

Submersible Motor Pump

Amarex KRT

Pump sizes DN 100 to DN 700

4-pole: 35 4_N to 350 4_N

6-pole: 32 6_N to 480 6_N

8-pole: 26 8_N to 400 8_N

10-pole: 40 10_N to 350 10_N

12-pole: 195 12_N to 300 12_N

Installation/Operating Manual



Ident number: 01106016



Installation/Operating Manual Amarex KRT
Original operating manual

KSB Aktiengesellschaft Pegnitz

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Glossary

Back pull-out unit

Pump without pump casing; partly completed machinery

Certificate of decontamination

A certificate of decontamination certifies that the pump (set) 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

Discharge line

The line which is connected to the discharge nozzle

Hydraulic system

The part of the pump in which the kinetic energy is converted into pressure energy.

Suction lift line/suction head line

The line which is connected to the suction nozzle

1 General

1.1 Principles

This manual is supplied as an integral part of the type series and variants indicated on the front cover (for details, please refer to the table below).

Table 1: Variants covered by this manual

Pump sizes	Impeller types	Material variants						
		Cast iron				Industrial materials		
		G	G1	G2	GH ¹⁾	H ¹⁾	C1 ¹⁾	C2 ¹⁾
100-401	E, F, K	E, F, K	F, K	F	F, K	F, K	F, K	F, K
150-401	E, F, K	E, F, K	F, K	F	F, K	F, K	F, K	F, K
150-500	K	K	K	-	-	-	-	-
151-401	K	K	K	-	K	K	K	K
200-330	K	K	K	-	K	K	K	K
200-401	E, K	E, K	K	-	K	K	K	K
200-500	K	K	K	-	-	-	-	-
200-501	K	K	K	-	-	-	-	-
200-631	K	K	K	-	-	-	-	-
250-400	K	K	K	-	K	K	K	K
250-401	K	K	K	-	K	K	K	K
250-630	K	K	K	-	-	-	-	-
300-400	K	K	K	-	K	K	K	K
300-401	K	K	K	-	K	K	K	K
300-420	K	K	K	-	-	-	-	-
300-500	K	K	K	-	-	-	-	-
300-503	K	K	K	-	-	-	-	-
350-420	K	K	K	-	-	-	-	-
350-500	K	K	K	-	-	-	-	-
350-501	K	K	K	-	-	-	-	-
350-630	K	K	K	-	-	-	-	-
350-636	K	K	K	-	-	-	-	-
350-710	K	K	K	-	-	-	-	-
400-500	K	K	K	-	-	-	-	-
400-630	K	K	K	-	-	-	-	-
500-630	K	K	K	-	-	-	-	-
500-640	K	K	K	-	-	-	-	-
500-641	K	K	K	-	-	-	-	-
600-520	K	K	K	-	-	-	-	-
600-710	K	K	K	-	-	-	-	-
700-900	K	K	K	-	-	-	-	-

This 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 case of damage, immediately contact your nearest KSB Service centre to maintain the right to claim under warranty.

¹⁾ Not for pump sets with cooling system

1 General

1.2 Installation of partly completed machinery

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

1.3 Target group

This manual is aimed at the target group of trained and qualified specialist technical personnel. (⇒ Section 2.4 Page 10)


1.4 Other applicable documents

Table 2: Overview of other applicable documents

Document	Contents
Technical data sheet	Description of the technical data of the pump set
General arrangement drawing/ outline drawing	Description of mating and installation dimensions for the pump set
Hydraulic characteristic curve	Characteristic curves showing head, flow rate, efficiency and power input
General assembly drawing ²⁾	Sectional drawing of the pump set
Sub-supplier documentation ²⁾	Operating manuals and other documentation of accessories and integrated machinery components
Spare parts lists ²⁾	Description of spare parts
Supplementary operating instructions ²⁾	For example for special accessories

1.5 Symbols

Table 3: Symbols used in this manual

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

²⁾ If agreed to be included in the scope of supply










2 Safety

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

2.1 Key to safety symbols/markings

Table 4: 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.
	Explosion protection This symbol identifies information about avoiding explosions in potentially explosive atmospheres in accordance with EC Directive 94/9/EC (ATEX).
	General hazard In conjunction with one of the signal words this symbol indicates a hazard which will or could result in death or serious injury.
	Electrical hazard In conjunction with one of the signal words this symbol indicates a hazard involving electrical voltage and identifies information about protection against electrical voltage.
	Machine damage In conjunction with the signal word CAUTION this symbol indicates a hazard for the machine and its functions.

2.2 General

This manual contains general installation, operating and maintenance instructions that must be observed to ensure safe pump operation and prevent personal injury and damage to property.

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

This manual must be read and completely understood by the responsible specialist personnel/operators prior to installation and commissioning.

The contents of this manual must be available to the specialist personnel at the site at all times.

Information attached directly to the pump must always be complied with and be 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 in this manual.




2.3 Intended use

Only operate the pump (set) within the application limits specified in the other applicable documents.

- Only operate pump sets which are in perfect technical condition.
- Do not operate partially assembled pump sets.

2 Safety

- Only use the pump to handle the fluids described in the data sheet or product literature of the pump model.
- Never operate the system without the fluid to be handled.
- Observe the limits for continuous operation specified in the data sheet or product literature ($Q_{min}^{3)}$ and $Q_{max}^{4)}$ (prevention of damage such as shaft fracture, bearing failure, damaged mechanical seal, etc).
- When handling untreated waste water the duty points in continuous operation lie within 0.7 to $1.2 \times Q_{opt}^{5)}$ to minimise the risk of clogging/hardening.
- Avoid duty points for continuous operation at very low speeds and small flow rates ($<0.7 \times Q_{opt}^{5)}$).
- Observe the information on the maximum flow rates provided in the data sheet or technical product literature (prevention of overheating damage, cavitation damage, bearing damage, etc).
- Do not throttle the flow rate on the suction side of the system (prevention of cavitation damage).
- For any operating modes which are not specified in the data sheet or product literature, contact the manufacturer.
- Only use the respective impeller types in combination with the fluids described below.

	Free-flow impeller (impeller type F)	Suitable for the following fluids: Fluids containing solids and stringy material as well as fluids with entrapped air or gas
	Closed single vane impeller (impeller type E)	Suitable for the following fluids: Fluids containing solids and stringy material
	Closed multi-vane impeller (impeller type K)	Suitable for the following fluids: Contaminated, solids-laden, non-gaseous fluids not liable to plait

Prevention of foreseeable misuse

- Observe the minimum flow velocities for fully open swing check valves to prevent the reduction of pressure and risk of clogging.
(Contact the manufacturer for the required minimum flow velocities/loss coefficients.)
- Never exceed the permissible application limits specified in the data sheet and in the product literature regarding pressure, temperature, etc.
- Observe all safety notes and instructions in this manual.

³⁾ Minimum permissible flow rate
⁴⁾ Maximum permissible flow rate
⁵⁾ Optimum efficiency

2.4 Personnel qualification and training

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

The responsibilities, competence and supervision of all personnel involved in 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.

2.5 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

2.6 Safety awareness

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

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

2.7 Safety information for the operator/user

- The operator shall fit contact guards for hot, cold or moving parts and check that the guards function properly.
- Do not remove the contact guard while the pump is running.
- Connect an earth conductor to the metal jacket if the fluid handled is electrostatically charged.
- 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.)

2.8 Safety information for maintenance, inspection and installation work

- Modifications or alterations of the pump are only permitted with the manufacturer's prior consent.
- Use only original spare parts or parts authorised by the manufacturer. The use of other parts can invalidate any liability of the manufacturer for consequential damage.
- The operator ensures that all maintenance, inspection and installation work is performed by authorised, qualified specialist personnel who are thoroughly familiar with the manual.
- Carry out work on the pump (set) during standstill only.
- The pump casing 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.
- Decontaminate pumps which handle fluids posing a health hazard.
- As soon as the work is complete, re-install and/or re-activate any safety-relevant and protective devices. Before returning the product to service, observe all instructions on commissioning. (⇒ Section 6.1 Page 41)

2.9 Unauthorised modes of operation

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

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

2.10 Explosion protection



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

Sections of the manual marked by the Ex symbol apply to explosion-proof pump sets also when temporarily operated outside potentially explosive atmospheres. Only pumps/pump sets marked as explosion-proof **and** identified as such in the data sheet must be used in potentially explosive atmospheres.

Special conditions apply to the operation of explosion-proof pump sets in accordance with EC Directive 94/9/EC (ATEX).

When operating explosion-proof pump sets, especially adhere to the additional requirements marked by the Ex symbol.

The explosion-proof status of the pump set is only assured if the pump set is used in accordance with its intended use.

Never operate the pump (set) outside the limits stated in the data sheet and on the name plate.

Prevent impermissible modes of operation at all times.


2.10.1 Repair

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

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

3 Transport/Temporary Storage/Disposal

3.1 Transport

	<div style="background-color: #f08080; padding: 5px;">⚠ DANGER</div> <p>Improper transport Danger to life from falling parts! Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Use the attachment point provided (eyebolt, lifting lug or bail) for attaching lifting tackle. ▷ Never suspend the pump set by its power cable. ▷ Never use chains or lifting ropes included in KSB's scope of supply for lifting loads other than the KSB product supplied. ▷ Safely attach transport ropes or chains to the pump and crane.
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Transport the pump set as illustrated.

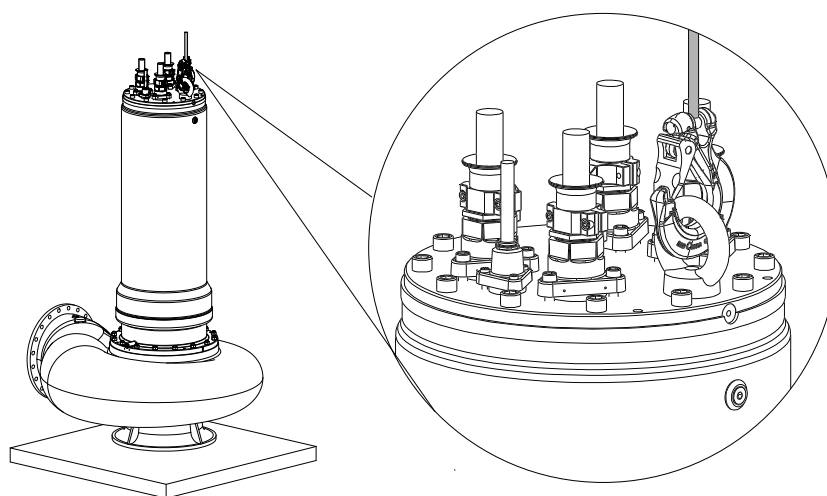



Fig. 1: Transporting the pump set

3.1.1 Positioning the pump set

It may be necessary to place the pump set in horizontal position during maintenance or installation.

Pump sets with cooling system (installation types D and K)

	<div style="background-color: #ffff00; padding: 5px;">CAUTION</div> <p>Improper transport/ Improper positioning of pump sets with cooling system Damage to the cooling system!</p> <ul style="list-style-type: none"> ▷ Never place the pump set on the cooling jacket or fasten it to the cooling system.
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Pump sets equipped with a cooling system are delivered with a support foot as a transport lock.

3 Transport/Temporary Storage/Disposal

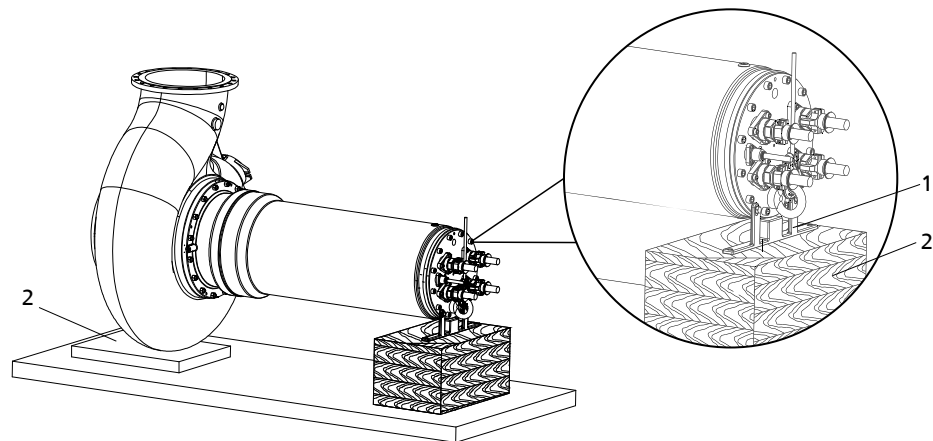


Fig. 2: Positioning a pump set with support foot

1	Support foot	2	Wooden support
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For positioning pump sets, observe the following points:

- Support foot (1)
 - Fit the support foot (1) of the pump prior to placing the pump in horizontal position.
 - Position the pump set on the support foot (1) and the pump casing.
- Wooden support (2)
 - Use wooden supports (2) to prevent any damage to the pump coating.

Pump sets without cooling system (installation types P and S)

For positioning pump sets, observe the following points:

- Place the pump set on the pump casing and directly on the edge of the motor housing cover.
- Use wooden supports to prevent any damage to the pump coating.



3.1.2 Placing the pump set in vertical position

To change the pump from horizontal to vertical position, attach lifting gear to the attachment point provided.

When the pump is pulled upright, the pump casing will act as pivot. Place wooden supports under the pivot points.

3.2 Storage and preservation

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

	<p>CAUTION</p> <p>Improper storage Damage to the power cables!</p> <ul style="list-style-type: none"> ▷ Support the power cables at the cable entry to prevent permanent deformation. ▷ Only remove the protective caps from the power cables at the time of installation.
	<p>CAUTION</p> <p>Damage during storage by humidity, dirt, or vermin Corrosion/contamination of the pump (set)!</p> <ul style="list-style-type: none"> ▷ For outdoor storage cover the pump (set) or the packaged pump (set) and accessories with waterproof material.

3 Transport/Temporary Storage/Disposal



	<div style="background-color: yellow; padding: 2px;">CAUTION</div> <p>Wet, contaminated or damaged openings and connections Leakage or damage to the pump set!</p> <p>► Only remove caps/covers from the openings of the pump set at the time of installation.</p>
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Table 5: Ambient conditions for storage

Ambient conditions	Value
Relative humidity	5 % to 85 % (non-condensing)
Ambient temperature	- 10 °C to + 70 °C


- Store the pump set under dry and vibration-free conditions, if possible in its original packaging.
- 1. Spray-coat the inside wall of the pump casing, and in particular the impeller clearance areas, with a preservative.
- 2. Spray the preservative through the suction and discharge nozzles.
It is advisable to then close the pump nozzles (e.g. with plastic caps or similar).

	<div style="background-color: #0070c0; color: white; padding: 2px;">NOTE</div> <p>Observe the manufacturer's instructions for application/removal of the preservative.</p>
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3. Rotate the impeller by hand once a month.

3.3 Return to supplier

1. Drain the pump as per operating instructions. (⇒ Section 7.3 Page 59)
2. Always flush and clean the pump, particularly if it has been used for handling noxious, explosive, hot or other hazardous fluids.
3. If the fluids handled by the pump leave residues which might lead to corrosion damage when coming into contact with atmospheric humidity, or which might ignite when coming into contact with oxygen, the pump set must also be neutralised, and anhydrous gas must be blown through the pump for drying purposes.
4. Always complete and enclose a certificate of decontamination when returning the pump (set). (⇒ Section 11 Page 90)
Always indicate the safety and decontamination measures taken.

	<div style="background-color: #0070c0; color: white; padding: 2px;">NOTE</div> <p>If required, a blank certificate of decontamination can be downloaded from the KSB web site at: www.ksb.com/certificate_of_decontamination</p>
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3.4 Disposal

	<div style="background-color: #ff9900; padding: 2px;">⚠ WARNING</div> <p>Fluids posing a health hazard Hazardous to persons and the environment!</p> <p>► Collect and properly dispose of flushing liquid and any fluid residues.</p> <p>► Wear safety clothing and a protective mask, if required.</p> <p>► Observe all legal regulations on the disposal of fluids posing a health hazard.</p>
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1. Dismantle the pump (set).
Collect greases and other lubricants during dismantling.
2. Separate and sort the pump materials, e.g. by:
 - Metals

3 Transport/Temporary Storage/Disposal

- Plastics
 - Electronic waste
 - Greases and other lubricants
3. Dispose of materials in acc. with local regulations or in another controlled manner.

4 Description of the Pump (Set)

4 Description of the Pump (Set)

4.1 General description

Pump for handling untreated waste water containing long fibres and solid substances, fluids containing gas and air as well as raw, activated and digested sludge.

4.2 Designation

Example: Amarex KRT K 150-401 / 80 4 XN G / S

Table 6: Key to the designation

Code	Description
Amarex KRT	Type series
K	Impeller type, e.g. K = channel impeller
150	Nominal discharge nozzle diameter [mm]
401	Maximum nominal impeller diameter [mm]
80	Motor size
4	Number of poles
XN	Motor version e.g. X = explosion-proof to ATEX II 2GT3
G	Casing material, e.g. G = grey cast iron
S	Installation type, e.g. S = stationary wet installation without cooling system

4.3 Name plate



a)		b)	
1	KSB Aktiengesellschaft 67227 Frankenthal	20	Typ Amarex KRTK 150-401/804XN G-S
2	Typ Amarex KRTK 150-401/804XN G-S	20	No. 9971311915
3	No. 9971311915	20	2009
4	Q 450 m³/h	20	H 40 m
5	K22K04-80	20	3~ M.-No. 654321
6	P ₂ 80 kW	20	400/690 V
7	1479 min⁻¹	20	50 Hz
8	159/992 A	20	40 °C
9	cos φ 0,79	20	1479 min⁻¹
10	IP 68	20	159/992 A
11	S1	20	cos φ 0,79
	IA/In 6,2	20	CE 0035 Ex II 2G Ex d IIB T 3 PTB 02 Atex 1055
	929 kg	20	IP 68 S1 IA/In 6,2
	Class H	20	929 kg Class H
	Ident-No. 01080556	20	WARNUNG - NICHT UNTER SPANNUNG ÖFFNEN
	ZN 3826-M12	20	WARNING - DO NOT OPEN WHEN ENERGIZED
		20	AVERTISSEMENT - NE PAS OUVRIR SOUS TENSION
		20	Ident-No. 01080556
		20	ZN 3826-M16

Fig. 3: Name plate a) Standard pump set b) Explosion-proof pump set

1	Designation	2	KSB order number
3	Flow rate	4	Motor type
5	Rated power	6	Rated speed
7	Rated voltage	8	Rated current
9	Enclosure	10	Mode of operation
11	Starting current ratio	12	Year of construction
13	Head	14	Motor number
15	Maximum fluid and ambient temperature	16	Rated frequency
17	Power factor at design point	18	Thermal class of winding insulation
19	Total weight	20	Marking for explosion-proof pump sets

4 Description of the Pump (Set)

4.4 Design details

Design

- Fully floodable submersible motor pump
- Not self-priming
- Close-coupled design

Impeller type

- Various, application-based impeller types

Shaft seal

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

Standard bearing assembly

Motor-end bearing:

- Grease-packed bearings sealed for life
- Maintenance-free

Pump-end bearing:

- Re-lubrication possible

Drive

- Three-phase asynchronous squirrel-cage motor

Motors integrated in explosion-proof pump sets are supplied in type of protection Ex d IIB.

4.5 Types of installation

Four design variants are available, depending on the installation type:

- **Installation type D**
Stationary dry installation with cooling system
- **Installation type K**
Stationary wet installation with cooling system
- **Installation type P**
Transportable wet installation without cooling system
- **Installation type S**
Stationary wet installation without cooling system

Pumps of installation types P and S

are designed for continuous operation in submerged condition. The motor is cooled by the fluid handled on the motor surface. Operation with the motor outside the fluid handled is possible for short periods.

Pumps of installation types D and K

are suitable for continuous operation with the motor outside the fluid. The motor is cooled by the integrated cooling system.

4 Description of the Pump (Set)

4.6 Design and function

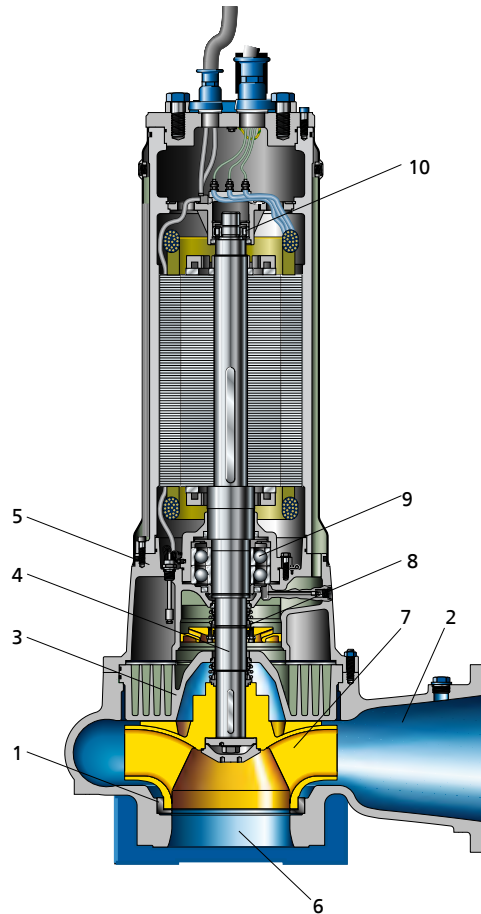


Fig. 4: Sectional drawing

1	Casing wear ring	2	Discharge nozzle
3	Discharge cover	4	Shaft
5	Bearing bracket	6	Suction nozzle
7	Impeller	8	Shaft seal
9	Bearing, pump end	10	Bearing, motor end

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

Function The fluid enters the pump axially via a suction nozzle (6) and is accelerated outward in a cylindrical flow by the rotating impeller (7). The flow profile of the pump casing converts the kinetic energy of the fluid into pressure energy. The fluid is pumped to the discharge nozzle (2), where it leaves the pump. The casing wear ring (1) prevents any fluid from flowing back from the casing into the inlet. At the rear side of the impeller, the shaft (4) enters the casing via the discharge cover (3). The shaft passage through the discharge cover is sealed towards the atmosphere with a shaft seal (8). The shaft runs in rolling element bearings (9 and 10), which are supported by a bearing bracket (5) linked with the pump casing and/or discharge cover.

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

Cooling system Pump sets of installation types K and D feature an integrated motor cooling system. The heat generated by the motor is transferred via the discharge cover to the fluid handled by internal circulation. The coolant serves as anti-corrosive and antifreeze agent and as a lubricant for the mechanical seals.

4 Description of the Pump (Set)

4.7 Scope of supply

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

Stationary wet installation (installation types K and S)

- Pump set complete with electric cables
- Claw with seal and mounting elements
- Lifting rope or chain
- Mounting bracket with mounting elements
- Duckfoot bend with mounting elements
- Guiding equipment
(guide rails are not included in KSB's scope of supply)

Stationary dry installation (installation type D)

- Pump set complete with electric cables
- Duckfoot bend with mounting elements
- Intake elbow

Transportable wet installation (installation type P)

- Pump set complete with electric cables
- Foot pad or pump stool with mounting elements
- Lifting rope or chain



NOTE



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

4.8 Dimensions and weights

For dimensions and weights please refer to the general arrangement drawing/outline drawing or data sheet of the pump set.

5 Installation at Site


5.1 Safety regulations

	<p>⚠ DANGER</p> <p>Improper installation in potentially explosive atmospheres Explosion hazard! Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Comply with the applicable local explosion protection regulations. ▷ Observe the information given in the data sheet and on the name plate of the pump set.
	<p>⚠ DANGER</p> <p>Persons in the tank during pump operation Electric shock!</p> <ul style="list-style-type: none"> ▷ Never start up the pump set when there are persons in the tank.

5.2 Checking the site before installation

5.2.1 Preparing the place of installation


Place of installation for stationary models

	<p>⚠ WARNING</p> <p>Installation on foundations which are unsecured and cannot support the load Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▷ Make sure the foundation concrete is of sufficient strength (min. C25/30 to DIN 1045). ▷ Make sure the foundation has set firmly before placing the duckfoot bend on it. ▷ Only place the duckfoot bend on horizontal and level surfaces. ▷ Refer to the weights given in the data sheet/name plate.
---	---

Resonances Any resonances at the usual excitation frequencies (1x and 2x rotational frequency, rotational noise) must be prevented both in the foundation and in the connected piping, as such frequencies may cause extreme vibrations.

1. Check the structural requirements.
All structural work required must have been prepared in accordance with the dimensions stated in the outline drawing/general arrangement drawing.

