without intermediate flange.

Size	DN ₂ min.	DN ₂ max.	D	a	a ₁	a ₂	a ₃	b	b ₁	b ₂	d ₇	d ₈	d ₁₀
700-471	400	700	711	650	1120	870	430	1500	300	600	600	710	760
800-471	500	800	813	700	1220	970	480	1500	300	600	600	710	760

Table 108: Dimensions [mm]

Size	e ₁ ⁶⁶⁾	e ₂	h ₇	l _{min.}	m	m ₁	n	p ₁	p ₂	s ₁	t ₃ ⁶⁶⁾	t ₄ min. ⁶⁷⁾	t ₅ min. ⁶⁸⁾	t ₉
400-290	265	440	225	880	770	300	960	660	760	7	210	1750	620	330
500-325	375	625	420	1250	930	350	1060	760	860	7	270	1850	670	375
600-351	375	625	540	1250	1050	405	1160	860	960	8	320	1900	720	470
700-471	450	750	420	1500	1170	455	1260	960	1060	8	380	2500	770	570
800-471	450	750	420	1500	1270	505	1375	1075	1175	8	380	2850	835	570

Permissible dimensional tolerances:

- Tolerances in building construction to DIN 18202, Part 4, Group B
- Welded design: 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:

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

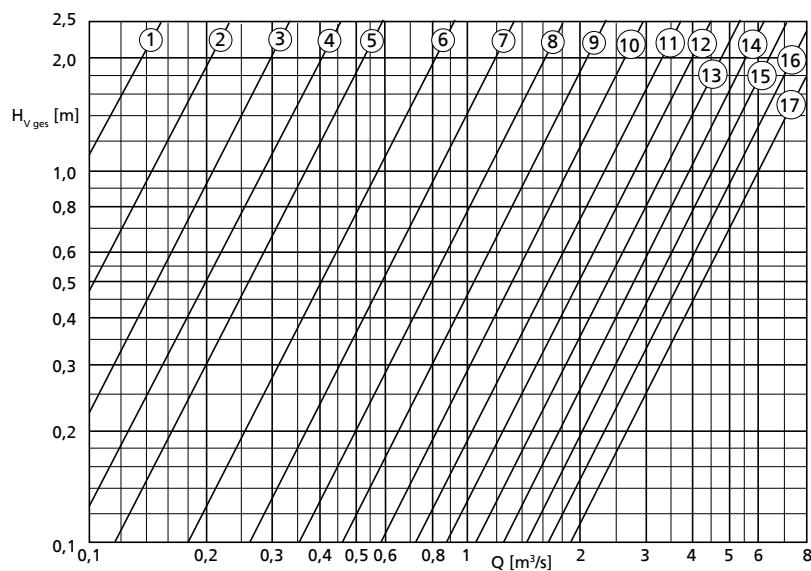
$$\Delta H_v$$

- 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 v²/2g



- 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

⁶⁶ Observe this dimension.

⁶⁷ Value for maximum motor length

⁶⁸ Selected for DN₂ max.