Place of installation for transportable models

	<p>⚠ WARNING</p> <p>Installation on unsecured, uneven mounting surfaces Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▷ Always install the pump set vertically with the motor on top on secured and level mounting surfaces. ▷ Observe the weights specified on the data sheet/name plate.
---	---

Resonances Any resonances at the usual excitation frequencies (1x and 2x rotational frequency, rotational noise) must be prevented both in the foundation and in the connected piping, as such frequencies may cause extreme vibrations.

1. Check the structural requirements.
All structural work required must have been prepared in accordance with the dimensions stated in the outline drawing/general arrangement drawing.

5 Installation at Site

5.2.2 Removing the transport lock (installation types K and D)

Pumps equipped with a cooling system are fitted with a support foot for transport, to prevent in-transit damage to the cooling jacket.

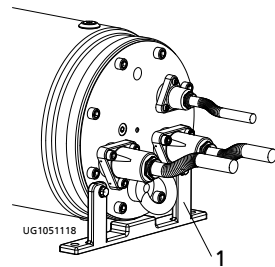


Fig. 5: Transport lock

1	Support foot
---	--------------

Remove the support foot (1) prior to commissioning and keep it for future servicing, interim storage or decommissioning of the pump.

5.2.3 Checking the lubricant level (installation types S and P)

Check the lubricant level of pump sets without cooling system.

The lubricant reservoirs are filled with an environmentally-friendly, non-toxic lubricant at the factory.

✓ The pump set has been placed in vertical position.

1. Unscrew screwed plug 903.03 with joint ring 411.03.

⇒ The lubricant level must reach the filler opening.

2. If the lubricant level is lower, top up lubricant through the filler opening until the lubricant reservoir overflows.

3. Close screwed plug 903.03 with joint ring 411.03 again.

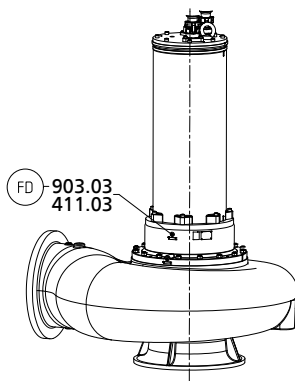


Fig. 6: Checking the lubricant level



NOTE

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

5.2.4 Checking the coolant level (installation types D and K)

Check the coolant level for pump sets with cooling system.

5 Installation at Site

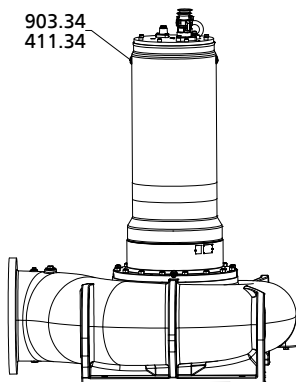


Fig. 7: Coolant filler opening

✓ The pump set has been placed in vertical position.

1. Position the pump set as illustrated.
2. Unscrew screwed plug 903.34 with joint ring 411.34.
3. Insert a paper test strip through the filler opening and read off the liquid level from the paper.
 - ⇒ The liquid level should not be more than 3 cm below the edge of the filler opening.
4. If the liquid level is lower, top up clear water through the filler opening until it overflows.
5. Close screwed plug 903.34 with joint ring 411.34 again.



NOTE

If more than 2 litres of coolant are required for topping up, this suggests a defect in the cooling system.

5.2.5 Checking the direction of rotation



⚠ DANGER

Pump set running dry
Explosion hazard!

- ▷ The direction of rotation of explosion-proof pump sets must be checked outside the potentially explosive atmosphere.



⚠ WARNING

Hands or objects inside 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.



CAUTION

Pump set running dry
Increased vibrations!
Damage to mechanical seals and bearings!

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

✓ The pump set is connected to the power supply.

1. Start the pump set and stop it again immediately to determine the motor's direction of rotation.
2. Checking the direction of rotation
 - ⇒ **Pump sets for wet installation (installation types K, S, P):** When looking at the pump mouth, impeller rotation must be anti-clockwise (seen from the inspection hole). On some pump casings, the direction of rotation is marked by an arrow.

5 Installation at Site

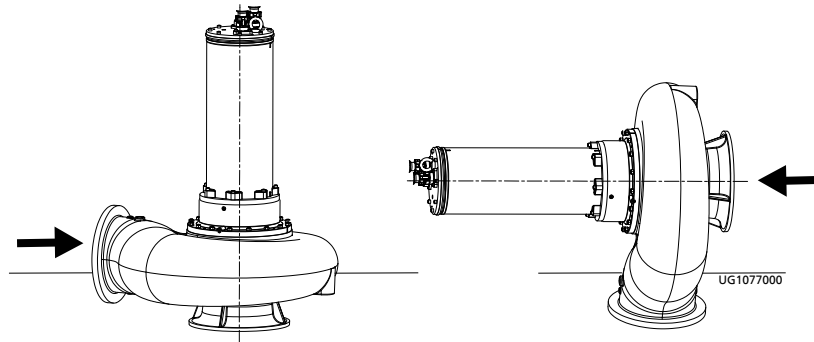


Fig. 8: Checking the direction of rotation.

⇒ **Pump sets for dry installation (installation type D):** When looking at the inspection hole of the pump set, impeller movement must be to the left (seen from the inspection hole). On some pump casings, the direction of rotation is marked by an arrow.

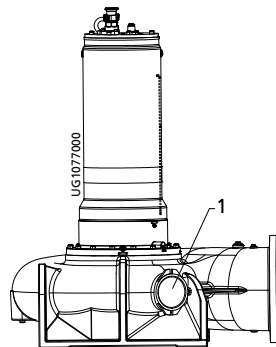


Fig. 9: Inspection hole

1	Inspection hole
---	-----------------

3. If the pump is running in the wrong direction of rotation, check the electrical connection of the pump and the control system, if necessary.
4. Disconnect the pump set from the power supply again and make sure it cannot be switched on accidentally.

5.3 Installing the pump set

Always observe the general arrangement drawing/outline drawing when installing the pump set.

5.3.1 Stationary wet installation

5.3.1.1 Fastening the duckfoot bend

Depending on the pump size, the duckfoot bend is either fastened with anchor bolts and/or foundation rails.

5 Installation at Site

Fastening the duckfoot bend with anchor bolts

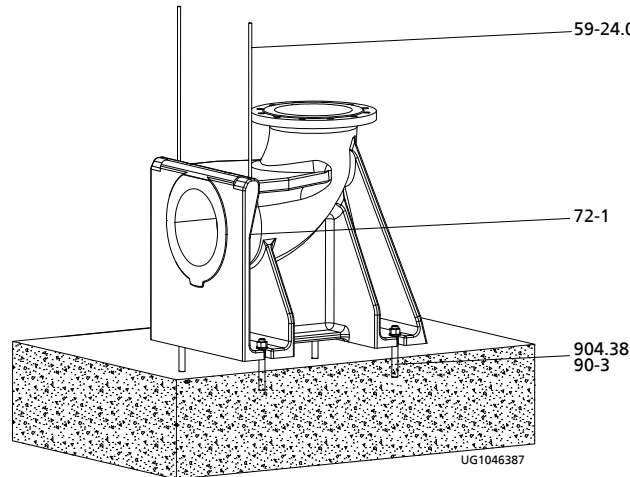


Fig. 10: Fastening the duckfoot bend with anchor bolts

1. Position duckfoot bend 72-1 at the bottom of the tank/well.
2. Insert anchor bolts 904.38.
3. Screw duckfoot bend 72-1 to the floor with anchor bolts 904.38.

Fastening the duckfoot bend with foundation rails and anchor bolts

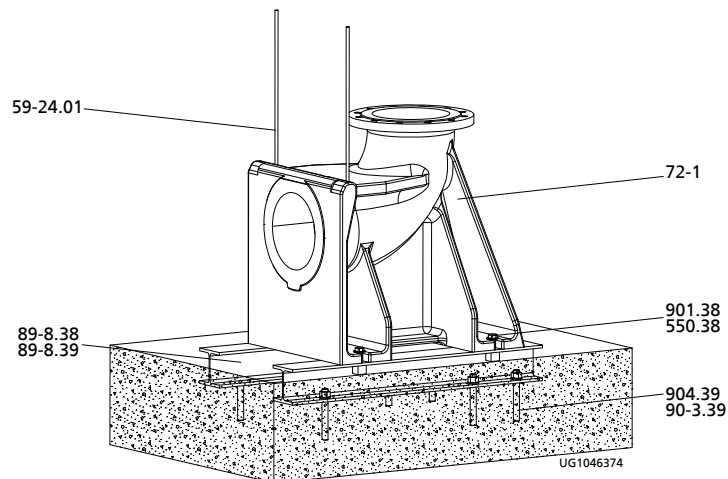


Fig. 11: Fastening the duckfoot bend with foundation rails and anchor bolts

1. Position duckfoot bend 72-1 with foundation rails 89-8.38/39 at the bottom of the tank/well.
2. Insert anchor bolts 904.38.
3. Use anchor bolts 904.38 to screw duckfoot bend 72-1 with foundation rails 89-8.38/39 to the floor.
4. Set the foundation rails in concrete.

5 Installation at Site

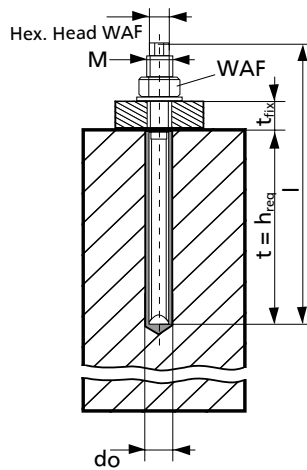


Fig. 12: Dimensions




Table 7: Anchor bolt dimensions

Bolt size	d _o [mm]	t=h _{req} [mm]	t _{fix} [mm]	WAF [mm]	M [mm]	Hex. head WAF [mm]	Torque [Nm]
M 10x130	12	90	20	17	10	7	20
M 12x160	14	110	25	19	12	8	40
M 16x190	18	125	35	24	16	12	60
M 20x260	25	170	65	30	20	12	120
M 24x300 ⁶⁾	28	210	65	36	24	-	150
M 30x380 ⁶⁾	35	280	65	46	30	-	300

Table 8: Curing times of mortar cartridge

Floor temperature	Curing time [min]
-5 °C to 0 °C	240
0 °C to +10 °C	45
+10 °C to +20 °C	20
> +20 °C	10

5.3.1.2 Connecting the piping

	<p>⚠ DANGER</p> <p>The permissible loads on the flange of the duckfoot bend have been exceeded Danger to life from leakage of hot, toxic, corrosive or flammable fluids!</p> <ul style="list-style-type: none"> Do not use the pump as an anchorage point for the piping. Anchor the pipelines in close proximity to the pump and connect them without transmitting any stresses or strains. Observe the permissible flange loads. Take appropriate measures to compensate thermal expansion of the piping.
	<p>NOTE</p> <p>When the pump set is used for draining low-level building areas, install a swing check valve in the discharge line to avoid backwash from the sewer system.</p>
	<p>CAUTION</p> <p>Critical speed Increased vibrations! Damage to mechanical seals and bearings!</p> <ul style="list-style-type: none"> Install a swing check valve in longer riser pipes to prevent the pump from excessive running in reverse. When fitting a swing check valve, make sure that the unit can still be vented properly.

⁶⁾ Mounting accessories of respective manufacturer required.

5 Installation at Site

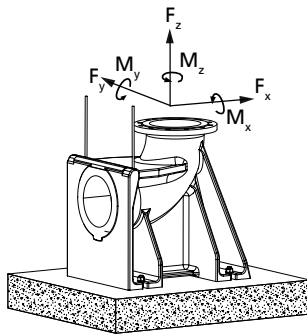


Fig. 13: Permissible flange loads

Table 9: Permissible flange loads

Nominal diameter of the flange	Forces [N]				Moments [Nm]			
	F_y	F_z	F_x	ΣF	M_y	M_z	M_x	ΣM
150	4050	5000	4500	7850	1750	2050	2500	3650
200	5400	6700	6000	10450	2300	2650	3250	4800
250	6750	8350	7450	13050	3150	3650	4450	6550
300	8050	10000	8950	15650	4300	4950	6050	8900
350	9400	11650	10450	18250	5500	6350	7750	11400
400	10750	13300	11950	20850	6900	7950	9700	14300
500	13450	16600	14950	26050	10250	11800	14450	21300
600	16150	19900	17950	31250	14400	16600	20200	29900
700	19100	22500	20800	36600	17200	21000	25700	37300

5.3.1.3 Fitting the guide wire arrangement

The pump set is guided into the sump or tank along two parallel, tightly stretched guide wires made of stainless steel. It attaches itself automatically to the duckfoot bend which has been fitted to the floor.



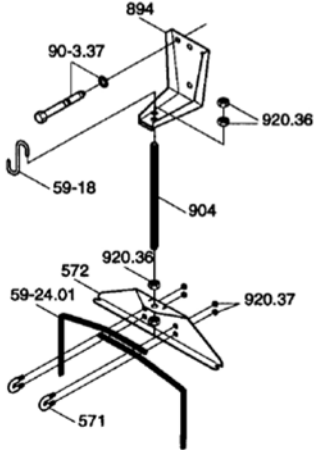
NOTE

Should site conditions/piping layout, etc. require the wire to run off the vertical, do not exceed a maximum angle of 5° to ensure reliable fitting and guiding of the pump set.

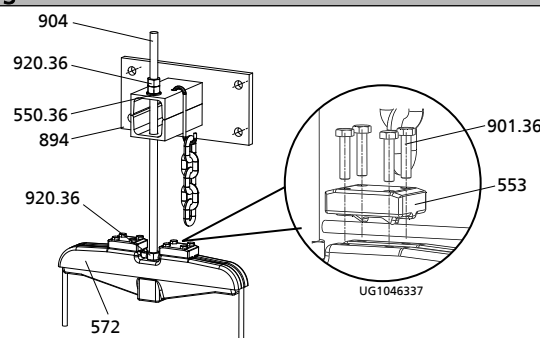
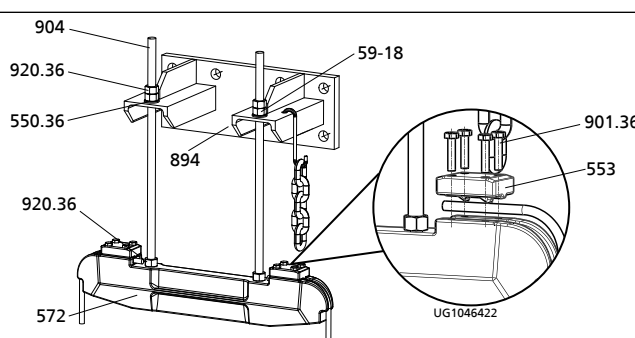
Fitting the mounting bracket

1. Fasten mounting bracket 894 to the edge of the sump opening with steel anchor bolts 90-3.37 and tighten the anchor bolts to a tightening torque of 10 Nm.
2. Push clamping piece 571 through the holes of suspension bracket 572 and fasten it with nuts 920.37.
3. Fasten threaded bolt 904 with pre-assembled clamping arrangement to the mounting bracket with nut 920.36.
Do not tighten nut 920.36 too much, to allow sufficient play for subsequently tensioning the guide wire.

Table 10: Variants of mounting brackets

Pump sizes	Mounting bracket variant	Part numbers	
150-401		59-18	Hook
151-401		59-24.01	Wire
150-500		90-3.37	Anchor bolt
200-330		571	Bail
200-401		572	Guide wire suspension bracket
		894	Mounting bracket
		904	Grub screw
		920.36/.37	Nut

5 Installation at Site

Pump sizes	Mounting bracket variant	Part numbers	
200-500 200-501 200-631 DN 250 DN 300		59-18	Hook
		59-24.01	Wire
		550.36	Disc
		553	Thrust insert
		572	Guide wire suspension bracket
		894	Mounting bracket
		901.36	Hexagon head bolt
		904	Grub screw
		920.36	Nut
DN 350 DN 400 DN 500 DN 600 DN 700		59-18	Hook
		59-24.01	Wire
		550.36	Disc
		553	Thrust insert
		572	Guide wire suspension bracket
		901.36	Hexagon head bolt
		904	Grub screw
		920.36	Nut

Inserting the guide wire

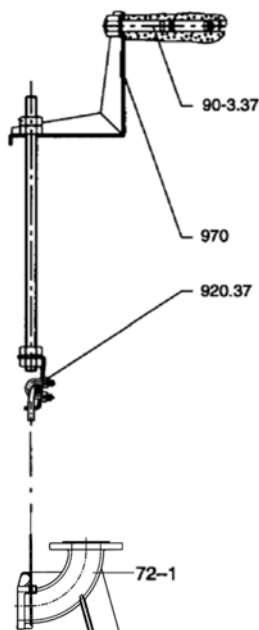


Fig. 14: Inserting the guide wire

1. Lift up thrust insert 533, insert one end of the wire and secure it with bolts 901.36.
2. Run wire 59-24.01 around duckfoot bend 72-1 and back again to suspension bracket 572 and insert it into thrust insert 533.
3. Manually tension wire 59-24.01 and secure it by means of bolts 901.36.
4. Pull the wire taut by tightening hexagon nut(s) 920.36 on the upper side of the mounting bracket.
Refer to the table "Guide wire tension".
5. Secure the nut(s) with a second hexagon nut.
6. The loose wire ends at the guide wire suspension bracket 572 can either be twisted into a ring or the end can be cut off.
After length adjustment, tape the ends to avoid fraying.
7. Attach hook 59-18 to mounting bracket 894 for attaching the lifting chain/rope at a later stage.

5 Installation at Site

Table 11: Guide wire tension

Pump size	Tightening torque M_A [Nm]	Guide wire tension P [N]
100-401 150-401 151-401 150-500 200-330 200-401	14	6000
200-500 200-501 200-631 250-400 250-401 250-630 300-400 300-401 300-420 300-500 300-503	30	10000
350-420 350-500 350-501 350-630 350-636 350-710 400-500 400-630 500-630 500-640 500-641 600-520 600-710 700-900	2 clamping screws, 21 Nm each	15000

5.3.1.4 Fitting the guide rail arrangement

The pump set is guided into the sump or tank along two vertical guide rails. It attaches itself automatically to the duckfoot bend which has been fitted to the floor.



NOTE

The guide rails are not included in KSB's scope of supply.
Select guide rail materials based on the fluid handled or as specified by the operator.

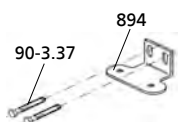
Observe the following dimensions for the guide rails:

Table 12: Guide rail dimensions

Size of hydraulic system	Outside diameter [mm]	Wall thickness [mm] ⁷⁾	
		Minimum	Maximum
DN 40 ... DN 150	60	2	5
DN 200 ... DN 700	89	3	6

Fitting the mounting bracket



1. Fasten mounting bracket 894 to the edge of the sump opening with steel anchor bolts 90-3.37 and tighten the anchor bolts to a tightening torque of 10 Nm. Observe the hole pattern for the anchor bolts. (See outline drawing.)


Fig. 15: Fitting the mounting bracket

⁷⁾ To DIN 2440/2442/2462 or equivalent standards

5 Installation at Site

Fitting the guide rails

	<p>CAUTION</p> <p>Improper installation of the guide rails Damage to the guide rail arrangement!</p> <p>► Always adjust the guide rails so that they are in a perfectly vertical position.</p>
	<p>NOTE</p> <p>For installation depths > 6 m, the scope of supply may include brackets as a middle support for the guide rails. The mounting brackets also serve as spacers between the two guide rails.</p>

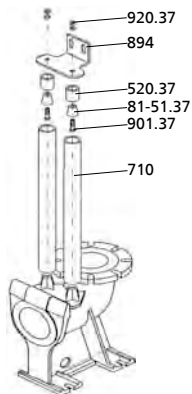


Fig. 16: Fitting the guide rails

1. Place rails 710 onto the conical bosses provided on duckfoot bend 72-1 and position vertically.
2. Mark the length of rails 710 (up to the lower edge of the mounting brackets), taking into account the adjusting range of the slotted holes in mounting bracket 894.
3. Shorten rails 710 with a 90° cut to the pipe axis and debur them inside and outside.
4. Insert mounting bracket 894 with elastic sleeves 520.37 into guide rails 710 until the mounting bracket rests on the rail ends.
5. Tighten nuts 920.37.
This pulls clamping sleeves 81-51.37 upwards and expands sleeves 520.37 against the inside pipe diameter.
6. Secure nuts 920.37 with a second nut.

5.3.1.5 Preparing the pump set

Fitting the claw

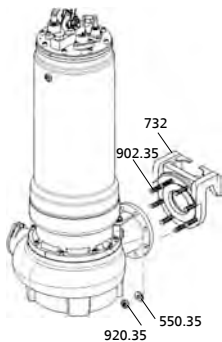


Fig. 17: Fitting the claw

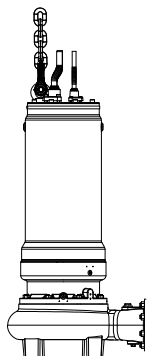
1. Fasten claw 732 to the discharge flange with studs 902.35, discs 550.35 and nuts 920.35.
Observe the tightening torques.
2. Fit profile joint 410 or round cord seal 99-6 into the groove of the claw.
This will seal the duckfoot bend / pump connection.

5 Installation at Site

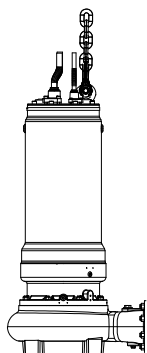
Attaching the lifting chain/rope

Stationary wet installation

1. Attach the lifting chain or rope to the eyebolt opposite the discharge nozzle or to the bail of the pump set.
This attachment point achieves a forward inclination of the pump unit towards the discharge nozzle, which allows the pump claw to hook onto the duckfoot bend.



Attaching the lifting chain/rope - stationary wet installation

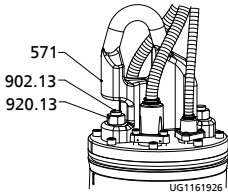
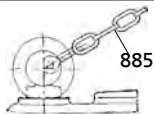


Attaching the lifting chain/rope - transportable wet installation

Transportable wet installation

1. Attach the lifting chain or rope to the eyebolt on the discharge nozzle side or to the bail of the pump set.

Table 13: Types of attachment

Drawing	Type of attachment	
	Bail	
	571	Bail
	902.13	Stud
	920.13	Nut
	Chain attached to the eyebolt with a shackle	
	59-17	Shackle
	885	Chain

5.3.1.6 Installing the pump set



NOTE

Make sure the pump set with the pre-assembled claw can easily be slipped over the mounting bracket, threaded onto the guide rails and lowered down. If required, alter the position of the crane during installation.

1. Guide the pump set over the suspension bracket/mounting bracket, thread it onto the guide wires/rails and slowly lower it down.
The pump set attaches itself to duckfoot bend 72-1.
2. Attach lifting chain/rope to hook 59-18 at the mounting bracket.

5 Installation at Site

5.3.2 Stationary dry installation

5.3.2.1 Installing the pump set



NOTE

If foundation rails 89-8 are included in our scope of supply, they must be set in concrete as shown in the general arrangement drawing/outline drawing.

5.3.2.1.1 Installing the pump set with a sole plate

Only for pump sizes: DN 100, DN 150, 200- 330, 200-500, 200-501

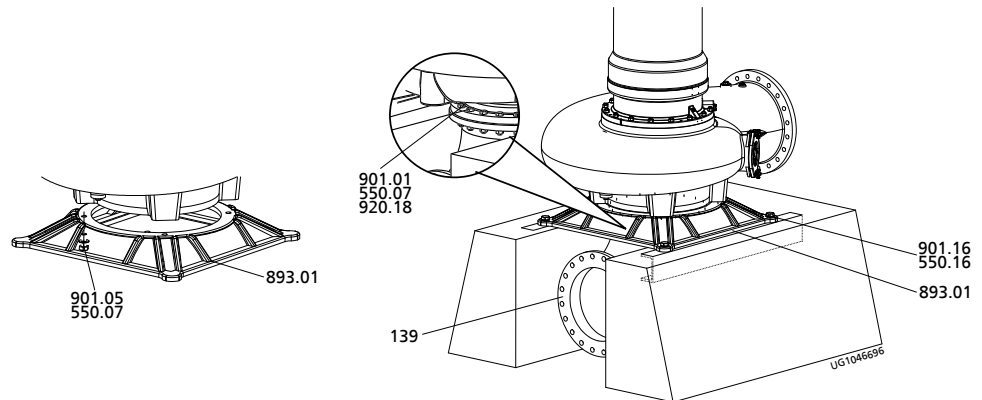


Fig. 18: Installing the pump set with a sole plate

1. Fasten duckfoot bend 139 with hexagon head bolts 901.01, discs 550.07 and nuts 920.18 to the suction nozzle.
2. Fasten sole plate 893.01 to the pump set with hexagon head bolts 901.05 and discs 550.05.
3. Place the pump set in vertical position and attach hoisting tackle to the attachment point on the discharge nozzle side (eyebolt or bail).
4. Place the pump set on the foundation.
Make sure the pump casing rests evenly on the foundation; use shims, if necessary.
5. Fasten the pump set with soleplate to the foundation with hexagon head bolts 901.16, discs 550.05 and rails 89-8 (optional).

5.3.2.1.2 Installing the pump set with integrally cast pump feet

All pump sizes expect those mentioned in (⇒ Section 5.3.2.1.1 Page 31)

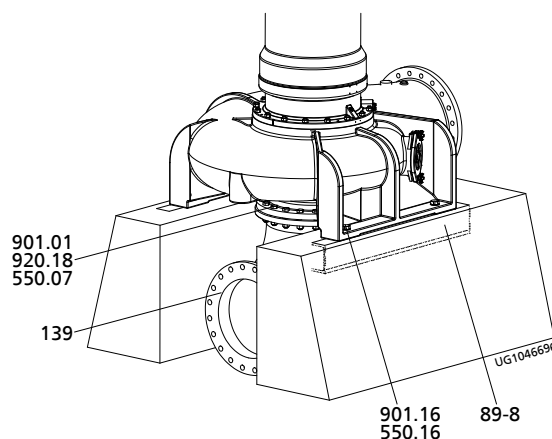





Fig. 19: Installing the pump set with pump feet

5 Installation at Site

1. Fasten duckfoot bend 139 to the suction nozzle with hexagon head bolts 901.01, discs 550.07 and nuts 920.18.
2. Place the pump set in vertical position and attach hoisting tackle to the attachment point provided (eyebolt).
3. Place the pump set on the foundation.
Make sure the pump casing rests evenly on the foundation; use shims, if necessary.
4. Fasten the integrally cast pump feet of the pump set to foundation rails 89-8 with hexagon head bolts 901.16 and discs 550.16.

5.3.2.2 Connecting the piping

	<div style="background-color: #f4a460; padding: 5px;">⚠ DANGER</div> <p>Excessive loads acting on the pump nozzles Danger to life from leakage of hot, toxic, corrosive or flammable fluids!</p> <ul style="list-style-type: none"> ▷ Do not use the pump as an anchorage point for the piping. ▷ Anchor the pipelines in close proximity to the pump and connect them without transmitting any stresses or strains. ▷ Observe the permissible forces and moments at the pump nozzles. ▷ Take appropriate measures to compensate thermal expansion of the piping.
	<div style="background-color: #f4d03f; padding: 5px;">CAUTION</div> <p>Incorrect earthing during welding work at the piping Destruction of rolling element bearings (pitting effect)!</p> <ul style="list-style-type: none"> ▷ Never earth the electric welding equipment on the pump or baseplate. ▷ Prevent current flowing through the rolling element bearings.
	<div style="background-color: #2980b9; color: white; padding: 5px;">NOTE</div> <p>It is recommended to install check and shut-off elements in the system, depending on the type of plant and pump. However, such elements must not obstruct proper drainage or hinder disassembly of the pump.</p>

- ✓ The suction lift line/suction head line has been laid with a rising/downward slope towards the pump.
 - ✓ The nominal diameters of the pipelines are at least equal to the nominal diameters of the pump nozzles.
 - ✓ To prevent excessive pressure losses, adapters to larger diameters have a diffuser angle of approx. 8°.
 - ✓ The pipelines have been anchored in close proximity to the pump and connected without transmitting any stresses or strains.
1. Thoroughly clean, flush and blow through all vessels, pipelines and connections (especially on new installations).
 2. Before installing the pump in the piping, remove the flange covers on the suction and discharge nozzles of the pump.
 3. Connect the pump nozzles with the piping.

5.3.2.2.1 Permissible forces and moments at the pump nozzles

The permissible nozzle loads are given in the following table.

5 Installation at Site

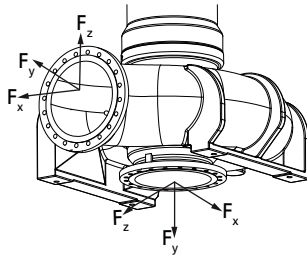


Fig. 20: Forces and moments at the pump nozzles

Table 14: Forces and moments

DN	Forces [N]				Moments [Nm]			
	F_x	F_y	F_z	ΣF	M_x	M_y	M_z	ΣM
100	2700	3350	3000	5250	1250	1450	1750	2600
125	3750	3400	4200	6600	2100	1500	1750	1350
150	4500	5000	4050	7850	2500	1750	2050	3650
200	6000	6700	5400	10450	3250	2300	2650	4800
250	7450	8350	6750	13050	4450	3150	3650	6550
300	8950	10000	8050	15650	6050	4300	4950	8900
350	10450	11650	9400	18250	7750	5500	6350	11400
400	11950	13300	10750	20850	9700	6900	7950	14300
500	14950	16600	13450	26050	14450	10250	11800	21300
600	17950	19900	16150	31250	20200	14400	16600	29900
700	20800	22500	19100	36600	25700	17200	21000	37300

5.3.2.2.2 Auxiliary connections

⚠ WARNING

Screwed plugs subjected to pressure
Risk of injuries by parts flying off and escaping fluid!

► Never use screwed plugs for releasing pressure from the pump casing.

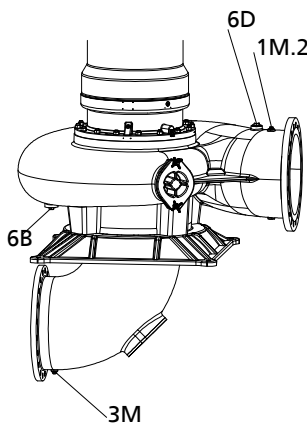


Fig. 21: Auxiliary connections

Table 15: Overview of auxiliary connections

Connection	Description	Thread	Part numbers screw/seal
1 M.2	Pressure gauge	G ½	903.12/411.12
6 D	Venting	G 1¼ ⁸⁾	903.13/411.13
3 M	Pressure/vacuum gauge	G ½	-
6 B	Casing drain	G 1	903.07/411.07

5.3.2.2.3 Vacuum balance line

NOTE

Where fluid has to be pumped out of a vessel under vacuum, it is recommended to install a vacuum balance line.

The following rules apply to vacuum balance lines:

- Minimum nominal line diameter 25 mm.
- The line extends above the highest permissible fluid level in the vessel.
- The shut-off element in the vacuum balance line always stays open during pump operation; it is only closed when the pump is shut down.

⁸⁾ For pump sizes K500-630: G1½; K600-520: G 2

5 Installation at Site

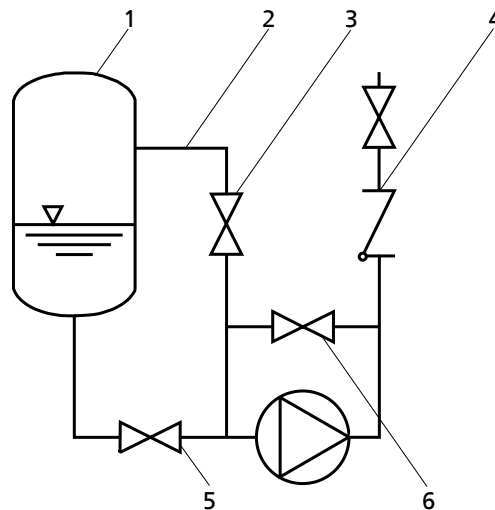


Fig. 22: Vacuum balance line

1	Vessel under vacuum	2	Vacuum balance line
3	Shut-off valve	4	Swing check valve
5	Main shut-off valve	6	Vacuum-tight shut-off valve



NOTE

An additional pipeline fitted with a shut-off valve – from the pump discharge nozzle to the balance line – facilitates venting of the pump before start-up.

5.3.3 Transportable wet installation

Fitting the foot plate or pump stool

Fit the foot plate or pump stool before installing the pump.
Tighten the screws as specified, see table "Tightening torques".

Attaching the lifting chain/rope

1. Attach the lifting chain or rope to the lug/eyebolt on the discharge nozzle side (see illustration on the left and table "Types of attachment").

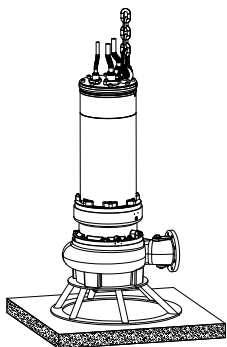


Fig. 23: Attaching the lifting chain/rope

Connecting the piping

The DIN connection can be connected to rigid or flexible pipes.

Installing the pump set

1. Lift the completely assembled pump set with a chain/rope and place it vertically on its prepared place of installation.


5 Installation at Site

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.

The pump set is supplied with power cables; it is designed for direct starting. Star-delta starting is also possible.



	<p>NOTE</p> <p>When laying a cable between the control system and the pump set's connection point, make sure that the number of conductors is sufficient for the sensors. A minimum cross-section of 1.5 mm² is required.</p>
---	---

The motors may be connected to electrical low-voltage grids with nominal voltages and voltage tolerances to IEC 38 or other grids or power supply facilities with maximum nominal voltage tolerances of $\pm 10\%$.

5.4.1.1 Overload protection

1. Protect the pump set against overloading by a thermal time-lag overload protection device in accordance with IEC 947 and local regulations.
2. Set the overload protection device to the rated current specified on the name plate.



5.4.1.2 Level control (not for dry installation - installation type D)

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

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

5.4.1.3 Frequency inverter operation

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


	<p>⚠ DANGER</p> <p>Operation outside the permitted frequency range Explosion hazard!</p> <p>▷ Never operate explosion-proof pump sets outside the specified range.</p>
	<p>⚠ DANGER</p> <p>Incorrect setting of frequency inverter current limit Explosion hazard!</p> <p>▷ Set the current limit to max. 1.2 times the rated current indicated on the name plate.</p>

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

5 Installation at Site


Start-up	<ul style="list-style-type: none"> Data provided by the manufacturer Electrical data of the pump set, particularly the rated current
	<ul style="list-style-type: none"> Ensure short start ramps (max. 5 s) 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	<p>Observe the following limits when operating the pump set via frequency inverter:</p> <ul style="list-style-type: none"> Only utilise up to 95 % of the motor power rating P_2 indicated on the name plate. Frequency range 25-50 Hz
Electromagnetic compatibility	<p>If the pump sets are operated via frequency inverter, RFI emissions will occur, the level of which varies depending on the inverter used (inverter type, interference suppression features, manufacturer). To ensure compliance of the drive system consisting of submersible motor and frequency inverter with the limits stipulated by EN 50081, it is imperative to observe the EMC information provided by the inverter manufacturer. If the manufacturer recommends shielded power cables, a pump set with shielded power cable must be used.</p>
Interference immunity	<p>The pump set generally meets the requirements on interference immunity stipulated by EN 50082. For monitoring the sensors installed, the operator must ensure sufficient interference immunity by selecting and routing the cables in the plant accordingly. No modifications are required on the power/control cable of the pump set itself. Suitable analysing devices must be selected. In this case we recommend to monitor the leakage sensor fitted inside the motor by means of a special relay available from KSB.</p>

5.4.1.4 Sensors

	<p>⚠ DANGER</p> <p>Operating an incompletely connected pump set Explosion hazard! Damage to the pump set!</p> <ul style="list-style-type: none"> Never start up a pump set with incompletely connected power cables or non-operational monitoring devices.
	<p>CAUTION</p> <p>Incorrect connection to power supply Damage to the sensors!</p> <ul style="list-style-type: none"> Observe the limits stated in the following sections of this manual when connecting the sensors.

The pump set is equipped with sensors designed to prevent hazards and damage to the pump set.


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

	<p>NOTE</p> <p>Reliable and safe operation of the pump within the scope of our warranty is only possible if the sensor signals are properly analysed as stipulated in these operating instructions.</p>
---	--

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

5 Installation at Site

5.4.1.4.1 Motor temperature

	<div style="background-color: #f08080; padding: 5px;">⚠ DANGER</div> <p>Insufficient cooling Explosion hazard! Winding damage!</p> <ul style="list-style-type: none"> ▶ Never operate a pump set without operational temperature monitoring. ▶ For explosion-proof pump sets use a thermistor tripping unit with manual reset which is ATEX-approved for monitoring the temperature of explosion-proof motors in "flameproof enclosure" Ex type of protection.
---	--

Pump sets with cooling system (installation types D and K):

Four series-connected thermistors (PTC) with terminals 10 and 11 monitor the winding and coolant temperature. Use a thermistor tripping unit with manual reset. For explosion-proof pump sets use a thermistor tripping unit with manual reset which is ATEX-approved for monitoring the temperature of explosion-proof motors in "flameproof enclosure" Ex d type of protection.

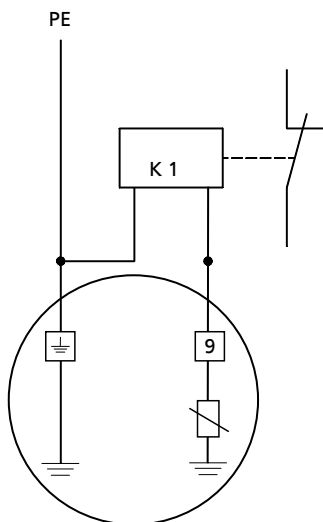
Pump sets without cooling system (installation types P and S):

The pump set is equipped with double monitoring of the winding temperature. Two bimetal switches (terminals 21 and 22, max. 250V~/2A) serve as temperature control devices which open when the winding temperature is too high.

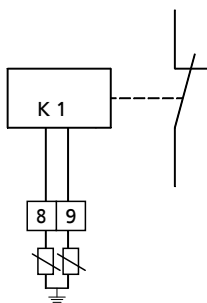
Opening of the switch contacts must result in the pump set cutting out. Automatic re-start is permissible.

For explosion-proof pump sets, the three additional, series-connected (PTC) thermistors with terminals 10 and 11 must be used. They must be connected to a thermistor tripping unit with manual reset and ATEX approval for monitoring the temperature of explosion-proof motors in "flameproof enclosure Ex d" type of protection.

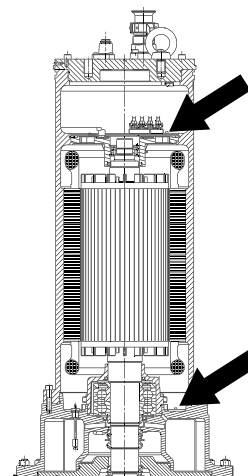
5.4.1.4.2 Leakage inside the motor



Wiring of the electrode relay (standard)



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



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 marking 9). They must be connected to an electrode relay. Tripping of the electrode relay must result in the pump set cutting out.

The electrode relay (K1) must meet the following requirements:

- Sensor circuit 10 to 30V ~
- Tripping current 0.5 to 3 mA (equivalent to a tripping resistance of 3 to 60 kΩ)

Pump sets with vibration sensors

The electrodes of pump sets with vibration sensors have a different wiring system.

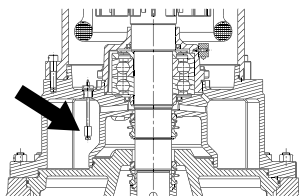


Fig. 24: Float switch

5.4.1.4.3 Leakage at the mechanical seal

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

5.4.1.4.4 Bearing temperature

The lower bearing of the pump set is equipped with a bearing temperature sensor. This sensor is a PT100 resistance thermometer. It has to be connected to a temperature control device with a PT100 input and 2 separate outputs for two different switching points (sensor circuit maximum 6 V/2 mA).

Set the following limits:

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

As an option, the upper bearing can also be equipped with a temperature sensor. The connection and settings are identical with the above. Check on the data sheet whether the pump set is equipped with bearing temperature monitoring.



5.4.1.4.5 Vibrations

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


Recommended settings for vibration monitoring:


- Alarm to be triggered at $v_{eff} = 11 \text{ mm/s}$ (for impeller type E: $v_{eff} = 14 \text{ mm/s}$)
 - These are vibration limits which require remedial action.
 - In general, pump operation may continue until the reasons for the change in vibration level have been detected and remedies have been determined.
- Cut-out at $v_{eff} = 14 \text{ mm/s}$ (for impeller type E: $v_{eff} = 17 \text{ mm/s}$)
 - If these vibration velocities are exceeded, continued pump set operation may result in damage.
 - Suitable action to reduce vibrations should be taken immediately, or the pump set should be switched off.

5.4.2 Electrical connection

	<p>⚠ DANGER</p> <p>Work on the pump set by unqualified personnel Danger of death from electric shock!</p> <ul style="list-style-type: none"> ▷ Always have the electrical connections installed by a trained electrician. ▷ Observe regulations IEC 30364 (DIN VDE 0100) and, for explosion-proof pump sets, IEC 60079 (DIN VDE 0165).
	<p>⚠ WARNING</p> <p>Incorrect connection to the mains Damage to the mains network, short circuit!</p> <ul style="list-style-type: none"> ▷ Observe the technical specifications of the local energy supply companies.


5 Installation at Site


	CAUTION Improper wiring Damage to the power cables! <ul style="list-style-type: none"> ▷ Never move the power cables at temperatures below -25 °C. ▷ Never bend or crush the power cables. ▷ Never use the power cables to lift up the pump set.
---	--


	CAUTION Motor overload Damage to the motor! <ul style="list-style-type: none"> ▷ Protect the motor against overloading by a thermal time-lag overload protection device in accordance with IEC 947 and local regulations.
---	---

For the connection to power supply observe the wiring diagrams (⇒ Section 9.2 Page 83) in the Annex and the information on planning the control system. (⇒ Section 5.4.1 Page 35)

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

	DANGER Incorrect wiring Explosion hazard! <ul style="list-style-type: none"> ▷ The core ends must be connected outside of the potentially explosive atmosphere or inside electrical equipment approved to equipment category II2G.
---	--

	DANGER Operating an incompletely connected pump set Explosion hazard! Damage to the pump set! <ul style="list-style-type: none"> ▷ Never start up a pump set with incompletely connected power cables or non-operational monitoring devices.
---	---

	CAUTION Flow-induced motion Damage to the power cable! <ul style="list-style-type: none"> ▷ Run the power cable upwards without slack.
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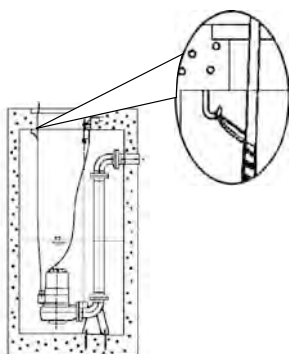


Fig. 25: Fastening the power cables



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

5.4.2.1 Potential equalisation

Wet installation
(installation types K, P, S)

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

5 Installation at Site

	<div style="background-color: #f4a460; padding: 5px;">⚠ DANGER</div> <p>Incorrect wiring Explosion hazard!</p> <ul style="list-style-type: none"> Explosion-proof pump sets installed in a tank must never be retrofitted with an external potential equalisation connection!
	<div style="background-color: #f4a460; padding: 5px;">⚠ DANGER</div> <p>Touching the pump set during operation Electric shock!</p> <ul style="list-style-type: none"> Make sure that the pump set cannot be touched during operation.

Dry installation (installation type D)

Pump sets for dry installation are provided with an external potential equalisation connection. Potential equalisation shall be provided for in compliance with IEC 60204.

Connecting the potential equalisation conductor

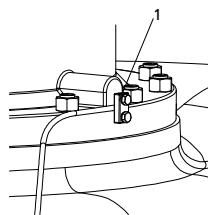


Fig. 26: Connecting the potential equalisation conductor

1	Potential equalisation
---	------------------------

- Connect the potential equalisation conductor to the terminal 81-51 provided on the outside of bearing housing 350.
- Fasten the conductor with hexagon head bolts 901.30 and spring washers 932.30.

6 Commissioning/Start-up/Shutdown


6.1 Commissioning/start-up

6.1.1 Prerequisites for commissioning/start-up

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

- The pump set has been properly connected to the electric power supply and is equipped with all protection devices.
- The pump has been primed with the fluid to be handled.
- The direction of rotation has been checked.
- All auxiliary connections required are connected and operational.
- The lubricant has been checked.
- After prolonged shutdown of the pump (set), the required activities have been carried out. (⇒ Section 6.4 Page 46)


6.1.2 Filling and venting the pump set (for dry installation only - installation type D)

	<div style="background-color: #f08080; padding: 5px;">⚠ DANGER</div> <p>Shaft seal failure caused by dry running Hot or toxic fluid could escape! Damage to the pump!</p> <p>▷ Before starting up the pump set, vent the pump and suction line and fill both with the fluid to be handled.</p>
--	--


1. Vent the pump and suction line and fill both with the fluid to be handled.
2. Fully open the shut-off valve in the suction line.
3. Fully open all auxiliary connections (barrier fluid, flushing liquid, etc).

6.1.3 Start-up

Wet installation (installation types K, P, S)

	<div style="background-color: #ffff00; padding: 5px;">CAUTION</div> <p>Re-starting while motor is still running down Damage to the pump set!</p> <p>▷ Do not re-start the pump set before it has come to a standstill. ▷ Never start up the pump set while the pump is running in reverse.</p>
---	--





- ✓ The fluid level is sufficiently high.

	<div style="background-color: #ffff00; padding: 5px;">CAUTION</div> <p>Pump start-up against a closed shut-off element Increased vibrations! Damage to mechanical seals and bearings!</p> <p>▷ Never operate the pump set against a closed shut-off element.</p>
---	--

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

6 Commissioning/Start-up/Shutdown

Dry installation (installation type D)


	<p>⚠ DANGER</p> <p>The permissible pressure and temperature limits will be exceeded if the pump is operated with the suction and discharge lines closed. Explosion hazard! Leakage of hot or toxic fluids!</p> <ul style="list-style-type: none"> ▶ Never operate the pump with the shut-off elements in the suction line and/or discharge line closed. ▶ Only start up the pump set with the discharge side gate valve slightly or fully open.
	<p>⚠ DANGER</p> <p>Excessive temperatures due to dry running or excessive gas content in the fluid handled Explosion hazard! Damage to the pump set!</p> <ul style="list-style-type: none"> ▶ Never operate the pump set without liquid fill. ▶ Prime the pump as specified. ▶ Always operate the pump within the permissible operating range.
	<p>CAUTION</p> <p>Abnormal noises, vibrations, temperatures or leakage Damage to the pump!</p> <ul style="list-style-type: none"> ▶ Switch off the pump (set) immediately. ▶ Eliminate the causes before returning the pump set to service.
	<p>CAUTION</p> <p>Start-up against open discharge line Overloading of the motor!</p> <ul style="list-style-type: none"> ▶ Use a soft starter. ▶ Use speed control. ▶ Make sure the power reserve of the motor is sufficient.

- ✓ Pump, suction line and inlet tank, if any, have been vented and filled with the fluid handled.
- ✓ The filling and venting lines have been closed.

1. Fully open the shut-off element in the suction head/suction lift line.
2. Close or slightly open the shut-off element in the discharge line.
3. Start up the motor.
4. Immediately after the pump has reached full rotational speed, slowly open the shut-off element in the discharge line and adjust it to the duty point.

6.1.4 Shutdown (only for dry installation - installation type D)


- ✓ The shut-off element in the suction line is and remains open.
1. Close the shut-off element in the discharge line.
 2. Switch off the motor and make sure the pump set runs down smoothly to a standstill.

	<p>NOTE</p> <p>If the discharge line is equipped with a non-return or check valve, the shut-off element may remain open if there is back pressure.</p>
---	---


For prolonged shutdown periods:

6 Commissioning/Start-up/Shut-down

1. Close the shut-off element in the suction line.
2. Close the auxiliary connections.


	CAUTION Danger of frost/freezing Damage to the pump set! <ul style="list-style-type: none"> ▷ Drain the pump set or protect it against freezing.
---	--

6.2 Operating limits

	⚠ DANGER Non-compliance with operating limits Damage to the pump set! <ul style="list-style-type: none"> ▷ Comply with the operating data indicated in the data sheet. ▷ Avoid operation against a closed shut-off element. ▷ Never operate an explosion-proof pump set at ambient and fluid temperatures exceeding those specified in the data sheet or on the name plate. ▷ Never operate the pump set outside the limits specified below.
---	---


6.2.1 Temperature of the fluid handled

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

	CAUTION Danger of frost/freezing Damage to the pump set! <ul style="list-style-type: none"> ▷ Drain the pump set or protect it against freezing.
---	--


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

6.2.2 Frequency of starts

	CAUTION Excessive frequency of starts Damage to the motor! <ul style="list-style-type: none"> ▷ Never exceed the specified frequency of starts.
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To prevent high temperature increases in the motor and excessive loads on the motor, seals and bearings, the frequency of starts shall not exceed 10 start-ups per hour and 5000 start-ups per year.