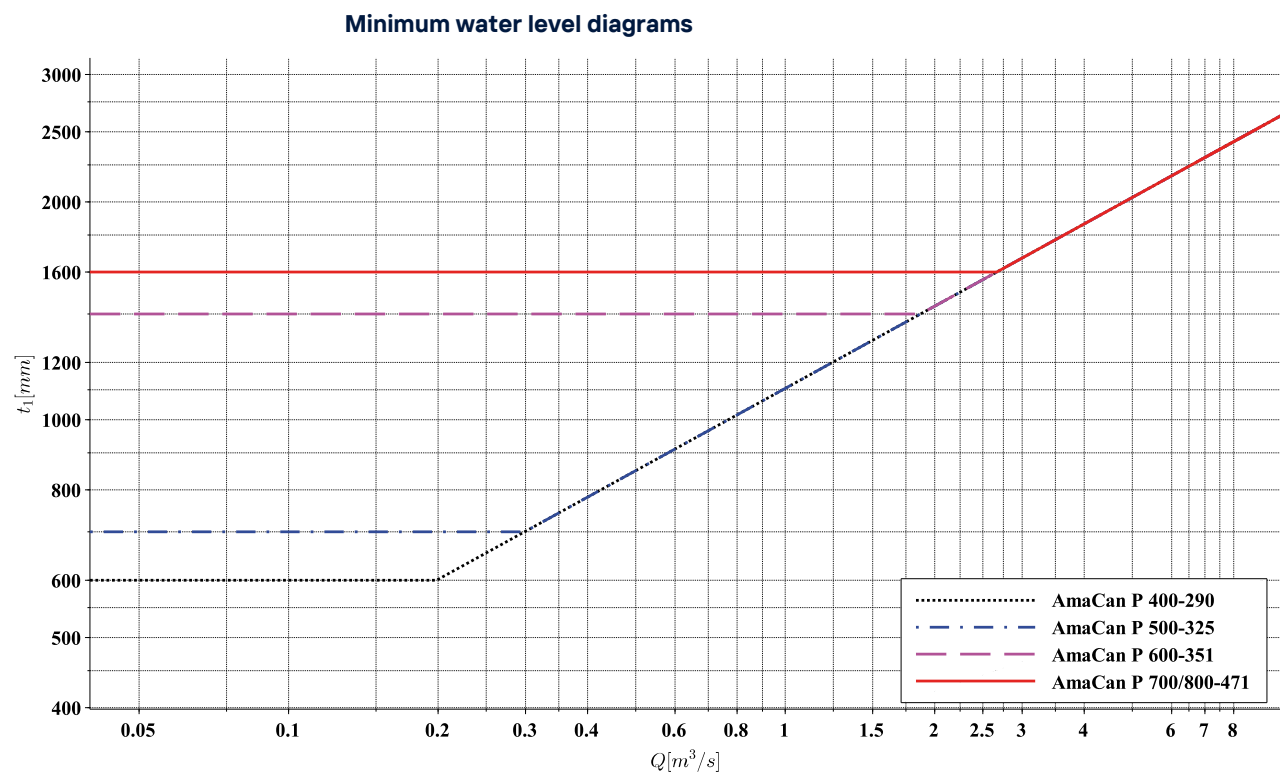
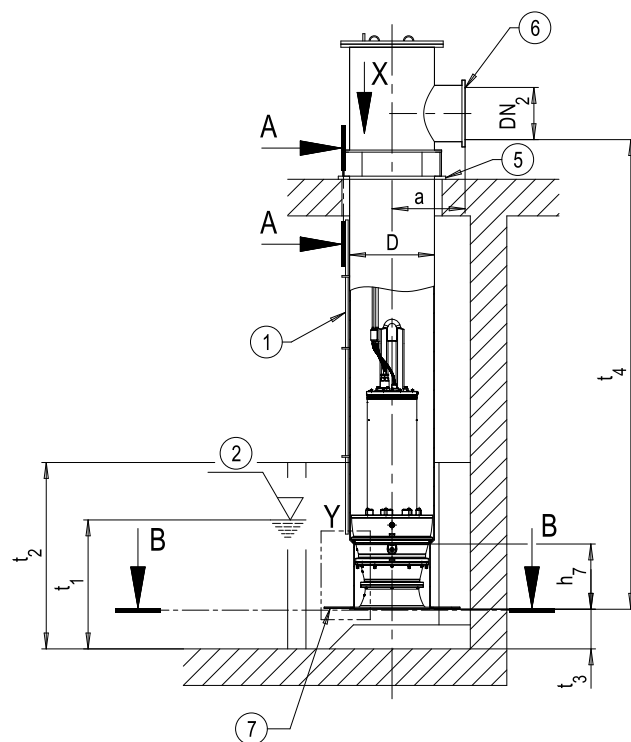
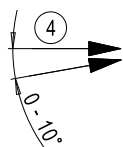
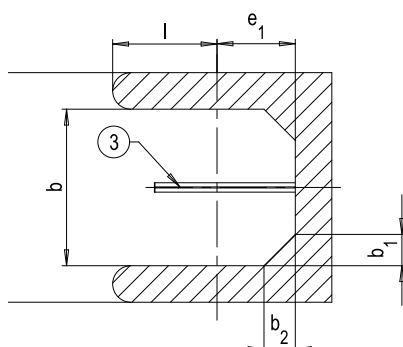