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

	CAUTION Re-starting while motor is still running down Damage to the pump set! <ul style="list-style-type: none"> ▷ Do not re-start the pump set before it has come to a standstill. ▷ Never start up the pump set while the pump is running in reverse.
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6 Commissioning/Start-up/Shutdown

6.2.3 Minimum fluid level

	<div style="background-color: #f08080; padding: 5px;">⚠ DANGER</div> <p>Pump set running dry Explosion hazard!</p> <p>▷ Never allow an explosion-proof pump set to run dry!</p>
	<div style="background-color: #ffff00; padding: 5px;">CAUTION</div> <p>Fluid level below the specified minimum Damage to the pump set by cavitation!</p> <p>▷ Never allow the fluid level to drop below the specified minimum.</p>

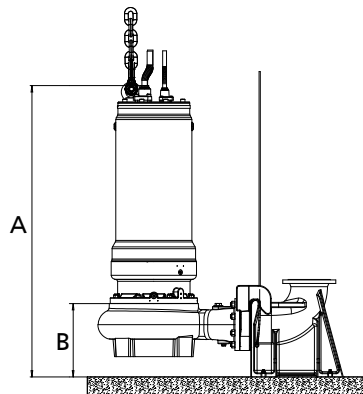


Fig. 27: Minimum fluid level

Pump sets without cooling system (installation types P and S)

Pump sets without cooling system are designed for continuously **submerged** operation. This condition has to be fulfilled for the motor to be cooled sufficiently.

Ready for operation

The pump set is ready for operation as soon as the motor is fully submerged (dimension A). Exact dimensions see general arrangement drawing/outline drawing.


The pump can be operated at a lower fluid level for short periods. If the motor is not sufficiently cooled, an internal temperature monitoring device will trip the pump set and automatically re-start it after the motor has cooled down. The fluid level must not drop below the specified minimum (dimension B). Exact dimensions see general arrangement drawing/outline drawing.

Pump sets with cooling system (installation type K)

Pump sets with cooling system are suitable for continuous operation with the motor **outside the fluid**.

Ready for operation


The pump set is ready for operation when the minimum fluid level has been reached (dimension B). Exact dimensions see general arrangement drawing/outline drawing.

	<div style="background-color: #0070c0; color: white; padding: 5px;">NOTE</div> <p>Compliance with dimension B does not guarantee trouble-free operation of the pump set. Depending on the pump's duty point, higher fluid levels may be required. Observe the NPSH values indicated in the characteristic curve (see hydraulic characteristic curves).</p>
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6.2.4 Density of the fluid handled

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

6 Commissioning/Start-up/Shutdown


	CAUTION
	<p>Excessive density of the fluid handled Motor overload!</p> <ul style="list-style-type: none"> ▶ Observe the information on fluid density indicated in the data sheet. ▶ Make sure the power reserve of the motor is sufficient.

6.2.5 Supply voltage


	⚠ DANGER
	<p>Non-compliance with permissible supply voltage tolerances Explosion hazard!</p> <ul style="list-style-type: none"> ▶ Never operate an explosion-proof pump (set) outside the specified range.

The maximum permissible supply voltage deviation is $\pm 10\%$, for explosion-proof pump sets $\pm 5\%$ of the rated voltage. The voltage difference between the individual phases must not exceed 1%.

6.2.6 Frequency inverter operation

	⚠ DANGER
	<p>Operation outside the permitted frequency range Explosion hazard!</p> <ul style="list-style-type: none"> ▶ Never operate explosion-proof pump sets outside the specified range.


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

	CAUTION
	<p>Pumping solids-laden fluids at reduced speed Increased wear and clogging!</p> <ul style="list-style-type: none"> ▶ Never operate the pump set with flow velocities below 0.7 m/s in horizontal pipes and 1.2 m/s in vertical pipes.



6.3 Shutdown/storage/preservation

6.3.1 Measures to be taken for shutdown

The pump set remains installed

	⚠ WARNING
	<p>Pump set started up inadvertently Risk of injury by moving parts!</p> <ul style="list-style-type: none"> ▶ Always make sure the electrical connections are disconnected before carrying out work on the pump set. ▶ Make sure that the pump set cannot be switched on accidentally.

6 Commissioning/Start-up/Shutdown

	<p>⚠ WARNING</p> <p>Fluids posing a health hazard or hot fluids Risk of personal injury!</p> <ul style="list-style-type: none"> ▷ Observe all relevant laws. ▷ When draining the fluid take appropriate measures to protect persons and the environment. ▷ Decontaminate pumps handling fluids posing a health hazard.
	<p>CAUTION</p> <p>Danger of frost/freezing Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ If there is any danger of frost/freezing, remove the pump set from the fluid handled and clean, preserve and store it.

- ✓ Make sure sufficient fluid is available for the operation check run of the pump set.
- 1. For prolonged shutdown periods, start up the pump set regularly between once a month and 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. (⇒ Section 7.1 Page 47)
- 1. Clean the pump set.
- 2. Preserve the pump set. (⇒ Section 3.2 Page 13)
- 3. Observe the instructions given in (⇒ Section 3.1 Page 12).

6.4 Returning to service

For returning the pump set to service observe the sections on commissioning/start-up (⇒ Section 6 Page 41) and the operating limits (⇒ Section 6.2 Page 43).





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

	<p>⚠ WARNING</p> <p>Failure to re-install or re-activate protective devices Risk of personal injury from moving parts or escaping fluid!</p> <ul style="list-style-type: none"> ▷ As soon as the work is complete, re-install and/or re-activate any safety-relevant and protective devices.
	<p>NOTE</p> <p>On pumps/pump sets older than 5 years we recommend replacing all elastomer seals.</p>


7 Servicing/Maintenance

7.1 Safety regulations

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

	<p>⚠ DANGER</p> <p>Sparks produced during maintenance work Explosion hazard!</p> <ul style="list-style-type: none"> ▶ Always perform maintenance work on explosion-proof pump sets outside potentially explosive atmospheres only.
	<p>⚠ WARNING</p> <p>Pump set started up inadvertently Risk of injury by moving parts!</p> <ul style="list-style-type: none"> ▶ Always make sure the electrical connections are disconnected before carrying out work on the pump set. ▶ Make sure that the pump set cannot be switched on accidentally.
	<p>⚠ WARNING</p> <p>Fluids posing a health hazard or hot fluids Risk of personal injury!</p> <ul style="list-style-type: none"> ▶ Observe all relevant laws. ▶ When draining the fluid take appropriate measures to protect persons and the environment. ▶ Decontaminate pumps handling fluids posing a health hazard.
	<p>NOTE</p> <p>Special regulations apply to repair work on explosion-proof pump sets. Modification or alteration of the pump set may affect explosion protection and are only permitted after consultation with the manufacturer.</p>

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.

	<p>NOTE</p> <p>All maintenance, service and installation work can be carried out by KSB Service. Find your contact in the attached "Addresses" booklet or on the Internet at www.ksb.com/contact.</p>
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Never use force when dismantling and reassembling a pump set.

7.2 Servicing/Inspection


	<p>NOTE</p> <p>Apply liquid sealing to all screwed plugs.</p>
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Table 16: Overview of maintenance work

Maintenance intervals	Maintenance work	For details see ...
After 4,000 operating hours ⁹⁾	Insulation resistance test	(⇒ Section 7.2.1.3 Page 48)
	Checking the power cables	(⇒ Section 7.2.1.2 Page 48)
	Visual inspection of lifting chain/rope	(⇒ Section 7.2.1.1 Page 48)

7 Servicing/Maintenance

Maintenance intervals	Maintenance work	For details see ...
After 8,000 operating hours ¹⁰⁾	Checking the sensors	(⇒ Section 7.2.1.4 Page 49)
	Checking the mechanical seal leakage	(⇒ Section 7.2.1.5 Page 50)
	Lubricant change or coolant check	(⇒ Section 7.2.3.1.4 Page 56) (⇒ Section 5.2.4 Page 21)
	Lubrication of bearings	(⇒ Section 7.2.3.2.3 Page 58)
Every five years	General overhaul (including coolant change on installation types K and D)	(⇒ Section 7.2.2.3 Page 53)

7.2.1 Inspection work


7.2.1.1 Checking the lifting chain/rope

- ✓ The pump set has been pulled out of the pump sump and cleaned.
- 1. Inspect the lifting chain or rope as well as the attachment for any visible damage.
- 2. Replace any damaged components by original spare parts.

7.2.1.2 Checking the power supply cables

- Visual inspection**
- ✓ The pump set has been pulled out of the pump sump and cleaned.
 - 1. Inspect the power supply cables for any visual damage.
 - 2. Replace any damaged components by original spare parts.

- Checking the earth conductor**
- ✓ The pump set has been pulled out of the pump sump and cleaned.
 - 1. Measure the resistance between earth conductor and earth.
The resistance measured must be less than 1 Ω.
 - 2. Replace any damaged components by original spare parts.

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

7.2.1.3 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 max. measuring voltage is 1000 V.
 - 1. Measure winding against earth.
To do so, connect all winding ends together.
 - 2. Measure the winding temperature sensor against earth.
To do so, connect all conductor ends of the winding temperature sensors together and connect all winding ends to earth.
- ⇒ The insulation resistance of the conductor ends against earth 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.


⁹⁾ At least once a year

¹⁰⁾ At least every two years

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	NOTE If the insulation resistance for one of the power supply cables is less than 1 MΩ, the cable is defective and must be replaced.
	NOTE If the insulation resistance values measured on the motor are too low, the winding insulation is defective. The pump set must not be returned to service in this case.

7.2.1.4 Checking the sensors

	CAUTION Excessive test voltage Damage to the sensors! ▷ Never test the sensors with voltages exceeding 30 V.
---	---

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

Temperature sensors in the motor winding

Table 17: Resistance measurement

Measurement between terminals ...	Resistance
21 and 22 ¹¹⁾	> 1 Ω
10 and 11	200 Ω - 1000 Ω

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

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

If the sensors need to be repaired, use the back-up sensors provided at the same place in the stator winding.

Leakage sensors in the motor

Table 18: Measuring resistance of leakage sensor in the motor

Measurement between terminals ...	Resistance
9 and earth conductor (PE)	> 60 kΩ
8 and 9 ¹²⁾	> 60 kΩ

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

Float switch (mechanical seal leakage)

Table 19: Resistance measurement of the float switch

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

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

Bearing temperature sensor



Table 20: Resistance measurement of the bearing temperature sensor

Measurement between terminals ...	Resistance
15 and 16 (also 16 and 17, if applicable)	100 Ω - 120 Ω

¹¹⁾ Only for pump sets without cooling system, installation types P and S

¹²⁾ Only for pump sets with vibration sensor

7.2.1.5 Checking the mechanical seal for leakage

	<div style="background-color: #f4a460; padding: 5px;">⚠ WARNING</div> <p>Fluids posing a health hazard Hazardous to persons and the environment!</p> <ul style="list-style-type: none"> ▷ Collect and properly dispose of flushing liquid and any fluid residues. ▷ Wear safety clothing and a protective mask, if required. ▷ Observe all legal regulations on the disposal of fluids posing a health hazard.
	<div style="background-color: #0070c0; color: white; padding: 5px;">NOTE</div> <p>Slight wear of the mechanical seal is unavoidable. This will be aggravated by abrasive substances contained in the fluid handled.</p>

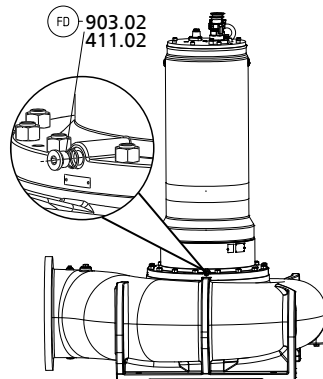



Fig. 28: Checking the mechanical seal for leakage


- ✓ The pump set has been placed in vertical position.
- 1. Place a suitable container under screwed plug 903.02.
- 2. Remove screwed plug 903.02 and joint ring 411.02.
- 3. Drain the leakage.

	<div style="background-color: #0070c0; color: white; padding: 5px;">NOTE</div> <p>If more than 5 litres of leakage should escape we recommend to replace the mechanical seals.</p>
---	---

- 4. Close screwed plug 903.02 with joint ring 411.02 again.

7.2.1.6 Visual inspection of the pump set through the inspection hole (only for dry installation - installation type D)

If there are problems with clogging, the inside of the pump casing and the impeller can be checked via the inspection hole.

	<div style="background-color: #f4a460; padding: 5px;">⚠ WARNING</div> <p>Fluids posing a health hazard Hazardous to persons and the environment!</p> <ul style="list-style-type: none"> ▷ Collect and properly dispose of flushing liquid and any fluid residues. ▷ Wear safety clothing and a protective mask, if required. ▷ Observe all legal regulations on the disposal of fluids posing a health hazard.
---	---



⚠ WARNING

Hands or objects inside 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.

If there is a problem which requires visual inspection, observe the following instructions:

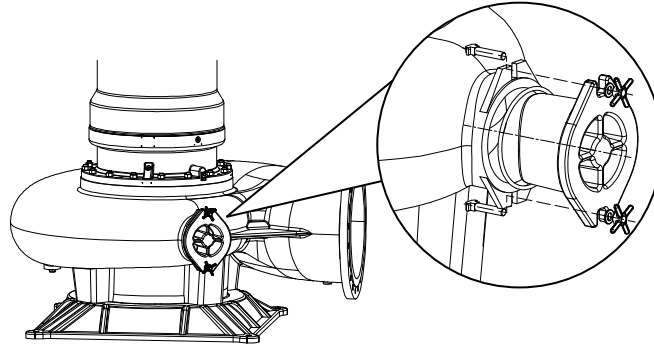


Fig. 29: Inspection hole at the casing

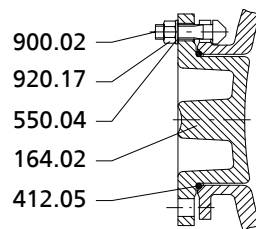


Fig. 30: Inspection hole in the casing

Opening the inspection hole

- Close the shut-off valve on the suction side.
- Switch off the drive and make sure it cannot be re-started accidentally.
- Close the shut-off valve on the discharge side.
- Open the drain plug (auxiliary connection 6B).
- Collect and dispose of any liquid residues.
- Unscrew nuts 920.17 at the inspection hole and remove inspection cover 164.02.
- Perform a visual inspection with a torch or similar.

Closing the inspection hole


- Fit new O-ring 412.05.
- Fit inspection cover 164.02.
- Fit discs 550.04 and nuts 920.17 on screws 900.02. Tighten the nuts.
- Observe the instructions on commissioning/start-up. (⇒ Section 6.1.1 Page 41)

7.2.2 Coolant (only for pump sets with cooling system - installation types D and K)

The pump set's cooling system is filled with an environmentally friendly propylene glycol / water mixture. The coolant additive prevents corrosion in the cooling system and provides frost protection down to -20°C. The coolant also lubricates the mechanical seals.

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7.2.2.1 Coolant quality

	CAUTION
	Incorrect coolant mixture Corrosion of the cooling system
	<p>► Always use the exact coolant mixture.</p>

1.2-propylene glycol/water mixture with corrosion inhibitors for frost protection down to -20°C.
(e.g. Tyfocor L¹³⁾ /water mixture, mixing ratio 38:62)

7.2.2.2 Coolant quantity

Table 21: Coolant quantity in litres


Hydraulic system	Motor					
	35 4	95 4	130 4	200 4	320 6	400 6
	50 4	110 4	155 4	250 4	360 6	440 6
	65 4	80 6	175 4	300 4	260 8	480 6
	80 4	100 6	120 6	350 4	300 8	350 8
	32 6	75 8	140 6	190 6	230 10	400 8
	40 6		165 6	225 6	195 12	270 10
	50 6		90 8	260 6		310 10
	60 6		110 8	150 8		350 10
	26 8		130 8	185 8		265 12
	35 8		40 10	220 8		230 12
	50 8		60 10	110 10		300 12
			75 10	150 10		
			90 10	190 10		
				105 12		
				135 12		
				165 12		
F, K 100-401	28	30	60	-	-	-
E, F, K 150-401	28	30	60	-	-	-
K 151-401	28	30	60	-	-	-
K 200-330	28	30	60	-	-	-
E, K 200-401	28	30	60	-	-	-
K 250-400	28	30	60	-	-	-
K 250-401	28	30	60	-	-	-
K 300-400	28	30	60	-	-	-
K 300-401	28	30	60	-	-	-
K 150-500	40	42	75	80	-	-
K200-500	40	42	75	80	-	-
K 200-501	40	42	75	80	-	-
K 300-420	40	42	75	80	-	-
K 300-500	40	42	75	80	-	-
K 300-503	40	42	75	80	-	-
K 350-420	40	42	75	80	-	-
K 350-500	40	42	75	80	-	-
K 350-501	40	42	75	80	-	-
K 400-500	40	42	75	80	-	-
K 200-631	-	-	90	90	110	120
K 250-630	-	-	90	90	110	120
K 350-630	-	-	90	90	110	120
K 350-636	-	-	90	90	110	120
K 400-630	-	-	90	90	110	120
K 500-630	-	-	90	90	110	120

¹³⁾ Made by: Metalsol Chemie, Magdeburg, Germany

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Hydraulic system	Motor					
	35 4	95 4	130 4	200 4	320 6	400 6
	50 4	110 4	155 4	250 4	360 6	440 6
	65 4	80 6	175 4	300 4	260 8	480 6
	80 4	100 6	120 6	350 4	300 8	350 8
	32 6	75 8	140 6	190 6	230 10	400 8
	40 6		165 6	225 6	195 12	270 10
	50 6		90 8	260 6		310 10
	60 6		110 8	150 8		350 10
	26 8		130 8	185 8		265 12
	35 8		40 10	220 8		230 12
	50 8		60 10	110 10		300 12
			75 10	150 10		
			90 10	190 10		
				105 12		
				135 12		
				165 12		
K 500-640	-	-	90	90	110	120
K 500-641	-	-	90	90l	110	120
K 600-520	-	-	90	90	-	-
K 350-710	-	-	-	90	110	120
K 600-710	-	-	-	90	110	120
K 700-900	-	-	-	-	125	135

7.2.2.3 Changing the coolant



⚠ WARNING

Coolants posing a health hazard
Risk to persons and the environment!

- ▶ When draining the coolant take appropriate measures to protect persons and the environment.
- ▶ Observe all legal regulations on the disposal of fluids which pose a health hazard.

Draining the coolant

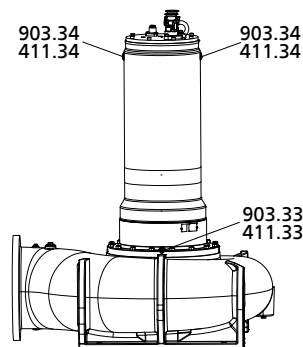



Fig. 31: Coolant filler openings

✓ The pump set has been placed in vertical position.

1. Place a suitable container under screwed plug 903.33. Coolant quantity see (⇒ Section 7.2.2.2 Page 52)
2. Unscrew both screwed plugs 903.34 with joint rings 411.34 from the coolant fillers openings (opposed by 180°)
3. Undo screwed plug 903.33 with joint ring 411.33 and drain off the coolant.

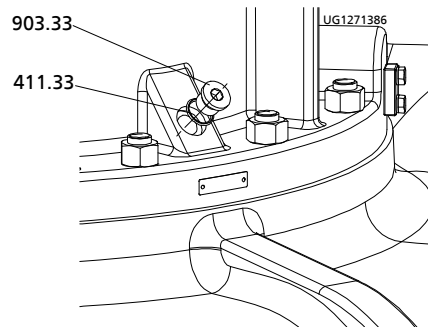


NOTE

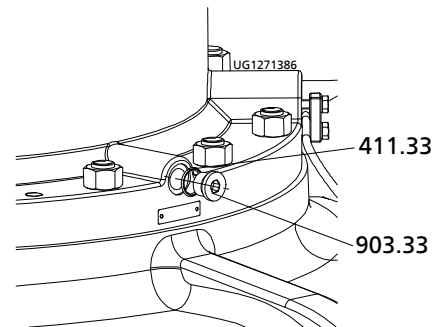
The drain plug is not located at the lowest point of the cooling system. To fully drain all coolant, proceed as follows:

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4. **Option 1:** Insert a suction pump through the coolant filler opening and pump off the remaining coolant.
Option 2: Place the pump in horizontal position to fully drain the cooling system.



Draining the coolant, option 1



Draining the coolant, option 2



NOTE

The coolant is bright and transparent in appearance. A slight discolouration, caused by the running-in process of new mechanical seals or small amounts of leakage from the fluid pumped, has no detrimental effect. However, if the coolant is severely contaminated by the fluid handled, this will suggest a defect on the mechanical seals.

Topping up the coolant

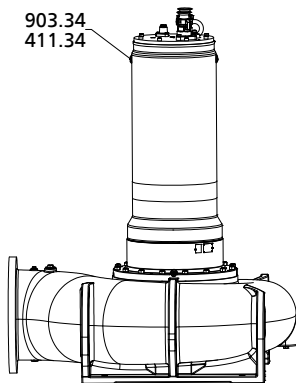


Fig. 32: Topping up the coolant

- ✓ The pump set has been placed in vertical position.
- 1. Close screwed plugs 903.33 with joint ring 411.33.
- 2. Fill coolant through the filler opening (screwed plug 903.34) until it overflows. (⇒ Section 7.2.2.2 Page 52)
- 3. Close screwed plug 903.34 again with a new joint ring 411.34.

7.2.3 Lubrication and lubricant change

7.2.3.1 Lubricating the mechanical seal (only for pump sets without cooling system - installation types S and P)

7.2.3.1.1 Intervals

Replace the lubricant every 8000 operating hours but at least every 2 years.

7.2.3.1.2 Lubricant quality


The lubricant reservoir is filled at the factory with an environmentally friendly, non-toxic lubricant of medical quality (unless otherwise required by the customer). The following lubricants can be used for lubricating the mechanical seals:

Recommended quality of lubricant

- Thin-bodied paraffin oil; made by Merck, No.: 7174
- Merkur white oil Pharma 40; made by DEA

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- Alternative:**
- Equivalent brand of medical quality, non-toxic
 - Water-glycol mixture
 - All non-doped and doped motor oils of classes SAE 10W to SAE 20W

	⚠ WARNING
	Contamination of fluid handled by lubricant Hazardous to persons and the environment! <p>► Using machine oil is only permitted if the oil is disposed of properly.</p>

7.2.3.1.3 Lubricant quantity



Table 22: Lubricant quantity in litres

Hydraulic system	Motor					
	35 4	95 4	130 4	200 4	320 6	400 6
	50 4	110 4	155 4	250 4	360 6	440 6
	65 4	80 6	175 4	300 4	260 8	480 6
	80 4	100 6	120 6	350 4	300 8	350 8
	32 6	75 8	140 6	190 6	230 10	400 8
	40 6		165 6	225 6	195 12	270 10
	50 6		90 8	260 6		310 10
	60 6		110 8	150 8		350 10
	26 8		130 8	185 8		265 12
	35 8		40 10	220 8		230 12
	50 8		60 10	110 10		300 12
			75 10	150 10		
			90 10	190 10		
				105 12		
				135 12		
				165 12		
F, K 100-401	4.0	5.5	-	-	-	-
E, F, K 150-401	4.0	5.5	-	-	-	-
K 151-401	4.0	5.5	-	-	-	-
K 200-330	4.0	5.5	-	-	-	-
E, K 200-401	4.0	5.5	-	-	-	-
K 250-400	4.0	5.5	-	-	-	-
K 250-401	4.0	5.5	-	-	-	-
K 300-400	4.0	5.5	-	-	-	-
K 300-401	4.0	5.5	-	-	-	-
K 150-500	4.7	7.0	7.5	-	-	-
K200-500	4.7	7.0	7.5	-	-	-
K 200-501	4.7	7.0	7.5	-	-	-
K 300-420	4.7	7.0	7.5	-	-	-
K 300-500	4.7	7.0	7.5	-	-	-
K 300-503	4.7	7.0	7.5	-	-	-
K 350-420	4.7	7.0	7.5	-	-	-
K 350-500	4.7	7.0	7.5	-	-	-
K 350-501	4.7	7.0	7.5	-	-	-
K 400-500	4.7	7.0	7.5	-	-	-
K 200-631	-	-	8.5	7.0	10.5	10.5
K 250-630	-	-	8.5	7.0	10.5	10.5
K 350-630	-	-	8.5	7.0	10.5	10.5
K 350-636	-	-	8.5	7.0	10.5	10.5
K 400-630	-	-	8.5	7.0	10.5	10.5
K 500-630	-	-	8.5	7.0	10.5	10.5
K 500-640	-	-	8.5	7.0	10.5	10.5
K 500-641	-	-	8.5	7.0	10.5	10.5
K 600-520	-	-	8.5	7.0	10.5	10.5

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Hydraulic system	Motor					
	35 4	95 4	130 4	200 4	320 6	400 6
	50 4	110 4	155 4	250 4	360 6	440 6
	65 4	80 6	175 4	300 4	260 8	480 6
	80 4	100 6	120 6	350 4	300 8	350 8
	32 6	75 8	140 6	190 6	230 10	400 8
	40 6		165 6	225 6	195 12	270 10
	50 6		90 8	260 6		310 10
	60 6		110 8	150 8		350 10
	26 8		130 8	185 8		265 12
	35 8		40 10	220 8		230 12
	50 8		60 10	110 10		300 12
			75 10	150 10		
			90 10	190 10		
				105 12		
				135 12		
				165 12		
K 350-710	-	-	-	7.0	10.5	10.5
K 600-710	-	-	-	7.0	10.5	10.5
K 700-900	-	-	-	-	10.5	10.5

7.2.3.1.4 Changing the lubricant

	WARNING
	Lubricants posing a health hazard Risk to persons and the environment! <ul style="list-style-type: none"> When draining the lubricant take appropriate measures to protect persons and the environment. Observe all legal regulations on the disposal of liquids posing a health hazard.
	WARNING
	Excess pressure in the lubricant reservoir Liquid spurting out when the lubricant reservoir is opened at operating temperature! <ul style="list-style-type: none"> Open the screwed plug of the lubricant reservoir very carefully.

Draining the lubricant

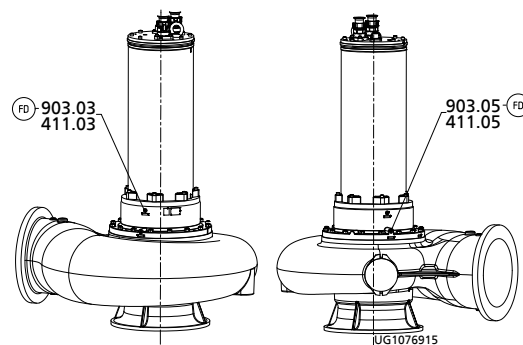


Fig. 33: Draining and re-filling the lubricant

- ✓ The pump set has been placed in vertical position.
 - 1. Place a suitable container under screwed plug 903.05.
 - 2. Unscrew and remove screwed plug 903.03 with joint ring 411.03.
 - 3. Undo screwed plugs 903.05 with joint ring 411.05 and drain off the lubricant.
- #### Filling in the lubricant
- ✓ The pump set has been placed in vertical position.
 - 1. Position the pump set as illustrated.
 - 2. Close screwed plugs 903.05 with joint ring 411.05.


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3. Pour lubricant into lubricant filler opening 903.03 until the lubricant reservoir overflows. (⇒ Section 7.2.3.1.3 Page 55)
4. Close screwed plug 903.03 again with a new joint ring 411.03.

7.2.3.2 Lubricating the rolling element bearings

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


7.2.3.2.1 Grease quality

	<div style="background-color: yellow; padding: 2px;">CAUTION</div> <p>Mix of different grease types Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ 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:

Grease quality	<ul style="list-style-type: none"> ▪ Type A¹⁴⁾ <ul style="list-style-type: none"> – Lithium soap grease suitable for high temperatures ▪ Type B¹⁴⁾ <ul style="list-style-type: none"> – Synthetic high-temperature grease
Recommended commercially available brands	<ul style="list-style-type: none"> ▪ Type A¹⁴⁾ <ul style="list-style-type: none"> – ESSO UNIREX N3 – FAG ARCANOL L40 – Total multis Complex EP 2 ▪ Type B¹⁴⁾ <ul style="list-style-type: none"> – Klueberquiet BQH 72-102

7.2.3.2.2 Grease quantity

	<div style="background-color: #0070C0; color: white; padding: 2px;">NOTE</div> <p>Always use grease type B for motors in stainless steel design (..NC.. motors).</p>
---	---

¹⁴⁾ Also see grease type in the section on Grease quantity.

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Table 23: Grease quantity

Motor	35 4	95 4	130 4	155...-K	200 4	320 6	400 6
	50 4	110 4	155 4...-S	155...-D	250 4	360 6	440 6
	65 4	80 6	155 4...-P		300 4	260 4	480 6
	80 4	100 6	175 4		350 4	300 8	350 8
	32 6	75 8	120 6		190 6	230 10	400 8
	40 6		140 6		225 6	195 12	270 10
	50 6		165 6		260 6		310 10
	60 6		90 8		150 8		350 10
	26 8		110 8		185 8		265 12
	35 8		130 8		220 8		230 12
	50 8		40 10		110 10		300 12
			60 10		150 10		
			75 10		190 10		
			90 10		105 12		
					135 12		
					165 10		
Grease quantity	70g	90g	110g	110g	160g	180g	180g
Grease type ¹⁵⁾	Type A	Type A	Type A	Type B	Type B	Type B	Type B

7.2.3.2.3 Re-lubrication

Lubricating nipple

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

	⚠ DANGER Dry running Risk of explosion! <ul style="list-style-type: none"> Re-lubricate explosion-proof pump sets outside potentially explosive atmospheres.
	⚠ WARNING Hands or objects inside the pump casing Risk of injuries, damage to the pump! <ul style="list-style-type: none"> Never insert your hands or any other objects into the pump. Check that the inside of the pump is free from any foreign objects.
	CAUTION Incomplete re-lubrication Bearing damage! <ul style="list-style-type: none"> Always re-lubricate the bearings with the pump set in operation.

¹⁵⁾ Also see the section on Grease quality.

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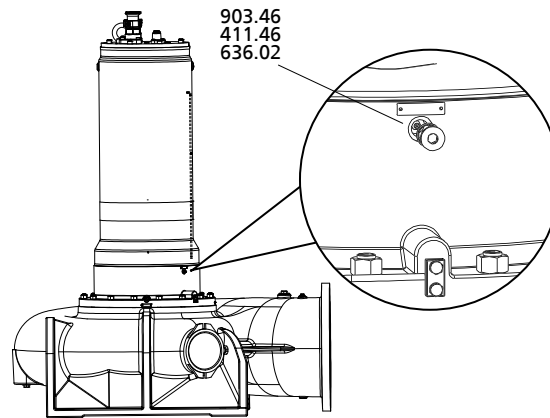




Fig. 34: Lubricating nipple

- ✓ The pump set has been positioned on a level surface.
- ✓ The pump set is secured against tipping over.
- 1. Remove screwed plug 903.46 and joint ring 411.46.
- 2. Connect the pump set to the power supply.

	<p>CAUTION</p> <p>Pump set running dry Increased vibrations! Damage to mechanical seals and bearings!</p> <ul style="list-style-type: none"> ▷ Never operate the pump set for more than 60 seconds outside the fluid to be handled.
---	--

- 3. Start up the pump set.
- 4. Fill in grease via lubricating nipple 636.02
- 5. Disconnect the pump set from the power supply again and make sure it cannot be switched on accidentally.
- 6. Close screwed plug 903.46 with joint ring 411.46 again.

7.3 Drainage/disposal



	<p>⚠ WARNING</p> <p>Fluids posing a health hazard Hazardous to persons and the environment!</p> <ul style="list-style-type: none"> ▷ Collect and properly dispose of flushing liquid and any fluid residues. ▷ Wear safety clothing and a protective mask, if required. ▷ Observe all legal regulations on the disposal of fluids posing a health hazard.
---	--

- 1. Always flush the pump if it has been used for handling noxious, explosive, hot or other hazardous fluids.
- 2. Always flush and clean the pump before sending it to the workshop.
Make sure to add a certificate of decontamination. (⇒ Section 11 Page 90)

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7.4 Dismantling the pump set


7.4.1 General information/Safety regulations

	<p>⚠ WARNING</p> <p>Unqualified personnel performing work on the pump (set) Risk of personal injury!</p> <ul style="list-style-type: none"> ▶ Always have repair and maintenance work performed by specially trained, qualified personnel.
	<p>⚠ WARNING</p> <p>Hot surface Risk of personal injury!</p> <ul style="list-style-type: none"> ▶ Allow the pump set to cool down to ambient temperature.

Observe the general safety instructions and information.

For dismantling and reassembly observe the general assembly drawing.

In case of damage you can always contact our service staff.

	<p>⚠ DANGER</p> <p>Insufficient preparation of work on the pump (set) Risk of personal injury!</p> <ul style="list-style-type: none"> ▶ Properly shut down the pump set. ▶ Close the shut-off elements in the suction and discharge line. ▶ Drain the pump and release the pump pressure. ▶ Close any auxiliary connections. ▶ Allow the pump set to cool down to ambient temperature.
--	---

7.4.2 Preparing the pump set

- ✓ The notes and steps stated in (⇒ Section 7.4.1 Page 60) have been observed/ carried out.
- 1. Completely disconnect the pump set from the power supply.
- 2. On pump sets with cooling system (installation types S and P) drain the lubricant.
- 3. On pump sets with cooling system (installation types D and K) drain the coolant.
- 4. Drain the leakage chamber and leave it open for the duration of the disassembly.

7.4.3 Dismantling the pump section

Dismantle the pump section in accordance with the relevant general assembly drawing.

7.4.3.1 Removing the back pull-out unit

1. Unscrew screwed connection 902.01 and 920.01 and pull the complete back pull-out unit out of pump casing 101.
2. Place the back pull-out unit in a safe and dry installation area and secure it against tipping over or rolling off.

7.4.3.2 Removing the impeller

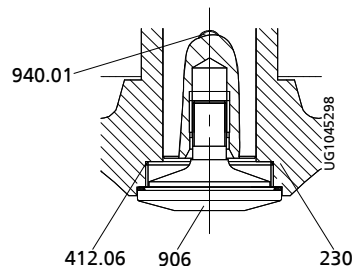
The procedures for removing the impeller differ depending on the hydraulic system and motor in question.

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Table 24: Impeller fastening elements

Hydraulic system	Motor	Impeller fastening elements
F 100-401	all	N055
K 100-401		
E 150-401		
K 150-401		
F 150-401		
K 151-401		
K 200-330		
K 200-401		
K 250-400		
K 250-401		
K 300-400		
K 300-401		
E 200-401		
K 150-500	all	M85x2
K 200-500		M125x2
K 200-501		M100x2
K 300-420		M100x2
K 300-500		M125x2
K 300-503		M125x2
K 350-420	60 6	M85x2
	80 6	
	100 6	
	120 6	
	140 6	M100x2
	165 6	
K 350-500	all	M125x2
K 350-501		M100x2
K 400-500		M100x2
K 200-631		M125x2
K 250-630		M125x2
K 350-630		M125x2
K 350-636		M125x2
K 400-630		M125x2
K 500-630		M125x2
K 500-640		M100x2
K 500-641		M100x2
K 350-710	all	M125x2
K 600-710		M125x2
K 700-900		M125x2
K 600-520	all	M100x2

Impeller fastening elements N055:


Fig. 35: Impeller fastening elements N055

1. Unscrew impeller screw 906 (right-hand thread).
2. Remove O-ring 412.06.

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3. Pull off impeller 230 with a special puller.
4. Remove key 940.01.

Impeller fastening elements M85x2, M100x2, M125x2

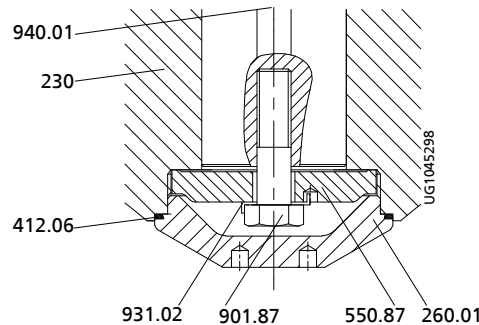


Fig. 36: Impeller fastening elements M85x2, M125x2 and M100x2

1. Unscrew impeller hub cap 260.01 using a special wrench (right-hand thread).
2. Remove O-ring 412.06.
3. Bend open lockwasher 931.02, undo hexagon head bolt 901.87 and remove them together with disc 550.87.
4. Pull off impeller 230 with a special puller.
5. Remove key 940.01.

Impeller fastening elements M100x2 (for hydraulic system K 500-641)

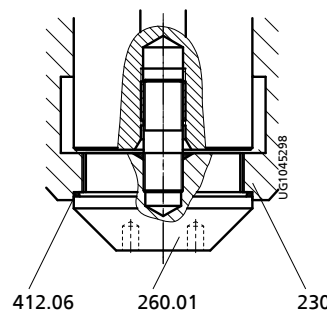


Fig. 37: Impeller fastening elements M100x2

1. Unscrew impeller screw 906.01 using a special wrench (right-hand thread).
2. Remove O-ring 412.06.
3. Pull off impeller 230 with a special puller.
4. Remove key 940.01.

7.4.3.2.1 Using a special puller

1. Screw hexagon head bolt 1 into the shaft end to prevent the shaft thread from being damaged.
2. Screw part 2 into the impeller.
3. Screw threaded bolt 3 into part 2 and pull off the impeller.

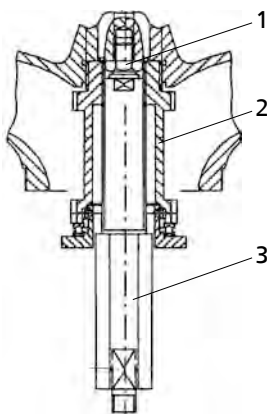


Fig. 38: Puller

Table 25: Special puller for removing the impeller

Hydraulic system	Motor	Impeller fastening elements	Puller
F 100-401	all	N055	AV1
K 100-401			
E 150-401			
K 150-401			
F 150-401			
K 151-401			
K 200-330			

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Hydraulic system	Motor	Impeller fastening elements	Puller
K 200-401			
K 250-400			
K 250-401			
K 300-400			
K 300-401			
E 200-401			AV2
K 150-500	all	M85x2	AV3
K 200-500		M125x2	AV4
K 200-501		M100x2	AV5
K 300-420		M100x2	AV4
K 300-500		M125x2	
K 300-503		M125x2	
K 350-420	60 6 80 6 100 6	M85x2	AV3
	120 6 140 6 165 6	M100x2	AV5
K 350-500	all	M125x2	AV4
K 350-501		M100x2	AV5
K 400-500		M100x2	AV4
K 200-631		M125x2	
K 250-630		M125x2	
K 350-630		M125x2	
K 350-636		M125x2	
K 400-630		M125x2	AV5
K 500-630		M125x2	
K 500-640		M100x2	AV5
K 500-641		M100x2	AV5
K 350-710	all	M125x2	AV4
K 600-710		M125x2	
K 700-900		M125x2	
K 600-520	all	M100x2	AV5

7.4.3.3 Dismantling the mechanical seal

Dismantle the mechanical seal in accordance with the general arrangement drawings. (⇒ Section 9.4 Page 88)

7.4.3.3.1 Dismantling the pump-end mechanical seal


- ✓ The back pull-out unit and the impeller have been removed as described above.
- 1. Pull the rotating assembly of mechanical seal 433.02 off shaft 210.
- 2. Remove discharge cover 163 from bearing bracket 330.
- 3. Push the stationary seat of mechanical seal 433.02 out of discharge cover 163.

7.4.3.3.2 Dismantling the motor-end mechanical seal

- ✓ The back pull-out unit and the impeller have been removed as described above.
- 1. Remove taper lock ring 515 or circlip 932.03.
- 2. Pull the rotating assembly of mechanical seal 433.01 off shaft 210.


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7.4.3.4 Removing the cooling jacket

	<p>CAUTION</p> <p>Removing the cooling jacket without using eyebolts Damage to the cooling jacket!</p> <p>▷ Always use eyebolts to pull of the cooling jacket.</p>
---	--

1. Screw two G ½ or R½ eyebolts into the filler openings.
2. Attach hoisting tackle to the eyebolts.
3. Use the hoisting tackle to pull the cooling jacket upwards and remove it from the pump set.

7.4.4 Dismantling the motor section


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

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

7.5 Reassembling the pump set

7.5.1 General information/Safety regulations

	<p>CAUTION</p> <p>Improper reassembly Damage to the pump!</p> <p>▷ Reassemble the pump (set) in accordance with the general rules of sound engineering practice.</p> <p>▷ Use original spare parts only.</p>
---	--



	<p>NOTE</p> <p>Before reassembling the motor section, check that all joints relevant to explosion protection (flamepaths) are undamaged. Replace any components with damaged flamepaths. Refer to the "Flamepaths" annex for the position of the flamepaths.</p>
---	---

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

- Seal elements**
- O-rings
 - Check O-rings for any damage and replace by new O-rings, if required.
 - Never use O-rings that have been glued together from material sold by the metre.
 - Assembly adhesives
 - Avoid the use of assembly adhesives, if possible.

Tightening torques During reassembly tighten all screws and bolts as specified in this manual. All bolted/screwed connections closing off the flameproof enclosure must be secured with a thread-locking agent (Loctite Type 243).

7.5.2 Reassembling the motor section

	<p>NOTE</p> <p>Before reassembling the motor section, check that all joints relevant to explosion protection (flamepaths) are undamaged. Any components with damaged flamepaths must be replaced. Only use original spare parts made by KSB for explosion-proof pumps. Observe the flamepath positions specified in the Annex. Secure all screwed connections closing off a flameproof enclosure with a thread-locking agent (Loctite type 243).</p>
	<p>⚠ DANGER</p> <p>Incorrect screws are being used Explosion hazard!</p> <ul style="list-style-type: none"> ▷ Always use the original screws for assembling an explosion-proof pump set. ▷ Never use screws of different dimensions or of a lower property class.

7.5.3 Reassembling the pump section

7.5.3.1 Installing the mechanical seal

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

- Only remove the protective wrapping of the contact faces immediately before assembly takes place.
 - Make sure the surface of the shaft is absolutely clean and undamaged.
 - Before the actual installation of the mechanical seal, wet the contact faces with a drop of oil.
 - For easier installation of bellows-type mechanical seals, wet the inside diameter of the bellows with soapy water (no oil).
 - To prevent any damage to the rubber bellows, place a thin foil (thickness approximately 0.1 to 0.3 mm) around the free shaft stub. Slip the rotating assembly over the foil into its installation position. Then remove the foil.
 - ✓ The shaft and rolling element bearings have been properly installed in the motor.
1. Push drive-end mechanical seal 433.01 on shaft 210 and secure it with circlip 932.03.
 2. Insert O-rings 412.04/412.35 and 412.15/412.11 into discharge cover 163, and press them into bearing bracket 330 as far as they will go.
 3. Push pump-end mechanical seal 433.02 onto shaft 210.

7.5.3.2 Fitting the impeller

The procedures for fitting the impeller differ depending on the hydraulic system and motor in question. (⇒ Section 7.4.3.2 Page 60)

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Impeller fastening elements N055

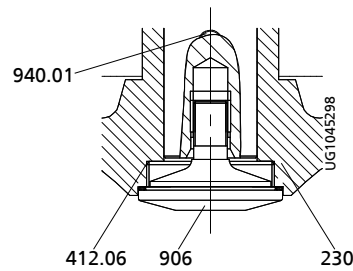


Fig. 39: Impeller fastening elements N055

1. Insert key 940.01.
2. Pull on impeller 230 with a special puller.
3. Insert O-ring 412.06.
4. Screw in impeller screw 906 (right-hand thread).

Impeller fastening elements M85x2, M125x2, M100x2

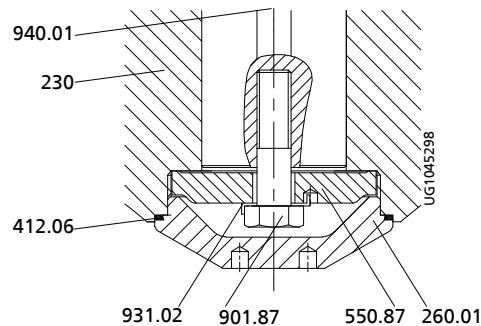


Fig. 40: Impeller fastening elements M85x2, M125x2 and M100x2

1. Insert key 940.01.
2. Pull on impeller 230 with a special puller.
3. Screw in hexagon head bolt 901.87 with disc 550.87 and bend back lockwasher 931.02.
4. Insert O-ring 412.06.
5. Screw in impeller hub cap 260.01 using a special wrench (right-hand thread).

Impeller fastening elements M100x2

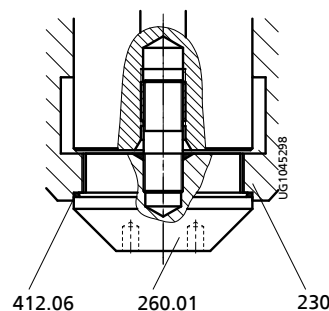


Fig. 41: Impeller fastening elements M100x2

1. Insert key 940.01.
2. Pull on impeller 230 with a special puller.
3. Insert O-ring 412.06.
4. Screw in impeller screw 906.01 using a special wrench (right-hand thread).

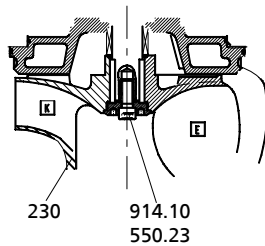


Fig. 42: Fitting the impeller

7.5.3.2.1 Fitting the impeller with a special puller

1. Fit the impeller with a special puller. (⇒ Section 7.5.3.2.1.1 Page 67)
2. Insert impeller hub cap 260 and fasten it with impeller screw 914.10.

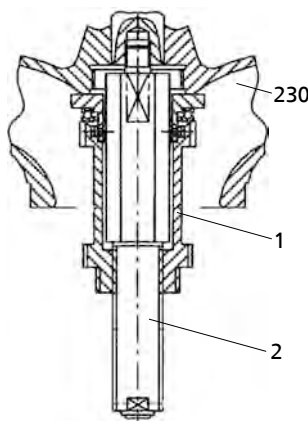


Fig. 43: Special puller

7.5.3.2.1.1 Using a special puller

1. Screw part 2 of the puller into the shaft end of the pump set.
2. Screw part 1 to the threaded bolt part 2.

7.5.3.3 Installing the back pull-out unit

- ✓ The shaft, rolling element bearings, mechanical seal and impeller have been assembled properly.
1. Insert the complete back pull-out unit into the pump casing.
 2. Evenly tighten screwed connection 920.01 between pump casing and bearing bracket.

7.5.4 Checking for leakage

After reassembly, always check the mechanical seal area (oil reservoir or cooling system) and the motor for leakage.

7.5.4.1 Checking the mechanical seal area for leakage

Observe the following values for leak testing:

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

- On pump sets with cooling system (installation types K and D): coolant filler or drainage openings

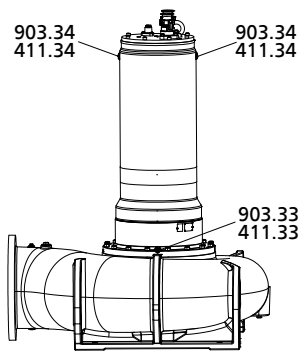


Fig. 44: Pump sets with cooling system

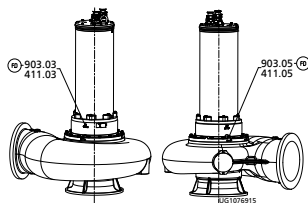


Fig. 45: Pump sets without cooling system

- On pump sets without cooling system (installation types S and P): lubricant filler or drainage openings

1. Screw out screwed plug and joint ring of the lubricant reservoir or cooling system.
2. Screw the testing device tightly into the G $\frac{1}{2}$ plug thread.
3. Carry out the leak test with the values specified above.
 - ⇒ The pressure must not drop during the test period.
 - ⇒ If the pressure does drop, check the seals and screwed connections.
4. Perform another leak test, if required.

7.5.4.2 Checking the motor for leakage

Observe the following values for leak testing:

- **Test medium:** nitrogen
- **Test pressure:** 0.8 bar
- **Test period:** 2 minutes
- **Opening:** hole of screwed plug 903.31

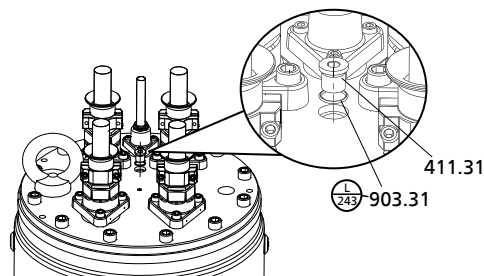




Fig. 46: Checking the motor for leakage

1. Remove screwed plug 903.31 and joint ring 411.31.
2. Screw the testing device tightly into the G $\frac{1}{2}$ plug thread.
3. Carry out the leak test with the values specified above.
 - ⇒ The pressure must not drop during the test period.
 - ⇒ If the pressure does drop, check the seals and screwed connections.
4. Perform another leak test, if required.
5. Remove the testing device.