Fig. 143: Installation type CG: Covered intake chamber

9.7.2.5 Installation types DU/DUS

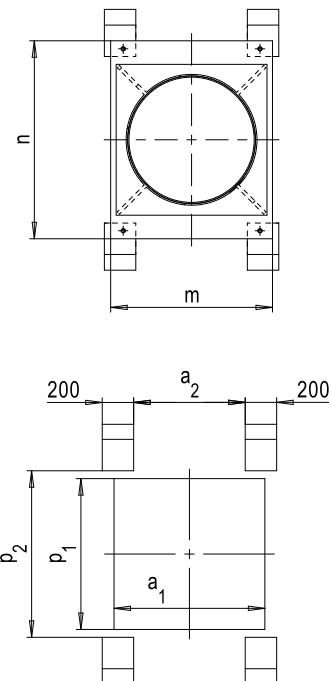


B-B

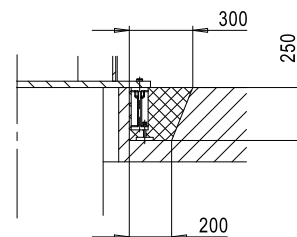


$v_{max.} = 3.3 \text{ ft/s}$
 $v_{max.} = 1 \text{ m/s}$

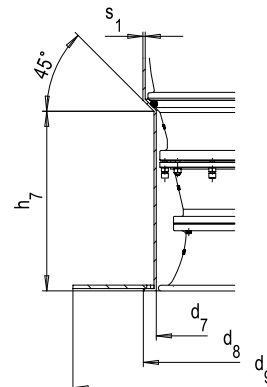
- ①: Vent line
- ②: Minimum water level (values see diagram on the next pages)
- ③: Flow-straightening vane ($\Rightarrow$ Section 9.7.2.7, Page 193)
- ④: Approach flow
- ⑤: Not pressure-proof
- ⑥: Connect the discharge pipe to the discharge tube without transmitting any stresses or strains.
- ⑦: Suction umbrella; option for reducing the minimum water level t_1



Detail X: Support plate of the discharge tube, foundation recesses⁶⁹⁾ Dimensions in [mm]



Section A-A: Foundation recesses, dimensions in [mm]



Detail Y: Seating ring

⁶⁹ All dimensions for foundation recesses apply to discharge tube design without intermediate flange.

Table 109: 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
400-290	250	400	406	420	550	300	880	175	–	175	–
500-325	300	500	508	530	650	400	1250	250	–	250	–
600-351	350	600	610	610	760	510	1250	250	–	250	–
700-471	400	700	711	650	860	610	1500	300	–	300	–
800-471	500	800	813	700	960	710	1500	300	–	300	–

Table 110: Dimensions [mm]

Size	d ₇	d ₈	d ₉	e ₁ ⁷⁰⁾		h ₇	l _{min.}	m	n	p ₁	p ₂	s ₁	t ₃ ⁷⁰⁾	t _{4 min.} ⁷¹⁾
				Suction umbrella										
				✗	✓									
				d ₈	d ₉									
400-290	350	405	650	300	425	225	500	620	860	550	650	7	210	1750
500-325	440	505	800	350	500	420	850	720	960	650	750	7	270	1850
600-351	500	610	800	400	500	540	850	830	1060	760	860	8	320	1900
700-471	600	710	1100	450	650	420	1050	930	1160	860	960	8	380	2500
800-471	600	710	1100	450	650	420	1050	1030	1260	960	1060	8	380	2850

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

Permissible dimensional tolerances:

- Tolerances in building construction to DIN 18202, Part 4, Group B
- Welded design: 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:

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

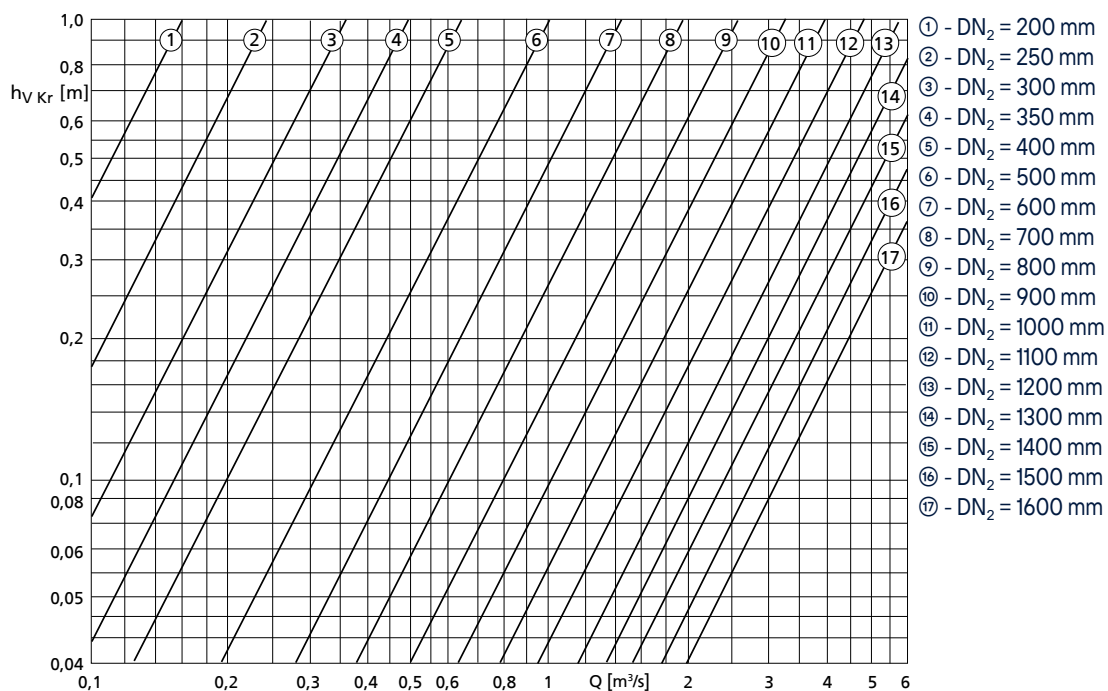
$$\Delta H_v$$

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

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

70 Observe this dimension.

71 Value for maximum motor length



Minimum water level diagrams

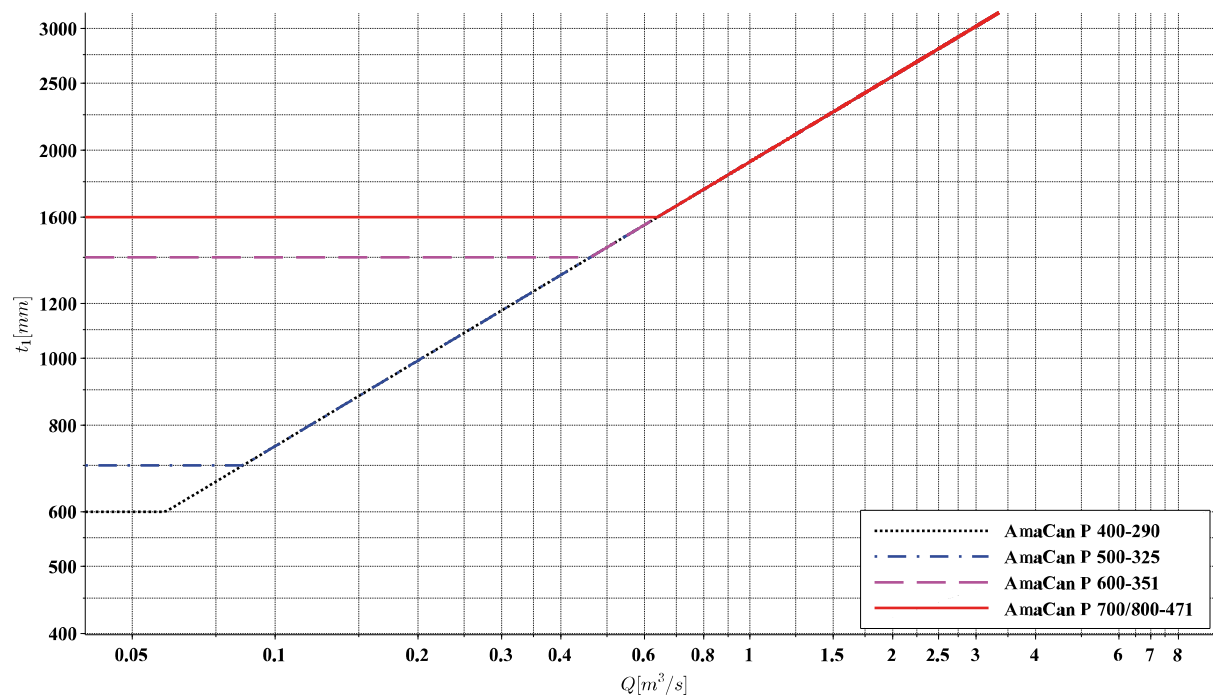


Fig. 144: Installation type DU: Open intake chamber, design without suction umbrella $\varnothing d_8$