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 	⚠ DANGER
	Screwed plug leaking or missing Explosion hazard! Damage to the motor! <ul style="list-style-type: none"> ▷ Never start up a pump set without screwed plug 903.31. ▷ Apply a thread-locking agent (Loctite 243) to screwed plug 903.31.

6. Apply a thread-locking agent (Loctite, type 243) to screwed plug 903.31.
7. Close screwed plug 903.31 with new joint ring 411.31.

7.5.5 Checking the connection of motor/power supply

After reassembly, carry out the measures specified in (⇒ Section 7.2.1 Page 48).

7.6 Tightening torques

Table 26: Tightening torques

Thread	A4-50	A4-70	1.4462	8.8
Property class Rp 0.2 N/mm ²	210	450	450	640
M8	-	17	17	25
M10	-	35	35	50
M12	-	60	60	85
M14	-	90	90	130
M16	-	150	150	210
M20	-	290	290	410
M24	230	-	500	700
M30	460	-	1000	1400
M42	1300	-	2750	3900
M48	1950	-	4200	6000

7.7 Spare parts stock

7.7.1 Ordering spare parts

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

- Pump type
- KSB order number
- Motor number

Refer to the name plate for all data.

Also supply the following data:

- Part description
- Part No.
- Quantity of spare parts
- Shipping address
- Mode of dispatch (freight, mail, express freight, air freight)

Refer to the general assembly drawing for part numbers and descriptions.

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

Table 27: Quantity of spare parts for recommended spare parts stock¹⁶⁾

Part No.	Part description	Number of pump sets (including stand-by pump sets)						
		2	3	4	5	6 and 7	8 and 9	10 and more
80-1	Motor section	-	-	-	1	1	2	30 %
834	Cable gland	1	1	2	2	2	3	40 %
818	Rotor	-	-	-	1	1	2	30 %
230	Impeller	1	1	1	2	2	3	30 %
502	Casing wear ring	2	2	2	3	3	4	50 %
433.01	Mechanical seal, motor end	2	3	4	5	6	7	90 %
433.02	Mechanical seal, pump end	2	3	4	5	6	7	90 %
321.01 / 322	Rolling element bearing, motor end	1	1	2	2	3	4	50 %
320 / 321.02	Rolling element bearing, pump end	1	1	2	2	3	4	50 %
99-9	Set of seal elements for the motor	4	6	8	8	9	10	100 %
99-9	Set of seal elements for the hydraulic system	4	6	8	8	9	10	100 %

¹⁶⁾ For two years of continuous operation or 17,800 operating hours

8 Trouble-shooting

8 Trouble-shooting

- A Pump is running but does not deliver
- B Pump delivers insufficient flow rate
- C Excessive current/power consumption
- D Insufficient discharge head
- E Vibrations and noise during pump operation

Table 28: Trouble-shooting

A	B	C	D	E	Possible cause	Remedy
	X				Pump delivers against an excessively high discharge pressure.	Re-adjust to duty point.
	X				Gate valve in the discharge line is not fully open.	Fully open the gate valve.
		X		X	Pump is running in off-design conditions (low flow / overload).	Check the pump's operating data.
X					Pump or piping are not completely vented.	Dry installation: Vent and/or prime the pump and piping; fit a vent valve if required. Wet installation: Vent by lifting the pump off the duckfoot bend and lowering it again.
X	X		X	X	Wet installation: Pump intake clogged by deposits.	Clean the intake, pump components and non-return valve.
					Dry installation: Inlet line clogged by deposits.	Clean the intake or inlet line, pump components and non-return valve.
		X		X	Dirt/fibres in the clearance between the casing wall and impeller of a sluggish rotor	Check whether the impeller can be easily rotated. Clean the impeller, if required.
	X	X	X	X	Wear	Replace worn parts by new ones.
X	X		X		Defective riser (pipe and seal elements)	Replace defective riser pipes. Replace seal elements.
	X		X	X	Impermissible air or gas content in the fluid handled	Contact KSB.
				X	System-induced vibrations	Contact KSB.
	X	X	X	X	Wrong direction of rotation	Check the connection of the motor and switchgear, if any.
	X		X		Wrong supply voltage	Check power cable. Check cable connections.
X					No voltage	Check the electrical installation. Contact the energy supplier.
				X	Worn or defective rolling element bearings	Contact KSB.
	X		X		In case of star-delta configuration: motor running in star configuration only.	Check star-delta contactor.
X					Defective motor winding	Contact KSB.
	X				Wet installation: Water level lowered too much during operation.	Check the level control.
					Dry installation: Suction head is too high, NPSH _{available} (positive suction head) is too low.	Check the inlet line for clogging, clean if necessary; fully open the gate valve in the inlet line.
X					Pump sets without cooling system (installation types P and S): The temperature control device for monitoring the winding has tripped due to high winding temperature.	The motor will restart automatically once the winding has cooled down.

8 Trouble-shooting

A	B	C	D	E	Possible cause	Remedy
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.	Assign qualified and trained personnel to determine and remedy the cause of failure. Pump sets with cooling system: Check the coolant level.
X					The leakage monitoring system of the motor has tripped.	Assign qualified and trained personnel to determine and remedy the cause of failure.
X					The mechanical seal monitoring system has tripped.	Assign qualified and trained personnel to determine and remedy the cause of failure.
X					The bearing temperature monitoring system has tripped	Assign qualified and trained personnel to determine and remedy the cause of failure.

9 Related Documents

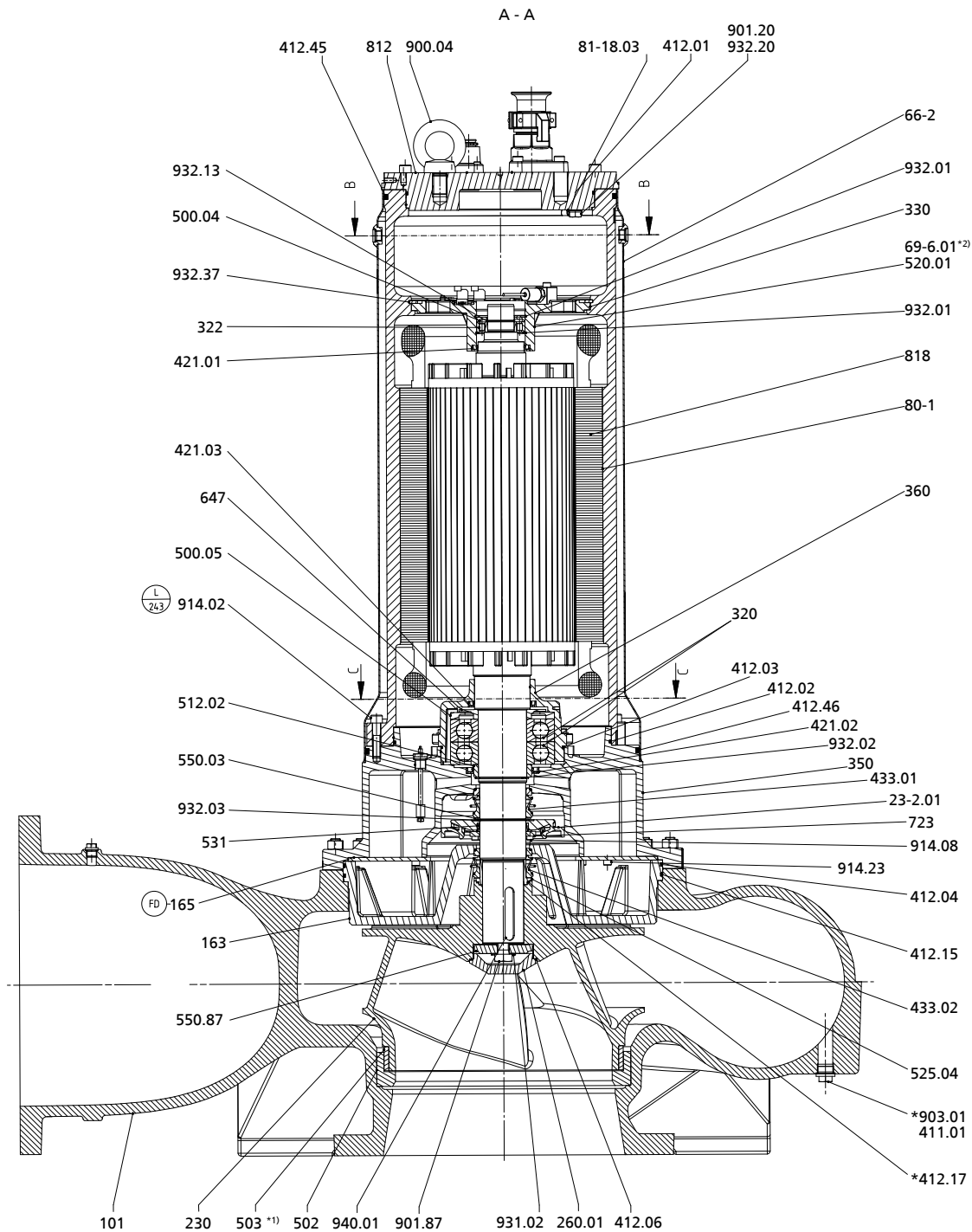
9.1 General assembly drawings

9.1.1 Pump sets with cooling system (installation types K and D):

* For dry installation only

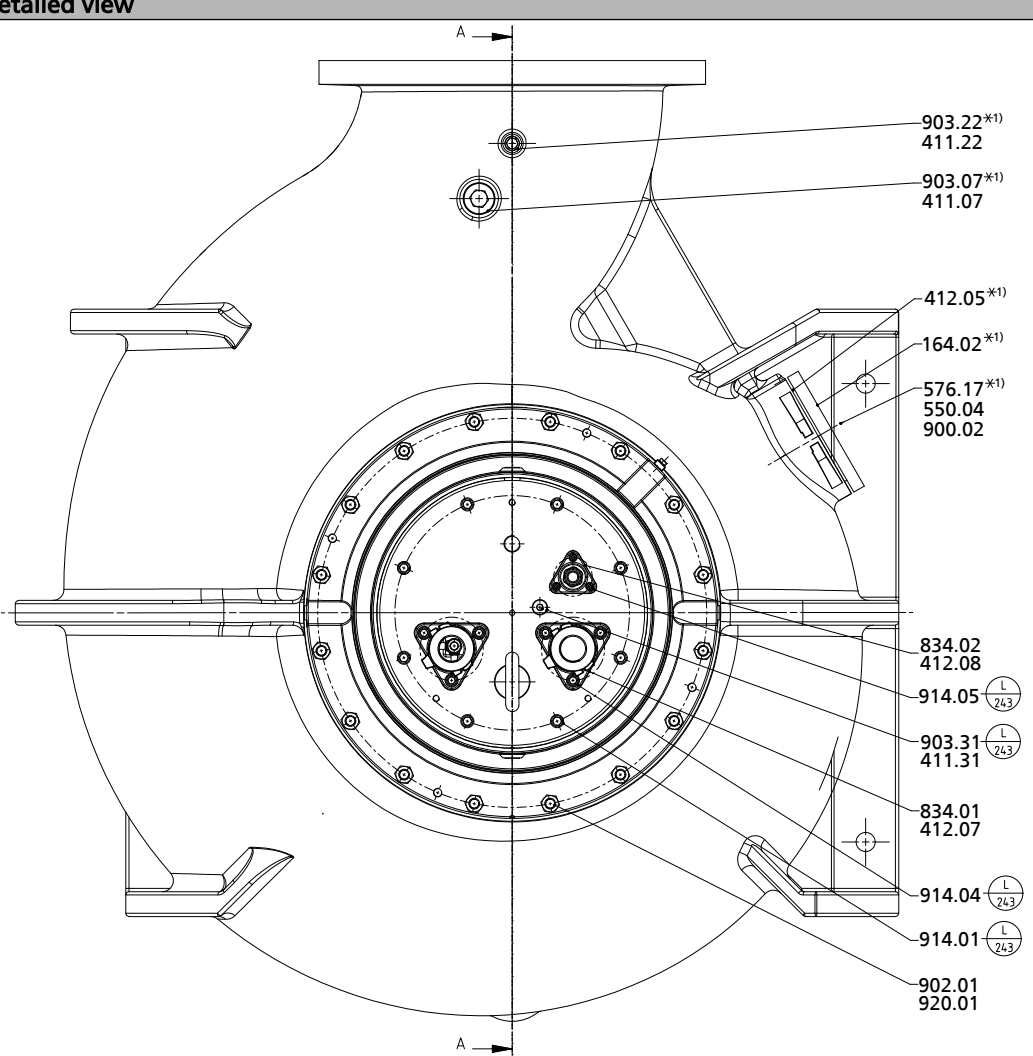
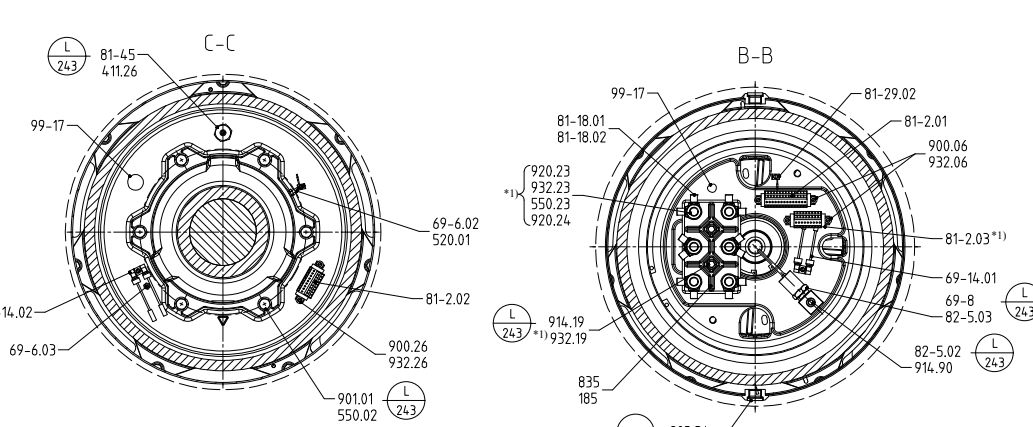
*1) If applicable

*2) Optional

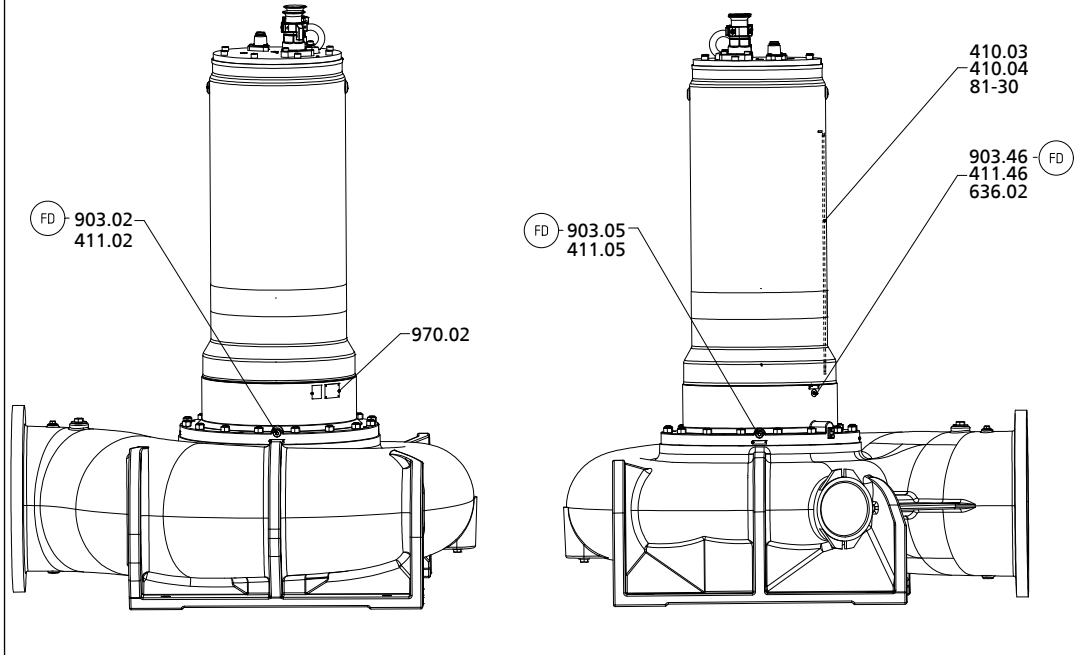
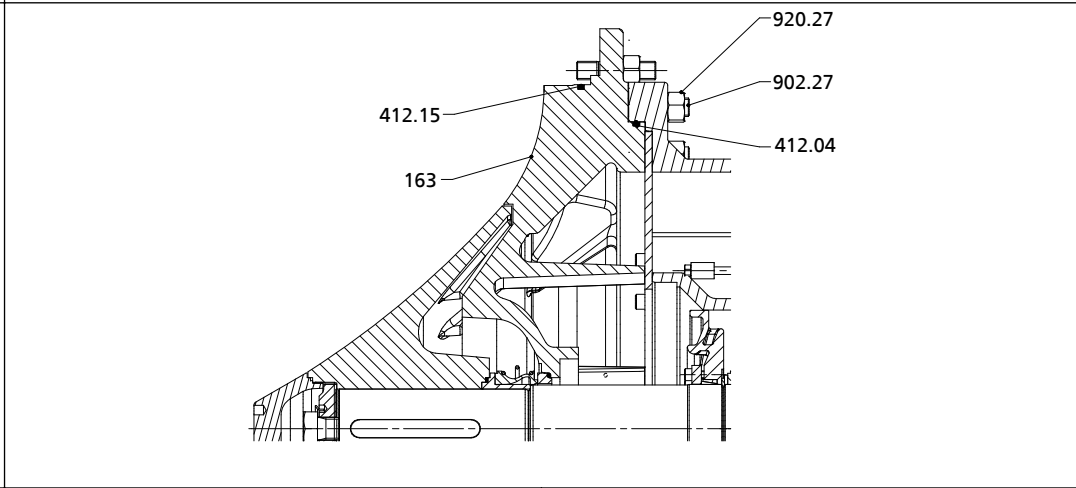
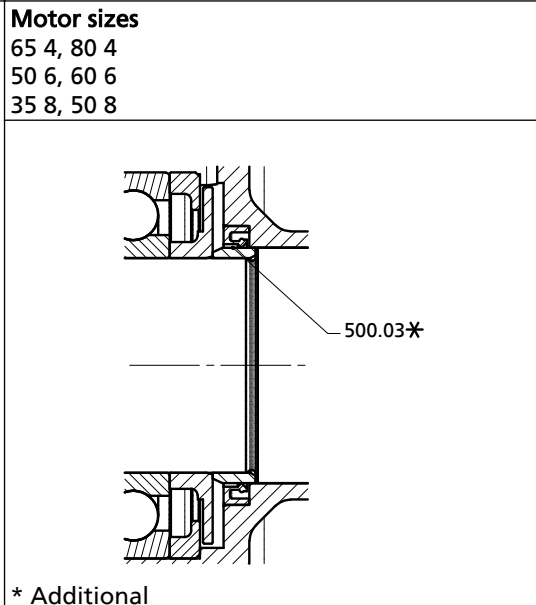
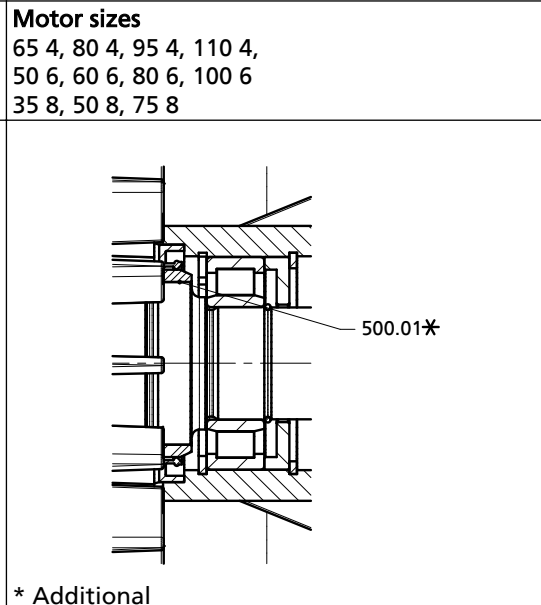


General assembly drawing pump set with cooling system, impeller type K

Table 29: Detailed view of the general assembly drawing, pump set with cooling system

Section	Detailed view
From above	 <p>Top view of the pump set assembly. The drawing shows a circular pump housing with a central motor assembly. Various components are labeled with part numbers and callouts. The central motor assembly is labeled with 903.22*1) and 411.22. The motor housing is labeled with 903.07*1) and 411.07. The motor base is labeled with 412.05*1). The motor mounting bracket is labeled with 164.02*1). The motor base plate is labeled with 576.17*1), 550.04, and 900.02. The motor base plate is also labeled with 834.02 and 412.08. The motor base plate is also labeled with 914.05 (L 243). The motor base plate is also labeled with 903.31 (L 243) and 411.31. The motor base plate is also labeled with 834.01 and 412.07. The motor base plate is also labeled with 914.04 (L 243) and 914.01 (L 243). The motor base plate is also labeled with 902.01 and 920.01. The motor base plate is also labeled with 81-45 (L 243) and 411.26. The motor base plate is also labeled with 99-17. The motor base plate is also labeled with 69-6.02 and 520.01. The motor base plate is also labeled with 81-2.02. The motor base plate is also labeled with 900.26 and 932.26. The motor base plate is also labeled with 901.01 (L 243) and 550.02. The motor base plate is also labeled with 69-14.02 and 69-6.03. The motor base plate is also labeled with 920.23, 932.23, 550.23, and 920.24. The motor base plate is also labeled with 914.19 (L 243) and 932.19. The motor base plate is also labeled with 835 and 185. The motor base plate is also labeled with 903.34 (FD) and 411.34. The motor base plate is also labeled with 81-18.01 and 81-18.02. The motor base plate is also labeled with 81-29.02 and 81-2.01. The motor base plate is also labeled with 900.06 and 932.06. The motor base plate is also labeled with 81-2.03*1). The motor base plate is also labeled with 69-14.01 and 69-8. The motor base plate is also labeled with 82-5.03 (L 243) and 82-5.02 (L 243) and 914.90. The motor base plate is also labeled with 99-17.</p>
Sensors and terminals	 <p>Two cross-sectional views of the pump set assembly. The left view is labeled C-C and shows the internal components of the pump housing. The right view is labeled B-B and shows the internal components of the motor housing. Various components are labeled with part numbers and callouts. The left view is labeled with 81-45 (L 243) and 411.26. The left view is also labeled with 99-17. The left view is also labeled with 69-6.02 and 520.01. The left view is also labeled with 81-2.02. The left view is also labeled with 900.26 and 932.26. The left view is also labeled with 901.01 (L 243) and 550.02. The left view is also labeled with 69-14.02 and 69-6.03. The right view is labeled with 920.23, 932.23, 550.23, and 920.24. The right view is also labeled with 914.19 (L 243) and 932.19. The right view is also labeled with 835 and 185. The right view is also labeled with 903.34 (FD) and 411.34. The right view is also labeled with 81-18.01 and 81-18.02. The right view is also labeled with 81-29.02 and 81-2.01. The right view is also labeled with 900.06 and 932.06. The right view is also labeled with 81-2.03*1). The right view is also labeled with 69-14.01 and 69-8. The right view is also labeled with 82-5.03 (L 243) and 82-5.02 (L 243) and 914.90. The right view is also labeled with 99-17.</p>

9 Related Documents

Section	Detailed view	
From the side		
Special features of hydraulic system K600-520		
Bearings	<p>Motor sizes 65 4, 80 4 50 6, 60 6 35 8, 50 8</p>  <p>* Additional</p>	<p>Motor sizes 65 4, 80 4, 95 4, 110 4, 50 6, 60 6, 80 6, 100 6 35 8, 50 8, 75 8</p>  <p>* Additional</p>

9 Related Documents

Part No.	Description	Part No.	Description
69-6.01/.02	Temperature sensor	471	Seal cover
69-8	Sensor	500.01/.03/.04/.05	Ring
69-14.01/.02	Leakage sensor	502	Casing wear ring
80-1	Submersible motor	503	Impeller wear ring
81-2.01/.02	Motor section	512.02	Wear ring
81-18.01/.02	Terminal	520.01	Sleeve
81-29.02	Cable socket	525.04	Spacer sleeve
81-45	Float switch	550.02/.03/.23/.87	Disc
81-99	Electric part	636.02	Lubricating nipple
82-5.02/.03	Adapter	647	Grease quantity control
99-17	Dessicant	812	Motor housing cover
101	Pump casing	818	Rotor
163	Discharge cover	834.01/.02	Cable gland
185	Plate	835	Terminal board
230	Impeller	900.04/.06/.26	Screw
260.01	Impeller hub cap	901.01/.20/.87	Hexagon head bolt
320	Rolling element bearing	902.01/.27	Stud
322	Radial roller bearing	903.02/.03/.05/.31/.46	Screwed plug
330	Bearing bracket	906	Impeller screw
350	Bearing housing	914.01/.02/.04/.05/.19	Socket head cap screw
360	Bearing cover	920.01/.23/.24/.27	Nut
411.02/.03/.05/.26/.31/.46	Joint ring	931.02	Lockwasher
412.01/.02/.03/.04/.06/.07/.08/.15/.17/.24/.40	O-ring	932.01/.02/.03/.06/.13/.19/.20/.23/.26/.37	Circlip
421.01/.02/.03	Lip seal	970.02	Plate
433.01/.02	Mechanical seal		