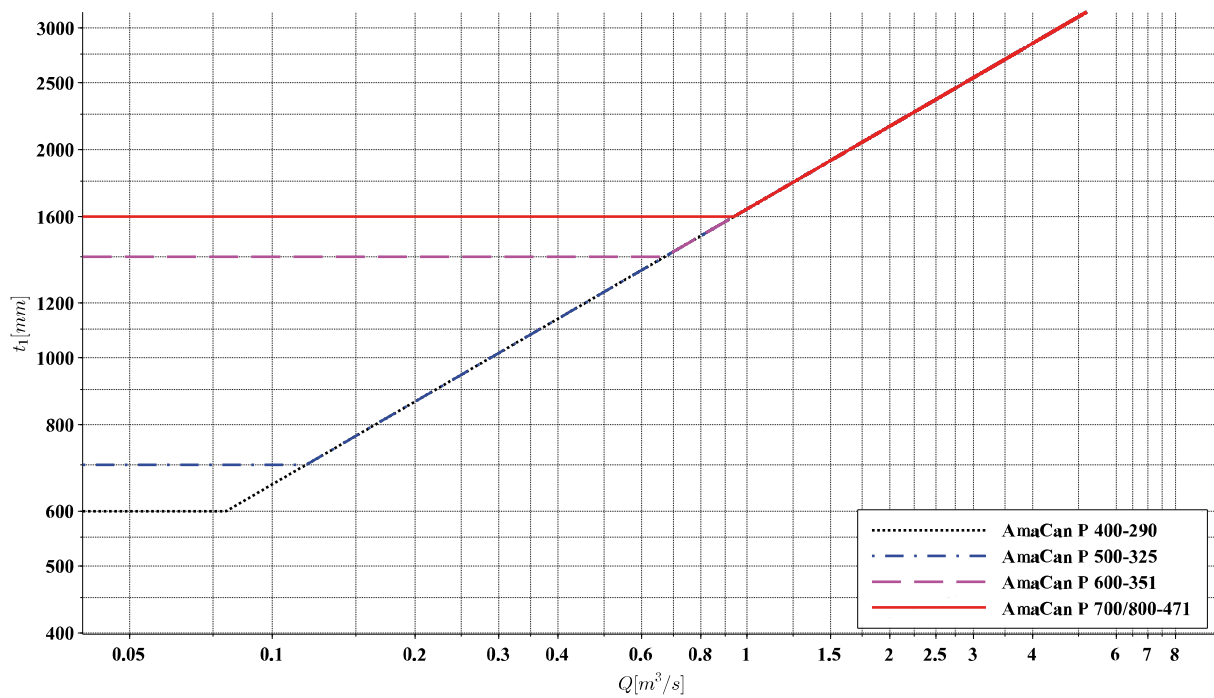
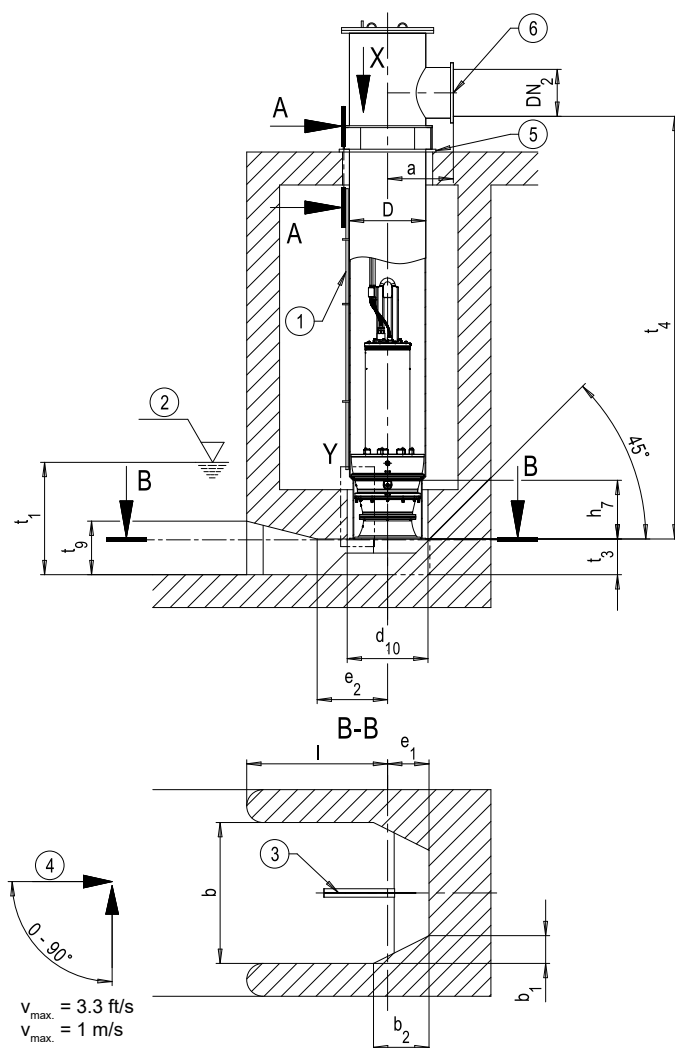
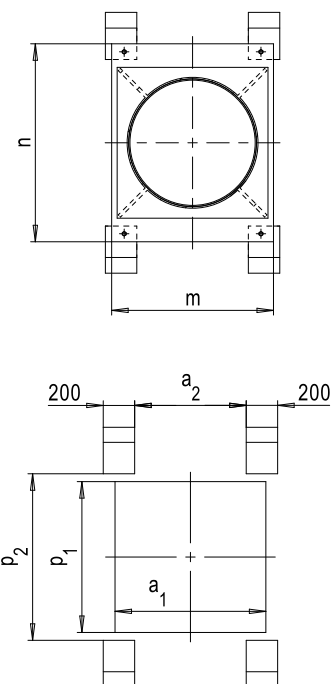