9 Related Documents

9.1.2 Pump sets without cooling system (installation types S and P)

*¹⁾If applicable (⇒ Section 9.4 Page 88)

*²⁾ Optional

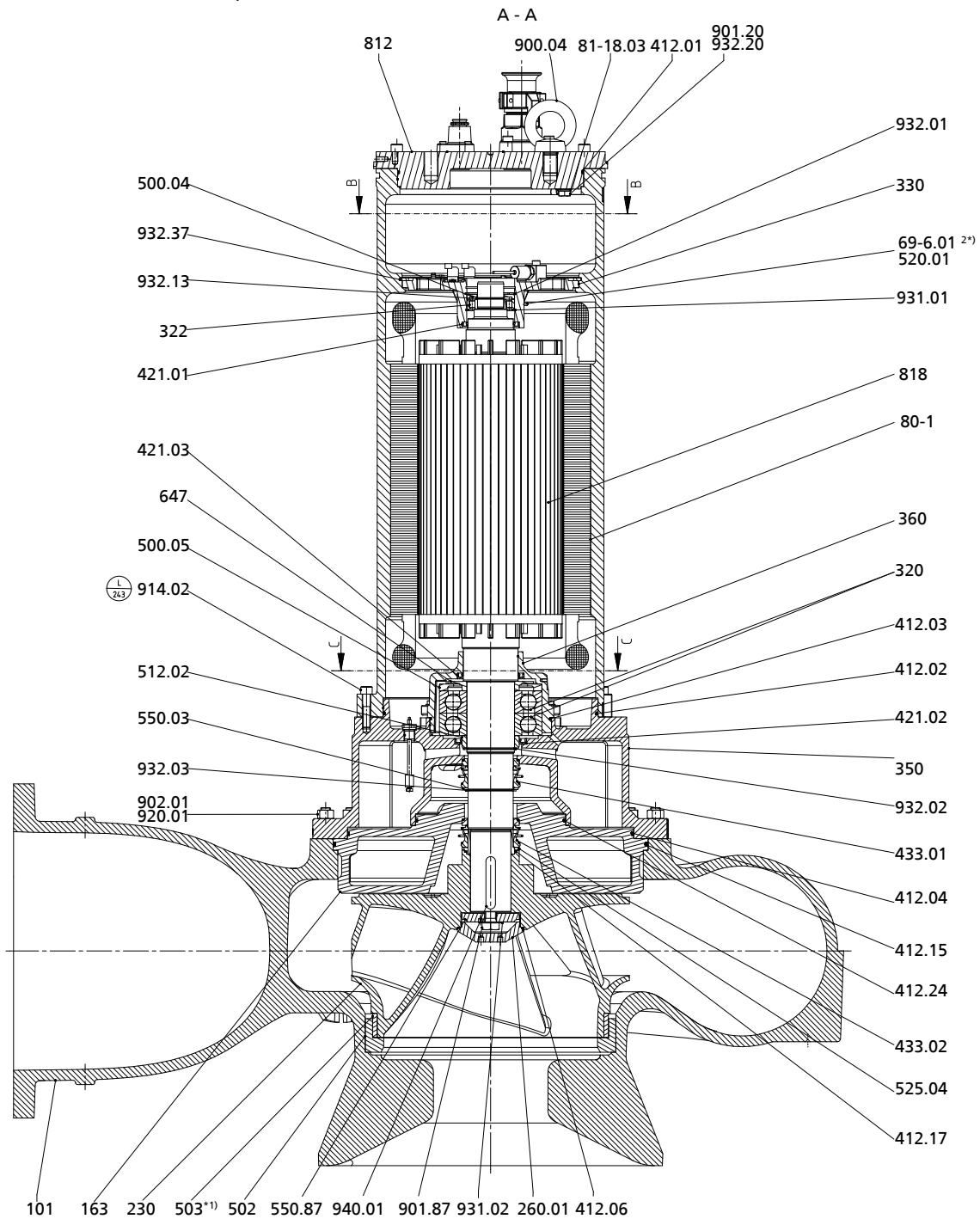
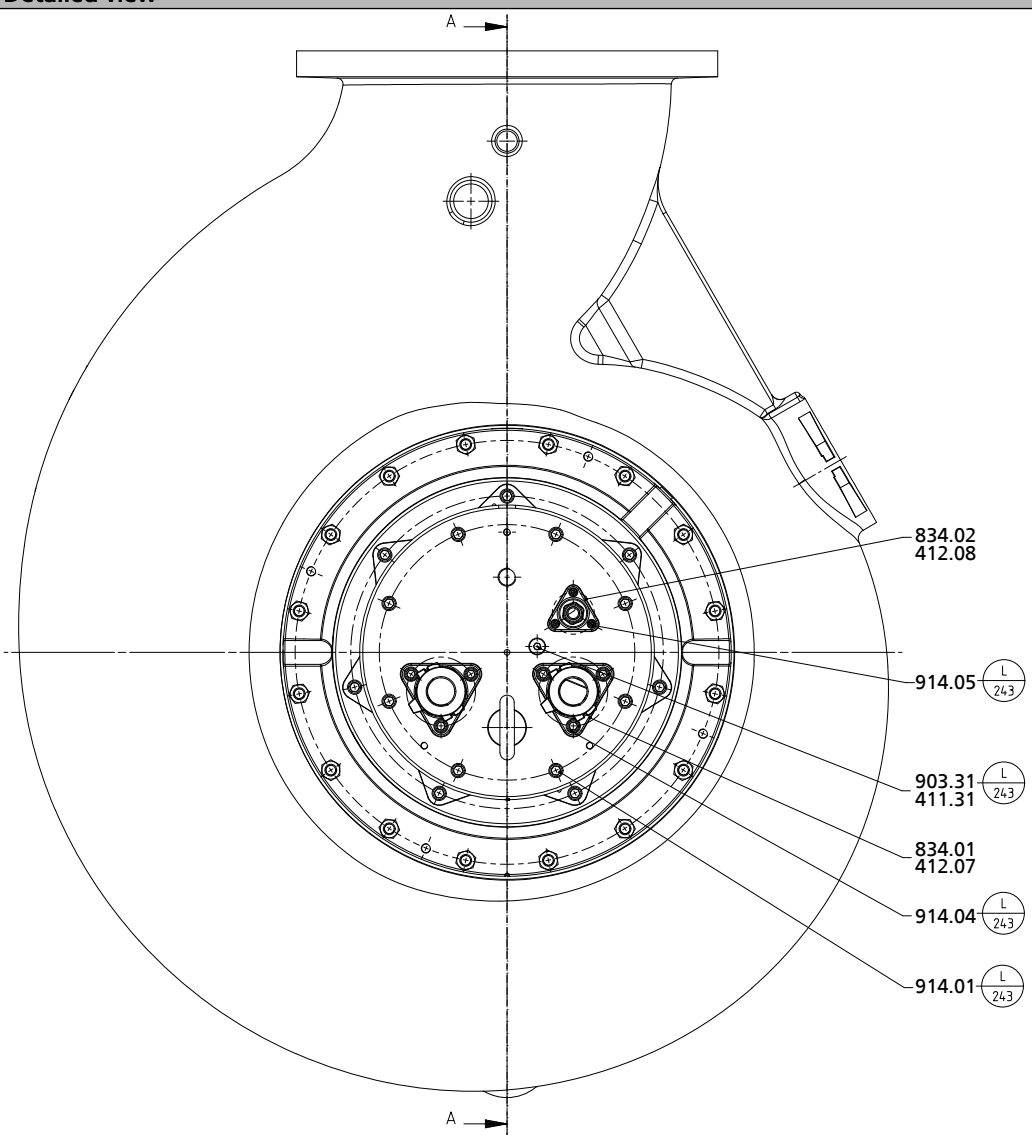
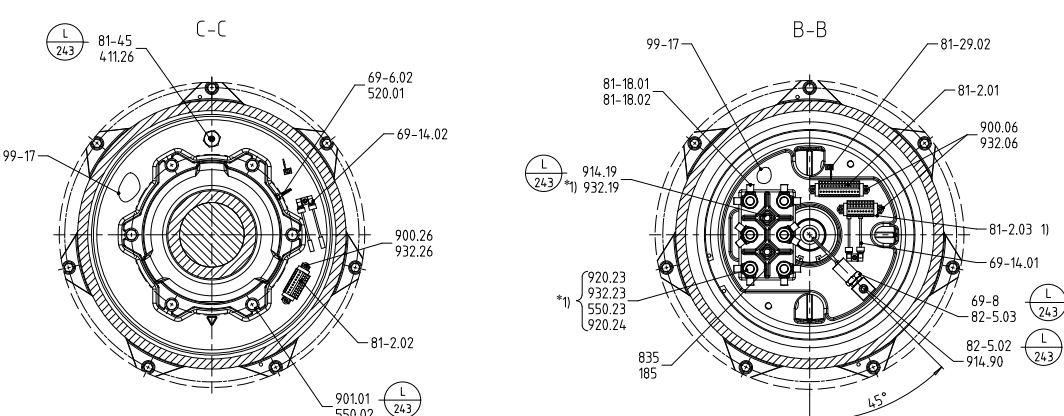
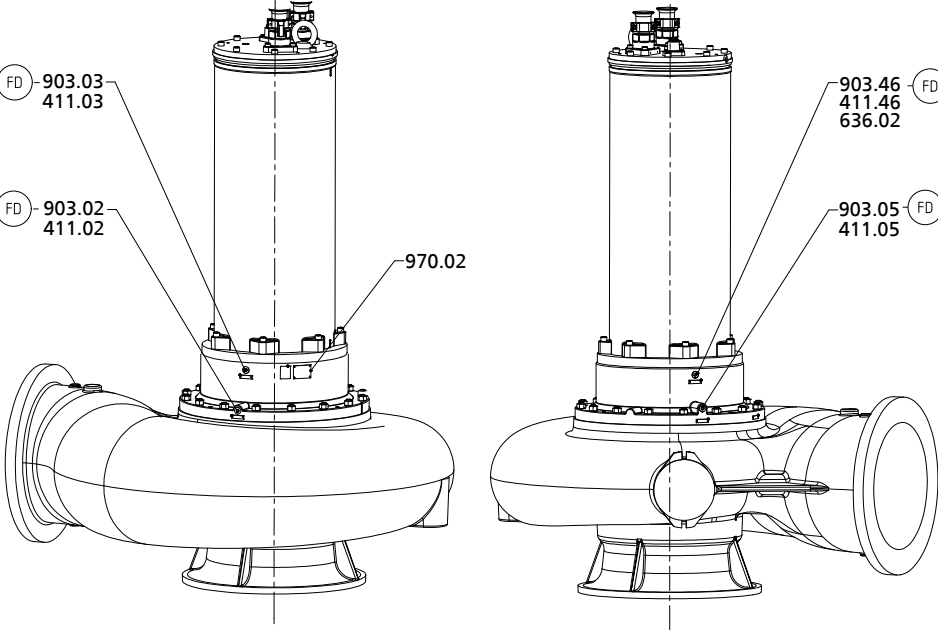
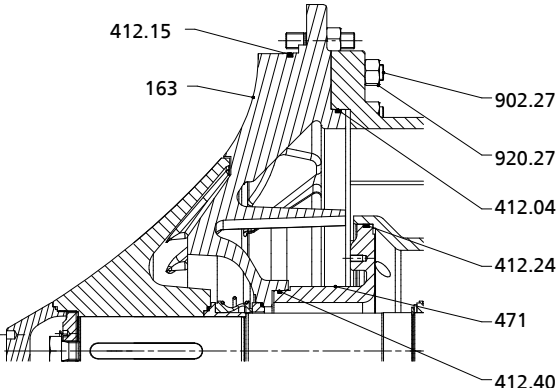


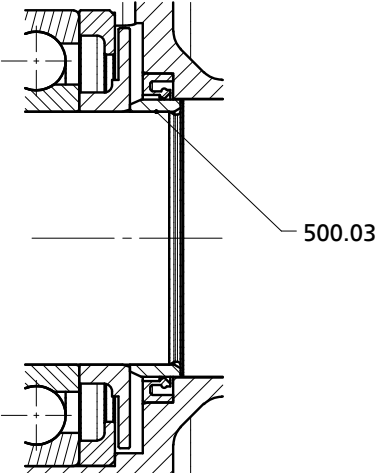
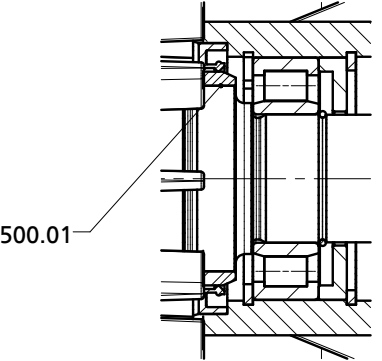
Table 30: Detailed view of the general assembly drawing, pump set without cooling system

Section	Detailed view
From above	 <p>Top view of the pump set assembly. The drawing shows the motor, pump, and various components with callouts. The callouts include: 834.02, 412.08, 914.05 (L/243), 903.31 (L/243), 411.31, 834.01, 412.07, 914.04 (L/243), and 914.01 (L/243). The drawing is divided into two sections by a vertical line labeled 'A' at the top and bottom.</p>
Sensors and terminals	 <p>Two detailed views of the pump set assembly showing sensors and terminals. The left view is labeled 'C-C' and the right view is labeled 'B-B'. The left view shows components 81-45 (L/243), 411.26, 69-6.02, 520.01, 69-14.02, 99-17, 900.26, 932.26, 81-2.02, and 901.01 (L/243), 550.02. The right view shows components 99-17, 81-18.01, 81-18.02, 81-29.02, 81-2.01, 900.06, 932.06, 81-2.03 1), 69-14.01, 69-8 (L/243), 82-5.03 (L/243), 82-5.02 (L/243), 914.90, 835, 185, 920.23, 932.23, 550.23, 920.24, 914.19, 932.19, and 914.19 (L/243). The right view also shows a 45° angle.</p>

9 Related Documents

Section	Detailed view
From the side	
Special features of hydraulic system K600-520	

9 Related Documents

Section	Detailed view	
Impeller fastening elements	Motor sizes 35 4...80 4 32 6...60 6 26 8...50 8	Motor sizes 35 4...110 4 32 6...100 6 26 8...75 8
		

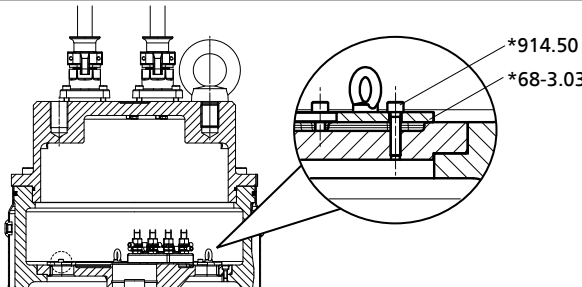
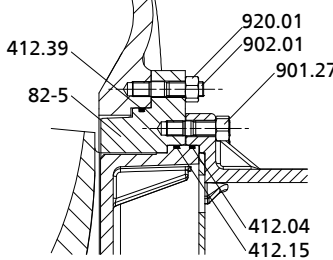
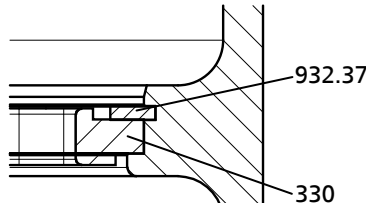
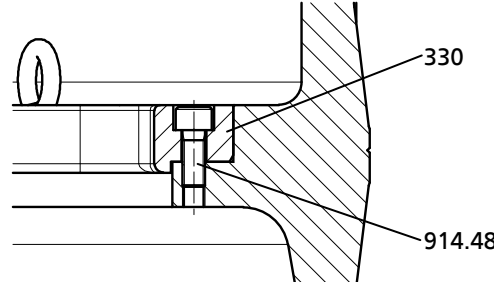
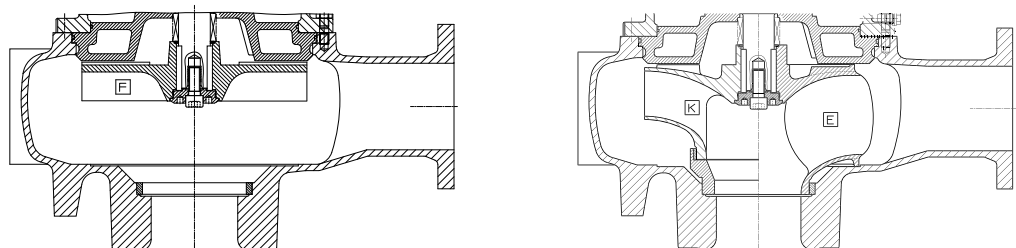
Part No.	Description	Part No.	Description
23-2.01	Auxiliary impeller (inducer)	433.01/.02	Mechanical seal
66-2	Cooling jacket	441	Shaft seal housing
69-6.01/.02/.03	Temperature sensor	500.01/.02/.03/.04/.05	Ring
69-8	Sensor	502	Casing wear ring
69-14.01/.02	Leakage sensor	503	Impeller wear ring
80-1	Submersible motor	512.02	Wear ring
81-2.01/.02	Motor section	520.01	Sleeve
81-18.01/.02/.03	Cable socket	525.04	Spacer sleeve
81-29.02	Terminal	531	Locking element
81-30	Guide rail	550.02/.03/.04/.23/.87	Disc
81-45	Float switch	576.17	Handle
81-99	Electric part	636.02	Lubricating nipple
82-5.02/.03	Adapter	647	Grease quantity control
99-17	Dessicant	723	Flange
101	Pump casing	812	Motor housing cover
164.02	Inspection cover	818	Rotor
165	Cooling chamber cover	834.01/.02	Cable gland
163	Discharge cover	835	Terminal board
185	Plate	900.02/.04/.06/.26	Screw
230	Impeller	901.01/.20/.87	Hexagon head bolt
260.01	Impeller hub cap	902.01/.27	Stud
322	Radial roller bearing	903.01/.02/.05/.07/.22/.31/.34/.46	Screwed plug
330	Bearing bracket	904.01	Grub screw
350	Bearing housing	906	Impeller screw
360	Bearing cover	914.01/.02/.04/.05/.08/.19/.23	Socket head cap screw
410.03/.04	Profile joint	920.01/.23/.24/.27	Nut
411.01/.02/.05/.07/.22/.26/.31/.34/.46	Joint ring	931.02	Lockwasher

9 Related Documents

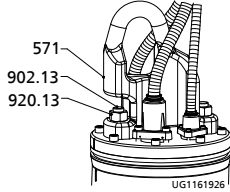
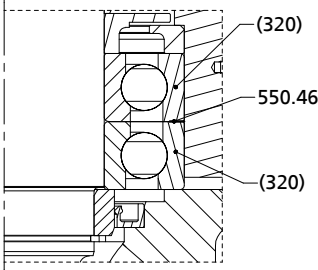
Part No.	Description	Part No.	Description
412.01/.02/.03/.04/.05/.06/.07/.08/.15/.17/.45/.46	O-ring	932.01/.02/.03/.06/.13/.19/.20/.23/.26/.37	Circlip
421.01/.02/.03	Lip seal	970.02	Plate

9.1.3 Special features

Table 31: Special features

Section	Detailed view	
Terminal box for K35 motors 320 6...480 6 260 8...400 8 230 10...350 10 195 12...300 12	 <p>*For explosion-proof variants only.</p>	
Hydraulic systems K350-710 K600-710		
Bearing bracket assembly	Motor sizes 35 4...175 4 32 6...165 6 26 8...130 8 40 10...90 10	
	Motor sizes 200 4...350 4 190 6...480 6 150 8...400 8 110 10...350 10 105 12...300 12	
Impellers		

9 Related Documents

Section	Detailed view
Bail	
Bearing housing made of stainless steel (C) (..NC.. motors)	

Part No.	Description	Part No.	Description
68-3.03	Cover plate	902.01/.27	Stud
82-5	Adapter	914.48/.50	Socket head cap screw
330	Bearing bracket	920.01	Nut
412.04/.15/.39	O-ring	932.37	Circlip

9.2 Wiring diagrams

9.2.1 Wiring diagram for the power cables

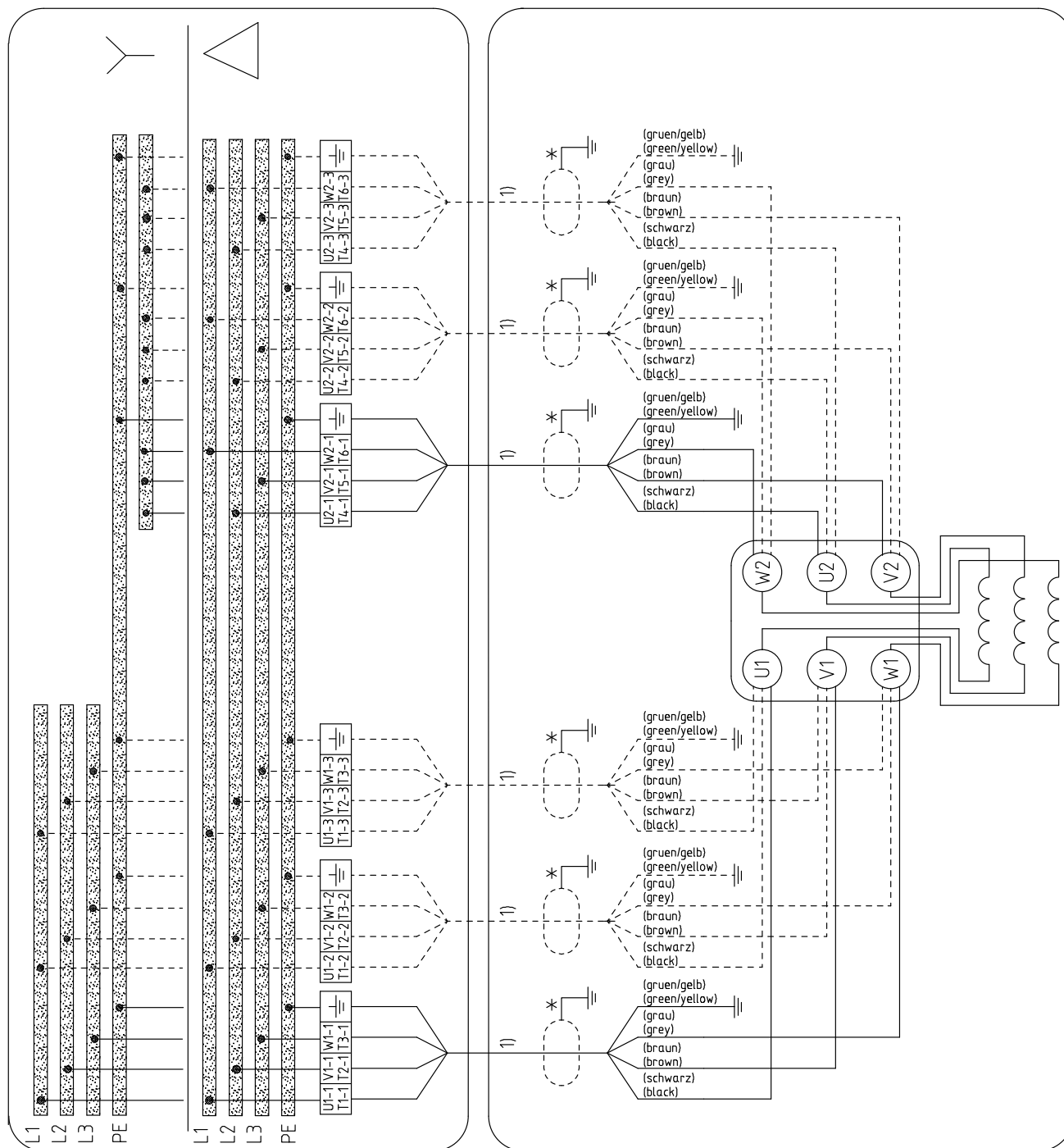


Fig. 47: Wiring diagram for the power cables

* Screened cable optional

¹⁾ Up to 3 parallel cable pairs possible

9 Related Documents

9.2.2 Wiring diagrams for the sensors

Pump sets with cooling system

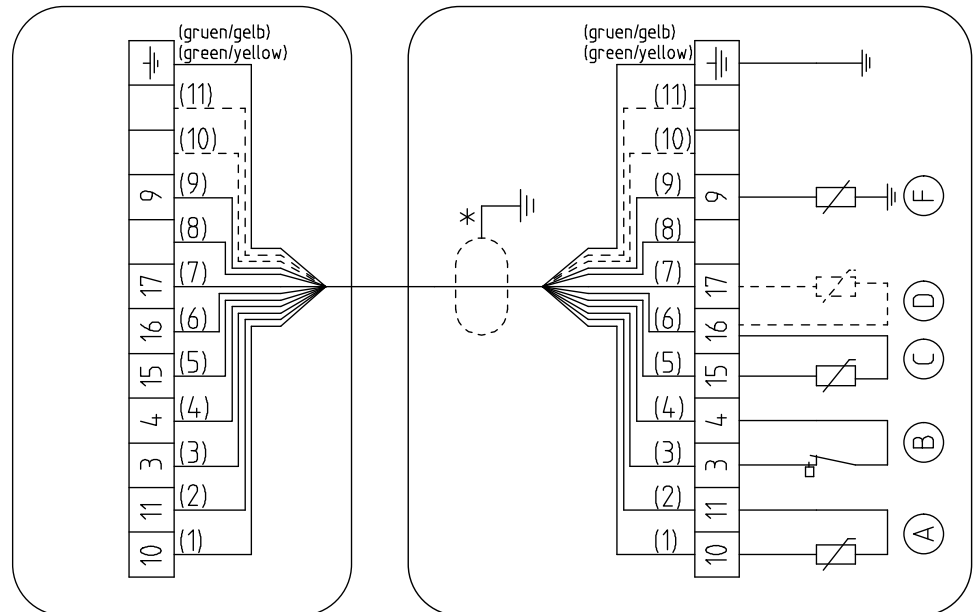


Fig. 48: Wiring diagram for sensors of pump sets with cooling system

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

Pump sets with cooling system with vibration sensor

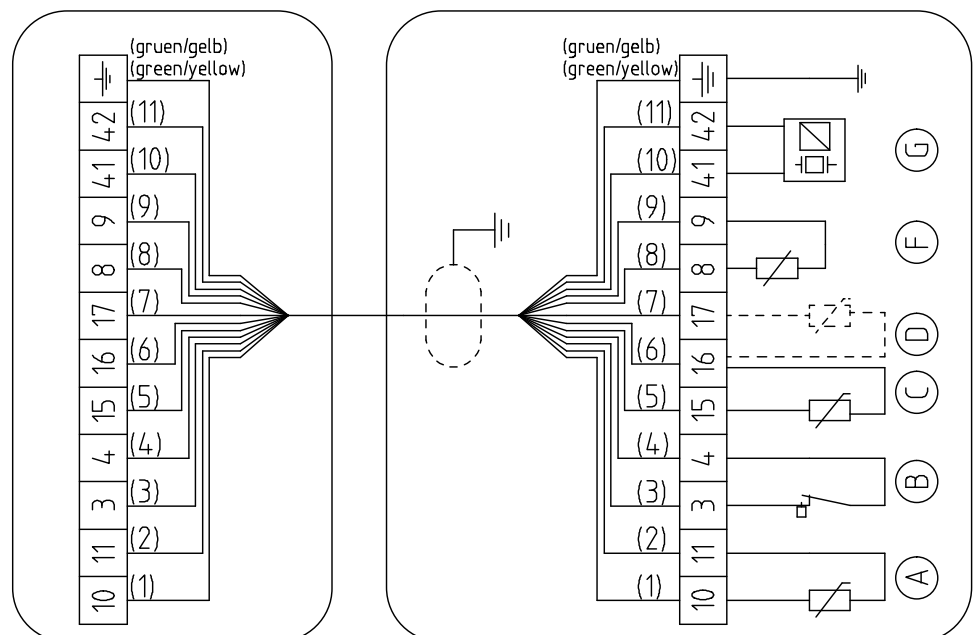


Fig. 49: Wiring diagram for sensors of pump sets with cooling system and vibration sensor

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

9 Related Documents

Pump sets without cooling system

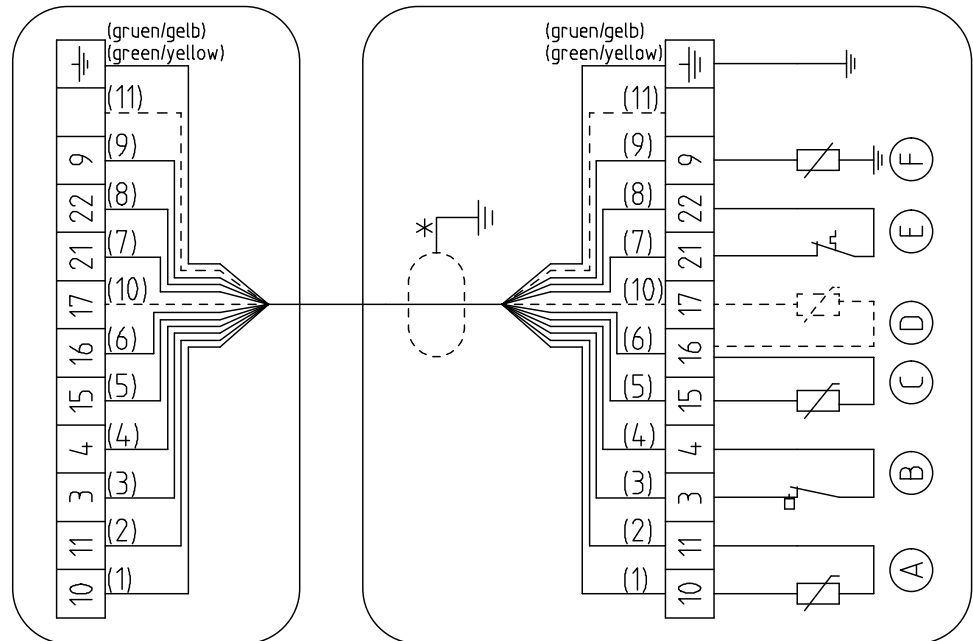


Fig. 50: Wiring diagram for sensors of pump sets without cooling system

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

9 Related Documents

Pump sets without cooling
system and
with vibration sensor

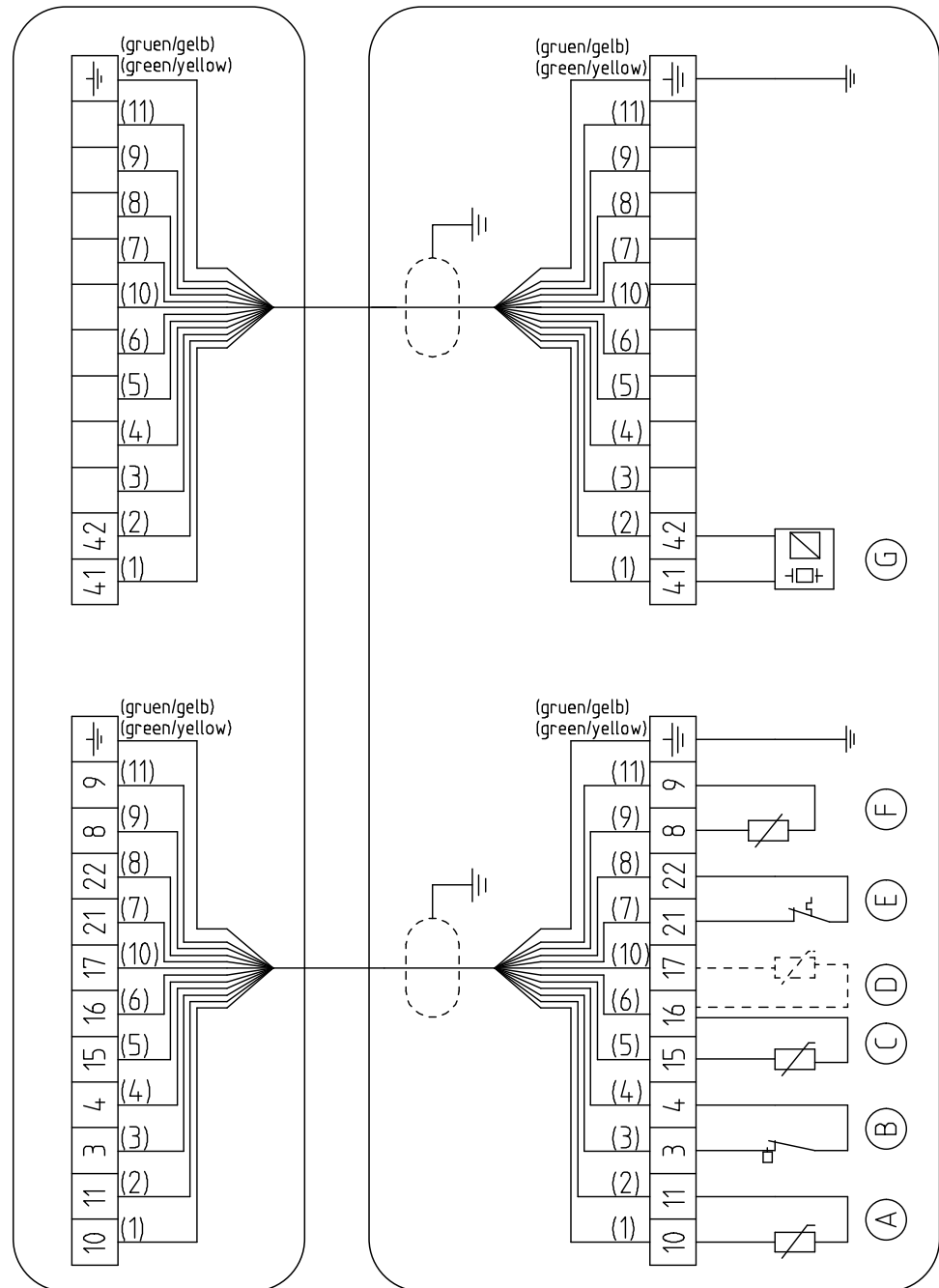


Fig. 51: Wiring diagram for sensors of pump sets without cooling system and with vibration sensor

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

9.3 Flamepaths on explosion-proof motors

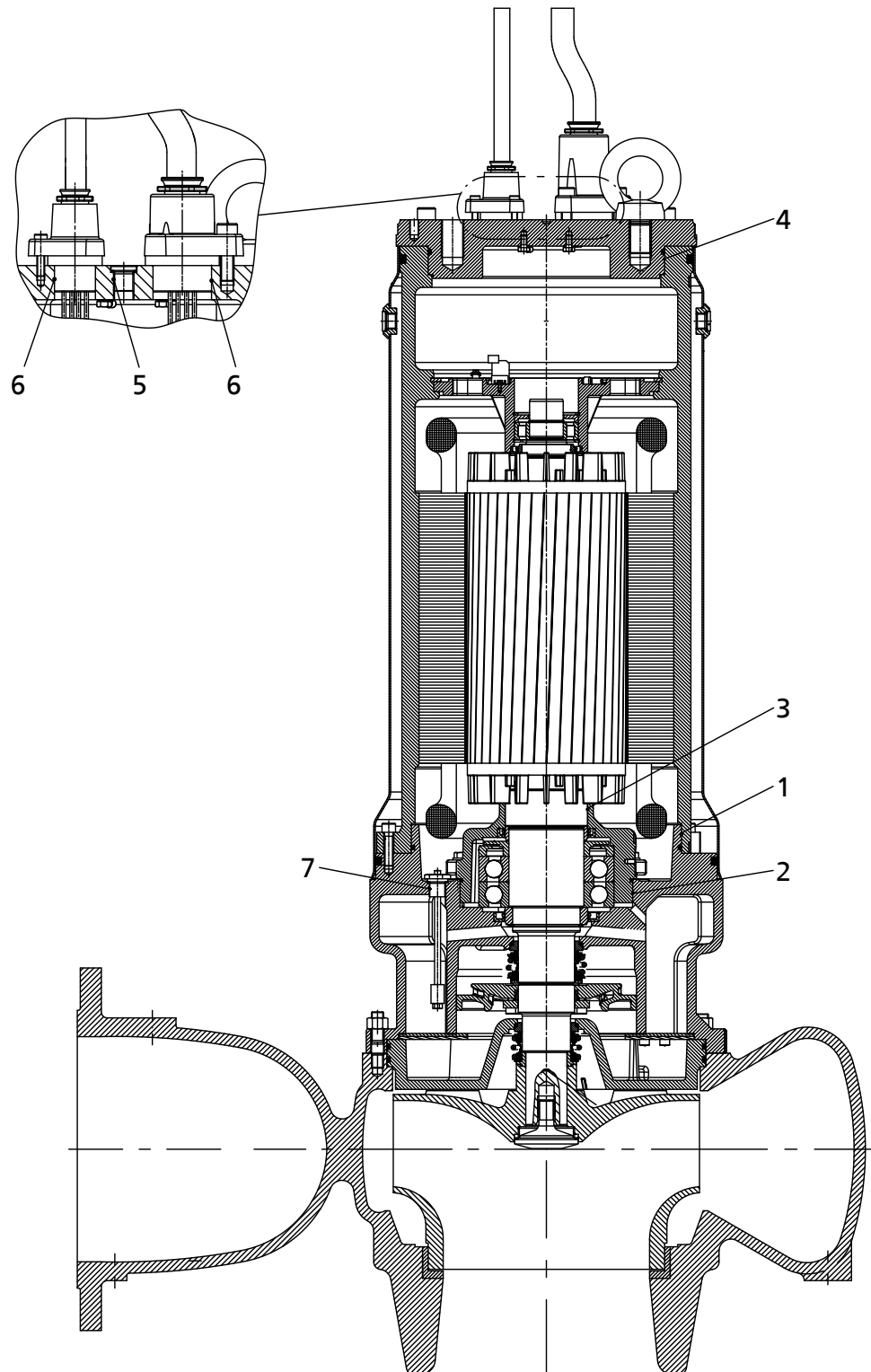
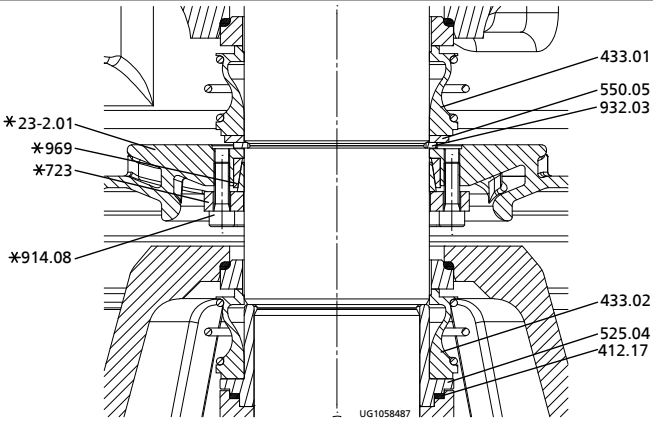
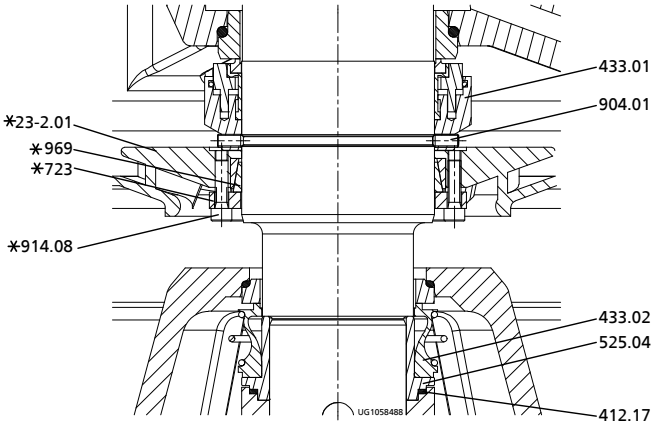
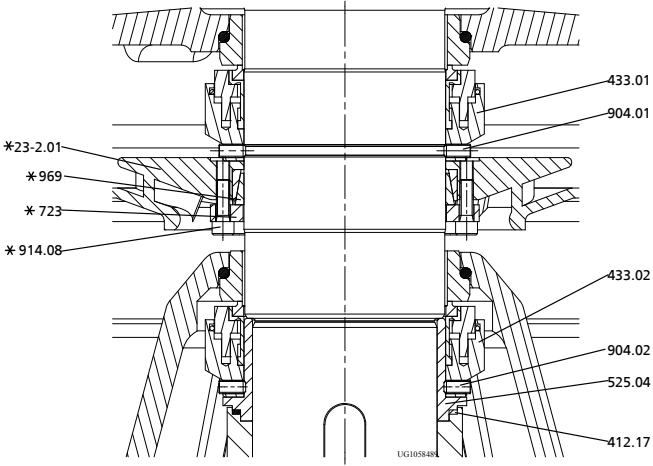


Fig. 52: Flamepaths on explosion-proof motors

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

9.4 Sectional drawings of the mechanical seal

Table 32: Sectional drawings of the mechanical seal

Section	Sectional drawing	
Motor sizes 35 4...175 4 32 6...165 6 26 8...130 8 40 10...90 10	23-2.01	Auxiliary impeller (inducer)
	412.17	O-ring
	433.01/0 2	Mechanical seal
	525.04	Spacer sleeve
	550.05	Disc
	723	Flange
	914.08	Socket head cap screw
	932.03	Circlip
	969	Tool
	 <p>* Only for pump sets with cooling system</p>	
Motor sizes 200 4...350 4 190 6...260 6 150 8...220 8 110 10...190 10 105 12...165 12	23-2.01	Auxiliary impeller (inducer)
	412.17	O-ring
	433.01/0 2	Mechanical seal
	525.04	Spacer sleeve
	723	Flange
	904.01	Grub screw
	914.08	Socket head cap screw
	969	Tool
	 <p>* Only for pump sets with cooling system</p>	
Motor sizes 320 6...480 6 260 8...400 8 230 10...350 10 195 12...300 12	23-2.01	Auxiliary impeller (inducer)
	412.17	O-ring
	433.01/0 2	Mechanical seal
	525.04	Spacer sleeve
	723	Flange
	904.01/0 2	Grub screw
	914.08	Socket head cap screw
	969	Tool
	 <p>* Only for pump sets with cooling system</p>	

10 EC Declaration of Conformity

Manufacturer:

**KSB Aktiengesellschaft
Johann-Klein-Straße 9
67227 Frankenthal (Germany)**

The manufacturer herewith declares that **the pump/pump set:**

Amarex KRT

KSB order number:

- is in conformity with the provisions of the following directives as applicable in their current version:
 - EC Machinery Directive 2006/42/EC

The manufacturer also declares that

- the following harmonised international standards were applied:
 - ISO 12100-1/A1, ISO 12100-2/A1,
 - ISO 14121-1,
 - EN 809/A1,
 - EN 60034-1, EN 60034-5/A1

Halle, 29.12.2009

.....

Name

Function

Responsible for compiling the technical documentation
KSB Aktiengesellschaft
Turmstraße 92
06110 Halle (Germany)

11 Certificate of Decontamination

11 Certificate of Decontamination

Type
Order number/
Order item number¹⁷⁾

Delivery date

Field of application:

Fluid handled¹⁷⁾:

Please tick where applicable¹⁷⁾:



☐
radioactive



☐
explosive



☐
corrosive



☐
toxic



☐
harmful



☐
bio-hazardous



☐
highly flammable



☐
safe

Reason for return¹⁷⁾:

Comments:

.....

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

On sealless pumps, the rotor has been removed from the pump for cleaning.

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

.....

.....

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

.....
Place, date and signature

.....
Address

.....
Company stamp

¹⁷⁾ Required fields

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KSB Aktiengesellschaft

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Tel. +49 345 4826-0 • Fax +49 345 4826-4699

www.ksb.com

2553.8048/6-10

PUMP	ASSET_CLASS	DATE_MANUFA	DATE_INSTAL	MANUF	SUPPLIER	MODEL	SERIAL_NO
SP320 OLD TOOWOOMBA RD LEICHHARDT PUMP No.1	5W		02.10.12	KSB		KRTE 150-315/294UG	280097
SP320 OLD TOOWOOMBA RD LEICHHARDT PUMP No.2	5W		02.10.12	KSB		KRTE 150-315/294UG	280098
SP343 MCAULIFFE ST REDBANK PUMP No.1	5W		02.08.12	KSB		KRTK 250-630/2256UNG	281909
SP343 MCAULIFFE ST REDBANK PUMP No.2	5W		02.08.12	KSB		KRTK 250-630/2256UNG	281910
SP344 BRISBANE RD REDBANK PUMP No.1	5W		19.12.12	KSB		KRTK 250-630/2256UNG	281948
SP344 BRISBANE RD REDBANK PUMP No.2	5W		19.12.12	KSB		KRTK 250-630/2256UNG	281949

PUMP	REGISTRATION	TYPE	PUMP_TYPE	MEDIUM	IMPELLOR_TYPE	IMPELLOR_REF	PHASES	VOLTAGE	FREQ
SP320 OLD TOOWOOMBA RD LEICHHARDT PUMP No.1			PT08	ME50			3	415	50
SP320 OLD TOOWOOMBA RD LEICHHARDT PUMP No.2			PT08	ME50			3	415	50
SP343 MCAULIFFE ST REDBANK PUMP No.1			PT08	ME50			3	415	50
SP343 MCAULIFFE ST REDBANK PUMP No.2			PT08	ME50			3	415	50
SP344 BRISBANE RD REDBANK PUMP No.1			PT08	ME50			3	415	50
SP344 BRISBANE RD REDBANK PUMP No.2			PT08	ME50			3	415	50

PUMP	AMPS	SPEED	DRIVE	POWER_RATING	POWER_OUTPUT	FRAME_SIZE	FRAME_TYPE	DIAM_MM
SP320 OLD TOOWOOMBA RD LEICHHARDT PUMP No.1	53	1455		27				305
SP320 OLD TOOWOOMBA RD LEICHHARDT PUMP No.2	53	1455		27				305
SP343 MCAULIFFE ST REDBANK PUMP No.1	354	996		200				522
SP343 MCAULIFFE ST REDBANK PUMP No.2	354	996		200				522
SP344 BRISBANE RD REDBANK PUMP No.1	354	996		200				500
SP344 BRISBANE RD REDBANK PUMP No.2	354	996		200				500
								Originally 540mm

PUMP	VOLUME	WIDTH_MM	HEIGHT_MM	LENGTH_MM	INLET_MM	OUTLET_MM	WEIGHT	FLOW_CURVE
SP320 OLD TOOWOOMBA RD LEICHHARDT PUMP No.1							367	
SP320 OLD TOOWOOMBA RD LEICHHARDT PUMP No.2							367	
SP343 MCAULIFFE ST REDBANK PUMP No.1							2122	
SP343 MCAULIFFE ST REDBANK PUMP No.2							2122	
SP344 BRISBANE RD REDBANK PUMP No.1							2122	
SP344 BRISBANE RD REDBANK PUMP No.2							2122	

PUMP	FLOW	HEAD	INLET_PRESSURE	OUTLET_PRESSURE	MAX_PRESSURE
SP320 OLD TOOWOOMBA RD LEICHHARDT PUMP No.1	98.71	17.05			
SP320 OLD TOOWOOMBA RD LEICHHARDT PUMP No.2	98.71	17.05			
SP343 MCAULIFFE ST REDBANK PUMP No.1	360	31.9			
SP343 MCAULIFFE ST REDBANK PUMP No.2	360	31.9			
SP344 BRISBANE RD REDBANK PUMP No.1	315	39			
SP344 BRISBANE RD REDBANK PUMP No.2	315	39			
	Original duty prior to trimming impeller				

PUMP	SWL	ROTATION	MATERIAL
SP320 OLD TOOWOOMBA RD LEICHHARDT PUMP No.1			
SP320 OLD TOOWOOMBA RD LEICHHARDT PUMP No.2			
SP343 MCAULIFFE ST REDBANK PUMP No.1			
SP343 MCAULIFFE ST REDBANK PUMP No.2			
SP344 BRISBANE RD REDBANK PUMP No.1			
SP344 BRISBANE RD REDBANK PUMP No.2			

Queensland Urban Utilities

Contract Number I112-015 - Supply of Pumps

SP343 McAuliffe Street SPS

Pump model

Designation Amarex KRT K 250 – 630 / 225 6 UN G

Code Designation

Amarex KRT	Type series
K	Channel impeller
250	Nominal discharge diameter
630	Nominal maximum impeller diameter
225	Motor size
6	Number of poles
UN	Motor design variant
G	Materials of construction variant

Serial number 9972018567/000200

MCR	200 kW
Voltage	415 V
Speed	997 rpm
Current	354 Amps
Frequency	50 Hz

Performance

Head	360 l/s
Flow	31.9 mhd
Impeller diameter	520 mm