Fig. 145: Installation type DUS: Open intake chamber, design with suction umbrella $\varnothing d_g$

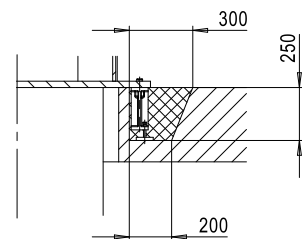
9.7.2.6 Installation type DG



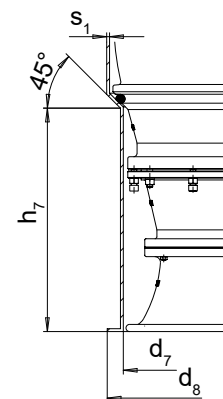
- ①: Vent line
 ②: Minimum water level (values see diagram on the next pages)
 ③: Flow-straightening vane (⇒ Section 9.7.2.7, Page 193)
 ④: Approach flow
 ⑤: Not pressure-proof
 ⑥: Connect the discharge pipe to the discharge tube without transmitting any stresses or strains.



Detail X: Support plate of the discharge tube, foundation recesses⁷²⁾ Dimensions in [mm]



Section A-A: Foundation recesses, dimensions in [mm]



Detail Y: Seating ring

Table 111: 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
400-290	250	400	406	420	550	300	880	175	350	350	405	455
500-325	300	500	508	530	650	400	1250	250	500	440	505	555
600-351	350	600	610	610	760	510	1250	250	500	500	610	660

⁷² All dimensions for foundation recesses apply to discharge tube design without intermediate flange.

Size	DN _{2 min.}	DN _{2 max.}	D	a	a ₁	a ₂	b	b ₁	b ₂	d ₇	d ₈	d ₁₀
700-471	400	700	711	650	860	610	1500	300	600	600	710	760
800-471	500	800	813	700	960	710	1500	300	600	600	710	760

Table 112: Dimensions [mm]

Size	e ₁ ⁷³⁾	e ₂	h ₇	l _{min.}	m	n	p ₁	p ₂	s ₁	t ₃ ⁷³⁾	t _{4 min.} ⁷⁴⁾	t ₉
400-290	265	440	225	880	620	860	550	650	7	210	1750	330
500-325	375	625	420	1250	720	960	650	750	7	270	1850	375
600-351	375	625	540	1250	830	1060	760	860	8	320	1900	470
700-471	450	750	420	1500	930	1160	860	960	8	380	2500	570
800-471	450	750	420	1500	1030	1260	960	1060	8	380	2850	570

Permissible dimensional tolerances:

- Tolerances in building construction to DIN 18202, Part 4, Group B
- Welded design: 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

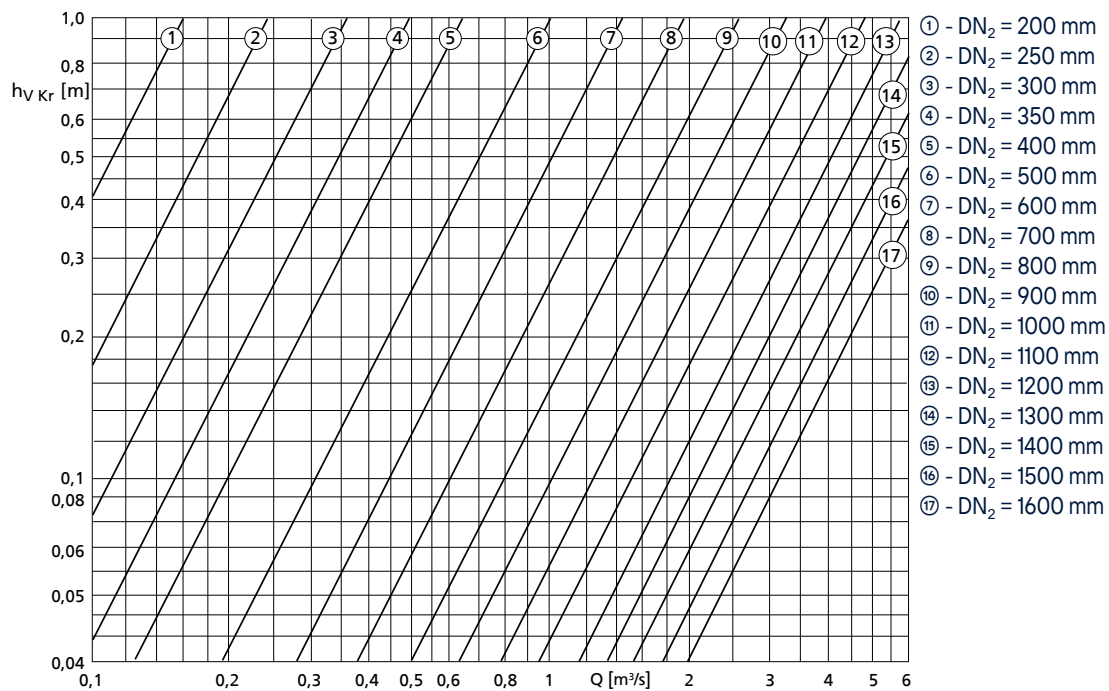
Calculation formulas:

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

$$\Delta H_v$$

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

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



⁷³ Observe this dimension.

⁷⁴ Value for maximum motor length

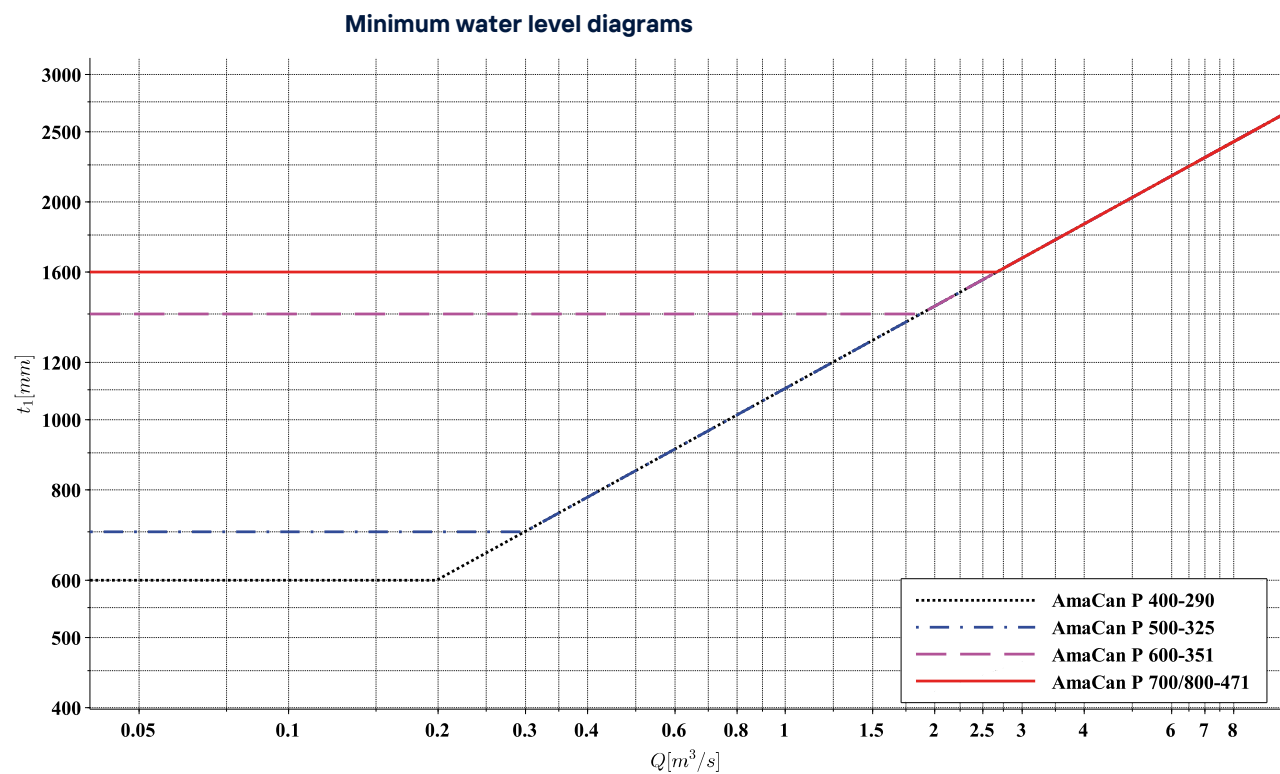


Fig. 146: Installation type DG: Covered intake chamber

9.7.2.7 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 minimize 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.

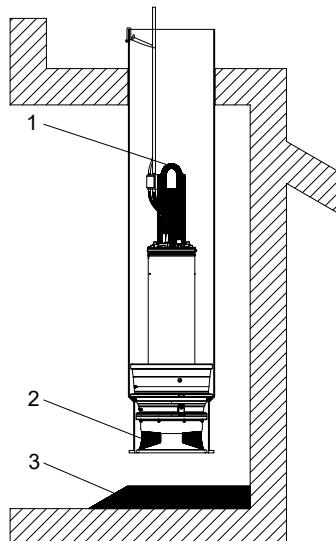
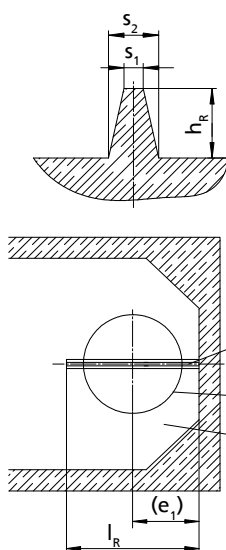


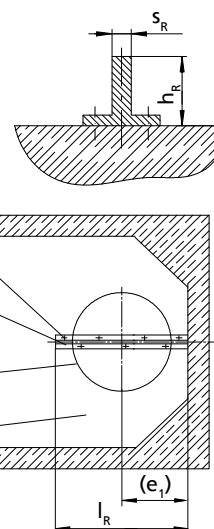
Fig. 147: Installation position of the pump set

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 centered beneath the discharge tube

C	Discharge tube
D	Intake chamber

Installation types BU, BUS, CU, CUS, DU, DUS

Table 113: Dimensions [mm]

Size	h_R	s_1	s_2	s_R	(e_1)		l_R	
					Suction umbrella		Suction umbrella	
					χ	$\checkmark$	χ	$\checkmark$
					d_8	d_9	d_8	d_9
400-290	130	15	60	10	300	425	540	750
500-325	190	20	70	10	350	500	700	940
600-351	190	20	70	10	400	500	875	940
700-471	230	25	90	10	450	650	1000	1200
800-471	230	25	90	10	450	650	1000	1200

Installation types BG, CG, DG

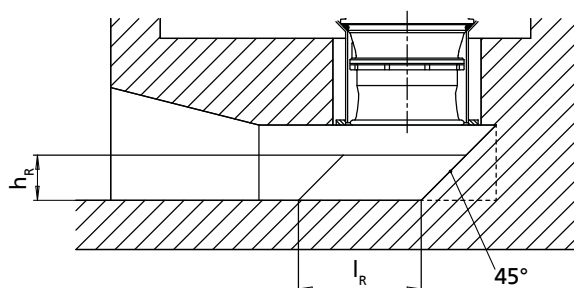


Fig. 148: Flow-straightening vane for covered intake chamber

Table 114: Dimensions [mm]

Size	h_R	s_1	s_2	s_R	$l_R^{75)}$
400-290	130	15	60	10	320
500-325	190	20	70	10	480
600-351	190	20	70	10	545
700-471	230	25	90	10	650
800-471	230	25	90	10	650

⁷⁵ Adjust length l_R of the flow-straightening vane to the 45° angle of the intake chamber.

10 Certificate of Decontamination

Type:

Order number/.....

Order item number⁷⁶):

Delivery date:

Field of application:

Fluid handled⁷⁶):

Please check where applicable⁷⁶):


☐

Corrosive


☐

Oxidizing


☐

Flammable


☐

Explosive


☐

Hazardous to health


☐

Seriously hazardous to health


☐

Toxic


☐

Radioactive


☐

Hazardous to the environment


☐

Safe

Reason for return⁷⁶):

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, 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 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.

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 shipping is effected in accordance with the relevant legal provisions.

.....
Place, date and signature

.....
Address

.....
Company stamp

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